# *The* AIRCRAFT YEAR BOOK

*For 1936*

# AIRCRAFT YEAR BOOK FOR 1936

AMERICAN WINGS FOR THE PACIFIC

A Hornet-powered Sikorsky S-42 flying boat "Pan American Clipper" over California just before Pan American Airways sent it out to blaze a new route across the Pacific in 1935.

# *The* AIRCRAFT YEAR BOOK

*(Registered U. S. Patent Office)*

## *For 1936*

EIGHTEENTH ANNUAL EDITION

HOWARD MINGOS
Editor

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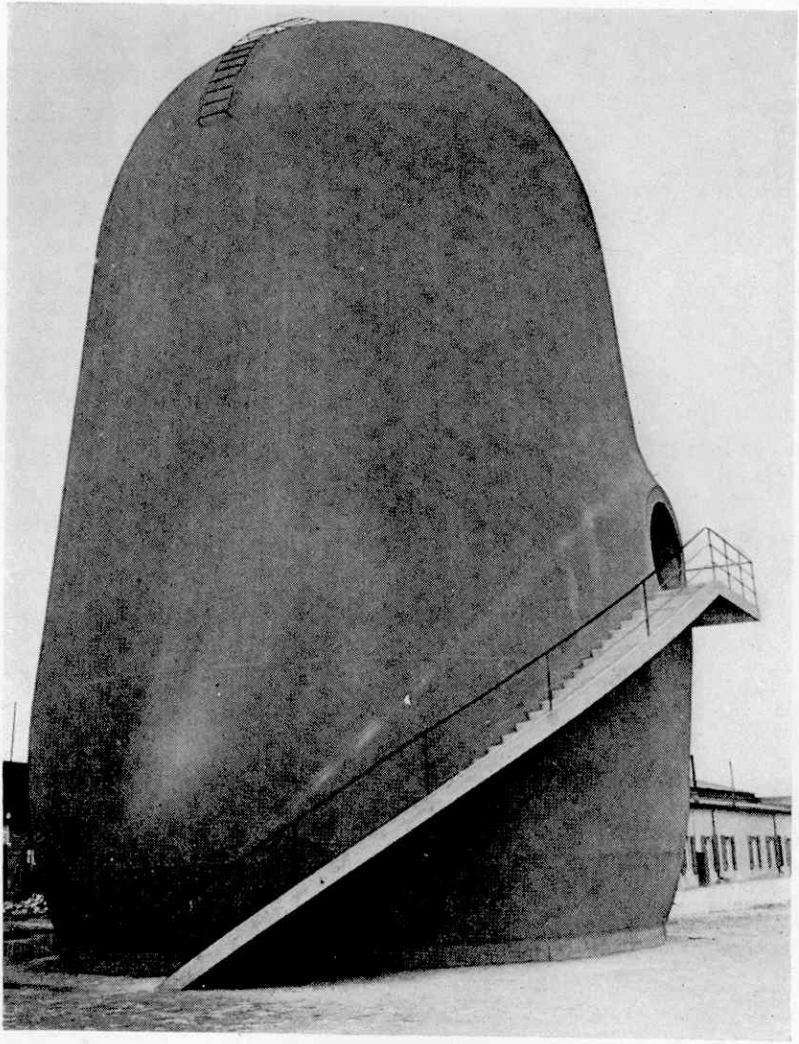


PROGRESS IN AERODYNAMICS

The new free-spinning wind tunnel, erected in 1935 at Adlershof, Germany. Its peculiar construction permits operation under pressure of two atmospheres. See Chapter III.

## CHAPTER I

### DEVELOPMENT OF AIR POWER

An Effective Weapon of Diplomacy—The World's Expanding Air Forces—Growth of Aircraft Industries Abroad—Significance of Aeronautical Research in Europe.

THE most significant fact about aviation today is the astounding efficiency of the modern airplane and the rapidity with which other peoples are taking advantage of it as a means of national power.

During the last 12 months the flying machine has become what the aeronautical scientists and engineers have always said that it would, an extremely fast carrier of heavy loads capable of spanning vast distances over land and water, with every assurance of reaching its destination on schedule. The importance of this lies in the effectiveness with which aircraft now can be used in peace and war. A nation no longer has to break down barriers, either physical or political. It hurdles them.

Within recent months we have seen the Russian Government in Moscow successfully defying Japan by using, not an army, not a navy, but instead a fleet of bombing planes stationed in Siberia, within striking range of Japan's industrial centers. Japan, meanwhile, is creating a powerful air force to prevent the Russians doing that very thing. Eventually every strong nation will back up its national policy with an air force that can be depended upon to work whenever diplomacy fails—all of which plagues the diplomats who have been accustomed to proceed along traditional paths hedged in by armies and navies and the things that armies and navies can do.

The world first learned that the old order on the other side of the Atlantic had changed definitely, when early in 1935 Hitler's Government invited foreign statesmen to sit down and listen while he told them of Germany's rearmament plans. When he had finished the British and French went home and shuddered. Germany's new air force could back up anything that Germany might want to do; so Hitler told the world.

Italy sent an army into Ethiopia after all Europe told Mussolini not to do it. But he kept most of his air forces at home. When Britain sent her great navy into the Mediterranean to show Mussolini that she still was mistress of the seas, Britain showed him that and nothing

more, because Mussolini had an air force and a good one; and he knew that he could fight any force Great Britain and France together might send against him. Both Great Britain and France understood the situation when Italy declined to be bluffed out of the diplomatic poker game. Mussolini went ahead in Ethiopia.

Great Britain, France, Germany, Italy, Japan, Russia and the United States form the seven great air powers of the world.

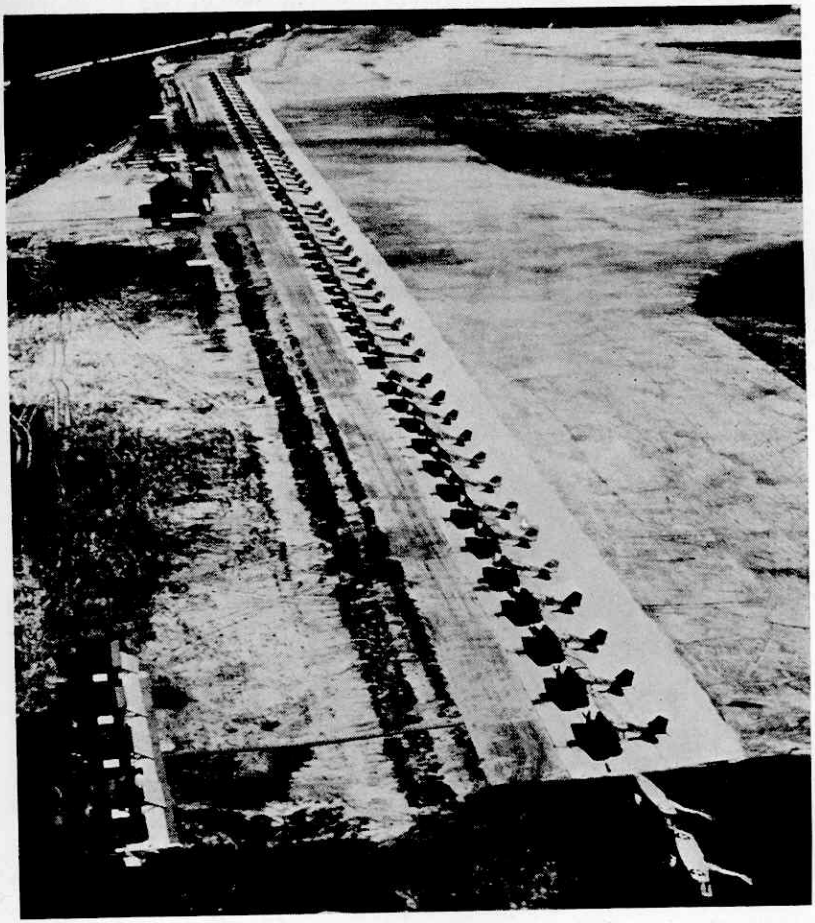
Until 1935 Germany had no air force to speak of, but she possessed

THE AIR CORPS AT MARCH FIELD, CALIF.
1st Wing concentration on April 14, 1935.

air power, nevertheless. German designers and engineers had continued their research and development even when the treaty of Versailles prevented their building military aircraft. They designed commercial machines, transports, light planes and gliders. And German aircraft factories built them. The nucleus of an aircraft industry was never abandoned. The Government maintained an ever-growing technical research and experimental organization. It encouraged leading universities to maintain their aeronautical laboratories. It supported

the Deutsche Luft Hansa transport combine with liberal subsidies. For years the Government spent money training air-minded youth. When Hitler spoke of his air strength in 1935 he was not bluffing. In numbers of combat planes Germany was relatively weak; but Hitler knew that he could build as many as he might need at any time. Germany is spending considerable money on the scientific development of her air strength.

Great Britain and France have increased their aviation appropriations twice within 12 months; and they are now double those of the



THE NAVY'S ANNAPOLIS OF THE AIR

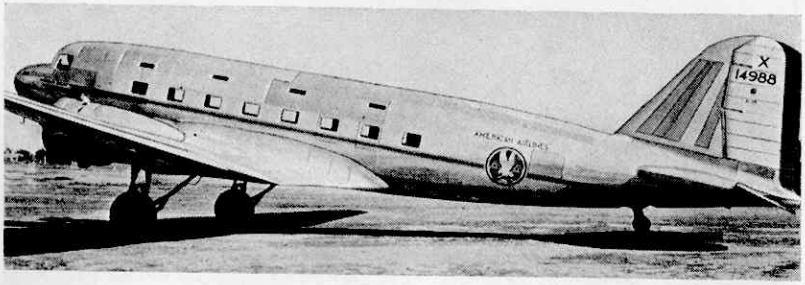
Squadrons 2 and 5 on the line at Corry Field, Pensacola, Fla.

last fiscal year. Italy is appropriating as much as the aviation chieftains want. Japan has doubled her appropriations and is modernizing her army and navy air forces. Russia is striving to outdo the rest of the world under difficult conditions. The full import of what Europe is doing in the way of research and development will be realized in the United States in 1937 when the results of the present scientific progress are incorporated in new commercial and military aircraft.

At the beginning of 1936 the United States was about 18 months ahead of the rest of the world in technical development. The American transports, bombers and fighters now available in very small numbers are the results of the intensive development started several years ago. At present the best machines abroad bear striking resemblance to these American planes. In another year the products of foreign factories should represent original and advanced knowledge of aerodynamics and other branches of the aeronautical sciences.

The United States now lags fifth among other powers in numbers of combat planes in its air forces, a position it has occupied for two years. Today the others are building huge air forces, with trained personnel and vast industries to keep them huge in an emergency. They are doing their utmost to establish international air lines and foreign markets for surplus equipment. The United States is beginning to feel this competition, which is gaining strength month by month.

Developments in 1935 and the trend during the present year are described in the following pages.




SIDE VIEW OF DOUGLAS SLEEPER

It contains lower and upper berths for 16 passengers, and is powered with two Wright G Cyclone engines.

## CHAPTER II

### THE UNITED STATES IN THE AIR

Retains Technical Supremacy But Still Ranks Fifth in Numbers of Combat Planes—Confusion as to Government Policy—Supremacy of Air Transport and Private Flying—Curtailed Development and Production—Improved Airways and Airports—Activities of Leading Organizations.

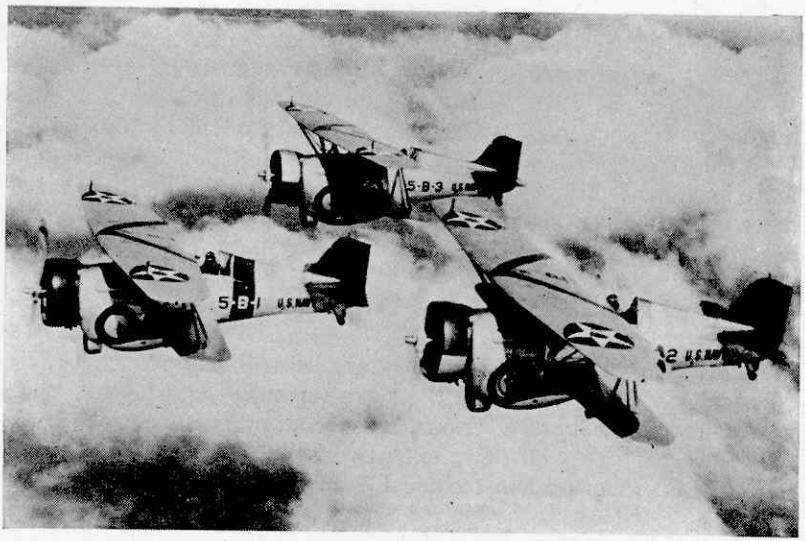
IN SPEED and efficiency the commercial airplanes of the United States are far superior to those of other countries, as this chapter is written early in 1936. Nearly every nation on earth is either buying these products of American factories or trying to imitate them. Upward of 40 world records are held here. The air lines are doing more business than those of the rest of the world combined. There is more private flying, more charter service and generally more practical everyday use of airplanes. Statistics for 1935 in all branches of civil flying show gains over 1934.

On the other hand the United States, among the seven air powers of the world, occupies fifth place in numbers of combat airplanes, in the fighting machines its air forces have immediately available for an emergency. That not only is the same unenviable position it held a year ago; it is even more serious, because all other powers are equipping their air forces far more extensively than is the United States.

The American lead in technical development has been shortened by half. Prior to 1935 the United States was nearly three years ahead of other nations in the science of designing and constructing airplanes. That margin has now been reduced to about 18 months. It is not through any fault of American scientists or the members of the aircraft industry. They have carried on to the limit of their resources. But there are many forms of experimentation and development which no individual unit of an industry can afford to carry on; and there the Government must contribute, in two ways—one, by support which encourages and in part pays for constant improvement by the industry; two, through extensive Government research and experimentation in the pure science of aeronautics.

In Government support the industry has not fared very well since 1932. Of Government research Americans have had the best in the world, through the National Advisory Committee for Aeronautics and its great laboratories at Langley Field, Va. During the last two

years Great Britain, France, Italy and Germany have been doubling government expenditures with their industries, at the same time setting up experimental establishments modeled after those of the National Advisory Committee here. They are doing all that without regard to cost. That is why the foreigners are gaining momentum while the United States, generally speaking, is ambling along on the momentum of the past and the rather hesitant support of a Government which has been confused, to say the least, as to what best to do for American aviation in order to develop it for transportation and meet the ever present need for adequate national defense.




Official U. S. Navy Photo

CURTISS FIGHTERS FROM THE "RANGER"

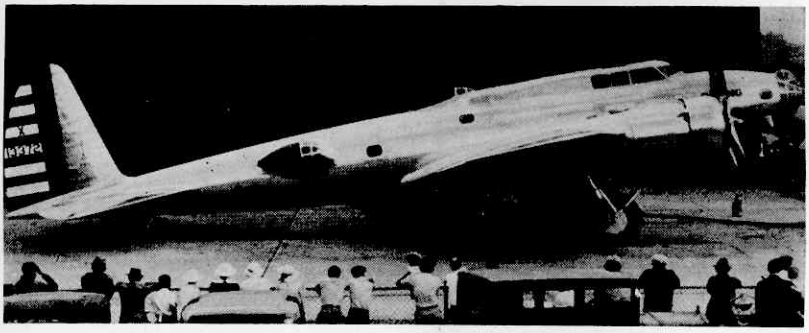
Three of the 28 Cyclone-powered Curtiss $BF_2C$-1 Navy single-seat fighters led by Lieut. Comdr. J. D. Barnes. They berth on the carrier "Ranger."

The comprehensive report of the Federal Aviation Commission, filed with Congress in January, 1935, has been virtually ignored by both Congress and the Administration which appointed it in 1934, and set it at work to write a complete program for American aviation. The Commission's recommendations, which were published in the Aircraft Year Book for 1935, offer a complete program, particularly as to matters of policy and methods. That they have not been adopted is further evidence of the present state of confusion existing in Washington.

The United States Army Air Corps at the beginning of 1935 had on hand about 1,200 combat planes, including those used by the National Guard and organized reserves. At the beginning of 1936 that number had fallen to about 1,100 combat planes. The relatively few machines delivered during the last 12 months had replaced some of the machines too old for further use, and the Army had lost ground to the extent of 100 planes.

The United States Navy Bureau of Aeronautics at the beginning of 1935 had on hand about 860 combat planes, some 260 of them ready to be discarded as no longer serviceable. At the beginning of 1936 the Navy had about 800 combat planes which would be useful in an emergency.

The Army's 1,100 and the Navy's 800 combat planes gave the



THE BOEING "FLYING FORTRESS"

Hailed as one of the world's greatest achievements in aircraft design and construction in 1935 the four-motored Boeing bomber 299, powered with four Pratt & Whitney Hornet engines, is groomed for flight at the Boeing plant in Seattle, Wash.

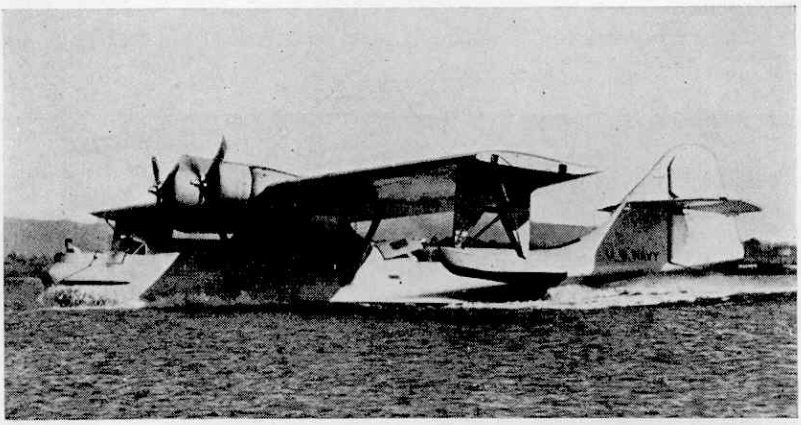
United States a total of 1,900 combat planes at the beginning of the year. Basing its figures on the recommendations of several expert military committees and the plans of the General Staff, charged with the responsibility of keeping the Army adequately prepared, the War Department asked Congress for 800 machines during the fiscal year 1937. That number, with about 500 planes to be delivered in 1936, was calculated to replace old ships and build up the Air Corps strength in line with the Army's plan to have, as quickly as possible, at least 2,500 and, eventually, the 4,000 planes believed to be necessary for adequate national defense.

The Navy Department advised Congress to appropriate funds for 330 new planes during the fiscal year 1937. That number, the

plans indicated, should be purchased in order to carry on the Navy's program to have 1,910 planes in service by 1940.

If the Army receives 500 combat planes and the Navy 250 during the calendar year 1936, the air forces should have on hand, after allowing for replacements, about 2,200 combat planes in January, 1937. Even then the United States will remain in fifth place, because, as the following chapter shows, the other powers also will have increased their combat strength, and in some instances far more extensively.

As the chapters on Army and Navy aviation point out in detail, confusion in Washington as to policy, appropriations and methods of



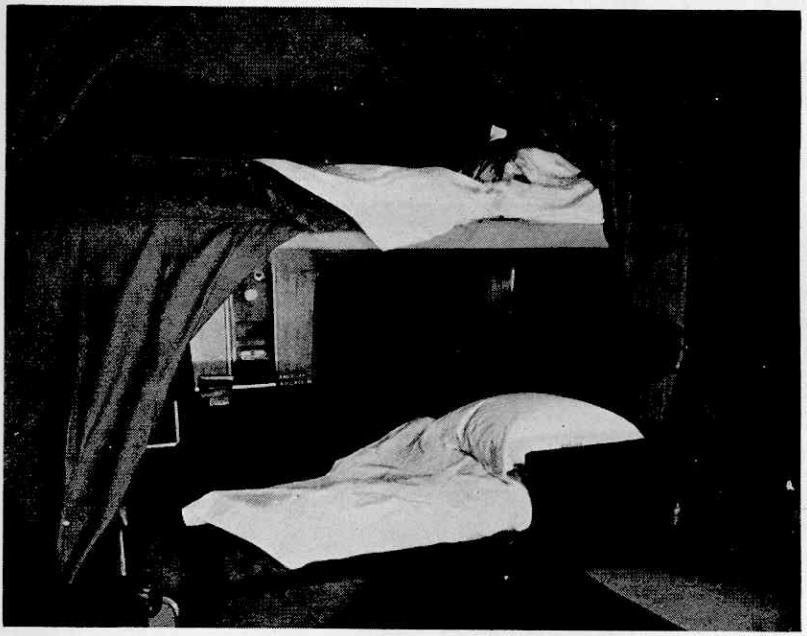
NEW RECORD-BREAKING CONSOLIDATED P3Y-1

Powered with two Pratt & Whitney twin-row Wasp Junior engines this latest Navy patrol boat built by the Consolidated Aircraft Corporation flew non-stop 3,300 miles for a world distance record with seaplanes in October, 1935. It flew from Panama to Alameda, Calif., in less than 35 hours, in charge of Lieut. Comdr. Knefler McGinnis.

procurement, has held back production orders necessary for a modern air force. This of course has been reflected in the present condition of the aviation industry. Several plants which the Government would need badly in the event of an emergency, with its positive demands for thousands of combat planes as quickly as possible, have devoted their production to casual orders for military equipment in the past, and now have little and in some cases no business. Others are carrying on important development work for the services at a loss. A few have profitable orders; and one or two companies are expanding.

A brief summary of the production tables in the appendix indicates that the industry manufactured more planes in 1935 than during

1934. But the increase was largely commercial, and the increased commercial planes were generally light planes. Approximate figures show 1,109 commercial planes built in 1935 as against 772 during 1934. In value, however, the 1935 production without engines was only ten and a half million dollars as compared to ten millions in 1934. The industry's military and naval production of 437 machines in 1934, valued at about nine million dollars, was increased to about 459, valued at eleven and a half millions. Aircraft engine production followed

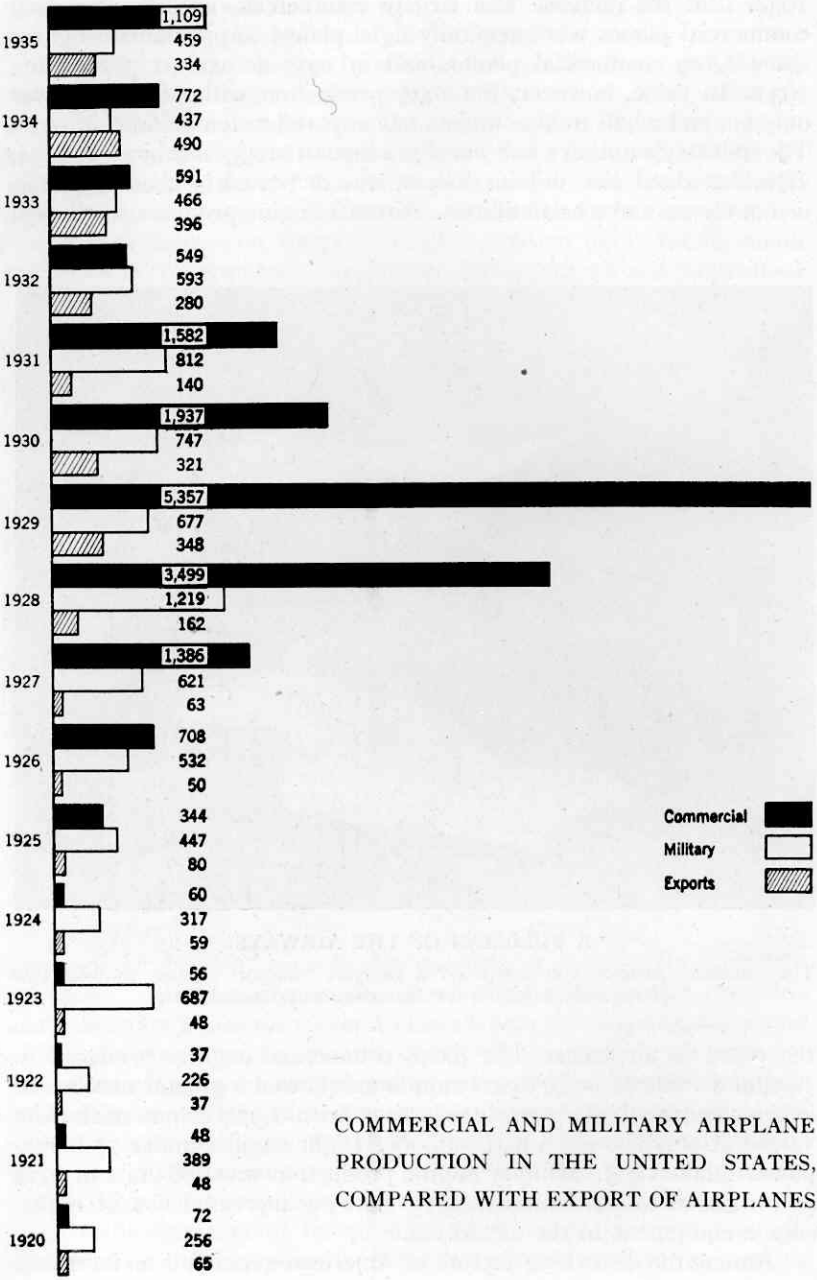


A PULLMAN OF THE AIRWAYS

The American Airlines' Cyclone-powered Douglas transport sleeper, showing two of its sixteen berths for transcontinental passengers.

the trend in airplanes. The 2,048 commercial engines produced in 1934 at a value of more than ten millions showed a greater number of heavier engines built than during 1935 with 1,974 commercial units valued at only six and a half millions. Light engines under 75 horsepower totalled 405. Military engine production was 688 units in 1934 as compared to 991 units in 1935, showing increased use of multi-engine equipment in the air forces.

Among the disturbing factors in American aviation is an increased




COMMERCIAL AND MILITARY AIRPLANE PRODUCTION IN THE UNITED STATES, COMPARED WITH EXPORT OF AIRPLANES

tendency in some official circles to consider seriously government manufacture of aircraft and engines, although there is ample evidence the world over that no government plant ever succeeded in producing machines in the slightest degree comparable, type for type, to contemporary models designed and built by private industry.

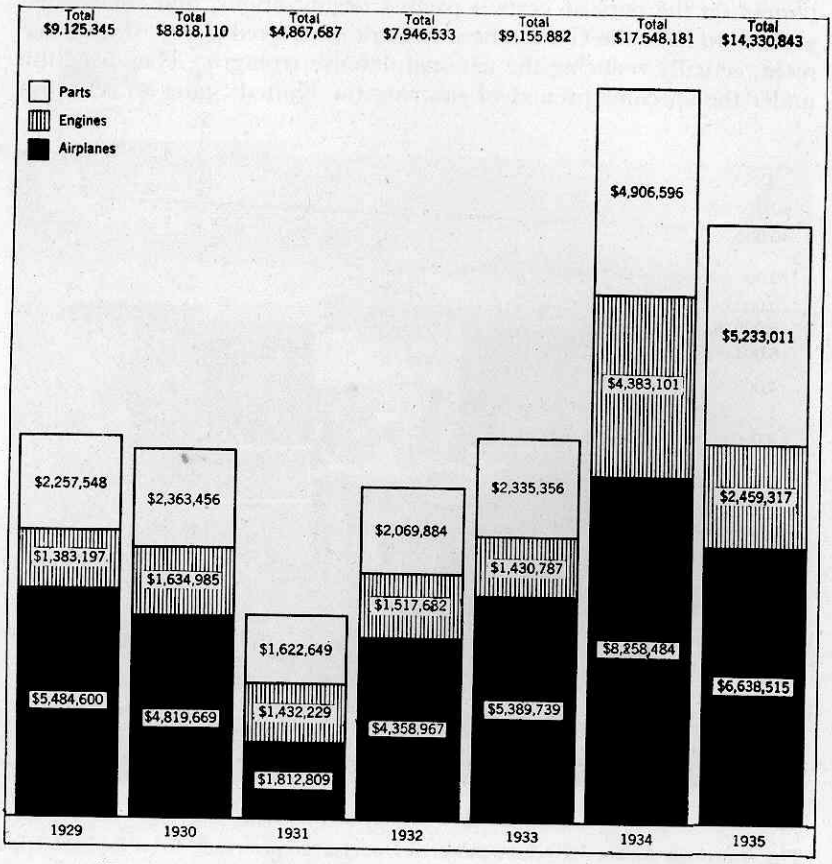
Equally impractical but quite as persistent are the recurrent attempts on the part of certain pacifist organizations, and some other groups, to have the Government embark on a fixed policy of disarmament, actually reducing the national defense strength. They urge this under the specious pretext of desiring the United States to set a fine

MADE UP FOR DAY FLYING

The American Airlines' Cyclone-powered Douglas sleeper ready for a daylight trip.

example for other nations. Advocates of that policy decry nationalism and isolation. Those charged with maintenance of the national defense, and who are familiar with world conditions, wonder why those who are trying to disarm the United States should thus attempt such a display of national isolation, for such it surely would be, in view of the apparent unanimity with which all other nations are increasing armaments.

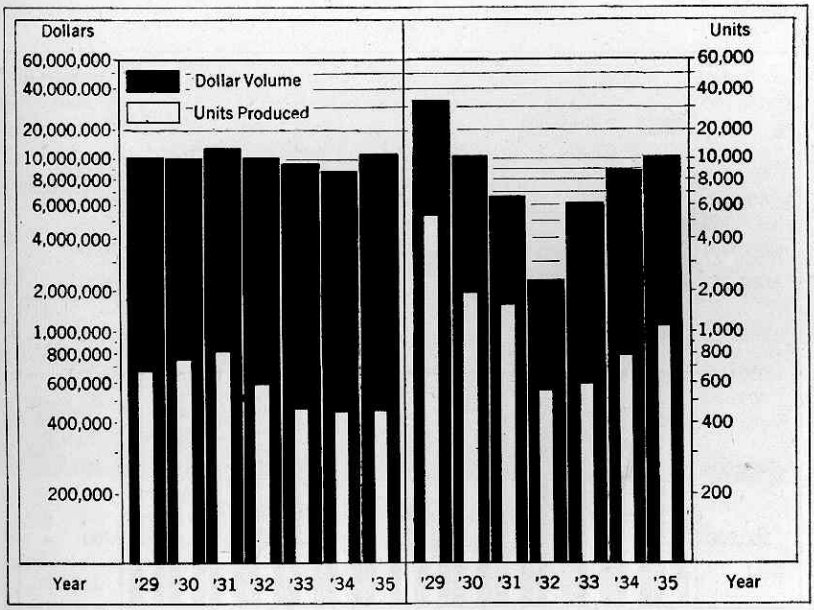
Embargo laws and other neutrality legislation have combined with various investigations to curtail the export trade in aircraft products, to the advantage of other nations, the governments of which have been earnestly helping their industries create export sales, with subsidies, credits and actual dumping at prices ridiculously below cost.




AERONAUTICAL EXPORTS FROM THE UNITED STATES

American exports of aeronautical products totalled more than those of any two other nations in 1933. They increased in 1934 to a record of about $17,548,181, including planes, engines, parts and accessories. That export trade accounted for nearly 40 per cent of the total airplane production. In 1935, however, American manufacturers built for export only 334 machines as compared to 490 in 1934.

Official Department of Commerce foreign trade figures for the calendar year 1935 show a marked decline in actual exports of aeronautical products, the 1934 total of $17,548,181 falling to $14,330,843 in 1935. Shipments of airplanes dropped from 490 worth $8,258,484 in 1934 to 334 planes worth $6,638,515 in 1935. Shipments of aircraft engines fell off from 1,007 worth $4,383,101 in 1934 to 568 engines worth $2,459,317 in 1935. The slight increase in value of parts and accessories from a value of $4,808,130 in 1934 to $5,069,810 in 1935 may be attributed to the desire of former purchasers to keep their equipment fit for service.



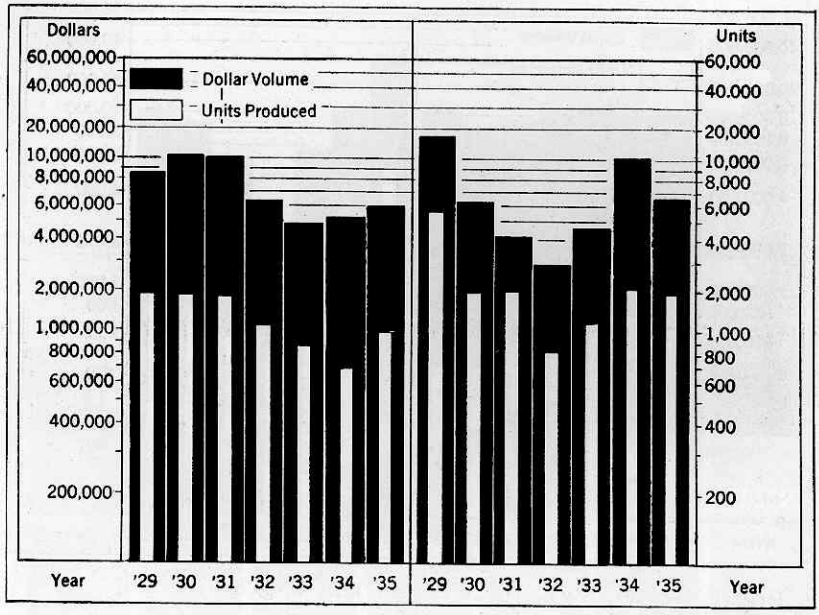

AIRPLANE PRODUCTION IN THE UNITED STATES

The description of the office of Arms and Munitions Control in the chapter on Government activities explains the export laws and regulations at the beginning of 1936.

The amended air mail act in the appendix and the chapter on air transportation will explain the difficulties of the operators and also their accomplishments. Despite indifferent legislation and considerable confusion in Washington as to whether the Post Office Department or the Interstate Commerce Commission shall hold the whip hand over the air lines, traffic is increasing. The operators are deter-

mined to continue improving their service, and hope for the best, or at least, better than they have received in the form of encouragement from a Government whose people really want air transport. The calendar year 1935 brought a tremendous increase over 1934 in traffic on all the air lines of the United States, both domestic and foreign, as follows:

| | 1934 | 1935 |
|---|---|---|
| Passengers | 537,637 | 908,185 |
| Express, pounds | 2,946,460 | 6,162,056 |
| Mail, pounds | 7,155,281 | 13,538,952 |

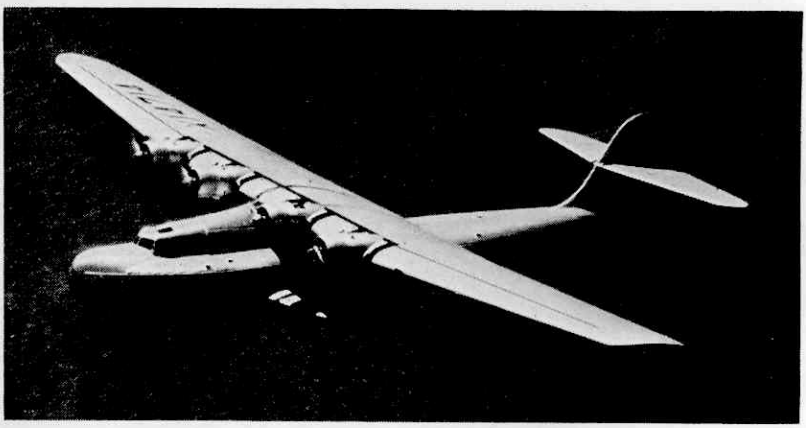



AIRPLANE ENGINE PRODUCTION IN THE UNITED STATES

Highlights of air transport in 1935 were the Pan American Airways transpacific service, quicker time between coasts on the transcontinental air lines and improvements in instrument and radio flying. Larger transports, including new sleeper planes, and more powerful engines are to enter regular service in 1936.

The chapter on engineering and manufacturing describes many of the new planes, engines and accessories—all in fact that the Gov-

ernment does not retain as military secrets. The air forces have machines in process of development which in speed, capacity and range are far superior to anything abroad. Other powers are striving to develop pursuit and attack ships with speeds of 300 miles an hour. The United States will have ships making nearly that speed before the end of 1936. Other powers are trying to develop bombers to make 240 miles an hour. The United States should have some squadrons flying such bombers before the end of the year. The question is whether American air forces will have enough modern planes, and whether the Government will change its policy and permit greater research and development, by both the industry and the federal agencies that are ready to do it.



PAN AMERICAN AIRWAYS "CHINA CLIPPER"

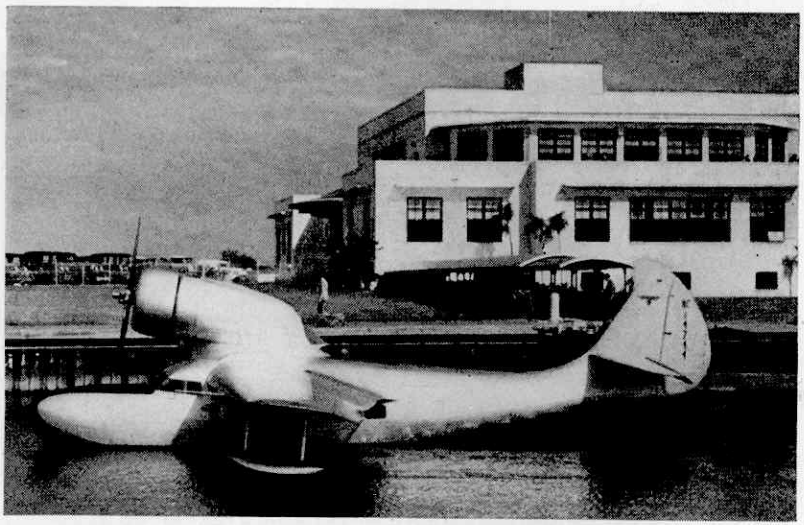
One of the Wasp-powered Glenn L. Martin flying boats for Pan American trans-ocean service. It can carry 24 passengers, a ton of mail and cargo for 3,000 miles without stopping, and its speed is 2½ miles a minute. It weighs 25 tons.

Private flying is increasing steadily if slowly, notably in the use of aircraft by business and industrial concerns. At the beginning of 1936 there were 14,805 licensed pilots as compared to 13,949 licensed pilots in 1935; and 7,371 licensed aircraft as against 6,339 in January, 1935. More than 22,000 men and women held student pilot permits at the beginning of 1936. In 1935 a million persons paid for some kind of a flight in the United States, outside of regular air line service. There is some evidence that a number of short haul feeder lines will be established in 1936.

Several thousand miles were added to the Federal Airways System in 1935. Nearly 700 airports are now equipped for night flying

operations. The Works Progress Administration is spending money on airport development. Hundreds of waterfront cities and towns are considering marine air terminal facilities for over water flying craft.

In lighter-than-air development the loss of the "Macon" early in 1935 proved discouraging. An official committee has recommended that the Navy carry on rigid airship experiments. The fact that the United States possesses sufficient non-inflammable helium gas for airship operations is one of the many good reasons for using airships in the United States. The projected trips of the new Zeppelin "Hin-



THE FAIRCHILD 91 AMPHIBION

One of the "baby clipper" ships for Pan American Airways service over the Amazon River, moored at the system's base in Miami, Fla.

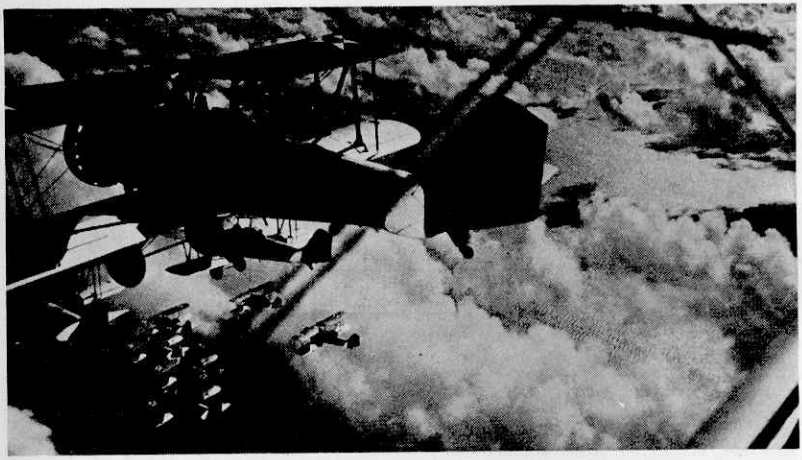
denburg" during the summer of 1936 should arouse great public interest. The world record stratosphere trip of the balloon "Explorer II" in November, 1935, may speed up development of stratosphere flying.

As the chapter on Governmental activities shows, there are 29 different federal departments, bureaus and agencies concerned with aviation. The chapter on laws and regulations indicates that there is much confusion about aviation legislation both in Congress and among the 48 States. The chapter on State activities considers that subject in detail. Burdensome gasoline taxes and a growing difference of opinion as to whether State commissions should be empowered to make

their own rules for aviation are among the problems remaining to be settled before aviation can be expected to get into full stride commercially.

A number of important organizations represent the interests of American aviation in its various branches, including the Aeronautical Chamber of Commerce of America, Air Transport Association of America, American Society of Mechanical Engineers, Institute of the Aeronautical Sciences, Manufacturers Aircraft Association, National Aeronautic Association, National Association of State Aviation Officials and the Society of Automotive Engineers.

The Air Transport Association of America was organized in January, 1936. It is described in the chapter on air lines. The work of



TWO MILES HIGH DURING PACIFIC MANEUVERS

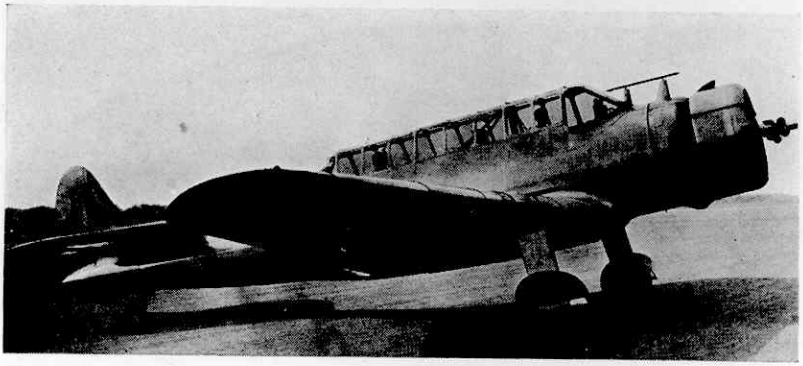
Wasp-powered Vought scouts from the carrier "Saratoga" on the wing during the Navy's maneuvers in the Pacific early in 1935.

the National Association of State Aviation Officials is explained in the chapter on State activities. The activities of the other organizations are summarized here.

### Aeronautical Chamber of Commerce of America

The Aeronautical Chamber of Commerce of America, as the trade association for the aircraft manufacturing industry, in 1935 held scores of meetings dealing with problems peculiar to individual branches of the industry. A comprehensive survey of Far Eastern trade conditions, with particular reference to aircraft exports, was made in connection with the American Economic Mission's trip to

China and Japan during the summer of 1935. Leighton W. Rogers, president of the Aeronautical Chamber of Commerce of America, was a member of the Mission. The Chamber carried on a campaign for marine air terminals, and cooperated with city officials and others in advising on the kinds of facilities best suited for the purpose in each of 300 waterfront communities. A series of meetings was held to develop further standard maintenance practices in aircraft operations. Through its headquarters in Washington, D. C., the Chamber cooperated with all federal departments, agencies and Congressional committees, making available on request the coordinated thought of the industry in all matters concerning its relations with the Government. The Chamber cooperated with the National Association of State Aviation Officials on all matters pertaining to intrastate aircraft operations. Through its aeronautical library the Chamber replied to an increasing number of requests for factual information and statistics concerning the aircraft industry.



THE VULTEE ATTACK-BOMBER

This Cyclone-powered all metal machine has retractable landing gear and armament for attack on bombing missions.

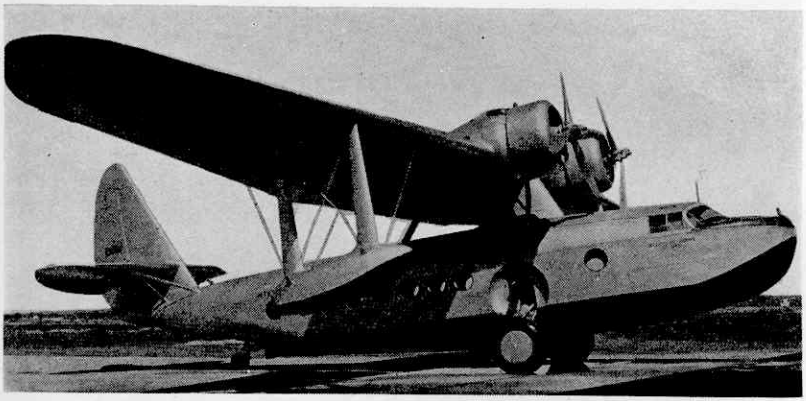
### American Society of Mechanical Engineers

The American Society of Mechanical Engineers held several aviation meetings through its Aeronautic Division in 1935.

### Institute of the Aeronautical Sciences

The Institute of the Aeronautical Sciences held meetings in New York and California during 1935. The Institute started work on compilation of a card index system covering the entire field of aeronautics; and 200,000 cards with more than a million references had been

indexed at the end of the year. At the annual meeting in January, 1936, the Institute's Sylvanus Albert Reed Award for 1935 went to Frank W. Caldwell, chief engineer of the Hamilton Standard Propellers division of United Aircraft Manufacturing Corporation, for his work in developing the constant speed propeller. Major General Benjamin D. Foulois, former chief of the Army Air Corps, received honorary membership and Dr. William F. Durand, professor emeritus of Stanford University, and Dr. Th. von Karman received honorary fellowships. Officials announced that an anonymous donor had



THE SIKORSKY S-43 AMPHIBION

Side view of the twin-engine Hornet-powered land or water transport.

made provisions to bequeath to the Institute at his death a trust fund at present worth a half million dollars.

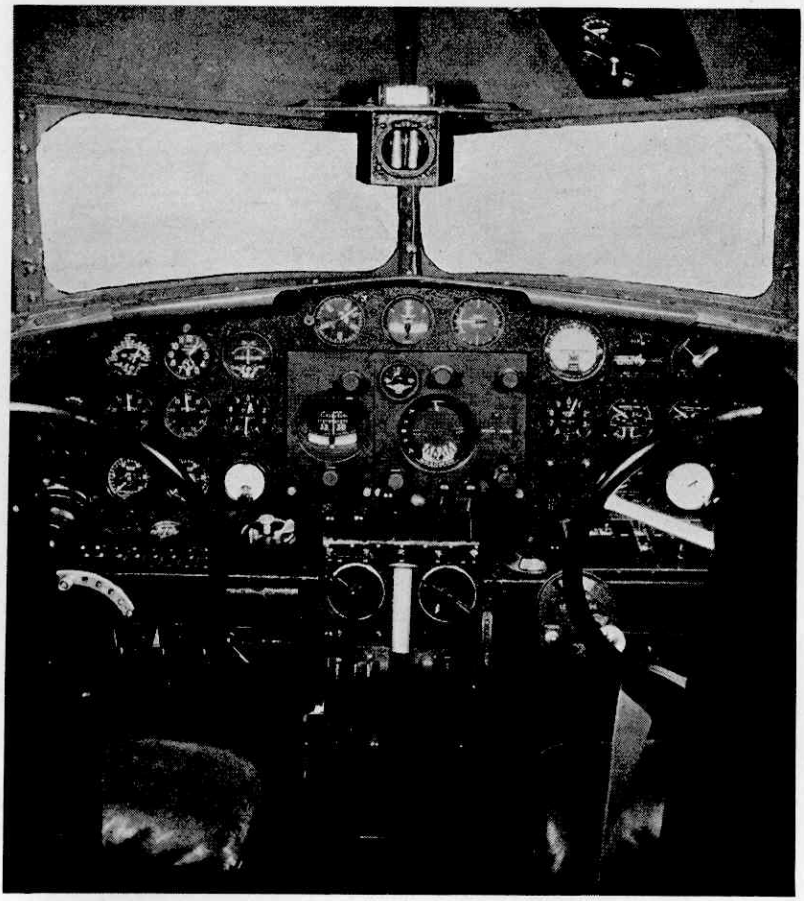
### Manufacturers Aircraft Association

The Manufacturers Aircraft Association in 1935 celebrated its 18th year of administering the cross-license patents agreement of the airplane manufacturing industry. During the year 54 new patents were reported and licensed to members of the Association, making a total of more than 800 patents owned or controlled by its members. On January 1, 1936, the Association reported a total of 33,259 airplanes manufactured since July, 1917, had been licensed to use the inventions covered by all the above patents. The Association maintains for the industry a patent research division and library, and publishes a patent digest of all current American and British airplane patents, including abstracts of the patent specifications and official drawings. The patents and research library of the Association in-

cludes copies of American and foreign airplane patents, as well as books and other publications on the engineering and scientific aspects of aviation.

### National Aeronautical Association

The National Aeronautic Association in 1935 increased its membership from 1,700 to 4,500, published the National Aeronautic Magazine and served as the American member of the Fédération Aéronautique Internationale in homologating all American and interna-



UP FRONT IN AN AIR LINER

Instrument board of the Lockheed Electra equipped with Sperry gyropilot and Western Electric two-way radio.

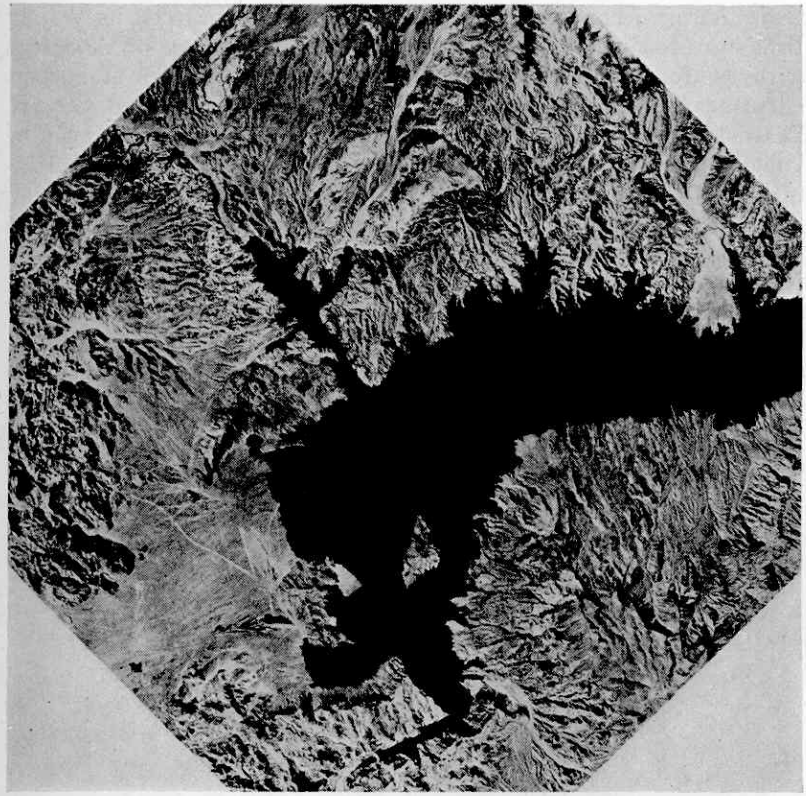


Photo by Fairchild Aerial Surveys

BOULDER DAM FROM HEIGHT OF 20,000 FEET

This remarkable picture showing more than 200 square miles, including the dam and lake, was taken with one shot from the Fairchild 10-lens camera. The dam can be seen at the bottom.

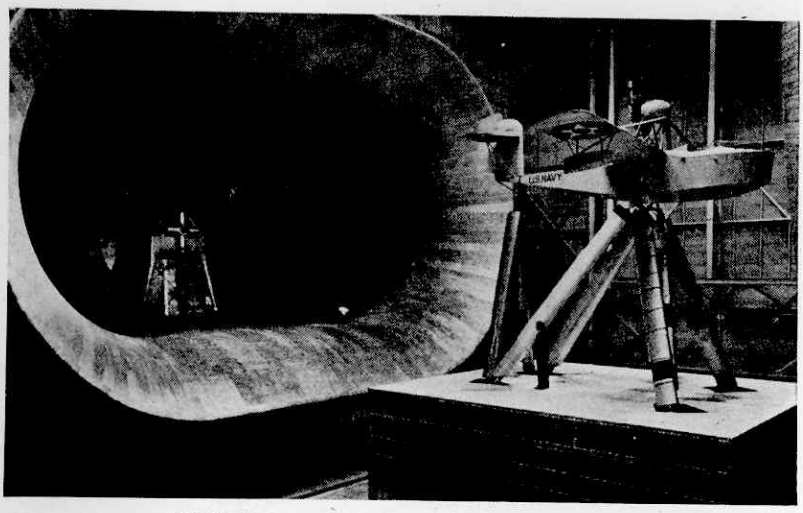
tional record flights. A medical aviation section and an airport managers section were organized during the year. Seven air meets were sanctioned. A total of 442 F. A. I. licenses were issued. The National Intercollegiate Flying Club was organized among the flying groups of American colleges; and it was directly affiliated with the Association.

### Society of Automotive Engineers

The Society of Automotive Engineers held 24 aviation sessions in 1935. A number of aircraft and aircraft engine research and stand-

ardization projects were launched. The S. A. E. awarded its Wright Brothers Medal to William Littlewood, chief engineer of American Airlines, for his paper on "Operating Requirements for Transport Airplanes." Its Manly Memorial Medal was awarded to Guy E. Beardsley, Jr., project engineer of the Pratt & Whitney division of United Aircraft, for his paper on "An Automatic Power and Mixture Control for Aircraft Engines."

The need for more intensive aeronautical development in the United States is urgent, in view of the programs of other nations. In the last 12 months the world picture has changed completely. It makes everything about aviation in the past seem small indeed. If the United States continues to keep its air force program as small as it has in the past, there is no question about where it will be in the near future. It will be in last place among other powers in the air.



TESTING A PLANE BEFORE IT FLIES

A Loening submarine plane mounted in the full-scale wind tunnel of the National Advisory Committee for Aeronautics research laboratories. It is attached to mechanism underneath which records all its flying characteristics.

## CHAPTER III

### OTHER WORLD AIR POWERS

Relative Combat Airplane Strength—European Governments Establish Great Research and Development Centers—Great Britain's Superior Strength—The French Development Program—Germany Rearms in the Air—Italy's Air Force Program—Japan's Modern Air Force—Russia Strives for Air Power.

GREAT BRITAIN, France, Germany, Italy, Japan and Russia, in the order named, were making real progress in the development of their air strength at the beginning of 1936. Each nation was increasing its flying personnel, expanding training facilities, creating reserves of pilots and equipment, perfecting its methods of research and development and setting up greater aircraft manufacturing industries capable of producing fleets of military airplanes in the event of war.

One way of gauging relative air force strength is to compare the number of combat planes on hand and those projected for certain periods. When combined with a fairly accurate knowledge of air force organization, plant capacity and the kind of machines the industry is capable of producing, it enables one to determine actual air power. The following table has been compiled for the Aircraft Year Book for 1936. It includes all armed planes, pursuit-fighters, light and heavy bombers, attack, armed scout and observation, armed patrol and transport ships, machines in active service, reserves and secondary reserves. It is not in any sense an official report; but it is an attempt to set down the approximate strength, based on all that has been said, written and observed about these air forces during the last 12 months, what they are believed to have had on January 1, 1936, as compared to the machines they had 12 months previously, and what they plan to have on January 1, 1937. The United States is included for purposes of comparison.

In explanation of the table on combat airplane strength these facts should be noted: The United States is where it was a year ago—fifth. Germany shows the most rapid development; but it is nothing compared to what she could have produced had it accorded with her plans. Germany prefers to reach the highest state of technical development and perfect her production facilities before turning out any large fleet

of planes, and then in numbers sufficient to keep pace with her great air force program. It is to equal any force in the world.

**Combat Airplane Strength**

| | January 1935 | January 1936 | January 1937 |
|---|---|---|---|
| British Empire | 2,800 | 3,600 | 4,500 |
| France | 3,600 | 3,400 | 4,000 |
| Russia | 3,000 | 3,300 | 4,000 |
| Italy | 2,300 | 2,800 | 3,000 |
| United States | 2,060 | 1,900 | 2,200 |
| Japan | 1,850 | 1,800 | 2,100 |
| Germany | 600 | 1,600 | 2,600 |

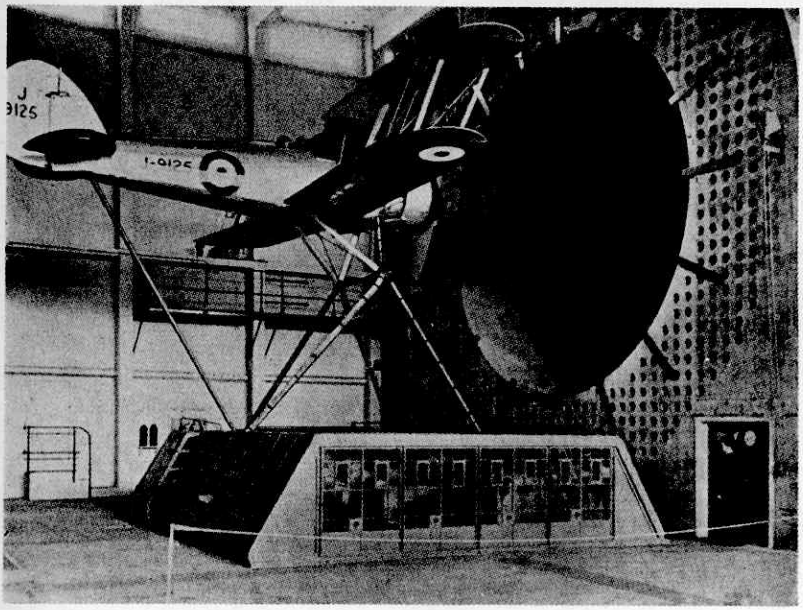
The United States, France and Japan lost in actual numerical strength during 1935, but that is not nearly as significant as the fact that in each country technical progress has been rapid. France a year ago had many combat planes, but was falling behind the others in the performance of equipment. In 1935 France devoted a great effort toward modernizing her combat planes. Japan commenced turning out all metal fighting machines with fairly high performance, planning to re-equip all squadrons by 1938. The rate of increase in combat planes equals that of the United States. Japan's production capacity has increased in the last year. The United States, as explained in Chapter II, is still ahead of other nations in the technical excellence of its combat planes. But that can be traced solely to the momentum of the past. Where it had once been three years in the lead, it was only 18 months ahead in technical development at the beginning of 1936. Others were beginning to make faster progress in aerodynamic science.

Great Britain, France, Italy and Germany have spared no expense in perfecting their Government laboratories for aeronautical research and experimentation. For years they have watched the work of the National Advisory Committee for Aeronautics in the United States. They know that the superior performance of American commercial and military planes must be attributed partly to the knowledge gained from the research in the NACA laboratories at Langley Field, Va. The foreigners are now establishing new laboratories in an effort to overcome this American leadership in technical development.

Russia's large fleet can be compared to those of other nations only in numbers. With few exceptions the Russian planes are slower, more cumbersome and more difficult to keep in repair. That can be attributed to several factors, among them unskilled personnel in the shops, the relatively few capable designers and engineers and the system of State-owned and operated plants.

### Britain's Superior Strength

Great Britain's present strength does not lie alone in what the air force is today, but in what the Government should be able to have in readiness immediately on a declaration of war. Great Britain has the resources of the empire, trained air forces in nearly every one of her far-flung outposts, thoroughly adequate reserves of personnel and the greatest aircraft industry in Europe which, augmented by the production of plants in Canada and Australia, should provide additional equipment sufficient for any emergency.



DEVELOPING BRITISH AIR POWER

England's largest wind tunnel. It was placed in operation at the Farnborough laboratories in 1935.

Added to that is the present sentiment, created by world conditions. British feeling was summarized by Winston Churchill in November, 1935, when he said: "Our position now is far more dangerous than in 1914 because the air menace is new and unmeasured, and our old lines of defense on blue water are no longer sufficient to preserve us. Moreover we are much more deeply entangled on the Continent than we were in 1914."

Great Britain is earnestly working on an expansion program cal-

culated to keep her ahead of other nations in the air. The combat planes which the Government could bring into service increased from 2,800 in 1935 to 3,600 in January, 1936. Total combat strength, including reserves, is to be built up to 4,500 machines by January, 1937.

The Home Defense Force—a part of the Royal Air Force—is being expanded from 52 squadrons with 580 first line planes and reserves to 123 squadrons with 1,500 planes and 100 per cent reserves. The program is to be completed during 1936. Including reserves the British air strength at the beginning of the year was divided as follows: In the British Isles 1,000 combat planes in service and 1,000 reserves; 500 combat planes, including reserves, assigned to the Navy; about 600 combat planes, including reserves, assigned to Royal Air Force contingents on duty abroad; and about 500 combat planes in service with the various air forces maintained by other governments in the British Empire.

The regular Royal Air Force personnel is to be doubled numerically, to a total of about 60,000, including 5,000 pilots. Nine new flight training schools are being established. Forty-nine new air stations are to be created, with special attention to strategic points on the East Coast. Reserve squadrons are being increased, and a number of new reserve squadrons are to be organized among the colleges and schools. Amateur pilots receiving commissions will receive 115 pounds sterling to reimburse them for the cost of learning to fly.

With 35 airplane factories in the United Kingdom the Government maintains on its active approved list for military procurement 11 factories. They are capable of producing about 10 combat planes a day. The Government's air force expansion program, enlarged twice during 1935, calls for a plant production capacity of 75 planes a week by July 1, 1936. That output is to provide replacements for obsolete equipment and add 900 modern planes to the roster of the British air forces by the end of the year. Many observers believe that objective will not be reached, however, in view of the need for slowing up production to incorporate the latest technical developments.

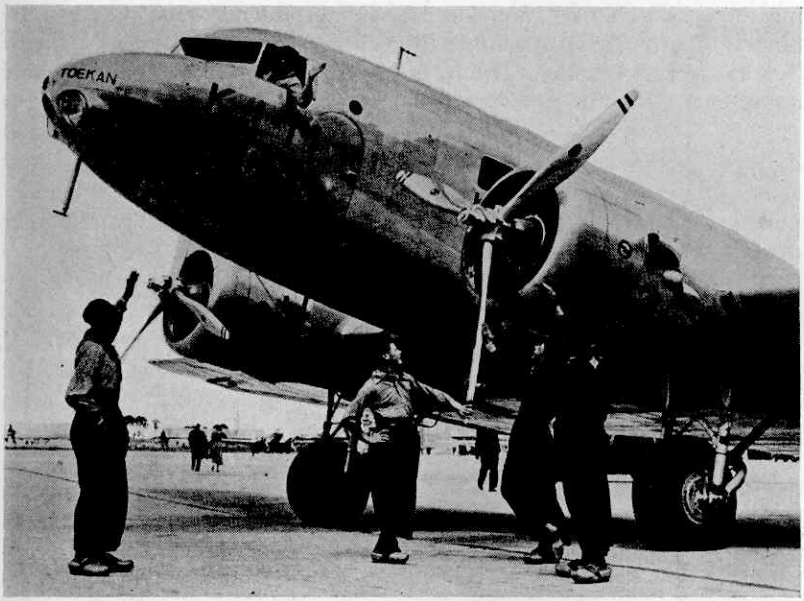
The need for the most intensive development is considered acute, because of conditions on the Continent where both Germany and Italy are concentrating on improvements which should increase aircraft performance in another year. The possibility of fleets of long-range bombers flying high enough and fast enough and with sufficient loads of bombs to destroy whole cities has convinced Britain that her new air force must be able to carry out three separate missions.

The missions are: (1) To meet an invading air force and shoot it down or drive it back; (2) to invade enemy territory and destroy its air force centers and concentration depots; (3) at the same time to

protect and keep open the lanes of communication throughout the empire. For those reasons the Government is spending larger amounts on research and development.

Aside from the research which promises to produce new methods of design and construction before 1937, the Air Ministry has given the manufacturers orders for immediate development of high-speed, long-range bombers capable of carrying from 30 to 50 armed men or from two to four tons of bombs over long distances non-stop.

A Gloster single-seat pursuit plane was the fastest machine in reg-




AMERICAN AIRCRAFT IN SERVICE ABROAD

A Hornet-powered Douglas transport, one of the fleet operated by K-L-M, receives a visit from some enthusiastic Dutch lads at the Amsterdam airport.

ular service at the beginning of 1936. It had a service speed of 231 miles an hour. Experimental machines now are making greater speeds, and the British hope to start equipping their squadrons with planes doing 270 miles an hour before the end of 1937. New Gloster and Hawker pursuits are on the program. The DeHavilland Comet type is being developed into a twin-engine fighter. An exceptionally fast Vickers general purpose plane, an Avro scout and other armed observation types are among the projects under way.

New machines on the production line include the Armstrong Whit-

worth, with two 810 horsepower Siddeley Tiger engines, a troop transport or bomber with a speed of more than 215 miles an hour, a new Bristol, model 130, designed for a crew of three and 24 soldiers or two tons of bombs. The new Handley Page 51 bomber will carry 30 men or two tons of bombs. A new Bristol twin-engine model, resembling the American Army types developed in 1935, is reported to have a speed greater than 240 miles an hour.

The Government has definitely adopted a policy against nationalization of the aircraft manufacturing industry. After 18 years of experience the Royal Aircraft Establishment at Farnborough, according to reports in 1935, has succeeded in producing only one very ordinary type of flying machine, the Queen Bee type, used as a target in anti-aircraft practice. It has, however, carried on some worthwhile experiments in wireless control of aircraft, using the Queen Bee.

The Government has also revised its procurement methods to facilitate production of modern machines while they still are modern. The new system provides that the Air Ministry specifications shall be simplified, to afford the constructors some leeway in creating satisfactory machines for the air forces. The extent of service tests and even the first tests at the Martlesham technical station have been materially reduced. All those changes can be summarized in one sentence: The Air Ministry has decided to tell the British aircraft industry what it wants and then give the industry an opportunity to produce it with the least possible red tape and delay. A practical safeguard remains; if a manufacturer does not succeed in producing what the Government wants, he may not receive further orders. It is up to him.

British official scientific research is concentrated largely in the laboratories at Farnborough, corresponding to the Langley Laboratories of the National Advisory Committee for Aeronautics in the United States. New apparatus was installed in 1935, including a big wind tunnel, and research facilities were to be further increased during 1936.

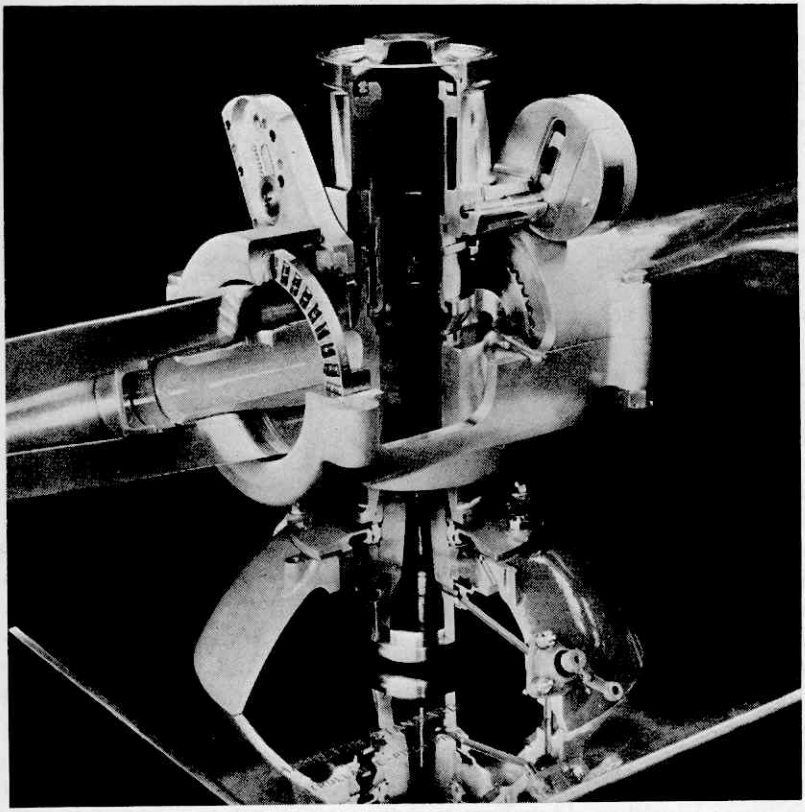
At the beginning of 1936 the aircraft industry was in an excellent position to carry out its share of the air force expansion program. Its record foreign trade in 1935 had augmented the increasing orders from the Government so that a majority of the plants had full crews of trained personnel. Many of the larger plants were working day and night. More than $11,000,000 worth of aircraft products were shipped abroad during the first 10 months of 1935. Quantities of aircraft engines were shipped to Germany. Accessories were shipped to Russia. Military aircraft as well as commercial planes were sold in South America.

Like all other nations abroad Great Britain is encouraging her air transport lines to improve their service, and thus advance British

interests on the international trade routes. Also, the increased use of transport equipment helps maintain the aircraft manufacturing industry as an established reservoir for national defense equipment.

The greater part of civil air transport in the British Empire is centered in Imperial Airways. Smaller companies operate services in the British Isles, Canada, Australia and other units of the empire. Imperial Airways links London with European cities, operates routes the length of Africa and also maintains schedules from London to Egypt, Near East, India, the Orient and Australia. It may start operations across the Atlantic early in 1937.

Imperial Airways has ordered 29 large flying boats and 12 huge land transports, to be delivered before the end of 1936. The flying



HAMILTON STANDARD CONTROLLABLE PITCH PROPELLER

Showing the mechanism which turns the blades so that they always bite out just the right amount of air for best performance at any height.

boats are being built by Short Brothers and are to have sleeping accommodations for 16 passengers or chairs for 24. The land planes are being built by Armstrong Whitworth, and are to be high-wing monoplanes with retractable wheels. They will seat 27 passengers by day or carry berths for 20 at night. The new transports will have higher speeds, materially quickening Imperial Airways service between London and cities on the Continent. London to Capetown, South Africa, is to be covered on schedule in four days. London and Australia are to be spanned in seven days. Feeder lines are to be established in South Africa.

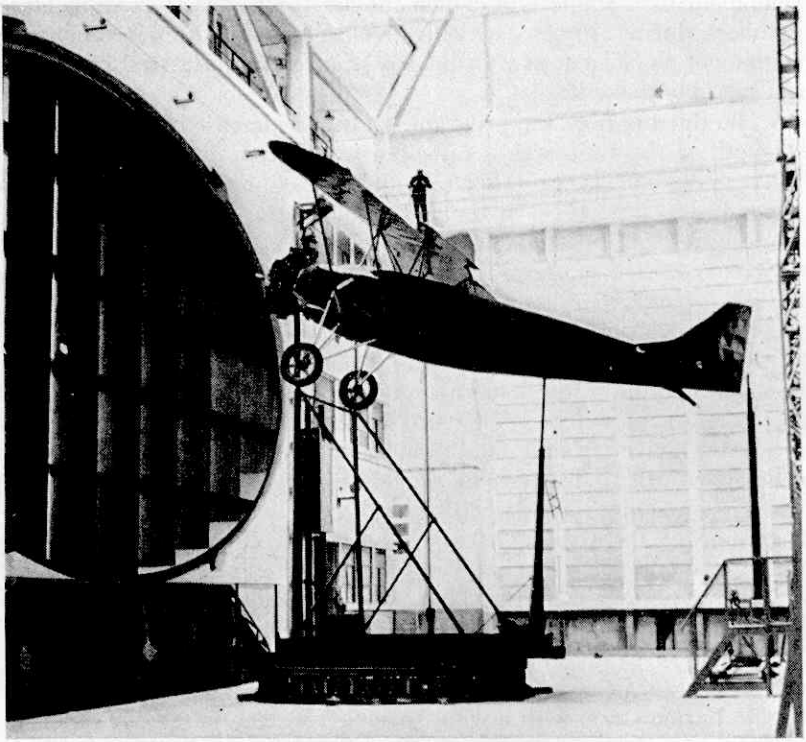
Imperial Airways also has under construction several experimental transports, one a flying boat of sufficient range to fly the Atlantic. Another is a huge flying boat with a smaller seaplane on top of it, the idea being to take off with the smaller ship carrying a full paying load, get it up in the air and then let it fly on from there, the mother plane returning to its base. The company is negotiating with the Post Office Department, in efforts to have all first-class mail within the Empire transported by air. Arrangements are being made for a joint New York-Bermuda service in cooperation with the Pan American Airways System.

### The French Development Program

At the beginning of 1936 France had 3,400 combat planes at home and abroad, in active service and in reserve, as compared to 3,600 machines in 1935. Like the United States the French Government has permitted the air forces to fall behind in combat equipment, and for precisely the same reasons—confusion as to policy and methods of procurement. Germany's astonishing progress and the Italian-Ethiopian situation have now jolted the French into realizing the danger involved in letting the air force fall behind that of other nations, both in numbers of planes and in performance. The Government now has an intensive program under way. French factories delivered approximately 600 combat planes during 1935. They took the places of 800 machines which had been written off the air force lists through obsolescence or crashes. Like that of the United States some of the remaining equipment was more than six years old. The French air forces are to have an aggregate of 4,000 combat machines at the end of 1936. That number, the Government believes, will be a 50 per cent lead over the number that Germany may have at that time.

At the beginning of 1936 combat machines were distributed as follows: In metropolitan France there were in active service 240 pursuit planes, 240 bombers and 620 armed scout and observation machines. For every plane in active service there was another in reserve,

ready to be run out on the front line to take its place. That gave the air force 2,200 combat planes in France. Back in warehouses and available for emergency were approximately 600 older models, secondary reserves which the French were reluctant to destroy for fear they might need them in an emergency. Assigned to the Navy were 180 combat planes, with 180 held in reserve. French air forces in the



INCREASING FRENCH AIR STRENGTH

The new full-scale wind tunnel at the Chalais-Meudon laboratories, placed in operation during 1935.

colonies and dependencies had about 240 combat machines, mostly obsolescent.

The Government's program for 1936 is threefold. It will increase the number of combat planes. It will provide greater amounts for research and development. Aroused by Italy's creation of the great experimental station at Guidonia and Germany's similar development at Adlershof, the Government is sparing no effort in expanding its own

central department of technical development and scientific research at Chalais-Meudon. Improved laboratory facilities have been provided, the scientific staff considerably increased and the research and development work of the Government and industry coordinated to a degree which the French themselves once thought impossible. Under the new system experimental contracts are often shared by as many as three rival manufacturing companies, all working toward the development of a single type which the air forces are to have in large numbers during 1937. The objective is to have the new air force equipment as efficient as coordinated science and industrial enterprise can possibly make it.

The third part of the program is toward increased personnel. The strength of the air forces is to be increased from an existing total of 3,500 pilots and 37,000 other men at the beginning of 1936 to 4,200 pilots and 42,000 others at the end of the year.

Decentralization of the 25 French aircraft factories in the vicinity of Paris, started in 1935, is still being carried on, the plan being to have independent manufacturing units far enough apart to prevent wholesale destruction by air raids.

New machines assigned to the squadrons include a new Bloch bomber carrying a ton bomb load at 186 miles an hour with a range of 745 miles. Forty twin-engine Amiots with a range of 1,000 miles are being delivered, and an additional 60 may be ordered during the summer of 1936. The pursuit squadrons are being wholly provided with new machines. Half of them had received new machines at the beginning of the year. Nieuports and a Dewoitine 500 were among the new single-place machines having speeds in excess of 230 miles an hour at service ceilings. They represented a 20 per cent increase in speed over the old types.

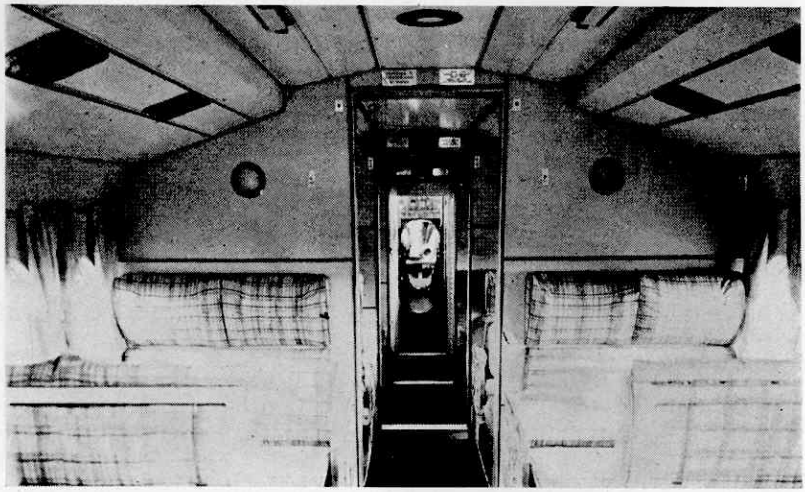
Like those of all other powers the French program embraces plans for an extraordinary development of large fast bombers. The four-engine Farman 221, with a wing span of 108 feet, is reliably reported to have a service speed of more than 200 miles an hour and a long cruising range. Twin-engine light attack bombers with service speeds of 240 miles an hour were being delivered at the rate of two a week at the beginning of 1936. But the program was for still faster equipment, if possible, before the end of the year, with pursuit planes making 280 miles an hour under full service conditions and bombers doing 250 miles an hour. Among the new planes were the Bloch 130 twin-engine fighter, Bloch 200 night bomber and a Bleriot-Spad.

Aside from a number of domestic air lines and a few independent air transport services extending into Africa the French have concentrated in Air France their international transport development. Air

France at the beginning of the year was operating daily throughout Europe with a weekly mail service to South America and another service weekly to Indo-China and Siam. The French also intend to start regular passenger and mail operations across the Atlantic to North America, as quickly as the equipment can be provided. At the beginning of the year they, like the British and Germans, were seeking cooperation with American companies.

### Germany Rearms in the Air

The rearmament of Germany was the most significant development in world air power during 1935. The ground work was laid se-



INTERIOR OF AN OCEAN AIR LINER

Looking down the corridor of a Sikorsky S-42A flying boat.

cretly by General Hermann Goering, Reich Air Minister. He worked for two years prior to 1935, secretly planning, projecting and, where possible, building. Possessing the absolute confidence of Hitler he was able to command the resources of Germany; and there is no exaggeration in the statement that he made the most of his opportunity. A hero of the German air service in the World War, brilliant, efficient and one of the most practical of men, Goering was able to surround himself with the best talent available in the Third Reich. His aides soon won reputations for enthusiasm and ability. Nowhere was there such an exhibition of expert, practical planning as that which Germany offered to the world late in 1935, offered, that is, with reserva-

tions. General Goering as a leader of the famous Richthofen squadron was noted for his surprise attacks. He likes to work in secret in order to prepare surprises for his friends as well as potential enemies.

The German air force program got under way with the rise of the Hitler Government. At the beginning of 1935 Germany could have mustered about 600 combat planes. None, however, was the equal, type for type, of the latest combat planes built elsewhere. But at the beginning of 1936 the German air forces had available approximately 1,600 combat planes; and a large number of them compared favorably with the best machines in Europe. Goering's plan is for 2,600 combat planes by the end of 1936.

The 1,600 combat planes early in 1936 were divided approximately as follows: 600 heavy bombers, 200 light bombers and scout planes and 200 pursuit ships, aggregating 1,000 first-line combat planes, with 300 in reserve and 300 assigned for combat training.

There were fewer than 1,000 military pilots in active service at the beginning of 1936, and a majority of them were on a training status. The number is increasing rapidly with the establishment of training facilities.

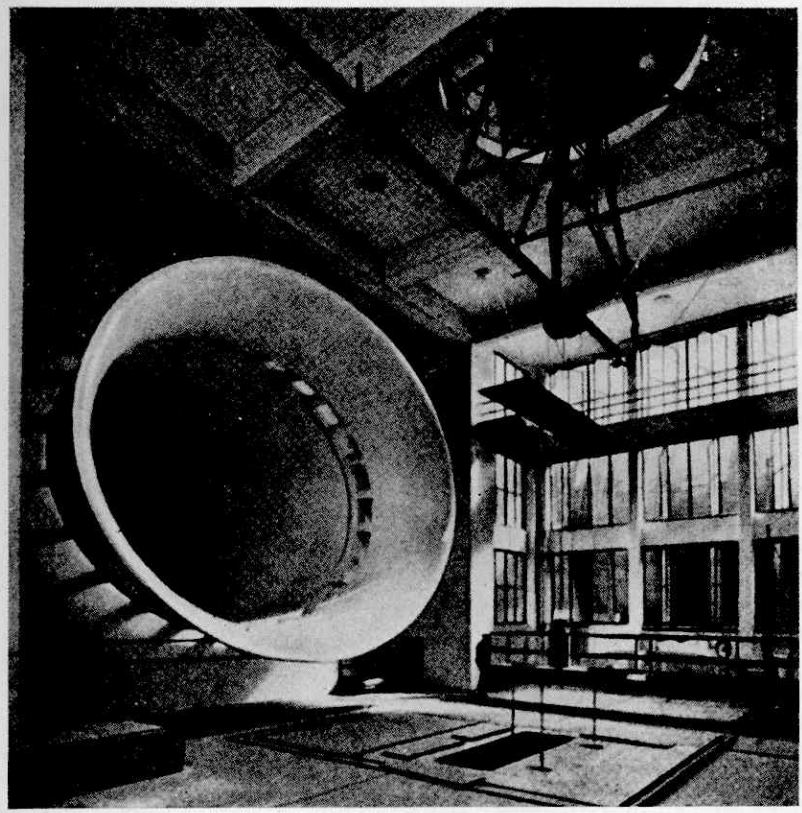
The organization of the air force is built around the air regiment, generally comprising 81 airplanes, in turn divided into wings, squadrons and flights. Four complete air regiments were equipped with first-line planes at the beginning of 1936, with others in process of organization, some partly equipped.

The present program is replete with changes which elsewhere would be considered of a most radical nature. The Government has forced the industry into a mobilization plan far more exacting than that prevailing in any country during the World War. Put into effect late in 1935 this plan places under Goering's absolute authority the disposal of raw materials, decision as to where they shall be shipped for fabrication, and power to stipulate the kind of development and production work which each plant shall carry out.

As a result the 17 airplane factories have actually been reduced to 11 factories. Certain authorized plants are given development orders, with ample funds to design and build a new model. Instead of building one plane the plant is asked to produce 12. The 12 machines are put through constant development processes, as one after another they come from the plant. If the model meets expectations, it is taken away from that plant, together with all jigs, plans and the necessary personnel familiar with all details—all are transferred to another plant, one of a number designated solely as production plants. There the required number of planes is turned out under a system which, Goering and his aides believe, will assure maximum production in an emer-

gency, less waste of materials and a much shorter period of time in obtaining given quantities of machines.

The largest production plant is that of Junkers at Dessau. It employs 15,000 men and its capacity production, if devoted to one model, is 1,000 completed combat machines a month. When one realizes that the entire industry in the United States, Great Britain or France



TO DEVELOP GERMAN AIR POWER

The new high speed wind tunnel at Adlershof, placed in operation during 1935.

could produce that number of planes only after expanding for seven months under actual wartime mobilization conditions, the significance of the German program becomes more apparent.

It means that German air power is to be geared up to a point where it is ready for the immediate demands of any war effort, not seven

months or a year after the fighting starts but on the day that war is declared.

The German ability to produce aircraft possessing the best performance qualities was thoroughly demonstrated during the World War, when Germany alone turned out 50,000 military airplanes. At the time of the armistice, despite a serious shortage of raw materials, the factories were producing 2,000 machines a month.

Junkers products are famous the world over. They have formed the principal equipment on the Deutsche Luft Hansa, the great German air line system; and they have been sold at relatively low prices in more than a score of other countries, thereby providing revenues to keep alive part of the German industry.

The Junkers Ju-52, a three-engine metal transport for 17 passengers, was produced in such large quantities in 1935 that there was no place to store them under cover. Luft Hansa had all that it could operate and maintain in reserve. The Berlin airport, Tempelhof, became littered with Ju-52 transports. Scores were seen standing in a corner of the field. When some disappeared, others soon took their places.

The Ju-52 was not very fast; but it had a definite kind of efficiency. It could carry good loads at a speed of about 150 miles an hour. It was, frankly, a disguised, if cumbersome, bomber. The passenger compartment could be easily transformed. There were mountings for bomb racks along the walls. The flooring came up in places, to disclose complete traps for bomb release and all such facilities. The lavatory in the rear of the passenger compartment was actually a gunners cockpit. The roof was demountable, and there were fittings for machine guns, sights and a communications system to the pilots' cockpit in front.

Late in 1935 the Germans started selling Ju-52 machines throughout the world, sometimes for only five per cent of the estimated cost of production. The reason for exporting the Ju-52 was that the Ju-86 was coming off the production line in increasing numbers. The Ju-86 is a twin-engine smooth-skin transport-bomber with retractable landing gear and oval fuselage. It has a cruising speed of 186 miles an hour at 8,000 feet with full loads. In appearance it resembles the leading American transports of 1935.

The Arado plant at Warnemunde is building advanced trainers and two-seat fighters. Dornier at Friedrichshafen is building light bombers and attack planes with slender bodies and high speeds. Dornier was experimenting with all metal construction during the World War. The famous Gothas of the war, the great bombers that raided England and other Allied countries, will soon be in the air again. The

factory at Gotha commenced operations again late in 1934, and in 1935 it had produced two small, promising combat types. Hamburg combat machines are being built by a subsidiary of the great shipbuilding firm of Blohm & Voss at Hamburg. The airplane factory was established in 1933.

Ernst Heinkel's large plant at Rostock has been developing aircraft of increasing efficiency for years. His mail planes were the fastest machines in Europe three years ago. In 1935 the new Richthofen

AIR LINE PILOTS PLAN FLIGHTS IN ADVANCE

All air lines of the United States require that their pilots and dispatchers carefully project height, speed and all possible emergencies before setting out with a load of passengers. Here are dispatcher, pilot and meteorologist working out a flight path for a regular run over Transcontinental & Western Air.

pursuit squadron had Heinkel-50 one-seat biplane fighters with service speeds of 215 miles an hour. Coming off the production line at present is the He-70 pursuit, with a more modern and powerful engine. It is believed to have a service speed of 250 miles an hour. Heinkel is bringing out a very fast twin-engine attack-bomber in 1936, the He-111. He is selling combat planes in China.

The Henschel locomotive, truck and bus manufacturing company

since 1933 has been building up a large airplane manufacturing plant at Johanisthal; and it is now producing general purpose planes, which within two years have increased in speed from 160 to more than 200 miles an hour. The Weser aircraft plant, started in 1934, working on machines designed by Dr. Rohrbach, has taken over the former Rohrbach plant in Berlin and established another at Bremen. It is building both land and sea machines. The Buecker plant at Rangsdorf, started in 1933, has been turning out training planes. The name of Messerschmitt is again in the air with Germany's new squadrons. The designer, W. Messerschmitt, has been chief engineer of the B. F. W. plant at Augsburg, and it is producing two-place fighters and light attack-bombers. Focke-Wulf is building fast planes.

The German aircraft industry today has priority orders on essential materials; and the Government is acquiring huge stocks of manganese, copper, rubber and aluminum alloys.

The comprehensive plan for development of the new German air force does not provide for immediate mass production of combat planes. General Goering is far too practical to waste money and materials on machines that must become relatively inferior within a year. There is no indication that mass production of combat planes is contemplated during 1936. The fact is, however, that General Goering can do it if conditions should warrant. Observers believe that production will be kept down to provide a total of 1,500 first-line combat planes and 900 reserves by the end of 1936.

The chief problem has been the training of aviators for active military duty. General Goering and his experienced officers are wholly familiar with the demands of a modern air force; and they alone, among all air force commands in the world, are absolutely free from outside interference. They have a free hand. Being practical men, they are not bluffing or rigging up their air force as an official ballyhoo.

Their air force personnel is being chosen with far greater care than even pre-war Germany witnessed in its officers' corps. The youth of the old aristocracy is being drawn into the air force. Sons of powerful officials choose it above all other branches of the service, evidence that it promises more in the form of rapid promotion, high office and fame. It also assures Germany's future position in the air.

The air force program radiates from three great centers. One is the now famous house of 2,000 rooms, a modern structure in Berlin. It houses the entire Air Ministry. Beyond question it is the first building of the kind designed to coordinate and facilitate the organization and direction of modern air power in all its complex forms. Here Goering and his high command plan and direct every movement to-

ward their one objective. Here, with all forms of radio and the latest devices of electricity, they maintain instantaneous contact with every outpost on the frontiers, the flying fields and other branches. One needs little imagination to visualize a campaign of the future being conducted by push-buttons from this house of 2,000 rooms, combining the speed of aircraft with the speed of electricity and its henchman, radio.

If that is the heart and soul of the German air power, then at Gatow-Kladow, near Berlin, is the brain. It is Goering's masterpiece; and if he should pass out of the picture today, Gatow-Kladow should perpetuate his name among Germans. With his actual air force experience during the war as a background, with ever growing visions of the future of aviation through the postwar years, with the

A WACO MILITARY PLANE FOR EXPORT

It is Model D with fittings for three machine guns and a heavy load of bombs.

dominant thought that Germany's one hope of regaining her status as a great power lies in the air, Goering has used his unlimited powers to make of Kladow the most thorough center of military aviation research and tactical development in the world today.

Kladow became a colossal air city late in 1935; and it was only starting. Four thousand men were working day and night on that development, which is eight miles in circumference. There, being completed, were the Academy of Air War and the Technical School. Offices, halls, lecture rooms, dormitories and other facilities give it the appearance of a university. There are full-scale models of all the modern implements of aerial warfare, and drawings, designs and small models of things to come. There are motion picture halls, a

radio station, models of cities, fortifications and war zones representing every conceivable kind of bombing target. There are research rooms with charts, descriptions and other data about every country in Europe and Africa. The buildings, some with four floors, are of permanent construction. There is a central heating plant. Kladow has its own yacht club on the shore of the lake that flanks one side of the air city. There is an L-shaped landing field, on one side of which are hangars, repair shops and a transportation department. It is rumored that Kladow has plenty of bomb-proof shelters, in case of enemy air raids.

There is an air force school in each of the six air districts, at Berlin, Koenigsberg, Fresden, Muenster, Munich and Kiel. There are air fighting schools, an air armament school for land and one for sea, schools for training pilots, anti-aircraft artillery schools and air observer schools.

Doeberitz is an example of the type of air force base that Germany is creating. It is possibly the most modern air service base in the world. The buildings have been carefully designed and located so that if one should be struck by a bomb, the others will not catch fire. Hangars and workshops are not bunched together on an open plain, to offer bright targets from above; instead, they are strung out along the edge of a forest, widely separated, long thin buildings especially designed to prevent wholesale destruction. The roof, two ends and rear side of each hangar are round, sloping outward from top to ground. Walls and roofs are thickly padded, possibly with concrete and covered with cement which is painted to resemble the surrounding surface. The entire front side of each hangar is a series of modern folding doors, mechanically operated. Observers say that bombs striking anywhere save directly in front of the doors should do slight damage. From the air the hangars appear to be underground.

Forty military flying fields are to be established by the end of 1936.

Although starting comparatively late in building up Germany's air power, General Goering and his fellow enthusiasts have had the advantage of freedom of action. That and the fact that they could begin at the bottom and build with new materials, instead of trying to renovate an old institution, provided the tremendous impetus in the third major activity in their aeronautical development, the central research and experimental organization with its principal station at Adlershof. The German name for it is abbreviated to DVL, and it corresponds to the National Advisory Committee for Aeronautics in the United States, which maintains the Langley Laboratories at Langley Field, Va. Like the British research center at Farnborough, the new French center at Chalais-Meudon and the new experimental air city of Gui-

donia in Italy, the DVL at Adlershof has been following the lead of the National Advisory Committee for Aeronautics.

The NACA's development of motor cowling, its patient research into all forms of wing surfaces, wind tunnel tests with full-size models, experiments with all kinds of engines and countless other forms of research in the science of flight, all placed at the disposal of the manufacturers, have contributed materially to the rapid technical improvement of American airplanes.

ARTHUR BRISBANE TAKES THE AIR

**Famous editor and columnist about to leave New York on a United Air Lines plane for the Pacific coast.**

In adopting American design and construction practice the European constructors soon learned that if they were to carry on any real independent development they must set up establishments for scientific research similar to that of the NACA. Adlershof is the German answer to that demand. Having unlimited funds at its disposal the DVL has a program which will make it the equal at least of any aeronautical research institution in the world.

Briefly, that kind of scientific research and experimentation, under favorable conditions and with adequate equipment, takes all the guesswork out of aircraft design and construction. One knows precisely

what a design will do before a pilot takes it up in the air. And one may determine, if he desires, what he must do to a design in order to have it give a certain kind of performance. The laboratories at Adlershof are being provided with every device required for the most thorough research, the latest being a vertical wind tunnel for the study of free-spinning airplane models. The pear-shaped structure of the Adlershof vertical tunnel permits operations under a pressure of two atmospheres. It means that here under laboratory conditions scientists may test and record accurately tests of models under conditions exactly similar to those existing when a pilot takes up a new plane for flight tests. A full-scale wind tunnel was added in 1935.

The DVL also collaborates with the universities which have aeronautical laboratories, notably Goetingen, Hanover, Stuttgart, Berlin and Aachen. The practical tests of models from the designers and manufacturers generally go to the universities for tests, while the scientists and staff at the Adlershof laboratories continue to delve into the unknown, prying loose for the future improvement of German air power the secrets which otherwise might remain forever mysteries.

At the other extreme of German air power is the DLV, the national organization for the air training of German youth. It is partly subsidized by the Government and partly by local communities with contributions from private industries and individuals. It has a large training center in each of the 16 political divisions of the Reich. Each town and village has its own little air center, a sort of boys' club where aviation is the sole matter of interest.

Boys who qualify for training receive a month or two at one of the 16 central training schools, tuition and board free. Back home they make models, graduate to gliders and even receive flight training. By the time they are 18 they are able to decide whether or not they want a career in aviation. Some enter the aircraft industry, others become mechanics, engineers and helpers on the air lines. They may elect to enter the air forces, where they start in the lowest ranks, with opportunities to work their way up through the non-commissioned grades. Many become non-commissioned pilots. German officials believe that they have available when needed more than 50,000 young men who have been trained in the various branches of military and commercial aeronautics. And each of the 16 main training centers is turning out approximately 600 upper classmen a year, a total of some 10,000 trained airmen annually.

German air transport is developing more rapidly than ever before because General Goering believes firmly that the future of the country does not lie in air force preparations alone but in air transportation linking together all corners of the earth. With that in mind he has

encouraged the expansion of the Deutsche Luft Hansa combine, which operates throughout Europe, with day and night schedules to all cities in Germany and to all foreign cities where international agreements permit. Deutsche Luft Hansa through a subsidiary operates services to Moscow and to Seville, Spain, and thence across the South Atlantic to Brazil. Its mail and freight service across the South Atlantic is carried on with seaplanes using a mother ship in mid-ocean. In combination with the Zeppelin company, another subsidiary operates the "Graf Zeppelin" between Germany and Brazil. At the beginning of 1936 negotiations were under way for a North Atlantic service to the

FOR GREATER ITALIAN AIR STRENGTH

The new Italian research and experimental center, the air city of Guidonia, near Rome. Left to right: Radio building, Administration building, Physics and Chemistry building, model shops and the Aerodynamics building. It was nearing completion at the end of 1935.

United States in cooperation with American lines. A new Zeppelin, the "Hindenburg", larger than the "Graf Zeppelin", was to make its maiden flight to the United States in May, 1936. Airplane operating subsidiaries of Luft Hansa were being established in various countries of South America, the German plan being to compete with the Pan American Airways System with a complete chain of inter-connecting lines throughout that continent.

### Italy's Air Force Program

Premier Mussolini has expanded Italy's air force development

program twice during the last 12 months. To the 2,000 pilots and 20,000 other personnel in the regular air forces early in 1935 he will have added 1,500 pilots and 13,000 others by the end of 1936. Combat airplanes, numbering 2,300 early in 1935, had increased to 2,800 in January, 1936, besides replacements for losses incurred in the Ethiopian campaign and during training activities in Italy and Libya. The combat airplane strength is to be increased to 3,000 effectives by the end of 1936, most of the new planes replacing old equipment.

Italy's 15 airplane factories are on a war basis. The Savoia and Caproni plants are turning out rush orders for new long-range bombing machines. Fiat's aviation subsidiary is producing three different models of pursuit ship. The Romeo works is producing pursuit and three-place observation planes. The Piaggio plant is supplying a fast single-float seaplane for Mediterranean squadrons and also a three-engine monoplane bomber with retractable wheels and a speed of 220 miles an hour. Hundreds of Savoia twin-hull flying boats with long cruising range and speed of 140 miles an hour are also in service at an increasing number of coastal air stations.

The Italian campaign in Ethiopia started with inferior equipment, the thought being that the Ethiopians had no air force, and thus were unable to offer real resistance to Italy's squadrons no matter with what they were equipped. The futility of that reasoning became apparent early in the campaign. The unusually long distances to be covered forced the Italians to fly with heavy fuel loads; and they had to fly dangerously low. There was no possibility of making surprise attacks. Then too, the Caproni bombers were obsolete, with low ceilings and relatively short range, too short to permit reaching some of the principal objectives. The expeditionary forces on land found great difficulty in maintaining contact with the observation squadrons in the air overhead. During surface engagements with the enemy in the mountains observers failed to locate them even when flying directly overhead, such was the nature of the country.

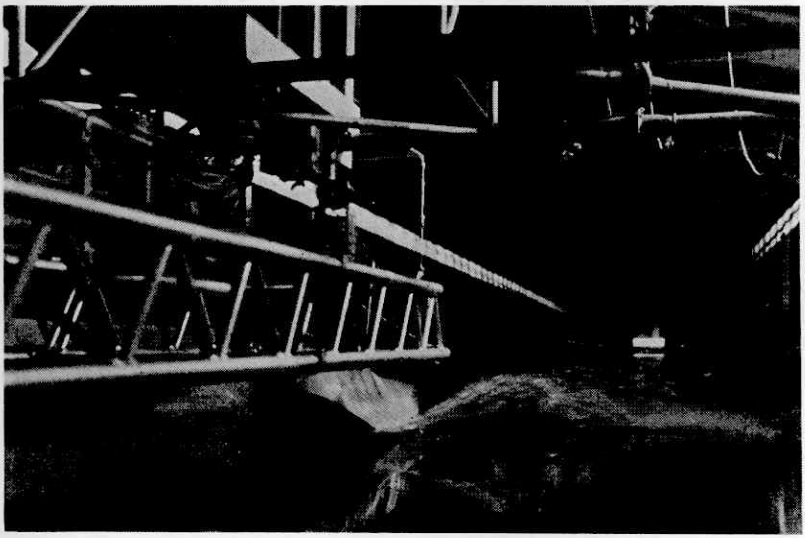
In March, 1936, the Italian bombing squadrons in Ethiopia were to receive new machines, Savoia S-81 models, cruising at 217 miles an hour with full crews and two tons of bombs at a height of 13,000 feet with a range of 900 miles.

The high-speed school maintained by the Government at Lake Garda, which had enabled Italy to retain the world speed record for several years, has produced practical results in improved streamlining, control at high speeds, engine cooling and high altitude performance. New pursuit planes to be in front line service in 1936 are to have speeds the equal of any in Europe and exceptionally high service ceilings.

The new experimental and research program has been thoroughly coordinated in the magnificent new air city of Guidonia. There the Government has assembled a corps of scientists, each qualified in some special form of aeronautical research. The modern laboratories contain facilities for every kind of research and test in the development of aircraft, engines, propellers and instruments. There the value of all new ideas and inventions is determined.

### Japan's Modern Air Force

While the world was puzzled and debating on the thoroughness



THE NACA WATER CHANNEL

The National Advisory Committee's tank at its Langley laboratories, for investigation of seaplane and flying boat hulls. The electric carriage draws them through the water at mile-a-minute speed. This is one of the American facilities now being duplicated abroad.

with which Germany was building up her air power in 1935 the Japanese Army and Navy air forces were quietly, but none the less efficiently, modernizing their equipment and tactical organizations. At the end of 1935 Japan was in fact a power to be seriously considered in any comparison of air force strength.

"The future of our national defense is in the air," exclaimed a spokesman for the Army in demanding unlimited appropriations for 1936.

The Army and Navy air forces are modeled closely after those

of the United States Army and Navy, admittedly the best tactical organizations in the world. The Japanese Army has an organization similar to the U. S. Army Air Corps. It also is creating in that service a general headquarters air force which will become the striking force of the military establishment. The Japanese Navy's aviation service ranks second among all the powers, being excelled only by that of the United States, the most efficient Navy air force in existence.

In January, 1935, Japan possessed approximately 1,850 combat airplanes, including reserves. In January, 1936, the number had been reduced to 1,800; not through oversight or failure to build machines but due to the need for replacing obsolete equipment with new. The Navy squadrons were receiving increasing numbers of new machines at the end of the year. The Army squadrons were to receive quantities of new machines in 1936. The program provided for an increase, besides replacements, giving Japan a combat plane strength of some 2,100 machines at the end of 1936.

The Japanese Navy has approximately the same number of combat planes as the U. S. Navy. Japan has about 390 combat machines on her carriers and cruisers and 470 at shore stations. The Army has 940 combat planes, including reserves. It has an air brigade in Korea and another in Formosa. The entire Army air force is receiving assignments to duty in Manchuria, the squadrons being transferred back and forth to afford training opportunities for all.

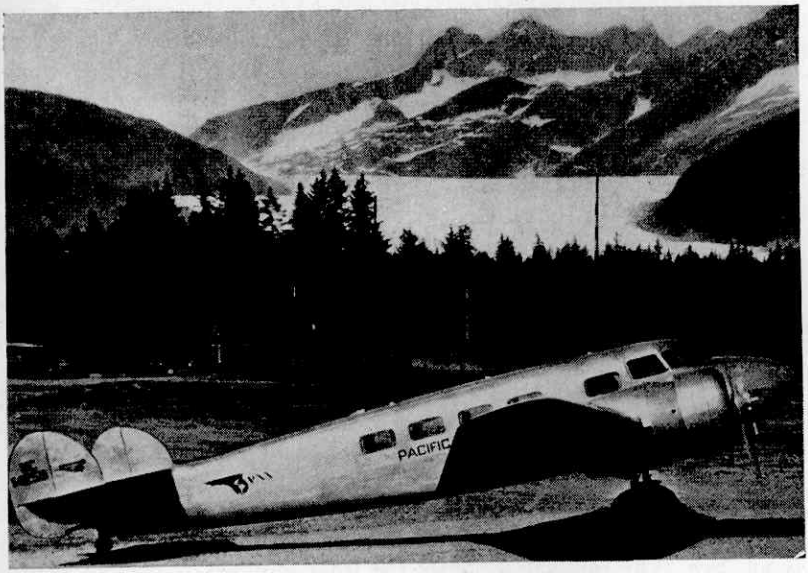
Until 1935 the average Japanese military plane was always three or four years behind those of the United States and Europe. That was because Japanese factories were building to the foreign designs and they required two or three years to get into production. But the policy of building up a domestic industry so that it shall always be self-sustaining and available for any emergency has been a Japanese policy since 1884 when the Government turned over to private companies its Navy shipyards, and thenceforth encouraged all private industries to expand to be ready to build to any Government order, however large. That policy has prevailed in Japanese aviation.

Manufacturing rights to designs of planes, engines and accessories have been purchased from all countries displaying products that show improved design and performance. Germany has been selling Japan convertible transport planes, and these are being used in Manchuria and North China.

The greatest production plant in Japan is that of the Mitsubishi company which so successfully developed Japan's naval construction program before the turn of the century. Its aircraft factory at Nogoya covers 71 acres and has 4,000 employees. In 1935 modern machinery was installed for the fabrication of all metal aircraft under

British licenses. The Kawasaki company is also building all metal planes, including twin-engine, low-wing monoplane bombers. For the first time in her aviation history Japan is now able to equip all her air forces with combat planes capable of speeds greater than 200 miles an hour.

Menaced by Russia's growing Red Air Fleet which can be sent against her most important arsenals and industries with fair prospects of bombing them into chaos unless met and destroyed before reaching their objectives, Japan is establishing huge air force bases at strategic




AIR TRANSPORT IN ALASKA

One of the Lockheed Electras operated by the Pan American Airways System on its Alaskan routes.

points from which they can be sent out to meet an enemy. The appropriations for Navy aviation have been doubled for 1936, and the Army air force is to receive unlimited funds. The 26 military squadrons will be increased by eight in 1936. The Navy's 22 squadrons are to be increased by 18 before 1938.

Japan's aviators are receiving constant training in China, Manchuria and more recently in the northern areas of the empire. Cold weather maneuvers were carried out in February, 1936, whole squadrons of planes operating under conditions which would provide expe-

rience necessary to cope, for example, with an enemy striking from the North, East or West.

### Russia Strives for Air Power

Two airplanes a day from each of 11 aircraft plants, and 10,000 machines ready for war by 1939, with legions of trained pilots available for duty on any frontier—that was the Russian plan early in 1936. Among the numerous obstacles in the way of that program is the fact that the aircraft plants cannot produce that many planes under the present system. There are not enough experienced designers to develop the various types required by any balanced air force. There are not enough aircraft plants. Technically, Russia has a long hard road to travel before being a serious competitor with other world air powers. Able officials in Russia believe that if the present air force should set out against any first-class power, Japan for example, entire fleets of planes would be destroyed without one ship reaching its objective. Relatively fast, high-flying planes could shoot down the slower machines without much danger of being shot down in return. But Russia has an air force.

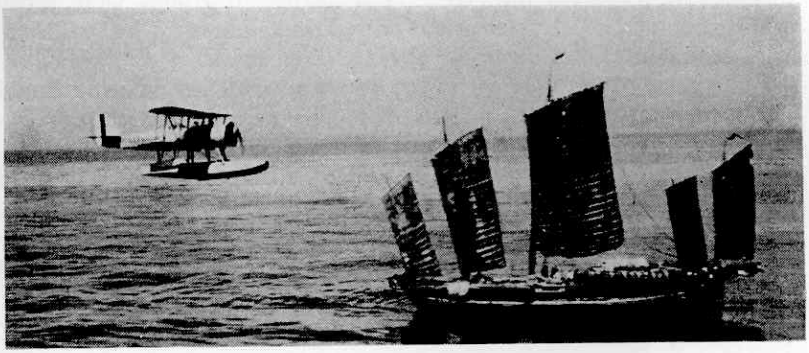
Squadrons of the Red Fleet are on active duty throughout Russia. An increasing number of able, enthusiastic young pilots are joining this air force. The number is a jealously guarded secret. As to the number of planes one finds little difficulty in reaching an approximation. Almost any observer can learn the number of machines being turned out of a factory over a certain period, and the number it can produce under the same conditions in future.

In January, 1935, Russia had approximately 3,000 so-called combat planes, some 600 of them in the Vladivostok area, others distributed among the 35 air force bases that extend from Leningrad to the Black Sea. On January 1, 1936, the total number of combat planes had increased to 3,300, and 1,000 of them were in eastern Siberia. Approximately 600 machines had been produced in 1935, an average of two for each working day for the entire country. Half that number had been used for replacements. The official program contemplated an increased production of some 1,500 combat planes in 1936; but those charged with manufacturing them knew they would not be able to produce more than half that many. A fair estimate places Russia's combat strength at 4,000 planes by the end of 1936. New bombers now being delivered to the squadrons can cruise at 150 miles an hour with 30 soldiers or two tons of bombs. They have a range of 1,200 miles.

Unlike the factories in other countries many of Russia's airplane plants are not used for building airplanes. They are devoted solely

to repairs. Only three large plants are building combat aircraft. The plant at Fili is the most modern in Russia. It was formerly the German Junkers branch. Its employees were trained by Germans. They are now working in metal, and they are building nearly all the huge metal bombing machines, planes with two, three, four and six engines. The factory contained 4,000 employees in 1935, and it was to be enlarged in 1936 to a capacity production of 1,500 planes a year, if the Soviet plans materialized. The old Dux plant in Moscow produces pursuit and scout planes. It is being expanded. The plant at Taganrog in South Russia was placed on a production basis in 1935. During 1936 it was to be expanded to a force of 7,000 workers, with a production capacity of 1,000 planes a year.

Another military aircraft plant is being completed at Voronesh.



ON DUTY IN CHINESE WATERS

A Vought Corsair from the "U. S. S. Augusta" passes one of the oldest forms of transport in Asia.

It is to have a personnel of 9,000 and the program calls for an annual production of 1,500 small, fast pursuit planes.

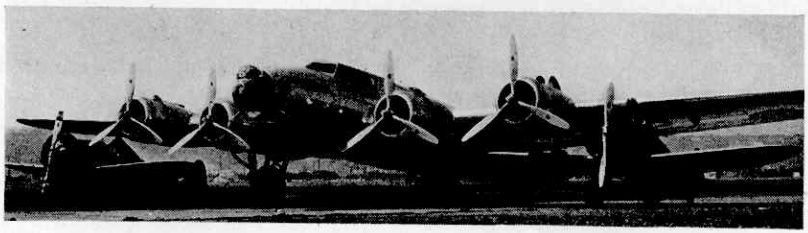
During an official celebration in Moscow when the Soviet Government could be expected to muster all available aircraft for a demonstration over the heads of foreigners, a total of 635 planes were counted, including 400 attack machines, 100 pursuit and 135 heavy bombers. The Government, however, had staged demonstrations in other sections of the country.

The Central Aero Hydrodynamics Institute at Moscow is the heart and soul of Russia's program for air development. It is rapidly being equipped with all the latest facilities for thorough research and experimentation, including wind tunnels, water channels and engine development equipment. It is responsible for the huge planes pro-

duced in recent years, although actual construction is turned over to the Fili plant.

The larger planes in 1935 had relatively low speeds, ranging between 100 and 140 miles an hour. Russia's fastest bombers could not make more than 160 miles an hour, according to reliable observers. Other factories are making commercial machines and light training planes, the designs based largely on foreign models.

If popular enthusiasm for things aeronautical means anything Russia should have a great future in the air. The country is ideally suited to aerial transportation with modern equipment and thoroughly trained personnel. It is destructive to equipment in the hands of inexperienced operators, however. But the people like aviation. They are willing to follow their leaders in any enterprise, such as parachute jumping. Thousands of young men and women became parachute jumpers in 1935. In the Army large bodies of troops were flown across country and dropped with full fighting equipment by parachute behind imaginary enemy lines; although one might reasonably question the value of such tactics on any occasion when a real enemy would be on guard. An entire company of soldiers drifting down on parachutes might easily be killed off by a squad of infantry before ever reaching the ground. But such maneuvers stir the imagination of all Russians and arouse them to great heights of enthusiasm. Elsewhere in the world official attention is concentrated solely on the more serious aspects of flying—technical development, increased production facilities and still greater effectiveness on the part of the air forces.



BIG BOEING AND LITTLE BOEINGS

Two of the Boeing Wasp-powered Air Corps P26-A pursuit ships nestle under the wings of the great Hornet-powered Boeing bomber 299. It weighs 15 tons, the little pursuits 1½ tons each.

## CHAPTER IV

### WITH THE ARMY AIR CORPS

Serious Shortage of Planes Despite Superiority of American Aircraft —Reasons for Delay in Equipping the Air Corps—Secretary Dern's Report—686 Machines Ordered—Program for 3,000 Combat Planes in Five Years—Importance of the Aircraft Industry—The GHQ Air Force—New Air Corps Bases—Activities During 1935.

ON January 1, 1936, the Army Air Corps had in active service approximately 1,200 officer pilots, 14,000 enlisted men and some 300 combat airplanes fit for real war duty. The remaining 800 machines on the Air Corps list were obsolete enough to be cast aside in any determination of actual air force strength. They were from four to eight years old, and lacked the high speed and other performance requisites of modern military aircraft. The average of three military aviators to every useful combat plane in the Air Corps evidenced the acute shortage of equipment in this important branch of the defense establishment.

That serious situation could not be attributed to ordinary causes. The aircraft plants in the United States were recognized as being fully capable of producing machines in sufficient quantities and of such high performance as to keep the air forces numerically stronger and vastly more efficient than any other air force in the world. The American aircraft manufacturing industry technically was at least 18 months ahead of any foreign competitor. It could produce any type of plane with assurance that it would be superior to similar types built abroad. Despite the armament race in Europe, which was causing the larger powers to work their aircraft plants three labor shifts a day, the products of the American manufacturers possessed far greater speed, climbing ability, load-carrying capacity and flying range. Without exception all other powers attempting to create huge air forces were following American practice in design and construction.

A majority of the members of Congress long had been in favor of maintaining the Army Air Corps at a strength commensurate with the forces of other powers. Congress was disposed to appropriate all necessary funds for that purpose. The General Staff of the Army and in fact everybody concerned with the national defense were in

agreement as to the desirability of maintaining a military air force at all times equipped with between 2,500 and 3,500 first-line planes.

Delay in providing modern Air Corps equipment could be traced to several reasons.

For several years Congress had failed to appropriate enough money to supply the Air Corps with machines which it should have been acquiring annually. Congress also failed to supply sufficient funds for experimental and development work. The equipment on hand either wore out or became obsolescent. Attempts to supply some machines with limited PWA funds did not bring immediate results.

Also, The Air Corps methods of procurement tended to create long delays between the inception of a new design and actual produc-

CONSOLIDATED A-11 ATTACK PLANE

One of the two-place attack monoplanes in the Air Corps. It is powered with a Curtiss liquid-cooled Conqueror engine.

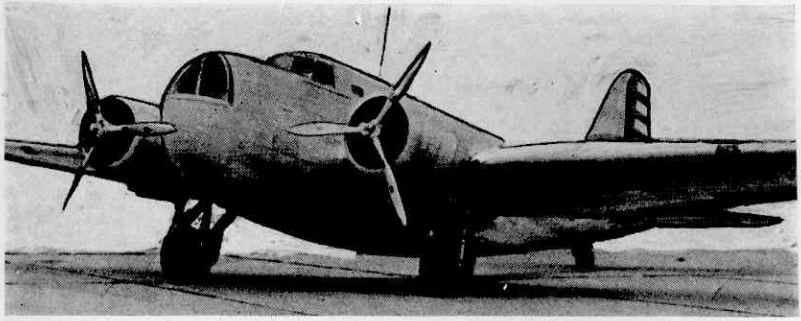
tion orders. The system did not assure a program of continuous delivery of modern machines under any circumstance.

Lastly, Congress was investigating the various phases of the Air Corps procurement system. There was considerable controversy over the methods by which the War Department should encourage manufacturers to develop new and improved designs without losing money, methods of letting contracts for experimental machines, the Air Corps methods of testing the machines, and lastly, its methods of completing tests before placing the models in production.

By 1935 the lack of funds, the Air Corps procurement system and the desire of Congress to investigate the situation thoroughly had combined to deprive the Air Corps of equipment which it should have been

receiving in annual increments for years and the need for which had become imperative. The beginning of 1936 found Congress and the War Department confronted with the immediate necessity for working out a procurement system which should be satisfactory to all concerned.

Early in 1934 the War Department had established a policy of holding design competitions and buying aircraft only through the medium of competitive bidding instead of by negotiated contracts. Summarizing results of that system, which was one of the most debatable phases of the whole procurement problem, Secretary of War George H. Dern on January 15, 1936, wrote Congressman John J. McSwain, chairman of the House Military Affairs Committee, that then, 18 months after the "present policy was put into effect the War Department has contracted for and now has on order 685 airplanes."



*U. S. Army Air Corps Official Photo*

THE NEW DOUGLAS BOMBER

Several Army Air Corps squadrons are being equipped with this machine.

Secretary Dern continued: "The first contract for this group was let on June 28, 1934, and to date 10 airplanes have been delivered thereunder. In addition, the first airplane under each of the several other contracts has been delivered and accepted. Inasmuch as this delivery may at first glance seem small, I wish to emphasize here that the major problems creating delay in the delivery of aircraft arise in connection with the test and acceptance of the first airplane under the contract and that thereafter the delivery of the remaining planes is accomplished at a very much accelerated rate. This is significantly borne out by the fact that deliveries of aircraft under the aforementioned contracts will total more than 500 during the year 1936, commencing at the rate of approximately 20 for the month of January (1936) and increasing progressively each month thereafter.

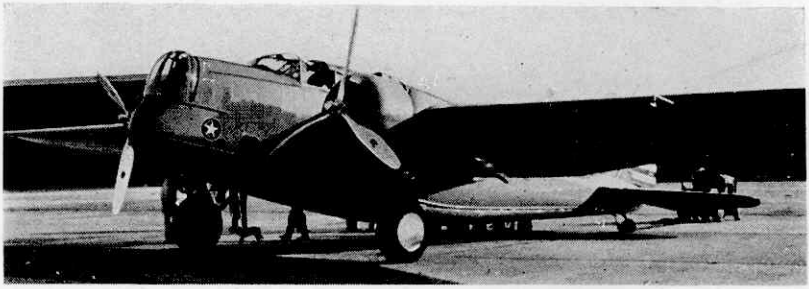
"I am going into the matter of the 'time factor' in some detail, because one of the chief criticisms against the War Department has been the length of time between the inception of an airplane design and the delivery of airplanes of this design in quantity to the tactical units in

ATTACK PLANES IN STEP FORMATION

Col. Earl Naiden leads his 3rd Attack Group over Barksdale Field, La. The planes are Cyclone-powered Curtiss A-12 all metal destroyers each carrying five machine guns and a load of bombs.

the field. Since the present procedure has been put into effect, constant efforts have been made to reduce this elapsed period. One step taken is to issue circular proposals to the trade sufficiently far in advance of the availability of funds to permit the awarding of contracts almost immediately after appropriated funds become available to the department. For example, circular proposals have already been issued to the trade covering 1937 requirements. Another step taken is the submitting of the airplane of the successful bidder to an 'accelerated service test' for a period of 90 days, which procedure will reduce to a minimum the necessity of change orders with the delays incident thereto.

"I am pleased to be able to inform you that under the new policy of competitive bidding and the subsequent improvements which have been made therein, quantity deliveries of aircraft are now being made



*Charles Jarbeau photo*

MARTIN EXPERIMENTAL BOMBER

Latest model of a line that Glenn L. Martin has developed steadily since 1918.

for tactical use within something less than two years of the date of advertising. For example, the circular proposal for attack airplanes was issued on May 28, 1934, and delivery of six airplanes has already been made, with delivery of approximately 40 more due by May, 1936. Such a rate of delivery compares most favorably with that of foreign powers on which information is available."

One of the points in controversy was that the lag of two years between design and delivery of aircraft to the air forces constitutes real danger, because the air forces cannot have the benefit of training with machines which represent the latest design. There was much varied opinion as to whether foreign powers actually delivered such old developments to their air forces. In view of the speed with which other air powers were producing service machines at the beginning of 1936, Secretary Dern's comment in his annual report for the fiscal year

1935, is of unusual interest. He stated: "Modern equipment for our Air Corps presents a somewhat special problem, because the radical changes and astonishing improvements that are being made from year to year in aircraft design indicate that the airplane is not yet a standardized article which may be safely procured in large quantities without danger of obsolescence."

The report continues: "Nevertheless, the air element will undoubtedly play an important part in modern warfare, and the latest combat planes have reached such a degree of efficiency that they will unquestionably remain useful for a number of years, even if improved models should come out. A sound preparedness policy, therefore, dictates that we should at least equip ourselves with enough of the most modern fighting planes to repel an invader at the outbreak of hostilities. At

NORTH AMERICAN AVIATION'S TRAINER

These Cyclone-powered basic trainers for the Army Air Corps have top speeds of more than three miles a minute.

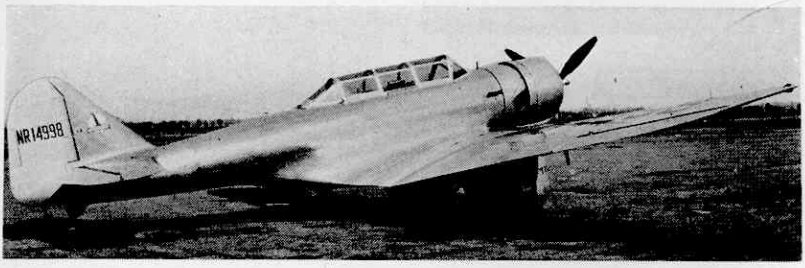
present our air force is far short of its reasonable requirements. Under the most favorable circumstances it will be several years before this shortage can be met through the adoption of an orderly procurement program. The life of an airplane is relatively short and in a few years it has either become worn out or is obsolescent by reason of new developments. Hence the annual requirements merely for replacements are high.

"With a view to developing and equipping our force with modern planes of the best type I urgently recommend the inauguration of a 5-year aircraft-procurement program under which approximately 800 airplanes of various types will be procured annually. It is estimated that of this number approximately one-half would be required for replacement purposes and the other half would augment the pres-

ent strength. At the end of this 5-year period we would possess at least 3,000 combat airplanes of modern design, plus a considerable number which could be used for training, transport, and other purposes. Last year I endorsed the recommendation of the Baker Board for 2,320 planes by the end of 3 years. It does not seem to me that the 5-year program above suggested is inconsistent with that recommendation."

The Assistant Secretary of War, Harry H. Woodring, charged with actual War Department purchases and also the maintenance of the plan for the mobilization of all industries to assure adequate supplies after a declaration of war, made the following comment in his annual report for 1935:

"I am forced to the conclusion that this country must look to its great private industry for the supply of munitions. In order to make

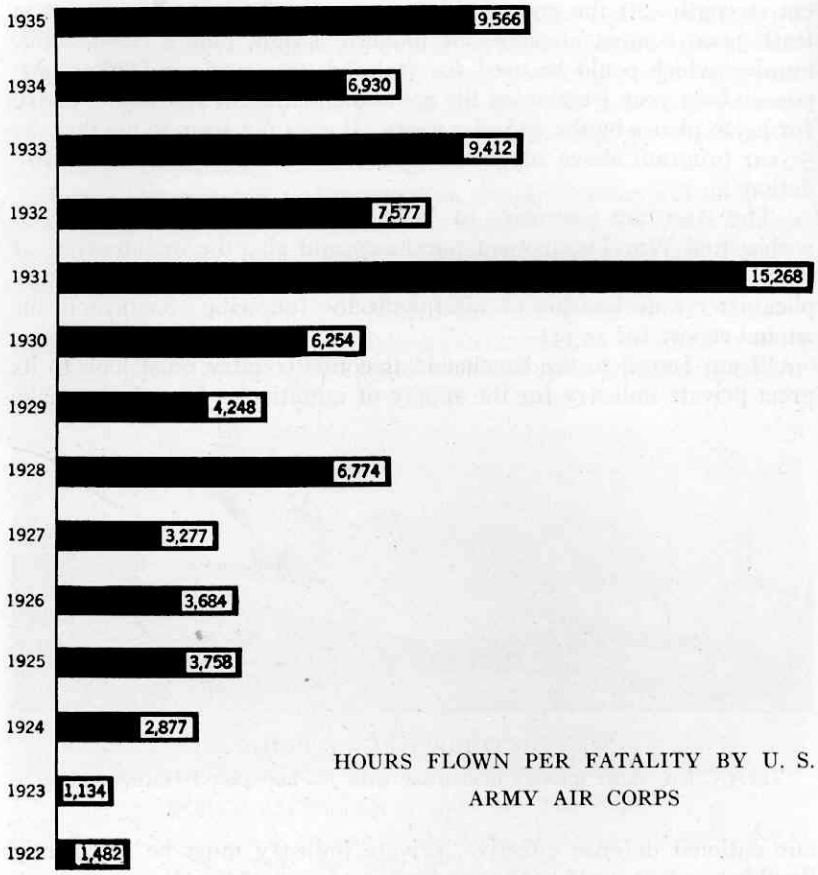



THE NORTHROP ATTACK-BOMBER

The 5-C long-range military monoplane with 750 horsepower Hornet engine.

our national defense effective, private industry must be sufficiently flexible to adapt itself to the production of war materials soon enough after the opening of hostilities. It follows that American industry should be prepared to perform its war mission. This means that industry should be given munitions work in time of peace, for any plant that has once produced munitions is thereafter better qualified to produce the same munitions in war. I feel impelled to emphasize the importance of obtaining legislation which will permit the War Department, in time of peace, to place educational orders, so that selected industries may actually produce, before the emergency arises, a limited amount of the kind of materiel assigned them for war manufacture. Under the present laws requiring competitive bidding, no assurance can be given that any selected plant could receive such educational orders."

Close observers of national affairs believed that the Assistant Sec-




HOURS FLOWN PER FATALITY BY U. S. ARMY AIR CORPS

retary of War was expressing that finding in an effort to combat the propaganda, inspired by both aliens and various socalled pacifist organizations, favoring nationalization of the aircraft plants; or failing in that, the manufacture of all Government aircraft in Government-owned plants.

Secretary of War Dern gave official recognition to the fact that alien pacifist propaganda does not meet with the approval of those charged with the defense of the United States when he made the following comment in his annual report for 1935:

"The success of an army depends upon having an adequate number of trained officers. Our scheme of national defense contemplates securing the extra officers that will be needed in war time from the offi-

cers commissioned in the Organized Reserves, who are chiefly college Reserve Officers' Training Corps graduates. This is one of the basic and essential parts of our scheme of national defense. Those well-meaning but misguided persons who agitate against military training in colleges are therefore seeking to undermine the Nation's ability to defend itself.

"The propaganda against military training in colleges is based upon the fallacy that such training instills a spirit of militarism in the youth of America. In my opinion, any candid, unbiased observer will reach the conclusion that this is a sheer assumption which has no foundation

THE AIR CORPS IN FORMATION FLYING

Wasp-powered Boeing P-26A ships of the 24th Pursuit Squadron over southern California.

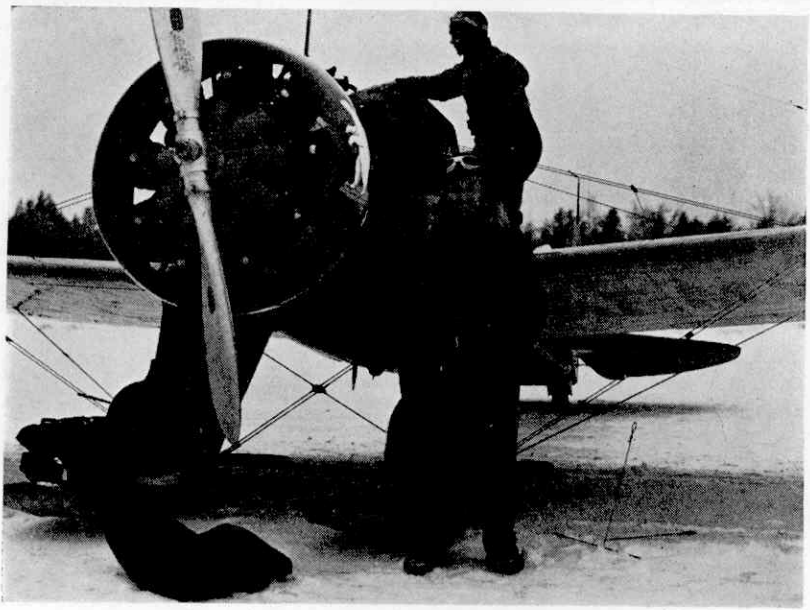
in fact. It is no rash assertion to say that Reserve Officers' Training Corps graduates are no more jingoistic or truculent in international affairs than those who have not had military training. But they are better prepared to serve their country in time of national peril.

"We must assume that all citizens, except a few who despise our form of government and desire its overthrow, think the United States is worth fighting for. If they have that patriotic feeling in their hearts they should not permit themselves to be misled by seditious propaganda, but should willingly and loyally support every agency created

by the National Defense Act, which sets up the best organization for a citizen army that has ever been conceived. The provisions of that act are entirely democratic and are consistent with the aspirations of the most idealistic lover of peace."

Early in 1935 the General Headquarters Air Force was organized under the direct command of Major General Frank M. Andrews. Secretary Dern described that organization in his report, as follows:

"One of the most important steps toward improved national defense that was taken by the War Department during the past fiscal



READY FOR COLD WEATHER FLYING

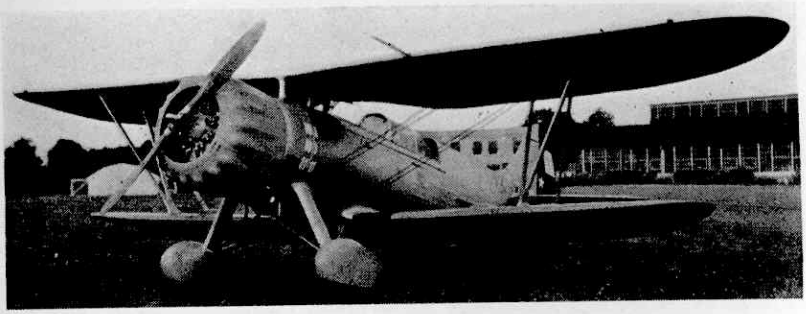
Lieut. Col. Ralph Royce, commander of the First Pursuit Group at Selfridge Field, prepares to lead a squadron on cold weather maneuvers through the Northwest.

year was the organization of the new General Headquarters Air Force. This force is composed of practically all of the combat elements of the Air Corps in continental United States, together with certain observation and service units. The various elements of the force are at flying fields throughout the country, but are so organized as to permit their concentration at any point without delay. The commanding general of the General Headquarters Air Force is directly under the Chief of Staff in time of peace and of the commander in chief of the field forces in time of war. This force is highly mobile and possesses great striking

power. It will be able to employ its mobility in such a way as to exert the maximum influence upon land defense, being ready to reinforce the Army on any front.

"The elements of the General Headquarters Air Force have been grouped in three territorial subcommands or wings, with headquarters on the west coast, the east coast, and in the south central section of the country. Each wing is strategically well located, and at the same time is in a position to reinforce the other wings.

"One important change in policy coincident with the organization of the General Headquarters Air Force is to relieve the Chief of the Air Corps of the responsibility for training, administration, and command of Air Corps units. The Chief of the Air Corps is thus enabled to give his undivided attention to procurement, technique, and aviation schools, which are of great importance in this highly technical arm.



A WACO FIGHTER FOR CUBA

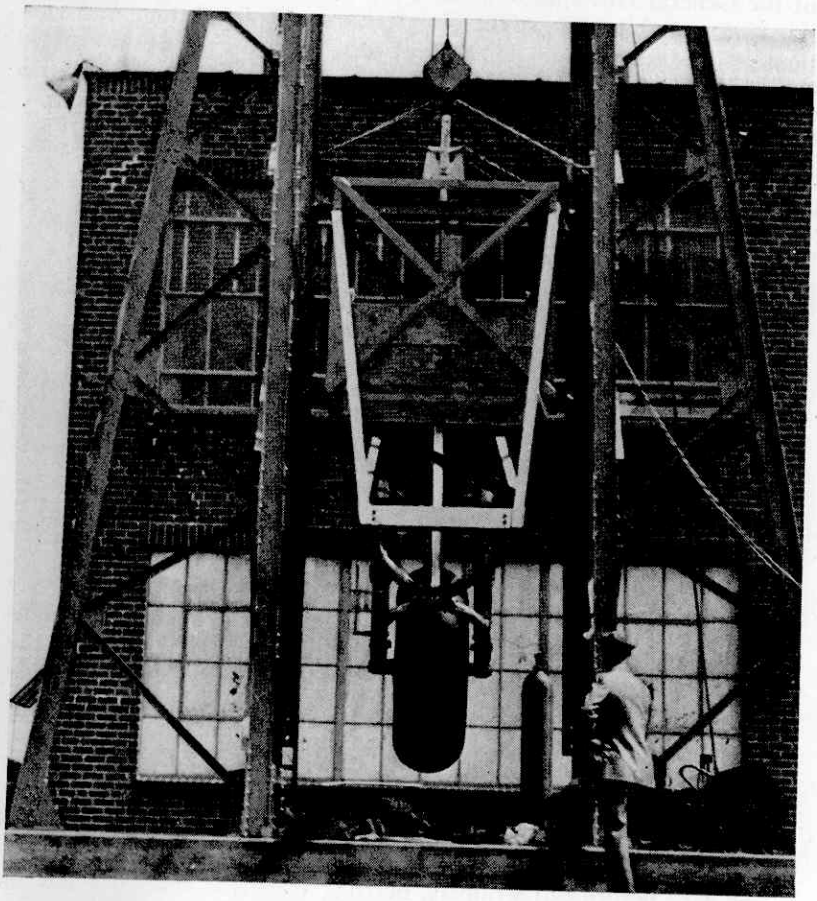
Two bomb racks and three machine guns lurk in this Wasp Junior-powered Waco S3HDA biplane delivered to the Cuban air forces.

"The Air Corps has lacked officers of rank appropriate to the command of many of its units, and because of the technical nature of the duties it was not feasible to transfer higher ranking officers to this arm. To remedy this situation, advantage was taken of authority contained in the act of 1926 and many Air Corps officers were given temporary promotions. With the enactment of the new promotion law Air Corps officers shared with other officers in permanent advancement, so that the number of temporary promotions required will be greatly reduced."

Shortly before adjournment in 1935 Congress enacted a law as suggested in the Wilcox Bill authorizing new military air bases at strategic points throughout the United States and in Alaska and Hawaii. Congress, however, failed to appropriate the money for such

bases. A special War Department board was appointed to study and report on all available sites; and Congress was to be asked in 1936 to appropriate the money for this important development. The need for such bases was imperative. Secretary Dern made the following recommendation:

"Shortly after the close of the fiscal year a bill authorizing the establishment of military air bases and depots in strategic locations became a law. This act establishes an important military air policy, but funds to carry out the purposes of the act are not available. In



SAFETY IN LANDING WHEELS

The mammoth drop test jig built by the Boeing Aircraft Company to test the landing gear of the Boeing 299 four-engine bomber. Tests revealed that while the bomber's gross weight is 15 tons, the landing gear will withstand a load of 80 tons.

order that the object of the act may be attained, I recommend that sufficient funds to begin the acquisition of land and the construction of these bases be appropriated."

A total of 924 reserve officers saw active duty with the Air Corps during the fiscal year 1935. The number of Air Corps officers in regular service decreased by 81, from 1,307 to 1,226 during that fiscal year.

The end of 1935 saw the retirement of Major General Benjamin D. Foulois, as Chief of the Air Corps. He was the first Army officer to become a military pilot, and had served 26 years in military aviation. Major General Foulois was succeeded in command of the Air Corps by Major General Oscar Westover who had previously occupied the office of Assistant Chief.

THE BOEING BOMBER PASSES MOUNT RAINIER

The 1935 four-engine, Hornet-powered Boeing 299 flying high and fast as it averaged 232 miles an hour on its non-stop flight from Seattle, Wash., to Dayton, O.

Adventure, life-saving and scientific experiments tending to make aircraft ever more efficient featured the activities of the Army Air Corps at home and abroad during 1935. By way of testing their strength and endurance in extremely cold weather a group of Air Corps officers and men with 17 airplanes of different types set out in February, 1935, under the command of Lieut. Col. Ralph Royce. The planes were equipped with wheel skis. They ranged between Selfridge Field, Mich., and Great Falls, Mont. At Sheboygan, Wis., Lieut. I. N. Ott received an assignment to fly 12 miles out over the Straits of Mackinac in a storm to land and rescue a fisherman marooned on Big Beaver Island. He returned with the grateful sur-

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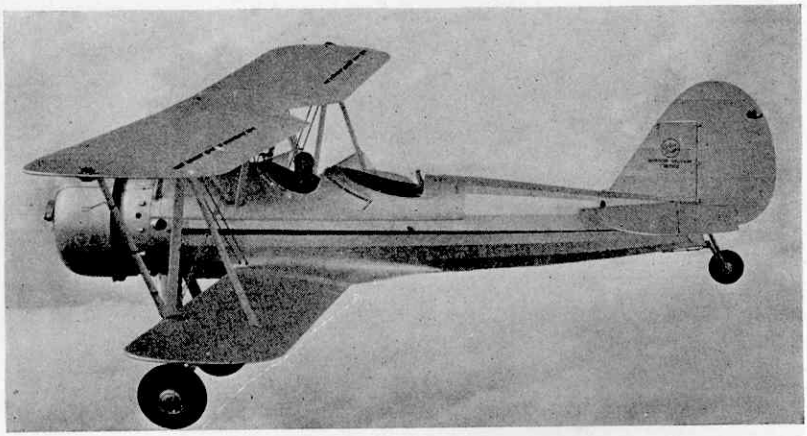
vivor within an hour. A few days later, while at Duluth, Minn., the Air Corps group received a phone call from the Commanding General of that Corps Area requesting that they send a plane to Ely, Minn., with an oxygen tank to save the life of a C. C. C. worker stricken with double pneumonia. Capt. Calcin E. Griffin and Lieut. Birrell Walsh procured two 125 pound tanks of oxygen and an oxygen tent from the Duluth Hospital, and then set out for Ely despite a blizzard which was halting all traffic on the surface. Not even a motor car was moving in that part of the country, such was the severity of the storm. The pilots had to fly within 100 feet of the surface in order to follow the railroad into Ely. At one point they flew through a canyon with snow so thick they could see nothing ahead. But they delivered the oxygen, and that



CURTISS-WRIGHT ADVANCED TRAINER

Developed for the Air Corps, and powered by a 250 h.p. Wright Whirlwind engine.

night the patient passed the crisis and started to recover. Next day the pilots started back to Duluth. When they started through the canyon in the clearing weather they found that it was only wide enough to allow about five feet clearance for the wings on each side. And they had flown through it the day before without knowing how narrow it was.

In April, 1935, a troop of young sea scouts put out to sea on a cruise, when somebody back on shore discovered that their supply of food was poisonous. The picture of a troop of sea scouts being poisoned at sea threw the authorities into a panic; and they called in the Army. Within a few minutes a fast bomber was winging its way seaward, its objective being two boats riding closely together. Within

a few minutes the boats were spotted. The bomber dived down, one of its pilots leaned over the edge of a cockpit and dropped a sheaf of messages, then waited to see if they were being read. They were. They told the boys not to eat that food, but to put back for a new supply.

Sixty members of a military training camp near Medina City, Texas, were marooned by floods in June. Airplanes from Kelly Field and Duncan Field ferried in supplies, and then flew on over the countryside, dropping parachutes laden with food whenever they saw persons isolated by the waters. On other flights the pilots dropped messages warning the inhabitants of impending floods. Meanwhile pilots of the Washington National Guard, a reserve air force of the Air Corps, cooperated with the police of Spokane in a series of tests using

FLYING HIGH AND FAST

A group of the 95th Pursuit Squadron, Army Air Corps, speeding above the clouds, in its Wasp-powered Boeing P-26A machines.

planes to locate bandit motor cars speeding over the highways, after which the location was radioed to the police cars.

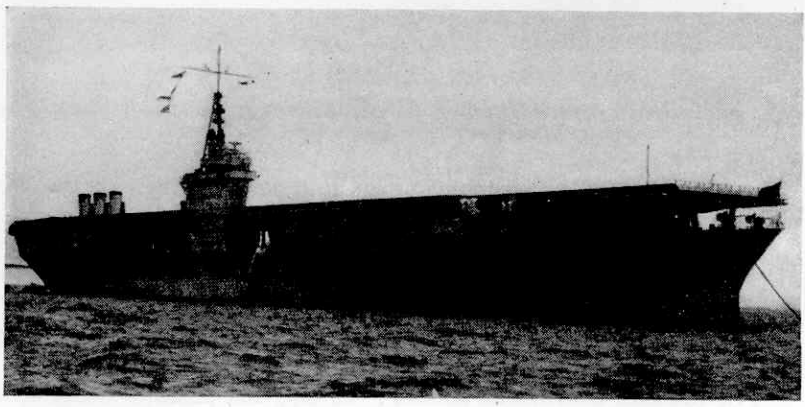
Brigadier General Henry H. Arnold received the Mackay Trophy in recognition of his leadership as commanding officer of the Army Air Corps Alaskan flight in 1934, during which 10 Martin bombers were flown to Alaska and back, 8,290 miles, without once stopping on foreign territory.

For his solo instrument landing, bringing his plane to earth at a designated spot while alone in a plane and under a hooded cockpit so that he was wholly dependent upon his instruments, and for his work in the development of instrument landing equipment, Captain Albert F. Hegenberger was awarded the Collier Trophy by the National Aero-

nautic Association. It is given annually for the greatest achievement in aviation in America, the value of which has been demonstrated by actual use during the preceding year. Lieut. Frederick L. Anderson received the Distinguished Flying Cross for heroism displayed when his plane caught fire over San Fransisco. He ordered his mechanic to jump with a parachute; and then despite the fact that the ship was almost completely enveloped in flames, piloted it across the city and far out over San Francisco Bay so that it would not fall and crash in the streets with possible destruction to others. On reaching his objective Anderson also went over the side, to be picked up by a fast motor launch as quickly as he landed in the water.

Amazing developments in aerial photography were demonstrated when Air Corps planes from March Field went up at night and photographed the Exposition at San Diego, Calif., taking pictures with the aid of flares, with results equal to those obtained during daylight hours.

During the year an increasing number of officers and men, and cadets from civilian life, were enrolled in the basic Air Corps schools at Randolph Field, Texas. Graduates of the primary school at Randolph, after their eight months course, are given four months additional training in the Advanced Flying School at Kelly Field, thus producing a military aviator in one year.



THE NAVY'S LATEST CARRIER "RANGER"

## CHAPTER V

### THE NAVY'S AIR FORCES

Pilots and Combat Planes—Secretary Swanson's Report—Aircraft Carriers—Shortage of Personnel—Naval Aircraft Factory's Plane—Rear Admiral King's Summary of Improvements—Recommendations—Operations with the Fleet—Activities During 1935.

ON January 1, 1936, the Bureau of Aeronautics, U. S. Navy, had in active service approximately 1,300 pilots and 800 combat planes, including Marine Corps personnel and equipment. Some 450 modern combat planes had been ordered, and they were being delivered to the Navy in steadily increasing numbers at the beginning of the year.

Secretary of the Navy Claude A. Swanson, in his annual report for the fiscal year 1935, stated:

"Naval aviation has made further satisfactory progress and the scope of its activities with the Fleet has been enlarged. The present system, wherein aviation is an integral part of the Navy and subject wholly to naval control and administration, has met all tests and has demonstrated its soundness."

Secretary Swanson gave the status of aircraft carriers in the following table:

| | *Total built* | | *Total built under age* | | *Building and appropriated for* | | *Additional permitted by treaty to be laid down before Dec. 31, 1936* |
|---|---|---|---|---|---|---|---|
| | Number | Tons | Number | Tons | Number | Tons | Tons |
| United States: | 4 | 92,000 | 3 | 80,500 | 3 | 54,500 | 0 |
| British Empire: | 6 | 115,350 | 6 | 115,350 | 1 | 15,000 | 19,100* |
| Japan: | 4 | 68,370 | 4 | 68,370 | 2 | 20,050 | 50 |

*May also replace *Furious, Eagle, and Hermes* (experimental ships).

The three carriers referred to as under construction for the U. S. Navy included the "Yorktown" and "Enterprise" to be completed in 1937 and the "Essex" to be completed by 1939. The carriers "Saratoga," "Lexington" and "Langley" were assigned to the battle force of the Fleet throughout the year. The new carrier "Ranger" reported to the Fleet for duty on April 8, 1935.

Secretary Swanson made the following comment on the loss of the rigid airship "Macon" off the California coast on February 12, 1935: "The cause of the casualty was a structural failure near the point where the fin was attached to the hull. As a result of this failure gas cells Nos. 1 and 2 were ruptured and deflated, being followed immediately by cell zero. A progressive breaking up of the ship's structure

THE STEARMAN NAVY TRAINER

One of 20 Stearman Model 73 trainers, with 220 h.p. Wright Whirlwind engine, purchased by the U. S. Navy.

followed and the dirigible sank in 125 fathoms of water. The vessel was extremely well handled after the accident and the crew functioned perfectly. The ship was abandoned upon hitting the water and all but two of the crew were picked up by vessels of the Fleet."

Commenting on the Navy's aircraft program, Secretary Swanson reported:

"The Vinson-Trammell Treaty Navy bill authorizes the procurement of naval aircraft in numbers commensurate with the strength of the Navy in surface ships. A tentative program of aircraft construction has been recommended which will provide approximately 1,910 airplanes by 1940-42. During the past year new airplanes have been

added to the Naval Aeronautical Organization in accordance with this program. Funds have been provided in the 1936 Budget to provide the airplanes for the new carriers "Yorktown" and "Enterprise" and six new cruisers now building."

Congress was to be asked to provide further legislation to build up the aviation personnel and also the Naval Reserve. In his report Secretary Swanson stated:

"The rapid expansion of naval aviation has created a personnel problem of the first magnitude. It will be impossible to supply all the officers for this branch from the Naval Academy. To make up the certain shortage, legislation has recently been enacted authorizing the

Official U. S. Navy Photo

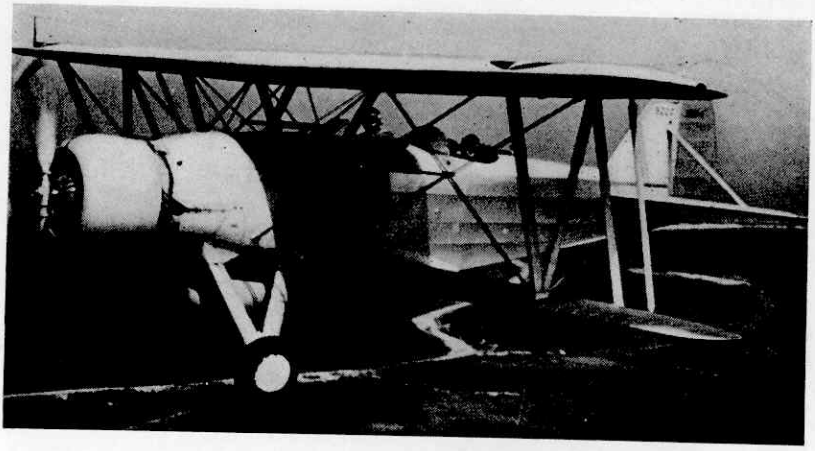
CHEVRON FORMATION OF NAVY FIGHTERS

The carrier "Ranger" sends its full squadron of Curtiss $BF_2C$-1 single-seat fighters above the clouds during 1935 maneuvers in the Pacific.

training and employment of aviation cadets for limited periods of time. In the pending line personnel bill is a provision that will further relieve the demand for officers of aviation training by lifting the statutory limit of 81 for nonflying tactical and gunnery observers. Essential corrective legislation authorizing the creation of a group of full-time technical experts within the line of the Navy for employment with matters of aeronautical engineering has been enacted into law. This act fills a long-felt need and will operate for the increased efficiency of this important group as well as assuring the future of those officers involved.

"Detailed studies have been made during the past year with a view to recommending remedial legislation for the organization and administration of an adequate Naval Reserve. The Naval Reserve Act of 1925 was in general an excellent piece of legislation and its basic principles remain unchanged, but certain minor defects have become evident during the 10 years of Naval Reserve administration under its provisions. In the near future corrective legislation for this important adjunct of the Navy will be proposed."

On August 23, 1935, the Navy Department issued a press release concerning the first plane to be built at the Philadelphia Naval Aircraft Factory under the terms of the Vinson-Trammell Act of March



Official Photo, U. S. Navy

ONE OF THE NAVY'S MYSTERY SHIPS

A bombing, fighting plane built for the naval air forces by the Great Lakes Aircraft Corporation.

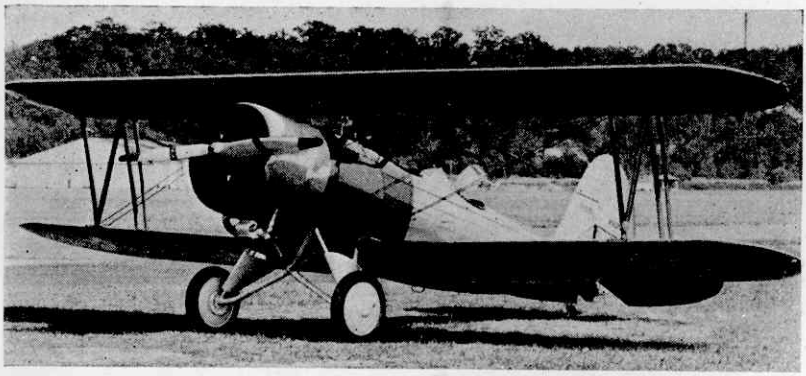
27, 1934, authorizing not less than 10 per cent of aircraft and engines for the treaty strength Navy to be manufactured in Government-owned or operated plants. That statement follows:

"The first plane produced at the Naval Aircraft Factory, Philadelphia, under the provisions of the Vinson-Trammell Act will be flown on August 27th by Naval personnel at Philadelphia. Later the plane (experimental type) designated as XN3N-1, will be delivered to the Flight Test Section, Naval Air Station, Anacostia, D. C., for regular tests which are required by the Navy of all commercially built aircraft. Designed as the third type of training plane constructed by the Navy, it is a two-place biplane, equipped with dual controls, and is convertible into land plane or seaplane. Twenty-five feet in length, it

has an upper wing span of 34 feet. The fuselage is fabric covered and the plane, powered by a Wright J-5 engine, will have a speed of approximately 125 miles an hour. Quantity production of this type of plane will be dependent upon the result of its trials, and if they are successful, it is the plan of the Navy Department to furnish these planes chiefly to the Naval Air Station, Pensacola, for use in the student training program, as well as to other naval aviation activities requiring planes of this type."

That was the last statement made by the Navy Department or any other official agency concerning this machine during 1935.

In his report for the fiscal year 1935 Rear Admiral Ernest J. King, Chief of the Bureau of Aeronautics, stated that "ever-increasing high



*Official U. S. Navy Photo*

A PLANE OF GOVERNMENT MANUFACTURE

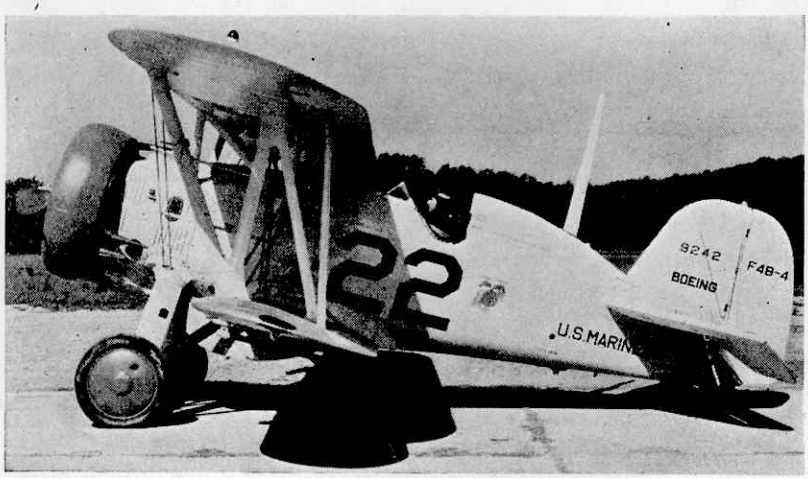
This is the XN3X-1, a trainer, built at the Naval Aircraft Factory in 1935.

speeds have increased the take-off run and landing speed (of planes), both of the most extreme importance on board a carrier. The improvement in controllable pitch propellers and the development of landing flaps have improved the landing and take-off characteristics of aircraft to the extent that carrier aircraft are now provided which compare favorably in performance with the land planes which operate entirely from fields ashore."

Admiral King also reported the overhaul of 488 airplanes and 748 engines at naval aviation overhaul bases, and a substantial increase in the number of flying hours between overhauls. The following recommendations for the new year were made:

(a) Provision of personnel required by the prospective increases in the Naval Aeronautic Organization.

(b) Method of carrying out provisions of Aeronautical Engineering Duty. Act of June 5, 1935.
(c) Provision of adequate tender facilities for patrol planes.
(d) Improvement and increase in shore facilities at Naval Air Stations and Fleet Air Bases to care for projected increase in number of naval aircraft.
(e) Establishment of a Naval Air Station in the San Francisco Bay Area.
(f) Construction of Margarita Breakwater at Fleet Air Base, Coco Solo, C. Z.
(g) Improvement in existing carriers and seaplane handling and launching facilities in other ships.




A FLYING MARINE

U. S. Marine Corps pilot ready to hop off in his Boeing F4B-4 single-seat Wasp-powered Navy carrier fighter. He carries two machine guns and underneath the wings, racks for 50-pound bombs.

Admiral King also commented on reserve equipment and training, as follows:

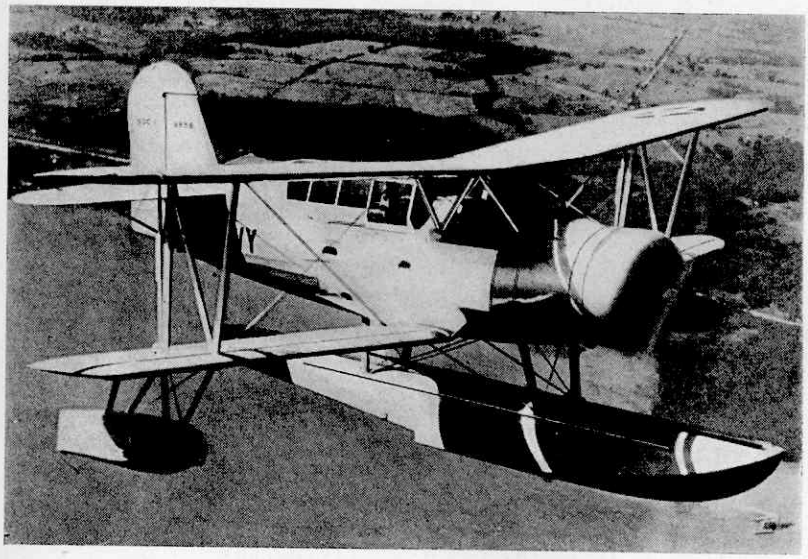
"The material condition of the reserve planes is good in view of their age. A replacement program has been begun and will continue during the fiscal year 1936.

"Forty-eight Naval Reserve and twelve Marine Corps Reserve students received elimination training at Pensacola, of which twenty-four and six, respectively, were selected for flight training.

"Because of the fact that there was no class in flight training in the fiscal year 1934, there were no reserve officers on active duty with aircraft squadrons of the Fleet during the current fiscal year.

"No funds were provided for flight training of any aviators of the Volunteer Reserve, and if this class of reserve officers is not given refresher flight training shortly the members thereof will cease to be aviators and this loss will be serious. Already an adverse effect has been manifest.

"The Aviation Cadet program as now contemplated will prove very valuable, first in making up the existing deficit of Naval Aviators in the Fleet and, second, eventually building up the Reserve to a proper size."



*Official U. S. Navy Photo*

A NEW SCOUT FOR THE NAVY

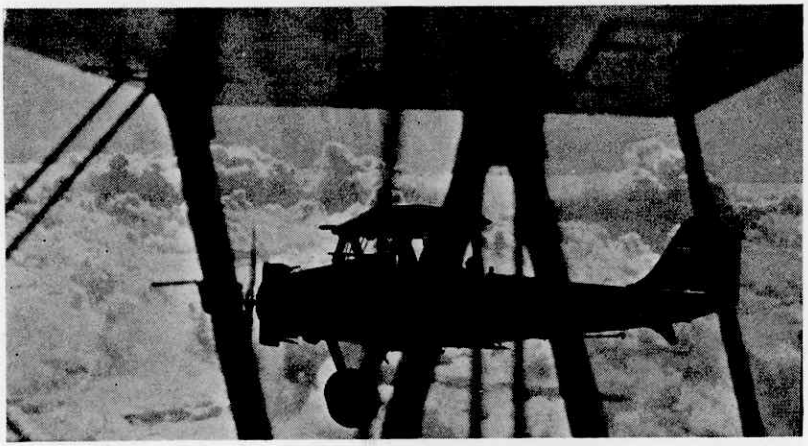
One of the Curtiss SOC-1 observation-scouting biplanes delivered to the Navy in 1936.

The Navy was able to spend only $1,800,000 for experimental and development work during the fiscal year 1935, as compared to $2,226,-222 in 1934. That decrease of $426,222 was believed to be serious in view of the rapidity with which other nations were increasing facilities for development work, planning to keep abreast of all rivals in the technical development of naval aviation. Nearly a half million dollars was lopped off the Navy's budget for replacement aircraft during the fiscal year of 1935, the amounts available being $6,607,230 in 1934 and $6,130,000 in 1935, a decrease of $477,230.

The report of Admiral King also contained these comments of interest:

"An unexpected and drastic rise in the price of gasoline increased the cost of operating aircraft about $400,000.00 over anticipated expenditures. In order to keep inside the appropriation without reducing the number of aircraft in operation a policy was adopted of authorizing only the most urgent repairs and improvements at shore stations, and postponing all other work until adequate funds become available.

"During the fiscal year 1935 the President made $12,902,722 available to the Navy Department from the Emergency Appropriation Act,



THE NAVY GOES ABOVE THE CLOUDS

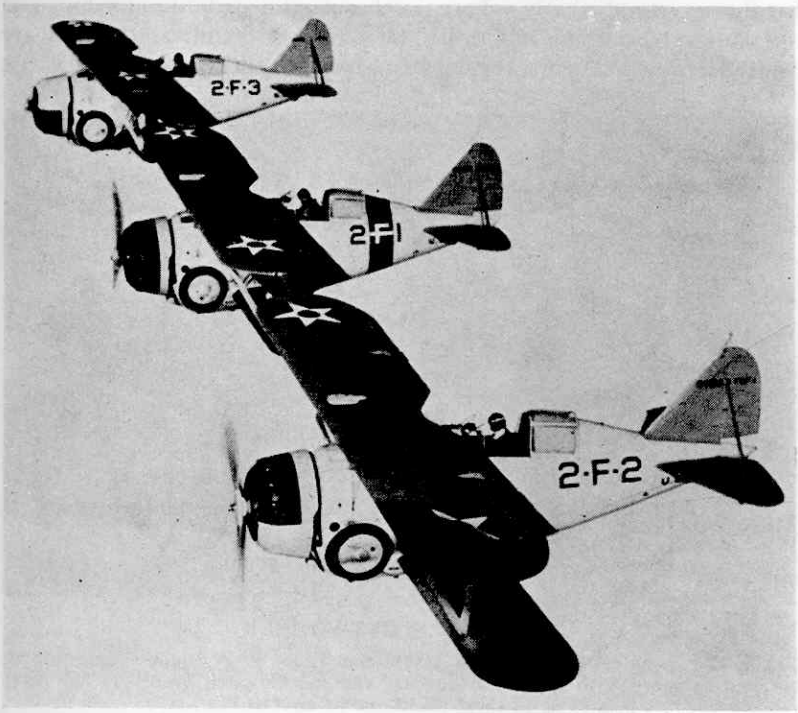
Hornet-powered Vought Corsair as seen from a sister ship during a patrol flight from the aircraft carrier "Lexington."

fiscal year 1935, for the purchase of the first installment of the aircraft which are to be added to the Naval Aeronautical Organization under the provisions of the Act approved March 27, 1934, authorizing the procurement of naval aircraft for vessels and other naval purposes in numbers commensurate with a treaty navy. The same act directed that existing plants, factories and facilities owned by the Government shall be expanded and equipped to enable the Government to construct, manufacture and repair not less than 10 per cent of its naval aircraft therein. To carry out this mandate the President made an additional allotment from the Emergency Appropriation of $2,708,800 to bear the cost of expanding the naval aircraft factory at Philadelphia."

The Congressional Record of January 16, 1936, (Appendix Page 532) contains a description of activities at the Naval Aircraft Factory,

by Rear Admiral W. C. Watts, commandant of the League Island Navy Yard, during an address before the Philadelphia Rotary Club on November 18, 1935:

"This being naval aviation night for this club, I want to allude particularly to this naval aircraft factory in our navy yard, which plays an important part in the general scheme for the administration of naval aviation. The factory is organized as a separate department




*Official U. S. Navy Photo*

GRUMMAN F2F-1 NAVY FIGHTERS

Lt. Comdr. Andrew Crinkley leads a formation of his VF Squadron 2B from the aircraft carrier "Lexington."

of the yard and, through the commandant, is controlled largely by the Bureau of Aeronautics of the Navy Department, whose distinguished Chief you have had the pleasure of hearing this evening. It has its own manager and its own supply department, and is located in its own distinct area of the yard, occupying the entire eastern end of League Island. It employs about 1,400 men and women, with a pay roll of

about $220,000 per month, these figures being included in those already given for the yard as a whole. The total cost of operating the factory is about $4,000,000 per year, which is its contribution to Philadelphia's economic life blood. Its supply department received articles in the past year costing about $12,000,000, and its annual issues exceeded that sum by a million and a quarter dollars. The value of its stock on hand is about $10,000,000.

"The naval aircraft factory has a varied mission. It is a central depot for the service of supply, where purchase and distribution to ships and operating stations of practically all naval aeronautical supplies are centralized. It is a central repair base, for both the Navy and the Coast

A VOUGHT SCOUT-BOMBER

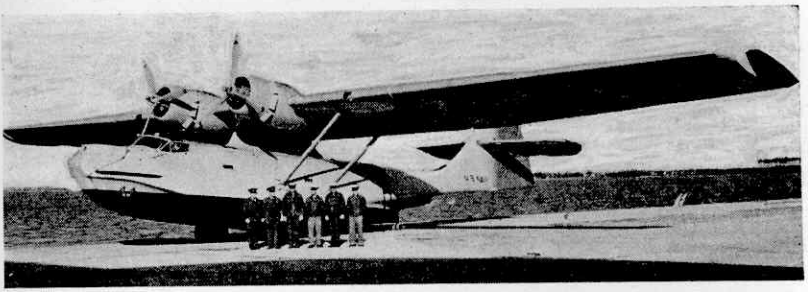
The SBU-1, powered with a Pratt & Whitney Twin Wasp Junior engine of 700 h.p. and equipped with Hamilton Standard controllable pitch propeller. The Navy bought 84 of these planes for its aircraft carriers.

Guard, and a manufacturing unit for airplanes and engines, and serves as an experimental station for all types of aeronautical test and research. It is equipped with highly developed laboratories for research and testing of aeronautical engines and structures, and for many operating and flight problems. Its flight activities require an extensive modern flying field and beach. Mustin Field, while not a commercial operating field, does serve as a very useful terminus for Federal and State planes, and makes an ideal emergency landing lighted field directly on the Camden-Washington Airway.

"Besides its contribution to Philadelphia's economic life, the aircraft

factory, being a Government-owned institution, not operated for profit, can and does maintain the highest standards of design and workmanship in the aeronautical art. These standards of design and workmanship, determined and maintained, and the findings of its laboratories available, except in confidential matters, to the entire aviation industry, together with the trained personnel in both professional and mechanical callings which the factory constantly turns out into that industry, are invaluable contributions toward attaining practical and safe commercial and military aviation."

When the U. S. Navy held maneuvers in the Pacific during the spring of 1935 nearly 450 airplanes of the Navy's air forces went out over the ocean on day and night assignments, either as "the eyes of the Fleet" or bombers to sink a theoretical enemy's fleet coming up to attack the Hawaiian Islands. On countless flights the



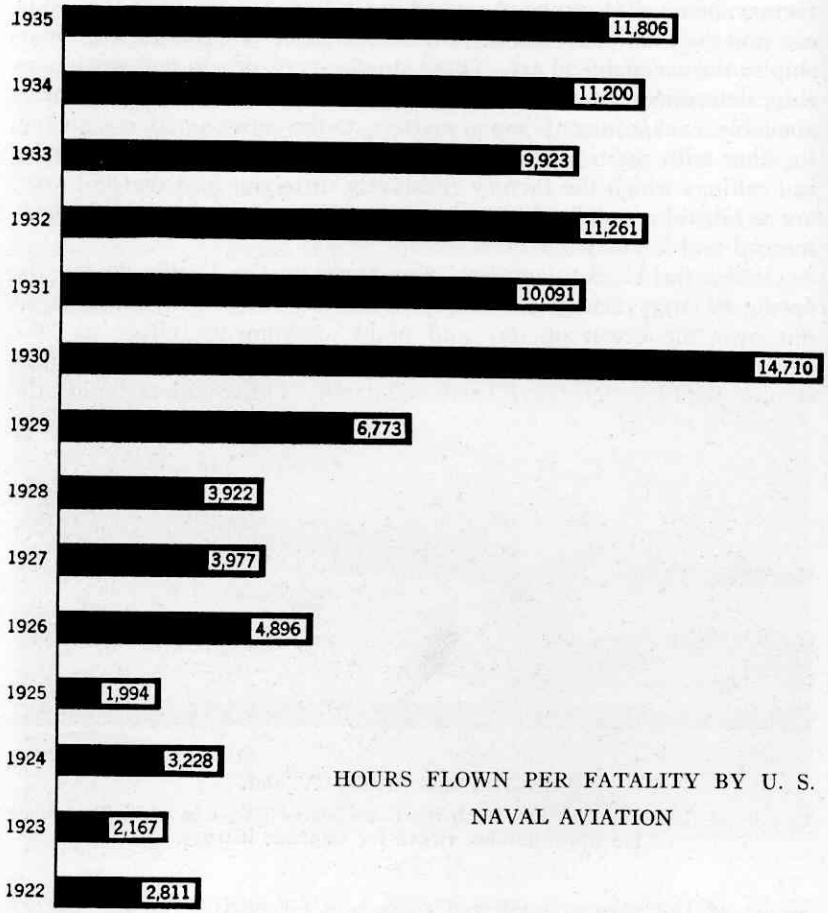
*U. S. Navy Official Photo*

LONG-RANGE NAVY PATROL

Comdr. McGinnis and his crew with the Consolidated PY3-1 in which they made the world distance record for seaplanes in 1935.

crews of the planes navigated their winged craft over the watery wastes by instruments only, flying in all kinds of weather, when storms swept suddenly out of the distant horizon to blanket the sea and blot out the sky with black, impenetrable clouds. There were nights without a star to guide these eagles of the Navy along their course, nights when mountainous banks of fog rose up from the water in the path of the flying squadrons, long barriers of mist and rain through which the sharpest eyes could not see even a few feet ahead. There were winds of gale force that rocked and buffeted the speeding planes, as if an angry sea at its worst behavior were reaching up with wet and tentacled hands to grasp these fast ships of the air and pull them off their line of flight into some lost port of the skies.

Such a flight was that of the massed squadron of 43 patrol boats

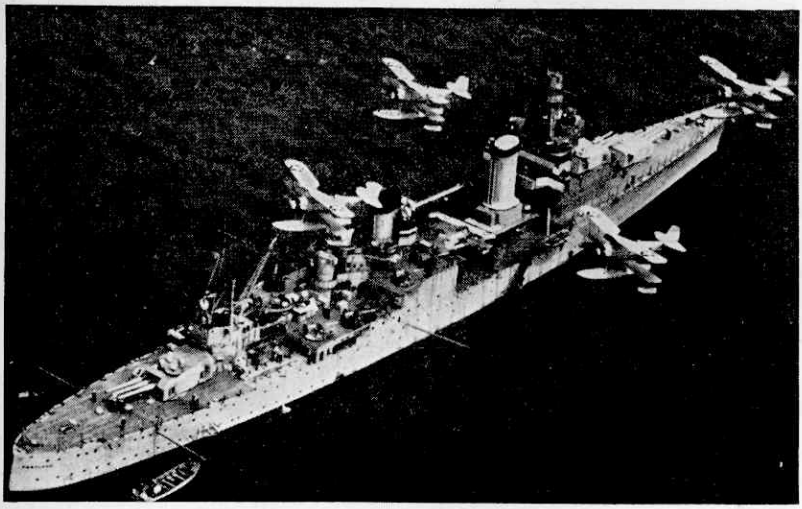



HOURS FLOWN PER FATALITY BY U. S. NAVAL AVIATION

which Comdr. E. W. Tod led out of Pearl Harbor, Honolulu, on May 9, bound for the Midway Islands, 1,323 miles away. The great carrier "Lexington" lay at Midway, her squadrons awaiting the patrol planes before attacking the opposing force which included the carriers "Ranger" and "Langley." For more than a week hundreds of planes scouted and bombed and brought back invaluable facts about what the others, the enemies, were doing. Only one tragedy marred this greatest air force demonstration in the Navy's history. Fifty miles at sea off Midway a giant patrol ship was forced down to the surface. Lieut. Harry Brandenburger and his crew of five came up in their patrol plane and hovered overhead, meanwhile sending radio calls to

surface craft, one of which came up that night and took the disabled plane in tow. At that juncture the radio calls from Brandenburger's plane ceased abruptly. Next day searchers found an oil slick and a few bits of wreckage. The sea had claimed another sacrifice to the cause of preparedness in the air.

Nevertheless, Rear Admiral King reported that a complete survey of naval aviation proved conclusively that flying in the Navy had become three times as safe as it was 10 years ago, the Navy aviators doing three times the flying for each serious accident. For the naval squadron with the best record for safe flying Training Squadron Two was awarded the Herbert Schiff Memorial Trophy for the fiscal year



EYES OF THE FLEET

Wasp-powered Vought Corsairs over the cruiser "Portland."

1935. The squadron flew a total of 18,699 hours without serious accident during the 12 months. Other squadrons flew all year without serious accident and with nearly as many flying hours as the winner of the Schiff award.

The flight of Lieut. Comdr. Knefler McGinnis and crew from the Panama Canal Zone to Alameda, Calif., non-stop, in the first of the Navy's new fleet of 60 Consolidated patrol flying boats is described at length in the chapter on notable flights.

Lieut. Comdr. Herbert V. Wiley, heroic captain of the rigid airship "Macon" which was wrecked off the California coast in February, 1935, received a letter of commendation from the Secretary

of the Navy for "heroic and prompt action" in saving the life of a brother officer after they had abandoned the sinking airship. Its huge hulk had crashed down on Lieut. George Campbell leaving him hurt and dazed. Comdr. Wiley saw it, and disregarding the imminent danger, swam into the swirling waters about the wreck, reached the officer and bore him out to the safety of a life raft. In July the Secretary of the Navy commended Lieut. Comdr. Ralph S. Barnaby for his remarkable success in gliding experiments during the last 25 years. Barnaby was the first to make a glider descent from an airship.

In 1935 several classes of aviation cadets received instruction at Pensacola in the course of an intensive program to build up the Naval Aviation Reserve. Nearly 500 cadets were to receive training during the 1935 program. The Mayor of Toronto, Canada, in June wrote the Commandant of the U. S. Marine Corps congratulating him on the amazing performance of Lieut. Col. Roy A. Geiger's flying detachment of Marines from Quantico, Va., when they gave an aerial acrobatic performance over the Canadian city. The Marines also gave a thrilling flying show during the National Air Races at Cleveland in September.

Every day of the year a Navy plane takes off from the air station at Anacostia, near Washington, D. C., and flies up to a height of 17,000 feet, to collect data for the Weather Bureau and the Department of Agriculture.

A RESCUE AT SEA

The Coast Guard flies out to take off the crew of a burning fishing boat in March, 1935.

## CHAPTER VI

### THE FLYING COAST GUARD

Strength of Coast Guard Aviation—Statistics for 1935—Adventures Over Land and Sea—Life-saving from the Air—Mercy Flights —Spotting Outlaws—With the Ice Patrol—Aircraft in Coast Guard Service.

ON January 1, 1936, the aviation division of the U. S. Coast Guard had in active service 48 pilots and 43 airplanes. The aviation units were located at Salem, Mass., Cape May, N. J., Miami, Fla., Biloxi, Miss., San Antonio, Tex., San Diego, Calif., and Port Angeles, Wash., with a headquarters detachment on duty in Washington, D. C. Seven officers were receiving flight training at the naval air station, Pensacola, Fla.

Arrangements had been made to establish a new flying base at Floyd Bennett Field, Brooklyn, New York. Another base was to be set up at Charleston, S. C. New shops and a hangar were being completed at Cape May, N. J., and a new station was to be constructed at San Diego, Calif.

During the fiscal year 1935, 15,617 aircraft were sighted and checked at Coast Guard life saving stations. Coast Guard planes cruised 527,756 miles during the 12 months, over land and sea, day and night, in all kinds of weather. An aggregate of 6,601,192 square miles was covered by the Coast Guard pilots on patrol. They spent 5,709 hours in the air. They identified 16,225 surface vessels, large ships and small, liners, yachts and small pleasure craft. On 143 separate occasions during the 12 months Coast Guard planes rendered assistance to persons in distress. They transported 42 emergency cases by air. Coast Guard observers on flying patrol located 159 illicit stills which were later destroyed. Fifteen commissioned officers and 10 enlisted men were graduated from Pensacola as full-fledged pilots during the fiscal year 1935.

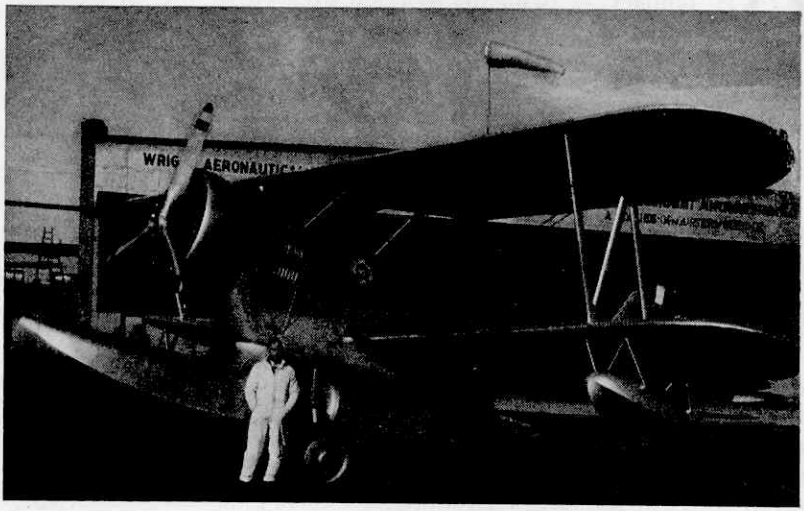
Commander E. F. Stone, one of the heroes of the first ærial crossing of the Atlantic, the flight of the Navy NC-4 in 1919, and Lieut. R. L. Burke, both of the Coast Guard, established flight records during the year.

The radio man at the Miami air station of the U. S. Coast Guard was humming a tune to himself as he glanced out the window. It was, or should have been, the most peaceful hour of the day, that hour of

twilight when the summer sun leaves the earth in a mellow haze and the sky blends with the land and sea in one quiet, restful scene. But not on this evening of June 24.

In place of quiet there was tumult. No soft blending of mellow colors here. There was no evening sky. It was streaked with black. Heavy clouds scurried low and lashed the sea into foam-crested waves. Far out over the horizon lightning flashed, long brilliant flashes as yet too far off for the echoing thunder to be heard.

All the same it was going to be a bad night out there, and the radio man congratulated himself on his nice soft berth ashore. From where he sat he could see the hangar all snug for the night, its great seaplane



CYCLONE-POWERED GRUMMAN AMPHIBION

One of the Coast Guard utility planes on land at Caldwell, N. J

"Arcturus" nicely sheltered behind closed doors. Not far away the lights were being switched on in the officers' lounge and men were gathering in the club room, with nothing to do until the regular patrols on the morrow. Then the wireless commenced spitting signals.

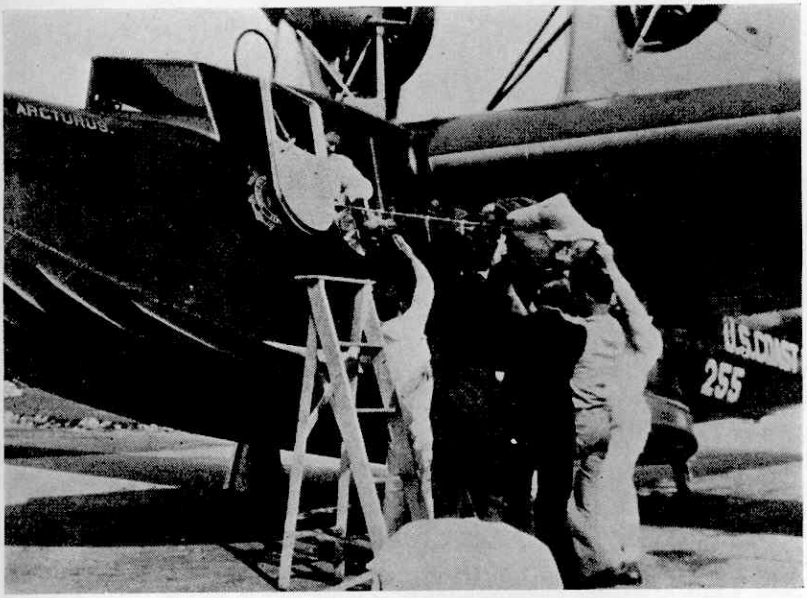
They were for this station. For several minutes the radio operator was kept busy unscrambling a terse message out of the static cast up by the storm. The Army transport "Republic" bound for New York from Panama and now 270 miles off Miami had on board an officer, Major Walter Gullion. He was desperately ill. Could some means be found to get him ashore to a hospital, for an operation?

Within two minutes Lieut. Olsen, the Coast Guard commander at

that station, had the message and was dictating a reply. As if making a simple, routine appointment, the message read that a plane would contact the "Republic" at five o'clock next morning off Hole-in-the-Wall, Fla. Back came another message. That would be too late. The patient must be operated on that very night to save his life.

Olsen and his men glanced at one another for a brief moment. There was a picture of a ship tossing in the waves out there nearly 300 miles from shore, and a sick man aboard whose life might be saved, if—

Then orders came thick and fast. Like firemen climbing into boots



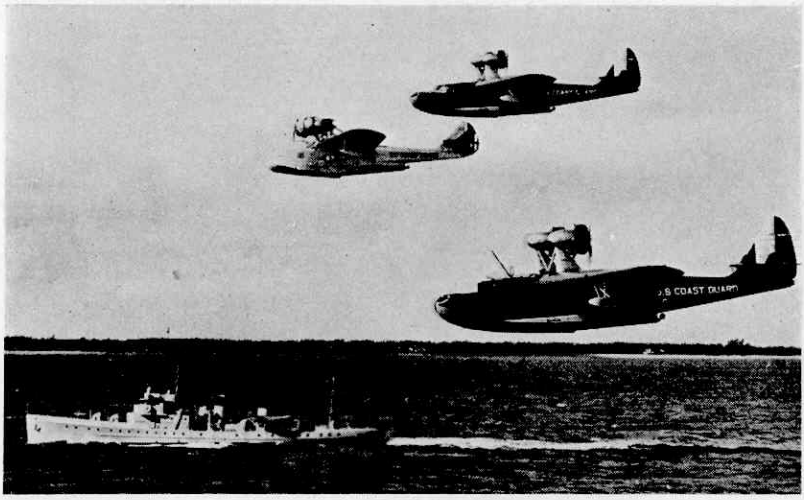

INJURED SAILOR IS FLOWN TO PORT

The Coast Guard plane "Arcturus" flew far out to sea in response to a radio call from the "S. S. Cerro Ebana" and brought him back to Miami.

and rubber coats even before the shrill alarm of the clanging bell should end, these guardians of the coast had donned flying togs and were running toward the hangar which now was being lashed by the first great pelting onslaught of the storm. The doors of the hangar swung open. The "Arcturus" was wheeled out on the ramp and down into the water, with engines warming up. Lieut. Olsen was at the controls, his crew at their stations, the radio operator ready to start send-

ing as quickly as they should get into the air and the antenna could be lowered.

All that was only a matter of a few minutes. Then the "Arcturus" was lifted free of the tumbling waves and its bow pointed straight toward the position of the "Republic" 270 miles away. Lightning appeared to be the chief obstacle at first. It might knock out the radio and prevent their keeping on a true course. Heavy winds, however, proved worse than the lightning, for they came in gusts and they struck the seaplane on first one side then the other, and constantly swept it off course, but the trained hands at the controls immediately swept it back again. Straight into the blackest part of the storm sped the "Arcturus."



THE COAST GUARD ON PARADE

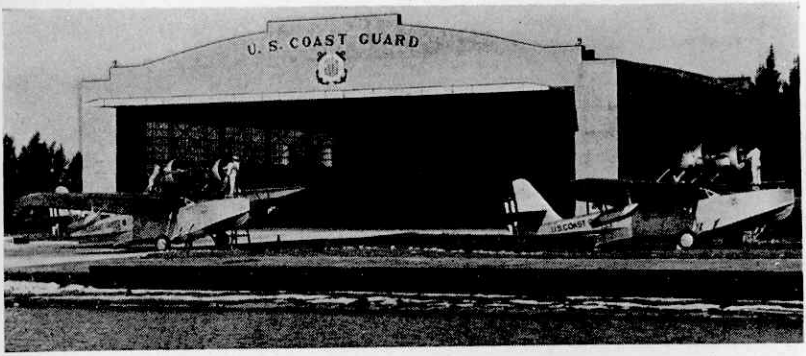
With a surface cutter and two North American Aviation flying boats and one Douglas amphibion the Guardsmen pass in review.

All eyes peered ahead searching the murk for a single beam of light that would mark the "Republic" which was steadily sending forth radio messages, and despite the lightning maintaining close, if invisible, contact with the rescue craft. The transport had radioed that her searchlight would be on. Would the tumbling clouds and rain obscure its rays?

No matter, so long as the radio worked, because it would serve as a straight line of flight. For three hours and a half the seaplane and its crew crept through the storm, long hours and tedious, as any one knows who has encountered head winds over the watery waste in a

storm at night without even a star for company. But the hours passed, and the radio man continued to hand up messages showing that they were gradually coming up on their objective. Then a speck of light, as small as that from a candle at first, then stronger, momentarily stronger, and soon the "Arcturus" was circling the "Republic" now showing all lights and pointing her beacons into the wind to show the seaplane a good landing course. Down glided the "Arcturus" kissing the tops of the waves at first then settling slowly on the choppy sea. The crew of the transport and its passengers cheered.

Tense moments followed. A lifeboat was being lowered. Steady hands pulled it over the rough waters toward the seaplane. Equally steady hands grabbed the lines and hauled the boat alongside. There was the patient on a stretcher. There also was a woman, muffled in oil-




THE COAST GUARD AT MIAMI

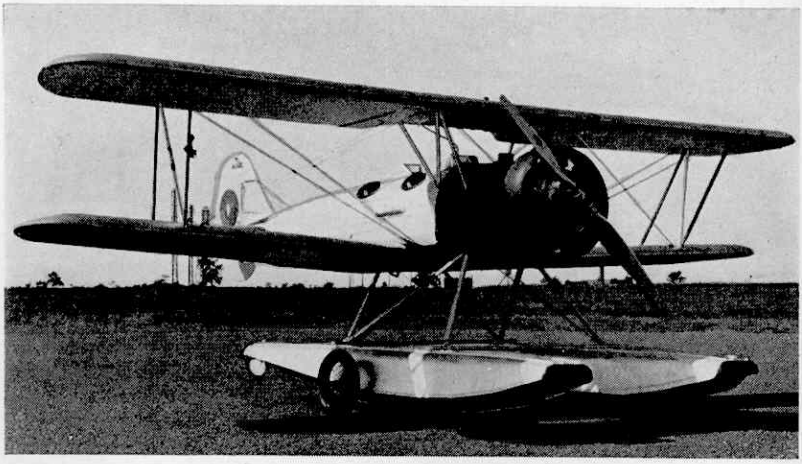
The planes are Douglas Wasp-powered amphibions with which the flying Guardsmen made many rescues during 1935.

skins against the pelting rain. The officer in charge of the lifeboat explained. The Major's wife had refused to leave her husband's side. Where he went there would she go, too. So she was flying ashore with him, in a storm. They helped her through the hatch in the bow of the boat. Again the nose of the "Arcturus" was pointed into the wind. Its propellers hummed. The "Republic" blew a long series of blasts on her strongest whistles. In the language of the sea they meant "Well done!"

Ten minutes after midnight the driver of an ambulance waiting at the air station looked up into the sky and then started the motor. The landing lights of the "Arcturus" showed that it was gliding in with its patient. Within a few minutes Major Gullion was in the hospital being prepared for an immediate operation, which was successful, and

he soon was on the road to complete recovery. Exactly six lines in the official Coast Guard records remain as evidence of that flight into the storm, 540 miles of ocean flying to save a life.

Two boys and a girl adventuring in a sailboat off the coast near their homes at Naranja, Fla., were caught by a gust of wind which capsized their craft. Bravely they set to work, managing to cut the mast adrift and righting the boat. They had to climb in quickly, however, because the sharks had come up and were swimming slowly but in narrow circles around the disabled craft which was nearly full of water. Night came on. The wet and hungry trio huddled in the little boat, expecting it to sink momentarily. Thus they



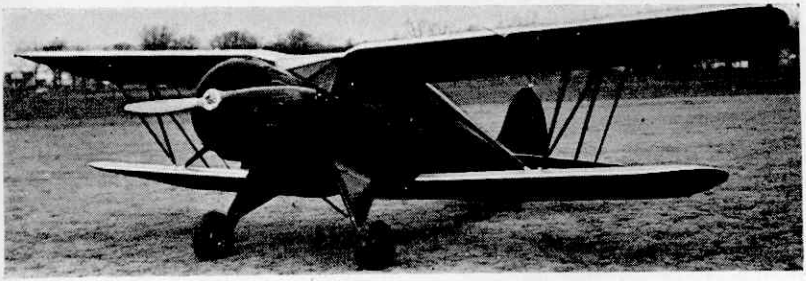
CONSOLIDATED MODEL 21 SEAPLANE

A two-place training or observation ship powered with a 250 horsepower Wright Whirlwind engine.

spent the wretched hours until daylight, which was even more terrifying because they could then see the sharks. Meanwhile when they did not return home that forenoon their parents notified the Coast Guard; and soon a plane was skimming over the sea. Five miles east of Miami the Guardsmen found the derelict, and they also saw the sharks waiting patiently for their expected victims. After 13 hours of blood-chilling adventure the three were picked up and brought safely ashore within a few minutes.

No less than four or five times every month the flying contingents of the U. S. Coast Guard were called upon to save human life during 1935. Not adventure but comfort, the most comfortable way of trans-

porting a very sick man, led his doctors to place Angus W. McLean, former Governor of North Carolina, aboard a Coast Guard amphibion and fly him from Atlantic City to a hospital in Washington, D. C., in May. It saved him many hours of painful traveling on the surface. When ice floes choked the lower Potomac River and Chesapeake Bay in January, Coast Guard planes went up almost daily dropping food and other supplies to fishermen and game protectors marooned on the islands and cut off from all communication with the shore. In August a Coast Guard plane from the Cape May, N. J., station took a Navy doctor aboard and sped 275 miles straight out over a rough tempestuous sea to take an injured seaman off a tanker and fly him to the Marine Hospital at Norfolk, Va., in time to save his life. A hundred miles out in the Atlantic one day in March, Ivan Armistead, a seaman on the freighter "Cornelia," fell through an open hatch and cut his head so badly that he soon was in danger of bleeding to death. The



WACO STANDARD SERIES CABIN PLANE

ship's radio sent out an appeal for help. A Coast Guard amphibion hopped out of the Cape May station and within two hours Armistead was in the sick bay of the air station, resting comfortably and out of danger.

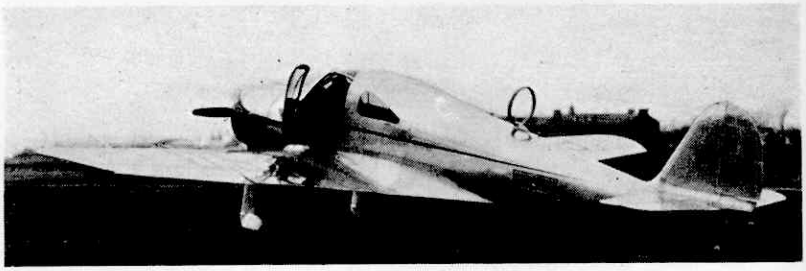
The Coast Guard air patrol at San Antonio, Tex., in June worked with the Red Cross throughout the flood area along the Colorado River. All railroad and highway bridges were checked for damage, and warning sent to nearby towns. Inhabitants of the lower valley were notified by parachute messages so they were able to escape the flood. Two families stranded on top of a floating barn were rescued. The Governor sent his personal thanks for the magnificent work of the Coast Guard. Over a most dangerous terrain of mountains and ravines made impassable by spring storms the Coast Guard patrol from the San Diego, Calif., station in April went out to pick up a

typhoid patient and the doctor attending him. They were brought back to San Diego and placed in a Navy ambulance waiting at the field.

Poachers, outlaws and gangs of criminals fleeing from police officers were harassed and on many occasions actually run down by Coast Guard planes. There were innumerable mercy flights with medicines, serums and emergency apparatus for the sick and injured. The closest watch was kept on all vessels approaching the uninhabited shores of sheltered waters on the Gulf of Mexico to make sure that they did not smuggle in aliens, narcotics and other forms of contraband.

During the year the Coast Guard aviation units became generally known in official circles as the "eye in the sky" for the U. S. Treasury Department, because of their increasing usefulness along the coast and international boundary lines. They cooperated with the surface cutters on the international ice patrol in the North Atlantic, spotting icebergs and warning vessels of the danger.

Coast Guard equipment included Douglas amphibions, North American Aviation flying boats, Grumman utility amphibions, Stinson land planes for patrol and radio communications, Consolidated Aircraft trainers for the student aviators of this important service, and Vought land planes for border and customs patrol.



LIGHT PLANES—CURTISS-WRIGHT COUPE

The Curtiss-Wright Coupe, a two-place machine with 90 h.p. Lambert engine, built for the U. S. Bureau of Air Commerce.

## CHAPTER VII

### GOVERNMENTAL ACTIVITIES

Twenty-nine Federal Agencies Concerned with Aviation—Miscellaneous Activities—Bureau of Air Commerce—Bureau of Fisheries—Communications Commission—Hydrographic Office—Interdepartmental Committee on International Civil Aviation—Interstate Commerce Commission—National Advisory Committee for Aeronautics—Bureau of Standards—Arms and Munitions Control—Public Health Service—Soil Conservation Service—Tennessee Valley Authority—Coast and Geodetic Survey—U.S. Forest Service—U.S. Geological Survey—U.S. Weather Bureau

NO less than 29 departments, bureaus and other agencies of the federal Government were engaged in some form of aviation activity at the beginning of 1936. All were parts of the executive, the administrative, branch of the Government. They did not include the numerous committees of Congress dealing with aviation in one form or another. Nor did they include the judicial branch. The Court of Claims, for example, had before it a variety of cases based on aviation.

The air force activities of the Army, the Navy and the Coast Guard are treated in individual chapters. The air mail service of the Post Office Department is described in the chapter on air lines. Nine other general agencies embraced aviation among their routine duties.

The Department of Justice had the manifold responsibility of defending the Government against claims, instituting suits and at the same time investigating innumerable aviation matters. The Office of the Comptroller General handled aviation problems as a general accounting office dealing with all federal expenditures. The Procurement Division of the Treasury Department was charged with determination of policies and methods of procurement with regard to everything purchased by the Government. The Patent Office received an average of three aeronautical patent applications daily. The Reconstruction Finance Corporation made loans for aircraft manufacture. The National Labor Relations Board, under the legislation of 1935, was intended to exercise considerable control over labor in the aircraft industry. The Bureau of Foreign and Domestic Commerce, created under the law "to promote and develop the foreign and domestic commerce of the United States," included aeronautical work among its

activities. The Bureau of Customs examined passengers and cargoes of aircraft entering the United States.

There also was the Council of National Defense, including six members of the President's Cabinet. According to the Congressional Directory of January, 1936, it "was charged by the Act of August 29, 1916, among other things, with the 'coordination of industries and resources for the national security and welfare' and with the 'creation of relations which will render possible in time of need the immediate concentration and utilization of the resources of the Nation.' No appropriations have been made for nor any meetings held by the Council since the fiscal year 1921. The records of the Council of National Defense, as well as those of the War Industries Board and the Committee of Public Information, are now under the jurisdiction of the Assistant Secretary of War, who is charged by law (Act of June 4, 1920) with the 'assurance of adequate provision for the mobilization of materiel and industrial organizations essential to war-time needs.' "

### Bureau of Air Commerce

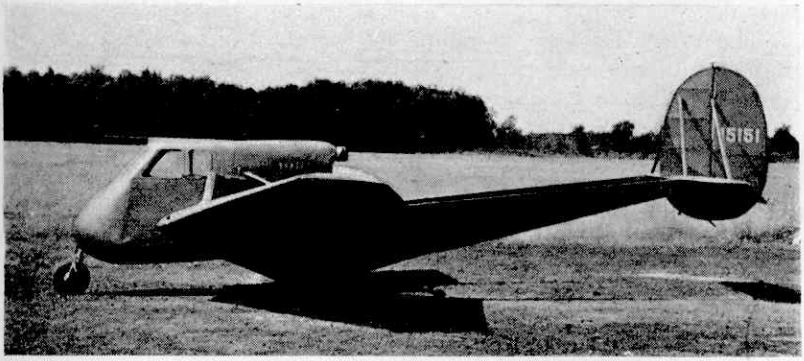
Governmental regulation of civil aviation was handled partly through the Bureau of Air Commerce of the Department of Commerce. In 1935 the Bureau increased the mileage of lighted and radio-equipped routes on the Federal Airways System from 19,081 to nearly 22,000 miles. The Bureau licensed pilots and aircraft, examined newly designed machines, engines and accessories for type approval certificates. It regulated air transport, examined schools and repair stations for approval (on request) and enforced air traffic rules. Air line regulations were revised to keep them abreast of rapid advances in scheduled air transportation. The first steps were taken toward setting up traffic control procedure for airways and major airports, the latter directed especially to control of airplane movements during poor visibility.

Contracts were let for construction of experimental planes, engines and propellers, in line with the Bureau's policy of attempting to develop aircraft for private use which should embody increased safety, simplicity of operation, reduction of costs or a combination of those factors. Equipment and technique for an instrument approach landing system to assist pilots during poor visibility were further developed in 1935, and installations were made. Problems incident to high-altitude flying were studied. Bids were issued for an airplane suitable in air transport for short flights with small passenger load.

On behalf of the WPA the Bureau examined all airport projects proposed for development with WPA funds. At the beginning of 1936 the Bureau reported that approval had been given for some 650 such projects involving an expenditure of approximately $55,000,000, and that 200 were under construction, employing 40,000 men.

Airway extension and improvement begun in 1933 had been virtually completed, made possible by allotments of funds from the PWA, including nearly 3,000 miles of new airways lighted and radio-equipped, and modernization of existing routes. Radio approach equipment was in operation at the Newark Airport, installed by the Bureau. At Pittsburgh the Bureau had in operation an experimental station seeking the transmission of directional signals and voice simultaneously to overcome the danger of silencing directional signals for periodical broadcasts of weather information.

The Pittsburgh experimental station showed much promise. The two sets of signals transmitted by a station of the type tested at Pittsburgh not only may be broadcast simultaneously, but also may be received simultaneously by the pilot, if he has the necessary equipment.



LIGHT PLANES—THE HAMMOND

The Hammond Model Y, a two-place machine with 95 h.p. Menasco engine, built for the U. S. Bureau of Air Commerce.

If so, he may direct the directional signals into a converter operating a needle dial on his instrument panel, listening to voice broadcasts with his earphone. Or, he may elect to listen either to voice, or to directional signals with the earphone, and the latter possibility is open to the pilot with a radio receiver and special filter, but not the converter.

Other radio developments included the station location marker, an auxiliary transmitter operating a flash light in the cockpit when the plane passes over the transmitter of a radio range beacon. A number were installed in 1935. Radio teletypewriter and radio facsimile transmission were further developed with a view to using those systems instead of leased telephone circuits. A new radio direction finder was developed by a company under contract with the Bureau.

A coordinated system of air traffic control, using towers at air-

ports, was developed in 1935. A complete set of regulations was to be issued early in 1936, based on the Bureau's conferences with aviation interests concerned. Thirty-seven of the Bureau's medical examiners were appointed "air line medical examiners" to examine physically all air line pilots every three months.

The status of the Bureau's light airplane program at the beginning of 1936 was as follows:

The Arrow company's Arrowplane was still under development.

The Hammond Y was being changed by the designer and manufacturer, and was about ready for further tests by the Bureau.

The Waterman Arrowplane, a tailless machine, had been delivered, and was undergoing service tests.

A direct control Pitcairn autogiro, with chassis drive so that it might be driven on the highway like a motor car, was scheduled for early delivery in 1936.

The Weick machine, as rebuilt by Fairchild to incorporate a new aileron and flap combination, was under tests in the laboratory of the National Advisory Committee for Aeronautics.

The Curtiss-Wright Coupe, an all-metal, two-place cabin monoplane, had been delivered.

An endurance test of an Essex automobile engine, provided with a belt drive to a propeller, was completed by the Casey Jones School of Aeronautics.

The Continental Aircraft Engine Company, of Detroit, Mich., had under development for the Bureau a six-cylinder radial aircooled engine of the two-stroke, sleeve valve, uniflow scavenging type.

The first of an order of solid steel, drop-forged propellers designed for 100 horsepower two-place aircraft was under test.

Tests were under way seeking a practical means of cooling pusher in-line aircooled engines.

### Bureau of Fisheries

The Bureau of Fisheries of the Department of Commerce used planes to patrol the fishing grounds of Alaska, to make inspection of spawning grounds and to transport officials to isolated districts. Airplanes were chartered from six different companies, and were used an aggregate of 40 days during which more than 17,000 miles were traversed.

### Federal Communications Commission

Increased transport schedules incident to the growth of air traffic created a need for additional radio communication. The Federal Communications Commission allocated additional frequencies to the aviation branches. Seven major chains, using 56 frequencies for com-

munication with aircraft and 34 frequencies for point-to-point communication for transmission of messages were operating at the beginning of 1936. At the end of the fiscal year 1935 there were 27 airport radio stations, 193 aeronautical radio stations, 96 aeronautical point-to-point stations and 359 aircraft radio stations licensed by the Commission.

The radio obstruction marker beacon was established in 1935. It is used as a miniature radio beacon to mark the location of the major obstructions to the airways served by the radio range stations operated by the Department of Commerce. Installations were made in connection with broadcast stations WOR at Newark, WBNS at Columbus, O., WJR at Detroit and WLW at Cincinnati.

### Hydrographic Office

The Hydrographic Office, U.S. Navy, distributed pilot charts of

LIGHT PLANES—WEICK RUDDERLESS

U. S. Bureau of Air Commerce experimental model, rebuilt by Fairchild Aircraft Corporation.

the upper air, notices to aviators, memoranda for aviators and strip charts of the coastal areas of North and Central America, Mexico and the West Indies. In addition, the office had on file considerable data pertaining to the principal airports and seaplane bases of all foriegn countries, and it was supplied to pilots on specific request.

### Interdepartmental Committee

The President of the United States on July 2, 1935, appointed as members of the Interdepartmental Committee on Civil International Aviation, R. Walton Moore, Assistant Secretary of State; Stephen B. Gibbons, Assistant Secretary of the Treasury; Harllee Branch, Second Assistant Postmaster General; and John Monroe Johnson, Assistant Secretary of Commerce. The White House announced

their appointment was "for the purpose of making observations and gathering information pertaining to civil international aviation in all its phases and submitting such recommendations as may seem called for."

In December, 1935, that committee met with representatives of Great Britain, Irish Free State and Canada to discuss reciprocal landing rights and other forms of international cooperation in connection with the projected Atlantic air transport services contemplated by nationals of different governments.

### Interstate Commerce Commission

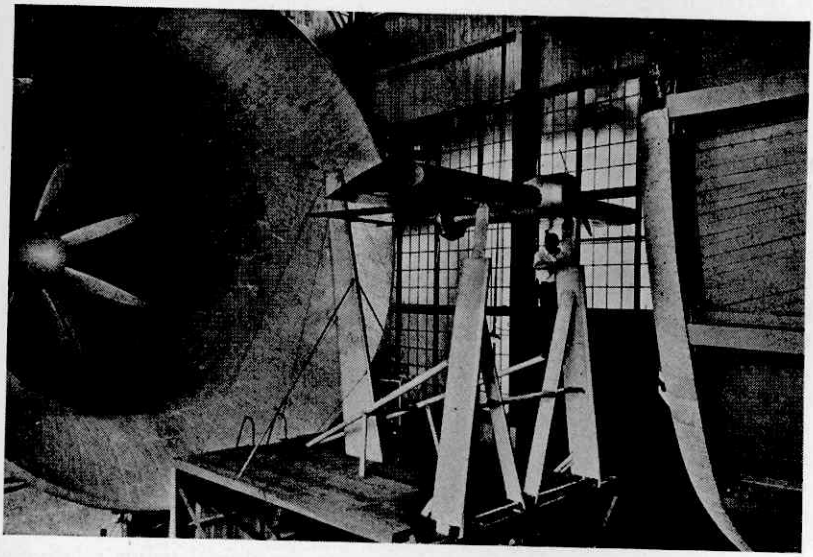
The Air Mail Act approved June 12, 1934, and amended August 14, 1935, conferred on the Interstate Commerce Commission certain jurisdiction over air transportation. Rates of payment for carrying the mail, scrutiny of revenues and profits of the air mail contract lines, new routes and schedules, and all allegations of unfair practices were held to come within the scope of the Commission's jurisdiction. There was some controversy between the Commission and the Post Office Department as to the exact nature of the control each bureau was granted under the Act. New legislation was proposed, clarifying the duties of each bureau. This was opposed by the Post Office Department which held that there should be no change in the 1935 legislation. Briefly, the Post Office Department held that the Commission had power only to determine rates of payment for carrying the mail.

### National Advisory Committee for Aeronautics

Long-range planning of fundamental research and the scientific study of all problems of flight, with a view to their practical solution, at the same time conducting research and experiments and correlating such activities so as to prevent duplication of effort either in the industry or Government bureaus—such were the activities of the National Advisory Committee for Aeronautics during 1935. Aeronautical inventions offered to the Government, for use in the Army and Navy Air forces and other federal branches were submitted to the Patents and Design Board created by Act of Congress in 1926. The Board included the Assistant Secretaries of War, Navy and Commerce. The Board sent the inventions to the National Advisory Committee, which examined them and returned them with recommendations for further development or rejection. The Government might pay as much as $75,000 for an accepted invention or idea. Approximately 1,000 new ideas were submitted to the Committee in 1935.

The Committee's laboratories at Langley Field, Va., were reputed to be the best-equipped and most fruitful aeronautical research in-

stitution in the world. It comprised 12 structures, and it had a research staff aggregating 320 employees. Equipment included a full-scale wind tunnel, a seaplane tank, a propeller research tunnel, a variable density wind tunnel, and engine research laboratory and a flight research laboratory. In 1935 the Committee placed in operation a new free-spinning wind tunnel and a 24-inch high-velocity jet-type wind tunnel. Another wind tunnel was nearing completion at the beginning of 1936—an eight-foot 500-mile-an-hour wind tunnel, known as a full-speed wind tunnel. Those facilities assured everything possible being learned about a design before actual flight.



AT THE NACA LABORATORIES

The National Advisory Committee's propeller research tunnel at Langley Field, Va., part of the scientific facilities being duplicated abroad with increasing intensity.

At the beginning of 1936 the Committee reported that the trend of development is generally toward larger airplanes with increased wing loading and also aircraft engines of increased horsepower. Many of the researches in 1935 sought to improve the aerodynamic and structural characteristics of large seaplanes and at the same time develop engine and propeller performance. The Committee noted a marked advance in speed of aircraft in 1935.

Enhanced speed was attributed to improved cowling and cooling of radial aircooled engines and the location of the engine nacelles in multi-engine planes in such manner as to obtain maximum propulsive

efficiency and minimum resistence. The Committee was carrying on further studies seeking increased speed, improved engine nacelles, wings and wing-fuselage arrangements, development of more efficient high-lift devices to permit higher wing loadings. The reduction of parasite drag, greater efficiency at high altitudes and greater power output of engines for the same weight and piston displacement were among other researches in progress.

The Committee was investigating a number of devices which promised to give high lift and at the same time provide safe landing speed through satisfactory lateral control. Work on the development of the compression-ignition type of aircraft engine had progressed far enough to promise early development of such a type.

### National Bureau of Standards

The National Bureau of Standards of the Department of Commerce in 1935 investigated the behavior of materials used in aircraft construction, performance of engines, fuels, lubricants and ignition systems, and occasionally designed and constructed special instruments and apparatus for Government use. The development of visual aids to air navigation received considerable attention. In cooperation with the National Advisory Committee for Aeronautics the Bureau studied the pressure sphere as a means of measuring the turbulence of an air stream.

The Bureau found confirmation of Paeschke's discovery that the relative humidity of the air has an important effect on the velocity, as indicated by an improved hit wire equipment which the Bureau developed for that purpose. An error as great as six per cent in the determination of air speed, it was learned, may result from a change of relative humidity from 25 to 70 per cent at 25 degrees Centigrade. A new method of measuring turbulence was developed using relatively simple equipment.

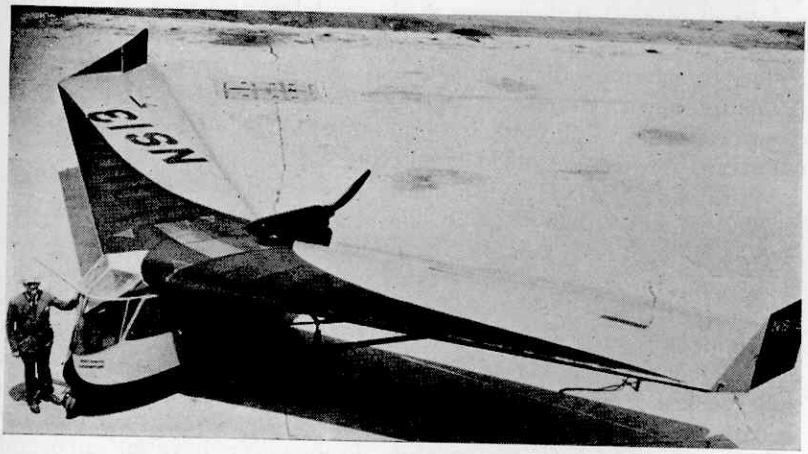
Years of study of the effect of atmospheric exposure on aluminum alloys with and without protective coatings resulted in important discoveries; for example, aluminum alloys containing magnesium are by far the most resistant to corrosion; and surface oxidation by anodic electrolytic treatment is the best priming for subsequent coatings.

At the beginning of 1936 the Bureau was investigating the effects of temperatures (as low as 112 degrees below zero Fahrenheit) on the mechanical properties, particularly impact resistance, of low-alloy structural steels, nickel alloys and light metal alloys commonly used in aircraft.

During 1935 the Bureau discovered from numerous reports of tests that fatigue failures by far outnumber those resulting from improper

material. They are often brought about by "stress raisers" such as improper design features and effects at points where two or more members are joined. They serve to localize the fatigue break. Corrosion of fuel tanks and lines was recognized as a serious matter, and one demanding complete investigation. Salt water was believed to be a primary cause of corrosion, but the severity and distribution appeared to be influenced by the character of the deposit resulting from the decomposition of treated gasolines.

A study was made of aviation textiles covered with various plastic materials. It indicated that fabrics doped with cellulose derivatives absorb only small amounts of moisture, while the same fabrics covered with gelatin latex absorb moisture much more rapidly and therefore




LIGHT PLANES—WATERMAN ARROWPLANE

Waldo Waterman's experimental tailless machine, with 95 h.p. Menasco engine, built for the U. S. Bureau of Air Commerce.

show considerable increases in weight when exposed to humid atmospheres. Offsetting that advantage, it was found, the cellulose nitrate dope, commonly used, is highly inflammable; and the Bureau was seeking a substitute. It had developed an airplane covering showing good resistance to ignition. A boric acid-borax mixture was first applied to the cloth which was then doped with cellulose acetate.

For the Navy the Bureau was working on a rubber substitute as a coating for gas cells in rigid airships. It can be produced cheaply from domestic materials. Its aging properties were being tested on the "Los Angeles."

In cooperation with the National Advisory Committee for Aero-

nautics the Bureau of Standards continued work of testing the strength of welded joints, including welded lattice and T-joints in chromium-molybdenum tubing. A report was prepared for publication. Preliminary tests to determine the modulus of rupture of tubing under combined axial and transverse loads were completed, and main tests were to be conducted in 1936. In cooperation with the Bureau of Aeronautics an investigation was made of the strength of columns such as compression members of welded or riveted aircraft structures. About 200 column specimens of various materials were tested, and a method developed for applying the results in design of actual aircraft.

Transparent substitutes for glass were being developed and tested in cooperation with the National Advisory Committee for Aeronautics. The substitutes were found to be more easily fabricated and half the weight of glass; but they were easily scratched and were much more expensive. All available resins and cellulose derivatives were being examined to determine their transparency, resistance to surface abrasion, flexibility, impact strength at high and low temperatures, resistance to deterioration by heat, cold, sunlight, water, gasoline, soap and other materials, their dimensional stability and flame resistance.

Formation of snow in the intake systems of aircraft engines has long been looked upon as responsible for otherwise unexplainable accidents. Since it was thought that the heat of vaporization of aircraft fuels might be a factor in the formation of ice, data were secured by vaporizing the fuel inside a calorimeter by means of a current of air, thus permitting vaporization at ordinary temperatures. Measurements of a number of motor and aviation gasolines and a special "safety" fuel indicate, however, that their heats of vaporization do not differ sufficiently to make this an important factor in the choice of a fuel for aviation use. Heats of vaporization do, however, have an important influence on other factors which affect engine performance. The adoption by the National Advisory Committee for Aeronautics of a standard nomenclature on combustion research acceptable to the various workers in this field has been proposed.

An improved type of shielded spark plug was developed. Shielding is obtained by means of a metal cage made integral with the spark plug shell. The design specified gives shielding equal to that provided by complete metallic enclosure. Protection against moisture and flashover is secured by means of an insulating sleeve which screws on the top terminal of the plug. This design reduces cable temperature both by dissipating heat and by reducing heat flow.

An investigation of the stability of aircraft engine lubricating oil was undertaken in cooperation with the Bureau of Aeronautics. The object of the work is to develop a convenient laboratory test for oil

stability that will reproduce the changes which take place in the oil during service. Two engines were being operated on a variety of commercial aviation oils and samples were removed periodically for analysis during each run. Several types of laboratory tests were being studied, all involving heating the oil under oxidizing conditions. Evaporation loss was measured and analyses made of the viscosity, sludge, acidity and carbon residue.

A preliminary investigation was made to ascertain what becomes of the lead when an aircraft engine is operated on gasoline treated with tetraethyl lead. An aircraft engine was operated under full-throttle and cruising conditions on aviation gasolines containing average and high concentrations of tetraethyl lead. The lead recovered was, on the average, about 25 per cent of the lead brought into the cylinder by the fuel, yet the lead retained in the engine at the conclusion of the tests

LIGHT PLANES—ARROW ARROWPLANE

The Arrow experimental Model F, with converted Ford V-8 engine, built for the U. S. Bureau of Air Commerce.

was only approximately five per cent of the total lead in all the fuel burned. This indicates that continuous runs of many hours duration would be required to obtain a true lead balance and is in accord with earlier experiments on a small single-cyclinder engine where the lead content of the exhaust was found to vary from 10 per cent to 119 per cent of the amount introduced as fuel.

As a part of its work on aviation batteries, the Bureau constructed certain storage batteries with plates one-sixteenth inch in thickness, and these were found to meet specification requirements as to size, weight, and capacity, and to have a life exceeding by 100 per cent that of the batteries commonly used which have plates one-twentieth of an inch thick.

By means of an electrically driven apparatus, vibrations were set

up in non-rotating airplane propellers, and the deflection of the blades was measured by sensitive optical devices. The points of maximum stress were found to correspond closely to the locations of two of the three known types of propeller failures in service. Artificial failures as the result of vibration were obtained in the laboratory. They corresponded very closely to one type of service failure. This work, together with a method of computing the stresses in vibrating blades, was described in the Journal of Research of the National Bureau of Standards. The next logical step is to develop an instrument which will indicate to the pilot when dangerous vibrations are being developed in flight. Work on such an instrument was in progress in 1936.

The Bureau continued its study of aircraft instrument performance and designed several special instruments for the Bureau of Aeronautics. They included an improved carbon monoxide indicator and equipment for testing the instrument in the field; several experimental models of a combination breathing mask and a microphone; a maximum airspeed recorder with a range of 500 miles an hour; an improved fuel flow meter; and aerograph test equipment for field stations. Specifications for a directional gyroscope, an artificial horizon, and an engine cylinder thermometer test set were prepared for the Bureau of Aeronautics.

The standard altitude tables were extended to 80,000 feet, and reports on a method of testing oxygen regulators and on the measurement of altitude in blind flying were prepared for the National Advisory Committee for Aeronautics. The Bureau cooperated with the National Geographic Society and the Army Air Corps in the design and construction of the instrumental equipment of the balloon "Explorer II", the director of the Bureau being chairman of the scientific advisory committee on the record stratosphere ascent. The Bureau constructed a resistance thermometer; calibrated barographs; prepared the purchase specification for, and tested two precision aneroid barometers; and constructed and tested two high altitude mercury barometers; which were used in the "Explorer II."

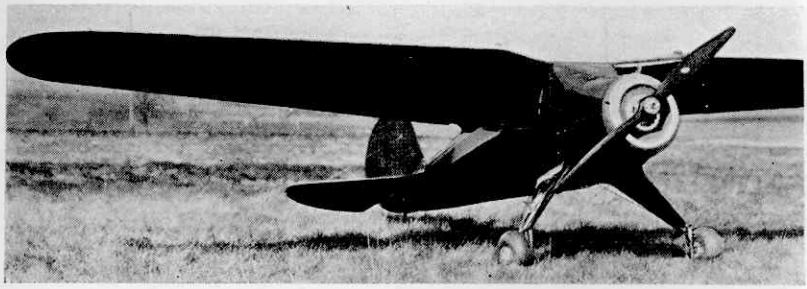
At the request of the Bureau of Aeronautics an attempt was being made to find a lubricating oil for fine mechanisms that would be satisfactory over the range of temperatures encountered in aircraft and which would remain in a satisfactory condition at least three years.

The Bureau cooperated with the Bureau of Air Commerce in testing and improving aviation lighting equipment. As a result, changes in the 24-inch beacons were in progress which should give those beacons higher maximum candlepower with 500-watt lamps than was formerly obtained with 1,000-watt lamps. Manufacturers of position lights were assisted in the development of improved lights, and pro-

gress was made in the development of practical approach and contact lights for use in conjunction with radio aids in fog landings.

### Office of Arms and Munitions Control

The 1935 neutrality legislation was embodied in Joint Resolution No. 67, (public) First Session, 74th Congress, August, 1935. The neutrality policies set forth in that law were temporary, to last only until February 29, 1936, at which time Administration leaders and others in Congress expected permanent legislation to take its place. The clauses providing for register-license of all manfacturers and exporters of designated products termed arms or munitions were permanent. The 1935 legislation created an Office of Arms and Munitions Control in the Office of the Secretary of State, and at the same time



LIGHT PLANES—FAHLIN'S MONOPLANE

The Fahlin experimental monoplane, powered with a Plymouth automobile engine.

provided for the National Munitions Control Board. That Board "shall consist of the Secretary of State, who shall be chairman and executive officer of the Board, the Secretary of the Treasury, the Secretary of War, the Secretary of the Navy and the Secretary of Commerce." Under the law the Board "shall hold at least one meeting a year."

The Office of Arms and Munitions Control is thus officially described in the Congressional Directory: "Is charged with the registration of manufacturers, exporters and importers of articles proclaimed by the President to be arms, ammunition and implements of war, the export or import of which without a license would be a violation of any law of the United States; the issuance of licenses for the exportation or importation of arms, ammunition and implements of war under such regulations as may be promulgated by the Secretary of State; such supervision of international traffic in arms, ammunition and implements of war as falls within the jurisdiction of the Secretary of State under treaties and statutes."

Leighton W. Rogers, president of the Aeronautical Chamber of Commerce of America, issued a comprehensive analysis of the regulations, so far as they relate to aviation, as follows:

"With regard to the regulations:

"You will note on pages 3 and 4 the definitions of what constitutes arms, ammunition and implements of war for the purpose of the Act. Category III, paragraph (1) states: 'Aircraft, assembled or dismantled, both heavier and lighter than air, which are designed, adapted, and intended for aerial combat by the use of machine guns or of artillery or for the carrying and dropping of bombs, or which are equipped with, or which by reason of design or construction are prepared for, any of the appliances referred to in paragraph (2), below.

" '(2) Aerial gun mounts and frames, bomb racks, torpedo carriers, and bomb or torpedo release mechanisms.'

"Category V. '(1) Aircraft assembled or dismantled, both heavier and lighter than air, other than those included in Category III;

" '(2) Propellers or air screws, fuselages, hulls, tail units, and under-carriage units;

" '(3) Aircraft engines.'

"You will note that the definition does not include aircraft instruments or spare parts, other than fuselages, hulls, tail units and under-carriage units.

"The statement in the fifth paragraph on page 2 of the regulations is significant. 'No purchase of arms, ammunition, and implements of war shall be made on behalf of the United States by any officer, executive department, or independent establishment of the Government from any person who shall have failed to register under the provisions of this Act.'

"Particular attention is called to paragraph (5), Section III, of the General Regulations, as follows:

" '(5) The production for experimental or scientific purposes, when such production is not followed by sale, of the appliances and substances included in Category VI, or of single units of other arms, ammunition, and implements of war, is not considered as manufacture for the purposes of section 2 of the joint resolution.'

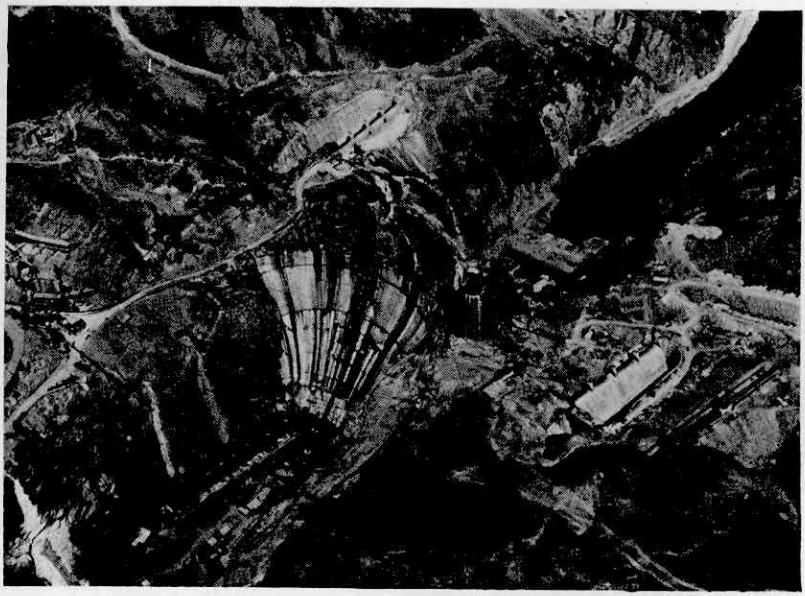
"The licenses granted under these regulations are good for a period of four months. They are, however, subject to revocation without notice."

### Public Health Service

At the beginning of 1936 the U. S. Public Health Service, operating under the Treasury Department, reported that it had found travel by airplane of increasing importance in its work of protecting the health

of the people. It was using aircraft in emergency transport to regions where epidemics required utmost speed. The Service also found that the reduced time of airplane travel from foreign countries is well within the incubation period of many communicable diseases, and that this factor was rapidly creating a major problem with the rapid increase in air travel.

In its quarantine work the Public Health Service inspected air-



BOULDER DAM IN MARCH, 1935

A camera man flying for Fairchild Aerial Surveys caught this picture of the completed dam.

planes and their passengers and crews arriving from foreign countries. During the fiscal year 1935, 4,081 airplanes, carrying 34,135 persons, arrived at United States airports from other countries, as compared with 3,668 planes carrying 26,951 persons in 1934. Of those arriving in 1935, 2,636 planes, carrying 30,249 persons, of whom 2,000 were aliens, were given medical inspection by Public Health Service officers as required by law; the remaining planes arrived at airports of entry at which no medical officers were available for duty, and therefore, did not undergo inspection.

The International Sanitary Convention for Aerial Navigation, which was opened for signature at The Hague on April 12, 1933, and

was signed on behalf of the United States on April 6, 1934, was ratified by the United States Senate on June 5, 1935, and came into effect on August 1, 1935. At the close of the year, 34 nations had ratified or were adhering to the Convention. This Convention provides a sanitary code which reconciles the interests of international air traffic with reasonable requirements for the protection of the public health.

### Soil Conservation Service

The Soil Conservation Service, of the Department of Agriculture, during 1935 started its Colorado River Survey as part of its plan to control the silt above Boulder Dam. Engineers of the Service and the Fairchild Aerial Surveys established 180 control points in connection with the aerial mapping of the district. The largest aerial survey ever attempted in the United States was completed by Fairchild Aerial Surveys for the Soil Conservation Service in 1935. It included 22,000,000 acres in the watershed of the Rio Grande in Cenral New Mexico. The Fairchild 10-lens tandem camera was used for part of the work, securing control strips at an average altitude of 24,000 feet. In that phase of the work about 400 photographs were taken. The actual mapping was done with a smaller camera, taking a total of 9,000 pictures.

### Tennessee Valley Authority

Charged with the long-range development of the Tennessee River Basin, the TVA operated three airplanes during 1935, a Monocoach and two Bellancas. They were employed in making surveys, maps and photographs, the control of malarial mosquitoes, forest fires patrol and transportation. The Authority found planes of special value for technical and engineering work. The Tennessee Valley embraces more than 40,000 square miles of hills and low country. It was found that information about its streams and rivers, forest growth, soil erosion conditions and other physical features could be determined in a fraction of the time required by surface methods. Planes were also used for making studies in connection with the relocation of highways in dam reservoir areas.

Experiments were carried on by plane over the Wilson Dam area to determine the feasibility of controlling mosquitoes on the lake by dusting the shore line with insecticidal materials. The tests proved the method of airplane dusting both economical and practical. In the spring of 1936 airplane dusting was to be extended to Lake Wheeler.

In cooperation with the Forest Service, fire patrols were made by plane over the national park areas from Bristol, Va., to Chattanooga, Tenn., and 75 fires were located and reported. The fire patrol main-

tained contact with ground stations by radio. On official business the planes proved remarkable time-savers. They transported officials and supplies between Norris Dam and Muscle Shoals, for example in only an hour and a half, as compared to seven and ten hours by train and motor car.

### U. S. Coast and Geodetic Survey

The world's largest single unit multi-lens aerial mapping camera was built by Fairchild Aviation Corporation for the Coast and Geo-

*Courtesy McLaughlin Aerial Surveys*

NEW YORK'S NEW TRIBORO BRIDGE

Progress on one of the largest PWA projects in the East is recorded by photographs taken from the air.

detic Survey in 1935. The camera had nine lenses, eight of them with associated steel mirrors of high reflectivity. It weighed 305 pounds when loaded and stood 38 inches high. Loaded for filming and with its accessories the outfit weighed 636 pounds. The camera was designed by Lieut. O. S. Reading of the Coast and Geodetic Survey in coopera-

tion with the Fairchild engineers. The camera was fully automatic. With one exposure of all nine lenses it could photograph about 600 square miles from an altitude of 30,000 feet. It would make a composite photograph 35 inches square.

During the fiscal year 1935 the Coast and Geodetic Survey compiled line maps from aerial photographs of 10,000 square miles of the area adjacent to the coast and intracoastal waterways. Single-lens photographs were used for important harbors where plenty of ground control was available and five-lens for general areas. The photographs were taken by commercial companies and the Army Air Corps. The areas mapped extended from New Haven to New York; along the south coast of Long Island; Albemarle Sound, N. C., to Jacksonville, Fla.; Apalachicola to Mobile; the Louisiana coast from Chandeleur Sound to Atchafalaya Bay; the Texas coast from the south end of Galveston Bay to Corpus Christi; and the California coast from the Mexican border to Los Angeles. The line maps were printed on scales of 1:10,000 and 1:20,000, large enough for use in sounding the adjacent waters as well as affording data of considerable use to engineers and others interested in development of the coast.

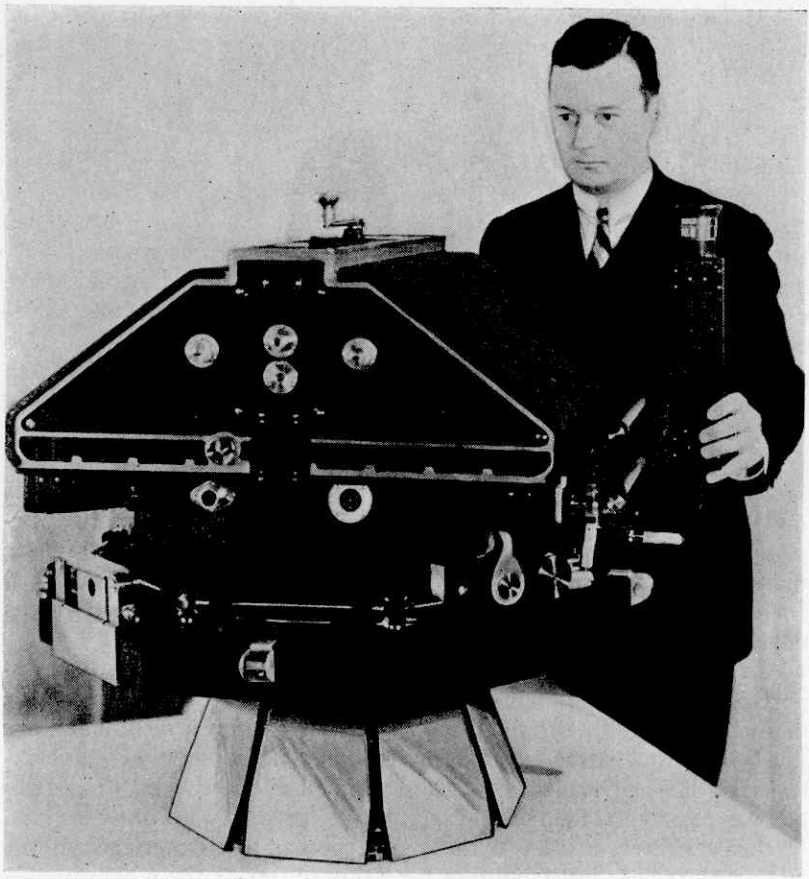
Before 1935, the Coast and Geodetic Survey had compiled and printed for the Bureau of Air Commerce 31 strip airway maps and 27 sectional aeronautical charts. Owing to the need for sectional aeronautical charts covering the entire United States, a comprehensive program was initiated in the fall of 1934 with the aid of a Public Works allotment to complete the entire series of 87 sectional charts. Under the enlarged program, 34 additional charts were printed by January 1, 1936, making a total of 61 sectional charts available to the public. The remaining 26 were to be printed within the fiscal year ending June 30, 1936.

During the fiscal year 1935 flight checking was done by 10 flight check observers in 46 States. A total of 2,834 flight check flying hours were spent in covering 2,554,600 square miles and 60 sectional charts without an accident. The planes and pilots were supplied by the Bureau of Air Commerce.

The sectional aeronautical charts were formerly known as airway maps; however, since they are equally useful for navigation off the airways, and are in every way comparable to the nautical charts so essential for safety at sea, the new designation was adopted. The series of sectional charts is printed at a scale of 1:500,000, or about 8 miles to the inch. In order to meet the need of high-speed long-distance flying, there was started an additional series, known as regional aeronautical charts. This second series is at a scale of 1:1,000,000, or about 16 miles to the inch. Two regional charts had been published by

January 1936, but work on the rest of this series has been indefinitely postponed, to complete the sectional charts with the present greatly reduced personnel.

In December, 1935, the Coast and Geodetic Survey also published a pamphlet of 60 pages, entitled, "Practical Air Navigation and the Use of the Aeronautical Charts of the Department of Commerce." In addition to providing a condensed text on air navigation by piloting, dead reckoning, and radio, this pamphlet was expected to promote a more intelligent use of the charts, thus increasing their value to pilots.



WORLD'S LARGEST AERIAL CAMERA

Sherman M. Fairchild and his nine-lens aerial camera built for the U. S. Coast and Geodetic Survey. The camera weighs 305 pounds loaded. It will photograph an area of 600 square miles at one shot from a height of 30,000 feet.

### U. S. Forest Service

The Forest Service, of the Department of Agriculture, carried on forest fire control activities and aerial survey in 1935. Also, the Service spent considerable time on experiments aimed at developing new uses for aircraft in forest fire suppression. The Forest Service contracts with private companies for aircraft use.

During the fire season of 1935, 1,027 flying hours were recorded in the transportation of 257,475 pounds of supplies and equipment; 1,464 men were carried by planes, adding 458 flying hours to the total. More than 20,000 square miles of forest area were photographed for the purpose of map making, survey of timber and grazing lands and for other purposes.

The Forest Service generally receives an annual appropriation of from $25,000 to $50,000 for the use of airplanes in protecting the national forests from fire. This is spent on forest fire presuppression activities, such as patrol, on transportation of supplies and equipment, construction of emergency landing fields and the like. Also, other funds are available for use of planes to reach fires requiring scouting and transportation of crews and equipment. The most extensive use of aircraft by the Forest Service has been in northern Idaho, western Montana, Oregon, Washington and California. Planes are also playing an important part in the protection of the forests of Minnesota and the Lake States.

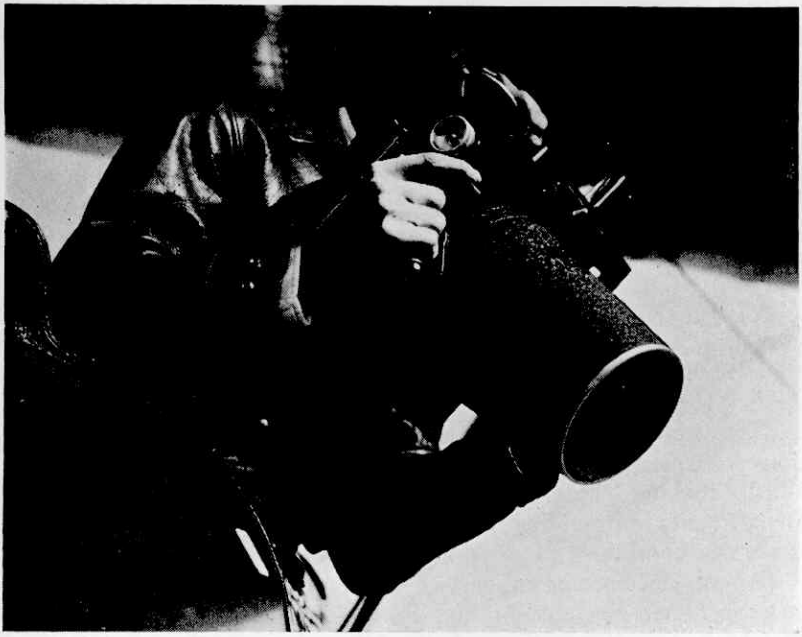
Aircraft are not generally used in the detection of forest fires, but are employed increasingly for scouting and reconnaissance on large fires already started and for quick transportation of men and supplies into areas difficult to penetrate by ground transportation methods. Airplanes for this use save time and money. To facilitate this service, many new emergency landing fields have been built in the national forests under CCC and Public Works programs in back-country areas not served by roads.

In the experimental field, further advance in the technic of transporting of men and equipment is being studied. Tests have been made of the feasibility of dropping tools, supplies and even men at the fire line by means of parachutes. The possibility of dropping water, chemical retardants or explosives direct from planes upon forest fires is another experimental field being carefully explored by the Forest Service. So far, however, results of these experiments and experience of the last 15 years have indicated that for the near future, the most valuable field of aircraft utilization by the Forest Service lies in the transportation of supplies, men and equipment. To this end, exhaustive inquiries in all new aeronautical developments are being made such as

those which are probing the possibilities of using autogiros, because they possess the advantage of requiring smaller landing fields than the conventional type plane.

### U. S. Geological Survey

During the fiscal year 1935 the Geological Survey, of the Department of the Interior, continued extensive use of aerial photographs in connection with standard topographic mapping. Planimetric maps of about 40 7½ inch-quadrangles and parts of quadrangles in



THE EYE IN THE SKY

An aerial photographer taking shots with a Fairchild Cyclops camera.

Louisiana, a total area of 2,585 square miles, were compiled from aerial photographs. Line map bases of more than 40 quadrangles and parts of quadrangles in other States, a total area of 5,340 square miles, were completed by the same method. The Air Corps photographed for the Geological Survey 250 square miles and commercial firms 16,291 square miles during the year. The total area compiled from aerial photographs by the Geological Survey in the United

States, exclusive of work accomplished in the Tennessee Valley under the Survey's direction, was 85,544 square miles.

The five-lens type of photograph was used in most of the mapping. An increasing amount of photography was carried on with wide-angle single-lens cameras at high altitudes. This type of photograph covers a larger area on a single-lens 7 by 9-inch negative than the ordinary photograph taken with a long focal-length lens. Ratioed enlargements were made from the small-scale negatives to the mapping scale. The method adopted for compiling data from these prints is similar to that of the multi-lens type, namely, the radial-line intersection method. This method will probably be superseded to a certain extent by a stereoscopic apparatus, the Multiplex Aeroprojector, with which the Survey was to be equipped, in future.

### U. S. Weather Bureau

During the year of 1935, the Weather Bureau, of the Department of Agriculture, made considerable progress toward strengthening the meteorological service provided through that agency for the Federal Airways System.

The following major changes in the service were effected during the year:

Through cooperation with the Bureau of Air Commerce, the transmission of weather maps by teletype was discontinued. This permitted more circuit time for the transmission of important meteorological and other information.

Two additional Weather Bureau contract airplane observation stations were established, one at El Paso, Tex., and the other at Spokane, Wash., making a total of eight. Cooperation of the War and Navy Departments in providing such flights at approximately 15 of their air bases was continued.

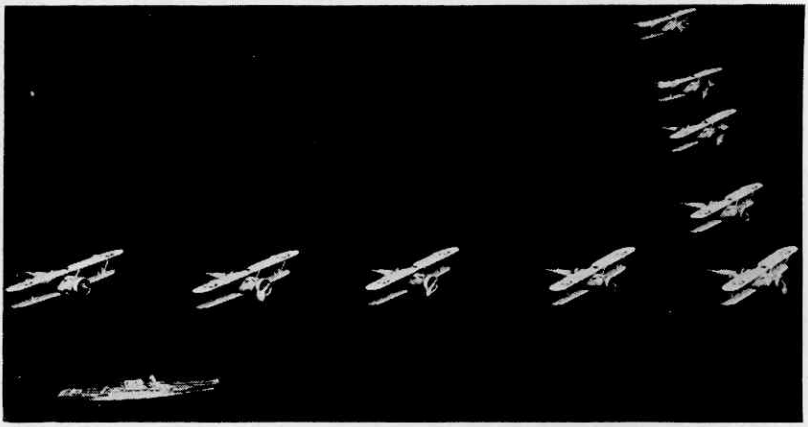
Airway meteorological service was put in operation over the Seattle-Spokane, Spokane-Billings-Fargo, Cheyenne-Billings, Omaha-Bismarck, Twin Cities-Sioux Falls, Albuquerque-El Paso, Cincinnati-Washington, Nashville-Washington, Newark-Buffalo, Newark-Atlantic City, and Charleston-Atlanta airways, approximating 3,960 miles.

A program of consolidation of Weather Bureau and Bureau of Air Commerce activities at terminal airports, where practicable, was completed. Thirty-five stations were affected. At about half of these places the Weather Bureau personnel took over most of the communications work, and at the other half the Bureau of Air Commerce personnel took over the weather-reporting work. That program permitted the conduct of service on a very efficient and economical basis and also

provided personnel for strengthening the meteorological service at the larger terminals and general supervising stations.

A new base for airway weather maps was designed and placed in use, resulting in the preparation of uniform maps at all airway centers in the country. In addition to the land area of the United States, these maps cover a wide expanse of the Pacific Ocean, Alaska, Canada, Mexico and the Atlantic Ocean.

A nation-wide collection of airway and off-airway reports at 2 a. m. and 2 p. m., E. S. T., was started, making practicable the preparation of complete maps of the United States four times each day. Relays of the data were made by teletype, the off-airway reports being



Official U. S. Navy Photo

NAVY FIGHTERS ON MANEUVERS

1st Division of VF-5B Squadron over their mother ship, the carrier "Lexington" during the 1935 maneuvers in the Pacific. The planes are Cyclone-powered Grummans.

telegraphed to designated points on the teletype circuits where they were decoded and placed in sequence-report form and then placed on the circuits in proper order.

To complete as far as possible the off-airway network of stations reporting each six hours, 12 additional such stations were established, nearly all being in the far northern and western sections of the country.

The use of air mass and frontal analysis in the airway meteorological service was expanded by applying it to maps made at airway forecast centers and other first-order stations at terminal airports. To aid in this, the daily analysis of the 8 a. m., E. S. T., map, made at Washington by specially trained personnel, was arranged in code for transmission to all such stations on the teletype network.

At the beginning of 1936 there were 51 first-order stations at terminal airports and approximately 525 intermediate stations with 62 off-airway stations in the airway weather network. Weather reports were charted every six hours at 10 general supervising stations, from which six-hourly regional, terminal and trip airway forecasts were issued covering all airways in the United States.

The enormous increase in airway traffic during 1935 created a problem for the officials, who believed that further expansion of the Weather Bureau service was imperative, if the public was to receive adequate protection in the form of reliable weather data at all times.

Fairchild Aerial Surveys Photo

HARTFORD, CONN., IN ONE PHOTOGRAPH

Fairchild photographers took this picture when they made a complete aerial map of Connecticut. It was taken with one shot of the Fairchild K-3 camera from a height of 11,400 feet. It shows 1,200 feet to an inch.

## CHAPTER VIII

### STATE AVIATION ACTIVITIES

Each State Confronted with its Own Problems—Efforts to Establish Uniform State Laws—National Association of State Aviation Officials—Promotion of Flying Within the States—Reports from State Aeronautical Executives.

AT the beginning of 1936 the rapid progress of aviation made imperative the State promotion of flying along lines best suited to the peculiar conditions existing in the respective commonwealths. Few of the States had similar problems with respect to aviation within their boundaries. Climatic conditions and industrial and economic demands differed in nearly every State. The nature of the country over which aircraft operate created different problems, especially in laying out airways and constructing airports. But all the States had one common problem; how to promote aviation so that it should develop into an institution as valuable as surface transportation.

In that one common problem lay all the various questions of law, supervision and regulation, the vexatious question of property rights, and the manifold details involving accommodations—all questions which had afflicted State governments during the early growth of the railroads and motor car industries. Franchises, rights-of-way, common carrier obligations and the maintenance of safeguards, taxes —all the surface transportation problems of another generation had now taken to the air; and they were hanging there, over the heads of the State governments, awaiting solution.

Efforts of the American Bar Association and other legal organizations to establish some form of uniform State law that should serve as a model for all States had begun shortly after the World War. The National Conference of Commissioners on Uniform State Laws and the American Bar Association appointed committees to work on the problem in 1920. They have never ceased working on it.

With the organization of the National Association of State Aviation Officials in 1931, however, American aviation for the first time had a national group of aviation experts, working in the field and therefore becoming more familiar with State aeronautics with each passing year. The manner in which the National Association of State Aviation Officials carried on its activities is described in the following report from its Secretary-Treasurer, Fred D. Fagg, Jr., a member of the Illinois Aeronautics Commission:

"The Uniform State Law for Aeronautics (of 1922) was enacted into law in about 21 States. It was non-regulatory, intended only to establish the legal status of air navigation in relation to general law. When it was drafted in 1922 the prevailing thought was that Congress should assume control of all regulatory phases.

"The federal Air Commerce Act of 1926, however, failed to require all aircraft and airmen to be licensed by federal authority; and instead required only those engaged in interstate and foreign air commerce as defined by the Act to be so licensed. The Senate Report made it clear that the States should adopt uniform laws providing for their own State aviation.

"The Uniform State Law thus became inadequate by 1926, and the aviation committees immediately centered their attention on the development of a uniform State air licensing law. Such an act was drafted and finally approved by the National Conference, although it was not approved by the American Bar Association Committee. Instead, the latter body was at work on a comprehensive Aeronautical Code which it had asked permission, in 1929, to prepare. While there were considerable differences of opinion as to the method of providing for federal licensing of all State aircraft and airmen, the legislative trend was definitely in favor of the federal requirement.

"Decided differences of opinion, as to the proposed draft of an Aeronautical Code, between the members of the Committee on Aeronautical Law of the American Bar Association and those of the Aviation Committee of the National Conference of Commissioners on Uniform State Laws prevented any action for several years. In May of 1934 the two committees agreed to sponsor an Aeronautical Code which should consist of three parts, as follows: (1) a Uniform Regulatory Act, (2) a Uniform Airports Act, and (3) a Uniform Non-Regulatory Act—dealing with questions of liability, insurance, jurisdiction, etc. The American Bar Association Committee prepared the proposed Regulatory Act and submitted it to the Conference Committee for approval at the Milwaukee meeting in August, 1934. The Conference Committee failed to act at that time and merely advanced the proposal to second reading. The Conference Committee did approve the Uniform Airports Act. No action has been taken on the third section of the proposed uniform code. The members of the National Association of State Aviation Officials adopted, at their annual meeting in Cheyenne in 1934, a Uniform State Aeronautical Regulatory Act.

"The most important activity of the National Association of State Aviation Officials, until 1935, was the development of that uniform State code for aeronautics. Two parts of the code have been com-

pleted, and are now ready for adoption by the several States. The third section of the code, dealing with substantive law questions such as liability, right of flight, jurisdiction, etc., is now being prepared.

"During 1935 the Association activities went far beyond the problem of a uniform State law. They now are tending more closely toward the distinctly promotional phases of aviation. Committees have been formed to study the following problems: Airport maintenance, com-

KELLETT AUTOGIRO LANDS ON A ROOF

Pilot Louis Levy flew his wingless autogiro from Camden to Philadelphia with a load of mail and landed it on the roof of the new post office.

pulsory wheel brakes, student instruction, airport information schedules, areonautical education, airmarking, airport manager's police authority, State highway rights-of-way, and regulation of charter operators. Full reports are expected in time for the annual convention in Hartford, Conn., in September, 1936."

The roster of officers of the association will be found in the appendix.

Nearly all the States had some kind of law requiring aircraft operators to conform to regulations similar to those of the Bureau of Air Commerce of the U. S. Department of Commerce, even when operating within the State. There was considerable difference, however, in the manner by which the laws were administered. Some States had little or no aviation personnel on their official lists. Others had complete organizations.

On January 1, 1936, a number of States had no official State aeronautics agencies. They included Arkansas, California, Colorado, Delaware, Georgia, Indiana, Kansas, Mississippi, Missouri, North Carolina, Texas, Utah, Wisconsin and Wyoming.

Alabama's State Aviation Commission, according to a report from its director, John M. Donalson, was promoting the construction of airports throughout the State under the WPA program. Aviation was under the immediate jurisdiction of the State Highway Department.

Arizona's State aviation was supervised by the State Corporation Commission, with Charles R. Howe as chairman.

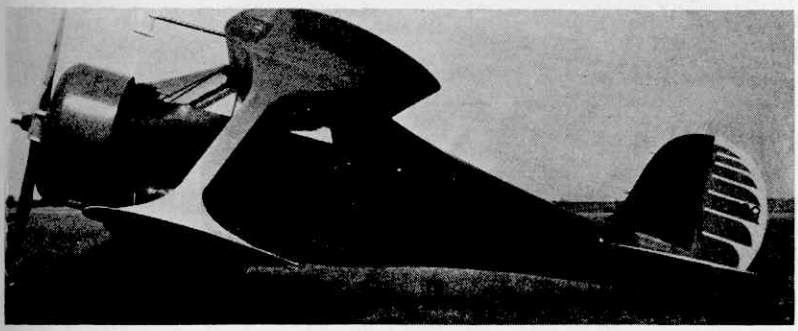
Connecticut's Department of Aeronautics, as reported by Commissioner Charles L. Morris, expanded and improved 18 airports during 1935. More than 400 airmarking signs were added to those already existing, making an average of one to every four square miles. Six marine air terminals were projected. With the active cooperation of the Connecticut Manufacturers Association every plant in the State, if possible, was to be airmarked. The State law provided for licensing and registration of pilots and aircraft. A total of 376 pilot licenses and 152 aircraft registrations, with 38 accidents, mostly minor in character, were reported in 1935. The State Aviation Commission included 11 members, with seven other members on the advisory board. Hartford, New Haven and Meridian had their own local air boards. The State Airports Commission was located at Groton, and included four members.

Florida's State Road Department had an aviation division under the direction of A. B. McMullen. A 10-year program for aviation development in the State was under way in 1935. It contemplated construction of airports or fields at intervals of approximately 15 miles. At the beginning of 1936 there were 120 airports completed, and 14 under construction.

Idaho's Bureau of Aeronautics, operating in the Department of Public Works, planned to improve its 57 airports and fields during 1936, using PWA funds, according to Director William R. Graham. The State law provided for an aircraft license fee of 2½ cents per pound of the useful load on all machines operating in the State for more than 30 days. A pilot could obtain a State license without charge,

based on his Department of Commerce license. There were three State auxiliary fields and four Forest Service fields, all within a 25-mile radius of the timber country. Boise was within an hour of the State's best elk and deer hunting districts. State aviation officials planned to increase the use of aircraft in reaching the various recreation areas. The numerous lakes afforded excellent landing places for over-water flying craft.

Illinois, through its Aeronautics Commission, as reported by Elwood B. Cole, secretary, investigated every aircraft accident in the State during 1935, and at the same time followed up all reported violations of law. Monthly bulletins were issued and sent to all licensed pilots. Expansion of the airport development program was carried on with the aid of the CWA and FERA. Four new projects were being financed with PWA funds and more were contemplat-



A BEECHCRAFT FOR THE PRIVATE OWNER

Model A17F, Cyclone-powered, has a door leading to the baggage compartment.

ed at the beginning of the year. A State-wide airmarking program was carried out. Seventy trail markers were built, large letters set in the ground so that they may be easily seen under all conditions. The State commission cooperated with the State Commerce Commission in granting certificates of convenience and necessity to air lines operating intrastate service; with the highway police in emergency cases; with the executive departments in supplying emergency transportation; with the Department of Conservation in studying soil erosion; with the Department of Public Welfare in airmarking State institutions; and with the Attorney General's office in all claim cases.

Iowa's Aeronautics Commission worked actively to establish more airports and to abolish unlicensed flying, according to a report from the chairman, Lieut. Col. Charles W. Gatschet. The State

Highway Police were instructed in the State laws and regulations. The commission planned in 1936 to promote a more uniform State law system. It also sponsored a WPA project for airmarking 600 towns and erecting 300 highway signs. By June, 1936, Iowa was to be thoroughly airmarked, so that pilots might fly anywhere in the State at all times within 20 miles of an airmarked town ranging between 300 and 140,000 population.

Kentucky's Air Board was inactive during 1935, through lack of funds. At the beginning of 1936 the State had embarked on an even more extensive program of economy. H. M. Derickson, a member of the Air Board, recommended that the board be abolished and in its place there be passed the uniform State law with a single administrative officer handling all aviation matters. Prior to the dearth of funds the Air Board had carried on an extensive educational program throughout the State. An effort was to be made to develop all commercial and State military aviation on a level with that of neighboring States.

Louisiana's aviation was administered by D. O. Langstaff, State Inspector of Aviation.

Maine's aviation activities under the law are controlled from the office of the Secretary of State, with three aeronautical inspectors, all pilots, headed by the chief, Burtis F. Fowler. In 1935, 43 pilots were licensed and 38 planes were registered by the department. Hard-surfaced runways were to be located on the State's 22 airports during 1936. The airport at Bangor was to be lighted for night flying. Maine officials were working aggressively on the problem of keeping the airports free of snow at all times.

Maryland's aviation interests were in the hands of a State Aviation Commission, with Dr. H. H. Young, chairman.

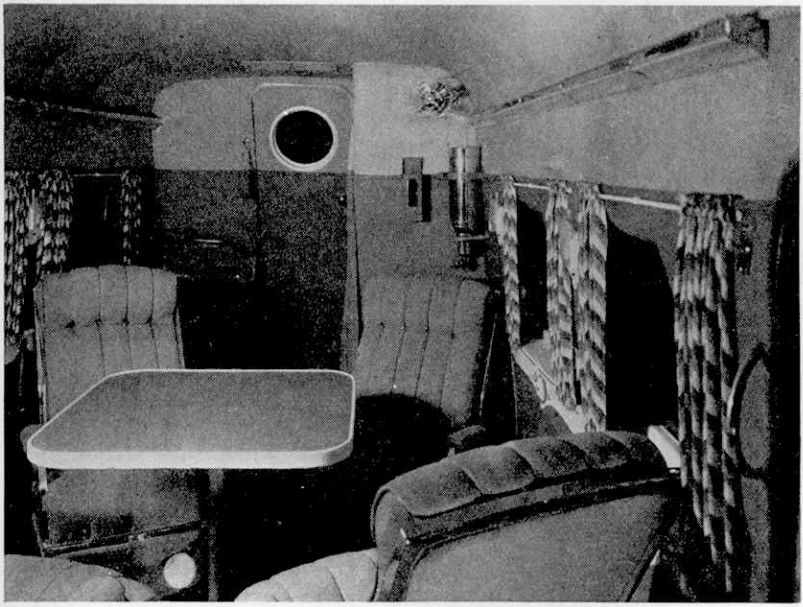
Massachusetts had an aviation section operating in the Department of Motor Vehicles. In 1935 the State aviation code was amended to conform to certain provisions of the basic uniform law.

Michigan's Board of Aeronautics, as reported by Assistant Director Sheldon B. Steers, during 1935 built 11 hangars, two administration buildings, 18 new landing fields; and improved 64 old fields. That development cost $1,230,359. The board also operated the lighted airway between Detroit and Muskegon, a series of beacons along the Detroit-Chicago airway and a lighted emergency field on the Detroit-Toledo airway. Nine serious accidents were investigated. Thirty-seven violations were investigated, and five violators were prosecuted. Seventeen aircraft were grounded as being unairworthy. Considerable assistance was given in using airplane patrol during forest fires. Men and materials were transported for

the State Police during several emergencies. Aviation schools were licensed. The 1936 program included construction of 10 new hangars and 24 new fields, improvements of 61 old fields—all to cost approximately $1,680,000. About $37,000 was to be spent airmarking 540 towns.

Minnesota's State Aeronautics Commission was directed by Major Ray S. Miller, chairman, at St. Paul.

Montana's Aeronautics Commission was headed by Fred B. Sheriff, commissioner. Among the activities of this body was the



INSIDE A STINSON MODEL A

This Lycoming-powered tri-motored Stinson transport was outfitted for a private owner.

improvement of airports throughout the State and a project for promoting the growth of both private flying and commercial aviation enterprises.

Nebraska's State Aeronautics Commission was created by law in 1935, with powers somewhat similar to those provided under the basic uniform regulatory law.

New Hampshire's aviation laws were administered by the Public Service Commission, which employed two men for part time aero-

nautical work. At the beginning of the year the State law was being revised.

New Jersey's Department of Aviation under Director Gill Robb Wilson operated on a budget of less than $10,000 during 1935, yet all air traffic was so regulated as to prevent any fatal accident to passengers of aircraft. Besides 401 licensed pilots in the State there were over 600 student pilots. The State was widely covered with airmarkers. In addition to roof signs more than 500 miles of highways were marked for aerial traffic. Aircraft were inspected, and likewise airport maintenance. Barnstorming activities and air shows involving stunting were closely regulated. Educational programs were conducted. In cooperation with the highway patrol and other State agencies the department carried on aerial photography and supplied emergency transportation.

New Mexico's aviation was in the hands of the State Corporation Commission, with Don R. Casados, chairman.

New York's State Aviation Commission, under the chairmanship of State Senator A. Spencer Feld, in its report for 1935 reviewed the status of aviation in the State, termed present aids to air navigation inadequate, urged State ownership of sites of the federal intermediate or emergency fields, State ownership and operation of new intrastate airways feeder routes to the trunkline systems, airmarking of all highways outside of towns, an aerial mapping survey of the entire State, a State airports Act, legislation providing for a permanent aeronautics bureau, and finally, the creation of emergency fields in recreation parks and all resort areas. The commission estimated that such a State program as that proposed could be operated at a minimum cost of $128,000 taxes on the aviation industry of the State, which would be "in no way objectionable to those paying same." Asserting that a State aviation bureau with a program such as that suggested by Senator Feld's commission would cost more than $200,000 annually, 200 members of the transport, airport and miscellaneous branches of the industry met in Albany on January 16, 1936, and organized the New York State Aviation Association. The announced purpose of the new organization was to protect the industry from unwise legislation, burdensome taxes and a State program that might duplicate that of the Federal Government so far as regulation and maintenance of airways are concerned. The industry felt that without extreme caution in passing State aviation legislation, there was great danger of creating an expensive State bureau which would gradually absorb airports and other flying activities, and be increasingly costly to the taxpayers, while at the same time seriously handicapping the industry it was intended to serve. There was no objection to creating a permanent State bu-

reau. It was generally believed that New York should pass the uniform State law, provided the industry was not taxed to support an unnecessary system of State regulation.

North Dakota's aviation affairs were in the hands of the State Board of Railroad Commissioners, with Ben C. Larkin as president.

Ohio's Bureau of Aeronautics under Director Fred L. Smith continued its expansion program of developing airports and landing fields in connection with work relief programs. All major airports were extended and otherwise improved. The indexing of photographs covering 8,000 square miles or more than 20 per cent of the State's area, was completed in 1935. The bureau cooperated with the Adjutant General's Department, agricultural experiment stations and others.

BELLANCA SENIOR SKYROCKET DELUXE

A Pratt & Whitney Wasp, 550 h.p., powers this plane for the business executive.

All towns on the airway sectional maps were to be airmarked, and the work was to be completed during 1936.

Oklahoma's Aviation Department carried out no program in 1935, owing to lack of funds, according to a report from J. M. Gentry, secretary. The Secretary of State, under the law, acted as State Aircraft Officer, without compensation. The State Highway Commission drafted rules and regulations for the aviation department, but the absence of funds promised no change in the situation during 1936.

Oregon's Board of Aeronautics, with J. G. "Tex" Rankin as chairman, reported in progress a complete survey of aviation in the State, with hearings at various centers to determine means of procuring airports for all communities, encouragement of aircraft factories and accessories plants to locate in Oregon, revision of laws to encourage flying, and airway and air route marking. The board also supported

efforts to obtain for Oregon one of the main Air Corps bases under the provisions of the Wilcox law. It projected an educational program designed to cultivate an interest in aviation among young and old alike. It projected a complete aviation map of the State. It made plans to encourage feeder lines, straighten existing airways, and it arranged to cooperate with other State agencies including the police and highway commission. The board also sponsored a series of aviation meets in key communities. All told, the board had a 16-point program for 1936.

Pennsylvania's State aviation law of 1933 was administered by a division of aeronautics in the Department of Revenue, under Chief Cammy Vinet.

Rhode Island's Division of State Airports, under the direction of Chief Daniel J. Kiely, in the Department of Public Works, was created during 1935 to replace the former aviation commission. At the beginning of 1936 a State airport was under construction at Providence. Plans were made for a hangar to be 400 by 200 feet, doors clearing 185 feet. Legislation governing administration, air traffic and registration of pilots and planes, all based on the uniform State law, was being prepared. Auxiliary fields were to be developed throughout the State, and were to be owned and operated by the State.

South Carolina's State Aeronautics Commission handled aviation affairs for that State, with Dexter C. Martin, director.

South Dakota's Aeronautics Commission, with T. B. Roberts, Jr., as chairman, reported in 1935 enactment of a uniform State law with the exception of minor changes to make it conform to the South Dakota statute. At the beginning of 1936 pilots and aircraft were operating under State registration. The commission had a project for ground school classes to be conducted with the aid of the FERA. Airport construction was to be encouraged.

Tennessee's Aeronautics Commission, with R. O. Lindsay, director, was set up in 1935 after the passage of the uniform State law. The commission received an appropriation of $15,000 for the year. Airport development and airmarkings under PWA projects were among the early activities of the commission. In 1936 the commission was to survey the maintenance requirements of airports in smaller communities, with a view toward providing for some form of assistance. A State aviation map was among future projects. The possibility of using aircraft in sowing grass seed in mountainous areas to prevent soil erosion was being investigated early in the year.

Vermont's aviation law placed licensing and registration under the jurisdiction of the Motor Vehicle Department. It did not provide for the development of airports or any similar encouragement of aero-

nautics. Both a federal and State license must be obtained before aircraft can be operated legally in the State. Pilots also must have both federal and State licenses. There is no charge for student permits issued by the State. The Commissioner of Motor Vehicles must first approve an airport before it is used for commercial flying. Vermont had 10 such airports, 37 licensed aircraft and 70 licensed pilots at the beginning of 1936.

Virginia's State Corporation Commission handled aviation through a director, R. E. Steele, who reported construction work in progress on 15 new airports, with improvements being made to 12 old fields, mostly through the medium of Government funds.

Washington passed a State aviation law in 1929, but it was not until 1933 that the full enforcement of the law was placed in the hands of the Washington State Patrol, the chief of which, William Cole, reported that some 25 unlicensed and unairworthy aircraft had been

THE HAMMOND PLANE FOR PRIVATE OWNERS

This Menasco-powered Model Y was developed by the Hammond Aircraft Corporation for two persons.

grounded during the last two years. In 1935 there were no licensed plane or licensed pilot fatalities; and only one fatal accident, which involved an unlicensed plane flying in from a neighboring State. That State, incidentally, permitted the use of unlicensed aircraft. The State Patrol planned to use aircraft for law enforcement purposes in 1936, at the same time carrying on an educational campaign and assisting in the development of popular flying.

West Virginia's Board of Aeronautics was under the direction of David M. Giltinan, acting chairman.

Wisconsin had no State agency governing aviation, but it had a law, passed in 1932 and amended in 1935, providing for federal licensing of pilots and planes operating in the State, with other provisions designed to bring flying within the common law. Cities and other communities were authorized to establish airports. The importance of aviation and its rapid growth was recognized among an increasing

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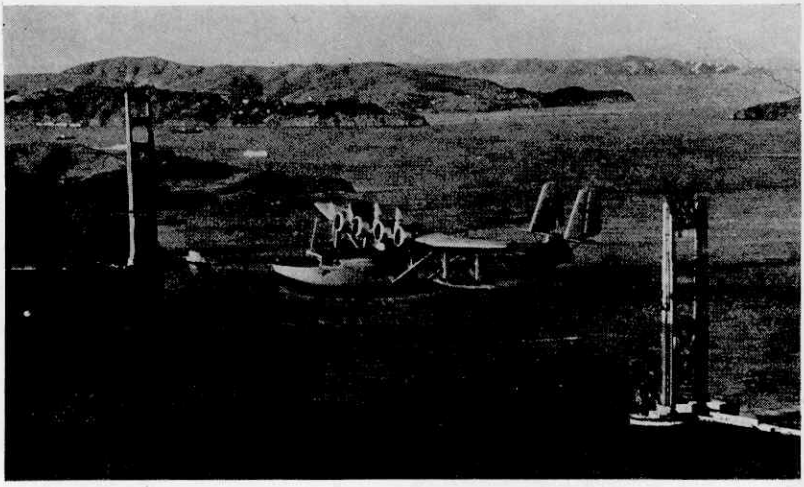
number of State officials, and an effort was to be made in 1936 to establish a State aeronautics bureau.

Wyoming had no aeronautics commission at the end of 1935; but there was considerable public demand for a state aeronautics commission, and the legislature was to be asked to provide for such a body during 1936. Efforts were to be made to pass the proposed Uniform State Aeronautical Regulatory Act. Under the active direction of J. Kirk Baldwin, State Treasurer, an airmarking program was being carried on throughout the State. At the regional meeting of the National Association of State Aviation Officials in Cheyenne 176 delegates passed a series of resolutions seeking improved conditions and better laws for commercial aviation.

Comments on State laws and regulations of 1935 will be found in the chapter on laws and regulations.

The State aviation gasoline tax summary is in the appendix.



PAN AMERICAN CLIPPER AT GOLDEN GATE

The Hornet-powered Sikorsky S-42 ocean flying boat sets out on its great flight over the Pacific.

## CHAPTER IX

### NOTABLE FLIGHTS OF 1935

Pioneer Hawaiian Flight of the "Pan American Clipper"—Ellsworth's Adventurous Flight Across the Antarctic—Amelia Earhart's Flights—Atlantic Flights—Howard Hughes Makes Land Speed Record—Key Brothers Stay Up 27 Days —Tomlinson's Record Flights—U. S. Navy's Seaplane Record—Flight of the Boeing Bomber— Laura Ingalls Breaks Women's Record.

ALL things considered, the trip of the giant Sikorsky S-42 "Pan American Clipper" from San Francisco to Honolulu in April, 1935, was the most notable flight of the year in world aeronautics. Many factors made it superlatively notable. It was not a stunt, not an adventure of the air, not a daring achievement. It was made within one minute of the exact schedule laid out for it months before. It demonstrated the absolute practicability of regular transpacific air transport. It demonstrated the oft-repeated truth that in aviation, as in anything else, practice makes perfect. It proved beyond doubt that the great Pan American Airways System during its years of successful operations in the Western Hemisphere had built experience on top of experience until it had achieved near-perfection in long-distance over-water transport.

The flight of the "Pan American Clipper" was especially notable because it promised the world that during the ensuing months an American flag line would start regular passenger, mail and express service from the Pacific Coast of the United States 2,410 miles to Hawaii, 1,380 miles to Midway Islands, 1,242 miles to Wake Island, 1,450 miles to Guam Island and 1,500 miles to Manila, whence at some future date connections would be made between the capital of the Philippines and Canton 700 miles eastward on the main coast of Asia.

Capt. Edwin C. Musick and the five other experts who made up the crew of the "Pan American Clipper" loaded it with 3,000 gallons of gasoline, 10,000 pieces of mail and a vast array of technical apparatus and scientific instruments shortly before the start on the evening of April 16. But let Capt. Musick tell the story in his own words:

"The explanation of how it was possible to complete a 2,550-mile flight actually within one minute of the schedule established—the flight

including not only the 2,410-mile crossing, but approximately 150 miles of landing areas survey as well—lies in the thoroughness with which each problem was plotted in advance and the technical solution provided. Our part, we feel, was largely one of carrying out those technical solutions as developed by our operations engineers.

"As the sun was setting behind the fiery western horizon, we moved into a world beneath a limitless star-studded canopy above, with an impenetrable floor of clouds, 4,000 feet below. For nearly 12 hours, we were without sight of the ocean, maintaining our flight level at an altitude of six to seven thousand feet. For training purposes, this afforded an excellent opportunity for close correlation of celestial, dead reckoning and radio compass navigation.

"With a remarkably dependable radio set-up, our stations in both California and Hawaii followed us every mile of the way across. We were able to explore at will the variations between Great Circle and Mercator lines and other course deviations required of us. With infrequent changes in the major contour aspects of the cloud floor, the only sights within the vast moonlight-flooded area, there was little sightseeing to be done, even if we had had the time to do any. Each officer in the crew, in addition to his share of routine operations, had special projects assigned to him for study. Because we were so busy, perhaps, the long hours passed swiftly.

"Relieved of a considerable part of the mechanical details of flying by the Sperry gyropilot at intervals both First Officer R. O. D. Sullivan and I were able to devote long periods to instrument flying beneath the hood which entirely shields either section of our cockpit from all outside visibility.

"Engineering Officer Victor Wright, with his task of recording the operation of mechanical features aboard and the readings of 71 separate instruments, was hardly absent from his post long enough to share our midnight supper, prepared from the self-heating foods we carried.

"Radio Officer W. T. Jarboe, Jr., had an extremely busy, but occasionally entertaining time communicating with our three Pan American guarding stations, at Alameda, Honolulu and Miami. Between receiving weather reports approximately every 20 minutes and dispatching position reports and a complete flight progress analysis every 30 minutes, he somehow found time to speak to the Pan American air base construction steamer, then at the Midway Islands, and to all seven steamers on the Pacific between Hawaii and the mainland, on some of which he took bearings by our radio compass. Navigating Officer Fred J. Noonan did not take his scheduled rest period during the entire 18 hours and 40 minutes we were aloft. Swathed in a heavy flying suit,

face mask and goggles, he made more than a dozen trips down the long aisle to the aft observation hatch to take his periodic sights of the stars and to employ drift sight smoke and light bombs. In addition to his navigation duties, he also recorded a complete analysis of wind and weather conditions on the entire area we covered. Junior Flight Officer Harry Canaday, who is a qualified relief officer for every post aboard ship, stood more than his share of watches, and was an invaluable aid. Needless to say, the flight so interested all aboard, that the comfortable berths in the after cabin were unused.

"Little occurred to change the monotony of steady flight, hour

CAPTAIN AND MATE OF THE "PAN AMERICAN CLIPPER"

Capt. Edwin C. Musick and First Officer Pilot R.O. D. Sullivan, just before taking off for their famous flight to Hawaii in the Sikorsky S-42 to blaze the Pacific trail for Pan American Airways.

after hour. That our flight was a routine performance in every respect was greatly due to the expert way in which these officers manned their difficult posts. On this flight, of course, we were endeavoring to learn all that was possible concerning our assigned area of the Pacific, and to make the fullest possible use of the flight for training purposes as well. Before this flight, the crew had flown some 15,000 miles on this Sikorsky S-42 type 'Pan American Clipper' under the closest possible approximation of the conditions we met on the actual flight. In addition, during nearly three years, all our marine personnel have been schooled in navigation and operating problems based on the Pacific as well as the Atlantic. In those flights, we had 'flown' the 'Pacific' so many times that the actual flight appeared to us as something which we had done many times before. Approaching the half-way mark shortly after midnight, First Officer Sullivan leaned over to me and said, 'Why, I've recognized every cloud in this stretch of the Pacific.' "

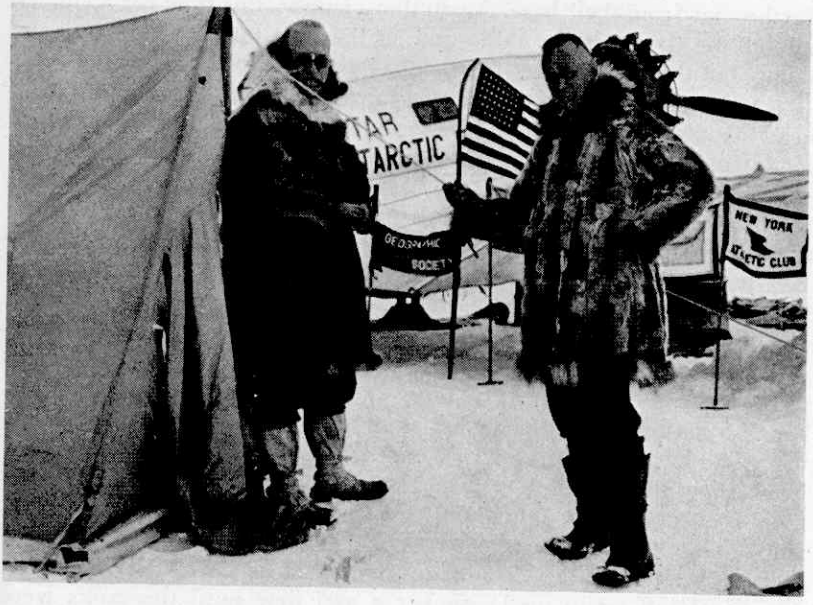
**Ellsworth's Antarctic Adventure**

For thrilling adventure and exploits far off the beaten path the 1935 achievement of Lincoln Ellsworth and his pilot, Herbert Hollick-Kenyon, in flying across the Antarctic continent ranked as one of the notable flights of the year. Ellsworth long had planned to make that flight. He failed on the verge of starting in 1934 when his plane was caught in an ice jam and badly damaged by the drifting floes. But he went back again, his expedition including Sir Hubert Wilkins, second in command, and in charge of the base ship "Wyatt Earp" which carried them to Dundee Island in the Weddell Sea. There the "Polar Star" was prepared for the dash across the Antarctic. It was a Northrop Gamma monoplane, all-metal, powered with a Pratt & Whitney Wasp engine, and loaded with Texaco aviation fuel and lubricants. Plane, engine and fuel were highly commended by Ellsworth, and for good reasons, when one considers the amazing tests to which they were subjected.

The "Polar Star" carried a load of 8,000 pounds when at 3 o'clock on the morning of November 23, 1935, Ellsworth and Hollick-Kenyon lifted it off the ice on Dundee Island and headed out into the unknown, their objective Rear Admiral Richard E. Byrd's former base at Little America, on the Ross Sea, about 2,140 miles airline distance, on the other side of Antarctica. None had ever traversed that region before. Byrd on his two expeditions had penetrated many miles of the wilderness outside Little America, and had explored by plane some of the mountain ranges in Marie Byrd Land. Returning from his second trip in 1935, he had reported to the National Geographic Society:

"The Society's map of Antarctica shows a great white unknown blank space north of the 75th parallel of latitude and between longitude 120 and 160 west. By ship and airplane we wiped that area off the map and put it into the column of the known by proving it to be a part of the Pacific Ocean. Our airplanes flew a total of 26,000 miles."

Ellsworth's objective was to determine what lies between 60 and 120 degrees longitude. The adventurous manner by which he suc-




*Wide World Photo*

ADVENTURES OVER POLAR WASTES

Lincoln Ellsworth (right) and Herbert Hollick-Kenyon beside the tent in which they camped out during their flight across Antarctica.

ceeded will remain forever a bright page in the thrilling history of Polar exploration. They climbed to a height of 13,000 feet soon after leaving Dundee Island on the morning of November 23, and this enabled them to cross the Hearst Land mountains by a safe margin. They were still able to keep in touch with their base ship by radio. But shortly after 11 o'clock that morning something went wrong. Their signals ceased. Later Ellsworth explained that they never succeeded in repairing their radio. But they kept on flying, and dropped the

American flag at a spot approximately halfway on their course. Clouds and extremely high winds gave them considerable trouble, and they knew that there was danger of having the wind drift them far off their course. Even the most exact navigating in the air might lead them astray in such wind, as they knew. So a few hours later, 13 hours and 15 minutes after leaving Dundee Island, they landed the "Polar Star" on a bleak plateau, 6,400 feet above sea level. Checking their distance they found they had flown 1,450 miles. There they set up their tent and camped for 17 hours. On November 24 they took off again, but 30 minutes later found the visibility too bad; so they landed, 60 miles farther out from their base. Again they camped, this time for 57 hours, attempting to repair the radio and let the base know what they were doing, but they did not get their signals through to the "Wyatt Earp."

On November 27 they took off again and flew for 50 minutes, covering about 100 miles. Again they came down in thick weather which made further navigation impossible. In those regions flying by dead reckoning could not be attempted because of compass errors and other factors which might have guided them in a hopeless, tragic circle. Soon a blizzard struck their camp. It raged for eight days; and it was perfect testimony to the efficient preparations of the expedition before the flight that they were able to live fairly comfortably and without physical distress.

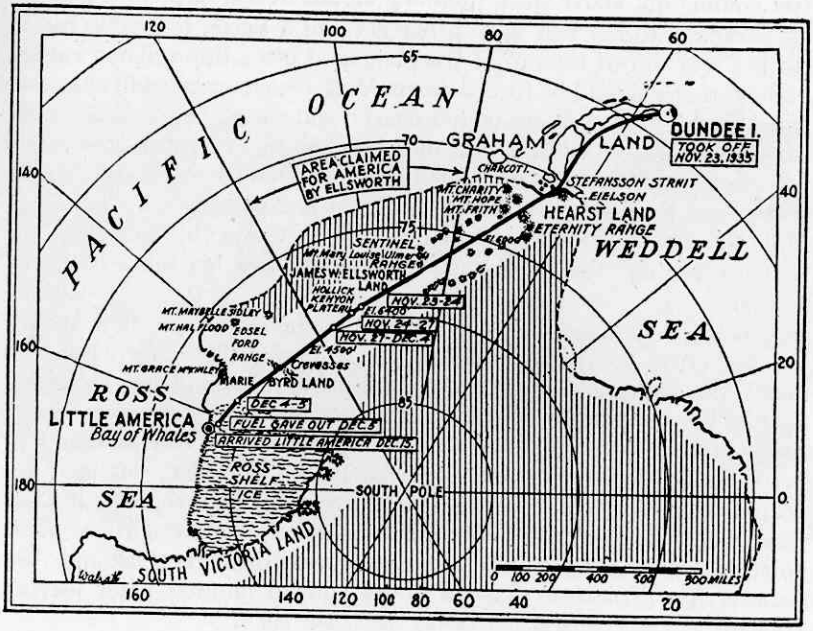
On December 4 they took off at 7 o'clock in the evening, and after flying about 660 miles in three hours 55 minutes they again came down, for two reasons. They knew that they were falling short of gasoline. They had been flying 19 hours 5 minutes since leaving Dundee Island. They should be somewhere near Little America and they must be, if their fuel supply was to hold out. So they checked their position carefully. They found they were on their course and within 150 miles of their destination. They decided to fly on just as far as they could go. They took off again on December 5 and flew until the tanks were empty. Then they glided merrily down. The "Polar Star" had brought them to within 25 miles of Little America.

They knew that the "Wyatt Earp" would come around to Little America with all speed, but that it would require nearly a month; so they were in no hurry. They pitched their little tent again and made everything snug. They remained four days, fastening down their faithful "Polar Star" and removing everything that they wanted to take on their sled. Then on December 9 they set out afoot. They took their time about it, stopping and resting whenever they became weary. This apparently was no dash against time and the ravages of sickness which fill the records of pre-aviation exploration. In fact, they spent six days trudging and pulling their sled into Little America, where on

December 15 they arrived at Byrd's deserted camp. There they made themselves comfortable. Hollick-Kenyon caught a cold; that was all.

On January 15, 1936, a month after their arrival, the British Royal Research Society ship "Discovery II," which had steamed as closely as possible to Little America, sighted Hollick-Kenyon on the ice in the Bay of Whales. He was brought aboard, and a few hours later a ship's party went over to the Byrd camp and returned with Ellsworth. The "Wyatt Earp" came up later in the month and took them aboard for the voyage homeward.

From Ellsworth's first accounts of the remarkable flying journey




*Courtesy the New York Times*

ELLSWORTH'S FLIGHT ACROSS ANTARCTICA

After this flight November 23—December 15, 1935, Lincoln Ellsworth claimed for the United States all land between 80 and 120 degrees west longitude.

across the unknown Antarctic the "Polar Star" actually flew about 2,400 miles, which is nearly the distance across the United States from coast to coast. Ellsworth's flight confirmed Byrd's belief that the land mass between the Ross and Weddell seas is unbroken by straits, being in fact one solid section of the Antarctic continent.

### Amelia Earhart's Flights

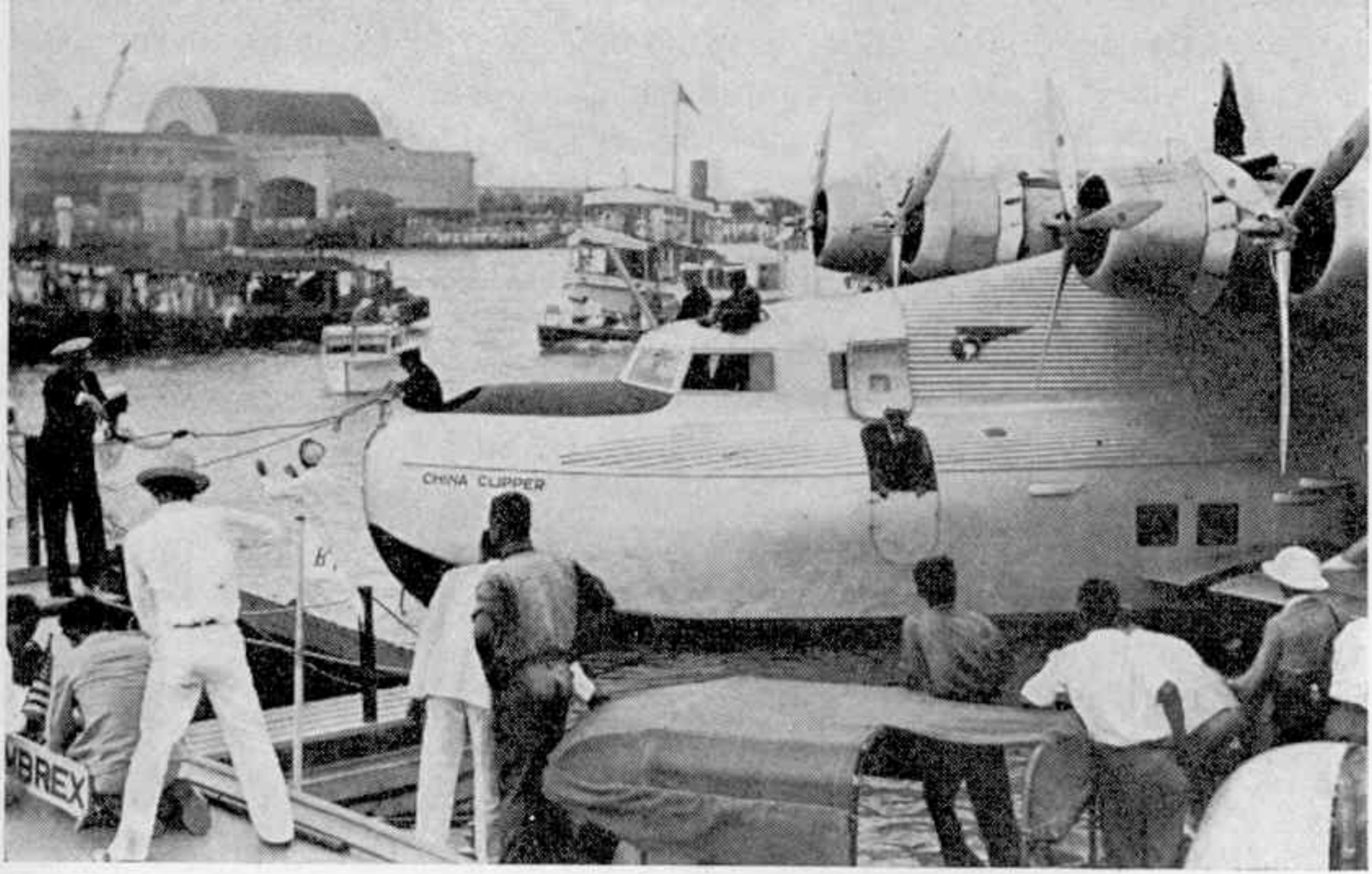
From another viewpoint, that of daring and sheer skill in piloting,

Amelia Earhart's flight from Honolulu to Oakland, Calif., in January, 1935, possibly ranks as the most sensational of the year. Long recognized as the leading woman pilot in the United States Miss Earhart spent two weeks in Honolulu testing, checking and preparing for her gallant feat which was to be the first flight over the Pacific to be made by a pilot flying alone. Hers was a land plane, her famous Lockheed Vega with its equally famous Pratt & Whitney Wasp engine, and it weighed about three tons when late in the afternoon of January 11 she lifted it off the rain-soaked surface of Wheeler Field and headed across Honolulu, skirted the island of Molokai and climbed to 6,000 feet coming out above thick tumbling clouds over a darkening sea.

Strapped to her belt were a hatchet and a knife, to enable her to cut her way out of the tail of the plane and use a tiny inflated rubber lifeboat if she should be forced down. With consummate skill she navigated a course marked out on her charts, and she managed to keep her two-way radio set working, so that she was in fairly constant touch with shore stations. She was able to receive answers to questions in 12 minutes or less. Shortly before midnight she passed over the "S. S. Maliko," 900 miles from Honolulu, and that was the only ship she sighted, although the Navy tanker "Ramapo" saw her plane half-way across.

Taking advantage of every clearing in the clouds she flew at altitudes varying between 700 and 8,000 feet over the water. For two hours she thought she saw the coast of California, and struggled against the temptation to ignore her instruments and swerve off the true course toward what she thought was land. The instruments told her that she was too far out over the Pacific for that; but land appeared to be there just the same. Finally she solved the mystery. It was a huge bank of clouds mirrored in the sea. She brought her plane down in front of the wildly enthusiastic crowds at the Oakland Airport on San Francisco Bay 18 hours and 16 minutes after leaving Hawaii.

Amelia Earhart made another notable flight when on May 8, 1935, she flew her plane non-stop from Mexico, D. F., to Newark Airport, spanning the 2,100 miles of mountains, water and lowlands between the Mexican capital and New York in 14 hours 19 minutes. She had breakfast in Mexico city and dinner in New York. She used the same equipment that won her success on the Pacific hop, including the two-way radio set developed by the Bell laboratories of the Western Electric Company. Over the Gulf of Mexico she had a bad hour when strong headwinds threatened to reduce her fuel supply so that she might not reach her goal. After that, she explained, it was "just a matter of sitting still and waiting to get to New York."

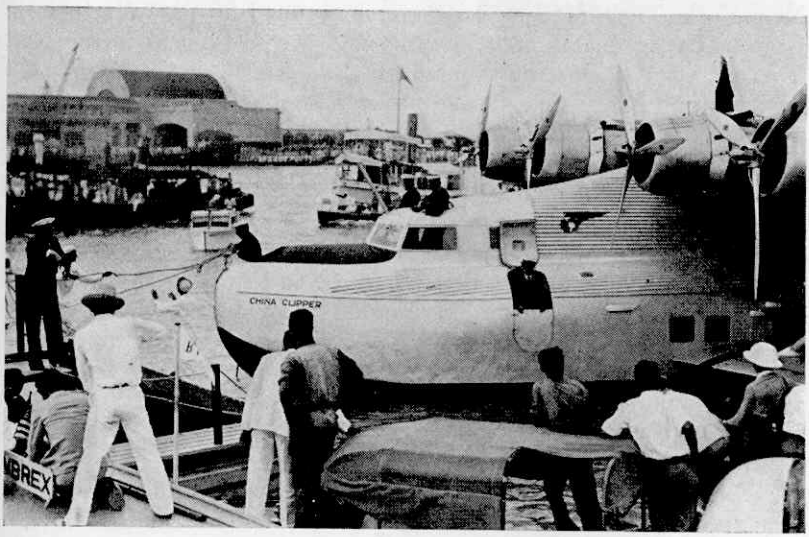



AMERICAN WINGS AT MANILA

The Pan American Airways "China Clipper," a Martin flying boat, reaches the end of her first flight to the Philippines.

### Atlantic Flights of 1935

Among the daring flights of the year was that of Felix Waitkus, a young pilot who yearned to be the first to fly to Lithuania. He, also, flew a Lockheed Vega, powered with a Wasp engine. He left Floyd Bennett Field, New York, on September 21, and made his way up the New England coast to Nova Scotia which was the last land he saw. After that, over Newfoundland and the ocean, he flew through fog and rain and clouds. After leaving the comparative safety of the North American continent young Waitkus discovered that he was using too




AMERICAN WINGS AT MANILA

The Pan American Airways "China Clipper," a Martin flying boat, reaches the end of her first flight to the Philippines.

much gasoline, and that he could not hope to reach Lithuania. So he decided to drop down in Ireland and refuel. All through the night he flew by instrument only, aided immensely by hourly broadcasts from an Irish radio station. At times he flew nearly two miles above the sea, but twice he found ice forming on the wings and had to come down very low until it thawed off in the warmer strata of air. Over Ireland he ran into a heavy mist which led him to land in the first open field that he saw. Unfortunately one wing tip struck the ground first, skidded the ship around, smashing the landing gear and breaking

things up generally. But he had flown from New York to Ballinrobe, Ireland, in 23 hours 15 minutes.

Juan Ignacio Pombo, a Spanish youth of barely 21 years, became the youngest aviator to fly alone across the Atlantic when on May 21, 1935, he landed his Gipsy-powered British Aircraft Eagle plane at Natal, Brazil, after a flight of 16 hours 55 minutes from Bathurst, Gambia, West Africa.

Thor Solberg, Brooklyn manufacturer, realized his ambition of years when on August 16, 1935, he and his radio operator, Paul Oscanyan, set down their Wright Cyclone-powered Loening amphibion in the harbor at Bergen, Norway, after flying by easy stages from New York. They left Floyd Bennett Field on July 18. "We took off from Cartwright, Labrador, on July 28," wrote Solberg in the New York Times, "and set our course for Julianshaab in Greenland. We flew for 600 miles through and above fog. The sun shone down on unbroken fields of ice. We did not see an opening the entire trip. Eight hours after we took off we sighted the mountains back of Julianshaab straight ahead, which proved that the compass and directional gyro were working perfectly."

Again: "When we left two days later, we followed the coast south to Cape Farewell and then flew along the eastern shore to the north until we reached Angmagsalik. Finding a landing place in the ice-choked fjords was far from simple. We radioed the colony for suggestions, and they advised us to try a large lake in the upper end of the fjord. We climbed up to 10,000 feet to get over the highest mountains and found room to land among the scattered bergs. We came down between mountain walls 7,000 feet high.

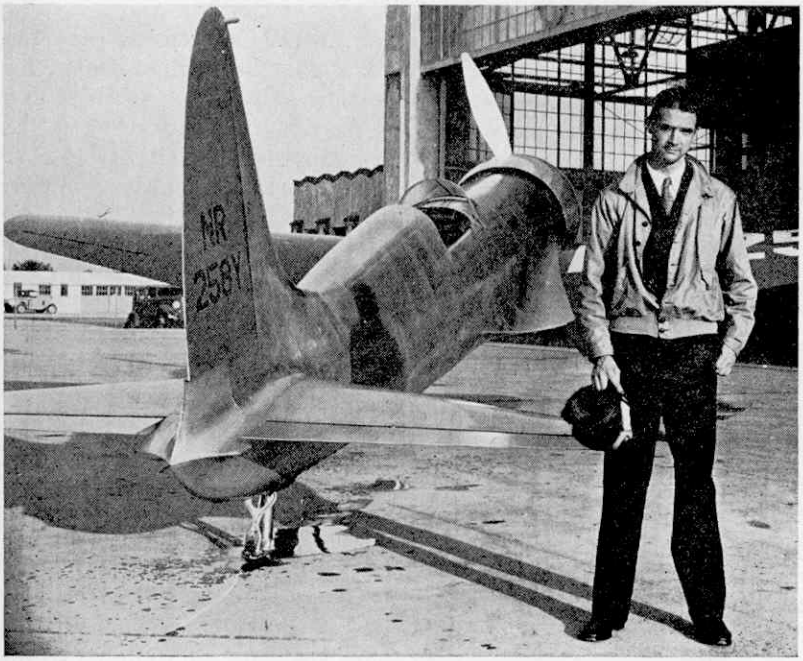
"After leaving Greenland for Iceland we had not flown for more than an hour before we found fog and low clouds ahead of us to the south and west. I shifted our course northward in an endeavor to fly around it and make for the northern part of Iceland. Conditions did not improve and we climbed from 500 to 7,500 feet in our efforts to get above it. We descended to 1,000 feet and flew by instruments through the now dense fog. About 50 miles from the coast we sighted some fish-trawlers. Oscanyan tried to get them to radio their position but they did not answer. Instead, they saluted us with three blasts of their whistles, as we could see by the white plumes of steam from their stacks."

They landed in Iceland a few hours later. The rest of the flight to Norway was made without incident.

One of the splendid failures of the year was that of Paul Codos and Maurice Rossi, famous French aviators, who have held the world's non-stop flight record for distance since they flew from New York to

Syria in 1933. In their veteran Hispano-powered Bleriot monoplane "Joseph LeBrix" (the same machine in which they made the record flight and in which they flew from Paris to New York in 1934) they set out on February 16, 1935, to fly from Istres, France, to Buenos Aires, Argentina, a distance of 6,835 miles which was calculated to break their record of 5,635 miles in 1933. But they did not make it.

They had completed nearly half of their trip and were far out in




HOWARD HUGHES AND HIS RECORD SPEED PLANE

He won the world speed record in 1935 with this specially designed plane, powered with a Pratt & Whitney Twin Wasp Junior engine and a Hamilton Standard constant speed propeller.

mid-Atlantic when the engine started over-heating; the oil pressure dropped alarmingly, and they knew they must turn back toward land. For more than five hours they struggled to keep their plane in the air, alternating between radio calls for help and reassuring messages to their families back home. They landed safely at Porto Praia in the Cape Verde Islands. On March 15 they flew non-stop back to Paris, 2,800 miles in 25 hours.

### United States Leads in Records

For the first time in seven years the United States during 1935 wrested one record after another from the erstwhile victorious French and won from them the enviable first place in the air among the nations of the earth. Upward of 40 world records were held by the United States at the end of the year. Two of the new records were sensational, one for land plane speed and the other for duration flights with refueling.

### Howard Hughes Makes Speed Record

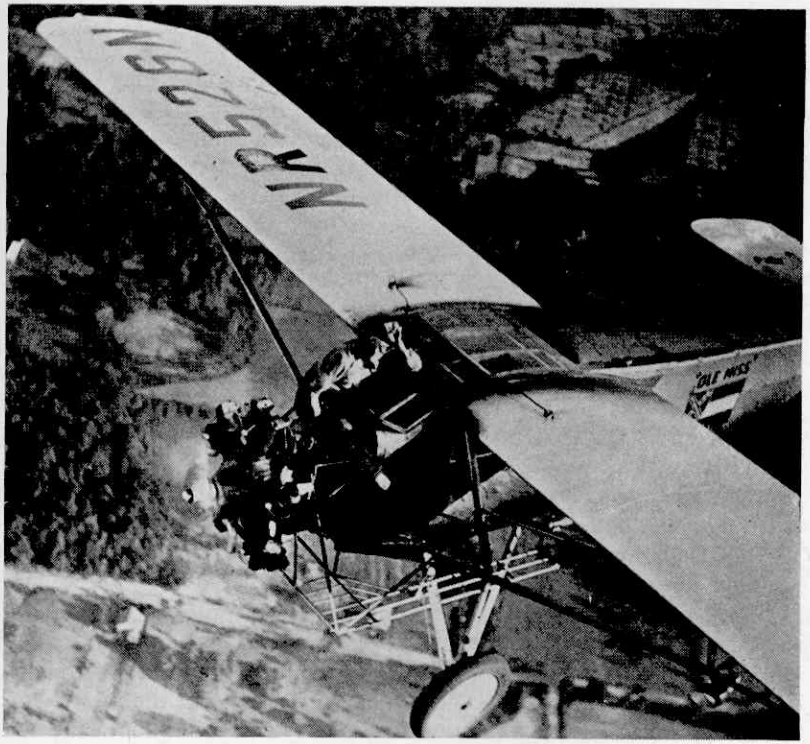
Young, ambitious Howard Hughes, already famous as a motion picture producer and an amateur pilot who had demonstrated his ability at many air race meets, built his own airplane and flew it to a world record for land planes, making the remarkable speed of 352.38 miles an hour. On September 13, 1935, Hughes made six dashes over an official course at Santa Ana, Calif., on each dash beating the time of Raymond Delmotte, the French pilot who in December, 1934, had won the land plane speed record in a Caudron monoplane racer powered with a 380 horsepower Renault engine, at an average speed of 314 miles an hour.

Hughes built his racer in Charles Babb's hangar at Grand Central Air Terminal, Glendale, Calif. It required 18 months of engineering and construction, and the services of a skilled organization built up by Hughes for that purpose. The racer was a combination of wood and metal, body 27 feet long with one seat in the cockpit, wings 25 feet between wing tips. The wheels were drawn up into the body during flight. The power plant was a geared Pratt & Whitney Twin Wasp Junior engine rated at 700 horsepower at 8,500 feet, but capable of delivering 1,000 horsepower for racing purposes. A constant speed controllable pitch Hamilton Standard metal propeller hurled the tiny ship through space at its average speed of nearly six miles a minute. An indication of the accuracy with which airplanes can be designed for certain purposes was given during the record flight. Before the plane was built a model received complete tests in the wind tunnel at the California Institute of Technology, and those tests showed the plane to be capable of making 365 miles an hour. In actual flight, under practical conditions, Howard Hughes averaged within 13 miles an hour of the maximum shown by the wind tunnel tests.

### Key Brothers Stay Aloft 27 Days

On June 4, 1935, two brothers, Al and Fred Key, went up over a Meridian, Miss., airport in a Wright Whirlwind-powered Curtiss Robin plane, determined not to come down again until they had broken the official endurance record of 553 hours established by the Hunter

brothers in 1930. For more than 27 days the Key brothers remained up in the air, through all kinds of weather and the most tedious kind of physical strain, flying in a small circle around and around, always within sight of the airport and the official observers on the ground. When they finally came down on July 1, they had broken not only the Hunter brothers record but the unofficial record set up by Dale Jack-




THEY REMAINED IN THE AIR 27 DAYS

Al and Fred Key in their 175 h.p. Wright Whirlwind-powered Curtiss Robin "Ole Miss" winning the world record for endurance flying by staying up 653 hours 34 minutes.

son and Forest O'Brine at St. Louis in 1930. By staying up 653 hours and 34 minutes the Key brothers broke the unofficial record by six hours, six minutes.

The record of the Hunter brothers, incidentally, was established with a Whirlwind-powered Stinson at Chicago. That record stood for nearly five years, and it remained for the Key brothers to again demon-

strate the dependability of American aircraft engines. After the flight the Whirlwind engine was torn down and thoroughly examined. It was found that though the engine had been running steadily 27 days during an estimated 52,320 miles of flying and had made 58,860,000 revolutions without stopping, the wear on the various parts was negligible. New exhaust valve guides and a new set of rings were the only replacements necessary to put the engine in first-class condition.

### A TWA Douglas Breaks 19 Records

Speed with loads, demonstrating the increasing efficiency of transport planes and engines, featured many of the record flights of the year. Most impressive, perhaps, from the viewpoint of performance and the number of records broken were the flights made by Comdr. D. W. Tomlinson and Joseph Bartles in a TWA Douglas transport powered with two Wright Cyclone engines. On May 17, 1935, they broke 14 records when they completed 5,000 kilometers of non-stop flying over a closed course in 18 hours, 22 minutes and 49 seconds. Their average speed was 169.03 miles an hour. They flew a triangular course between Floyd Bennett Field, Brooklyn, Washington, D. C., and Norfolk, Va., an official 1,000-kilometer closed course. Tomlinson and Bartles intended to fly it five times, but when a very low ceiling developed over the Norfolk area after the fourth lap, and after a flight to and from Washington they completed the fifth lap in six short shuttle flights between Newark Airport, North Beach Airport in Queens and Floyd Bennett Field.

Their payload weighed slightly more than a long ton of 2,200 pounds. Their fuel load, which they considered necessary to power the two 715 horsepower Cyclone engines for 1,500 kilometers or 3,105 miles, was 1,600 gallons of gasoline. All told, the loaded plane weighed 24,845 pounds. Its burden was more than three tons heavier than its normal loaded weight of 18,000 pounds. Despite that the pilots were able to fly at an altitude of 10,000 feet, nearly two miles above the surface with a winged craft aggregating 12 tons. They broke five world records and nine American records.

Not content with that performance they went up next day and took five more records over the same course. They also bettered all their marks of the previous day for distances up to 2,000 kilometers. They completed the first lap of the 621-mile closed course in three hours, 16 minutes and four seconds, an average speed of 190.143 miles an hour. That broke the former world record of 174.76 miles an hour for 1,000 kilometers with 1,000 kilograms (2,205 pounds) made by M. Lemoine in a French Potez plane in 1933. The second world record to go to the pilots of the TWA Douglas on their second day of record-

breaking was for 2,000 kilograms (4,410 pounds) payload for 1,000 kilometers. They had doubled their payload of the previous day, and at 190.143 miles an hour on the first lap took the record away from the French who had held it at 158.6 miles an hour since 1933. They also broke by substantial margins the three records for flight without payload requirements which they had set the day before, so that their two days of effort can be summarized as follows:

WORLD RECORDS BROKEN

| | Speed |
|---|---|
| 1,000 kilometers, 1,000 kilograms load | 191.674 m.p.h. |
| 1,000 kilometers, 2,000 kilograms load | 191.674 m.p.h. |
| 2,000 kilometers, 500 kilograms load | 190.906 m.p.h. |
| 2,000 kilometers, 1,000 kilograms load | 190.906 m.p.h. |
| 2,000 kilometers, 2,000 kilograms load | 190.906 m.p.h. |
| 5,000 kilometers, without load | 169.03 m.p.h. |

WORLD RECORDS SET

(No previous record)

| | |
|---|---|
| 5,000 kilometers, 500 kilograms load | 169.03 m.p.h. |
| 5,000 kilometers, 1,000 kilograms load | 169.03 m.p.h. |

AMERICAN RECORDS BROKEN

| | |
|---|---|
| 1,000 kilometers, without load | 191.674 m.p.h. |
| 1,000 kilometers, 1,000 kilograms load | 191.674 m.p.h. |
| 2,000 kilometers, without load | 190.906 m.p.h. |

AMERICAN RECORDS SET

| | |
|---|---|
| 1,000 kilometers, 500 kilograms load | 191.674 m.p.h. |
| 1,000 kilometers, 2,000 kilograms load | 191.674 m.p.h. |
| 2,000 kilometers, 500 kilograms load | 190.906 m.p.h. |
| 2,000 kilometers, 1,000 kilograms load | 190.906 m.p.h. |
| 2,000 kilometers, 2,000 kilograms load | 190.906 m.p.h. |
| 5,000 kilometers, without load | 169.03 m.p.h. |
| 5,000 kilometers, 500 kilograms load | 169.03 m.p.h. |
| 5,000 kilometers, 1,000 kilograms load | 169.03 m.p.h. |

**Tomlinson's Transcontinental Records**

One of the most amazing flights of the year was Comdr. D. W. Tomlinson's non-stop flight from Los Angeles to New York on April 30, 1935. He was flying so fast when he reached New York that he had to keep on going for 10 miles out over the Atlantic Ocean and turn round in order to slow down and come low enough to glide into Floyd Bennett Field. Accompanied by Harold Snead, radio beam expert, and Peter Redpath, expert navigator, both of them also skilled pilots, Tomlinson used the same Cyclone-powered Douglas transport which TWA had turned into a laboratory ship to develop improved service in regular operations.

They took off from Los Angeles in the morning, a 10½ ton load

which climbed to 11,000 feet over Old Baldy in the San Bernardino Mountains. There they set their Hamilton-Standard controllable pitch propellers for high altitudes, turned a knob which automatically placed the controls of the giant Douglas in complete charge of the Sperry gyropilot, and aimed straight for Floyd Bennett Field, New York. They navigated solely by instrument, without any relation to the surface. Over the Continental Divide at Durango, Colo., they ran into a snow storm, and ice commenced forming on the plane. They swerved

TWA'S RECORD-BREAKING DOUGLAS

Loading the Cyclone-powered air liner with 2,200 pounds of sand bags prior to the flights which broke 19 records.

40 miles southward over the Grand Canyon, dodged round the storm and resumed their straight course. Next came a dust storm over the Pueblo Valley. They ignored it by climbing to 15,000 feet, and flew 1,000 miles with the dust clouds underneath. Then with the Sperry gyropilot doing the hard work at the controls, the trio comfortably and leisurely ate a hot meal. Toward evening they made ready to land in New York. Checking their speed on the instruments they found they

were flying at a speed of 280 miles an hour, with the aid of a high tail wind and the light air through which they were traveling about three miles high.

Within one minute of eight o'clock they streaked across Floyd Bennett Field, but they could not stop. They were too high, and they were going too fast. For 10 miles out to sea they worked at slowing down and dropping down closer to the surface, then turned and glided into the airport. They had made the 2,400 miles across the continent in 11 hours five minutes, beating by 28½ minutes the remarkable rec-

HE HOLDS 1935 RECORD FOR RECORD-BREAKING

D. W. Tomlinson in the pilot's cockpit of his TWA laboratory plane, a Cyclone-powered Douglas liner with all the latest navigational instruments.

ord for transports established by Leland S. Andrews in a Cyclone-powered Vultee transport on February 21, 1935. They estimated that the Sperry gyropilot had reduced their time considerably because it had kept them within 10 miles of their true course throughout more than 80 per cent of the flight. On the other hand they lost 18 minutes dodging the snow storm over Colorado. Their flight not only won the transcontinental record for transport ships, but also won the non-stop transcontinental record, because Roscoe Turner's former record with a racing plane was made with four stops for refueling.

### General Andrews Sets Three Records

On August 24, 1935, Major General Frank M. Andrews, commanding officer of the G. H. Q. Air Force, accompanied by two assistants, hurled his Hornet-powered Martin B-12 bomber on Edo floats over a 1,000-kilometer course at 165.04 miles an hour on the second lap of a 2,000-kilometer non-stop flight. The course was laid from Hampton Roads, Va. to New York and return by way of Washington, D. C. Flying at an altitude of 10,000 feet or more General Andrews completed the second lap of 1,000 kilometers in three hours 45 minutes and 13 seconds, and carried a payload of 2,235 pounds made up of two big aerial bombs. At the speed of 165.04 miles an hour General Andrews broke three world seaplane speed records, for 1,000 kilometers; one without payload, the second with payload of 500 kilograms and the third with payload of 1,000 kilograms.

### Non-stop Seaplane Records

The French flying boat "Southern Cross," a Latécoère product with four Hispano-Suiza motors, interrupted its routine on the South Atlantic mail run and on June 22-23, 1935, made a world record seaplane flight from Cherbourg, France, to Ziguinchor, Senegal, a distance of 2,695 miles, breaking the former record held by Italy, by 129 miles. The 24-ton ship carried a crew of six commanded by Lieut. de Vaisseau Hebrard. It set out with 14½ tons of gasoline. On July 16 and 17, 1935, the Italians recaptured the non-stop distance record for seaplanes when Mario Stoppani and Capt. Casimiro Babbi flew a naval scout plane from Monfalcone, near Trieste, to Berbera, British Somaliland, a distance of 3,063 miles, thereby beating the new French record by 368 miles. Throughout the flight they maintained constant contact by wireless with military stations near Rome.

### U. S. Navy Breaks All Non-stop Seaplane Records

Then on October 15, 1935, the U. S. Navy took the record away from the Italians when a Consolidated P3Y-1, powered with two Pratt & Whitney Twin Wasp engines, commanded by Lieut. Comdr. Knefler McGinnis, arrived in Alameda, Calif., after a non-stop flight of 3,281 statute miles airline distance and approximately 3,443 statute miles broken line distance from Coco Solo, Panama Canal Zone. Comdr. McGinnis was accompanied by a crew of five. They required 34 hours 45 minutes to make the flight from Panama to San Francisco Bay. The P3Y-1 was the first of 60 new patrol boats which the Consolidated Aircraft Corporation of San Diego was building for the Navy at the beginning of 1936.

### Boeing Bomber Makes Epic Flight

Marking a new era in the performance of bombing aircraft and thereby worthy of being termed an epic was the achievement of the new Boeing bomber 299 when on August 20, 1935, Leslie R. Tower with a crew of three flew the giant machine from Seattle, Wash., to Dayton, O., a distance of 2,100 miles at an average speed of 232.2 miles an hour, non-stop. Appropriately named "flying fortress" the great bomber was powered by four Pratt & Whitney Hornet engines each twirling three-blade Hamilton Standard constant speed propellers. Its single wing spanned 105 feet between tips, and the turreted body was 70 feet long. It had a retractable landing gear and was

AMERICAN AIRLINES RECORD-BREAKING VULTEE

Pilot Andrews and his Cyclone-powered Vultee in which he broke the transcontinental flight record in February, 1935.

equipped with flaps on the rear edges of its wings to serve as air brakes in landing. The bomber weighed about 15 tons. Tower flew the ship at an average altitude of 12,500 feet, with the Sperry gyropilot operating the controls most of the way. Despite the high speed averaged during the non-stop flight only 63 per cent of the available 3,000 horsepower was required.

### Laura Ingalls Breaks Women's Record

Laura Ingalls, who made an adventurous flight around South America in 1934, climaxed her career in 1935 by record flights for women each way between New York and Los Angeles. In her Wasp-powered Lockheed, heavily loaded with 600 gallons of gasoline and 40

gallons of oil, she took off from Floyd Bennett Field on the morning of July 11, and braved the head winds which usually confront the pilot flying west. She had made two previous attempts at a transcontinental record, trying to fly from Los Angeles to New York, and this westward flight was planned to thwart whatever jinx had first forced her down in a dust storm and on her second attempt piled up enough mechanical trouble to stop her at Indianapolis. This westward flight was to be successful, although the lightning and dense rain clouds of a bad storm over Arizona threatened to hold her up. But she got through, arriving at Union Air Terminal at Burbank, Calif., 18 hours and 23 minutes after leaving New York.

Shortly before midnight on September 12, 1935, the crowd at Floyd Bennett Field saw Laura Ingalls fly back non-stop from Los Angeles in 13 hours 34 minutes five seconds, averaging nearly 200 miles an hour, breaking Amelia Earhart's record of 17 hours seven minutes. "My radio went out of order west of Columbus when I needed it most," Miss Ingalls explained. "I found myself flying on the wrong beam and so I just turned east and came on."

LAURA INGALLS AND HER LOCKHEED ORION

She established two new transcontinental records for women during 1935. The engine is a Pratt & Whitney Wasp.

## CHAPTER X

### AIR LINES OF THE UNITED STATES

A Model Service for the Whole World—Organization of the Air Transport Association of America—Insurance for Air Line Travelers Similar to Surface Coverage—Railway Express Agency Reports Increased Air Traffic—The Air Mail Situation—Operations of Lines in the United States—The Pan American Airways System.

FIFTEEN hours from coast to coast, eight hours between important cities of the north and the south, hot meals on board, with scenes that can be viewed only from an airplane—those were only a few of the wonders which the air lines of the United States offered the aerial traveler at the beginning of 1936. More than 3,000 persons, 24 tons of mail and nine tons of express were flying over these lines every 24 hours, nearly half the time at night, at speeds of more than three miles a minute, often three miles above the surface of the earth in luxuriously heated cabins with automatic ventilation and all the comforts of home. So amazing had been the growth of this air line service during the last 12 months that all the larger nations were sending their people here to learn how Americans managed to create such facilities which had no counterpart abroad. The United States had more air transport than all Europe combined. There was no comparison in the uninterrupted service day and night. The 22 companies using the airways inside the United States and the four which were operating routes to other countries had approximately 500 transport aircraft in service. They employed about 600 pilots, 350 co-pilots, 197 hostesses, 2,700 mechanics and ground crew men, 1,600 hangar and field employees and 3,000 operations and office experts. They were using about thirty million gallons of gasoline and a million gallons of oil a year. Their average fare for passengers was slightly less than six cents a mile. They were completing about 95 per cent of the trips they started. More than half of their available passenger seats were occupied on an average trip, and passengers flew an average of nearly 450 miles on each trip. The lines were flying regular schedules over nearly 30,000 miles of federal airways in the United States and more than 22,000 miles of air routes outside the country at the beginning of 1936. Inside the United States alone they were flying about 180,000 miles every 24 hours with passengers and ex-

press, while about 120,000 miles of that flying also included air mail. The following pages will give the reader an idea of how the individual companies were contributing to this remarkable development which is generally admitted to be without parallel in the entire history of transportation, on land or sea or in the air.

The amazing increase in traffic is shown by figures for 1935 as compared with 1934, on all air lines of the United States, as follows:

| | 1934 | 1935 |
|---|---|---|
| Passengers | 537,637 | 908,185 |
| Express, pounds | 2,946,460 | 6,162,056 |
| Mail, pounds | 7,155,281 | 13,538,952 |

In January, 1936, the domestic air line operators of the United States formed a national organization to be known as the Air Transport Association of America. They elected as their president Col. Edgar S. Gorrell, chief of staff of the Army air service abroad during the World War, later president of the Stutz Motor Company and an industrial engineer of note. Col. Gorrell summarized the objectives of the new association as being closer relations among the air line companies, improvement of the air transportation service, improvement of airports and airways and promotion of safety in air travel.

There were many real signs at the beginning of 1936 that air travel has in fact become recognized as a relatively safe form of transportation. C. R. Smith, president of American Airlines, late in 1935 received a letter from T. D. Harvey, vice president of the Massachusetts Indemnity Insurance Company of Boston, as follows:

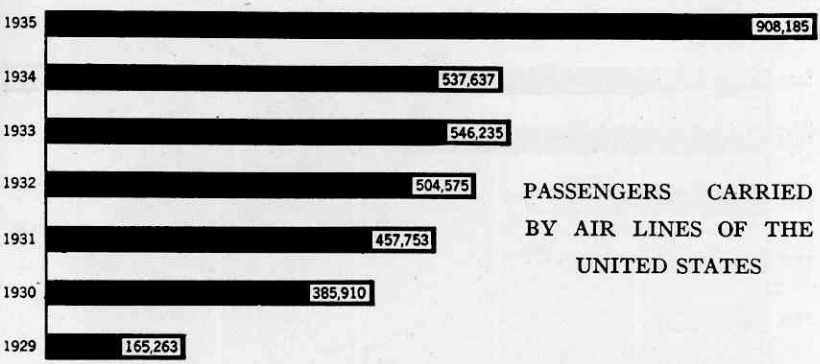
"Concerning the comparable hazards of the various modes of transportation available today, this company has, on a basis of experience, promulgated a ruling that executives or salesmen traveling by air on regularly established air lines are to be classified as "A" whereas executives or salesmen traveling by automobile are to be classified as "B" risks.

"This is made necessary by the fact that in our opinion transportation by air does not present hazards comparable with those incident to the use of an automobile."

Six of the largest casualty insurance companies in the United States announced on January 1, 1936, through David C. Beebe, president of the United States Aviation Underwriters, Inc., that they were prepared to underwrite a new form of insurance for air line commercial travelers, comparing favorably in cost with other travel insurance. The companies were the Aetna Casualty and Surety Company, Century Indemnity Company, Hartford Accident and Indemnity Company, Maryland Casualty Company, New Amsterdam Casualty Company and United States Fidelity and Guaranty Company.

The new insurance, termed "airsurance", was an employer's voluntary contractual liability policy under which it was possible for an employer to obtain up to $10,000 insurance for each employee named in the policy, at a rate of $1.00 per $1,000 a year. The minimum premium for any one employer was $50, covering five or more persons, as the employer might designate. The new policy was developed at the request of large corporations which had sought such a form of insurance for their executives and other employees to encourage them to take advantage of the time saved by air travel.

"Airsurance was developed by aviation insurance underwriters after several years of actuarial study", Mr. Beebe said. "It has been enthusiastically approved by air line officials and by many leading corporations. Heretofore special air insurance covering employees and executives has been so costly as to make it prohibitive to many firms,




thus causing these firms to forbid their employees or executives to use the air lines for business trips. Airsurance will definitely eliminate this objection. Any employer will now be able to obtain this insurance under a blanket coverage and may add additional names as the occasion demands."

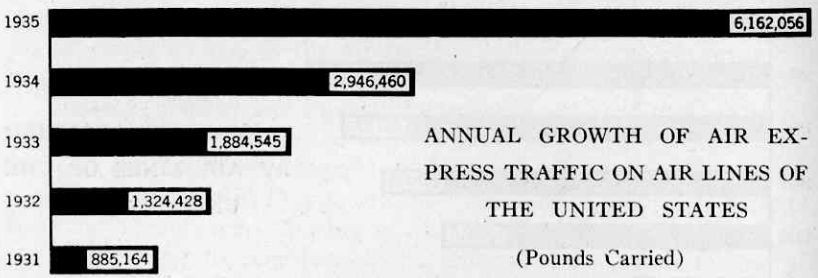
### Air Express

A nationwide unified air and air-rail express service providing high-speed shipping service to and from every point in the United States was started on February 1, 1936. Through contracts signed by 20 of the domestic air lines in the United States and Pan American Airways with the Railway Express Agency, direct air express service, with door-to-door pick-up and delivery service, was provided to 215 cities in the United States and Canada with a population of forty million, and to 32 foreign countries and colonies through the Pan Ameri-

can Airways System in the western hemisphere. In addition, through the use of combination air-rail service, all the 23,000 Railway Express offices became air express stations.

L. O. Head, president of the Railway Express Agency, characterized the improved, expanded air express service as one of the most progressive developments in express transportation since the original consolidation of the various express services of the country nearly two decades ago. The Express Agency first entered the air express field in 1927.

"With the progress of aviation, improved equipment, and general development, air express has grown rapidly until at present it provides an important phase of air transport operation", said Mr. Head. "The vast fleet of transport planes now being operated on domestic and Pan American foreign lines will carry express shipments. These planes flying the equivalent of nearly five times around the world daily will be at the service of shippers for high-speed transportation. Many in-




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

(Pounds Carried)

dustries have come to be regular users of air express. Efficiency in maintenance of schedules by the air lines has been a major factor in the rapid development of air express. During 1935, 95 per cent of all scheduled trips were completed by the air lines."

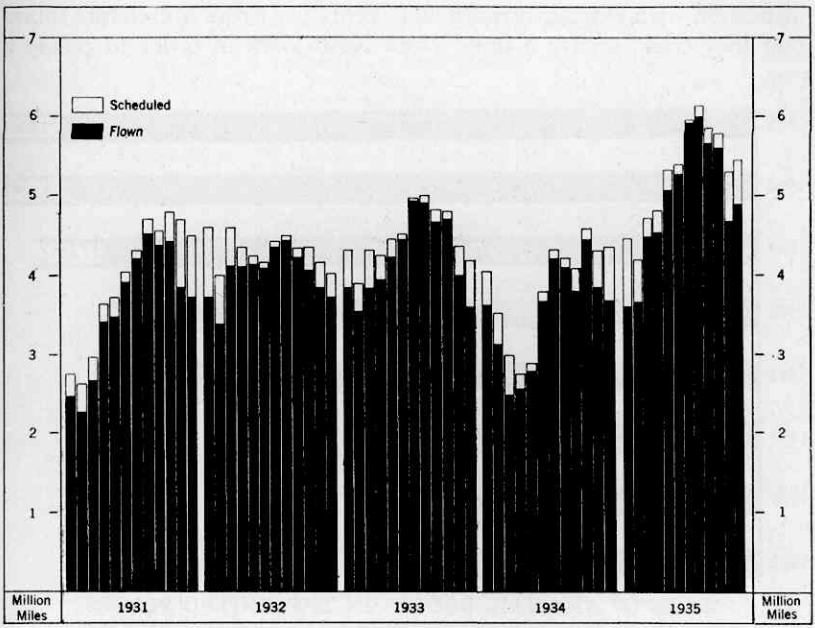
Development of air express traffic has been particularly swift during the last three years, until in 1936 it had become a regularly used transportation service by thousands of industrial concerns. Outstanding among these were the news and advertising fields, automotive industries, fashion goods and allied industries, motion picture companies, drug manufacturers and machinery makers.

During 1935 the Railway Express Agency through its 50,000 employees, all working on the new kind of business, found air express traffic developing at an amazing rate. In one month the poundage carried was more than that for any two months in 1934. In one month of 1935 shipments nearly equaled the total number throughout 1932.

New low rates, with charges of only one dollar per shipment up to

25 pounds between centers not more than 149 air miles apart, were profitable to motor car agencies in obtaining parts from nearby factory branches or wholesalers. A Detroit company sent out 826 such shipments in two days. Production parts were flown to assembly plants, sometimes more than could be taken aboard one plane. The garment, hat and shoe industries increased their air express shipments about 400 per cent over previous years.

A Denton, Tex., storekeeper wired New York one morning, for a dress. The customer wore it out of his store the next day. A Cleve-

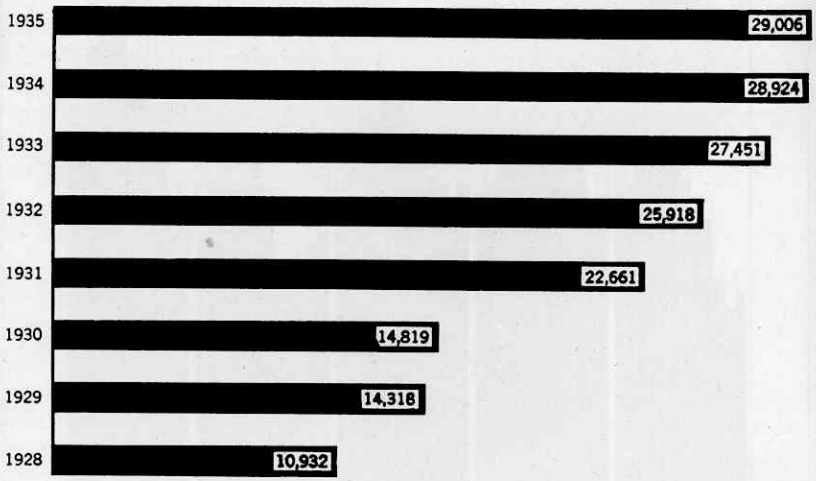



MILES SCHEDULED AND MILES ACTUALLY FLOWN BY THE AIR LINES OF THE UNITED STATES

land woman phoned New York for a dinner dress and received it that afternoon. Exclusive shops regularly featured gowns, furs and coats received from New York overnight by air. One company received 75 air shipments in a week. Air express made possible the sale of 48 band uniforms and in another instance 30 sweaters for a football team. A San Francisco store received 1,400 pounds of carpet divided in 12 bales. Several hundred dozen pairs of silk stockings and 200 silk dresses were flown to South America by Pan American Airways in one month. A San Francisco millinery company offered to ship, air

express free, orders of a half dozen or more hats. A suit manufacturer sent a sample by air and next day received an order for 300. Merchants were able to keep their stock reduced to a minimum, with decreased inventory and overhead, without impairing service to their customers.

Merchants also found that often air express was less costly to them than making alterations. For example, a silk dress rarely weighs over two pounds packed. Air charges from New York to Cleveland were one dollar, to Chicago $1.20, to Dallas $1.48, to Denver $1.60 and to Minneapolis $1.36. The charges included special delivery and $50 insurance, with extra insurance at 10 cents per $100. Merchants found that they could secure a dress from New York in order to please a




MILES OF AIR MAIL ROUTES IN THE UNITED STATES

customer at less cost than altering one that they might have in stock.

Public service utilities air expressed supplies to storm-swept areas. Parts flown for refrigerating plants have saved the contents of huge cold storage warehouses. Replacement coils weighing 2,650 pounds were flown across the continent, saving $1,000 a day and restoring work to hundreds of employees. A single shipment of oil well machinery weighing 500 pounds was flown to Mexico. Steam shovel parts were flown to the great dam projects. Blueprints, specifications and engineering reports were flown constantly.

Literally hundreds of different manufacturing enterprises quickened their service and often saved tedious delay through shutdowns

## SCHEDULED AIR TRANSPORT OPERATIONS

January 1, 1936

| *Route No.* | *Operator* | *Routes Operated* | *Route Mileage* | *Class of Service* |
|---|---|---|---|---|
| 1 | American Airlines, Inc. | New York to Fort Worth (via Washington and Nashville) | 1466 | MPE |
| | | Fort Worth to Los Angeles | 1293 | MPE |
| | | New York to Chicago (via Buffalo and Detroit) | 754 | MPE |
| | | Detroit to Chicago (via Kalamazoo) | 263 | MPE |
| | | Chicago to Fort Worth (via Peoria, St. Louis, Tulsa and Oklahoma City) | 950 | MPE |
| | | New York to Boston (via Hartford and New Haven) | 209 | MPE |
| | | Boston to Cleveland (via Albany and Buffalo) | 637 | MPE |
| | | Cleveland to Nashville (via Columbus and Louisville) | 469 | MPE |
| | | Washington to Chicago (via Cincinnati and Indianapolis) | 684 | MPE |
| | | New York to Montreal | 332 | MPE |
| 2 | Bowen Air Lines, Inc. | Fort Worth-Dallas to San Antonio | 286 | PE |
| | | Fort Worth-Dallas to Houston | 255 | PE |
| 3 | Braniff Airways, Inc. | Chicago to Dallas (via Tulsa) | 865 | PE |
| | | Chicago to Dallas (via Kansas City, Wichita and Oklahoma City) | 964 | MPE |
| | | Amarillo to Fort Worth | 315 | MPE |
| | | Dallas to Brownsville | 546 | MPE |
| | | Waco to Galveston | 206 | MPE |
| 4 | Central Airlines, Inc. | Washington to Detroit | 469 | MPE |
| 5 | Chicago & Southern Air Lines, Inc. | Chicago to New Orleans (via Peoria) | 872 | MPE |
| 6 | Columbia Airlines, Inc. | St. Louis to Detroit (via Louisville) | 571 | PE |
| 7 | Consolidated Airlines | San Francisco to Sacramento | 80 | PE |
| 8 | Delta Air Corporation | Charleston, S. C. to Dallas | 1065 | MPE |
| 9 | Hanford Airlines, Inc. | St. Paul to Omaha (via Sioux Falls) | 369 | MPE |
| | | Omaha to Kansas City | 168 | MPE |
| | | Bismarck to Sioux Falls | 315 | MPE |
| 10 | National Airlines System | St. Petersburg to Jacksonville (via Daytona Beach) | 237 | MPE |
| 11 | National Airways, Inc. | Boston to Bangor | 213 | MPE |
| | | Boston to Burlington | 193 | MPE |
| 12 | National Parks Airways, Inc. | Salt Lake City to Great Falls | 489 | MPE |
| 13 | North American Aviation, Inc. (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 Miami (via Jacksonville, Louisville and Nashville) | 1267 | MPE |
| 14 | Northwest Airlines, Inc. | Chicago to St. Paul (via Rochester) | 356 | MPE |
| | | Chicago to Pembina (via Milwaukee) | 769 | MPE |
| | | Fargo to Seattle | 1267 | MPE |
| | | Pembina to Winnipeg | 65 | MPE |
| 15 | Pan American Airways, Inc. | Miami to Havana | 229 | MPE |
| | | Miami to San Juan | 1161 | MPE |
| | | San Juan to Paramaribo | 1340 | MPE |
| | | Paramaribo to Buenos Aires | 4761 | MPE |
| | | Miami to Mexico City | 1484 | MPE |
| | | Miami to Cristobal (via Kingston and Barranquilla) | 1713 | MPE |
| | | Cristobal to Port of Spain | 1345 | MPE |
| | | Miami to Nassau | 188 | MPE |
| | | Brownsville to Mexico City (via Tampico) | 466 | MPE |
| | | Mexico City to Cristobal | 1764 | MPE |

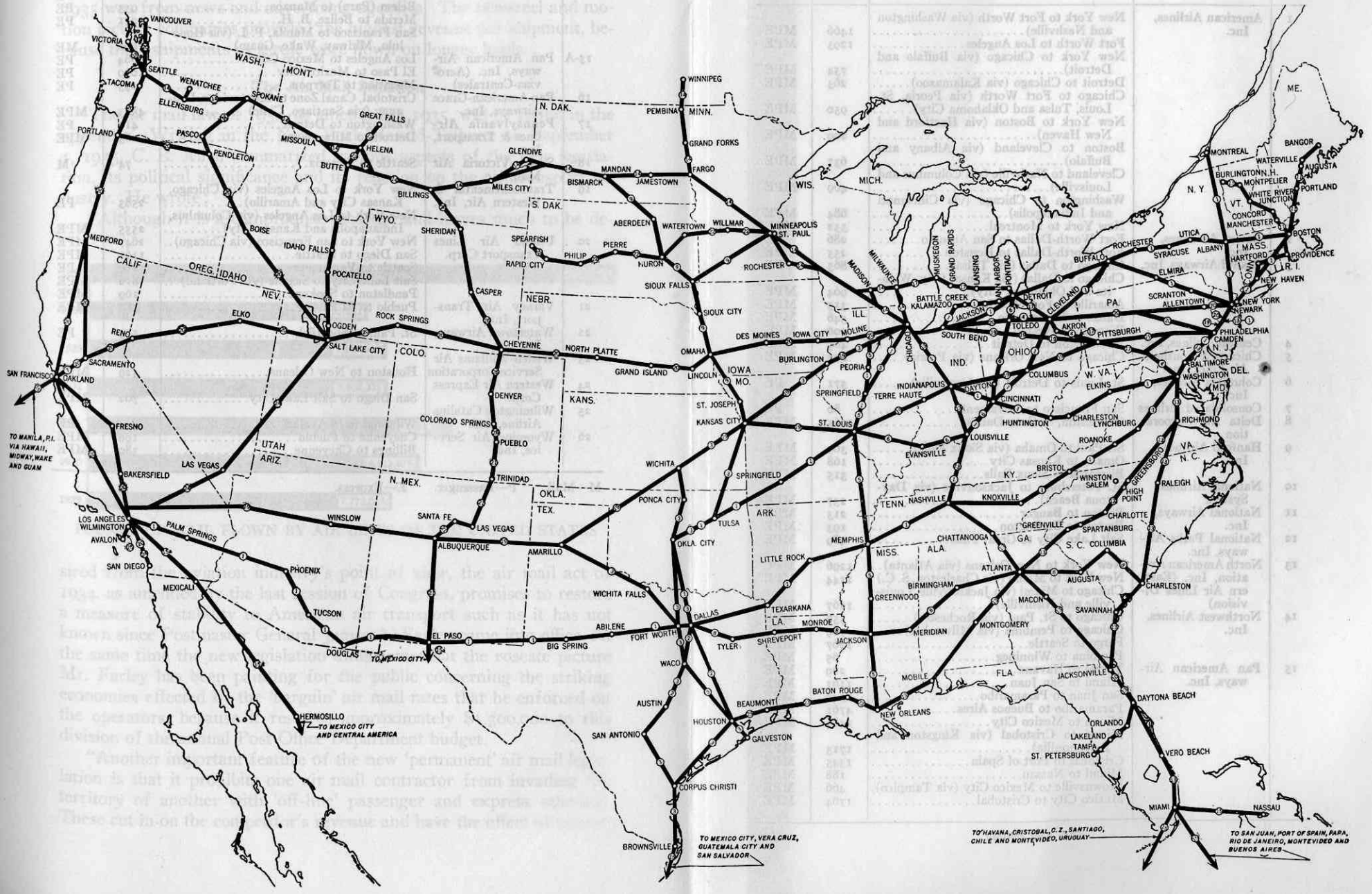
*See next column*

U. S. DEPARTMENT OF COMMERCE

Bureau of Air Commerce

# AIR LINES IN THE UNITED STATES

January 1, 1936



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|---|---|---|---|---|
| 1 | American Airlines, Inc. | New York to Fort Worth (via Washington and Nashville) | 1466 | MPE |
| | | Fort Worth to Los Angeles | 1293 | MPE |
| | | New York to Chicago (via Buffalo and Detroit) | 754 | MPE |
| | | Detroit to Chicago (via Kalamazoo) | 263 | MPE |
| | | Chicago to Fort Worth (via Peoria, St. Louis, Tulsa and Oklahoma City) | 950 | MPE |
| | | New York to Boston (via Hartford and New Haven) | 209 | MPE |
| | | Boston to Cleveland (via Albany and Buffalo) | 637 | MPE |
| | | Cleveland to Nashville (via Columbus and Louisville) | 469 | MPE |
| | | Washington to Chicago (via Cincinnati and Indianapolis) | 684 | MPE |
| | | New York to Montreal | 332 | MPE |
| 2 | Bowen Air Lines, Inc. | Fort Worth-Dallas to San Antonio | 286 | PE |
| | | Fort Worth-Dallas to Houston | 255 | PE |
| 3 | Braniff Airways, Inc. | Chicago to Dallas (via Tulsa) | 865 | PE |
| | | Chicago to Dallas (via Kansas City, Wichita and Oklahoma City) | 964 | MPE |
| | | Amarillo to Fort Worth | 315 | MPE |
| | | Dallas to Brownsville | 546 | MPE |
| | | Waco to Galveston | 206 | MPE |
| 4 | Central Airlines, Inc. | Washington to Detroit | 469 | MPE |
| 5 | Chicago & Southern Air Lines, Inc. | Chicago to New Orleans (via Peoria) | 872 | MPE |
| 6 | Columbia Airlines, Inc. | St. Louis to Detroit (via Louisville) | 571 | PE |
| 7 | Consolidated Airlines | San Francisco to Sacramento | 80 | PE |
| 8 | Delta Air Corporation | Charleston, S. C. to Dallas | 1065 | MPE |
| 9 | Hanford Airlines, Inc. | St. Paul to Omaha (via Sioux Falls) | 369 | MPE |
| | | Omaha to Kansas City | 168 | MPE |
| | | Bismarck to Sioux Falls | 315 | MPE |
| 10 | National Airlines System | St. Petersburg to Jacksonville (via Daytona Beach) | 237 | MPE |
| 11 | National Airways, Inc. | Boston to Bangor | 213 | MPE |
| | | Boston to Burlington | 193 | MPE |
| 12 | National Parks Airways, Inc. | Salt Lake City to Great Falls | 489 | MPE |
| 13 | North American Aviation, Inc. (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 Miami (via Jacksonville, Louisville and Nashville) | 1267 | MPE |
| 14 | Northwest Airlines, Inc. | Chicago to St. Paul (via Rochester) | 356 | MPE |
| | | Chicago to Pembina (via Milwaukee) | 769 | MPE |
| | | Fargo to Seattle | 1267 | MPE |
| | | Pembina to Winnipeg | 65 | MPE |
| 15 | Pan American Airways, Inc. | Miami to Havana | 229 | MPE |
| | | Miami to San Juan | 1161 | MPE |
| | | San Juan to Paramaribo | 1340 | MPE |
| | | Paramaribo to Buenos Aires | 4761 | MPE |
| | | Miami to Mexico City | 1484 | MPE |
| | | Miami to Cristobal (via Kingston and Barranquilla) | 1713 | MPE |
| | | Cristobal to Port of Spain | 1345 | MPE |
| | | Miami to Nassau | 188 | MPE |
| | | Brownsville to Mexico City (via Tampico) | 466 | MPE |
| | | Mexico City to Cristobal | 1764 | MPE |
| | | Kingston to Port au Prince | 455 | PE |
| | | Port au Prince to Santo Domingo | 162 | PE |
| | | Belem (Para) to Manaos | 933 | PE |
| | | Merida to Belize, B. H. | 251 | PE |
| | | San Francisco to Manila, P. I. (via Honolulu, Midway, Wake, Guam) | 7990 | ME |
| 15-A | Pan American Airways, Inc. (Aerovias-Centrales) | Los Angeles to Mexico City | 1684 | PE |
| | | El Paso to Mexico City | 1039 | PE |
| | | Mazatlan to Torrpon | 255 | PE |
| 16 | Pan American-Grace Airways, Inc. | Cristobal, Canal Zone to Montevideo, Uruguay (via Santiago, Chile) | 4543 | MPE |
| 17 | Pennsylvania Airlines & Transport, Inc. | Washington to Detroit | 410 | PE |
| | | Detroit to Milwaukee | 265 | MPE |
| 18 | Seattle-Victoria Air Mail, Inc. | Seattle to Victoria | 74 | M |
| 19 | Transcontinental & Western Air, Inc. | New York to Los Angeles (via Chicago, Kansas City and Amarillo) | 2583 | PE |
| | | New York to Los Angeles (via Columbus, Indianapolis and Kansas City) | 2555 | MPE |
| 20 | United Air Lines Transport Corp. | New York to San Francisco (via Chicago) | 2647 | MPE |
| | | San Diego to Seattle | 1161 | MPE |
| | | Seattle to Vancouver | 119 | PE |
| | | Salt Lake City to Seattle (via Portland) | 816 | MPE |
| | | Pendleton to Spokane | 169 | MPE |
| 21 | Varney Air Transport, Inc. | Pueblo to El Paso | 519 | MPE |
| 22 | Watertown Airways, Inc. | St. Paul to Spearfish | 559 | PE |
| 23 | Wedell-Williams Air Service Corporation | Houston to New Orleans | 329 | MPE |
| 24 | Western Air Express Corp. | San Diego to Salt Lake City | 702 | MPE |
| 25 | Wilmington Catalina Airline, Ltd. | Wilmington to Avalon | 31 | PE |
| 26 | Wyoming Air Service, Inc. | Cheyenne to Pueblo | 199 | MPE |
| | | Billings to Cheyenne | 380 | MPE |

M—Mail. P—Passenger. E—Express.

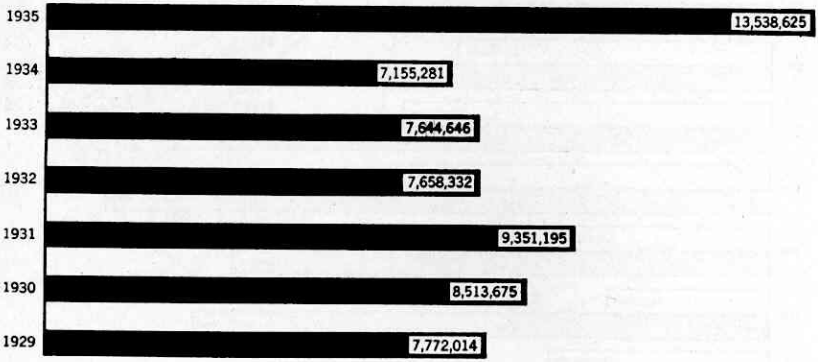
*See next column*

by ordering emergency supplies rushed through by air express. The news and advertising professions increased their use of air express tremendously in 1935. More than 25 per cent of the air express in 1935 was from news and advertising agencies. The newsreel and motion picture companies provided the highest revenue per shipment, because their shipments as a rule were flown on longer hauls.

### The Air Mail Situation

The air mail law of 1934, as amended in 1935, will be found in the appendix. Writing in the New York Herald-Tribune on September 1, 1935, C. B. Allen summarized various aspects of the new legislation, its political significance and its reaction on the air transport industry. He wrote:

"Although it is a compromise measure and leaves much to be de-




POUNDS OF MAIL FLOWN BY AIR LINES OF THE UNITED STATES

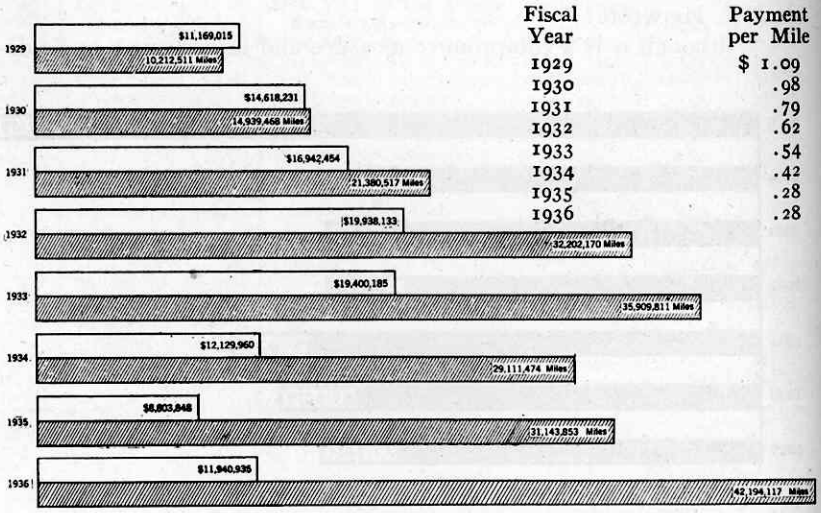
sired from the aviation industry's point of view, the air mail act of 1934, as amended by the last session of Congress, promises to restore a measure of stability to American air transport such as it has not known since Postmaster General James A. Farley came into office. At the same time the new legislation dims somewhat the roseate picture Mr. Farley has been painting for the public concerning the striking economies effected by the 'bargain' air mail rates that he enforced on the operators, because it restores approximately $1,300,000 to this division of the annual Post Office Department budget.

"Another important feature of the new 'permanent' air mail legislation is that it prohibits one air mail contractor from invading the territory of another with 'off-line' passenger and express schedule. These cut in on the competitor's revenue and have the effect of raising

air mail costs to the government, since the I. C. C. is now empowered to revise rates paid the operators on the basis of mandatory yearly operating cost surveys, and loss of passenger and express traffic inevitably would be reflected in the need for more revenue from the Post Office Department.

"The amended air mail act 'freezes' the off-line flying map as of July 1, 1935, so that T. W. A.'s New York-Chicago service remains unaffected except in so far as any contemplated future expansion is concerned. The status quo of various other similar routes likewise is

DECREASE IN ANNUAL COST TO THE GOVERNMENT FOR EACH MILE FLOWN WITH MAIL



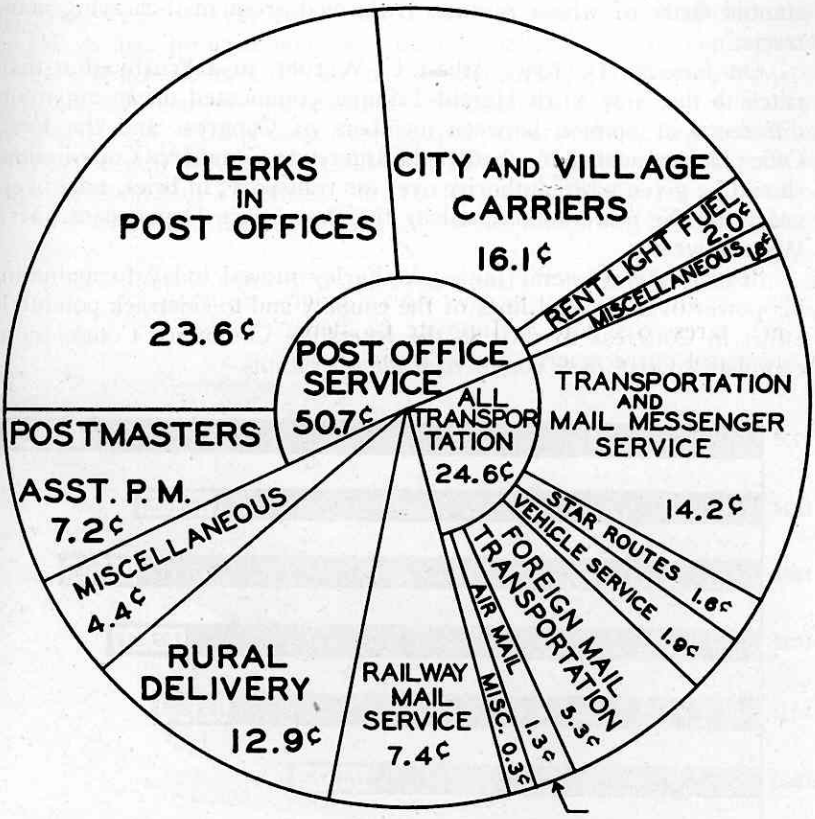

THE GOVERNMENT CUTS AIR MAIL PAYMENTS

This graph shows, in white bars, Post Office payments and, in shaded bars, the number of miles of air mail flying by domestic lines in the United States by fiscal years. During the fiscal years 1935 and 1936 the average rate of payment per mile of flying with mail was 28 cents.

maintained, but this one is by far the most outstanding example of the compromise solution arrived at in this troublesome phase of American air transport.

"The old 'vengeance clause' against the operators who participated in the so-called 'spoils conference' with former Postmaster General Walter F. Brown, and thereby gave Mr. Farley his pretext for canceling their contracts, still persists in the revamped air mail act.

"But, for all of the shift of power over the air mail operators from




THE POSTAL DOLLAR

During the fiscal year 1935 only 1.3 cents out of every dollar of expenditures by the U. S. Post Office Department were spent for flying the mail in the United States. This was a drop from the two cents spent on domestic air mail in 1934.

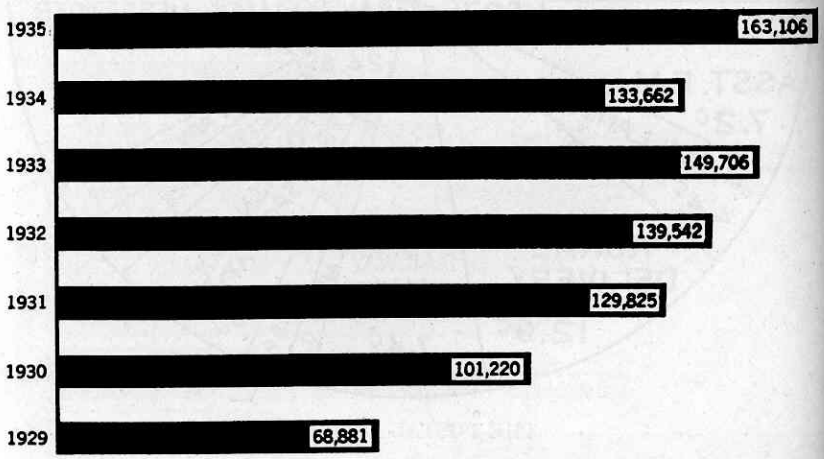
the Post Office Department to the I. C. C. in the new legislation, the lines still remain very much at the mercy of the Postmaster General, and it is unlikely that any of them will risk his displeasure by any such open defiance of past Farley edicts.

"Another humiliating passage for the operators in the air mail act as now constituted is the arbitrary requirement that no air line official or employee may receive more than $17,500 a year. They contend that this is class legislation and that the government has no moral right to cram it down the aviation industry's throat unless it is going to apply a similar rule to high officials of railroad and steamship lines, a sub-

stantial share of whose revenue is derived from mail-carrying contracts."

On January 15, 1936, Albert L. Warner, in a Washington dispatch to the New York Herald-Tribune, commented on an apparent difference of opinion between members of Congress and the Post Office Department as to whether the Interstate Commerce Commission should be given more authority over air transport; in brief, take over nearly all the powers exercised by the Post Office Department. Mr. Warner wrote:

"Postmaster General James A. Farley moved today to maintain his power over air mail lines of the country and to sidetrack potential effort in Congress to shift to the Interstate Commerce Commission complete control over commercial air operations.




AVERAGE NUMBER OF MILES FLOWN DAILY BY THE AIR LINES OF THE UNITED STATES

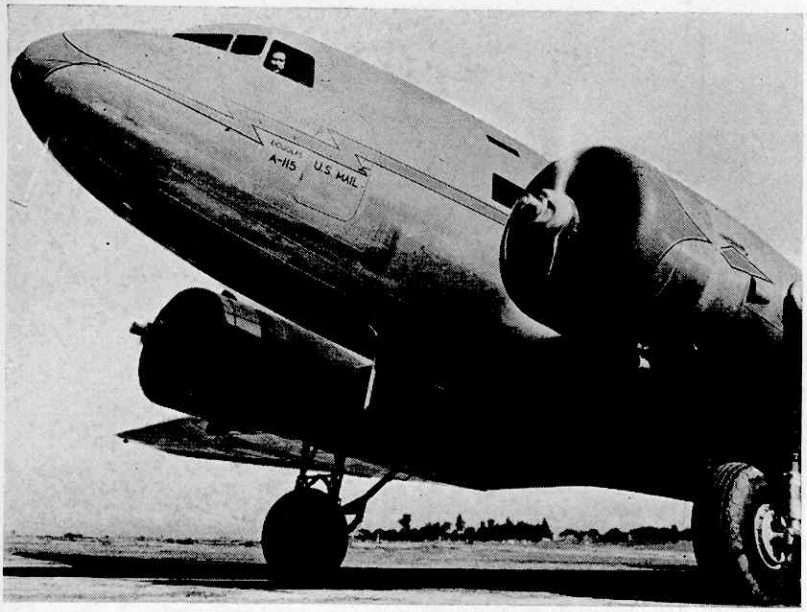
"In a 17-page letter to Senator Burton K. Wheeler, chairman of the Senate Interstate Commerce Committee, Mr. Farley championed the administrative authority of the Post Office Department, declared for flexibility in the rates of air lines and advocated competition in the industry. He deprecated 'strict or hide-bound rules or regulations' as to fixed tariffs.

"Mr. Farley wrote his letter with particular attention to a bill on the Senate calendar sponsored by Senator Pat McCarran, Democrat, of Nevada, that would transfer air control to the I. C. C. Now the I. C. C. is limited to raising or lowering air-mail rates.

"By resisting the proposal to transfer control to the I. C. C., Mr.

Farley took another step toward maintenance of an authority that already has brought him into private conflict with the commission. Even under the existing new air mail Act, which the Postmaster General would continue substantially unchanged, he ran into difficulties with the I. C. C. this week over an application of the Transcontinental and Western Air, Inc., to establish a new route between Albuquerque, N. M., and San Francisco. Mr. Farley contended the I. C. C. had no jurisdiction, but the commission overruled him and scheduled a hearing.

"The Farley letter also indicated a shift in what was once an Ad-




CLOSE-UP OF THE DOUGLAS SLEEPER

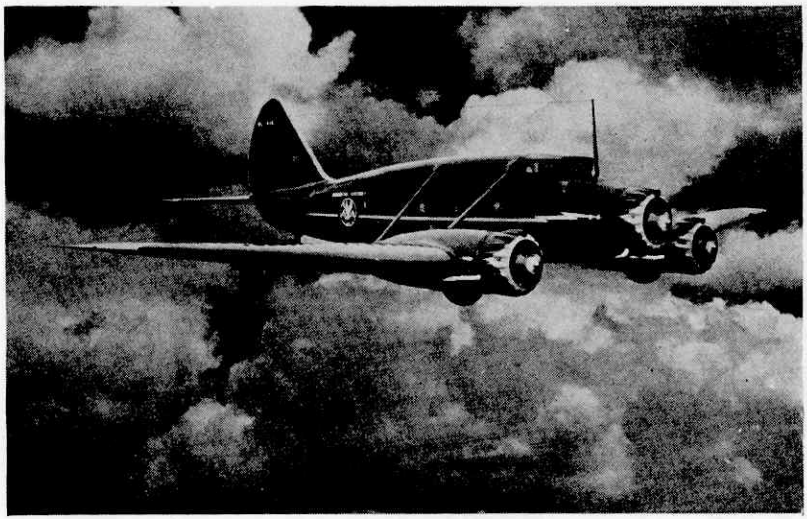
One of the Wright Cyclone-powered transports for American Airlines service.

ministration program to consolidate land, air and water regulation under an expanded Interstate Commerce Commission. The letter further was notable for laying down a definite policy for the handling of air lines and their development in the next few years.

"Involved in political discussion since President Roosevelt and Mr. Farley, who also is the Democratic National Committee chairman, canceled the then existing air mail contracts in 1934, post office

regulation of air lines is expected to be the subject of Congressional consideration once again.

" 'In the experimental state in which this industry now is,' Mr. Farley wrote to Senator Wheeler, 'it is more likely to suffer than to be benefited by being compelled to observe strict or hidebound rules and regulations with reference to fixed charges for the carrying of passengers and express, than if they are permitted to continue to feel their way along, test out public sentiment and adopt such practices and fix such tariffs as they think will produce increased revenues and business. Again, it is emphasized that it is my opinion that the natural



One of the Model A passenger ships with three Lycoming engines and Smith controllable pitch propellers in service on the short routes of American Airlines.

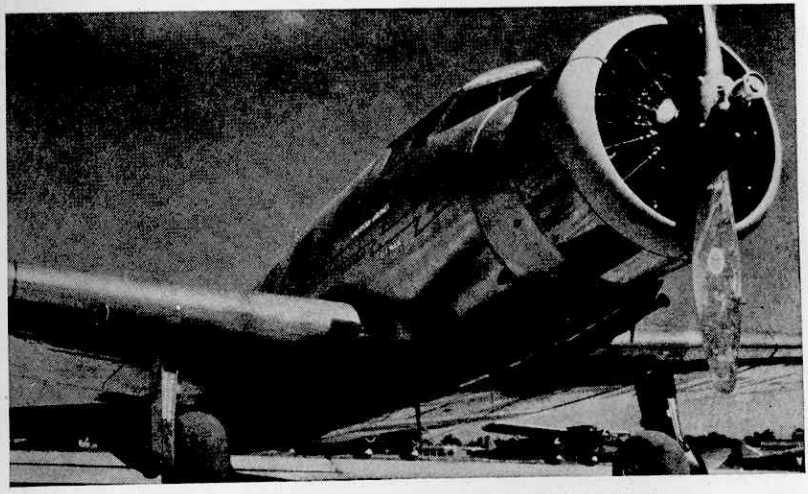
and fair competition existing will do more to develop the aviation industry than any rules made by a government bureau.' "

### American Airlines

At the beginning of 1936 American Airlines was operating day and night schedules over 6,639 miles of airways, and its planes were flying 36,765 miles every 24 hours. The company employed 1,363 persons, including 105 pilots, 66 co-pilots and 43 hostesses. American Airlines 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. The company had on order with the Douglas Aircraft Company 10 new DST type sleeper transports, the first of which were expected to be placed in service in the spring of 1936. Those new transports were to be the largest land planes operated in regular service in the United States.

Each of the new Douglas sleepers was to carry berths for sixteen persons, with other comforts for the passengers, dressing rooms for men and women, lavatories, and a complete commissary with facilities for keeping food either hot or cold for indefinite periods.



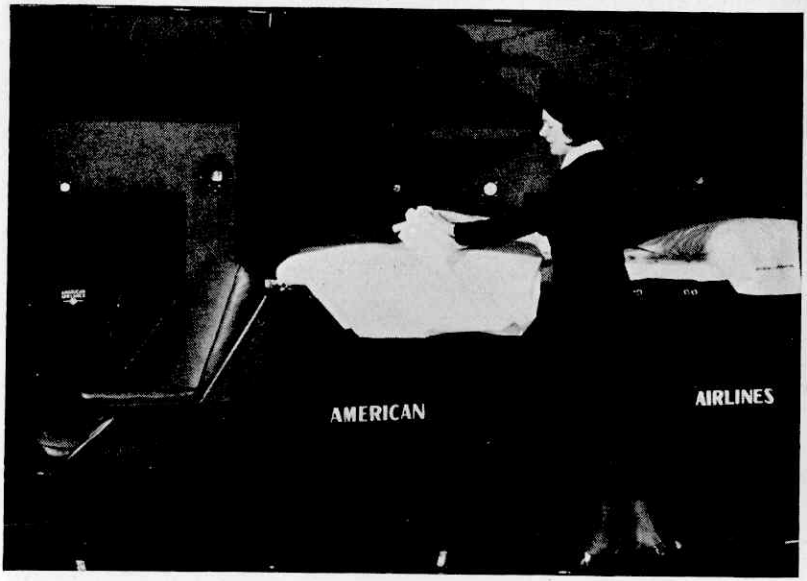
AMERICAN AIRLINES VULTEE TRANSPORT

Showing Cyclone engine and Hamilton Standard propeller.

In addition American Airlines had placed orders with the Stinson Aircraft Corporation for 15 new low-wing tri-motored transport planes, Model A type, and they were to be installed in service between intermediate cities on the company's routes, connecting with the through schedules and providing improved service for a greater number of patrons.

A steadily improved service with more and faster schedules featured American Airlines operations during 1935. The completed southern transcontinental route was opened. New schedules were added between Chicago and New York, with less time between the two terminals. The service between Chicago and Washington was speeded up, resulting in increased traffic. The service between Chi-

cago, Fort Worth, Dallas and the Southwest was also improved. The southern transcontinental route became one unified service with the opening of the new Washington, D. C. to Nashville section; and it linked together the American Airlines system providing direct service between Los Angeles and New York and thence to Boston. It also provided the first transcontinental service permitting travelers to spend the night in a sleeper plane, in berths. That forward step was made by combining the speed of the Douglas transports on day runs with the spacious comfort of the Curtiss-Wright Condor sleepers.




AN AMERICAN AIRLINES SLEEPER PLANE

The lower berth of this Curtiss-Wright Condor has the curtains drawn, while the hostess prepares the upper berth for the night.

Schedules of the Southerner permitted passengers to make the daylight portion of their westward trip in a Douglas plane as far west as Fort Worth where they boarded the Curtiss-Wright sleepers for Los Angeles. On the eastbound trips passengers left Los Angeles aboard the sleeper planes and transferred to the Douglas ships the next morning at Fort Worth.

Service between Chicago and New York was increased to six schedules daily, Douglas planes being used. Four trips daily were routed through Detroit and Buffalo, while two others made the flights with one stop at Detroit. Three additional daily schedules were run

between Chicago and Detroit, and one other flight between Buffalo and New York, by way of Elmira and Scranton.

Sleeper service was established between Cleveland and Fort Worth, connecting at Cleveland with New York planes and providing an alternate service between the coasts. Daylight Douglas service between Dallas and Los Angeles connected at the eastern terminal with the sleeper planes for Cleveland. Direct service to Washington, through Indianapolis, Cincinnati and Charleston was speeded up with the introduction of Condor day planes on that route. Elkins, West Va., was added as a station stop. Vultee transports were operated on two schedules between Chicago, Tulsa, Oklahoma City, Fort Worth and

AMERICAN AIRLINES LEAVING CHICAGO

Cyclone-powered Douglas transport on regular schedule speeds over the farmlands of the Middle West.

Dallas, giving patrons from the terminal cities their choice of a morning or noon departure and providing intermediate cities with a good choice of schedules. Local schedules between Chicago and St. Louis were increased to five daily, with only Vultee equipment used. A Texas-Oklahoma Vultee schedule was added between Fort Worth-Dallas and Tulsa during the summer months.

Service on the New York-Boston route was increased to eight daily, including four non-stop flights and four which made scheduled stops at either Hartford or New Haven. The American Airlines training schools for traffic personnel, stewardesses and other em-

ployees resulted in attracting public attention to the excellence of the service. Caterers preparing meals served aloft throughout the system were brought to Chicago and given special courses, with resulting improvements in the quality and variety of the meals. That was reflected in the increased patronage on all routes. From a total of 6,721 passengers flown during January, 1935, the traffic increased until the last full month of summer it had reached 20,819 for the 30-day period. Air express showed a proportionate increase.

With the thought in mind that the stunt flight of today surely becomes the commonplace of tomorrow, the transcontinental flight of Leland S. Andrews, American Airlines pilot, in one of the company's Cyclone-powered Vultee transports is of more than usual interest. Andrews, on leave from his regular schedule between Los Angeles and El Paso, Tex., took aboard a co-pilot, Henry Meyers, and G. D. Rayburn, radio operator. They left Los Angeles shortly before midnight on February 20, 1935, and landed at Floyd Bennett Field, New York, after lunch the next day. They had spanned the continent in a transport plane in 11 hours, 34 minutes and 16 seconds. But on that flight they had also flown non-stop from Los Angeles to Washington, D. C., 2,295 miles in 10 hours, 22 minutes and 54 seconds, an average speed of 221 miles an hour or nearly four miles a minute. Andrews flew the same plane in which James H. Doolittle had won the ever-changing non-stop transcontinental record in January, 1935.

### Boston-Maine Airways

During 1935 the National Airways operated the routes of the Boston-Maine Airways, using a fleet of tri-motored Lycoming-powered Stinson transports in a passenger, mail and express service between Boston, Mass., and Portland, Augusta, Waterville, Bangor and Bar Harbor, Me. The transports were equipped with radio. The service transported passengers between Boston and Bar Harbor in less than three hours.

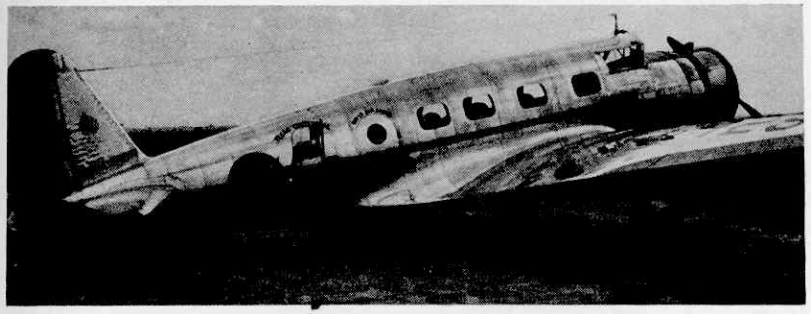
### Bowen Air Lines

Increased passenger traffic led Bowen Air Lines to double its schedules between Fort Worth, Dallas and Houston, and between Fort Worth, Dallas, Austin and San Antonio, Tex. One trip a day was made between Fort Worth and Brownsville by way of Corpus Christi. Cyclone-powered Vultee transports installed in service during the year speeded up all schedules and increased patronage. The company reported an increase of 15 per cent in express poundage over the preceding year. At the beginning of 1936 Bowen had an operating schedule of 186 miles an hour, while on one route the schedule called

for 190 miles an hour. New schedules were to be added early in 1936 with the opening of the Texas Centennial in Dallas. Practically the entire original pilot, mechanic and traffic staff of the company remained in its employ at the end of 1935, the fifth year of operations.

### Braniff Airways

Using fast Lockheed Electra transport planes Braniff Airways at the beginning of 1936 was operating passenger, mail and express service between Chicago and Brownsville, Tex., by way of Kansas City, Mo., and Fort Worth. Houston, Galveston, Dallas, Wichita Falls and Amarillo, Tex., were also included in the company's schedules, as were Oklahoma City and Tulsa, Okla., and Wichita, Kan. Dallas and Brownsville were spanned within four hours, Chicago and Kansas City within three hours, San Antonio and Corpus Christi in less than



A BOWEN AIR LINES VULTEE

One of the Cyclone-powered transports in service between Texas cities.

one hour, and the 925 miles between Fort Worth and Chicago in five hours. There were 18 communities on the Braniff system, including flag stops. Some of the flights were distinguished by names such as Chicago Limited, Starlight Express and Legislative Special.

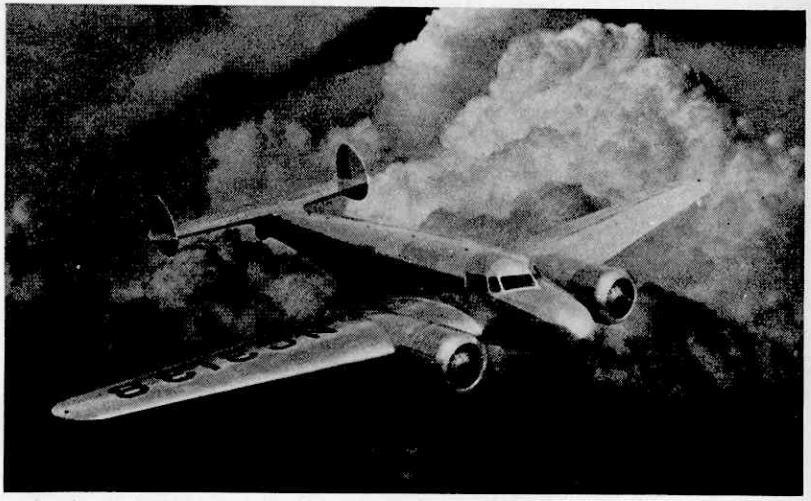
### Central Airlines

Central Airlines during 1935 operated a fleet of Lycoming-powered Stinson tri-motored transports on daily schedules with passengers, mail and express between Washington, D. C., and Detroit, Mich., making connections with United Air Lines, American Airlines, TWA, Eastern Air Lines and Pennsylvania Airlines.

### Chicago and Southern Air Lines

At the beginning of 1936 Chicago and Southern, operating be-

tween Chicago and New Orleans, was planning to replace its trimotored equipment with fast low-wing transport monoplanes capable of making an average speed of more than 180 miles an hour. The company based its rates on railroad fare plus pullman and that innovation more than doubled passenger traffic during the latter half of 1935. The company moved its main base from Memphis, Tenn., to Lambert Field at Robertson, Mo., and established district traffic managers in city offices in Chicago, St. Louis, Memphis, Jackson and New Orleans. Two-way radio was installed on the system late in 1935. Two schedules were maintained each way between Chicago, Peoria, Springfield, St. Louis, Memphis, Greenwood, Jackson and



BRANIFF AIRWAYS HURDLES A DUST STORM

Passengers fly above the thickening clouds in this Wasp-powered Lockheed Electra during a dust storm over the Middle West.

New Orleans. The 909 miles between the two terminals could be flown by passengers for $34 one way and $62 a round trip.

### Columbia Airlines

Late in 1935 Columbia Airlines started a feeder line service between Detroit and East St. Louis, by way of Toledo, Dayton, Cincinnati and Louisville, Ky., with one forenoon and one afternoon schedule each way daily. Dayton, O., and Evansville, Ind., were thereby added again to the air map of the United States. At the same time direct connections were made with all the through transport

systems. The equipment included tri-motored Lycoming-powered Stinsons and two-way radio.

### Consolidated Air Lines

A record of having flown more than 300,000 pounds of daily newspapers out of San Francisco during its two years of operations was reported by the Consolidated Air Lines at the beginning of 1936.

ALL SPACE SOLD ON BRANIFF AIRWAYS

Passengers in every seat of a Lockheed Electra on the Braniff line between Chicago and Brownsville, Texas.

Several thousand passengers and about 3,500 pounds of express were also flown between Alameda and Sacramento, Calif. Three schedules each way daily except Sunday were maintained by the company.

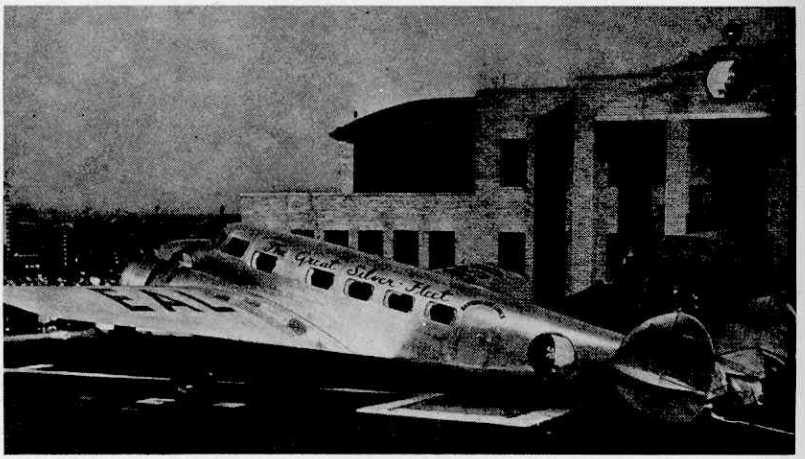
### Delta Air Lines

Using Lycoming-powered, tri-motored Stinson monoplanes the

Delta Air Lines at the beginning of 1936 was operating a passenger, mail and express service between Dallas, Tex., and Charleston, S. C. Delta maintained one schedule each way daily between Charleston and Atlanta, Ga., and two passenger and three mail and express schedules between Atlanta and Dallas, with stops at Birmingham, Ala., Meridian and Jackson, Miss., Shreveport, La., and Tyler, Tex.

### Eastern Air Lines

Eastern Air Lines, a division of North American Aviation, Inc., at the beginning of 1936 was operating Cyclone-powered Douglas transports and Whirlwind-powered Lockheed Electra transports between Newark, N. J., and Atlanta, Chicago and Atlanta, Atlanta and




READY FOR PASSENGERS AT NEWARK

One of the five Wright Whirlwind-powered Lockheed Electra air liners in the Eastern Air Lines fleet about to take on passengers for all points south.

New Orleans, Miami and Atlanta, and between Miami and Washington, D. C., by way of Charleston, S. C. Twelve round trips daily were being flown between New York and the nation's capital, the 220 miles being traversed in about 80 minutes. Four round trips were scheduled between New York and Miami, two between Chicago and Miami, two between New York and New Orleans. In addition, there were local schedules between Miami and Jacksonville, Fla., between Richmond, Va., and New York, and express schedules between New York and Washington to provide almost hourly service between the two cities. The year 1935, according to Capt. E. V. Rickenbacker, general manager of this pioneer seaboard air line, had been one of intensive

development marked by constant growth in the company's passenger, mail and express traffic.

Eastern Air Lines had named its 14 Douglas transports and five Lockheed Electras "The Great Silver Fleet." New York was linked to New Orleans with an eight-hour service. Chicago became only eight hours distant from Miami, as was New York. Twenty-three radio ground stations were installed and a 24-hour meteorological service became a fact, supplying the planes with complete weather

THE "CHICAGO FLYER" FLIES HIGH

An Eastern Air Lines Douglas transport bound from Chicago to Miami, Fla.

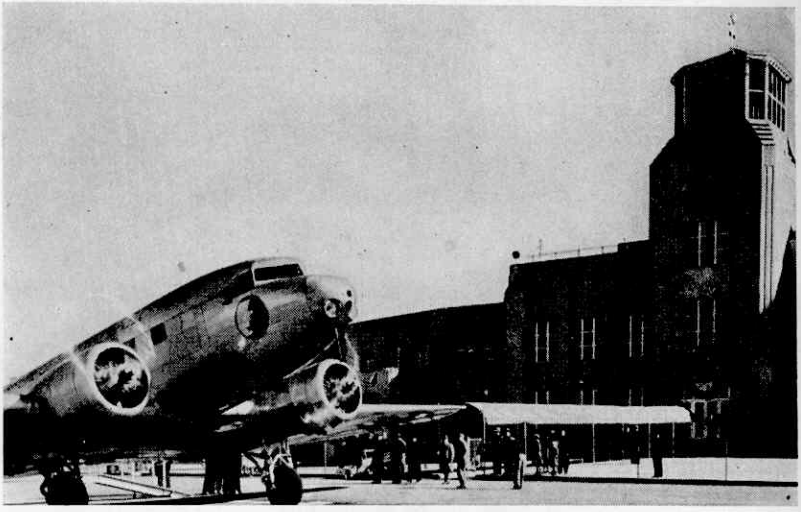
service on all flights. The 20 cities on the company's system were provided with a perfected air express service with pick-up and delivery at moderate rates. Eastern Air carried an approximate average of 7,000 passengers, 52 tons of mail and seven tons of air express a month. During one week in the early part of 1935 Eastern Air sold every passenger seat on its two daily southbound flights, every seat on the three extra sections leaving Wednesday and Thursday, and every seat on the three extra sections northbound from Miami on that fol-

lowing Sunday, besides a waiting list of 50. Approximately 500 passengers flew northbound from Florida in one week.

The first bonded air shipment in the United States flown by an officially bonded carrier was carried by Eastern Air from New York to Miami on the overnight Florida Flyer. The shipment included several pounds of bacterial cultures sent from Denmark to the Colombian National Hygienic Laboratories.

### Hanford Airlines

Hanford Airlines early in 1935 re-opened its service between Omaha, Neb., and Kansas City, Mo. That route had been let out to



ALL ABOARD FOR POINTS NORTH

One of Eastern Air Lines' Cyclone-powered Douglas air liners takes on passengers at New Orleans.

Rapid Air Lines during 1934. Passenger, mail and express service was maintained on the Bismarck, N. D.-Omaha divisions using Wasp-powered Lockheed Vegas, and on the St. Paul-Omaha division using all metal tri-motored planes.

### 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

FLORIDA TO THE GREAT LAKES IN EIGHT HOURS

A Cyclone-powered Douglas air liner leaves Miami on its eight hour run to Chicago over Eastern Air Lines.

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.

### National Airlines System

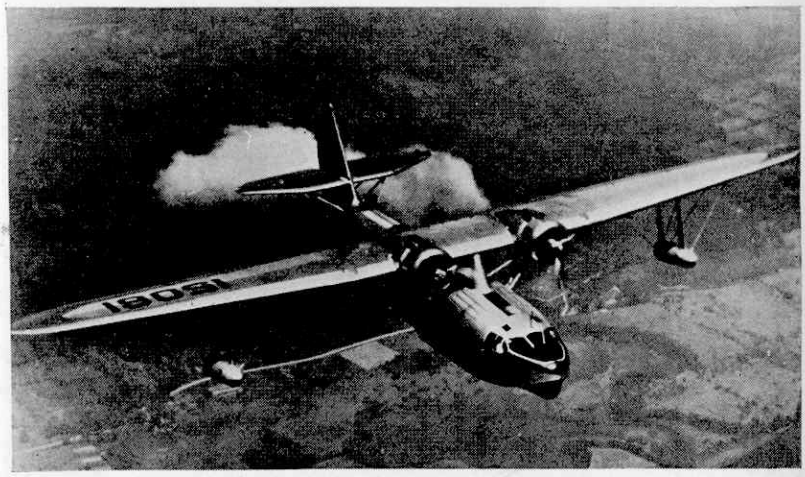
National Airlines System operated passenger, mail and express service between Jacksonville and St. Petersburg, Fla., with station stops at Daytona Beach, Orlando, Lakeland and Tampa, providing a daily schedule both ways over the 241-mile route, making connections with Eastern Air Lines at Jacksonville.

### National Airways

National Airways continued as operating contractor for passenger and express traffic on the Boston-Maine Airways and Central Vermont Airways, using 10-passenger tri-motored Lycoming-powered Stinson transports between Boston, Mass., and Bangor, Me., with station stops at Portland, Augusta and Waterville, and between Boston and Burlington, Vt., with stops at Manchester and Concord, N. H., White River Junction and Montpelier, Vt.

### National Parks Airways

Operating Wasp-powered Boeing transports National Parks Air-



INTER-ISLAND AIRWAYS SIKORSKY S-43

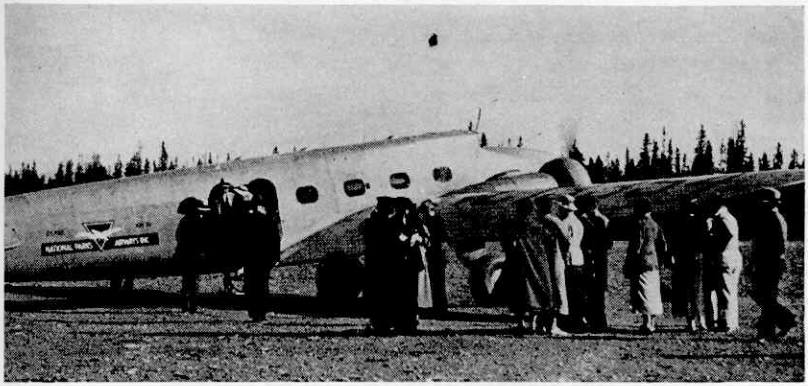
This Hornet-powered twin-motored Sikorsky amphibion was built for scheduled passenger service in the Hawaiian Islands.

ways provided a fast passenger, mail and express service between Salt Lake City, Utah, and Great Falls, Mont., by way of Ogden, Pocatello, Idaho Falls, West Yellowstone, Butte and Helena. The extra schedule to West Yellowstone during the summer months provided the first service in the United States leading direct to the gateway of a national park, in this instance the famous Yellowstone. In August, 1935, National Parks Airways celebrated its seventh anniversary of continuous operations over that intermountain route, during which 17 million pieces of mail, 20,000 pounds of air express and more than 16,000 passengers were carried, the passengers averaging about 200 miles per trip. The company reported a steady increase in

traffic, with a rapid growth of air express. Connecting with United Air Lines and Western Air Express at Salt Lake City and with Northwest Airlines at Butte and Helena, Mont., National Parks Airways enabled passengers to reach the gate of Yellowstone National Park by one overnight trip from cities as far distant as the Pacific and Atlantic coasts.

### Northwest Airlines

Operating a fleet of Wasp-powered Lockheed Electra transports on its rapid passenger, mail and express schedules between Chicago and the cities of the Northwest as far as Seattle and north to Winnipeg, Canada, the Northwest Airlines reported a 123 per cent increase



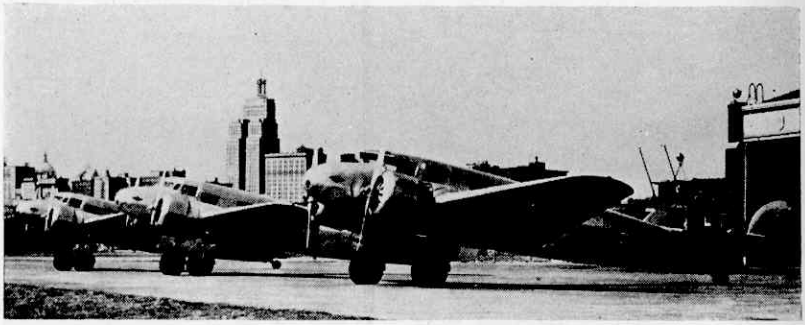
NATIONAL PARKS AIRWAYS AT YELLOWSTONE

Passengers boarding a Wasp-powered Boeing transport in National Parks Airways service at the gateway of Yellowstone National Park.

in passenger traffic, 437 per cent increase in express traffic and 278 per cent growth in air mail during 1935. Northwest was flying more than a million and a half passenger miles a month at the beginning of 1936, maintaining two round trips daily between Chicago and Seattle, four round trips daily between Chicago and the Twin Cities, and one round trip daily between Fargo, N. D., and Winnipeg, Manitoba. Passengers traveled between Chicago and Milwaukee, Wis., in 35 minutes, between Chicago and Minneapolis in less than three hours. Station stops on the company's system, besides the terminals, included Wenatchee and Spokane, Wash., Missoula, Helena, Butte and Billings, Miles City and Glendive, Mont., Bismarck, Jamestown, Fargo, Grand Forks and Pembina, N. D., Rochester, Minneapolis and St. Paul, Minn., and Milwaukee, Wis.

### Pennsylvania Airlines

An increase in passenger traffic of more than 200 per cent was reported by the Pennsylvania Airlines system for the year 1935. Air express increased by more than 365 per cent over 1934. Early in the year the company had installed fast Wasp-powered Boeing transports on its line between Washington, D. C., and Detroit, Mich., with station stops at Pittsburgh, Akron and Cleveland. Passenger, mail and express service between Detroit, Pontiac, Lansing, Grand Rapids, Muskegon, Mich., and Milwaukee, Wis., was provided by tri-motored Ford transports. On the Washington, D. C.-Detroit division Pennsylvania Airlines schedules required 180,000 miles of flying every month. On some of the schedules passengers could fly from Washington to Cleveland in two hours, from Cleveland to Detroit in 45



NORTHWEST AIRLINES AT ST. PAUL
Lockheed Electra transports awaiting the hour of departure.

minutes, and from Detroit to Milwaukee in less than two hours. Direct connections were made with the transcontinental air lines at Pittsburgh and Cleveland, and with Eastern Air Lines at Washington.

### Transcontinental & Western Air

Eighteen flights every 24 hours, four transcontinental runs each way between New York and Los Angeles and five trips each way between Chicago and New York, 29,000 miles of flying every day, or about one million miles a month, such was the condensed schedule of Transcontinental & Western Air (TWA), also popularly known as the Lindbergh Line. The company used a fleet of 30 twin-engine Cyclone-powered Douglas transports which were first built in 1934 to specifications laid down by the company's technical committee headed by Col. Charles A. Lindbergh.

One of the notable schedules of TWA was that of the Sky Chief between New York and Los Angeles, carrying passengers, mail and express in 14 hours and 58 minutes eastbound from Los Angeles to New York. The Sun Racer, Second Sky Chief, Third Sky Chief and Sky Master, all Douglas transports, at the beginning of 1936 were leaving New York at various hours and landing passengers in Los Angeles in about 16 hours. The Sun Racer had a particularly appropriate name, because that flight, leaving New York at 8:30 in the morning, landed TWA passengers in Los Angeles a half hour before midnight the same day, having virtually raced the sun across the continent in a single day, with the sun winning, of course, but not so

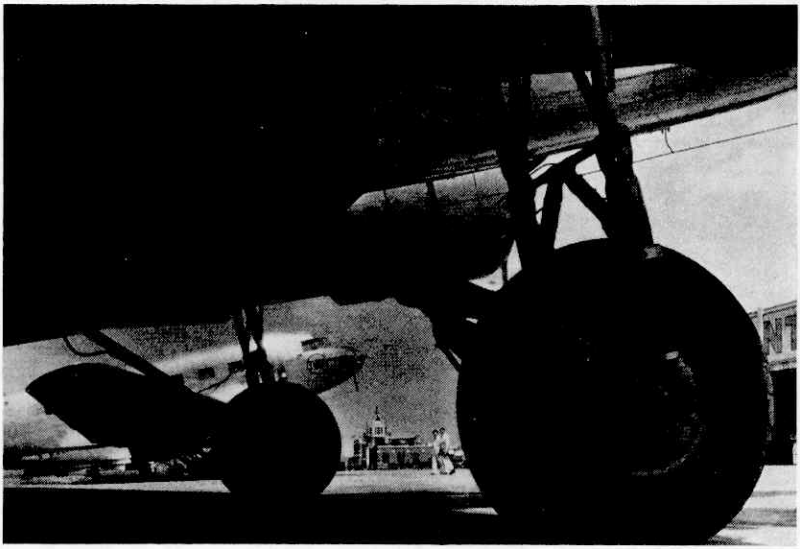
ALL ABOARD ON PENNSYLVANIA AIRLINES

One of its Wasp-powered Boeing transports at Detroit City Airport. Pennsylvania Airlines carried thousands of passengers between Washington, D. C., Detroit and Milwaukee during 1935.

gloriously after all; because, if TWA forced its passengers to go aboard the plane for departure at sunrise in New York, they could be landed in Los Angeles while it was setting over the Pacific coast. One of the most popular transcontinental trips over TWA was that of the Sky Master leaving New York a half hour before midnight and landing in Los Angeles late the next afternoon, thus giving the passengers an opportunity to view the great Southwest in all its beauty and marvels of nature which few persons have the time to see by spending days of tedious travel over the surface. Such scenic wonders as the great meteor crater, the Sky City of Acoma, The Painted Desert, The Petrified Forest, the Grand Canyon of Arizona and Boulder Dam were presented to full view from the cabin windows of

TWA planes between Los Angeles and Albuquerque, N. M., on flights made over that country during the daylight hours.

One of the TWA flights from Chicago to New York was made non-stop every afternoon, the 744 miles being traversed in less than four hours. Other schedules had intermediate stops at Pittsburgh and Philadelphia, with schedules between Pittsburgh, St. Louis and Kansas City by way of Columbus, O., and Indianapolis, Ind. From Kansas City, TWA routes lay westward to Wichita, Kan., Amarillo, Tex., and thence to Albuquerque and Los Angeles.



Margaret Bourke-White Photo

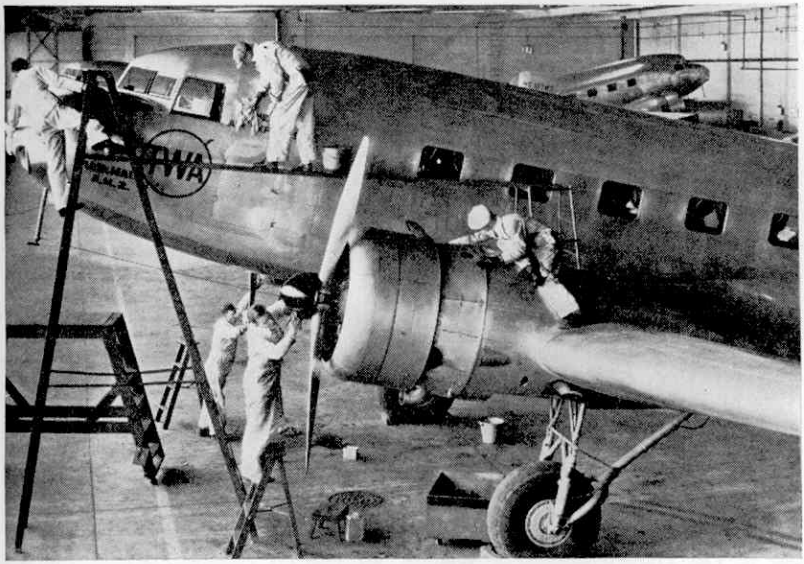
TWA DOUGLAS TRANSPORTS AT KANSAS CITY

Transcontinental & Western Air's ships ready to fly out on their schedules east, west and north.

With its main operating base at Kansas City, TWA installed new experimental equipment in one of its Douglas transports and used it for test flights and other development work in a series of cross-country hops in charge of Comdr. D. W. Tomlinson, who in May, 1935, broke 14 world records and five American records in two series of flights over the official triangular course between New York and Virginia points. After that amazing feat the TWA Douglas was taken back to Kansas City and equipped with still newer aids to flying, including the Hamilton Standard constant speed propeller, an improved homing radio compass and a new fuel mixture control. With

that additional array of equipment Tomlinson made a record flight from Los Angeles to New York. Both achievements are described in detail in the chapter on notable flights.

Prior to leaving on his ill-fated adventure flight to Alaska with Will Rogers, Wiley Post had carried on important stratosphere flying experiments under the banner of TWA. These flights were not precisely TWA flights, however, because Wiley Post insisted on using his veteran ship the "Winnie Mae" for experiments which most observers believed warranted the most modern equipment obtainable. Post's several attempts to fly the sub-stratosphere and stratosphere at




WHY AIR LINERS ARE SLEEK AND TRIM

TWA overhaul crew at the Kansas City base gives a Cyclone-powered Douglas one of its periodic housecleanings.

very high altitudes using oxygen all the way proved conclusively that only the most efficient equipment and extensive preparations could assure success. With that in mind the TWA organization continued to carry on where Wiley Post ceased.

September 5, 1935, Tomlinson, accompanied by Harlan Hull, chief pilot of TWA, and Howard Morgan, radio engineer, went up over Kansas City for a sub-stratosphere flight to New York non-stop. They took their Cyclone-powered Douglas up to 30,000 feet and remained there for several hours, using oxygen and navigating the plane solely

by radio. On that flight they proved that transports at such heights not only gain speed rapidly but maintain speed with a minimum of motor power, and that radio aids from the surface function perfectly in the sub-stratosphere. Two days later, on the return flight from New York to Kansas City, they put a hood over the pilot's cockpit, which made it impossible for them to see outside in any direction. As soon as they were in the air they levelled off and started using the homing radio compass. From Newark to Pittsburgh they followed the radio beam to the latter city. Then they picked up a broadcast at Columbus. Thence to Kansas City where they disconnected their compass, uncovered the cockpit and made a landing in the usual manner.

Late in the year TWA pilots were experimenting with landings

TWA PASSENGERS, MAIL AND EXPRESS

One of the Transcontinental & Western Air fleet of Cyclone-powered Douglas transports about ready for its cross-country flight.

made by instruments only, using the new runway localizer installed at Kansas City. When perfected for everyday use the instrument landing system, as described in the chapter on airports and airways, will permit landings in any kind of weather, including fog.

### United Air Lines

United Air Lines at the beginning of 1936 still maintained its reputation for flying more miles, more passengers, more mail and more air express than any other single air line system in the world. During 1935 United had flown approximately 15,000,000 miles, carrying about 180,000 passengers, 3,300 tons of air mail and 900 tons of

air express. United Air Lines routes totalled more than 5,000 miles of airways at the end of 1935. By April, 1935, United had flown 80,000,000 miles during its nine years of operating regularly scheduled transport service. In July, 1935, traffic demands were so great that United was flying six round trips daily between Chicago and San Francisco, and eleven round trips daily between Chicago and New York. United carried more than 20,000 passengers during that month, a world record for any similar period. In August the total was even better—21,122 passengers. At the same time the average

UNITED AIR LINES SERVES LUNCHEON

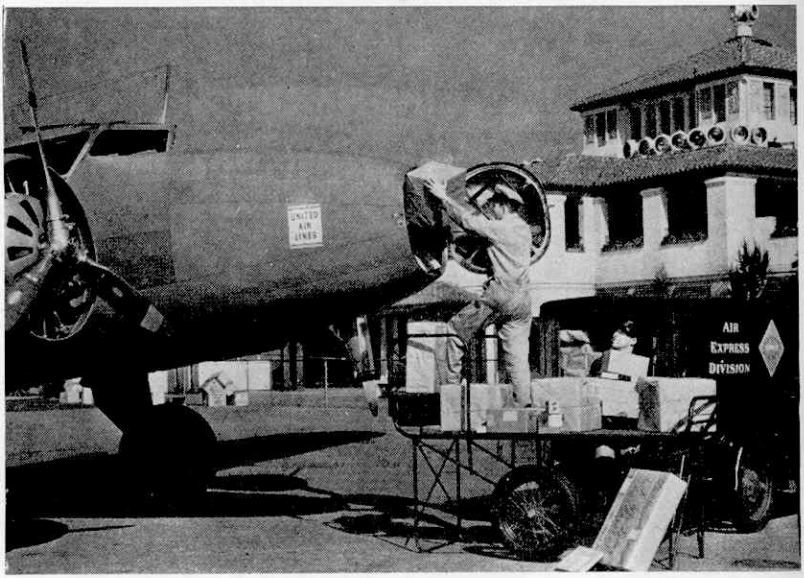
Interior of a Wasp-powered Boeing 247-D during flight over the coast-to-coast route of United Air Lines.

trip per passenger increased in length, reaching an average of 746 miles during the summer months.

Illustrating the company's expansion of passenger and express traffic, its financial statement showed that for the first time less than half of the annual gross revenues of United Air Lines was derived from air mail payments by the Post Office Department. In other words, passenger and express traffic brought in more than half of the revenues. Incidentally, about 40 per cent of United Air Lines airplane mileage flown daily was without benefit of any air mail revenue.

At the same time United was serving 35 cities in 15 States from New York and Philadelphia to the Pacific Coast cities between Seattle, Wash., and San Diego, Calif.

During the year the company discontinued operations between Kansas City and Chicago, following the loss of the Chicago-Dallas mail contract under competitive bidding. It also ceased operations between Seattle and Spokane, Wash., it being the company's policy not to operate passenger and express service over an airway on which another operator held an air mail contract. United extended its opera-



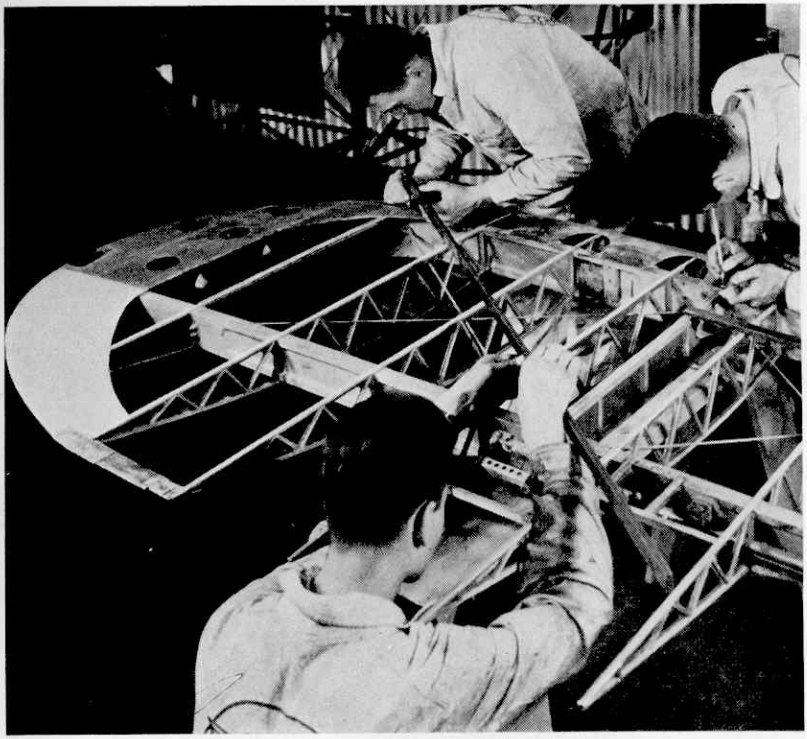

UNITED AIR LINES EXPRESS

Loading a Boeing transport at the United Air Lines Terminal at Burbank, Calif. This air express will fly the length of the Pacific coast at three miles a minute speed.

tions, however, to Vancouver, B. C., thus providing service to every city of 100,000 population or more on the Pacific coast.

On its mid-continent airway United made closer working arrangements regarding connections with various lines touching it at New York, Cleveland, Chicago, Omaha, Cheyenne and Salt Lake City; and this served to increase traffic originating at off-line points. Changing of the airway lighted beacons shortened United's cross-country route by 87 miles. In May the United planes leaving New York at the close of business landed on the Pacific coast at the breakfast hour,

making it possible for passengers to have a full business day in San Francisco, Portland, Seattle and, through connections, Los Angeles and San Diego. Eastbound service was even faster with the prevailing winds permitting regular overnight schedules between the Pacific coast cities and Philadelphia and New York. Meanwhile United planes were flying passengers, mail and express between Chicago and New York in about four hours.



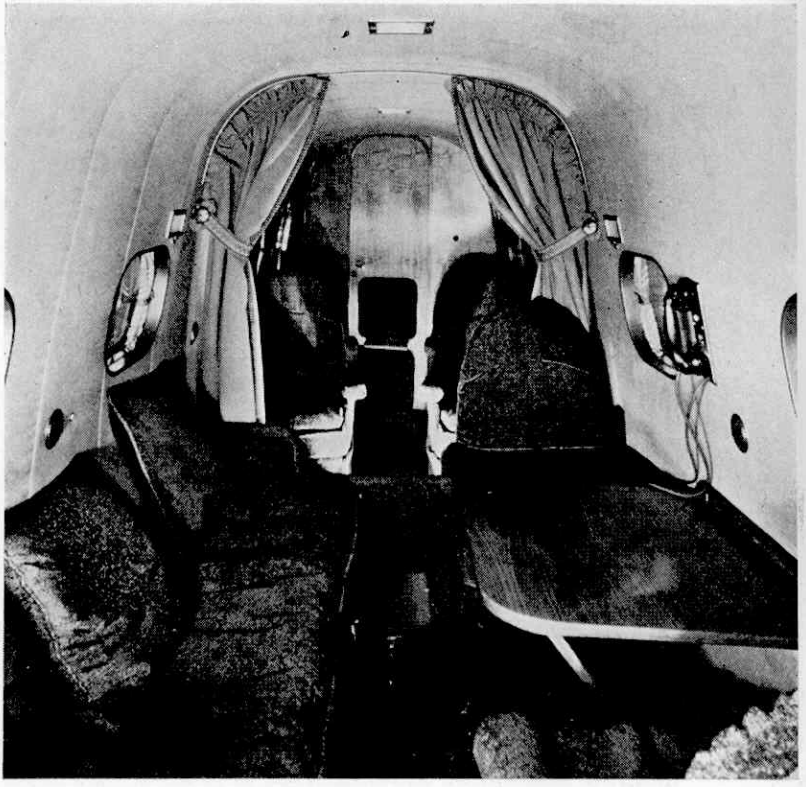
BOEING SCHOOL OF AERONAUTICS STUDENTS

They are constructing an airplane wing as part of their training in the school operated by United Air Lines at Oakland, Calif.

The 60 twin-motored Wasp-powered Boeing transports in the United Air Lines service at the beginning of 1936 formed the largest air line fleet operating in any one country in the world. The cruising speed of those transports was 189 miles an hour. Improvements made during 1935 included greater soundproofing of the cabins, modified streamlining and other refinements. The Hamilton Standard pro-

pellers were equipped with that company's new constant speed control so that the service was flown with greater engine efficiency and performance.

Round-the-world flying traffic connections, whereby one may soon buy a single ticket and fly all the way around the earth on it, were brought several steps nearer actual realization during the year when



A BOEING CLUB CAR OF THE AIR

This Wasp-powered Boeing 247-D for the Phillips Petroleum Co. has an electric refrigerator and radio telephone.

United, Pan American Airways and other lines commenced making interline agreements with foreign lines including K-L-M, Imperial Airways, the Zeppelin company and others.

Interesting facts were assembled by the traffic department of the company in the course of an energetic campaign to build up new

sources of patronage, from vacationists traveling to the national parks and dude ranches, elderly persons desiring to spend a few days on a tour of the country, college classes, convention delegates and others. Four passengers in a single group who flew from Salt Lake City to Boise, Ida., and return, were all seventy years or more. S. L. Davis, president of the Hupmobile Illinois Company, made a 4,400 mile tour of his western offices with only 40 hours spent outside his headquarters in Chicago. A Colorado judge weighing 410 pounds flew with United Air Lines and liked it. Arthur Brisbane, famous editor and columnist, flew over United Air Lines and remarked that more than

WALL STREET FROM THE EAST RIVER

Brooklyn and Manhattan bridges, downtown New York and in the background Jersey City across the Hudson. This is a Fairchild aerial photograph.

ever he was convinced that air travel soon would be a commonplace mode of travel.

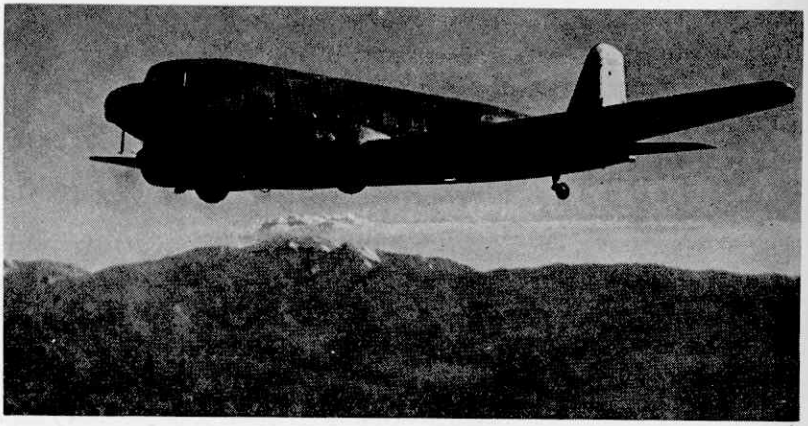
Twenty-five United pilots had records of flying a million miles or more. Passengers on United planes could view some of the most wonderful scenes in America, including Mount Rainier, Mount Shasta, the High Sierras, and, through connections with Western Air Express between San Diego and Salt Lake, Boulder Dam. Allentown, Pa., became a regular station stop during the year.

United Air Lines continued to operate its famous Boeing School of Aeronautics at Oakland Airport, opposite San Francisco on the

bay. The air line's most experienced pilots and other technicians were members of the advisory board of the Boeing School. Students preparing for active air line work were given practical training in United equipment when it could be released from active service on the scheduled routes. A number of the graduates of Boeing School were assigned positions with United and with other lines.

### Varney Air Transport

Varney Air Transport, formerly Varney Speed Lines, operated passenger, mail and express service between Denver, Colo., and El Paso, Tex., by way of Albuquerque, N. M. Its route between Denver



Margaret Bourke-White Photo

TWA OVER THE ROCKY MOUNTAINS

A Cyclone-powered Douglas speeding toward Los Angeles.

and Pueblo was operated by Wyoming Air Service holding air mail contract 29.

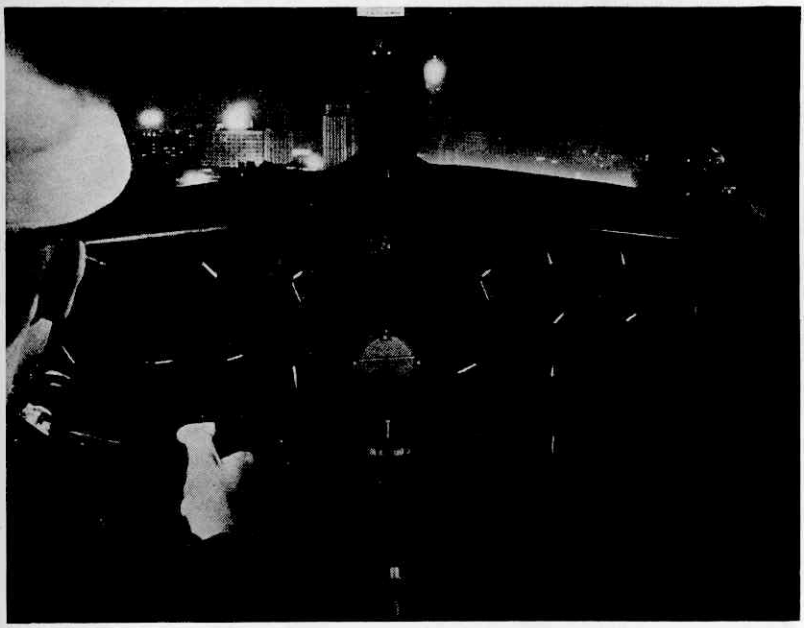
### Watertown Airways

In May, 1935, a group of veteran pilots of Watertown, S. D., commenced operating scheduled round trip service between St. Paul, Minn., and Spearfish, S. D., with station stops at Willmar, Minn., Watertown, Huron, Pierre, Philip and Rapid City, S. D. The 11 cities served directly by Watertown Airways were trading areas and traffic centers for more than 2,000,000 persons. During one period the company flew 54,000 passenger miles completing all 88 trips started. Only one scheduled trip was postponed. The line operated

one Whirlwind-powered Travelair plane carrying four passengers, pilot and baggage.

### Wedell-Williams Air Service

Wedell-Williams Air Service operated passenger, mail and express service between Houston, Tex., and New Orleans, and late in 1935 added another division between Houston and San Antonio. Intermediate station stops included Baton Rouge and Beaumont.

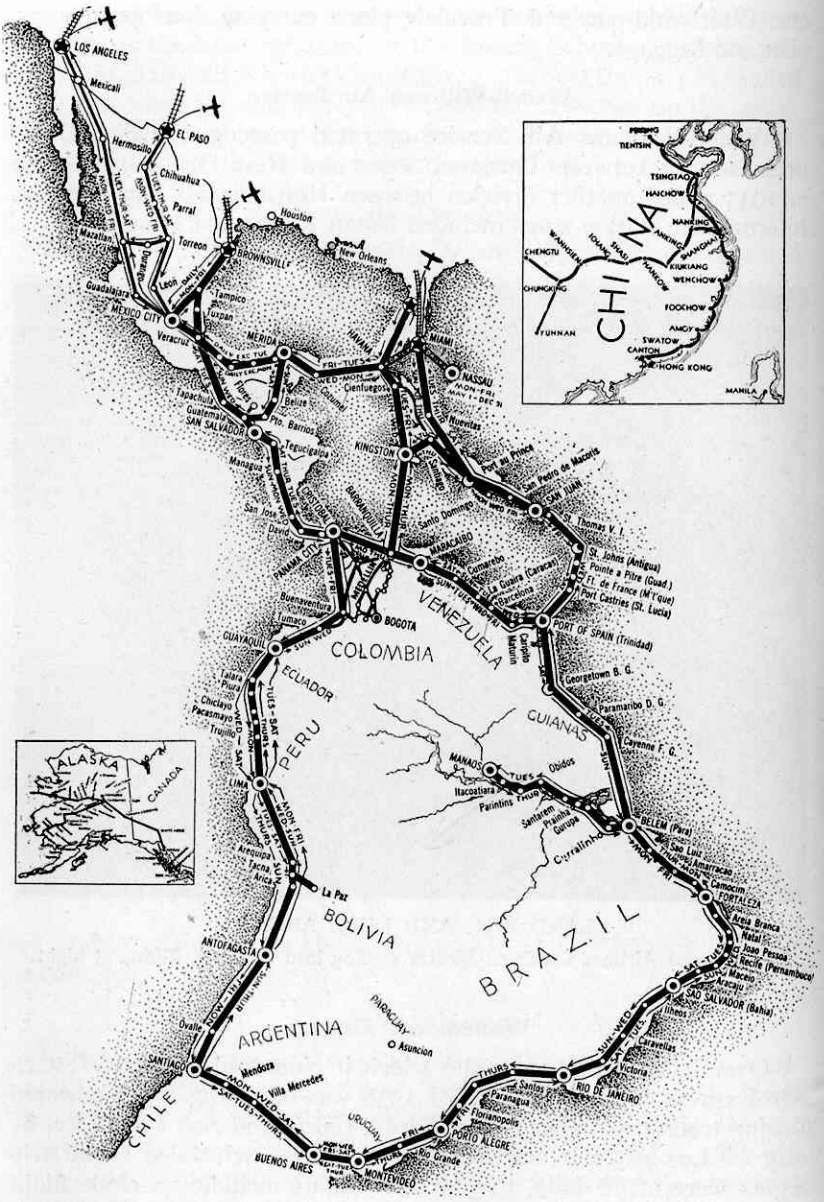


LAND HO! AND DEAD AHEAD!

A Northwest Airlines Lockheed Electra coming into St. Paul, Minn., at night.

### Western Air Express

Over its 774 miles of route which it pioneered in 1927 Western Air Express at the beginning of 1936 was operating Wasp-powered Boeing transports between San Diego, Calif., and Salt Lake City, by way of Los Angeles and Las Vegas. Three scheduled round trip flights were made daily, the daylight flights including a circle flight around the great Boulder Dam project. Connections were made with United Air Lines at Salt Lake City, and with southern transcontinental services at Los Angeles.




ROUTES OF THE
PAN AMERICAN AIRWAYS
SYSTEM

### Wilmington-Catalina Airline

With general offices at Avalon, on Catalina Island, Calif., the Wilmington-Catalina Airline operated a passenger and express service between Wilmington and Avalon, using 12-passenger Douglas Dolphin amphibions.

### Wyoming Air Service

Two divisions were operated by Wyoming Air Service during 1935, one being a passenger, mail and express schedule both ways between Cheyenne, Wyo., and Pueblo, Colo., by way of Denver, and the other a passenger, mail and express schedule between Cheyenne and Billings, Mont. High speed Boeing transports were used between Cheyenne and Denver, and Lockheed Orions and Stinson transports were flown on other sections of the route.

### The Pan American Airways System

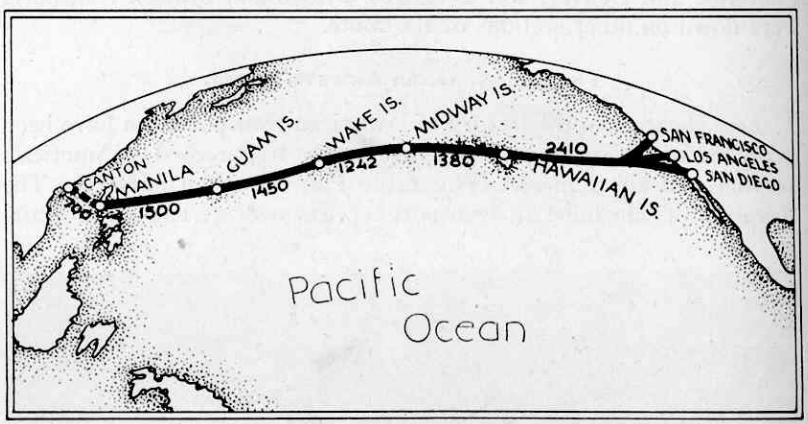
Few chapters in the history of American transportation have been so packed with significant achievement as the 1935 record of America's international air transport system, the Pan American Airways. The operation of scheduled air transport services over 41,183 miles of air-

PAN AMERICAN'S MIAMI BASE

One of the ports of entry for America's international merchant marine of the air.

ways, serving 39 countries and colonies, linking three continents, North and South America and Asia; the opening of a 9,000-mile ocean airway across the Pacific between America and Asia; the acquisition of a succession of world-record flying "Clipper Ships," and the establishment of 150 mile-an-hour schedules on all international trunk air lines between North and South America, in Alaska, and in China—those were the high spots of Pan American's work in 1935.

With astonishing swiftness, yet without a single important deviation from prearranged plans, the Pacific project moved from its first public announcement late in 1934 to the beginning of regular scheduled air mail service on November 22, 1935. In January, 1935, the personal nucleus for the Pacific Division, headed by Clarence M.



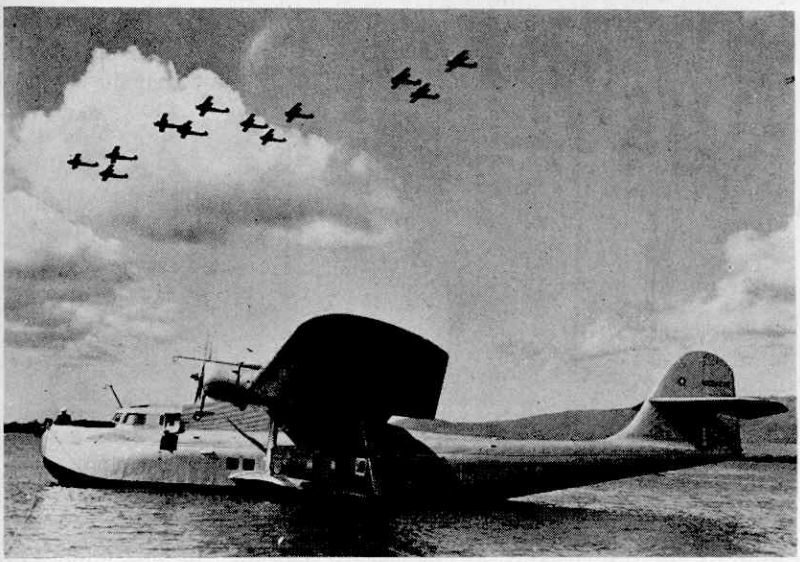

THE PAN AMERICAN AIRWAYS TRANSPACIFIC ROUTE

Young, set up headquarters in San Francisco. Late in March the second Sikorsky S-42 to be delivered to the System arrived in Alameda. Christened the "Pan American Clipper" and fitted as a flying laboratory, it took off on April 16 for the first of a series of remarkable survey and engineering flights over the long skyway to the Orient. Eighteen hours later Captain Edwin C. Musick and his crew of five landed it gently on the waters of Pearl Harbor, Hawaii. His story will be found in the chapter on notable flights. Less than a month earlier the steamer "North Haven" had sailed through the Golden Gate with hold and decks crammed with all the buildings and equipment and gear needed to set up ocean air bases at Midway, Wake and Guam, to supplement those at Honolulu and Manila.

By April 23 the "Pan American Clipper" had returned to Cali-

fornia. In June it once more headed westward. This time it flew on from Hawaii to land at the new ocean air base at Midway, 1,380 miles beyond Honolulu, before it turned homeward. Then to Wake and return in August, 1,252 miles more, now under command of Captain R. O. D. Sullivan. Finally in October it carried through on a final round trip to Guam, last stepping stone before Manila, and 6,602 miles from the mainland.

The "North Haven" expedition had returned from its operations in July leaving well-equipped, fully-manned bases ready on Midway



THE "CHINA CLIPPER" AT HONOLULU

One of the transpacific flying boats built by the Glenn L. Martin Company for Pan American Airways. It is powered by four Pratt & Whitney Twin Row Wasps.

and Wake, and radio equipment and fuel supplies at the other three islands.

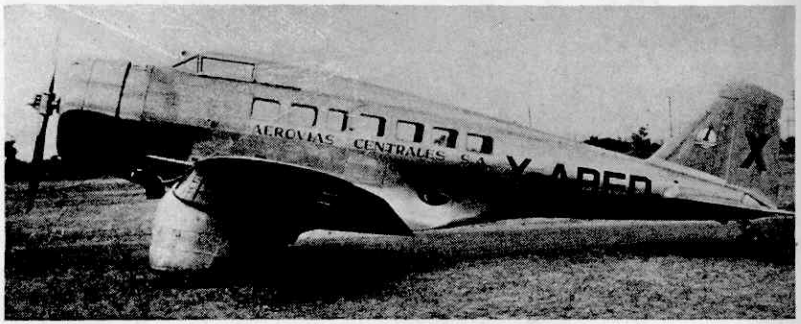
In August Postmaster General Farley issued an invitation for bids on an air mail service from California to China. So exacting were these requirements, so far ahead had Pan American gone with its long program of preparations, not a single rival bid had been received by the deadline set for opening on October 21. Late that same week Postmaster General Farley, after a conference with other cabinet members, announced the award of the contract to Pan American.

The rate set for the first 800 pounds of mail was $2.00 a mile. Additional poundage might be added at $1 a pound for each 1,000 miles.

Meanwhile the Martin factory in Baltimore had been putting the three huge flying boats, built to Pan American specifications, through exhaustive flight tests. Early in October they delivered the first one, the "China Clipper". Thirty days later it lay ready for service off the seaplane ramp in Alameda.

On November 22, 1935, the service opened. More than 1,860 pounds of mail were loaded into the great ship. Postmaster General Farley read a letter of congratulation from President Roosevelt, as he opened the colorful ceremony at the Alameda base. It stated:

"Please convey to the people of the Pacific Coast the deep interest and heartfelt congratulations of an air-minded sailor. Even at this distance I thrill at the wonder of it all. They tell me that the inaugu-




NORTHROP DELTA TRANSPORT

One of the Cyclone-powered ships in service on the Mexican air line.

ration of the transpacific sky mail also celebrates the one hundredth anniversary of the arrival of the first clipper ship in San Francisco. The years between the two events mark a century of progress that is without parallel, and it is our just pride that America and Americans have played no minor part in the blazing of new trails. There can be no higher hope than that this heritage of courage, daring, initiative and enterprise, will be conserved and intensified."

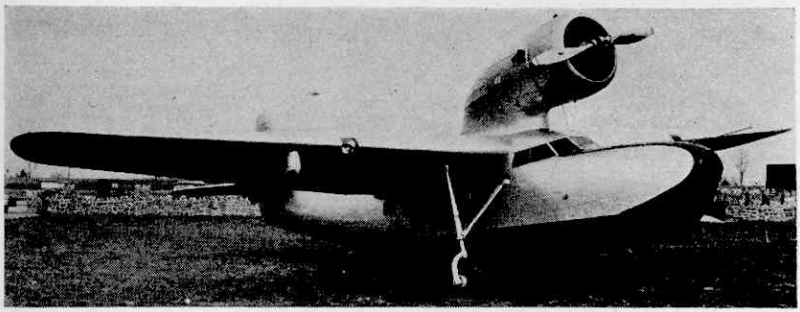
Other officials including Governor Merriam of California, Governor Poindexter of Hawaii, and President Quezon of the Philippines spoke briefly over an international radio hook-up of 300 stations. Juan T. Trippe, president of Pan American Airways, turned to the waiting clipper crew: "Captain Musick . . . . . you have your sailing orders . . . . . cast off and depart for Manila in accordance therewith."

On November 29 the "China Clipper" was taxiing ashore to a

warm reception in Manila, on schedule to the minute. Twenty-four hours after the "China Clipper" left Alameda the second Martin, the "Philippine Clipper," had arrived from Baltimore by way of Miami and Mexico. By the end of the year all three were on hand.

The final steps of the Pacific project were carried out with so little apparent difficulty, it was hard to realize that nearly five years of constant, painstaking, pioneering effort, and the expenditure of some $4,000,000 had been required before the first actual scheduled service was ready for public demonstration.

Broadly, five formidable difficulties faced the company's experts gathered in 1931 to map the attack on the project: (1) No planes had ever been built, until then, which could make the 2,400 mile hop from California to Hawaii with ample fuel reserve, let alone a practical payload. (2) No methods of navigation existed which were nearly



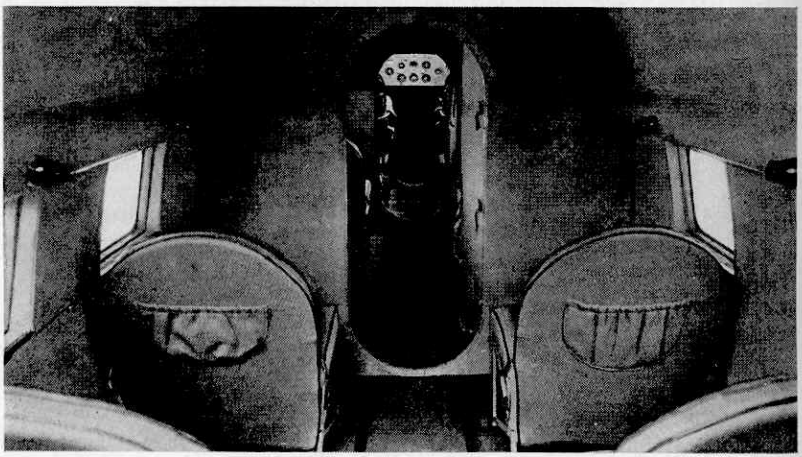
THE FAIRCHILD AMPHIBION TRANSPORT

One of the Hornet-powered fleet built for Pan American Airways service on its river routes.

enough infallible over thousands of miles of ocean to justify such an operation. (3) No men had ever been trained to the pitch of perfection required. (4) No organization of expertly-trained and experienced ground and flight crews existed, even in part, anywhere in the world. (5) No proper air bases existed on four of the island stepping stones the new service would use between California and the China coast. One was an uninhabited coral atoll; one a mere cable relay station.

The story of the bold acceptance of the challenge of Pan American's flying boat specifications by Igor Sikorsky and Glenn L. Martin has been told in preceding year books. How well they succeeded can be shown by the facts that (1) both the Sikorsky S-42 and the Martin 130 set new, unapproached flying boat records for ratio of useful to empty total loaded weight, 46 per cent for the Sikorsky, 54 per cent

for the Martin. (2) Officially observed tests of the Sikorsky brought it 11 international records for seaplane performance with heavy loads. In routine test flights the Martin type exceeded every recorded mark for performance. (3) Both ships brought about a new conception of flying boat cruising speeds with cruising performances of better than 150 miles an hour. (4) The Martin clippers are able to make the long California to Hawaii hop with 25 per cent of reserve fuel, a ton of mail and 18 passengers, on an overnight schedule of 17 hours. At the beginning of 1936 six Sikorsky-type clippers and three of the Martins had been delivered. Four more Sikorskys were nearing completion in the Bridgeport factory.



INTERIOR OF FAIRCHILD 91 AMPHIBION

Watertight bulkheads divide the hull into several compartments.

Early in its campaign to perfect navigation methods and personnel, Pan American set up on its Caribbean Division an immense laboratory for transoceanic operations. Early, too, the company decided that radio direction finding equipment was a vital key to the navigation problem. From the beginning of its operations in 1927 the System had been faced with such severe static problems in its tropical operations that it had been forced to develop its own radio equipment, to use code instead of voice communications, to use direction finders instead of the fixed radio beams used ordinarily. Soon it had set up complete radio laboratories of its own. There it developed and built its own equipment.

Few, reading of precise radio bearings transmitted from Wake

Island to the "Pan American Clipper" speeding into San Francisco Harbor in 1935, realized that it marked a ten-fold extension of the range of such equipment from previous standards. Few appreciated the precision of the navigation of the pioneering flights, a position made possible by years of expert drill in celestial navigation, specifically designed instruments and by constant bearings transmitted from the base stations and from ocean vessels along the route, supplemented by bearings taken from the flying boats on the base stations, on the ships, even on shore broadcasting stations. Yet the technical effort making possible such feats was no less deserving of praise than the design work on the ships themselves.

THEY'RE GOING PAN AMERICAN

Looking down the aisle of a Sikorsky S-42 "clipper" ship operated by Pan American Airways.

In 1931 Pan American officials worked out an ideal conception of a crew to man a transoceanic flying boat—captain, first officer, navigator, radio officer, flight engineer, junior flight officer. They wanted these men interchangeable. A radio operator should be capable of commanding the engine room of a flying ocean liner; an engineer should be able to navigate through the worst of weather; an ocean captain should be capable of sending and receiving wireless messages.

To produce such men, the System set up courses at divisional headquarters for all its personnel. Pilots, no matter how extensive their experience, went through systematic instruction in blind flying, and

were given experience on a wide selection of airplane types. All flying personnel took lessons in meteorology, navigation, radio and seamanship. New pilots were passed through long training periods in engine shop work. For years after joining the line they served as apprentice pilots, as junior officers, as clerks in charge of every detail of clearing the cargoes and caring for passengers, as radio operators, weather men, mechanics.

The System opened a flying boat route from Miami directly southwest to Barranquilla, over 1,250 miles of the Caribbean. That gave an "ocean laboratory" to train crews in out-of-sight-of-land navigation. The first of the 17-ton Sikorsky clipper ships was soon available and the practice work became even more direct, with the full ideal complement of officers. Crews took noon sights of the sun to figure their position. They checked them with radio bearings from shore stations. They practiced navigation by dead reckoning, using drift sights on the ocean surface.

In 1934 three 19-ton Sikorskys became available, the first transocean transports. Two of them went immediately into service on the eastern trade route to Brazil and Argentina. One was turned into a laboratory plane for the final phases of training for the Pacific project. Great fuel tanks filled its cabin compartments, enabling it to operate 1,000 miles more than the longest section of the route. Chart rooms and special hatches for navigation were installed. Crews picked from the System's entire personnel assembled at Miami to fly the great craft through endless tests and exercises. Early in 1935 everything was ready for actual training over the long skyway toward Asia.

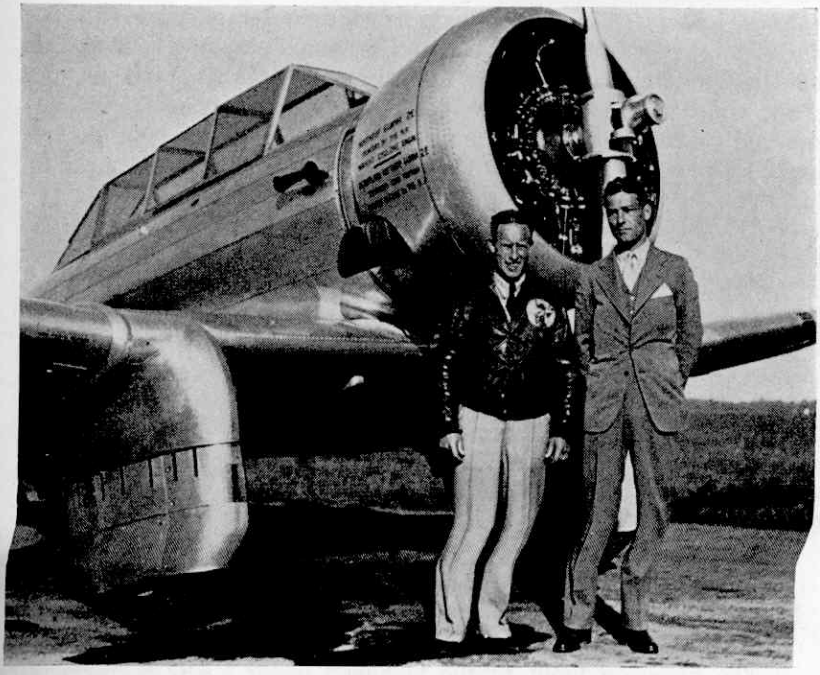
Mechanics from the transocean school were sent to the Alameda base on San Francisco Bay and to Hawaii. Others went with the airport building expedition to Midway, Wake, Guam and Manila. With them went radio crews and base managers, each with distinguished years of service behind him. Then step by step the last rehearsals of each man in his long studied duties began.

Most of the flights were purposely headed into as severe weather conditions as could be found along the route to give as stern a test as possible. For hours the crew practiced flying by instruments alone as curtains over cockpit windows shut out all view of the ocean beneath them.

A plan of crew rotation was carefully followed. Captain Musick commanded the first two flights, then Captain Sullivan took over, varying his roster of under officers from flight to flight. By the opening of scheduled operations five full crews were ready to man the great 25½-ton Martin-type clippers.

The whole conception of a transpacific seaplane service was of

course founded upon the existence of a chain of island "stepping stones" which broke the crossing into five stages. Fortunately all the islands along the most ideal route to China belonged to the United States—Hawaii, Midway, Wake, Guam, Manila. But a dot on a map and permission to land on the island it represents do not make an air base. Each island required a landing float, fuel tanks, an elaborate radio system, a crew to man the base, and facilities for housing and maintaining them.



FRANK HAWKS AND HIS NORTHROP GAMMA

With G. H. Irving, chief test pilot for the Northrop Corporation, and the Cyclone-powered plane in which they made an 8,090 mile flight from Buenos Aires to Los Angeles in 1935, at an average flying speed of 203 m.p.h.

At Hawaii and Manila the task of erecting such a plant presented few difficulties. Guam, too, was a regular steamer call and possessed resources of its own. But Midway was a mere cable station, and Wake was a desert coral atoll which no man had visited in a decade.

Pan American decided to send a single expedition to set up all five island bases. It was an astounding experiment. Months before, airport engineers laid out settlements on charts of the islands. Radio

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men, maintenance supervisors, architects, dieticians, carpenters, plumbers, electricians, doctors, all studied lists of countless necessary items. Purchasing agents scurried through a dozen States. Buildings were constructed, tested, then taken down in sections for quick assembly. By the end of March, 1935, everything was ready.

On March 23, 1935, the steamer "North Haven" left the Golden Gate with 6,000 tons of cargo which included two complete villages, equipment for five air bases, a quarter million gallons of fuel, 44 air line technicians, a construction force of 78, food to feed them for months, and 1,018,897 other items of equipment and material. Ten days later, after a brief stop at Hawaii, the ship lay in a driving rain off the booming barrier reefs that circle the Midway Islands. By dawn, winches were getting a 2,000-ton mountain of crates, poles, barrels and gear off the steamer and on barges that rose and fell 20 feet in the ocean swell. Launches towed the heavy loads through four miles of treacherous reefs and breaking surf to the beach.

Fifteen days later the "North Haven" steamed off toward Wake Island, Wilkes Island and Peale Island. Only on tiny Peale was the land high enough to be safe from storms, and Peale has the only soil that promised water. But locating the base on Peale instead of Wilkes, as had been originally planned, meant trans-shipping every single item across the lagoon. Time was short, too; the men must work against a rigid schedule to keep the "North Haven's" charter within set limits. They must be ready for the imminent flights of the first clipper ship from the mainland. The hardest kind of work began. Intense heat blistered eyelids, armpits, chins and nostrils. It was a Herculean job, but they completed it.

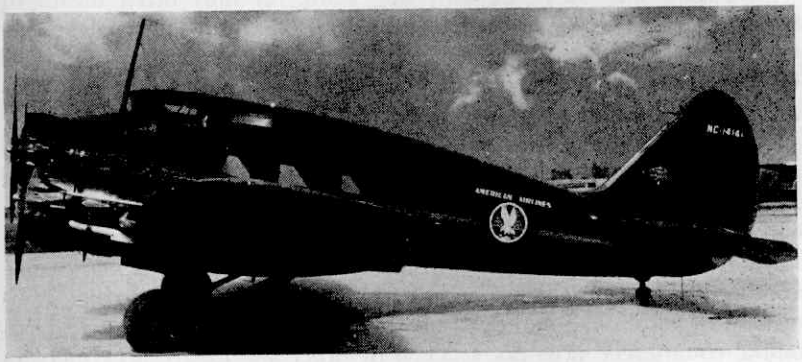
Ten days later, the base in order, the "North Haven" steamed quietly on, to land small groups at Guam and Manila. By the end of July she was back at her home pier in Seattle, with all the construction crew returned.

The precision flight of the "China Clipper," was a spectacular achievement—yet, even without its creation of a high-speed aerial trade route for America's commerce a third the way around the world to the China Seas, Pan American Airways should have been warranted in counting 1935 a major turning point in its operating history.

Over its great network of 32,973 miles of operating airways, traffic in 1935 reached new high marks, schedule efficiency reached new levels of perfection, with a record of 99.89 per cent of all scheduled mileage completed. During 1935, 8,728 miles of airways were added to this international air transport system, bringing the total to 41,183 airway miles, by far the greatest of any air transport system in the world, and nearly double the aerial trade route mileage of Europe's

great companies. Imperial Airways of Great Britain, Deutsche Lufthansa of Germany, or Air France.

On November 1, 1935, 150-mile-per-hour operating schedules were established on all main trunk air lines of the Pan American Airways System, the highest international transport speed in the world. To make that possible, a wide program of procurement of more efficient multi-engine aircraft had been under way, keyed to meet, and surpass, the advances Europe's subsidized air lines had made in the South American trade territory. By November 1, a fleet that included seven transocean 32 and 40-passenger, four-motored clippers; 18 Cyclone-powered twin-engine Douglas air liners and 19 twin Wasp engine, 200 mile-an-hour Lockheed Electras were commissioned into scheduled service after prolonged periods of training flights over the routes.



AMERICAN AIRLINES STINSON TRANSPORT

One of the tri-motored fleet equipped with Lycoming engines and Smith controllable pitch propellers.

Behind them, to augment this high-speed advancement, were still other Sikorsky clippers, a fleet of the Wasp-powered Sikorsky S-43 amphibions for some of Pan American's coastal routes on the southern continent and possibly China, as well as additional units of advanced type Douglas and Lockheed ships for other southern routes and for Alaska. They were initial units in a procurement program advanced by Pan American in 1933, which placed with the industry some $8,000,000 worth of orders for aircraft, equipment and auxiliary items.

As a result of these new schedules the time over the main long distance trunk routes was cut to half that existing when the lines were first established. Mail, passenger and express time between principal cities in the United States and Buenos Aires, the most distant capital

in South America, was cut to five and a half days by way of either coast of the southern continent, with proportionate savings between all intermediate countries. Panama Canal Zone, through a one-third cut in schedule time by way of Mexico and Central America, was brought within two days of the United States. In that time-zone every land bordering the Caribbean could be reached. Countries in the West Indies as far as Puerto Rico, and in Central America as far as Guatemala, were brought within one day of Miami and Brownsville, respectively. Lockheed Electras, on Pan American's feeder line between Mexico City and Los Angeles cut that 1,800-mile route down to a leisurely daylight flight, and provided a rapid channel for Pacific States commerce into Latin America. In Alaska, the same equipment made possible a trans-Alaska schedule, from Juneau in the south, through Fairbanks, to Nome, on the Bering Sea, of seven hours—to compare with a minimum of 72 days by dog team, the only other means of transportation. Douglas equipment, added on the China routes, likewise halved the fastest former schedules on the coastal route from Canton to Shanghai and to Peiping, in the North, and to distant Chengtu, 1,600 miles up the Yangtse River from the seacoast.

A typical example of Pan American pioneering was recorded in their remarkable survey, the first ever accomplished, from Rio de Janeiro through interior Brazil to the Amazon. This study was made looking toward the creation of a through express route direct from Para over land to Rio de Janeiro, which not only should make possible another tremendous saving over the coastal route to the Brazilian capital but, in addition, could open up for Brazil and America a great potential commercial area not reached by other services. Pan American engineers were hopeful that mapping and complete organization of the route could be completed for service during the summer of 1936.

On this same eastern trunk route, service was extended to Point-a-Pitre, Guadeloupe and Martinique, in the French West Indies, lying between Puerto Rico and Trinidad. While major improvements were effected in marine terminal facilities in a number of key ports on that route, the Brazilian Government, as a bid to the operation of Pan American's great four-engine clipper ships, began construction on what is planned to be "the finest airdrome in the world," a great combined marine and land transport air base in the center of Rio de Janeiro's famous waterfront and within three minutes of the center of the city.

Service along the busy north coast of South America was again increased during 1935 by a third weekly schedule between Port of Spain, on the east, and Maracaibo, Venezuela, on the west, on the transcontinental route which, serving Colombia and Venezuela, linked

with the eastern and western trunk air lines at Trinidad and the Panama Canal Zone respectively.

On the west coast of South America, Pan American-Grace Airways completely equipped their trunk route from northern Peru to Santiago, Chile, thence across the Andes to Buenos Aires, using high-speed Cyclone-powered Douglas air liners, cutting their fastest previous schedules one-third. A major construction program was also completed over this airway, making it one of the most highly developed aerial routes in the western hemisphere. To supplement the greater passenger and cargo capacity of the Douglas air liners over the trimotored Fords which they replaced, Pan American-Grace also replaced their amphibion service, operated over that section of their route from Panama Canal Zone to Trujillo, Peru, using 18-passenger twin-Hornet powered Consolidated Commodores. New Sikorsky S-43 amphibions were scheduled for this section of the route early in 1936.

In Cuba, Pan American's associated National Airways of Cuba, in step with improved schedules over the entire network, commissioned a fleet of Lockheed Electras early in 1935 and in the summer had established a seven-hour service from one end of the island to the other, saving an entire day over previous schedules, and with direct connection with Pan American's trunk routes both north and south.

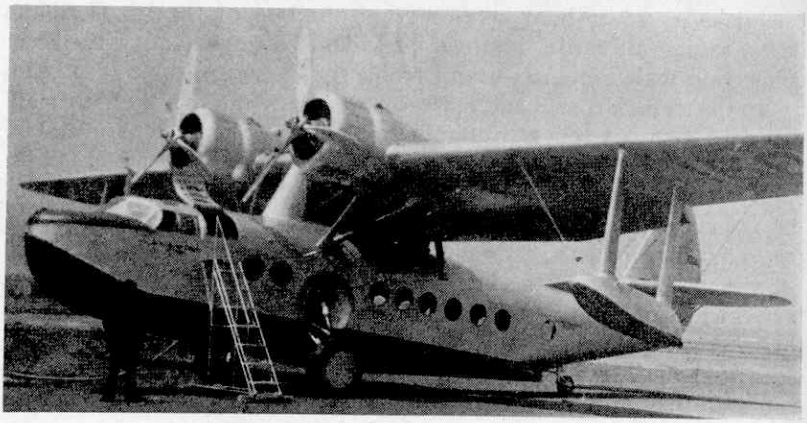
In the traffic department, increases were registered in each division. Over the year, passenger traffic increased 27 per cent from a total of 112,354 in 1934 to 142,630 in 1935. The big four-engine clipper ships, commissioned during the year, and the close coordination of feeder lines, serving to amplify the tourist as well as commercial travel facilities, plus the higher speeds during the latter two months, accounted for the major part of the increase. More direct through connections between all domestic air lines and the international system also aided in the increase. Baggage allowances were increased for passengers traveling the longer routes, over domestic lines as well as over Pan American, and other improvements in the passenger service contributed to its popularity.

Express during the latter months of 1935, increased sharply over 1934 record figures. Totals for 1935 were 1,819,116 pounds, or an 89 per cent gain over 1934. During 1935 air express service was extended to Venezuela, completing the single, simplified shipping procedure to every country south of the United States. In December, 1935, air express service was made available to Alaska. Later it was to be installed on the transpacific route to the Orient.

During 1935 Pan American added to its long and dramatic relief record in the Caribbean by spectacular services during and immediately following the hurricanes which struck southern Florida, Haiti and

Jamaica. In the Alaskan Division, also, its planes played a vital role in rescue expeditions. Most tragic of its assignments were the difficult flights made by Pilot Joe Crosson to Point Barrow after the bodies of Will Rogers and Wiley Post, and his return with them southward to the United States.

Pan American Airways suffered a severe setback in 1935 when the U. S. Post Office Department reduced by $1,000,000 the annual payments for flying the mail in Latin America. Coming at a time when the highly subsidized lines of Europe were expanding their services in Latin America, the reduction in mail pay placed an obstacle in the path of the American line which had always been a leader in this international race for air transport supremacy among the peoples south of the United States.



THE SIKORSKY S-43 AMPHIBION

One of the important developments of 1935 in over-water aircraft, the S-43 is powered by two Pratt & Whitney Hornets and Hamilton Standard propellers. It carries 15 passengers, crew of two and 1,500 pounds of cargo.

## CHAPTER XI

### PRIVATE FLYING

Increase in Licensed Pilots and Planes—Thirty-five Different Models for the Private Owner—Flying for Sport and Business—The Races at Cleveland—Private Pilots Break Records—Light Plane Experiments—Intercollegiate Flying—Gliding and Soaring.

RECORDS of the Bureau of Air Commerce, U. S. Department of Commerce, showed a gain in private flying during 1935. On January 1, 1936, there were 14,805 licensed pilots as compared to 13,949 12 months earlier. There were 7,371 licensed aircraft at the beginning of 1936, as compared to 6,339 the year before. The unlicensed machines fell off numerically, from 1,983 at the beginning of 1935 to 1,701 on January 1, 1936. The total of all aircraft in the United States was 9,072 on January 1, 1936, as against 8,322 the year before. The pilot licenses on January 1, 1936, were divided as follows: 7,186 transport licenses, 909 limited commercial, 5,961 private, 746 amateur and three industrial. No new licenses will be issued in the last classification. The licensed pilots included 410 women classified as follows: transport 71, limited commercial 29, private 256 and amateur 54. More than half the airplanes built in 1935 were for private owners.

No less than 35 different models of American flying craft awaited the choice of the private owner at the beginning of 1936. One had as many different kinds of plane as he had motor cars to pick out for his own individual pleasure. In each case the builders apparently had made an attempt to produce the finest, quietest, fastest or most comfortable airplane for the money. There were machines with only one seat, others with two, a number with eight chairs and a majority with four; some with cabins, heated and ventilated. There were others without cabins, nicely calculated to appeal to those who like to take the air in the open. There were planes priced as low as $1,800. Yet one could pay as much as $50,000 for his aerial limousine or private club car on wings. One could go to a dealer and pay cash for his plane; or, like buying an automobile or radio on the installment plan, he could pay something like $500 down and $100 a month. He could buy a machine giving him 25 miles for every gallon of gasoline, or he could use more gasoline in a plane that would take him through

space at about four miles a minute. He could buy a plane with wheels and a boat-shaped body capable of operating on land or water; and he could have a little runabout on floats for sporty over-water flying. He could buy a big plane with parlor, bedroom and bath, with sound-proofed cabin and all the comforts of home, including a radio. He could have a machine with wheel brakes and air brakes; in other words, flaps on the rear edges of the wings requiring only the touch of a button to let them swing down and offer enough resistance to the air to slow down speed while coming in for a landing. One could buy a plane with double controls and teach his friends how to fly. Some of the planes could be flown for as little as nine cents a mile, including

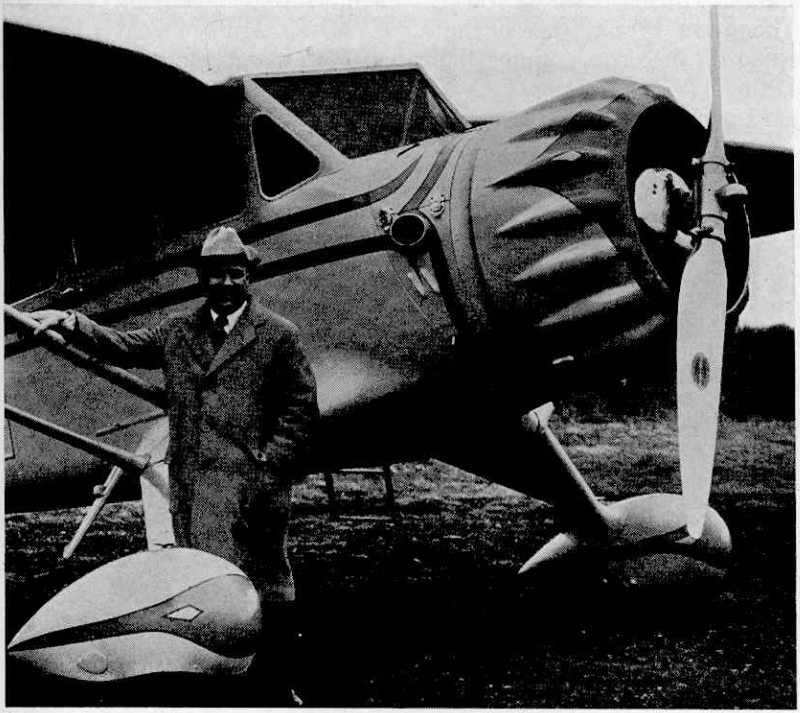
HAROLD NEUMANN AND HIS RACER

In his Menasco-powered Howard racer he won the bulk of the prize money in the Thompson Trophy race at the National Air Races in September, 1935.

all overhead costs, all of which served to bring the private plane down into the same class with motoring, so far as expenses went. In every other respect flying was in a class of its own. It was faster, and it permitted one to cover more territory no matter what he was after.

Take for example, Dr. Barnum Brown of the American Museum of Natural History. He went out early in the year and spent a few weeks flying over 20,000 miles in seven of the Rocky Mountain States, hunting fossils. Flying low, Dr. Brown was able to study the rocks and spot the formations old enough to contain fossils. He located the second largest dinosaur herd ever found, more than 4,000 fossils

representing some 20 dinosaurs, the largest of them being 50 feet long and estimated to have lived no less than one hundred forty million years ago. The Brown expedition was financed by the Sinclair Refining Company, which has made a notable contribution to science by exploring the ages of the most distant past. With the aid of the airplane, Dr. Brown said, he was able to do more in seven weeks than in twenty years working solely on the surface.



THE STINSON RELIANT

Major James H. Doolittle and the Lycoming-powered plane he uses on executive business for the Shell Oil Company. It is equipped with a Lycoming-Smith controllable pitch propeller.

Late in the year Harold L. Farquhar and Fritz Bieler had arrived in Asia in the course of their leisurely flight in a Beechcraft seaplane on Edo floats. Starting from the United States they were flying to Helsingfors, Finland. In Olean, N. Y., Arthur Pierce had his plane tuned up to scatter food to game birds when heavy snow should threaten them with starvation. Hundreds of private pilots attended

the annual air meet in Miami, Fla., in December, and planned to do the same in 1936. There were scores of smaller amateur pilot gatherings throughout the country. At the air races in Cleveland during the Labor Day week-end a host of private pilots appeared, each with new machines, some fast and others distinguished for their weird design. Ben Howard came flying in from Los Angeles to Cleveland, winning the famous Bendix trophy race in his Wasp-powered "Mister Mulligan," just 24 seconds ahead of Roscoe Turner who trailed him in his special Hornet-powered racer. Then Harold Neumann won the Thompson Trophy race in the same "Mister Mulligan." Its average speed on the cross-country flight had been about 239 miles an hour. Major Al Williams of the Gulf Refining Company showed the crowds what one could do if he tried, throwing his Curtiss Hawk upside down,

THE TAYLOR CUB

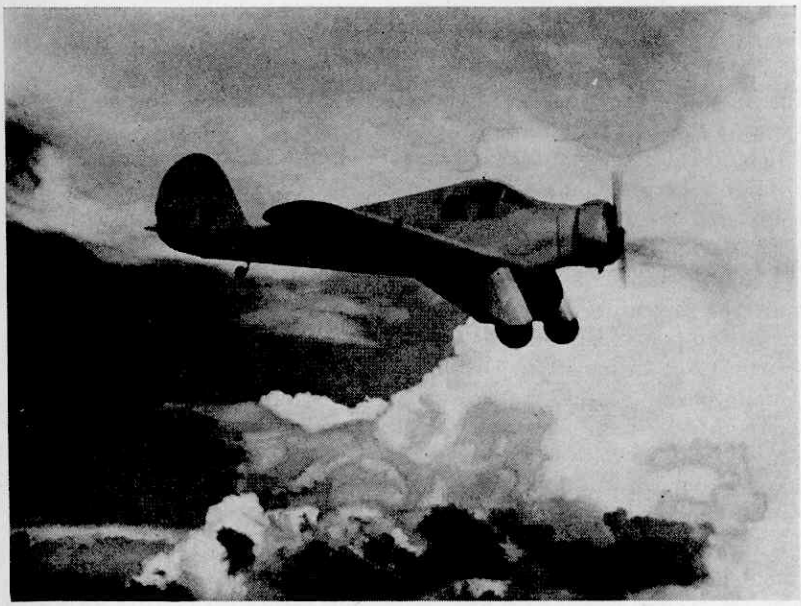
One of the popular light planes of the year, this model built by the Taylor Aircraft Company seats two side by side.

making outside loop the loops, inverted snap barrel rolls and inverted falling leaves, all of which made straight flying appear ridiculously simple.

Earlier in the year Major E. E. Aldrin of the Standard Oil Company of New Jersey made an amphibion speed record in his new Wasp-powered Douglas Dolphin. Late in September Benjamin King of Washington, D. C., took his little Aeronca on Edo floats up to 16,000 feet, breaking another record for light seaplanes. Comdr. Frank Hawks made a quiet good will flight between the United States and the leading countries of South America, at one stage flying his Northrop Gamma the 1,945 miles from Lima, Peru, to the Panama Canal in about nine hours. Forty private airplanes with their owners and friends flew from New York to Montreal and return in July, and six Canadian planes with 18 occupants flew down to New York to

return the visit in September. The Aviation Country Club of Long Island made its annual seaplane cruise, this time up the New England coast.

The development of an airplane for private ownership, one requiring less skill to operate safely, in other words a machine capable of being operated by inexperienced pilots, and further, a plane that should cost much less to buy than conventional types, was one of the projects of the Development Section of the Bureau of Air Commerce, U. S. Department of Commerce, in 1935. Models which might possibly be



FOR SPORT FLYING

The low-wing Aeronca monoplane with LeBlond engine.

included in the above classification, some of which were developed for the Bureau of Air Commerce, included: the Weick W1-A, redesigned and rebuilt for the Bureau by the Fairchild Aircraft Corporation; Waldo Waterman's Arrowplane; the Hammond Y; Fahlin's Plymacoupe; Arrow's Arrow; and the Curtiss-Wright Coupe. The accompanying photographs and captions give further details concerning those machines.

Following is a statement by William D. Strohmeier, of Amherst College, and president of the National Intercollegiate Flying Club:

"In April, 1935, 74 college airmen and airwomen convened in Washington, D. C., under the auspices of the National Aeronautic Association, for the First National Intercollegiate Flying Conference. These delegates came from all parts of the country, representing 23 different colleges and universities in the United States. Some were members of highly organized college flying units. Others came with the idea of finding out how they might get their own colleges into the air. There are now some 50 flying clubs in the colleges and universities.

"The idea of intercollegiate air meets had an auspicious beginning last May when the first New England Intercollegiate Air Meet was held at Northampton, Mass. Eight teams competed in the event, which included bomb dropping, spot landings, and balloon bursting, and which was witnessed by eight thousand people. It launched what in future years may become a very significant factor in intercollegiate sports. President Stanley King, of Amherst, in accepting the New England Intercollegiate Flying Trophy in behalf of the college and the Amherst Flying Club after the meet, stated: 'Amherst is proud to come into possession of this trophy symbolizing pioneer supremacy in a sport which someday will rank with other intercollegiate activities.'

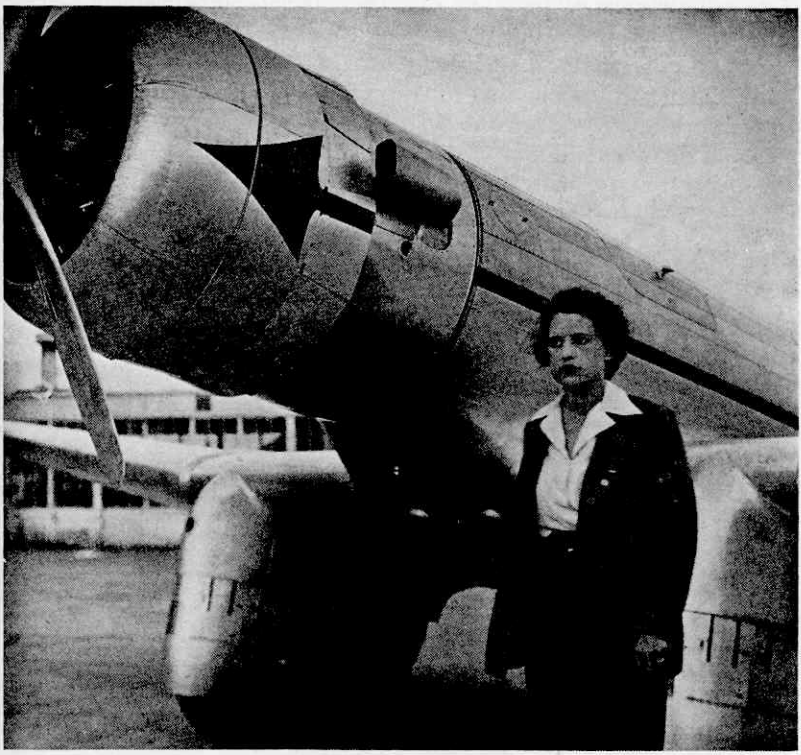
"This was followed in June by the National Intercollegiates at the Purdue University Airport in Indiana. Teams from various parts of the nation participated in this event, establishing even further this new sport. The Purdue Flying Club, incidentally, won the national championship after beating the University of Minnesota in the last event. The indirect effect of air meets such as these, in the form of publicity and so forth, is the increased interest in the sport, not only among the actual participants but also, and this is even more important, other college students."

The main event of 1935 in soaring and gliding was the annual national soaring contest held for the sixth consecutive time on the soaring ridges surrounding Elmira, N. Y., which has come to be regarded as the center of American soaring. Despite the fact that meteorological conditions were unfavorable except for a few days at the close of the contest, the 1935 meeting was in many respects one of the most important to date. No official American or world records were established but the facilities and the administration were the best yet achieved, more pilots and soaring craft were entered and the feverish activity of the closing days accounted for 185 hours of soaring by all craft, a new high mark.

Richard C. duPont of Wilmington, Del., retained the Edward S. Evans trophy, symbolic of the American soaring championship, by winning most points in the various events of the contest and became the first pilot to win the championship two years. He used his Bowlus-

duPont sailplane "Albatross I". He also won the Vincent Bendix Soaring Trophy for the longest flight across country during the meet.

Ninety-six pilots were entered, compared to 63 in 1934; 40 soaring craft were entered and 31 were actually flown. The "C" (soaring) license was earned by 29 new pilots and 10 others secured "B" licenses, indicating proficiency in gliding. At one time there were 20 craft soaring in front of the main ridge simultaneously. Pilots flew a total of 330 miles across country; nine soared to altitudes exceeding 3,000 feet and three to altitudes above 4,000 feet. Interest in soaring among women gained, although only two of those entered in the contest actually competed. Mrs. Allaire duPont of Wilmington, Del., remained aloft five hours 31 minutes and Mrs. Dorothy C. Holderman of Le Roy, New York, soared for five hours three minutes.



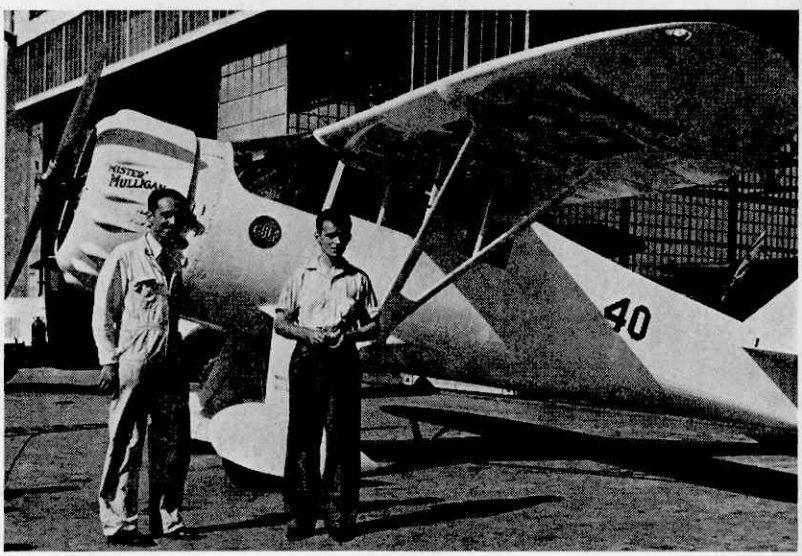
JACQUELINE COCHRAN AND HER NORTHROP GAMMA

The plane is powered with a Pratt & Whitney Twin Wasp Junior engine.

During 1935 soaring flights were made in New York, Pennsylvania, Florida, Virginia, Ohio and Michigan. One of the most important was the flight by Lewin E. Barringer in a Bowlus-DuPont sailplane from Ellenville, N. Y., to a point near Harrisburg, Pa. It fell just short of the American record of 158 miles.

Experiments with gliders as primary flying training for students at the Naval Air Station, Pensacola, continued through the year with interesting results. The Navy made no official announcement regarding the use of gliders but the interest displayed by the Navy Department and experienced naval pilots led the Federal Aviation Commission to suggest the same sort of training for the Air Corps.

Under the auspices of the Soaring Society of America, the second annual soaring expedition to the Shenandoah was held September 27-October 13, 1935, with headquarters at Big Meadows, Va. Twenty pilots participated. Stanley Smith, of Rochester, N. Y., won the trophy as individual champion of the contest.




"MISTER MULLIGAN" THE AIR RACE FAVORITE

Built by Benny Howard, at left, and with a Pratt & Whitney Wasp engine, it proved the greatest prize-winner at the National Air Races in 1935. Co-pilot Gordon Israel is with Mr. Howard.

## CHAPTER XII

### AERIAL SERVICE

Number of Planes in Miscellaneous Use—Growth of Charter Service —Flood Relief—Traffic Surveys—Hunting Criminals—Emergency Flights—Aerial Mapping and Photography.

DURING 1935 more than a million persons went out and hired aerial service planes to fly them one place or another in a hurry, whether for a sightseeing trip over Niagara Falls, the Grand Canyon of the Colorado, New York or Los Angeles at night, a fast trip to a distant ball game or a horse race, a vacation in the mountains or a honeymoon trip across the country. Nearly 4,500 airplanes were kept tuned up and ready in the United States, prepared to take anybody almost anywhere on a few moments notice. Meanwhile a majority of aerial service operators welcomed students for flight instruction, and they were eager to undertake crop dusting, aerial photography, emergency flying with precious merchandise, medicines, news photos, motion picture films, anything at all that required speed to make it useful when it reached its destination. Some 2,500 aerial service organizations and individuals were available for aerial service in the United States at the beginning of 1936.

During the flood in New York State in July, 1935, Red Cross workers surveyed the entire distressed district by plane, and quickly concentrated relief measures in the affected areas, thus doing in a few hours a task which might have required weeks if attempted on the surface.

After a two-miles-a-minute chase across the skies scientists of Chicago and Northwestern universities returned to their laboratories with the strangest spoils ever brought back by a hunter. They had snared silt specimens of dust storms, using for traps balsam-treated plates, vacuum tubes and suction devices projecting from the windows of their cabin plane. They learned that most of the dirt in a dust storm moves between the ground and the 3,500 foot level, then in lesser density and in wave formation as high as 10,000 feet. Feldspar, quartz and other minerals in the captured dust indicated that it had been blown all the way from Colorado and Kansas over Chicago.

Aviators on Long Island went up during the winter and dropped food to the birds marooned by heavy snows in the wild fowl sanctuary

at Jones Beach State Park. A group of actors hired a 10-passenger plane to take them on a three months tour of the country playing one night stands. When a firebug started setting forest fires along the New Jersey shore in May, Col. Leonidas Coyle, State Fire Warden, hired Jack Thropp of Trenton to take him up for a survey of the damage done the previous day. Near Buckingham they saw a man get

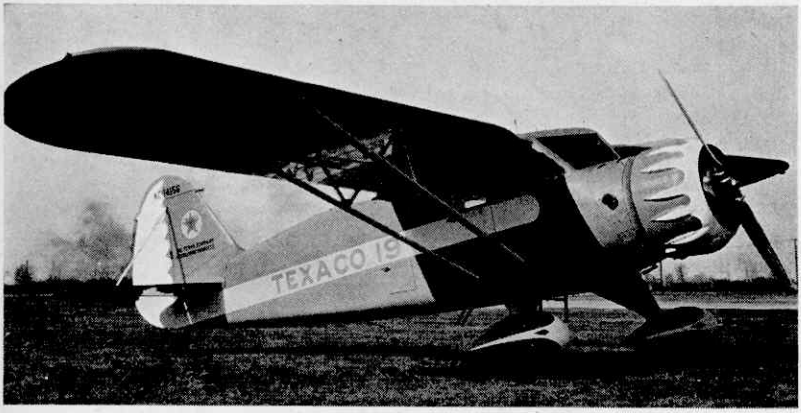
INTERIOR OF A LOCKHEED ELECTRA

This air liner is especially outfitted for a private owner.

out of a motor car and deliberately set the woods afire. Then he drove three miles, got out and started another fire. Thropp put his plane in a steep dive and as he pulled up, speeding past the pyromaniac, the warden secured a good description of the man and his car. The culprit made his escape, but he set no more fires in the woods.

Employing planes, autogiros and blimps, Deputy Police Commissioner Harold Fowler of New York made a complete survey of sur-

face traffic congestion from the air. He found that density of traffic during holidays, bottle-necks, snarls caused by accidents and other obstacles to the free flow of traffic in the metropolis and its environs might be relieved considerably by airplane patrol and radio. The airplane patrol would radio to the surface and cause traffic to be shunted over minor roads until main arteries could be cleared. Traffic at bridge entrances could be staggered through different highways, while the airplane observers kept watch aloft and at the right time gave signals for changes in routing. During the year Roy O. Hunt was sworn in as a deputy sheriff to head Oklahoma's new air police unit and chase bank robbers and other bandits. U. S. Marshal Draughon chartered a plane and flew two prisoners from Puerto Rico to the Atlanta peni-

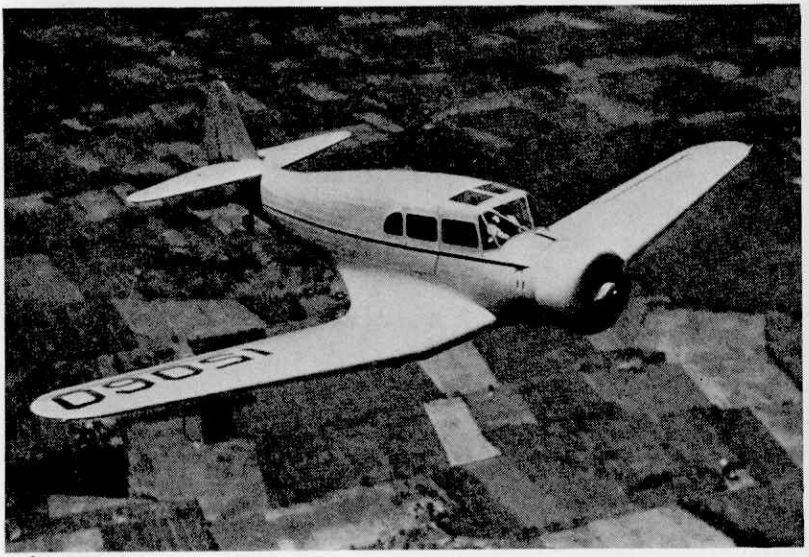



A STINSON RELIANT FOR BUSINESS
One of the Texas Company's fleet of executive planes.

tentiary. An unfrocked bishop hired a cabin plane and pilot to fly him around the country preaching communism. Another communist hired a plane to bombard the Pennsylvania National Guard with Red literature during its annual encampment. Twelve young prong-horn antelope, so small that they had to be fed from a bottle, were placed aboard a plane at Pitchfork, Wyo., and delivered by air to various zoos in the United States. In Georgia Detective Albert Dodd jumped into a plane and ordered the pilot to trail a hit-and-run motorist, and he caught him. A Boston contractor vacationing at Martha's Vineyard chartered a plane to fly him back and forth to his favorite barber in town. Twelve planes were used in covering the trial of Bruno Hauptmann for killing the Lindbergh baby. Photos, newsreels and news stories were flown from Flemington, N. J., to New York in 20 min-

utes, Philadelphia 25 minutes, Boston within two hours. Jack Cram and his Whirlwind-powered Stearman were hired by the State Police for strike patrol duty in the State of Washington. Fresh worms once a day provided first-class bait for the hundreds of fishing boats in Long Island waters. The special worms most fancied by the fish grew in the sand at Brunswick, Me., and 10,000 to a plane load were flown into Riverhead, L. I., daily during the season.

The largest aerial mapping project ever undertaken, 35,000 square miles in central New Mexico along the Rio Grande watershed, was



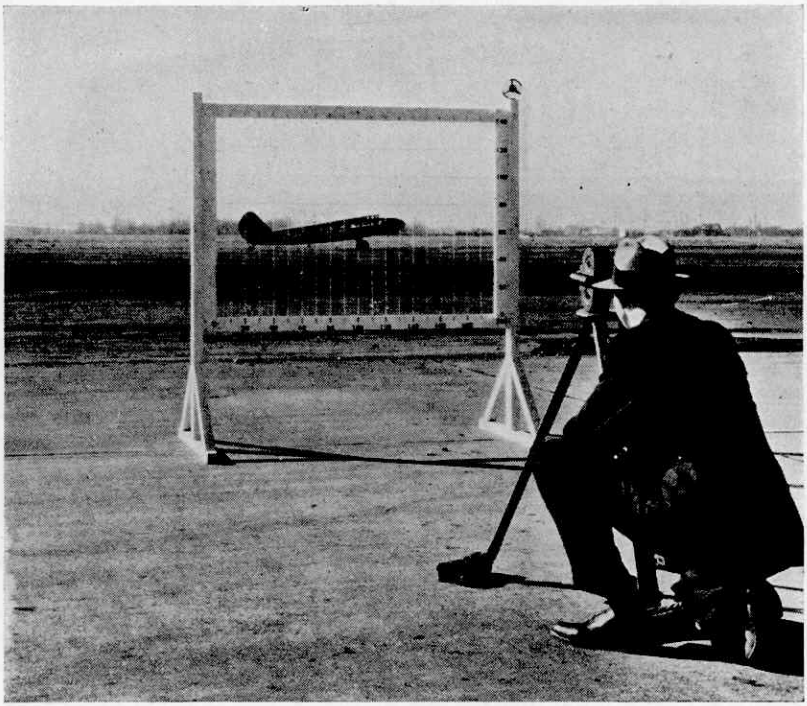
THE FIVE-PLACE FAIRCHILD 45

Whirlwind-powered "Sedan of the Air" in flight near Hagerstown, Md., where it was built.

started by Fairchild Aerial Surveys in July, on contract with the Department of Agriculture. It followed the famous Boulder Dam survey by the same company in the spring of 1935. The Boulder Dam maps were to be used by the Government in measuring and controlling the filtration of silt into the great reservoir. The Rio Grande survey project was for the use of the Soil Conservation Service. A new Fairchild 10-lens camera weighing 270 pounds and 10 rolls of film weighing 70 pounds were taken up in a special Fairchild photographic plane on each flight made during the survey, sufficient

for 2,000 photographs, or 200 composite photographs, each 32 inches square.

Early in 1935 Fairchild Aerial Surveys delivered to the State of Connecticut the final prints which completed the first complete aerial survey of an entire State. All the 5,004 square miles of Connecticut are now available on photographs, or aerial maps, for use in local tax

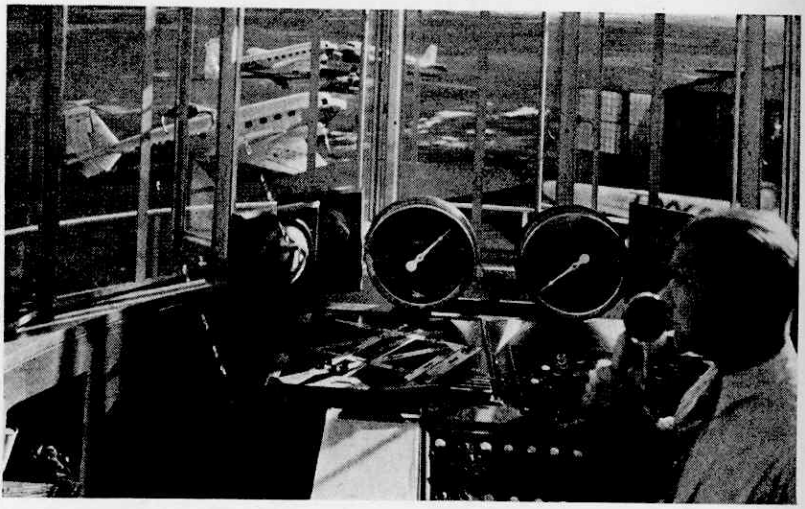


CHECKING ACCURATE LANDING SPEED

The Boeing Aircraft Company's new method of determining the landing speed of planes. A motion picture camera photographing the flight through the grid, with the anemometer measuring the wind allowance, permits plotting the line of flight and speed.

studies, highway engineering, industrial management and private property survey. The aerial survey company operated three of its own planes and had the assistance of one from the Connecticut National Guard. A total of 10,479 individual photographs were made during 153 hours of flying. At an altitude of 11,400 feet the aerial camera men took photos of about three and a quarter square miles at each shot. The photos were then mounted on boards measuring five

by seven feet. The boards were copied twice, first at one inch to every 234 square miles, again at one inch to every 26 square miles, thus making available an entire State in two different sizes; for example, on the larger map one inch represents 600 feet, on the smaller, one inch represents 18,000 feet. The work was completed within nine months.



Western Electric Co. Photo

RADIO TRAFFIC CONTROL AT NEWARK AIRPORT

W. J. Conrad directs the take-off and landing of planes by radio. On his desk may be seen controls for lighting the field, two wind indicators and three of the five loudspeakers, one each for the four air lines using the airport as a terminal and the fifth to receive calls from itinerant pilots.

## CHAPTER XIII

### AIRWAYS AND AIRPORTS

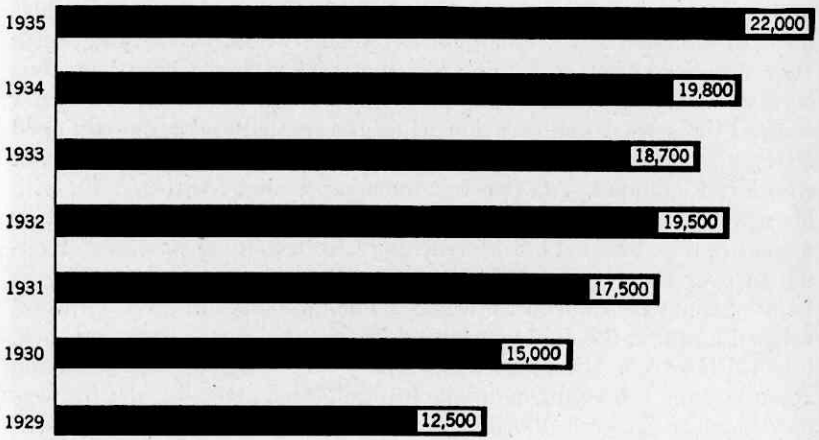
The Federal Airways System—Airports and Landing Fields in the United States—Progress in Radio Landings—Marine Air Terminals—Activities at Leading Airports.

IN day or night flying over the routes of the Federal Airways System which form the highways of the sky, a pilot may now use the lighted beacons, radio direction finder and weather broadcasts or land at one of the intermediate fields maintained by the Department of Commerce for emergencies; yet he would be carrying out a very simple routine, something like that of a motorist on a long tour across country. But almost any pilot who flies across the United States can tell of at least one occasion when the lighted and radio-equipped airways saved him from disaster. Such was the adventure of a pilot who left Richmond, Va., one fair morning, bound for the south, with his next stop to be Charleston, S. C. It looked like good weather for the entire trip, but just before reaching Charleston the pilot saw creeping in over the surface a bank of fog that obliterated everything in front of him. He radioed for advice. The radio operator at Charleston warned him that the field was buried in fog. Yet he could not go back, because head winds had used up nearly all his gasoline. He circled about seeking a hole through which to glide to earth; but the fog was too thick. Meanwhile the pilot and the radio operator at Charleston had been carrying on considerable conversation. Then the operator was seized with a brilliant idea. He telephoned the Navy Yard field four miles away. Yes, that field was clear of fog. Then the Federal Airways man tuned back to the befogged pilot. "Come on into Charleston," he was instructed, "but swing over and land at the Navy Yard field." So that flight ended safely, thanks to the watch kept by the Government experts.

Several thousand miles of lighted airways were added to the Federal Airways System in 1935, so that at the beginning of 1936 there were more than 22,000 miles of reasonably safe flying routes in the United States, either day or night. Most notable among the new routes was the northern transcontinental over which Northwest Airlines operates a passenger, mail and express service.

The valuable aids to air navigation on the entire Federal Airways System included 1,841 beacon lights spaced at 10 to 15-mile intervals;

and on a clear night pilots always have three of these lighthouses of the sky in line, showing an absolutely straight course. Three kinds of radio service are available to the pilot who finds himself in weather which hides the beacons. There are 73 radio communications stations supplying weather information, 119 radio range beacons to point the course along the airways by means of directional radio beams, and there are also 55 low-powered radio stations to broadcast voice and radio range beams for short distances. Nearly 13,000 miles of teletypewriter circuits are operating constantly, collecting weather data and making it available for broadcast to all pilots flying the airways. The number of intermediate, that is emergency, landing fields had reached 291 during the year. They are maintained by the Bureau of




MILES OF LIGHTED AIRWAYS IN THE UNITED STATES

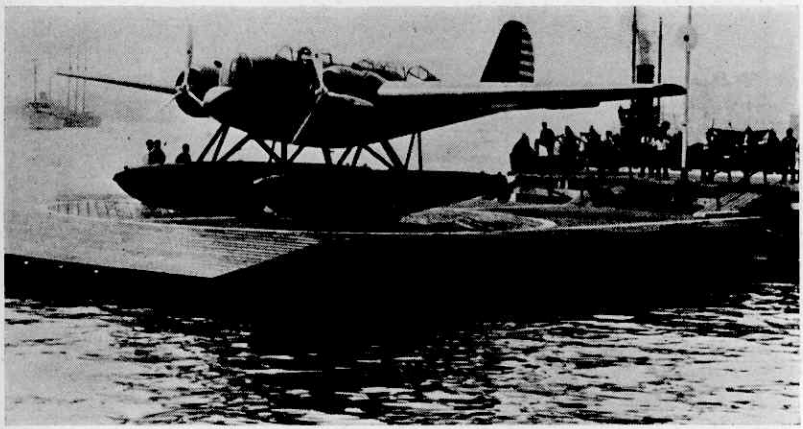
Air Commerce, with caretakers, beacons showing green lights to any pilot wandering about in the air seeking refuge from trouble, and telephones for any kind of quick communication.

Located throughout the United States were 739 municipal airports, 494 commercial airports, 630 auxiliary fields and 125 miscellaneous Government, private and State airports; also 63 Army and 26 Navy fields. No less than 696 of the airports were lighted and ready to receive visitors at night.

Radio assistance for landings in fog met with much progress in 1935; and the Bureau of Air Commerce was planning to install the Army Corps radio approach system at Atlanta, Ga., Buffalo, N. Y., Cheyenne, Wyo., Indianapolis, Ind., Los Angeles, Calif., St. Louis,

Mo., and several other places where negotiations for adequate sites were under way at the end of the year.

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 instru-



THE MARTIN BOMBER ON EDO FLOATS
At the mid-town marine air terminal in New York.

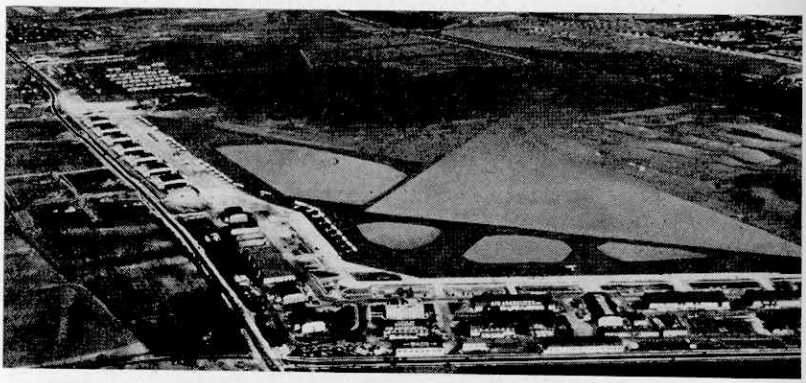
ment located near the radio compass indicator on the instrument panel in the plane. This secondary transmitter caused a light to flash in the plane as the airplane passed over the ground station, or airport.

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 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.

The complete list of airports and landing fields by States will be found in the appendix. Of the 2,368 airports and fields only six States



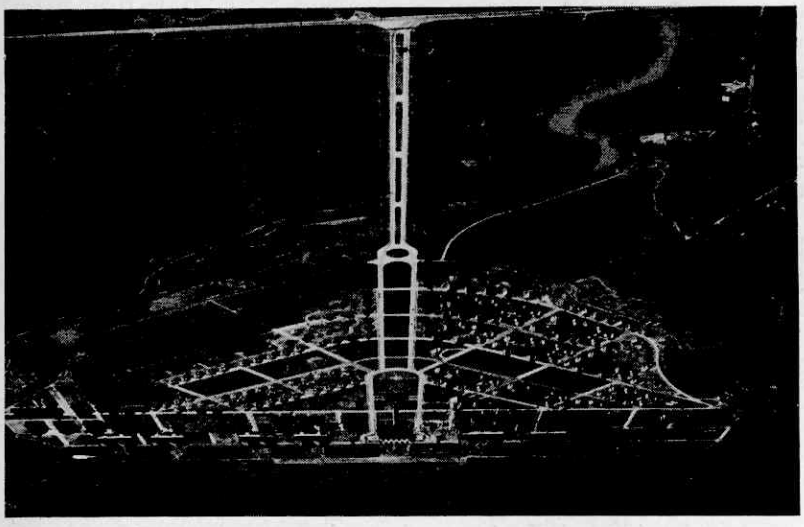
ROOSEVELT FIELD, LONG ISLAND

An air view of one of the most popular commercial airports in the United States. Roosevelt Aviation School is located here.

possessed more than 100 each. California had 192; Texas, 134; Michigan, 117; Pennsylvania, 117; Florida, 107 and Ohio, 103. New York had 99.

Late in 1935 the Bureau of Air Commerce of the U. S. Department of Commerce announced appointment of seven regional supervisors and 13 district supervisors for airport development work. They were to assist the field men of the Works Progress Administration in passing upon application for federal assistance in the construction and improvement of airport facilities. Eugene L. Vidal, Director of Air Commerce, placed supervision of his bureau's phase of this work in the hands of John S. Wynne, chief of the airport, marking and mapping section of the Bureau. Paul Myers, assistant chief, was to supervise District No. 1.

Holding that municipal, State and federal road building paved the way for the present motor traffic, and that development of the nation's airports made possible the use of more than 9,000 land planes, the Marine Air Terminals Committee of the Aeronautical Chamber of Commerce of America in 1935, through its chairman, George B. Post, started a general campaign for water flying terminals to be located in the center or close to the center of all waterfront communities. Landing floats, fueling and occasional storage facilities were recommended by the committee. At the beginning of 1936 an increasing number of cities had such projects well under way.



HOME OF THE AIR CORPS 3rd ATTACK GROUP

This important air force post is Barksdale Field, Shreveport, La.

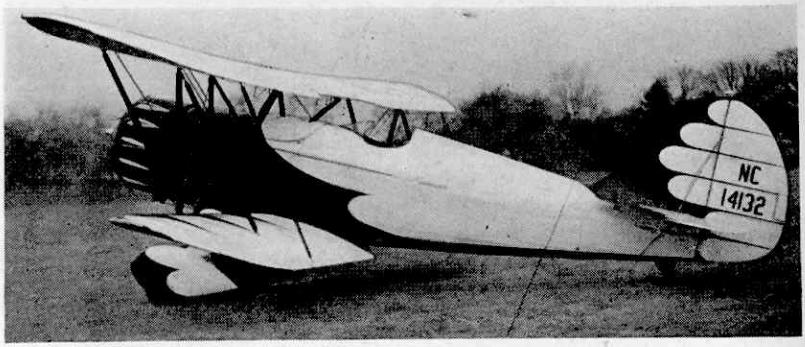
The growing use of airports with improved business conditions was reflected in reports from leading airports in different parts of the country. Union Air Terminal at Burbank, Calif., reported that more than 60,000 air line passengers flew in or out of that important Los Angeles terminal during 1935. The daily average was 169 compared to the 1934 average of 107. United Air Lines accounted for 46,052 of the passengers, and Western Air Express had 14,633 as compared to 7,171 in 1934. A total of 48,611 take-offs and landings of all kinds of aircraft, without an accident, was Union Air Terminal's remarkable record for 1935. More than 100 private owners kept their machines at the airport. They made 3,146 flights. There were

9,138 student instruction flights, 1,745 commercial flights, 1,208 charter passenger flights, 3,591 persons carried on sightseeing hops, and 3,343 visiting planes, besides 605 Army and Navy planes arriving during the year. The grand total of all persons who flew in or out of Union Air Terminal was 169,348 compared with 128,876 in 1934.

Transcontinental Airport of Toledo, O., handled 2,365 passengers arriving by air line in 1935, while 2,119 persons left by air line. Transient passengers numbered 2,548, while those taking short hops numbered 2,011.

Allegheny County Municipal Airport at Pittsburgh, Pa., became one of the nation's most important air travel centers in 1935. Nearly a million gallons of aviation gasoline were sold. More than 20,000 regular air line passengers went through the airport. The 1,535 transient planes using the port at various times carried 4,605 passengers. A total of 30,381 passengers took short hops or sight-seeing flights. There were more than 850,000 visitors to the airport during the year. Approximately 3,000 night landings were made by planes, without an accident. Military aircraft made 1,304 landings during the year.

Kansas City, Mo., municipal airport handled 56,492 regular air line passengers in 1935. Private and commercial passengers totaled 5,574. Aircraft made 11,668 landings and 11,697 take-offs, without accident.




THE WACO MODEL F-5

A three-place private plane powered with Continental or Jacobs engine.

# CHAPTER XIV

## AIRSHIPS AND BALLOONS

Official Story of the World Record Stratosphere Ascent—Loss of the "Macon" a Blow to Lighter-than-air Development in the United States—Germans Make Progress with Airships—Non-rigid Activities of American Air Forces—New Goodyear Mast—Poland Wins International Balloon Race.

THE outstanding event of 1935 in lighter-than-air achievements was the new world record altitude mark established by Americans rising to nearly 14 miles above the earth's surface in a balloon. The National Geographic Society prepared the following official account especially for this edition of the Aircraft Year Book. After a wait of nearly six weeks for the proper weather, "Explorer II," the 3,700,000-cubic-foot balloon of the National Geographic Society-Army Air Corps Stratosphere Expedition, rose from the Stratocamp in the Black Hills near Rapid City, S. D., at 7:01 a. m., Mountain Standard Time, on November 11. Within less than five hours it established a new world record altitude mark, 72,395 feet above sea level.

Approximately three hours later the gondola came to earth so gently that none of the delicate instruments was injured. The balloon was under the command of Capt. Albert W. Stevens, who also was scientific observer, and was piloted by Capt. Orvil A. Anderson, both of the U. S. Army Air Corps.

The weather was practically perfect for the flight. Although it was extremely cold at the Stratocamp on the night of the inflation—close to zero Fahrenheit—there was no wind to disturb the 2 2/3 acres of cloth as it was lifted by helium above the inflation floor and held to earth by its tethering ropes. A snow storm 30 hours before the take-off had cleared the atmosphere of all dust, and there was not a cloud in the sky during the eight hours and 13 minutes that the balloon was in the air.

It was the largest free balloon ever built, and had such great lifting power that it was possible to send into the stratosphere the largest cargo of scientific instruments ever taken aloft. The 9-foot gondola in which the men and instruments were carried proved to be completely

air-tight. Despite the fact that it reached a region where the temperature of the air was 77.8 degrees below zero Fahrenheit, conditions remained comfortable inside the metal ball.

The pilots closed the two manholes and sealed themselves in at an altitude of about 16,500 feet. From that time until the balloon reached its ceiling and then descended to about the 18,000-foot level, they were dependent on artificial air to keep them alive. This was supplied by an air-conditioning apparatus which released a mixture of liquid oxygen and liquid nitrogen. At the same time chemicals absorbed the carbonic acid gas and moisture breathed out by the men. The system worked so well that Stevens and Anderson hardly noticed the difference when the manholes were opened, and natural air was admitted.

Although the temperature outside was bitter cold, that inside the gondola never dropped lower than 19 degrees above zero. Both Stevens and Anderson were dressed in heavy clothing and were comfortable throughout the flight, during which the balloon drifted southeastward from Rapid City, S. D., almost to the Nebraska line, then turned northeastward and came to earth about 25 miles east of the Missouri River near White Lake, S. D. It had covered an airline distance of 225 miles from the Stratocamp.

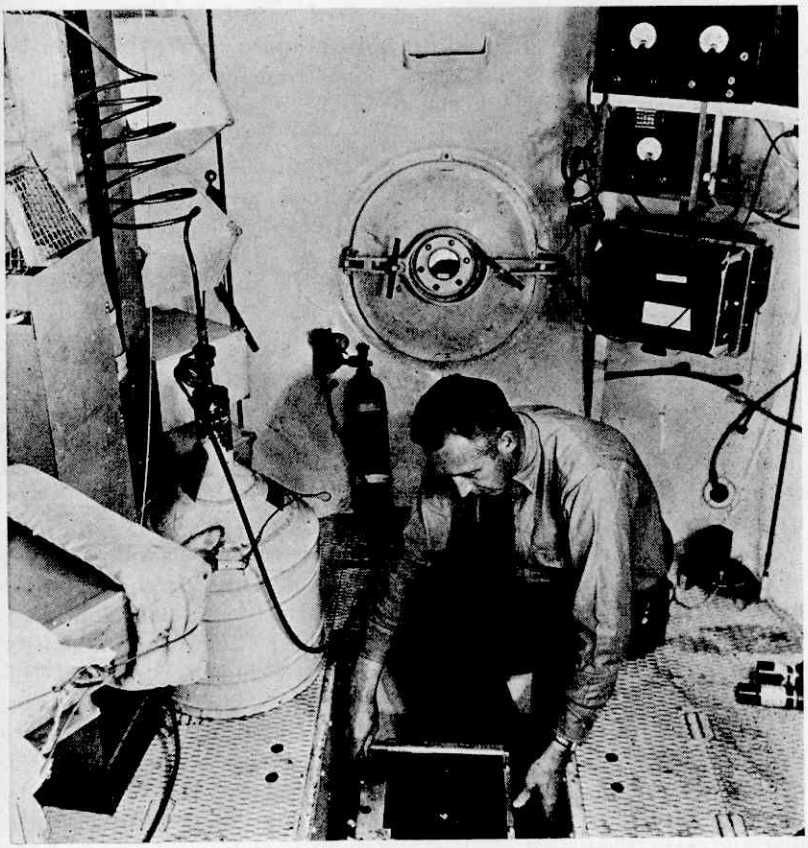
When they rose from the ground, the balloon and gondola, together with their loads of rope, ballast, men and instruments, weighed about 15,000 pounds. The gondola itself, built of a very light magnesium alloy, weighed only a little more than 600 pounds.

Inside the ball were a score or more of instruments, both for use in navigating the balloon and in obtaining scientific data about conditions in the stratosphere. Practically all the instruments were equipped with automatic recording devices. Most of these worked by means of cameras which took pictures of instrument dials at intervals of from 15 seconds to a minute and a half. More than 15,000 photographs were made during the flight. These films were developed in various scientific laboratories, and from them the detailed scientific story of the flight was written. It added materially to the world's knowledge of cosmic rays, the spectrum of the sun, and general conditions in the upper atmosphere.

Throughout the flight the crew was in constant touch with the base camp at Rapid City through short wave radio communication, and thence over telephone wires with officers of the National Geographic Society and the Air Corps in Washington. At intervals their conversations were broadcast over National Broadcasting Campany networks, and so clear was the reception that listeners throughout the continent were able to hear the clicking of instruments as well as the voices of the voyagers. At one time Captain Stevens talked with the

crew of the "China Clipper," in flight near San Francisco, and later carried on a conversation with a newspaper reporter in London.

One of the flight's most exciting moments, which came about midnight during the night of inflation, was the occurrence of a 17-foot rip in the balloon fabric. A sharp report from under the mass of fabric indicated that something had given way. Careful search revealed the rip. It was successfully patched and cemented by Goodyear-Zeppelin technicians and Army experts despite the severe cold. The patch held perfectly throughout the flight.



*Courtesy National Geographic Magazine*

INSIDE THE GONDOLA OF THE EXPLORER II

Preparing for the world record stratosphere ascent. Here a Fairchild aerial camera is being installed.

Another trying moment came just as the huge bag was rising from the Stratobowl. Struck by a downdraft of air, it began to lose altitude rapidly. For a moment a crash against the cliffs seemed inevitable, but Capt. Anderson finally stopped the descent by quickly emptying 10 bags of lead dust ballast, lightening the craft by more than 750 pounds.

In recognition of their achievements Capt. Stevens and Capt. Anderson received Hubbard Gold Medals, highest award of the National Geographic Society, at a special ceremony in Washington, D. C., December 11. The awards were "for distinguished achievement in scientific research," and were presented by General John J. Pershing.

In connection with the ceremonies, striking pictures were taken by Capt. Stevens from the flight "ceiling" of 72,395 feet. They showed the earth's actual curvature on the horizon more clearly than ever before, and revealed how the world looks from the greatest height at which photographs ever had been made.

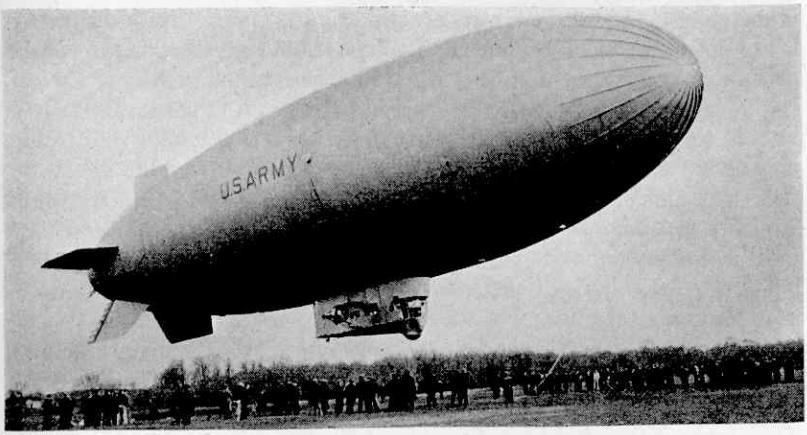
The picture showing the lateral curvature of the earth included a stretch of the horizon 220 miles in length, nearly three degrees of a circle, close to one per cent of the total circumference of the earth. The curve of the horizon was easily noticeable when the picture was projected on a screen—photographic evidence that the world is round. When the edge of a ruler was laid along the horizon line the curvature was even more plainly visible.

In taking this picture the camera used by Capt. Stevens "saw" a distance of about 300 miles, far beyond the range of the human eye. The horizon showing in the photograph is estimated to have been at that distance from the camera. The photograph was taken by infra-red light, which is capable of piercing distant haze. All the other colors of sunlight are shut out of the camera by a red filter in making this kind of long-distance photograph.

The picture shows a vast stretch of western South Dakota, covering more than 33,000 square miles. The Black Hills, from which the flight started and which have an area of about 6,000 square miles, appear as a large dark area at one side of the picture 160 miles in the background. The first scientific conclusion obtained from data collected on the flight was the discovery that tiny spores of plant diseases, which are spread by winds, can survive a trip of nearly 13¾ miles into the stratosphere, where a man exposed to the same conditions would die in a very short time. Millions of spores far too small to be seen by the naked eye representing seven types of fungi, some of which cause plant diseases, were sent aloft on the flight in tiny quartz tubes, hung outside the gondola, where they would be fully exposed to the conditions in the stratosphere. These tubes were exposed to cold greater than 65 degrees below zero Fahrenheit, as well as extremely low at-

mospheric pressure which would kill a man, ultra-violet light rays from the sun which do not penetrate to the earth's surface and are capable of killing some lower forms of life, extreme dryness, and ozone, which has some germicidal properties. Despite these conditions, five of the seven types germinated and grew normally when brought back to the laboratory, showing that apparently they were not injured by the ordeal.

The results added knowledge of the heights at which wind-borne spores of plant diseases, and other spore types friendly to man, can travel on air currents hundreds of miles. It may aid scientists in fighting air-borne plant diseases by spraying and development of disease-resistant types of crops.




THE ARMY'S NON-RIGID AIRSHIP

The TC-13 built for the Army by Goodyear-Zeppelin.

To learn whether spores of other microscopic forms of life exist in the stratosphere normally, a "spore-trap" was dropped from the balloon on a parachute at the ceiling of the flight . It was designed to collect spores that might exist in the air down to the base of the stratosphere, about six and one half miles from the ground, at which level it closed automatically. The trap was recovered intact and sent to the U. S. Department of Agriculture for analysis of its "catch."

The spectrographs carried on the flight made perfect and complete records of the sun's spectrum at altitudes higher than such data previously have been collected. Cosmic rays were found to increase greatly in number as the balloon rose above the earth, there being

roughly more than 50 times as many passing through the recording apparatus at the balloon's ceiling as at sea level.

Electrical conductivity of the air was found to increase steadily with altitude, being nearly 100 times as great at 72,000 feet as at sea level. Samples of stratosphere air were collected to determine whether its composition differs from air nearer the surface of the earth.

A number of drosophila, or fruit flies, were carried aloft inside the gondola, to determine whether exposure to increased cosmic radiation at great heights would cause genetic changes affecting their offspring. It is known that such changes can be brought about by exposing the flies to x-rays and radium, and if cosmic rays can do the same thing, the finding will have important evolutionary implications.

The brightness of the sun, sky and earth were measured continuously during the flight. Wind direction and velocity, air temperature and atmospheric pressure were recorded. A small propeller at the end of a 14-foot arm extending out from the gondola kept the balloon turning so that instruments could be pointed in all directions, but near the ceiling the air was so thin that the propeller spun as in a vacuum, its blades unable to "bite" into the rare atmosphere. At the ceiling the balloon was above 96 per cent of the earth's atmosphere by weight.

From this height the horizon appeared as a band of white haze. The sky ranged in color from light blue just above the horizon to almost complete black at the highest angle at which it could be seen from below the huge bulk of the balloon. The earth was a vast expanse of brown, apparently flat.

The balloonists were equipped with regulation army parachutes. In addition a large 80-foot parachute was attached to the top of the gondola, designed to break its fall in case of accident to the balloon. Two large inflated rubber "doughnuts" were attached to the bottom of the gondola to ease any shock in landing, but they proved to be unnecessary, so gentle was the descent.

In charge of the ground operations and weather forecasts for the flight was Capt. Randolph P. Williams, Army Air Corps. Soldiers from the Fourth U. S. Cavalry of Fort Meade, S. D., under Col. Robert McC. Beck, Jr., served as ground crew for the take-off and aided in preparations at the Stratocamp.

The Scientific Advisory Committee for the flight included: Dr. Lyman J. Briggs, Chairman, Director, National Bureau of Standards; Major General Oscar Westover, Chief of Air Corps; Dr. Frederick V. Coville, Chairman of the Research Committee, National Geographic Society; Dr. W. F. G. Swann, Director Bartol Research Foundation, Franklin Institute; Capt. R. S. Patton, Director, U. S. Coast and Geodetic Survey; Mr. Willis R. Gregg, Chief, U. S. Weather Bureau;

Dr. Floyd K. Richtmyer, Cornell University, and Research Council, National Academy of Sciences; Dr. L. B. Tuckerman, National Bureau of Standards; Dr. Charles E. K. Mees, Director, Research Laboratory, Eastman Kodak Company; Dr. John Oliver La Gorce, Vice President, National Geographic Society; and Mr. Thomas W. McKnew, National Geographic Society, Secretary to the Committee.

The loss of the great Navy airship "Macon" off the California coast in February, 1935, proved a sad blow to American airship aspirations, for the time being at least, although the increasing activities of the Germans in developing a whole fleet of super-dirigibles indicated that the world soon should see these leviathans of the sky plying back and forth across the oceans on regular trips with passengers and cargoes of mail and freight. Secretary of the Navy Swanson appointed a commission of eminent scientists, headed by Dr. W. F. Durand of Leland Stanford University, to make a complete study of airships as the basis for determining future policies; and this Science Advisory Board was expected to report before the opening of the new Congress in 1936. Meanwhile the old "Los Angeles," laid up at the Naval Air Station at Lakehurst, N. J., in order to save the cost of operations, was brushed up and inflated after the loss of the "Macon" and was used during the year for a series of mooring mast tests and weather studies.

During the fall the famous "Graf Zeppelin" completed its hundredth commercial voyage between Friedrichshafen, Germany, and Rio de Janeiro, Brazil. In a huge shed adjoining the home berth of the "Graf Zeppelin" a larger Zeppelin, the LZ-129, meaning the 129th airship built by the Zeppelin Company, was rapidly nearing completion, and it was to be in regular service early in 1936. The LZ-129 was to be the largest airship ever built, having a gas capacity of 7,070,000 cubic feet, powered by four 1,150 horsepower Daimler-Benz engines of diesel type, and with complete ocean liner accommodations for 50 passengers. A third Zeppelin was to be started as quickly as the LZ-129 left the erection shed.

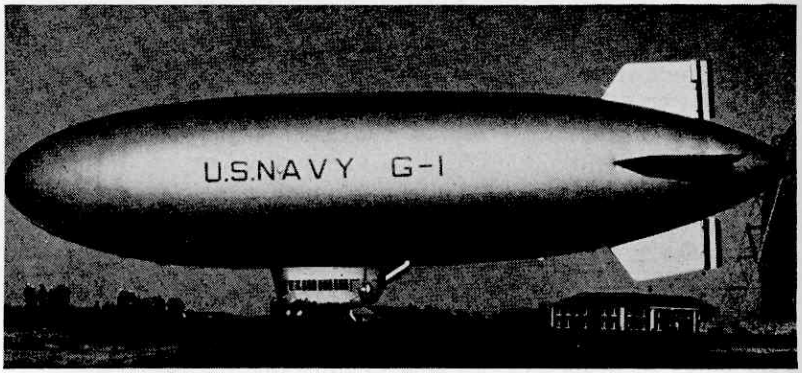
In the non-rigid airship field the Army Air Corps 350,000 cubic foot TC-13, flying on coast patrol out of Langley Field, Va., was joined by a sister ship, the TC-14 which was assigned to the Army airship base at Fort Scott, Ill. Both non-rigid ships were used for intensive training of airship crews.

The Navy added to its fleet of blimps the Goodyear "Defender" and gave it a new name, G-1, as the first Navy craft of the type G. That ship joined the K-1, J-4 and NC-2 at the Lakehurst Naval Air Station. The G-1 has a commodious cabin with space for 10 passengers and two pilots. It was being used primarily for training of crews at the beginning of 1936.

The famous Goodyear fleet of commercial non-rigid ships operated at New York, Washington, D. C., Chicago, Akron, Miami and St. Petersburg, Fla. The combined fleet at the end of 1935 had a magnificent record of 73,182 completed flights during 47,462 hours in the air, cruising 2,144,000 miles and carrying 189,063 passengers, all without a passenger being injured.

Among the scientific developments of 1935 was a new mooring mast developed by Goodyear at Akron. The new mast permits non-rigid ships to be moored by the nose, and it swings with the ship in the wind like a weather vane, requiring no help from ground crews in winds up to 60 miles an hour velocity.

On September 15, 1935, 13 free balloons floated up into the air above the old city of Warsaw, Poland, their crews representing various air-minded nations, determined to keep the bags in the air until they had outdistanced all competitors. The prize was the International Gordon Bennett Balloon Race Trophy, and especial interest was attached to it in 1935 because the Polish balloonists had won the trophy twice out of the three times necessary to keep it permanently. The United States was represented by a Navy balloon piloted by Lieut. Raymond F. Tyler and navigated by Lieut. Howard T. Orville. They landed near Owrucz, Russia, 332 miles from their starting point. One of the Polish balloons, piloted by Capt. Zbigniew Burzynski and navigated by Wladyslaw Wysocki, covered 1,025 miles, landing at Tiszkino, near Stalingrad, Russia, 58 hours after the start. That proved to be the winner, thereby letting Poland retain the trophy.




NAVY NON-RIGID AIRSHIP G-1

Making ready to take off from the air station at Lakehurst, N. J.

## CHAPTER XV

### TRAINING AND EDUCATION

Opportunities in Aviation—Costs of Aeronautical Education—Schools Teaching Flying Trades—Colleges and Technical Schools.

MORE than 22,000 men and women, both young and old, held student licenses in the United States and were learning to pilot aircraft at the beginning of 1936. A majority intended to make aviation their life work as pilots, engineers, designers or specialists in the various branches of aviation. Others were learning to fly for pleasure. In a remarkably thorough survey of the training facilities and opportunities existing in the different fields of aeronautics the Bureau of Air Commerce of the U. S. Department of Commerce had this to say:

"There are many positions in the aeronautics industry that are available to young men, with a relatively smaller number open to young women as well. For the person who is qualified physically and temperamentally to fly professionally, the pilot's position is attainable and offers many attractions. The industry needs pilots. It does not need a great many at this time, but it demands a high degree of skill and experience in those it does employ, and is willing to pay salaries in proportion. Piloting may or may not be the role for which the interested individual is fitted. If not, he may well consider that the scheduled air lines employ some 6,500 persons of whom only about 750 are pilots and co-pilots, and that the proportionate number of professional pilots in other phases of the industry is even smaller. There are executives filling posts of great responsibility who are not pilots.

"The scheduled air lines employ pilots and co-pilots, radio operators, stewards and stewardesses (hostesses), dispatchers, meteorologists, operations managers, airplane mechanics, engine mechanics, radio engineers, radio mechanics, instrument technicians and repairmen, maintenance superintendents, aircraft and engine engineers and traffic agents.

"Miscellaneous operations include aerial services, charter and sightseeing services, instruction of students, aircraft sales

and servicing, aerial photography, crop dusting, aerial advertising, experimental and test flying, and operation of airplanes privately owned for business or pleasure. These activities provide employment for pilots, airplane and engine mechanics, parachute riggers, instrument repairmen, flying instructors, ground school instructors, aerial photographers, salesmen and demonstrators, specialists in aerial photography, crop dusting and commercial aerial observation work, airport engineers, managers, ground men and helpers.

"The aircraft, engine, propeller and accessories manufacturing plants employ aeronautical engineers, test pilots, salesmen and demonstrators, draftsmen, skilled artisans such as welders, woodworkers, sheet-metal workers, machinists, assemblymen and helpers. In addition there are executives and supervisors, inspectors, auditors, bookkeepers, secretaries, stenographers and clerks. No matter what the job is, a prior knowledge of aviation is desirable, and in most cases essential. More than 20 bureaus and agencies of the Federal Government employ aviation specialists, and nearly all State and many municipal governments have aeronautical specialists on their payrolls."

NORTH AMERICAN AVIATION BASIC TRAINER

Front view of the Cyclone-powered enclosed trainer developed for the Army Air Corps.

Salaries vary. Wages are as high as in any other industry. A recent survey by the Department of Commerce showed that the average wage of airplane and engine mechanics employed by the air lines was $133 a month.

A survey of flying schools made by the Bureau of Air Commerce shows that the course of instruction in a flying school leading to an amateur pilot license usually takes 10 weeks and costs the student $276. A private course takes 17 weeks and costs $505. A course for the limited commercial license requires 20 weeks and costs $553. A course preparing one for the transport pilot license requires an average of 46 weeks and costs about $1,777 on an average. Students pay as little as $950 and as much as $2,900 for aviator's training.

The same school invariably offers a wide variety of courses. For example, the Boeing School of Aeronautics at Oakland, Calif., municipal airport, enrolled an increased number of students in 1935, in the following courses: air line pilot, air line operations, air line pilot and operations, air line technician and air line mechanics. Nearly every

STUDENTS AT PARKS AIR COLLEGE

During an eight-term course of 96 weeks, student mechanics become skilled in each phase of aircraft and engine maintenance.

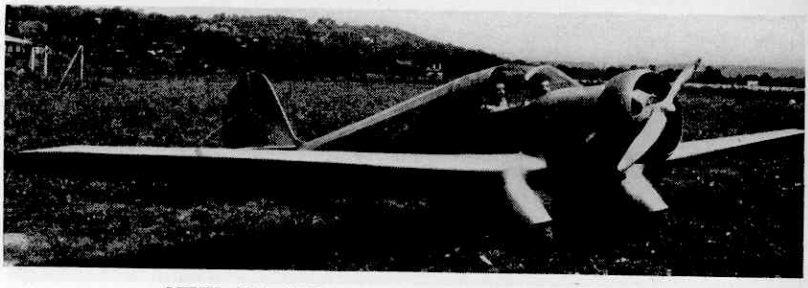
State and many foreign countries were represented at the Boeing School, including three officers of the British Royal Air Force. The metals, engines, instruments, and radio shops were all enlarged as well as the avigation, meteorology, and aeronautical science laboratories of the school. Five faculty members were added to the teaching staff.

Parks Air College at East St. Louis, Ill., gave a very wide range of optional courses for students, from flight training to courses in aeronautical engineering. The major courses required two years for completion, and they equaled approximately three years of the conventional college course. The number of students enrolling for the major courses increased 77 per cent during 1935; while nearly all students taking the shorter courses announced their intentions of eventually completing one of the major courses. Parks Air College commenced an expansion

program in 1934; and it was planned to continue expansion in 1936. A number of experts, including professors from leading universities, were added to the Parks faculty in 1935.

The Roosevelt Aviation School, at Mineola, Long Island, N. Y., reported an increase in students at the beginning of 1936. Its courses included all those flying branches leading to the different pilot licenses, and a modern mechanics division preparing for the federal mechanics license, including seven months practical experience in repair and overhaul.

Other schools teaching either flying or aircraft trades, or both, included: The Grand Central Flying School at Glendale, (Los Angeles) Calif., Casey Jones School of Aeronautics at Newark, N. J., The Aeronautical University at Chicago, Ill., Dallas Aviation School and Air College at Dallas, Tex., D. W. Flying Service at LeRoy, N. Y., Erickson & Remmert at Floyd Bennett Field, Brooklyn, N. Y., Lincoln Air-



NEW AERONCA LOW-WING MONOPLANE

Powered with the LeBlond engine, it seats two persons side by side.

plane & Flying School at Lincoln, Nebr., Los Angeles Aircraft, Ltd., at Inglewood, Calif., New England Aircraft School at Boston, Mass., North-Suburban Flying Corporation at Glenview, Ill., Safair flying school at Roosevelt Field, Mineola, Long Island, N. Y., Commercial Aircraft Company School at Portland, Ore., Ryan School of Aeronautics at San Diego, Calif., Spartan School of Aeronautics at Tulsa, Okla., The Stewart Technical Trade School at New York City, Rising Sun Aircraft School at Philadelphia, Pa., 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., Capt. Sansom's Aviation School at Hartford, Conn., Scott Flying Service at Long Beach, 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.

Several special technical schools outside the universities and colleges were devoted solely to aviation, among them 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

LEARNING ABOUT AIRCRAFT ENGINES

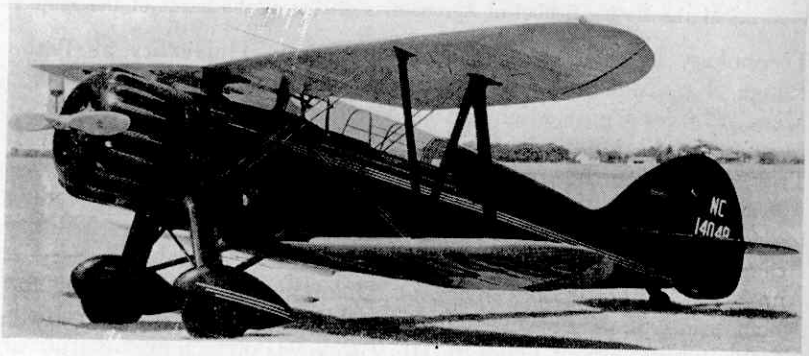
Students at the Boeing School of Aeronautics getting at the inside of the subject.

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 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., 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., University of Washington at Seattle, Wash., Wilberforce University at Wilberforce, O., Worcester Polytechnic Institute at Worcester, Mass.

The number of high schools giving aeronautical education continued to increase in 1935. New York University's School of Education, under the direction of Prof. Roland Spaulding, continued to provide courses for the training of teachers in aeronautical education. The summer course was attended by students from all sections of the country.




ENCLOSED COCKPIT WACO FOR ANY PURPOSE

This Wasp-powered biplane is Waco's commercial Model D for the private owner.

## CHAPTER XVI

### LAWS AND REGULATIONS

Acts and Measures of Congress—State Aeronautical Legislation During 1935—Bureau of Air Commerce Regulations.

FOLLOWING is a review of aviation legislation passed or proposed during the first session of the 74th Congress, 1935, some of the measures to be considered during the second session, 1936, the status of aeronautical laws passed by State legislatures in 1935, and also federal regulations of the Bureau of Air Commerce during the year.

The amended Air Mail Act is printed in full in the appendix, and discussed in the chapter on air lines. The Act was amended only after many other air mail bills had been introduced. They ranged from H. R. 4880, proposing Government ownership of all air transport, to H. R. 5174, setting up an independent civil aviation commission as suggested in the report of the Federal Aviation Commission of 1935. A Senate bill, S. 3420, was intended to take air transport control away from the Post Office Department and place it in the hands of the Interstate Commerce Commission. It came up early in 1936, and the Postmaster General opposed it vigorously.

A Senate Committee, headed by Senator Royal S. Copeland, was authorized to conduct an exhaustive investigation of air transportation, and that committee was assembling data preparatory to hearings in 1936. A House Resolution, 344, authorized another investigation of the air mail situation. An amendment to the Interstate Commerce Act, known as the Motor Carrier Act, S. 1629, was passed, Public Law 255, placing all motor carriers in interstate commerce under the jurisdiction of the Interstate Commerce Commission. Other bills were introduced, placing both water carriers and air carriers under the same jurisdiction. They were to come up during 1936.

Joint Resolution 173, Public 67, signed by the President August 31, 1935, was the culmination of diverse attempts at neutrality legislation. It set up a National Munitions Control Board and an Office of Arms and Munitions Control in the State Department. That section of the law was permanent legislation, providing for registration and licensing of all manufacturing interests and exporters or importers and dealers of designated war supplies. A second part, directing the President to impose mandatory embargoes on shipments to warring

nations, was temporary, lasting until February 29, 1936. Under that section the President proclaimed an embargo against exports of specified munitions to Italy and Ethiopia.

When Congress reconvened in January, 1936, the subject of further neutrality legislation became the center of controversy in which party lines largely disappeared. There was some evidence that certain so-called pacifist organizations were employing the national desire for peace to force through legislation which might seriously hamper the maintenance of the national defense establishment, particularly the maintenance of manufacturing plants essential as a reservoir of materials, fabricated parts and completed implements in an emergency. On

AMERICAN AIRLINES SLEEPER TRANSPORT

The Cyclone-powered Curtiss-Wright Condor with 12 berths takes on eastbound passengers at Los Angeles.

the other hand, there were many members of Congress who voiced their opposition to any legislation which should prevent the United States carrying on trade with other nations while other governments were permitting sales of munitions to belligerents. The question was further complicated by the apparent inability or unwillingness of European powers to impose drastic sanctions against such nations as the League of Nations might term "Aggressor" in any conflict. This was particularly noticeable with regard to aircraft supplies. It was known that immediately after the President of the United States declared an embargo against munitions shipments to Bolivia and Paraguay during their war, foreign governments appeared to encourage their nationals to make such shipments to the belligerents. In 1935, after the American

embargo had been declared against Italy and Ethiopia, aircraft shipments were made to both countries from various European manufacturers. The English companies, for example, continued shipping aircraft supplies to Ethiopia, while Americans were prevented from filling any possible orders that might come in from either of the warring governments.

The full details of the 1935 munitions legislation, in so far as it relates to aviation, will be found in the chapter on Government activities, in that section outlining the operations of the Office of Arms and Munitions Control.

EASTERN AIR LINES OVER NEW JERSEY

One of the 14 Wright Cyclone-powered Douglas liners in the Eastern Air fleet. Each of these liners carries 14 passengers.

The Guffey Coal legislation of 1935 required Government contractors to use only coal produced under the coal code and further required the contractor to certify that his subcontractors are doing the same. Hearings on the constitutionality of that Act were scheduled for March, 1936.

The Walsh bill, S.3055, would make it mandatory for any person selling supplies to the Government, or receiving loans from the Government, to adhere to hours and wage requirements of the President's

re-employment agreement. The bill passed the Senate August 12, 1935, and was referred to the Judiciary Committee. It was to come up again in 1936.

The Wagner labor law, Public 198, set up a National Labor Board and provided for a permanent method of arbitrating labor disputes. Measures seeking a 30-hour labor week were introduced, and were to come up again in 1936. Senate bill 2496 passed the Senate, was held over, and was to come up again in 1936. It would amend the Railway Labor Act to include common carriers by air engaged in interstate and foreign commerce. In view of the fact that many believed that air transport employees should come under the provisions set forth in the 1936 law, Public 400, providing for a tax on carriers to carry the Railroad Employees' Retirement fund, the proposed amendment to the Railway Labor Act might have considerable to do with air transportation.

Naval procurement under the Vinson Act of 1934 was badly handicapped by the 10 per cent profit limitation clause. The Navy Department, cooperating with the House Committee on Naval Affairs, undertook to amend the Act, spreading the 10 per cent profit limitation over a two-year period rather than calculating profits on each individual contract as provided under the law as it stood. The bill for amendment passed the House, but was not reported out of the Senate Committee on Naval Affairs. The bill was to be brought up again in 1936.

Numerous bills pertaining to Army Air Corps procurement methods were introduced, but none was reported out of the House Military Affairs Committee, which was continuing its investigation of the problem when Congress met in 1936.

A most important piece of military aviation legislation was passed in 1935, however. It was the Wilcox bill H.R. 7022. It authorized the creation of air bases throughout the country and in Alaska and Hawaii. It provided for the appointment of a "Special Committee on Air Bases" to be named by the Secretary of War. The Committee was to make a complete survey of the need for more bases for the Army Air Corps, suggest locations and also suggest improvements to existing bases. The Wilcox law did not appropriate funds for actual construction of the bases; and there was considerable and growing sentiment favoring such appropriations during the 1936 session.

Public Law 36 authorized the Secretary of the Navy to carry on with construction under the PWA program. Public Law 37 authorized the training of aviation cadets in the Naval Reserve. Public Law 212 increased the line officer strength of the Navy to the requirements of a treaty navy. The National Guard Air Unit Act and the Thomason Act authorized increases in air officer strength of the Army Air Corps.

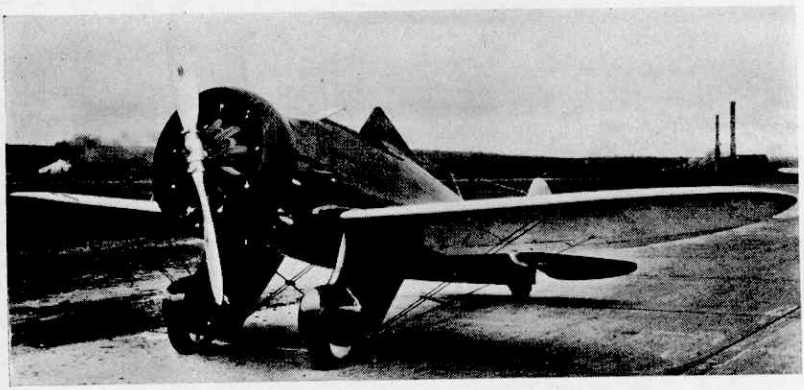
### State Laws Passed in 1935

A State gasoline tax summary will be found in the appendix.

California amended its civil and penal codes to enable municipalities to lease for 50 years lands for any aviation purpose, and providing a $200 fine and three months in jail for using aircraft without the owner's consent.

Connecticut passed a law for rigid inspection and licensing of parachutes, another law empowering the Commissioner of Aeronautics to collect an aircraft registration fee of two cents a pound gross load, $10 minimum and $40 maximum, and another law placing pilot licenses under control of the commissioner.

Florida passed a law for municipal ownership of airports, granting of franchises and exercising rights of eminent domain; and other laws authorizing counties to do the same thing.



BOEING 281 EXPORT PURSUIT PLANE

Powered with a 550 h.p. supercharged Wasp engine, this all metal, low-wing single-seat fighter is popular in the foreign market.

Illinois amended a law in order to permit municipalities of less than a half million population to finance their own airport development; amended a law to compel all aircraft and pilots to be federally licensed; passed new laws permitting municipal park boards to convert lands for airport use, with the consent of the local populations; and adopted another law enabling cities of 150,000 or more to reclaim submerged lands for airport use.

Iowa amended an act to broaden the powers of its aeronautics commission.

Maine passed a law authorizing railroads to operate aircraft and

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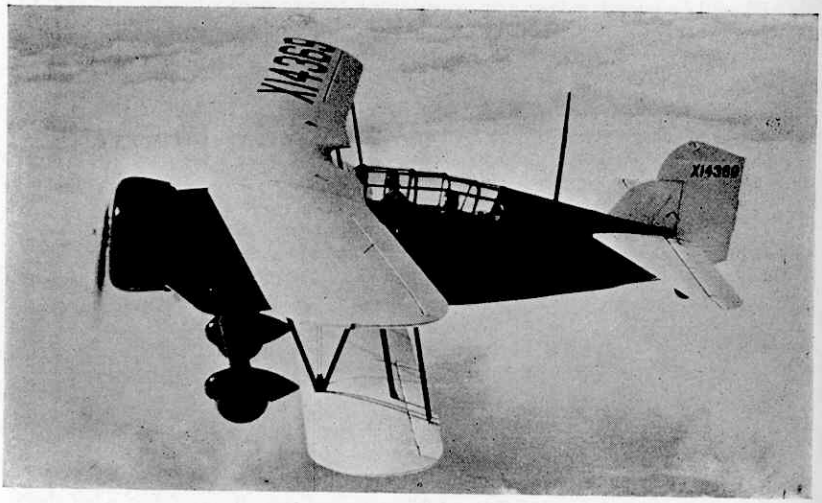
boats for passenger and freight transportation; and also authorized the State to lease the Augusta city airport.

Maryland passed a law for a comprehensive system of State control under its aviation commission; and passed another law exempting from taxation until 1946 all American owned aircraft weighing more than five tons.

Massachusetts adopted a uniform aeronautical code to be administered by a State aeronautics department.

Michigan amended a law in order to establish an aeronautics board and provide for a State weather reporting service; adopted a law trans-



THE CURTISS FALCON

A two-place observation plane powered by a Wright Cyclone engine.

ferring certain lands for use by the Army Air Corps; amended a law to provide for highway traffic control in vicinity of airports; adopted a law for special tax on aviation gasoline; and also passed a law empowering counties and cities to operate aviation facilities.

Minnesota passed a law providing for a State aeronautics commission similar to the uniform code, with commercial aircraft license fees of $25 for single-engine and $50 for multi-motored machines, and also providing that all aviation facilities must be approved by the State commission.

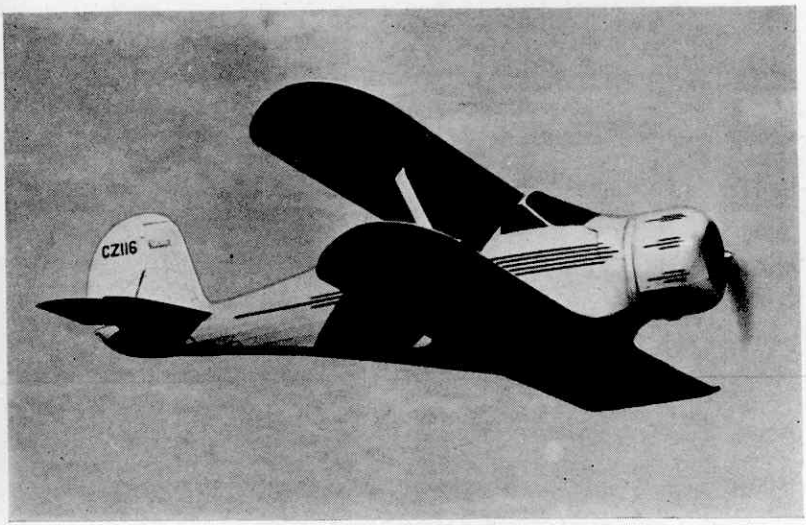
Nebraska created an aviation commission with powers and duties similar to the uniform code, with expenditures limited by revenues

from the aviation gasoline tax levy. Another law permits companies to write aircraft insurance.

New Jersey also adopted a law authorizing the writing of aircraft insurance.

New York extended the life of its aviation commission to March 1, 1936, pending further legislation; and also adopted a law permitting neighboring cities to operate an airport jointly.

North Carolina amended a law to authorize an airport commission for Rocky Mount; also passed two laws permitting airport activities by Asheville and Morganton.




A NEW BEECHCRAFT

One of the Beech Aircraft Company's 1936 models in flight.

North Dakota provided that one committing an offense against any aircraft in flight may be tried in any county.

Ohio amended its general code to conform to its uniform aviation law, and conferred upon counties the same taxing authority as held by municipalities.

Oklahoma adopted a resolution petitioning Congress to establish an aviation ground school at the Oklahoma Military Academy at Claremore.

Oregon authorized cities and counties to maintain airports.

Pennsylvania amended earlier laws, and placed aeronautical regulations with the State Department of Revenue, provided for licensing

and registration, defined legal status of air navigation and provided police powers similar to those for surface transport media. Obstructions near airports are prohibited. The Secretary of Revenue shall become the agent for the service of process in any civil suit involving accidents to aircraft from outside the State.

Rhode Island provided for a Division of State Airports.

South Carolina provided a law similar to the uniform code, with an aeronautics commission. Guests riding free are prohibited from suing owners of aircraft in accidents, without first proving intent or reckless disregard.

South Dakota also adopted a law similar to the uniform code.

Tennessee also adopted a law similar to the uniform code.

Texas authorized cities of more than 160,000 population to operate airports, their cost to be limited to $125,000; and further, that all

THE KINNER PLAYBOY

A two-place monoplane with 160 horsepower Kinner engine.

financing be within the limits of fees and revenues accruing from each airport operation.

Vermont authorized municipalities to operate airports individually or jointly.

Washington included aviation in a new law providing for taxation of any "public service business."

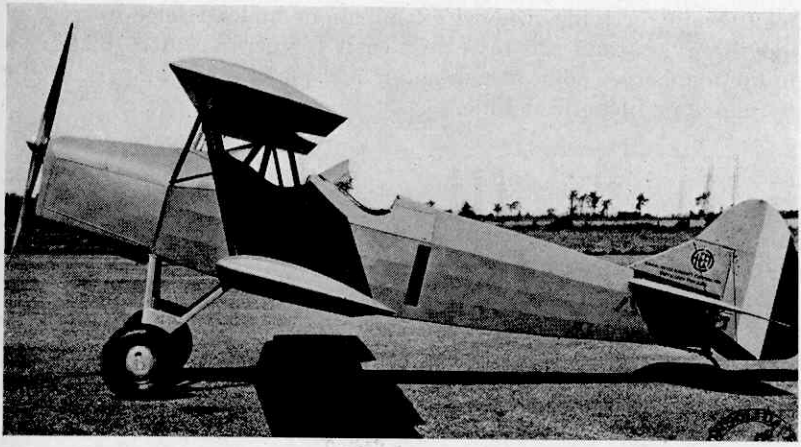
West Virginia passed an amendment to its air law, and provided that all aircraft and pilots be federally licensed.

Wisconsin amended its general statutes empowering county boards to operate airports and providing that they carry liability insurance covering all activities involving possibility of damage to the general public. Another amendment provided that aircraft must be federally

licensed, and that aircraft may be held on lien for amounts due airports or other service stations.

### Federal Regulations

The Bureau of Air Commerce, of the U. S. Department of Commerce, charged by Act of Congress with safeguarding interstate air traffic through regulations, in 1935 commenced development of a coordinated traffic control system for the entire country. Following conferences with air line officials and others representing all other flying activities, the Bureau in November issued a precautionary notice giving requirements for those making radio and instrument flights during poor visibility.



A CONSOLIDATED FLEET 10-G TRAINER

A two-place training or sport biplane.

By its terms, air lines with facilities for two-way communication systems were authorized to clear their planes for radio and instrument flights. All others were required to make known their flight plans to Department of Commerce stations and to at least one air line using that airway. It in turn would notify all other lines. The purpose of the regulation, of course, was to prevent collision of aircraft in thick weather.

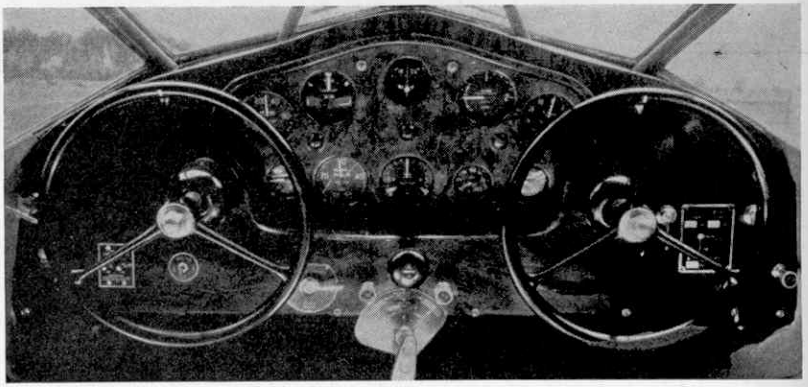
The Bureau also approved an inter-line agreement governing operations on the Chicago-Cleveland-Newark airway, and published it for all pilots. Other routes then were subjected to similar agreements.

The Bureau received suggestions for a permanent set of regulations, including those governing traffic control at airports, with quali-

fications of operators at the airport control towers. Recommendations included the designation of flight control officers to direct movements of aircraft along the airways between airports; rules for flying at definite levels, determined by the direction; and rules for circling over control points to await directions from the control officer. At the beginning of 1936 the Bureau was drafting complete traffic control regulations.

The Bureau also required that cabin attendants be provided to observe and care for passengers on all air line planes flying above 15,000 feet to 18,000 feet. Permission could be obtained for operations above 18,000 feet if the air line provided oxygen equipment or supercharged cabins containing air of sea level oxygen content.

An intensive study of pilot fatigue was being made; and air line pilots were receiving medical examinations at least once every three months. The study was to form a basis for permanent regulations as to the number of hours which an air line pilot should be permitted to fly in a stated length of time.



AS SIMPLE AS A MOTOR CAR

The instrument panel on this Stinson Reliant with dual controls was simplified for the private owner.

## CHAPTER XVII

### ENGINEERING AND MANUFACTURING

High Lights in American Aircraft Development—The Work of Each Aircraft Manufacturer—Projects for 1936—With the Aircraft Engine Builders—Advances in Engines, Propellers, Instruments—Radio, Fuels and Other Accessories

SPARK plugs with fins to keep them cool, propellers that changed the pitch of the blades automatically to bite out just the right chunk of air at every stage of a flight, air-conditioned club planes with electric refrigerators, rubber gadgets tougher than steel and designed to protect metal from being worn away by fast speed through dust or sleet-laden air, little planes with slots and flaps that almost any novice might bring to earth without much risk, still faster and larger aircraft for the scheduled air lines, ships that could fly the oceans; great, giant war craft capable of flying across the United States at nearly four miles a minute without stopping; machines fairly bristling with machine guns and heavy bombs, and aircraft radio that could actually help an automatic pilot keep a plane directly on a true course miles above the earth—those were only a few of the highlights of American aviation at the beginning of 1936. Just how each manufacturer and engineer had contributed to that progress and the trend of developments planned during the next 12 months will be explained in this account of the activities in the numerous plants of the aircraft industry and all its allied branches. The story of the accomplishments during 1935 is as romantic as any to be found in the long history of American achievement; and it goes a long way toward explaining why the United States has the best airplanes in the world.

#### Aircraft Manufacturers

Aeronautical Corporation of America, Cincinnati, O., was producing two different types of airplane for the private owner. The Aeronca C-3 was a two-place high-wing monoplane equipped with the Aeronca E-113C engine of 36 h.p., with a wing area of 142 square feet, gross weight 1,006 pounds, payload capacity 213 pounds, a stated high speed of 93 m.p.h., cruising at 85, with ceiling of 12,000 feet and range of 200 miles. The late model C-3 had a built-in cabin with faired fuselage, heavier flying wires and fittings. A British firm was licensed to build Aeronca models. New developments late in 1935

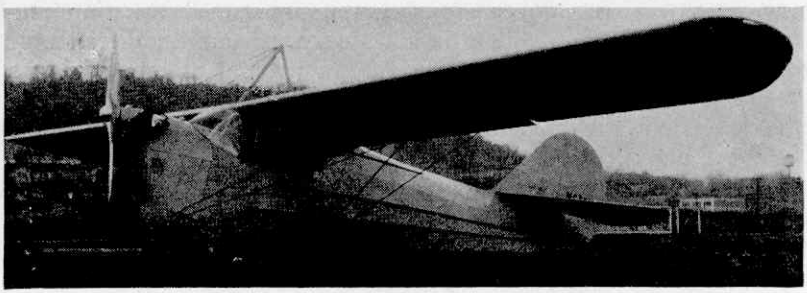
were represented by the C-70 and C-85 low-wing planes for private owners and flying schools desiring machines in the $2,500 price range. The C-70 was equipped with a LeBlond 70 h.p. engine, had 150 square feet wing area, gross weight 1,500 pounds, payload 290 pounds, stated high speed of 115 m.p.h., cruising at 100 with range of 450 miles. The C-85 model with LeBlond 85 h.p. engine was similar save for payload of 300 pounds, stated high speed of 120 m.p.h. and cruising at 105 m.p.h. The C-70 and C-85 had an overall length of 22½ feet and wing span of 36 feet. They also could be powered with the 90 h.p. Warner Scarab Junior or the 90 h.p. Lambert.

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 Aviation Manufacturing 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, payload 1,810 pounds and gross weight 8,500 pounds, with an absolute ceiling of 20,000 feet.



AN AERONCA FOR PRIVATE OWNERS

Model C-3, with Aeronca E-113C engine, carries two.

One of the Airplane Development Corporation's new models was the Vultee attack bomber, V-11, an all metal, low-wing monoplane, with retractable landing gear, for high performance military service. Tandem cockpits under a transparent canopy provided good vision and protection for the pilot and the gunner. Armament included four fixed machine guns, a flexible gun and both internal and external bomb racks for a total bomb load of 1,135 pounds. The fuselage was of monocoque construction without longitudinals. It was 37 feet 10 inches long. The wing span was 50 feet, height 10 feet, weight empty 5,512 pounds, gross weight 8,500 pounds and useful load as an attack plane 2,988 pounds. As a bomber the gross weight was 10,800 pounds, useful load 5,288 pounds. Powered with a single Wright Cyclone F-53 engine the Model V-11 had a stated high speed of 230 m.p.h. at 11,000 feet, cruising at 210 m.p.h. at 20,700 feet, service ceiling 24,000 feet, absolute ceiling 26,000 feet,

range as an attack plane 900 miles, as a bomber 2,200 miles; landing speed 65 m.p.h.

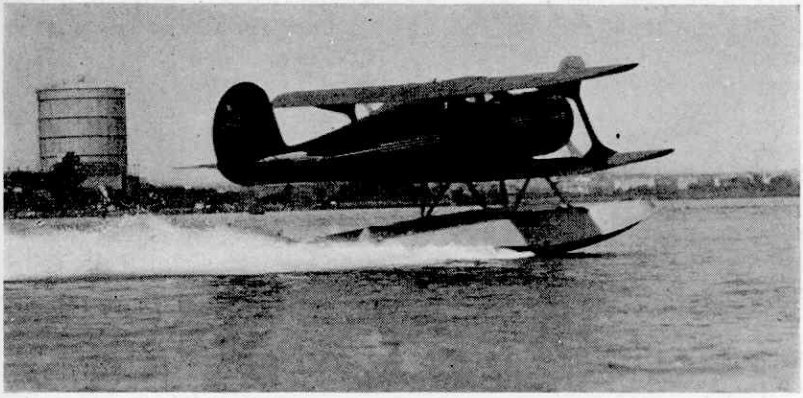
The Autogiro Company of America, Willow Grove, Pa., was continuing its intensive experimental work seeking further developments of rotor blade type aircraft. Three objectives were being reached, experimentally—a perfected means of direct control wholly independent of motor power and forward speed; direct take-off without any forward run; and third, development of an autogiro with characteristics of a motor car so that it might be operated on highways when not in flight. A model of that design was being completed for the Bureau of Air Commerce. Experimental models of military design showed top speeds approaching 150 m.p.h., an increase of 20 per cent over the speed of fixed-wing models using the same engine horsepower.

Direct control was accomplished by mounting the rotor head on bearings so that the movement of the pilot's control stick simultaneously moved the rotor, tilting it, and thus displacing the direction of rotor lift in respect to the center of gravity and thereby giving a definitely related controlling force during any flight speed, even in vertical descent. Elimination of wings and movable control surfaces enhanced the simplicity of the autogiro. Direct take-off was obtained by a control permitting the pilot to flatten the blades. The pilot started his blades through the conventional rotor clutch and steer mechanism, then brought them, with blades flattened and not exerting lift, to a speed considerably greater than normal rotating speed. He then released the starter clutch, permitting the blades to assume normal flight incidence. The excess kinetic energy represented in the excess speed of the rotor was then converted into a direct lifting force sufficient to lift the machine directly off the ground. Individual designs developed by the Company's licensees, Kellett Autogiro Corporation and Pitcairn Autogiro Company, are described in the sections devoted to those concerns.

The Beech Aircraft Company, Wichita, Kan., developed three new models. Two were added to its Beechcraft line of four and five place cabin planes, with reverse stagger, formerly represented solely by the Jacobs-powered B17L. With that model still in production the company added the B17E with 285 h.p. Wright Whirlwind engine and the B17R with 420 h.p. Whirlwind, the latter having a stated cruising speed of 202 m.p.h., landing at 50 m.p.h. All models were available with Edo float installation. As land planes they had retractable landing gear. A twin-engine monoplane for feeder lines or individual use was to be produced in 1936. It was to be known as Beechcraft model 18K, low-wing and all metal, with two 270 h.p. Jacobs L-5

engines, a gross weight of 6,500 pounds, carrying a maximum payload of 1,420 pounds, with places for four, six or eight persons, a stated cruising speed of 176 m.p.h. and a range of 1,200 miles. All models were offered for export as well as domestic use.

Bell Aircraft Corporation, Buffalo, N. Y., was incorporated under the laws of the State of New York in July, 1935, with Lawrence D. Bell president and general manager, Ray P. Whitman vice president and treasurer, Robert J. Woods chief engineer and Charles L. Beard secretary and assistant treasurer. All were formerly connected with the Consolidated Aircraft Corporation. Bell Aircraft Corporation occupied temporary quarters until Consolidated moved to San Diego in August, 1935, at which time Bell moved into the plant vacated by



A BEECHCRAFT ON EDO FLOATS

This private plane is powered with a Jacobs engine of 225 h.p., and cruises at 130 m.p.h.

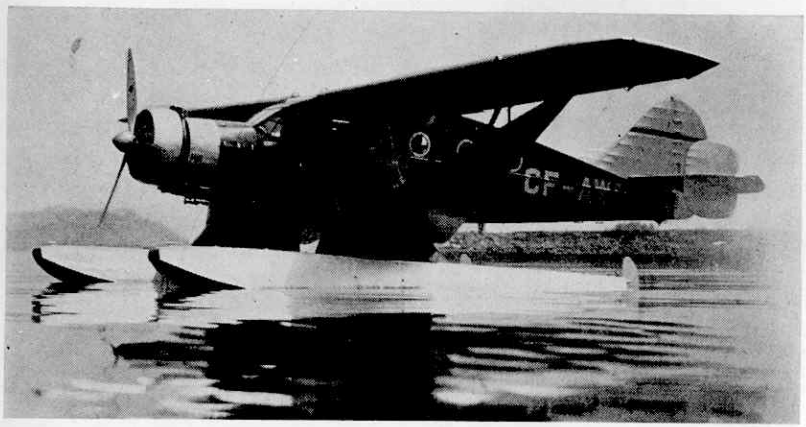
the latter concern. The plant had about 44,000 square feet of floor space, with adjacent factory space available when needed. At the beginning of 1936 Bell Aircraft was officially recognized as a qualified constructor of service equipment for both the Army and Navy air forces. Small orders were being produced for the Air Corps, and definite engineering plans were well under way.

Bellanca Aircraft Corporation, New Castle, Del., produced both commercial and military planes, notably the Senior Skyrocket series, Senior Pacemakers and the Bellanca Aircruisers. Two twin-engine seaplane bombers were delivered to the Government of Colombia. The Senior Skyrockets had newly designed tail surfaces, new engine cowling and a 550 h.p. Pratt & Whitney Wasp engine. Such models

were delivered to Wallace Beery, the Gilmore Oil Co., W. O. Todd of Los Angeles; W. C. Langley of New York; and Dr. Richard U. Light of New Haven, Conn. Two versions of the Senior Pacemaker were sold. The series eight Pacemaker freighter with 420 h.p. Wright Whirlwind engine, payload of 2,000 pounds and a cruising range of 400-500 miles was delivered to General Airways of Canada, making five Bellancas in that company's fleet of aircraft. The freighter on Edo floats had a payload capacity of 1,787 pounds and a stated cruising speed of 150 m.p.h. The Senior Pacemaker executive type like that delivered to R. R. M. Carpenter of Wilmington, Del. had a performance similar to that of the freighter. The Aircruisers were further developed in speed, range and payload capacity. The Cargo Aircruisers, with Wright Cyclone engine and a Hamilton Standard three blade controllable pitch propeller, carried a payload of 4,000 pounds at a stated cruising speed of 142 m.p.h. One was delivered to Mackenzie Air Service of Edmonton, Alberta, in March, 1935. It was put on skis and placed in service over the grueling route between Fort McMurray and the Great Bear Lake mining district, hauling radium and silver ore from the mines of the Eldorado Mining Co. to the railhead at Fort McMurray, 900 miles distant. In three weeks the plane carried 30,537 pounds of concentrates to Fort McMurray and 35,000 pounds of passengers and supplies to Great Bear Lake. The cargo aircruiser was also licensed as a seaplane with Edo floats, carrying a payload of 3,445 pounds. Another Aircruiser all-purpose type, Model 66-75, was delivered to the Cuban Army. It was powered with a 750 h.p. Pratt & Whitney Hornet engine. This model was capable of being used for four different purposes; one, as an executive transport for 10 passengers, pilot and co-pilot; two, as a bomber-troop carrier, equipped with three machine guns, two of them fixed and one flexible, and racks for five 30-pound or two 200-pound bombs; three, as an ambulance plane with accommodations for six patients and attendants; four, as a cargo plane with payload of 3,600 pounds.

Boeing Aircraft Company, Seattle, Wash., produced a giant, all metal four-engine bomber, the Boeing 299, and it quickly gained world fame as the "flying fortress." It was the largest land plane in the United States and sensationally fast for its range of action. It was flown from Seattle to Dayton, O., in August, 1935, and submitted to the Army Air Corps in open competition with other types. On that flight it covered the 2,100 miles non-stop at an average speed of 232 m.p.h., which warranted the achievement being included among the notable flights of the year. Construction of the big bomber was of the semi-monocoque type consisting of longerons, skin stiffeners, bulkheads and smooth outside metal skin. Its monoplane wing measured

about 100 feet between tips. The fuselage was 70 feet long, and the bomber stood 15 feet high, with a gross weight of 15 tons. It contained a number of armament installations developed by Boeing engineers, the details regarded as military secrets. For the first time on any American plane the landing gear wheels had air brakes, which with wheels and tires, the diameter of which equalled the average height of a man, were developed especially for the Boeing 299. The power plant, which proved capable of hurling this 15-ton bomber through the air for 2,100 miles non-stop at an average speed of nearly four miles a minute, included four 750 h.p. Pratt & Whitney Hornet engines each twirling a three-blade Hamilton Standard constant speed propeller. The Army Air Corps ordered 13 of the Boeing 299



BELLANCA AIRCRUISER ON EDO FLOATS

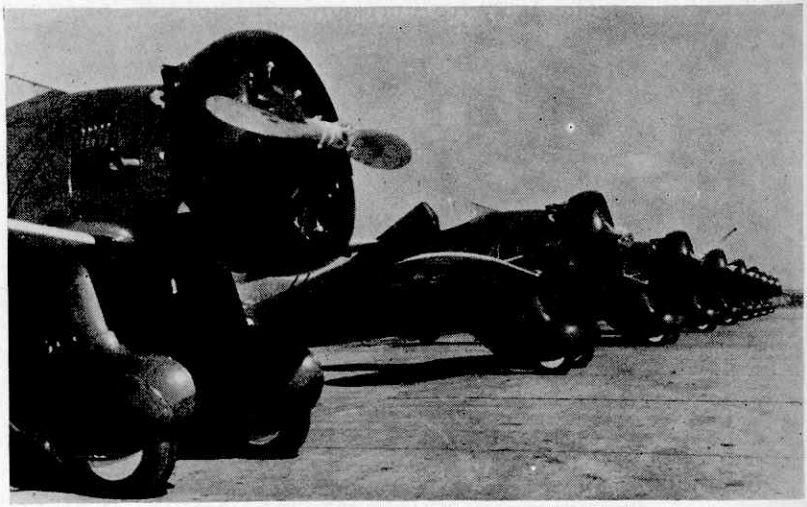
Powered with a Wright Cyclone engine it was used as an ore-cargo carrier in Canada.

super-bombers, and contemplated future orders sufficient to equip several squadrons with that type of "flying fortress."

Early in 1936 the Boeing Company announced that it had built to its own designs and delivered a total of 1,900 commercial and military airplanes during its lifetime of 19 years, the different models aggregating 62.

During 1935 the Boeing company completed delivery of 75 Model 247 and 247-D transports. Sixty of the Model 247-D, with a stated top speed of 202 m.p.h. and cruising speed of 189 m.p.h., were in service on United Air Lines, the increased speed enabling that company to establish a 16-hour, overnight service from San Francisco to New York. Other air lines using Boeing transports included Pennsyl-

vania Airlines, Western Air Express, National Parks Airways and Wyoming Air Service. Boeing 247-D transports also were used by the Deutsche Lufthansa of Germany, Marshal Chang Hsueh-liang in China and the Phillips Petroleum Company of Bartlesville, Okla. The transport delivered to the Phillips Company had overstuffed chairs, a berth, walnut cabinets, refrigerator, cabin flight instruments, built-in radio for entertainment programs, and an inter-phone radio telephone for passengers desiring to communicate with ground stations. The Boeing company also produced an export version of the Air Corps P-26A pursuit, designated as Model 281, a single-seat, all



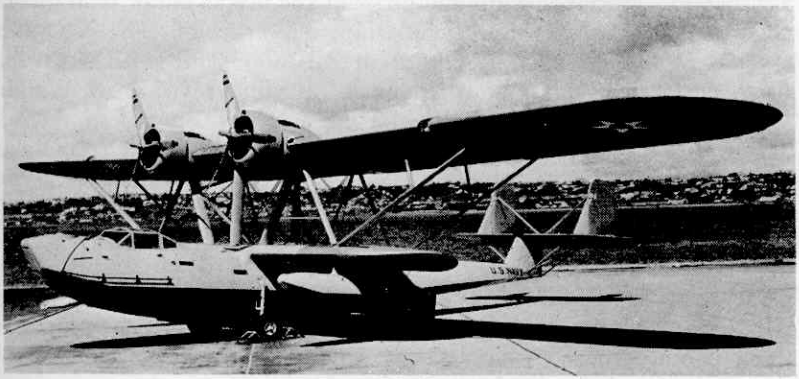
EYES RIGHT! HERE COMES THE GENERAL

A group of Wasp-powered Boeing P-26A pursuit ships on the line ready for delivery to the Air Corps.

metal low-wing fighter with a stated top speed of 235 m.p.h. and climb to 10,000 feet above sea level in five minutes. It was equipped with a 550 h.p. Pratt & Whitney supercharged Wasp engine, and had three kinds of performance conditions; one, as a fighter with normal fuel load and equipped with two 30-cal. machine guns or one 30-cal. and one 50-cal. gun, with a stated top speed of 232.5 m.p.h. and range of 386 miles at a cruising speed of 210 m.p.h.; two, as a fighter with maximum fuel and the same military load, a stated top speed of 230.5 m.p.h. and range of 745 miles at 208 m.p.h. cruising, climbing to 17,900 feet in 10 minutes, with service ceiling of 28,200 feet; three, as a fighter-bomber carrying either five 30-pound bombs or two 122-

pound bombs, a stated top speed of 221 m.p.h., with rate of climb of almost 2,000 feet a minute at sea level.

Consolidated Aircraft Corporation, formerly of Buffalo, N. Y., dedicated its new plant occupying 33 acres at Lindbergh Field, San Diego, Calif., on October 20, 1935, and continued to produce heavy duty patrol flying boats for the U. S. Navy, 60 of which designated as Type P3Y were being manufactured according to Navy specifications at the beginning of 1936. The P3Y, according to Washington newspaper dispatches (official data was withheld for military reasons) was a monoplane flying boat measuring 104 feet between wing tips, with hull and tail surfaces 63 feet in length. Double struts braced the wing to the boat-shaped body. Wing floats suspended from the tips



A CONSOLIDATED P2Y-3 NAVY PATROL

One of the 50 Cyclone-powered long-range patrol-bomber flying boats flown by squadrons in operations with the Fleet. They are equipped with Curtiss controllable pitch propellers.

were retractable, being pulled up into the lower surface of the wing during flight to reduce resistance and enhance speed. On October 15, 1935, the first P3Y boat to be turned over to the Navy for experimental purposes made a world record flight for seaplanes flying non-stop. With Lieut. Comdr. Knefler McGinnis and a crew of five the P3Y-1 flew from Panama to Alameda, Calif., a distance of 3,281 miles, non-stop, in 34 hours 45 minutes, at times averaging 130 miles an hour. That flight bettered the Italian record of July by 218 miles. The same plane had flown from Norfolk, Va., to Panama during the previous week, covering the distance non-stop in 17 hours 33 minutes at an average speed of 124 miles an hour. The P3Y-1 was powered with two Twin Wasp engines set in the leading edge of the wing.

Consolidated Aircraft Corporation in 1935 also completed delivery of 23 P2Y-3 flying boats for the Navy. Sixty Fleet trainers were delivered to foreign governments. Consolidated's Canadian subsidiary, Fleet Aircraft of Canada, Ltd., at Fort Erie, Ont., worked at capacity output during the year, producing Fleet planes for the Canadian and foreign governments. In January, 1935, the Air Corps awarded the Consolidated Aircraft Corporation a contract for 50 P-30 two-seat pursuit planes, redesignated the PB2A, powered with the Curtiss Conqueror engine. They were to be delivered in 1936.

Curtiss Aeroplane & Motor Company, Buffalo N. Y., a division of Curtiss-Wright Corporation, delivered to the U. S. Navy 135 observation biplanes of the O3C-1 type, which were equipped with slots and flaps in the upper wing and adapted for use as either land planes or seaplanes aboard carriers, battleships and cruisers. The XF13C-1 single-seat fighter, a high-wing all metal monoplane with slots and flaps, enclosed cockpit, powered by a 14-cylinder twin-row Wright Whirlwind engine, was developed for the Navy Bureau of Aeronautics. Twenty-seven BF2C-1 single-place fighters with retractable landing gear were delivered to the Navy for service on the carrier "Ranger." An experimental, all metal, two engine, low-wing attack monoplane, with two 14-cylinder Wright Whirlwind engines, was designed and built in 1935. An experimental low-wing pursuit monoplane, with a 14-cylinder Whirlwind, was developed for the Army Air Corps. A new 1935 Falcon two-place observation attack biplane, Cyclone-powered, with single strut landing gear, was produced for the export market. At the beginning of 1936 Curtiss models, aside from experimental types still regarded as military secrets, included: Hawk 1, with 720 h.p. Cyclone, 252 square feet wing area, gross weight 3,447 pounds, useful load 686 pounds, stated high speed 209 m.p.h., cruising at 180, service ceiling 30,600 feet and range of 442 miles; Hawk 2, land plane, 720 h.p. Cyclone, 3,876 pounds gross weight, useful load 973 pounds, stated high speed 208 m.p.h., cruising at 179, service ceiling 26,400 feet and range 635 miles; Hawk 2, seaplane, 715 h.p. Cyclone, gross weight 4,266 pounds, useful load 973 pounds, stated high speed 192 m.p.h., cruising at 163 with range of 577 miles; Hawk 3, with 780 h.p. Cyclone, 262 square feet wing area, gross weight 4,230 pounds, useful load 1,067 pounds, stated high speed 244 m.p.h., cruising at 204 with range of 561 miles; Shrike, 775 h.p. Cyclone, wing area 285 square feet, gross weight 5,875 pounds, useful load 1,910 pounds, stated high speed 210 m.p.h., cruising at 178 m.p.h. with range of 516 miles; Falcon 2, with 750 h.p. Cyclone, wing area 362 square feet, gross weight 5,065 pounds, useful load 1,401 pounds,

stated high speed 209 m.p.h., cruising at 185 with range of 672 miles; (in following types certain details were held secret) Raven 1, with 750 h.p. Cyclone, 338 square feet wing area, gross weight 4,763 pounds, useful load 1,155 pounds; Raven 2, with 750 h.p. Cyclone, 265 square feet wing area, gross weight 4,917 pounds, useful load 1,155 pounds; Hawk P-6E, 650 h.p. Conqueror, wing area 252 square feet, stated high speed 198 m.p.h., service ceiling 24,700 feet, cruising range 570; Navy Fighter F9C-2, 420 h.p. Whirlwind, 153.9 square feet wing area, gross weight 2,752 pounds, useful load 662 pounds; Fighter F11C-2, 750 h.p. Cyclone, 252 square feet wing area, 4,074 pounds

THE CURTISS GULF HAWK

This Cyclone-powered pursuit type plane is flown by Major Al Williams on business for the Gulf Refining Company.

gross weight, 1,094 pounds useful load, stated high speed 193 m.p.h., service ceiling 25,400 feet, cruising range 570 miles; Falcon O-39, 650 h.p. Conqueror, 348 square feet wing area, 4,700 pounds gross weight, 1,334 pounds useful load, stated high speed 172 m.p.h., service ceiling 20,900 feet, range 730 miles.

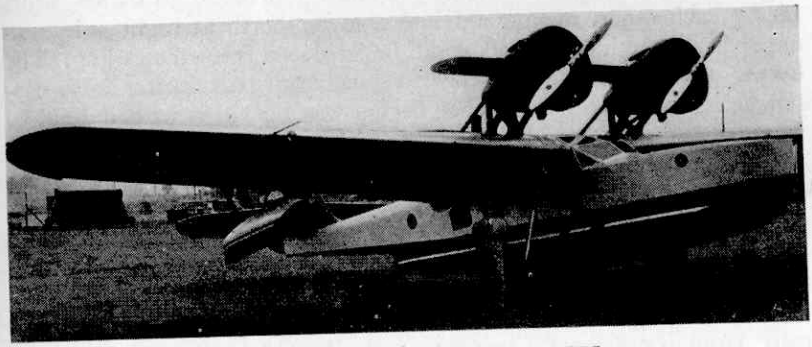
Curtiss Aeroplane & Motor Company carried on extensive development of the Curtiss electric controllable pitch propeller during 1935. A number of these propellers were delivered to the Air Corps for installation on pursuit planes, and to the Navy Bureau of Aeronautics for installation on patrol planes. The Consolidated patrol plane, P3Y-1, on the record breaking flight from Panama to Ala-

meda, Calif., was equipped with Curtiss electric controllable pitch propellers. The propeller could be adjusted to practically any pitch to obtain the maximum efficiency of the motor, regardless of altitude.

Curtiss-Wright Airplane Company, Robertson, Mo., a division of Curtiss-Wright Corporation, designed and built for the Bureau of Air Commerce a new all metal, two-place side-by-side, low-wing closed monoplane, known as the Curtiss-Wright Coupe, powered by an R-266 Lambert 90 h.p. engine. The Coupe was equipped with a fixed slot and a flap extending over 70 per cent of the wing span, a feature which, combined with aileron control, was intended to make the plane practically stall-proof and spin-proof. New shock-absorbing landing gear was designed for inexperienced pilots. The Coupe had a stated top speed of 131 m.p.h., cruising at 115 m.p.h. at 5,000 feet altitude, with normal range of 580 miles and maximum range of 1,150 miles, with gasoline consumption of 5.8 gallons an hour. The Curtiss-Wright Sport, a three-place biplane with 175 h.p. Whirlwind, and the Speedwing, a one to three-place biplane with 250, 330 or 440 h.p. Whirlwind, were built for the commercial market. The company continued the production of the AT-32 Condor all-sleeper transport biplane with two Cyclone engines of 750 h.p. each, and the BT-32 Condor bomber, several of which were delivered to foreign governments. Also produced were the Trainer, a two-place biplane with 175 h.p. Whirlwind, and the Osprey, a two-place biplane fighter with 440 h.p. Whirlwind engine. An advanced military trainer, two-place, with 250 h.p. Whirlwind, was designed for export. At the beginning of 1936 the company's models, besides the Coupe and Condor transports and bomber, included: Land Trainer, 175 h.p. Whirlwind, gross weight 1,950 pounds, useful load 630 pounds, stated high speed 131 m.p.h., cruising at 111, range 336 miles; Seaplane Trainer, same engine, 2,200 pounds gross weight, 600 pounds useful load, stated high speed 125 m.p.h., cruising at 106, range 324 miles; Advanced Trainer, 240 h.p. Whirlwind, gross weight 2,975 pounds, 745 pounds useful load, stated top speed 131 m.p.h., cruising at 111, range 450 miles; Trainer 16W, 125 h.p. Warner Scarab, gross weight 1,950 pounds, useful load 375 pounds, stated high speed 116, cruising at 97, range 340 miles; Sport 16E, 175 h.p. Whirlwind, gross weight 2,150, useful load 392 pounds, stated high speed 126 m.p.h., cruising at 106, range 275 miles; Speedwing A14D, 285 h.p. Whirlwind, 2,800 pounds gross weight, 544 pounds useful load, stated top speed 148 m.p.h., cruising at 126, range 560 miles; Speedwing DeLuxe B14B, 330 h.p. Whirlwind, 2,920 pounds gross weight, 448 pounds useful load, stated top speed 156 m.p.h., cruising at 136, range 490 miles; Osprey C14-R, 420 h.p. Whirlwind, 3,067 pounds gross weight, useful load 369

pounds, stated top speed 170 m.p.h., cruising at 146, range 430 miles; Condor Cargo Plane, two 715 h.p. Cyclones, 1,208 square feet wing area, 18,500 pounds gross weight, 4,598 pounds useful load, stated top speed 180 m.p.h., cruising at 160, range 750 miles.

Douglas Aircraft Company, Inc., Santa Monica, Calif., with an enviable record of having produced one of the most efficient and popular air transports, the Douglas DC-2, was delivering these machines to customers throughout the world at the beginning of 1936, and had under construction three new models of transport aircraft. The Douglas program called for their completion during 1936. They included: one, a new large, twin-engine flying boat of advanced design, a gross weight of 27,000 pounds, with improved payload capacity, performance and range; two, a twin-engine amphibion with a gross weight of 23,000 pounds and similar in construction and arrangement



STANDARD'S DOUGLAS DOLPHIN

Major E. E. Aldrin, aviation manager of Standard Oil Company of New Jersey, and the amphibion with which he broke a speed record in May, 1935.

to the flying boat; three, a new twin-engine air liner of 24,000 pounds gross weight, model DST, to be available as a sleeper plane with accommodations for 16 night passengers in berths, or as a day transport with accommodations for 24 passengers.

The larger Douglas transport of 1936 was produced in two versions, one the DST sleeper plane, with lower and upper berths for 16 persons, and the other the DC-3 day plane with reclinable chairs for 24 passengers. Optional power plants were two G series Wright Cyclones or two Pratt & Whitney twin-row SBG Wasps. The transport, either as a day plane or as a sleeper, had a 95-foot wing span, wing area of 987 square feet, a fuselage length of 65 feet and height of 16 feet four inches. It weighed empty 15,750 pounds and had a gross weight of 24,000 pounds. The sleeper had a useful load of

8,250 pounds, the day plane 9,155 pounds. With its gross weight the transport had a stated landing speed of 65 m.p.h., cruising speeds of between 181 and 184 m.p.h. at 10,000 feet, high speed of 212 to 219 m.p.h. at 4,300 feet, a service ceiling of from 19,900 to 23,300 feet and absolute ceiling of 22,100 to 25,200 feet. Its take-off run was approximately 1,000 feet, landing run 950 feet; and its maximum range at 10,000 feet altitude was 2,150 miles with fuel capacity of 820 gallons. The transport was of all metal construction.

In the fuselage of the sleeper were the control cabin in front, behind it on the right a combined mail and cargo compartment of 35 cubic feet capacity, and on the left a completely equipped buffet. Then followed the passenger cabin, divided into eight sections, four on each side of a wide aisle, the cabin measuring 26 feet in length, seven feet eight inches wide and six feet six inches high. In each of the eight sections were deeply upholstered seats, 36 inches wide, facing each other, making up into a lower berth at night, while an upper berth, 32 inches wide, could be let down from the ceiling. The berths were six feet five inches long between partitions. Each passenger in both lower and upper berths was provided with individual window, ventilator, reading light, call button and other conveniences. Air ducts in each compartment provided warm air, maintaining a constant temperature of 70 degrees, even with the outside air 20 degrees below zero. Behind the sleeper cabin were two comfortable dressing rooms with adjoining lavatories. Behind the lavatories was a baggage compartment of 107 cubic feet capacity.

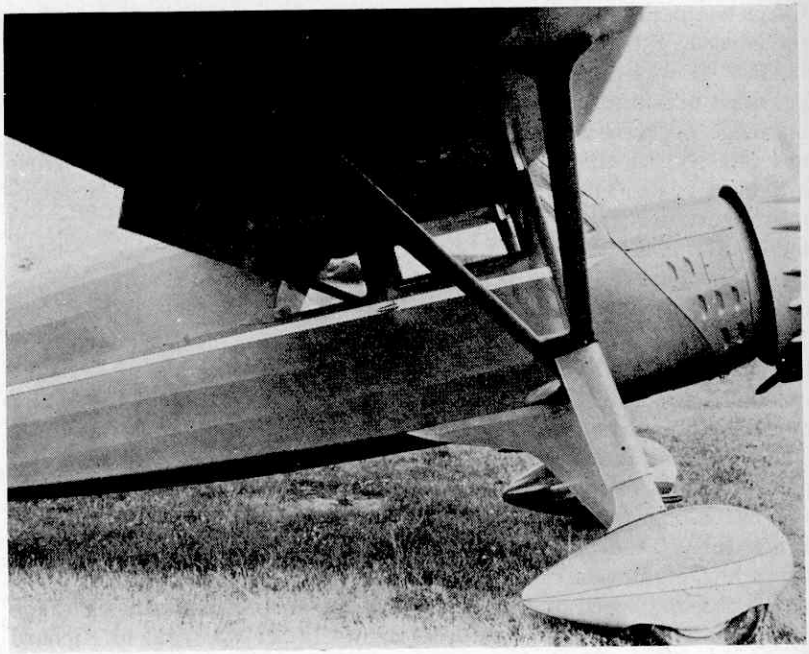
Behind the pilots' compartment the DC-3 day plane differed radically from the sleeper. Instead of the buffet on the left it had a mail compartment, retaining the mail and cargo space on the right. A wide aisle extended the length of the passenger cabin, with eight rows of three individual chairs, two on the left side and one on the right side, a total of 24 seats. In the rear, behind the passenger cabin, were a buffet and a lavatory, and behind that a baggage compartment of 151 cubic feet capacity.

More than 100 Douglas DC-2 transports were in service on the air lines of the world in 1936, while others were being flown by business houses. Fifty-eight of these transports were in day and night service on TWA, American Airlines, Eastern Air Transport and Pan American Airways. Thirty-four of the liners were delivered to Royal Dutch Air Lines (K-L-M), Avio Linee Italiane S. A.; Swissair, Spanish Air Mail Line, Japan Air Transport, China National and other services abroad. The Douglas transports were powered with two Pratt & Whitney Hornets or two Wright Cyclones. They were low-wing all metal monoplanes, with a wing span of 85 feet,

length of nearly 62 feet, and an average gross weight of 18,200 pounds, with useful load of 6,010 pounds. Their stated maximum speed was 210 m.p.h., cruising at 200 m.p.h., with 75 per cent of power, at 185 m.p.h. with 62.5 per cent of power. The company also had in process of design and construction a number of models for the U. S. Army and Navy. The Douglas plant had been steadily enlarged, until at the beginning of 1936 it occupied eight acres with 390,000 square feet of floor space, and employed 2,000 persons. One of the plant's productions in 1935 was a monoplane bomber, twin-engine, with long range and fast speed. It was entered in the Air Corps competition at Dayton, O., and resembled the general design of the new DST transport, although the wing appeared to be somewhat higher. It was also deep-chested, for bomb loads; and the interior provided maximum comfort for the crew, the equipment showing the influence of successful transport development. The Air Corps had ordered 100 of the Douglas bombers, with possibilities of further orders in 1936. The Douglas Company was also engaged in development work for the Navy, and in 1936 had a Navy order for 114 torpedo bombers to be used on two carriers, which were to be completed in 1937. A Douglas subsidiary, the Northrop Corporation, is described in this chapter.

Fairchild Aviation Corporation, New York, discontinued using the name of Kreider-Reisner for its airplane manufacturing division, expanded the plant at Hagerstown, Md., and introduced three new models. The division was named Fairchild Aircraft Corporation. The Fairchild Baby Clipper, a large single-engine amphibion transport, was built to specifications of the Pan American Airways System for use along the river routes. The Baby Clipper with either a Pratt & Whitney Hornet or a Wright Cyclone engine carried two pilots, eight passengers and 1,000 pounds of mail or express at a stated cruising speed of 152 m.p.h. at 5,800 feet with a cruising range of 750 miles. A Cyclone-powered Baby Clipper was sold to Richard Archbold of New York for use on a projected aerial research expedition in New Guinea in 1936 under the auspices of the American Museum of Natural History. The amphibion was a monoplane with a wing span of 56 feet, overall length of 46 feet, gross weight of 9,600 pounds, payload capacity of 2,445 pounds, landing speed with flaps 58 m.p.h., and service ceiling 18,000 feet. The Fairchild 24 with a 145 h.p. Ranger engine was introduced in 1935, the inverted, in-line aircooled engine affording unusual visibility from the cockpit. The 24 was a three-place cabin monoplane. The Fairchild 45 produced later in the year was a five-place low-wing monoplane with a Wright Whirlwind engine, the interior of the cabin built to resemble that

of a streamlined motor car. Its rear seat was 51 inches wide, the front seat 47 inches. Model 45 had a wing span of 39½ feet, gross weight 3,600 pounds, payload 759 pounds, a stated cruising speed of 147 m.p.h., landing with flaps at 48 m.p.h. To the 41,000 square feet of floor space in the old factory a wing was added, with 29,000 square feet of additional space. During the year Fairchild rebuilt and delivered to the Bureau of Air Commerce the re-designed Weick "rudderless" plane, one of the Bureau's units in its low-priced airplane development program. The new plane was turned over to the National



SIDE VIEW OF FAIRCHILD 24

Showing the "air brake" flap on rear edge of wing full down for landing.

Advisory Committee for Aeronautics for tests. Fairchild delivered to the U. S. Navy a special design of the 22—a two-place open high-wing monoplane to be used in test flying of various designs of wings and airfoil surfaces. The Fairchild factory also reconditioned for a leisurely flight around the world the famous "Stars and Stripes," the Fairchild cabin plane which Admiral Byrd took with him on his first trip to the Antarctic. The expedition returned home, leaving the machine buried in the snow. Nearly five years later the second Byrd

expedition went back and again put the machine in the air after tuning it up. Thus a plane built in 1928 was flown 146 hours on the first Byrd trip, 41 hours on the second, and in 1935 was purchased by Alton H. Walker of Kansas City, Mo., who planned to use it on a flying jaunt around the world. Early in 1935 Eugenio G. Minetti and Count Leonardo Bonzi in a Fairchild 24 flew from Oran, Algeria, to Timbuctu in the French Sudan. That was Mr. Minetti's second Fairchild. He received delivery on a third Fairchild plane late in 1935.

Fleetwings, Inc., Bristol, Pa., designed and placed under construction for flight tests early in 1935 its model F401 amphibion, to be fabricated entirely of 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.

Great Lakes Aircraft Corporation, Cleveland, O., operated at near capacity in 1935, 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 1936 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.

A number of carrier squadrons were equipped with a new Navy fighter, Grumman B2F-1, early in 1936. The B2F-1 was a biplane with retractable wheels, powered by a Pratt & Whitney Twin Wasp Junior 650 h.p. engine. It had a wing span of 28 feet six inches and a stated high speed of 240 m.p.h. Its cruising range was 650 miles. It carried two fixed machine guns.

Gyro Air Lines, Inc., Denver, Colo., was building a six-place commercial monoplane, Buccaneer AG-6, similar to its four-place Crusader, with cabin set between two outrigger spars supporting the tail structure. Two Menasco engines were used to power each ship.

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

THE CRUSADER IN FLIGHT

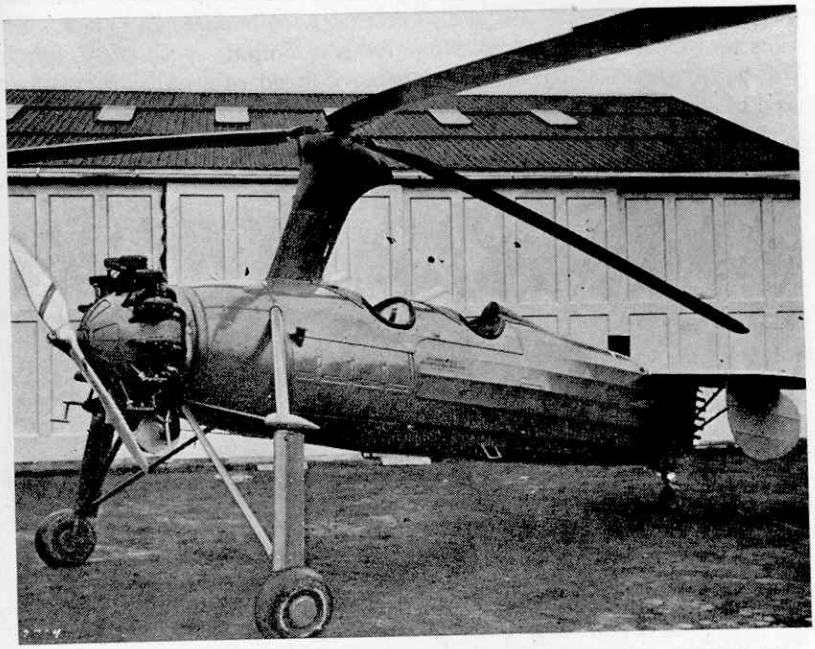
This four-place machine of unusual design, built by the American Gyro Company, is powered by Menasco engines.

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., continued development work on its Model Y, a two-place, side-by-side, cabin plane of metal construction save for the fabric-covered wings and control surfaces. It was designed for the private owner, and had a stated cruising speed of 110 m.p.h. with Menasco engine. The Bureau of Air Commerce had ordered 15 planes of this design. A feature of the Hammond Y was its third landing wheel in front to prevent nosing

over. It was said to have a gasoline consumption similar to that of a low-priced motor car.

Kellett Autogiro Corporation, Philadelphia, Pa., produced the KD-1 direct control wingless autogiro, and at the beginning of 1936 had made many improvements over the original types. Direct control of the rotor developed improved landing, taxiing and take-off. An effective blade damper mechanism and a new rotor starting system increased efficiency and reduced maintenance problems. A notable



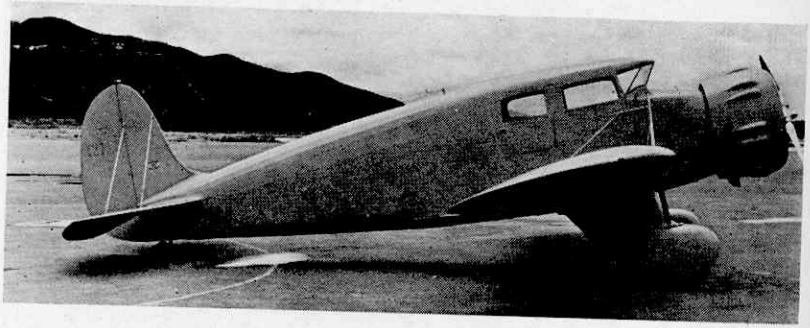
THE KELLETT WINGLESS AUTOGIRO

This two-place YG-1 model with a 225 horsepower Jacobs engine was built for the Army Air Corps.

advance was a new method of supporting the rotor system. The rotor blades were controllably mounted on a single cantilever pylon strut, transmitting the rotor loads directly to the fuselage frame. The pylon strut was encased in a streamline housing also bearing the rotor controls from the rotor head to the fuselage. The absence of a fixed wing and the simple blade-folding adjustment reduced the space required for storage. On May 25, 1935, the KD-1 ferried a load of mail from the Camden airport to the Philadelphia post office, landing on the roof, utilizing only a third of the available space. The Kellett Corpor-

ation designed and constructed the YG-1 autogiro for the Army Air Corps, a machine similar in design to the KD-1, for use as an observation ship. The KD-1 was powered with a Jacobs L4-MA 225 h.p. engine. It had a gross weight of 2,075 pounds, a payload capacity of 200 pounds, a stated high speed of 114 m.p.h., cruising at 95 m.p.h., service ceiling of 13,000 feet and cruising range of 300 miles.

Kinner Airplane & Motor Corporation, Ltd., Glendale, Calif., at the beginning of 1936 was producing five models 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. With the 300 h.p. Kinner C-7 engine it had a stated high speed of 165 m.p.h. and cruising speed of 150 m.p.h. Adjustable metal propeller, dual control, safety glass in windshield and cabin windows, stream-



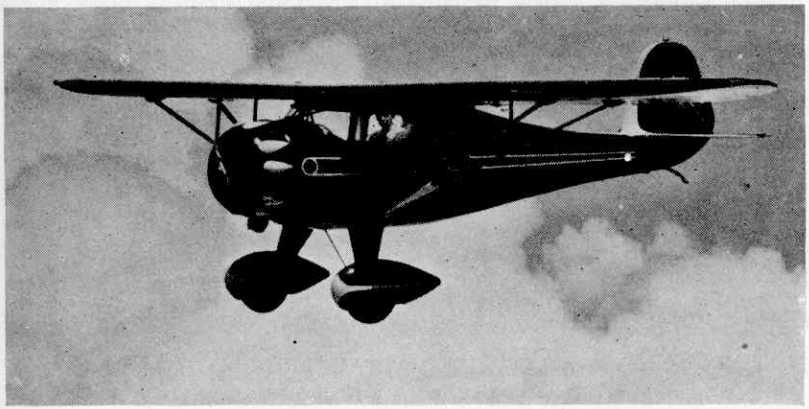
THE KINNER ENVOY

A four-place cabin ship with 300 horsepower Kinner engine.

lined landing gear, wheel pants and radio were features of the Envoy. The Kinner company delivered several of these ships to the United States Navy for transportation of personnel. The Envoy, of course, was also sold to private owners. The Sportster, with Kinner 100 or 125 h.p. motor, was a two-place side-by-side open low-wing monoplane designed for students and amateur pilots. It was suitable for instruction purposes because of its slow landing speed, stability and lack of ground looping tendency. The Sportwing, also a two-place side-by-side open low-wing monoplane, was faster and had more equipment than the Sportster. It was designed to meet the requirements of sportsmen pilots. Originally equipped with the 125 h.p. Kinner motor, it was being brought out with 160 h.p. Kinner. The Playboy was a two-place externally wire-braced low-wing cabin monoplane with the Kinner 160 h.p. engine, fully equipped, including special low

drag engine cowl, adjustable metal propeller and wheel pants. It had a stated top speed of 137½ m.p.h., cruising at 125 and landing at 55 m.p.h. with five-hour cruising range. A number of Playboys were purchased by the Bureau of Air Commerce. A new Kinner model was the Invader, a six-place, two-engine, low-wing cabin monoplane, powered with two supercharged Kinner C-7 engines.

Lambert Aircraft Corporation, Robertson, Mo., with its subsidiaries, Monocoupe Corporation, of Robertson, and Lambert Engine and Machine Company of Moline, Ill., continued to produce airplanes and engines, the latter described in the engine section of this chapter. At the beginning of 1936 Lambert was producing four different types of airplane. The Monocoupe 90-A was a two-place cabin monoplane



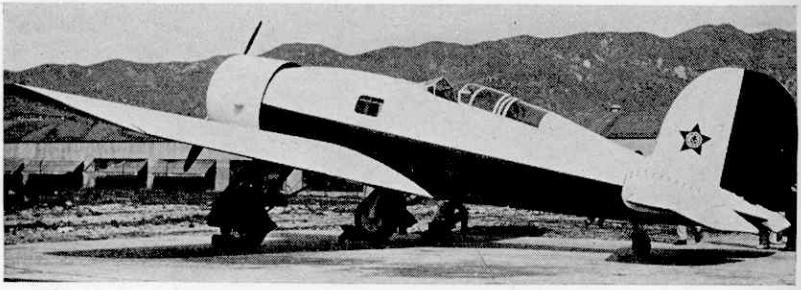
FLYING IN A LAMBERT MONOCOUPE DELUXE

This new model for the private owner is powered with a Lambert 90 h.p. motor. It carries two.

with the 90 h.p. Lambert R-266 engine, a gross weight of 1,610 pounds, stated high speed of 130 m.p.h., cruising at 115 and range 650 miles. To increase that model's comfort and visibility the cowling was changed from the tunnel cowling to a bumped-out N. A. C. A. type. Passenger seats were redesigned and spring cushions added. The landing gear was widened by 12 inches. A swivel tail wheel was developed to replace the shoe of the tail skid. The new Monoprep was designed for training, and was powered with the 90 h.p. Lambert engine. The new Monosport Model GC, also powered with the 90 h.p. Lambert engine, had a gross weight of 1,550 pounds, payload capacity of 260 pounds, a stated high speed of 135 m.p.h., cruising at 115 and range of 575 miles. The new Lambert Monocoach was to

be a four-place low-wing cabin monoplane with two 90 h.p. Lambert engines, with full electrical equipment, retractable landing gear, flaps and soundproofing. It was to have a stated high speed of 170 m.p.h., cruising at 145, range of 1,015 miles, gross weight 3,173 pounds and a payload capacity of 710 pounds.

Lockheed Aircraft Corporation, Burbank, Calif., continued to produce its single-engine Orion, Vega and Altair models, and delivered numbers of its high speed, all metal twin-engine Electra air liners in response to the growing demand for fast multi-engine transports. At the beginning of 1936 a large part of the Lockheed manufacturing facilities was being devoted to Electra transports, which were being used by Northwest Airlines, Braniff Airways, Delta Air Lines, Pan American Airways and Eastern Air Lines. The Eastern Air Lines system pioneered a new practice of providing express plane speed



A LOCKHEED ALTAIR MODEL
It is powered with a Pratt & Whitney Wasp S1D1.

on shorter routes feeding the long haul services. Eastern Air Lines had a fleet of Electras with Wright Whirlwind engines equipped with the new dynamic balancer. Northwest Airlines, Braniff Airways and Delta Air Lines used Electras powered with Pratt & Whitney Wasp Juniors, while Pan American's Electras were equipped with the senior Wasp models. A new development of the Lockheed air liner was the club model for private owners, of standard construction, luxurious, individual cabin appointments. Lounges, end tables, buffets, food cabinets, map cabinets, extra fuel tankage, writing desks, filing cabinets and radio facilities formed optional equipment for the private owners. When one purchaser desired his Lockheed Electra to be painted an opalescent green the company finished the entire interior in green leather, and then added an electric stove and electric refrigerator. The Lockheed models in production at the beginning of 1936 were specifically described as follows: Electra 10A, 400 h.p. Wasp

Junior engines, 458.3 square feet wing area, gross weight of 9,750 pounds, stated high speed 210 m.p.h., cruising at 195 m.p.h. with cruising radius of 850 miles; Electra 10B, 440 h.p. Whirlwind engines, stated high speed of 200 m.p.h., cruising at 186 m.p.h., with range of 800 miles; Electra 10C, Wasp engines of 450 h.p., gross weight of 10,300 pounds, stated high speed of 205 m.p.h., cruising at 193 with range of 950 miles; Orion 9D, 550 h.p. Wasp engine, with wing area of 294.1 square feet, gross weight of 5,800 pounds, stated high speed of 225 m.p.h., cruising at 205 m.p.h. with range of 720 miles; Altair 8E, with 550 h.p. Wasp engine, gross weight of 5,800 pounds, stated high speed 220 m.p.h., cruising at 205 with range of 1,150 miles; Vega 5C, with 450 Wasp engine, gross weight 4,750 pounds, stated high speed 190 m.p.h., cruising at 180 m.p.h. with range of 660 miles.

A new Lockheed product of 1936 was the Lockheed 12, an eight-place, twin-engine transport, with a wing span of 49 feet six inches, length of 36 feet four inches and accommodations for two pilots and six passengers. It was offered with four different models of engines, for air line, feeder line or private owner operations.

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., was carrying out a threefold program at the beginning of 1936; one, completing an order of Model 139 bombers for the Army Air Corps; two, delivering Martin transocean flying boats to Pan American Airways; three, developing a new bomber for the Army Air Corps. The first of the experimental bombers had a wing spread of about 76 feet, a gross weight of about 10 tons, including full military load, the exact details of which are Army secrets. It was assumed to have a speed of at least

250 m.p.h., that being Air Corps requirements for all its new bombers. A new high lift arrangement on the monoplane wing was said to contribute to its high performance in combination with other advanced aerodynamic features. It was powered by two Wright Cyclone engines of 800 h.p. each, geared and supercharged, and streamlined into the wing. It carried a crew of four or five men, Sperry gyropilot, two-way radio, a new radio homing compass, complete enclosures for both front and rear cockpits, three machine guns covering all angles of approach and a special bomb rack. Sleeping accommodations, heated cockpits and a lavatory were provided for the crew, among the military devices calculated to permit long-range flights in all kinds of weather at great heights. In general appearance the new bomber resembled the older Model 139. The three Martin flying boats developed for Pan American Airways had a stated high speed of 180 m.p.h., cruising at 157 m.p.h. with range of 4,000 miles as a mail transport and 3,000 miles as a passenger and mail transport. Their power plant included four geared and supercharged Pratt & Whitney twin-row Wasp engines of 800 h.p. each with Hamilton Standard constant speed propellers. Their gross weight was 25½ tons each, useful load for ocean service 22,784 pounds, wing span 130 feet and overall length 89½ feet. The first of the three ships to enter the Pan American service was named the "China Clipper." It pioneered the transpacific route late in 1935. Other Martin developments included successful application of the new Fowler-type flap, improved corrosion-preventing compounds and processes and advanced methods of building stressed skin structure with integral fuel tanks.

North American Aviation, Inc., New York, through its engineering and manufacturing division, successor to General Aviation Manufacturing Corporation and B/J Aircraft Corporation, was designing and developing military aircraft at the beginning of 1936. The plant at Dundalk, Md., was working on a U. S. Navy contract for floats for new Navy scout planes. A new factory with 150,000 square feet of floor space was opened in Inglewood, Calif., and there the company was constructing basic training machines for the Army Air Corps. The basic trainer was known as Model NA-16. It was a low-wing cantilever monoplane of all metal construction, except for fabric-covered control surfaces, metal tubing fuselage with removable fabric side panels for accessibility in servicing. It was powered with a Wright Cyclone engine, the distinctive feature being that the entire power plant was removable, permitting a complete change from fire wall in 40 minutes. The wing area of the trainer was 248.15 square feet. It had a stated top speed of 186 m.p.h., landing with flaps at 61 m.p.h. The NA-18 fighter was produced for export. Of the same

general design as the basic trainer it was powered with a Pratt & Whitney Wasp S1D1 engine and had a stated high speed of 210 m.p.h. at 5,000 feet.

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 1936. 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

THE TEXACO EXECUTIVE PLANE

A Cyclone-powered Northrop Gamma flown by officials of the Texas Company.

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 Antarc-

tic 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 1936 the Northrop company had a number of orders from the export field; and was beginning work on production orders aggregating more than 200 all metal, low-wing attack planes for the Air Corps.

The Pitcairn Autogiro Company, Willow Grove, Pa., delivered to the Air Corps a Model YG-2 direct control type autogiro, a two-place machine with a rotor span of 50 feet, stated high speed of 150 m.p.h., cruising at 125 m.p.h., and with a range of 350 miles. A Navy autogiro, the XOP-2, was of similar basic design and performance; and was equipped with flotation gear.

Rearwin Airplanes, Inc., Kansas City, Mo., produced the Rearwin Speedster, a tandem two-place sport plane powered by either the 95 h.p. Cirrus or 125 h.p. Menasco engine. Another product was the Rearwin Sportster with LeBlond engine.

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. At the beginning of 1936 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. The company built and submitted a primary trainer for the Air Corps.

Seversky Aircraft Corporation, Farmingdale, N. Y., was in production on 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 1935 made an amphibion speed record. The new trainers were to be two-place low-wing monoplanes powered with Wright Whirlwind engines.

Sikorsky Aircraft, Bridgeport, Conn., a division of United Aircraft Manufacturing Corporation, produced two different types of

PITCAIRN WINGLESS AUTOGIRO

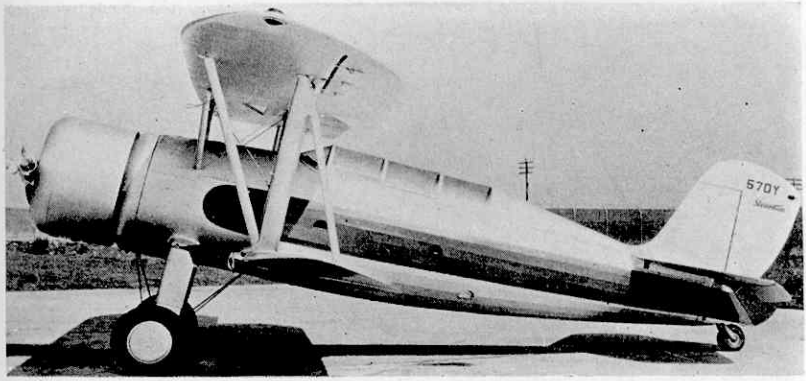
Model YG-2, with 420 horsepower Wright Whirlwind engine, in flight over Philadelphia. It was built for the Army Air Corps.

water flying transports in 1935, the S-42 and the S-43. At the beginning of 1936 it was completing its second order of S-42 ships for the Pan American Airways System, upon delivery of which the five units combined with the three of the first order were to make a total of eight S-42 and S-42A flying boats in the Pan American Airways service. The gross weight of the S-42A was increased by substituting 24 ST dural for the former 17 ST dural, giving a gross weight of 40,000 pounds and adding 1,500 pounds to the payload, making a total payload capacity of 7,900 pounds. The wing span was increased four feet making 118 feet two inches between tips, wing area 1,340

square feet, length 67 feet eight inches, height 17 feet four inches. With four Pratt & Whitney E Hornet engines supercharged to deliver 750 h.p. each at 7,000 feet and Hamilton Standard constant speed propellers, the S-42A had a stated top speed of 190 m.p.h. at 7,000 feet with 40,000 pounds gross weight, cruising speed at 12,000 feet on 70 per cent of power of 170 m.p.h., with range of 1,200 miles carrying crew of five, 32 passengers and full cargo. When equipped for transocean mail service with a cargo load of 1,000 pounds the S-42A could fly non-stop 3,000 miles cruising at 12,000 feet. The new wing loading of 29.9 and increased power loading of 13.33 pounds per BHP contributed to exceptionally smooth flying for the occupants in rough air. Special soundproofing of rubberized, sterilized, vermin-proof animal hair reduced the decibel rating to 70 in the passenger compartment, permitting normal conversation. The first S-43 amphibion was produced for the Inter-Island Airways of Hawaii. It was powered with two Pratt & Whitney Hornet engines with Hamilton Standard propellers. It had accommodations for 15 passengers, crew of three and a baggage and cargo capacity of 1,050 pounds, with a range of 603 miles under those load conditions. Its gross weight was 19,000 pounds, useful load 6,430 pounds as an amphibion or 7,530 pounds as a seaplane. The hull was 50 feet two inches long, the wing span 86 feet. It had a stated top speed of 194 m.p.h., cruising at 169 m.p.h.

The Stearman Aircraft Company, Wichita, Kan., a subsidiary of the Boeing Airplane Company, was designing and constructing training planes for the air forces at the beginning of 1936. The Army Air Corps and Navy Bureau of Aeronautics ordered 46 planes in 1935, the Army order being for 26 primary trainers known as Model 75 and the Navy contract for 20 Model 73 trainers. The models were identical except for finish and minor installations. The Navy trainer with 220 h.p. Wright Whirlwind engine had a stated high speed of 125 m.p.h. with service ceiling of 14,000 feet. The Army trainer was equipped with the 225 h.p. Whirlwind and its performance was secret. Both models were of metal, wood and fabric construction, fuselage of welded steel tube frame, fabric covered, wings of laminated spruce spars, spruce ribs and aluminum alloy channel drag struts, all fabric covered. Full cantilever landing gear, oleo-equipped was used. An expeditionary or advanced trainer was developed from the above models and offered by the Stearman company in both the domestic and export markets. It was suitable for use for training purposes or as a scout, observation or light bombing biplane. It was designed for any of these four engines, Wright Whirlwind 320 or 420 h.p., Pratt & Whitney Wasp Junior supercharged 400 h.p. or 420 h.p.

Provision was made for installation of two 30-cal. wing-type machine guns, one flexible machine gun and one bomb rack, with camera equipment in the rear cockpit. That plane had a wing span of 32 feet two inches, height nine feet four inches, length 25 feet, weight empty 2,104 pounds and gross weight 3,310 pounds. With a 420 h.p. engine it had a stated top speed of 164 miles an hour, service ceiling of 21,000 feet and range of 2.65 hours. Model 73 or 75 could be equipped with single or twin floats and Model 76 with twin floats. The engine installation and mount could be removed as a unit. The Stearman Company was completing an order of primary training machines for the Philippine Constabulary and an order for 10 advanced trainers for the Argentine Government.

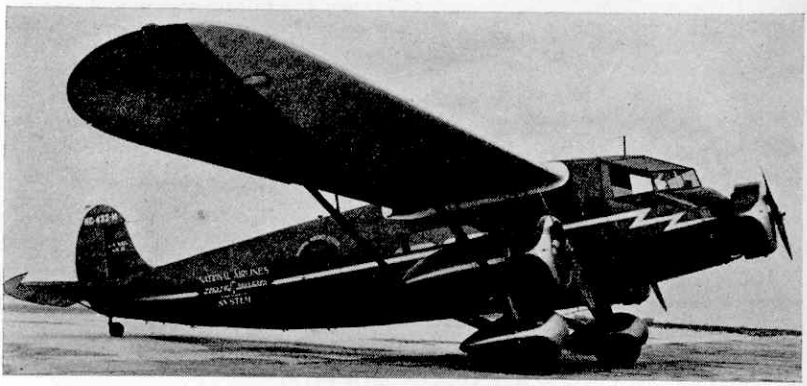



STEARMAN MODEL 81

A two-place, long distance basic training plane convertible for air mail or military service, powered by a Wasp Junior.

Stinson Aircraft Corporation, Wayne, Mich., a division of the Aviation Manufacturing Corporation, produced three different types of airplanes, the tri-motored Model A, the Reliant, represented by Models SR6-A and SR6-B, and the PT. The Model A, first produced in 1933, was an eight-passenger transport low-wing monoplane with the third engine in the nose of the ship. It was also produced as an executive or private air yacht such as the model purchased by R. J. Reynolds, Jr., of Winston-Salem, N. C. Model A was equipped with three Lycoming R-680-5 aircooled engines, each with Lycoming-Smith controllable pitch propeller. Its wing area was 500 square feet, gross weight 10,100 pounds, payload capacity 1,860 pounds, stated high speed 180 m.p.h., cruising at 163, service ceiling 17,000 feet and cruising radius 500 miles. Automatic retracting landing gear,

flaps and latest navigational equipment were standard. The wing measured 60 feet between tips, the cabin was 36 feet 10 inches long and the height 12 feet nine inches. At the beginning of 1936 Stinson Model A transports were in service on American Airlines, Central Airlines and Delta Air Lines. The Reliant models were Stinson's "transport planes for private owners." They were high-wing monoplanes with a span of 41 feet, length 26 feet 10 inches, wing area 230 feet and places for four passengers including pilot. The SR6-A was equipped with the 245 h.p. Lycoming R-680-4 engine, Lycoming-Smith controllable pitch propeller, with a gross weight of 3,325 pounds, a payload capacity of 745 pounds, stated high speed of 138 m.p.h., cruising at 129 and range of 375 miles. The SR6-B had the 260 h.p. Lycoming R-680-5 engine with Lycoming-Smith control-



A NATIONAL AIRLINES STINSON

One of the transports in regular service, powered by three Lycoming engines with Smith controllable pitch propellers.

lable propeller, a gross weight of 3,550 pounds, payload capacity of 842 pounds, stated high speed of 142 m.p.h., cruising at 133 m.p.h. and range of 500 miles. Safety glass, controls built into the instrument panel thus giving more leg room for the pilot, and a total overhead operating cost of about nine cents a mile were important features of the Reliant models. Stinson's PT pursuit trainer was designed to meet the training requirements of modern air forces and the first line needs of air forces under certain conditions. It could be used as a secondary trainer when equipped with retractable landing gear and controllable propeller or as a primary trainer with fixed gear and propeller. The PT was equipped with the 260 h.p. Lycoming R-680-5 engine, had a wing area of 223 square feet, gross weight of 2,740

pounds, useful load 780 pounds, a stated high speed of 160 m.p.h. and landing speed of 49 m.p.h. Early in 1936 Stinson announced its new Model B, a two-engine, low-wing, six-place transport powered by two 260 h.p. Lycoming R-680-5 engines. It had a wing span of 52 feet six inches, length 31 feet eight inches, height 10 feet six inches and an estimated cruising speed of 160 m.p.h.

Taylor Aircraft Company, Bradford, Pa., was producing three models, two-place light monoplanes with convertible cabins, the Cub E-2, the Cub F-2 and Cub H-2, powered with Continental A-40-2, Aeromarine AR3-40 and Szekely 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

CLOSE-UP OF MARINE CORPS VOUGHT

One of the Wasp-powered Corsairs used by the "Ace of Spades" squadron, U. S. Marine Corps.

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. The H-2 with its 40 h.p. Szekely engine had a cruising range of 225 miles.

Chance Vought Aircraft, East Hartford, Conn., a division of United Aircraft Manufacturing Corporation, reported at the begin-

ning of 1936 that it had produced more than 1,000 planes of the Corsair type, a majority delivered to the U. S. Navy and others to Argentina, Brazil, Cuba, China, Great Britain, Japan, Mexico, Peru, San Domingo and Siam. Vought produced two distinct types for the U. S. Navy in 1935 one the O3U-6 being a further development of the basic Corsair type of two-seater observation biplane. The O3U-6 with Pratt & Whitney Wasp engine was equipped, for the first time in a service type plane, with the new adjustable cowl flaps developed by United Aircraft's technical staff and designed to develop increased speed and use full power in climbing without overheating the engine. Deliveries of the O3U-6 were assigned to the U. S. Marine Corps, and were convertible as carrier-deck, land planes or seaplanes. Representing a distinct departure from conventional Corsair design was the second production model of the year, the SBU-1, a two-seat scout-bomber for carrier-deck operations, all metal structure with fabric covering and equipped with flaps on the lower wings. The power plant of the SBU-1 was a 700 h.p. Pratt & Whitney geared Twin Wasp Junior, with the new flapped N. A. C. A. cowl and a two-blade Hamilton Standard controllable pitch propeller. Two new types were under experimental development for the Navy at the beginning of 1936. Chance Vought also continued to produce the V-80, V-90 and V-100 Corsair series. The V-80 single-seat and V-90 two-seat were convertible as land or seaplanes and could be powered with any one of several engines. They were adaptable to relatively small air forces, the two models together possessing a high degree of tactical flexibility at moderate cost. The Corsair Junior was designed to fill the requirements for a light military plane as well as all primary and advanced training operations; and was similar in design to the basic Corsair type, simplified by low initial cost and maintenance.

Waco Aircraft Company, Troy, O., at the beginning of 1936 reported Waco planes flying in military or commercial service in 28 countries abroad, that export trade representing 25 per cent of the company's total annual production. Sales for 1935 had represented the greatest number of planes since 1930 and the greatest dollar volume since 1929, the business being about equally divided between sportsman pilot, industrial and commercial firms in other lines using aircraft for executive, sales and advertising travel. In line with its general design policy Waco introduced the new four-place cabin known as the custom series, a biplane with larger interior than preceding models, an increase in upper wing area and a decrease in lower wing area. New control features included flaps and a tab on the left aileron to permit correcting for wing heaviness in flight. Streamlined fairing included all interplane struts. The Waco Custom Cabin model

with Jacobs 225 h.p. or Wright Whirlwind 240 h.p. had stated cruising speeds of 140 and 148 m.p.h. respectively, 160 and 168 top speed, wing span of 35 feet, length 25½ feet, gross weight 3,100 pounds, with Jacobs, useful load 1,181 pounds and range of 500 miles. More rounded fuselages, wider front seats and roomier cockpits featured the Waco F-3 series, newly designated the F-5 and offered with Jacobs, Continental or Wright Whirlwind. Model D was also produced in 1935, with Wright Whirlwind nine and seven cylinders and with the Pratt & Whitney Wasp Junior. The earlier series cabin was sold at a substantial reduction in price in its modified form with a selection of Continental, Jacobs or Wright engines.

Waldo D. Waterman, Los Angeles, Calif., early in 1935 received

A WACO CUSTOM SERIES CABIN PLANE

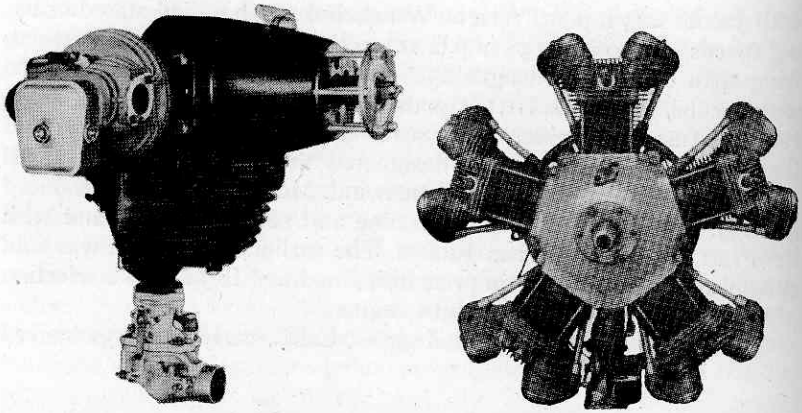
It may be powered with a Continental, Jacobs or Wright Whirlwind engine.

a contract from the Bureau of Air Commerce to construct a tailless airplane in accordance with his designs submitted some months previously.

### Engine Manufacturers

Aeronautical Corporation of America, Cincinnati, O., was producing its improved engine under the name of E-113C, with A.T.C. No. 71, 36 h.p., similar to the E-113B except for a new type plain bearing used on the crankpins. The bearings were made in a shell that they might be replaced. They had a cadmium, silver and copper lining with a thick steel backing.

Allison Engineering Company, Indianapolis, Ind., a division of

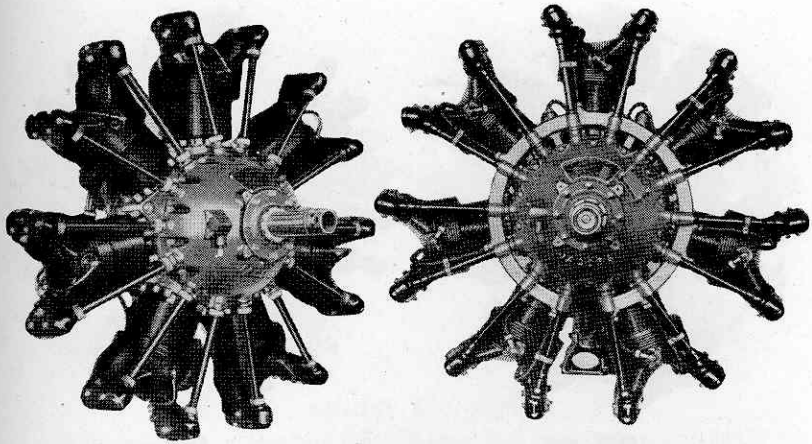


AERONCA AND LAMBERT ENGINES

Aeronca E113-C, 36 horsepower (left); Lambert R-266, 90 horsepower (right).

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 during the year. The standard 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,

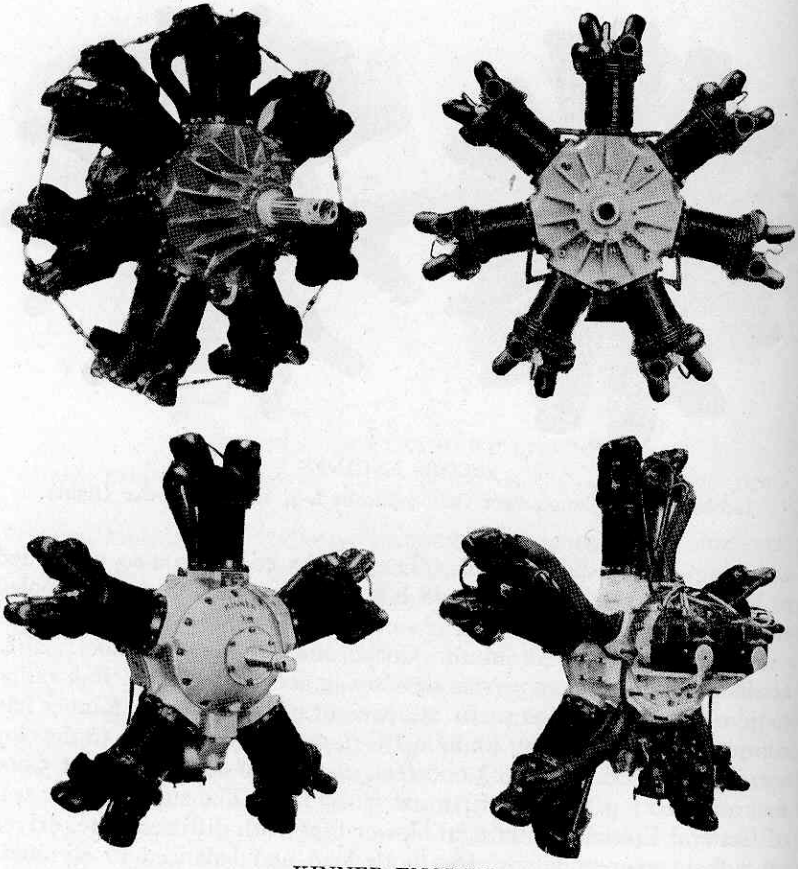


JACOBS ENGINES

Jacobs L-5, 285 horsepower (left); Jacobs L-4, 225 horsepower (right).

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.

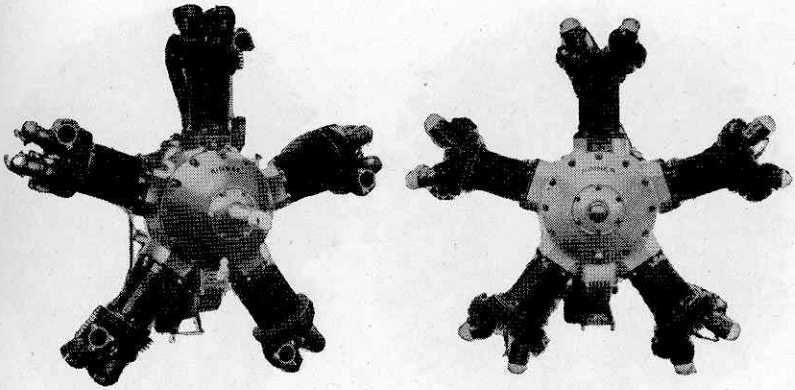
Kinner Airplane & Motor Corporation, Ltd., Glendale, Calif., at the beginning of 1936 was developing its new series 2 R-5 radial to give 160 h.p. at 1,850 r.p.m. at a weight of 315 pounds. Kinner had completed supercharging its model C-7, normally 300 h.p., to develop 350 h.p. at 1,800 r.p.m. at 5,000 feet, 420 h.p. at 2,200 r.p.m. at 5,000 feet and 460 h.p. at 2,400 r.p.m. at 5,000 feet. The supercharger was of General Electric centrifugal blower type with diffuser plate, driven by a train gear equalized for tooth load and balanced to eliminate radial load on impeller bearings, with springs to relieve stress on gear train. Auxiliary drives were provided for two magnetos, electric starter, electric generator, fuel pump, vacuum pump, two gun synchronizers and tachometer. Accessories were not run through the supercharger chamber but were driven from an extension of the crankshaft. Among other Kinner products were 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



KINNER ENGINES

Kinner SC-7, 370 horsepower (upper left); Kinner C-7, 300 horsepower (upper right); Kinner R-5, 160 horsepower (lower left); Kinner R-5, Series 2, 160 horsepower (lower right).

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 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. A new



KINNER ENGINES

Kinner K-5, 100 horsepower (left); Kinner B-5, 125 horsepower (right).

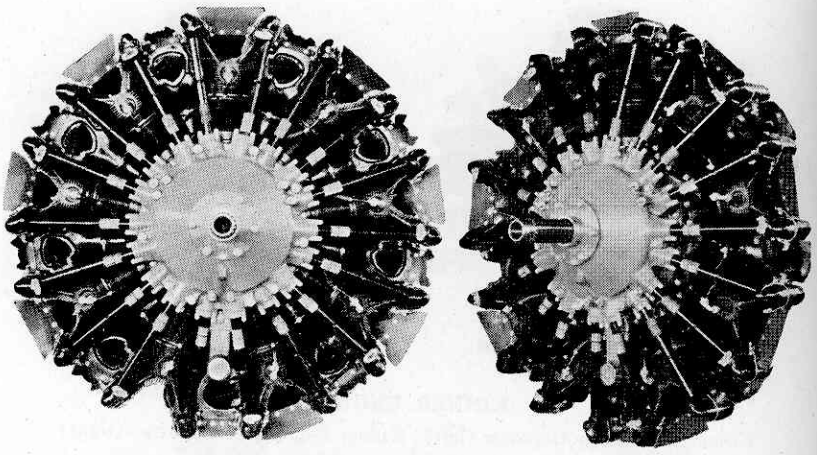
Kinner engine was the SC-7, a seven-cylinder radial aircooled motor developing 370 h.p. at 1,900 r.p.m. at 5,000 feet altitude. It weighed 650 pounds.

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 1936 covered a complete range from 200 to 260 h.p., from 2,000 r.p.m. to 2,300 r.p.m., the last being the R-680-5. 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.

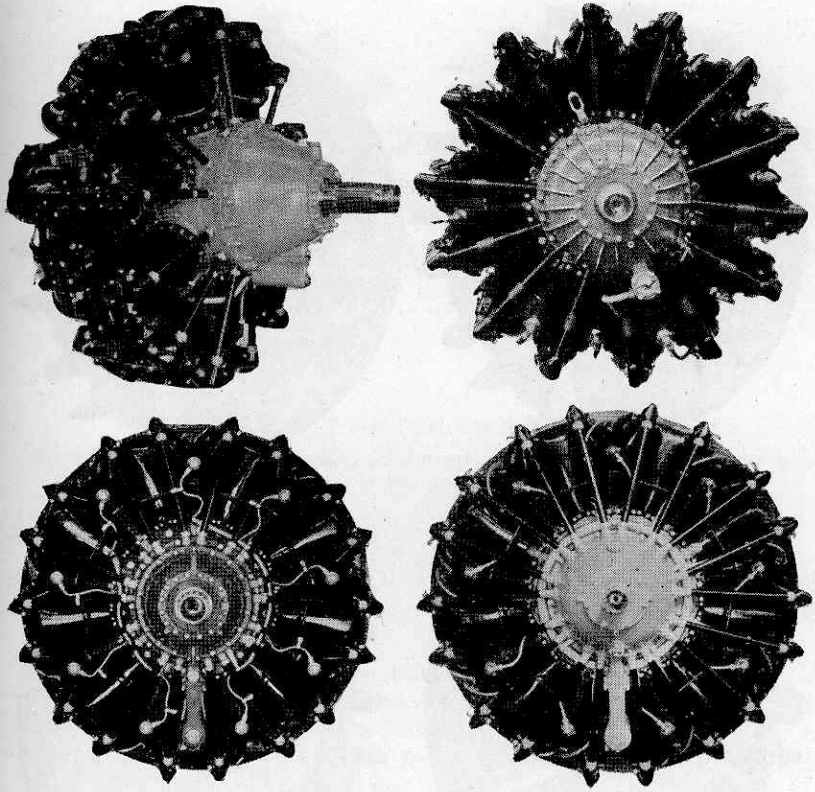
Pratt & Whitney Aircraft, East Hartford, Conn., a division of United Aircraft Manufacturing Corporation, in 1935 celebrated its tenth birthday with the announcement that it had produced more than



LYCOMING ENGINES

Lycoming R-680-4, 225 horsepower; R-680-6, 245 horsepower; R-680-2, 240 horsepower; R-680-5, 260 horsepower: Front view (left); Three-quarters front view (right).

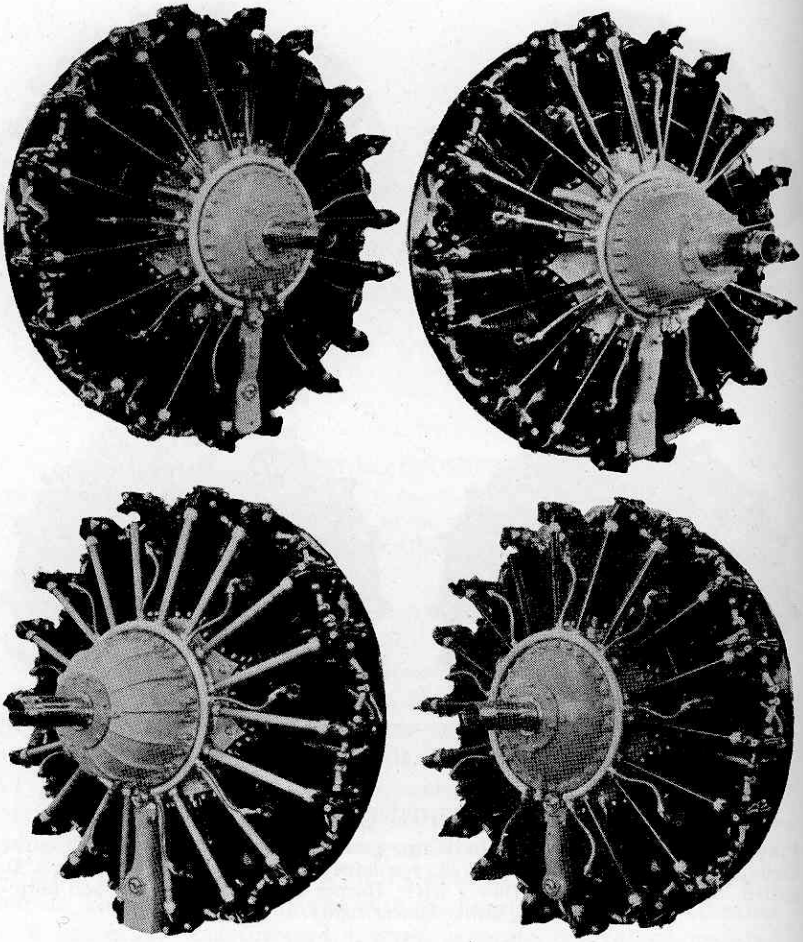
9,000 aircraft engines of the Wasp and Hornet types now used throughout the world. Two basic aircooled types were in production at the beginning of 1936, the single-row radials and the double-row radials originally developed for the air forces of the United States. They included the Twin Wasp Junior and Twin Wasp models. Both the single-row and double-row models with both direct drive and geared types available covered a wide power range for military and commercial aircraft. All the new engines except the Wasp Junior were equipped with full automatic valve gear lubrication and could be equipped with the new Pratt & Whitney automatic mixture and power control. That feature, combined with the Hamilton Standard constant speed propeller, was directed toward accurate control of cruising power and fuel consumption with maximum cruising performance at any selected altitude. In 1935 Pratt & Whitney adopted a new policy of indicating engine power by "cruising rating" rather than by the power available for limited periods, based on the fact that air line schedules are determined by cruising performance rather than maximum power. At the same time Pratt & Whitney engines were developed to meet the demand for high propeller thrust caused by the practice of high wing loading in airplane design. The Wasp Junior, Wasp and Hornet engines were nine-cylinder, aircooled and fixed radial types built up of cast aluminum head with integral valve mechanism housing, screwed and shrunk on a forged steel barrel having



PRATT & WHITNEY ENGINES

Pratt & Whitney Series B Twin Wasp, geared, 850 horsepower (upper left); Series B Twin Wasp Junior, geared, 750 horsepower (upper right); Hornet D, geared, 650-700 horsepower (lower left); Hornet D, direct drive, 625-700 horsepower (lower right).

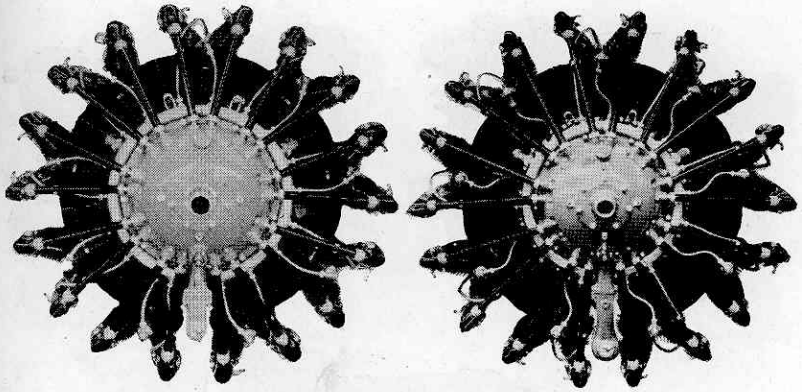
integral fins. Series H1 Wasp and E Hornet had an increased number of deeper fins for greater cooling and with individually removable baffles for uniform air distribution under severe flight conditions, oil-tight rocker box covers, exhaust ports with stainless steel liners and steel exhaust. The Wasp H1 and E Hornets had split-in type pistons with 31 splines. The geared drive types had roller bearings supporting front end of the shaft in the anchor plate. The H Wasps and E Hornets had exceptionally strong exhaust valves, sodium-cooled and faced with stellite for longer life and a minimum of maintenance. All accessories were grouped in the rear. Supercharger models were of the built-in centrifugal types. The ignition included two Scintilla



PRATT & WHITNEY ENGINES

Pratt & Whitney E Hornet, direct drive, 525-700 horsepower (upper left); E Hornet, geared 750 horsepower, (upper right); H Wasp geared, 550 horsepower (lower left); H Wasp, direct drive, 550 horsepower (lower right).

magnetos each firing spark plugs on all nine cylinders independently, with radio shielding as standard equipment. The propeller reduction gearing was of the planetary type, with ratios of 3:2 and 4:3. The Pratt & Whitney Twin Wasp Junior and Twin Wasp engines were of the 14-cylinder, two-row aircooled fixed radial type, with reduction gear available in ratios of 3:2 and 4:3. The Wasp Junior B had a rated horsepower of 400, the Wasp H1 550 h.p., Wasp H1 (geared)



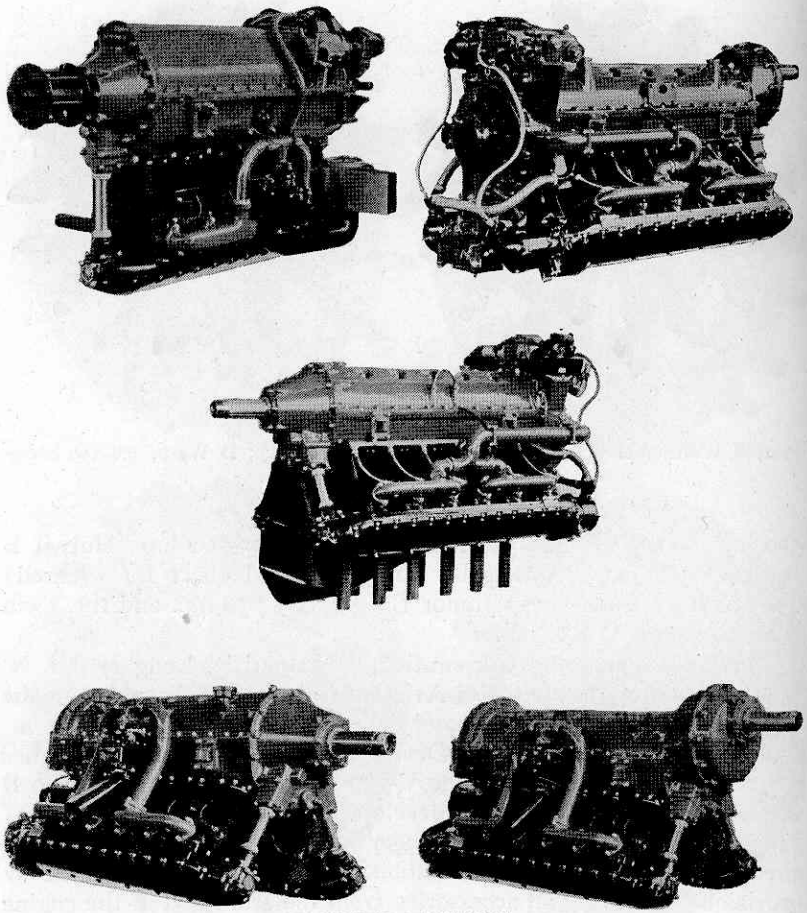
PRATT & WHITNEY ENGINES

Pratt & Whitney B Wasp Junior, 400 horsepower (left); D Wasp, 420-550 horsepower (right).

550 h.p., Wasp D1 420-550 h.p., Hornet E 525-700 h.p., Hornet E (geared) 750 h.p., Hornet D1 625-700 h.p., Hornet D1 (geared) 650-700 h.p., Twin Wasp Junior B (geared) 750 h.p. and the Twin Wasp B (geared) 850 h.p.

Ranger Engineering Corporation, Farmingdale, Long Island, N. Y., a division of the Fairchild Aviation Corporation, brought out the six-cylinder Ranger 6-390-B, and delivered 15 of that model for installation in the Fairchild 24. Development was continued on higher powered models, particularly the V-770-SG of 420 h.p. The 6-390-B was a refinement of the 6-390 developed in 1931. It had a rating of 145 h.p. at 2,250 r.p.m. All Ranger models were in-line, inverted, aircooled with automatic lubrication. They were distinguished by provision for driving all accessories from the front end of the engine rather than from the rear. At the beginning of 1936 Ranger was starting a quantity production program, with an increase of staff and plant facilities. Other Ranger models included V-770 direct drive, rated 290 h.p.; V-770-G geared drive, rated 320 h.p.; V-770-S supercharged, rated 350 h.p.; and the V-770-SG geared supercharged, rated at 420 h.p. with considerably increased horsepower for military use. All V models were inverted 60 degree type with 12 cylinders.

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

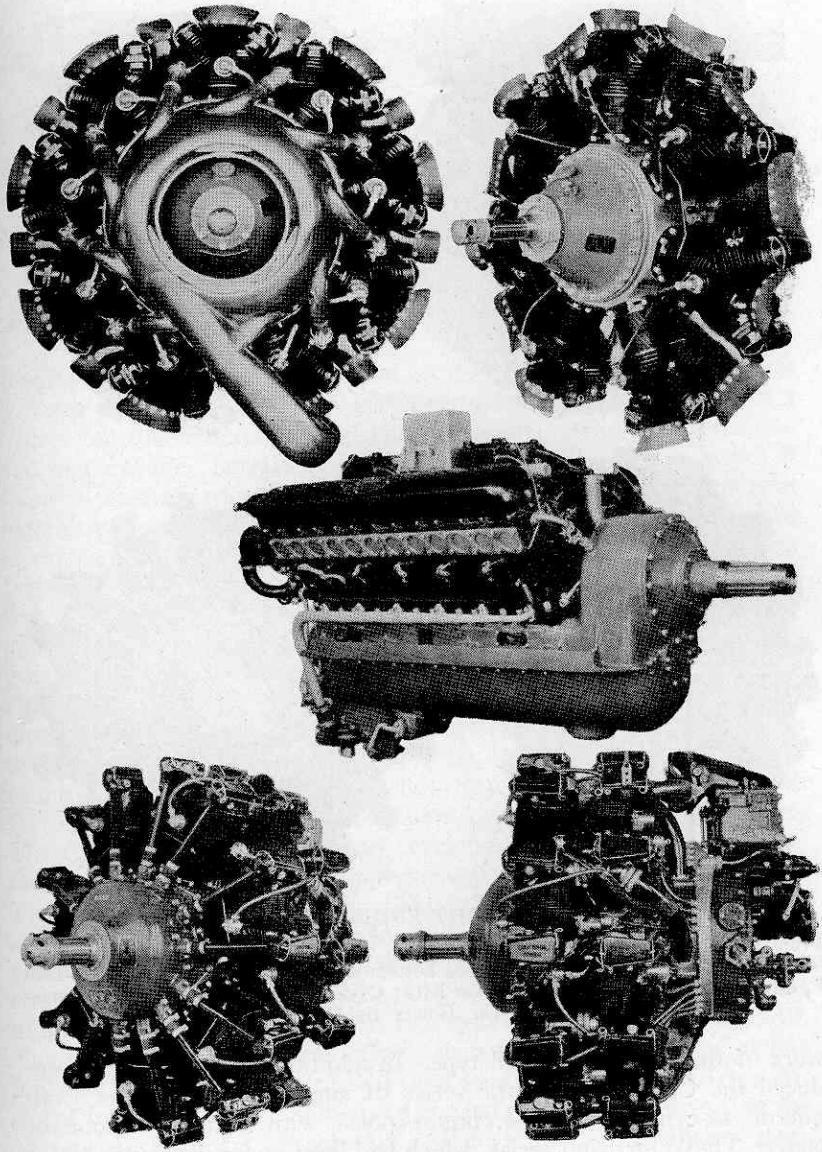


RANGER ENGINES

Model 6-390, 145 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).

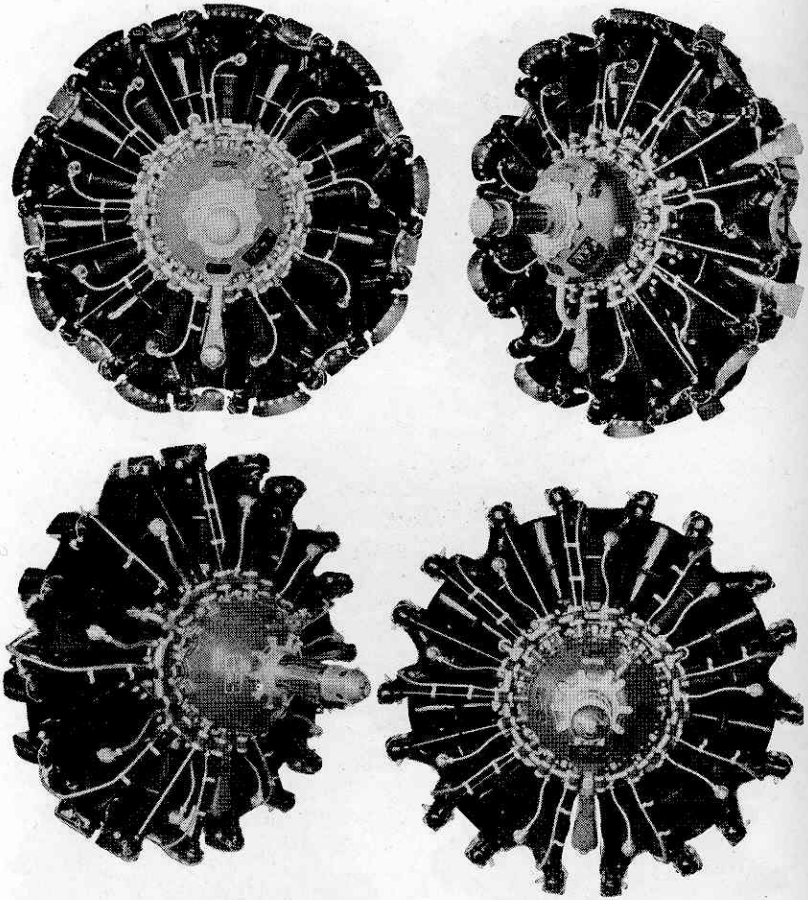
r.p.m. Warner also manufactured parts for the commercial airplane market.

Wright Aeronautical Corporation, Paterson, N. J., the aircraft engine division of the Curtiss-Wright Corporation, produced five distinct series of aircraft engines. They were the Whirlwind series of five, seven and nine cylinders; the Wright Cyclone F and F-50 series, the Wright Cyclone G series, high-powered nine-cylinder engines; and the 14-cylinder Wright double-row Whirlwind series. All four series



WRIGHT ENGINES

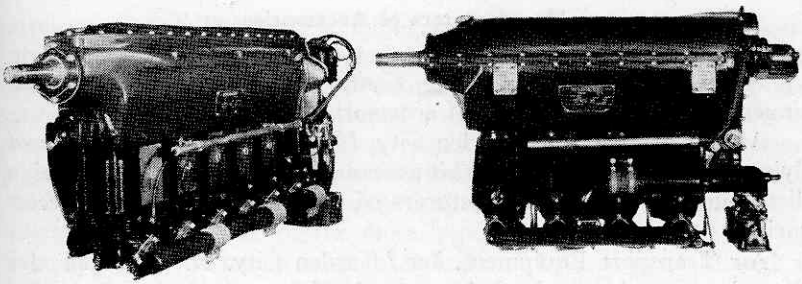
Front view of Wright Whirlwind R-975-E, 330-365-420-450 horsepower (upper left); Whirlwind R-760-E, 235-250-285-320 horsepower (upper right); Curtiss Geared Conqueror GV-1570, 705 horsepower, (center); Double-row Whirlwind R-1510, 715 horsepower (lower left); Side view of R-1510, (lower right).



WRIGHT ENGINES

Front view of Wright Cyclone R-1820 F-52, direct drive, 804 horsepower (upper left); Geared Cyclone R-1820 F-52, 804 horsepower (upper right); Cyclone R-1820 F, direct drive, 770 horsepower (lower left); Cyclone R-1820 F, geared, 750 horsepower (lower right).

were of the radial, aircooled type. In addition the corporation produced the Curtiss Conqueror series of engines including the Conqueror 12-cylinder, V-type, liquid-cooled with either Prestone or water. The Whirlwind series, which had been under development for 16 years, was produced in these models: five-cylinder 175 h.p. Whirlwind, seven-cylinder 235 h.p., 250 h.p., 285 h.p. and 320 h.p.; and the nine-cylinder Whirlwinds of 330 h.p., 365 h.p. and 440 h.p. The Whirlwind engines were refined to marked extent during 1935. New



MENASCO ENGINES

Menasco B6S Buccaneer, 160 horsepower (left); B4 Pirate, 95 horsepower (right).

features included the incorporation on the crank-shaft of the Wright dynamic damper, full pressure baffling, mechanism for operation of a hydro-controllable electric propeller, automatic valve gear lubrication and new cylinder barrels permitting regrinding twice. The series F Cyclone was refined and developed to produce high power outputs at high altitudes without increase in performance at sea level. The new Cyclones, designated as F-50 series engines, demonstrated many new features of design and construction, including the dynamic damper which promoted smooth operation, a new type of cylinder head with more closely spaced fins, controlled pressure lubrication of the valve gear and improvements in the supercharger section to augment high altitude performance. The series F-50 Cyclone was produced in three direct drive models and their 16:11 geared counterparts. These were the Cyclone R-1820-F52 rated at 775 h.p. at 5,800 feet with take-off rating of 820 h.p.; the Cyclone R-1820-F53, rated at 750 h.p. at 11,000 feet; and the Cyclone R-1820-F54 rated at 700 h.p. at 16,200 feet. The Cyclone G series was a late development, incorporating new cylinder construction and other improvements to increase its horsepower. The R-1820-G Cyclone was rated at 950 h.p. for take-off and 815 h.p. at 13,500 feet. The double-row Whirlwind, designed for military purposes, was developed into higher horsepower classes. It was of the two-row staggered radial type, 14 cylinders, with an overall diameter of 45 inches and rated 775 h.p. at 10,000 feet and 830 h.p. for take-off. The Curtiss Conqueror was offered as a geared engine rated at 625 h.p. and 675 h.p. Engines of that type were ordered by the Army Air Corps for installation in high-speed combat planes. The factory of the Wright Aeronautical Corporation at Paterson, N. J., comprised more than 650,000 square feet of floor space, including the foundry where all castings for the engines were constructed, being the only foundry in the world devoted exclusively to the manufacture of aluminum alloy castings for aircraft engines.

### 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.

Air Transport Equipment, Inc., Garden City, N. Y., supplied a line of accessories to the industry and private owners.

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.

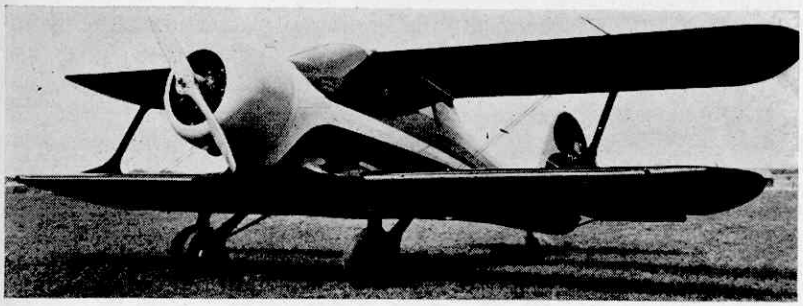
Aluminum Company of America, New York, continued to produce its line of aluminum and aluminum alloy materials for aircraft construction. Corrosion resistant and high strength alloys were distributed throughout the industry. Wider application of Alclad materials was developed, Alclad being highly corrosion 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 1935. Other advances noted at the beginning of 1936 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 Telephone and Telegraph Company, Inc., New York, 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 1936 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 1934 was placed in production in 1935, 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 1935 conducted considerable development work in the perfection of dopes to eliminate blush-



FRONT VIEW OF BEECHCRAFT B17L
It is powered with a Jacobs engine.

ing, 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. Large quantities of aircraft finishes were supplied to governments abroad.

The B. G. Corporation, New York, produced a new line of spark plugs for the latest aviation engines. They were made of special materials and were so constructed that they would maintain proper temperatures under all conditions. They were also characterized by

cooling fins as an aid in maintaining even temperatures and to eliminate electrode burning. That served to materially lengthen the periods between removals for cleaning and adjustment of the electrodes.

The E. K. Bishop Lumber Company, Aberdeen, Wash., continued to produce airplane spruce, which it supplied to leading aircraft factories in the United States and several other countries.

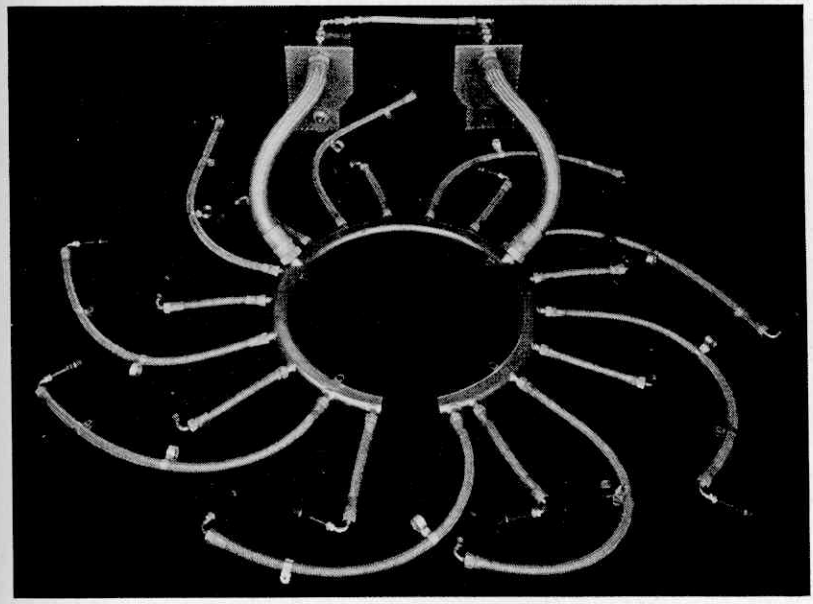
Breeze Corporations, Newark, N. J., produced aircraft parts and accessories for civil and military equipment, including radio ignition shielding, aeroflex fuel and oil lines, tie rods, ammunition rounds counters, elevator tab controls, flexible shafting and casing and flexible tubing. Breeze radio shielding was recognized as standard. It eliminated electrical interference from the ignition system to the radio set and also protected the entire ignition system against oil and moisture. The Breeze shielding conduit and fixtures saved the manufacturer the trouble of making special parts. The tie rods were designed to save time in installation. All Breeze products were used by the air forces, other Government departments and leading airplane and engine manufacturers.

Champion Spark Plug Company, Toledo, O., continued to produce its Aero M-3 mica aircraft spark plug, and introduced a new mica plug having an improved gap design and adjustment. It was known as the M-3-1, its improved gap being the four point type, providing a large area of sparking surface, longer life and longer period between spark plug checks. Champion Aero A and Aero 3A of the ceramic type and Aero RA and Aero 3RA, two shielded ceramic plugs, were also marketed.

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 1935 delivered Curtiss electric controllable pitch propellers for airplanes operating in the United States, South America and China. 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 sea-



BREEZE RADIO IGNITION SHIELDING
One of the valuable accessories in modern airplanes.

planes 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, was marketing 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,

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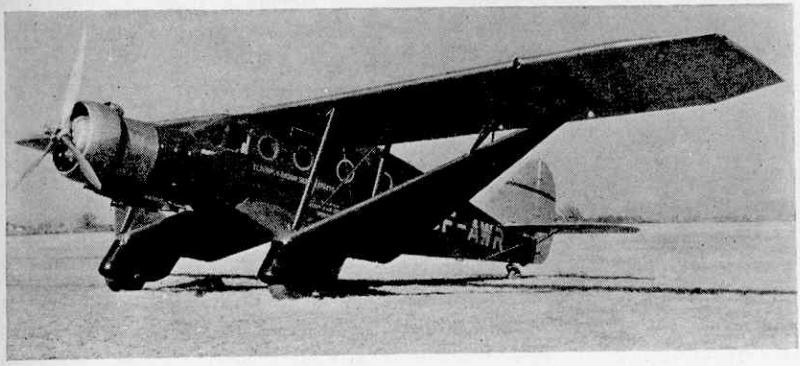
became standard airport equipment. The Eclipse vacuum instrument pump and Eclipse de-icer, the latter developed in cooperation with the B. F. Goodrich Company, were being produced and sold in greater volume. The Eclipse portable gasoline engine as an auxiliary power supply for aircraft was developed. 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 considerable progress in development of alternating current equipment, with apparent saving in weight and simplicity of electrical power supply installations. Eclipse had 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 increasing volume of business.

Edo Aircraft Corporation, College Point, N. Y., during 1935 equipped numerous large and small planes with all metal float gear in place of the standard wheel landing gear. More than 130 different types of aircraft had been equipped with Edo floats in nine years, varying from small single-seat sport planes to 14-passenger transports with a gross weight of 14,000 pounds and from single-seat pursuit ships to large twin-engine bombers. The 1935 Edo installations included the Martin YB-10 bomber, TWA Ford tri-motored transport, Bellanca Aircruiser and Senior Pacemaker, Beechcrafts, Wàco D fighter and Fairchild C-8-C. Edo maintained in stock at the beginning of 1936 a total of 10 different standard sizes of metal floats, while designs and jigs for floats to be installed on ships with gross weights of 8,000 pounds or more were ready for quick fabrication. Improved float design from the shallow, wide, flat-bottomed type to the deep, narrow type incorporating the fluted V bottom of 30 degrees was announced by Edo. The new design permitted smoother operation on rough water, less parasitic resistance, higher water and air speeds and improved streamlining. Edo also designed and produced a dolly for handling twin float seaplanes, adjustable for different sizes of ships appearing at the same marine air terminal, thus making it possible to use the same dolly on a variety of ships. The dolly could be removed from the seaplane while in the hangar. Edo Aircraft cooperated in the campaign of the Aeronautical Chamber of Commerce of America to develop marine air terminals in all waterfront communities.

The Egyptian Lacquer Manufacturing Company, New York, continued to supply the aircraft industry with its line of clear and pig-

mented dopes, solvents, thinners, lacquer enamels, undercoats and other finishes for fabric, metal and wood parts, including special grades made to Government and other specifications. New developments included refinements in technical points such as covering, ease of working qualities, durability and flexibility.

The Fairchild Aerial Camera Corporation, Woodside, Long Island, N. Y., a division of the Fairchild Aviation Corporation, expanded its organization and plant equipment during 1935, and added several navigating devices to its large line of instruments, including refinement and production of military and commercial cameras for all purposes. Its new navigating instruments included the Hagner position finder,



BELLANCA CARGO AIRCRUISER

Cyclone-powered freighter used in Canada.

for marine as well as aeronautical use, the Maxson navigation computer and the commercial models of the Kruesi radio compass, several hundred of which were delivered to the Army Air Corps in 1935. Fairchild developed the world's largest aerial camera, the Fairchild Tandem 10-Lens, for the specific purpose of minimizing the control work required in the course of the Rio Grande Survey in New Mexico for the Soil Conservation Service of the Department of Agriculture. The 10-lens camera consisted of two Fairchild T-3A five-lens cameras coordinated on a special high precision mount of aluminum alloy, highly machined and carefully heat-treated to assure accuracy. Simultaneous operation of the 10 electric-controlled shutters, so essential to the success of each shot, was achieved by means of a master electrical control operated manually by the photographer. One of the cameras was set at a 45-degree angle to the other so that the 10 photographs overlapped to form an octagonal composite measuring 32 by

32 inches. The tandem camera used 10 rolls of film, 1,200 feet, sufficient for 2,000 individual exposures or 200 composite photographs of 10 exposures each. The camera was capable of photographing an area of 760 square miles at one operation of the shutters from an altitude of 30,000 feet above sea level. At the beginning of 1936 the corporation was completing a giant nine-lens aerial camera for the U. S. Coast & Geodetic Survey. It was to be the world's largest composite camera. It was a single unit, exposure being made on one large film instead of on 10 separate films as was the case with the assembled two five-lens cameras. It was to have a focal length of eight inches, standing 38 inches high, with a maximum diameter of 38 inches and weight of 305 pounds when loaded with 200 feet of film. Fairchild also developed a self-contained vacuum back for holding aerial film absolutely flat in a camera, and further improved its Cyclops aerial camera. Fairchild cameras were used in 30 countries.

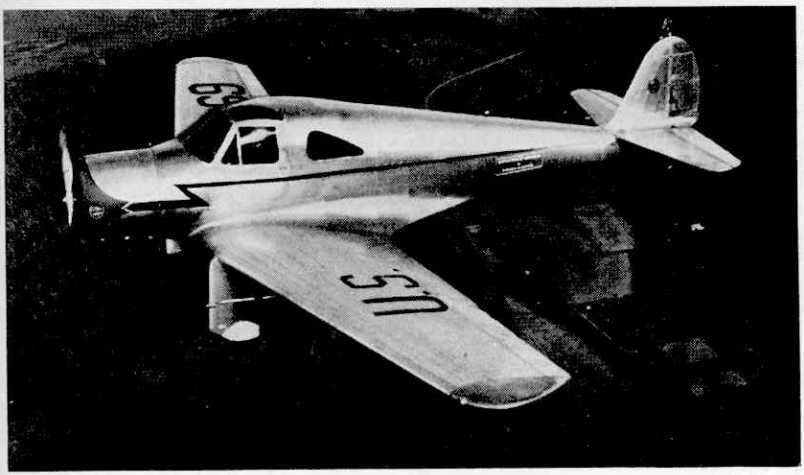
General Electric Company, Inc., Schenectady, N. Y., continued its development program on superchargers, its test set-up measuring the power required and the exact amount of pressure rise obtained from a gear-driven supercharger at various engine speeds. Development was also continued on different types 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 1935.

The B. F. Goodrich Company, Akron, O., developed new rubber products for aviation use, continued refinements in its aircraft tires, and at the beginning of 1936 was manufacturing 50 different things for the aeronautical industry. Working with transport line technicians Goodrich engineers improved the Goodrich de-icers, particularly in the method of fastening them to aircraft surfaces where ice forms during flight. Blind riveting, made possible by a special tool for inserting the rivets, took the place of the former cement process. The de-icers were more completely streamlined and the process of manufacturing generally improved in anticipation of numerous installations to be made on air liners during 1936. Abrasion shoes of rubber, known to actually outwear steel, were made available for stabilizers and other parts of aircraft to resist the action of wind, rain, sleet, sand, pebbles and cinders which otherwise would wear down duralumin and other structural materials used in plane construction. Goodrich also

developed new testing equipment for proving durability and shock absorbing characteristics of airplane tires. Other accessories included radiator hose, gasoline hose, refueling hose, Prestone-resisting hose, air speed indicator tubing, ventilator hose, pontoon man hole covers, spark plug safety nipples, rubber grommets, handle grips, shock absorber cord, airplane matting, push rod retainer rings, rubber cements for aircraft uses, acidseal paint, sheet rubber, sponge rubber, channel rubber and sealing strips, motor mounts and tires.

Goodyear Tire & Rubber Company, Akron, O., continued its development of airplane tires, tubes, wheels, brakes and brake controls



THE CURTISS-WRIGHT COUPE IN FLIGHT

This Lambert-powered light plane for private owners was developed for the Bureau of Air Commerce.

to meet the constantly changing requirements of the industry. With the tendency toward retractable landing gears, Goodyear airwheels for large contact area with extra low pressures were generally acceptable because they caused no more drag than other types. New tire sizes with corresponding wheels and brakes were developed. The Goodyear hydraulic disc type brakes were made available for other types of wheels and tires. A new pneumatic disc type brake was developed for large transports or military ships, permitting the machines to be pedal-controlled as easily as smaller planes. New metering valves were developed to meter the air in such a manner as to give the pilot the same feel from the brake pedal action where air brakes are used, as he would have if they were hydraulically controlled.

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 Propellers, East Hartford, Conn., a division of United Aircraft Manufacturing Corporation, reported that its two-position controllable pitch propellers were becoming standard equipment on many air lines in the United States and other countries. Licensees for the Hamilton Standard propellers included companies in England, France, Italy, Germany and Japan. The Hamilton Standard constant speed propeller added five pounds to the weight of the former two-position installation. The original controllable pitch screw was limited to two pitch positions, a low pitch for take-off and climb and a high pitch for cruising or high speed. In the constant speed propeller the early limitations to two positions were completely removed, and the propeller developed to a point where an infinite number of pitch positions were available, the optimum position being automatically selected for the pilot under all flight conditions. That automatic selection of the blade pitch was considered of utmost importance because continuous selecting of the optimum pitch setting by manual control would demand too much of the pilot's attention. Also, the constant speed control served to act 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 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.

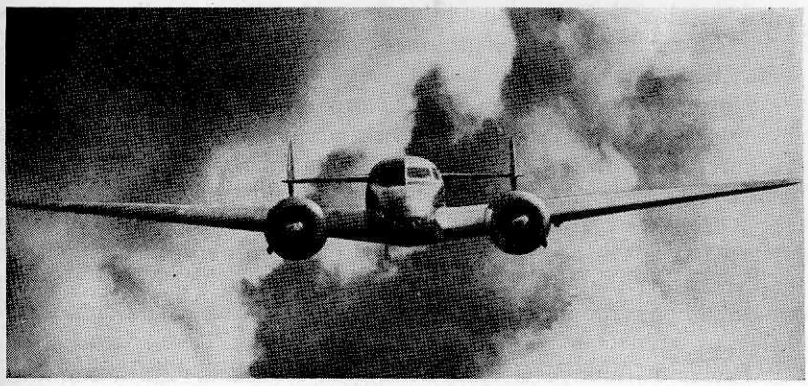
International Flare-Signal Company, Tippecanoe City, O., continued to market its complete line of parachute flares, each type approved by the Department of Commerce.

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, N. Y., continued to expand its plant facilities and personnel to keep pace with the growth of its Government, commercial and foreign business. Many improvements were made in the company's instruments, notably the

inclusion of full range temperature compensation in the Kollsman sensitive altimeter, and altitude and temperature compensation in its new low-lag vertical speed indicator, both of which were adopted as standard Air Corps equipment, as was a new magnetic compass produced by the company. Development work was continued on the Kollsman system of lighting instruments for night flying. New products included an accelerometer, a centrifugal tachometer of new design, an electrically heated Pitot static tube, an optical speed and drift indicator and a sensitive fuel level gauge having two pointers for greater sensitivity. New instruments were to be announced early in 1936.

Leece-Neville Company, Cleveland, O., supplied the industry with



STREAMLINING IN THE AIR

A Lockheed Electra 10A transport with two Pratt & Whitney Wasp Junior engines coming head on at 3½ miles a minute speed over southern California.

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 Aviation Manufacturing 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.

The Merrimac Chemical Company, Boston, Mass., in 1935, supplied the aircraft industry and the Government with its line of acetate fire resistant finishes, dopes, thinners, lacquers, surfacers, primers and synthetics.

Norma-Hoffmann Bearings Corporation, Stamford, Conn., brought out a number of new types and sizes of small ball bearings for aircraft control applications, also several new types of very small sensitive bearings for aircraft instruments. In response to a demand for increased range of types and sizes of bearings of the completely inclosed type the company increased its range of 7000 series up to and including the 50 m/m bore size, and established two new series of extra light type inch ball bearings to include single and double side shields.

Pacific Airmotive 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, N. Y., a subsidiary of Bendix Aviation Corporation, developed several new magnetic compasses and a universal compensator. The demand for electrically operated instruments was met by further development of the autosyn system, employing small autosyn synchronous motors transmitting any type of indication to the instrument board. The system was calculated to eliminate all capillaries and tubing. Besides indicating oil pressure, engine speed, manifold pressure and temperature, the system could be used to show position of flaps, wheels and other gear. Pioneer also manufactured a line of sensitive altimeters. The Pioneer octant was further developed, as was an optical drift meter to meet Air Corps

specifications. An improved heating element was devised for the electrically heated Pitot static tube. The Pioneer ring light was developed, giving adequate illumination without glare or light leakage, and it could be installed on all instruments. A new universal mechanism was developed to be used in standard altimeters, manifold gauges, airspeed indicators, suction and fuel level gauges.

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 1936, 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 aviation radio section at the beginning of 1936 was developing and improving radio apparatus to reduce the cost of radio communication equipment for air lines, airports and private owners. RCA airport radio traffic control apparatus was supplied to many leading airports in 1935. A new line of equipment for the private owner was produced in the forms of AVR-7 aircraft weather-entertainment receiver and AVR-7-A weather communications receiver and AVT-3-A transmitter. Multi-frequency air line point-to-point and ground-to-ship transmitter equipment was supplied to many air transport companies, including ship receivers types AVR-3 communications, AVR-2 weather and AVR-5 all wave ground station receiver. Crossed loop runway localizers forming an attachment to the standard AVT-1-A airport traffic control transmitter, superseding the AVT-1, were installed at Floyd Bennett Field, New York, and Cleveland Municipal Airport. The trend of the RCA development was to produce non-obsolescent equipment capable of use

with improved apparatus year after year. Among developments under way at the beginning of 1936 were equipment for applying facsimile transmitter apparatus to existing point-to-point circuits on the surface, thereby speeding up transmission of that traffic and placing it definitely in a secrecy band. That equipment was also intended to materially reduce interference caused by closely allied frequencies as well as to permit a reduction in personnel at certain outlying point-to-point stations. Modifications of the facsimile equipment were to be developed for mounting in aircraft, as a means of providing typed, written or drafted instructions directly to the pilot without any necessity for decoding.

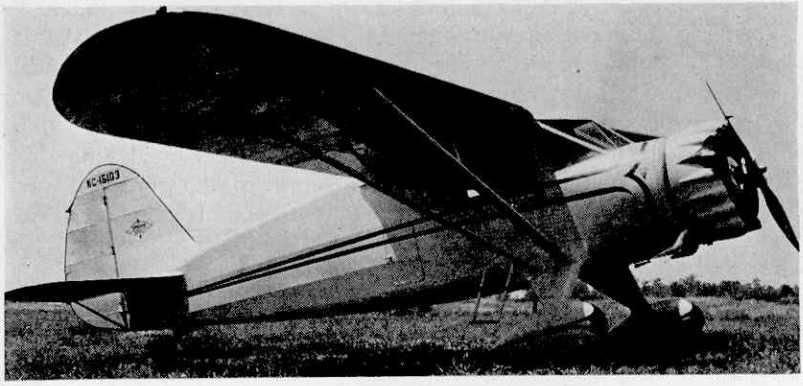
John A. Roebling's Sons Company, Trenton, N. J., continued to supply the industry with special control cables, welding wire and other wire rope accessories.

Scintilla Magneto Company, Inc., Sidney, N. Y., a subsidiary of Bendix Aviation Corporation, produced its magnetos for aircraft with rotating magnets, the coil, condenser and contact breaker being stationary. The latest types had pivotless contact breakers and coils encased in hard rubber to prevent their being affected by excessive moisture in tropical service. They generally operated for 300-hour periods without attention. Nearly all Scintilla magnetos were radio shielded to prevent ignition noises being heard in the radio receiver. Scintilla also produced a double magneto on one mounting, really two magnetos electrically. One drive shaft and magnet were used, but there were two coils and two breakers. Scintilla aircraft ignition switches were made in numerous combinations for one to four engines. Battery ignition equipment was supplied in a variety of forms for engines up to nine cylinders. Timers could be mounted directly on the engine for drive at one-half crankshaft speed or were available as replacement units for engines designed for magneto ignition.

Shell Petroleum Corporation, St. Louis, Mo., the Shell Oil Company in the west and Shell Eastern Petroleum Products, Inc., New York, in 1935 marketed three grades of aviation gasoline, including 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 six 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 con-

ventional 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 1936, 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 1935 were made with Shell aviation gasolines. Shell also produced a 100 octave leaded aviation gasoline and had under development fuels of still higher knock rating.

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



THE STINSON RELIANT

Carrying four passengers and a pilot this plane for the private owner was powered with a 245 h.p. Lycoming R-680-4 engine and a Lycoming-Smith controllable pitch propeller.

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 1935 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, N. Y., reported 500 of its gyropilots, sometimes referred to as the automatic pilot, either in use or on order at the beginning of 1936. It had proved amazingly valuable in combination with the radio compass, permitting an airplane to be set on a predetermined radio course and flown automatically directly toward the transmitting station. The Sperry gyropilot and connecting device developed by the Sperry company could be used with any radio homing equipment. Sperry also developed a new design of indication for the bank and climb unit of the gyropilot, providing a miniature airplane at the center of the climb indicator which might be observed in relation to the bar on the dial in the same manner as the gyro-horizon indication. The level flight control of the gyropilot compensating for changes in the center of gravity was made so sensitive that weight could be shifted in the plane without effect in flight. The gyro-horizon was further improved, the miniature plane on the dial being made adjustable to compensate for changes in fore and aft trim of the plane, raised or lowered as desired by turning a small knob on the face of the instrument. Sperry soundproofing was further developed in 1935. The Sikorsky S-42, S-42A and Martin 130 were among the big ocean flying craft soundproofed by Sperry, as were several European lines including Avio Linee of Italy. For soundproofing flying boats a material was developed which could be stripped from the walls of the plane to permit inspection of underlying surfaces and then replaced.

Stanavo Specification Board, Inc., New York, organized in 1929 by the Standard Oil companies of California, Indiana and New Jersey, continued its research and development work directed toward the progressive improvement of aviation fuels and lubricants. A new 100 octane fuel was developed and placed on the market during 1935, the result of special refining processes which made possible that high antiknock quality with a minimum quantity of lead. The new aviation gasoline, 100 octane, was named Stanavo Ethyl Gasoline 100. It was

supplied to the Army Air Corps for use in high-speed military planes, to engine manufacturers and air lines for special tests and to others for record flights and racing purposes. The increased power made possible by that fuel, as demonstrated by actual tests in Army planes, was from 25 to 33 per cent. The advantage gained in air transport operations, for take-off purposes, was clearly recognized. Nine grades of aviation fuels were marketed by the Stanavo distributors, including leaded and unleaded gasoline covering all kinds of aircraft operations.

AN AIRPLANE RADIO SET

This RCA aircraft radio was developed for private owners. It weighs only 38 pounds.

Five grades of aviation oil, ranging from 60 to 140 Salbolt viscosity, were made available to the industry, in addition to the regular line of rocker arm greases, two new rocker arm lubricants of 3,000 and 300 seconds viscosity respectively, and specialty products, including magneto oil, compass fluid and utility oil. The Board continued its policy of expanding its distribution facilities to include all points of aviation interest throughout the world, and a large majority of the important flights of the year were serviced by the Stanavo distributing system.

The Steel Products Engineering Company, Springfield, O., was among the active concerns supplying the industry with special machinery, tools and aircraft parts, including fuel level signal devices, automatic fuel valves and gasoline segregators which positively removed water and other impurities from the fuel supply.

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. An improved lubricant was to be marketed in 1936. The company operated a fleet of three planes.

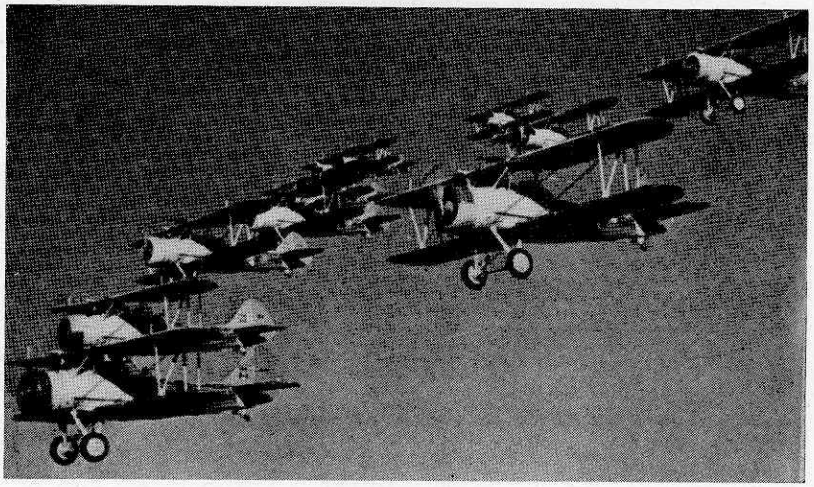
Thompson Products, Inc., Cleveland, O., produced for the aircraft engine trade valves of several types, including tungsten, cobalt-chrome and silchrome in both solid and hollow stem forms; also valve insert seats, piston pins and valve stem locks. The Thompson latest sodium-cooled valve had a hollow head as well as a hollow stem. It was made of TPA steel alloy, inlaid on seat and stem tip with Steelite. The sodium in the stem became liquid at 200 degrees, splashing and cooling the entire inside surface as the valve operated.

Thurston Cutting Corporation, New York, marketed its special line of Dartmouth Tex airplane fabric and other accessories.

The Vellumoid Company, Worcester, Mass., at the beginning of 1936 was marketing its new No. 170 Velvestos sheet, compressed asbestos material for use on magnesium or aluminum castings where corrosion is a factor. It also supplied the industry with various packing and gaskets for oil, gasoline, air and water application.

Western Electric Company, Inc., New York, provided the industry and private owners with radio communication facilities, including the new multi-channel dial selection 14-type radio transmitter with its associated, highly selective 11-type receiver. The equipment was designed by the Bell Telephone Laboratories. It embodied the unique feature of transmitting on 10 different frequencies, the shift from one to another being made automatically by a single twirl of the dial. Ten quartz crystals, one for each channel, maintained the carrier with .025 per cent of the assigned frequency. The transmitter delivered 400 watts of power and offered three types of transmission, voice, tone telegraphy and continuous wave telegraphy. On code the power was as high as 900 watts. The Western Electric system incorporating the multi-frequency 50-watt transmitter and associated superhe-

terodyne receiver, both using quartz crystal oscillators, was extended to new planes placed in service on several air lines. For the private plane the company introduced complete two-way communication equipment, a midget radio telephone receiver and transmitter, which enabled the private pilot to enjoy the same two-way voice communication as the transport systems. The receiver for the private owner weighed only 10¾ pounds and measured about 7¾ inches each way.



NEW CORSAIRS FOR THE MARINES

The U. S. Marine Corps received 32 of these Vought O3U-6 Wasp-powered Vought Corsairs in 1935.

# Aircraft and Engine Designs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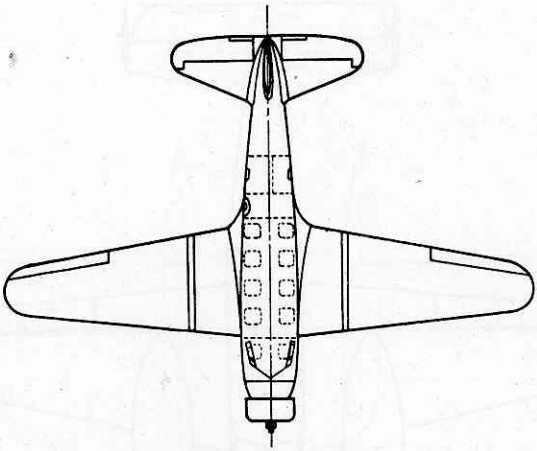
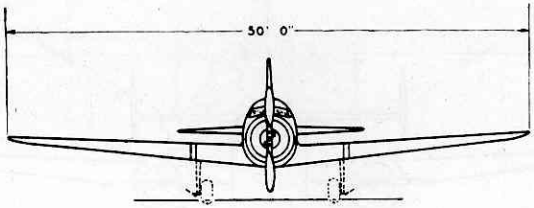
Passenger and Cargo Transport . . . . . 315

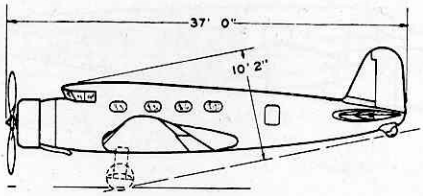
Private Operations and Aerial Service . . . . . 339

Military Aircraft . . . . . 373

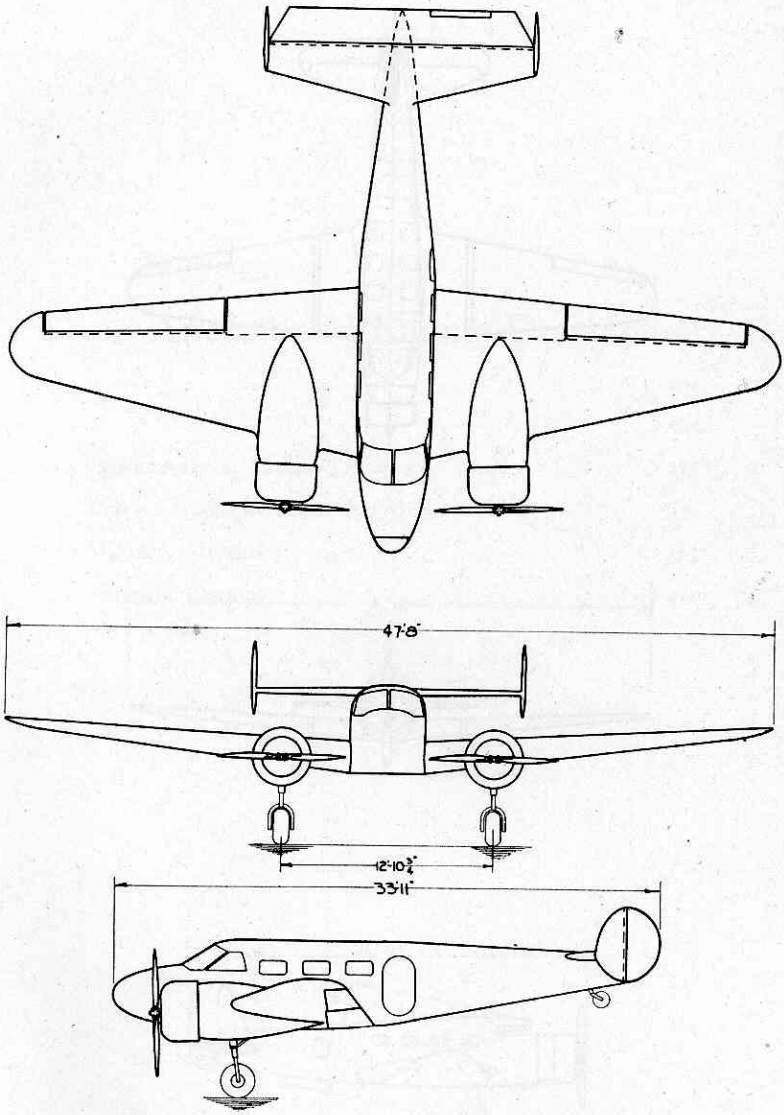
Aircraft Engines . . . . . 411



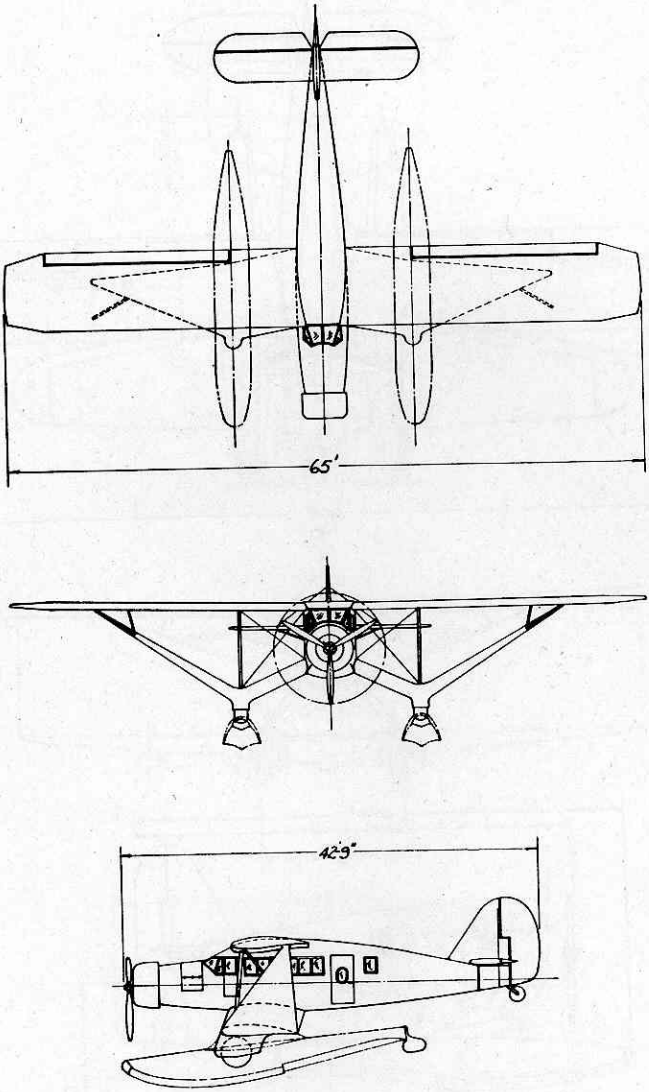


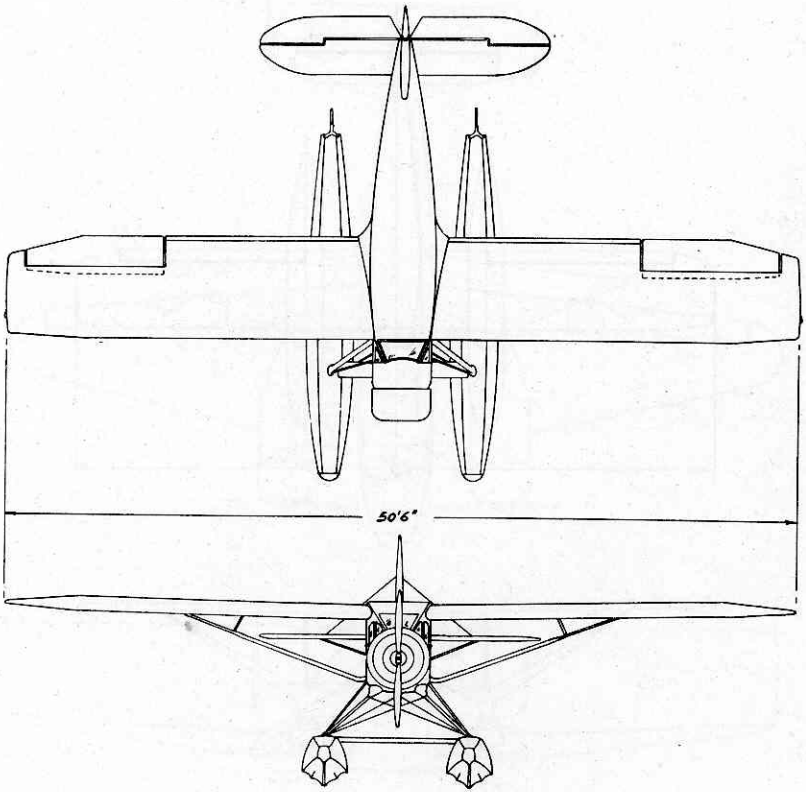

**AIRPLANE DEVELOPMENT CORPORATION**
Glendale, Calif.
MODEL V-1A —— 9-10 PLACE
ENGINE: WRIGHT CYCLONE

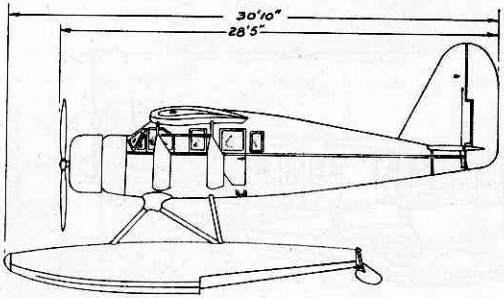



BEECH AIRCRAFT COMPANY
Wichita, Kans.
MODEL 18K —— 4-8 PLACE
ENGINES: TWO JACOBS L-5




BELLANCA AIRCRAFT CORPORATION
New Castle, Del.
AIRCRUISER CARGO—LAND OR SEAPLANE
ENGINE: PRATT & WHITNEY HORNET
WRIGHT CYCLONE



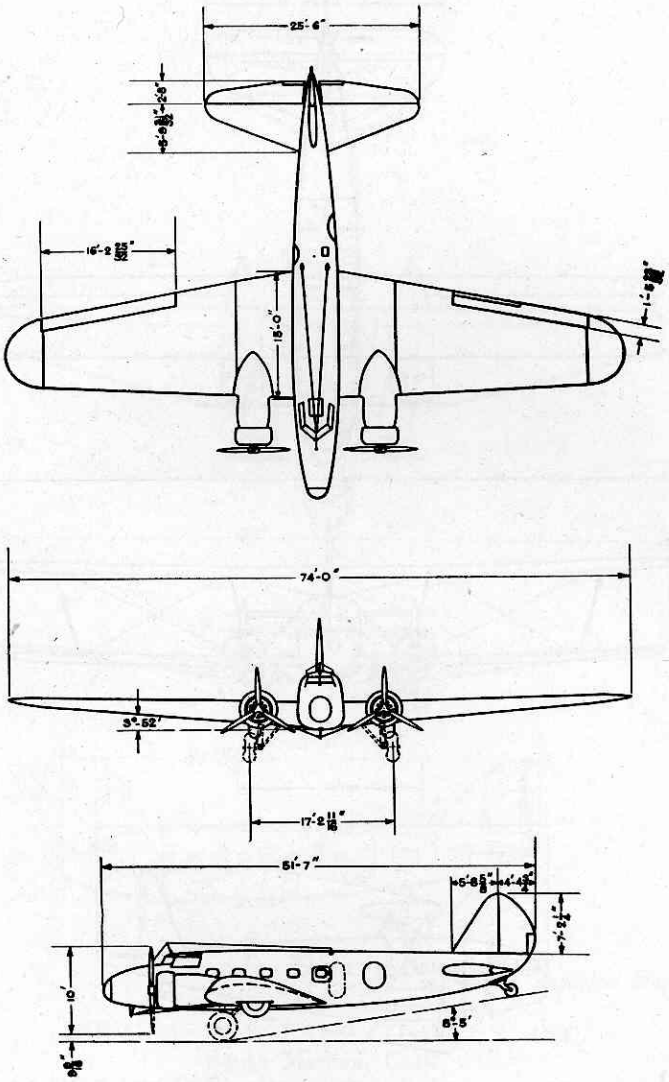




## BELLANCA AIRCRAFT CORPORATION

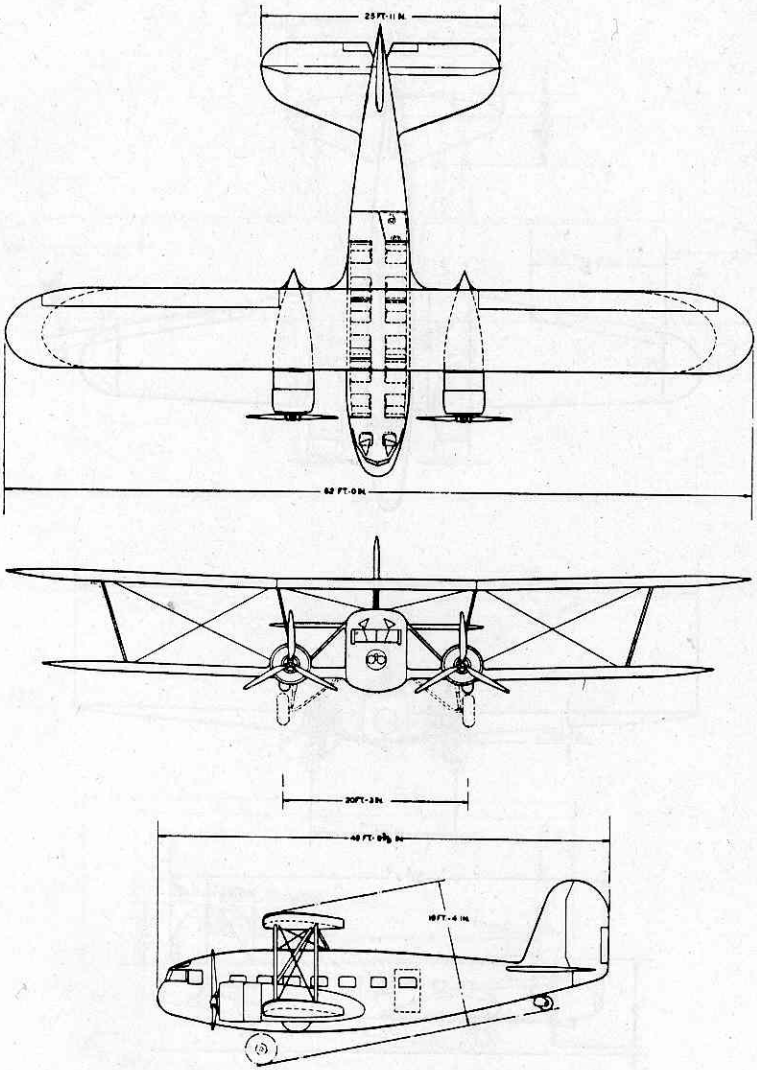
New Castle, Del.

SENIOR PACEMAKER —— FREIGHTER LANDPLANE OR SEAPLANE
SENIOR SKYROCKET

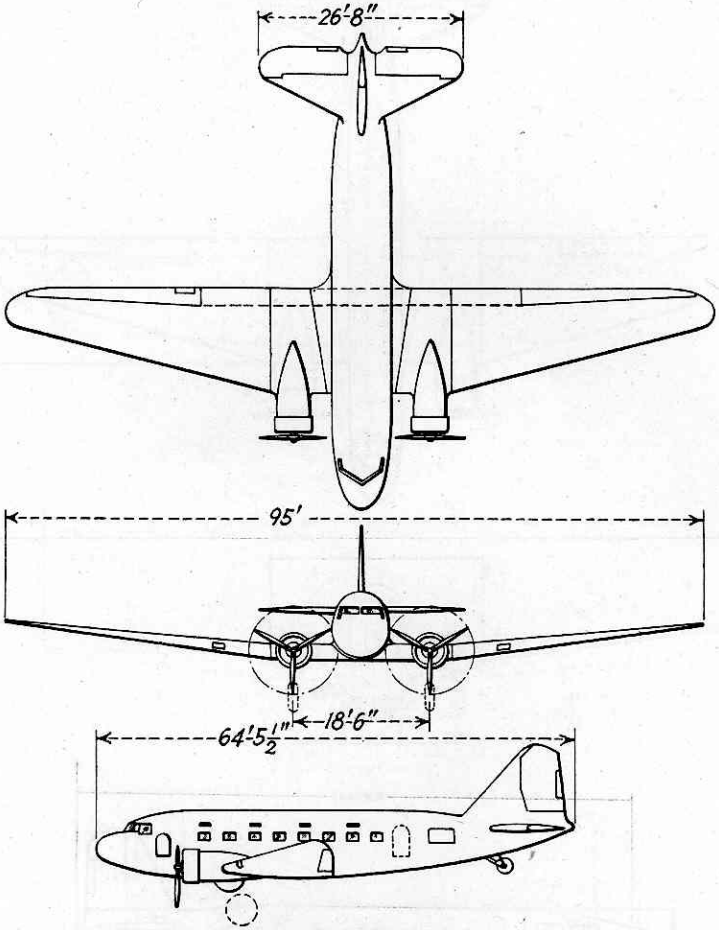
ENGINE: PRATT & WHITNEY WASP 550 H.P.
WRIGHT WHIRLWIND 420 H.P.




**BOEING AIRCRAFT COMPANY**
Seattle, Wash.
MODEL 247-D —— 12 PLACE
ENGINES: 2 PRATT & WHITNEY WASPS

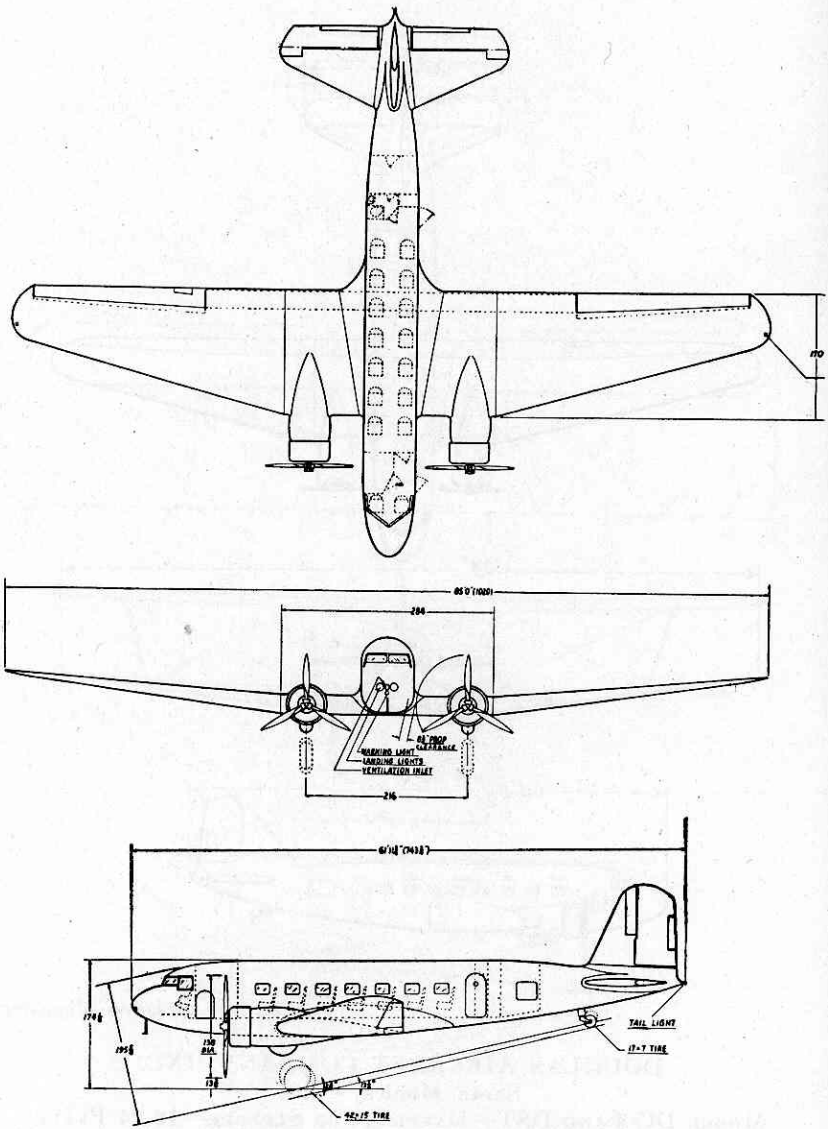


CURTISS-WRIGHT AIRPLANE COMPANY
Robertson, Mo.
MODEL AT-32 CONDOR —— 15 PLACE AS ALL-SLEEPER
18 PLACE AS DAY PLANE
ENGINES: TWO GEARED WRIGHT CYCLONES

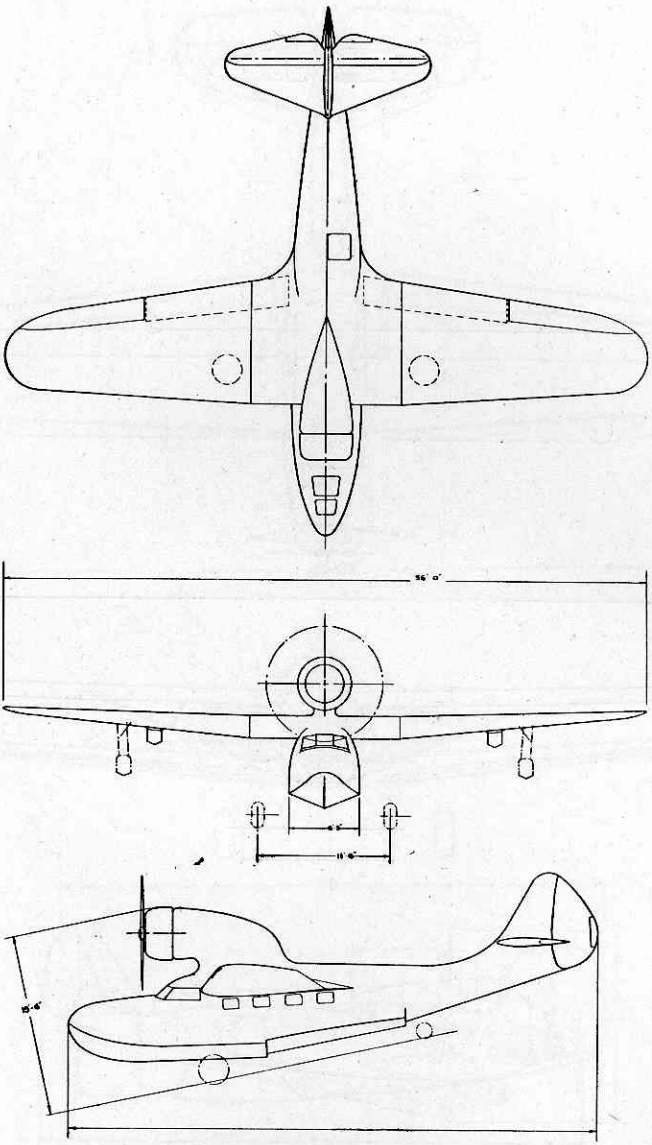



*Courtesy Aviation Magazine*

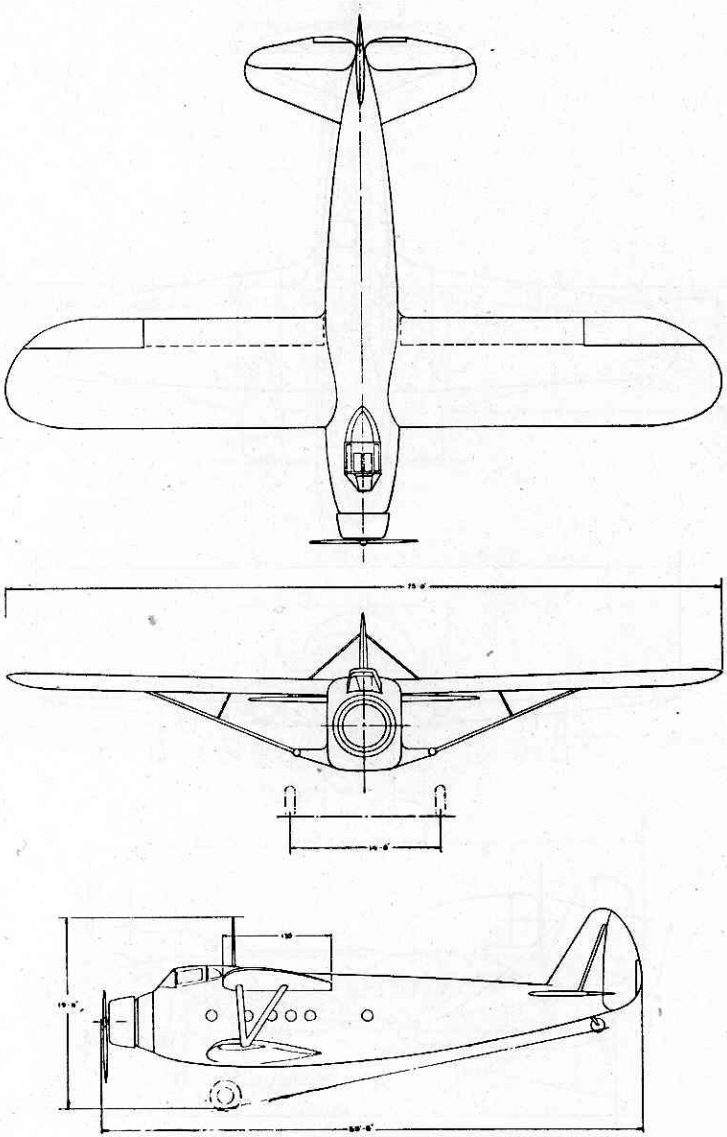
**DOUGLAS AIRCRAFT COMPANY, INC.**
Santa Monica, Calif.
MODEL DC-3 AND DST—DAYPLANE OR SLEEPER—16-24 PLACE
ENGINES: TWO PRATT & WHITNEY TWIN WASPS
TWO WRIGHT CYCLONES



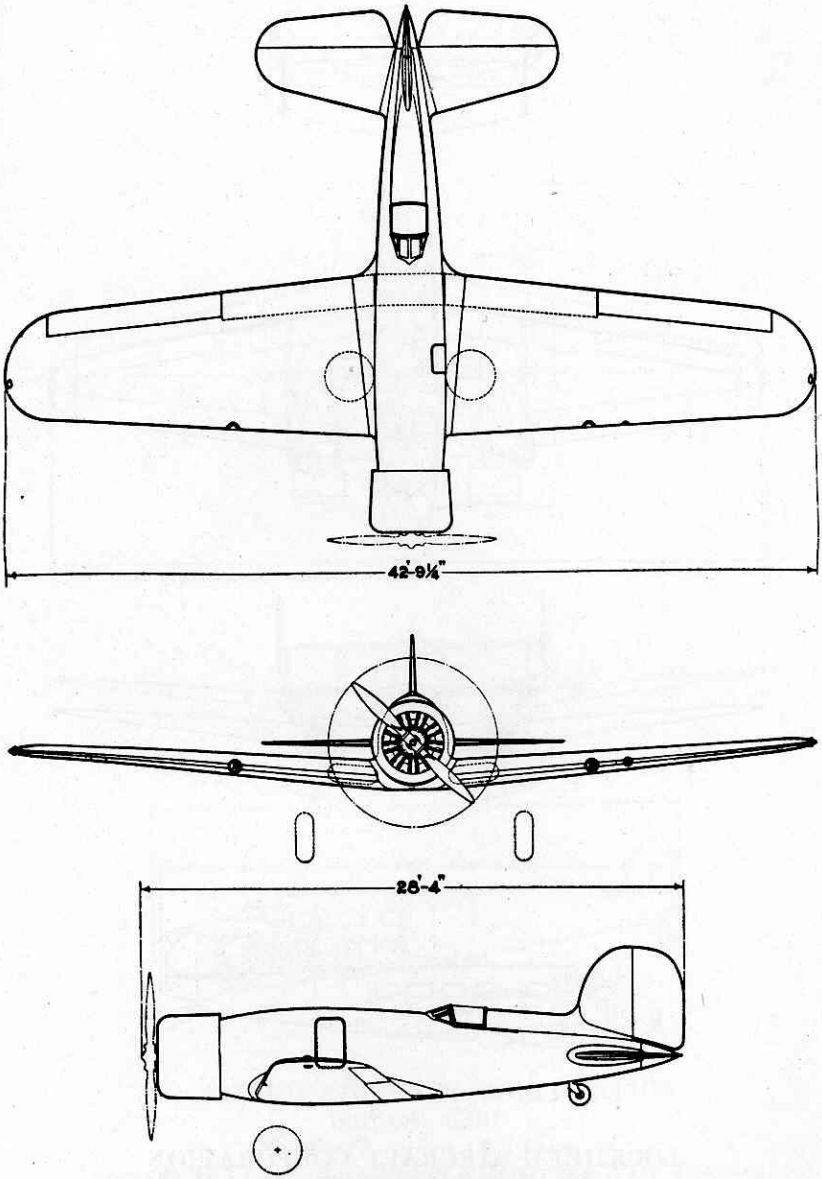

DOUGLAS AIRCRAFT COMPANY, INC.
Santa Monica, Calif.
TRANSPORT DC-2 —— 16-20 PLACE
ENGINES: TWO PRATT & WHITNEY HORNETS
TWO WRIGHT CYCLONES



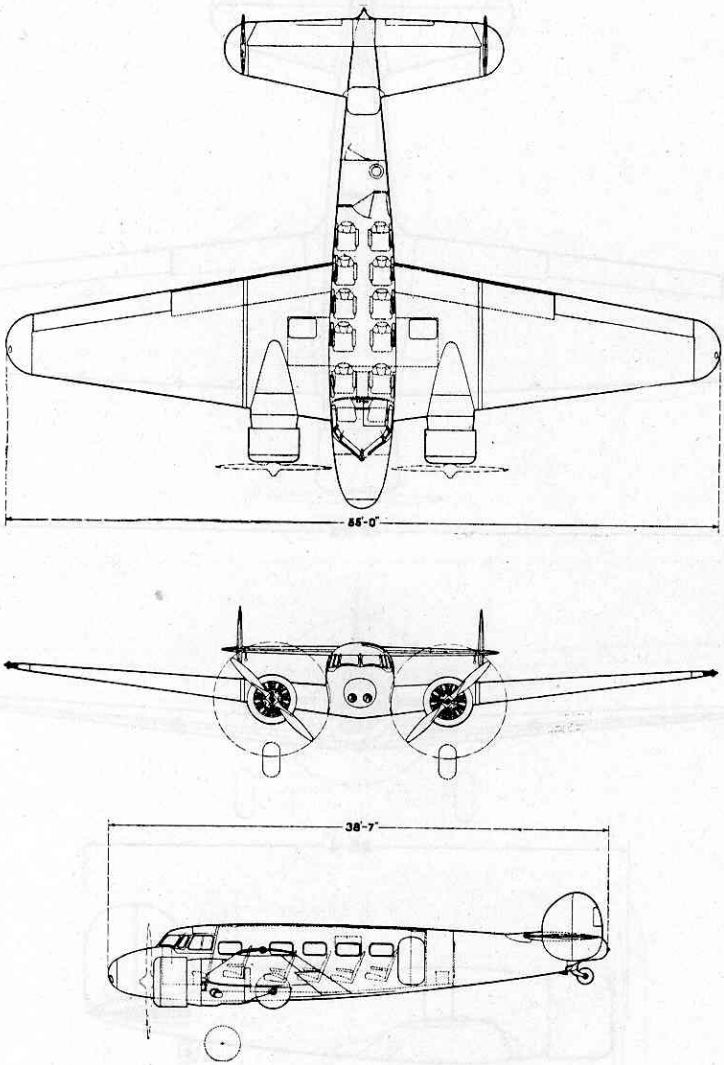
FAIRCHILD AIRCRAFT CORPORATION
Hagerstown, Md.
MODEL "91" FAIRCHILD AMPHIBION —— 10 PLACE
ENGINE: PRATT & WHITNEY HORNET
WRIGHT CYCLONE



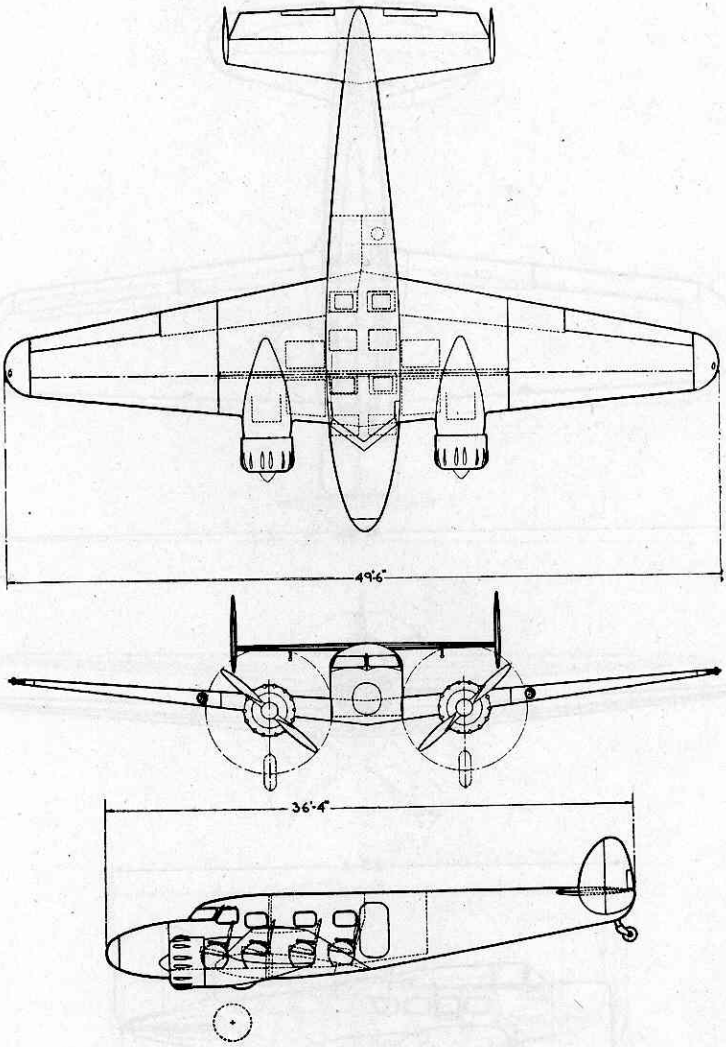
**FAIRCHILD AIRCRAFT CORPORATION**
**Hagerstown, Md.**
**Model XC-31 Cargo Transport —— 1-15 Place**
**Engine: Wright Cyclone**




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 OR WASP JUNIORS
TWO WRIGHT WHIRLWINDS

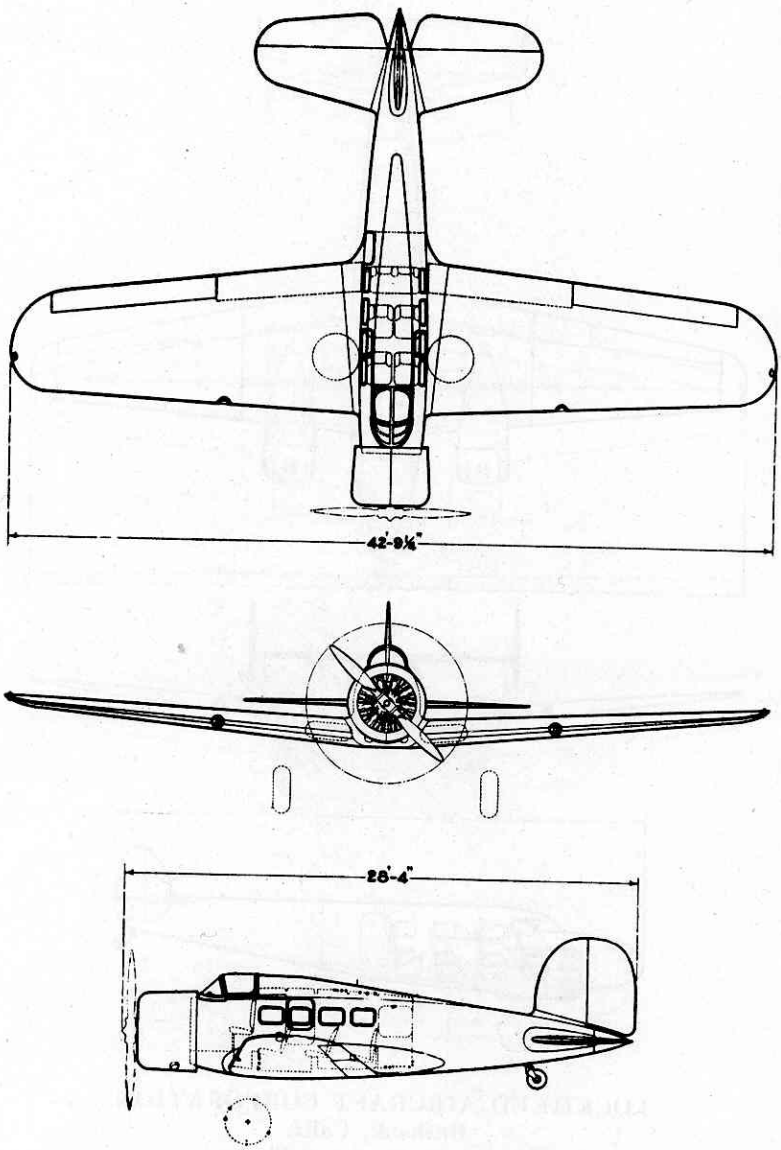



## LOCKHEED AIRCRAFT CORPORATION

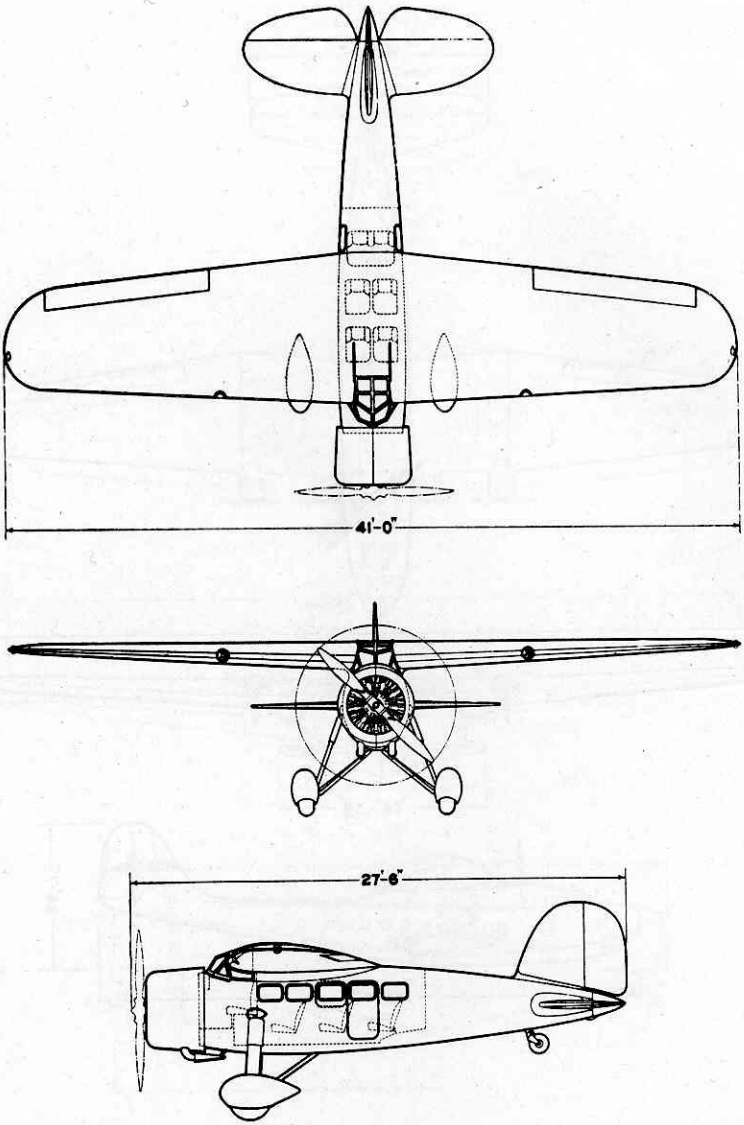
Burbank, Calif.

MODEL 12 —— 8 PLACE

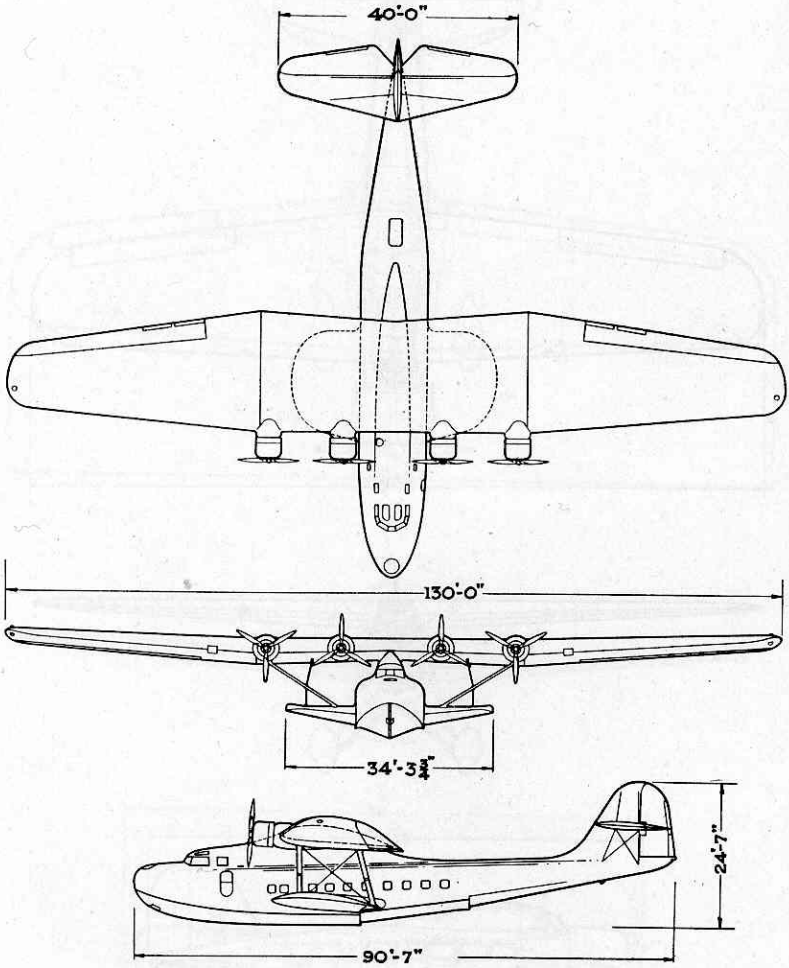
ENGINES: 12A — TWO PRATT & WHITNEY WASP JUNIORS
12B — TWO WRIGHT WHIRLWINDS
12F — TWO WRIGHT WHIRLWINDS
12M — TWO MENASCOS



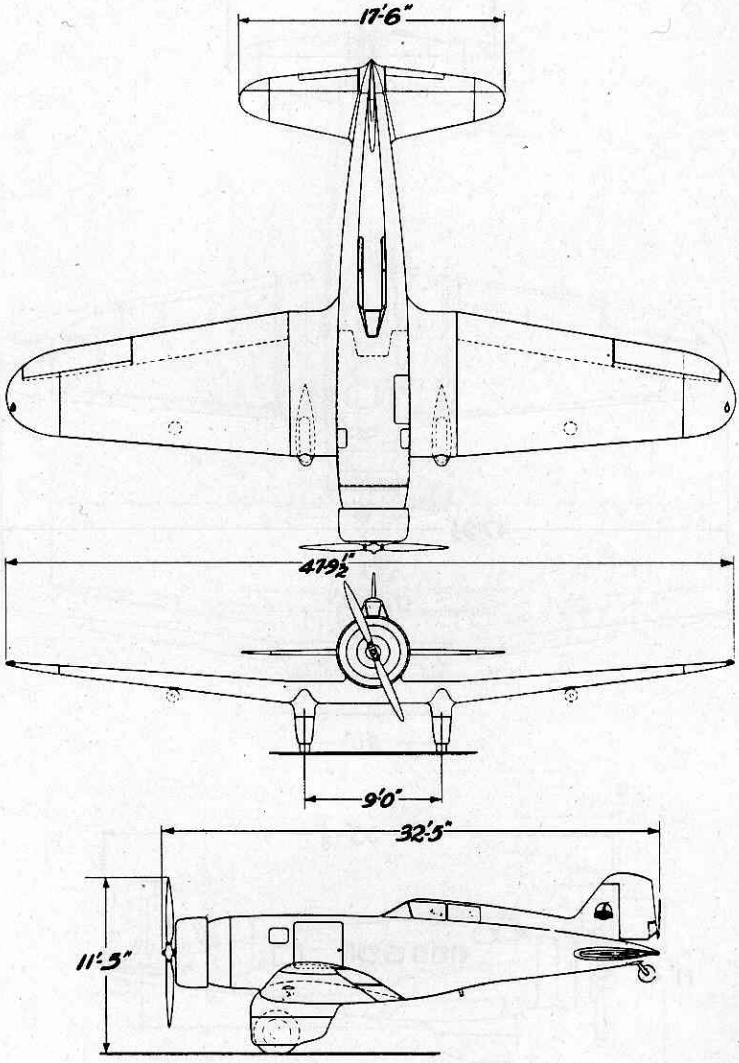

LOCKHEED AIRCRAFT CORPORATION
Burbank, Calif.
ORION —— 1-5 PLACE
ENGINE: PRATT & WHITNEY WASP



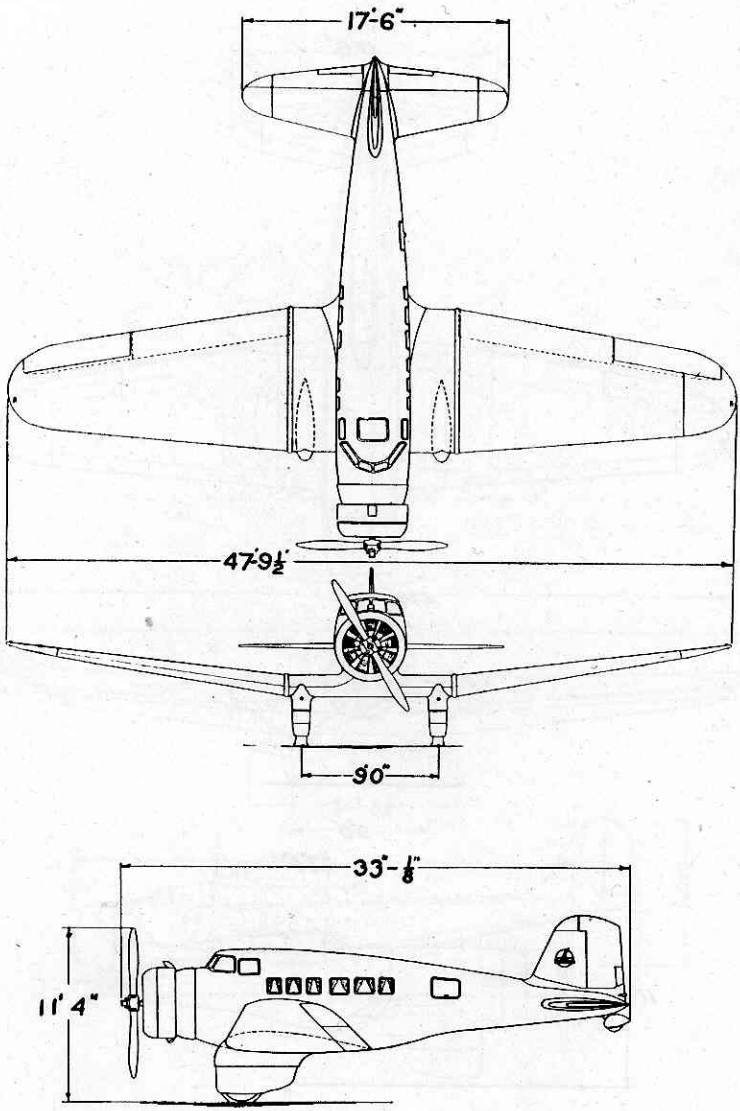

LOCKHEED AIRCRAFT CORPORATION
Burbank, Calif.
VEGA —— 7 PLACE
ENGINE: PRATT & WHITNEY WASP



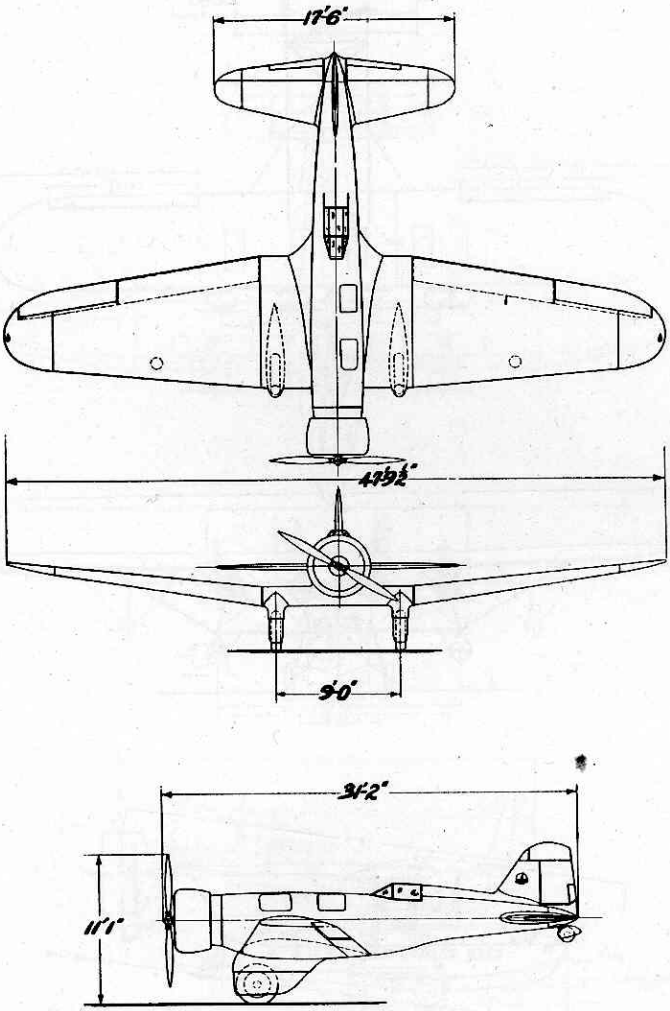

THE GLENN L. MARTIN COMPANY
Baltimore, Md.
MODEL 130 OCEAN TRANSPORT FLYING BOAT —— 50 PLACE
ENGINES: 4 PRATT & WHITNEY TWIN WASPS



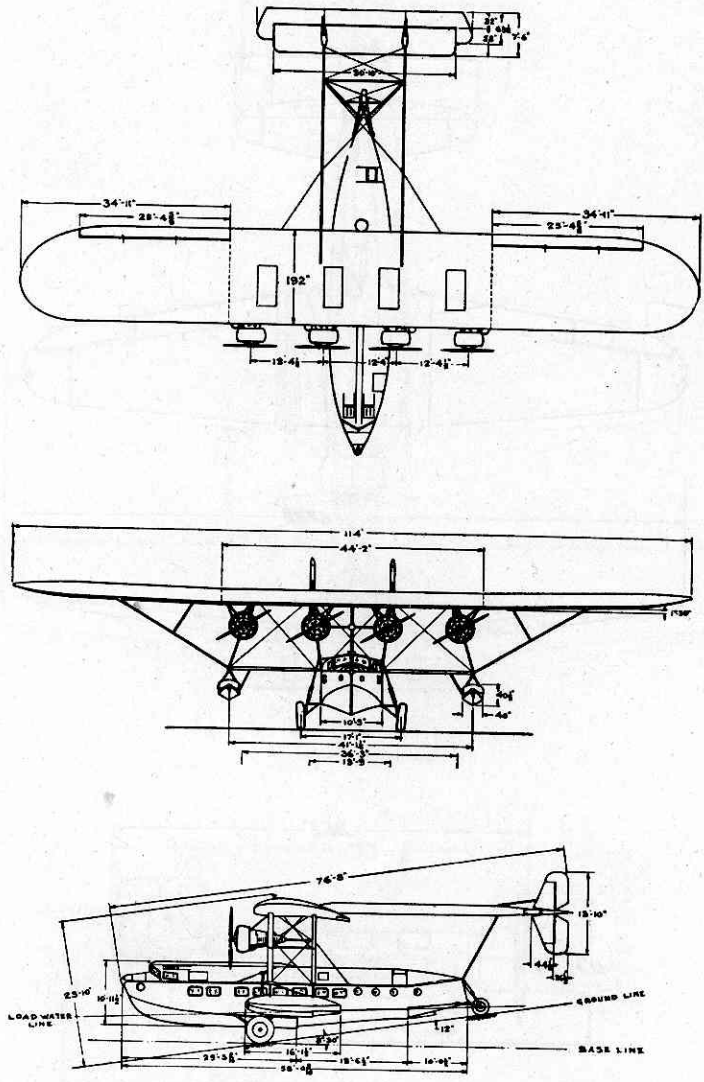

**THE NORTHROP CORPORATION**
Inglewood, Calif.
DELTA MAIL PLANE —— 1 PLACE
ENGINE: PRATT & WHITNEY HORNET



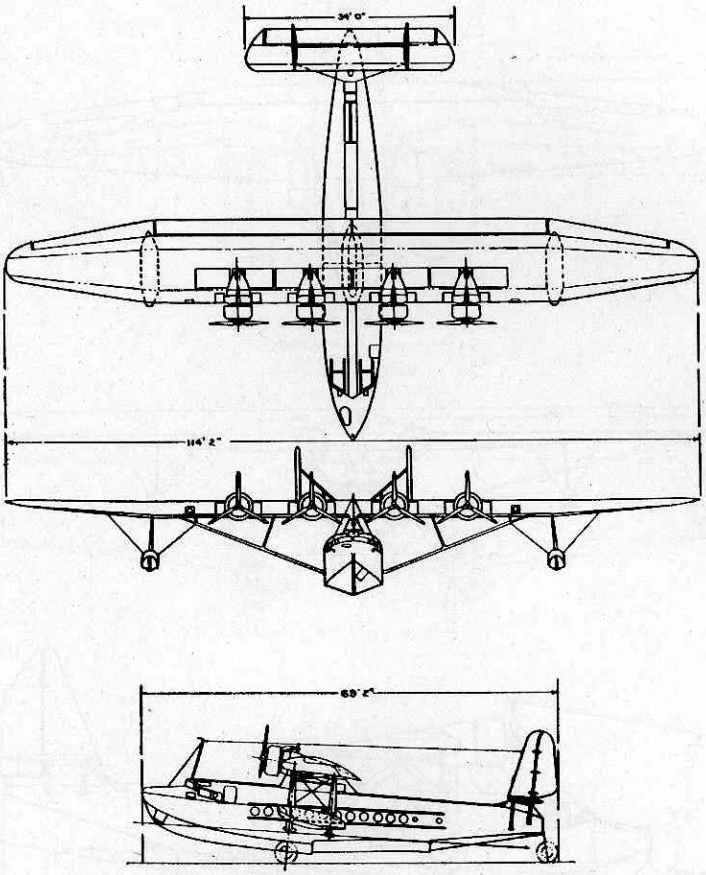

**THE NORTHROP CORPORATION**
Inglewood, Calif.
DELTA TRANSPORT —— 7-9 PLACE
ENGINE: WRIGHT CYCLONE



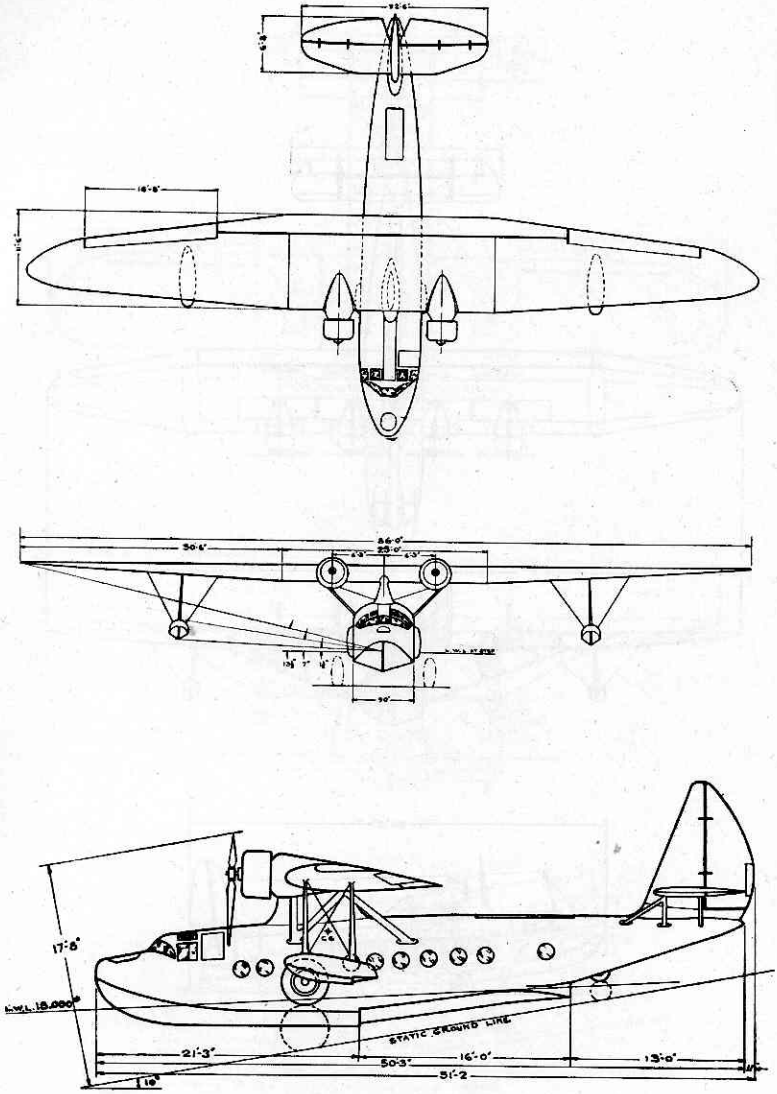

**THE NORTHROP CORPORATION**
Inglewood, Calif.
GAMMA MAIL PLANE —— 1 PLACE
ENGINE: WRIGHT CYCLONE



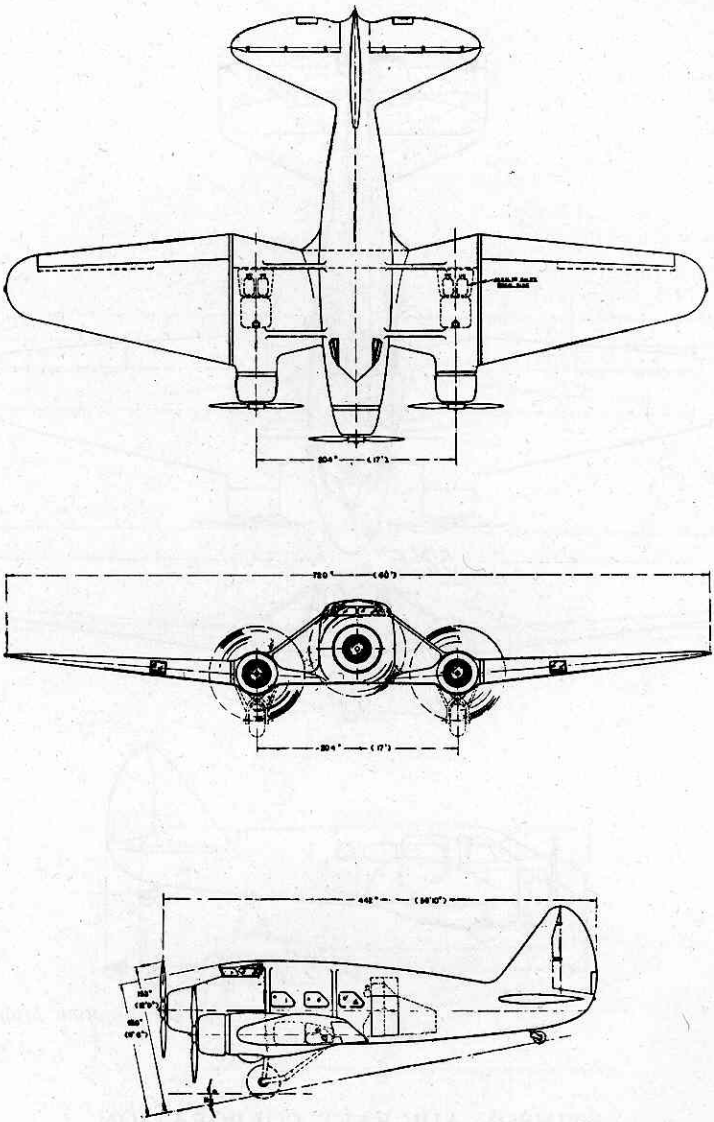

**SIKORSKY AIRCRAFT**
Division of United Aircraft Manufacturing Corporation
Bridgeport, Conn.
AMPHIBION S-40 —— 38 PLACE
ENGINES: FOUR PRATT & WHITNEY HORNETS



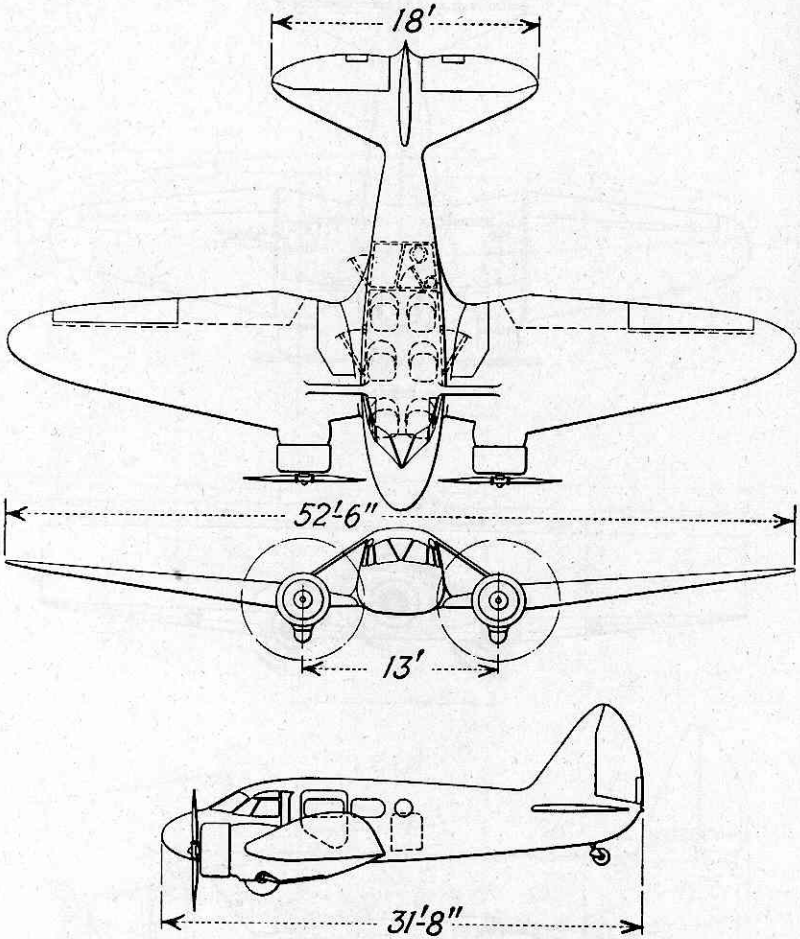
**SIKORSKY AIRCRAFT**
Division of United Aircraft Manufacturing Corporation
Bridgeport, Conn.
MODEL S-42A —— 32-40 PLACE
ENGINES: FOUR PRATT & WHITNEY HORNETS




**SIKORSKY AIRCRAFT**
Division of United Aircraft Manufacturing Corporation
East Hartford, Conn.
S-43 —— 15-25 PLACE
ENGINES: TWO PRATT & WHITNEY HORNETS

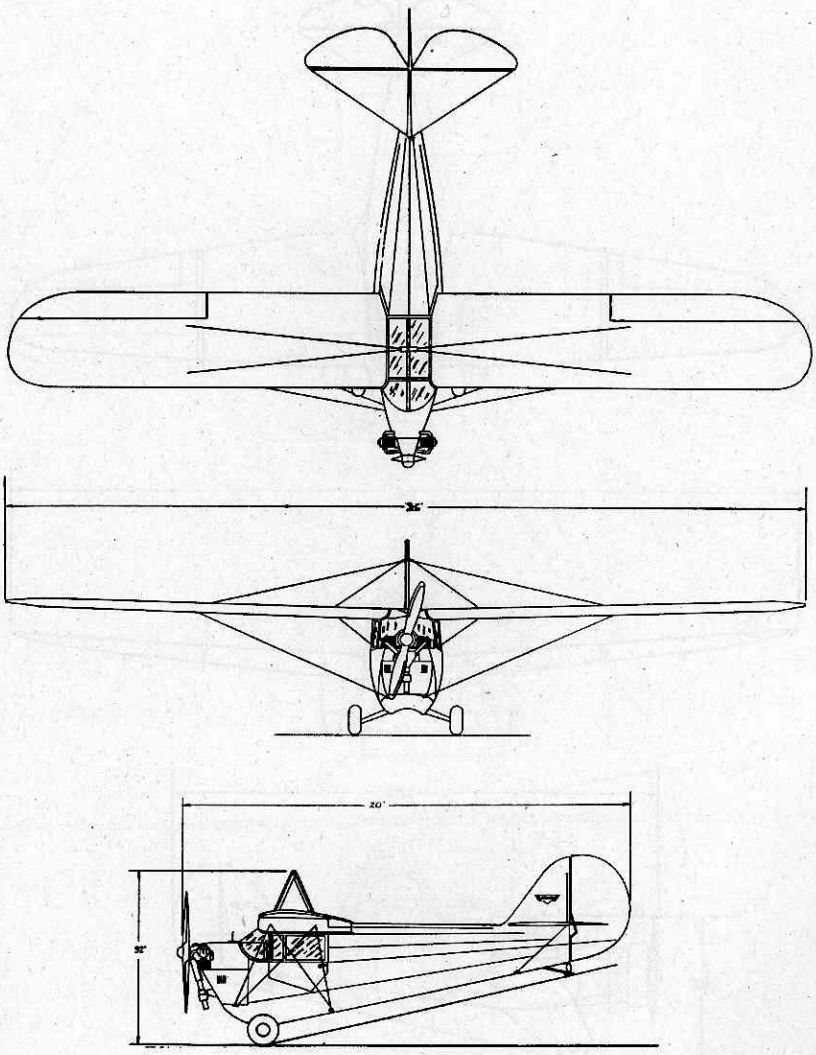


STINSON AIRCRAFT CORPORATION
Wayne, Mich.
MODEL A —— 10 PLACE
ENGINES: THREE LYCOMINGS

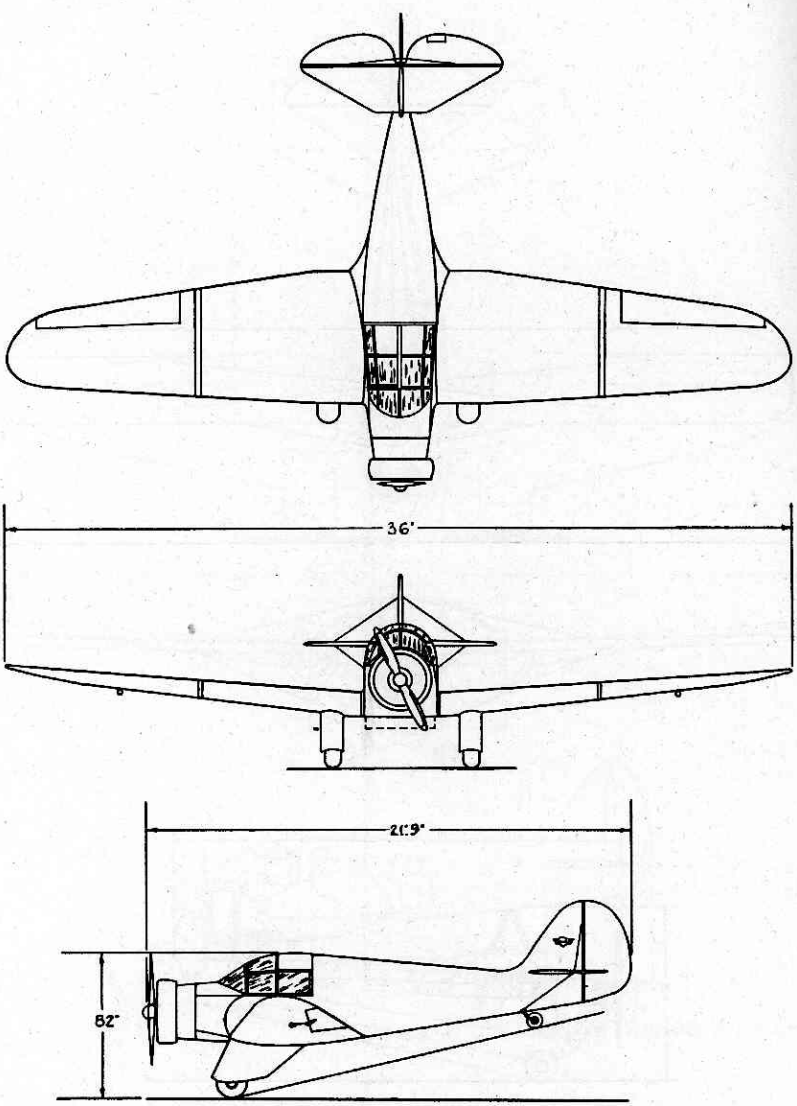



*Courtesy Aviation Magazine*

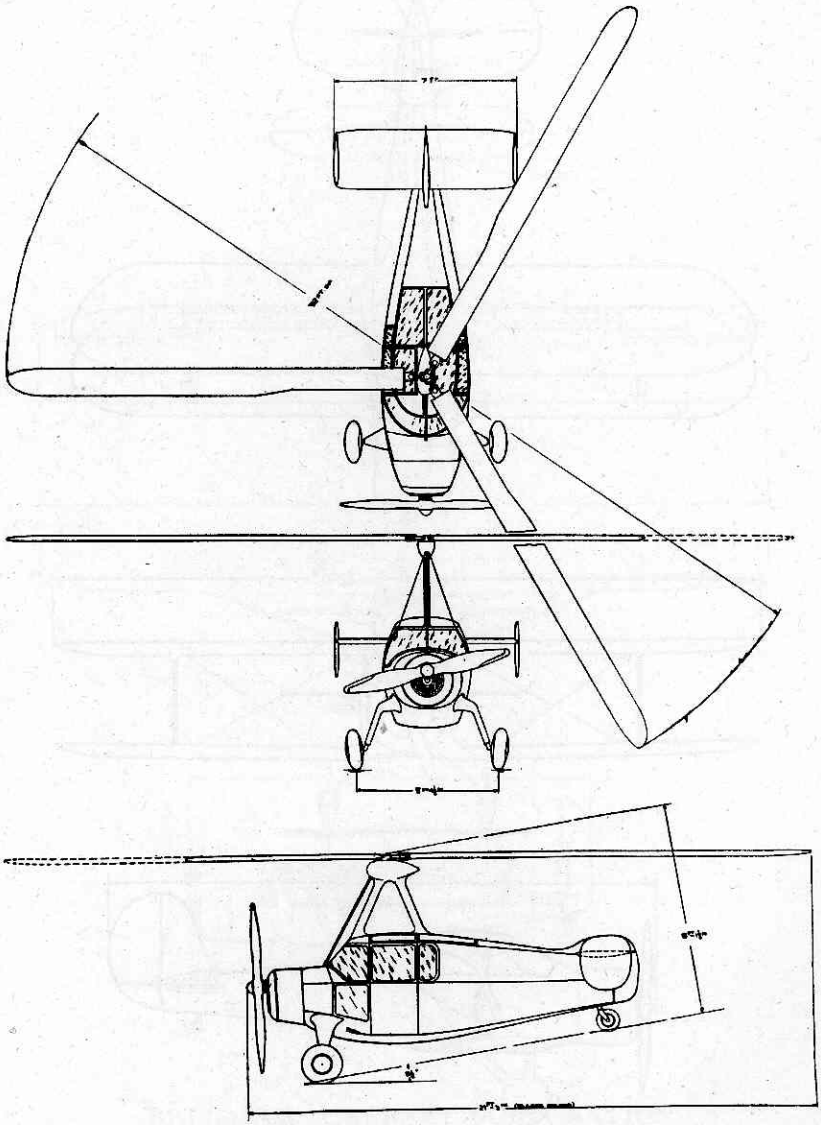
**STINSON AIRCRAFT CORPORATION**
Wayne, Mich.
MODEL B —— 6 PLACE
ENGINES: 2 LYCOMINGS



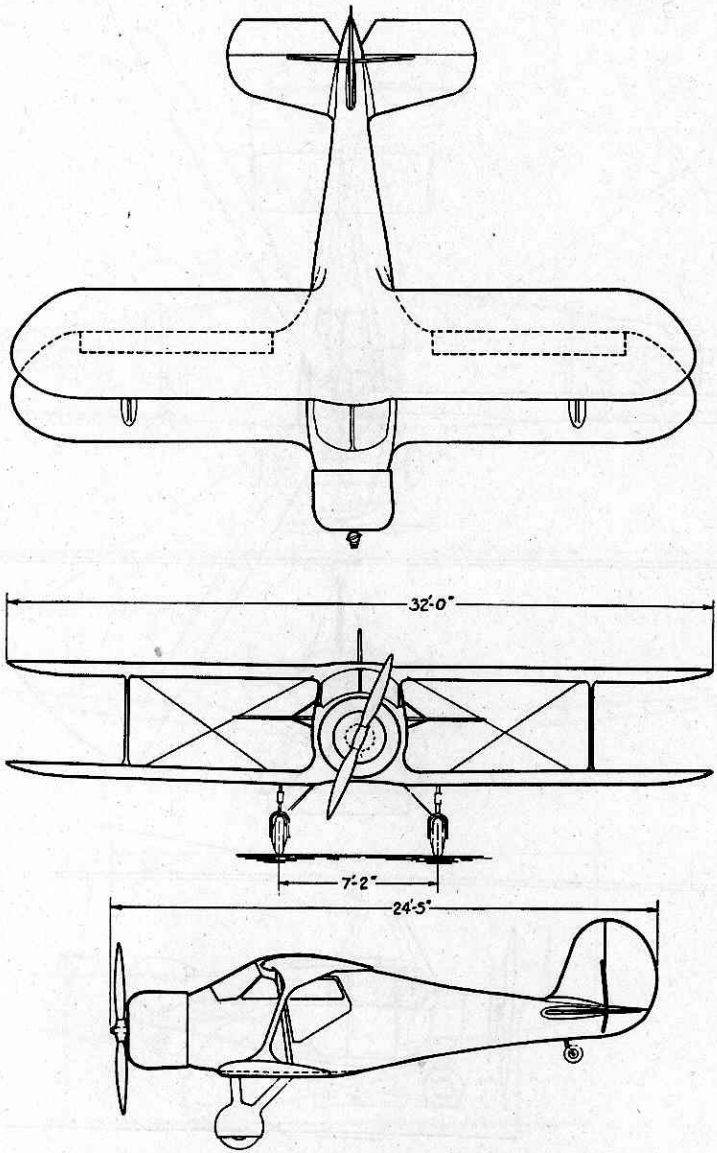
AERONAUTICAL CORPORATION OF AMERICA
Cincinnati, Ohio
AERONCA C-3 —— 2 PLACE
ENGINE: AERONCA E-113-C




**AERONAUTICAL CORPORATION OF AMERICA**
Cincinnati, Ohio
MODEL LA AND LB —— 2 PLACE
ENGINES: LEBLOND "70"
LEBLOND "85"



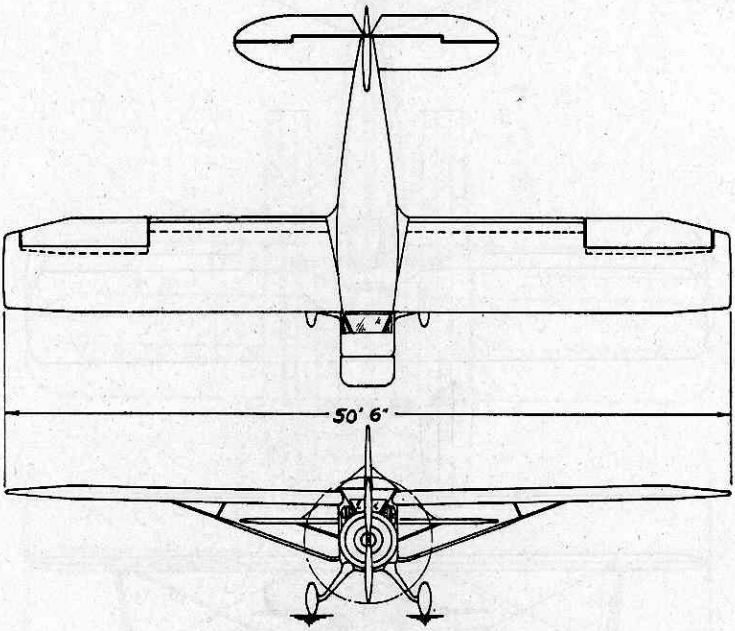
AUTOGIRO COMPANY OF AMERICA
Willow Grove, Pa.
PA-22 —— 2 PLACE
ENGINE: POBJOY 90 H.P.

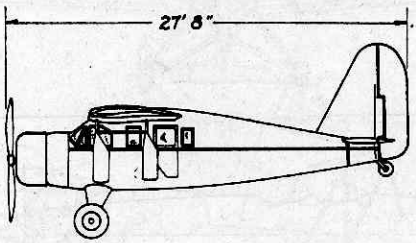



## BEECH AIRCRAFT COMPANY

Wichita, Kans.

MODEL B17E — 4 PLACE — ENGINE: WRIGHT WHIRLWIND 285 H.P.
B17L — 4 PLACE — JACOBS L-4
B17R — 4 PLACE — WRIGHT WHIRLWIND 420 H.P.

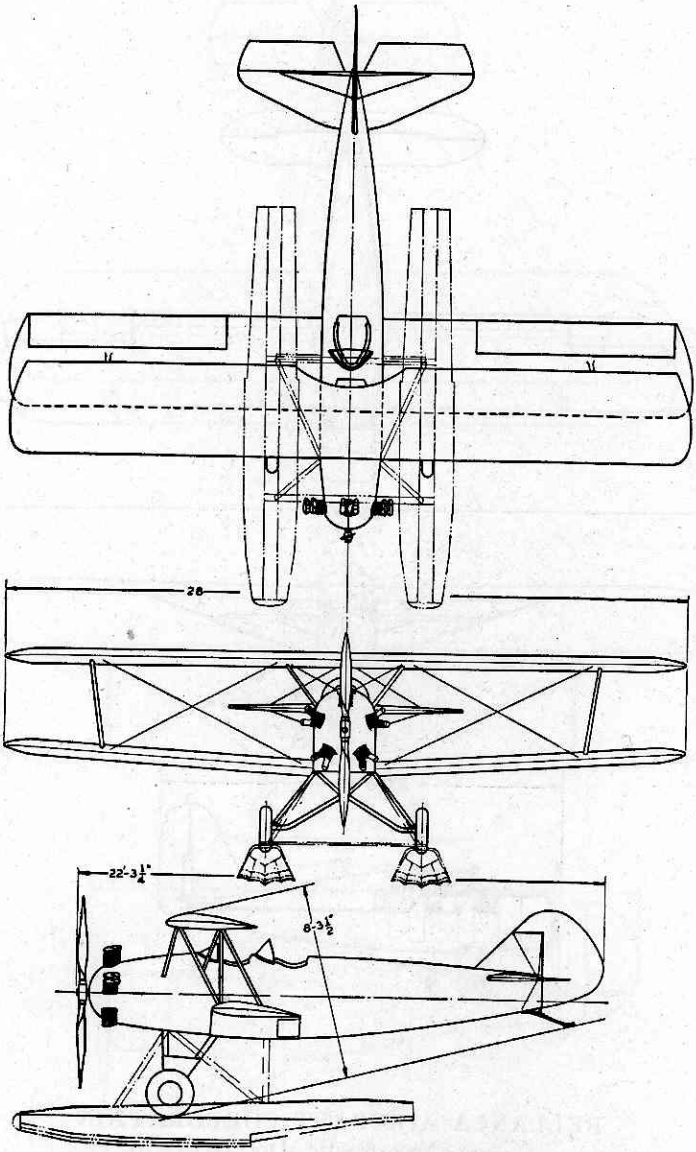


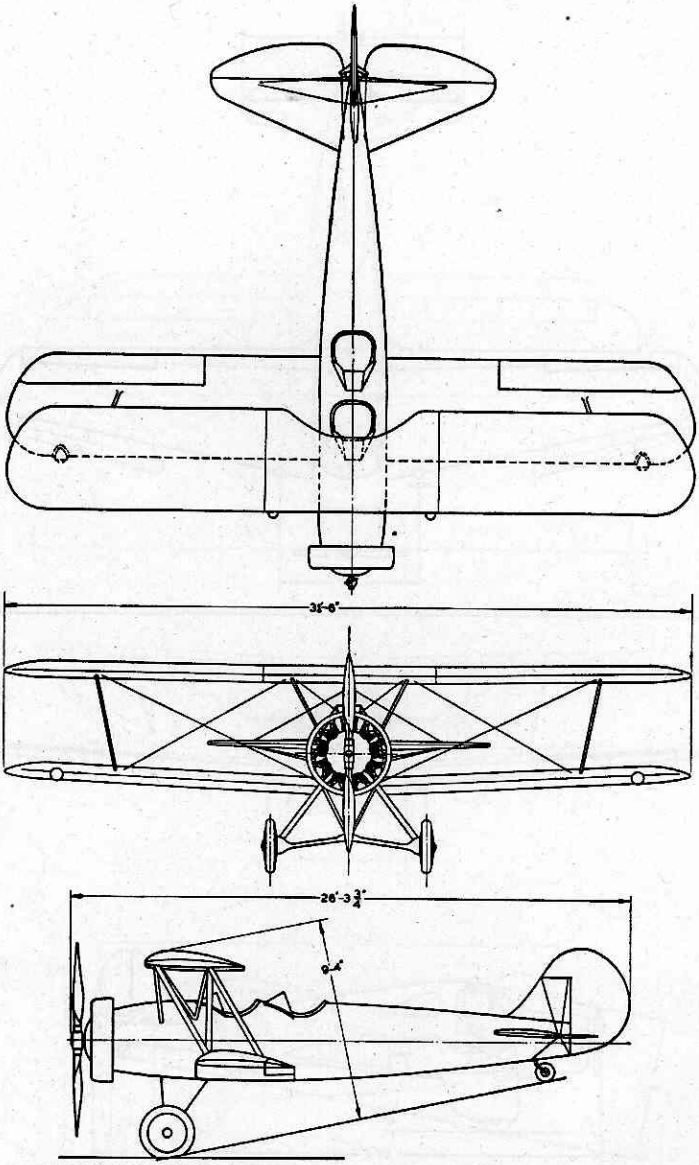

## BELLANCA AIRCRAFT CORPORATION

New Castle, Del.

SENIOR PACEMAKER EXECUTIVE —— 6 PLACE
SENIOR SKYROCKET DELUXE —— 6 PLACE
ENGINE: PRATT & WHITNEY WASP
WRIGHT WHIRLWIND




**CONSOLIDATED AIRCRAFT CORPORATION**
San Diego, Calif.
MODELS: F-5, 10 & 11 —— 2 PLACE
ENGINES: KINNER K-5, B-5 & R-5

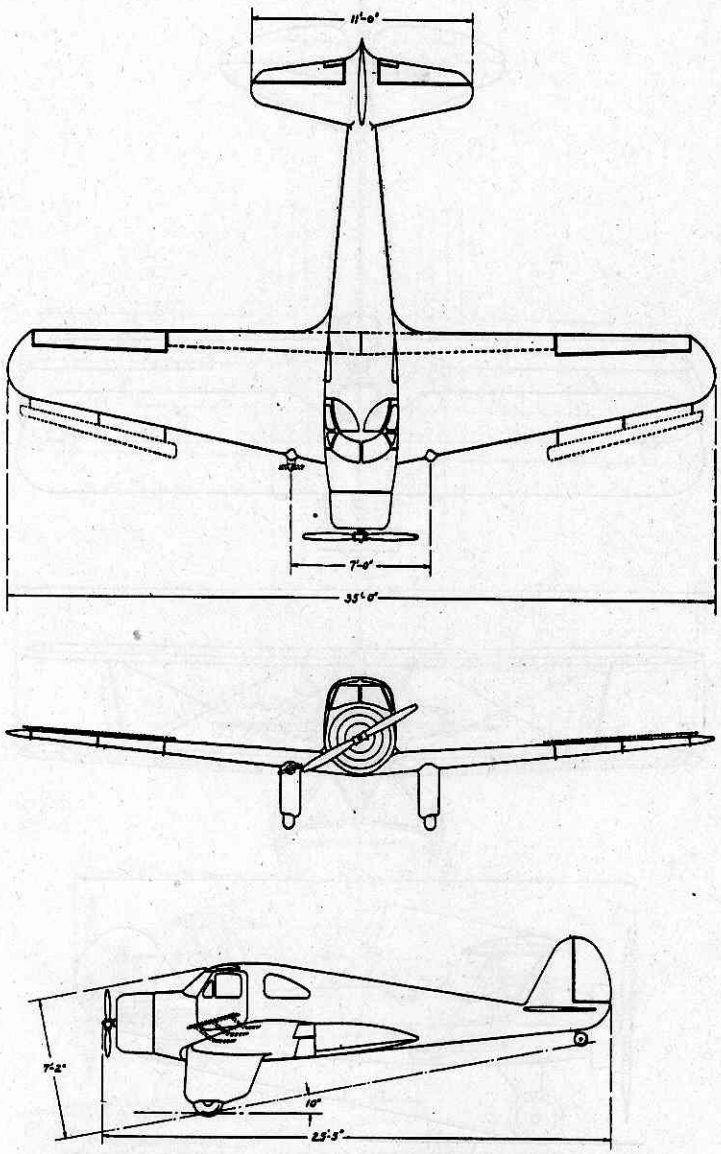



## CONSOLIDATED AIRCRAFT CORPORATION

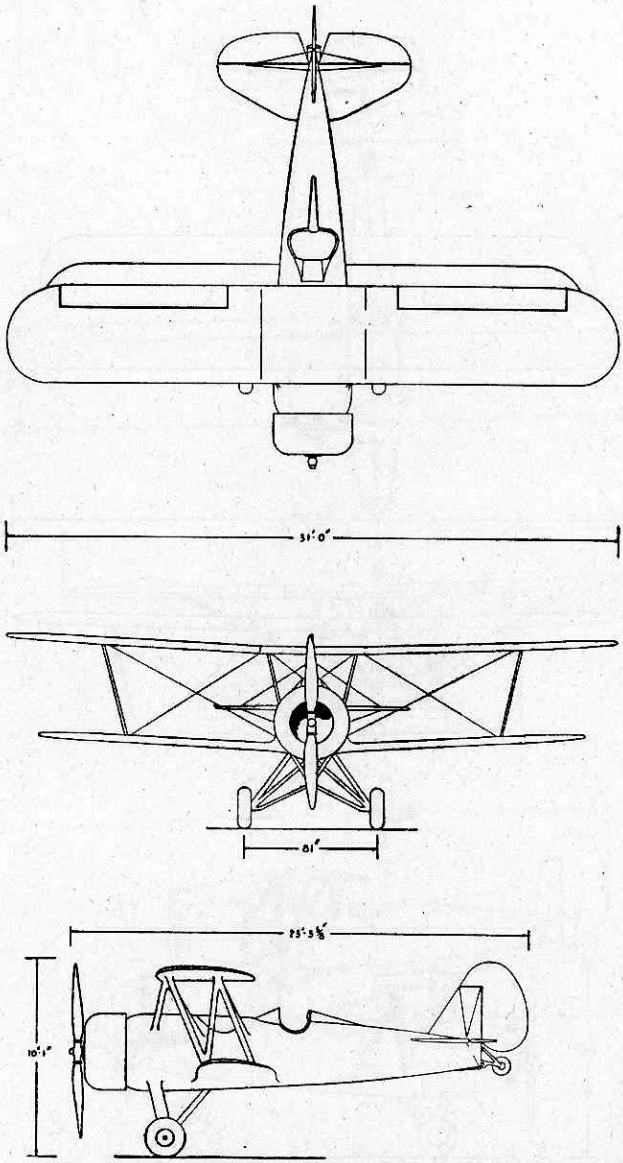
San Diego, Calif.

MODELS 21-C, D —— 2 PLACE

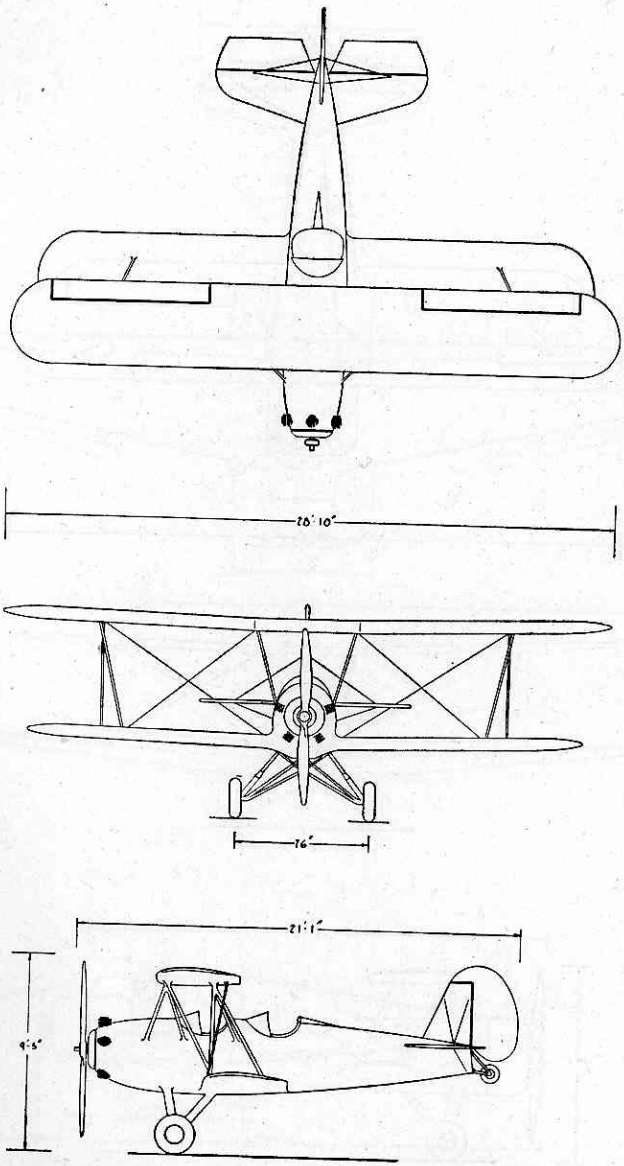
ENGINE: PRATT & WHITNEY WASP JUNIOR
LYCOMING



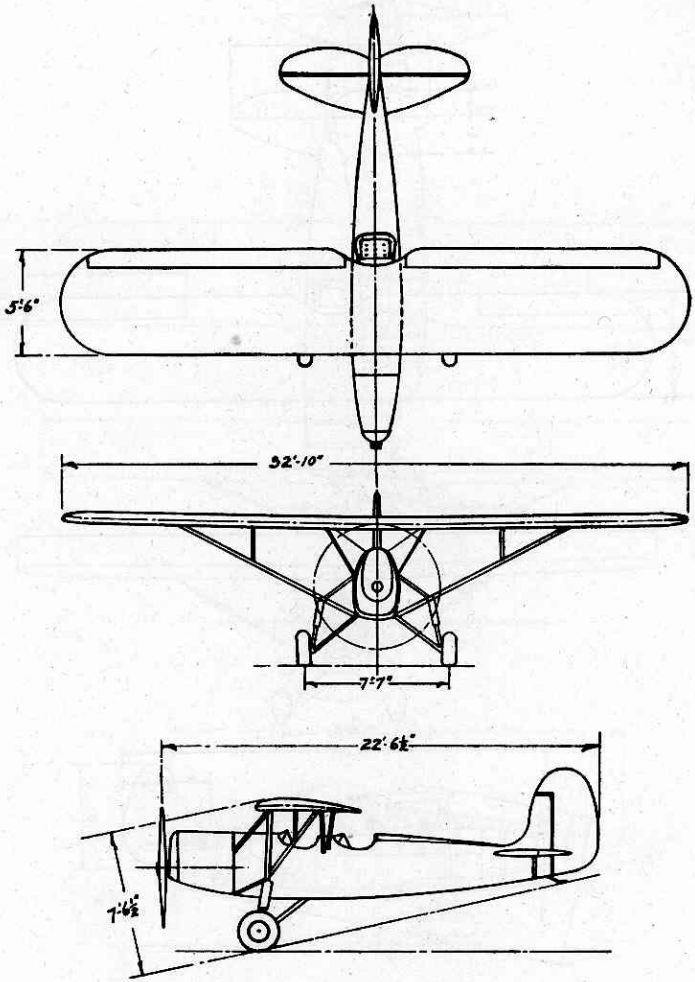

CURTISS-WRIGHT AIRPLANE COMPANY
Robertson, Mo.
COUPE —— 2 PLACE
ENGINE: LAMBERT 90 H.P.



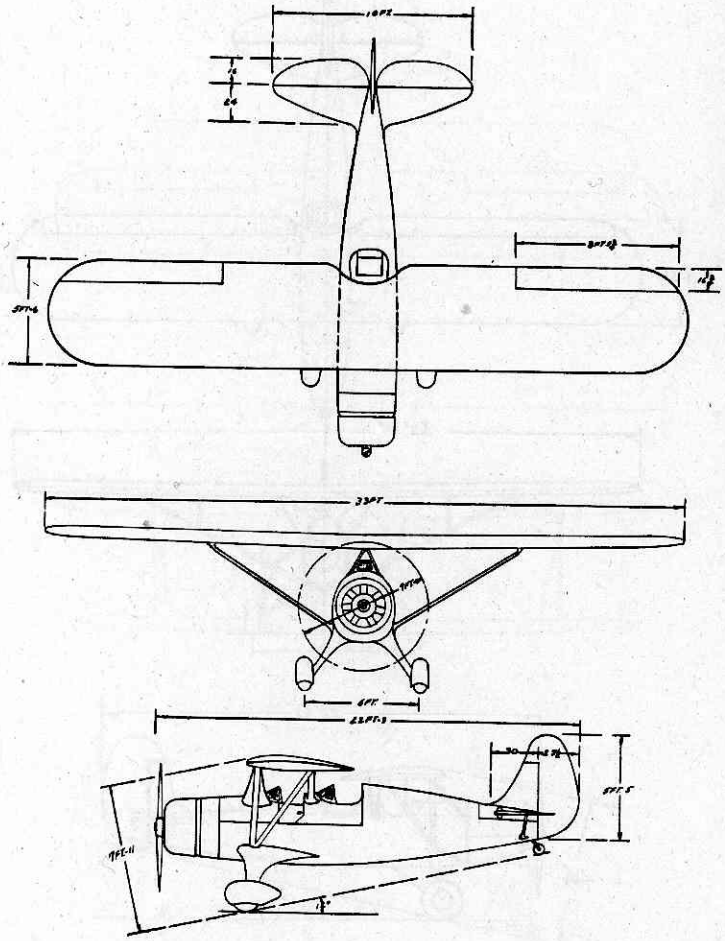
CURTISS-WRIGHT AIRPLANE COMPANY
Robertson, Mo.
SPEEDWING —— 1-3 PLACE
ENGINES: WRIGHT WHIRLWIND 285, 330, 420 H.P.



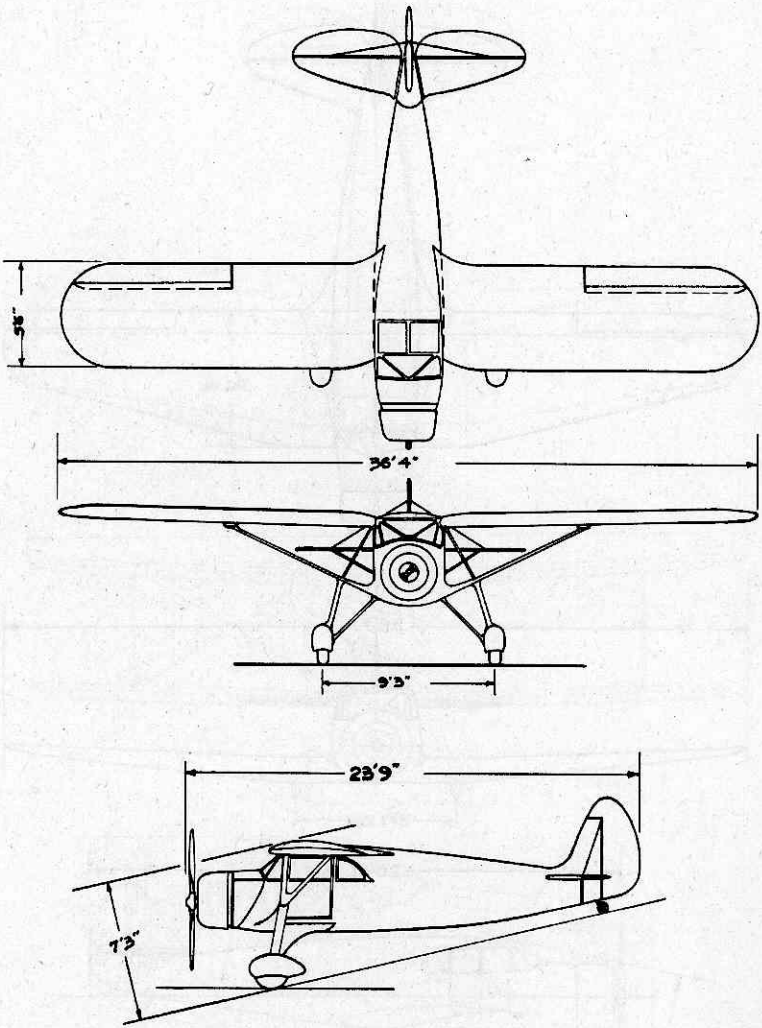

**CURTISS-WRIGHT AIRPLANE COMPANY**
Robertson, Mo.
MODEL 16-E —— 3 PLACE
ENGINE: WRIGHT WHIRLWIND 175 H.P.



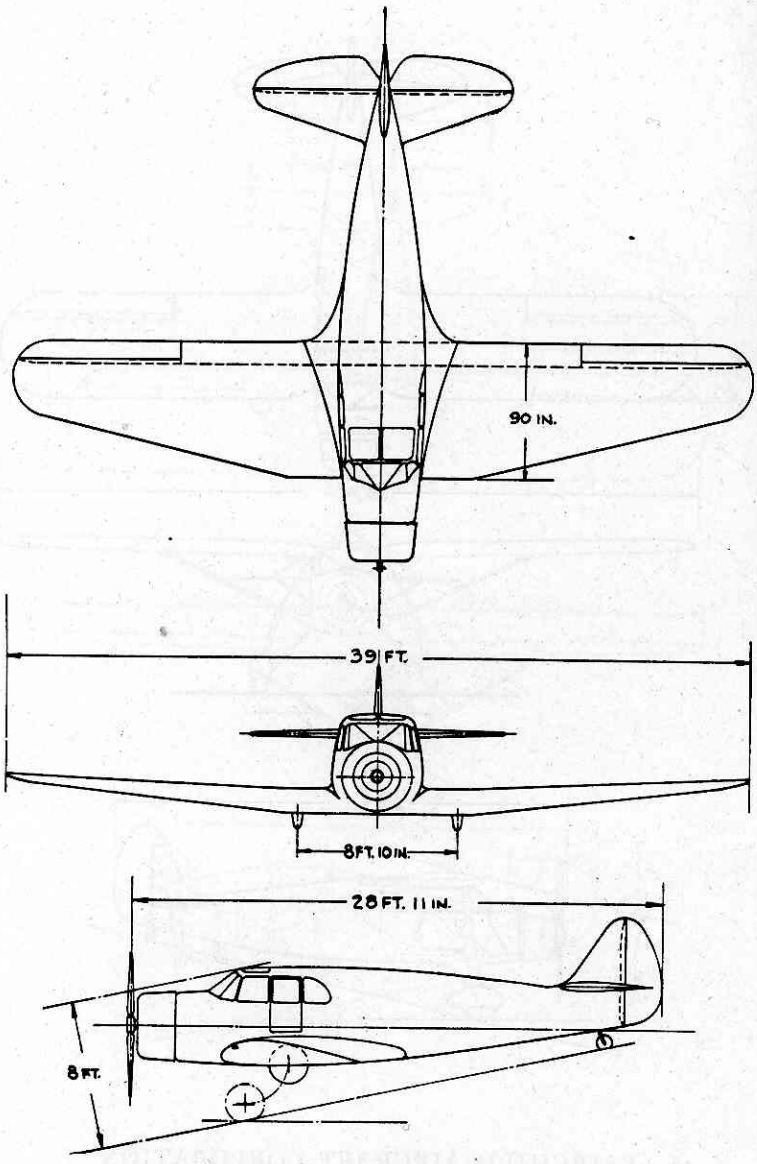

FAIRCHILD AIRCRAFT CORPORATION
Hagerstown, Md.
FAIRCHILD 22 MODEL C7-D —— 2 PLACE
ENGINE: WRIGHT GIPSY



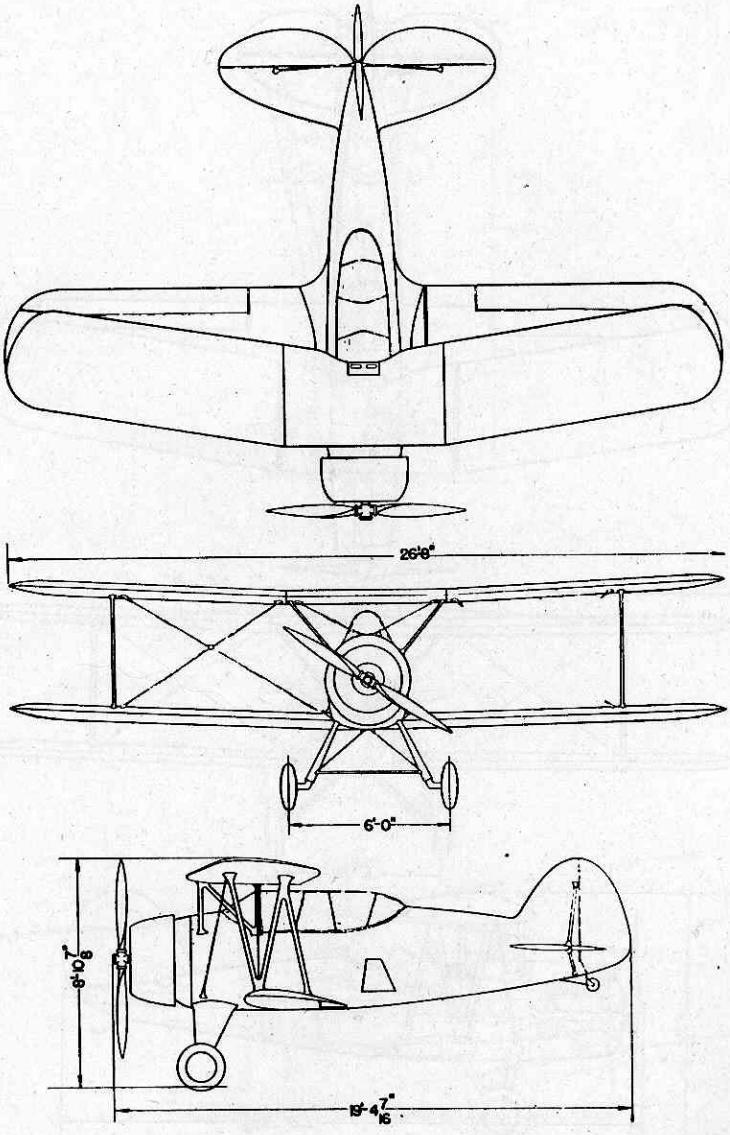
FAIRCHILD AIRCRAFT CORPORATION
Hagerstown, Md.
FAIRCHILD 22 MODEL C7-G —— 2 PLACE
ENGINE: WARNER SUPER SCARAB



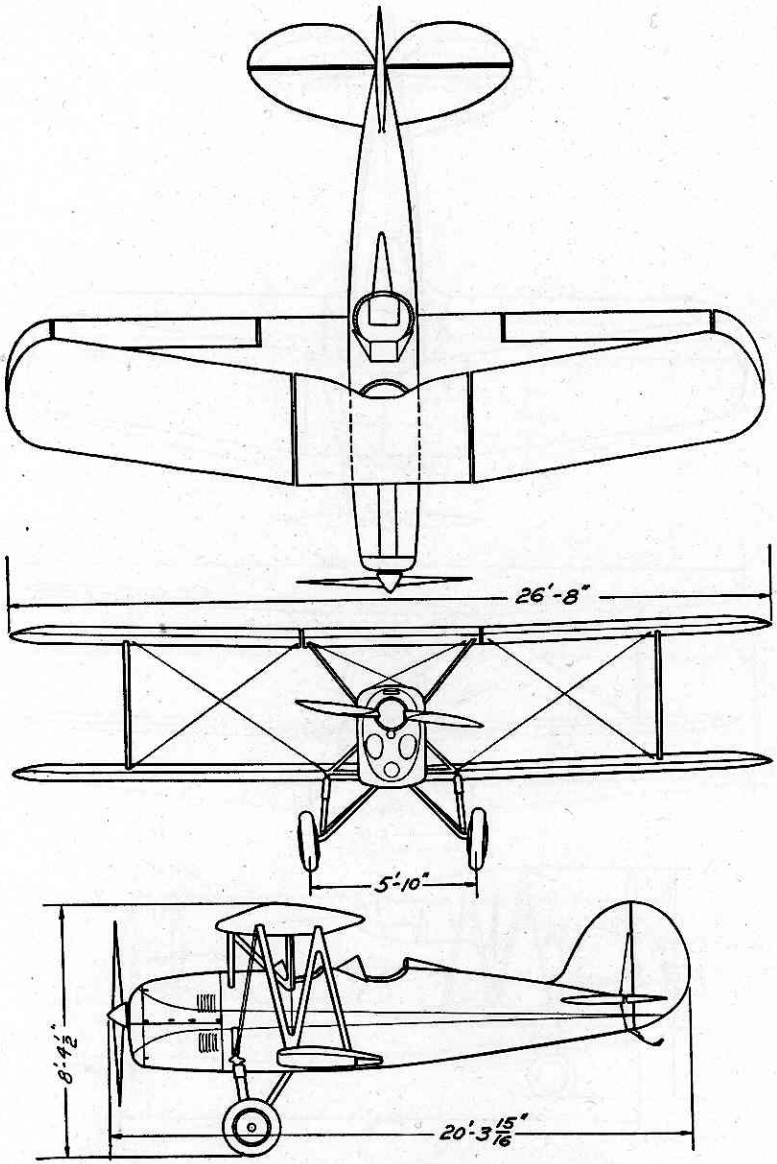

FAIRCHILD AIRCRAFT CORPORATION
Hagerstown, Md.
FAIRCHILD 24 MODEL C8-C —— 3 PLACE
ENGINE: RANGER 145 H.P.
WARNER SUPER SCARAB



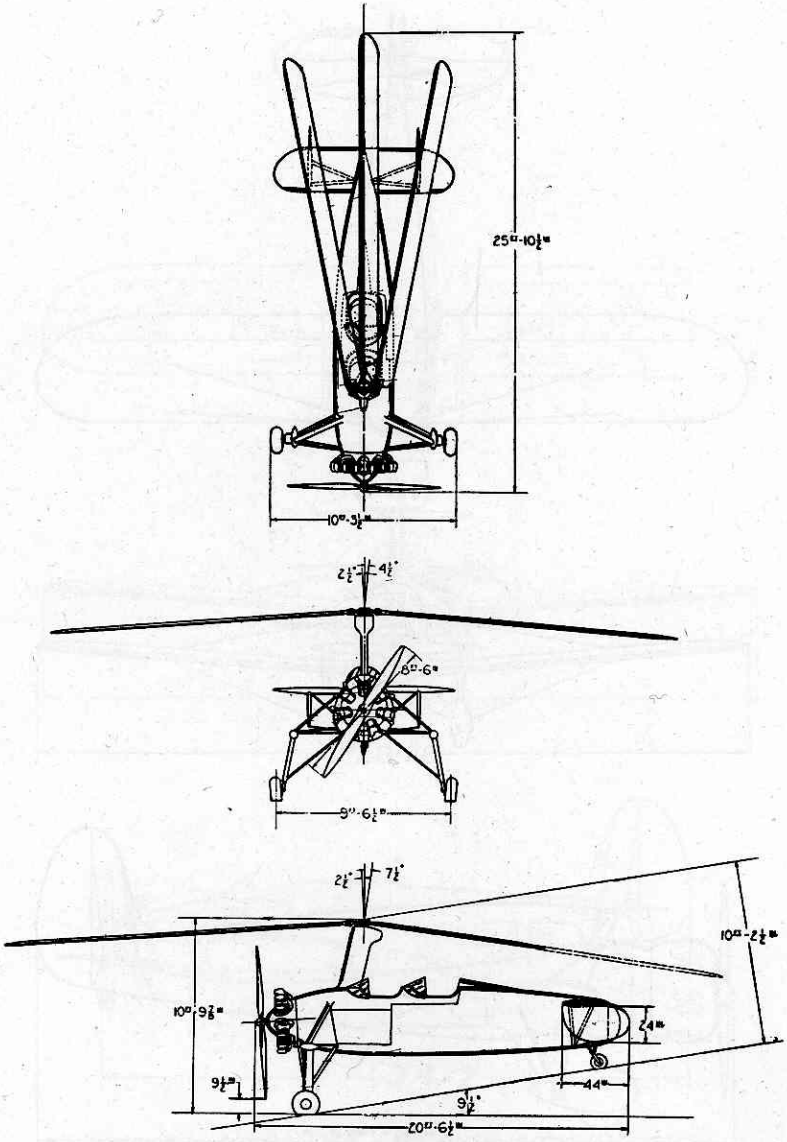

FAIRCHILD AIRCRAFT CORPORATION
Hagerstown, Md.
FAIRCHILD 45 —— 5 PLACE
ENGINE: WRIGHT WHIRLWIND



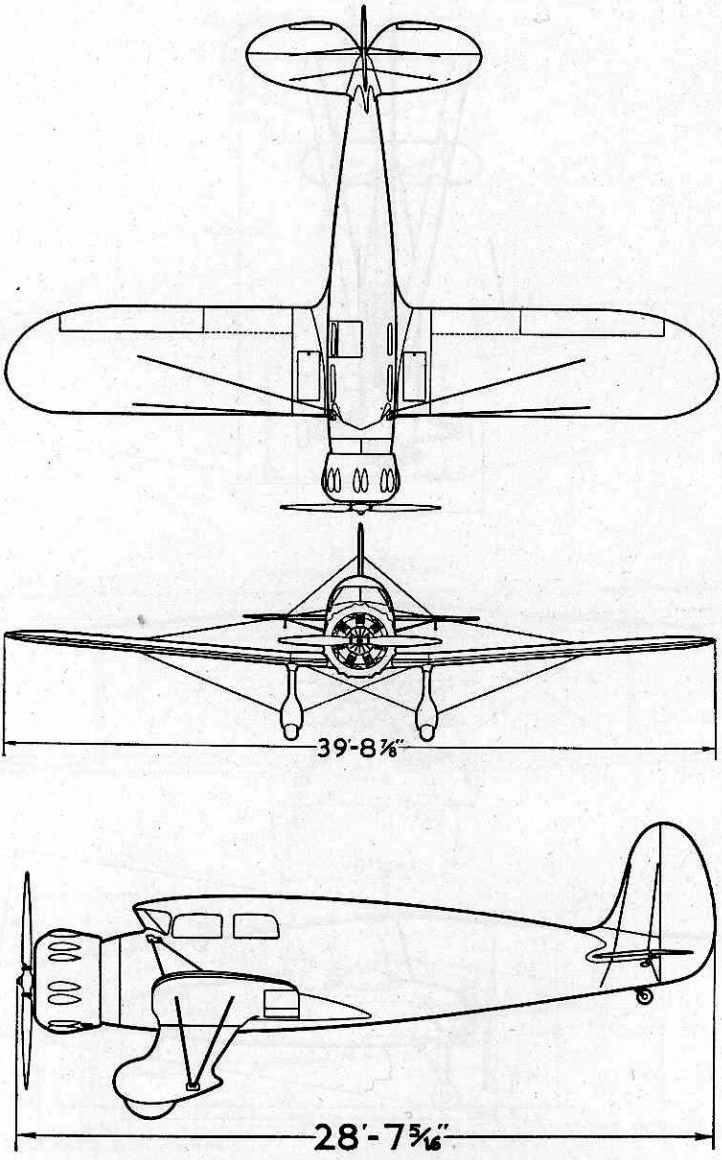

**GREAT LAKES AIRCRAFT CORPORATION**
Cleveland, Ohio
MODEL 2S-W —— 2 PLACE
ENGINE: WARNER SUPER SCARAB



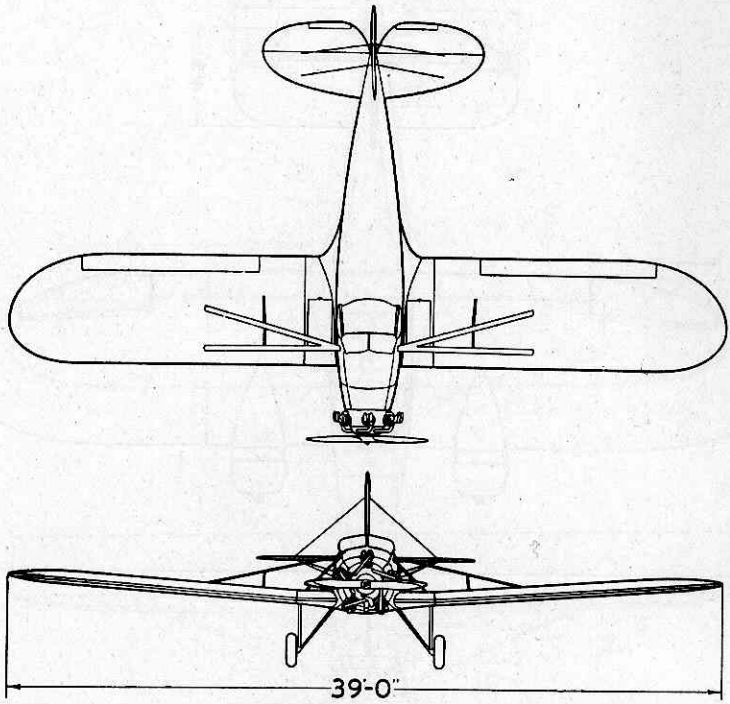

**GREAT LAKES AIRCRAFT CORPORATION**
Cleveland, Ohio
MODEL 2T-1A —— 2 PLACE
ENGINE: AMERICAN CIRRUS

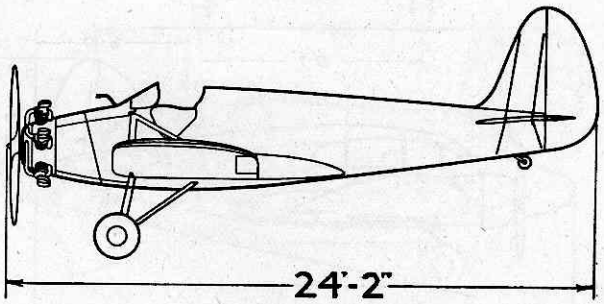



**KELLETT AUTOGIRO CORPORATION**
Philadelphia, Pa.
MODEL KD-1 —— 2 PLACE
ENGINE: JACOBS L-4-MA

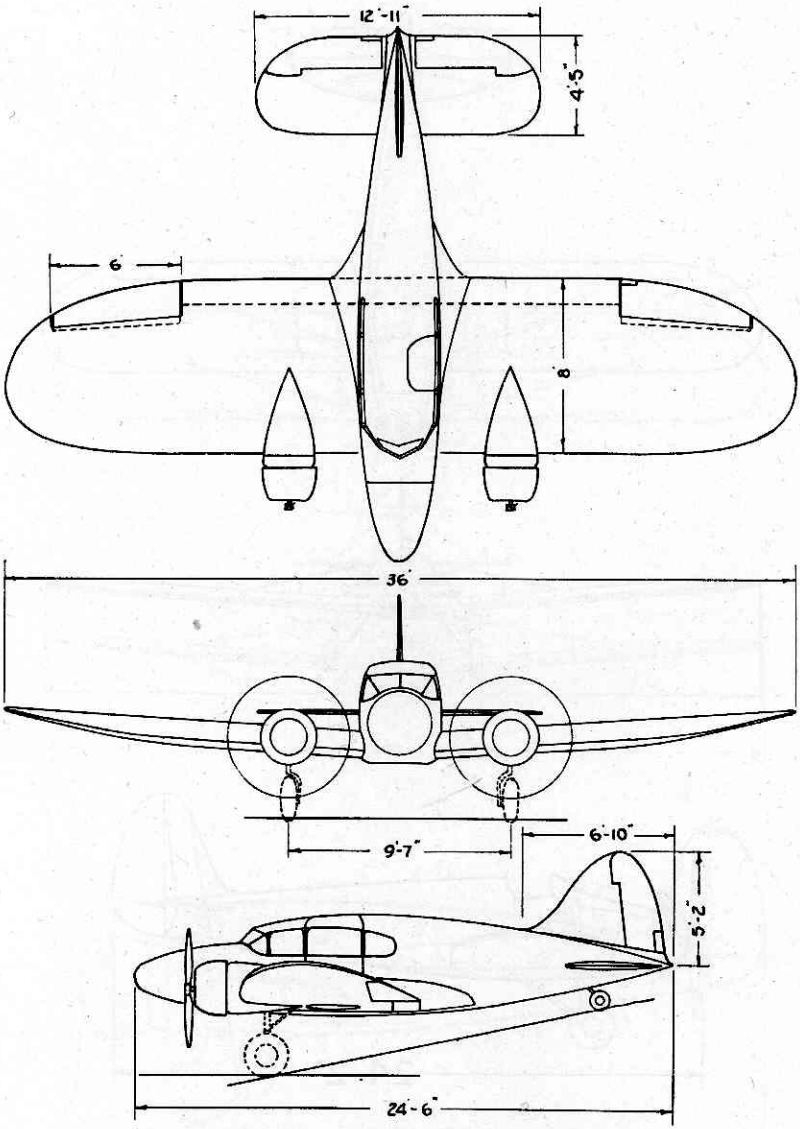



KINNER AIRPLANE & MOTOR CORPORATION
Glendale, Calif.
ENVOY —— 4 PLACE
ENGINE: KINNER C-7

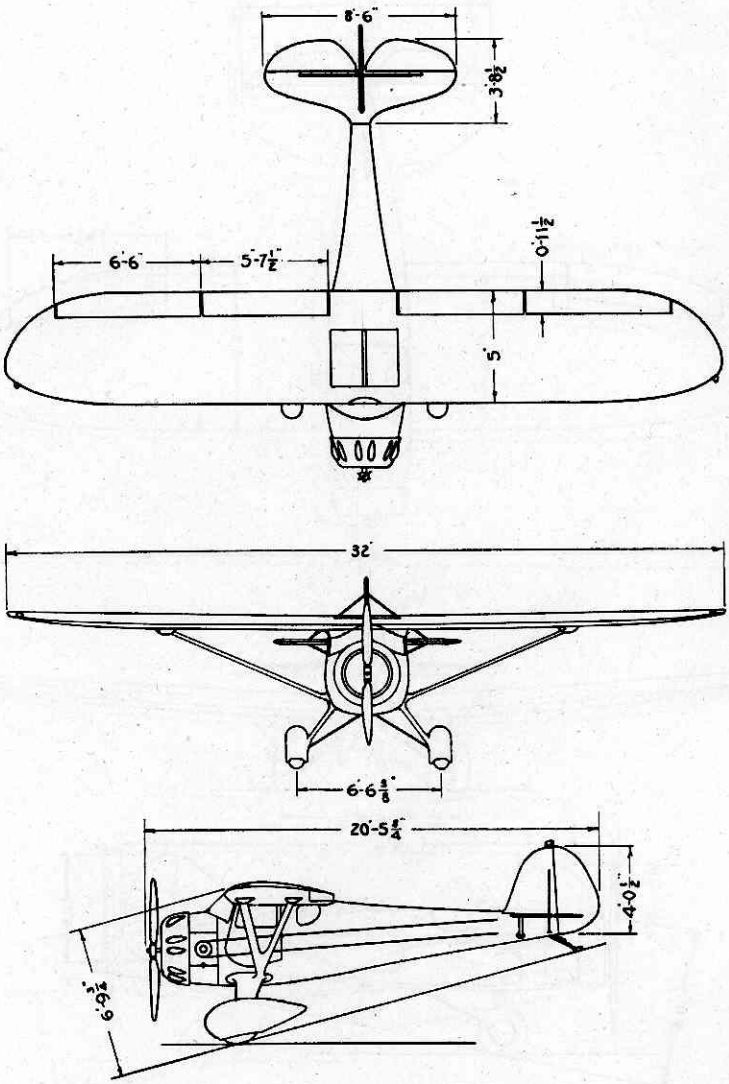


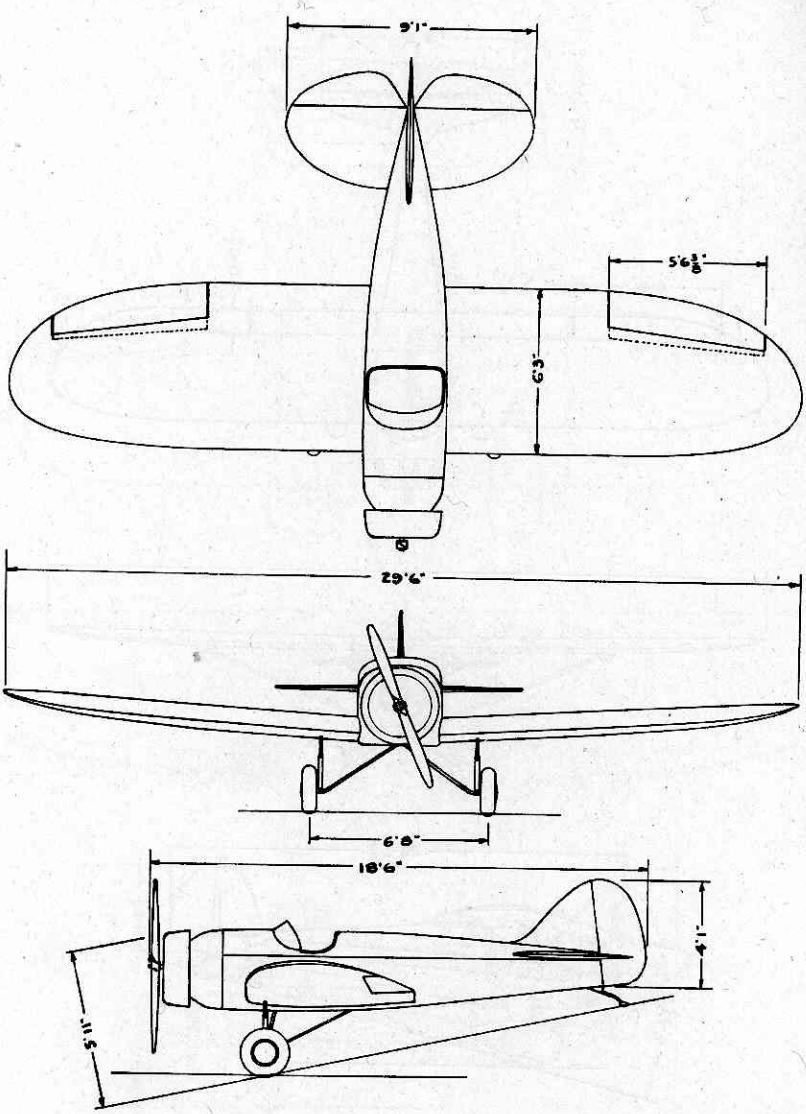

**KINNER AIRPLANE & MOTOR CORPORATION**
Glendale, Calif.
SPORTSTER —— 2 PLACE
ENGINE: KINNER K-5
KINNER B-5



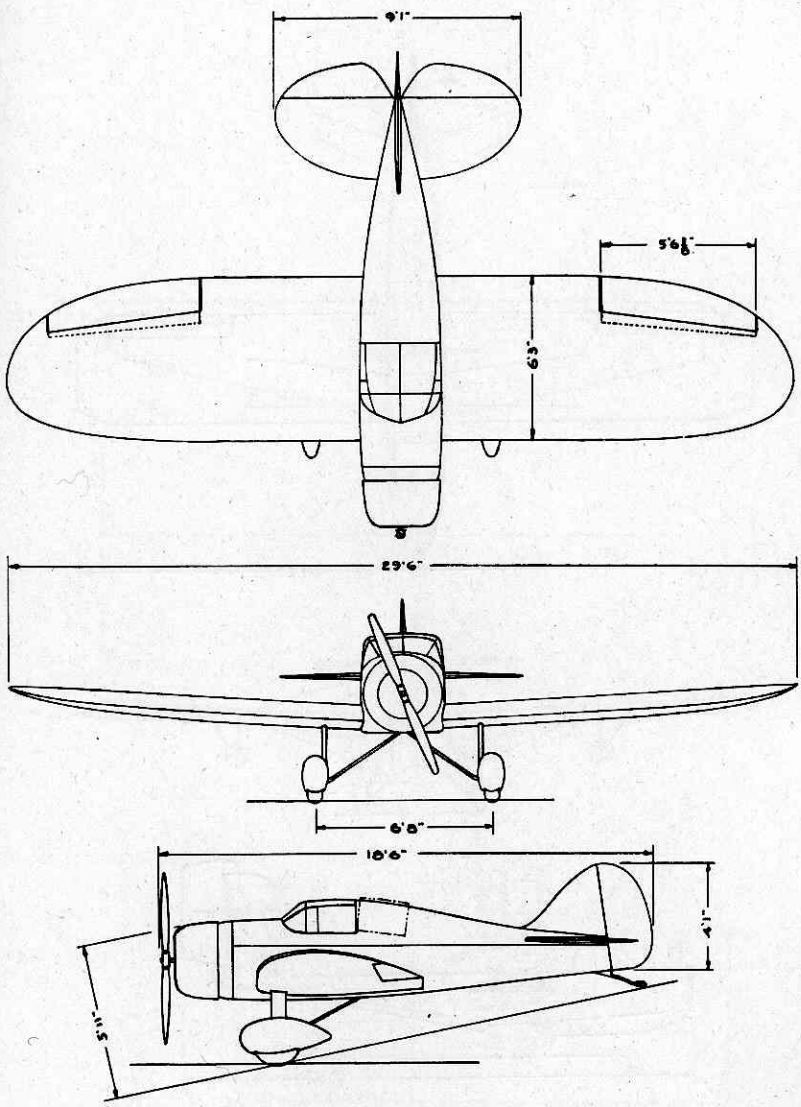

LAMBERT AIRCRAFT CORPORATION,
Robertson, Mo.
TWIN MONOCOACH CABIN DELUXE —— 4 PLACE
ENGINES: TWO LAMBERTS R-266 90 H.P.



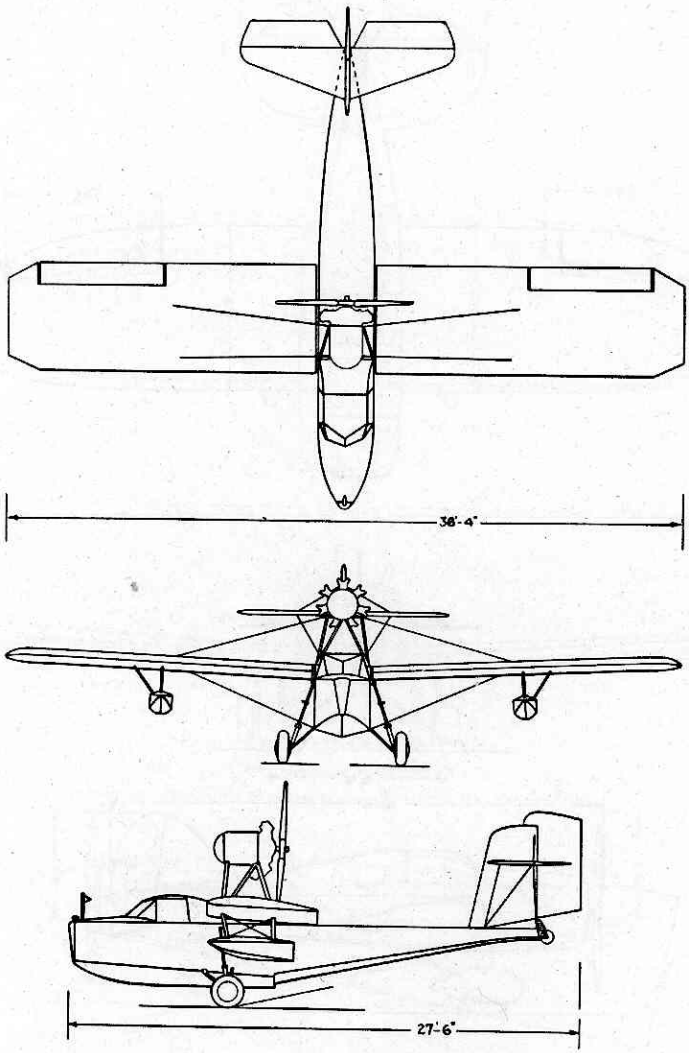

**LAMBERT AIRCRAFT CORPORATION**
Robertson, Mo.
MONOCOUPE CABIN DELUXE —— 2 PLACE
ENGINE: LAMBERT R-266 90 H.P.



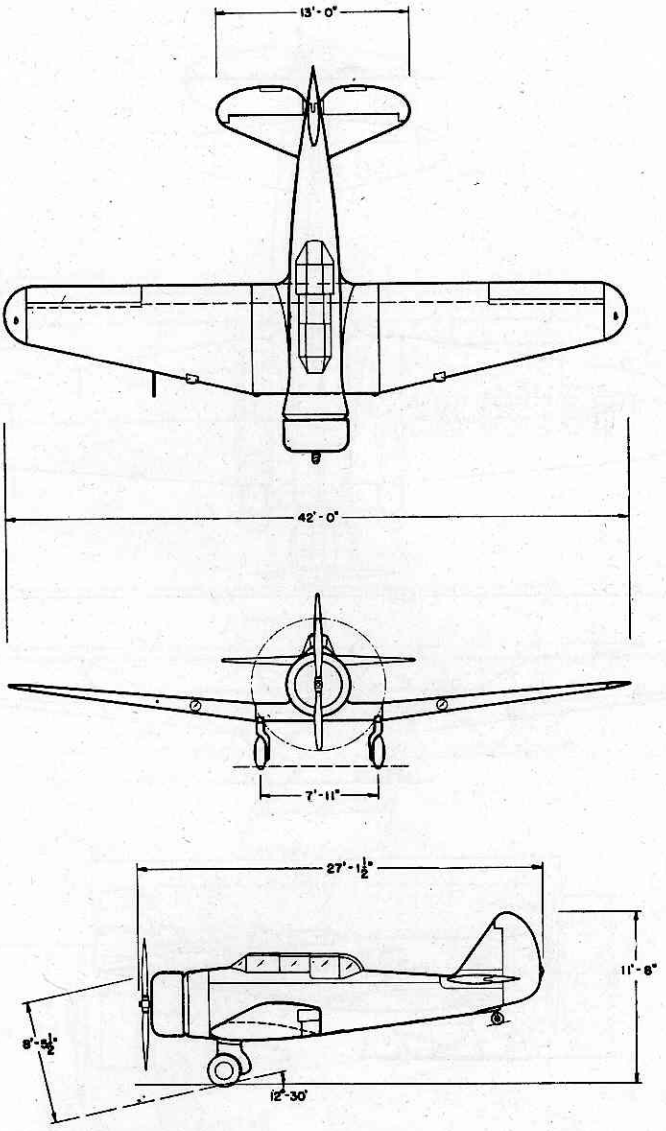

LAMBERT AIRCRAFT CORPORATION
Robertson, Mo.
NEW MONOPREP—OPEN TRAINER —— 2 PLACE
ENGINE: LAMBERT R-266 90 H.P.



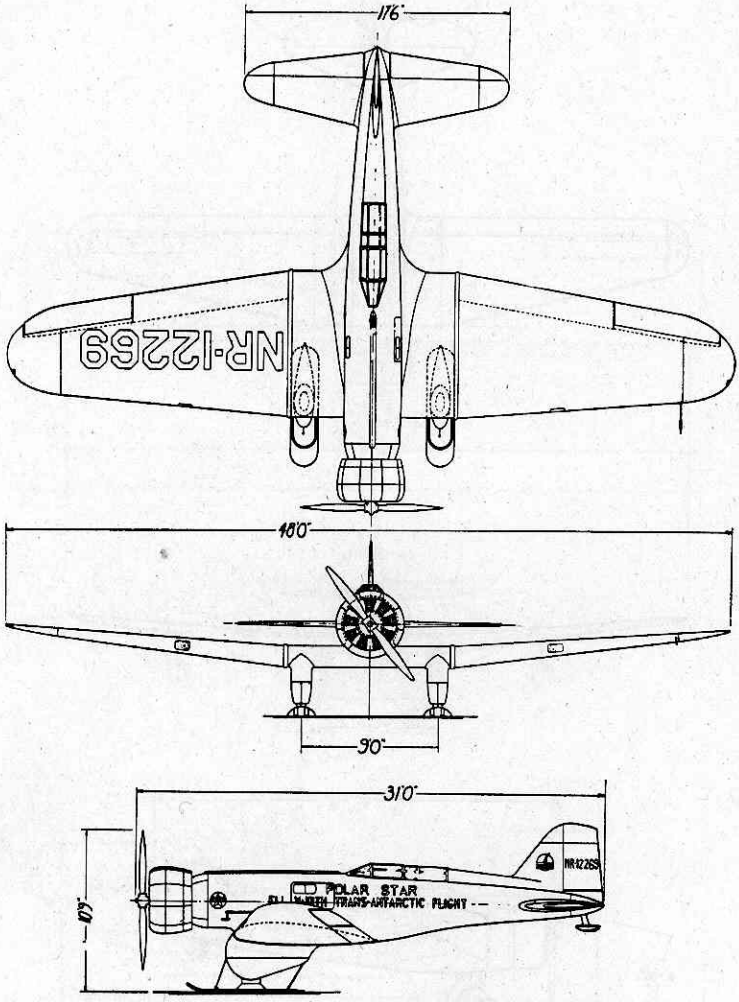

**LAMBERT AIRCRAFT CORPORATION**
Robertson, Mo.
NEW MONOSPORT CONVERTIBLE—SPORT MODEL DELUXE — 2 PLACE
ENGINE: LAMBERT R-266 90 H.P.



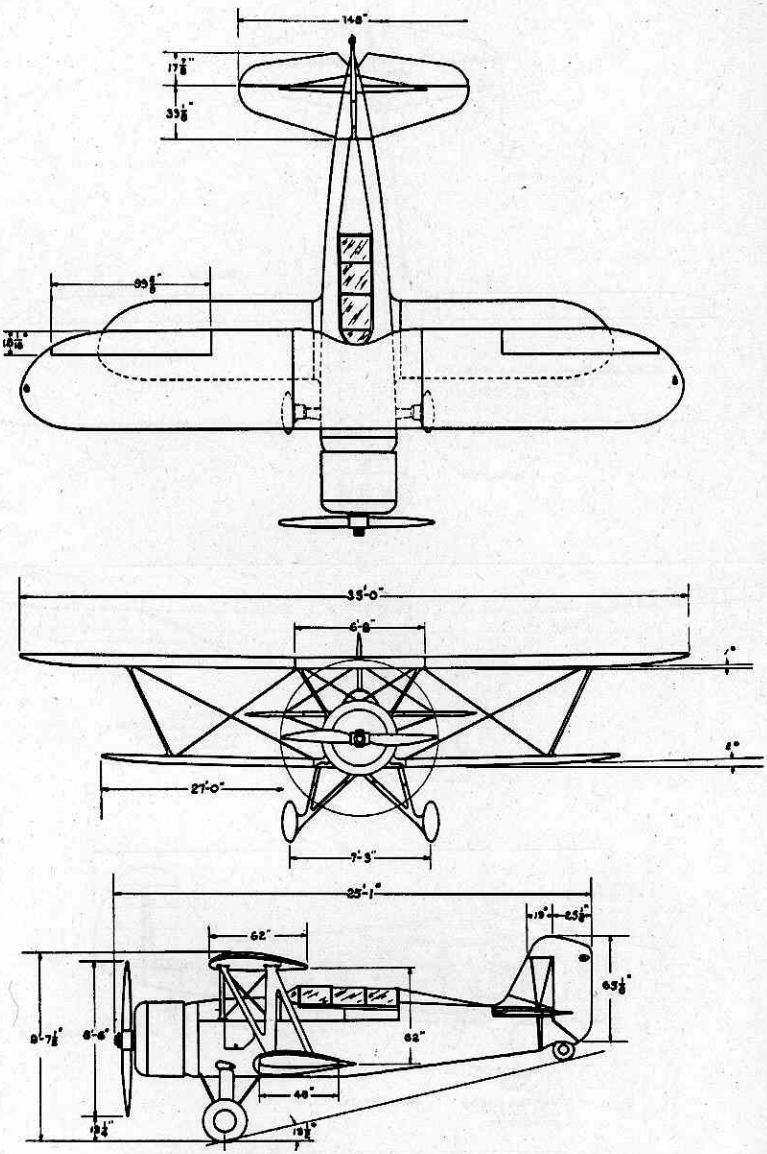

**GROVER LOENING AIRCRAFT COMPANY, INC.**
Garden City, L. I., N. Y.
DUCKLING —— 2 PLACE
ENGINE: WARNER SCARAB



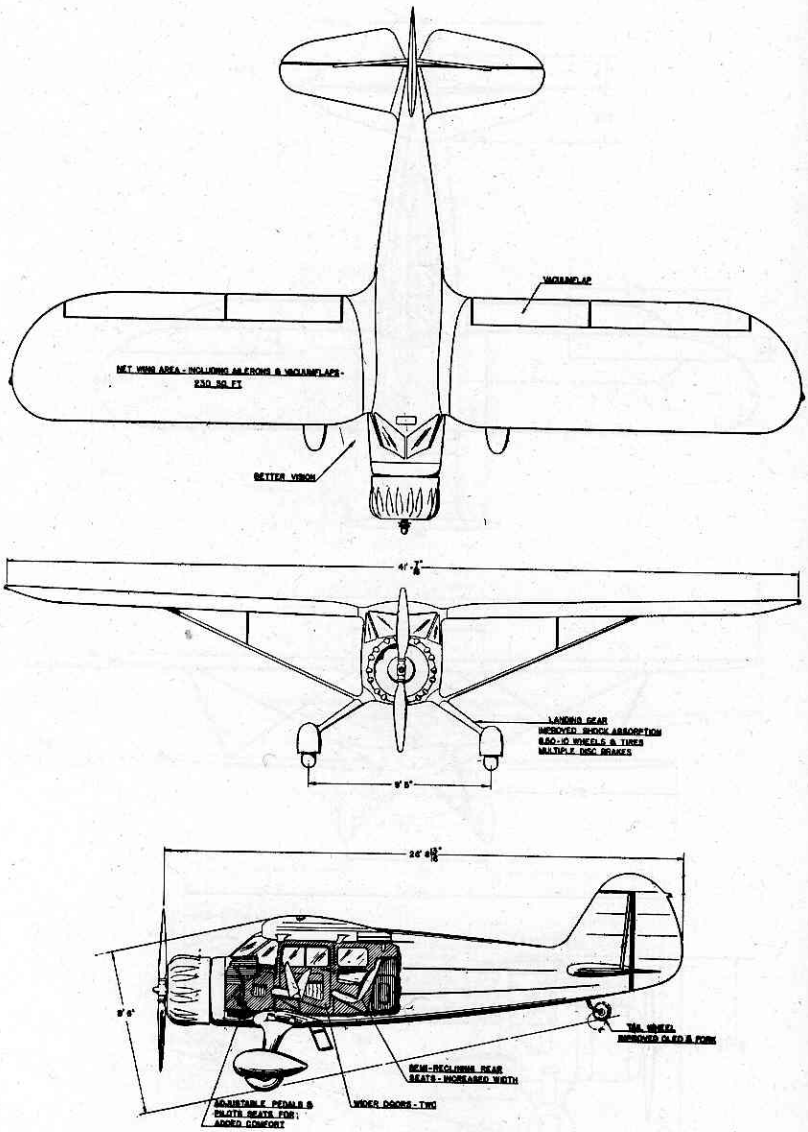

NORTH AMERICAN AVIATION, INC.
Manufacturing Division
Dundalk, Md.
MODEL NA-18 —— 2 PLACE
ENGINE: PRATT & WHITNEY WASP




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



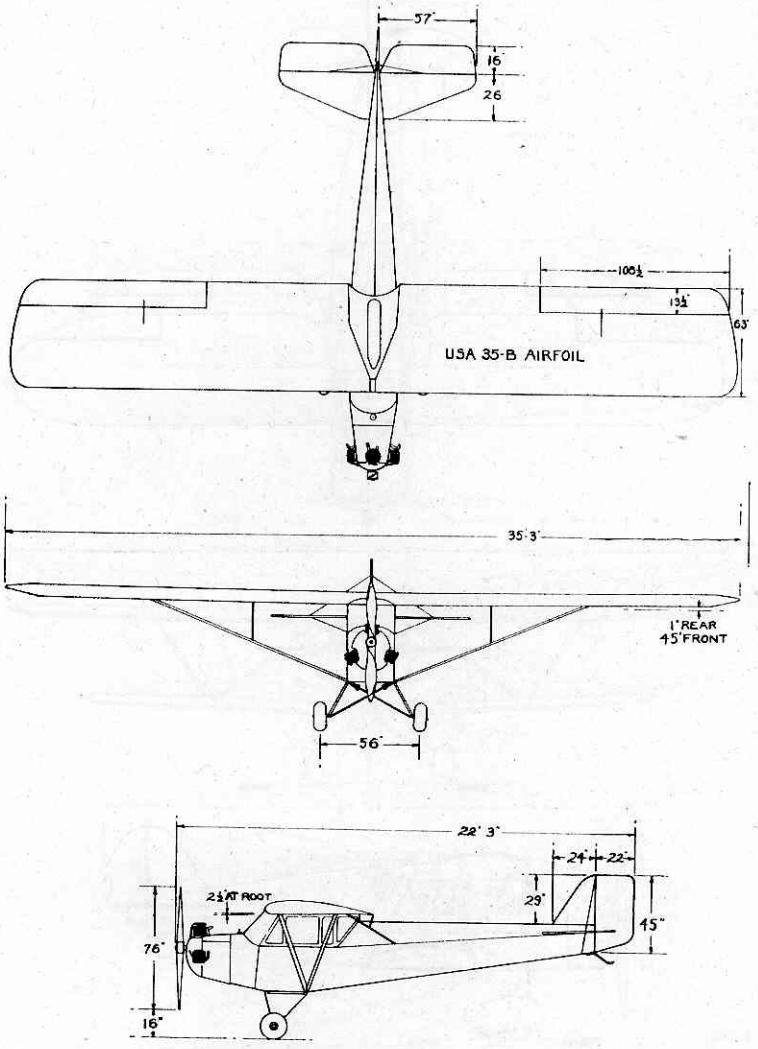

## STINSON AIRCRAFT CORPORATION

Wayne, Mich.

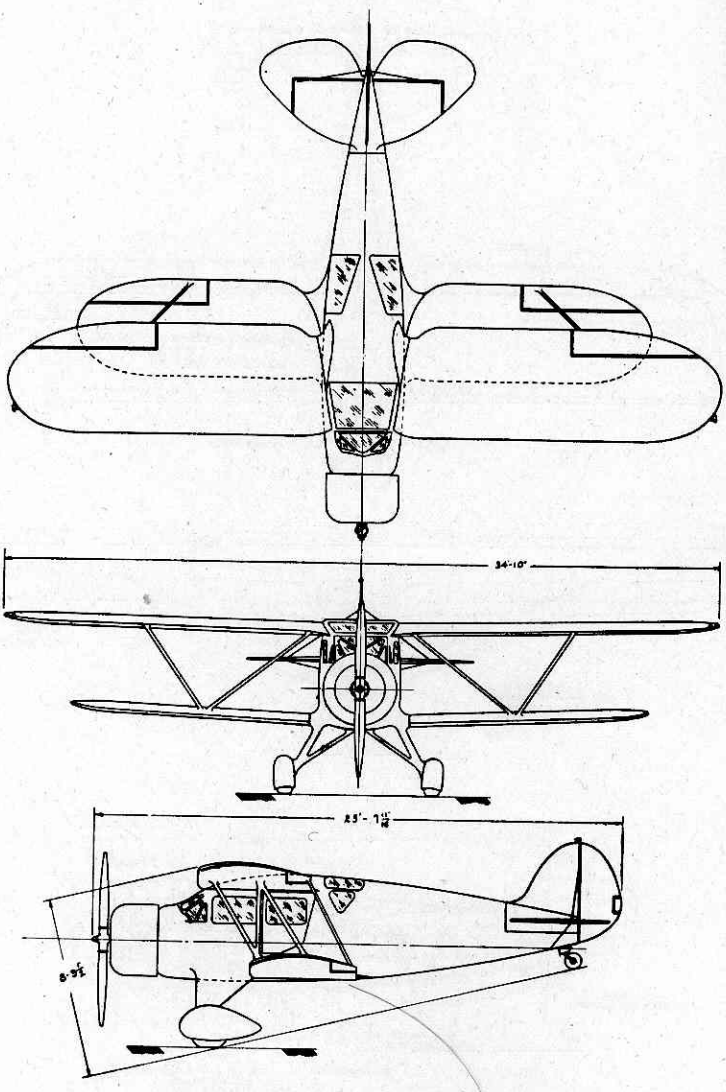
RELIANT —— 4 PLACE

MODEL SR6-A — ENGINE: LYCOMING R-680-4

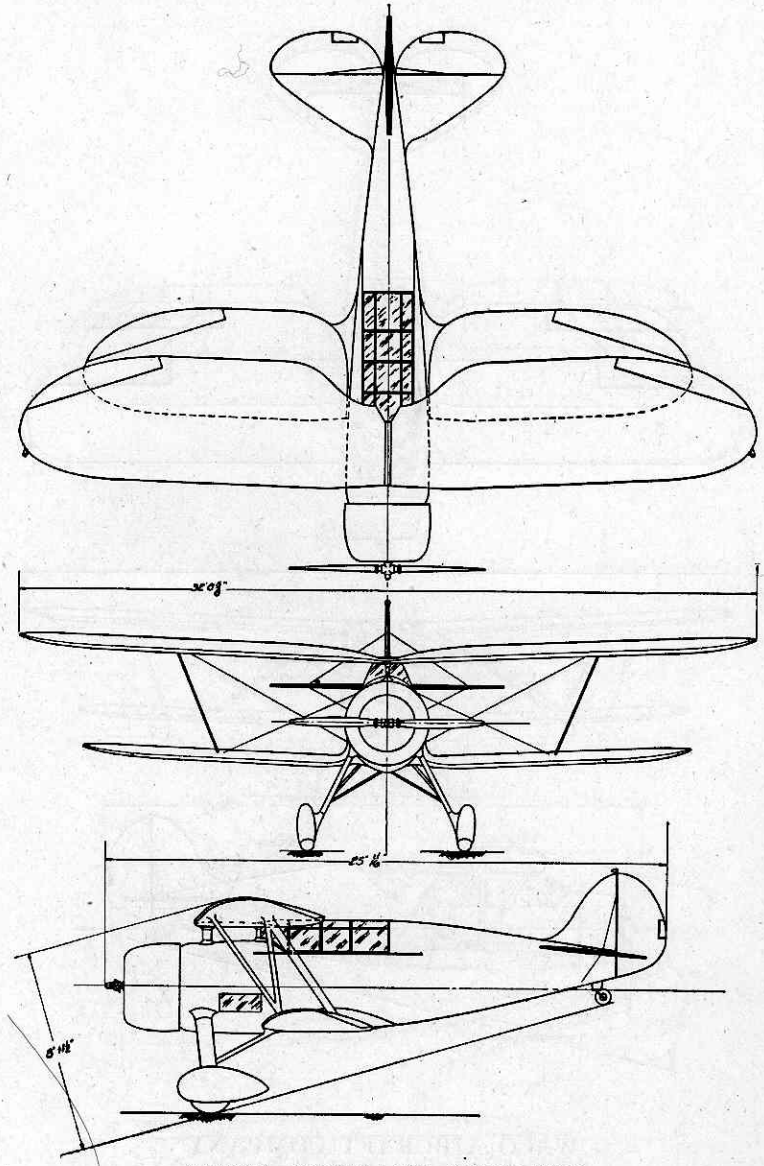
SR6-B — LYCOMING R-680-5



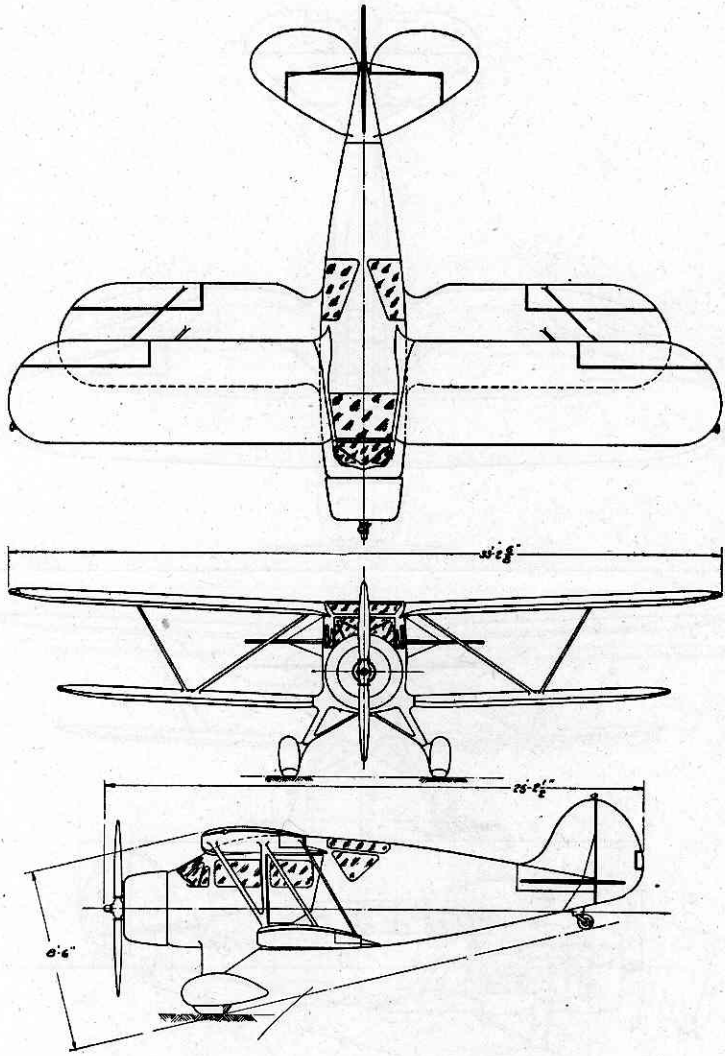

**TAYLOR AIRCRAFT COMPANY**
**Bradford, Pa.**
**TAYLOR CUB F-2 —— 2 PLACE**
**ENGINE: AEROMARINE AR3-40**



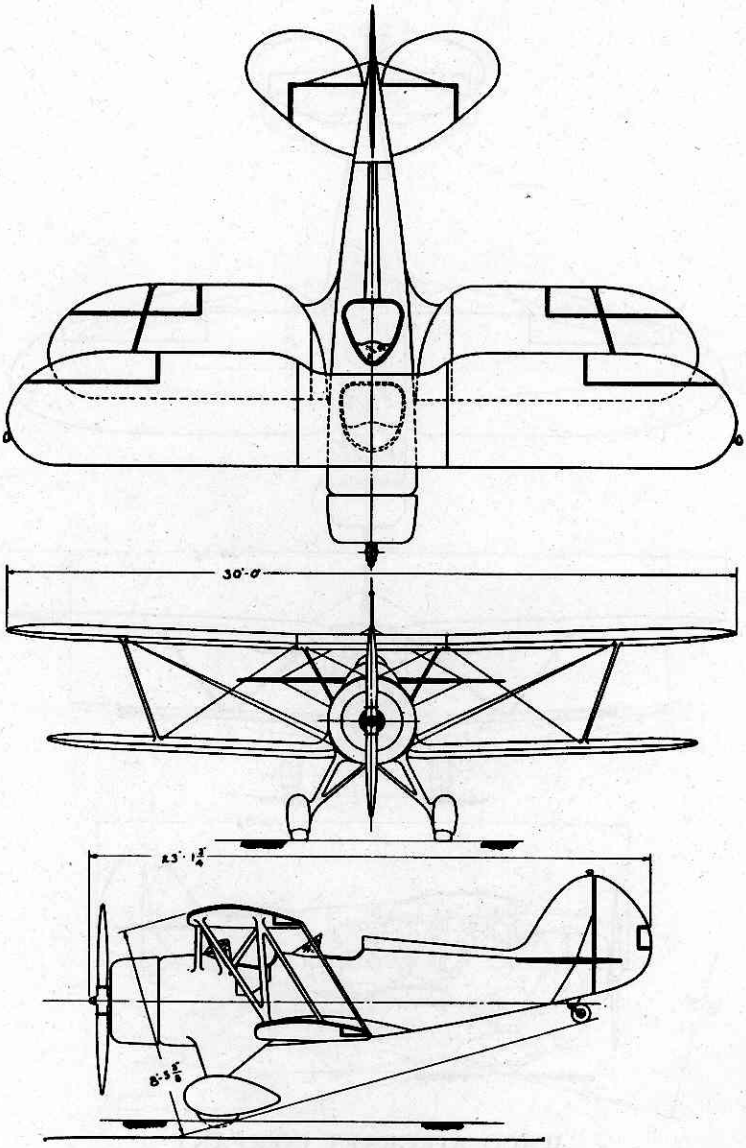
WACO AIRCRAFT COMPANY
Troy, Ohio
MODEL CJC-S —— 4 PLACE
ENGINE: WRIGHT WHIRLWIND



WACO AIRCRAFT COMPANY
Troy, Ohio
MODEL WHD —— 2 PLACE
ENGINE: PRATT & WHITNEY WASP JUNIOR
WRIGHT WHIRLWIND



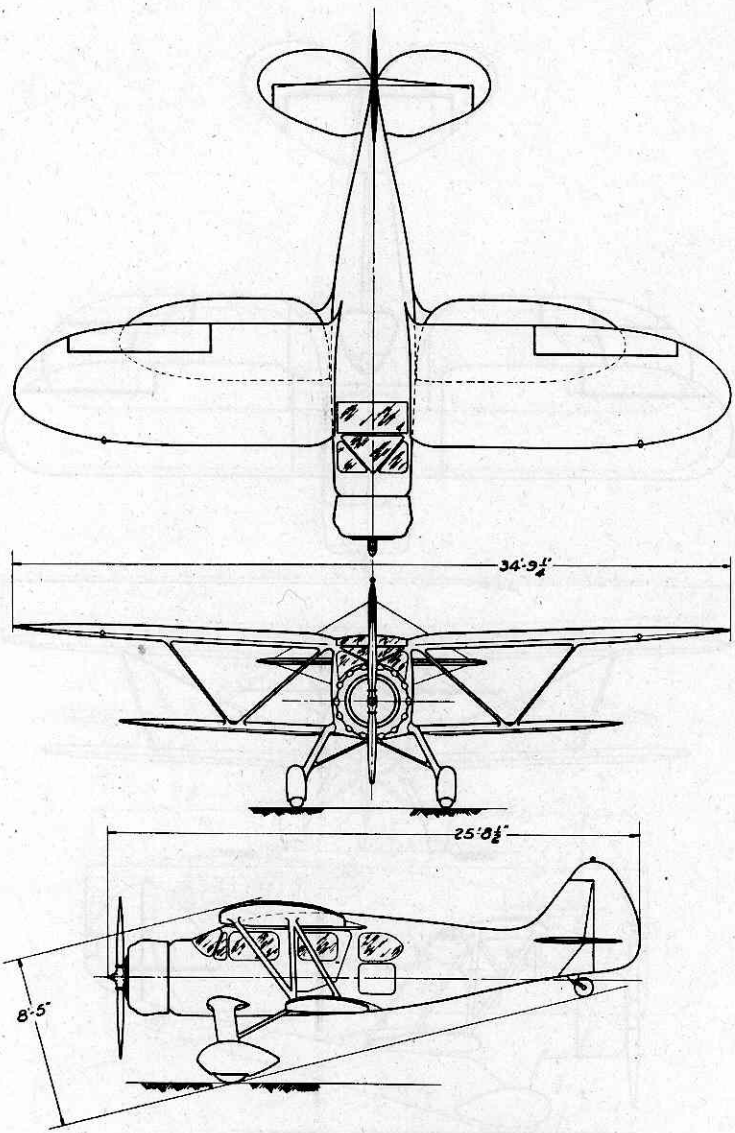
WACO AIRCRAFT COMPANY
Troy, Ohio
MODEL UKC-S —— 4 PLACE
ENGINE: CONTINENTAL
MODEL YKC-S
ENGINE: JACOBS L-4




## WACO AIRCRAFT COMPANY

Troy, Ohio

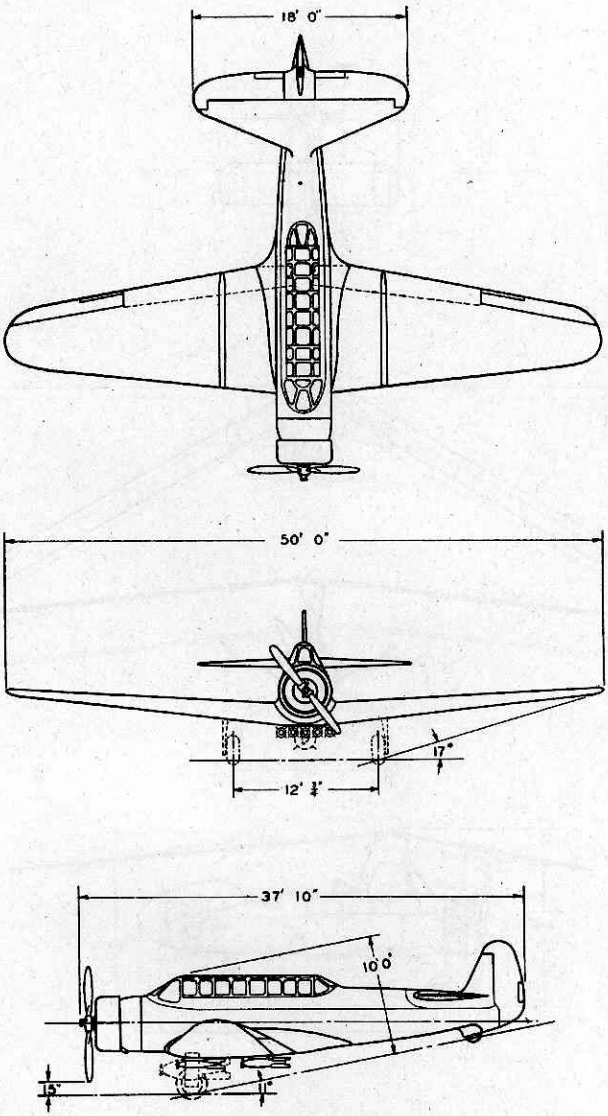
MODEL UMF——2 PLACE——ENGINE: CONTINENTAL
YMF——2 PLACE—— JACOBS L-4
CPF——2 PLACE—— WRIGHT WHIRLWIND R-760E



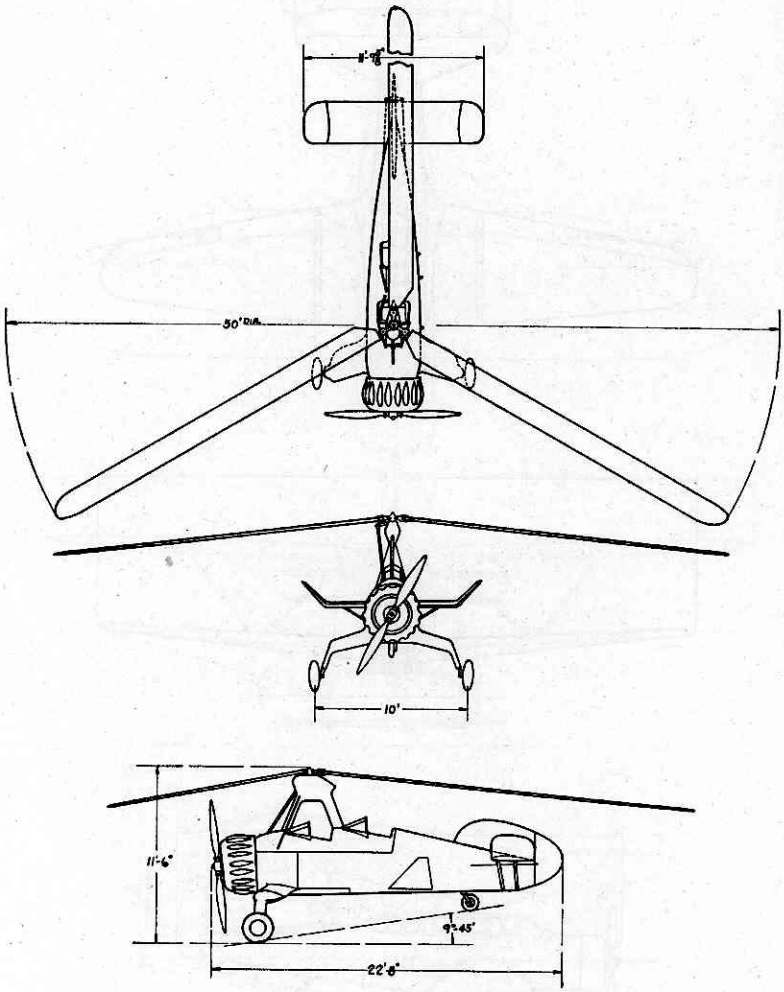

## WACO AIRCRAFT COMPANY

**Troy, Ohio**

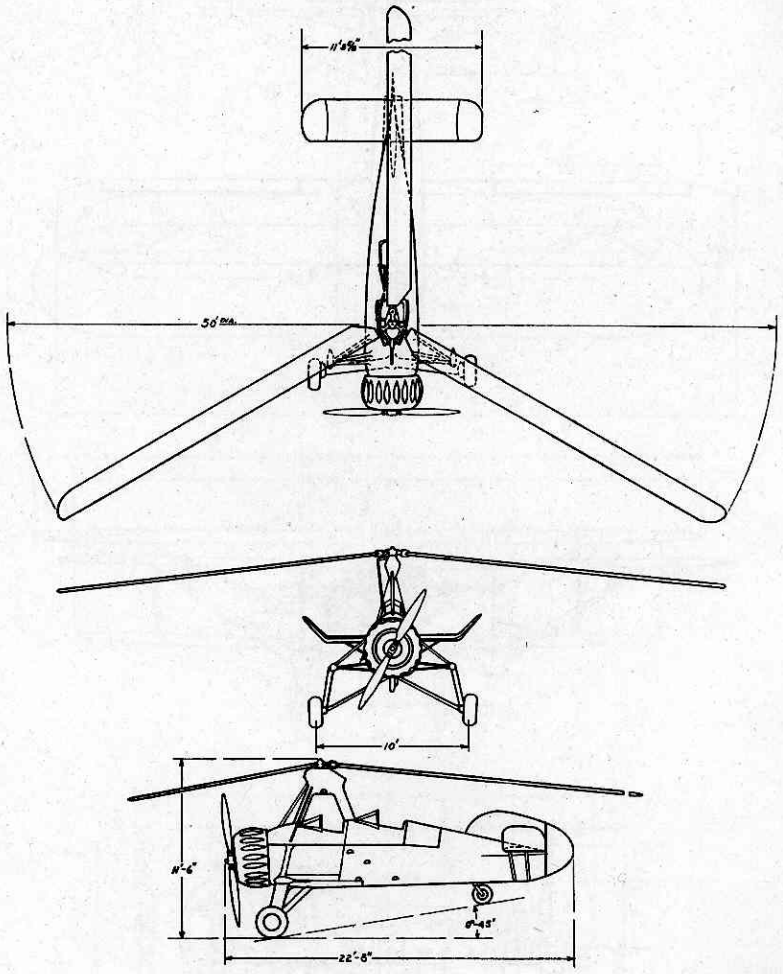
MODEL UOC — 4-5 PLACE — ENGINE: CONTINENTAL
YOC — 4-5 PLACE — JACOBS L-4
CUC — 4-5 PLACE — WRIGHT WHIRLWIND R-760E
WRIGHT WHIRLWIND R-760-E-2



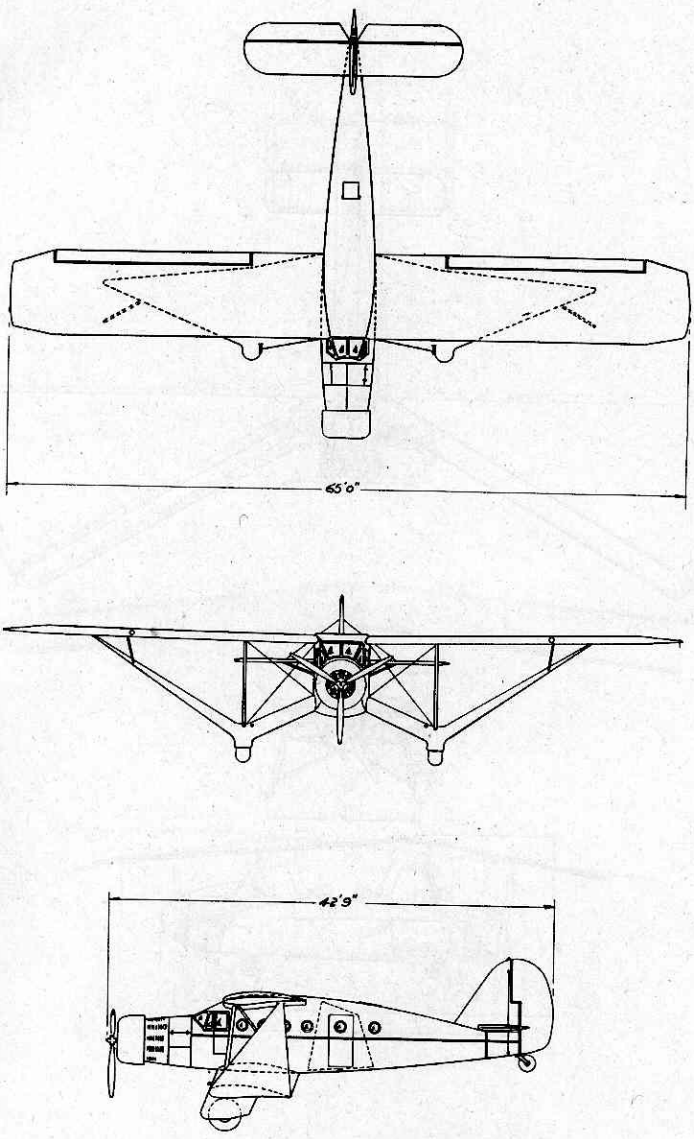

**AIRPLANE DEVELOPMENT CORPORATION**
Division of the Cord Corporation
Glendale, Calif.
MODEL V-11 —— ATTACK-BOMBER —— 2 PLACE
ENGINE: WRIGHT CYCLONE




AUTOGIRO COMPANY OF AMERICA
Willow Grove, Pa.
ARMY YG-2 —— 2 PLACE
ENGINE: WRIGHT WHIRLWIND 420 H.P.




AUTOGIRO COMPANY OF AMERICA
Willow Grove, Pa.
NAVY XOP-2 —— 2 PLACE
ENGINE: WRIGHT WHIRLWIND 420 H.P.

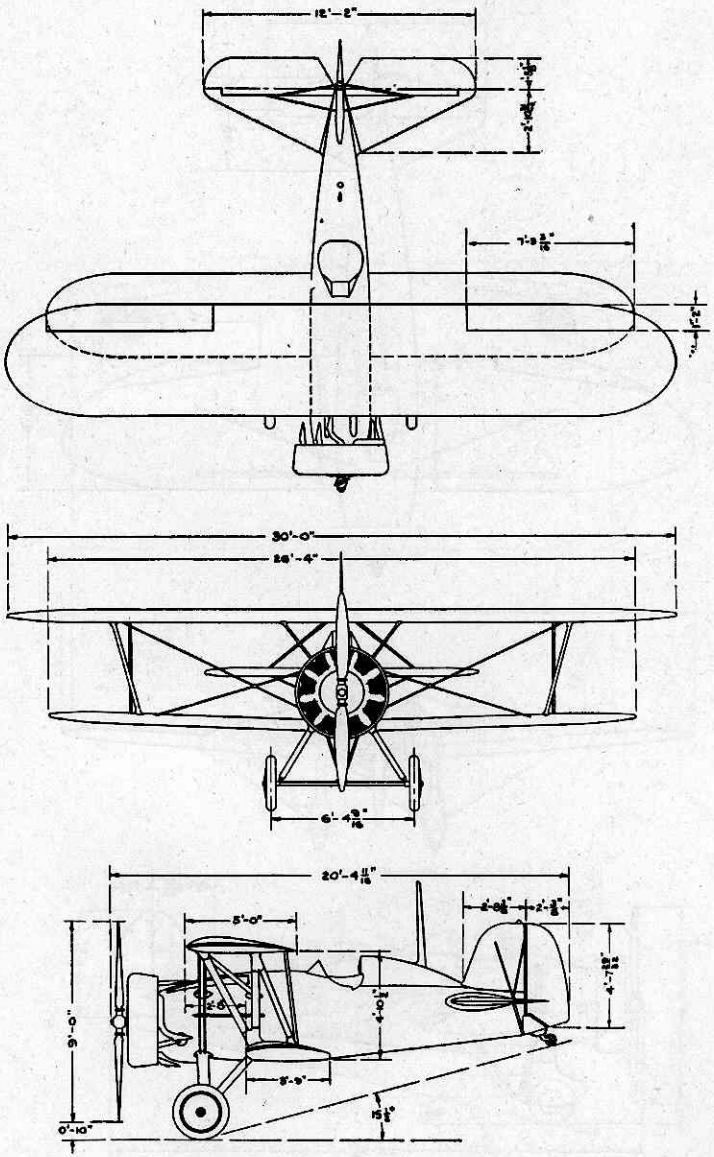



## BELLANCA AIRCRAFT CORPORATION

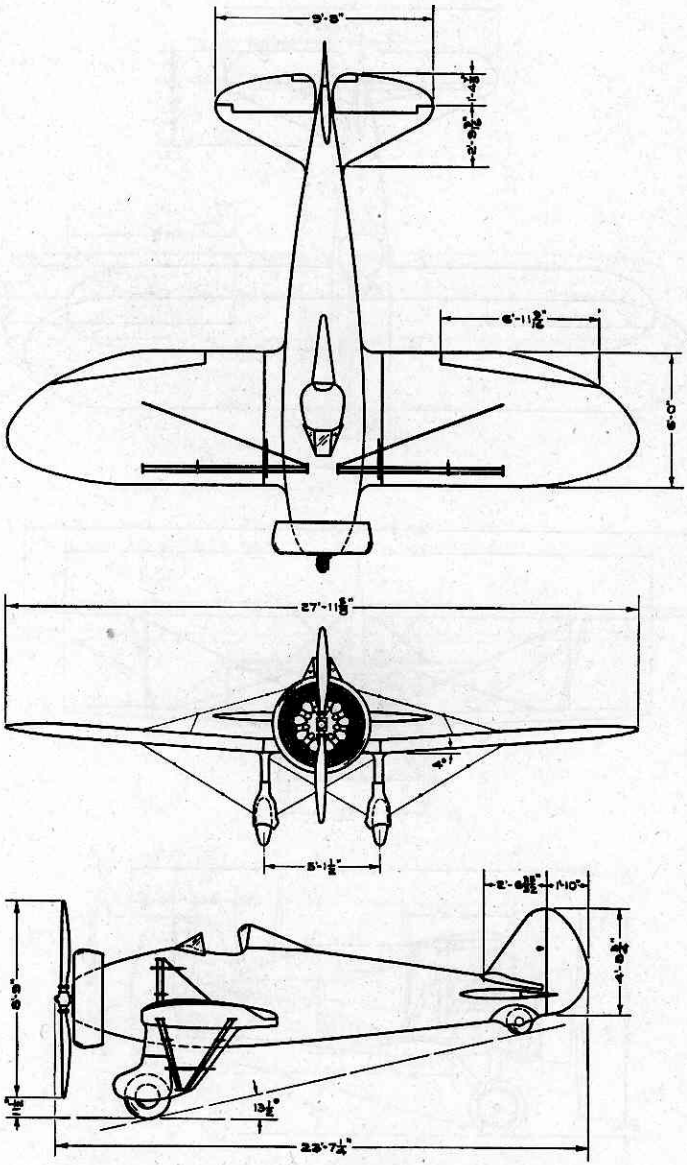
New Castle, Del.

AIRCRUISER ALL PURPOSE TRANSPORT-BOMBER

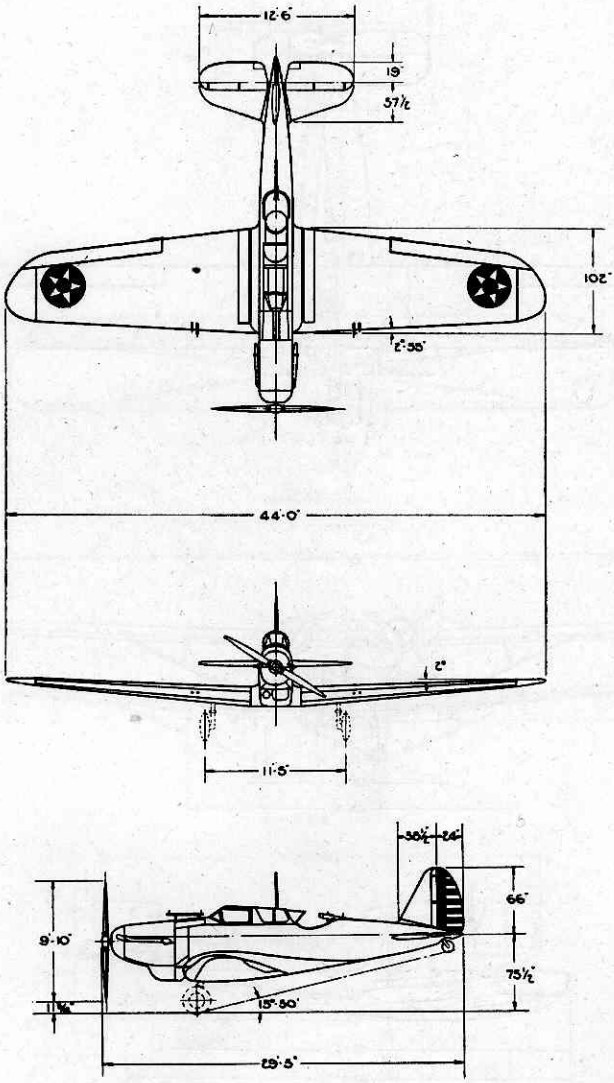
ENGINE: PRATT & WHITNEY HORNET 750 H.P.




**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



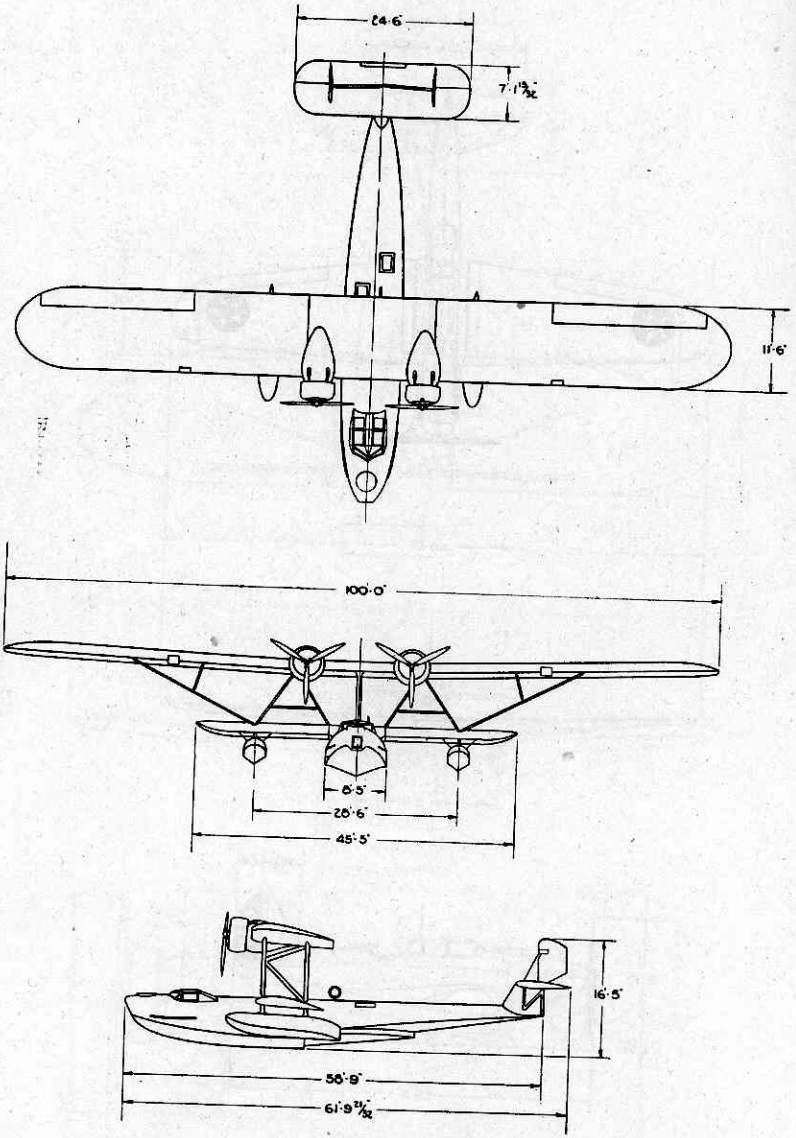

## CONSOLIDATED AIRCRAFT CORPORATION

San Diego, Calif.

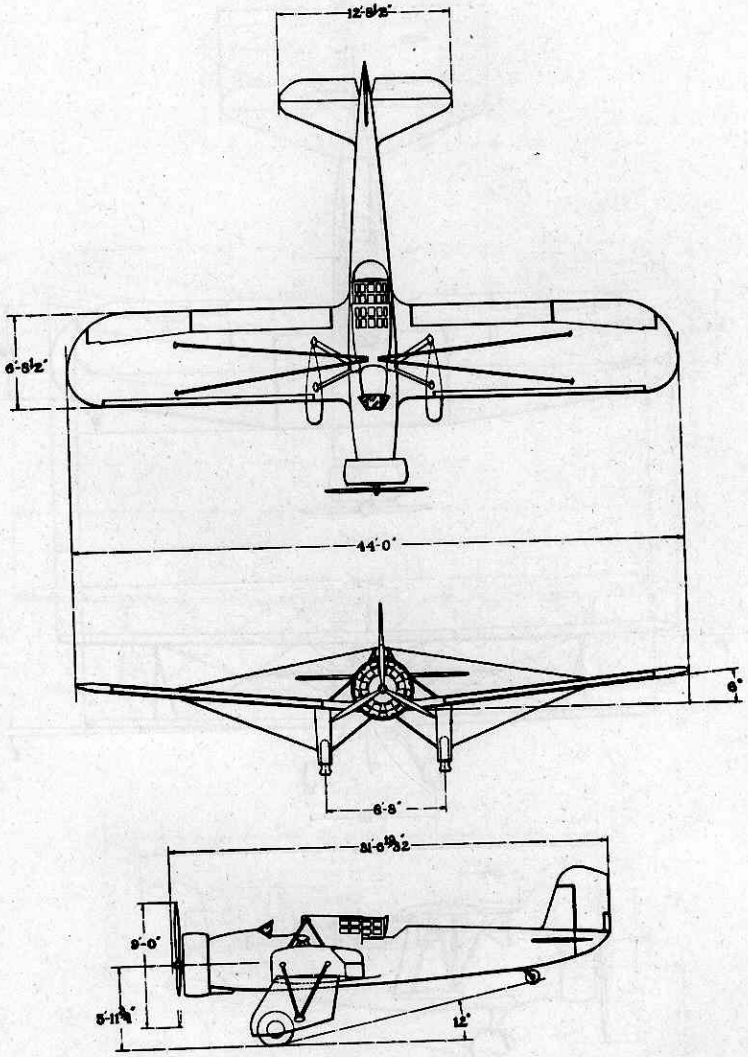
A-11 Attack —— 2 Place

Engine: Curtiss Conqueror

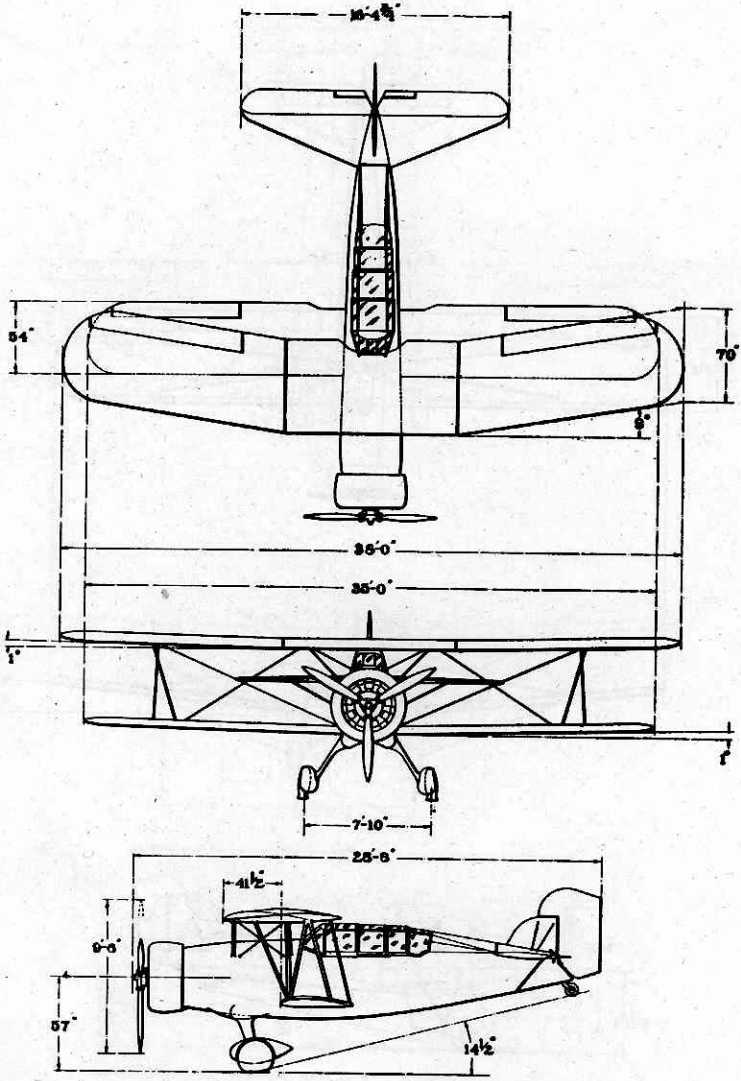
BERKELEY PUBLIC LIBRARY Berkeley, Cal.



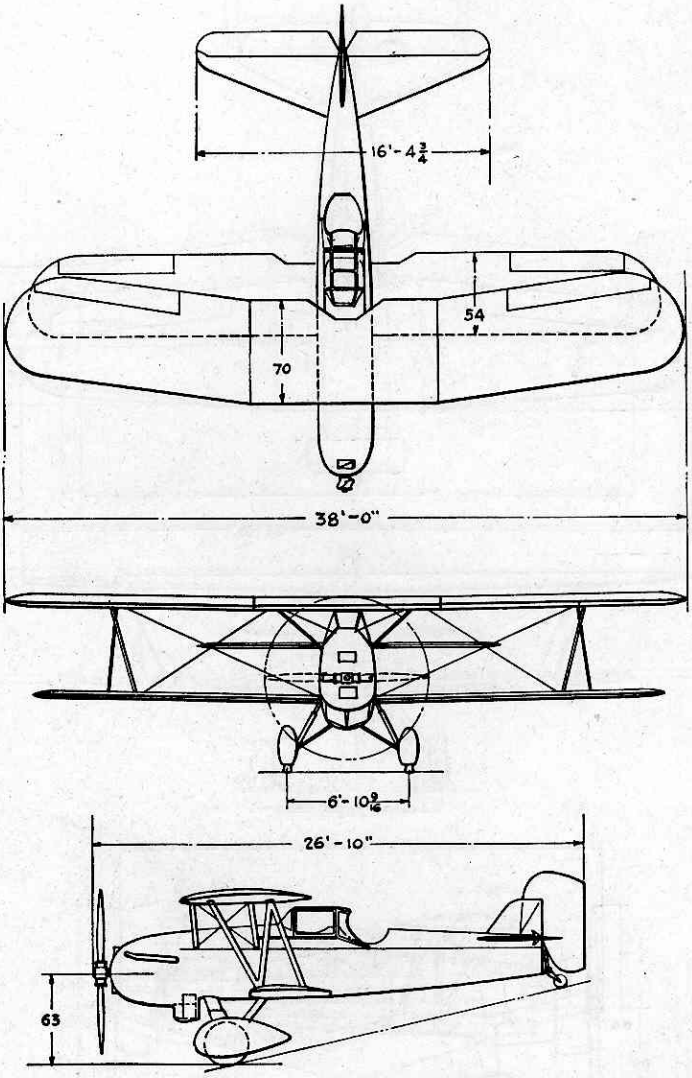

CONSOLIDATED AIRCRAFT CORPORATION
San Diego, Calif.
P2Y-3 Patrol Flying Boat
Engines: 2 Geared Wright Cyclones



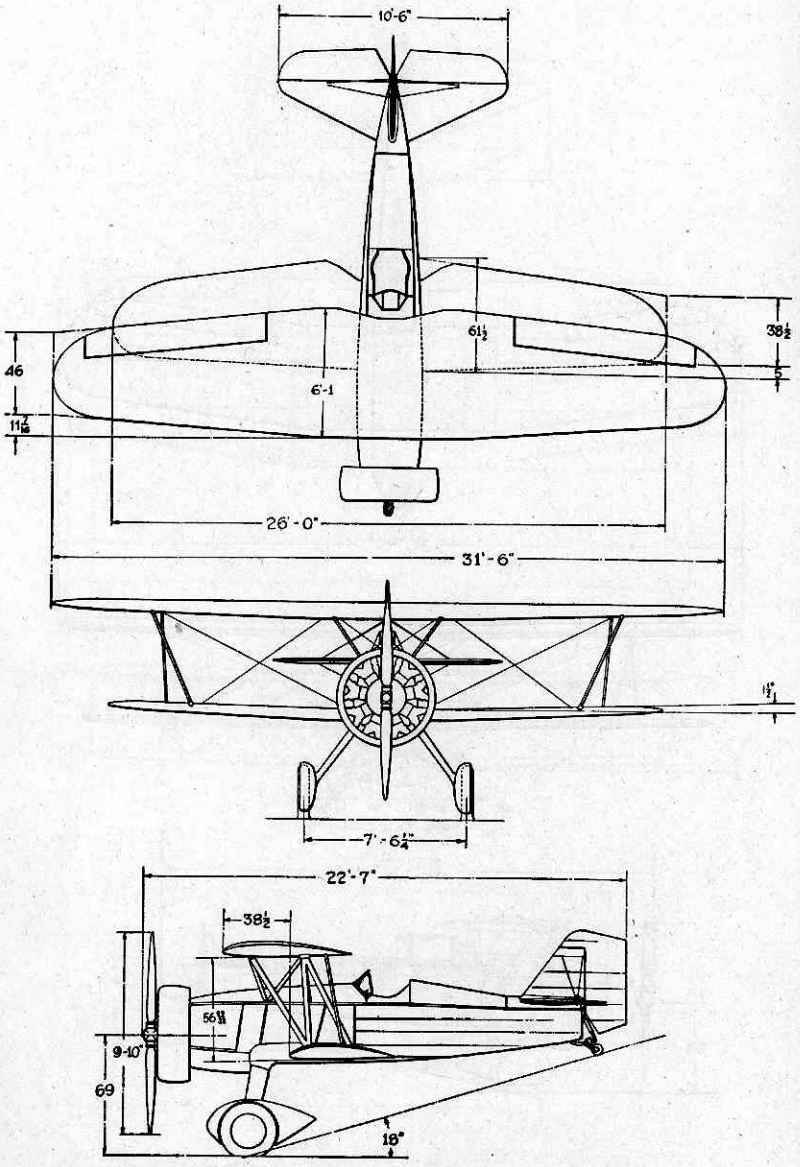

**CURTISS AEROPLANE & MOTOR COMPANY**
**Buffalo, N. Y.**
ATTACK A-12 —— SHRIKE
ENGINE: WRIGHT CYCLONE 775 H.P.



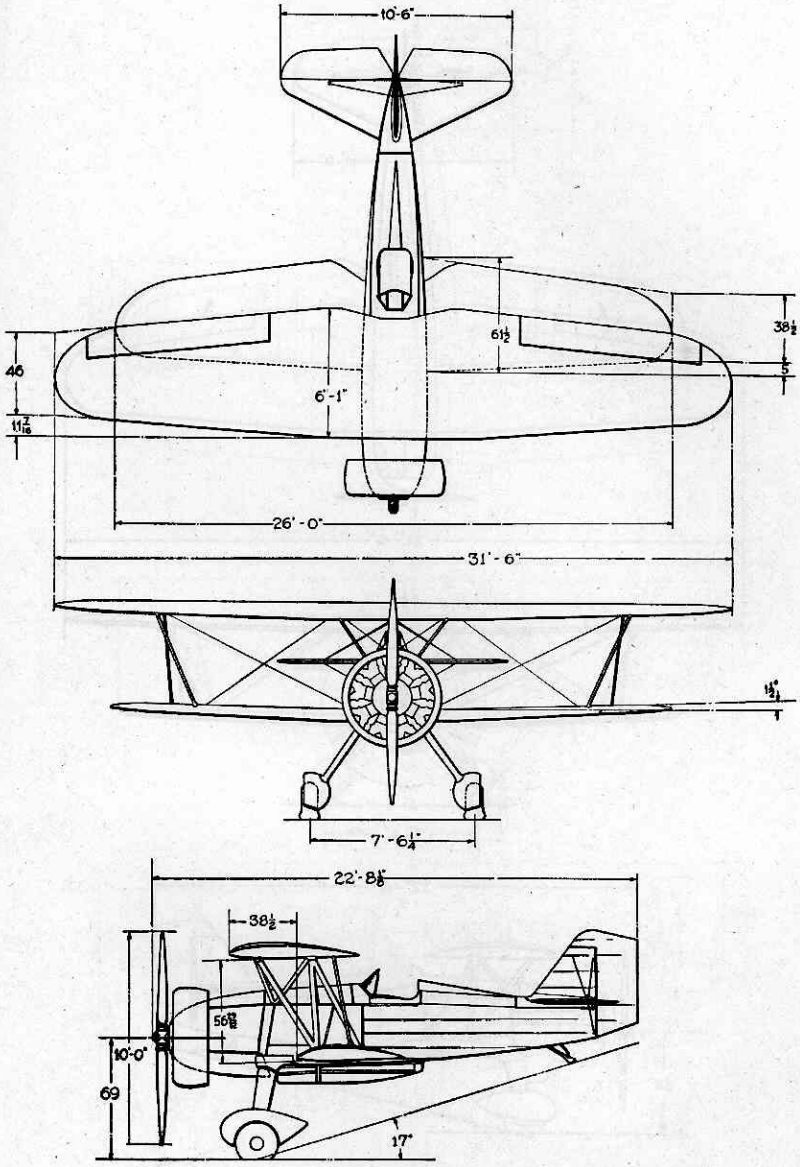

CURTISS AEROPLANE & MOTOR COMPANY
Buffalo, N. Y.
FALCON OBSERVATION & ATTACK
ENGINE: WRIGHT F CYCLONE 715 H.P.



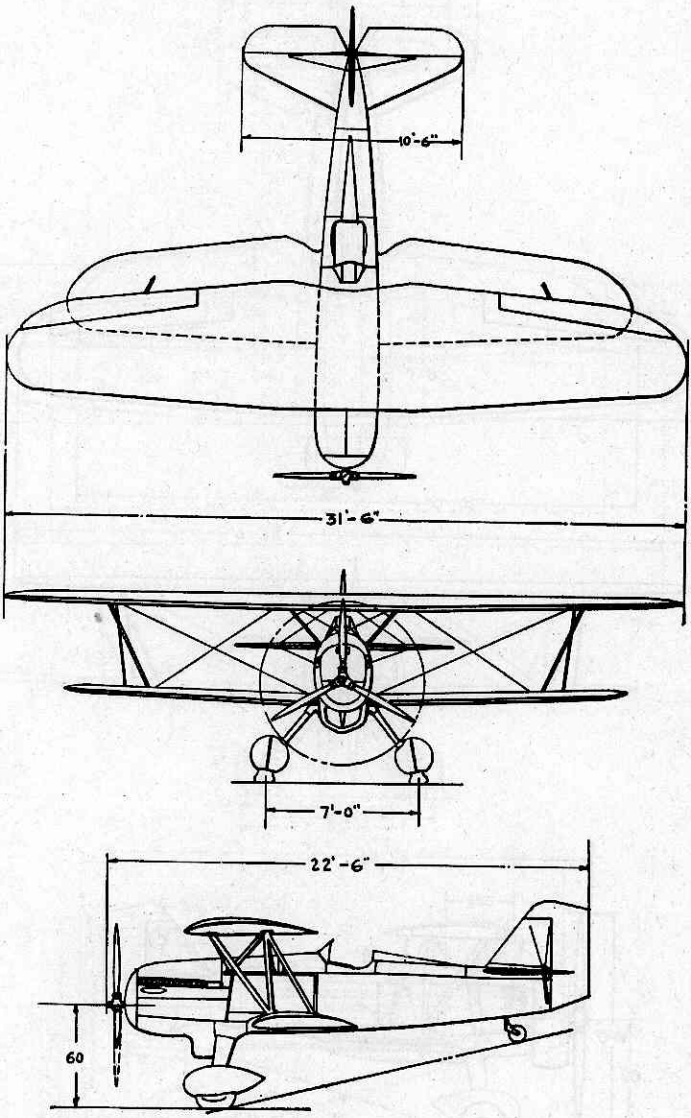

CURTISS AEROPLANE & MOTOR COMPANY
Buffalo, N. Y.
FALCON OBSERVATION O-39
ENGINE: CURTISS CONQUEROR 675 H.P.



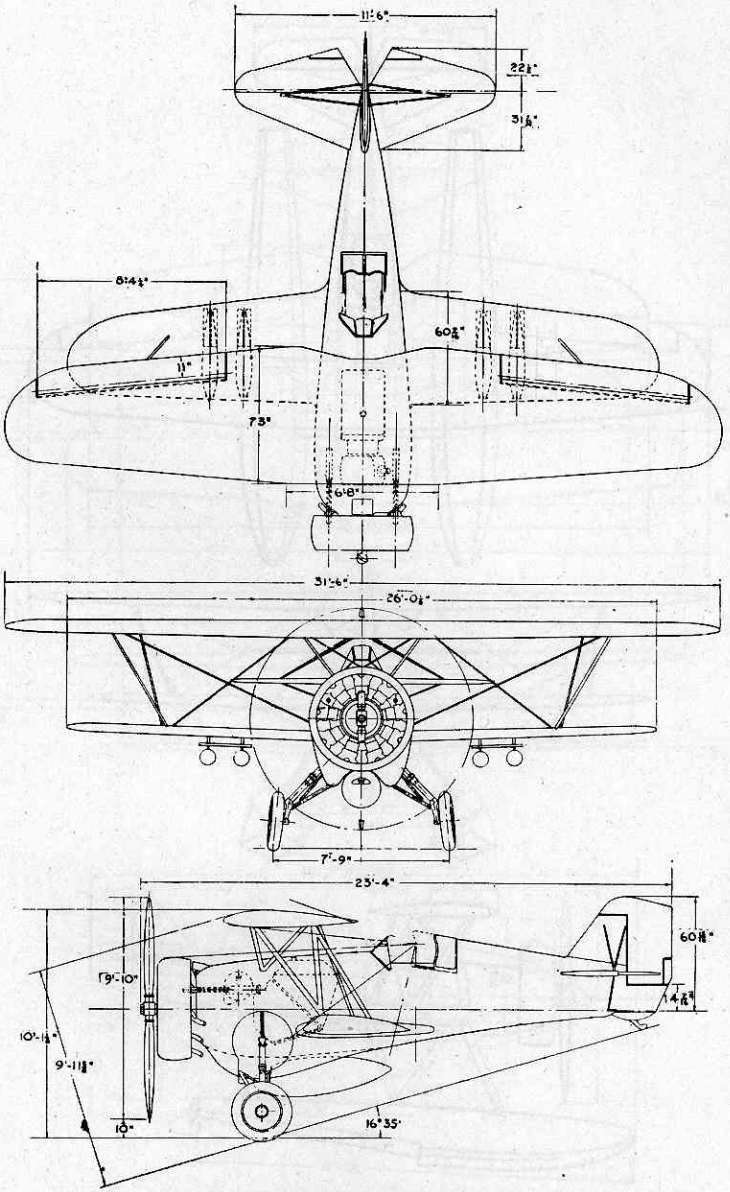

**CURTISS AEROPLANE & MOTOR COMPANY**
**Buffalo, N. Y.**
**FIGHTER F11C-2 —— HAWK**
**ENGINE: WRIGHT CYCLONE F —— 750 H.P.**



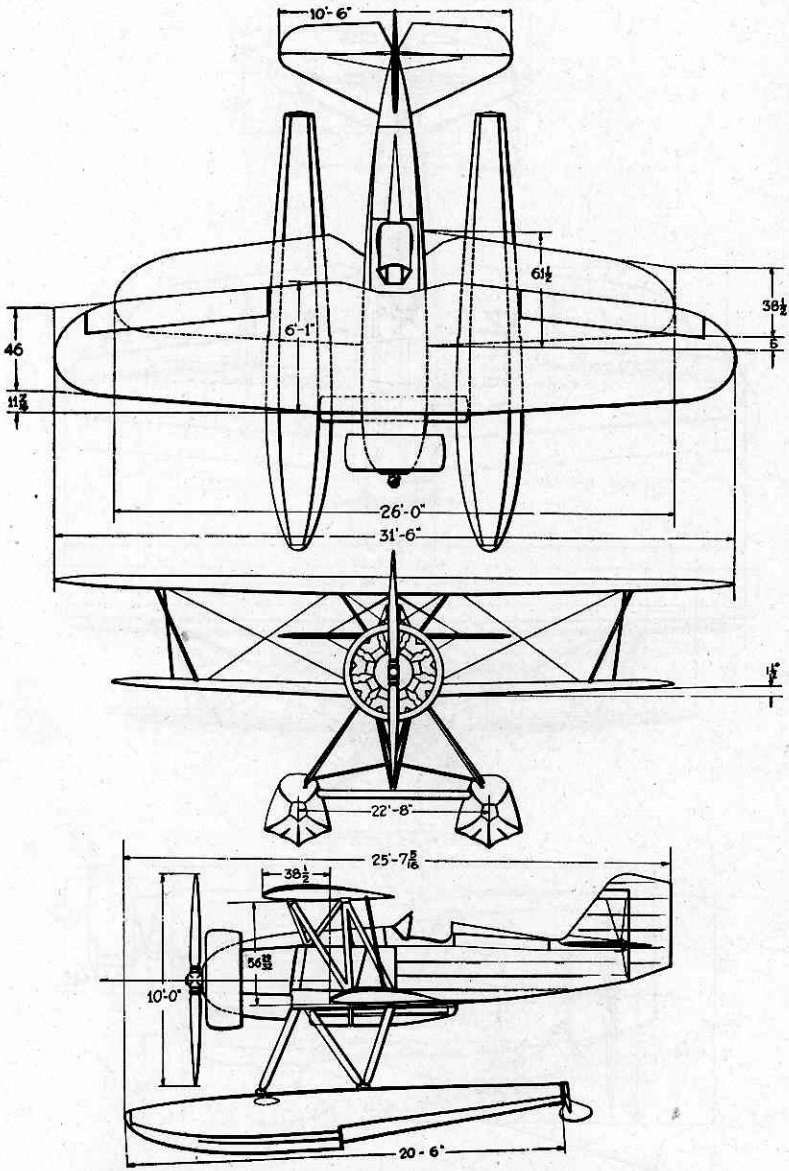

**CURTISS AEROPLANE & MOTOR COMPANY**
**Buffalo, N. Y.**
**HAWK PURSUIT LAND PLANE**
**ENGINE: WRIGHT CYCLONE —— 720 H.P.**



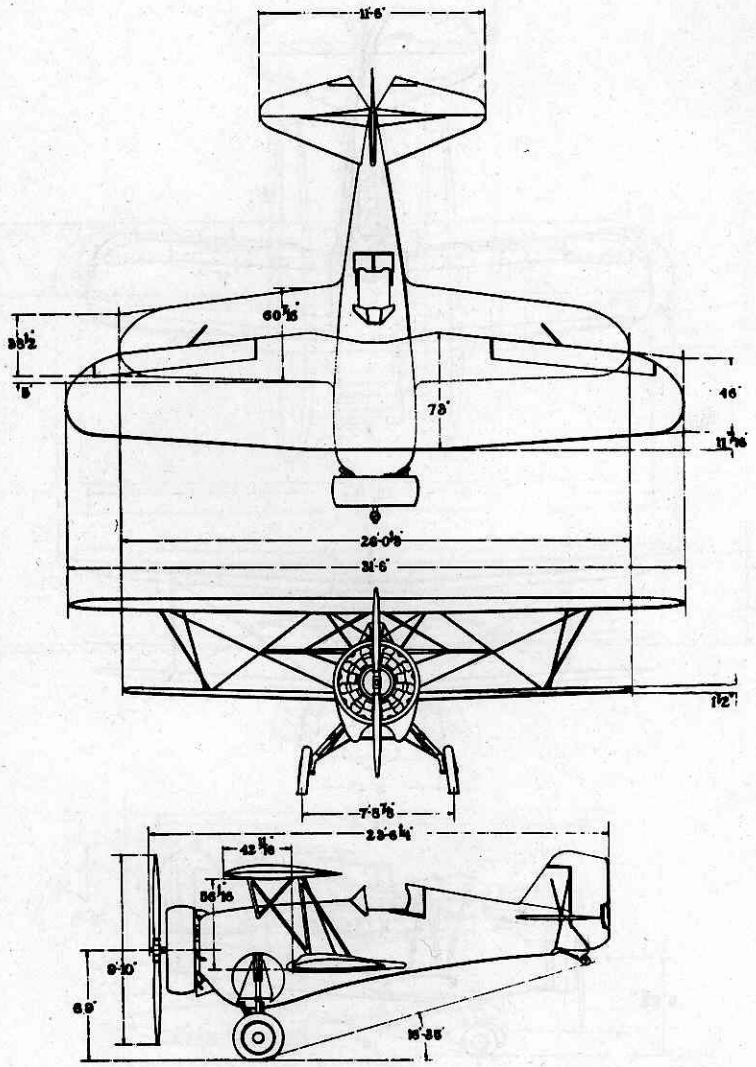

CURTISS AEROPLANE & MOTOR COMPANY
Buffalo, N. Y.
HAWK PURSUIT P 6-E
ENGINE: CURTISS CONQUEROR 675 H.P.



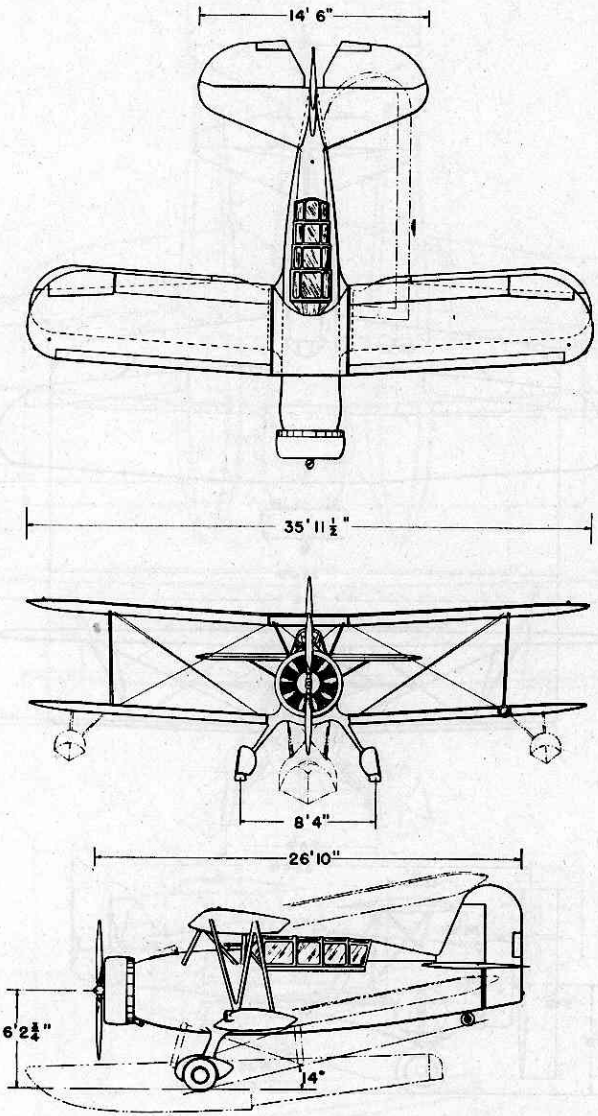

**CURTISS AEROPLANE & MOTOR COMPANY**
**Buffalo, N. Y.**
**HAWK PURSUIT TYPE III —— 1 PLACE**
**ENGINE: WRIGHT CYCLONE 780 H.P.**



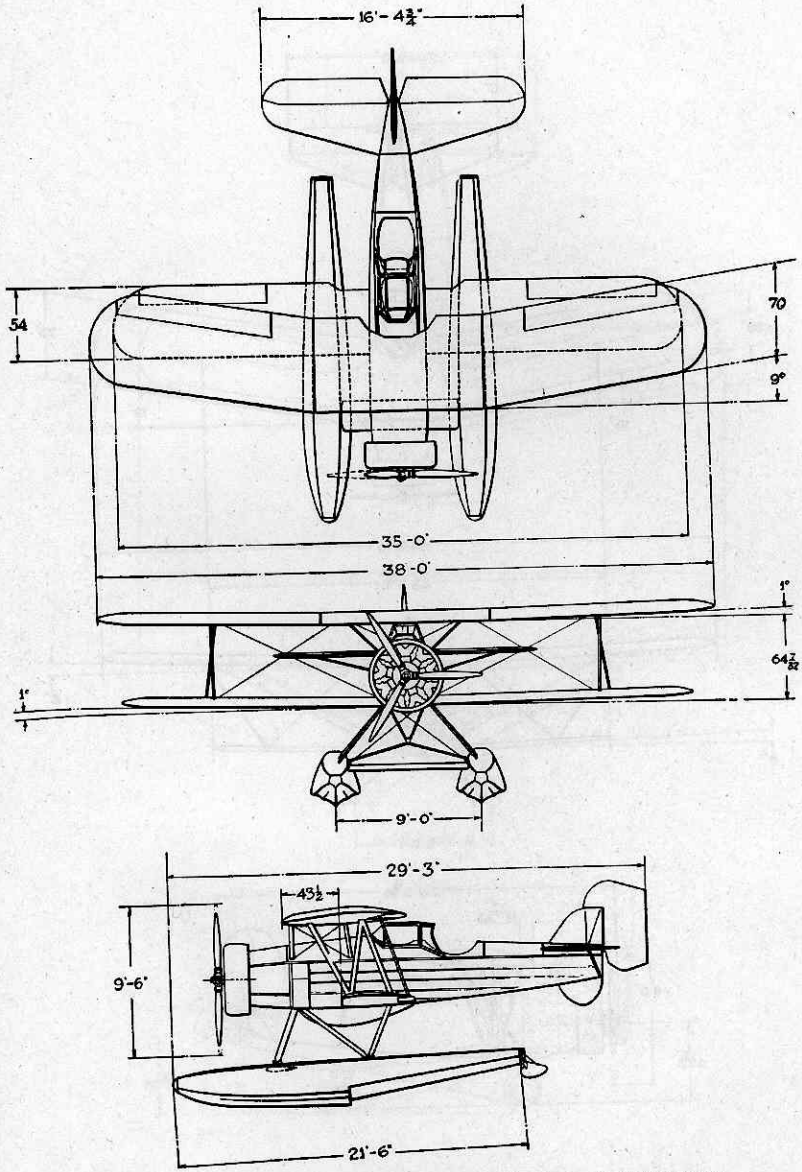

**CURTISS AEROPLANE & MOTOR COMPANY**
**Buffalo, N. Y.**
**HAWK PURSUIT SEAPLANE**
**ENGINE: WRIGHT CYCLONE F —— 715 H.P.**



CURTISS AEROPLANE & MOTOR COMPANY
Buffalo, N. Y.
NAVY HAWK FIGHTER BF2C-1 —— 1 PLACE
ENGINE: WRIGHT CYCLONE




CURTISS AEROPLANE & MOTOR COMPANY
Buffalo, N. Y.
Navy Observation-Scout Biplane —— SOC-1
ENGINE: PRATT & WHITNEY WASP

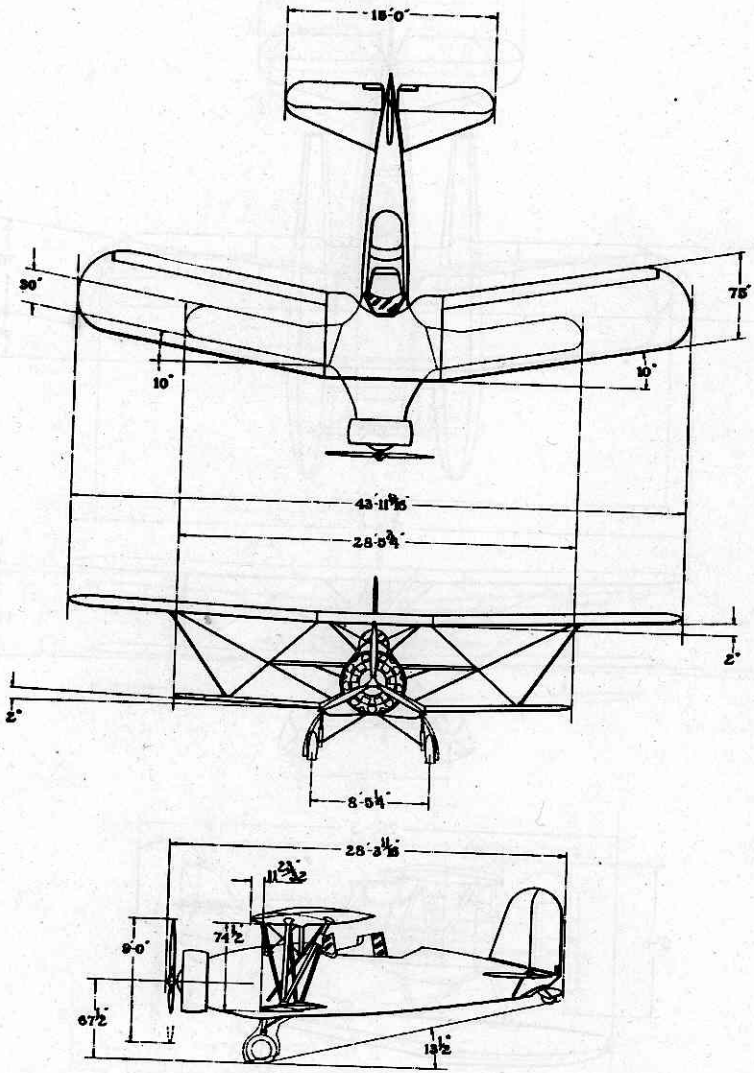



CURTISS AEROPLANE & MOTOR COMPANY

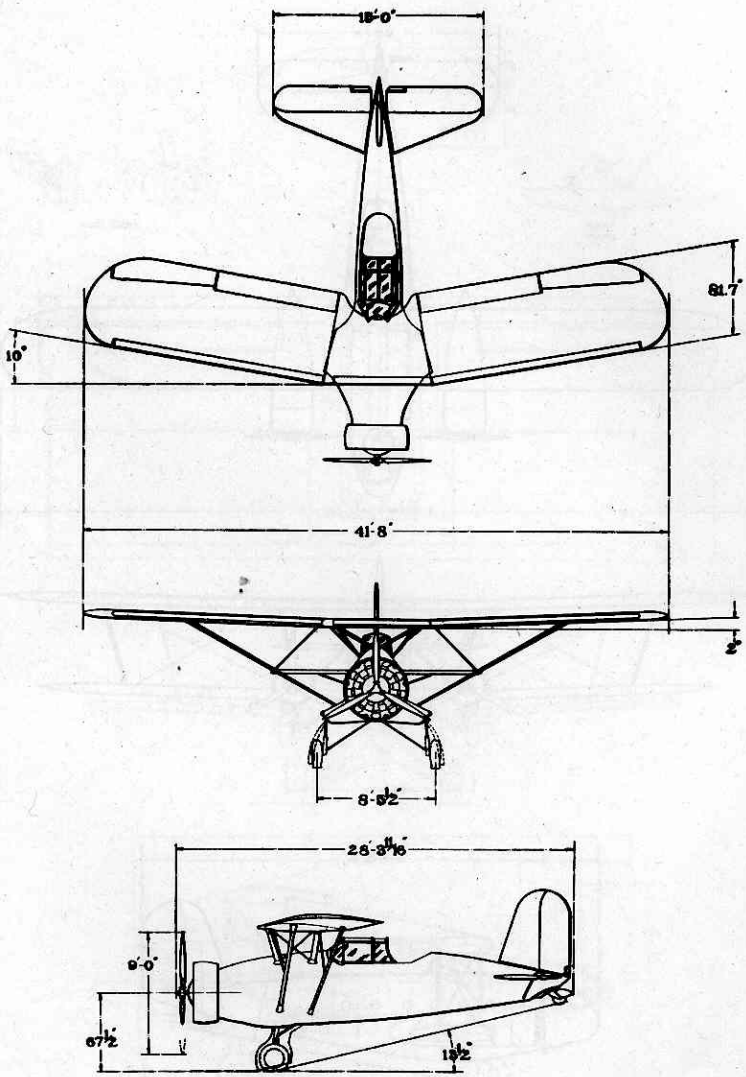
Buffalo, N. Y.

OBSERVATION & ATTACK —— FALCON SEAPLANE 2 PLACE

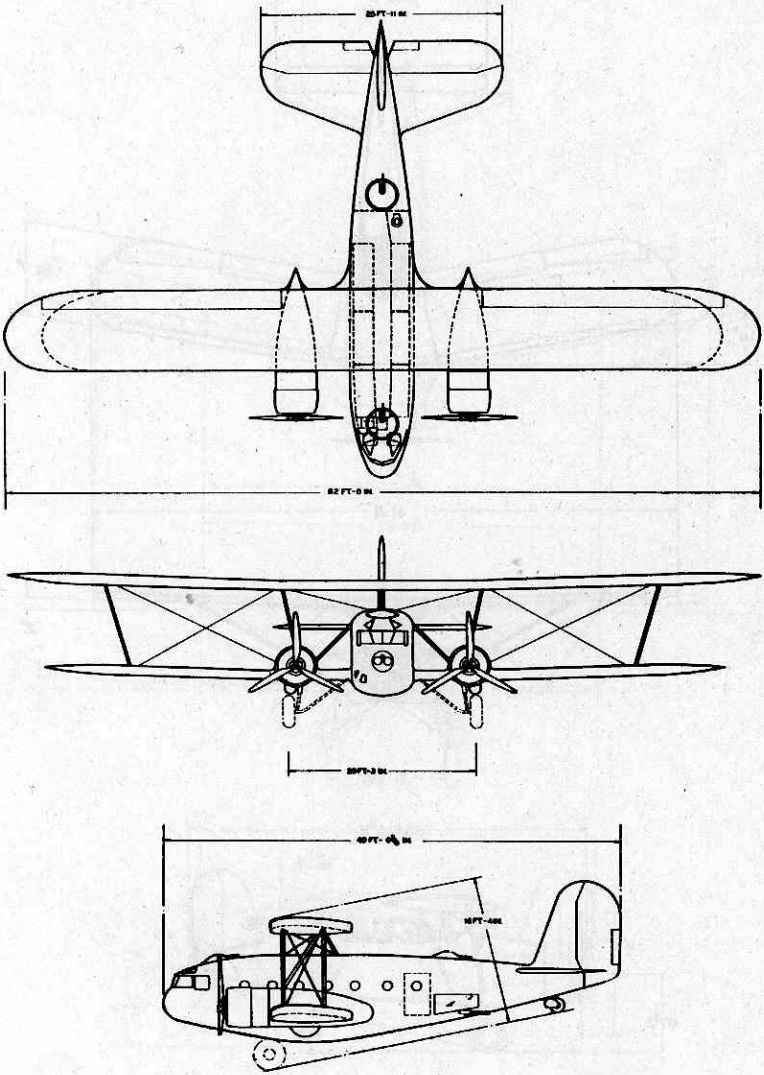
ENGINE: WRIGHT CYCLONE F —— 750 H.P.



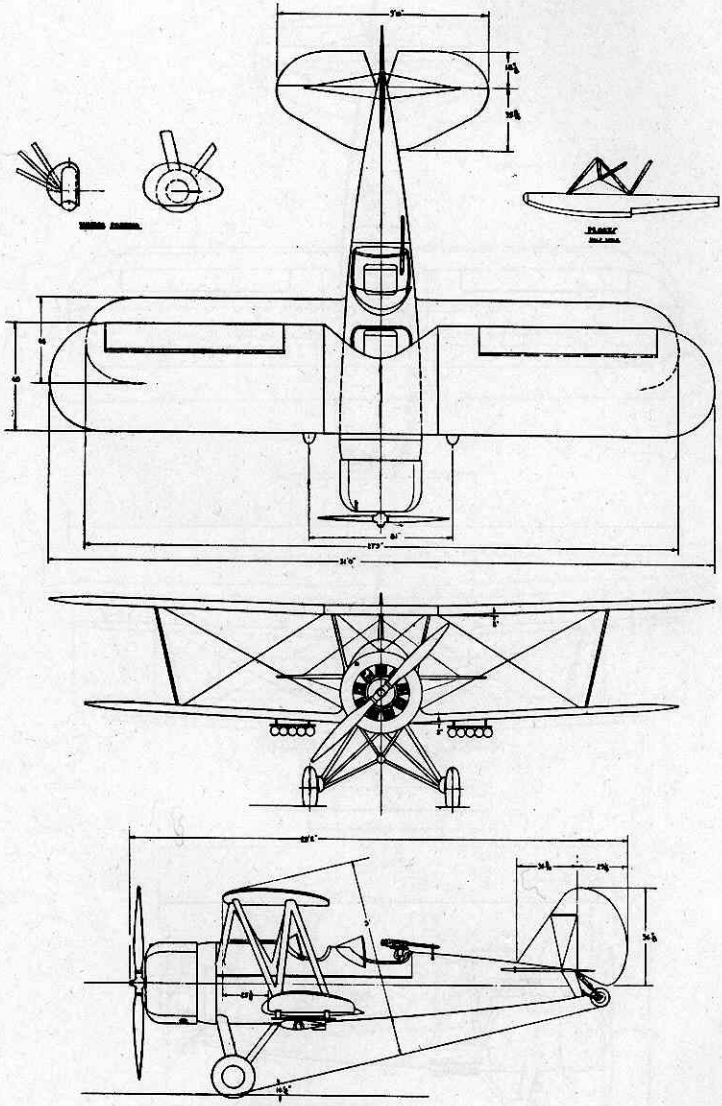

**CURTISS AEROPLANE & MOTOR COMPANY**
**Buffalo, N. Y.**
OBSERVATION YO-40A —— 2 PLACE
ENGINE: WRIGHT F CYCLONE 750 H.P.



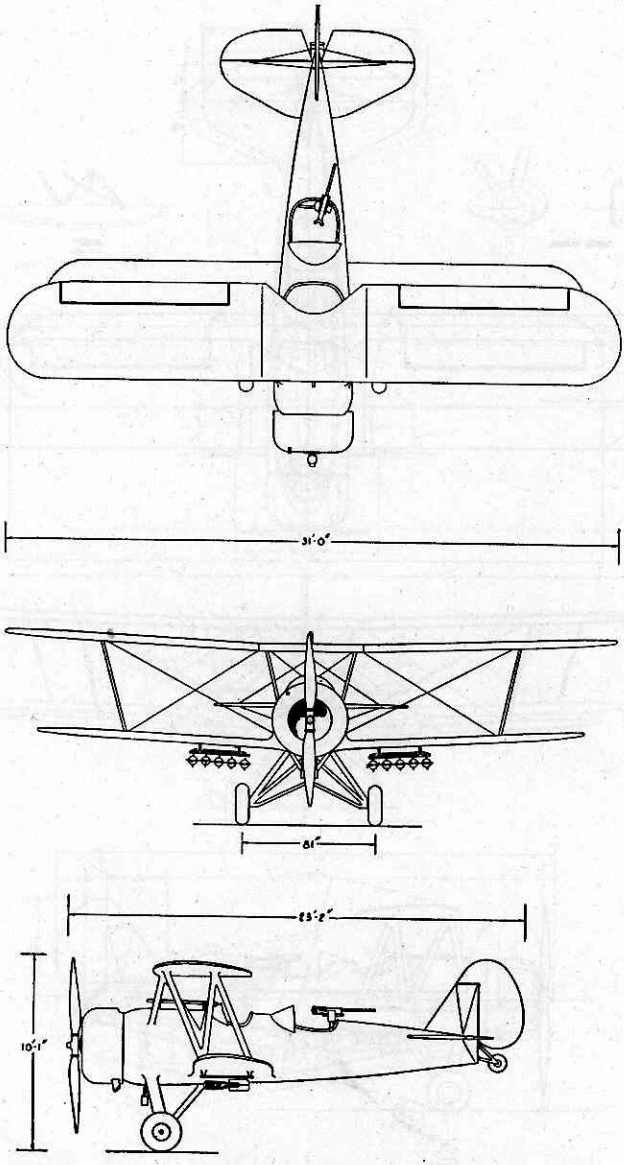

CURTISS AEROPLANE & MOTOR COMPANY
Buffalo, N. Y.
OBSERVATION YO-40B —— 2 PLACE
ENGINE: WRIGHT F CYCLONE 750 H.P.



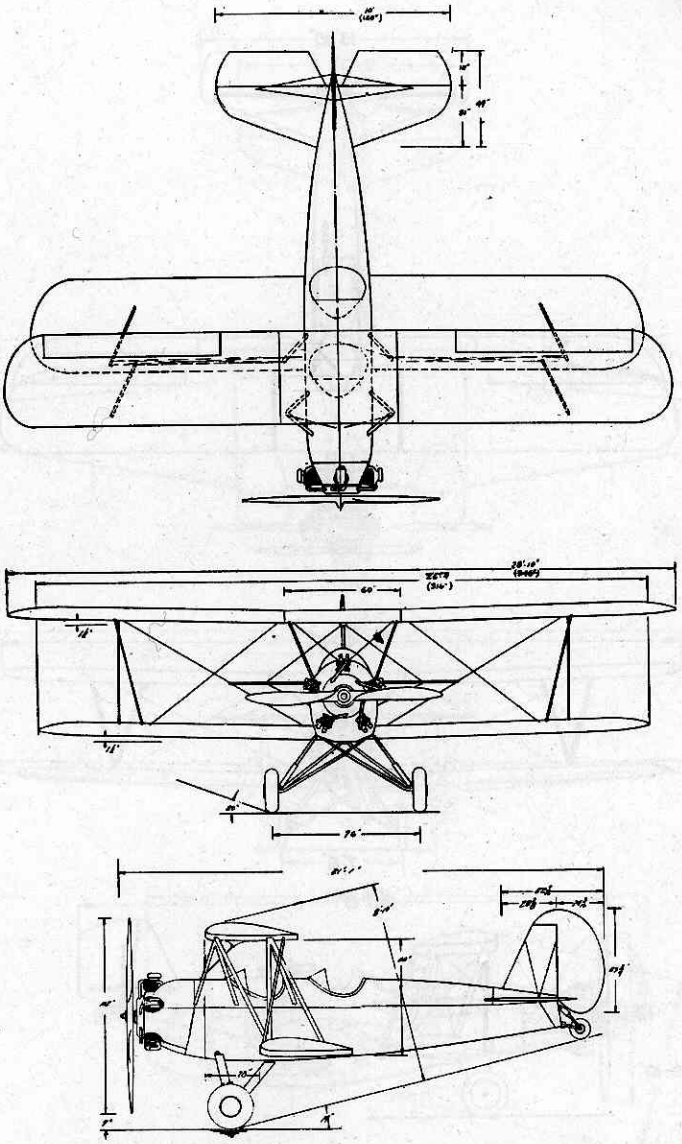
CURTISS-WRIGHT AIRPLANE COMPANY
Robertson, Mo.
CONDOR BOMBER BT-32
ENGINES: TWO WRIGHT CYCLONES 750 H.P.



CURTISS-WRIGHT AIRPLANE COMPANY
Robertson, Mo.
ADVANCED MILITARY TRAINER —— 2 PLACE
ENGINE: WRIGHT WHIRLWIND




**CURTISS-WRIGHT AIRPLANE COMPANY**
Robertson, Mo.
**Osprey —— 2 Place**
**Engine: Wright Whirlwind 420 H.P.**



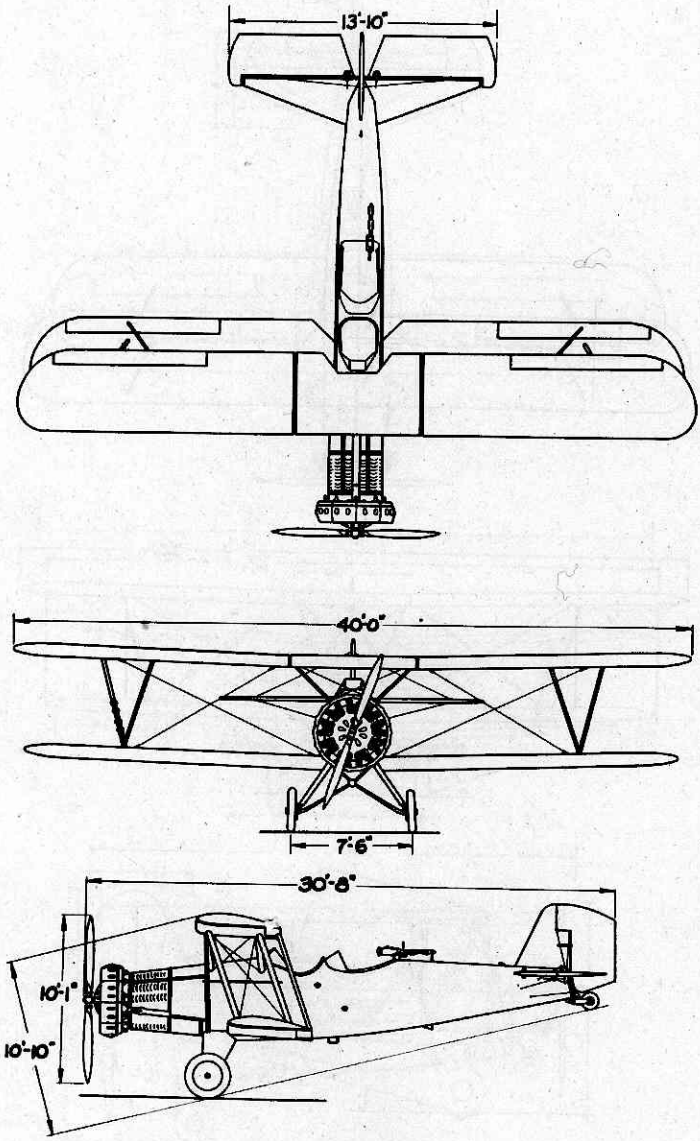
## CURTISS-WRIGHT AIRPLANE COMPANY

Robertson, Mo.

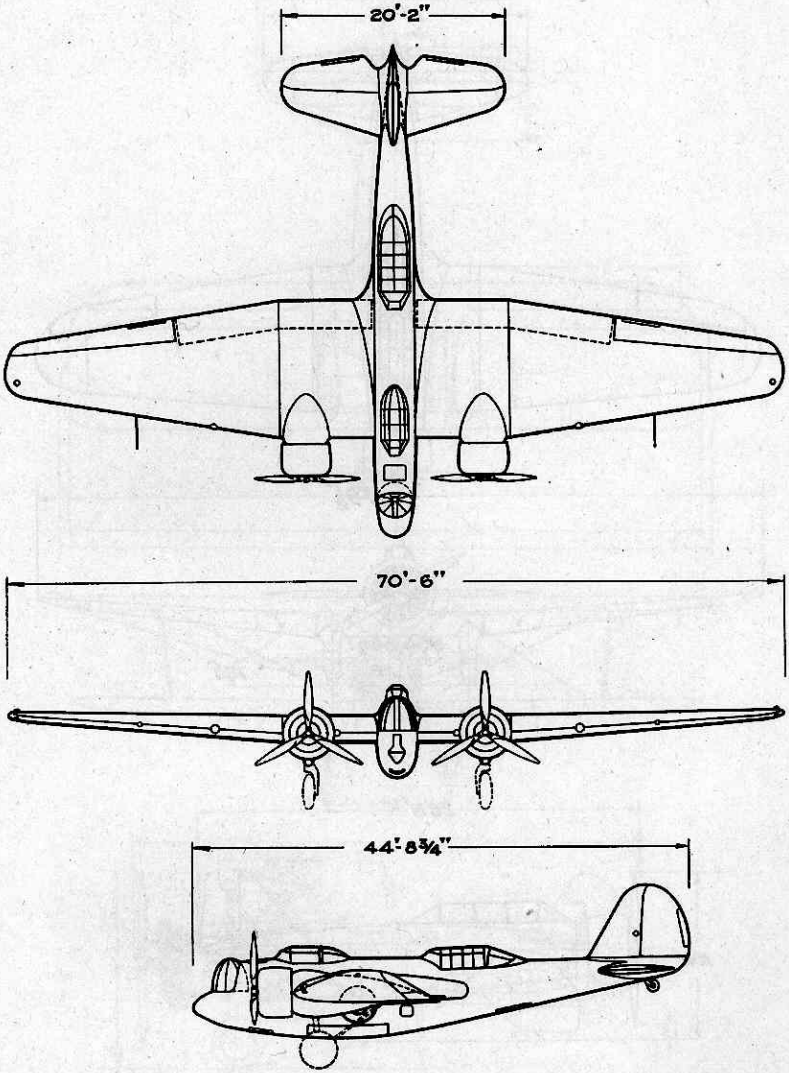
TRAINER—LAND OR SEAPLANE —— 2 PLACE

ENGINE: WARNER SCARAB

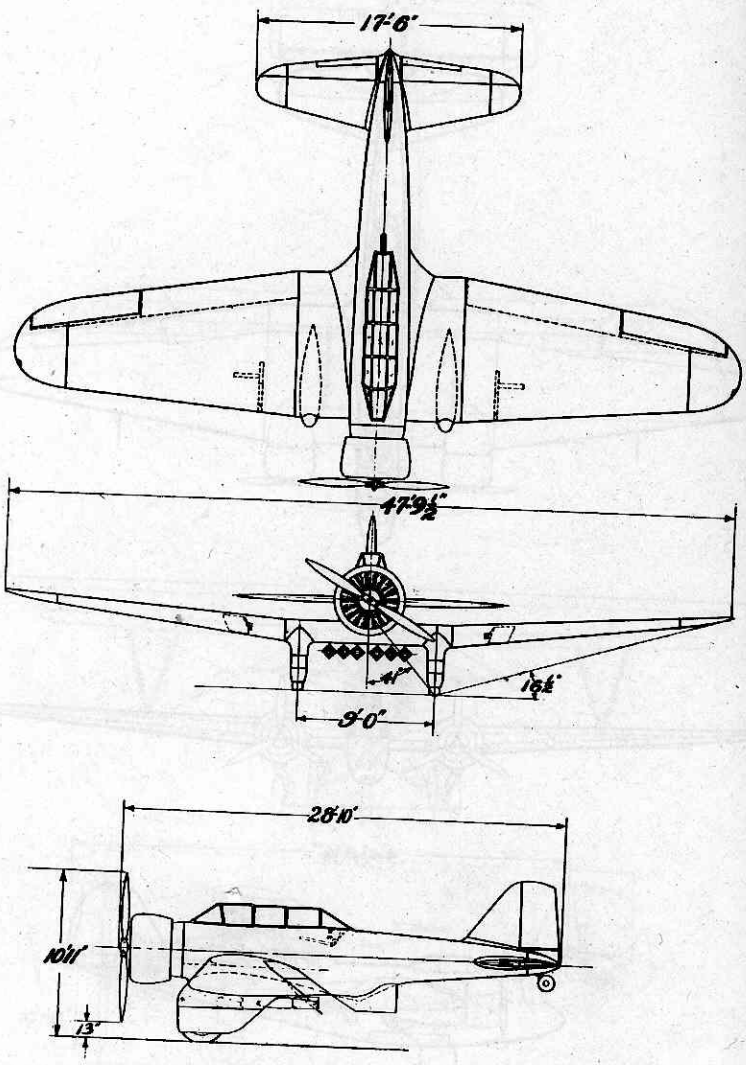
WRIGHT WHIRLWIND



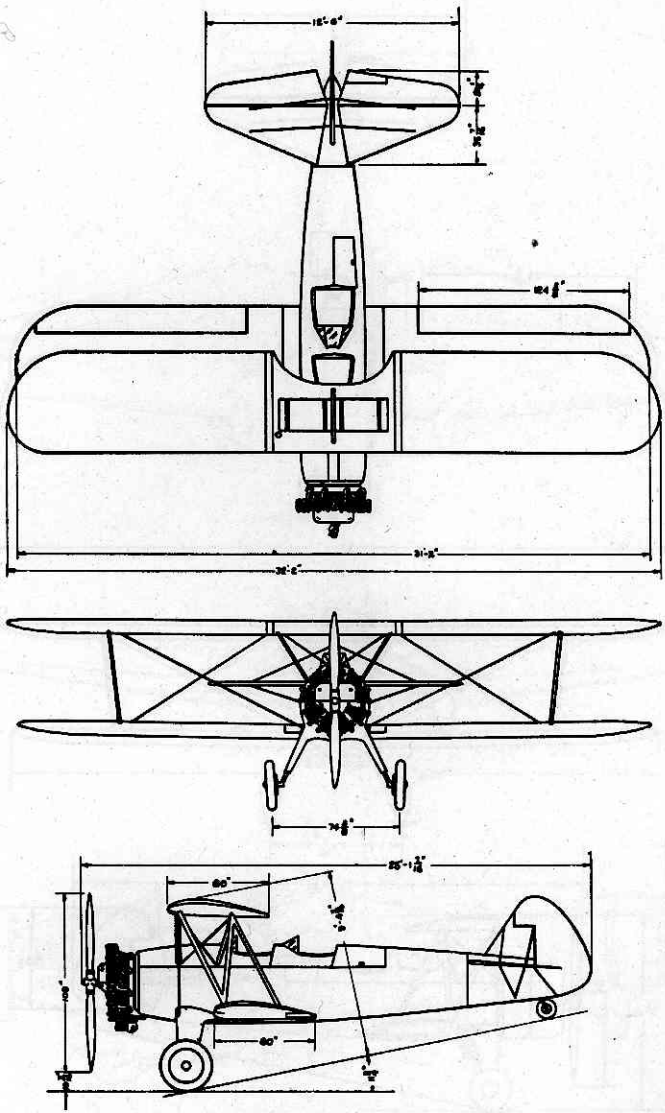

DOUGLAS AIRCRAFT COMPANY, INC.
Santa Monica, Calif.
ARMY OBSERVATION O-38B —— 2 PLACE
ENGINE: PRATT & WHITNEY HORNET



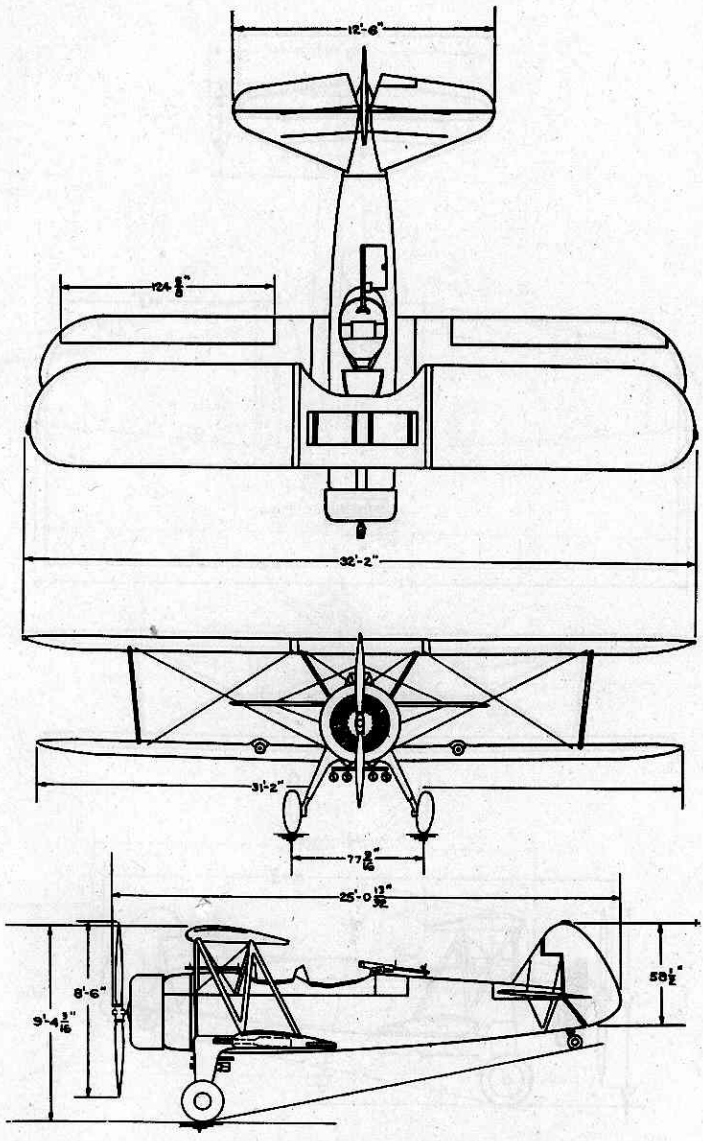

THE GLENN L. MARTIN COMPANY
Baltimore, Md.
MODEL 139 ARMY BOMBER
ENGINES: 2 WRIGHT CYCLONES



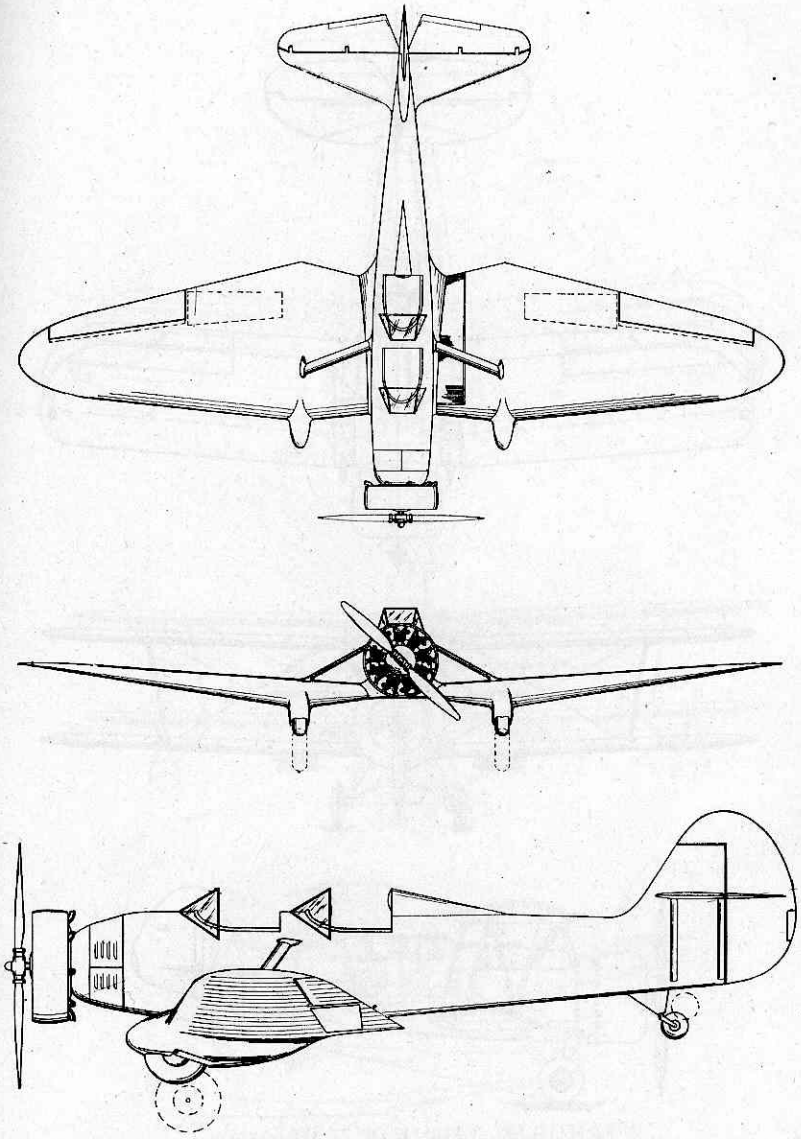

THE NORTHROP CORPORATION
Inglewood, Calif.
LONG RANGE BOMBER
ENGINE: WRIGHT CYCLONE



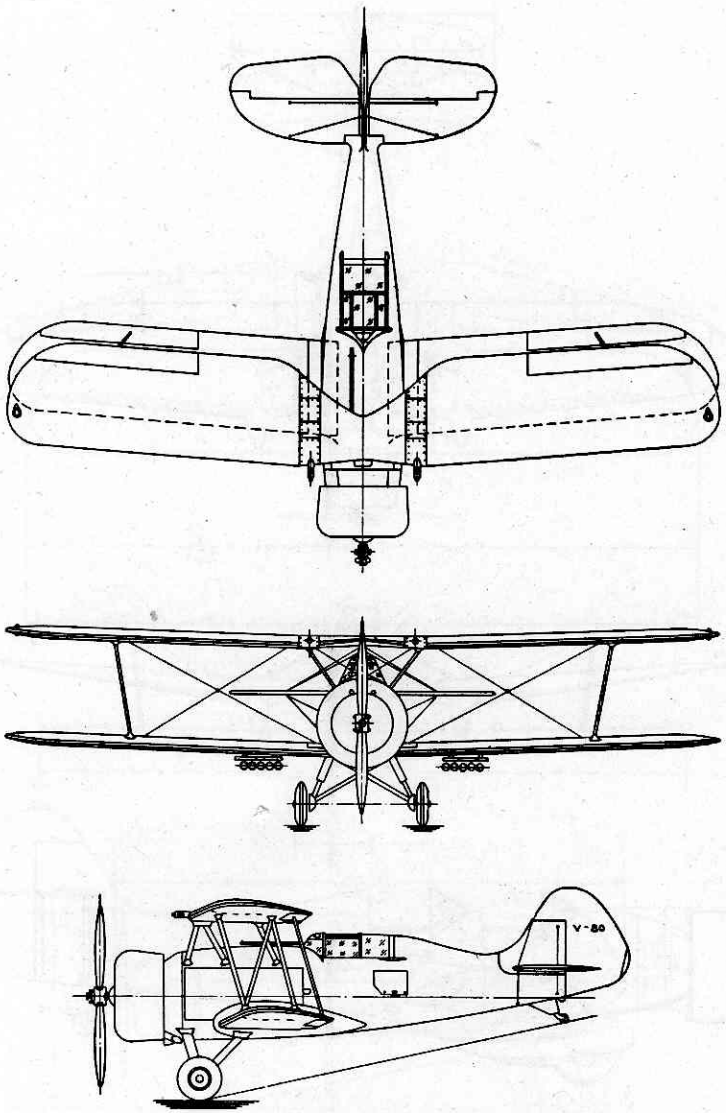
STEARMAN AIRCRAFT COMPANY
Wichita, Kans.
MODEL 73 NAVY TRAINER NS-1 —— 2 PLACE
ENGINE: WRIGHT WHIRLWIND



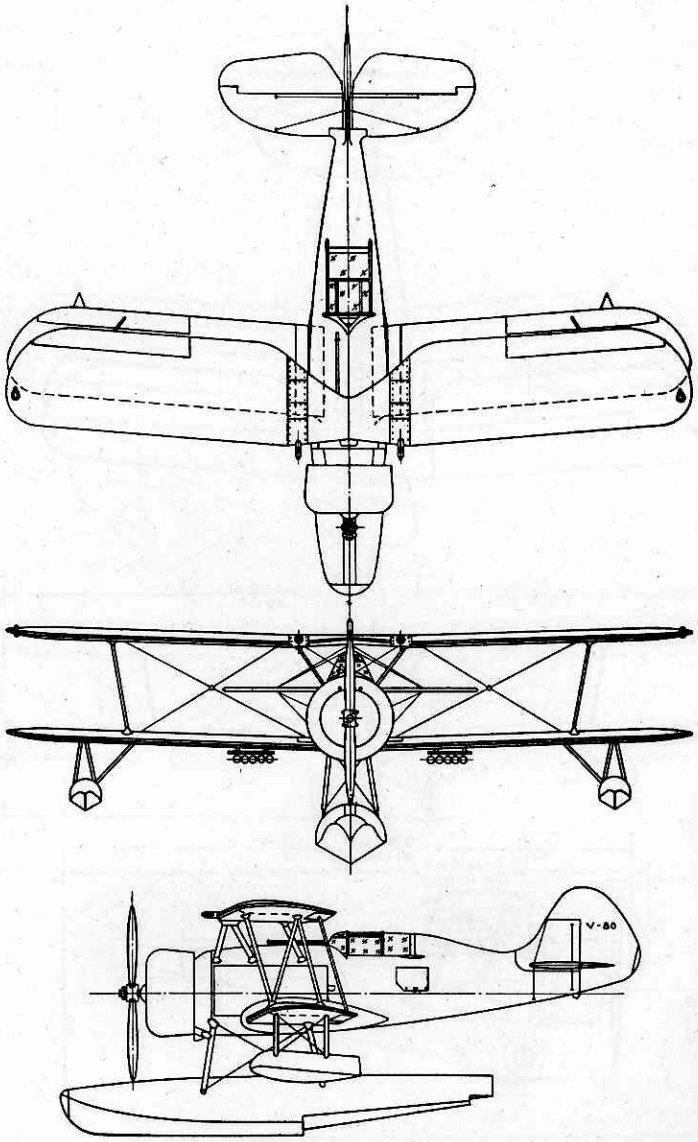

**STEARMAN AIRCRAFT COMPANY**
Wichita, Kans.
MODEL 76 —— ADVANCED TRAINER
ENGINE: PRATT & WHITNEY WASP JUNIOR
WRIGHT WHIRLWIND



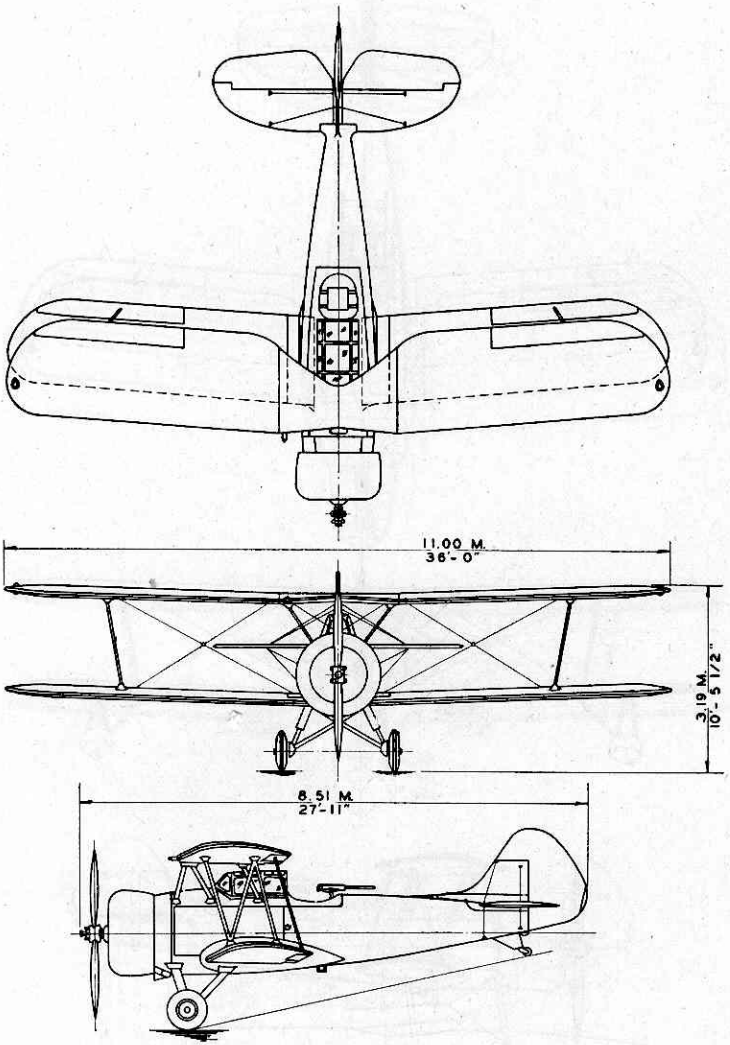
**STINSON AIRCRAFT CORPORATION**
Wayne, Mich.
MODEL PT —— PURSUIT TRAINER
ENGINE: LYCOMING R-680-5



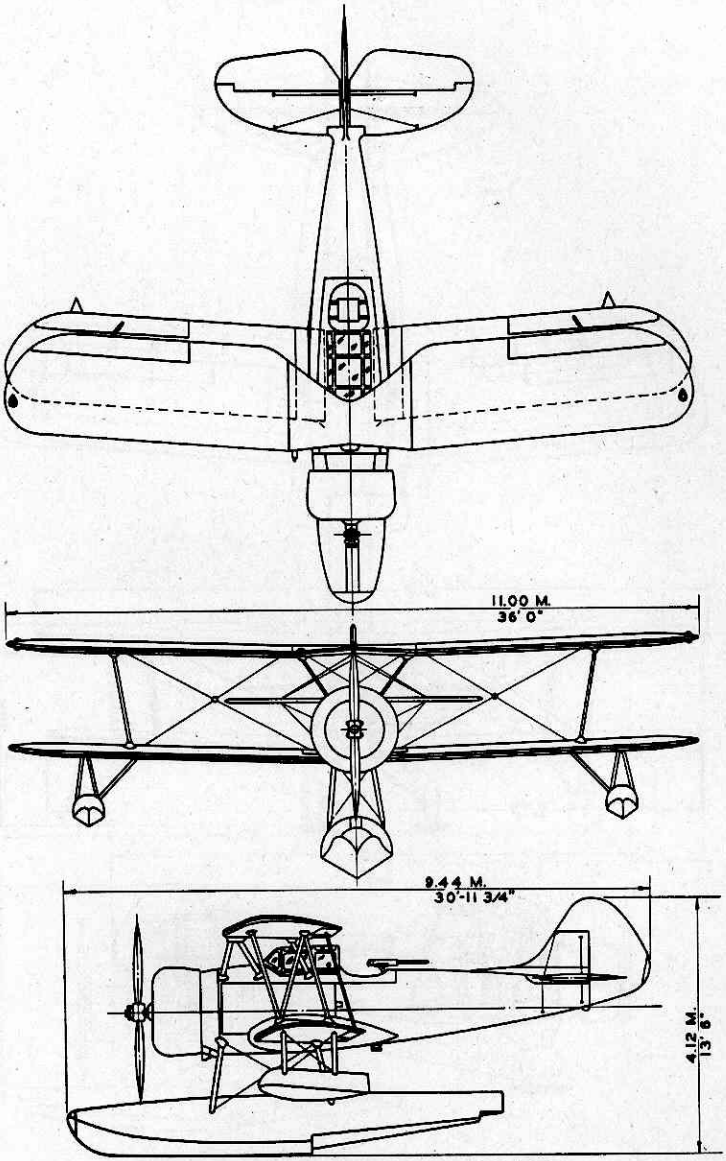

CHANCE VOUGHT AIRCRAFT
Division of United Aircraft Manufacturing Corporation
East Hartford, Conn.
CORSAIR V-80 —— 1 PLACE
ENGINE: PRATT & WHITNEY HORNET



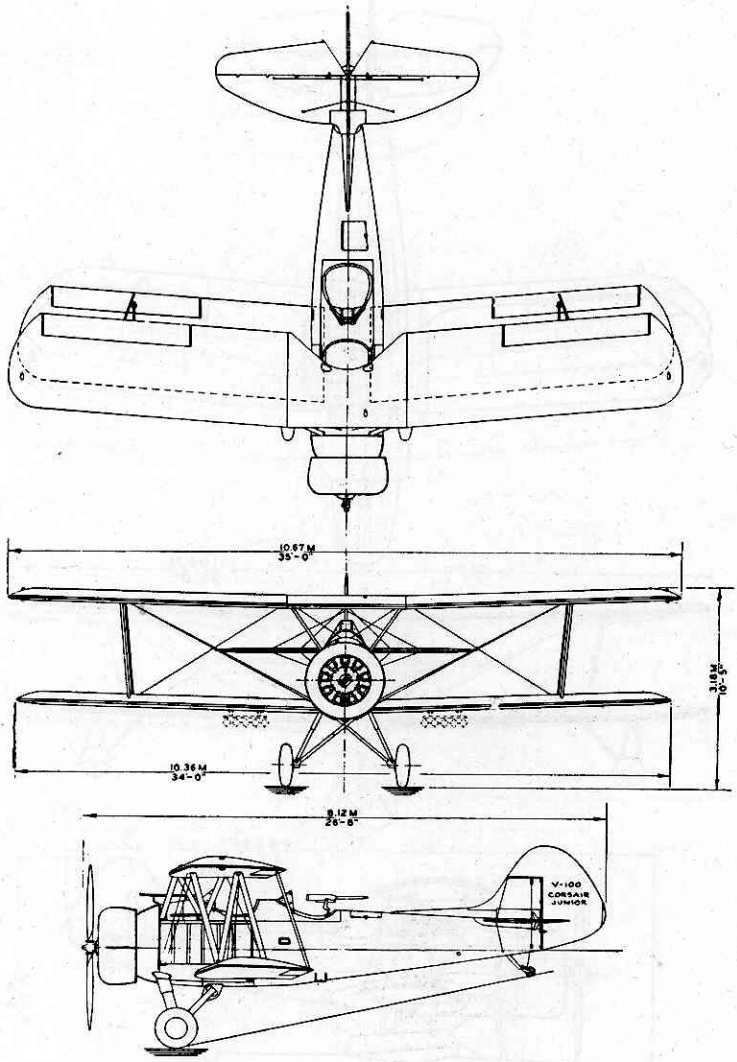

CHANCE VOUGHT AIRCRAFT
Division of United Aircraft Manufacturing Corporation
East Hartford, Conn.
CORSAIR V-80 SEAPLANE —— 1 PLACE
ENGINE: PRATT & WHITNEY HORNET




CHANCE VOUGHT AIRCRAFT
Division of United Aircraft Manufacturing Corporation
East Hartford, Conn.
CORSAIR SUPER V-90 —— 2 PLACE
ENGINE: PRATT & WHITNEY HORNET



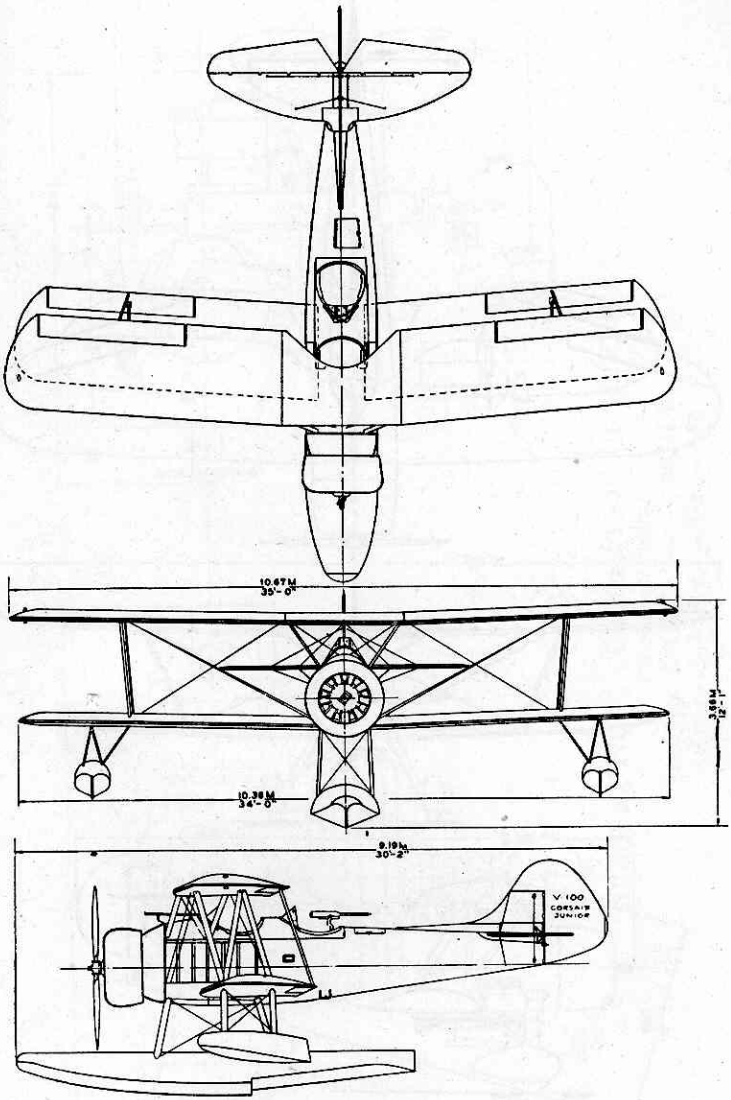

CHANCE VOUGHT AIRCRAFT
Division of United Aircraft Manufacturing Corporation
East Hartford, Conn.
CORSAIR SUPER V-90 SEAPLANE —— 2 PLACE
ENGINE: PRATT & WHITNEY HORNET



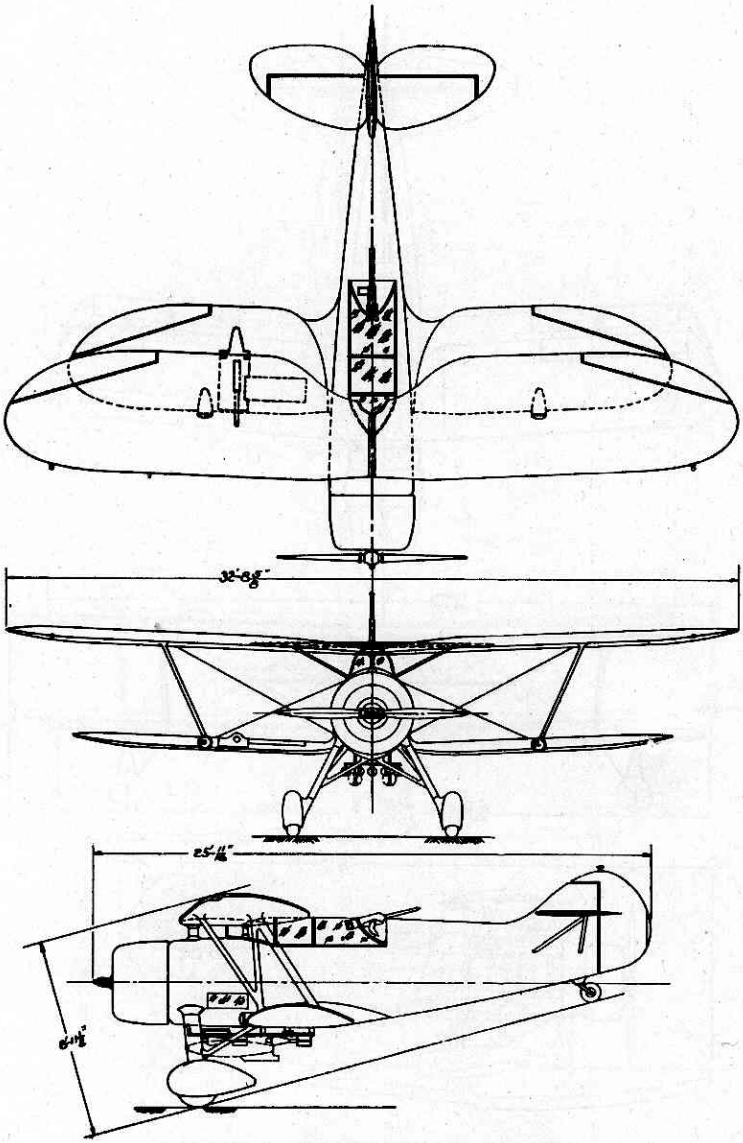

## CHANCE VOUGHT AIRCRAFT

**Division of United Aircraft Manufacturing Corporation**
**East Hartford, Conn.**

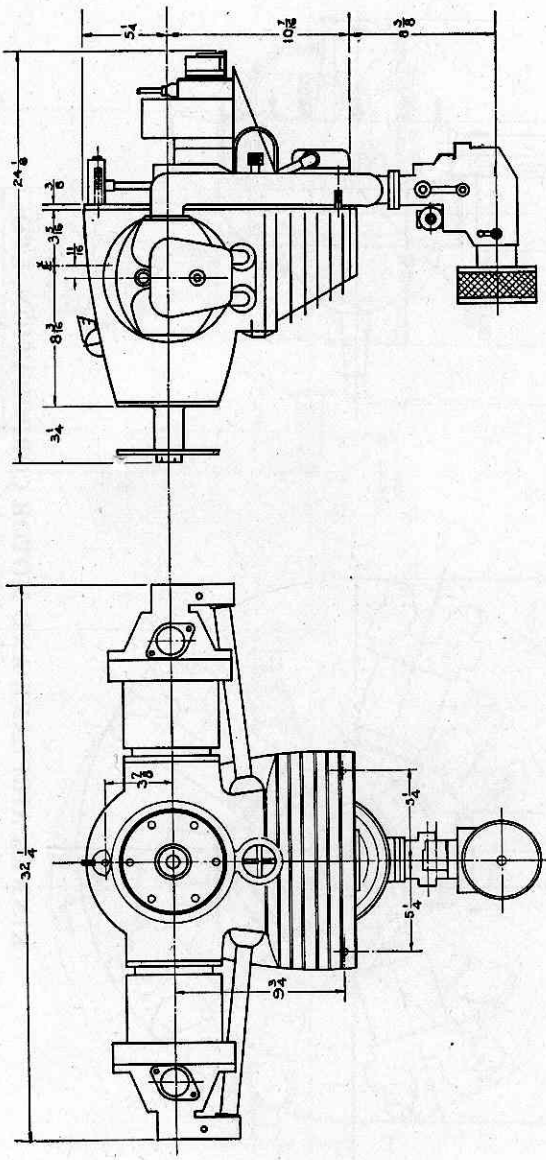
**Corsair Junior V-100 Seaplane —— 2 Place**
**Engine: Pratt & Whitney Wasp Junior**



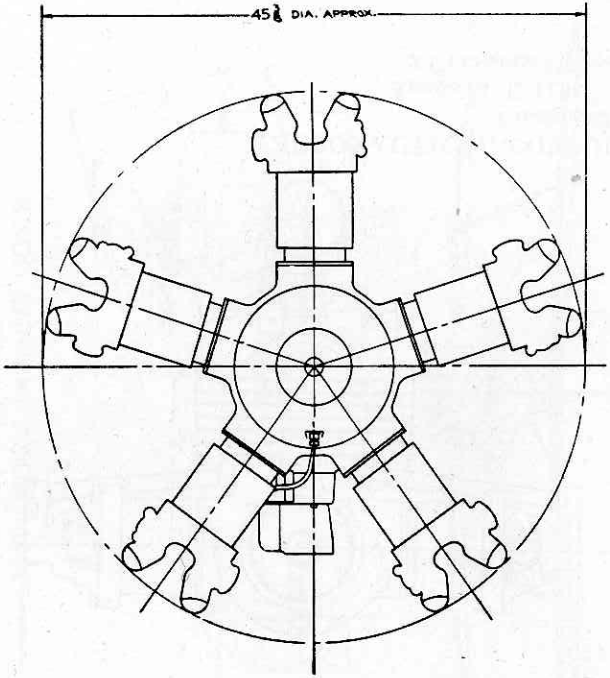

CHANCE VOUGHT AIRCRAFT
Division of United Aircraft Manufacturing Corporation
East Hartford, Conn.
CORSAIR JUNIOR V-100 SEAPLANE —— 2 PLACE
ENGINE: PRATT & WHITNEY WASP JUNIOR

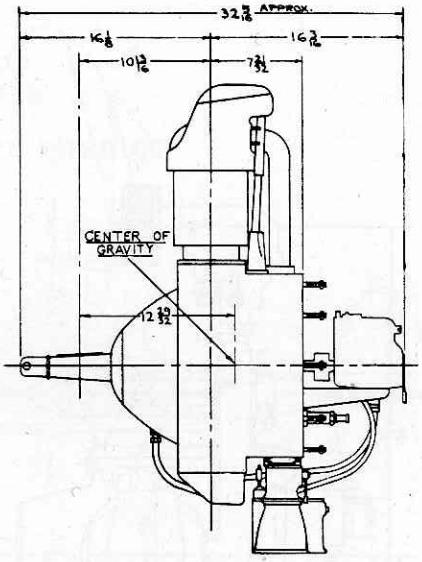


WACO AIRCRAFT COMPANY
Troy, Ohio
MODEL WHD-A —— 2 PLACE
ENGINE: WRIGHT WHIRLWIND

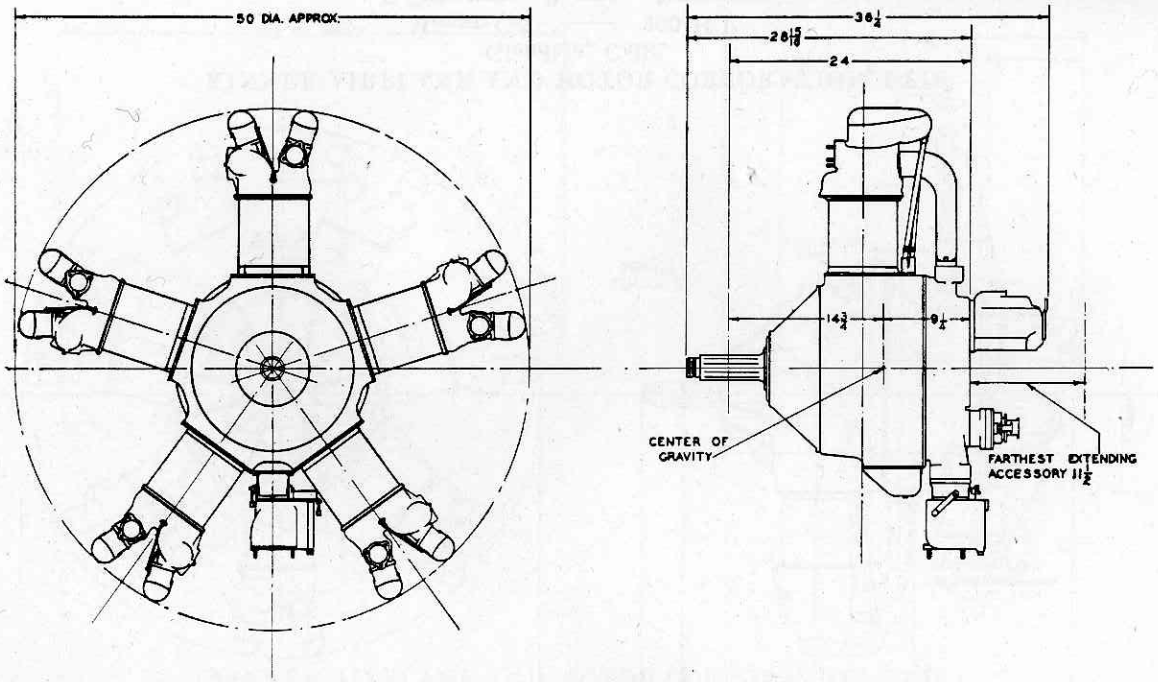



AERONAUTICAL CORPORATION OF AMERICA
Cincinnati, Ohio
AERONCA E-113C —— 36 H.P.
2 CYLINDER OPPOSED AIRCOOLED

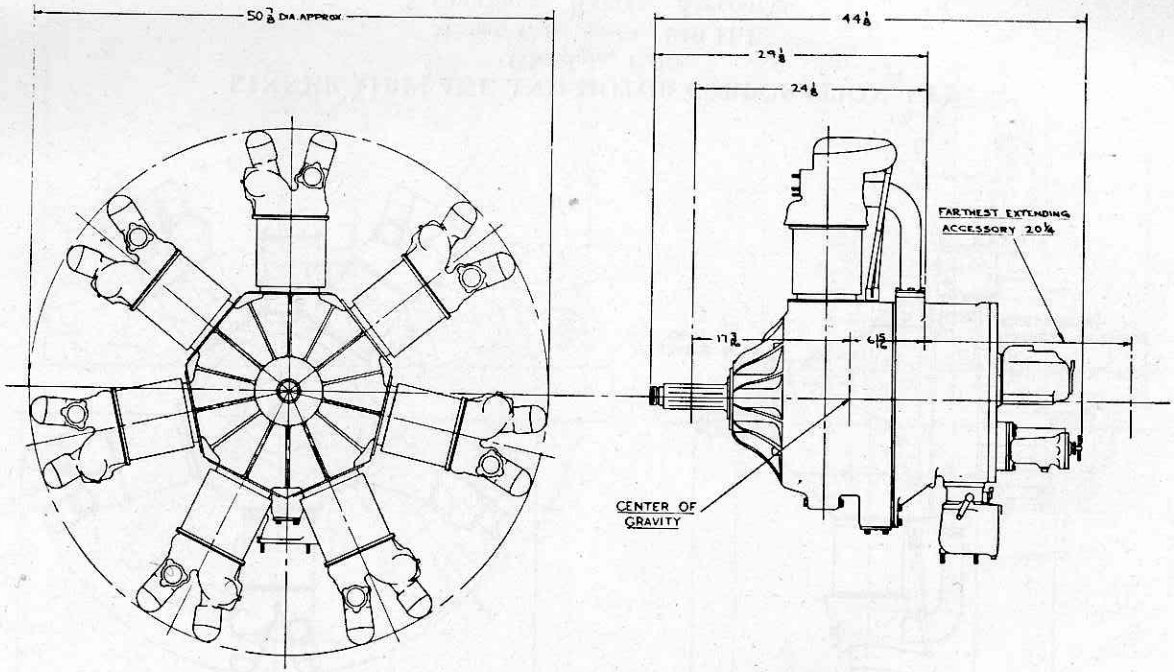


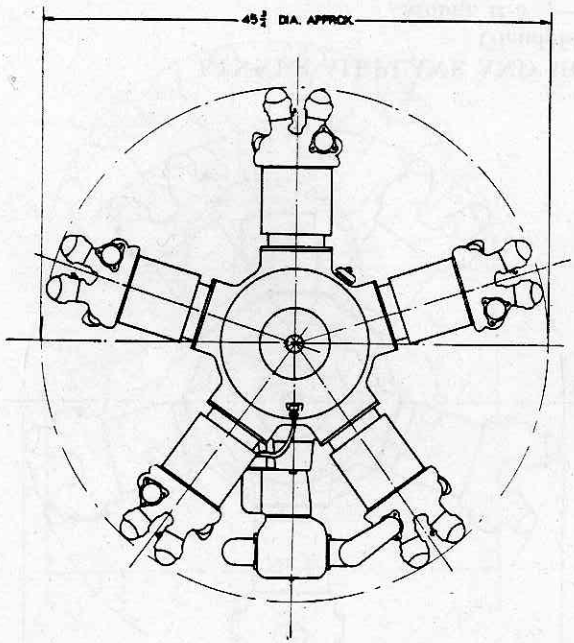

KINNER AIRPLANE AND MOTOR CORPORATION, LTD.
Glendale, Calif.
MODEL B-5 —— 125 H.P.
5 CYLINDER RADIAL AIRCOOLED

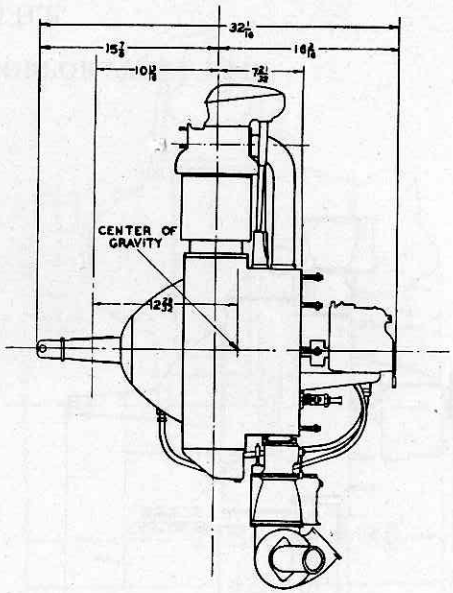



KINNER AIRPLANE AND MOTOR CORPORATION, LTD.
Glendale, Calif.
MODEL C-5 —— 210 H.P.
5 CYLINDER RADIAL AIRCOOLED

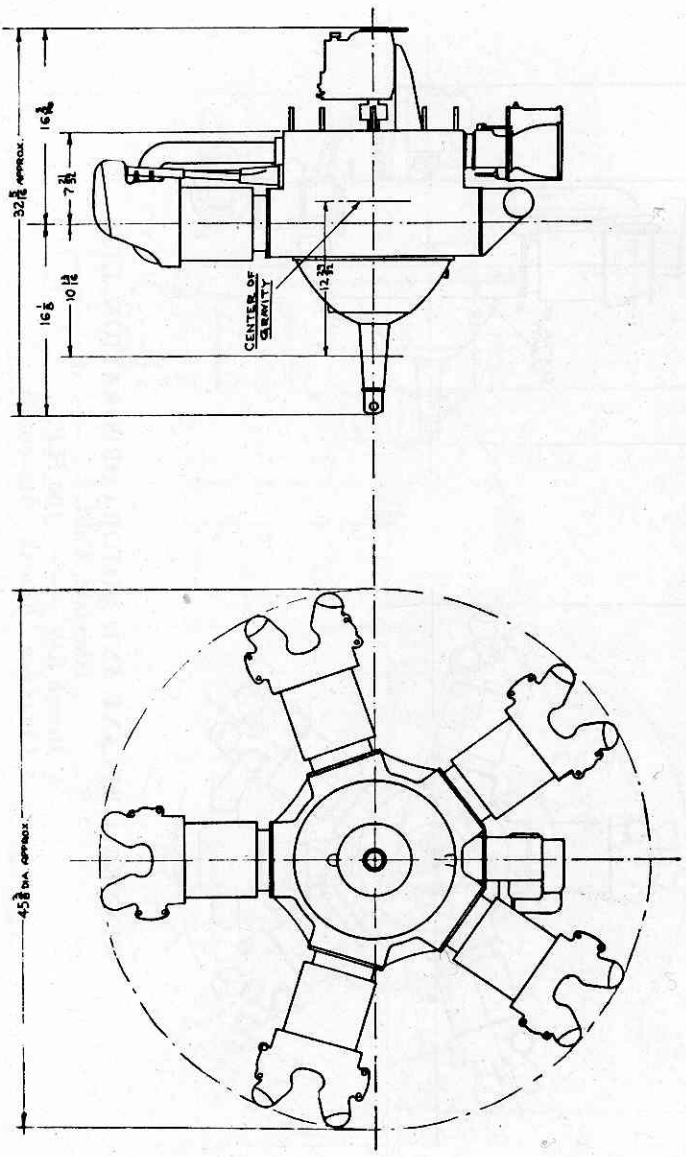



KINNER AIRPLANE AND MOTOR CORPORATION, LTD.
Glendale, Calif.
MODEL C-7 —— 300 H.P.
7 CYLINDER RADIAL AIRCOOLED

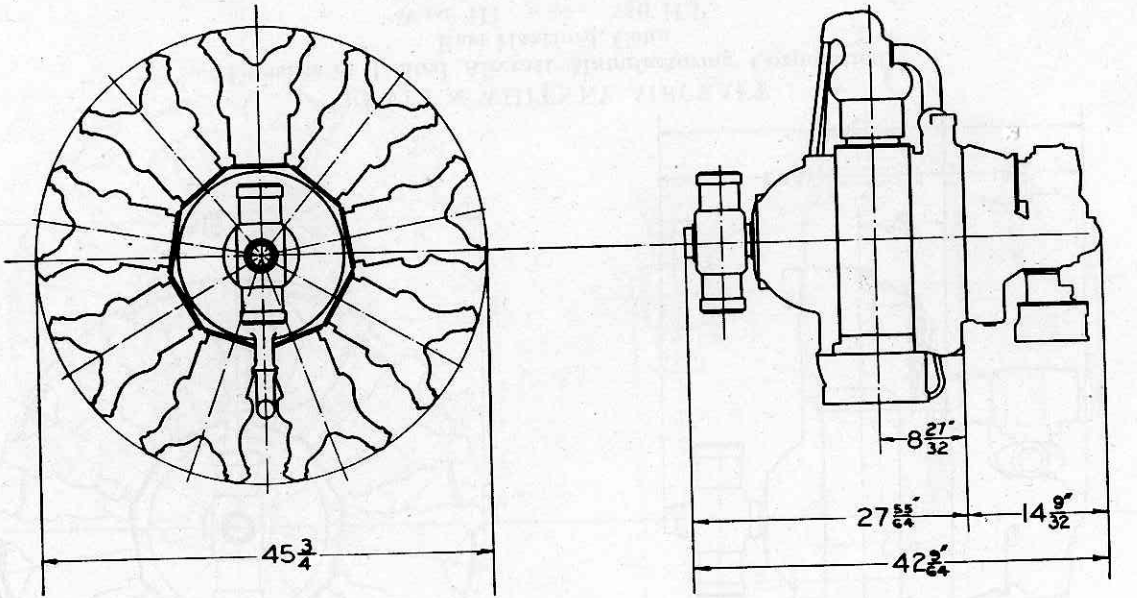


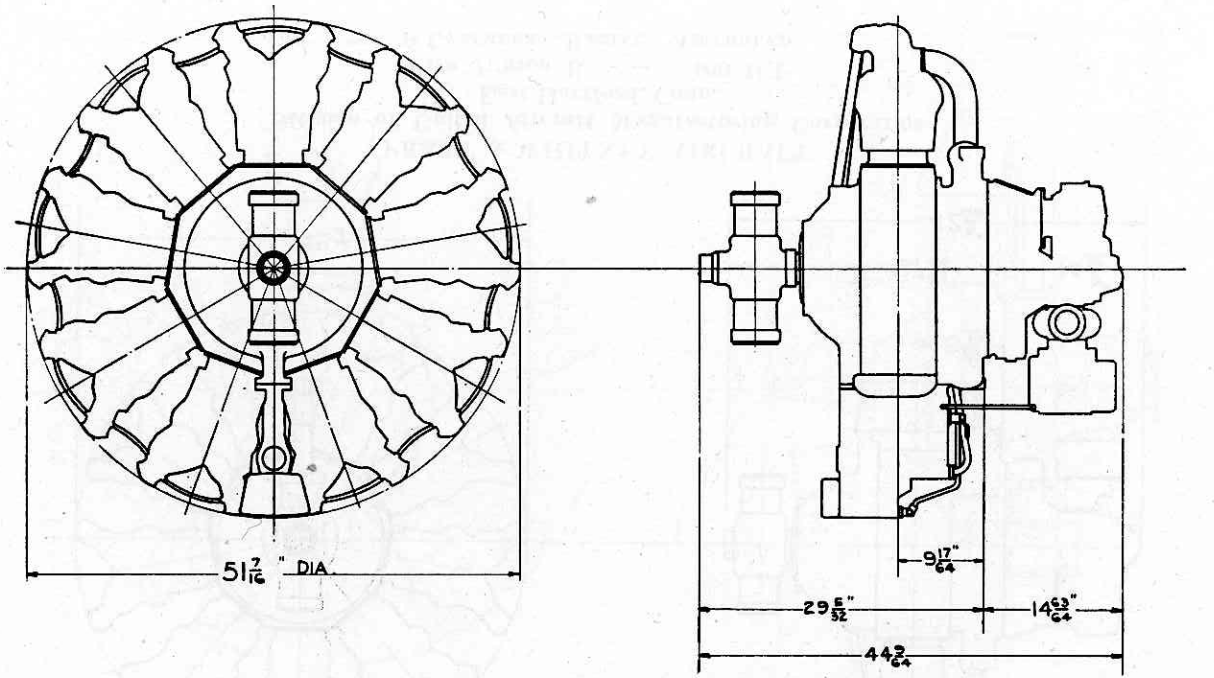

KINNER AIRPLANE AND MOTOR CORPORATION, LTD.
Glendale, Calif.
MODEL K-5 —— 100 H.P.
5 CYLINDER RADIAL AIRCOOLED



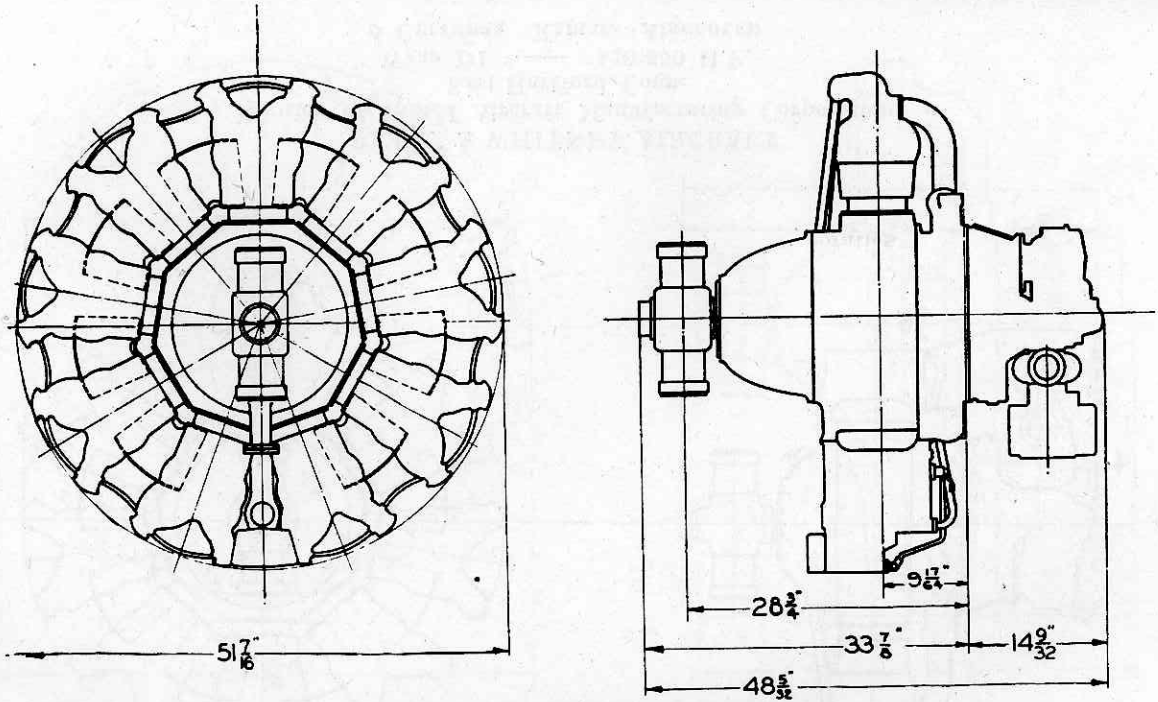

KINNER AIRPLANE AND MOTOR CORPORATION, LTD.
Glendale, Calif.
Model R-5 —— 160 H.P.
5 Cylinder Radial Aircooled



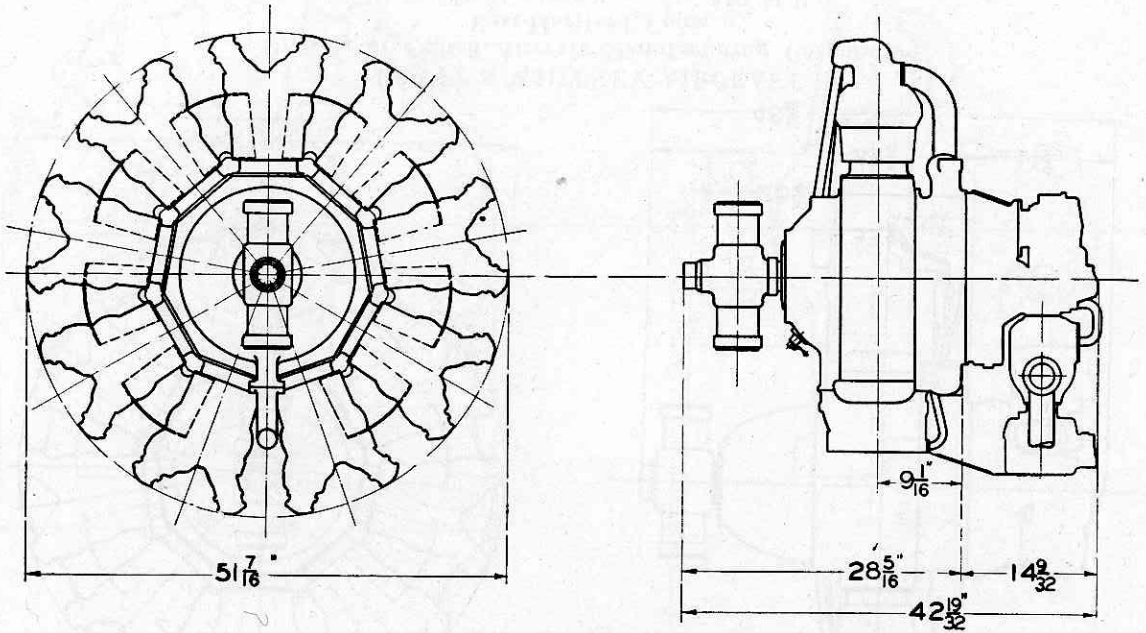

PRATT & WHITNEY AIRCRAFT
Division of United Aircraft Manufacturing Corporation
East Hartford, Conn.
WASP JUNIOR B —— 400 H.P.
9 CYLINDER RADIAL AIRCOOLED



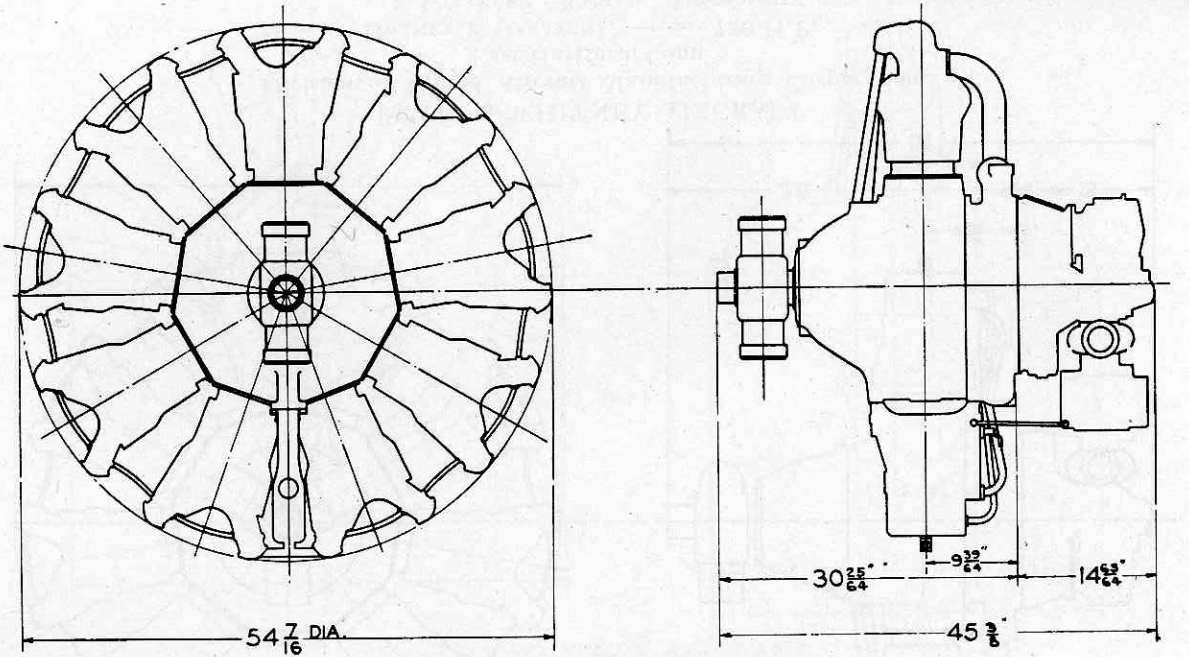

PRATT & WHITNEY AIRCRAFT
Division of United Aircraft Manufacturing Corporation
East Hartford, Conn.
WASP H1 —— 550 H.P.
9 CYLINDER RADIAL AIRCOOLED



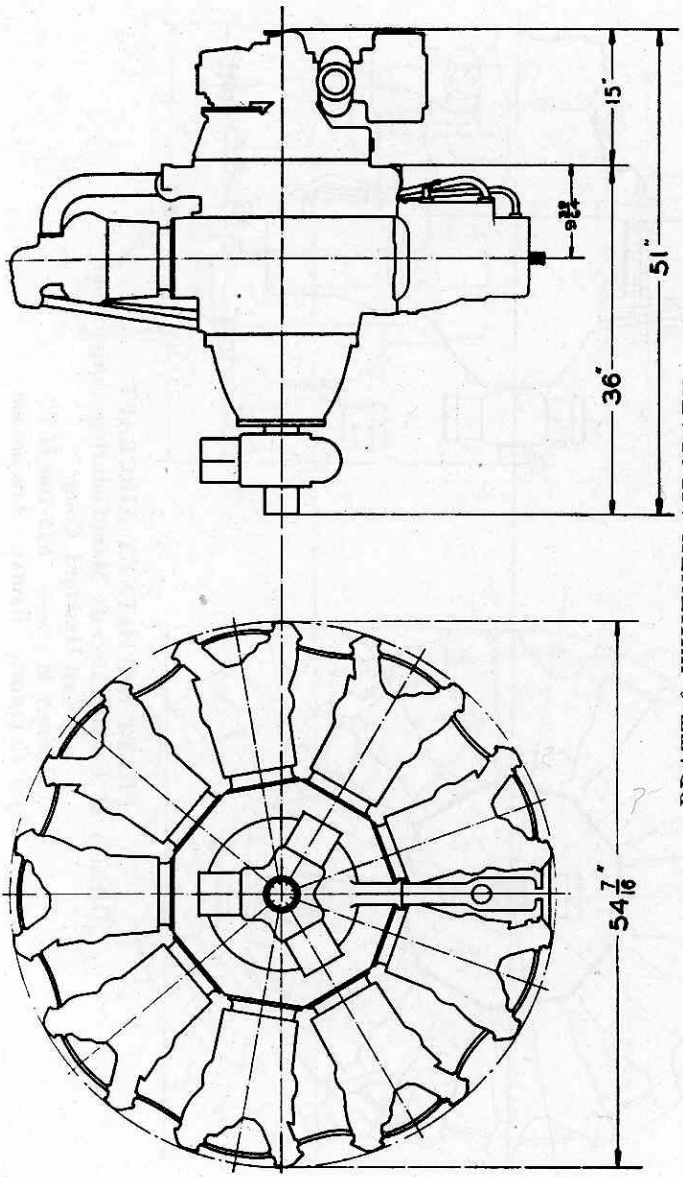

PRATT & WHITNEY AIRCRAFT
Division of United Aircraft Manufacturing Corporation
East Hartford, Conn.
WASP H1 (GEARED) —— 550 H.P.
9 CYLINDER RADIAL AIRCOOLED



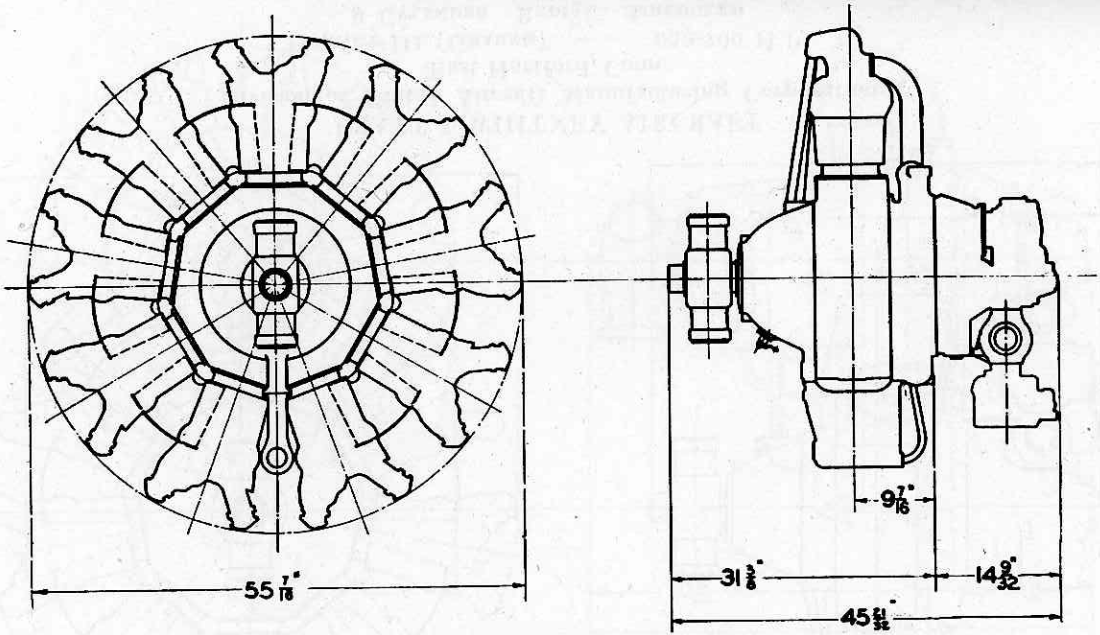

**PRATT & WHITNEY AIRCRAFT**
Division of United Aircraft Manufacturing Corporation
East Hartford, Conn.
WASP D1 —— 420-550 H.P.
9 CYLINDER RADIAL AIRCOOLED



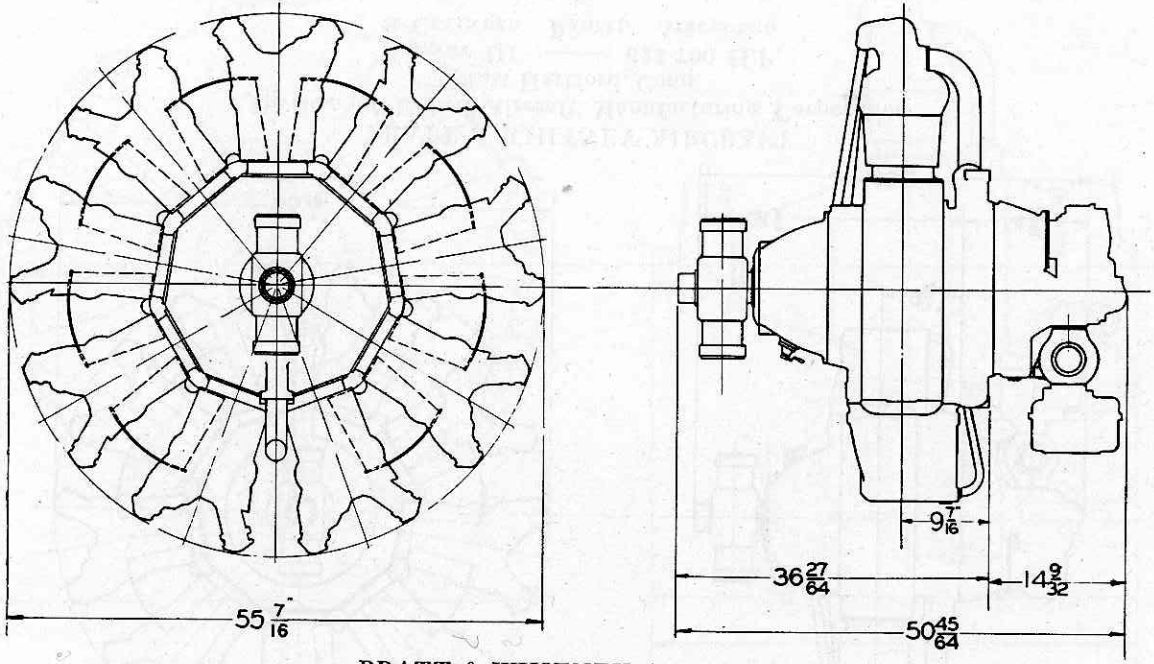

**PRATT & WHITNEY AIRCRAFT**
Division of United Aircraft Manufacturing Corporation
East Hartford, Conn.
HORNET E —— 525-700 H.P.
9 CYLINDER RADIAL AIRCOOLED



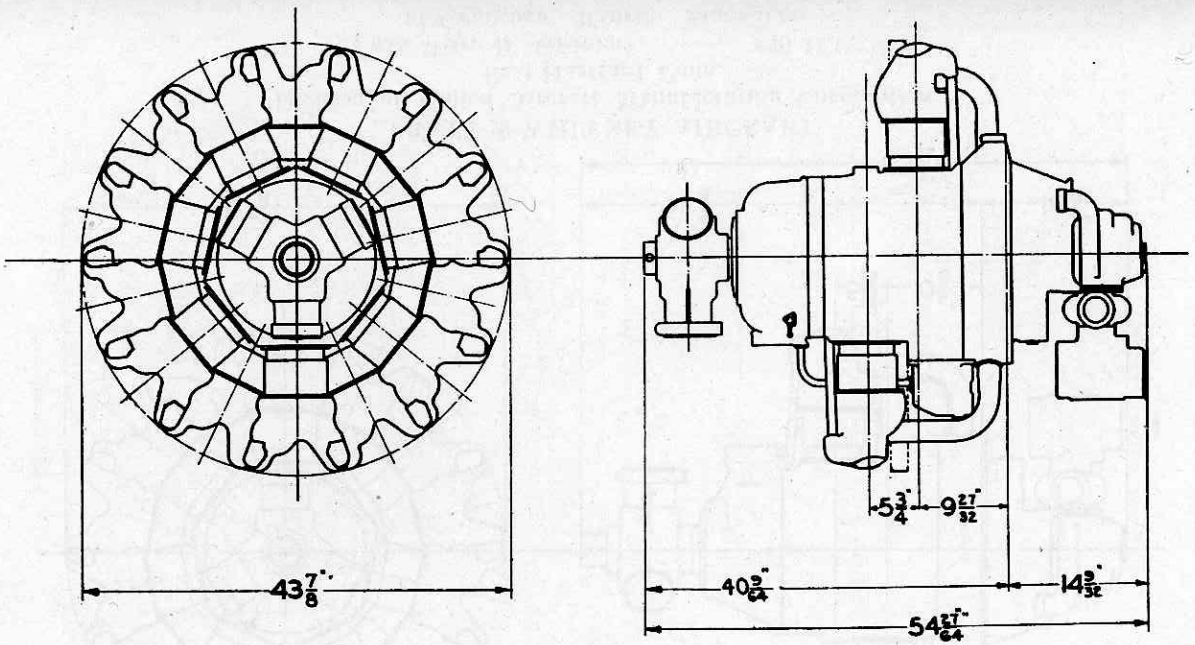

PRATT & WHITNEY AIRCRAFT
Division of United Aircraft Manufacturing Corporation
East Hartford, Conn.
HORNET E (GEARED) —— 750 H.P.
9 CYLINDER RADIAL AIRCOOLED



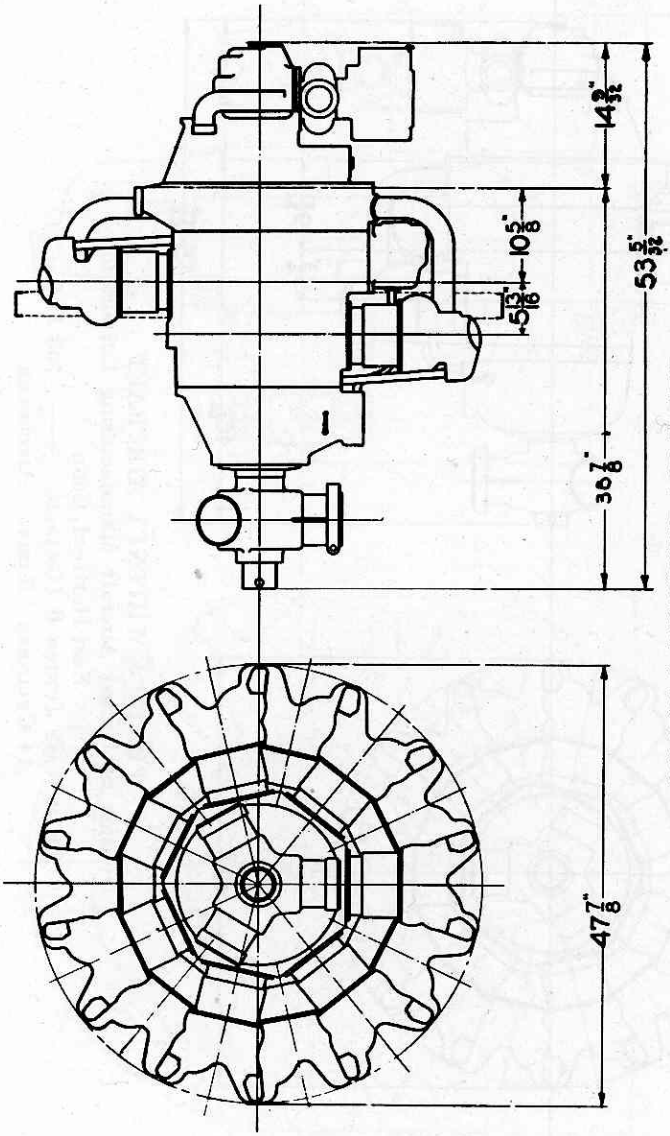

PRATT & WHITNEY AIRCRAFT
Division of United Aircraft Manufacturing Corporation
East Hartford, Conn.
HORNET D1 —— 625-700 H.P.
9 CYLINDER RADIAL AIRCOOLED



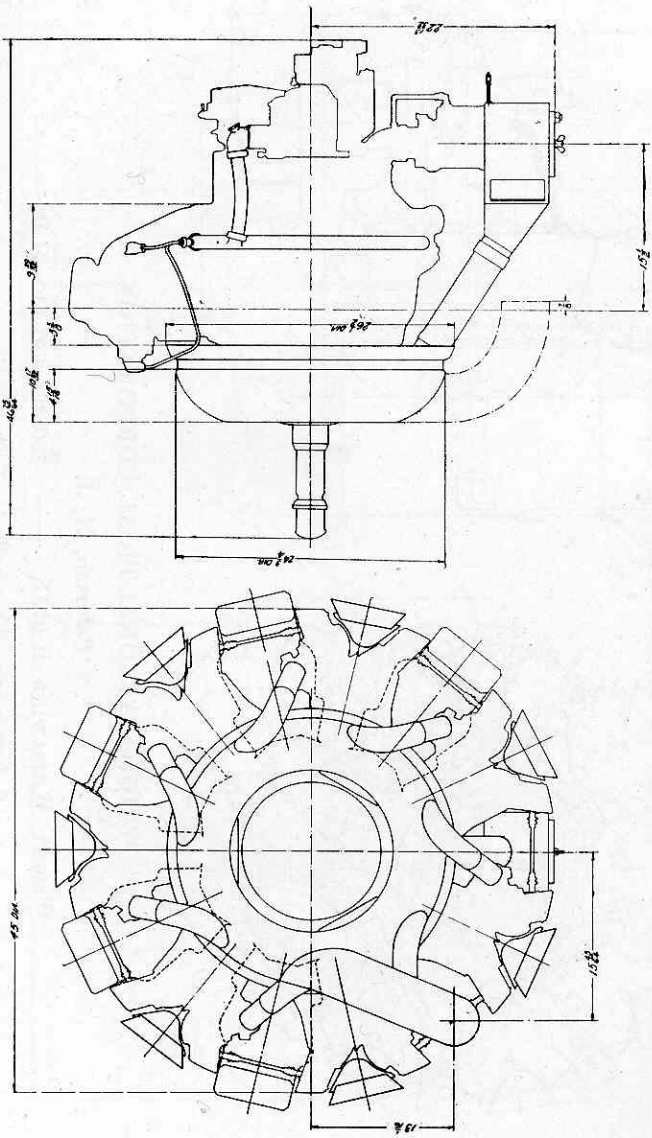

**PRATT & WHITNEY AIRCRAFT**
**Division of United Aircraft Manufacturing Corporation**
**East Hartford, Conn.**
**HORNET D1 (GEARED) —— 650-700 H.P.**
**9 CYLINDER RADIAL AIRCOOLED**



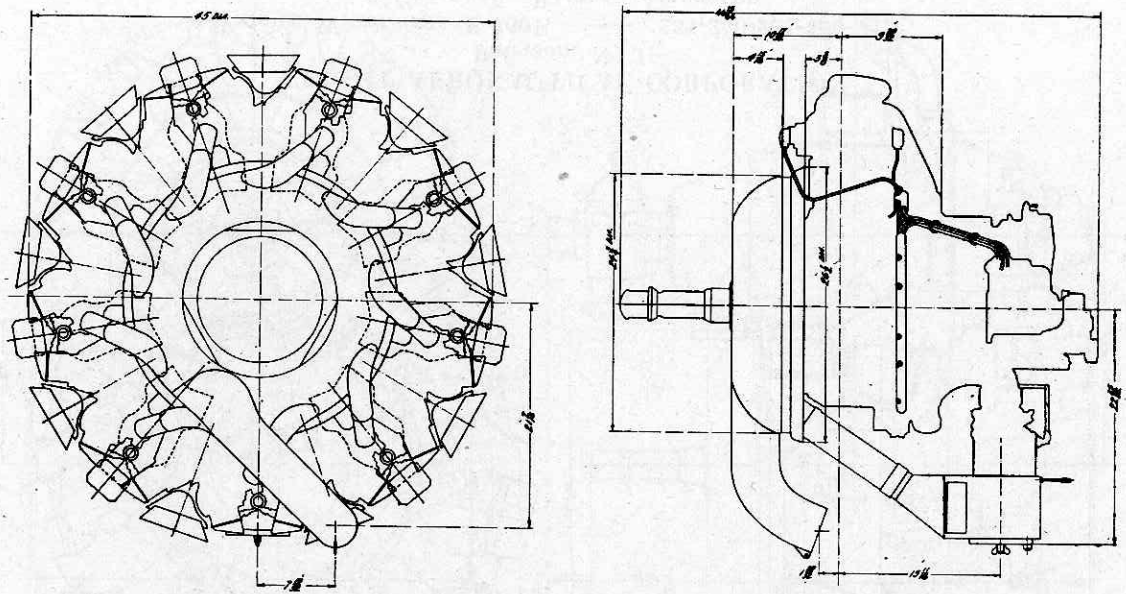

PRATT & WHITNEY AIRCRAFT
Division of United Aircraft Manufacturing Corporation
East Hartford, Conn.
TWIN WASP JUNIOR B (GEARED) —— 750 H.P.
14 CYLINDER RADIAL AIRCOOLED




PRATT & WHITNEY AIRCRAFT
Division of United Aircraft Manufacturing Corporation
East Hartford, Conn.
Twin Wasp B (Geared) —— 850 H.P.
14 Cylinder Radial Aircooled



WRIGHT AERONAUTICAL CORPORATION
Paterson, N. J.
WRIGHT WHIRLWIND R-760E —— 235-250-285-320 H.P.
7 CYLINDER RADIAL AIRCOOLED

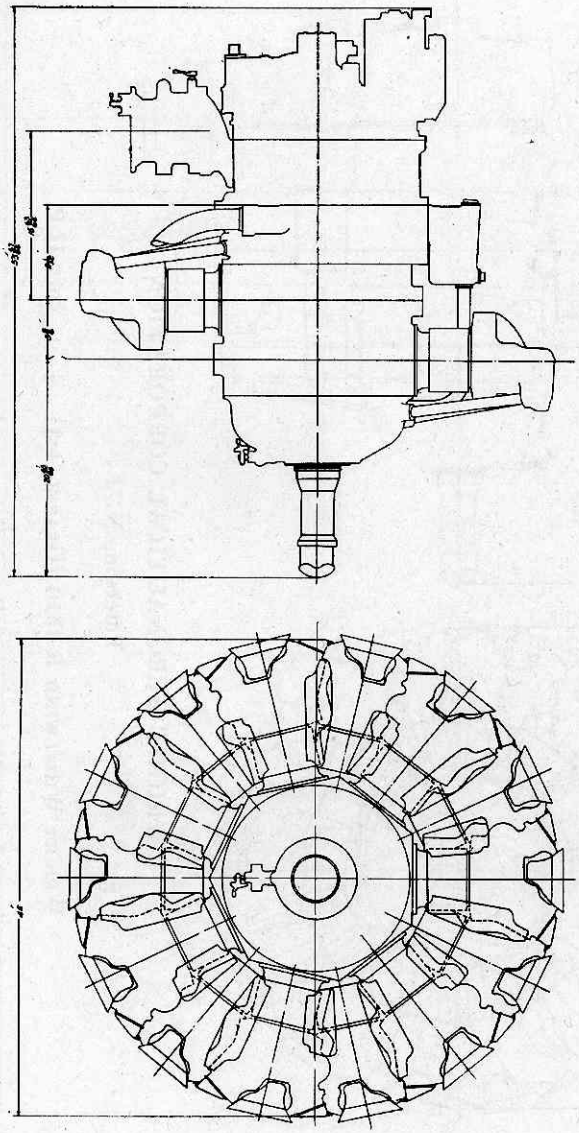


## WRIGHT AERONAUTICAL CORPORATION

Paterson, N. J.

WRIGHT WHIRLWIND R-975E —— 330-365-420-450 H.P.

9 CYLINDER FIXED RADIAL AIRCOOLED

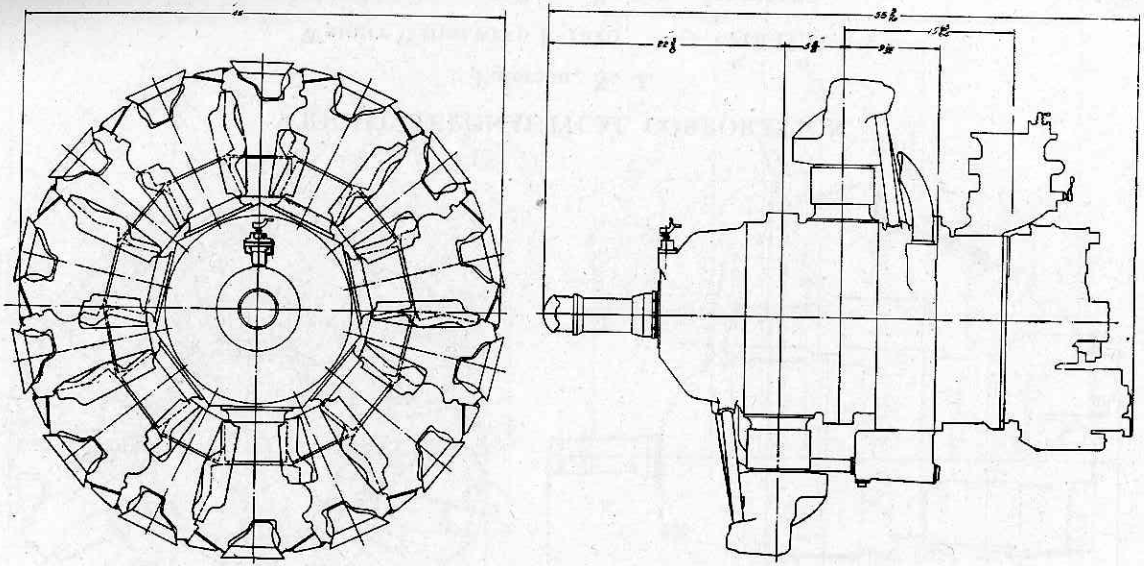


WRIGHT AERONAUTICAL CORPORATION

Paterson, N. J.

WRIGHT WHIRLWIND R-1510 — 715 H.P.

14 CYLINDER 2 ROW RADIAL AIRCOOLED

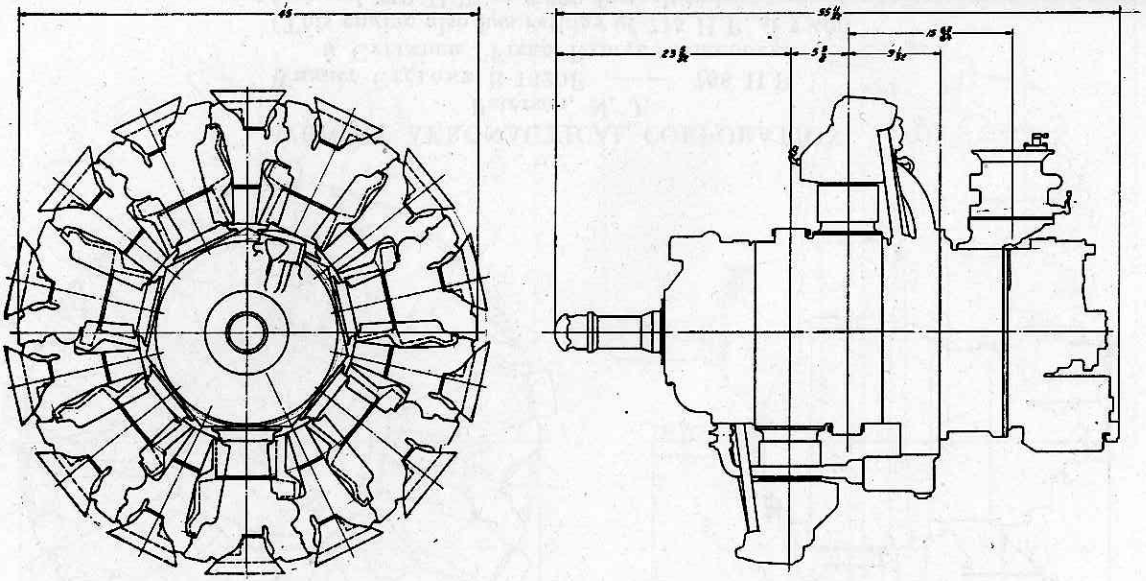


## WRIGHT AERONAUTICAL CORPORATION

Paterson, N. J.

WRIGHT WHIRLWIND R-1510 (GEARED 4:3) —— 765 H.P.

14 CYLINDER 2 ROW RADIAL AIRCOOLED

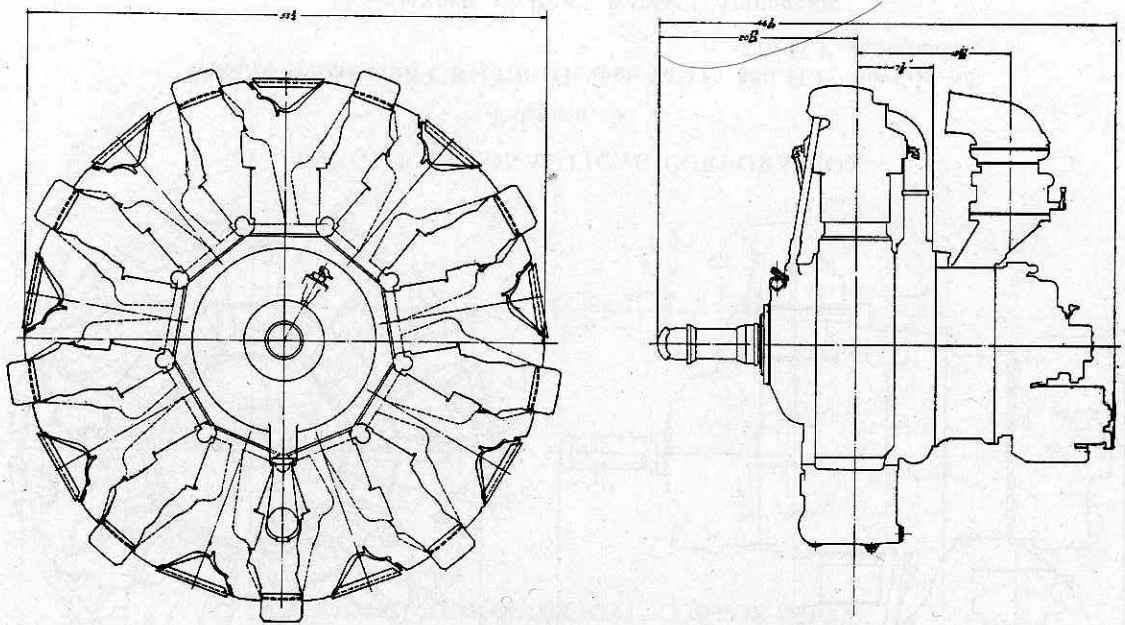


## WRIGHT AERONAUTICAL CORPORATION

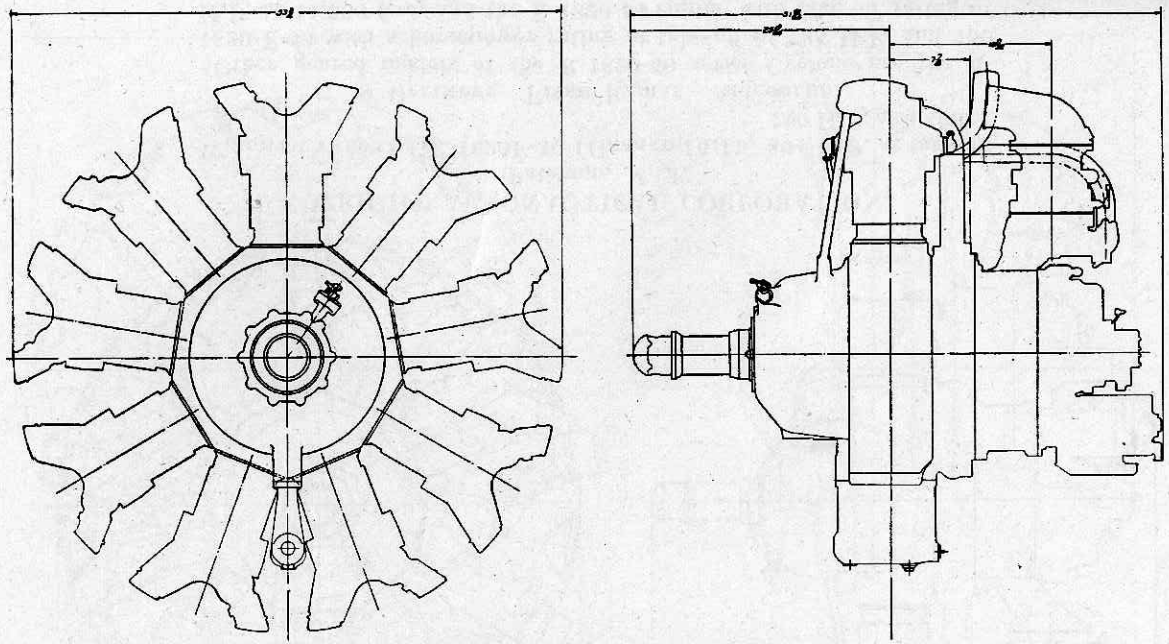
Paterson, N. J.

WRIGHT WHIRLWIND GR-1670 (GEARED 16:11) 830 H.P. for take-off
775 H.P. at 10,000 ft.

14 CYLINDER 2 ROW RADIAL AIRCOOLED



**WRIGHT AERONAUTICAL CORPORATION**
**Paterson, N. J.**
**WRIGHT CYCLONE R-1820F —— 768 H.P.**
**9 CYLINDER FIXED RADIAL AIRCOOLED**
**(This engine also has ratings of 715 H.P. at 7,400 feet and 750 H.P. at 2,600 feet altitude)**



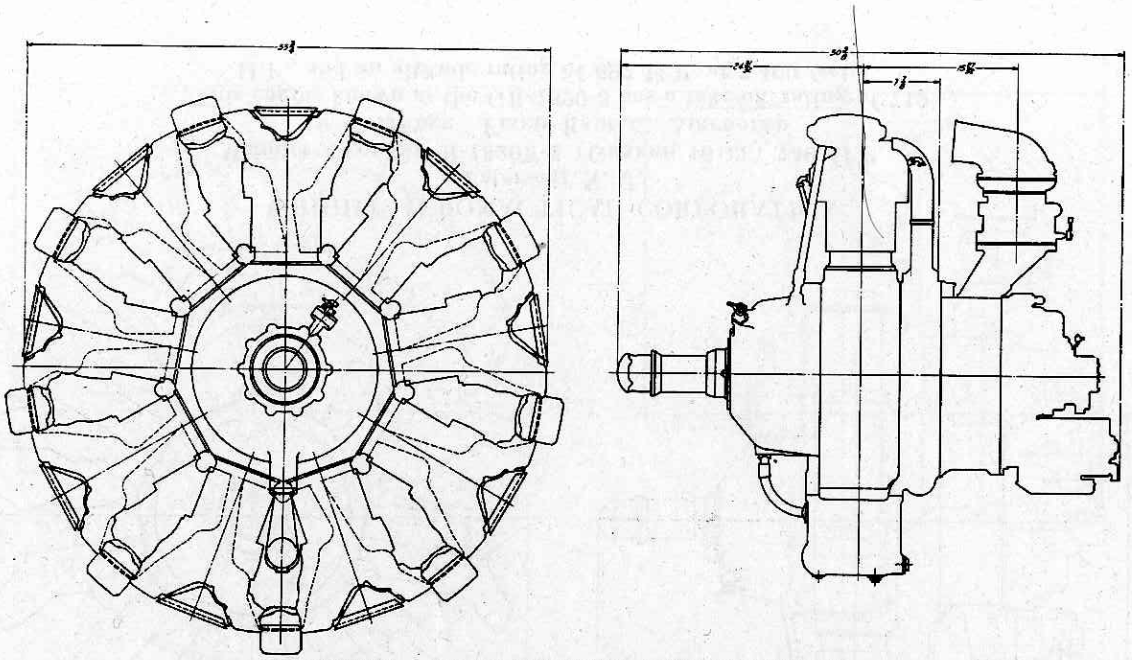
## WRIGHT AERONAUTICAL CORPORATION

Paterson, N. J.

WRIGHT CYCLONE R-1820F-2 (GEARED 16:11) 750 H.P.

9 CYLINDER FIXED RADIAL AIRCOOLED

(This engine known as the GR-1820-3 has a take-off rating of 712 H.P., and an altitude rating of 697 H.P. at 7,400 feet.)



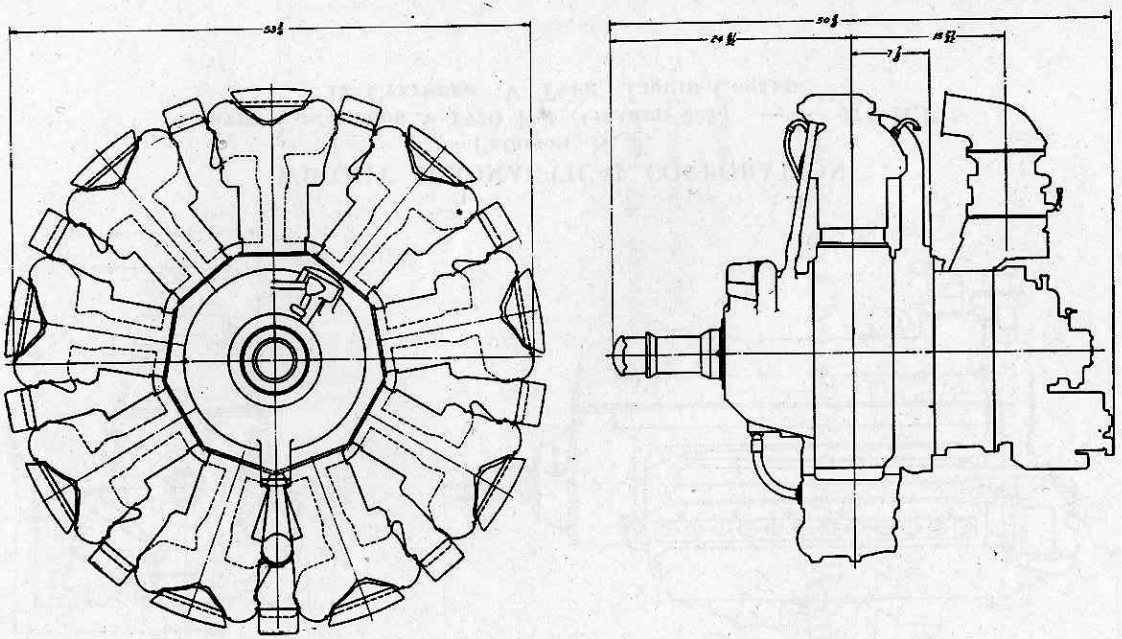
## WRIGHT AERONAUTICAL CORPORATION

Paterson, N. J.

WRIGHT CYCLONE GR-1820F-50 (GEARED 16:11) 804 H.P. at take-off
760 H.P. at 5,800 ft.

9 CYLINDER FIXED RADIAL AIRCOOLED

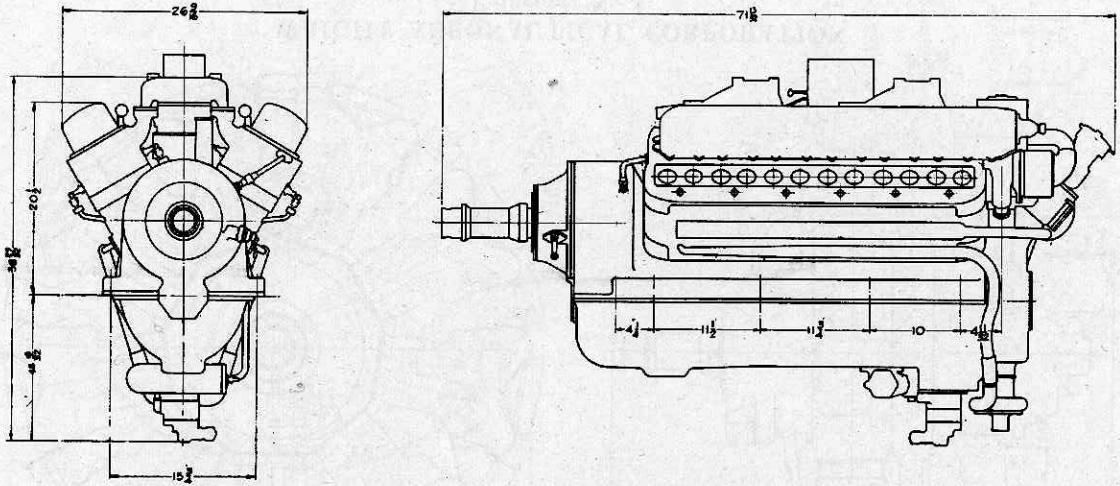
(Other geared models of the R-1820-50 series Cyclone are the R-1820-F-53 with a horsepower rating at take-off of 735 H.P. and 750 H.P. at 11,000 feet, and the R-1820-54 engine with take-off rating of 642 H.P. and 700 H.P. at 16,200 feet altitude.)



**WRIGHT AERONAUTICAL CORPORATION**
Paterson, N. J.

WRIGHT CYCLONE R-1820-G (GEARED 16:11) 950 H.P. for take-off
815 H.P. at 13,500 ft.

9 CYLINDER FIXED RADIAL AIRCOOLED




## WRIGHT AERONAUTICAL CORPORATION

Paterson, N. J.

CURTISS CONQUEROR V-1570 F-2 (GEARED 7:5) —— 675 H.P.

12 CYLINDER V TYPE LIQUID COOLED

# Aviation Chronology and Records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| Official Air Records | 442 |

## CHRONOLOGY FOR 1935

| | |
|---|---|
| Jan. 10-12 | Seventh Annual All-American Air Races held at Miami, Fla. |
| Jan. 11-12 | Amelia Earhart flies from Wheeler Field, Honolulu, to Oakland, Calif., in 18 hrs. 16 min., making first solo flight from Hawaii to the United States. (Lockheed Vega, Pratt & Whitney Wasp engine.) |
| Jan. 15 | Major James H. Doolittle, with two passengers, flies an American Airlines plane non-stop from Los Angeles, Calif., to Floyd Bennett Field, Brooklyn, New York, in 11 hrs. 59 min., making transcontinental record for passenger transport airplanes and non-stop west-east transcontinental record. (Airplane Development Vultee, Wright Cyclone engine.) |
| Jan. 15 | John H. Wright makes American speed record for 100 kms. for light airplanes in the first category of 172.225 m.p.h. at Miami, Fla. (Lambert Monocoupe, Warner Super Scarab engine.) |
| Jan. 15-16 | Navy flying boat XP2H-1 flies non-stop from Norfolk, Va., to Coco Solo, C. Z., in 24 hours. (Hall-Aluminum XP2H-1, 4 Curtiss Conqueror engines.) |
| Jan. 17 | Rex B. Beisel, A. Lewis MacClain, and F. M. Thomas receive Wright Brothers Medal and Manly Memorial Medal for 1934 from Society of Automotive Engineers for paper on engines. |
| Jan. 19-23 | Gaston Génin, Jean Laurent, and André Robert fly from Paris, France, to Madagascar in 3 days, 13 hrs. 18 min. (Farman 190, Lorraine Algol engine.) |
| Jan. 24 | Dr. Richard U. Light and Robert Wilson complete round-the-world trip by boat and airplane at College Point, N. Y., having covered 29,000 miles since leaving New Haven, Conn., on August 20, 1934. (Bellanca Skyrocket, Pratt & Whitney Wasp engine.) |
| Jan. 29 | Harry Richman makes amphibion altitude record of 18,641.676 feet at Miami, Fla. (Sikorsky S-39, Pratt & Whitney Wasp Junior engine.) |
| Jan. 30 | Prof. C. G. Rossby and Dr. H. C. Willett receive the Sylvanus Albert Reed Award for 1934 from the Institute of the Aeronautical Sciences for work in meteorology. |
| Feb. 10 | Harry Richman and George Daufkirch make amphibion speed record for 1,000 kms. of 99.95 m.p.h. at Miami, Fla. (Sikorsky S-39, Pratt & Whitney Wasp Junior engine.) |
| Feb. 12 | "U. S. S. Macon" crashes at sea off the California coast, with loss of two lives. |
| Feb. 16-17 | Paul Codos and Maurice Rossi attempt South Atlantic flight from Marseilles, France, but are forced down at Cape Verde Islands. (Bleriot-Zapata, Hispano-Suiza engine.) |
| Feb. 20-21 | Leland S. Andrews, with Henry Meyers, co-pilot, and G. D. Rayburn, radio operator, flies an American Airlines plane from Los Angeles, Calif., to Floyd Bennett Field, Brooklyn, New York, in 11 hrs. 34 min. 16 sec., making transcontinental record for passenger transport airplanes. (Airplane Development Vultee, Wright Cyclone engine.) |
| Mar. 15 | Paul Codos and Maurice Rossi fly from Cape Verde Islands to Paris non-stop. (Bleriot-Zapata, Hispano-Suiza engine.) |
| Mar. 15 | Wiley Post flies from Burbank, Calif., to Cleveland, O., in 8 hrs. 4 min. at an altitude of about 30,000 feet. (Lockheed Vega, Pratt & Whitney Wasp engine.) |
| Mar. 19 | Herbert Schiff Memorial Trophy for 1934 presented to Training Squadron Two, U. S. Naval Air Station, Pensacola, Fla. |
| Apr. 6 | "Graf Zeppelin" resumes its regular mail and passenger service between Germany and Brazil. |

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| Apr. 9 | Mackay Trophy for 1934 presented to Brig. Gen. Henry H. Arnold for leadership of U. S. Army Alaska flight. |
| Apr. 16-17 | "Pan American Clipper" flies from Alameda, Calif., to Honolulu, Hawaii, in 18 hrs. 39 min., in first test-flight for Pan American Airways. (Sikorsky S-42, 4 Pratt & Whitney Hornet engines.) |
| Apr. 19-20 | Amelia Earhart flies from Burbank, Calif., to Central Airport, Mexico City, Mex., with one stop, in 13 hrs. 33 min. elapsed time. (Lockheed Vega, Pratt & Whitney Wasp engine.) |
| Apr. 30 | D. W. Tomlinson, with H. B. Snead and Peter Redpath, flies a Transcontinental and Western Air plane non-stop from Burbank, Calif., to Floyd Bennett Field, Brooklyn, New York, in 11 hrs. 5 min. 45 sec., making record for transport airplanes and non-stop west-east transcontinental record. (Douglas DC-1, 2 Wright Cyclone engines.) |
| May 8 | Amelia Earhart makes first non-stop flight from Mexico City, Mex., to Newark, N. J. in 14 hrs. 19 min. (Lockheed Vega, Pratt & Whitney Wasp engine.) |
| May 10 | Rear Adm. Richard E. Byrd returns to the United States from Second Antarctic Expedition. |
| May 15 | Major E. E. Aldrin makes amphibion speed record for 100 kms. of 159.781 m.p.h. at Newark, N. J. (Douglas Dolphin, 2 Pratt & Whitney Wasp engines.) |
| May 16-17 | D. W. Tomlinson and J. S. Bartles make 14 speed records for airplanes at Floyd Bennett Field, Brooklyn, New York. (See Official air records.) (Douglas DC-1, 2 Wright Cyclone engines.) |
| May 18 | D. W. Tomlinson and J. S. Bartles make eight speed records for airplanes at Floyd Bennett Field, Brooklyn, New York. (See Official air records.) (Douglas DC-1, 2 Wright Cyclone engines.) |
| May 19 | Third annual Deutsch de la Meurthe Cup Race won by Raymond Delmotte at 275.8 m.p.h. (Caudron C.460, Renault engine.) |
| May 20-21 | Juan I. Pombo flies from Bathurst, Gambia, Africa, to Natal, Brazil, in 16 hrs. 55 min. (British Aircraft Eagle, De Havilland Gipsy Major engine.) |
| May 21 | Langley Medal for Aerodromics awarded by Smithsonian Institution to Dr. Joseph S. Ames for the work of the National Advisory Committee for Aeronautics. |
| May 25 | Empire Air Day celebrated at Royal Air Force stations in England. |
| June 4-July 1 | Fred and Al Key make refuelling duration record of 27 days, 5 hrs. 34 min. (653 hrs. 34 min.) at Meridian, Miss. (Curtiss Robin, Wright Whirlwind engine.) |
| June 16 | Benjamin King and Daniel Brimm make distance record for light seaplanes in the third category of 185.4 miles, from North Beach, N. Y., to Whitney's Landing, Anne Arundel County, Md. (Aeronautical Corporation Aeronca C-3, Aeronca E-113-A engine.) |
| June 17 | Maryse Hilsz makes women's altitude record of 37,038 feet at Villacoublay, France. (Morane, Gnôme & Rhône engine.) |
| June 20 | Marquise Carina Negrone makes women's altitude record of 39,511.036 feet at Rome, Italy. (Caproni 113R, Bristol Pegasus S.2 engine.) |
| June 22-23 | Lieut. de Vaisseau Hebrard and crew make seaplane distance record of 2,695.565 miles from Cherbourg, France, to Ziguinchor, Senegal, Africa. (Latécoère 300, 4 Hispano-Suiza engines.) |
| June 25 | Benjamin King makes distance record for light seaplanes in the second category of 221.20 miles. (Aeronautical Corporation Aeronca C-3, Aeronca E-113-A engine.) |

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| June 25 | Lieut. Richard L. Burke, U. S. Coast Guard, makes amphibion speed record for 100 kms. of 173.945 m.p.h. (Grumman, Wright Cyclone engine.) |
| June 27 | Lieut. Richard L. Burke, U. S. Coast Guard, makes altitude mark for amphibions with load of 500 kgs. of 17,877.243 feet. (Grumman, Wright Cyclone engine.) |
| June 29 | Sixteenth Annual Royal Air Force Display held at Hendon, England. |
| June 29-July 14 | Sixth Annual Soaring Meet held at Elmira, N. Y. |
| July 11 | Laura Ingalls flies non-stop from Floyd Bennett Field, Brooklyn, New York, to Burbank, Calif., in 18 hrs. 23 min., making east-west transcontinental record for women. (Lockheed Orion, Pratt & Whitney Wasp engine.) |
| July 16-17 | Mario Stoppani and Casimiro Babbi make seaplane distance record of 3,063.166 miles from Monfalcone, Italy, to Berbera, British Somaliland. (Cant Z-501, Isotta-Fraschini-Asso engine.) |
| July 18-Aug. 16 | Thor Solberg with Paul Oscanyan, radio operator, flies from Floyd Bennett Field, Brooklyn, New York, to Bergen, Norway, via Canada, Greenland, and Iceland. (Loening amphibion, Wright Cyclone engine.) |
| July 20-28 | All-American Aircraft Show held at Detroit, Mich., under sponsorship of Aeronautical Activities Association of Michigan and sanction of the Aeronautical Chamber of Commerce of America, Inc. |
| July 22 | Collier Trophy for 1934 presented to Capt. Albert F. Hegenberger for development and demonstration of a successful blind landing system. |
| Aug. 15 | Wiley Post and Will Rogers are killed near Point Barrow, Alaska, while taking off from narrow waterway. (Plane rebuilt from miscellaneous parts, Pratt & Whitney Wasp engine.) |
| Aug. 24 | Major Gen. Frank M. Andrews, U. S. Army, J. G. Moran, and H. O. Johnson make three seaplane speed records for 1,000 kms. of 165.040 m.p.h. at Floyd Bennett Field, Brooklyn, New York. (Martin B-12-A, 2 Pratt & Whitney Hornet engines.) |
| Aug. 26-Oct. 29 | Harold L. Farquhar and Fritz Bieler fly from North Beach, N. Y., to Heston, England, by way of Canada, Alaska, Russia, China, India, and North Africa. (Beech B17R, Wright Whirlwind engine.) |
| Aug. 30-Sept. 2 | National Air Races held at Cleveland, O. |
| Sept. 7 | King's Cup Race won by Flight Lieut. Tom Rose at 176.28 m.p.h. in England. (Miles Falcon, De Havilland Gipsy VI engine.) |
| Sept. 12 | Laura Ingalls flies non-stop from Burbank, Calif., to Floyd Bennett Field, Brooklyn, New York, in 13 hrs. 34 min. 5 sec., making west-east transcontinental record for women. (Lockheed Orion, Pratt & Whitney Wasp engine.) |
| Sept. 13 | Howard Hughes makes land plane speed record of 352.388 m.p.h. at Santa Ana, Calif. (Hughes Special, Pratt & Whitney Wasp Junior engine.) |
| Sept. 15 | Alexander P. de Seversky makes amphibion speed record of 230.413 m.p.h. at Detroit, Mich. (Seversky, Wright Cyclone engine.) |
| Sept. 15-18 | Gordon Bennett Balloon Race won by Z. Burzynski and W. Wysocki, Poland, covering 1,025.55 miles from Warsaw to Tiszkino, Russia, in 57 hrs. 54 min. |
| Sept. 21-22 | Felix Waitkus flies non-stop from Floyd Bennett Field, Brooklyn, New York, to Ballinrobe, Ireland, on projected flight to Lithuania. (Lockheed Vega, Pratt & Whitney Wasp engine.) |
| Sept. 24 | Benjamin King makes altitude record for light seaplanes in the fourth category of 15,081.976 feet at Anacostia, D. C. (Aeronautical Corporation Aeronca C-2, Aeronca E-113-A engine.) |

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| Sept. 26 | Benjamin King makes distance record for light seaplanes in the fourth category of 230.314 miles, from Anacostia, D. C., to Ossining, N. Y. (Aeronautical Corporation Aeronca C-2, Aeronca E-113-A engine.) |
| Oct. 9-10 | Navy flying boat $P_3Y$-1 flies non-stop from Norfolk, Va., to Coco Solo, C. Z., in 17 hrs. 33 min. (Consolidated $P_3Y$-1, 2 Pratt & Whitney Wasp Junior engines.) |
| Oct. 12-28 | International Aero Show held at Milan, Italy. |
| Oct. 14-15 | Lt. Comdr. Knefler McGinnis, U. S. Navy, and crew of five make seaplane distance record of 3,281.402 miles from Cristobal Harbor, C. Z., to Alameda, Calif. (Consolidated $P_3Y$-1, 2 Pratt & Whitney Wasp Junior engines.) |
| Oct. 19 | Mitchell Trophy Race won by Capt. Karl E. Gimmler, U. S. Air Corps, at 212.96 m.p.h. at Selfridge Field, Mich. (Boeing P-26A, Pratt & Whitney Wasp engine.) |
| Nov. 5-11 | David W. Llewellyn and Mrs. Jill Wyndham fly from Capetown, S. Africa, to Hanworth, England, in 6 days, 12 hrs. 17 min., making new record. (Hendy Heck, De Havilland Gipsy VI engine.) |
| Nov. 6 | Sir Charles Kingsford-Smith and J. T. Pethybridge leave Croydon, England, on projected flight to Australia. Unreported at end of 1935. (Lockheed Altair, Pratt & Whitney Wasp engine.) |
| Nov. 9 | U. S. Navy makes first massed flight from Honolulu to French Frigate Shoals, 41 seaplanes flying 759 miles non-stop in 6 hrs. 10 min. (Consolidated $P_2Y$-1, 2 Wright Cyclone engines.) |
| Nov. 11 | Capt. Albert W. Stevens and Capt. Orvil A. Anderson make altitude balloon record of 72,394.795 feet, traveling from Rapid City to White Lake, S. D. |
| Nov. 13 | Miss Jean Batten flies from Dakar, Senegal, to Natal, Brazil, in 13 hrs. 15 min. (Percival Gull, De Havilland Gipsy VI engine.) |
| Nov. 22 | Vladimir Kokinaki reported to have made unofficial airplane altitude record of about 47,800 feet at Moscow, Russia. |
| Nov. 22-29 | Pan American Airways starts first transpacific air mail service, flying from Alameda, Calif., to Manila, Philippine Islands, with stops at Honolulu, Midway, Wake and Guam Islands. (Martin flying boat, 4 Pratt & Whitney Wasp engines.) |
| Nov. 23-Dec. 5 | Lincoln Ellsworth and Herbert Hollick-Kenyon, pilot, fly approximately 2,100 miles from Dundee Island, Weddell Sea, Antarctica, to within 25 miles of Little America, Bay of Whales, Ross Sea. They were forced down four times by bad weather, and the last time by lack of fuel. (Northrop Gamma, Pratt & Whitney Wasp engine.) |
| Nov. 24 | Edward W. Stitt makes American distance record for light airplanes in the fourth category of 449.5 miles, from Toledo, O., to Laurenceville, Va. (Aeronautical Corporation Aeronca C-2, Aeronca 107-A engine.) |
| Dec. 3 | John Fritz Medal presented to Dr. William F. Durand for his work in aerodynamics and engineering. |
| Dec. 9 | Leighton W. Rogers is elected president of the Aeronautical Chamber of Commerce of America, Inc., succeeding Thomas A. Morgan, resigned. |
| Dec. 11 | Benjamin King makes speed record for 100 kms. for seaplanes in the fourth category of 80.931 m.p.h. at Miami, Fla. (Aeronautical Corporation Aeronca C-3, Aeronca E-113-A engine.) |
| Dec. 11 | Benjamin King makes speed record for 500 kms. for seaplanes in the fourth category of 70.499 m.p.h. at Miami, Fla. (Aeronautical Corporation Aeronca C-3, Aeronca E-113-A engine.) |

Dec. 11 — Hubbard Gold Medal of the National Geographic Society presented to Capt. Albert W. Stevens and Capt. Orvil A. Anderson for their stratosphere balloon ascent of Nov. 11.

Dec. 12 — Lieut. Hugh F. McCaffery, U. S. Army, and crew of five make amphibion distance record of 1,033.2 miles from San Juan, P. R., to Chapman Field, Miami, Fla. (Douglas OA5 amphibion, 2 Wright Cyclone engines.)

Dec. 12-14 — Eighth Annual All-American Air Maneuvers held at Miami, Fla.

Dec. 18-21 — Gaston Génin and André Robert fly from Paris, France, to Madagascar in 2 days, 9 hrs. 32 min., making new record. Caudron-Simoun, Renault engine.)

Dec. 24 — Major Gen. Oscar Westover is appointed Chief of the Air Corps, U. S. Army.

## 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, 1935

## 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.

DISTANCE, CLOSED CIRCUIT.....10,601.480 kilometers (6,587.441 miles)
Bossoutrot and Rossi, France, March 23, 24, 25 and 26, 1932.

ALTITUDE .....22,066 meters (72,394.795 feet)
Capt. Orvil A. Anderson and Capt. Albert W. Stevens, U. S. Army Air Corps, United States, November 11, 1935.

CIRCUIT OF WORLD .....(No record established)

AIRLINE DISTANCE WITH REFUELING.....(No record established)

## OFFICIAL INTERNATIONAL AND NATIONAL "CLASS" RECORDS

### AIRPLANES—CLASS C

DISTANCE, CLOSED CIRCUIT

International Record.....10,601.480 kilometers (6,587.441 miles)
Bossoutrot and Rossi, France, Bleriot 110 Monoplane, Hispano-Suiza 500 HP engine, March 23-26, 1932.

National (U.S.) Record.....4,050 kilometers (2,516.55 miles)
Lts. Kelly and Macready, USA, T-2 airplane, Liberty 375 HP engine, Dayton, Ohio, April 16 and 17, 1923.

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, 567.115 km.p.h. (352.388 m.p.h.)
Howard Hughes, United States, Hughes "Special" monoplane, Pratt & Whitney Wasp Junior 1000 HP engine, Santa Ana, California, September 13, 1935.
National (U.S.) Record.....Same as above.

## SPEEDS FOR SPECIFIED DISTANCES WITHOUT PAY LOAD

SPEED FOR 100 KILOMETERS (62.137 MILES)
International Record.....Speed, 476.316 km.p.h. (295.969 m.p.h.)
Maurice Arnoux, France, Caudron C.460 monoplane, Renault 360 HP engine, Chartres-Bonce-Etampes course, August 10, 1935.
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, 450.371 km.p.h. (279.847 m.p.h.)
Raymond Delmotte, France, Caudron C.460 monoplane, Renault 360 HP engine, Istres, August 24, 1935.
National (U.S.) Record.....Speed, 308.470 km.p.h. (191.674 m.p.h.)
D. W. Tomlinson, pilot; J. S. Bartles, co-pilot; Douglas DC-1 monoplane, 2 Wright Cyclone 710 HP engines, Floyd Bennett Field—Polling Field—Willoughby Spit—Floyd Bennett Field course, May 18, 1935.

SPEED FOR 2000 KILOMETERS (1242.739 MILES)
International Record.....Speed, 380.952 km.p.h. (236.712 m.p.h.)
Attileo Piseo and Gori Castellani, Italy, S-79 I-MAGO airplane, 3 Alfa-Romeo 125 engines, Monte-Cavo, Monte Nerone, Ansedonia course, September 23, 1935.
National (U.S.) Record.....Speed, 307.234 km.p.h. (190.906 m.p.h.)
D. W. Tomlinson, pilot; J. S. Bartles, co-pilot; Douglas DC-1 monoplane, 2 Wright Cyclone 710 HP engines, Floyd Bennett Field—Bolling Field—Willoughby Spit—Floyd Bennett Field course, May 18, 1935.

SPEED FOR 5000 KILOMETERS (3106.849 MILES)
International Record.....Speed, 272.030 km.p.h. (169.031 m.p.h.)
D. W. Tomlinson, pilot; J. S. Bartles, co-pilot; United States, Douglas DC-1 monoplane, 2 Wright Cyclone 710 HP engines, Floyd Bennett Field—Bolling Field—Willoughby Spit—Floyd Bennett Field Course, May 16-17, 1935.
National (U.S.) Record.....Same as above.

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, 390.371 km.p.h. (242.565 m.p.h.)
Attileo Biseo and Gori Castellani, Italy, S-79 I-MAGO airplane, 3 Alfa-Romeo 125 engines, Monte Cavo-Monte Nerone-Ansedonia course, September 23, 1935.
National (U.S.) Record.....Speed, 308.470 km.p.h. (191.674 m.p.h.)
D. W. Tomlinson, pilot; J. S. Bartles, co-pilot; Douglas DC-1 monoplane, 2 Wright Cyclone 710 HP engines, Floyd Bennett Field—Bolling Field—Willoughby Spit—Floyd Bennett Field course, May 18, 1935.
SPEED FOR 2000 KILOMETERS
International Record.....Speed, 380.952 km.p.h. (236.712 m.p.h.)
Attileo Biseo and Gori Castellani, Italy, S-79 I-MAGO airplane, 3 Alfa-Romeo 125 engines, Monte Cavo-Monte Nerone-Ansedonia course, September 23, 1935.
National (U.S.) Record.....Speed, 307.234 km.p.h. (190.906 m.p.h.)
D. W. Tomlinson, pilot; J. S. Bartles, co-pilot; Douglas DC-1 monoplane, 2 Wright Cyclone 710 HP engines, Floyd Bennett Field—Bolling Field—Willoughby Spit—Floyd Bennett Field course, May 18, 1935.
SPEED FOR 5000 KILOMETERS
International Record.....Speed, 272.030 km.p.h. (169.031 m.p.h.)
D. W. Tomlinson, pilot; J. S. Bartles, co-pilot; United States, Douglas DC-1 monoplane, 2 Wright Cyclone 710 HP engines, Floyd Bennett Field—Bolling Field—Willoughby Spit—Floyd Bennett Field course, May 16-17, 1935.
National (U.S.) Record.....Same as above.

## 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, 390.371 km.p.h. (242.565 m.p.h.)
Attileo Biseo and Gori Castellani, Italy, S-79 I-MAGO airplane, 3 Alfa-Romeo 125 engines, Monte Cavo-Monte Nerone-Ansedonia course, September 23, 1935.
National (U.S.) Record.....Speed, 308.470 km.p.h. (191.674 m.p.h.)
D. W. Tomlinson, pilot; J. S. Bartles, co-pilot; Douglas DC-1 monoplane, 2 Wright Cyclone 710 HP engines, Floyd Bennett Field—Bolling Field—Willoughby Spit—Floyd Bennett Field course, May 18, 1935.
SPEED FOR 2000 KILOMETERS
International Record.....Speed, 380.952 km.p.h. (236.712 m.p.h.)
Attileo Biseo and Gori Castellani, Italy, S-79 I-MAGO airplane, 3 Alfa-Romeo 125 engines, Monte Cavo-Monte Nerone-Ansedonia course, September 23, 1935.
National (U.S.) Record.....Speed, 307.234 km.p.h. (190.906 m.p.h.)
D. W. Tomlinson, pilot; J. S. Bartles, co-pilot; Douglas DC-1 monoplane, 2 Wright Cyclone 710 HP engines, Floyd Bennett Field—Bolling Field—Willoughby Spit—Floyd Bennett Field course, May 18, 1935.
SPEED FOR 5000 KILOMETERS
International Record.....Speed, 272.030 km.p.h. (169.031 m.p.h.)
D. W. Tomlinson, pilot; J. S. Bartles, co-pilot; United States, Douglas DC-1 monoplane, 2 Wright Cyclone 710 HP engines, Floyd Bennett Field—Bolling Field—Willoughby Spit—Floyd Bennett Field course, May 16-17, 1935.
National (U.S.) Record.....Same as above.

## 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, 390.371 km.p.h. (242.565 m.p.h.)
Attileo Biseo and Gori Castellani, Italy, S-79 I-MAGO airplane, 3 Alfa-Romeo 125 engines, Monte Cavo-Monte Nerone-Ansedonia course, September 23, 1935.
National (U.S.) Record.....Speed, 308.470 km.p.h. (191.674 m.p.h.)
D. W. Tomlinson, pilot; J. S. Bartles, co-pilot; Douglas DC-1 monoplane, 2 Wright Cyclone 710 HP engines, Floyd Bennett Field—Bolling Field—Willoughby Spit—Floyd Bennett Field course, May 18, 1935.

SPEED FOR 2000 KILOMETERS
International Record.....Speed, 380.952 km.p.h. (236.712 m.p.h.)
Attileo Piseo and Gori Castellani, Italy, S-79 I-MAGO airplane, 3 Alfa-Romeo 125 engines, Monte Cavo-Monte Nerone-Ansedonia course, September 23, 1935.
National (U.S.) Record.....Speed, 307.234 km.p.h. (190.906 m.p.h.)
D. W. Tomlinson, pilot; J. S. Bartles, co-pilot; Douglas DC-1 monoplane, 2 Wright Cyclone 710 HP engines, Floyd Bennett Field—Bolling Field—Willoughby Spit—Floyd Bennett Field course, May 18, 1935.
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, 453.743 km.p.h. (281.942 m.p.h.)
Maurice Arnoux and Mme. Becker, France, Caudron C.450 monoplane, Renault engine, Chartres-Bonce-Etampes course, August 8, 1935.
National (U.S.) Record.....Speed, 277.169 km.p.h. (172.225 m.p.h.)
John H. Wright, pilot; Karl E. Voelter, passenger; Monocoupe monoplane, Warner Super Scarab 145 HP engine, Miami, Florida, January 15, 1935.
SPEED FOR 1000 KILOMETERS
International Record.....Speed, 292.825 km.p.h. (181.953 m.p.h.)
Maurice Arnoux and Mme. Becker, France, Caudron "Rafale" C.660, Renault-Bengali 140 HP engine, Angers, July 7, 1935.
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, 358.664 km.p.h. (222.863 m.p.h.)
Arthur C. Chester, "Chester Special" monoplane, Menasco C-4-S 200 HP engine, Miami, Florida, January 9, 1935.
National (U.S.) Record.....Same as above.
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 Normani-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, 222.579 km.p.h. (138.304 m.p.h.)
Sebastiano Bedendo, pilot; Rinaldo Stenico, passenger; Italy, N-5 airplane, Pobjoy 75 h.p. engine, Ruderi od Infernaccio temporary course, February 17, 1935.
National (U.S.) Record.....None established.
SPEED FOR 500 KILOMETERS
International Record.....Speed, 213.676 km.p.h. (132.772 m.p.h.)
Sebastiano Bedendo, pilot; Rinaldo Stenico, passenger; Italy, N-5 airplane, Pobjoy 75 h.p. engine, Ruderi od Infernaccio temporary course, February 16, 1935.
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.....723.401 kms. (449.5 miles)
Edward W. Stitt, Aeronca C-2 airplane, Aeronca 107A engine, Toledo, Ohio, to Laurenceville, Virginia, November 24, 1935.
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. Whitman, United States, "Whitman 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.....5,280.015 kilometers (3,281.402 miles)
Lt. Comdr. Knefler McGinnis, USN, Lt. J. K. Averill, USN, NAP T. P. Wilkinson, USN, pilots; C. S. Bolka, A. E. J. Dionne and E. V. Sizer, crew; United States, Navy XP3Y-1 seaplane, 2 Pratt & Whitney 825 HP engines, from Cristobal Harbor, Canal Zone, to San Francisco Bay, Alameda, California, October 14-15, 1935.
National (U.S.) Record.....Same as above.
BROKEN LINE DISTANCE
International Record.....5,541.392 kilometers (3,443.255 miles)
Lt. Comdr. Knefler McGinnis, USN, Lt. J. K. Averill, USN, NAP T. P. Wilkinson, USN, pilots; C. S. Bolka, A. E. J. Dionne and E. V. Sizer, crew; United States, Navy XP3Y-1 seaplane, 2 Pratt & Whitney 825 HP engines, from Cristobal Harbor, Canal Zone, to San Francisco Bay, Alameda, California, October 14-15, 1935.
National (U.S.) Record.....Same as above.
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, 265.606 km.p.h. (165.040 m.p.h.)
Brig. Gen. F. M. Andrews, pilot; J. G. Moran and H. O. Johnson, crew; United States, Martin B-12-A seaplane, 2 P & W "Hornet" 700 HP engines, Willoughby Spit—Floyd Bennett Field—Bolling Field course, August 24, 1935.

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, 265.606 km.p.h. (165.040 m.p.h.)
Brig. Gen. F. M. Andrews, pilot; J. G. Moran and H. O. Johnson, crew; United States, Martin B-12-A seaplane, 2 P & W "Hornet" 700 HP engines, Willoughby Spit—Floyd Bennett Field—Bolling Field course, August 24, 1935.

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, 265.606 km.p.h. (165.040 m.p.h.)
Brig. Gen. F. M. Andrews, pilot; J. G. Moran and H. O. Johnson, crew; United States, Martin B-12-A seaplane, 2 P & W "Hornet" 700 HP engines, Willoughby Spit—Floyd Bennett Field—Bolling Field course, August 24, 1935.
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
International Record.....355.988 kilometers (221.20 miles)
Benjamin King, United States, Aeronca C-3 seaplane, Aeronca E113A 36 HP engine, from Port Washington, L.I., N.Y., to Naval Air Station, Anacostia, D. C., June 25, 1935.
National (U.S.) Record.....Same as above.

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
International Record.....298.373 kilometers (185.4 miles)
Benjamin King, pilot; Daniel Brimm, co-pilot; United States, Aeronca C-3 seaplane, Aeronca E113A 36 HP engine, from North Beach, L.I., N.Y., to Whitney's Landing, Anne Anundel County, Md., June 16, 1935.
National (U.S.) Record.....Same as above.

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
International Record.....370.656 kilometers (230.314 miles)
Benjamin King, United States, Aeronca C-2 seaplane, Aeronca E113A 36 HP engine, from Anacostia, D. C., to Croton Bay, Ossining, New York, September 26, 1935.
National (U.S.) Record.....Same as above.
ALTITUDE
International Record.....4,597 meters (15,081.976 feet)
Benjamin King, United States, Aeronca C-2 seaplane, Aeronca E113A 36 HP engine, Anacostia, D. C., September 24, 1935.
National (U.S.) Record.....Same as above.
SPEED FOR 100 KILOMETERS (62.137 MILES)
International Record.....80.931 m.p.h.
Benjamin King, United States, Aeronca C-2 seaplane, Aeronca E113A engine, Miami, Florida, December 11, 1935.
National (U.S.) Record.....Same as above.
SPEED FOR 500 KILOMETERS (310.685 MILES)
International Record.....70.499 m.p.h.
Benjamin King, United States, Aeronca C-2 seaplane, Aeronca E113A engine, Miami, Florida, December 11, 1935.
National (U.S.) Record.....Same as above.
SPEED FOR 1000 KILOMETERS (621.369 MILES)
Neither International nor National (U.S.) Record has been established.

## AMPHIBIONS—CLASS C3

AIRLINE DISTANCE
International Record.....1,033.2 miles
Lt. H. F. McCaffery, pilot; Capt. A. Y. Smith and Lt. A. S. Hansell, co-pilots; Corp. McKenna, Private Minor and Private Archer, crew; United States, Douglas OA5 amphibian, 2 Wright Cyclone engines, San Juan, Porto Rico, to Miami, Florida, December 12, 1935.
National (U.S.) Record.....Same as above.
BROKEN LINE DISTANCE
Neither International nor National (U.S.) Record has been established.
ALTITUDE
International Record.....5,682 meters (18,641.676 feet)
Harry Richman, United States, Sikorsky S-39 Amphibian, Pratt and Whitney 300 HP engine, at Miami, Florida, January 29, 1935.
National (U.S.) Record.....Same as above.
MAXIMUM SPEED
International Record.....Speed, 370.814 km.p.h. (230.413 m.p.h.)
Major Alexander P. de Seversky, United States, Seversky Amphibian, Wright "Cyclone" 710 HP engine, Detroit, Michigan, September 15, 1935.
National (U.S.) Record.....Same as above.
SPEED FOR 100 KILOMETERS (62.137 MILES) WITHOUT PAY LOAD
International Record.....Speed, 279.938 km.p.h. (173.945 m.p.h.)
Lt. R. L. Burke, USCG, United States, U. S. Coast Guard (Grumman) Amphibian No. 167, Wright Cyclone 710 HP engine, Cape May, New Jersey, June 25, 1935.
National (U.S.) Record.....Same as above.
SPEED FOR 1000 KILOMETERS (621.369 MILES) WITHOUT PAY LOAD
International Record.....Speed, 160.854 km.p.h. (99.950 m.p.h.)
Harry Richman and George Daufkirch, United States, Sikorsky S-39 Amphibian, Pratt and Whitney 300 HP engine, Miami, Florida, February 10, 1935.
National (U.S.) Record.....Same as above.

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.

CLASS C3—WITH PAY LOAD OF 500 KILOGRAMS (1102.311 lbs.)

ALTITUDE
International Record.....5,449 meters (17,877.243 feet)
Lt. R. L. Burke, USCG, United States, U. S. Coast Guard (Grumman) Amphibian No. 167, Wright Cyclone 710 HP engine, Cape May, New Jersey, June 27, 1935.
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.

## 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.....1,203.600 kms. (747.881 miles)
Eug. Stuber, pilot; Werner Schafer, passenger; Germany, "Leipziger Messe 11" balloon, from Bitterfeld, Germany, to Pazariche, Russia, March 25 and 26, 1935.
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.....57 hrs. 54 min.
Z. J. Burzynski and W. Wisocki, Poland, Gordon-Bennett Balloon Race, September 15-18, 1935.
National (U.S.) Record.....51 hours.
T. G. W. Settle and C. H. Kendall, Gordon-Bennett Balloon Race, Chicago, Illinois, September 2-4, 1933.
DISTANCE
International Record.....1,650.474 kilometers (1,025.555 miles)
Z. J. Burzynski and W. Wisocki, Poland, from Warsaw to Tiszkino, September 15-18, 1935.
National (U.S.) Record.....1,550 kilometers (963.123 miles)
T. G. W. Settle and Wilfred Bushnell, from Basle, Switzerland, to Daugieliski, Poland, Sept. 25-27, 1932.
ALTITUDE
Neither International nor National (U.S.) Record has been established.

SIXTH CATEGORY (2201-3000 *cubic meters*)

DURATION
International Record.....57 hrs. 54 min.
Z. J. Burzynski and W. Wisocki, Poland, Gordon-Bennett Balloon Race, September 15-18, 1935.
National (U.S.) Record.....51 hours.
T. G. W. Settle and C. H. Kendall, Gordon-Bennett Balloon Race, Chicago, Illinois, September 2-4, 1933.
DISTANCE
International Record.....1,650.474 kilometers (1,025.555 miles)
Z. J. Burzynski and W. Wisocki, Poland, from Warsaw to Tiszkino, September 15-18, 1935.
National (U.S.) Record.....1,550 kilometers (963.123 miles)
T. G. W. Settle and Wilfred Bushnell, from Basle, Switzerland, to Daugieliski, Poland, Sept. 25-27, 1932.
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.....57 hrs. 54 min.
Z. J. Burzynski and W. Wisocki, Poland, Gordon-Bennett Balloon Race, September 15-18, 1935.
National (U.S.) Record.....51 hours.
T. G. W. Settle and C. H. Kendall, Gordon-Bennett Balloon Race, September 2-4, 1933.

DISTANCE
International Record.....1,650.474 kilometers (1,025.555 miles)
Z. J. Burzynski and W. Wisocki, Poland, from Warsaw to Tiszkino, September 15-18, 1935.
National (U.S.) Record.....1,550 kilometers (963.123 miles)
T. G. W. Settle and Wilfred Bushnell, from Basle, Switzerland, to Daugieliski, Poland, Sept. 25-27, 1932.
ALTITUDE
International Record.....9,437 meters (30,961.193 feet)
Z. J. Burzinski, Poland, at Legjonowo, March 28, 1935.
National (U.S.) Record.....8,690 meters (28,508.413 feet)
Capt. Hawthorne C. Gray, at Scott Field, Belleville, Illinois, March 9, 1927.

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.....22,066 meters (72,394.795 feet)
Capt. Orvil A. Anderson and Capt. Albert W. Stevens, U. S. Army Air Corps, United States, take-off 11 miles southwest of Rapid City, S. D., landing 12 miles south of White Lake, S. D., November 11, 1935.
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

DISTANCE, AIRLINE
International Record.....504.200 kms. (313.295 miles)
Rudolf Oeltzschner, Germany, "D-Leuna" glider, from the Wasserkuppe to Brunn airport, Czechoslovakia, July 29, 1935.
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 ABOVE STARTING POINT
International Record.....4,325 meters (14,189.590 feet)
Heinrich Dittmar, Germany, "D-Condor" glider, at Campo dos Affonsos, Brazil, February 17, 1934.
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.....12,043 meters (39,511.036 feet)
Marquise Carina Negrone, Italy, Caproni 113 R. airplane, Pegasus S.2 engine of 502 HP, Montecelio, Rome, June 20, 1935.
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
Neither International nor National (U.S.) Record has been established.

ALTITUDE (FIRST CATEGORY)
International Record.....6,115 meters (20,062.295 feet)
Mrs. Madeleine Charnaux and Miss Clarck, France, Farman 357 monoplane, Renault 120 HP engine, at Orly, January 29, 1935.
National (U.S.) Record.....None established.

SPEED FOR 100 KILOMETERS (62.137 MILES)
International Record.....Speed, 268.169 km.p.h. (166.632 m.p.h.)
Miss Helen MacCloskey, United States, Monocoupe monoplane, Warner Super Scarab 145 HP engine, at Miami, Florida, January 15, 1935.
National (U.S.) Record.....Same as above.

SPEED FOR 1000 KILOMETERS (621.369 MILES)
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)
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.....7,338 meters (24,074.731 feet)
Mlle. Maryse Hilsz, France, Mauboussin M22 monoplane, "Corsaire," Salmson 9 A2R3 75 HP engine, Villacoublay, September 24, 1935.
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
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.....None established.

SPEED FOR 1000 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.

# Flying Facts and Figures


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## 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) |
| 1935 | 27 | 454 | 63,576,240 | 59,534,013 | 908,185 | 360,267,931 | 6,162,056(c) | 13,538,952(l) |

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. 19 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.
(l) Includes 674,613 pounds mail flown on F. A. M. routes.

### 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 | 1,258,675 |
| 1935..... | 61,166,810(a)* | 35,418,750(b)* | 500,468 | 1,721,895 |

(a) Includes National Guard.
(b) Includes Marine Corps and Naval Reserve.
* Based on total hours flown; miles flown computed from estimated speeds of various types of airplanes used.

## Monthly Air Transport Operations

Air Lines of the United States

| 1934 | Miles Scheduled | Miles Flown | Passengers | Passenger Miles | Mail (Pounds) | Express (Pounds) |
|---|---|---|---|---|---|---|
| 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 |
| 1935 | | | | | | |
| January | 4,475,122 | 3,604,054 | 36,349 | 16,263,365 | 859,929 | 266,195 |
| February | 4,205,204 | 3,668,342 | 42,878 | 19,360,737 | 881,100 | 263,271 |
| March | 4,744,115 | 4,493,058 | 63,795 | 28,483,795 | 1,048,203 | 329,762 |
| April | 4,838,274 | 4,548,789 | 70,509 | 30,243,996 | 1,044,038 | 357,424 |
| May | 5,347,312 | 5,066,224 | 72,267 | 30,455,455 | 1,127,725 | 407,230 |
| June | 5,407,493 | 5,291,473 | 81,559 | 35,205,844 | 1,119,848 | 487,537 |
| July | 5,972,269 | 5,952,646 | 92,748 | 38,067,860 | 1,187,029 | 456,299 |
| August | 6,143,560 | 6,010,315 | 97,715 | 40,133,601 | 1,245,929 | 551,886 |
| September | 5,879,740 | 5,677,013 | 84,326 | 36,023,938 | 1,186,415 | 560,361 |
| October | 5,804,242 | 5,628,771 | 78,846 | 33,030,788 | 1,312,023 | 624,962 |
| November | 5,314,227 | 4,693,256 | 59,048 | 25,166,343 | 1,191,987 | 504,925 |
| December | 5,444,682 | 4,900,072 | 63,019 | 27,832,209 | 1,334,726 | 889,229 |
| Total | 63,576,240 | 59,534,013 | 908,185(1) | 360,267,931 | 13,538,952(2) | 6,162,056(3) |

(1) Includes 65,126 passengers, which are not included in above data by months.
(2) Corrected totals not corrected in chart.
(3) Includes 462,975 pounds, which are not included in above data by months. This additional data was obtained from annual reports.

## REVIEW OF ANNUAL MILITARY AND COMMERCIAL PRODUCTION IN THE UNITED STATES

Calendar Years

### Airplane Production

| Year | Military Units | Military Value | Commercial Units | Commercial Value |
|---|---|---|---|---|
| 1925 | 447 | $ 5,174,025 | 268 | $ 1,499,634 |
| 1926 | 532 | 6,154,708 | 604 | 2,716,319 |
| 1927 | 621 | 7,528,383 | 1,565 | 6,976,616 |
| 1928 | 1,219 | 19,066,379 | 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 |
| 1935 | 459 | 11,418,382 | 1,109 | 10,410,334 |

## Airplane Engine Production

| Year | Military Units | Military Value | Commercial Units | Commercial Value |
|---|---|---|---|---|
| 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 |
| 1935 | 991 | 6,180,311 | 1,974 | 6,511,298 |

(1) This total does not include an indeterminate number of Liberty and OX engines that were reconditioned and put into service.

* Liberty and OX war surplus used.

# MONTHLY PRODUCTION AND SALES STATISTICS

## Military and Salable Commercial Aircraft

### PRODUCTION

| | 1934 Military Units | 1934 Military Value | 1934 Commercial Units | 1934 Commercial Value | 1935 Military Units | 1935 Military Value | 1935 Commercial Units | 1935 Commercial Value |
|---|---|---|---|---|---|---|---|---|
| January | 63 | $1.124,727 | 19 | $ 31,437 | 30 | $1,011,887 | 37 | $ 634,984 |
| February | 31 | 607,512 | 14 | 168,534 | 22 | 885,273 | 45 | 610,865 |
| March | 30 | 458,095 | 48 | 386,680 | 47 | 1,462,488 | 80 | 1,106,352 |
| April | 14 | 221,617 | 40 | 350,826 | 26 | 962,150 | 83 | 1,029,007 |
| May | 53 | 740,282 | 93 | 631,925 | 8 | 275,885 | 102 | 1,114,801 |
| June | 50 | 780,454 | 89 | 1,102,215 | 24 | 273,094 | 93 | 783,062 |
| July | 48 | 966,716 | 93 | 1,256,309 | 21 | 177,875 | 105 | 850,127 |
| August | 23 | 515,605 | 116 | 1,426,534 | 37 | 524,640 | 117 | 744,709 |
| September | 24 | 447,355 | 95 | 1,016,748 | 26 | 626,360 | 101 | 523,825 |
| October | 34 | 947,469 | 64 | 1,175,829 | 22 | 492,049 | 130 | 561,763 |
| November | 47 | 1,445,674 | 50 | 1,197,787 | 36 | 1,365,321 | 91 | 969,812 |
| December | 20 | 581,003 | 51 | 1,212,778 | 45 | 959,320 | 65 | 641,706 |
| Total | 437 | $8,836,509 | 772 | $9,957,602 | 459* | $11,418,382* | 1,109* | $10,410,334* |

### DELIVERIES

| | 1934 Military Units | 1934 Military Value | 1934 Commercial Units | 1934 Commercial Value | 1935 Military Units | 1935 Military Value | 1935 Commercial Units | 1935 Commercial Value |
|---|---|---|---|---|---|---|---|---|
| January | 62 | $1,119,727 | 29 | $ 105,195 | 30 | $1,011,887 | 31 | $ 617,662 |
| February | 32 | 617,512 | 14 | 165,711 | 21 | 867,273 | 56 | 773,618 |
| March | 30 | 458,095 | 49 | 375,828 | 47 | 1,462,488 | 80 | 1,111,682 |
| April | 14 | 221,617 | 36 | 324,281 | 24 | 862,150 | 86 | 1,034,380 |
| May | 53 | 740,282 | 91 | 635,045 | 8 | 275,885 | 97 | 1,106,659 |
| June | 50 | 780,454 | 84 | 1,067,130 | 31 | 332,594 | 92 | 786,002 |
| July | 48 | 966,716 | 97 | 1,278,887 | 21 | 174,544 | 107 | 841,618 |
| August | 23 | 515,605 | 119 | 1,448,177 | 37 | 518,297 | 115 | 720,220 |
| September | 24 | 447,355 | 96 | 1,031,732 | 26 | 626,360 | 98 | 502,951 |
| October | 32 | 936,469 | 63 | 1,183,561 | 22 | 492,049 | 120 | 498,307 |
| November | 46 | 1,439,674 | 49 | 463,107 | 36 | 1,365,321 | 95 | 995,971 |
| December | 20 | 581,003 | 48 | 1,203,255 | 41 | 887,455 | 69 | 680,744 |
| Total | 434 | $8,824,509 | 775 | $9,281,909 | 344 | $8,876,303 | 1,046 | $9,669,814 |

All values represent planes less engines.

* Production totals include additional data reported on an annual basis and not included in the monthly figures, as follows: Military, 115 units valued at $2,402,040; Commercial, 60 units, valued at $839,321.

## PRODUCTION AND DELIVERIES OF SALABLE AIRCRAFT IN THE UNITED STATES

### Commercial and Military

| Type | Places | Production—1934 | | Deliveries—1934 | | Production—1935 | | Deliveries—1935 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Units | Value | Units | Value | Units | Value | Units | Value |
| **Biplanes** | 1 | 0 | ..... | 0 | ..... | 0 | ..... | 0 | ..... |
| | 2 | 103 | $441,858 | 106 | $445,433 | 40 | $138,668 | 40 | $138,668 |
| Open Cockpit | 3 | 26 | 97,145 | 24 | 91,785 | 50 | 201,383 | 54 | 205,384 |
| | Up | 27 | 126,405 | 33 | 155,595 | 0 | ..... | 0 | ..... |
| Sub-total | | 156 | $665,408 | 163 | $692,813 | 90 | $340,051 | 94 | $344,052 |
| Cabin Single-Engine | All | 112 | 480,950 | 105 | 448,095 | 160 | 939,725 | 153 | 949,207 |
| Cabin Multi-Engine | All | 16 | 885,000 | 16 | 885,000 | 0 | ..... | 0 | ..... |
| **Total Biplanes** | | 284 | $2,031,358 | 284 | $2,025,908 | 250 | $1,279,776 | 247 | $1,293,259 |
| **Monoplanes** | 1 | 1 | 825 | 2 | 1,525 | 1 | 4,270 | 0 | ..... |
| | 2 | 62 | 162,015 | 67 | 173,345 | 61 | 125,935 | 62 | 132,852 |
| Open Cockpit | 3 | 0 | ..... | 0 | ..... | 0 | ..... | 0 | ..... |
| | Up | 0 | ..... | 0 | ..... | 0 | ..... | 0 | ..... |
| Sub-total | | 63 | $162,840 | 69 | $174,870 | 62 | $130,205 | 62 | $132,852 |
| | 1 | 1 | 17,000 | 1 | 17,000 | 17 | 47,425 | 18 | 53,100 |
| | 2 | 134 | 389,455 | 135 | 381,446 | 436 | 547,942 | 433 | 571,887 |
| | 3 | 60 | 180,028 | 57 | 183,335 | 73 | 237,370 | 72 | 236,380 |
| Cabin Single-Engine | 4 | 93 | 246,218 | 95 | 255,755 | 79 | 282,749 | 82 | 291,010 |
| | 5 | 3 | 48,700 | 2 | 32,750 | 2 | 33,900 | 2 | 33,900 |
| | 6 | 12 | 192,654 | 16 | 237,351 | 4 | 87,450 | 3 | 74,950 |
| | 7 | 2 | 62,532 | 3 | 74,532 | 0 | ..... | 0 | ..... |
| | 8 and Up | 28 | 1,211,208 | 28 | 1,211,208 | 8 | 316,307 | 9 | 333,057 |
| Sub-total | | 333 | $2,347,795 | 337 | $2,393,377 | 619 | $1,553,143 | 619 | $1,594,284 |
| Cabin Multi-Engine | All | 77 | 4,827,874 | 66 | 4,085,374 | 111 | 5,923,003 | 111 | 5,964,533 |
| **Total Monoplanes** | | 473 | $7,338,509 | 472 | $6,653,621 | 792 | $7,606,351 | 792 | $7,691,669 |
| Seaplanes | All | 6 | 408,978 | 7 | 410,873 | 3 | 485,773 | 3 | 485,773 |
| Amphibions | All | 8 | 167,007 | 9 | 167,257 | 4 | 199,113 | 4 | 199,113 |
| Autogiros | | 1 | 11,750 | 3 | 24,250 | 0 | ..... | 0 | ..... |
| Sub-total | | 15 | $587,735 | 19 | $602,380 | 7 | $684,886 | 7 | $684,886 |
| Commercial Total | | 772 | $9,957,602 | 775 | $9,281,909 | 1,109* | $10,410,334* | 1,046 | $9,669,814 |
| Military Total | | 437 | $8,836,509 | 434 | $8,824,509 | 459** | $11,418,382** | 344 | $8,876,303 |
| **Grand Total** | | 1,209 | $18,794,111 | 1,209 | $18,106,418 | 1,568 | $21,828,716 | 1,390 | $18,546,117 |

All values represent planes less engines.

* Includes 60 units valued at $839,321, obtained from annual production reports, which are not included in above breakdown by types, nor in delivery totals.

** Includes 115 units valued at $2,402,040, obtained from annual production reports, which are not included in delivery totals.

## MONTHLY PRODUCTION AND SALES STATISTICS

### Military and Commercial Aircraft Engines

#### PRODUCTION

| | 1934 | | | | 1935 | | | |
|---|---|---|---|---|---|---|---|---|
| | Military | | Commercial | | Military | | Commercial | |
| | Units | Value | Units | Value | Units | Value | Units | Value |
| January | 46 | $ 314,820 | 108 | $ 431,691 | 15 | $ 142,500 | 117 | $ 441,665 |
| February | 38 | 229,140 | 188 | 928,016 | 21 | 187,650 | 114 | 510,020 |
| March | 41 | 350,700 | 191 | 1,133,758 | 32 | 206,350 | 141 | 437,248 |
| April | 26 | 236,900 | 164 | 855,999 | 72 | 542,250 | 119 | 322,010 |
| May | 65 | 452,800 | 150 | 586,825 | 89 | 614,500 | 164 | 476,615 |
| June | 124 | 887,900 | 206 | 847,498 | 75 | 524,150 | 177 | 609,620 |
| July | 64 | 390,700 | 203 | 1,054,615 | 98 | 589,500 | 183 | 589,574 |
| August | 61 | 421,250 | 226 | 1,148,058 | 68 | 498,650 | 209 | 829,575 |
| September | 52 | 361,700 | 164 | 787,475 | 45 | 262,511 | 142 | 330,175 |
| October | 55 | 466,500 | 178 | 903,765 | 99 | 654,423 | 196 | 603,643 |
| November | 30 | 240,000 | 172 | 1,045,095 | 127 | 734,279 | 134 | 427,654 |
| December | 86 | 810,300 | 98 | 547,705 | 150 | 842,240 | 130 | 348,876 |
| Total | 688 | $5,162,710 | 2,048 | $10,270,500 | 991* | $6,180,311* | 1,974* | $6,511,298* |

#### DELIVERIES

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| January | 46 | $ 314,820 | 100 | $ 394,441 | 15 | $ 142,500 | 117 | $ 439,365 |
| February | 38 | 229,140 | 182 | 938,291 | 21 | 187,650 | 118 | 530,720 |
| March | 41 | 350,700 | 183 | 1,060,698 | 33 | 226,350 | 153 | 562,023 |
| April | 26 | 236,900 | 169 | 885,124 | 72 | 542,250 | 133 | 416,760 |
| May | 65 | 452,800 | 178 | 755,375 | 90 | 634,500 | 174 | 517,585 |
| June | 124 | 887,900 | 189 | 753,023 | 75 | 524,150 | 208 | 664,005 |
| July | 64 | 390,700 | 221 | 1,112,190 | 98 | 589,500 | 178 | 592,150 |
| August | 61 | 421,250 | 198 | 1,049,623 | 68 | 498,650 | 203 | 816,805 |
| September | 52 | 361,700 | 157 | 817,225 | 45 | 271,693 | 153 | 394,364 |
| October | 55 | 466,500 | 157 | 830,815 | 100 | 676,323 | 204 | 656,282 |
| November | 30 | 240,000 | 118 | 625,570 | 127 | 752,073 | 140 | 500,598 |
| December | 85 | 805,800 | 87 | 494,355 | 150 | 860,719 | 105 | 307,094 |
| Total | 687 | $5,158,210 | 1,939 | $9,716,730 | 894 | $5,906,358 | 1,886 | $6,397,751 |

* Production totals include additional data reported on an annual basis, and not included in the monthly figures, as follows: Military—100 units valued at $381,308; Commercial, 148 units valued at $584,623.

## 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 |
| 1935 | 2,857,201 | 2,090,176 | 755,698 | 5,703,075 |

## PRODUCTION AND DELIVERIES OF AIRPLANE ENGINES IN THE UNITED STATES

### Commercial and Military

| *Commercial* | *Production—1934* | | *Deliveries—1934* | | *Commercial* | *Production—1935* | | *Deliveries—1935* | |
|---|---|---|---|---|---|---|---|---|---|
| *Horsepower* | *Units* | *Value* | *Units* | *Value* | *Horsepower* | *Units* | *Value* | *Units* | *Value* |
| Under 75 | 99 | $60,735 | 98 | $60,060 | Under 75 | 405 | $216,364 | 402 | $221,850 |
| 76–125 | 129 | 164,775 | 111 | 150,875 | 76–125 | 244 | 279,284 | 231 | 270,334 |
| 126–175 | 134 | 193,155 | 127 | 186,105 | 126–175 | 97 | 133,470 | 87 | 118,070 |
| 176–225 | 317 | 690,249 | 308 | 662,754 | 176–225 | 171 | 332,351 | 151 | 295,523 |
| 226–300 | 64 | 209,986 | 63 | 208,436 | 226–300 | 200 | 482,158 | 229 | 540,506 |
| 301–400 | 80 | 337,400 | 61 | 258,000 | 301–400 | 56 | 238,785 | 82 | 348,495 |
| 401–500 | 65 | 334,500 | 77 | 394,700 | 401–500 | 98 | 435,100 | 99 | 434,700 |
| 501–600 | 100 | 595,700 | 79 | 453,000 | 501–600 | 150 | 912,690 | 181 | 1,099,640 |
| 601–Up | 1,060 | 7,684,000 | 1,015 | 7,342,800 | 601–700 | 29 | 193,260 | 35 | 228,650 |
| | | | | | 701–Up | 376 | 2,703,213 | 389 | 2,839,983 |
| Commercial Totals | 2,048 | $10,270,500 | 1,939 | $9,716,730 | Totals | 1,974* | $6,511,298* | 1,886 | $6,397,751 |
| *Military* | | | | | *Military* | | | | |
| *Horsepower* | | | | | *Horsepower* | | | | |
| 126–175 | 0 | ..... | 0 | ..... | 76–125 | 11 | $16,755 | 12 | $17,515 |
| 176–225 | 10 | $35,000 | 10 | $35,000 | 126–175 | 3 | 7,900 | 3 | 7,839 |
| 226–300 | 15 | 45,000 | 15 | 45,000 | 176–225 | 6 | 17,400 | 6 | 17,400 |
| 301–400 | 10 | 42,000 | 10 | 42,000 | 226–300 | 106 | 248,123 | 106 | 314,779 |
| 401–500 | 71 | 322,200 | 71 | 322,200 | 301–400 | 24 | 100,435 | 24 | 100,435 |
| 501–600 | 21 | 98,000 | 20 | 93,500 | 401–500 | 4 | 16,750 | 4 | 16,750 |
| 601–Up | 561 | 4,620,510 | 561 | 4,620,510 | 501–600 | 169 | 788,050 | 169 | 788,050 |
| | | | | | 601–700 | 168 | 1,461,200 | 170 | 1,501,200 |
| | | | | | 701–Up | 400 | 3,142,390 | 400 | 3,142,390 |
| Military Totals | 688 | $5,162,710 | 687 | $5,158,210 | Totals | 991** | $6,180,311** | 894 | $5,906,358 |
| GRAND TOTAL | 2,736 | $15,433,210 | 2,626 | $14,874,940 | GRAND TOTAL | 2,965 | $12,691,609 | 2,780 | $12,304,109 |

* Includes 148 units valued at $584,623, obtained from annual production reports, which are not included in above breakdown by horsepower, nor in delivery total.

** Includes 100 units valued at $381,308, obtained from annual production reports, which are not included in above breakdown by horsepower, nor in delivery total.

## UNITED STATES AERONAUTIC EXPORTS

**Compiled by U. S. Bureau of Foreign and Domestic Commerce**

### Total Value for Calendar Years

| *Country of Destination* | *1935 Value* | *1934 Value* | *1933 Value* |
|---|---|---|---|
| China | $ 2,522,538 | $ 3,778,262 | $ 1,762,247 |
| Netherlands | 1,821,729 | 410,431 | 319,803 |
| Russia | 1,020,518 | 3,276,490 | 380,222 |
| Japan | 950,101 | 320,562 | 338,908 |
| Brazil | 931,073 | 528,668 | 1,459,745 |
| Italy | 789,826 | 107,245 | 21,003 |
| Mexico | 639,589 | 598,133 | 297,058 |
| United Kingdom | 460,445 | 137,361 | 84,913 |
| Siam | 454,862 | 522,745 | 108,714 |
| Peru | 408,046 | 1,018,426 | 364,141 |
| Argentina | 401,951 | 519,961 | 677,437 |
| Canada | 399,318 | 188,928 | 64,088 |
| Netherland India | 375,758 | 19,028 | 51,113 |
| Switzerland | 326,738 | 259,063 | 2,669 |
| Poland and Danzig | 316,876 | 172,904 | 147,711 |
| Colombia | 296,915 | 1,615,778 | 936,081 |
| Spain | 251,266 | 14,382 | 7,438 |
| Chile | 245,677 | 45,214 | 59,284 |
| Germany | 195,464 | 1,761,607 | 349,090 |
| France | 155,321 | 196,935 | 16,952 |
| Sweden | 154,161 | 262,085 | 45,617 |
| Cuba | 113,334 | 13,898 | 25,404 |
| Turkey | 112,532 | 327,142 | 11,498 |
| Rumania | 105,254 | 101,092 | 24,726 |
| Panama | 93,601 | 145,967 | 232,616 |
| Trinidad and Tobago | 76,302 | 27,104 | 34,046 |
| Hong Kong | 68,543 | 64,248 | 484,115 |
| Philippine Islands | 67,908 | 47,135 | 95,176 |
| Australia | 66,571 | 105,447 | 43,625 |
| Netherland West Indies | 50,145 | 76,497 | 20,634 |
| Egypt | 47,139 | 5,384 | 5,636 |
| Ecuador | 45,626 | ..... | 18,971 |
| Union of South Africa | 43,382 | 58,238 | 30,707 |
| Belgium | 39,478 | 37,517 | 37,588 |
| Guatemala | 38,185 | 37,140 | 21,164 |
| Czechoslovakia | 25,611 | 55,735 | 10,876 |
| Nicaragua | 24,336 | 7,660 | 14,781 |
| Bolivia | 23,174 | 303,609 | 259,840 |
| Honduras | 21,306 | 36,694 | 80,189 |
| Costa Rica | 19,944 | 14,091 | 11,692 |
| El Salvador | 15,520 | 11,624 | 65,078 |
| Yugoslavia | 13,171 | 16,468 | 15,171 |
| Portugal | 11,776 | 56,797 | 25,304 |
| Finland | 11,069 | 25,888 | 4,482 |
| Liberia | 9,398 | ..... | ..... |
| Venezuela | 8,358 | 13,559 | 6,748 |
| Norway | 8,196 | 22,797 | 4,620 |
| Haiti | 7,343 | 4,528 | 1,392 |
| British Malaya | 7,069 | 1,157 | ..... |
| British India | 6,088 | 25 | 75 |
| British East Africa | 5,280 | 6,173 | 510 |
| Iran | 4,351 | ..... | ..... |
| Other British W. Indies | 4,308 | 873 | 1,932 |
| Dominican Republic | 3,309 | 13,926 | 22,145 |
| Latvia | 2,883 | ..... | ..... |
| Austria | 2,441 | 74,844 | 83 |
| British Guiana | 1,919 | 100 | 71 |
| Lithuania | 1,330 | 5,205 | 490 |
| British Honduras | 1,212 | ..... | ..... |
| Bulgaria | 942 | 200 | 1,140 |
| New Zealand | 788 | 4,449 | 6,876 |
| Kwantung | 728 | 2,143 | 3,965 |
| French Guiana | 398 | 36 | 164 |
| Saudi Arabia | 363 | 21,106 | 1,800 |
| Gibraltar | 310 | ..... | ..... |
| Morocco | 304 | 6,330 | ..... |
| Uruguay | 281 | 23,094 | 70 |

| *Country of Destination* | *1935 Value* | *1934 Value* | *1933 Value* |
|---|---|---|---|
| Jamaica | 276 | 330 | 429 |
| Barbados | 235 | ..... | ..... |
| French West Indies | 235 | ..... | ..... |
| Surinam | 232 | ..... | 198 |
| Greece | 179 | 50 | 65 |
| Newfoundland & Labrador | 8 | 3 | ..... |
| Irish Free State | ..... | 15,195 | ..... |
| Iraq | ..... | 1,054 | 63 |
| Other Asia | ..... | 1,035 | 826 |
| Denmark | ..... | 238 | 100 |
| Mozambique | ..... | 64 | 1,697 |
| Bermudas | ..... | 40 | ..... |
| Palestine | ..... | 22 | ..... |
| Hungary | ..... | 14 | ..... |
| Virgin Islands | ..... | 8 | 560 |
| Greenland | ..... | ..... | 30,000 |
| Paraguay | ..... | ..... | 2,111 |
| French Oceania | ..... | ..... | 149 |
| Syria | ..... | ..... | 50 |
| Totals | $14,330,843 | $17,548,181 | $ 9,155,882 |

## Airplanes, Seaplanes and Amphibions

| *Country of Destination* | *1935* | | *1934* | | *1933* | |
|---|---|---|---|---|---|---|
| | *Units* | *Value* | *Units* | *Value* | *Units* | *Value* |
| China | 81 | $1,645,062 | 132 | $3,236,742 | 74 | $1,456,580 |
| Netherlands | 26 | 1,381,816 | 2 | 66,683 | 2 | 12,042 |
| Brazil | 77 | 538,598 | 28 | 193,345 | 73 | 1,104,531 |
| Mexico | 22 | 521,799 | 46 | 498,312 | 49 | 249,467 |
| Siam | 12 | 319,200 | 24 | 498,678 | ... | ..... |
| Japan | 4 | 242,161 | 6 | 160,228 | 6 | 61,350 |
| Switzerland | 4 | 233,737 | 3 | 214,158 | ... | ..... |
| Spain | 4 | 200,345 | 4 | 6,267 | 1 | 4,204 |
| Poland & Danzig | 3 | 193,684 | ... | ..... | ... | ..... |
| Russia | 2 | 179,719 | ... | ..... | ... | ..... |
| Chile | 8 | 165,667 | 1 | 1,650 | 2 | 50,000 |
| Peru | 2 | 150,000 | 19 | 714,480 | 16 | 188,475 |
| Canada | 8 | 104,928 | 5 | 26,921 | 2 | 10,301 |
| Argentina | 13 | 87,412 | 9 | 134,448 | 38 | 417,962 |
| United Kingdom | 14 | 82,507 | 4 | 76,296 | 1 | 29,069 |
| Colombia | 4 | 81,000 | 78 | 1,064,633 | 30 | 656,593 |
| Cuba | 2 | 80,000 | ... | ..... | ... | ..... |
| Germany | 1 | 72,179 | 8 | 337,110 | 1 | 4,000 |
| Netherland W. Indies | 1 | 50,000 | 1 | 70,000 | 3 | 20,500 |
| Turkey | 1 | 43,000 | 18 | 93,189 | ... | ..... |
| Ecuador | 5 | 42,900 | ... | ..... | 1 | 15,200 |
| Guatemala | 3 | 31,500 | 5 | 26,860 | 2 | 12,500 |
| France | 1 | 30,000 | 3 | 102,567 | 1 | 5,915 |
| Union of South Africa | 5 | 25,228 | 5 | 33,391 | 3 | 30,300 |
| Nicaragua | 4 | 21,000 | 2 | 6,000 | 4 | 13,775 |
| Hong Kong | 4 | 16,782 | 12 | 41,298 | 36 | 474,508 |
| Philippine Islands | 3 | 15,575 | 5 | 25,128 | 6 | 74,603 |
| Italy | 3 | 14,552 | 1 | 3,355 | ... | ..... |
| Costa Rica | 4 | 13,150 | 2 | 8,000 | 3 | 9,800 |
| Yugoslavia | 1 | 9,500 | ... | ..... | ... | ..... |
| Liberia | 1 | 7,000 | ... | ..... | ... | ..... |
| British Malaya | 1 | 7,000 | 1 | 1,100 | ... | ..... |
| Panama | 3 | 6,055 | 5 | 31,200 | 9 | 146,363 |
| British India | 1 | 5,959 | ... | ..... | ... | ..... |
| Egypt | 1 | 5,800 | 1 | 3,758 | 2 | 5,400 |
| Belgium | 1 | 5,325 | 1 | 6,010 | ... | ..... |
| Honduras | 1 | 5,000 | 4 | 15,000 | 12 | 70,227 |
| Norway | 1 | 2,000 | 3 | 10,594 | ... | ..... |
| Netherland India | 1 | 1,140 | ... | ..... | ... | ..... |
| Barbados | 1 | 235 | ... | ..... | ... | ..... |
| Bolivia | .. | ..... | 9 | 180,469 | 7 | 133,000 |
| Rumania | .. | ..... | 22 | 83,450 | ... | ..... |
| Austria | .. | ..... | 1 | 74,579 | ... | ..... |
| Sweden | .. | ..... | 2 | 70,500 | ... | ..... |
| Portugal | .. | ..... | 6 | 37,995 | 5 | 21,600 |
| Australia | .. | ..... | 1 | 20,410 | ... | ..... |

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| Country of Destination | 1935 Units | 1935 Value | 1934 Units | 1934 Value | 1933 Units | 1933 Value |
|---|---|---|---|---|---|---|
| Arabia | .. | ..... | 1 | 19,000 | ... | ..... |
| Uruguay | .. | ..... | 2 | 16,080 | ... | ..... |
| Irish Free State | .. | ..... | 1 | 14,950 | ... | ..... |
| Dominican Republic | .. | ..... | 1 | 11,000 | 1 | 16,000 |
| Morocco | .. | ..... | 1 | 6,330 | ... | ..... |
| British East Africa | .. | ..... | 1 | 5,241 | ... | ..... |
| El Salvador | .. | ..... | 1 | 5,000 | 4 | 59,641 |
| New Zealand | .. | ..... | 1 | 3,479 | 1 | 5,833 |
| Czechoslovakia | .. | ..... | 2 | 2,600 | ... | ..... |
| Greenland | .. | ..... | ... | ..... | 1 | 30,000 |
| Totals | 334 | $6,638,515 | 490 | $8,258,484 | 396 | $5,389,739 |

## Aircraft Engines

| Country of Destination | 1935 Units | 1935 Value | 1934 Units | 1934 Value | 1933 Units | 1933 Value |
|---|---|---|---|---|---|---|
| Italy | 63 | $ 549,310 | 12 | $ 68,439 | 2 | $ 12,986 |
| United Kingdom | 48 | 277,905 | ... | ..... | 1 | 9,000 |
| China | 80 | 264,693 | 14 | 79,137 | 13 | 70,084 |
| Brazil | 42 | 149,926 | 42 | 191,201 | 8 | 22,395 |
| Japan | 25 | 141,339 | 5 | 36,161 | 2 | 1,800 |
| Netherlands | 22 | 131,339 | 34 | 137,859 | 40 | 221,750 |
| Argentina | 27 | 124,752 | 32 | 219,163 | 17 | 57,869 |
| Russia | 21 | 120,183 | 405 | 1,650,591 | 2,576 | 255,400 |
| Sweden | 11 | 78,745 | 21 | 134,550 | 4 | 25,200 |
| Mexico | 34 | 69,565 | 53 | 58,913 | 21 | 27,546 |
| Trinidad & Tobago | 24 | 64,000 | 11 | 21,551 | 12 | 31,282 |
| Germany | 7 | 55,349 | 213 | 1,166,774 | 48 | 200,446 |
| Canada | 46 | 54,491 | 6 | 11,440 | 12 | 8,255 |
| Peru | 10 | 49,065 | 13 | 78,732 | 3 | 14,198 |
| Switzerland | 6 | 38,495 | 4 | 23,662 | ... | ..... |
| Egypt | 8 | 34,784 | 1 | 1,500 | ... | ..... |
| Netherland India | 6 | 31,362 | ... | ..... | ... | ..... |
| Colombia | 8 | 29,847 | 18 | 102,840 | 20 | 94,139 |
| Poland & Danzig | 4 | 29,690 | 24 | 103,718 | 24 | 112,980 |
| Hong Kong | 5 | 24,560 | ... | ..... | 2 | 3,000 |
| Spain | 5 | 24,169 | 5 | 5,160 | 1 | 2,097 |
| Panama | 14 | 20,945 | 17 | 35,927 | 20 | 37,800 |
| Australia | 16 | 18,015 | 9 | 12,965 | 9 | 31,103 |
| Czechoslovakia | 2 | 16,540 | 8 | 46,835 | ... | ..... |
| Turkey | 3 | 10,433 | 8 | 45,600 | ... | ..... |
| Chile | 2 | 8,300 | 1 | 6,277 | ... | ..... |
| France | 1 | 6,969 | 2 | 11,200 | ... | ..... |
| Haiti | 1 | 5,000 | ... | ..... | ... | ..... |
| Venezuela | 2 | 4,095 | 4 | 11,500 | ... | ..... |
| Cuba | 2 | 4,000 | 2 | 2,500 | 20 | 11,047 |
| Philippine Islands | 1 | 3,500 | 1 | 2,819 | 3 | 10,070 |
| Costa Rica | 3 | 3,300 | 3 | 4,264 | 1 | 1,000 |
| Union of South Africa | 2 | 3,245 | 1 | 6,822 | ... | ..... |
| El Salvador | 2 | 1,750 | 1 | 6,277 | ... | ..... |
| Guatemala | 2 | 1,600 | 5 | 5,017 | 1 | 1,000 |
| Other Br. W. Indies | 1 | 1,600 | 1 | 300 | 3 | 950 |
| Honduras | 2 | 1,500 | 10 | 6,243 | 6 | 2,519 |
| Portugal | 1 | 1,155 | ... | ..... | ... | ..... |
| British Honduras | 2 | 994 | ... | ..... | ... | ..... |
| Bolivia | 1 | 930 | 5 | 36,878 | 11 | 57,688 |
| British Guiana | 1 | 748 | ... | ..... | ... | ..... |
| Finland | 1 | 410 | 2 | 3,550 | ... | ..... |
| Morocco | 1 | 304 | ... | ..... | ... | ..... |
| Nicaragua | 1 | 225 | 1 | 175 | 1 | 500 |
| Latvia | 2 | 190 | ... | ..... | ... | ..... |
| Siam | ... | ..... | 3 | 21,620 | 15 | 102,195 |
| Yugoslavia | ... | ..... | 1 | 9,500 | ... | ..... |
| Netherland W. Indies | ... | ..... | 2 | 6,440 | ... | ..... |
| Uruguay | ... | ..... | 1 | 5,750 | ... | ..... |
| Norway | ... | ..... | 2 | 1,760 | ... | ..... |
| Rumania | ... | ..... | 2 | 881 | ... | ..... |
| New Zealand | ... | ..... | 1 | 310 | ... | ..... |
| Kwantung | ... | ..... | 1 | 300 | ... | ..... |
| Dominican Republic | ... | ..... | ... | ..... | 3 | 2,238 |
| Arabia | ... | ..... | ... | ..... | 1 | 1,800 |
| Mozambique | ... | ..... | ... | ..... | 1 | 450 |
| Totals | 568 | $2,459,317 | 1,007 | $4,383,101 | 2,901 | $1,430,787 |

## Parachutes and Parts

| *Country of Destination* | *1935 Value* | *1934 Value* | *1933 Value* |
|---|---|---|---|
| Rumania | $ 96,480 | $ 150 | $ 910 |
| Argentina | 18,307 | 4,000 | 13,102 |
| Turkey | 10,303 | 28,253 | 3,417 |
| Spain | 8,893 | ..... | ..... |
| Hong Kong | 6,696 | 4,320 | ..... |
| Portugal | 4,250 | 14,517 | 3,704 |
| Japan | 3,066 | ..... | ..... |
| China | 3,012 | 550 | 5,600 |
| Netherland India | 3,000 | 7,472 | 311 |
| Siam | 3,000 | ..... | ..... |
| Cuba | 1,800 | ..... | 150 |
| British East Africa | 1,746 | ..... | ..... |
| Poland and Danzig | 550 | ..... | ..... |
| Bulgaria | 458 | ..... | ..... |
| United Kingdom | 360 | ..... | 452 |
| Russia | 315 | ..... | ..... |
| Venezuela | 300 | ..... | ..... |
| Switzerland | 275 | ..... | ..... |
| Canada | 229 | ..... | ..... |
| Philippine Islands | 154 | ..... | ..... |
| Haiti | 7 | ..... | ..... |
| Brazil | ..... | 24,107 | 16,052 |
| Colombia | ..... | 6,902 | 14,089 |
| Bolivia | ..... | 1,900 | 6,098 |
| Peru | ..... | 1,580 | 3,756 |
| Netherlands | ..... | 1,354 | ..... |
| Yugoslavia | ..... | 1,100 | 15,171 |
| Arabia | ..... | 1,000 | ..... |
| Other Asia | ..... | 625 | ..... |
| Belgium | ..... | 300 | ..... |
| Sweden | ..... | 252 | ..... |
| Mexico | ..... | 84 | 200 |
| Paraguay | ..... | ..... | 2,100 |
| El Salvador | ..... | ..... | 2,100 |
| Trinidad and Tobago | ..... | ..... | 200 |
| Panama | ..... | ..... | 110 |
| Totals | $163,201 | $ 98,466 | $ 87,522 |

## Aircraft Parts and Accessories (Except Tires)

| *Country of Destination* | *1935 Value* | *1934 Value* | *1933 Value* |
|---|---|---|---|
| Russia | $ 720,301 | $1,625,899 | $ 124,822 |
| China | 609,771 | 461,833 | 229,983 |
| Japan | 563,535 | 124,173 | 275,758 |
| Netherland India | 340,256 | 11,556 | 50,802 |
| Netherlands | 308,574 | 204,535 | 86,011 |
| Brazil | 242,549 | 120,015 | 316,767 |
| Canada | 239,670 | 150,567 | 45,532 |
| Italy | 225,964 | 35,451 | 8,017 |
| Peru | 208,981 | 223,634 | 157,712 |
| Colombia | 186,068 | 441,403 | 171,260 |
| Argentina | 171,480 | 162,350 | 188,504 |
| Siam | 132,662 | 2,447 | 6,519 |
| France | 118,352 | 83,168 | 11,037 |
| United Kingdom | 99,673 | 61,065 | 46,392 |
| Poland and Danzig | 92,952 | 69,186 | 34,731 |
| Sweden | 75,416 | 56,783 | 20,417 |
| Chile | 71,710 | 37,287 | 9,284 |
| Germany | 67,936 | 257,723 | 144,644 |
| Panama | 66,601 | 78,840 | 48,343 |
| Switzerland | 54,231 | 21,243 | 2,669 |
| Turkey | 48,796 | 160,100 | 8,081 |
| Philippine Islands | 48,679 | 19,188 | 10,503 |
| Australia | 48,556 | 72,072 | 12,522 |
| Mexico | 48,225 | 40,824 | 19,845 |
| Belgium | 34,153 | 31,207 | 37,588 |
| Cuba | 27,534 | 11,398 | 14,207 |

| *Country of Destination* | *1935 Value* | *1934 Value* | *1933 Value* |
|---|---|---|---|
| Bolivia | 22,244 | 84,362 | 63,054 |
| Hong Kong | 20,505 | 18,630 | 6,607 |
| Spain | 17,859 | 2,955 | 1,137 |
| Union of South Africa | 14,909 | 18,015 | 407 |
| Honduras | 14,806 | 15,451 | 7,443 |
| El Salvador | 13,770 | 347 | 3,337 |
| Trinidad and Tobago | 12,302 | 5,553 | 2,564 |
| Finland | 10,659 | 22,338 | 4,482 |
| Czechoslovakia | 9,071 | 6,300 | 10,876 |
| Rumania | 8,774 | 16,611 | 23,816 |
| Egypt | 6,555 | 136 | 236 |
| Portugal | 6,371 | 4,285 | ..... |
| Norway | 6,196 | 10,443 | 4,620 |
| Guatemala | 5,085 | 5,263 | 7,664 |
| Iran | 4,351 | ..... | ..... |
| Venezuela | 3,963 | 2,059 | 6,748 |
| Yugoslavia | 3,671 | 5,868 | ..... |
| British East Africa | 3,534 | 932 | 510 |
| Costa Rica | 3,494 | 1,827 | 892 |
| Dominican Republic | 3,309 | 2,926 | 3,907 |
| Nicaragua | 3,111 | 1,485 | 506 |
| Ecuador | 2,726 | ..... | 3,771 |
| Other British W. Indies | 2,708 | 573 | 982 |
| Austria | 2,441 | 265 | 83 |
| Latvia | 2,693 | ..... | ..... |
| Liberia | 2,398 | ..... | ..... |
| Haiti | 2,336 | 4,528 | 1,392 |
| Lithuania | 1,330 | 5,205 | 490 |
| British Guiana | 1,171 | 100 | 71 |
| New Zealand | 788 | 660 | 1,043 |
| Kwantung | 728 | 1,843 | 3,965 |
| Bulgaria | 484 | 200 | 1,140 |
| French Guiana | 398 | 36 | 164 |
| Saudi Arabia | 363 | 589 | ..... |
| Gibraltar | 310 | ..... | ..... |
| Uruguay | 281 | 1,264 | 70 |
| Jamaica | 276 | 330 | 429 |
| French West Indies | 235 | ..... | ..... |
| Surinam | 232 | ..... | 198 |
| British Honduras | 218 | ..... | ..... |
| Greece | 179 | 50 | 65 |
| Netherland West Indies | 145 | 57 | 134 |
| British India | 129 | 25 | ..... |
| British Malaya | 69 | 57 | 75 |
| Newfoundland & Labrador | 8 | 3 | ..... |
| Iraq | ..... | 1,054 | 63 |
| Albania | ..... | 517 | ..... |
| Other Asia | ..... | 410 | 826 |
| Irish Free State | ..... | 245 | ..... |
| Denmark | ..... | 238 | 100 |
| Mozambique | ..... | 64 | 1,247 |
| Bermudas | ..... | 40 | ..... |
| Palestine | ..... | 22 | ..... |
| Hungary | ..... | 14 | ..... |
| Virgin Islands | ..... | 8 | 560 |
| French Oceania | ..... | ..... | 149 |
| Syria | ..... | ..... | 50 |
| Paraguay | ..... | ..... | 11 |
| Totals | $5.069,810 | $4,808,130 | $2,247,834 |

## AERONAUTICAL PURCHASES BY MILITARY SERVICES

Fiscal Year 1935

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 1935, prepared with the aid of the Army Air Corps and the Bureau of Aeronautics of the Navy Department.

## ARMY AIR CORPS HEAVIER-THAN-AIR AERONAUTICAL CONTRACTS

| *Contract No.* | *Contractor* | *Quantity* | *Type* |
|---|---|---|---|
| W 535 ac-7220 | Consolidated Aircraft Corp., San Diego, Calif.... | *51 | P-30A Airplanes |
| W 535 ac-7326 | The Northrop Corp., Inglewood, Calif..... | *111 | A-17 Airplanes |
| W 535 ac-7342 | Douglas Aircraft Co., Inc., Santa Monica, Calif.. | 71 | O-46 Airplanes |
| W 535 ac-7348 | Seversky Aircraft Corp., New York, N. Y..... | 30 | BT-8 Airplanes |
| W 535 ac-7618 | Boeing Aircraft Company, Seattle, Wash..... | 1 | XB-15 Airplane |
| W 535 ac-7670 | Kellett Autogiro Corporation, Philadelphia, Pa... | 1 | YG-1 Autogiro |
| W 535 ac-7711 | Pitcairn Autogiro Company, Willow Grove, Pa... | 1 | PA-33 Autogiro |
| | Total..... | 262 | Complete Airplanes |
| | | 2 | Skeleton Airplanes |
| | | 2 | Autogiros |

* Includes 1 skeleton airplane for static test purposes.

## AIRPLANES DELIVERED TO ARMY AIR CORPS

| *Type* | *Contractor* | *Quantity* |
|---|---|---|
| *Pursuit* | | |
| P-26A | Boeing Airplane Co., Seattle, Wash. | 2 |
| P-26B | Boeing Airplane Co., Seattle, Wash. | 2 |
| P-29 | Boeing Airplane Co., Seattle, Wash. | 1 |
| P-29A | Boeing Airplane Co., Seattle, Wash. | 1 |
| P-29B | Boeing Airplane Co., Seattle, Wash. | 1 |
| *Bombardment* | | |
| B-12A | Glenn L. Martin Co., Baltimore, Md. | 10 |
| *Attack* | | |
| A-11 | Consolidated Aircraft Co., San Diego, Calif. | 4 |
| A-13 | Northrop Corporation, Inglewood, Calif. | 1 |
| *Observation* | | |
| O-43A | Douglas Aircraft Co., Inc., Santa Monica, Calif. | 23 |
| O-46 | Douglas Aircraft Co., Inc., Santa Monica, Calif. | 1 |
| *Observation-Amphibion* | | |
| OA-5 | Douglas Aircraft Co., Inc., Santa Monica, Calif. | 1 |
| *Cargo* | | |
| C-31 | Kreider-Reisner Aircraft Co., Hagerstown, Md. | 1 |
| | Total | 48 |

## ENGINES DELIVERED TO ARMY AIR CORPS

| *Type* | *Contractor* | *Quantity* |
|---|---|---|
| R-1340 | Pratt & Whitney Aircraft, E. Hartford, Conn. | 41 |
| R-1535 | Pratt & Whitney Aircraft, E. Hartford, Conn. | 3 |
| V-1570 | Curtiss Aeroplane & Motor Co., Buffalo, N. Y. | 34 |
| R-1690 | Pratt & Whitney Aircraft, E. Hartford, Conn. | 33 |
| R-1820 | Wright Aeronautical Corp., Paterson, N. J. | 175 |
| R-1830 | Pratt & Whitney Aircraft, E. Hartford, Conn. | 1 |
| | Total | 287 |

## NAVY PURCHASES OF AERONAUTICAL EQUIPMENT

Fiscal Year 1935

### Airplanes

| *Type* | *Factory Name* | *Quantity* |
|---|---|---|
| VO | Vought Observation with P&W R-1340 engine | 32 |
| VSO | Curtiss Scout Observation with P&W R-1340 engine | 135 |
| VSB | Vought Scout Bomber with P&W R-1535 engine | 86 |
| VB | Great Lakes Bomber with P&W R-1340 engine | 16 |
| VR | Kinner Transport with 2 R-1044 engines | 3 |
| VR | Douglas Transport with Wright R-1820 engine | 2 |
| VJ | Grumman Utility with Wright R-1820 engine | 40 |
| VN | Naval Aircraft Factory Training with R-760 engine | 86 |
| VPB | Consolidated Patrol Bomber with 2 P&W R-1830 engines | 60 |
| | Total | 460 |

### Engines

| *Type* | *Contractor* | *Quantity* |
|---|---|---|
| R-1510 | Wright Aeronautical Corporation | 2 |
| R-1820 | Wright Aeronautical Corporation | 72 |
| R-1830 | Pratt & Whitney Aircraft | 150 |
| R-1535 | Pratt & Whitney Aircraft | 142 |
| R-1340 | Pratt & Whitney Aircraft | 217 |
| | Total | 583 |

## AIRPLANES DELIVERED TO U. S. NAVY

| *Type* | *Factory Name* | *Quantity* |
|---|---|---|
| VBF | Curtiss Bomber Fighter with Wright R-1820 engine | 27 |
| VF | Grumman Fighter with P&W R-1535 engine | 47 |
| VO | North American Observation with P&W R-985 engine | 12 |
| VO | Vought Observation with P&W R-1340 engine | 28 |
| VP | Consolidated Patrol with 2 Wright R-1820 engines | 23 |
| VS | Grumman Scout with Wright R-1820 engine | 6 |
| VB | Great Lakes Bomber with P&W R-1535 engine | 44 |
| VJ | Grumman Utility with Wright R-1820 engine | 33 |
| VR | Douglas Transport with 2 P&W R-1340 engines | 16 |
| VR | Douglas Transport with 2 Wright R-1820 engines | 3 |
| VR | Kinner Transport with 2 R-1044 engines | 3 |
| VN | Stearman Training with R-790 engine | 11 |
| | Total | 253 |

## ENGINES DELIVERED TO U. S. NAVY

| *Type* | *Contractor* | *Quantity* |
|---|---|---|
| R-1830 | Pratt & Whitney Aircraft | 37 |
| R-985 | Pratt & Whitney Aircraft | 16 |
| R-1340 | Pratt & Whitney Aircraft | 40 |
| R-1535 | Pratt & Whitney Aircraft | 140 |
| R-1820 | Wright Aeronautical Corporation | 72 |
| SR-1820-F2 | Wright Aeronautical Corporation | 12 |
| | Total | 317 |

## AIRCRAFT APPROPRIATIONS, UNITED STATES

| Fiscal Year | | Department Appropriations | Total | Increase or Decrease | Net |
|---|---|---|---|---|---|
| 1924-25 | Army..... | $13,476,619(1) | | +$1,050,619 | |
| | Navy..... | 15,150,000 | | +502,826 | |
| | N.A.C.A..... | 470,000 | $ 29,096,619 | +187,000 | +$1,740,445 |
| 1925-26 | Army..... | 18,061,191(2) | | +4,584,572 | |
| | Navy..... | 15,130,000 | | −20,000 | |
| | Air Mail..... | 500,000 | | +500,000 | |
| | N.A.C.A..... | 534,000 | 34,225,191 | +64,000 | +5,128,572 |
| 1926-27 | Army..... | 18,256,694(3) | | +195,503 | |
| | Navy..... | 19,065,288 | | +3,935,288 | |
| | Air Mail..... | 2,000,000 | | +1,500,000 | |
| | N.A.C.A..... | 513,000 | | −21,000 | |
| | Commerce.... | 550,000(4) | 40,384,982 | +550,000 | +6,159,791 |
| 1927-28 | Army..... | 25,612,494(5) | | +7,355,800 | |
| | Navy..... | 20,100,000 | | +1,034,712 | |
| | Air Mail..... | 4,650,000(6) | | +2,650,000 | |
| | N.A.C.A..... | 550,000 | | +37,000 | |
| | Commerce.... | 3,791,500(7) | 54,703,994 | +3,241,500 | +14,319,012 |
| 1928-29 | Army..... | 33,911,431(8) | | +8,298,937 | |
| | Navy..... | 32,189,000 | | +12,089,000 | |
| | Air Mail..... | 14,480,000(9) | | +9,830,000 | |
| | N.A.C.A..... | 628,770 | | +78,770 | |
| | Commerce.... | 5,519,350(10) | 86,728,551 | +1,727,850 | +32,024,557 |
| 1929-30 | Army..... | 34,910,059 | | +998,628 | |
| | Navy..... | 31,430,000 | | −759,000 | |
| | Air Mail..... | 19,300,000(11) | | +4,820,000 | |
| | N.A.C.A..... | 1,508,000 | | +879,230 | |
| | Commerce.... | 6,416,620(12) | 93,564,679 | +897,270 | +6,836,128 |
| 1930-31 | Army..... | 38,892,968(13) | | +3,982,909 | |
| | Navy..... | 32,033,211 | | +603,211 | |
| | Air Mail..... | 24,600,000(14) | | +5,300,000 | |
| | N.A.C.A..... | 1,321,000 | | −187,000 | |
| | Commerce.... | 9,204,830(15) | 106,052,009 | +2,788,210 | +12,487,330 |

(1) Includes $678,043 under title of "reclassification of salaries."
(2) Includes $2,150,000 contract authorization and $1,000,000 for the construction of Wright Field.
(3) Includes $3,000,000 contract authorization.
(4) Consists of $250,000 for "aircraft in commerce" and $300,000 for "air navigation facilities."
(5) Includes $4,495,000 contract authorization and $514,900 deficiency appropriation.
(6) Made up as follows: Domestic, $4,500,000; Foreign, $150,000.
(7) Consists of $700,000 for "aircraft in commerce" and $3,091,500 for "air navigation facilities."
(8) Includes $5,000,000 contract authorization and $3,482,869 deficiency appropriation.
(9) Made up as follows: Domestic, $12,430,000; Foreign, $2,050,000.
(10) Consists of $859,500 "aircraft in commerce" and $4,659,850 for "air navigation facilities."
(11) Made up as follows: Domestic, $15,000,000; Foreign, $4,300,000.
(12) Consists of $958,000 for "aircraft in commerce" and $5,458,620 for "air navigation facilities".
(13) Includes deficiency appropriations of $871,100 and $1,298,810.
(14) Made up as follows: Domestic, $18,000,000; Foreign, $6,600,000.
(15) Consists of $1,260,830 for "aircraft in commerce" and $7,944,000 for "air navigation facilities".

## AIRCRAFT APPROPRIATIONS, UNITED STATES (Cont.)

| Fiscal Year | | Department Appropriations | Total | Increase or Decrease | Net |
|---|---|---|---|---|---|
| 1931-32 | Army..... | 31,850,892(16) | | −7,042,076 | |
| | Navy..... | 31,145,000 | | −888,211 | |
| | Air Mail..... | 27,000,000(17) | | +2,400,000 | |
| | N.A.C.A..... | 1,051,070 | | −269,930 | |
| | Commerce.... | 10,362,300(18) | 101,409,262 | +1,157,470 | −$4,642,747 |
| 1932-33 | Army..... | $25,673,236 | | −$6,177,656 | |
| | Navy..... | 32,745,420(19) | | +1,600,420 | |
| | Air Mail..... | 26,460,000(20) | | −540,000 | |
| | N.A.C.A..... | 920,000 | | −131,070 | |
| | Commerce.... | 8,553,500(21) | $ 94,352,156 | −1,808,800 | −7,057,106 |
| 1933-34 | Army..... | 34,037,769(22) | | +8,364,533 | |
| | Navy..... | 21,957,459 | | −10,787,961 | |
| | Air Mail..... | 22,000,000(23) | | −4,460,000 | |
| | N.A.C.A..... | 695,000 | | −225,000 | |
| | Commerce.... | 7,660,780(24) | 86,351,008 | −892,720 | −8,001,148 |
| 1934-35 | Army..... | 30,917,702(25) | | −3,120,067 | |
| | Navy..... | 34,842,253(26) | | +12,884,794 | |
| | Air Mail..... | 19,003,291(27) | | −2,996,709 | |
| | N.A.C.A..... | 726,492 | | +31,492 | |
| | Commerce.... | 5,681,029(28) | 91,170,767 | −1,979,751 | +4,819,759 |
| 1935-36 | Army..... | 53,287,197(29) | | +22,369,495 | |
| | Navy..... | 40,732,310 | | +5,890,057 | |
| | Air Mail..... | 18,700,000(30) | | −303,291 | |
| | N.A.C.A..... | 1,177,550 | | +451,058 | |
| | Commerce.... | 5,909,800(31) | 119,806,857 | +228,771 | +28,636,090 |
| 1936-37 | *Army..... | 70,000,000(32) | | +16,712,803 | |
| | *Navy..... | 52,000,000(33) | | +11,267,690 | |
| | *Air Mail..... | 20,480,000(34) | | +1,780,000 | |
| | *N.A.C.A..... | 1,177,550 | | | |
| | *Commerce.... | 6,220,000(35) | 149,877,550 | +310,200 | +30,070,693 |

(16) Includes $135,152 deficiency appropriation.
(17) Made up as follows: Domestic, $20,000,000; Foreign, $7,000,000.
(18) Consists of $1,369,660 for "aircraft in commerce" and $8,992,640 for "air navigation facilities".
(19) Includes $7,500,000 appropriated under the National Industrial Recovery Act.
(20) Made up as follows: Domestic, $19,460,000; Foreign, $7,000,000.
(21) Consists of $1,000,000 for "aircraft in commerce" and $7,553,500 for "air navigation facilities".
(22) Includes $3,000,000 contract authorization and $7,500,000 appropriated under the Public Works Administration. Only $12,692,553 of the $23,537,769 appropriation was available for the fiscal year 1934, the balance of $10,845,216 having been impounded.
(23) Made up as follows: Domestic $15,000,000; Foreign, $7,000,000.
(24) Consists of $1,070,570 for "aircraft in commerce" and $6,590,210 for "air navigation facilities".
(25) Includes $3,000,000 contract authorization and $325,909 for restoration of salary reduction.
(26) Includes $15,611,572 appropriated under the title of "Emergency Construction—Increase in the Navy".
(27) Made up as follows: Domestic, $12,003,291 (including salary restoration of $3,291); Foreign, $7,000,000.
(28) Consists of $676,249 for "aircraft in commerce" and $5,004,780 for "air navigation facilities".
(29) Includes $7,686,753 contract authorization; provides that $13,666,000 of the appropriation shall be used exclusively for the purchase of combat planes, their equipment and accessories.

(30) Made up as follows: Domestic, $10,700,000; Foreign, $8,000,000.
(31) Consists of $734,800 for "aircraft in commerce" and $5,175,000 for "air navigation facilities".
(32) Includes $8,000,000 contract authorization; provides that $27,817,602 of the appropriation shall be used exclusively for the purchase of combat planes, their equipment and accessories.
(33) Includes $12,000,000 contract authorization.
(34) Made up as follows: Domestic, $12,250,000; Foreign, $8,230,000.
(35) Consists of $790,000 for "aircraft in commerce" and $5,430,000 for "air navigation facilities".
* Proposed expenditures.
+ Shows amount of increase over preceding year.
− Shows amount of decrease from preceding year.

## POSTAGE RATES

### U. S. Air Mail to Possessions and Foreign Countries

January 1, 1936

| | *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 |
| Guam | 50 |
| Guatemala | 15 |
| Guianas (British, Dutch, and French) | 30 |
| Haiti | 10 |
| Hawaii | 25 |
| 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) | 55 |
| Peru | 40 |
| Philippine Islands | 75 |
| Puerto Rico | 10 |
| Salvador (El) | 15 |
| Trinidad | 20 |
| Uruguay | 55 |
| Venezuela (by air to Maracaibo, Cumarebo, La Guaira, Caripito) | 30 |
| Venezuela (including dispatch by Venezuelan air mail service from Maracaibo or La Guaira) | 45 |
| Virgin Islands of the United States | 10 |
| Windward Islands (Grenada, Grenadines, St. Lucia, St. Vincent) | 20 |

## AIRPORTS AND LANDING FIELDS

January 1, 1936

Compiled by Bureau of Air Commerce, U. S. Dept. of Commerce

| | *Municipal* | *Commercial* | *Intermediate* | *Auxiliary* | *Navy* | *Army* | *Miscellaneous Government, private, and State* | *Totals* | *Partially or fully lighted* |
|---|---|---|---|---|---|---|---|---|---|
| Alabama | 6 | 3 | 7 | 11 | 0 | 3 | 0 | 30 | 12 |
| Alaska | 1 | 2 | 0 | 79 | 0 | 0 | 0 | 82 | 2 |
| Arizona | 11 | 4 | 10 | 19 | 0 | 1 | 1 | 46 | 15 |
| Arkansas | 16 | 2 | 5 | 8 | 0 | 0 | 0 | 31 | 7 |
| California | 51 | 49 | 20 | 52 | 4 | 5 | 11 | 192 | 65 |
| Colorado | 12 | 4 | 2 | 16 | 0 | 1 | 0 | 35 | 7 |
| Connecticut | 7 | 6 | 1 | 4 | 0 | 0 | 2 | 20 | 6 |
| Delaware | 1 | 1 | 0 | 2 | 0 | 1 | 0 | 5 | 2 |
| District of Columbia | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 3 | 3 |
| Florida | 42 | 17 | 3 | 36 | 5 | 1 | 3 | 107 | 24 |
| Georgia | 19 | 2 | 12 | 14 | 0 | 1 | 0 | 48 | 19 |
| Idaho | 21 | 0 | 10 | 15 | 0 | 0 | 9 | 55 | 15 |
| Illinois | 15 | 32 | 6 | 1 | 1 | 2 | 2 | 59 | 29 |
| Indiana | 13 | 16 | 8 | 4 | 0 | 2 | 2 | 45 | 18 |
| Iowa | 16 | 10 | 3 | 7 | 0 | 0 | 1 | 37 | 13 |
| Kansas | 23 | 5 | 5 | 10 | 0 | 2 | 0 | 45 | 17 |
| Kentucky | 8 | 0 | 3 | 9 | 0 | 1 | 0 | 21 | 4 |
| Louisiana | 9 | 3 | 3 | 10 | 0 | 1 | 2 | 28 | 11 |
| Maine | 4 | 8 | 0 | 13 | 0 | 0 | 1 | 26 | 4 |
| Maryland | 2 | 9 | 2 | 0 | 1 | 3 | 3 | 20 | 8 |
| Massachusetts | 5 | 27 | 1 | 7 | 1 | 0 | 1 | 42 | 7 |
| Michigan | 46 | 14 | 0 | 19 | 1 | 3 | 34 | 117 | 23 |
| Minnesota | 10 | 5 | 3 | 14 | 0 | 1 | 1 | 34 | 8 |
| Mississippi | 12 | 0 | 6 | 6 | 1 | 0 | 1 | 26 | 11 |
| Missouri | 11 | 6 | 13 | 5 | 0 | 0 | 3 | 38 | 19 |
| Montana | 27 | 0 | 14 | 27 | 0 | 0 | 10 | 78 | 16 |
| Nebraska | 17 | 3 | 5 | 5 | 0 | 2 | 0 | 32 | 15 |
| Nevada | 3 | 2 | 9 | 7 | 1 | 0 | 0 | 22 | 12 |
| New Hampshire | 5 | 4 | 0 | 10 | 0 | 0 | 1 | 20 | 0 |
| New Jersey | 4 | 19 | 0 | 1 | 2 | 2 | 1 | 29 | 8 |
| New Mexico | 6 | 4 | 10 | 12 | 0 | 0 | 2 | 34 | 13 |
| New York | 27 | 43 | 5 | 15 | 0 | 4 | 5 | 99 | 28 |
| North Carolina | 12 | 6 | 3 | 8 | 0 | 1 | 0 | 30 | 8 |
| North Dakota | 20 | 3 | 5 | 18 | 0 | 0 | 1 | 47 | 8 |
| Ohio | 28 | 36 | 9 | 21 | 0 | 4 | 5 | 103 | 22 |
| Oklahoma | 23 | 6 | 7 | 12 | 0 | 1 | 0 | 49 | 20 |
| Oregon | 13 | 3 | 10 | 11 | 0 | 0 | 2 | 39 | 18 |
| Pennsylvania | 12 | 68 | 12 | 13 | 1 | 2 | 9 | 117 | 36 |
| Rhode Island | 0 | 4 | 0 | 3 | 1 | 0 | 1 | 9 | 1 |
| South Carolina | 10 | 2 | 4 | 9 | 3 | 0 | 2 | 30 | 8 |
| South Dakota | 17 | 5 | 0 | 4 | 0 | 0 | 0 | 26 | 1 |
| Tennessee | 12 | 2 | 5 | 5 | 0 | 0 | 0 | 24 | 9 |
| Texas | 56 | 9 | 25 | 28 | 0 | 13 | 3 | 134 | 50 |
| Utah | 5 | 1 | 16 | 2 | 0 | 0 | 0 | 24 | 17 |
| Vermont | 4 | 4 | 0 | 2 | 0 | 1 | 0 | 11 | 0 |
| Virginia | 12 | 9 | 5 | 14 | 2 | 1 | 0 | 43 | 12 |
| Washington | 21 | 10 | 9 | 6 | 1 | 3 | 2 | 52 | 13 |
| West Virginia | 8 | 4 | 0 | 9 | 0 | 0 | 1 | 22 | 1 |
| Wisconsin | 22 | 21 | 5 | 8 | 0 | 0 | 3 | 59 | 18 |
| Wyoming | 14 | 0 | 10 | 19 | 0 | 0 | 0 | 43 | 13 |
| Totals | 739 | 494 | 291 | 630 | 26 | 63 | 125 | 2,368 | 696 |

## AVIATION GASOLINE TAX SUMMARY

January 1, 1936

| 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 (1) | 3c | Highways | Yes | Refund |
| Delaware (2) | 4c | Highways | Yes | Refund |
| Dist. of Columbia | 2c | Highways | Yes | Refund |
| Florida | 7c | Roads; Schools | Yes | Exemption |
| Georgia | 6c | Roads; Schools | Yes | No |
| Idaho | 5c | Airfuel tax to Aeronautics Fund | Yes | 2½c per gal. tax on aircraft fuels |
| Illinois | 3c | Highways; Schools | Yes | Refund |
| Indiana | 4c | Highways | Yes | Refund |
| 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 | Refund 3c per gal. |
| Maryland | 4c | Highways | Yes | Refund |
| Massachusetts | 3c | Highways; General Fund | Yes | Refund |
| Michigan | 3c | Highways; Aeronautics | Yes | Refund |
| Minnesota | 3c | Highways | Yes | Refund |
| Mississippi | 6c | Highways | Yes | Refund |
| Missouri | 2c | Highways | Yes | Refund |
| Montana | 5c | Highways | Yes | Refund |
| Nebraska (3) | 5c | Highways | Yes | No |
| Nevada | 4c | Highways | Yes | Refund |
| New Hampshire | 4c | Highways | Yes | Refund |
| New Jersey | 3c | Traffic; Waterways | Yes | Refund |
| New Mexico | 5c | Highways | Yes | Refund |
| New York (4) | 4c | Highways; General Fund | Yes | Refund |
| North Carolina | 6c | Highways | Yes | Refund |
| North Dakota | 3c | Highways | Yes | Refund |
| Ohio | 4c | Highways; Schools; Poor Relief | Yes | Refund |
| Oklahoma | 4c | Highways | Yes | No |
| Oregon | 5c | Highways; Aeronautics | Yes | Refund |
| Pennsylvania (5) | 4c | 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 | 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 | Yes | Refund |

(1) Includes 1c increase effective October 1, 1935.
(2) Includes 1c increase effective July 1, 1935.
(3) Includes 1c increase effective November 26, 1935 until March 1, 1937.
(4) Includes 1c increase effective April 1, 1935 until June 30, 1936.
(5) Includes 1c increase effective July 1, 1935 until May 31, 1937.

## AIRPLANE AND PILOT LICENSES

January 1, 1936

Compiled by Bureau of Air Commerce, U. S. Dept. of Commerce

| State | AIRCRAFT | | | PILOTS | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | *Licensed* | *Unlicensed* | *Total* | *Transport* | *Ltd. Com.* | *Industrial* | *Private* | *Amateur* | *Total* |
| Alabama | 39 | 29 | 68 | 71 | 4 | 0 | 50 | 4 | 129 |
| Arizona | 55 | 12 | 67 | 34 | 5 | 0 | 55 | 9 | 103 |
| Arkansas | 45 | 15 | 60 | 54 | 3 | 0 | 29 | 1 | 87 |
| California | 831 | 103 | 934 | 1,118 | 107 | 1 | 1,226 | 159 | 2,611 |
| Colorado | 52 | 15 | 67 | 44 | 7 | 0 | 29 | 7 | 87 |
| Connecticut | 103 | 1 | 104 | 88 | 15 | 0 | 115 | 11 | 229 |
| Delaware | 41 | 1 | 42 | 13 | 0 | 0 | 20 | 0 | 33 |
| District of Columbia | 101 | 8 | 109 | 147 | 7 | 0 | 75 | 2 | 231 |
| Florida | 152 | 43 | 195 | 219 | 10 | 0 | 136 | 15 | 380 |
| Georgia | 67 | 43 | 110 | 71 | 6 | 0 | 48 | 4 | 129 |
| Idaho | 35 | 5 | 40 | 24 | 9 | 0 | 15 | 5 | 53 |
| Illinois | 517 | 44 | 561 | 440 | 47 | 0 | 378 | 41 | 906 |
| Indiana | 186 | 104 | 290 | 140 | 24 | 0 | 141 | 20 | 325 |
| Iowa | 146 | 39 | 185 | 89 | 13 | 0 | 86 | 0 | 188 |
| Kansas | 123 | 84 | 207 | 107 | 11 | 0 | 59 | 9 | 186 |
| Kentucky | 51 | 14 | 65 | 38 | 2 | 0 | 26 | 3 | 69 |
| Louisiana | 92 | 14 | 106 | 100 | 6 | 0 | 51 | 11 | 168 |
| Maine | 55 | 8 | 63 | 32 | 4 | 0 | 17 | 1 | 54 |
| Maryland | 81 | 25 | 106 | 78 | 10 | 0 | 82 | 6 | 176 |
| Massachusetts | 198 | 24 | 222 | 172 | 28 | 0 | 196 | 34 | 430 |
| Michigan | 299 | 96 | 395 | 283 | 31 | 0 | 222 | 44 | 580 |
| Minnesota | 134 | 53 | 187 | 155 | 28 | 0 | 38 | 11 | 232 |
| Mississippi | 57 | 7 | 64 | 21 | 4 | 0 | 23 | 1 | 49 |
| Missouri | 175 | 63 | 238 | 268 | 14 | 0 | 111 | 9 | 402 |
| Montana | 53 | 18 | 71 | 37 | 9 | 0 | 42 | 4 | 92 |
| Nebraska | 84 | 51 | 135 | 77 | 10 | 0 | 56 | 11 | 154 |
| Nevada | 15 | 9 | 24 | 7 | 1 | 0 | 8 | 3 | 19 |
| New Hampshire | 27 | 7 | 34 | 15 | 7 | 0 | 18 | 3 | 43 |
| New Jersey | 206 | 28 | 234 | 240 | 21 | 0 | 191 | 22 | 474 |
| New Mexico | 21 | 7 | 28 | 14 | 3 | 0 | 10 | 1 | 28 |
| New York | 887 | 50 | 937 | 583 | 131 | 1 | 648 | 81 | 1,444 |
| North Carolina | 73 | 51 | 124 | 47 | 3 | 0 | 39 | 5 | 94 |
| North Dakota | 58 | 28 | 86 | 42 | 2 | 0 | 26 | 2 | 72 |
| Ohio | 395 | 76 | 471 | 355 | 78 | 0 | 333 | 43 | 809 |
| Oklahoma | 177 | 37 | 214 | 124 | 14 | 0 | 109 | 17 | 264 |
| Oregon | 77 | 53 | 130 | 71 | 7 | 1 | 89 | 15 | 183 |
| Pennsylvania | 499 | 66 | 565 | 290 | 75 | 0 | 385 | 41 | 791 |
| Rhode Island | 37 | 1 | 38 | 20 | 2 | 0 | 29 | 2 | 53 |
| South Carolina | 26 | 28 | 54 | 33 | 7 | 0 | 12 | 1 | 53 |
| South Dakota | 69 | 10 | 79 | 35 | 11 | 0 | 46 | 5 | 97 |
| Tennessee | 93 | 24 | 117 | 80 | 4 | 0 | 95 | 3 | 182 |
| Texas | 325 | 138 | 463 | 459 | 37 | 0 | 201 | 26 | 723 |
| Utah | 33 | 5 | 38 | 41 | 5 | 0 | 20 | 2 | 68 |
| Vermont | 36 | 1 | 37 | 13 | 4 | 0 | 11 | 3 | 31 |
| Virginia | 89 | 24 | 113 | 188 | 14 | 0 | 70 | 2 | 274 |
| Washington | 126 | 27 | 153 | 153 | 21 | 0 | 118 | 18 | 310 |
| West Virginia | 54 | 10 | 64 | 37 | 9 | 0 | 38 | 9 | 93 |
| Wisconsin | 148 | 82 | 230 | 104 | 29 | 0 | 67 | 13 | 213 |
| Wyoming | 37 | 15 | 52 | 34 | 2 | 0 | 10 | 2 | 48 |
| Alaska | 69 | 1 | 70 | 53 | 2 | 0 | 7 | 0 | 62 |
| Canada(1) | 0 | 0 | 0 | 4 | 1 | 0 | 11 | 0 | 16 |
| Canal Zone | 0 | 1 | 1 | 40 | 1 | 0 | 6 | 0 | 47 |
| Hawaiian Islands | 17 | 2 | 19 | 93 | 2 | 0 | 10 | 2 | 107 |
| Mexico(1) | 0 | 1 | 1 | 10 | 0 | 0 | 7 | 0 | 17 |
| Philippine Islands | 0 | 0 | 0 | 15 | 0 | 0 | 3 | 0 | 18 |
| Foreign, Misc.(1) | 5 | 0 | 5 | 66 | 2 | 0 | 18 | 3 | 89 |
| Totals | 7,371 | 1,701 | 9,072(2) | 7,186(3) | 909 | 3 | 5,961 | 746 | 14,805(4) |
| Percentages | | | | 48.54 | 6.14 | .02 | 40.26 | 5.04 | |

(1) Figures for these countries mean pilots and aircraft licensed or identified by the United States.

(2) This figure includes 43 licensed autogiros.

(3) This figure includes 736 pilots who hold scheduled air transport ratings.

(4) This figure includes 410 women pilots, divided as follows: 71 transport, 29 limited commercial, 256 private, and 54 amateur.

## COMPARATIVE TABULATION OF ACCIDENTS IN CIVIL AERONAUTICS

1932, 1933, 1934 and the First Six Months of 1935

Compiled by Bureau of Air Commerce, U. S. Dept. of Commerce

### Mileage Flown Per Accident

| | *January-June, 1932** | *July-December, 1932* | *January-June, 1933** | *July-December, 1933* | *January-June, 1934** | *July-December, 1934* | *January-June, 1935** |
|---|---|---|---|---|---|---|---|
| Miles flown in scheduled transport operations | 24,668,414 | 26,264,553 | 25,862,120 | 28,780,425 | 21,517,658 | 27,268,893 | 28,729,128 |
| Miles flown in miscellaneous operations including student instruction and experimental flying | 33,722,685 | 44,456,015 | 32,748,485 | 38,474,360 | 36,780,157 | 38,821,995 | 40,234,185 |
| Total | 58,391,099 | 70,720,568 | 58,610,605 | 67,254,785 | 58,297,815 | 66,090,888 | 68,963,313 |
| Accidents, all services | 914 | 1,152 | 813 | 891 | 676 | 901 | 737 |
| Miles flown per accident, all services | 63,885 | 61,389 | 72,091 | 75,482 | 86,239 | 73,353 | 93,573 |
| Accidents, scheduled transport operations | 67 | 48 | 48 | 53 | 27 | 46 | 29 |
| Miles flown per accident, scheduled transport operations | 368,185 | 547,178 | 538,794 | 543,027 | 796,950 | 592,802 | 990,660 |
| Accidents, miscellaneous operations | 847 | 1,104 | 765 | 838 | 649 | 855 | 708 |
| Miles flown per accident, miscellaneous operations | 39,814 | 40,268 | 40,808 | 45,912 | 56,672 | 45,406 | 56,828 |
| Fatal accidents, all services** | 105 | 119 | 85 | 106 | 93 | 103 | 86 |
| Miles flown per fatal accident in all services | 556,106 | 594,290 | 689,536 | 634,478 | 626,858 | 641,658 | 801,899 |
| Fatal accidents, scheduled transport operations** | 11 | 6 | 5 | 4 | 6 | 4 | 5 |
| Miles flown per fatal accident, scheduled operations | 2,242,583 | 4,377,425 | 5,172,424 | 7,159,106 | 3,586,276 | 6,817,223 | 5,745,826 |
| Fatal accidents, miscellaneous operations** | 94 | 113 | 80 | 102 | 87 | 99 | 81 |
| Miles flown per fatal accident, miscellaneous operations | 358,752 | 393,416 | 409,356 | 377,200 | 422,760 | 392,141 | 496,718 |
| Pilot fatalities, all services | 82 | 99 | 72 | 90 | 74 | 84 | 72 |
| Miles flown per pilot fatality, all services | 712,086 | 714,349 | 814,036 | 747,275 | 787,808 | 786,796 | 957,824 |
| Pilot fatalities, scheduled transport operations | 10 | 5 | 4 | 4 | 6 | 4 | 5 |
| Miles flown per pilot fatality, scheduled transport operations | 2,466,841 | 5,252,911 | 6,465,530 | 7,159,106 | 3,586,276 | 6,817,223 | 5,745,826 |
| Pilot fatalities, miscellaneous operations | 72 | 94 | 68 | 86 | 68 | 80 | 67 |
| Miles flown per pilot fatality, miscellaneous operations | 468,371 | 472,936 | 481,595 | 447,376 | 540,885 | 485,275 | 600,510 |

* 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, 1932* | *July-December, 1932* | *January-June, 1933* | *July-December, 1933* | *January-June, 1934* | *July-December, 1934* | *January-June, 1935* |
| Number of accidents involved.... | 67 | 48 | 48 | 53 | 27 | 46 | 29 |
| PERSONNEL: | | | | | | | |
| Pilot: | | | | | | | |
| Error of judgment..... | 3.73 | 5.85 | 1.04 | 5.28 | 14.45 | 4.02 | 12.07 |
| Poor technique..... | 3.88 | 1.06 | 3.12 | 1.89 | 15.74 | 4.90 | 1.72 |
| Disobedience of orders..... | .37 | 0 | 0 | .47 | 0 | 0 | 3.45 |
| Carelessness or negligence... | 2.98 | 6.38 | 7.29 | 13.21 | 11.67 | 6.95 | 13.79 |
| Miscellaneous..... | 0 | 0 | 2.08 | 0 | 0 | 0 | 0 |
| *Total pilot errors*..... | 10.96 | 13.29 | 13.53 | 20.85 | 41.86 | 15.87 | 31.03 |
| Other personnel: | | | | | | | |
| Supervisory..... | 0 | 2.66 | 0 | 0 | 6.48 | 2.06 | 4.31 |
| Miscellaneous..... | 0 | 0 | 2.08 | 0 | 3.70 | 4.35 | 2.93 |
| *Total personnel errors*..... | 10.96 | 15.95 | 15.61 | 20.85 | 52.04 | 22.28 | 38.27 |
| MATERIAL: | | | | | | | |
| Power Plant: | | | | | | | |
| Fuel system..... | 6.71 | 6.39 | 7.30 | 8.49 | 3.70 | 3.04 | 6.90 |
| Cooling system..... | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ignition system..... | 1.49 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lubrication system..... | 0 | 0 | 0 | 0 | 0 | 4.34 | 0 |
| Engine structure..... | 7.47 | 6.38 | 2.08 | 7.55 | 0 | 2.18 | 0 |
| Propellers and accessories.... | 2.99 | 6.38 | 4.17 | 5.66 | 7.41 | 2.17 | 3.45 |
| Engine-control system..... | 1.49 | 0 | 2.08 | 0 | 0 | 2.18 | 0 |
| Miscellaneous..... | .75 | 2.13 | 0 | 0 | 0 | 0 | 3.45 |
| Undetermined..... | 1.49 | 2.13 | 6.25 | 3.77 | .74 | 8.70 | 0 |
| *Total power-plant failures*.. | 22.39 | 23.41 | 21.88 | 25.47 | 11.85 | 22.61 | 13.80 |
| Structural: | | | | | | | |
| Flight-control system..... | 0 | 1.06 | 0 | 0 | 0 | 0 | 0 |
| Movable surfaces..... | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Stabilizing surfaces..... | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Wings, struts, and bracings.. | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Undercarriage..... | 7.47 | 10.64 | 4.17 | 10.94 | 11.11 | 10.65 | 6.90 |
| Wheels, tires and brakes..... | 5.82 | 4.26 | 4.17 | 9.34 | 3.70 | 0 | 0 |
| Pontoons or boats..... | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Fuselage, engine mountings and fittings..... | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Tail-skid assembly..... | 0 | 3.19 | 2.08 | 0 | 3.70 | 4.35 | 3.45 |
| Miscellaneous..... | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Undetermined..... | 0 | 4.26 | 0 | 0 | 0 | 0 | 0 |
| *Total structural failures*.... | 13.29 | 23.41 | 10.42 | 20.28 | 18.51 | 15.00 | 10.35 |
| Handling qualities..... | 5.97 | 1.06 | 2.08 | 3.78 | 0 | 6.52 | 0 |
| Instruments..... | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Total airplane failures*..... | 19.26 | 24.47 | 12.50 | 24.06 | 18.51 | 21.52 | 10.35 |
| MISCELLANEOUS: | | | | | | | |
| Weather..... | 31.72 | 25.53 | 27.09 | 18.30 | 14.82 | 17.39 | 20.34 |
| Darkness..... | 2.24 | 0 | 0 | 0 | 0 | 0 | 0 |
| Airport and terrain..... | 13.43 | 6.38 | 14.59 | 7.55 | .93 | 9.57 | 13.79 |
| Other..... | 0 | 2.13 | 8.33 | 0 | 1.85 | 6.63 | 0 |
| *Total miscellaneous causes*.. | 47.39 | 34.04 | 50.01 | 25.85 | 17.60 | 33.59 | 34.13 |
| *Undetermined and doubtful*..... | 0 | 2.13 | 0 | 3.77 | 0 | 0 | 3.45 |
| *Total percentages*..... | 100 | 100 | 100 | 100 | 100 | 100 | 100 |

## CAUSES OF ACCIDENTS
### Non-Scheduled Flying

| Causes | Percentages | | | | | | |
|---|---|---|---|---|---|---|---|
| | *January-June, 1932* | *July-December, 1932* | *January-June, 1933* | *July-December, 1933* | *January-June, 1934* | *July-December, 1934* | *January-June, 1935* |
| Number of accidents involved | 847 | 1,104 | 765 | 838 | 649 | 855 | 708 |
| PERSONNEL: | | | | | | | |
| Pilot: | | | | | | | |
| Error of judgment | 7.19 | 6.85 | 7.00 | 9.18 | 8.07 | 6.73 | 8.96 |
| Poor technique | 35.85 | 34.25 | 36.62 | 33.09 | 34.72 | 33.95 | 30.77 |
| Disobedience of orders | 1.64 | 1.82 | 1.01 | 1.40 | 1.29 | .83 | .65 |
| Carelessness or negligence | 7.08 | 8.75 | 6.01 | 7.25 | 8.28 | 11.35 | 11.51 |
| Miscellaneous | .12 | .18 | .36 | .42 | .36 | .29 | 0 |
| *Total pilot errors* | 51.88 | 51.85 | 51.00 | 51.34 | 52.72 | 53.15 | 51.89 |
| Other personnel: | | | | | | | |
| Supervisory | 0 | 0 | 0 | .12 | 0 | .06 | .07 |
| Miscellaneous | .74 | .32 | .39 | .24 | 0 | .39 | .28 |
| *Total personnel errors* | 52.62 | 52.17 | 51.39 | 51.70 | 52.72 | 53.60 | 52.24 |
| MATERIAL: | | | | | | | |
| Power Plant: | | | | | | | |
| Fuel system | 6.27 | 6.69 | 7.90 | 7.06 | 5.68 | 5.68 | 5.72 |
| Cooling system | .55 | .14 | .59 | .71 | .31 | .76 | .14 |
| Ignition system | 2.08 | 1.83 | 1.37 | 1.75 | 2.62 | 1.06 | 1.63 |
| Lubrication system | .32 | .34 | .23 | .30 | 0 | .35 | .67 |
| Engine structure | 3.89 | 2.83 | 4.09 | 1.86 | 3.41 | 3.33 | 2.93 |
| Propellers and accessories | .12 | .59 | .52 | .60 | .46 | .94 | .14 |
| Engine-control system | .12 | .41 | .52 | .24 | .28 | .23 | .57 |
| Miscellaneous | .79 | .61 | 0 | .29 | .55 | 1.16 | .99 |
| Undetermined | 2.25 | 3.77 | 4.67 | 2.78 | 2.94 | 4.22 | 3.50 |
| *Total power-plant failures* | 16.39 | 17.21 | 19.89 | 15.59 | 16.25 | 17.73 | 16.29 |
| Structural: | | | | | | | |
| Flight-control system | .46 | .29 | .66 | .71 | .46 | .56 | .42 |
| Movable surfaces | .03 | .36 | .13 | .12 | .28 | .23 | .57 |
| Stabilizing surfaces | .25 | 0 | 0 | .36 | 0 | .12 | .28 |
| Wings, struts, and bracings | 1.26 | .63 | 1.11 | 1.91 | 1.19 | 1.89 | 1.56 |
| Undercarriage | 4.69 | 4.86 | 4.74 | 6.36 | 4.82 | 4.73 | 4.67 |
| Wheels, tires and brakes | 2.27 | 1.63 | .92 | 2.00 | 1.54 | 2.48 | .60 |
| Pontoons or boats | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Fuselage, engine mountings and fittings | .24 | .45 | .26 | .24 | .15 | .35 | .14 |
| Tail-skid assembly | .27 | .27 | 0 | .12 | 0 | .12 | 0 |
| Miscellaneous | .53 | 1.65 | .26 | .12 | .15 | .18 | .31 |
| Undetermined | 0 | .18 | 0 | 0 | .15 | 0 | 0 |
| *Total structural failures* | 10.00 | 10.32 | 8.08 | 11.94 | 8.74 | 10.66 | 8.55 |
| Handling qualities | 2.73 | 2.17 | 2.35 | 2.05 | 1.76 | .93 | 1.06 |
| Instruments | 0 | .09 | 0 | 0 | 0 | 0 | 0 |
| *Total airplane failures* | 12.73 | 12.58 | 10.43 | 13.99 | 10.50 | 11.59 | 9.61 |
| MISCELLANEOUS: | | | | | | | |
| Weather | 7.64 | 5.85 | 7.69 | 7.46 | 7.67 | 4.80 | 7.89 |
| Darkness | .53 | .41 | .02 | 0 | 0 | .28 | .21 |
| Airport and terrain | 8.64 | 8.56 | 7.54 | 8.37 | 10.24 | 9.74 | 11.07 |
| Other | .62 | 1.63 | 2.39 | 1.94 | 2.00 | 2.14 | 2.69 |
| *Total miscellaneous causes* | 17.43 | 16.45 | 17.64 | 17.77 | 19.91 | 16.96 | 21.86 |
| *Undetermined and doubtful* | .83 | 1.59 | .65 | .95 | .62 | .12 | 0 |
| *Total percentages* | 100 | 100 | 100 | 100 | 100 | 100 | 100 |

## INJURIES CLASSIFIED

July to December, 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 | 178 | 4 | 4 | 7 | 32 | 47 | 0 | 2 | 2 | 11 | 15 |
| Student Instruction | 314 | 28 | 12 | 30 | 164 | 234 | 4 | 7 | 4 | 34 | 49 |
| Experimental | 19 | 3 | 1 | 3 | 10 | 17 | 1 | 0 | 0 | 0 | 1 |
| Commercial | 478 | 10 | 8 | 26 | 144 | 188 | 0 | 0 | 0 | 4 | 4 |
| Pleasure | 748 | 39 | 19 | 46 | 321 | 425 | 2 | 0 | 0 | 5 | 7 |
| Total | 1737 | 84 | 44 | 112 | 671 | 911 | 7 | 9 | 6 | 54 | 76 |

| Kind of Flying | Total Persons Involved | Passengers | | | | | Aircraft Crew | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Fatal | Severe | Minor | No Injury | Total | Fatal | Severe | Minor | No Injury | Total |
| Schedule | 178 | 5 | 6 | 3 | 97 | 111 | 0 | 0 | 1 | 4 | 5 |
| Student Instruction | 314 | 8 | 1 | 7 | 15 | 31 | 0 | 0 | 0 | 0 | 0 |
| Experimental | 19 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| Commercial | 478 | 21 | 9 | 27 | 221 | 278 | 2 | 1 | 0 | 5 | 8 |
| Pleasure | 748 | 46 | 20 | 39 | 208 | 313 | 0 | 0 | 3 | 0 | 3 |
| Total | 1737 | 80 | 36 | 76 | 542 | 734 | 2 | 1 | 4 | 9 | 16 |

January to June, 1935, 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 | 160 | 5 | 0 | 2 | 22 | 29 | 1 | 0 | 1 | 9 | 11 |
| Student Instruction | 317 | 26 | 16 | 24 | 168 | 234 | 5 | 5 | 6 | 50 | 66 |
| Experimental | 18 | 1 | 0 | 1 | 10 | 12 | 0 | 0 | 0 | 1 | 1 |
| Commercial | 360 | 11 | 5 | 22 | 119 | 157 | 0 | 0 | 0 | 0 | 0 |
| Pleasure | 561 | 29 | 15 | 40 | 227 | 311 | 0 | 1 | 0 | 2 | 3 |
| Total | 1416 | 72 | 36 | 89 | 546 | 743 | 6 | 6 | 7 | 62 | 81 |

| Kind of Flying | Total Persons Involved | Passengers | | | | | Aircraft Crew | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Fatal | Severe | Minor | No Injury | Total | Fatal | Severe | Minor | No Injury | Total |
| Schedule | 160 | 4 | 10 | 6 | 93 | 113 | 0 | 0 | 1 | 6 | 7 |
| Student Instruction | 317 | 6 | 2 | 4 | 5 | 17 | 0 | 0 | 0 | 0 | 0 |
| Experimental | 18 | 0 | 0 | 0 | 2 | 2 | 0 | 0 | 0 | 3 | 3 |
| Commercial | 360 | 17 | 11 | 18 | 157 | 203 | 0 | 0 | 0 | 0 | 0 |
| Pleasure | 561 | 26 | 19 | 36 | 166 | 247 | 0 | 0 | 0 | 0 | 0 |
| Total | 1416 | 53 | 42 | 64 | 423 | 582 | 0 | 0 | 1 | 9 | 10 |

# Aeronautical Directory and Trade Index

## Aeronautical Directory


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Laboratories, Langley Field, Va.

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Ordnance Corps Representative.....Capt. F. F. Reed
Navy Representative.....Lt. Comdr. Byron J. Connell

## BUREAU OF AERONAUTICS, U. S. NAVY

Washington, D. C.

Claude A. Swanson, Secretary of the Navy

### Officers on Duty in Washington

Chief of Bureau.....Rear Admiral Ernest J. King
Assistant Chief of Bureau.....Capt. F. R. McCrary
Captains.....P. N. L. Bellinger, G. P. Shamer, (SC), H. C. Richardson (CC) (Ret.).
Commanders.....A. D. Bernhard, G. Fulton (CC), M. A. Mitscher, D. Royce (CC), R. D. Weyerbacher (CC), J. T. Mathews (CEC).
Lieut. Commanders.....J. R. Allen (CC), J. B. Anderson, J. J. Ballentine, T. S. Combs, W. S. Diehl (CC), H. F. Fick, A. Gavin, C. D. Glover, L. M. Grant (CC), O. B. Hardison, L. R. Hundt, T. C. Lonnequest, R. D. MacCart (CC), C. McGauly, A. C. Miles (CC), J. E. Ostrander, Jr., J. Perry, A. I. Price, A. O. Rule, W. D. Sample, M. T. Seligman, J. B. Sykes, L. D. Webb.
Lieutenants.....M. E. Arnold, C. F. Coe, N. A. Draim (CC), S. B. Dunlap, C. E. Ekstrom, T. J. Hedding, C. L. Helber (CC), R. L. Johnson, I. M. McQuiston (USNR), J. B. Moss, W. L. Rees, L. K. Rice, T. U. Sisson, S. B. Spangler, W. G. Switzer, T. T. Tucker.
Lieutenant (jg).....C. L. Miller

Marine Corps Aviation.....Col. R. E. Rowell; Major Field Harris; Major H. C. Major; Capt. C. C. Jerome; First Lieutenants P. P. Schrider; E. C. Dyer; W. D. Saunders.

U. S. Army Liaison Officer.....Capt. D. F. Stace, USA.

### Naval Air Stations

Lakehurst, N. J.....Comdr. C. E. Rosendahl
Anacostia, D. C.....Comdr. A. E. Montgomery
Norfolk, Va.....Capt. W. G. Child
San Diego, Calif.....Capt. J. H. Towers
Seattle, Wash.....Lt. Comdr. H. S. Kendall
Pensacola, Fla.....Capt. R. F. Zogbaum
Pearl Harbor, T. H.....Capt. K. Whiting
Coco Solo, C. Z.....Capt. E. D. McWhorter

### Marine Corps Flying Fields

Quantico, Va.....Lt. Col. R. S. Geiger
San Diego, Calif.....Lt. Col. R. S. Mitchell

### Carrier Division

Commander.....Rear Admiral H. V. Butler
(Aircraft Battle Force and Aircraft U. S. Fleet)
Chief of Staff.....Capt. A. W. Fitch
U. S. S. Lexington.....Commanding Officer.....Capt. A. B. Cook
U. S. S. Saratoga.....Commanding Officer.....Capt. W. F. Halsey, Jr.
U. S. S. Langley.....Commanding Officer.....Capt. A. C. Read

### Naval Aircraft Factory

Philadelphia, Pa.....Manager.....Comdr. S. J. Zeigler, Jr. (CC)

### Special Aviation Duty

Aide to Commander in Chief, U. S. Fleet.....Comdr. Frank Wagner
Aide to Commander, Battle Force.....Lt. Comdr. F. M. Maile
Aide to Commander, Scouting Force.....Lt. Comdr. J. M. Shoemaker
Officer of Naval Operations.....Capt. Newton H. White
Officer of Fleet Training.....Lt. Comdr. M. Schoeffel
Naval Examining Board.....Lt. Comdr. C. G. Halpine
Board of Inspection and Survey.....Lt. Comdr. Joseph J. Clark
Bureau of Navigation.....Lt. Comdr. Carlos W. Wieber; Lt. Paul C. Teadwell
Bureau of Ordnance.....Lt. Comdr. F. P. Sherman
Hydrographic Office.....Lt. Comdr. W. Sinton; Lt. A. W. Wheelock

## NATIONAL BUREAU OF STANDARDS

Connecticut Ave. and Van Ness St., Washington, D. C.

Director.....Lyman J. Briggs
Assistant Director for Research and Testing.....E. C. Crittenden
Assistant Director for Commercial Standardization.....A. S. McAllister
Assistant to Director (in charge of Office).....Henry D. Hubbard
Chief of Division of:
Electricity.....E. C. Crittenden
Weights and Measures.....F. S. Holbrook and H. W. Bearce
Heat and Power.....H. C. Dickinson
Optics.....C. A. Skinner
Chemistry.....P. H. Walker
Mechanics and Sound.....H. L. Dryden
Organic and Fibrous Materials.....W. E. Emley
Metallurgy.....H. S. Rawdon
Clay and Silicate Products.....P. H. Bates
Simplified Practice.....E. W. Ely
Trade Standards.....I. J. Fairchild
Codes and Specifications.....A. S. McAllister
Office.....Henry D. Hubbard
Plant.....O. L. Britt
Shops.....O. G. Lange

## BUREAU OF AIR COMMERCE
## U. S. DEPARTMENT OF COMMERCE

Washington, D. C.

Daniel C. Roper, Secretary of Commerce

J. M. Johnson, Asst. Secy. of Commerce in Charge of Transportation Bureaus

Director of Air Commerce.....Eugene L. Vidal
Assistant to the Director.....N. B. Sangree
Administrative Section, Chief.....John S. Collins
Aeronautic Information Section, Chief.....Frederick R. Neely
Airport, Marking and Mapping Section, Chief.....John S. Wynne
Development Section, Chief.....John H. Geisse

### Air Navigation Division

Rex Martin, Assistant Director of Air Commerce in Charge

Chief Airways Engineer.....Charles I. Stanton
Chief, Radio Development Section.....W. E. Jackson
Chief, Engineering Section.....H. A. Hook
Chief, Construction Section.....G. E. Stratton
Superintendent of Maintenance.....Alvin O. Preil
Chief, Communication Section.....Eugene Sibley
Airways District Managers and Headquarters:
No. 1, Newark, N. J.....D. G. Van De Water
No. 2, Atlanta, Ga.....I. H. Polk
No. 3, Chicago, Ill.....Carl McClure
No. 4, Fort Worth, Tex.....L. C. Elliott
No. 5, Salt Lake City, Utah.....C. C. Lange
No. 6, Oakland, Calif.....H. T. Bean

### Air Regulation Division

J. Carroll Cone, Assistant Director of Air Commerce in Charge

Assistant to Assistant Director.....R. S. Boutelle
Air Line Inspection Service, Chief.....R. W. Schroeder
General Inspection Service, Chief.....Joe T. Shumate
Manufacturing Inspection Service, Chief.....L. V. Kerber
Supervising Aeronautical Inspectors and Headquarters:
District No. 1, Garden City, L. I., N. Y.....S. L. Willits
District No. 2, Los Angeles, Calif.....J. S. Marriott
District No. 3, Atlanta, Ga.....Wiley R. Wright
District No. 4, Detroit, Mich.....(a) H. R. Neely
District No. 5, Chicago, Ill.....G. W. Vest
District No. 6, Kansas City, Mo.....L. W. Jurden
District No. 7, Dallas, Tex.....C. A. Rowe
District No. 8, Oakland, Calif.....R. D. Bedinger
District No. 9, Anchorage, Alaska.....Hugh Brewster
Chief, Medical Section.....Dr. R. E. Whitehead
Chief, Enforcement Section.....Denis Mulligan
Chief, Registration Section.....R. R. Reining
Chief, Safety Section.....J. W. Lankford

(a) Acting.

## U. S. COAST GUARD
## DEPARTMENT OF THE TREASURY

Washington, D. C.

Henry Morgenthau, Jr., Secretary of the Treasury

Stephen B. Gibbons, Asst. Secy. in Charge of Customs, Coast Guard, Narcotics

Commandant.....Rear Admiral H. G. Hamlet
Chief, Aviation Division.....Captain L. T. Chalker
Asst. Chief, Aviation Division.....Lieut. L. M. Melka
Senior Aeronautical Engineer.....H. S. Cocklin

## POST OFFICE DEPARTMENT AIR MAIL SERVICE

Washington, D. C.

Postmaster General.....James A. Farley
Second Assistant Postmaster General.....Harllee Branch
Deputy Second Assistant Postmaster General.....J. M. Donaldson
General Superintendent, Air and Railway Mail Service.....S. A. Cisler
Superintendent, Air Mail Service.....Charles P. Graddick
Assistant Superintendent, Air Mail Service.....J. W. Sutherin
J. A. Cruickshank, Assistant Superintendent.....New York, N. Y.
R. E. Pollard, Assistant Superintendent.....Chicago, Ill.
A. O. Willoughby, Assistant Superintendent.....San Francisco, Calif.
Alva Sole, Assistant Superintendent.....Fort Worth, Tex.
Ben H. Lockett, Assistant Superintendent.....Atlanta, Ga.
J. E. Lamiell, Director, Division of International Postal Service (Foreign Air Mail)

## U. S. WEATHER BUREAU

### DEPARTMENT OF AGRICULTURE

Washington, D. C.

Henry A. Wallace, Secretary of Agriculture

Chief.....Willis Ray Gregg
Assistant Chief.....Charles C. Clark
Chief Clerk.....William Weber

### Aerological Division

Chief.....Delbert M. Little
Assistant.....Leroy T. Samuels
Airways.....Paul A. Miller
In Charge South Washington Airport Station.....William C. Haines

### Forecast Division

Chief.....Edgar B. Calvert
Assistant.....Ivan R. Tannehill

### District Forecasting

District Forecaster.....Charles L. Mitchell
District Forecaster.....R. Hanson Weightman

### Instrument Division

Chief.....Benjamin C. Kadel
Assistant.....Roy N. Covert

### Library

Chief.....Charles F. Talman

### Field Organization—District Forecasting

Chicago.....Charles A. Donnel
Denver.....Julius M. Sherier
Jacksonville.....Walter J. Bennett
New Orleans.....Willard F. McDonald
San Francisco.....Edward H. Bowie

### General Supervising Airway Stations

(Six-hourly Airway Forecast Centers)

Atlanta.....Eugene M. Barto
Chicago.....Vincent E. Jakl
Cleveland.....Clarence G. Andrus
Dallas.....Henry P. Adams
Kansas City.....Leslie A. Warren
Los Angeles (Burbank).....George M. French
New York (Newark).....Homer W. Ball
Portland, Ore.....Julius C. Smith
Salt Lake City.....Harry M. Hightman
San Francisco (Oakland).....John A. Riley

## U. S. FOREST SERVICE
## DEPARTMENT OF AGRICULTURE

Washington, D. C.

Henry A. Wallace, Secretary of Agriculture

Chief of the Forest Service: F. A. Silcox

| | |
|---|---|
| Northern Region | Headquarters: Missoula, Mont.<br>Evan W. Kelley, Regional Forester |
| Rocky Mountain Region | Headquarters: Denver, Colo.<br>Allen S. Peck, Regional Forester |
| Southwestern Region | Headquarters: Albuquerque, N. M.<br>Frank C. W. Pooler, Regional Forester |
| Intermountain Region | Headquarters: Ogden, Utah<br>R. H. Rutledge, Regional Forester |
| California Region | Headquarters: San Francisco, Calif.<br>S. B. Show, Regional Forester |
| North Pacific Region | Headquarters: Portland, Oregon<br>C. J. Buck, Regional Forester |
| Eastern Region | Headquarters: Washington, D. C.<br>R. M. Evans, Regional Forester |
| Southern Region | Headquarters: Atlanta, Ga.<br>Joseph C. Kircher, Regional Forester |
| North Central Region | Headquarters: Milwaukee, Wis. |
| Alaska Region | Headquarters: Juneau, Alaska<br>Charles H. Flory Regional Forester |

## FEDERAL COMMUNICATIONS COMMISSION

Washington, D. C.

**Commissioners**

Anning S. Prall, Chairman

| | |
|---|---|
| Thad H. Brown | Irvin Stewart |
| Norman S. Case | Eugene O. Sykes |
| George Henry Payne | Paul Walker |

Herbert L. Pettey, Secretary

## STATE AVIATION OFFICIALS

ALABAMA: Alabama State Aviation Commission
Theodore Swann, Chairman, 930 Brown-Marx Bldg., Birmingham

ARIZONA: No aeronautical regulatory body.
(Arizona Corporation Commission, Charles R. Howe, Chairman, Phoenix, has jurisdiction over aircraft common carriers.)

ARKANSAS: No aeronautical regulatory body.

CALIFORNIA: No aeronautical regulatory body.

COLORADO: No aeronautical regulatory body.
(Some control exercised by Colorado Public Utilities Commission and Neil W. Kimball, Adjutant General of Colorado, State Museum Bldg., Denver.)

CONNECTICUT: Department of Aeronautics
Charles L. Morris, Commissioner of Aeronautics, P. O. Box 537, Hartford.

DELAWARE: No aeronautical regulatory body.

FLORIDA: No aeronautical regulatory body.
(Promotion work is under the direction of the State Road Department, A. B. McMullen, Director, Aviation Division, Tallahassee.)

| | |
|---|---|
| GEORGIA: | No aeronautical regulatory body. |
| IDAHO: | Department of Public Works<br>William R. Graham, Director of Aeronautics, Boise. |
| ILLINOIS: | Illinois Aeronautics Commission<br>L. P. Bonfoey, Chairman, Quincy.<br>(Illinois Commerce Commission, B. F. Lindheimer, Chairman, 1 N. La Salle St., Chicago, has jurisdiction over common carriage.) |
| INDIANA: | No aeronautical regulatory body. |
| IOWA: | Iowa Aeronautics Commission<br>Lt. Col. Charles W. Gatschet, Chairman, Des Moines. |
| KANSAS: | No aeronautical regulatory body. |
| KENTUCKY: | Division of Aviation, Military Department of Kentucky<br>Gen. Henry H. Denhardt, Adjutant General, Frankfort. |
| LOUISIANA: | No aeronautical regulatory body. |
| MAINE: | Office of Secretary of State<br>Lewis O. Barrows, Secretary of State, State House, Augusta. |
| MARYLAND: | Maryland Aviation Commission<br>Dr. Hugh H. Young, Chairman, Stewart Bldg., Baltimore. |
| MASSACHUSETTS: | Registrar of Motor Vehicles<br>Frank A. Goodwin, Registrar, 100 Nashua St., Boston. |
| MICHIGAN: | Michigan Board of Aeronautics<br>William B. Mayo, Chairman, 2272 First National Bank Bldg., Detroit. |
| MINNESOTA: | Minnesota Aeronautics Commission<br>Major Ray S. Miller, Chairman, Athletic Club, St. Paul. |
| MISSISSIPPI: | No aeronautical regulatory body. |
| MISSOURI: | No aeronautical regulatory body. |
| MONTANA: | Montana Aeronautics Commission<br>Fred B. Sheriff, Commissioner, Helena. (Promotion work only.) |
| NEBRASKA: | Nebraska Aeronautics Commission<br>Clinton J. Campbell, Chairman, 1523 Sharp Bldg., Lincoln. |
| NEVADA: | No aeronautical regulatory body.<br>(Nevada Public Service Commission, Harley A. Harmon, Chairman, Carson City, has jurisdiction over aircraft common carriers.) |
| NEW HAMPSHIRE: | New Hampshire Public Service Commission<br>Nelson Lee Smith, Chairman, Concord. |
| NEW JERSEY: | New Jersey Department of Aviation<br>Gill Robb Wilson, State Director of Aviation, Trenton. |
| NEW MEXICO: | State Corporation Commission<br>Don R. Casados, Chairman, Santa Fe. |
| NEW YORK: | New York Aviation Commission<br>A. Spencer Feld, Chairman, 110 E. 42nd St., New York, N. Y. |
| NORTH CAROLINA: | No aeronautical regulatory body. |
| NORTH DAKOTA: | No aeronautical regulatory body.<br>(Board of Railroad Commissioners, Ben C. Larkin, President, Bismarck, has limited regulatory powers.) |

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| OHIO: | State Bureau of Aeronautics<br>Fred L. Smith, Director of Aeronautics, State Office Bldg., Columbus. |
| OKLAHOMA: | Oklahoma State Highway Commission<br>J. M. Gentry, Member-Secretary and State Aircraft Officer, State Capitol, Oklahoma City. |
| OREGON: | Oregon State Board of Aeronautics<br>J. G. Rankin, Chairman, 619 Lumbermens Bldg., Portland. |
| PENNSYLVANIA: | Department of Revenue, Division of Aeronautics<br>Cammy Vinet, Chief of Aeronautics, Harrisburg |
| RHODE ISLAND: | Department of Public Works, Division of State Airports<br>Daniel J. Kiely, State Office Bldg., Providence. |
| SOUTH CAROLINA: | South Carolina Aeronautics Commission<br>J. P. Williamson, Chairman, Greenville. |
| SOUTH DAKOTA: | South Dakota Aeronautics Commission<br>T. B. Roberts, Jr., Chairman, Pierre. |
| TENNESSEE: | State Aeronautics Commission<br>Briggs Smith, Chairman, Nashville. |
| TEXAS: | No aeronautical regulatory body. |
| UTAH: | No aeronautical regulatory body. |
| VERMONT: | Motor Vehicle Department<br>Murdock A. Campbell, Commissioner of Vehicles, Montpelier. |
| VIRGINIA: | State Corporation Commission<br>Thomas W. Ozlin, Chairman, Richmond. |
| WASHINGTON: | Washington State Patrol, William Cole, Chief, Olympia. |
| WEST VIRGINIA: | West Virginia Board of Aeronautics<br>David M. Giltinan, Acting Chairman, Charleston. |
| WISCONSIN: | No aeronautical regulatory body. |
| WYOMING: | No aeronautical regulatory body. |

## REGIONAL SUPERVISORS AND DISTRICT ADVISERS FOR THE AIRPORT DEVELOPMENT PROGRAM

January 1, 1936

Appointed by the Bureau of Air Commerce, under the Airport, Marking and Mapping Section, this group is charged with the technical supervision of all airport projects prosecuted by the Works Progress Administration.

### Region I

Supervisor: Paul D. Myers, 6510 Commerce Building, Washington, D. C.
District 1: Maine, New Hampshire, Vermont, Massachusetts.
Adviser: Hervey F. Law, 459 Park Square Building, Boston, Mass.
District 2: New York, New Jersey, Connecticut, Rhode Island.
Adviser: William H. Hooker, 79 Madison Ave., c/o TERA, New York, N. Y.
District 3: Pennsylvania, Maryland, Delaware.
Adviser: Daniel H. Reed, 48 N. Cameron St., c/o WPA, Harrisburg, Pa.

### Region II

Supervisor: Charles E. Cox, 217 N. Senate St., Indianapolis, Ind.
District 1: West Virginia, Ohio, Kentucky.
Adviser: D. W. Alexander, 510 Pure Oil Building, Columbus, Ohio.
District 2: Wisconsin, Illinois.
Adviser: Herbert W. Anderson, 1319 South Michigan Ave., Chicago, Ill.
District 3: Indiana, Michigan.
Adviser: W. B. Morgan, 217 North Senate Street, Indianapolis, Ind.

### Region III

Supervisor: E. M. Haight, City Hall, Charlotte, N. C.
District 1: Virginia, North Carolina, South Carolina.
Adviser: Truman Miller, c/o WPA, Raleigh, North Carolina.
District 2: Tennessee, Mississippi, Alabama.
Adviser: Algene Key, 605 Millsaps Bldg., Jackson, Mississippi.
District 3: Georgia, Florida.
Adviser: Phillips Moore, 10 Forsyth Street Building, Atlanta, Georgia.

### Region IV

Supervisor: Fred F. Grieme, 801 Harrison Street, Topeka, Kansas.
District 1: North Dakota, South Dakota, Nebraska.
Adviser: Austin F. Lytle, Pierre, South Dakota.
District 2: Iowa, Minnesota, Kansas.
Adviser: R. S. Miller, 26 State Capitol, St. Paul, Minnesota.

### Region V

Supervisor: Moss Patterson, 400 W. Noble Street, Oklahoma City, Oklahoma.
District 1: Oklahoma, Texas.
Adviser: W. J. MacKenzie, 2601 Smith Young Tower Bldg., San Antonio, Texas.
District 2: Missouri, Arkansas, Louisiana.
Adviser: Thomas E. Flaherty, Old Post Office Bldg., Little Rock, Arkansas.

### Region VI

Supervisor: Jacob E. Garn, 300 Continental Bank Bldg., Salt Lake City, Utah.
District 1: Wyoming, Montana, Utah.
Adviser: Clark Fisher, Room 6, Silverbow Club Bldg., Butte, Montana.
District 2: Colorado, New Mexico, Arizona.
Adviser: J. Hall McKenney, 106 Welfare Bldg., Santa Fe, New Mexico.

### Region VII

Supervisor: B. M. Doolin, Room 204, 49 Fourth Street, San Francisco, California.
District 1: California, Nevada.
Adviser: R. L. Campbell, 49 Fourth Street, San Francisco, California.
District 2: Oregon, Washington, Idaho, Alaska.
Adviser: Edward Whitehead, 1011 Alaska Building, Seattle, Washington.

## CONGRESSIONAL COMMITTEES INTERESTED IN AVIATION

**Standing Committees of the 74th Congress 2nd Session, 1936**

### Senate

#### Appropriations

Carter Glass (chairman) (D-Va.)

| | | | |
|---|---|---|---|
| Kenneth McKellar | (D-Tenn.) | Joseph C. O'Mahoney | (D-Wyo.) |
| Royal S. Copeland | (D-N. Y.) | William Gibbs McAdoo | (D-Calif.) |
| Carl Hayden | (D-Ariz.) | Harry S. Truman | (D-Mo.) |
| Elmer Thomas | (D-Okla.) | Frederick Hale | (R-Me.) |
| James F. Byrnes | (D-S. C.) | Henry W. Keyes | (R-N. H.) |
| Millard E. Tydings | (D-Md.) | Gerald P. Nye | (R-N. D.) |
| Richard B. Russell, Jr. | (D-Ga.) | Frederick Steiwer | (R-Ore.) |

| | | | |
|---|---|---|---|
| Marcus A. Coolidge | (D-Mass.) | Peter Norbeck | (R-S. D.) |
| Alva B. Adams | (D-Colo.) | L. J. Dickinson | (R-Ia.) |
| Pat McCarran | (D-Nev.) | John G. Townsend, Jr. | (R-Del.) |
| John H. Overton | (D-La.) | Robert D. Carey | (R-Wyo.) |
| John H. Bankhead, 2nd | (D-Ala.) | | |

**Interstate Commerce**

Burton K. Wheeler (chairman) (D-Mont.)

| | | | |
|---|---|---|---|
| Ellison D. Smith | (D-S. C.) | Sherman Minton | (D-Ind.) |
| Robert F. Wagner | (D-N. Y.) | A. Harry Moore | (D-N. J.) |
| Alben W. Barkley | (D-Ky.) | Harry S. Truman | (D-Mo.) |
| Matthew M. Neely | (D-W. Va.) | James Couzens | (R-Mich.) |
| William H. Dieterich | (D-Ill.) | Jesse H. Metcalf | (R-R. I.) |
| Augustine Lonergan | (D-Conn.) | Daniel O. Hastings | (R-Del.) |
| Fred H. Brown | (D-N. H.) | Wallace H. White, Jr. | (R-Me.) |
| Homer T. Bone | (D-Wash.) | James J. Davis | (R-Pa.) |
| Vic Donahey | (D-O.) | Henrik Shipstead | (F-L-Minn.) |

**Military Affairs**

Morris Sheppard (chairman) (D-Tex.)

| | | | |
|---|---|---|---|
| Duncan U. Fletcher | (D-Fla.) | Elbert D. Thomas | (D-Utah) |
| Hugo L. Black | (D-Ala.) | Sherman Minton | (D-Ind.) |
| J. Hamilton Lewis | (D-Ill.) | Lewis B. Schwellenbach | (D-Wash.) |
| Marcus A. Coolidge | (D-Mass.) | Robert D. Carey | (R-Wyo.) |
| M. M. Logan | (D-Ky.) | L. J. Dickinson | (R-Ia.) |
| Robert R. Reynolds | (D-N. C.) | Warren R. Austin | (R-Vt.) |
| Nathan L. Bachman | (D-Tenn.) | W. Warren Barbour | (R-N. J.) |
| F. Ryan Duffy | (D-Wis.) | Gerald P. Nye | (R-N. D.) |

**Naval Affairs**

Park Trammell (chairman) (D-Fla.)

| | | | |
|---|---|---|---|
| David I. Walsh | (D-Mass.) | Fred H. Brown | (D-N. H.) |
| Millard E. Tydings | (D-Md.) | Peter G. Gerry | (D-R. I.) |
| Ellison D. Smith | (D-S. C.) | Rush D. Holt | (D-W. Va.) |
| George McGill | (D-Kan.) | Frederick Hale | (R-Me.) |
| Richard B. Russell, Jr. | (D-Ga.) | Jesse H. Metcalf | (R-R. I.) |
| Homer T. Bone | (D-Wash.) | James J. Davis | (R-Pa.) |
| Harry Flood Byrd | (D-Va.) | Henry W. Keyes | (R-N. H.) |
| William H. Dieterich | (D-Ill.) | Hiram W. Johnson | (R-Calif.) |

**Post Offices and Post Roads**

Kenneth McKellar (chairman) (D-Tenn.)

| | | | |
|---|---|---|---|
| Park Trammell | (D-Fla.) | Edward R. Burke | (D-Neb.) |
| Carl Hayden | (D-Ariz.) | Dennis Chavez | (D-N. M.) |
| Josiah W. Bailey | (D-N.C.) | Rush D. Holt | (D-W. Va.) |
| William J. Bulow | (D-S. D.) | Lynn J. Frazier | (R-N. D.) |
| James F. Byrnes | (D-S. C.) | Robert M. LaFollette, Jr. | (P-Wis.) |
| M. M. Logan | (D-Ky.) | W. Warren Barbour | (R-N. J.) |
| Fred H. Brown | (D-N. H.) | James J. Davis | (R-Pa.) |
| Joseph C. O'Mahoney | (D-Wyo.) | Ernest W. Gibson | (R-Vt.) |
| James E. Murray | (D-Mont.) | | |

**Special Committee on Investigation of the Munitions Industry**

Gerald P. Nye (chairman) (R-N. D.)

| | | | |
|---|---|---|---|
| James P. Pope | (D-Ida.) | Walter F. George | (D-Ga.) |
| Homer T. Bone | (D-Wash.) | W. Warren Barbour | (D-N. J.) |
| Bennett Champ Clark | (D-Mo.) | Arthur H. Vandenberg | (D-Mich.) |

**Commerce Subcommittee on Aircraft Investigation**

Royal S. Copeland (chairman) (D-N. Y.)

| | | | |
|---|---|---|---|
| Bennett Champ Clark | (D-Mo.) | Hiram W. Johnson | (R-Calif.) |
| Vic Donahey | (D-O.) | Wallace H. White, Jr. | (R-Me.) |

## House of Representatives

### Appropriations

James P. Buchanan (chairman) (D-Tex.)

| | | | |
|---|---|---|---|
| Edward T. Taylor | (D-Colo.) | John F. Dockweiler | (D-Calif.) |
| William B. Oliver | (D-Ala.) | Edward C. Moran, Jr. | (D-Me.) |
| John N. Sandlin | (D-La.) | James McAndrews | (D-Ill.) |
| Clarence Cannon | (D-Mo.) | Emmet O'Neal | (D-Ky.) |
| Clifton A. Woodrum | (D-Va.) | George W. Johnson | (D-W. Va.) |
| John J. Boylan | (D-N. Y.) | James G. Scrugham | (D-Nev.) |
| Tilman B. Parks | (D-Ark.) | James M. Fitzpatrick | (D-N. Y.) |
| Louis Ludlow | (D-Ind.) | John Taber | (R-N. Y.) |
| William J. Granfield | (D-Mass.) | Robert L. Bacon | (R-N. Y.) |
| Thomas L. Blanton | (D-Tex.) | Richard B. Wigglesworth | (R-Mass.) |
| Thomas S. McMillan | (D-S. C.) | Clarence J. McLeod | (R-Mich.) |
| Glover H. Cary | (D-Ky.) | Lloyd Thurston | (R-Ia.) |
| Bernhard M. Jacobsen | (D-Ia.) | Florence P. Kahn | (R-Calif.) |
| Malcolm C. Tarver | (D-Ga.) | John T. Buckbee | (R-Ill.) |
| Jed Johnson | (D-Okla.) | Chester C. Bolton | (R-O.) |
| J. Buell Snyder | (D-Pa.) | William P. Lambertson | (R-Kans.) |
| William B. Umstead | (D-N. C.) | D. Lane Powers | (R-N. J.) |
| William R. Thom | (D-O.) | J. William Ditter | (R-Pa.) |
| Marion A. Zioncheck | (D-Wash.) | | |

### Interstate and Foreign Commerce

Sam Rayburn (chairman) (D-Tex.)

| | | | |
|---|---|---|---|
| George Huddleston | (D-Ala.) | John A. Martin | (D-Colo.) |
| Clarence F. Lea | (D-Calif.) | Edward C. Eicher | (D-Ia.) |
| Robert Crosser | (D-O.) | Theodore A. Peyser | (D-N. Y.) |
| Parker Corning | (D-N. Y.) | Thomas J. O'Brien | (D-Ill.) |
| Alfred L. Bulwinkle | (D-N. C.) | David D. Terry | (D-Ark.) |
| Virgil Chapman | (D-Ky.) | John G. Cooper | (R-O.) |
| Paul H. Maloney | (D-La.) | Carl E. Mapes | (R-Mich.) |
| William P. Cole, Jr. | (D-Md.) | Charles A. Wolverton | (R-N. J.) |
| Samuel B. Pettengill | (D-Ind.) | James Wolfenden | (R-Pa.) |
| Edward A. Kelly | (D-Ill.) | Pehr G. Holmes | (R-Mass.) |
| Edward A. Kenney | (D-N. J.) | Schuyler Merritt | (R-Conn.) |
| George G. Sadowski | (D-Mich.) | B. Carroll Reece | (R-Tenn.) |
| Joseph P. Monaghan | (D-Mont.) | James W. Wadsworth | (R-N. Y.) |

### Military Affairs

John J. McSwain (chairman) (D-S. C.)

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|---|---|---|---|
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| Numa F. Montet | (D-La.) | John M. Costello | (D-Calif.) |
| Andrew J. May | (D-Ky.) | J. Mark Wilcox | (D-Fla.) |
| R. Ewing Thomason | (D-Tex.) | Paul J. Kvale | (F-L-Minn.) |
| William N. Rogers | (D-N. H.) | Harry C. Ransley | (R-Pa.) |
| Dow W. Harter | (D-O.) | Walter G. Andrews | (R-N. Y.) |
| Charles I. Faddis | (D-Pa.) | Donald H. McLean | (R-N. J.) |
| Clarence W. Turner | (D-Tenn.) | Charles A. Plumley | (R-Vt.) |
| Andrew Edmiston | (D-W. Va.) | Samuel L. Collins | (R-Calif.) |
| Edwin M. Schaefer | (D-Ill.) | Dewey Short | (R-Mo.) |
| J. Joseph Smith | (D-Conn.) | Leslie C. Arends | (R-Ill.) |
| Matthew J. Merritt | (D-N. Y.) | Samuel W. King | (R-Hawaii) |
| Maury Maverick | (D-Tex.) | | |

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Carl Vinson (chairman) (D-Ga.)

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|---|---|---|---|
| Patrick H. Drewry | (D-Va.) | John M. O'Connell | (D-R. I.) |
| Stephen W. Gambrill | (D-Md.) | Stephen M. Young | (D-O.) |
| John J. Delaney | (D-N. Y.) | Byron N. Scott | (D-Calif.) |
| Frank C. Kniffin | (D-O.) | Joseph E. Casey | (D-Mass.) |
| Joachim O. Fernandez | (D-La.) | George P. Darrow | (R-Pa.) |
| Patrick J. Boland | (D-Pa.) | A. Piatt Andrew | (R-Mass.) |
| Leonard W. Schuetz | (D-Ill.) | Charles D. Millard | (R-N. Y.) |
| William H. Sutphin | (D-N. J.) | George Burnham | (R-Calif.) |

| | | | |
|---|---|---|---|
| Joseph B. Shannon | (D-Mo.) | William L. Higgins | (R-Conn.) |
| William J. Sears | (D-Fla.) | Melvin J. Maas | (R-Minn.) |
| John J. McGrath | (D-Calif.) | Ralph E. Church | (R-Ill.) |
| Colgate W. Darden, Jr. | (D-Va.) | Samuel W. King | (R-Hawaii) |
| W. D. McFarlane | (D-Tex.) | | |

**Post Office and Post Roads**

James M. Mead (chairman) (D-N. Y.)

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|---|---|---|---|
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| Harry L. Haines | (D-Pa.) | Edward W. Patterson | (D-Kans.) |
| Thomas G. Burch | (D-Va.) | Sam Hobbs | (D-Ala.) |
| Martin L. Sweeney | (D-O.) | Gardner R. Withrow | (P-Wis.) |
| John C. Taylor | (D-S. C.) | Isaac H. Doutrich | (R-Pa.) |
| Donald C. Dobbins | (D-Ill.) | Fred A. Hartley, Jr. | (R-N. J.) |
| Fred H. Hildebrandt | (D-S. D.) | Philip A. Goodwin | (R-N. Y.) |
| A. Willis Robertson | (D-Va.) | John T. Buckbee | (R-Ill.) |
| William A. Ashbrook | (D-O.) | William D. Thomas | (R-N. Y.) |
| John P. Higgins | (D-Mass.) | William A. Pittenger | (R-Minn.) |
| Arthur W. Mitchell | (D-Ill.) | Albert J. Engel | (R-Mich.) |
| Henry C. Luckey | (D-Neb.) | Samuel W. King | (R-Hawaii) |

**Special Investigating Committee on Cross Licensing and Pooling of Patents**

William I. Sirovich (chairman) (D-N. Y.)
W. D. McFarlane (counsel) (D-Tex.)

| | | | |
|---|---|---|---|
| Fritz G. Lanham | (D-Tex.) | Clarence J. McLeod | (R-Mich.) |
| Braswell Deen | (D-Ga.) | Fred A. Hartley, Jr. | (R-N. J.) |
| Thomas O'Malley | (D-Wis.) | Leslie C. Arends | (R-Ill.) |
| Matthew A. Dunn | (D-Pa.) | Ralph E. Church | (R-Ill.) |
| Charles J. Colden | (D-Calif.) | Charles F. Risk | (R-R. I.) |
| Charles Kramer | (D-Calif.) | R. T. Buckler | (F-L-Minn.) |
| J. Burwood Daly | (D-Pa.) | Thomas R. Amlie | (P-Wis.) |
| Randolph Perkins | (R-N. J.) | | |

## DIPLOMATIC SERVICE OF THE UNITED STATES

### U. S. Army

Berlin, Germany.....Capt. Theodore J. Koenig, Air Corps; Asst. Military Attaché for Air, Germany.

Paris, France.....Capt. Townsend Griffis, Air Corps; Asst. Military Attaché for Air, France.

London, England.....Capt. John W. Monahan, Air Corps; Asst. Military Attaché for Air, Great Britain.

Rome, Italy.....Capt. Thomas D. White, Air Corps; Asst. Military Attaché for Air, Italy.

### U. S. Navy

Rio de Janeiro, Brazil.....Lt. Richard F. Whitehead, Naval Aviator; Naval Attaché.

London, England.....Lt. Comdr. Leslie C. Stevens, Construction Corps, Naval Aviator; Asst. Naval Attaché.

{Paris, France; Berlin, Germany; The Hague, The Netherlands.....} Lt. Comdr. Ben H. Wyatt, Naval Aviator; Asst. Naval Attaché.

Tokio, Japan.....Lt. Comdr. Ralph A. Ofstie, Naval Aviator; Asst. Naval Attaché.

## DIPLOMATIC SERVICE TO THE UNITED STATES

The following foreign aeronautical representatives may be addressed at their respective embassies in Washington, D. C., or as indicated.

Argentina.....Commander Horacio M. Smith, Naval Attaché
Belgium.....Count Robert van der Straten-Ponthoz, Ambassador E. and P.
Bolivia.....Mr. Walter Decker, Consul, 90 Broad St., New York, N. Y.
Brazil.....Commander Oscar F. Coutinho, Naval Attaché
Bulgaria.....Mr. C. Bear, Consul
Canada.....Mr. Merchant F. Mahoney, First Secretary
Chile.....Senor Don Fernando Illanes Benitez, Second Secretary
China.....Mr. Yung Kwai, Counselor of Embassy
Colombia.....Senor Don Juan A. Calvo, Commercial Attaché
Costa Rica.....Senor Don Manuel Gonzáles-Zeledón, Minister Resident
Cuba.....Major Felipe Munilla, Military Attaché
Czechoslovakia.....Mr. Josef Nemecek, Counselor of Legation
Denmark.....Mr. Otto Wadsted, E. E. and M. P.
Egypt.....Dr. Hussein Chawky, Attaché
El Salvador.....Senor Dr. Don Hector David Castro, E. E. and M. P.
Finland.....Dr. Sigurd von Numers, Secretary of Legation
France.....Major Norbert Champsaur, Air Attaché
Germany.....Lt. General Friedrich von Boetticher, Air and Military Attaché
Great Britain.....Group Captain T. E. B. Howe, Air Attaché
Greece.....Mr. Nicholas G. Lély, Counselor
Guatemala.....Senor Dr. Don Enrique López-Herrarte, First Secretary
Honduras.....Senor Dr. Don Julian R. Caceres, First Secretary of Legation and Charge d'Affaires ad interim
Hungary.....Mr. Anthony de Balázy, Counselor of Legation
Irish Free State.....Mr. Robert Brennan, Secretary of Legation
Italy.....Lt. Colonel Vincenzo Coppola, Air and Military Attaché
Japan.....Lt. Commander Eiitiroo Zyoo, I. J. N., Assistant Naval Attaché
Lithuania.....Dr. Mikas Bagdonas, Secretary of Legation
Mexico.....Senor Dr. Don Francisco Castillo Najera, Ambassador, E. and P.
Netherlands.....Jonkheer H. M. van der Wyck, Secretary of Legation
Norway.....Mr. Francis Irgens, Secretary of Legation
Panama.....Senor Don Juan B. Chevalier, Secretary of Legation and Charge d'Affaires ad interim
Peru.....Dr. Juan Mendoza Almenara, Counselor of Legation
Poland.....Mr. Wladyslaw Sokolowski, Counselor of Embassy and Charge d'Affaires ad interim
Portugal.....Mr. João de Deus Ramos, Secretary
Rumania.....Mr. George Boncesco, Financial Counselor of Legation
Siam.....Phya Abhibal Rajamaitri, E. E. and M. P.
South Africa.....Mr. Johannes N. Theron, Secretary of Legation
Spain.....Major José Vidal, Military Attaché
Sweden.....Mr. Per Wijkman, Commercial Counselor of Legation
Switzerland.....Mr. Louis H. Micheli, Counselor of Legation
Turkey.....Secretary of Legation
U. S. S. R.....Brigade Commander Vladimir Alexandrovich Burzin, Military Attaché
Captain Alexander M. Yakimichev, Acting Naval Attaché
Uruguay.....Mr. J. Richling, E. E. and M. P.
Venezuela.....Senor Don Pedro Rivero, Secretary of Legation
Yugoslavia.....Dr. Ivan Franges, Secretary of Legation

## FLYING SCHOOLS GRANTED APPROVED CERTIFICATES BY U. S. DEPARTMENT OF COMMERCE

January 1, 1936

The Aeronautical University, Inc., 1330 South Michigan Ave., Chicago, Ill. Airplane & Engine Mechanic.
Boeing School of Aeronautics, Oakland Municipal Airport, Oakland, Calif. Flying and Ground, Transport, Lim. Com., Private, Amateur, Airplane and Engine Mechanic.
California Air Service, Ltd., Alhambra Airport, Alhambra, Calif. Flying and Ground, Private, Amateur.

(Continued next page)

Commercial Aircraft Co. Inc., Portland Airport, Swan Island, Portland, Oreg. (In conjunction with Oregon Institute of Technology). Flying and Ground, Private, Amateur.

Curtiss-Wright Technical Institute of Aeronautics, Grand Central Air Terminal, Glendale, Calif. Airplane & Engine Mechanic.

D. W. Flying Service, Inc., LeRoy Airport, LeRoy, N. Y. Flying and Ground, Lim. Com., Private, Amateur.

Dallas Aviation School and Air Col., Love Field, Dallas, Texas. Flying and Ground, Transport, Lim. Com., Private, Amateur.

Erickson & Remmert, Floyd Bennett Field, Brooklyn, N. Y. (In conjunction with New York University Ground School) Flying and Ground, Private, Amateur.

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, Calif. Flying and Ground, Transport, Lim. Com., Private, Amateur.

Inter City Airlines, Inc., Boston Municipal Airport, East Boston, Mass. Flying and Ground, Transport, Lim. Com., Private, Amateur.

Casey Jones School of Aeronautics, Inc., 534 Broad St., Newark, N. J. Airplane and Engine Mechanic.

Lincoln Airplane & Flying School, 2415 O Street (Ground), Municipal Airport (Flying), Lincoln, Nebr. Flying and Ground, Transport, Lim. Com., Private, Amateur, Airplane and Engine Mechanic.

Los Angeles Aircraft, Ltd., Los Angeles Municipal Airport, Inglewood, Calif. Flying and Ground, Private.

Muncie Aviation Corporation, Center Pike, Muncie, Ind. Flying and Ground, Lim. Com., Private, Amateur.

New England Aircraft School, 126 Newbury Street, Boston, Mass. Airplane & Engine Mechanic.

North-Suburban Flying Corporation, Shermer Avenue, Glenview, Ill. (In conjunction with The Aeronautical University, Inc., 1336 South Michigan Ave., Chicago, Ill.) Flying and Ground, Transport, Lim. Com., Private, Amateur.

Parks Air College, Inc., Parks Airport, East St. Louis, Ill. Flying and Ground, Transport, Lim. Com., Private, Amateur, Airplane and Engine Mechanic.

Rising Sun Aircraft School, Inc., 857 East Luzerne Street, Philadelphia, Pa. Airplane and Engine Mechanic.

Roosevelt Aviation School, Inc., Roosevelt Field No. 1, Mineola, L. I., N. Y. Flying and Ground, Transport, Lim. Com., Private, Amateur, Airplane and Engine Mechanic.

Ryan School of Aeronautics, Ltd., Lindbergh Field, San Diego, Calif. Flying and Ground, Transport, Lim. Com., Private, Amateur.

Safair, Inc., Hangar B, Roosevelt Field, Garden City, L. I., N. Y. (In combination with New York University, 51 West Fourth Street, New York.) Flying and Ground, Transport, Lim. Com., Private, Amateur.

Capt. Sansom's Aviation School, 157 Charter Oak Ave., Hartford, Conn. Airplane & Engine Mechanic.

Scott Flying Service, Municipal Airport, Long Beach, Calif. Flying and Ground, Private, Amateur.

Spartan School of Aeronautics, Apache Blvd. & Chamberlain Drive, Tulsa, Okla. Flying and Ground, Transport, Lim. Com., Private, Amateur.

The Stewart Technical Trade School, 253-5-7 West 64th Street, New York, N. Y. Airplane and Engine Mechanic.

## DOMESTIC AIR MAIL CONTRACTS

January 1, 1936

A. M. 1—Newark, N. J. to Oakland, Calif.
Date service started: May 8, 1934—United Air Lines, Inc.
Contract transferred to United Air Lines Transport Corp. Dec. 28, 1934.

A. M. 2—Newark, N. J. to Los Angeles, Calif.
Date service started: May 13, 1934—T W A, Inc.
Contract transferred to Transcontinental & Western Air, Inc. Jan. 1, 1935.

A. M. 3—Fargo, N. D. to Seattle, Wash.
Date service started: May 26, 1934—Northwest Airlines, Inc.

A. M. 4—Fort Worth, Tex. to Los Angeles, Calif.
Date service started: May 13, 1934—American Airlines, Inc.

A. M. 5—Newark, N. J. to New Orleans, La.
Date service started: May 16, 1934 (Newark to Atlanta).
May 28, 1934 (Atlanta to New Orleans)—
Eastern Air Lines, Inc.

Contract transferred to North American Aviation, Inc. Jan. 1, 1935.
A. M. 6—Newark, N. J. to Miami, Fla.
Date service started: May 16, 1934—Eastern Air Lines, Inc.
Contract transferred to North American Aviation, Inc., Jan. 1, 1935.
A. M. 7—Newark, N. J. to Chicago, Ill.
Date service started: May 13, 1934—American Airlines, Inc.
A. M. 8—Chicago, Ill. to New Orleans, La.
Date service started: June 3, 1934—Pacific Seaboard Airlines, Inc.
Name of contractor changed to Chicago and Southern Air Lines, Inc. Feb. 1, 1935.
A. M. 9—Chicago, Ill. to Dallas, Tex.
Date service started: May 17, 1934—Braniff Airways, Inc.
A. M. 10—Chicago, Ill. to Jacksonville, Fla.
Date service started: June 1, 1934—Eastern Air Lines, Inc.
Contract transferred to North American Aviation, Inc., Jan. 1, 1935.
A. M. 11—Seattle, Wash. to San Diego, Calif.
Date service started: May 8, 1934—United Air Lines, Inc.
Contract transferred to United Air Lines Transport Corp. Dec. 28, 1934.
A. M. 12—Salt Lake City, Utah to Seattle, Wash.
Date service started: May 8, 1934—United Air Lines, Inc.
Contract transferred to United Air Lines Transport Corp. Dec. 28, 1934.
A. M. 13—Salt Lake City, Utah to San Diego, Calif.
Service started May 8, 1934—General Air Lines, Inc.
Contract transferred to Western Air Express Corp., Jan. 1, 1935.
A. M. 14—Washington, D. C. to Detroit, Mich.
Service started: May 17, 1934—Central Airlines, Inc.
A. M. 15—Amarillo to Brownsville, Tex.
Service started: June 1, 1934—Long & Harman, Inc.
Contract transferred to Braniff Airways, Inc., Jan. 1, 1935.
A. M. 16—Chicago, Ill. to Pembina, N. D.
Service started: June 1, 1934.
Contract transferred to Northwest Airlines, Inc., Jan. 1, 1935.
A. M. 17—Cheyenne, Wyo. to Pueblo, Colo.
Service started: May 15, 1934 (Cheyenne to Denver).
June 1, 1934 (Denver to Pueblo)—
Wyoming Air Service, Inc.
A. M. 18—Boston, Mass. to Newark, N. J.
Service started: May 13, 1934—American Airlines, Inc.
A. M. 19—Salt Lake City, Utah to Great Falls, Mont.
Service started: May 15, 1934—Alfred Frank.
Contract sublet to National Parks Airways, Inc., Dec. 1, 1934.
A. M. 20—New Orleans, La. to Houston, Tex.
Service started: July 25, 1934—Robertson Airplane Service Company.
Contract transferred to Wedell Williams Air Service Corp., Jan. 1, 1935.
A. M. 21—Boston, Mass. to Cleveland, Ohio.
Service started: June 10, 1934—American Airlines, Inc.
A. M. 22—Cleveland, Ohio to Nashville, Tenn.
Service started: June 10, 1934—American Airlines, Inc.
A. M. 23—Newark, N. J. to Fort Worth, Tex.
Service started: June 10, 1934—American Airlines, Inc. (Nashville to Fort Worth).
July 1, 1934 (Newark to Nashville).
A. M. 24—Charleston, S. C. to Fort Worth, Tex.
Service started: July 4, 1934 (Atlanta to Dallas).
July 7, 1934 (Atlanta to Charleston)—
Delta Air Corporation.
A. M. 25—Washington, D. C. to Chicago, Ill.
Date service started: June 10, 1934.—American Airlines, Inc.
A. M. 26—St. Paul and Minneapolis, Minn. to Omaha, Neb.
Service started: July 3, 1934—Hanfords Tri State Airlines, Inc.
A. M. 27—Boston, Mass. to Bangor, Me. and Burlington, Vt.
Service started: June 25, 1934 (Boston and Burlington).
June 26, 1934 (Boston and Bangor)—
National Airways, Inc.
A. M. 28—Billings, Mont. to Cheyenne, Wyo.
Service started: June 20, 1934—Wyoming Air Service, Inc.
A. M. 29—Pueblo, Colo. to El Paso, Tex.
Service started: July 15, 1934.—Varney Speed Lines, Inc.,
Contract transferred to Varney Air Transport, Inc., Feb. 1, 1935.
A. M. 30—Chicago, Ill. to Fort Worth, Tex.
Service started: June 15, 1934.—American Airlines, Inc.
A. M. 31—Daytona Beach to St. Petersburg, Fla.
Service started: October 15, 1934—D. K. Franklin and G. T. Baker.
Contract sublet to G. T. Baker Mar. 1, 1935.
A. M. 32—Detroit, Mich. to Milwaukee, Wis.
Service started: July 1, 1934.—Pennsylvania Airlines and Transport Co.
A. M. 33—Honolulu to Hilo and Lihue, Territory of Hawaii.
Service started: July 8, 1934—Inter-Island Airways, Inc.

## U. S. FOREIGN AIR MAIL ROUTES

January 1, 1936

| *Route No.* | *Contractor* | *One Way Distance* |
|---|---|---|
| F. A. M. 1 | Canadian Colonial Airways, Inc.<br>4848 West 63rd St.,<br>Chicago, Ill. | |
| | New York, N. Y. via Albany, N. Y. to Montreal, Canada | 334 miles |
| F. A. M. 2 | Seattle Victoria Air Mail, Inc.<br>56 Roanoke St.,<br>Seattle, Washington | |
| | Seattle, Washington to Victoria, B. C., and return | 74 miles |
| F. A. M. 5 | Pan American Airways, Inc.<br>135 East 42nd St.<br>New York, N. Y. | |
| | Miami, Fla. via Havana and Cienfuegos, Cuba; Kingston, Jamaica and Barranquilla, Colombia to Cristobal, Canal Zone and return. | 1,721.8 miles |
| | Miami, Fla. via Havana, Cuba; and Merida, Mexico, to Belize, British Honduras and return | 967.5 miles |
| | San Salvador, El Salvador via Tegucigalpa, Honduras; Managua, Nicaragua; San Jose, Costa Rica; David and Panama City, Panama; to Cristobal, Canal Zone, and return | 953 miles |
| F. A. M. 5 (Extended) | Barranquilla, Colombia via Maracaibo, Cumarebo, La Guaira and Caripito, Venezuela to Port of Spain, Trinidad and return | 987.4 miles |
| | Port of Spain, Trinidad via Georgetown, British Guiana to Paramaribo, Dutch Guiana and return | 589.5 miles |
| F. A. M. 6 | Pan American Airways, Inc.<br>135 East 42nd St.,<br>New York, N. Y. | |
| | Miami, Fla. via Nuevitas, Cuba; Port au Prince, Haiti; San Pedro de Macoris, Dominican Republic; San Juan, Puerto Rico; St. Thomas, U. S. V. I.; St. John, Antigua to Port of Spain, Trinidad and return | 1,909.5 miles |
| F. A. M. 7 | Pan American Airways, Inc.<br>135 East 42nd St.,<br>New York, N. Y. | |
| | Miami, Fla., to Nassau, Bahamas | 188 miles |
| F. A. M. 8 | Pan American Airways, Inc.<br>135 East 42nd St.,<br>New York, N. Y. | |
| | Brownsville, Texas via Tampico, Mexico City, and Tapachula, Mexico, and Guatemala City, Guatemala to San Salvador, El Salvador and return | 1,277.5 miles |
| F. A. M. 9 | Pan American-Grace Airways, Inc.<br>135 East 42nd St.,<br>New York, N. Y. | |
| | Cristobal, Canal Zone via Buenaventura and Tumaco, Colombia; Guayaquil, Ecuador; Talara, Trujillo, Lima, Arequipa and Tacna, Peru; Arica, Antofagasta and Santiago, Chile; Mendoza and Buenos Aires, Argentina; to Montevideo, Uruguay and return | 4,497.1 miles |
| F. A. M. 10 | Pan American Airways, Inc.<br>135 East 42nd St.,<br>New York, N. Y. | |
| | Paramaribo, Dutch Guiana via Cayenne, French Guiana; Para, Maranhao, Natal, Pernambuco, Bahia, Victoria, Rio de Janeiro, Santos and Porto Alegre, Brazil; and Montevideo, Uruguay to Buenos Aires, Argentina and return | 4,651.8 miles |
| F. A. M. 12 | Pan American Airways Co.<br>135 East 42nd St.<br>New York, N. Y.<br>(Not in operation at present). | |
| | Bangor, Maine via St. John, New Brunswick to Halifax, Nova Scotia | 281 miles |
| F. A. M. 14 | Pan American Airways Co.<br>135 East 42nd St.,<br>New York, N. Y. | |
| | San Francisco, Calif. via Honolulu, Hawaii; Midway Island; Wake Island; Guam and Manila, Philippine Islands to Canton, China or adjacent point and return<br>(Service to be operated to Macao at present). | 8,705.5 miles* |

* Subject to adjustment.

## FOREIGN AIR MAIL CONTRACTS

### 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. 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, Porto 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 24, 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. (subcontractor: 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. 14 From San Francisco, California, to Canton, China,* and return, including stops at Honolulu, Hawaii, Midway Island, Wake Island, Guam, Manila, P.I., and Macao, Portuguese Territory.
Contract made October 25, 1935 with Pan American Airways Inc. for a 10 year term beginning with inauguration of service on November 22, 1935.

* Service to Canton if landing privileges can be secured. Otherwise the western terminus will be Macao, Portuguese Territory, where landing rights have been granted.

## 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. |
| AVIATION | 330 W. 42nd St., New York, N. Y. |

(Continued)

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| | |
|---|---|
| JOURNAL OF AIR LAW | 357 E. Chicago Avenue, Chicago, Ill. |
| JOURNAL OF THE AERONAUTICAL SCIENCES | 30 Rockefeller Plaza, New York, N. Y. |
| MODEL AIRPLANE NEWS | 551 Fifth Avenue, 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 | Hotel Texas, Fort Worth, Tex. |
| SPORTSMAN PILOT | 515 Madison Avenue, New York, N. Y. |
| U. S. AIR SERVICES | Transportation Building, Washington, D. C. |
| WESTERN FLYING | 420 South San Pedro Street, Los Angeles, Calif. |

## WILCOX AIR DEFENSE LAW OF 1935

[PUBLIC—No. 263—74TH CONGRESS] [H. R. 7022]

AN ACT

To authorize the selection, construction, installation, and modification of permanent stations and depots for the Army Air Corps and frontier air-defense bases generally.

*Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled*, That the Secretary of War is hereby authorized and directed to determine in all strategic areas of the United States, including those of Alaska and our overseas possessions and holdings, the location of such additional permanent Air Corps stations and depots as he deems essential, in connection with the existing Air Corps stations and depots and the enlargement of the same when necessary, for the effective peace-time training of the General Headquarters Air Force and the Air Corps components of our overseas garrisons. In determining the locations of new stations and depots, consideration shall be given to the following regions for the respective purposes indicated: (1) The Atlantic Northeast—to provide for training in cold weather and in fog; (2) the Atlantic Southeast and Caribbean areas—to permit training in long-range operations, especially those incident to reinforcing the Panama Canal; (3) the Southeastern States—to provide a depot essential to the maintenance of the General Headquarters Air Force; (4) the Pacific Northwest—to establish and maintain air communication with Alaska; (5) Alaska—for training under conditions of extreme cold; (6) the Rocky Mountain area—to provide a depot essential to the maintenance of the General Headquarters Air Force, and to afford, in addition, opportunity for training in operations from fields in high altitudes; and (7) such intermediate stations as will provide for transcontinental movements incident to the concentration of the General Headquarters Air Force for maneuvers.

In the selection of sites for new permanent Air Corps stations and depots and in the determination of the existing stations and depots to be enlarged and/or altered, the Secretary of War shall give consideration to the following requirements:

First. The stations shall be suitably located to form the nucleus of the set-up for concentrations of General Headquarters Air Force units in war and to permit, in peace, training and effective planning, by responsible personnel in each strategic area, for the utilization and expansion in war, of commercial, municipal, and private flying installations.

Second. In each strategic area deemed necessary, there shall be provided adequate storage facilities for munitions and other essentials to facilitate effective movements, concentrations, maintenance, and operations of the General Headquarters Air Force in peace and in war.

Third. The stations and depots shall be located with a view to affording the maximum warning against surprise attack by enemy aircraft upon our own aviation and its essential installations, consistent with maintaining, in connection with existing or contemplated additional landing fields, the full power of the General Headquarters Air Force for such close and distant operations over land and sea as may be required in the defense of the continental United States and in the defense and the reinforcement of our overseas possessions and holdings.

Fourth. The number of stations and depots shall be limited to those essential to the foregoing purposes.

SEC. 2. To accomplish the purposes of this Act, the Secretary of War is authorized to accept, on behalf of the United States, free of encumbrances and without cost to the United States, the title in fee simple to such lands as he may deem necessary or desirable for new permanent Air Corps stations and depots and/or the extension of or addition to existing Air Corps stations or depots; or, with the written approval of the President, to exchange for such lands existing military reservations or portions thereof; or, if it be found impracticable to secure the necessary lands by either of these methods, to purchase the same by agreement or through condemnation proceedings.

SEC. 3. The Secretary of War is further authorized and directed to construct, install, and equip, or complete the construction, installation, and equipment, inclusive of bomb-proof protection as required, at each of said stations and depots, such buildings and utilities, technical buildings and utilities, landing fields and mats, and all utilities and appurtenances thereto, ammunition storage, fuel and oil storage and distribution systems therefor, roads, walks, aprons, docks, runways, sewer, water, power, station and aerodrome lighting, telephone and signal communications, and other essentials, including the necessary grading and removal or remodeling of existing structures and installations. He is authorized, also, to direct the necessary transportation of personnel, and purchase, renovation, and transportation of materials, as in his judgment may be required to carry out the purposes of this Act. The Secretary of War is further authorized to acquire by gift, purchase, lease, or otherwise, at such locations as may be desirable, such bombing and machine-gun ranges as may be required for the proper practice and training of tactical units.

SEC. 4. There is hereby authorized to be appropriated, out of any money in the Treasury of the United States not otherwise appropriated, such sums of money as may be necessary, to be expended under the direction of the Secretary of War for the purposes of this Act, including the expenses incident to the necessary surveys, which appropriation shall continue available until expended: *Provided*, That the provisions of section 1136, Revised Statutes (U.S.C., title 10, par. 1339), shall not apply to the construction of the aforesaid stations and depots.

Approved, August 12, 1935.

## AIR MAIL ACT OF 1934

As amended by H. R. 6511
Signed by the President August 14, 1935
*Italics are amendments of 1935*

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, 465c, 465d, and 465f), and the sections amended thereby are hereby repealed.

SECTION 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.

SECTION 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 three years, 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 extensions of any route: Provided, That the aggregate mileage of all such extensions on any route in effect at one time shall not exceed two hundred and fifty miles, and that the rate of pay for such extensions shall not be in excess of the rate per mile fixed for the service thus extended.*

(d) *The Postmaster General may designate certain routes as primary or as secondary routes. He shall designate as primary routes at least three transcontinental routes with such termini as he may deem advisable, and, in addition thereto, such other routes as he may consider in the public interest, but no route less than seven hundred and fifty miles in length shall be designated as a primary route: Provided, That the present routes from Seattle to San Diego and from Newark (or New York, as the case may be) to Miami, Florida, may be held and regarded as other than primary routes: Provided further, That the Southern Transcontinental Route from Boston via New York (or Newark, as the case may be) and Washington to Los Angeles, shall be designated as a primary route.* 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 thirty-two thousand miles, and shall not pay for air-mail transportation on such routes and extensions in excess of an annual aggregate of forty-five million airplane-miles. Subject to the foregoing, the Postmaster General shall prescribe the number and frequency of schedules, intermediate regular stops, and time of departure of all planes carrying air mail, with due regard for the volume of mail carried over each route and for connecting schedules, and he may, under such regulations as he may prescribe, authorize and, notwithstanding any other provisions of this Act, compensate for a special schedule or an extra or emergency trip in addition to any regular schedule over air-mail routes or portions thereof at the same mileage rate paid for regular schedules on the contract route or routes, or at a lesser rate if agreed to by the contractor and the Postmaster General, and he may utilize therefor any scheduled passenger or express flight of the contractor between the terminal points or over a portion of any route whenever the needs of the service may so require: Provided, That the Postmaster General may, upon application by an air-mail contractor, authorize said contractor for his own convenience to transport air mail on any nonmail schedule or plane, with the understanding that the weights of mail so transported will be credited to regular mail schedules and no mileage compensation will be claimed therefor and the miles flown in such cases will not be computed in the annual aggregate of flown mileage, authorized under this section.*

(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.

SECTION 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.

SECTION 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.

SECTION 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 within the limitations of this Act for the transportation of air mail by airplane and the service connected therewith over each air-mail route, and over each section thereof covered by a separate contract, 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, and so much of subsection (g) of section 3 of this Act as is in conflict with this section is hereby repealed.*

(b) *The Interstate Commerce Commission is hereby directed at least once in each calendar year from the date of the award of any contract to examine the books, accounts, contracts, and entire business records of the holder of each air-mail contract, and to review the rates of compensation being paid to such holder in order to be assured that no unreasonable profit is being derived or accruing therefrom, and in order to fix just rates. In determining what may constitute an unreasonable profit the said Commission shall take into consideration the income derived from the operation of airplanes over the routes affected, and in addition to the requirements of section 3 (f) of this Act, shall take into consideration all forms of expenditures of said companies in order to ascertain whether or not the expenditures have been upon a fair and reasonable basis on the part of said company and whether or not the said company has paid more than a fair and reasonable market value for the purchase or rent of planes, engines, or any other types or kind, or class, or goods, or services, including spare parts of all kinds, and whether or not the air-mail contracting company has purchased or rented any kind of goods, commodities, or services from any individuals who own stock in or are connected with the said contracting companies or has purchased such goods and services from any company or corporations in which any of the individuals employed by or owning stock in the air-mail contracting company have any interest or from which such purchase or rents any of the employees or stockholders of air-mail contracting companies would be directly or indirectly benefitted. Within thirty days after a decision has been reached upon such review by the Interstate Commerce Commission touching such profit a full report thereof shall be made to the Postmaster General, to the Secretary of the United States Senate, and to the Clerk of the House of Representatives.*

(c) *Any contract (1) let, extended, or assigned pursuant to the provisions of this Act, and in full force and effect on March 1, 1935, or (2) which may be let subsequent to such date pursuant to the provisions of this Act and shall have been satisfactorily performed by the contractor during its full initial period, shall, from and after such date, or from and after the termination of its initial period, as the case may be, be continued in effect for an indefinite period, and compensation therefor, on and after March 1, 1935, during such period of indefinite continuance, shall be paid at the rate fixed by order*

*of the Commission under this Act, subject to such additional conditions and terms as the Commission may prescribe, upon recommendation of the Postmaster General, which shall be consistent with the requirements and limitations contained in section 1 of this Act; but any contract so continued in effect may be terminated by the 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, in whole or in part, by mutual agreement of the Postmaster General and the contractor, or for cause by the contractor 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.

*In arriving at such determination the Commission shall disregard losses resulting, in the opinion of the Commission, from the unprofitable maintenance of nonmail schedules, in cases where the Commission may find that the gross receipts from such schedules fail to meet the additional operating expense occasioned thereby. In fixing and determining such rates, if it shall be contended or alleged by the holder of an air-mail contract that the rate of compensation in force for the service involved is insufficient, the burden of establishing such insufficiency and the extent thereof shall be assumed by him. In no case shall the rates fixed and determined by the said Commission hereunder exceed the limits prescribed in section 3 (a) of this Act.*

*The Commission is hereby authorized and directed, after having made a full and complete examination and audit of the books, and after having examined and carefully scrutinized all expenditures and purported expenditures, of the holders of the contracts hereinafter referred to, for goods, lands, commodities, and services, in order to determine whether or not such expenditures were fair and just, and were not improper, excessive, or collusive, in the cases of the eight air-mail contracts which are allowed, by a previous report of the Commission, the rate of 33 1/3 cents per mile, under the provisions of the Act of June 12, 1934, on routes Numbered 7, 12, 13, 14, 19, 25, 27, and 32, and the Commission shall make a report to the Congress, not later than January 15, 1936, whether or not, in its judgment, a fair and reasonable rate of compensation on each of said eight contracts, under the other provisions and conditions of said Act, as herein amended, is in excess of 33 1/3 cents per mile; together with full facts and reasons in detail why it recommends for or against any claim for increase.*

*(f) Each holder of an air-mail contract shall file with the Interstate Commerce Commission, in such form as the Commission shall require, on July 1st and January 1st of each year, a full statement of all free transportation hereafter furnished during the preceding semiannual period to any persons, including in each case the regular tariff value thereof, the name and address of the donee, and a statement of the reason for furnishing such free transportation.*

SECTION 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 or Interstate Commerce Commission 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 or Interstate Commerce Commission 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: Provided further, That it shall be unlawful for any officer or regular employee to draw a salary of more than $17,500 per year from any air-mail contractor, or a salary from any other company if such salary from any company makes his total compensation more than $17,500 per year.*

SECTION 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 cancellation 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).

SECTION 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.

SECTION 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, if and when he deems it advisable to do so, to examine and audit the books, records, and accounts of such contractors, and to require such contractors to submit full financial reports in such form and under such regulations as he may prescribe.*

*Whenever an audit of the books, records, or accounts of any air-mail contractor is made by the auditors of the Interstate Commerce Commission, a full and complete report thereof shall be made to the Post Office Department within thirty days, and that report shall contain all instances in which the contractor has failed to comply with any of the provisions of the uniform system of accounts prescribed by the Post Office Department; and the Postmaster General shall, upon request, have at all times access to the records and reports of the Commission concerning air mail and air-mail contracts. There is authorized to be used from the appropriations for Contract Air Mail Service for the fiscal year ending June 30, 1936, a sum not in excess of $25,000 for the purpose of auditing the books and records of air-mail contractors by the Post Office Department.*

SECTION 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.

SECTION 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.

SECTION 13. *It shall be a condition upon the holding of any air-mail contract that the rate of compensation and the working conditions and relations for all pilots and other employees of the holder of such contract shall conform to decisions heretofore or hereafter made by the National Labor Board, or its successor in authority, notwithstanding any limitation as to the period of its effectiveness included in any such decision heretofore rendered. This section shall not be construed as restricting the right of any such employees by collective bargaining to obtain higher rates of compensation or more favorable working conditions and relations.*

SECTION 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.

SECTION 15. *After June 30, 1935, no person holding a contract or contracts for carrying air mail on a primary route shall be awarded or hold any contract for carrying air mail on any other primary route, nor on more than three additional routes other than primary routes. In case one person holds several contracts covering different sections of one air-mail route as designated by the Postmaster General, such several contracts shall be counted as one contract for the purpose of the preceding sentence. 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. After June 30, 1935, no air-mail contractor shall be allowed to maintain passenger or express service*

*off the line of his air-mail route which in any way competes with passenger or express service available upon another air-mail route, except that off-line competitive service which has been regularly maintained on and prior to July 1, 1935, and such seasonal schedules as may have been regularly maintained during the year prior to July 1, 1935, may be continued if restricted to the number of schedules and to the stops scheduled and in effect during such period or season.*

*Upon application of the Postmaster General or of any interested air-mail contractor, setting forth that the general transport business or earnings upon an air mail route are being adversely affected by any alleged unfair practice of another air-mail contractor, or by any competitive air-transport service supplied by an air-mail contractor other than that supplied by him on the line of his prescribed air-mail route, or by any service inaugurated by him after July 1, 1935, through the scheduling of competitive nonmail flights over an air-mail route, the Interstate Commerce Commission shall, after giving reasonable notice to the air-mail contractor complained of, inquire fully into the subject matter of the allegations and if the Commission shall find such practice or competition or any part thereof to be unfair, or that such competitive service in whole or in part is not reasonably required in the interest of public convenience and necessity, and if the Commission shall further find that in either case the receipts or expenses of an air-mail contractor are so affected thereby as to tend to increase the cost of air-mail transportation, then it shall order such practice or competitive service, or both, as the case may be, discontinued or restricted in accordance with such findings, and the respondent air-mail contractor named in the order shall comply therewith within a reasonable time to be fixed in such order. If the Commission shall find after like application, notice and hearing that the public convenience and necessity requires additional service or schedules and such service or schedules do not tend to increase the cost of air-mail transportation, it may permit the institution and maintenance of such schedules and prescribe the frequency thereof. The compensation of any air-mail contractor shall be withheld during any period that it continues to violate any order of the Commission or any provision of this Act.*

SECTION 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).

SECTION 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.

SECTION 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.

SECTION 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.

SECTION 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.

SECTION 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 August 14, 1935.

# TRADE INDEX

## · DIVISION I ·

## AIRCRAFT AND ENGINE MANUFACTURERS

### AIRPLANE MANUFACTURERS

**THE BEECH AIRCRAFT COMPANY**
Manufacturers of
**Commercial and Custom Built Airplanes**
Office, Factory and Landing Field
**Wichita, Kansas**
Walter H. Beech 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.—R. M. Singer
Vice-Pres.—R. D. Work, Jr.
Sec. & Treas.—John R. Hunt

**CONSOLIDATED AIRCRAFT CORPORATION**
**San Diego, California**
Military and Commercial Aircraft
Training — Observation — Pursuit
Attack—Seaplanes—Flying Boats
Subsidiaries:
Fleet Aircraft of Canada, Ltd.
Fort Erie, Ontario, Canada

**CURTISS AEROPLANE & MOTOR CO., Buffalo, New York**
(A Division of Curtiss-Wright Corporation)
Manufacturers of aircraft for the U. S. Army and U. S. Navy
B. S. Wright, Vice President and Gen. Mgr.; J. A. B. Smith, Vice Pres.; T. P. Wright, Vice Pres.; Geo. S. Lapp, Treas.; E. S. Cramer, Sec.
Cable Address: "Aeroexco"

**CURTISS-WRIGHT AIRPLANE COMPANY**
**Robertson, Missouri**
(A Division of Curtiss-Wright Corporation)
Manufacturers of sport planes, commercial transports and military aircraft. G. J. Brandewiede, Vice President and Gen. Mgr. George M. Ebert, Treas.; E. S. Cramer, Sec.
Cable address: "Aeroexco"

**FAIRCHILD AIRCRAFT CORPORATION**
**(Subsidiary of Fairchild Aviation Corporation)**
Manufacturers of
Fairchild "22"
Fairchild "24"
Fairchild "45"
High Speed Amphibian Transport
Commercial and Military Cargo Transports
S. M. Fairchild, President

**GLENN L. MARTIN COMPANY**
Manufacturers of
Bombardment Airplanes
and
Ocean Transport Flying Boats
**Baltimore, Maryland**
Glenn L. Martin, President

**SIKORSKY AIRCRAFT**

Division of United Aircraft Manufacturing Corporation
**Bridgeport, Connecticut**

Designers and manufacturers of multi-motored transport amphibions and flying boats for private, commercial and government service.

E. E. Wilson, General Mgr.
I. I. Sikorsky, Engineering Mgr.
E. H. Glaettli, Asst. Secy. and Asst. Treas.

**STINSON AIRCRAFT CORP.**

Manufacturers of
Commercial & Military Airplanes
and
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