AIRCRAFT YEAR BOOK

1925

HARRISON BRAND, JR.

Huff, Daland & Company's airplane specially developed for dusting cotton fields and peach orchards. These planes carry 1000 lbs. of dust. Huff, Daland & Co. have purchased 16 Wright *Whirlwind* 200 h.p. engines for installation in these ships.—*U. S. Department of Agriculture.*

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PUBLISHED BY
AERONAUTICAL CHAMBER OF COMMERCE
OF AMERICA, INC.
NEW YORK CITY

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INTRODUCTION

THE editors of the Aircraft Year Book acknowledge their indebtedness to the officers and personnel of the U. S. Air Service, Navy Bureau of Aeronautics, Marine Corps Aviation and the Air Mail Service of the Post Office Department. Material and helpful suggestions also have been received from the Department of Commerce, Department of Agriculture and the Department of the Interior. Especial thanks are due to the National Advisory Committee for Aeronautics, Dr. George W. Lewis, Executive Officer.

AERONAUTICAL CHAMBER OF COMMERCE OF AMERICA, INC.

New York City, July 1, 1925.

CHAPTER I

AVIATION IN 1924—A NATION WIDE AWAKENING

IN retrospect, 1924 assumes far greater significance in the history of aviation than seemed to be the case during the year. It was, on the whole, a period of bigger achievement and of less disappointment than any since the closing of the World War, for it produced the first definite, tangible signs of legislative awakening, industrial regeneration and practical public patronage. During 1924 the front pages of the newspapers carried not only many stories of brilliant flights, but the business aspects and the practical utility of aircraft were continually emphasized.

In all the notable performances of the year, the United States maintained undisputed leadership. The Army Air Service, after months of careful planning and admirable organization, circled the globe by air, thereby bringing to the art in this country practical information of untold value, as well as the imperishable honor of having been the first to accomplish this unbelievably difficult task. Two of the four Douglas Cruisers which started out into the west from Seattle returned to Seattle out of the east. The third undoubtedly would have done likewise had it not been for damage received while it was being hoisted aboard a Navy warship for repairs.

The Navy Bureau of Aeronautics sent the airship *Shenandoah* on a round trip overland voyage from Lakehurst, N. J., to Seattle, and upon delivery of the Z.R.-3 from Friedrichshafen, Germany, sent this larger airship, rechristened the *Los Angeles,* upon journey after journey, overland to the middle west and oversea as far as Bermuda and the West Indies, thereby demonstrating, not only to the scores of prominent persons carried, but to the public as a whole, the comfort and safety of flight in helium-filled airships.

Just as the Army's Round-the-World Flight challenged the sense of romance and patriotism, Smith's feat in the air being comparable with that of Magellan centuries ago on the sea; so did the operation of the Navy airships *convince* the hundreds of thousands who saw the huge liners navigate, that commercial aviation, in both airplanes and airships, is at hand.

The Dawn-to-Dusk Flight which Maughan made in an Army-

Curtiss pursuit plane from New York to San Francisco was a startling demonstration of the further shrinking of the North American continent. In impressive contrast to Maughan's spectacular experience, was the establishment upon a through day and night schedule of the transcontinental Air Mail Service. Maughan's flight, in so far as aviation is concerned, has been likened to the Lewis and Clark Expedition and its relation to the extension of rail transportation. Both performances were romantic and prophetic. Lewis and Clark were followed by the railway trains; Maughan has been followed by the Air Mail and cargo planes.

Thirty-Two New World Records Won by America

In 1924 fifty-nine new world records were established with airplanes, seaplanes and helicopters. Of these, fourteen airplane and eighteen seaplane records—a total of thirty-two—were made in the United States by American flyers in American equipment. France took eight airplane, six seaplane and three helicopter. Czecho-Slovakia took four airplane; Denmark five seaplane and Sweden one seaplane.

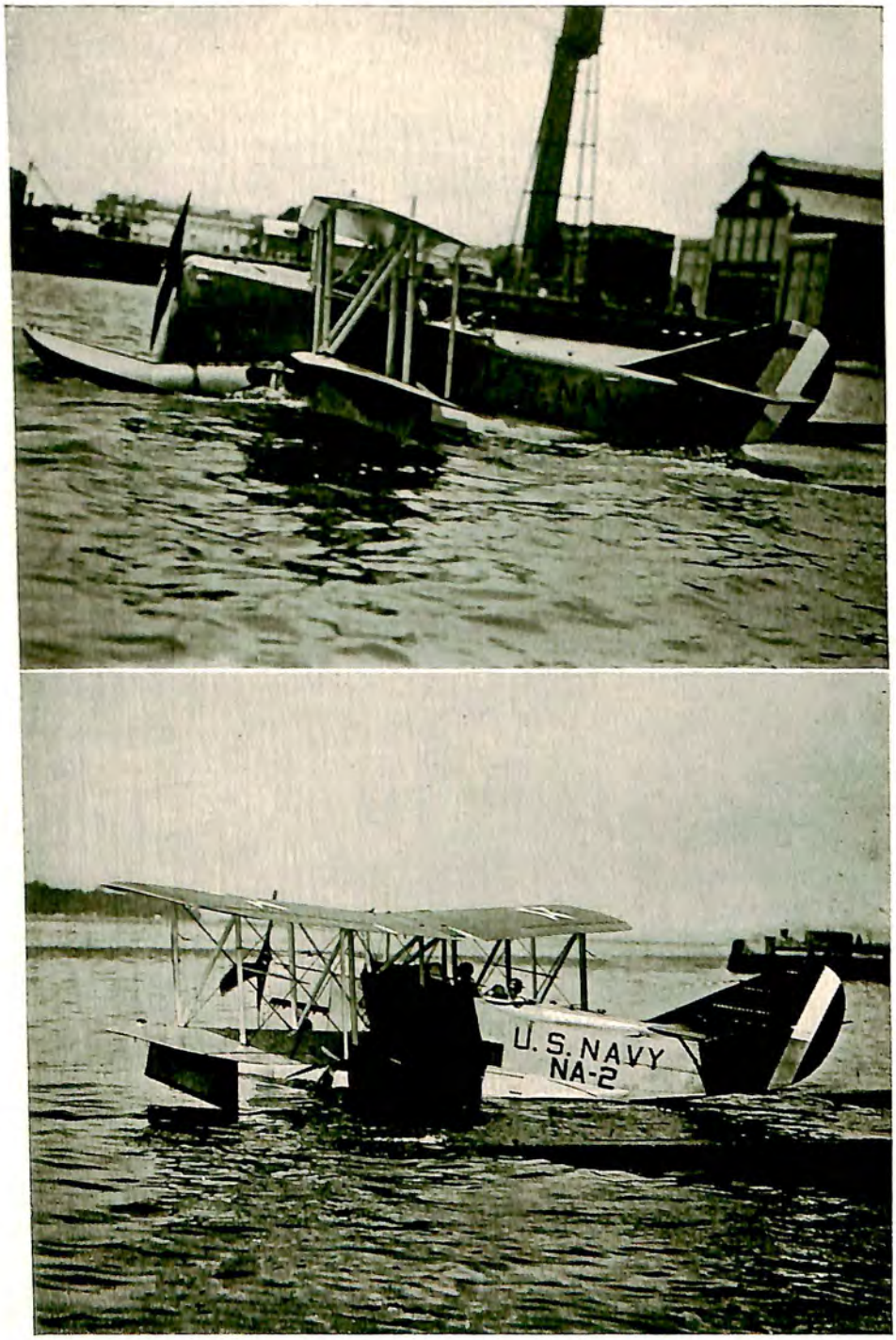
All told, 103 world flight records are recognized by the Federation Aeronautique Internationale. Of these, the United States holds fifty-four, France thirty-three, Denmark five, Czecho-Slovakia four, Germany three, Italy three and Sweden one.

In the new world records established by the United States in 1924 were some remarkable features. Among the land planes, Douglas D.-T-4s, with Wright engines and the Martin and Barling bombers, with Liberty engines, made impressive showings in duration, distance and altitude, with varying weights of useful loads.

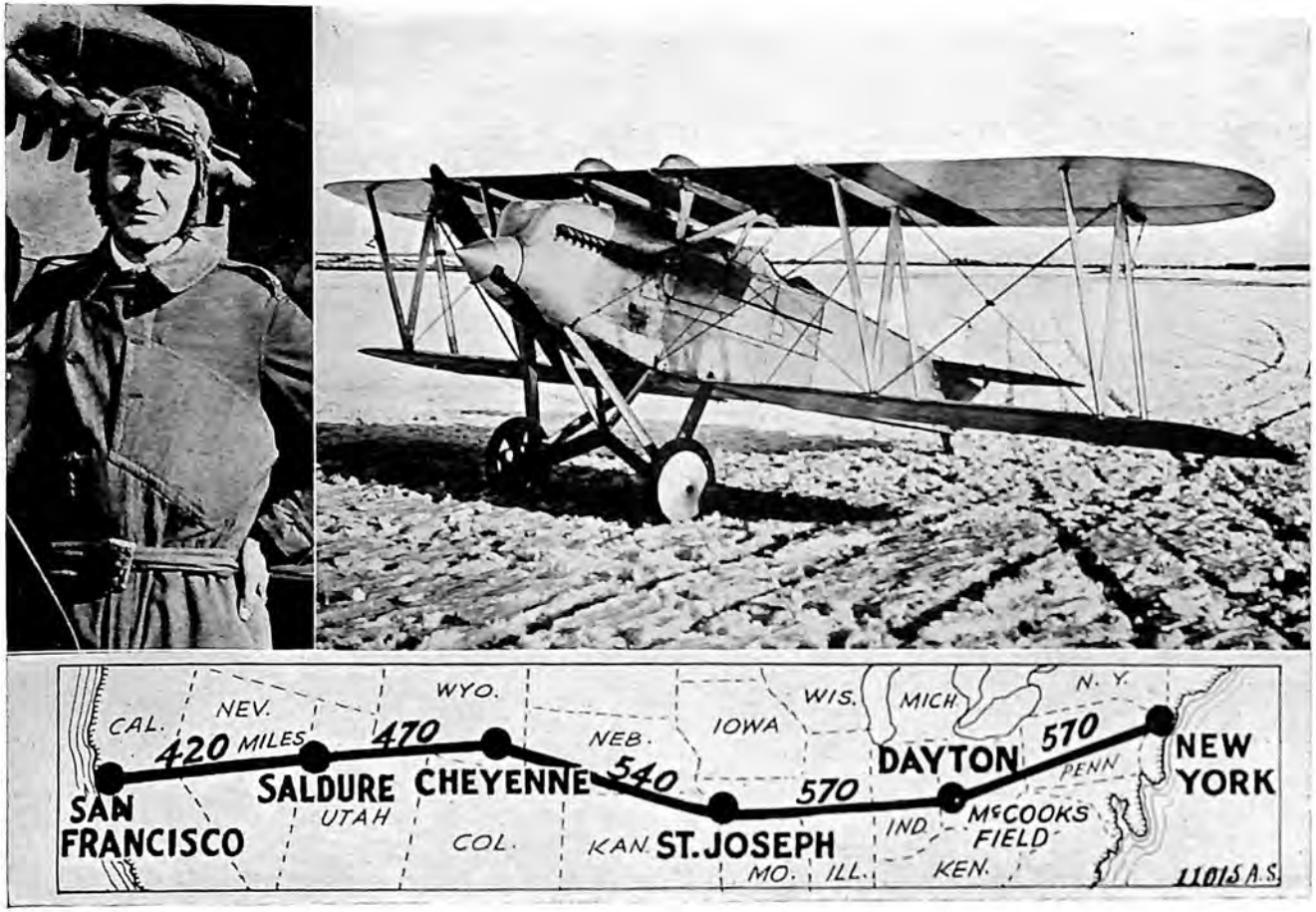
In the seaplane class, the new Curtiss C.S.-2, Wright 585 h.p. engine, made a duration record of 14 hr. 53 min. 44.2 sec.; and a distance record of 994.19 miles. A new world maximum seaplane speed record was made by the Curtiss C.R. seaplane, C.D.12 engine—188.08 m.p.h. This same plane also established new speed marks for 100, 200 and 500 km.

The Loening *Air Yacht,* Liberty engine, set a new world speed record of 101.642 m.p.h. for 1,000 km. Engineering in this craft led to the development by Loening of a new type of amphibian which, in the summer of 1925, was utilized by the Navy Department in its North Pole expedition.

Wright engines supplied power for flying boats, including the all metal hull Navy P.N., which established nine new world marks for



Loening Aeronautical Engineering Corporation's *Amphibian*, three of which are being used by Navy Department for 1925 North Pole Expedition. Plane No. 1 commanded by Lt. Comdr. R. E. Byrd who also is in command of flying end of expedition.—*Navy Bureau of Aeronautics.*



Lt. Russell L. Maughan and Curtiss Pursuit Plane in which he made transcontinental dawn-to-dusk flight.
—U. S. Air Service.

duration, distance and speed, carrying, respectively, 1,000, 1,500 and 2,000 kgs. of useful load.

To scan the above performances is, perhaps to receive the impression that the United States is supreme in record accomplishment. Such, unfortunately, is not the case. While our achievements are significant and important, the fact remains that the world records for maximum speed, altitude and duration, which in 1923 were all held by American pilots in American machines, in 1924, passed by comfortable margins to French pilots in French machines. Lt. A. J. Williams, speed of 266.59 m.p.h., made in his Navy-Curtiss Racer, was lifted to 278.48 m.p.h. Lt. J. A. Macready's altitude of 35,239 feet, was raised to 39,586 feet. Duration of 36 hr. 4 min. 34 sec., established by Lts. Macready and Oakley Kelly, was extended to 37 hr. 59 min. 10 sec.

Aeronautical engineers and military authorities generally recognize that air power rests primarily upon progressive design. That France took from the United States in 1924 certain of the more important world records—which are an indication of cruising range, climb and high speed—does not mean that the French industry has eclipsed the American. But it does mean that the French Government is more awake than is the American Government to the immediate necessities and almost certain probabilities of aviation. The loss of these coveted honors, with all that the loss implies in lack of fundamental air policy, was one of the points attracting most discussion at the hearings of the Congressional Select Committee of Inquiry into the Operation of the United States Air Services, which got under way late in the year.

Factors Essential to Aviation

In the six years that have elapsed since the close of the World War, the leading nations have had opportunity to reduce aeronautical speculation to a fairly definite form of practice. Before outlining and contrasting, briefly, the aviation situation here and abroad, it will be well to indicate in review those factors generally recognized as essential to Air Power, the Aircraft Industry and Commercial Aviation, as follows:

Air Power

1 Perception of the fact that, since the air encompasses the earth, that which operates in and controls the air, must inevitably control both land and sea.
2 Establishment within the Government of some centralized authority or some workable scheme of co-ordination, whereby the problems of the air will have specialized and sympathetic attention.
3 Provision of a national policy which will encourage the extension of the

aircraft industry upon a permanent basis, as it is recognized that the industry is the very foundation of aerial defense.

AIRCRAFT INDUSTRY

1 Establishment, through national policy, of such an understanding as will eliminate improper practices within the industry and unfair competition, either in design or construction, between the industry as a whole and the services.
2 Recognition that an aircraft or engine constructor must possess in his establishment such sound qualifications as financial responsibility, experience and skill in original engineering and adequate physical facilities for the production of equipment in quantity.
3 Recognition of the fact that the aircraft industry possesses a profitable future only in so far as it exerts itself—and is sympathetically aided through national policy—to establish a commercial market for its output.

COMMERCIAL AVIATION

1 Formulation and practical operation of a national policy which will accord to air transport those reasonable and legitimate aids in operation, such as charted airways, public terminals, lighting, communication and meteorological facilities; this policy being predicated upon and justified by our long-established national practice of developing and maintaining harbors and highways, together with incidental assistance, without which neither marine nor ground communications could have developed to their present flourishing state and vast extent.
2 Making this national policy operative through the enactment of an air law which, in addition to providing ground aids will also provide for the safeguarding of all property and personal interests, through the inspection of machines, certification of fields and licensing of pilots.
3 Placing the administration of this air law in the hands of some Governmental agency, such, as proposed, in a Bureau of Civil Aeronautics in the Department of Commerce.

AVIATION SHOULD BE REGARDED AS PRIMARILY COMMERCIAL

It may be said with little fear of contradiction that the above factors are to be found in practically every nation that is endeavoring to develop Air Power, the difference between the United States and such countries as Great Britain, France, Italy, Germany and Japan, with the possible exception of Great Britain, being that the approach to aviation abroad is primarily military and secondarily commercial, whereas in the United States it is—and let us hope ever will be—primarily commercial and secondarily military. The military urge is responsible for the apparent prosperity of air transport abroad. The lack of military urge is responsible for the apparent delay in establishing air transport in this country. But of the two positions, that of the United States will prove eventually to be the better, providing there is no further procrastination in the enactment of a national air policy.

Considering, in order, the phases of Air Power, the Aircraft Industry and Commercial Aviation, in the principal European countries, we find that in each named there has been either such a vivid realization on the part of military and naval authorities of the power of the air as to make special organization unnecessary, or, as in the case of Great Britain, a special agency has been designated to work out air problems free from the prejudices and criticisms of those who are not fully in sympathy with the idea of air defense. This has resulted in building up strong aerial forces predicated, in turn, upon the existence of a going aircraft industry. The industry flourishes according to the wisdom of the national policy in keeping the services out of the business of designing and manufacturing equipment and in the stimulation of originality on the part of the civilian engineers, with the consequent recognition of civilian design rights.

It is true that, to look at a map of Europe, with the operating air lines shown thereon, one will get the impression of tremendous activity and prosperity in civil air transport. But this is not wholly true. In the first place, these lines have been projected by military minds, and always with military objectives in view. Second, international problems which are always invited wherever there is a tinge of military policy, tend to deprive these lines of the economic support and usefulness which they would otherwise enjoy. Finally, this condition would require the payment of subsidies, even if there had been an attempt to avoid artificial stimulus.

Thus, in Europe, we find air lines heavily subsidized and enjoying, in addition, the operation of regulation and inspection through air law, the use of public terminals, beacons, communications and frequent weather information, so essential to aerial navigation in its present stage of development. In addition to Great Britain, France, Italy, and Germany, this situation is found, to a greater or less degree, in Argentina, Australia, Austria, Canada, Colombia, Czecho-Slovakia, Finland, India, Japan, the Netherlands, Norway, Soviet Russia, Spain and Switzerland.

In attempting to work out our own aviation problem, three or four features in 1924 stand out with extraordinary prominence. Foremost among these was the Select Committee of Inquiry into the Operations of the United States Air Services, appointed by Speaker Gillett. Next was the Special Committee of the Aircraft Industry, which came into being through general recognition of the fact that the industry had responsibilities of its own which it could only effectively meet by composite study and effort. Next were the most encouraging references to aviation by President Coolidge and the constructive recommendations by the National Advisory Committee

for Aeronautics and the chiefs of the Army and Navy Air Services. Of much significance, also, were remarks made at a dinner before the Economic Club of New York by Hon. Will H. Hays, former Postmaster General, and the Rt. Hon. Lord Thomson, former British Air Minister.

Attitude of the Services Toward the Industry

It is the intention and policy of the Aircraft Year Book to avoid those subjects which have to do more with military policy than they have with the industrial and commercial problems. However, these are so closely interwoven that reference to the latter requires brief mention of the former.

The report of the Special Board appointed by the Secretary of the Navy in response to direction from the President, and in connection with the widespread discussion aroused by testimony on Air Service unification before the House Committee on Military Affairs, forced public discussion of questions of military and naval aviation. In spite of the fact that this Special Board, which did not contain among its nine members a single representative of aviation, and notwithstanding most of its report was ardently framed around the conviction that the "battleship is the ultimate instrument of naval warfare," we find the following, as paragraph 270 of the report:

"Aviation has introduced a new and highly important factor in warfare both on land and on the sea. It was utilized on an enormous scale and with great effectiveness in land operations during the World War, but did not seriously influence sea operations. Its influence on naval warfare undoubtedly will increase in the future, but the prediction that it will assume paramount importance in sea warfare will not be realized."

Of the aircraft industry, the report has this to say (paragraph 190):

"The aviation industry in the United States is in a very unsatisfactory condition, the following being contributory causes:

(a) The letting of airplane contracts by competitive bidding. Awarding contracts to the lowest competitive bidder, often other than the company developing a certain plane, leaves the developing company to stand the cost of development and gives the Government a plane without giving the company a chance to recover cost of development.

(b) Lack of continuity of production in factories. This results in great upward and downward fluctuations in company pay rolls, resulting always in loss of money. This is due to lack of Government appropriations which would create a normal flow of business.

(c) Destruction of capital in the industry. Many companies operating during the war have liquidated and gone out of business. Probably two-thirds

of the capital invested at the close of the war has been wiped out or driven out of the industry."

Maj. Gen. M. M. Patrick, Chief of Air Service, in his annual report to the Secretary of War, stated:

"It is desirable and appropriate to lay particular emphasis on the unhealthy state of the aeronautical industry in the United States. No war reserve is in existence and quantity production in the event of an emergency would be almost as difficult as in 1917. Due to the lack of any appreciable use of aircraft for commercial purposes, our factories are entirely dependent for their support upon the meager appropriations provided annually by Congress for purely governmental purposes. If this deplorable situation is to be corrected, it must be in the first place through increased appropriations for the aeronautical agencies of the War, Navy and Post Office Departments, coupled with authority for those in charge to allocate orders for aircraft without resorting to competitive bids, and in the second place, through the enactment of legislation designed to insure the development and growth of commercial aviation."

At the close of 1924 it was estimated that the Army and Navy Air Services had in their employ about 2,500 civilians each, most of these being used in the service aircraft engineering, construction and repair plants. These 5,000 civilians considerably outnumbered all the operatives in all the private aircraft plants at that time.

Recommendations of National Advisory Committee for Aeronautics

The National Advisory Committee for Aeronautics, which reports directly to the President, and whose opinions, in consequence, are of great significance and influence, in its report to President Coolidge presented some admirable suggestions for a national policy concerning the aircraft industry and its relation to national defense. Here are salient excerpts:

"The present American aircraft industry is but a shadow of that which existed at the time of the Armistice. With the great stimulus in aircraft development and performance during the war, the aircraft manufacturers were hopeful that civil aviation would rapidly come into being with a resulting great demand for their product. Civil aviation has not developed as it was hoped it would, and this makes the situation more difficult. The aircraft manufacturers have had to rely for orders upon Government agencies, and the limited amount of governmental purchases has forced a number of manufacturers to go out of the aircraft business. It is a matter of grave concern lest the productive capacity of the industry may become so far diminished that there may not remain a satisfactory nucleus. By a 'satisfactory nucleus' is meant a number of aircraft manufacturers, distributed over the country, operating on a sound financial basis, and capable of rapid expansion to meet the Government's needs in an emergency."

In the Appendix will be found the complete text of the National Advisory Committee's report on the aircraft industry. The Committee makes certain definite recommendations, among which are the following:

"STEPS TO BE TAKEN BY THE INDUSTRY:

"First, every manufacturer intending to remain in the aircraft business and who has not readjusted his war-time plant and overhead expenses to a peace-time basis should do so without further delay.

"Second, the firms comprising the aircraft industry should specialize in the production of various types of aircraft with a view to the more continuous development of types by the same plants and the gradual recognition of proprietary rights in new designs.

"STEPS TO BE TAKEN BY THE GOVERNMENT:

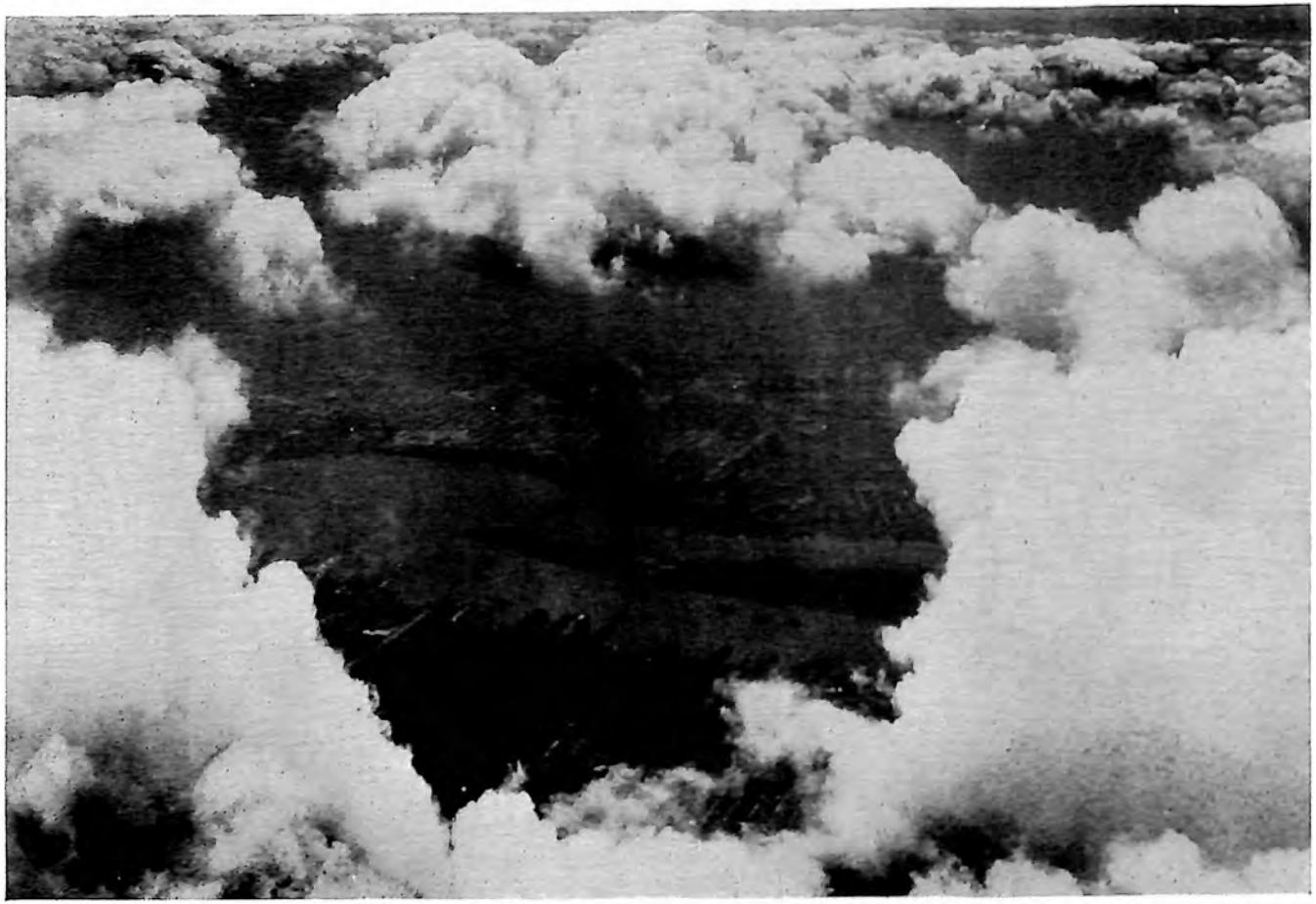
"First, the Army, Navy, and Postal Air Services should agree upon a balanced program setting forth from time to time the probable requirements of the Government for each type of aircraft for at least one year in advance, and should announce the same to the industry for its information and guidance.

"Second, orders for the different types should be placed with the different manufacturers at such intervals as to insure continuity of production and the gradual development of special facilities and skill by each manufacturer in the production of a given type of aircraft."

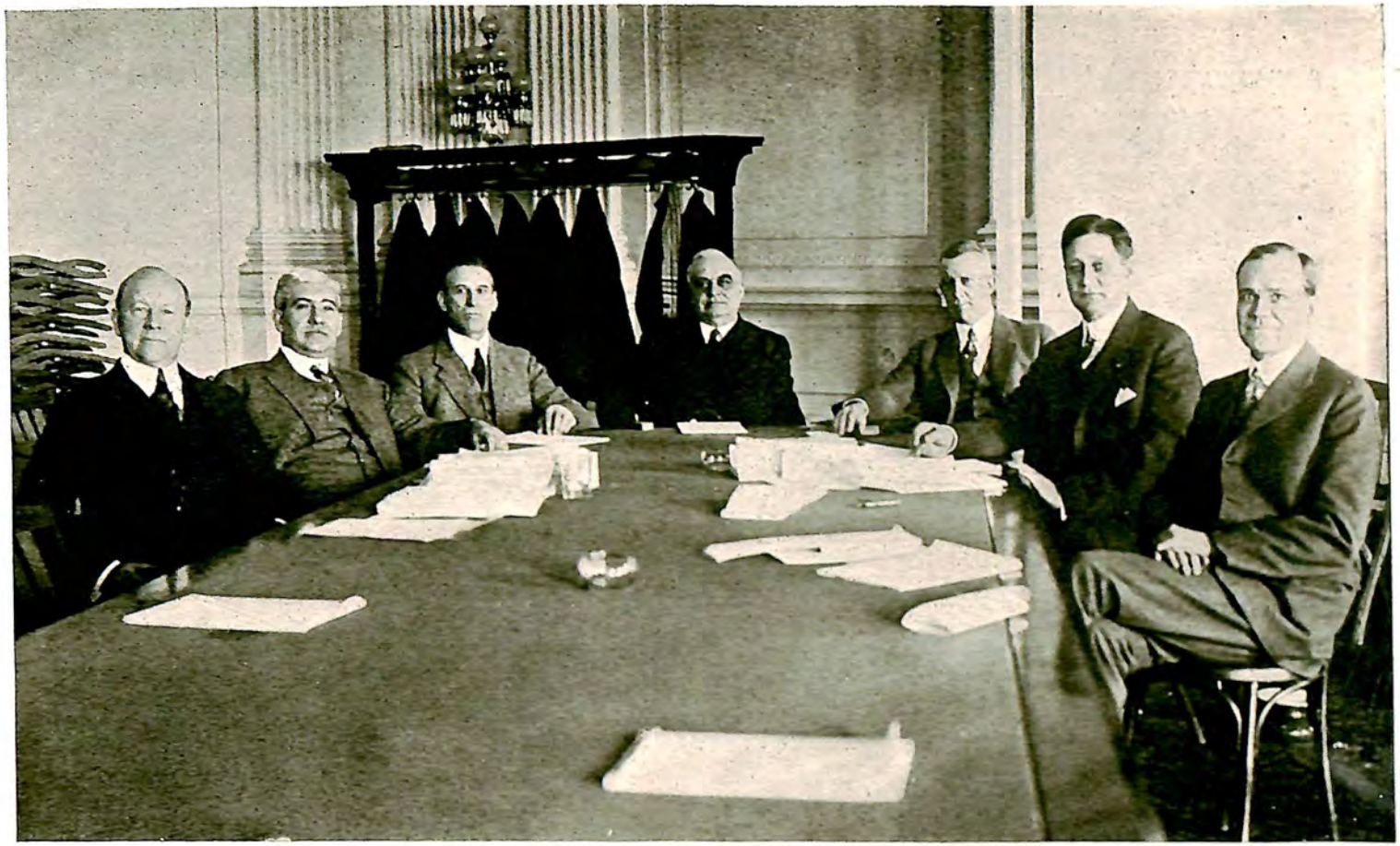
A CONSTRUCTIVE CONGRESSIONAL INQUIRY

On March 24, 1924, there passed the House of Representatives, H.R. 192, calling for another general aircraft investigation—the tenth, or possibly the twelfth since the Armistice. The language of this resolution was broad, leaving very largely to the discretion of such committee as should be appointed in what manner and how far the investigation should be conducted. Speaker Gillett accordingly appointed a Select Committee of Inquiry into the Operation of the United States Air Services, choosing the Republicans largely from the standing Committee on Patents, of which Florian Lampert, of Wisconsin, is chairman. Mr. Lampert consequently became chairman of the investigating body. His Republican associates were: Albert H. Vestal, of Indiana, the Republican "whip"; Randolph H. Perkins, of New Jersey; Charles L. Faust, of Missouri, and Frank R. Reid, of Illinois. The Democrats selected were Clarence F. Lea, of California, who had already served through one major aircraft inquiry; Anning S. Prall, of New York; Patrick B. O'Sullivan, of Connecticut, and William N. Rogers, of New Hampshire.

At its first formal meeting on Aug. 4, the committee authorized Congressman Lampert to make public a statement of policy as defined



Illustrating how clouds may hide from view an invading aerial fleet. Photograph by *Underwood & Underwood* over Philadelphia and Camden.



Congressional Select Committee of Inquiry Into Operations of the United States Air Services. (Left to Right): Representatives, Randolph Perkins, of New Jersey, Chief Examiner and Chairman Sub-Committee on Procedure; Albert H. Vestal, of Indiana, Republican "Whip"; Clarence F. Lea, of California; Florian Lampert, of Wisconsin, Chairman; Anning S. Prall, of New York; Charles L. Faust, of Missouri, and Frank R. Reid, of Illinois.—*Underwood and Underwood.*

and agreed upon by the committee. In this statement appeared the following:

"In the light of recent happenings, the word 'investigation' is very apt to be thought of as being synonymous with mud-slinging and muck-raking. This is not to be that sort of an investigation. A constructive and not a destructive investigation is the desire of the committee."

From this sound standpoint the committee approached its work. Its inquiry lay along three general lines: the Services, the Aircraft Industry and Commercial Aviation. Immediately upon organization, the committee chose a Sub-Committee on Procedure consisting of Mr. Perkins (chairman), and Messrs. Faust and Lea. Mr. Perkins was also chosen as Chief Examiner for the committee as a whole, and during the entire life of the committee he bore the burden of questioning which, when concluded, in the case of each witness, was followed by cross-examination entered into largely by Messrs. Lampert, Faust, Reid, Lea and Prall. Practically every important figure in governmental, industrial and commercial aviation was heard and it was not many days before the committee had before it opposing views of a highly controversial and somewhat sensational character concerning the state of our air defenses, our alarming deficiency in equipment, the starvation of the industry, the requirements for commercial air transport and, woven in and out arguments pro and con regarding the establishment of a Separate Department of Aeronautics or a Department of National Defense, with land, sea and air branches co-ordinate. With these political phases the Aircraft Year Book is not concerned, especially since the committee, in the closing days of the Sixty-Eighth Congress, received permission from the House to postpone filing its report until the opening of the Sixty-Ninth Congress, in December, 1925. References in this volume, therefore, will properly be confined to quotations from testimony concerning industrial and air transport needs, and to personal views of certain of the committee, which, possibly, give an indication of what turn the complete report will take.

Views of Weeks, Wilbur and Patrick

Asked specifically by Chief Examiner Perkins what he would suggest for the betterment of the aircraft industry, Gen. Patrick said:

"In some way arrange so that orders can be placed with these manufacturers, possibly at the discretion of the Secretary of War, or in some other way that the committee might devise, that would give the manufacturers an assurance of continuity in their work."

Cross-questioning Secretary of the Navy Wilbur, Congressman Faust said:

"The idea has been advanced here, Mr. Secretary, that it might be helpful to pattern after some of the other great powers, in having a selected list of manufacturers of various types of airplanes; men chosen, or companies or corporations chosen because of their plants and capacity; and that, by so doing we would encourage the industry in manufacturing airplanes, and that those plants might very readily lend themselves to expansion in time of war or other necessity. That has been suggested as an alternative to the competitive bidding."

To this Secretary Wilbur replied:

"Well, I think that the officers in connection with the Department would say at once that a plan of that kind would be much more satisfactory to them in dealing with this problem, because it would enable them to encourage skillful engineers to the development of the plant. It would enable them to distribute work so that the various plants would be maintained and get appropriations with the view of patronizing the worthy manufacturers."

As to the recognition of design rights, Secretary Wilbur said:

"The idea advanced by the Bureau of Aeronautics is that where a manufacturer has developed a type of plane and put in inventive genius and skill, even if it was not technically patentable, there is a proprietary right, perhaps, which should be recognized as entitling him to the preference. I think the Bureau of Aeronautics would be very glad to recognize such proprietary right by patronizing the people making such a claim."

Secretary of War Weeks, replying to questions by Chief Examiner Perkins, said:

"We must maintain the aircraft manufacturing industry. It is essential that we keep the aircraft industry going, especially those that are maintaining good engineering staffs. . . . I think it is to the direct interest of the War Department and the Government that these people make money on their contracts. I do not think it is a thing that we should encourage,—their taking contracts at losing prices. . . ."

As to competitive bidding, in response to inquiry from Congressman Lea, Secretary Weeks said:

"We try to encourage those who are maintaining engineering staffs which are likely to develop new things which will be of advantage to the service."

Congressman Reid's Exposure of Expenditures

When the taking of testimony of Cabinet officers was in progress, Congressman Reid startled his colleagues with the assertion, which was substantiated by official figures, that, in the five fiscal years, 1920–24, inclusive, the total aviation expenditures footed up $433,383,287.21. Mr. Reid said:

"For five years——practically since the Armistice—Congress has been criticized for failure to appropriate enough money for aviation. The decline of the industry, the woeful state of our air defences, and the prolonged delay in the appearance of commercial flying are continually laid at the door of Congress, until we ourselves have almost begun to believe it is true. The War and Navy Departments each year have come to Congress and have asked for appropriations largely on the plea that commercial aviation and a civil aircraft industry are vital to our air defenses. But, here we are, with no commercial flying except the Air Mail, and with a fragment of an aircraft industry, yet confronted with the certainty that air transport in time of peace and air power in time of war, are the great potential factors in our life in the near future. It would seem that if commercial aviation is basic and imperative we ought to spend more on it and less, proportionately, on military establishments. Furthermore, where many agencies are spending money for aviation there is bound to be duplication and waste. It is like pouring water into a leaky barrel to continue to appropriate money for aviation without having first formulated and enacted a national air policy."

A short time afterward—early in January, 1925, Mr. Reid made an unsuccessful attempt to eliminate from the pending appropriation bill a $500,000 item for enlarging the Army Air Service's experimental engineering station at Dayton, O. At the same time he endeavored, without success, to bring about the adoption of an amendment authorizing Government departments to purchase aircraft without competitive bidding, specifically limiting such purchases to "commercial aircraft manufacturing corporations in this country, in which none of the stock is directly or indirectly held, owned or controlled by foreigners." In presenting his amendment, Mr. Reid said:

"Instead of adopting, immediately after the Armistice, a continuing policy of procurement, both army and navy services have permitted themselves to get in a condition whereby, when it suits their convenience, they insist on purchasing aircraft through cut-throat competitive bidding, or, if they desire to punish one manufacturer or favor another, they can find excuses under the law, which permits buying proprietary designs or patented articles without competition, to allocate orders as they see fit. In the testimony of both General Patrick and Admiral Moffett, statements were made, first that it was the desire of the departments to get away from competitive bidding, and that the assistance of the committee was requested to this end to amend the law, and second, that the rule of competitive bidding was not always followed. I am convinced that it is the desire of the departments to clear up this confusion and I am convinced that it is imperative for public policy to do so. Under existing Legislation: (U. S. Comp. Stat. 1916, 6869, U. D. 3721, Purchase without Advertisements), the navy department is authorized to purchase in the open market without advertisements or competition, such items so essential to the national security, as cheese, butter, tobacco and ordnance. What I propose to do is to give aircraft, which constitutes today the dominant arm, the same consideration as is accorded big guns that are obsolete, and cheese, butter and tobacco."

Co-operation Between the Aircraft Industry and the Air Services

Before passing to the commercial aviation phases of the inquiry consideration should be given to the efforts made in 1924 by the aircraft industry to set its own house in order.

The genesis of the successful accomplishment of a co-operative arrangement between the entire aircraft industry as a unit and the Government air services, which was initiated in the latter part of 1924, may properly be traced to a dinner given Jan. 21, at the Racquet Club, Washington, D. C., in honor of Commander James Bird, Managing Director of the Supermarine Aviation Works, Ltd., Southampton, England, and Treasurer of the Society of British Aircraft Constructors. The dinner was given by the aircraft industry, both members and non-members of the Aeronautical Chamber of Commerce and was attended, as co-guests of honor with Commander Bird, by officers of the Army and Navy Air Services, including Maj. Gen. Mason M. Patrick and Rear Admiral William A. Moffett. Group Capt. M. G. Christie, British Air Attaché, was present in an unofficial capacity.

Commander Bird's lucid and convincing statement of the co-operation between the Society of British Aircraft Constructors and the British Air Ministry, evoked a frank discussion, during which comments were made by both officers and civilians concerning defects in and possible remedies for the industrial aviation situation in the United States. The practices followed in Great Britain, as well as those in France and Germany, are touched on elsewhere in this chapter, so it is sufficient here to state that out of this dinner there grew a fairer understanding of the American problems, and, what is more important, mutual appreciation of difficulties encountered on the one hand by the aircraft manufacturer, struggling to keep his plant going, and on the other by the Government procurement officer, limited by law and embarrassed by limitations of appropriations.

Conference Called by Maj. Gardner, Publisher of Aviation

The constructive activity of the Congressional Select Committee of Inquiry into the Operation of the United States Air Services, which assumed growing importance late in the Fall, led naturally to a reawakening both in the services and the industry. Out of the scattered discussions that took place from time to time there developed a general desire to get together for more formal consideration of the matter. At this point, Maj. L. D. Gardner, publisher of *Aviation,* who, as a former Air Service officer, possessed sympathetic

understanding of the whole problem, took the initiative and invited aircraft and engine constructors to a luncheon on Dec. 1, 1924, at the University Club, New York. To this conference he also invited Hon. Will H. Hays, President of the Motion Picture Producers and Distributors of America, and Frank C. Schmitz, General Manager of the Mahogany Association. Both Messrs. Hays and Schmitz had had experience, in their respective industries, along lines somewhat similar to those encountered by the aircraft manufacturers. In addition, Mr. Hays, as Postmaster General at a time when the Air Mail Service was reorganized to its present efficient and expanding basis, possessed a rather intimate knowledge of the situation in its broader aspects. There were present at this original conference, the following:

Inglis M. Uppercu, President, Aeromarine Plane & Motor Co.
Carl B. Fritsche, General Manager, Aircraft Development Corp.
Lorillard Spencer, President, Atlantic Aircraft Corp.
J. L. Callan and Beckwith Havens, Airships Incorporated.
Edgar N. Gott, President, Boeing Airplane Co.
Reuben H. Fleet, President, Consolidated Aircraft Corp.
C. M. Keys, President, and F. H. Russell, Vice President, Curtiss Aeroplane & Motor Co.
A. J. Elias, President, G. Elias & Bro., Inc.
C. F. Stone, Goodyear-Zeppelin Corp.
Sidney Newburg, Huff, Daland & Co.
A. P. Loening, Vice President, Loening Aeronautical Engineering Corp.
Glenn L. Martin, President, the Glenn L. Martin Co.
L. M. Woolson, Packard Motor Car Co.
Raymond Ware, Secretary, Thomas-Morse Aircraft Corp.
Chance Vought, Chance Vought Corp.
Charles L. Lawrance, Vice President, Wright Aeronautical Corp.
S. S. Bradley, General Manager, Aeronautical Chamber of Commerce.

Following talks by Mr. Hays and Mr. Schmitz, there was general discussion, as a result of which it was unanimously decided that the time had come for the industry to work together in greater sympathy and that, to this end, a Special Committee of the Aircraft Industry should be appointed. The following committee was thereupon chosen: C. B. Fritsche, A. P. Loening, Glenn L. Martin, F. H. Russell, Chance Vought and Charles L. Lawrance. S. S. Bradley was chosen Secretary of the Committee. The committee immediately organized and chose Mr. Lawrance as Chairman.

Encouraged by President's References to Aviation

At this general conference a resolution was adopted, copies later being circulated among those units of the industry not present. This resolution reads:

WHEREAS, the President of the United States, in his Message to the Congress transmitting the Budget, has said:

> "Aside from the important factor of training personnel, our National Defense is largely an industrial problem. Today the outstanding weakness in the industrial situation as it affects National Defense, is the inadequacy of the facilities to supply air service needs. The airplane industry in this country at the present time is dependent almost entirely upon Government business. To strengthen this industry is to strengthen our National Defense;" and

WHEREAS, the Aircraft Industry, sensing its duty in this regard, purposes fullest co-operation to that end.

NOW, THEREFORE, BE IT RESOLVED, that we, the undersigned, representing the Aircraft Industry in the United States of America, proceed immediately to the consideration of what should be done to enable us to ascertain and develop a sounder policy within the Aeronautical Industry, so that closer co-operation between the Government and the Industry may obtain through relations of such character and on such a sound basis as will permit the safe and economical expansion of the industry and the development of military and commercial aeronautics, and thus provide the essential nuclei for production of service types for the National Defense and Emergencies.

To this resolution the following units in the aircraft industry gave their complete endorsement; signatures being by the officials named:

Aeromarine Plane & Motor Co., Keyport, N. J. Inglis M. Uppercu, President.
Aircraft Development Corp., Detroit, Mich. C. B. Fritsche, General Manager.
Airships Incorporated, Hammondsport, N. Y. J. L. Callan, President.
Atlantic Aircraft Corp., Hasbrouck Heights, N. J. Lorillard Spencer, President.
Boeing Airplane Co., Seattle, Wash. E. N. Gott, President.
Vincent J. Burnelli, New York. Vincent J. Burnelli.
Consolidated Aircraft Corp., Buffalo, N. Y. R. H. Fleet, President.
Cox-Klemin Aircraft Corp., Baldwin, L. I. L. Charles Cox, President.
Curtiss Aeroplane & Motor Co., Garden City, L. I. F. H. Russell, Vice President.
Douglas Company, Santa Monica, Cal. Donald W. Douglas, President.
G. Elias & Bro., Inc., Buffalo, N. Y. A. J. Elias, President.
Goodyear-Zeppelin Corp., Akron, O. Edw. G. Wilmer.
Charles Ward Hall, Inc., New York. Charles Ward Hall.
Huff, Daland & Co., Ogdensburg, N. Y. Thomas H. Huff, President.
Johnson Airplane & Supply Co., Dayton, O. J. M. Johnson.
Loening Aeronautical Engineering Corp., New York. A. P. Loening, Vice President.
Glenn L. Martin Co., Cleveland, O. Glenn L. Martin, President.
Packard Motor Car Co., Detroit, Mich. J. G. Vincent.
Lawrence Sperry Aircraft Corp., Farmingdale, L. I. Robert Simon, Secretary.
Stout Metal Airplane Co., Detroit, Mich. William B. Stout, General Manager.

Chance Vought Corp., Long Island City, L. I. Chance M. Vought, Assistant Treasurer.
Wright Aeronautical Corp., Paterson, N. J. Charles L. Lawrance, Vice President.

The Special Committee headed by Mr. Lawrance, met at frequent intervals, numbers of times with Mr. Hays. Conferences were arranged with the Secretary of War and the Secretary of the Navy, following which the committee, in response to an invitation from President Coolidge visited the White House for a brief report and discussion of the progress being made. Later, in accordance with the suggestion made at the meetings with the President and Secretaries of War and Navy, the study of specific questions of detail were taken up with the respective services through the Assistant Secretary of War, Col. Dwight F. Davis, and the Assistant Secretary of the Navy, Hon. T. Douglas Robinson.

The committee's labors were dual. They had first to consider policies for the guidance of the aircraft industry, and then to suggest a governmental policy in reference to aircraft development and procurement. Early in 1925 the special committee presented to meetings of the industry as a whole drafts of the two subjects, and late in February and early in March the final text of the industry's policy was formally approved and signed at a general meeting of the industry, and the final text of suggestions for a governmental policy was endorsed by the Assistant Secretaries of War and Navy, in conferences with the special committee, as follows:

Policies for Guidance of Aircraft Industry

The policies for the guidance of the aircraft industry read as follows:

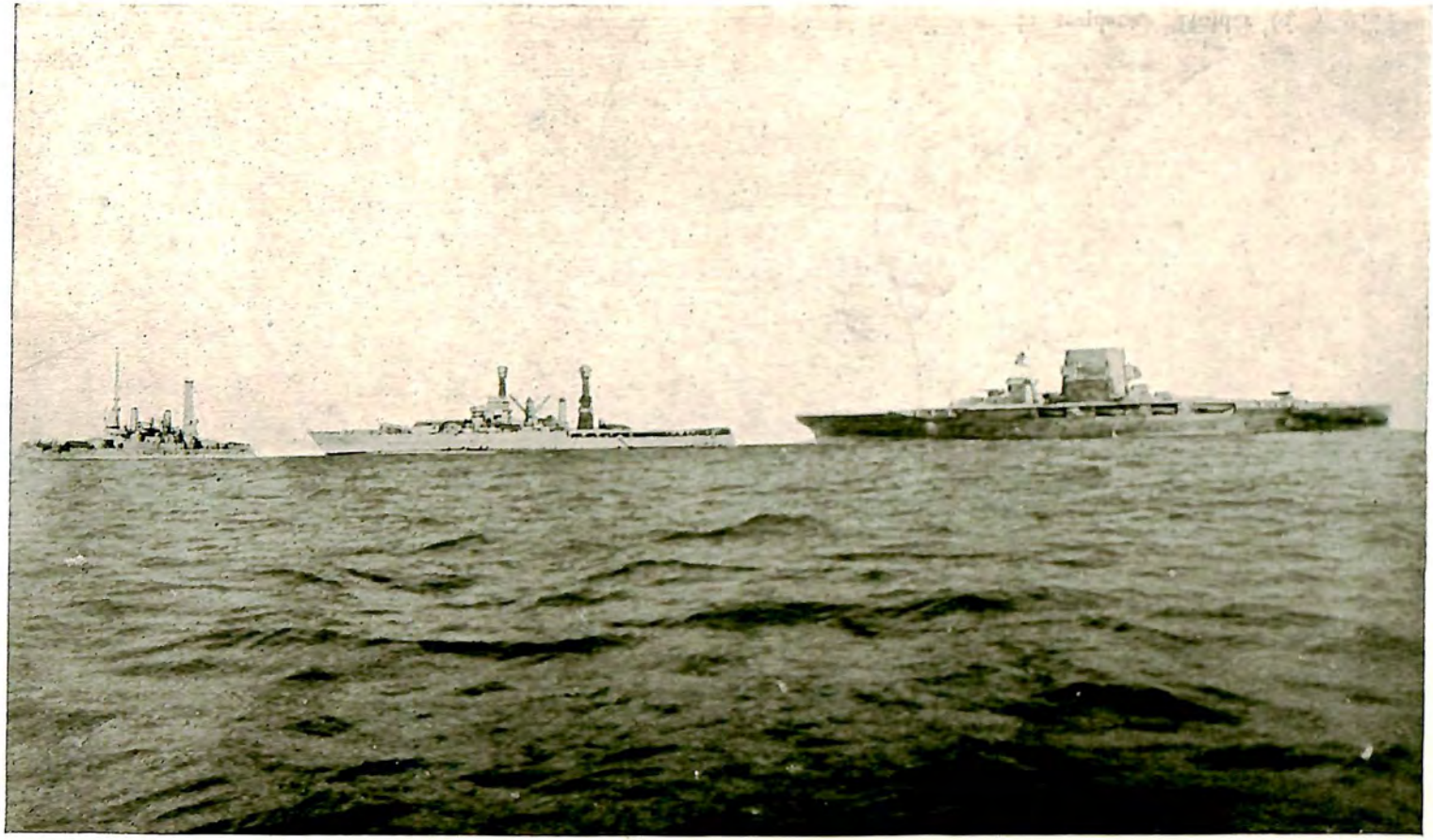
1. Each manufacturer shall maintain a spirit of confidence and cordial co-operation in all relations with other manufacturers in the aircraft industry. All differences of opinion or acts constituting a basis for complaint or violation of this principle, shall be at once frankly stated by the complainant to the manufacturer against whom complaint is noted. A manufacturer, upon receiving a complaint from another manufacturer, will at once give it courteous and careful consideration. If the matter complained of can not be promptly composed by the parties immediately interested, the question shall be at once referred to arbitration.
2. Each manufacturer of aircraft, aircraft motors and special aircraft equipment, shall maintain as the basis of satisfactory and progressive development within the industry, capable and efficient staffs and experimental facilities adjusted to the peace time requirements of the Government, yet capable of quick expansion for emergency needs.

3. The "design rights" principle shall be paramount. Each manufacturer will honor the design rights of others. In order to improve the quality and performance of their products and effect economies to the Government, each manufacturer will tend toward specialization in types, so that maximum progress along their several and distinct lines may be realized with the least possible duplication of effort and with competition based upon engineering and designing skill, as well as competition of manufacturing ability and price.
4. The creative facilities of the industry will co-operate in every practicable manner with the engineering departments of the Services, in order to meet as nearly as possible the needs of the Government.
5. Every unit of the industry shall take pride in maintaining the highest standard of excellence of its products and to this end shall maintain the most rigid inspection and control of production in all stages of fabrication. The industry, through a realization of the fact that the responsibility for its products does not end with payment, shall maintain service in the field, in order to secure the successful performance of its products and at the same time provide for progressive development and improvement.
6. Each manufacturer shall accept the principle of sub-contracting within the industry—the creator retaining engineering control and contractual relations with the Government—as a basis of maintaining proper balance of production throughout the industry.

Suggestions for Governmental Policy

The suggestions for a governmental policy read as follows:

1. The Government shall encourage and promote the design and manufacture, by other than Government agencies, of aircraft, aircraft engines and equipment. The Government shall not engage in such work in competition with the aeronautical industry.
2. The Government shall recognize and sustain the principle of proprietary design rights applied to all aeronautical material.
3. The Government will not purchase or acquire the design rights for aircraft, aircraft engines or accessories when these are the products of established manufacturers.
4. The Government will not purchase aircraft, aircraft engines or accessories of new design until after the actual articles have been presented for test, nor until said articles have demonstrated their superiority over existing and accepted standard types, unless the design project is of such magnitude as to demand Government assistance in its development.
5. The Government shall avail itself as much as practicable of the facilities of the industry for all major overhauling and reconstruction.
6. The Government shall co-operate with the industry toward the continuance of successful operation of its units and wherever necessary recognize the principle of sub-contracting within the industry itself.
7. The Government will continue the policy of conferring from time to time with the accredited representatives of the industry in the consideration of their mutual problems.



Three generations of fighting ships (Left to Right) Battleship *Oregon* of Spanish War fame; Dreadnought ***California;*** Aircraft Carrier *Saratoga* launched in April 1925.—*Navy Bureau of Aeronautics.*

Navy Curtiss C.S.2, Wright engine. Three purpose, scouting, bombing and torpedo seaplane. Holder of World's records for seaplane endurance and distance flown in non-stop flight.—*Navy Bureau of Aeronautics.*

8. The Government shall, as far as possible, standardize aeronautical accessories, materials and hardware and otherwise assist in the procurement of non-standard materials and supplies.

Both of the foregoing suggestions of policy were subsequently presented to the Congressional Select Committee of Inquiry into the Operations of the United States Air Services.

The Special Committee of the Aircraft Industry, as this volume goes to press, is continuing its labors in the application of these policy suggestions to practical ends.

England Urges Commercial Aviation as Basic

There is very little, if any, difference between consideration of problems of the aircraft industry and those of commercial aviation. It is helpful, at this point, therefore, to refer briefly to remarks made at an aviation dinner given by the Economic Club of New York, at the Hotel Astor, Jan. 16, 1925.

The Rt. Hon. Lord Thomson, former Secretary of State for Air in Great Britain, said:

"Everything (in England) is under one man. We tried other methods in the war, and in the stern test of war we were forced, before it ended, to concentrate all military, naval and air force activities under one directing head. And now, and indeed almost immediately after the war, we found it necessary to even put to a certain extent commercial aviation under the Secretary for Air. . . . Now, as I understand it, any country which wishes to keep its pace in the van of progress will have to get the habit of the air, and I should be very sorry to be Air Minister in ten years' time if there was a war in Europe and if, behind the Air Force that was being directed by the Air Staff in London, there was not a commercial aviation service whereby one could, in various concentration centers, find pilots, factories for machines, reserves for mechanics, and all those human and material factors which go to make up a reserve. No central Air Force, however costly, however well organized, could possibly cope with the situation which will arise in Europe if there is a European war, because the air will be the first line of defense and the first line of attack in all countries. You might survive the first three weeks, but it will be on those reserves inside of your country, on the factories, on the civilian population, that will depend whether you will survive the first six months, and victory in the air is largely dependent on the existence of a commercial air service behind a military air service."

Suggestions by Former Postmaster General Hays

On the same occasion, Hon. Will H. Hays, former Postmaster General, was unsparing in his constructive criticism of both the Government services and the aircraft industry. He said:

"Preaching commercial aviation, we have failed utterly to develop it. . . . The industry itself has definite duties to perform. *It must be united upon the basis of confidence and co-operation, recognizing that it is not primarily a munitions industry.* It must develop and practice a code of proper conduct squaring always with right principles and calculated to aid itself in the discharge of its duties and the development of its maximum usefulness. The industry itself must give complete and absolute adherence to the design rights principle. It can not be expected that the buyers of aircraft will respect proprietary rights if the manufacturers themselves ignore them. The protection of proprietary rights carries with it the presumption that the industry must maintain competent and active design staffs, capable of developing new and progressive types, adjusted to peace-time requirements, yet capable of quick expansion for emergency needs, and each manufacturer must establish and maintain the highest standards of excellence in his product based upon the highest type of engineering and manufacturing skill—and backed by the most rigid and intelligent inspection. There must be competition based upon engineering and designing skill as well as competition of manufacturing ability and price. The manufacturer must take upon himself the responsibility for his products and service. It is as important that aircraft remain sold and capable of operation after sale as it is to sell them. *The industry must immediately direct its best attention and its most consummate skill to the development of types for commercial use, and prove by its performance its faith in its profession that it is not a munitions business; and prove its faith, too, in the future.*"

In speeches responding to those of Mr. Hays and Lord Thomson, Gen. Patrick and Capt. Geo. W. Steele, on behalf of the Army and Navy Air Services, respectively; and Charles L. Lawrance, as President of the Aeronautical Chamber of Commerce and Chairman of the Special Committee, expressed their determination effectively to solve all problems.

National Advisory Committee on a Commercial Policy

Reverting to the annual report of the National Advisory Committee for Aeronautics one finds the following recommendation covering commercial aviation:

"Rapid development of commercial aviation is primarily dependent upon the increasing reliability and economy of aircraft. Other countries, notably England and France, have encouraged commercial aviation by direct subsidies, and their experience has indicated that unless governmental aid is given, directly or indirectly, commercial air transportation can not be financially successful in the present state of aviation development. Legislation providing for the reasonable regulation of aircraft, airdromes, and aviators, and affording necessary aids to air navigation along designated national airways, would be most helpful. The establishment of landing fields generally would also stimulate improvement in the reliability and economy of aircraft operation and facilitate the development of commercial air transportation in this country on a sound basis."

The Select Committee of Inquiry into the Operation of the United States Air Services devoted much time and thought to the consideration of commercial aviation, calling on many recognized figures in public life, in banking, railway and steamship transportation, express and industry.

Secretary Hoover's Recommendations

Secretary of Commerce Hoover was explicit in his recommendations that the Federal Government or municipalities should provide for commercial aviation such aids as fields, airways, lights, etc., as is shown by the following:

> Congressman Faust: "But generally—I take it it is your opinion that the Government should stimulate commercial aviation?"
> Secretary Hoover: "I think there is no question about it. First, for defense purposes, as obviously it is a necessary adjunct to maintain personnel and equipment, and secondly because of the valuable results that would come from successful commercial aviation development."
> Congressman Lea: "At the present time the airplane concern is handicapped not only by the high cost of transportation, but a lack of airways and airdromes and facilities for operation."
> Secretary Hoover: "Yes, I think we have here the same thing that we see in the development of any other form of transportation. You do not have business until you have got the transportation agency. One has to get the start somewhere."
> Congressman Lea: "It is practically impossible for an ordinary concern to establish all these agencies that are essential to profit making?"
> Secretary Hoover: "Quite."
> Congressman Lea: "And that is the field of the Government, largely, is it not, to provide the routes, and, to a large extent, the accommodations?"
> Secretary Hoover: "I think so. I think it has got to be done by the public in some fashion. For instance, your landing fields would probably be developed by municipalities much as most of the ports of the United States have been developed by municipalities, but the Government would need to install what you might call the aids, lighting, a study of air currents, determination of routes and materials of that kind much as we have done in water navigation."

Bankers Give Their Views on Aviation

During its sittings in New York, the Congressional Committee heard, among others: Raymond E. Jones, First Vice President, Bank of the Manhattan Company; Francis H. Sisson, Vice President, Guaranty Trust Co.; John W. Newlean, Vice President and Treasurer, American Railway Express Co., who presented also the written views of Robert E. M. Cowie, President; A. G. Smith, President,

American Steamship Owners' Association and President, the Ward Line; and Howard Elliott, Chairman of the Board, Northern Pacific Railway, and a director and member of the executive committee of the Chicago, Burlington & Quincy, New York, New Haven & Hartford and Colorado & Southern railways.

"In my opinion," declared Mr. Jones, "the way for us to get ahead is to prepare along commercial lines. Commercial aviation is basic. I think the Air Mail has demonstrated itself to be of enormous benefit to all business, especially to banking."

"I have been very much impressed with the necessity of developing commercial aviation in this country, both as a business proposition and as an arm of the national defense," said Mr. Sisson. "We use the air mail service in our institution and at times find it most important. We would be glad to see it perfected and possibly cheapened. . . . In the transmission of such things as valuable papers and first-class letter mail, where it is important to get it to its destination hurriedly, we have found it most convenient to use the air mail and we have found the service of inestimable value."

Mr. Cowie, in a telegram read to the committee by Mr. Newlean, said:

> "In my opinion the establishment of commercial aviation is of the utmost importance in the development of air power as national defense, and the Government should encourage commercial aviation by furnishing without cost the use of landing and starting fields, beacon lights and other paraphernalia essential for successful flying, in the same manner as they do navigation, by lighthouses, life saving stations, ocean charts, etc. Commercial aviation should be rated in importance, first for handling emergency express shipments, second for handling mail, third for handling passengers. Commercial aviation is purely a business proposition. Flying has been accomplished and the thing remaining to be done is to adapt this facility to commercial purposes. We are ready to consider contractual arrangements for air service as soon as any dependable, well set up and strongly financed organization can furnish us the service, preferably beginning with a route between New York and Chicago with night flying."

Mr. Smith, who was a member of the Department of Commerce's committee on the co-ordination of rail and water transport, said: "I have thought that in the matter of transportation, leaving aside all carriage of heavy material, which I assume is not involved, and dealing particularly with postal matter, letters, packages, and perhaps bullion, specie, gold—I am speaking particularly of any commodities of that sort—I think that arrangements could be made whereby there would be co-ordination between the railroads, the steamships and the proper aviation service that would expedite the delivery of the goods,

which is an all-important matter, and would be very beneficial to the commercial interests of this country."

Howard E. Coffin, vice president of the Hudson Motor Car Co., long a student of transportation and industrial problems, during the war a member of the Aircraft Production Board, the Aircraft Board, the General Munitions Board and the Munitions Standards Board, and in 1919 a member of the American Aviation Mission, which made a European investigation for the Secretary of War, said:

> "We should, under governmental auspices, effect such extension of the air mail project as will in future provide the United States with a reasonably complete system of airways linking large centers of population and all points of strategic importance for purposes of the national defense. There may thus be provided at governmental expense, and in accordance with a definitely co-ordinated plan, all those aids to air navigation, including port facilities, lighting and signalling devices, charts, weather forecasts, systems of communication, etc., which have for many years been furnished for the encouragement and facilitation of water-borne traffic—all of which, while vitally necessary to any orderly development of commercial air transportation, are clearly beyond the means of any private corporation or individual to install. . . . The best way to get the support of the public is through the air mail. The quickest way to interest the individual citizen is to make him think of aviation in terms of everyday service to him personally."

"I should say," declared Mr. Elliott, "that I personally am a believer in aviation as one of the elements of civilized life; that it has a distinct field that will in time be a benefit to civilization as the processes of building and operating and safeguarding aircraft develop. Speaking about it from a business standpoint, I have been all my life engaged in transportation by rail, and some by water, and I do not fear the advent of aviation, because it is a supplementary form of transportation, and as our population grows in density it is probably going to need all the methods of transportation that are economically possible."

In an article in the *Saturday Evening Post* of March 21, 1925, entitled *"This Aviation Business,"* by Wesley W. Stout, there appeared interviews with Chairman Lampert and Chief Examiner Perkins. *"I shall recommend," said Mr. Lampert, "that an aviation budget be set up at once and the Director of the Budget instructed to assign a competent man to scrutinize all requests, direct and indirect, for aviation money. I shall recommend that the Army and Navy cease competing with the industry and that all aircraft work be distributed among an approved list of civilian constructors according to their engineering talent, production facilities and financial responsibility. Without detracting from the necessities of air defense, we must spend more for commercial aviation directly. We must put*

planes to work carrying passengers, mail, express and freight, resume patrolling our forests against fire, patrol our coast line and boundaries against liquor and alien running, perform commercial mapping, spray our crops and capture the interest of the amateur flyer."

"A Department of the Air and a separate air force," said Chief Examiner Perkins, "may not be immediately practicable politically. Meanwhile we must take immediate steps upon which Congress, the services and the industry can agree. I believe that with budget control we could save from $10,000,000 to $20,000,000 of the $86,000,000 we have been spending annually on aviation. The savings should go to the Agriculture, Post Office, Treasury, Commerce and Interior Departments to buy commercial planes and put them to work and to build, equip and light national airways. The Army and Navy should be required to limit their factory operations to field repairs and reasonable experimental engineering, and all aircraft orders distributed without competitive bidding among an approved list of manufacturers in proportion to their engineering, plant and financial equipment. The Winslow Bill, establishing a Bureau of Aeronautics in the Department of Commerce, setting up basic law for the regulation of civil flying, licensing of pilots, inspection of aircraft and certification of landing fields and terminals, should be passed at once."

On Feb. 23, a few days before Congress adjourned, Chief Examiner Perkins issued a statement, indicative, possibly, of the determination of the committee as a whole to steer clear of personal controversy and to keep ever before it as its objective the desire to do all in its power to expedite the formulation of a national air policy. In this statement, Congressman Perkins said:

> "The hearings thus far have disclosed certain facts which, in my opinion, make several conclusions inescapable: Aviation is about to assume a most important contributing place in the world's transportation and communication systems. Out of this commercial aviation will inevitably grow Air Power, which, while it will never displace land or sea forces, will undoubtedly profoundly alter and extend warfare. I know members of the committee clearly differentiate between personality and principle. We have not been confused, and we hope the public will not be confused, by extreme statements made in the hearings. I find no more substance in the allegations of an industrial and service conspiracy, as made by disappointed inventors, than I find in the picturesque and more startling denunciations by proponents or antagonists of the claim that in future wars the air arm will be supreme."

As upon Congressman Perkins rested the burdensome task of interrogating all witnesses, it may reasonably be assumed that his conclusions reflect, to a considerable degree, not only the opinions of

responsible individuals called to the chair, but also the judgment of other members of the committee, in addition to himself. He said:

"Amid the suggestion of violent controversy between the extreme advocates of Air Power on the one hand and big guns and big ships on the other, there are certain points upon which we all can agree and these points, I am sure, point the way toward final recommendations which the committee will consider. The first point is that commercial aviation is primary and military aviation secondary; that, in my opinion, a moral duty rests upon the United States to show the way for the world to escape another costly race for armament, this time in the air, and thus spare future generations the misery and suffering which must ensue from unlimited development of aviation for destructive instead of constructive purposes. In short, it must be recognized and practically proved that the mission of aircraft is to serve humanity and not to destroy it."

CHAPTER II

THE AIR MAIL

TIME FLIES SAVE TIME FLY YOUR MAIL

EXTRAVAGANT promise with barren fulfillment has been said many times to be the despair of aviation. In reviewing the progress of the transportation of mail by air, one's mind turns instinctively to the past, then instantly leaps into the future.

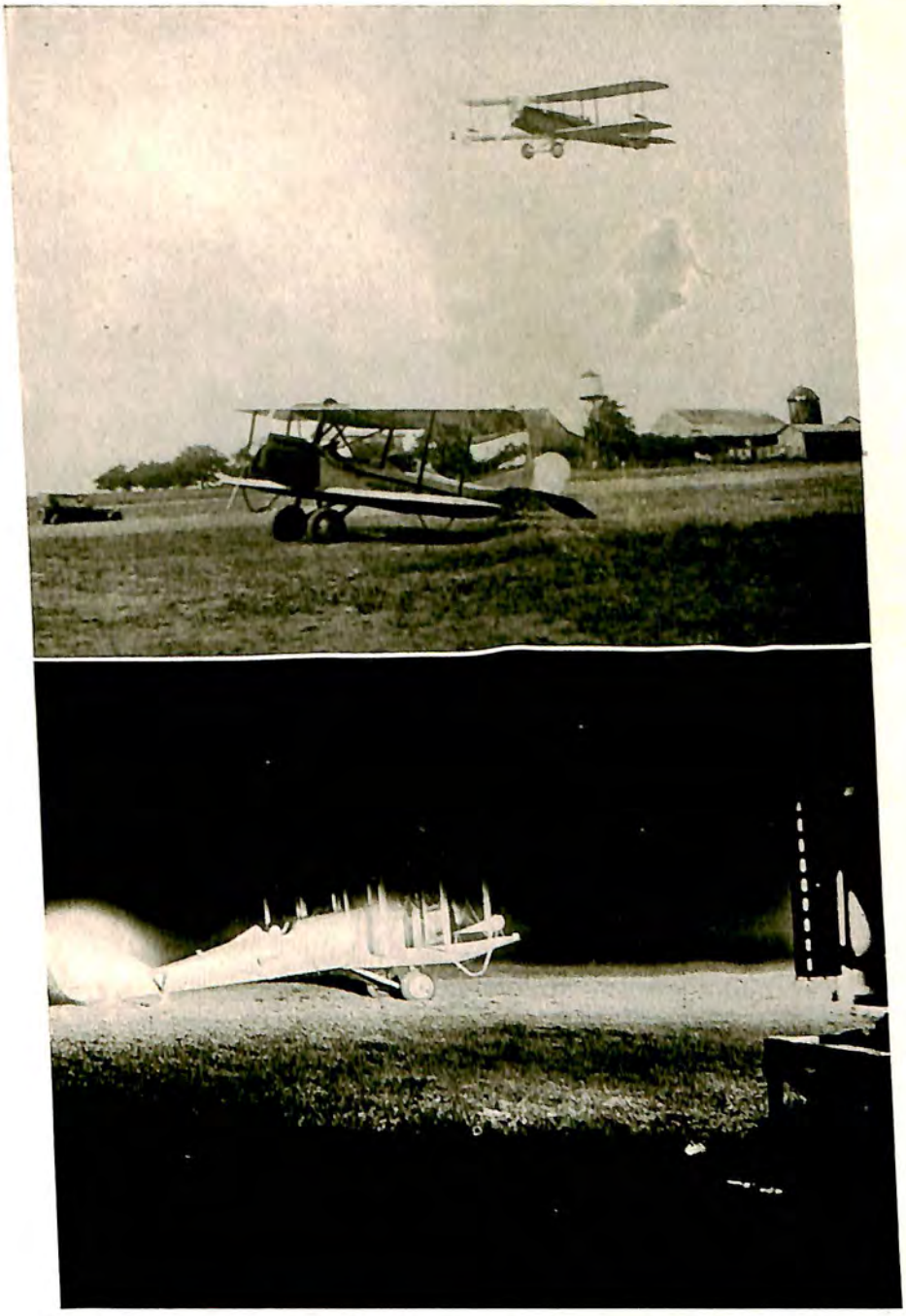
It has been the function of the Aircraft Year Book to record accomplishments, and upon this basis modestly to forecast the probable and conservative line of development. In the Aircraft Year Book for 1919 we read:

"The airplane came at a time when the world urgently needed it. The physical need was great and the mind of man was ready to accept it. So it came with liberty riding upon its wings. . . . Perhaps the first commercial need is that of the mail service. Less than a century ago, mail was carried by pony express, the same method that had been used all the ages before, and it took 36 hours to get the mail from New York to Washington. The aerial mail will meet conditions that can never be met by the railroad. It is planned to have radio system block stations every twenty-five miles. These, of course, would provide a system of lights for night flying. The longer the route, the greater the advantage will be given by the aerial mail."

These words, written very shortly after the Armistice, six years ago, were the words of prophecy, and their fulfillment has been far from barren. In truth, of all the fascinating predictions made during this period as to the part which aviation might take in peace and war, that involving the Air Mail has alone been completely justified. The reason is obvious. For the Air Mail there is a real human, business need, and the meeting of this need, transporting *things* instead of *people,* follows the line of least resistance.

Air Mail Indorsed by Public

The fulfillment has been slow, but consistent and sure. Notwithstanding the spectacular emphasis placed upon military phases, the public has unmistakably expressed its indorsement of the Air Mail as the first and obvious proof of the widely accepted conviction that aircraft can and must be applied to profitable economic ends, instead



(Top) Trans-continental Mail leaving Hadley Field (New York Terminal) for its 32-hour flight to San Francisco. Plane in foreground is Curtiss *Puddle Jumper* used for emergency transportation to repair beacons. (Bottom) Overnight Air Mail about to leave New York for Chicago. The light is the BBT 500,000,000 c.p. flood-light used to illuminate Air Mail terminal fields between New York and Rock Springs, Wyo.—*U. S. Air Mail Service.*

Thousand pound capacity night mail plane designed and built by G. Elias & Bro.

of being limited to the area of war. Today, letters move nearly 3,000 miles across the continent in less than 34 hours, so that New York and San Francisco are in this generation actually closer together than New York and Washington were during three generations now past. Today, as was predicted by the Aircraft Year Book six years ago, the regular day and night Air Mail Service is dispatched by radio, and every twenty-five miles for the 1,900-mile stretch between New York and Rock Springs, Wyo., powerful electric beacons guide the planes unerringly upon their way. Thus, what, in 1918, was an experiment, has outgrown the laboratory, has found its legitimate and profitable place in business, and, as this volume is being written, steps forth, with the approval of Congress, the Administration and the Post Office Department, upon the threshold of commercial operation. Before another year has passed, it may be regarded as certain that several privately-owned Air Mail lines will be in operation between cities so far apart as to preclude over-night train service, but at the same time to encourage transport by plane or dirigible, the Post Office Department in the meantime continuing its indispensable pioneering work of laying out night-lighted routes, literally blazing a trail through the air.

There is nothing phenomenal about the development of the Air Mail. Its growth and its occupany today of the pre-eminent position in aviation have been the natural results of vision, coupled with sufficient conservatism to make but one move at a time. When Col. Paul Henderson, on assuming the office of Second Assistant Postmaster General, early in April, 1921, determined to fly the mail at night, he did not order attempts to be made forthwith. Rather did he undertake a conscientious and prolonged examination of all factors, physical and psychological. This occupied almost two and a half years, for it was not until August 21, 1923, that he felt sufficiently prepared to undertake an actual test.

Preparing for Month's Operation

In the Aircraft Year Book for 1924 will be found complete description of those trials, upon the conclusion of which, Col. Henderson recommended to Postmaster General New that a further test, of one month's duration, be made as soon as the Service felt that it had assimilated and applied all that had been learned. This was approved, and thereafter for ten months, in addition to carrying through the regular schedule of daylight hops, Col. Henderson, with the devoted assistance of the operating personnel under General Superintendent Carl F. Egge, and the illuminating engineers, under

direction of Special Assistant J. V. Magee, devoted much of his attention to preparing for the solid month of day and night flying which, in the opinion of many, would determine how soon, and in what way, commercial aviation could be expected to develop.

The four completely successful experimental flights in 1923 attracted nation-wide admiration and interest. Press comment and municipal and business appeals poured in upon Congress. About this time the Aeronautical Chamber of Commerce completed and submitted to the Post Office Department its analysis of a special Air Mail Survey, begun many months previous upon the suggestion of Col. Henderson, who desired to obtain all information possible as to what real interest there was in the Air Mail among the business men of the country.

Cities Report Widespread Interest

A questionnaire (see Aircraft Year Book 1924) was sent to 570 municipal chambers of commerce and of these, 237, or 42 per cent., replied. Of the 237 cities reporting, 59 were classed as of such economic importance as to be regarded as key points, or possible division points, on future Air Mail lines. Of all the municipalities reporting, only nine commented unfavorably on the Air Mail, and of these nine none was a city of key importance. The Chamber's questionnaire was of such a nature that it required careful inquiry by the recipient among the local banking, mercantile and manufacturing houses. One hundred and forty-six cities, including all the 59 larger or key cities, reported a very great demand for the Air Mail, especially among bankers. One hundred and sixty-eight cities reported that interest was such that the payment of extra postage for extra speed would be welcomed.

Congress Appropriates $2,750,000

For the fiscal year 1924-25, Congress appropriated $2,750,000 for the Air Mail, including the development and operation of night-flying, so as to make through service possible from New York to San Francisco. This money, of course, was not available until July 1, 1924, the beginning of the fiscal year, but even had it been available, it is doubtful whether the Department could have gotten ready before that date to fly on through schedule. Certainly it was contrary to Col. Henderson's policy to make the attempt until he himself felt sure of success.

In setting about this big job, the Post Office Department was

actually putting into effect principles of policy expressed by various Administrations, Republican and Democratic. It must not be forgotten that the original Air Mail effort was begun when Mr. Wilson was President, and that the support which the Air Mail has received in Congress has been non-partisan, coming, at various times, with equal vigor from Democrats and Republicans alike. This political phenomenon is explained by the basic fact underlying the Air Mail, the Air Mail stimulates the imagination and appeals to patriotism. Some, only, of us may desire to fly; but all are enthusiastic to see *things* fly. Appropriations for war equipment, past, present and future, come hard, except during military excitement. Appropriations for phases of aviation which offer even a slight hope of returning something to the Treasury, or of stimulating general business, not only are justified politically—they are the inevitable results of public demand from constituencies. So, in effect, what the Post Office Department set about to do was to realize on behalf of many thousands of persons, in the Government and in civil life, the common desire that aircraft be not primarily instruments of destruction but vehicles of commerce; that, instead of being regarded as productive only as "war insurance," they could be put to work and thus earn as well as protect. It is important to remember this, for the mental attitude on the part of the public was in no small measure responsible for ultimate Air Mail success. The Air Mail has succeeded because the public wanted it to succeed. It will grow because the public wants it to grow.

The Four Big Tasks

The task divided itself naturally into four sections, which were approached by the Post Office Department in the order stated:

Fields and Field Equipment.
Flying Equipment.
Operations.
Traffic.

The line of transcontinental flight had already been determined, both by necessity and law. It extended for 2,680 miles from New York to San Francisco, via Bellefonte, Cleveland, Bryan, Chicago, Iowa City, Omaha, North Platte, Cheyenne, Rawlins, Rock Springs, Salt Lake City, Elko and Reno. The route crosses three major mountain ranges—Allegheny, Rocky and Sierra Nevada. For obvious reasons the comparatively level sector of 885 miles between Chicago and Cheyenne was chosen for night-flying. At Chicago,

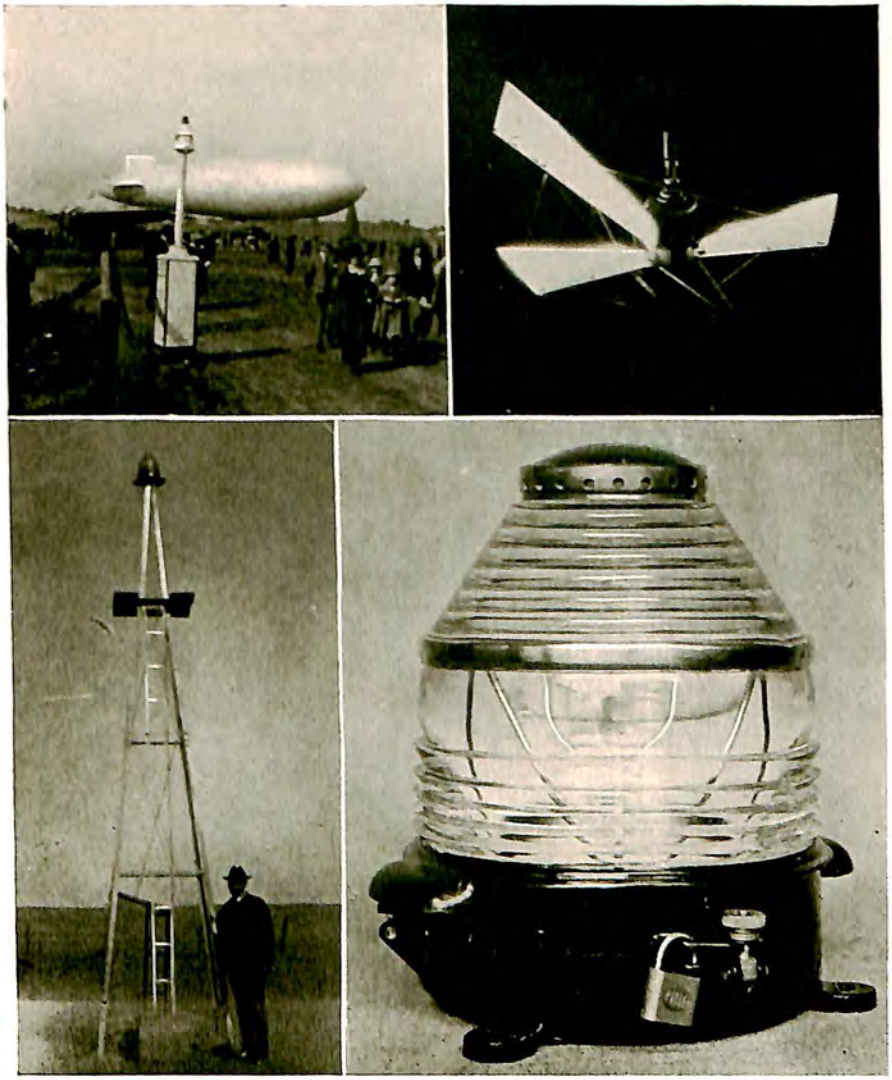
Iowa City, Omaha, North Platte and Cheyenne, were erected 500,000,000 candle power electric arc beacons. These, mounted on a 50-foot tower, and revolving three times a minute, penetrated 100 to 150 miles. A second lamp of like power, mounted on a chassis, flood-lighted the field. Both types were developed by the Sperry Gyroscope Company, of Brooklyn, N. Y. The boundaries of the fields were outlined, and in the center of the landing tee there was installed a mushroom cluster, flush with the surface of the ground. Radio mast, wind cone and all buildings were lighted.

Scheme of Field Illumination

Emergency fields were laid out every twenty-five miles. Each was equipped with one 5,000,000 candle power incandescent electric beacon, whose beam, set one-half of one degree above the horizon, penetrated 60 to 75 miles. This type was developed in the laboratories of the General Electric Company, Schenectady, N. Y., Edison Lamp Works, Harrison, N. J., and National Lamp Works, Cleveland, O. The boundaries of these fields, as well as all buildings or other obstructions were illuminated.

In between, about every three miles, or wherever suitable ground could be leased, there was installed a 5,000 candle power acetylene gas flashing beacon, visible 6 to 9 miles, depending upon the density of the atmosphere. This type was originated and produced by the American Gas Accumulator Company, Harrison, N. J.

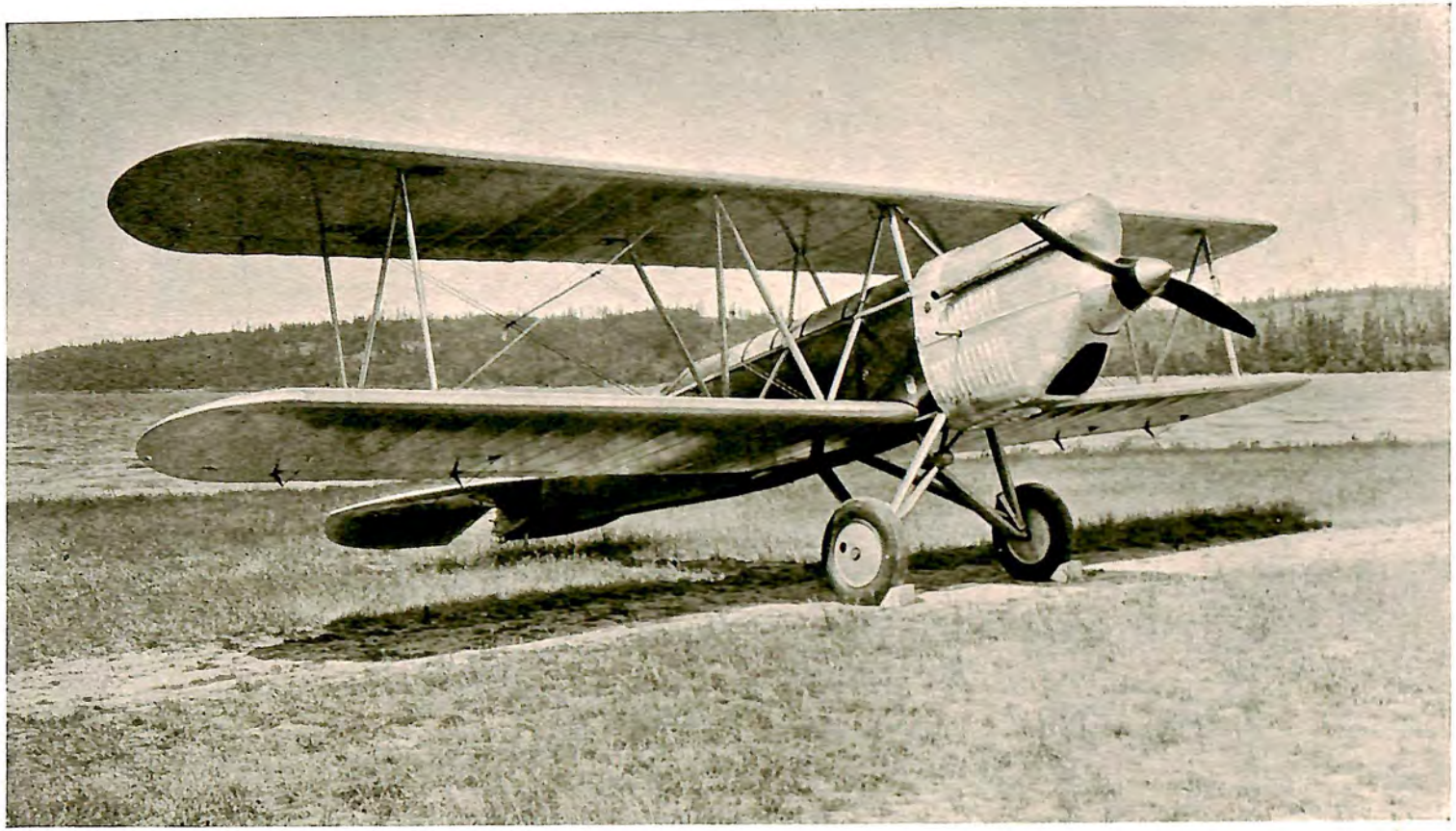
During the short summer nights it was more than ample to have route illumination between Chicago and Cheyenne, but not so as the summer waned and the days became shorter. So, little by little, working eastward from Chicago until they reached Cleveland, and westward from Cheyenne until they reached Rock Springs, Air Mail engineers repeated the process of lighting Terminal, Semi-Terminal and Emergency fields, until, by the time winter had set in, there was in fact an unbroken chain of light for 1,912 miles. Flying from beacon to beacon the transcontinental mileage was increased to 2,697. Terminal fields were those implied by the name, corresponding to division points or equipment stops on a railway. Semi-Terminal were those with minor repair facilities. Emergency fields ranged in importance from those with supplies, caretaker and communication facilities to bare ground with only the friendly beacon. Of the terminal fields, Coast to Coast, the Air Mail now has seventeen. Between Cleveland and Rock Springs there are fifty-five Emergency fields, including seven classed as Semi-Terminal. Between Cleveland and New York, thirteen Emergency fields are being laid



(Top Left) American Gas Accumulator Route Beacon used by Army Air Service and Air Mail. (Top Right) AGA illuminated wind indicator. (Bottom Left) Interflash Signal Corporation's Aerial Beacon used by Army Air Service and Air Mail. (Bottom Right) Close-up of Interflash Beacon, visible 360 degrees and 180 degrees through the vertical; operates one year without attention.

Curtiss Aeroplane & Motor Company's *Carrier Pigeon.* This new type cargo airplane carries 1,000 lbs. of mail or express, has radius of 500 miles and a top speed of 126 m.p.h.

(Top) Air Mail Pilot taking aboard snow shoes and emergency rations. (Bottom) Skiis replace wheels on Air Mail De Havilands.—*U. S. Air Mail Service.*



Boeing Night Air Mail Plane.

out. This shows a total of 85 fields, either in existence or in the making, in the United States Air Mail Service.

At each one of the seventeen Terminal fields, except Rawlins, there is a radio station. Another station is at Washington so that Col. Henderson is kept instantly advised of routine progress or extraordinary developments. At the Terminal fields are hangars. At the Emergency fields are caretakers. At Chicago, or more properly speaking, Maywood, is the Repair Depot of the service.

Experimental Flying Equipment

The trouble—or one of the troubles—with aviation in this country has been that there has been much talk but little action on commercial aviation. The industry, unable to proceed of itself though desirous of so doing, awaited the apathetic pleasure of succeeding Congresses and Administrations in the enactment of laws, the laying out of airways, the night-lighting of these airways and, more important than all, the actual ordering of commercial types of machines. But, until the institution of night flying by the Post Office Department, little of the sort had been done.

Col. Henderson, in 1923, obtained from the Aeromarine Plane & Motor Company, Keyport, N. J., Curtiss Aeroplane and Motor Co., Garden City, N. Y., and the Glenn L. Martin Co., Cleveland, O., examples of three distinct experimental types of night flying ships. These ships were experimental of necessity. The industry for six years had *thought* and *built* only along military lines, and it was not to be expected that its engineers could turn forthwith to the creation, or its workmen to the construction, of an airplane the like of which did not exist. The Wright Aeronautical Corp., Paterson, N. J., installed in the Glenn L. Martin ship one of its 200 h.p. Wright E-4 engines. The Curtiss company installed in its ship one of its own 163 h.p. Curtiss C-6 engines. The Aeromarine company utilized the standard 400 h.p. Liberty. Valuable lessons were learned from each. The Curtiss job, equipped with oversize tires, was put into line service and christened the "Puddle Jumper." In storm or clear, this plane was kept flying up and down the lighted zone, wherever the electricians had to go to correct illuminating trouble. This meant trips as frequently by night as well as by day.

Deficiencies of the De Haviland

But it was a question of quantity available, as well as service while in use. So the Department had to continue to use the modified De Haviland, adding to its already numerous deficiencies the fur-

ther weight handicap of generators and batteries to feed the lamps, of 250,000 beam candle power, installed underneath the leading edge at the tip of each lower wing; of parachutes for the pilots, and of two 500,000 candle power parachute flares. The extreme mail capacity of a De Haviland, with its 400 h.p. Liberty engine, even in the day-time, is 500 pounds. Night flying removed a hundred to a hundred and fifty pounds otherwise available for the mail and thus reduced the efficiency of the Air Mail as an economic service. But it could not be helped.

It is no paradox to state that an air line is tied to the ground. Therefore the problem of operating this day and night service began on the ground. Sufficient De Havilands were available to have three on the line, or in the hangar, practically ready to take off, for every one actually in the air. Spares and supplies were allocated to each of the fields clear across the continent. The pilots were given many months of training—with good pay—over the night course.

Loyalty and Devotion of Personnel

The spirit of the entire personnel was such as to assure the Department that each man felt an individual responsibility—rare enough in private business, remarkable in the Government. The system of constant inspection at terminals before and after each flight, by riggers, motor mechanics and ignition experts, extended and made more rigid with the institution of night flying, explains, more than any other factor, the operating success of the Air Mail. Each pilot having his own ship; each ship having individual attention; each employee realizing that any delinquency on his own part might have farreaching consequences—this attitude of mind may well be termed the spirit of the flying post.

In military flying the objective is the great end, whether property and life are lost. In civil flying, which the postal service approximates, responsibility for life and property are the guiding motives. It is apparent, therefore, that, no matter how much glamour attaches to military exploits, even such achievements as the round-the-world flight and the voyages of the *Shenandoah* and *Los Angeles,* the fact remains that military and civil viewpoints are contrary and the civil viewpoint is imperative to the successful early development of commercial aviation.

Obstacles Encountered in Operation

Two or three weeks before the opening of the service, July 1, 1924, Col. Henderson established temporary executive headquarters

in Chicago. This being the midway point he was able to keep the more quickly in direct touch with the entire line. Just the week before the start a cyclone blew down the hangar in Omaha and wiped out nearly a dozen ships. By extreme effort this loss was replaced, so that the start could be made as scheduled. The line had not been operating many weeks before the Cheyenne hangar burned and destroyed several more planes. But this handicap in equipment, too, was overcome and enough planes were always available, each plane having the inspection and care required.

If there were space thrilling tales could be told of the flying post. It must suffice to state that the month of July witnessed one electrical storm after another between Chicago and Cheyenne. What had been in previous years a placid month was whipped into turbulence by the fury of tempests and gales which frequently attained a velocity of 80 miles an hour. On the daylight stretches, too, there was bad weather, so that, if praise be given the pilots on the night sector, who flew not only for duty but for extra pay, it must not be omitted for the pilots in the Alleghenies, Rockies and Sierras who, without front-page publicity and with but ordinary compensation, did their part, day in and day out. Heroes in aviation make good reading, but every-day work, from light caretaker to mechanic, to radioman, to clerk, to pilot and field executive, is what did the trick for the transcontinental Air Mail.

A Hard Schedule Set Up

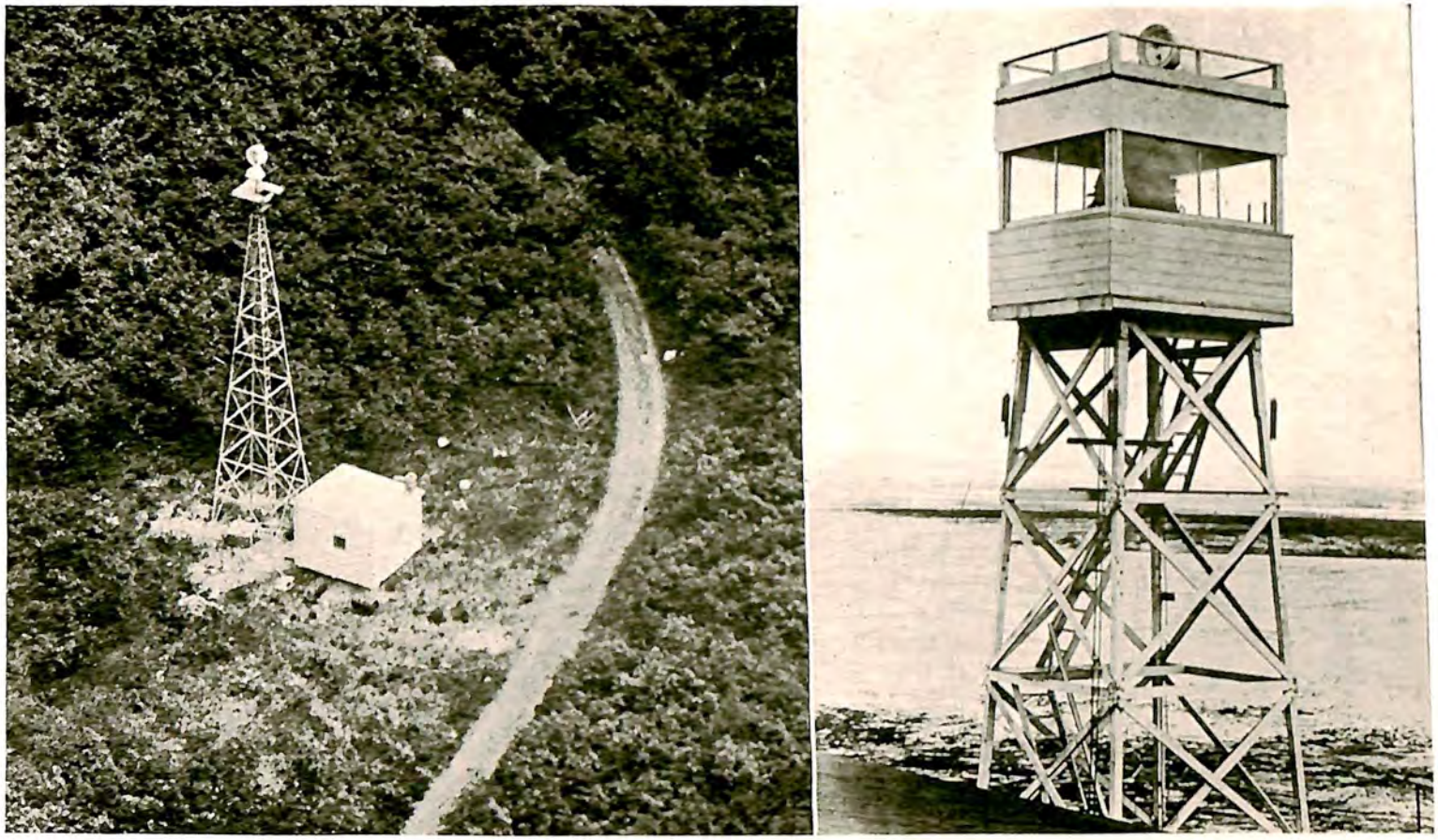
Leaving one Ocean in the morning of today and delivering mail on the shores of the other Ocean tomorrow evening was a stiff schedule. It would be silly to attempt to analyze the performance of the Air Mail through the long, inclement winter days and nights. It was not perfect. It could not have been perfect. But it so nearly approximated perfection that it set a new mark in aviation, here and abroad. The Department's policy is always "Get the mail through." This does not mean that if the mail starts in one conveyance it must go through by that conveyance. Delivery to destination is the thing, no matter how achieved. So, when the division superintendents, in these early experimental weeks, both summer gale and winter blizzard or stifling fog, felt that it was unwise for life and property to attempt to go through by air, planes were held, just as trains and steamers are held, for improved weather conditions. Or, if, at either end, prolonged delays found the Air Mail benighted in the Alleghenies or Sierras, rather than wait all night and further unnecessarily delay delivery at the terminal, the pouches were entrained

and thus reached their destination in time for delivery the following morning.

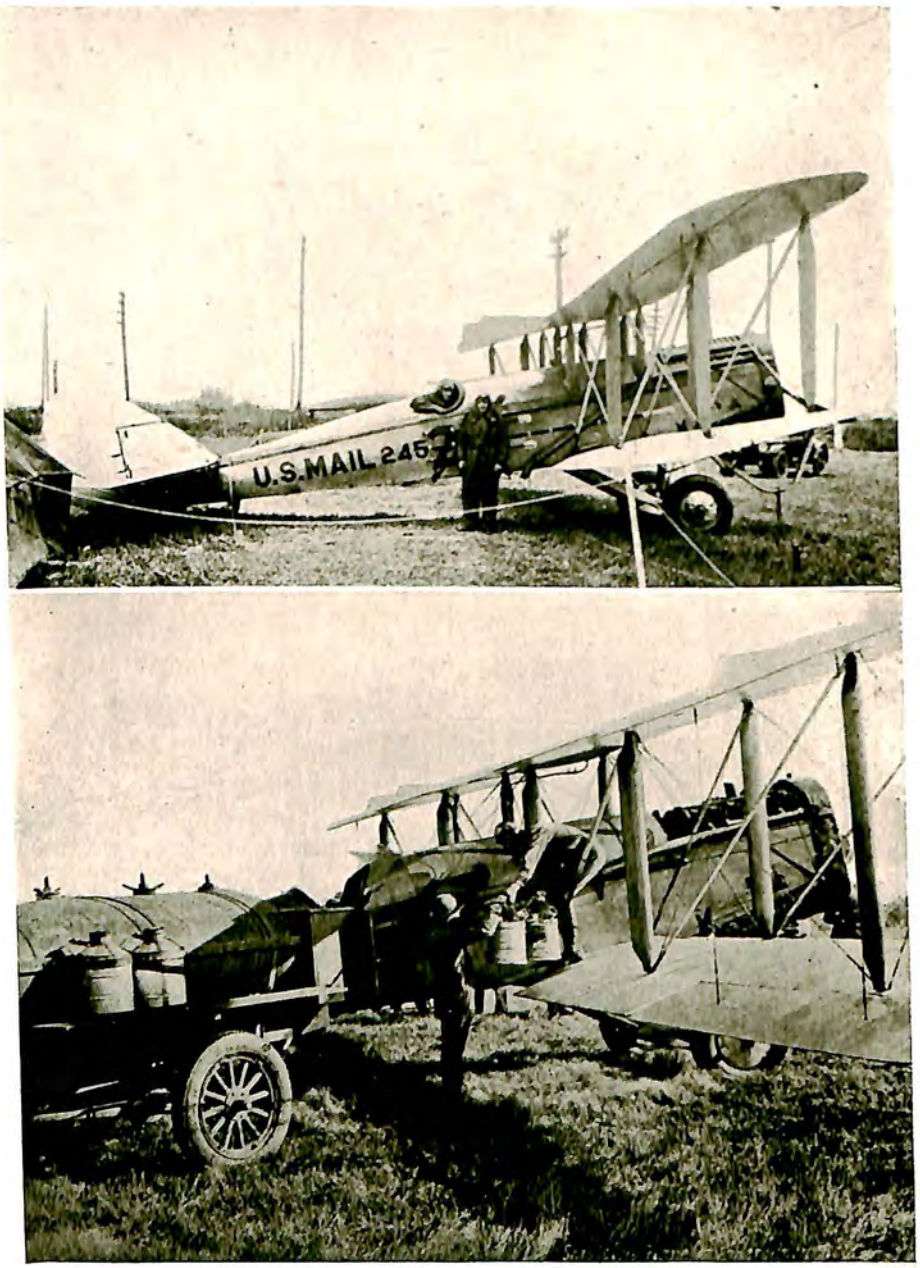
The Air Mail has not been operated as an isolated entity, but as a unit of the Department, co-ordinated with other postal facilities. Yet notwithstanding this, the performance record of the Air Mail during July, August and September was 85 per cent., and in October, November and December 65 per cent., making an average of 75 per cent. for the first six months. The winter has been rigorous. The same conditions that held up the Air Mail affected also the railways. Under such circumstances, a railway operating a train from Coast to Coast on a five day basis, can be 24 or even 36 hours late without exciting much comment. But the Air Mail, operating on a 34 hour schedule, is, by this very fact, held more rigidly to a severe scrutiny of performance. But it is ever thus with new endeavors, and as this volume is being written, flying performance has again risen to nearly 100 per cent., with the definite knowledge that many of the handicaps which first proved perplexing will shortly be completely removed.

Problems of Traffic

Late in 1923 the Aeronautical Chamber of Commerce discerned the need for specifically calling to the attention of individual business men the advantages of the day and night transcontinental Air Mail. Accordingly steps were taken for the formation of the Air Mail Extension Committee of the Aeronautical Chamber of Commerce, which was formally announced by telegram to the Postmaster General and the Second Assistant Postmaster General, on July 1, the day the service started. The organizing committee included such names as W. Averill Harriman, of the United American Lines; Robert E. M. Cowie, President, American Railway Express Co.; C. C. Campbell, Vice President, Seaboard National Bank, New York; Francis H. Sisson, Vice President, Guaranty Trust Co., New York; Jesse I. Straus, President, R. H. Macy Co.; Frank C. Towle, Willcox & Gibbs Sewing Machine Co.; Edsel B. Ford, President Ford Motor Co.; Roy D. Chapin, Chairman of Board, Hudson Motor Car Co.; Alvan Macauley, President, Packard Motor Car Co.; Allan Jackson, Vice President, Standard Oil Co. (Indiana); Louis S. Cates, Vice President and General Manager, Utah Copper Co., Salt Lake City, and James Otis, Otis, McAllister & Co., San Francisco.



(Left) In Allegheny Mountains between New Tripoli and Ringtown, Pa. The New York-Chicago Overnight Air Mail has twenty 5,000,000 candle power beacons developed by General Electric Co. (Right) 500,000,000 candle power beacons developed by Sperry Gyroscope Co. for Air Mail Service. These beacons are located every 200 miles between Chicago and Cheyenne.—*U. S. Air Mail Service.*



(Top) Air Mail plane used by General Electric Co. in developing radio telephone. Pilot Jack Knight shown with Mechanic Whalen. (Bottom) Illustrating how Standard Oil Co. (Indiana) services mail planes at emergency fields. *—U. S. Mail Service.*

"Time Flies, Save Time, Fly Your Mail"

The Committee conducted an energetic campaign. It originated and established nationally the slogan—"Time Flies, Save Time, Fly Your Mail." It designed and distributed a seal of striking beauty, for affixing to Air Mail letters.

The Committee originated a unique design of special Air Mail envelope, bearing red, white and blue stripes horizontally across the face, just below the space for stamps and bearing, in addition to the sender's return card, the words—

VIA
AIR MAIL
ENVELOPES OF THIS DESIGN APPROVED BY P. O. D. FOR EXCLUSIVE USE IN AIR MAIL

This type of envelope was formally approved by the Post Office Department, as a means of identifying and accelerating the Air Mail and its use was indorsed in Postal Bulletin, Nov. 14, 1924.

Air Mail Extension Committee's Good Work

The Air Mail Extension Committee obtained through membership the active support of 504 corporations, chambers of commerce, trade associations and publications in California, Colorado, Connecticut, Illinois, Indiana, Iowa, Massachusetts, Michigan, Minnesota, Missouri, Nebraska, Nevada, New Jersey, New York, Ohio,

Oklahoma, Pennsylvania, Rhode Island, Tennessee, Utah, and Washington. Among those patronizing the Air Mail and soliciting others to do so were to be found such nationally known names as: First National Bank and the Emporium, San Francisco; Pacific Southwest Trust and Savings Bank and Bullock's, Los Angeles; First National Bank and Denver National Bank, Denver; Hartford Fire Insurance Co., and Ætna Life Insurance Co., Hartford; Yale & Towne Mfg. Co., Stamford; Brown & Sharpe Mfg. Co., Providence; The Pullman Co., Chicago, Rock Island & Pacific Railway, Sears, Roebuck & Co., and Illinois Merchants Trust Co., Chicago; E. C. Atkins & Co. and Nordyke & Marmon, Indianapolis; Massachusetts Trust Co. and Wm. Filene's Sons Co., Boston; Union Trust Co. and Fisher Body Co., Detroit; Minneapolis Loan & Trust Co., Minneapolis; Corn Exchange National Bank, Omaha; Reno National Bank, Reno; Thomas A. Edison, Inc., Orange, N. J.; Campbell Soup Co., Camden; Bankers Trust Co., National City Bank, Bank of the Manhattan Co., American Express Co., Dillon, Read & Co., Hayden, Stone & Co., C. M. Keys & Co., B. Altman & Co., John Wanamaker, United Cigar Stores of America, Singer Mfg. Co., Metropolitan Life Insurance Co., Standard Oil Co. (New York), Radio Corporation of America, and American Tel. & Tel. Co., all of New York City; Eastman Kodak Co., Rochester; Cleveland Trust Co., Pickards Mather & Co. and National Lamp Works, Cleveland; and Pennsylvania Railway Lines, Philadelphia. In addition, there were the chambers of commerce or merchants' associations in half a hundred principal cities, together with the leading newspapers in each place.

In a letter of thanks to each member, Col. Henderson said:

"The Postmaster General and I feel that such manifestation of interest as is being evidenced by you and other members of the Air Mail Extension Committee is of very practical benefit, and my purpose in writing you this letter is to convey our appreciation. The future of the Air Mail rests with those who patronize it. In other words, it rests with you and with other national users of the mails who find the air service of practical benefit."

Patronage the Unknown Factor

To the Post Office Department, on undertaking a scheduled aviation service, the unknown factor was patronage. It seemed that it would be just as unfortunate for the planes to fly successfully, but empty, as it would be for them to fail to fly at all. Once, early in the history of the Air Mail, the Department attempted to impose special charge for special speed, but the time was premature and traffic did not develop. It was determined not to run such a risk

again. Col. Henderson realized that what the Post Office Department was doing was, in effect, demonstrating in fact what had previously only been talked in the theory of national policy—real commercial aviation. He was about to undertake to prove what we, as a nation, had been saying was true—that aircraft should be useful in commerce and that they could at least approximate a business-like performance in the matter of a balance sheet. So he determined to set up a Traffic Department, for the express purpose of seeing to it that patronage did not fail, either through lack of understanding by the public, or through incomplete co-ordination between the various activities of the Post Office Department touching the Air Mail.

In response to his invitation, Luther K. Bell resigned as Secretary of the Aeronautical Chamber of Commerce on June 15, and was appointed Traffic Manager of the Air Mail Service, working directly under the Second Assistant Postmaster General.

Writing early in August, 1924, of the first month's operations, Col. Henderson said:

"I realize that the question of revenue is one of the utmost importance in this new service. We have under way an intensive campaign of traffic solicitation. It is being carried on primarily through postmasters, secondarily through the commercial clubs and other business organizations across the route."

Air Mail "Line" Becomes Air Mail "Belt"

The first approach to traffic was to define the scope of the Air Mail. Was it to be a "line," serving only those comparatively few points it touched? Or was it to be an integral unit of postal facilities? Obviously the latter. So the transcontinental service was introduced to the public as a "belt," extending, according to rail connections, from 500 to 1,000 miles north or south of the actual line of flight. Postmasters in this broad path were quick to respond to requests for assistance, and the advantages of the Air Mail were told in every conceivable way. The municipal chambers of commerce, particularly the Boston Chamber of Commerce, Merchants' Association of Greater New York, Chamber of Commerce of the State of New York, the chambers of commerce in Buffalo and Cleveland, the Chicago Association of commerce, the municipal commercial clubs in Minneapolis-St. Paul, Milwaukee, Detroit, Indianapolis, St. Louis, Kansas City, Omaha, Denver, Cheyenne, Salt Lake City and Reno contributed much to the success of this phase of the Air Mail. On the Pacific Coast, the Air Mail probably meant more than in the East, and consequently the chambers of commerce in Seattle, Portland, San Francisco, Los Angeles and San Diego

were a unit in advertising its advantages, and in utilizing these advantages themselves.

To Mr. Bell there were assigned as assistants three experts from the Railway Mail Service, which is also under the supervision of the Second Assistant Postmaster General, and these men, E. C. Garrabrant of New York, B. F. Myers of Chicago, and G. H. Worley of Omaha were the means of working out schedules whereby the public in the entire Air Mail "belt" could intelligently take advantage of the accelerated service. This meant close co-ordination of facilities offered by local post offices, by the Railway Mail and by the Air Mail.

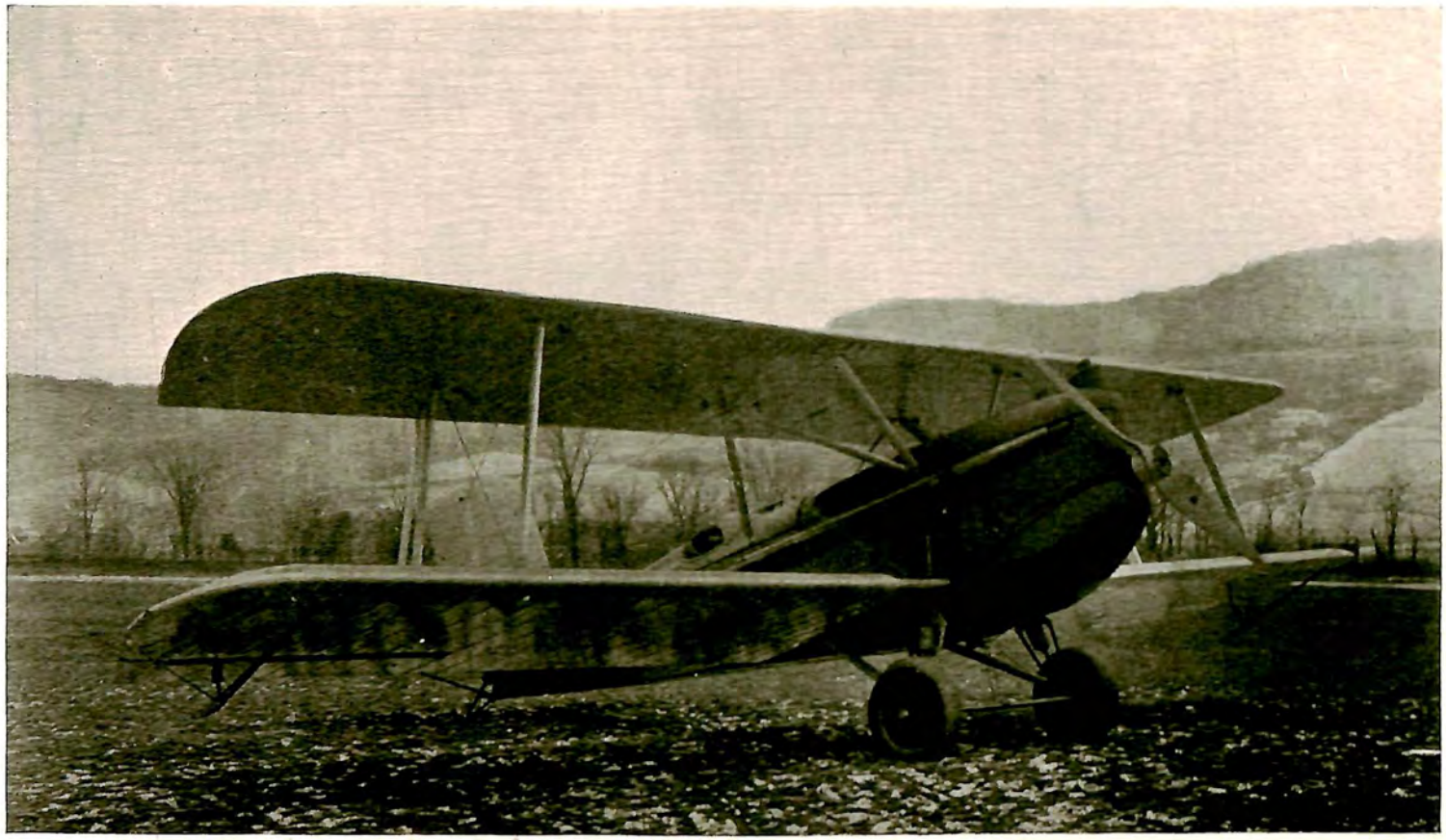
First Cargoes Souvenir Mail

When the transcontinental service started on July 1 the cargo consisted mainly of novelty letters, cards and parcels. Picture cards there were by the thousand and souvenir letters by the hundredweight. The packages for the most part were justified only by their publicity value—suits of clothes, candy, flowers and live chicks, "a day old in New York and two days old in Frisco." But the novelty soon wore off. The traffic steadily dropped, then slowly began to climb and since then there has been an average slow but steady increase. Except for occasional flares, publicity patronage has disappeared, and in its place has appeared the steady, reliable business which means that no letter gets on the plane unless the expenditure of excess postage is justified for business or strong personal reasons.

Bankers Heaviest Regular Patrons

Today the heaviest patrons of the Air Mail are the banks and brokerage houses. The reason is apparent. The commodity these people deal in is money. "Time is money." To save time is for the banker to save money. It has been estimated that there is probably half a billion dollars in daily "float," or process of collection, throughout the United States. Most of this is circulating in the Air Mail "belt." If collection can be accelerated interest is reduced and unproductive funds are put to work. That is why bankers, traditionally regarded as most conservative, are, for the Air Mail, most enthusiastic.

Next after the bankers come import and export houses. Sometimes to catch a certain steamer means to save weeks, especially in the Oriental trade. These vast organizations, with branches throughout the world, were quick to discern and utilize the advan-



Aerial *Mercury,* 1000 lbs. capacity night mail plane designed and built by Aerial Service Corporation.

Illustrating the kind of country Air Mail Service operates over night and day between New York and Chicago. This is the worst section of the Allegheny Mountains. It shows the five main ridges, the valleys of which are submerged in fog. When the valleys are clear of fog, the mountain peaks are frequently covered with clouds.—*Underwood and Underwood.*

tages of the Air Mail. It has been brought home to the Department more than once, also, that foreign corporations, particularly those in England, France and Japan, are awake to the value of the Air Mail and instruct their American agents to use it in the conduct of their affairs.

Big Railroads Interested in Air Mail

While it is not apparent on the surface, it is believed that the railroads are deeply, and more than passively interested in air transport. To an executive whose life has been spent in transportation and communication, any new means of acceleration is interesting. To the small mind it may appear as rival; to the broad mind it appears as a supplement. Thus in the Air Mail pouches are the official letters—big fat ones, with lots of stamps—of many of the greatest railway systems of the country—Pennsylvania, New York Central, Union Pacific and Southern Pacific. So, too, with the steamship lines, with the American Railway Express Company and the Radio Corp. of America.

The tendency of modern merchandizing is nationalization. Thousands of dealers and agents are tied together by nationwide advertising. Nationwide advertising and distribution mean, of necessity nationwide communication centering upon the main executive office. Thus heavy patronage of the Air Mail is drawn from the best-known national manufacturers and merchandizers, who find aviation a potent means for lengthening the sales arm.

Closely tied to manufacturing and merchandizing is the advertising agency and the newspaper and periodical publishing business. Each of these factors is a generous contributor to the Air Mail pouches.

At the end comes the general public. Its contribution is now the smallest, but like experience in other branches, correspondence from the general public, or the individual, is certain to constitute the bulk of aviation mail, probably at no far distant date.

Revenue of Transcontinental Air Mail

The revenue of the Air Mail in the first six months of its existence has, to many persons, been astonishing. If it was somewhat disappointing to those who had high and extravagant hopes of planes being so heavily loaded that they could scarcely waddle off the field, it was impressive to those who foresaw complete failure. What is probably most significant, the greatest impression was made on the minds of congressmen. From July 1 to Dec. 31, 1924, the Air Mail

returned to the United States Treasury $320,529.73 in excess postage, over and above the ordinary two cents deducted by the Department for administrative purposes. This amount was collected in the transportation of nearly 5,000,000 letters. To paraphrase the words of one congressman—"For the first time in the history of American aviation we have seen the airplane actually earning something. Always it has been public appropriation for military defense; now it is financial return, even though small, for economic service. That is why the Air Mail has so many friends in Congress."

Insurance Indorsement of Air Mail Safety

The relation between reliability and traffic is intimate. The belief that transportation by air was unduly hazardous was a handicap which the Post Office Department had to overcome. The most effective argument was past performance, of which the following is an illustration:

	Calendar Year 1922	*Calendar Year 1923*	*Calendar Year 1924*
Total mileage flown.....	1,756,803	1,870,422	2,156,403
Total number letters carried...	60,487,880	65,295,920	24,059,296
Total pounds of mail carried...	1,512,197	1,632,398	851,483
Pounds of mail destroyed.....	none	none	125

It will be seen from the above that during three years of flying, including day and night, winter and summer, storm and fair, in which 5,783,628 miles were flown and 159,843,096 letters were carried, only 125 pounds of mail, or approximately 5,000 letters were destroyed.

In connection with the foregoing, Hon. James E. Power, Postmaster of San Francisco, received the following letter from the Royal Insurance Co., Ltd.:

"Referring to your inquiry, we are pleased to state that we are not making any additional charge for securities, etc., shipped by aeroplane mail, and do not believe that any of the companies are going to make any additional charge for this class of service. The matter has been under close observation and the insurance companies seem satisfied to write Air Mail shipments at ordinary rates."

Demand for New York-Chicago Overnight Service

On July 10, Col. Henderson addressed a meeting of Loop bankers in Chicago, the invitation having been extended by the Illinois Bankers' Association. The results of this meeting, together with formal letters of notification of the service which Col. Hender-

son had previously sent to the leading bankers in New York, were far-reaching. Bankers were interested and they immediately set about to prove for themselves the utility of the New York-San Francisco service. As soon as they had opportunity to check on comparative delivery, they notified the Department that, while they had some business west of Chicago, the vast bulk lay between the country's two great cities. "Therefore," they asked, "why leave New York and Chicago in the morning; why not fly at night? Give us overnight service, thereby saving us a full business day, and we will give you all the mail we have."

These demands, in time, were duplicated from other points, even those in the far west. In view of the requests pouring in upon the Department and upon members of Congress, Col. Henderson felt it imperative, even while the transcontinental service was barely two months old, to prepare for the New York-Chicago overnight mail. He caused engineering and traffic surveys to be made. The latter indicated that, at the very minimum, there should be well over 1,000 pounds available each night out of New York, and 350 pounds out of Chicago, a total of almost seven times as much as the average transcontinental daily load.

Accordingly, money which would otherwise have been expended for new flying equipment was invested in night-lighting the New York-Chicago route, which is identical with the transcontinental. Equipment is being supplied by Sperry, American Gas Accumulator Co., and General Electric and General Electric and the Inter-Flash Signal Corporation of New York are working on new developments which it is believed will be of distinct advantage in night air navigation over the low-lying, but thickly-wooded and frequently fog-enshrouded Allegheny mountains. The AGA has installed on its acetylene gas beacons a sun valve which enables these lights to operate for six months without attention. A new type of electric beacon, with an exceedingly effective lens, has been introduced and installed by the W. Wallace Kellett Company of Philadelphia, representatives in the United States of a French company, Barbier, Benard & Turenne.

Tentative New York-Chicago Schedule

The tentative schedule, at the time of this writing, calls for departure from New York at 9:30 p.m., Eastern Time and arrival in Chicago 5:30 a.m. Central Time. Leaving Chicago at 8:30 p.m., Central Time, planes are due to arrive in New York at 6:30 a.m., Eastern Time. Service will thus be had on the first morning delivery, in ample time for bank clearance.

Steps to Obtain New Flying Equipment

Like the old woman's stocking which was kept perennially new by means of a foot one year and a leg the next, the war-time De Havilands handed down by the Army to the Post Office Department, are still usable, but they are seven years old in design and retain many of the unsatisfactory and even dangerous features of aerodynamics and construction of 1917-1918. Even with their 400 h.p. Liberty engine they are capable of carrying only some 200 or 250 pounds of mail, when they are encumbered, as they must of necessity be, with heavy night-flying equipment. For commercial aviation purposes, the De Haviland is about as economical and as satisfactory as a destroyer would be in the South American banana trade—lots of speed and little else.

The Post Office Department issued a general invitation to the aircraft industry to design, construct and submit for possible purchase a new type of mail plane. Contrary to the minute restrictions and outlines frequently imposed in military orders, Col. Henderson specified only such general characteristics as: cruising speed of at least 100 m.p.h., landing speed 50 m.p.h., or less; cargo capacity, 1,000 pounds of mail. The Liberty engine had to be utilized. Aside from these directions, the engineer had a free hand.

Six organizations indicated their desire to submit aircraft: Aerial Service Corp., Hammondsport, N. Y.; Boeing Airplane Co., Seattle, Wash.; Curtiss Aeroplane & Motor Co., Garden City, L. I.; The Douglas Co., Santa Monica, Cal.; G. Elias & Bro., Buffalo, N. Y.; the Huff-Daland Co., Ogdensburg, N. Y., and the Stout Metal Airplane Co., Detroit, Mich.

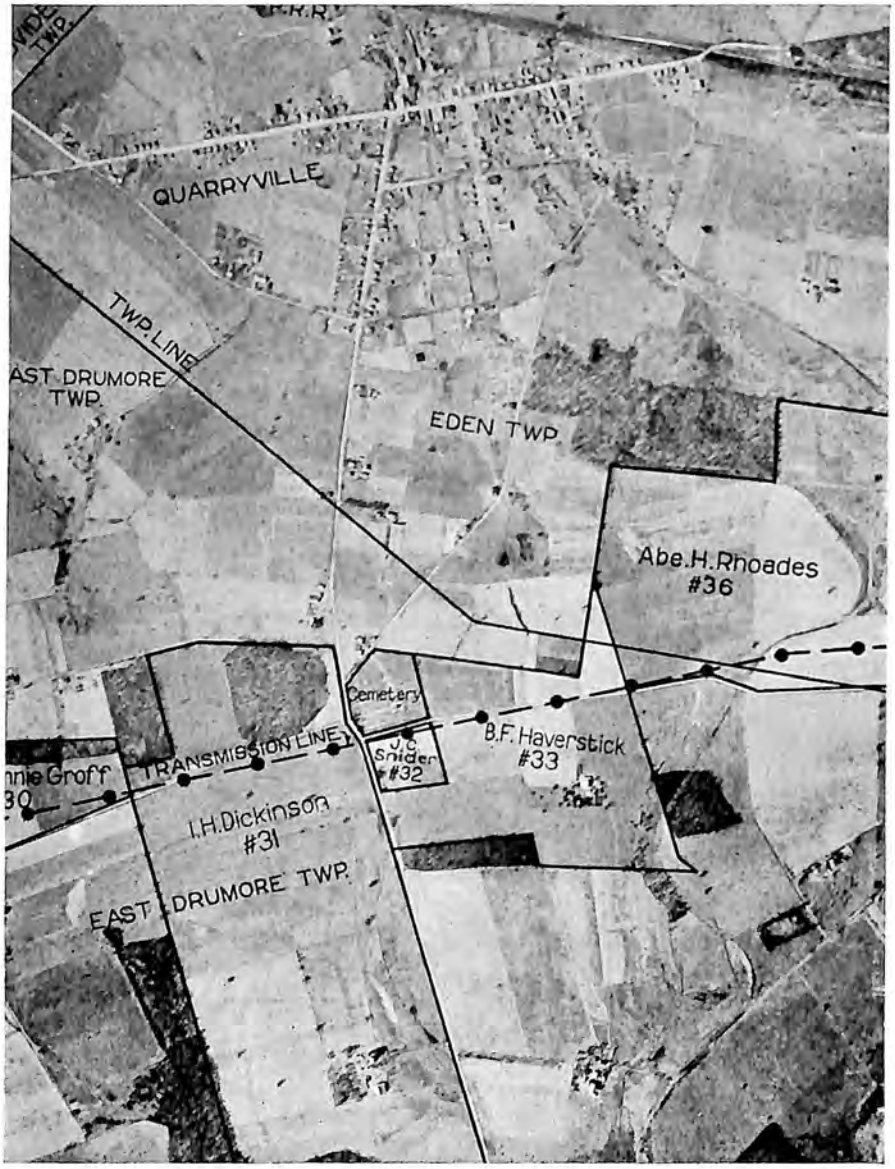
Stout *Air Pullman*

Stout's ship was already constructed. It successfully passed the tests and was purchased. For some weeks, up to the time of this writing, the Stout all-metal monoplane had been in regular service between Cleveland and Chicago, day run one way, night the other. It performed to the full satisfaction, both of the builders and the Air Mail. Equipped with one Liberty, this craft carries a useful load of 2,379 pounds, makes 116 m.p.h., on straightaway flight. When used as an *"air pullman,"* it carries eight people, including the pilot. Its wing span is 58 feet and its length 45 feet.

The Curtiss "Carrier Pigeon"

The Curtiss company's plane was the first special type to be submitted. It illustrated forcefully the putting into effect of the com-

(Top) Stout *Air Pullman.* This ship is to be put in operation by Ford Motor Co. (Bottom) Walter T. Varney with Laird *Swallows.* Mr. Varney operates an aerial taxi service in combination with Checker Taxi Co. of San Francisco.



Section of aerial photographic map used in projecting high tension transmission line. Savings of over 50% in cost of right of way have been reported from such use of aerial maps.—*Fairchild Aerial Surveys, Inc.*

pany's policy of "pushing forward the commercial branches of your company's business," as expressed by C. M. Keys, President, in his report of March 2, 1925. The ship was christened the *"Carrier Pigeon."* With its very deep fuselage and new radiator installation, its oversize tires and massive wings, it resembles nothing so much as a commercial truck—which is exactly what it was designed to be, a high-speed truck for the delivery of mail and express through the air. The *"Carrier Pigeon,"* with the same power as a De Haviland, carries 1,000 pounds of mail and can fly 500 miles at 100 miles an hour without replenishing its fuel supply.

The most impressive feature of the *"Carrier Pigeon"* is the interchangeability of upper and lower wings and of ailerons, elevators and rudder. In service charges this means a reduction of possibly 25 per cent. or more. The ship has carried from 50 to 1,000 pounds without altering balance. Its tail skid, undercarriage and control wires are all so designed as to permit forced landings at night in rough or even brush-covered ground. Instead of its radiator presenting excessive parasite resistance, as in the De Haviland, it is placed partly underneath the engine bed. The engine compartment is practically air tight and such precautions have been taken as to render the ship practically fire-proof. Prominent among these latter features is the fact that, by touching a trigger, the pilot can drop his gas tanks. The *"Carrier Pigeon"* has a high speed of 126 m.p.h., and lands at about 50 miles an hour. It is equipped with a Curtiss-Reed duralumin propeller. Dimensions of the *"Carrier Pigeon"* are: span upper wing, 39 ft. 1½ in.; lower wing, 41 ft. 11 in.; length, 28 ft. 7⅛ in.; height, 12 ft. 1 in.

The "Aerial Mercury"

The Aerial Service Company's *"Aerial Mercury"* was the next submitted. Unlike the Curtiss *"Carrier Pigeon,"* which has a steel fuselage, the Aerial Service craft's fuselage is all wood. Wings are wood and fabric. It carries half a ton of mail. Its cruising speed was set by its builders at 105 miles an hour and its top speed at 125 m.p.h. It has a cruising range of 500 miles. Its dimensions are: span upper wing, 42 ft. 11 in.; lower wing, 47 ft. 1 in.; length 28 ft. 6 in.; height 11 ft. 4 in.

Elias Mail Plane

The Elias mail plane was given its first test upon a soft, muddy field, which gave opportunity to demonstrate its very wide tread—eight feet—and the practicability of its oversize 36″ x 8″ wheels.

The Elias plane has a welded steel fuselage and chassis. The mail compartment is all-metal. Especial attention has been given to the fire hazard. The gasoline tanks may be released from the pilot's seat. Between the mail compartment and the engine is a double firewall, including asbestos and an air space. The ship is exceedingly sturdy. Its divided landing gear and strong, steerable tail skid commend it for cross country flying at night. The wing span is 40 feet and length over all, 28 feet. Fully loaded, including 1,000 pounds of mail, it weighs 4,667 pounds. Its low speed is reported at 48 miles an hour, high speed 130 and cruising speed, 105 miles an hour.

At the time of writing none of the other ships had been delivered.

New Loening Wing Improves De Haviland

The Loening Aeronautic Engineering Company of New York during the summer of 1924 made a careful analysis of the problems of the Department in operating the De Havilands. Much of the difficulty, so far as efficiency and controllability were concerned, lay with the old-type wings. Grover C. Loening designed and constructed thirteen sets of wings, which have been installed on De H. fuselages and are in regular day and night service. For the old curve Mr. Loening substituted the Loening No. 10A section. The internal construction consists of metal, with the exception of the spars. This doubles the safety factor, making it 9, instead of 4½. It raises the high speed of the De Haviland about 11 m.p.h. and decreases the landing speed 10 m.p.h. It increases carrying efficiency, but what is probably most important, it very greatly improves lateral control of the De H. at stalling speed.

In the rehabilitation of old machines and the development of new ones, the Air Mail has had the valuable co-operation of the Haskelite Manufacturing Company and the New Jersey Veneer Co., the Meisel Press Manufacturing Co., and the Aluminum Co. of America.

Consideration of Contract Air Mail Bill

On Tuesday, April 29, 1924, the House Committee on the Post Office and Post Roads held public hearings on H. R. 6942 and H. R. 7064. The former, sponsored by Hon. F. H. La Guardia of New York, sought to empower the Postmaster General to designate Air Mail routes and to operate them. The second, advanced by Hon. M. Clyde Kelly of Pittsburgh, authorized the Postmaster General to designate Air Mail routes and to contract with private

parties for their operation. The committee heard the views, either in person or by letter, of twenty-five or thirty individuals or companies that were looking ahead to the time when the Air Mail would be privately operated. There was general endorsement of the Kelly bill, though considerable difference of opinion existed as to rates. This, in advance of the day and night experiments by the Department, was speculative, as traffic was an unknown factor and the service itself would require some time for standardization.

Under the provision for the transportation of foreign mail, the Post Office Department has been able for several years to make contracts for the private transportation of Air Mail between Seattle and Victoria and New Orleans and Pilottown, the former a distance of 84 miles and the latter a distance of 80 miles. The Seattle service has been operated by Edward Hubbard under the name, Alaska Airways, Inc., and the New Orleans service by the New Orleans Airline. Both are desirous of extending their activities. In the year Oct. 1, 1923-Nov. 1, 1924, Alaska Airways flew 22,000 miles and carried 60,000 pounds of mail. In the same period the New Orleans Airline flew 40,000 miles, carrying 27,000 pounds of mail.

Demands for More Air Mail Lines

From the start of the day and night transcontinental service demands began to pour into the Department for the extension of the Air Mail. These demands came mostly from chambers of commerce or other municipal bodies. In most instances they were supported by personal letters from members of Congress and in some instances were supplemented by letters from private corporations. In addition to correspondence, scarcely a day passed during the session of Congress in the winter of 1924-25 but the Second Assistant Postmaster General received personal calls from members of Congress and representatives of municipal or trade organizations urging extension of the Air Mail.

In general, the sentiment expressed was that the Post Office Department should, wherever possible, continue its policy of laying out and night-lighting air routes, these routes eventually to be used by any private commercial carrier. Among the services thus urgently sought were:

New York-Boston.
Chicago-St. Louis-Kansas City-St. Joseph-Omaha.
Salt Lake City-Los Angeles.
Elko, Nev.-Pasco, Wash. (Pacific Northwest).

All of these extensions coincided with estimates made by the Traffic Manager as to which were the most profitable fields to draw traffic from and thereby feed the main transcontinental line, or the backbone of the service.

Kelly Bill Becomes a Law

In December both the La Guardia and Kelly bills came before the House and both passed after brief and highly congratulatory discussion. On reaching the Senate, however, the La Guardia bill was kept in committee, and died there, while the Kelly bill went through unanimously, was repassed by the House and on Feb. 2, 1925, was signed by the President. The Kelly bill reads as follows:

A BILL

To encourage commercial aviation and to authorize the Postmaster General to contract for Air Mail service.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, that this Act may be cited as the Air Mail Act.

Sec. 2. That when used in this Act the term "air mail" means first class mail prepaid at the rates of postage herein prescribed.

Sec. 3. That the rates of postage on air mail shall not be less than 10 cents for each ounce or fraction thereof.

Sec. 4. That the Postmaster General is authorized to contract with any individual, firm, or corporation for the transportation of air mail by aircraft between such points as he may designate at a rate not to exceed four-fifths of the revenues derived from such air mail, and to further contract for the transportation by aircraft of first-class mail other than air mail at a rate not to exceed four-fifths of the revenues derived from such first-class mail.

Sec. 5. That the Postmaster General may make such rules, regulations and orders as may be necessary to carry out the provisions of this Act: *Provided,* That nothing in this Act shall be construed to interfere with the postage charged or to be charged on Government operated air-mail routes.

The Postmaster General is proceeding accordingly and the Department, while preparing for the night operation between New York and Chicago, is also considering the applications of individuals, groups and organizations desirous of carrying the mail by air. A half million dollar appropriation is available for such contracts.

As was brought out in the debates on the Kelly bill and in testimony given before the Select Committee of Inquiry into the Operation of the United States Air Services, it would seem that the day of practical commercial aviation is at hand.

CHAPTER III

AERIAL SURVEYING—PHOTOGRAPHY—APPLICATION IN CITY AND WILDERNESS

AERIAL surveying is today the largest organized phase of commercial aviation, both in gross business and in the number of planes utilized and the number of men employed. At a time when other aspects of the new art were struggliing for practical recognition, gross sales in aerial surveying advanced from $30,000 in 1919 to half a million dollars in 1924, with a conservative estimate of over $1,000,000 for 1925.

From the individual efforts of a few airplane owners with small equipment in 1919, the business has developed and consolidated into a few corporations, of which the most active are the Fairchild Aerial Surveys, Inc., Hamilton Maxwell, Inc., Underwood & Underwood, and Fairchild Aerial Surveys (of Canada), Ltd. The largest is Fairchild, which manufactures its own equipment, operates its own airplanes, employs over 120 men, and has branch offices in New York, Washington, Boston, Dayton, Chicago, St. Petersburg, Dallas, Los Angeles, London, England, Grand' Mere and Montreal, Canada.

The growth of aerial surveys has been due to a real demand which from the start has been carefully cultivated. In the first two or three years, the principal use made of aerial photographs was as illustrations for newspapers and magazines, some were used for display advertising purposes and some were adopted by the large industrial plants of the country in place of the imaginative and so-called "bird's eye views." The idea that aerial surveying was a fad and dependent on novelty of the pictures from an airplane has faded and there is every indication that the industry will continue its rapid growth and remain the largest commercial phase of aviation until commercial air transportation is properly developed.

Growth of Fairchild Organization

In 1924 the Fairchild Aerial Camera Corporation organized a subsidiary company—Fairchild Aerial Surveys—to take over and handle all of their photographic and surveying operations. This

subsidiary has lately absorbed the Pioneer Aerial Engineering Company of Los Angeles, which had been developing the industry in the Pacific Coast states. Another subsidiary company—Fairchild Aerial Surveys (of Canada), Ltd.—is continuing the expansion of the business started several years ago in the Dominion, dealing largely with mapping and surveying of large tracts of timber and the furnishing of timber estimates. Still another corporation has been incorporated in Mexico and the interest shown in aerial maps and surveys in that country has been remarkable. The rapid growth of the Fairchild organization has in a large extent been due to the policy laid down at the inception of the company and its primary object is that of offering a real service to the engineers and such commercial organizations as have occasion to use good maps. This policy has been carried out not only in the spirit of developing new methods and new equipment in order that ever better and better work be accomplished, but also with the idea that educational and informative information should be supplied to the fullest possible extent to the engineers and organizations who have need for these maps.

With this policy in mind, the Fairchild organization very early in their existence found it necessary to establish research and experimental departments and have become known as the pioneers in the developing of precision instruments and equipment for their own use and for various governmental agencies as aids in the making of better aerial maps. Among these instruments might be mentioned the K.-3 camera, which is the official mapping camera of the United States Army and Navy air services, the Canadian air service and the Brazilian air service. It was with this camera that Capt. A. W. Stevens of the United States Army took a single photograph on one film showing the entire city of Dayton, O., from a height of six miles, at the same time that he and his pilot were breaking the world's two-man altitude record. During the early months of 1925, Capt. Stevens was in Brazil for the Fairchild company, instructing the Brazilian navy in the use of the Fairchild camera and in aerial photography generally. This was a part of the service rendered to the Brazilian government in connection with the contract they had placed with Fairchild for cameras and other supplies. While in Brazil, Capt. Stevens joined the Hamilton Rice Expedition, engaged in exploring the courses of the Amazon River. With Lt. Walter Hinton, pilot of the N.C.-4 (Navy-Curtiss), the first heavier-than-air machine to fly the Atlantic, Capt. Stevens photographed the headwaters of the Amazon, which photographs are a part of the records of the Rice expedition. MacMillan, the noted Arctic ex-

plorer, whose expedition in 1925 to the North Pole includes a detachment of Loening Amphibian planes, supplied by the American Navy, is also completely equipped with Fairchild cameras. The importance of the aerial camera in exploration is obvious. It is significant, also, that the Fairchild equipment should have been found to function equally satisfactorily in the tropics and the arctic region.

Translating Air Photos Into Maps

Not only was research and development required along the line of suitable equipment in order to secure better photographs from which to make aerial maps, but it was decidedly important that new methods in assembling and constructing these maps and in making line maps of various descriptions from the photographs be developed. This work was undertaken by Fairchild experts and they have perfected and introduced commercially a system of line mapping which has proven extremely advantageous to public utility organizations engaged in hydro-electric development. This method is described later in this chapter.

The Fairchild organization owns and controls entirely its own airplanes, builds its own equipment, and maintains its own staff of consulting engineers. One of the functions of its consulting engineering department is the preparation and publishing for the benefit of the engineering profession of all information regarding developments by governmental agencies all over the world and by the few private aerial surveying organizations offering their services to the public. A part of this work consists in reviewing all of the important technical publications and, wherever possible, securing reprints of articles appearing in these publications, which articles are furnished to some 10,000 engineers, public officials and public utility companies, bound in standard form and with such comments as their own engineering staff deem proper. This service provides for all such engineers and officials a complete file of the more important articles on the development and uses of aerial surveying that are being made throughout the world. In addition to this service, the consulting staff is always available to clients to advise them regarding the proper application of aerial maps and in several instances, recommendations made by the Fairchild organization have saved clients considerable sums in the preparation of maps or other surveying operations.

During the past year the Fairchild organization has had the privilege of offering commercially a system of making line maps, which consists of taking the aerial photograph in the usual manner, fur-

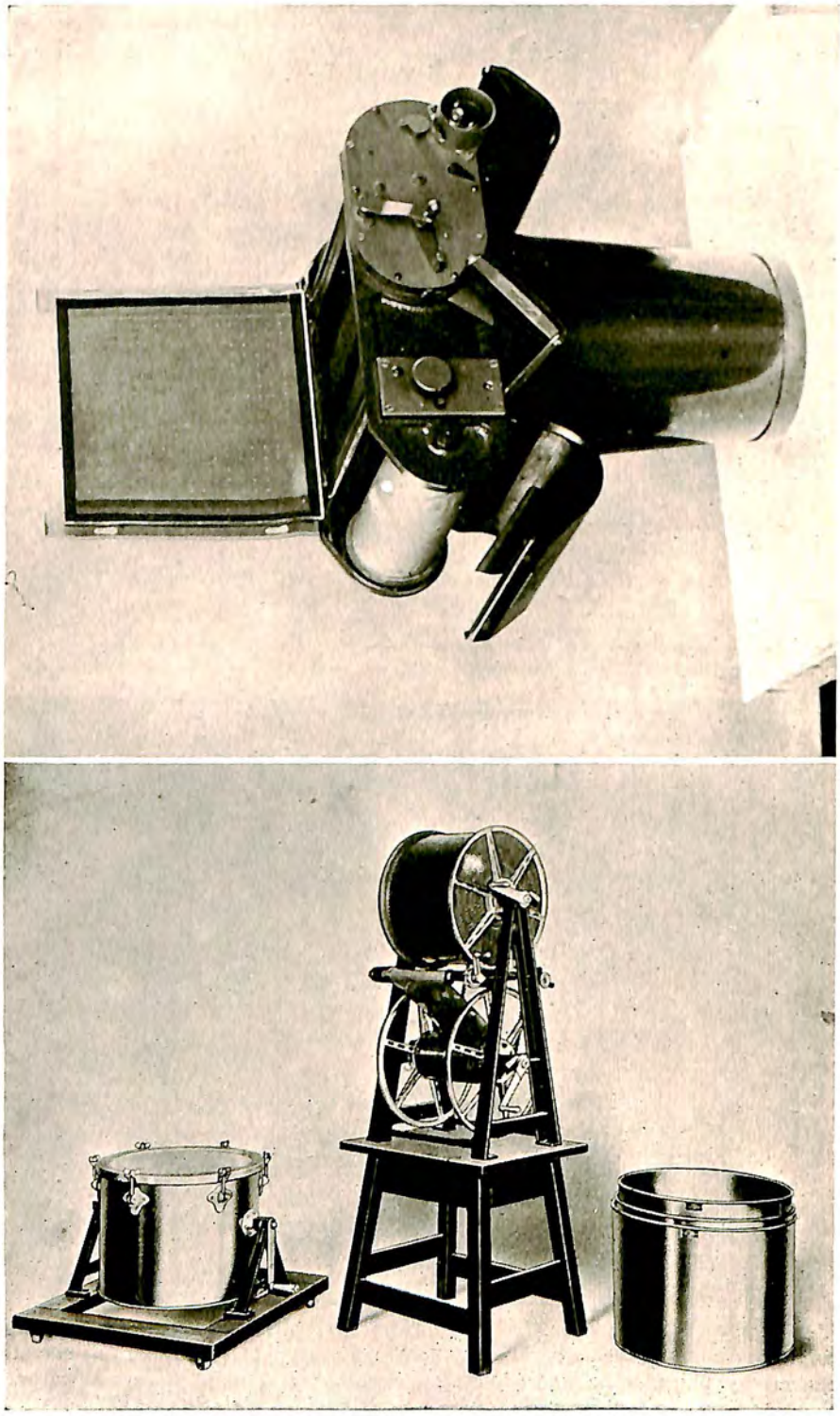
nishing a complete set of these prints to the engineers of the client who take the photographs into the field and by using them as plane table sheets determine by stadia survey the proper elevation on the ground and sketch in the contours on the uncorrected aerial photographs. Photographs with the contours inked in and such other topographic details as are desired to be shown on the finished map, are then returned to the Fairchild laboratories, where by a process known as "radial control," which is quite similar to that employed by the United States War Department in its survey of the Tennessee River Valley, the maps are completed, all corrections for scale being made in the process of tracing. An illustration of this type of map is shown in connection with this chapter. In one specific instance, and for one company located in the northwest where a number of hydro-electric developments were planned and storage reservoirs necessary, the entire survey was made by this method. In fact, this particular company has just received a map of a fourth area which was made by this process. In this case, the country is comparatively flat and the maps were made at a scale of 1,000 feet to the inch, showing contour intervals of two feet. The company using these maps reports that they are far more accurate than similar maps made on the ground and that the cost was about one-half of that involved in making maps of similar terrain at the same scale without the aid of aerial photographs.

Use in Tax Reappraisal

Another new development in the use of aerial maps has come to the front during the past year in their utilization for tax reappraisal. The value of aerial photographic maps in this work can best be illustrated by the experience of two townships in a single eastern state. In one township, comprising some 13 square miles, appraisal engineers were employed to make a new tax assessment. The work was started about 1920. It required four years to obtain the necessary mapping information and to collect the data required in making a correct reappraisal. It required an additional year to put these data in suitable form for the use of the township. The cost to the township of the complete reappraisal, including the surveying involved and the making of the necessary maps, was $80,000.

For another township in the same State, which covered an area of 43 square miles, more than three times the area of the township just described, the Fairchild organization was called in and prepared an aerial photographic map at a scale of 800 feet to the inch, with enlargements from the individual negatives to a scale of 100 feet to

(Top) Line map developed from aerial photograph. (Bottom) On this photograph were superimposed in the field contour lines designating elevations secured by plane table and stadia method. Aerial map more accurate than Government ground survey.—*Fairchild Aerial Surveys, Inc.*



(Top) Eastman K5 Air Camera. (Bottom) Eastman Air Film Developing Outfit.

the inch. All of the mapping information was obtained in this manner within 90 days and the same engineers who had been forced to spend nearly 4 years in compiling and arranging their data on the first township, were able on this second township, with the aid of the photographic maps, to complete the reappraisal in 14 months. The total cost of reappraisal including the photographic maps by this second method was $22,000. By the use of the Fairchild system the assessed value of properties was increased from $58,000,000 to $98,500,000 and not a single case of increase in value was carried into the courts or to the State Board of Tax Appeal. Whenever a property owner objected to the assessment, the valuation was substantiated and he was ready to agree that it was a fair valuation after he had had the opportunity to study the aerial map and system by which the value was determined on, during which course of study he gained a better knowledge of the layout of the land he owned than he formerly had.

The development of the Fairchild Mirror Stereoscope has proved exceptionally useful to engineers and city officials in studying overlapping aerial photographs, and in this manner securing an unusual conception of the relief of the area involved in working out their particular problems. This instrument is comparatively simple in construction and has been produced in quantity by Fairchild.

The Fairchild and Eastman Aerial Cameras

Aerial surveying and photography is dependent upon two makes of cameras— the Fairchild Type K-3 and K-4 Aerial Cameras, and the Eastman Type K-5. The Fairchild Cameras are the standard Automatic Cameras of the United States Army and Navy Air Services, and in addition are used by the Canadian Air Force and the Brazilian Air Force. The Eastman K-5 is also used by the Army and by practically all of the other commercial aerial survey corporations.

The Fairchild K.-3 and Eastman K.-5 aerial cameras differ radically. The former uses a "between-the-lens" high efficiency shutter and a glass plate with pressure plate for holding the film flat, in contrast to the focal plane shutter used by Eastman and a suction device for holding the film flat. The Fairchild K.-3 camera is electrically driven and fully automatic in operation, while the Eastman K.-5 camera is hand-operated. There is also a wide difference in the complexity and cost of the two cameras, the Fairchild being much more complicated and costing about three times that of the Eastman camera.

The outstanding military camera development of the year is the Fairchild K.-6 camera developed by the Fairchild Aerial Camera Corporation for the United States Army Air Service. This camera for the first time employs a focal plane shutter in which evenness of exposure and consistency of shutter speeds are assured by the use of a governor which controls the speed of travel of the focal plane shutter. This camera is designed for spotting from high altitudes. It is equipped with a 20″ lens and a standard Fairchild K.-3 magazine.

The New Eastman Aerial Camera Film

The Eastman Kodak Company has made great progress in the development of film for aerial survey work. First, the orthrochromatic film was improved by the substitution of a panchromatic emulsion, which allowed rapid exposures to be made even with heavy colored filters. Later this panchromatic film was hypersensitized by an ammonia process so that now it may be said that it is the fastest film in the world and that pictures on it may be taken under almost unbelievable conditions.

Mapping Greater New York from the Air

A most notable feature in the development of aerial surveying and its recognition by city officials and prominent engineers was the completion during the past year of the aerial photographic map of Greater New York. This map was made on a contract awarded by the Chief Engineer of the Board of Estimate and Apportionment of the City of New York and covered all five boroughs with the adjoining sections of New Jersey, Nassau and Westchester Counties, New York. The area comprised some 620 square miles. The map was delivered at a scale of 600 feet to the inch and consisted, in addition to a wall map, some 8 feet square (the wall map was at a scale of 2,000 feet to the inch), of some 140 sections, each approximately 18″ by 25″ in size. These sheets portray the city in the most minute detail, showing every structure from the contractor's temporary tool shed to the skyscraper, existing streets and boulevards, as well as unrecorded footpaths and trails through the parks, and even the automobiles on the streets at the time the picture was taken, and are now available through the City of New York to any citizen who desires to make a detailed study of any section of the city.

The comment of Arthur S. Tuttle, the Chief Engineer of the Board of Estimate and Apportionment, after having received and

checked the map, was that it entirely met with the specifications which had been laid down by the city and that he anticipated a saving in city departments alone within the next year or two of a far greater sum than the actual cost of the entire map. This statement, of course, does not disclose the value which will be derived by the various business organizations, real estate companies and individuals, through having available such information at very reasonable cost.

Some Big Users of Aerial Photographs

Among the larger users of aerial photographic maps during the past year have been Electric Bond & Share Company, Pennsylvania Power & Light Company, Pennsylvania Power & Water Company of Baltimore, Consolidated Gas, Electric Light & Power Company of Baltimore, Philadelphia Electric Company, C. H. Tenney Company of Boston, New England Power Company of Worcester, Mass., Edison Electric Illuminating Company of Boston, Minnesota Power & Light Company, Texas Light & Power Company, Allied Chemical & Dye Corporation, Messrs. Olmstead Brothers of Brookline, Mass., Messrs. Krenn & Dato of Chicago, Messrs. S. E. Minor & Company, engineers, of Connecticut, Westchester County (New York) Park Commission, Istokpoga Drainage District in Florida and the Towns of Middletown, Bristol and Westhaven, Conn.

Fairchild Work in Canadian Forests

Fairchild Aerial Surveys (of Canada), Ltd., a subsidiary of the American company, under the direction of Ellwood Wilson, formerly Chief Forester for the Laurentide Company of Grand' Mere, Quebec, have continued the operations started several years ago by the Fairchild organization in the production of aerial photographic maps and in furnishing to the owners of timber acreage in Canada detailed estimates of the number of cords of wood which can be cut within the limits owned, have successfully completed contracts for the James McLaren Company, the Wayagamack Pulp & Paper Company, Quebec Streams Commission, the Laurentide Company, Ltd., International Paper Company and others. Most of the maps for timber cruising purposes are made at scales of 600 to 800 feet to the inch. A considerable portion of the work has been done in the winter with snow covering the ground and for this purpose the pontoons (hydro-airplanes are used for work during the summer) were removed and skiis substituted, the planes then landing on the

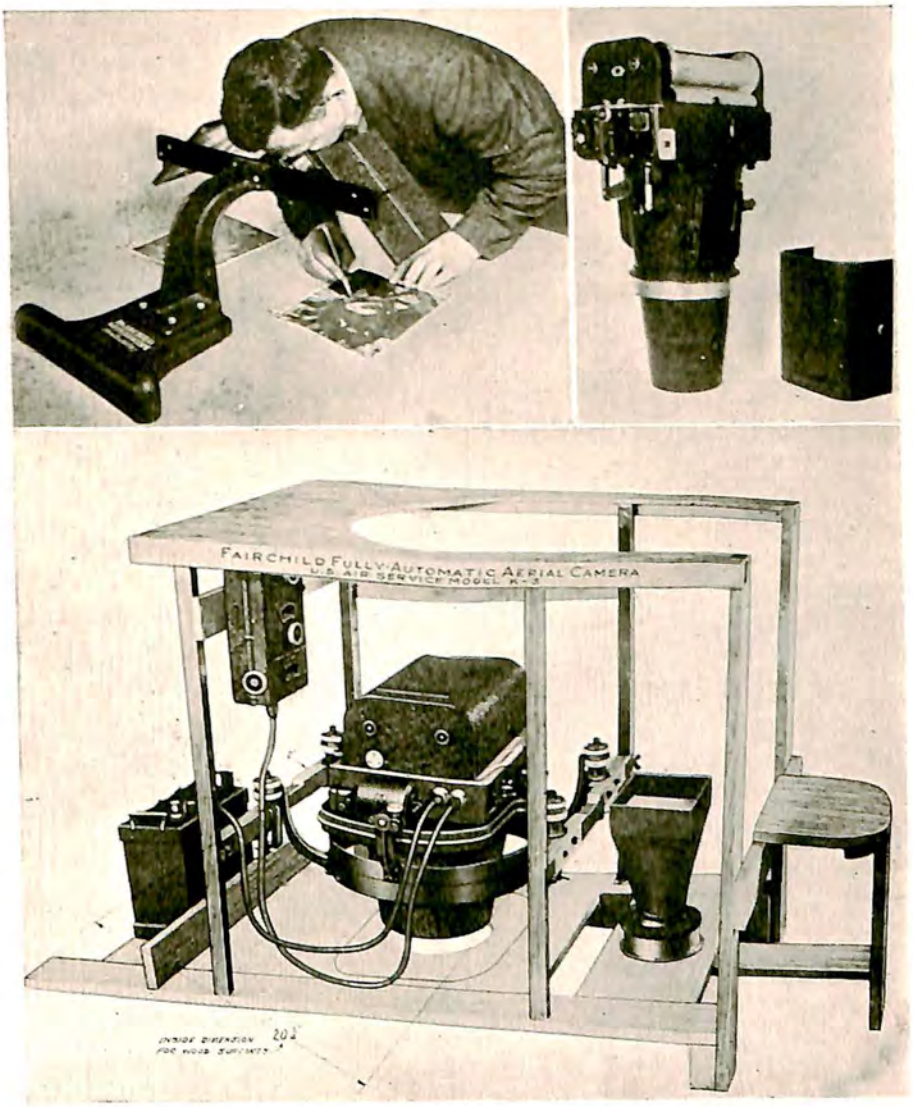
frozen lakes. In fact, winter pictures were discovered to be more valuable than those taken with the foliage on the ground.

In addition to the work carried on by the Fairchild organization in Canada, the Canadian government, using Fairchild K.-3 cameras, has surveyed large areas of the Dominion which have never been mapped before and the results obtained and the efficiency of the method can probably best be described by the following quotation from the Report of the Canadian Air Board:

"A third feature of the year has been the very remarkable advance in the practical application on a large scale of aerial photography to surveying, exploration and map production, and in addition, to railway location and other engineering problems. Though much remains to be done before the production of maps from aerial photographs, correct in horizontal and vertical scales, is practicable, yet a very large field exists today in Canada, in map revision and exploratory mapping, for the practical application of those partial solutions of the problem which are now available. An area of well over 40,000 square miles was covered this year by oblique and vertical pictures for the Topographical Survey Branch of the Department of Interior, and it is not too much to say that aerial photography has already revolutionized their system of map production in many respects. The problem of aerial surveying in this country is very different from that existing in the smaller and older civilizations of Europe, where ordnance survey maps, correct to the last minute detail, exist. Here, the existing maps are imperfect, and great areas have never been surveyed at all. The production of accurate topographical maps to keep pace with the growing demands for land settlement, lumbering operations, and many other activities, is a difficult problem; and despite the great efforts made by the Survey Services during the past generation, map production still lags behind the demand. The new method is of great benefit as it will enable the Survey Services to increase their output and lessen the ground work in the field, this enabling each party to cover a larger area in the season. The mapping field is of interest principally to the Government Service; but in commercial work there is also a great outlet for aerial photography.

"Energetic steps are being taken to develop this by the Fairchild Aerial Surveys Company (of Canada) Ltd. Photographic mosaics are much in demand for town-planning purposes, preliminary surveys of railroad and power transmission lines, and the development of water-power projects. Though these mosaics cannot take the place of accurate topographical surveys, yet in many cases they are of tremendous value to the engineer, in that they show every detail of the terrain in a way which no map does."

The Canadian Fairchild Company last year mapped over 1,000 square miles in the Province of Quebec for the pulpwood interests alone. A recent announcement has been made that the Fairchild Canadian Company has entered into a working agreement with the James D. Lacy Company, probably the best-known firm of timber cruisers in North America, whereby the Fairchild Company will furnish all photography and all aerial transportation for the timber



(Upper Left) Fairchild mirror stereoscope which brings into relief position of terrain common to overlapping vertical aerial photographs. (Upper Right) Fairchild K6 Aerial Camera. (Bottom) Fairchild K3 Automatic Aerial Camera, official mapping camera of United States Army and Navy Air Services and Canadian and Brazilian Governments.

These illustrations reveal discrepancies found in comparing aerial and ground maps. Line map at top made on the ground; photograph below is section of photomap similar to those used by Canadian paper companies in identifying standing timber.—*Fairchild Aerial Surveys, Inc.*

cruising reports prepared by the Lacy Company. These contracts, as well as those of the Fairchild organization, will be executed under the personal direction of two of the leading foresters in Canada, F. D. Jenkins of the Lacy Company, and Mr. Wilson of the Fairchild Company.

Information has recently reached the United States that a new aerial surveying organization has been formed in England, with principal offices in London, and that this company has secured a contract from the Government of the City of London for an aerial photographic map of the world's metropolis. Several organizations have been developed in both France and Germany which are doing quite creditable aerial photographic surveying, but without question the United States predominates in the development of aerial surveying and during the past year this particular branch of aviation has without question stepped to the front and has become the leader in the commercial development of this new science and industry.

Geological Survey and Air Photography

The United States Geological Survey reports to the Aeronautical Chamber of Commerce that it has made a beginning in the use of air photographs for geologic mapping. "Photographs have been taken for the Survey, by both the Army Air Service and the Navy Air Service," writes F. M. Goodwin, Assistant Secretary of the Department of the Interior, "and in each instance these photographs have proven of great value in the detection of geologic features and as bases for geologic field work. The process will be most useful in the west, where the rock outcrops are not obscured by vegetation. One of the trials, in Arizona, was particularly successful. Another test, in California, also indicates that the method, under favorable conditions, will be of great value as an aid in geologic field work.

"In topographic mapping even greater progress has been made, and during the past year the Army Air Service has co-operated with the Geological Survey to the extent of making airplane photographs of approximately 15,000 square miles of territory in the United States, the resulting photographs furnishing data which have been of the greatest value, both from the point of economy and that of expediting the completion of the mapping."

CHAPTER IV

COMMERCIAL OPERATIONS—ORGANIZATION OF THE NATIONAL AIR TRANSPORT, INC.—CROP DUSTING AND SURVEY—FOREST PATROL

COMMERCIAL air operations in 1924 suffered a noticeable decline from 1923, as is shown by the following table:

	1924	1923	1922
Fixed-base operations reporting	60	124	129
Aircraft in use	217	429	450
Miles flown	922,048	3,014,611	2,846,037
Passengers carried	48,904	80,888	75,268
Pounds of freight carried .....*	159,564	208,302	110,663
Average charge per short flight	$4.73	$5.50	$7.00
Average charge per passenger mile	.39	.46	.428
Average charge per machine hour	$40.00	....	....
Average charge per pound mile	.0018	.104	.036

*Of this, mail constituted 88,500 pounds.

The history of commercial air operations since the Armistice may be summed up in a few words. First, tremendous optimism founded upon the widespread curiosity of the public; limited financing built upon the assumption that curiosity would force the development of air transport without further engineering and without the application of a deliberately worked out national policy. Second, diminishing enthusiasm and waning curiosity; dissolution of ambitious undertakings because of obsolete equipment, lack of airways, lack of public terminals, and, above all, lack of paying business. Third, readjustment upon a reduced but sounder financial basis; activities limited to those phases of aviation for which there is a demand; this demand increasing as evidences multiply of the early formulation of national air policy.

If the accompanying list of aircraft operators be scrutinized it will be seen that the most successful of those remaining in the business have had some definite specialty, such as aerial photography or air mail contracts, the latter, limited at the present time to routes making foreign steamship connections. Others have built up a recognized service for long-distance inter-city flights for the trans-

port of persons or urgently needed merchandise and which, consequently, will justify an extra tariff for extra speed. Aerial photography is discussed under a separate chapter of the same heading, as it is today the most important of all phases of commercial aviation. Air mail contracts, especially those in prospect in the near future, are certain to lead naturally, though possibly after a brief period of testing and adjustment, to the carriage of passengers and general cargoes of high-class freight, in which field is felt to lie the greatest profit for air transport.

Interest in Mail Contracts

Under the provisions of law covering foreign mail, it has been possible for the Post Office Department for several years to contract for private air mail movement between Seattle, Wash., and Vancouver, B. C., and New Orleans and Pilottown, La. These contracts have formed the "bread and butter" earnings of the two modest but significant activities carried on in 1924. They are an indication of what may reasonably be expected when the new Kelly law, permitting the letting of private air mail contracts within continental United States becomes fully operative. The Seattle contract is held by Edward Hubbard and the New Orleans by the New Orleans Air Line, Arthur E. Cambas, General Manager.

The outstanding feature of commercial aviation was the performance of the Curtiss Exhibition Co., subsidiary of the Curtiss Aeroplane & Motor Co. During the period covered by the report of the Curtiss Exhibition Co., of which Charles S. Jones is manager, this company flew 100,000 miles and carried 3,400 passengers to points as far distant as 1,000 miles from New York. One of the notable performances was the delivery of a New York morning newspaper in Cleveland every morning during the Republican National Convention. Two machines left Garden City each day with 500 pounds of newspapers each, and with the saving in time, delivered the papers in Cleveland in time for breakfast in the morning, the service being much appreciated by the delegates. On the return flights the ships brought back pictures and films visualizing the day's developments.

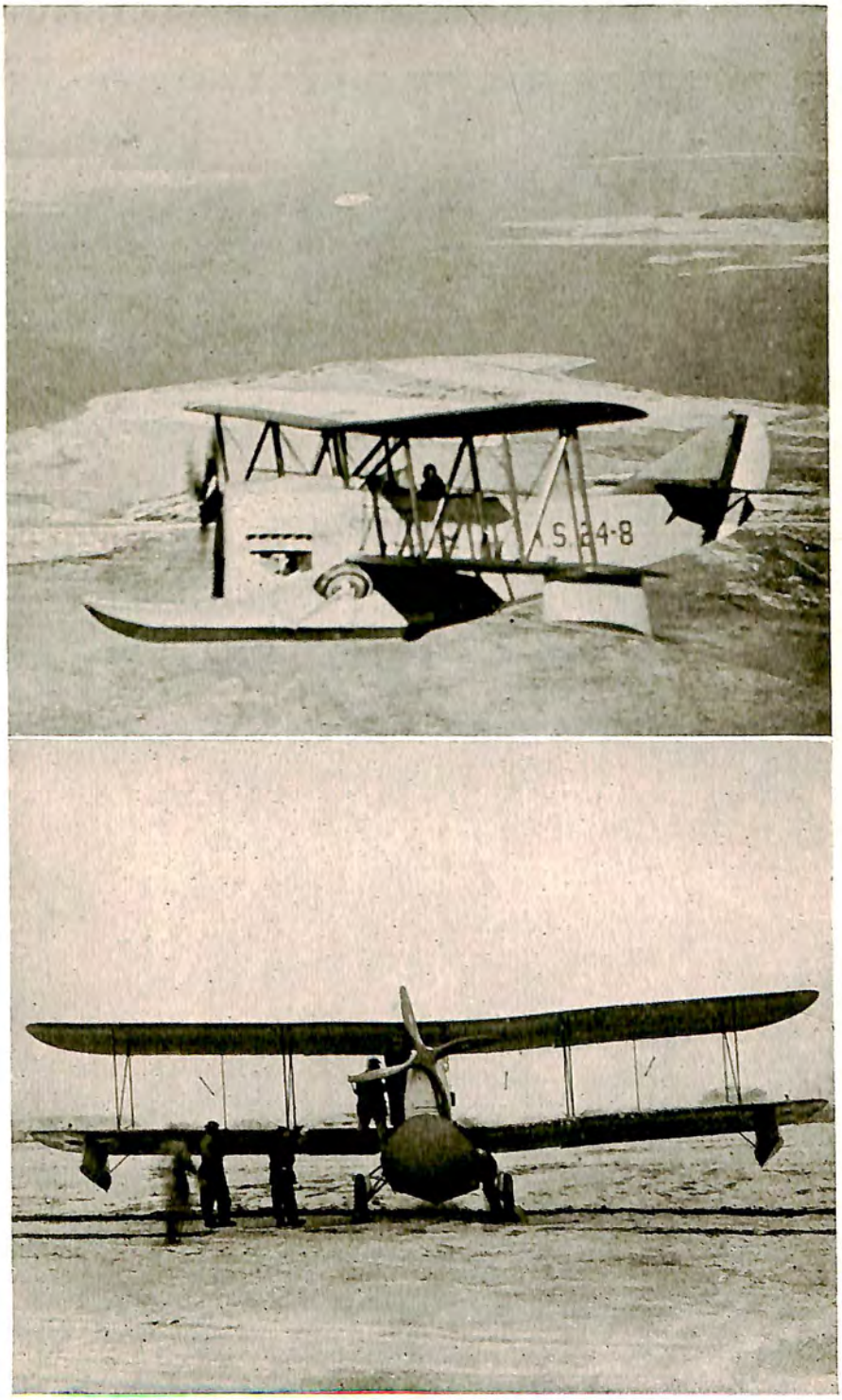
The Curtiss Exhibition Company reports considerable demand for the Curtiss amphibian flying boat, particularly on low photographic work around New York City. Another flight of interest was a trip made in a special *Oriole* from Boston to New York, carrying pictures of the return of the World Flyers, the 200-mile flight being made in 1 hr. 35 min. During the year the Curtiss

Exhibition Co. co-operated with several motion picture companies in making films, the most notable of which was the Lone Wolf story by Joseph Vance. The bringing back of the pictures at the time of the Sandusky, O., tornado, which occurred early in the evening, was also of considerable interest. The company, through a connection in Cleveland, had an airplane with a photographer over the scene of the disaster at daybreak the next morning. The pictures were brought into Cleveland and developed, where they were picked up by a Curtiss Exhibition plane from New York and brought to New York the same day. Twenty-four hours after the tornado these pictures were published in the East.

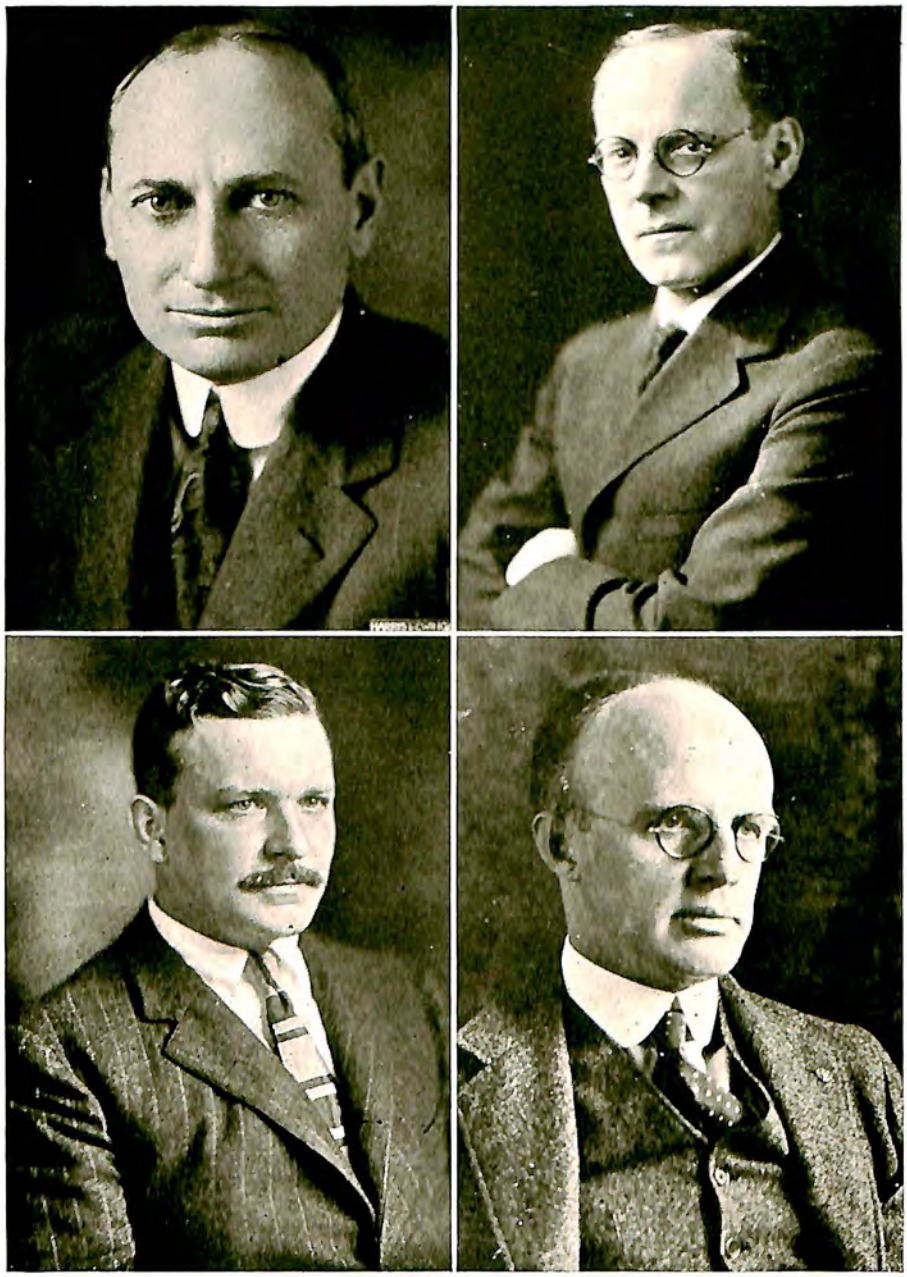
When President Coolidge was inaugurated the Curtiss Exhibition Co., Ludington Exhibition Co., the Harold F. Pitcairn Aviation Co., and other operators, successfully carried through a scheme for photograph distribution on the same day of the ceremony to points as far as 1,000 miles distant. Through the representations made by the Aeronautical Chamber of Commerce on behalf of the commercial operators, the government services refrained from competing, as in the past. The results were gratifying as demonstrating the ability of commercial aviation to meet the public demands.

The Curtiss Metropolitan Company continued during 1924 its long, unbroken period of operation, which antedates our entrance into the World War. There was much passenger work along the coast near New York, and in Florida waters. This company is equipped jointly with Curtiss and Loening flying boats.

There was, as previously, a good deal of short flight passenger carrying, notably by such organizations as Burns Flyers, Fenton, Mich.; Fenton Airways, Fenton, Mich.; Florida Aviation Camp, Hialeah, Fla.; K. R. Garver, Attica, Kas.; Heath Airplane Co., Chicago; Johnson Flying Service, Inc., Dayton, O.; Ludington Exhibition Co., Philadelphia; N. B. Mamer, Spokane; Marvin A. Northrop, Minneapolis; Ontario Aircraft Corp., Ontario, Cal.; Clarence O. Prest, Arlington, Cal.; Robertson Aircraft Corp., St. Louis; E. M. Ronne, Buffalo; Sheldon Air Line, Sheldon, Ill.; Walter T. Varney, San Francisco, and Yackey Aircraft Co., Maywood, Ill. The Johnson Flying Service's record was similar to that of the Curtiss Company, though on a lesser scale. Passengers were transported between various points in Ohio, Indiana, Illinois, Michigan and Kentucky. The Robertson Aircraft Corp., operating from St. Louis, flew far into the Southwest, and, in addition, developed an extensive jobbing business. On the Pacific coast, Walter T. Varney made a unique arrangement with the Checker Cab Co., of San Francisco, whereby four Laird *Swallow* planes are held in



(Top) Loening *Amphibian* in flight. (Bottom) Illustrating how Loening *Amphibian* is used as a land plane.



Officers of the National Air Transport, Inc. (Top Left) Howard E. Coffin, President, (*Harris & Ewing*); (Top Right) C. M. Keys, Chairman, Executive Committee, (*Underwood & Underwood*); (Bottom Left) Charles L. Lawrance, 1st Vice President, (*Gessford*); (Bottom Right) Col. Paul Henderson, General Manager.

instant readiness for chartering to practically any part of the state. The Sky-Writers' Corp. of America continued the demonstration of unique aerial advertising.

Ford and the National Air Transport, Inc.

As this volume goes to press, word comes of two significant developments in aerial transportation. The Ford Motor Company, which, through Edsel Ford, has for the past three or four years taken an increasingly active interest in aviation, has formally announced its entrance into air transport. Henry Ford believes in the future of commercial flying. At Dearborn, Mich., a few miles from Detroit, he has established an air port of the first class. There are complete service facilities for airplanes and airships, a mooring mast superior to those developed by the Navy having been erected. Shop facilities have been provided for the Stout Metal Airplane Co. It is reported that the Fords have acquired control of the latter company and that they propose to use Stout all-metal airplanes in their private air line experimentation, carrying strictly Ford cargoes, first between Detroit and Chicago, then between Detroit and Minneapolis.

The National Air Transport, Inc., was formed in Chicago early this year by a group of men, in various cities, who are desirous of undertaking the operation of aircraft upon a scale hitherto unattempted in this country. The corporation has as its president, Howard E. Coffin, who was prominently identified with aircraft production during the world war, who was a member of the Naval Consulting Board, and who was the first president of the National Aeronautic Association. C. M. Keys, president of the Curtiss Aeroplane & Motor Company, is chairman of the executive committee. Charles L. Lawrance, president of the Wright Aeronautical Corp., is first vice president; Wayne Chatfield-Taylor, of Chicago, is second vice president, and Eugene W. Lewis, a Detroit banker, is third vice president. Carl B. Fritsche, general manager of the Aircraft Development Corp., is secretary, and John J. Mitchell, Jr., of the Illinois Merchants Trust Co., Chicago, is treasurer. Chester W. Cuthell, of New York, and William P. MacCracken, of Chicago, are counsel. Paul Henderson, Second Assistant Postmaster General, was invited to become general manager, and accepted, his resignation as an official of the Government to take effect Aug. 1, 1925.

The National Air Transport, Inc., has an authorized capital stock of $10,000,000, of which $2,000,000 was paid in at the time

of organization. Among the purposes for which it was formed, according to the certificate of incorporation, are: to transport by aircraft in interstate commerce, freight, securities and articles of merchandise of every nature and description; to carry mail under contract with the United States Government; to acquire by purchase or otherwise, to own, lease, operate, sell or otherwise dispose of aircraft of every nature and description, the motors therefor and accessories thereto.

Stockholders of the National Air Transport, Inc., are drawn principally from New York, Chicago and Detroit, it being understood that the company's first endeavor will be to operate an overnight air express between the Atlantic coast and the Great Lakes. Directors are as follows:

From New York: Trowbridge Callaway, Callaway, Fish & Co.; Leonard Kennedy, Leonard Kennedy and Co.; C. M. Keys; Charles L. Lawrance; Jeremiah Milbank. *From Chicago:* Charles F. Glore, Marshall Field, Glore, Ward & Co.; Lester Armour, Armour & Co.; Phillip K. Wrigley, Wm. Wrigley, Jr., Co.; Robert P. Lamont, president American Steel Foundry Co.; Earle H. Reynolds, president, Peoples Trust & Savings Bank. *From Detroit:* Howard E. Coffin, vice president, Hudson Motor Car Co.; William E. Metzger, president, Detroit Aviation Society; Walter O. Briggs, Briggs Manufacturing Co.; Harold H. Emmons, Clark, Emmons, Bryant & Klein; George M. Holley, president, Holley Carburetor Co. *At large:* John Hays Hammond, Washington, D. C.; C. F. Kettering, General Motors Research Corp., Dayton, O.; W. J. Austin, the Austin Co., Cleveland, O.; C. T. Ludington, Ludington Exhibition Co., Philadelphia; William A. Rockefeller, New York.

Stockholders other than directors are: *From New York:* Stuyvesant Fish, Glenn H. Curtiss, Chester W. Cuthell, F. Trubee Davison, Dunlevy Milbank, Duncan D. Sutphen. *From Detroit:* Roy D. Chapin, Eugene W. Lewis, Carl B. Fritsche. *From Philadelphia:* James A. Develin, Jr., J. Brooks B. Parker, Harold F. Pitcairn. *From Dayton, O.:* H. E. Talbot. *From Cincinnati, O.:* John W. Pattison.

The oft-discussed relation between commercial aviation and the military defenses finds an important consideration in the certificate of incorporation, as follows:

"If at any time, in the opinion of the Board of Directors of this corporation, a national emergency exists, the Board of Directors shall have the power to make available to the United States Government all or any part of the organization, equipment and facilities of this corporation, upon such terms and conditions as the Board of Directors deem proper; and every stockholder

of this corporation, by the acceptance of his shares of stock herein, shall be deemed to consent to such action by the Directors."

Saving Crops from the Air

In previous aircraft year books the pioneering work of Dr. B. R. Coad has been mentioned, with especial relation to the application of aircraft in dusting boll weevil-infested cotton areas. Dr. Coad, who is the scientist in charge of the Delta Laboratory, Bureau of Entomology, Department of Agriculture, at Tallulah, La., began as far back as 1922 to experiment with airplanes. He knew that nearly 400,000,000 acres of cotton were infested with the boll weevil and that the pest was gradually extending its operations. The application of calcium arsenate was a problem. The poison itself was highly effective, if applied after a rain, or in the early hours of dawn when the dew was still on the plants. But ground machines were expensive. They had to be dragged through muddy fields by mules, and being operated by negro labor, were unsatisfactory, even under the best of conditions. In the war on the weevil, the cotton planters are losing at the rate of $200,000,000 a year.

In 1923, as related in the 1924 Aircraft Year Book, Dr. Coad enjoyed the co-operation of the Army Air Service when there were assigned to him three or four De Haviland planes, with the necessary personnel. In order intelligently to approach this dual problem, Dr. Coad learned how to fly. He was then in position to determine not only the comparative value of ground and air dusting, but also the type of equipment required. Through the Aeronautical Chamber of Commerce, the industry was invited to share in this preliminary investigation. Huff, Daland & Company, of Ogdensburg, N. Y., through G. B. Post, were the first to become actively interested and have established themselves in this new commercial field upon a very promising basis, having developed special types of flying equipment, trained pilots, and built up liaison with the various agricultural and entomological authorities in the south.

Huff, Daland Ships; Wright Engines

One of the most serious phases of the cotton dusting problem was the procurement of an airplane with sufficient power, maneuverability and safety. Huff, Daland & Co. tried out, in competition, various types of motors, including the Liberty. They finally chose the Wright *Whirlwind* J-4. The engineers of the Wright Aeronautical Corp. worked out joint problems with Huff, Daland and as a result sixteen of these 200 h.p. air cooled radials are being

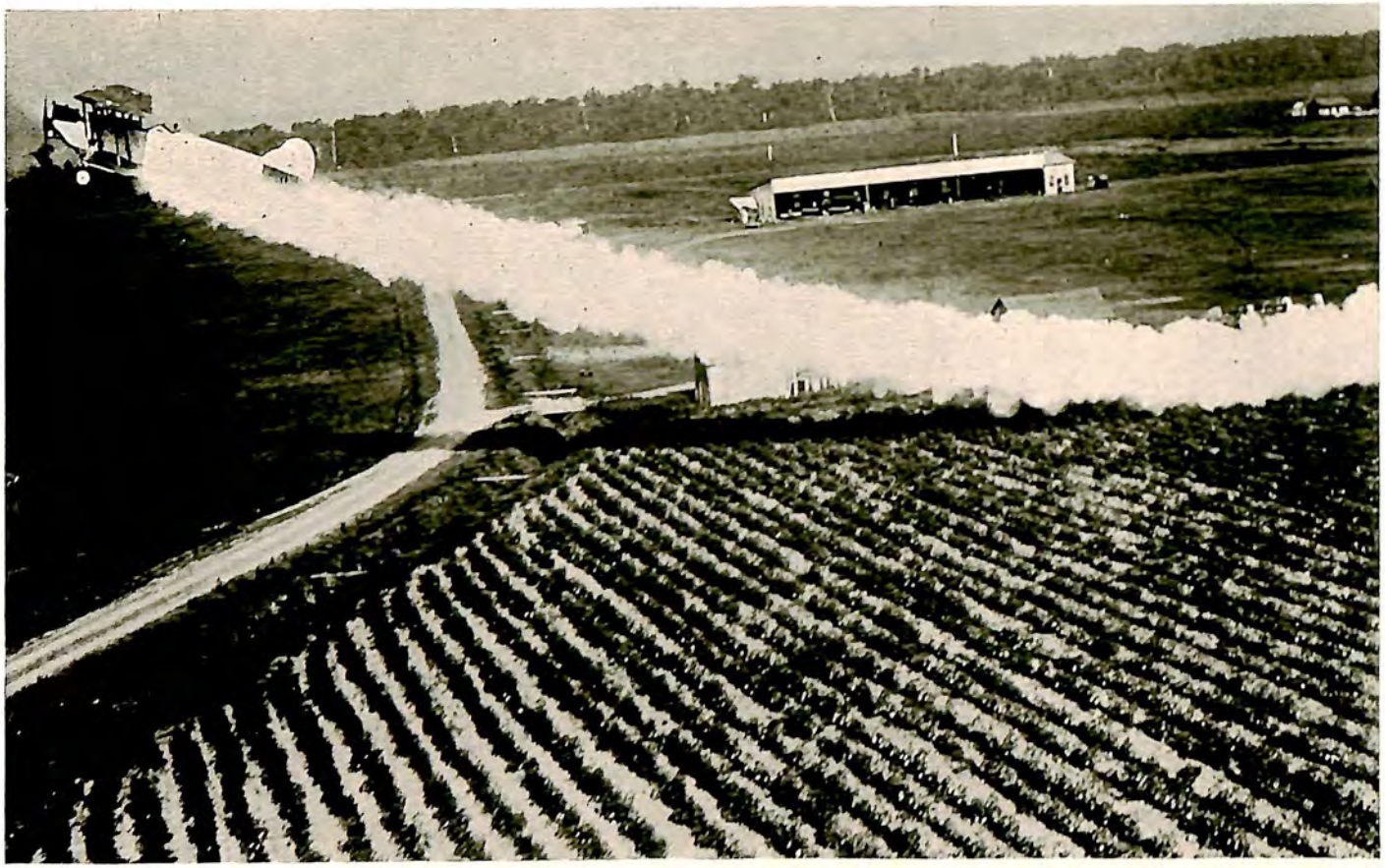
installed in "dusting ships." Some of these *Whirlwinds* have been in service continuously for months, under the most trying conditions, and are reported to be functioning perfectly with a minimum of attention.

A separate corporation—Huff, Daland Dusters, Inc.—has been formed, with headquarters at Macon, Ga. Through co-operation with the Georgia State College of Agriculture and the Federal Department of Agriculture, experiments have been carried on in airplane dusting of cotton fields in Louisiana and Mississippi, and of peach and other fruit orchards in Georgia. At Fort Valley, Ga., 10,000 peach trees were dusted with a compound of arsenate of lead and hydrated lime in 1 hr. 55 min., which time included frequent trips to the field for new loads of poison. Early in 1925 this activity was extended to include 1,000 acres of peach trees, the work to be observed by the Fort Valley Laboratory of the Bureau of Agriculture. In the fall of 1925, experiments were to be extended to the extensive pecan groves to be found in the south.

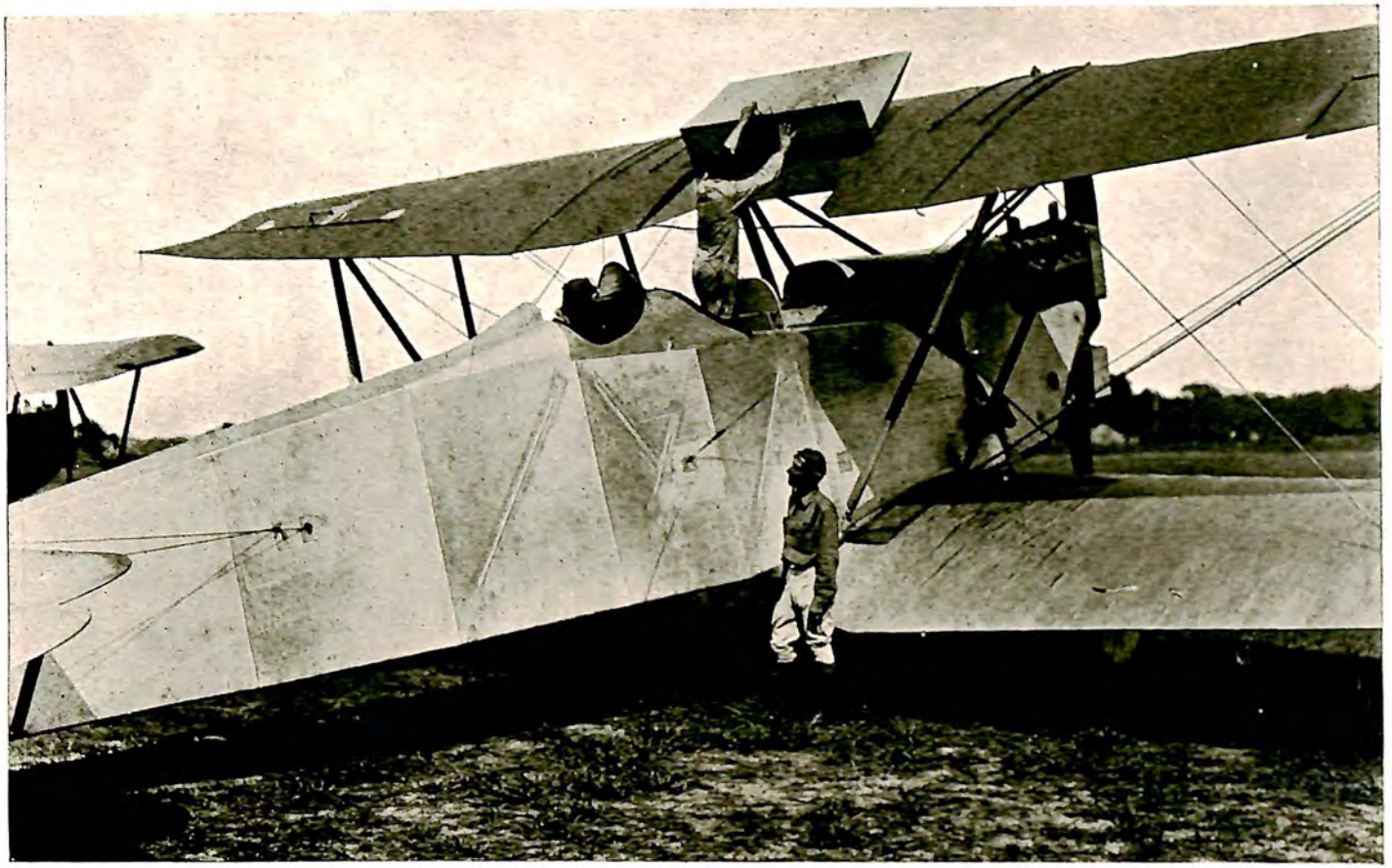
Huff, Daland Dusters, Inc., have developed a novel means of operation. Through the Federal and State authorities local interest and co-operation among the farmers is aroused. A field is obtained in the center of a region where work is likely to be done. Here is established the operating base. To it are assigned two of the special Huff, Daland planes, a pilot, mechanic and a boll weevil expert. It has been found most effective to serve from 5,000 to 7,000 acres, in a radius of ten miles from the field. The plane is flown at a speed of 80 to 90 miles an hour, at ten feet or so above the fields. Dust cast from the hopper is caught in the propeller blast and distributed over a path 200 feet wide. Coming to the end of the field, the plane zooms, turns and dusts another path.

The first thing done on taking a dusting contract is to photograph the plantation, which serves both as a record, as a means of guidance, and also as a means of education for the farmer. The company provides bond to keep its end of the contract. The work is supervised by Federal and State agricultural representatives. Farmers subscribing to this new means of crop protection may insure their crops, through arrangements newly made by one of the Ætna affiliated companies.

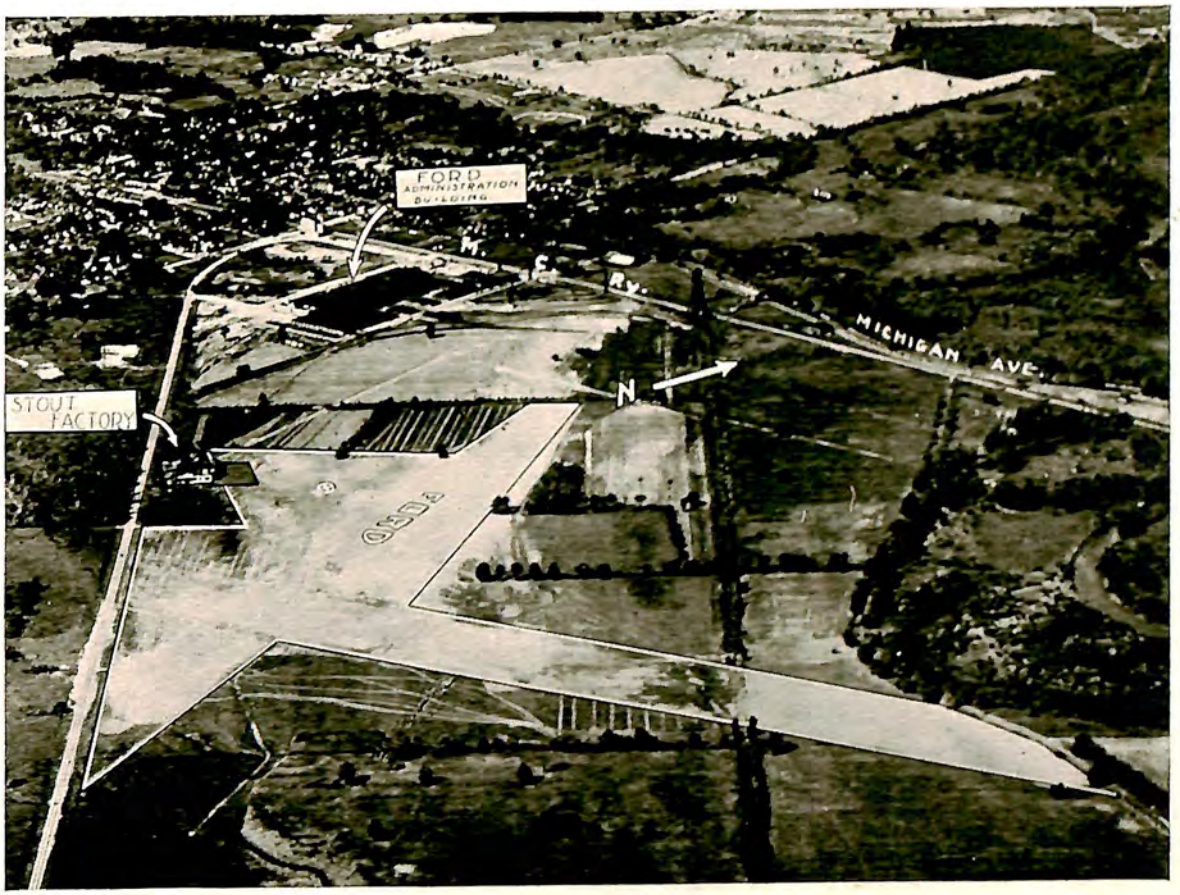
Lt. Harold R. Harris has been released from the Army Air Service and is in charge of Huff, Daland dusting operations. In the past year his planes have made demonstrations at Tallulah, La., Athens, Cordele, Tifton and Blakely, Ga., and Greenville, Miss. The trials at Athens, Aug. 26, 1924, were attended by 10,000 persons. Dusting from the air saves from 50 to 60 per cent. of the



Illustrating how Huff, Daland & Company's dusting planes zoom to get into the corners of cotton fields. Wright *Whirlwind* engines provide the power.—*U. S. Department of Agriculture.*



Hinged wing section of Huff, Daland "Duster" Ship (Wright engine), open for convenience in loading hopper.—*U. S. Dept. of Agriculture.*



Ford Airport, Dearborn, Mich., just outside Detroit.

(Top) Sikorsky Aero Engineering Corporation's Air Transport. (Bottom) Interior seating arrangement of Sikorsky Plane, accommodating 8 people.

calcium arsenate used and does the work in infinitely less time. A mule-drawn, negro-operated ground machine covers 30 acres in one night. One airplane can dust from 200 to 1,000 acres in an hour, depending upon local conditions. One plane thus displaces from 50 to 75 mule-drawn ground dusters and increases the crop yield about 33 per cent. The cost of air equipment in quantity is much less than that of the ground equipment displaced; the cost of operation from the air is much less than that on the ground.

The commercial field for dusting from the air is almost unlimited. In caring for the cotton crop alone, it is estimated that 2,500 airplanes could profitably be employed.

Crop Survey from the Air

Closely allied to the dusting of crops by airplane is crop survey from the air. Experiments begun in 1923, and fully recorded in the 1924 Aircraft Year Book, were continued in 1924. In addition a fairly complete photographic survey was made of the rice producing area of Louisiana, when an attempt was made to obtain a detailed map. Chas. T. Gage, Administrative Officer, Division of Crop and Livestock Estimate, sees very great possibilities in the application of airplane travel to the visual inspection of crops during the growing season. Extension of the work obviously depends on the extension of air travel facilities, such as air routes and landing fields. Aerial crop survey can be conducted in the same machines used for dusting and it is expected that, with developments in the interpretation of aerial photograps of growing crops, this phase of commercial aviation can be largely extended.

Forest Air Patrol

Air patrol of standing timber in the western states, which was suspended for several seasons, due to lack of funds, was to be resumed in 1925, $50,000 having been made available by Congress especially for this purpose.

As this book goes to press, the Forestry Service and the Army Air Service were working out a scheme of co-operation, so as to get the most out of the small amount of money provided. As in the past, the Army Air Service will do the flying, and military equipment will be used. It is contemplated to establish five operating bases, probably at the following points: Arcadia Field (Southern California), Corning or Mather Field (Northern California), Eugene, Ore., Vancouver, Wash., and either Cœur d'Alene, Ida., or Missoula, Mont.

Co-operation, and possibly financial assistance will be sought of private timber associations, and of the several states to be benefited. Instead of the air patrol presuming to displace the ground patrol, which would be premature, special work is to be assigned the flyers, in liaison with the Foresters. This work will include reconnaissance flights over large areas that are afire; special flights to search for areas hidden by smoke and consequently not visible from mountain peak observatories; special patrols when the presence of smoke and the direction of the wind makes ground operation impracticable; special flights immediately after dry electrical storms, when fires are apt to start and to continue burning without making sufficient smoke to enable the ground Foresters to detect them. In addition, there will be aerial surveying and timber cruising, as the need arises.

Maj. H. H. Arnold, who, as Air Service Officer stationed at San Francisco, was the individual most responsible for the origin and success of the forest air patrol, has been transferred to Washington as Chief of the Information Division, Office of Chief of Air Service, where he is in position to provide effective liaison between the Chief of Air Service and the Chief Forester.

It is the expectation and hope that the forest air patrol will follow the same practical course as crop dusting, when commercial operators will, within a short time, be able to assume complete responsibility, operating for both the public and private timber authorities.

Airplanes in Mining

The Department of the Interior reports that the Bureau of Mines is using commercial airplanes to operate from one mining district to another in the Territory of Alaska, thus saving much time and considerable expense. As related in previous issues of the Aircraft Year Book, the Bureau has long used airplanes for the speedy transportation of relief apparatus needed at scenes of disaster.

In the fall of 1924 occurred an explosion at Sublet, Wyo. At the time, the Bureau of Mines engineer was at Cheyenne and found that he would be unable to get a train for Rock Springs for many hours. As this was along the transcontinental route of the Air Mail, the Postmaster General granted the request of the Secretary of the Interior for urgent transportation for the Bureau of Mines engineer. The Secretary of the Interior stated that this service by air was the means of saving many lives.

DIRECTORY OF AIRCRAFT OPERATORS

NOTE:—In the following directory there is given condensed information covering aircraft operators reporting to the Aircraft Year Book, 1925: Name, address, number of aircraft, total mileage, passengers carried, freight carried and type of flying in which operator is especially interested. Operating reports cover year: Oct. 1, 1923—Oct. 31, 1924.

AERO SERVICE CORP., Philadelphia, Pa.
Two machines. 16,000 miles. Aerial Photography.

AEROMARINE AIRWAYS CORP., New York.
Re-equipping. 37,500 miles, 2,500 passengers, 1,000 lbs. freight.

AIRCRAFT SALES CO., Kansas City, Mo.
Three machines. Aerial Photography. Cross Country. Sight Seeing.

ANDERSON AIRCRAFT MFG. CO., Anderson, Ind.
Twenty-one machines in stock. 11,000 miles, 739 passengers, 184 lbs. freight. Sight Seeing. Cross Country.

MAX BERGHAMMER, Marshfield, Wis.
Two machines. Sight Seeing.

ANTON F. BROTZ, Kohler, Wis.
Three machines, 3,900 miles, 230 passengers. Aerial Photography.

BURNS FLYERS, Fenton, Mich.
Four machines, 7,000 miles, 1,000 passengers. Sight Seeing. Instruction.

CLEVELAND AIR SERVICE, Coventry, Vt. Re-equipping. Aerial Photography.

HARRY DEPEW COPLAND, Hartford, Conn.
One machine. Aerial Photography. Cross Country.

CRESCENT AIRPORT CO., Covington, Ky.
One machine. Sight Seeing.

E. C. CURRAN, Spearfish, S. D.
One machine. Sight Seeing.

CURTISS EXHIBITION CO., Garden City, N. Y.
Thirty machines. 100,000 miles, 3,400 passengers, 400 lbs. freight. Cross Country. Instruction.

CURTISS METROPOLITAN AIRPLANE CO., Port Washington, N. Y.
Four machines. 10,950 miles. 594 passengers. Cross Country. Aerial Photography.

ESSINGTON SCHOOL OF AVIATION, Essington, Pa.
Four machines. 4,000 miles, 500 passengers. Sight Seeing. Cross Country. Instruction.

FAIRCHILD AERIAL CAMERA CORP.
Three planes. 32,640 miles. Aerial survey and photography.

FENTON AIRWAYS, Fenton, Mich.
Four machines. 480 passengers. Sight Seeing. Aerial Photography.

FLORIDA AVIATION CAMP, Hialeah, Fla.
Three machines. 40,000 miles, 1,000 passengers. Sight Seeing. Aerial Photo.

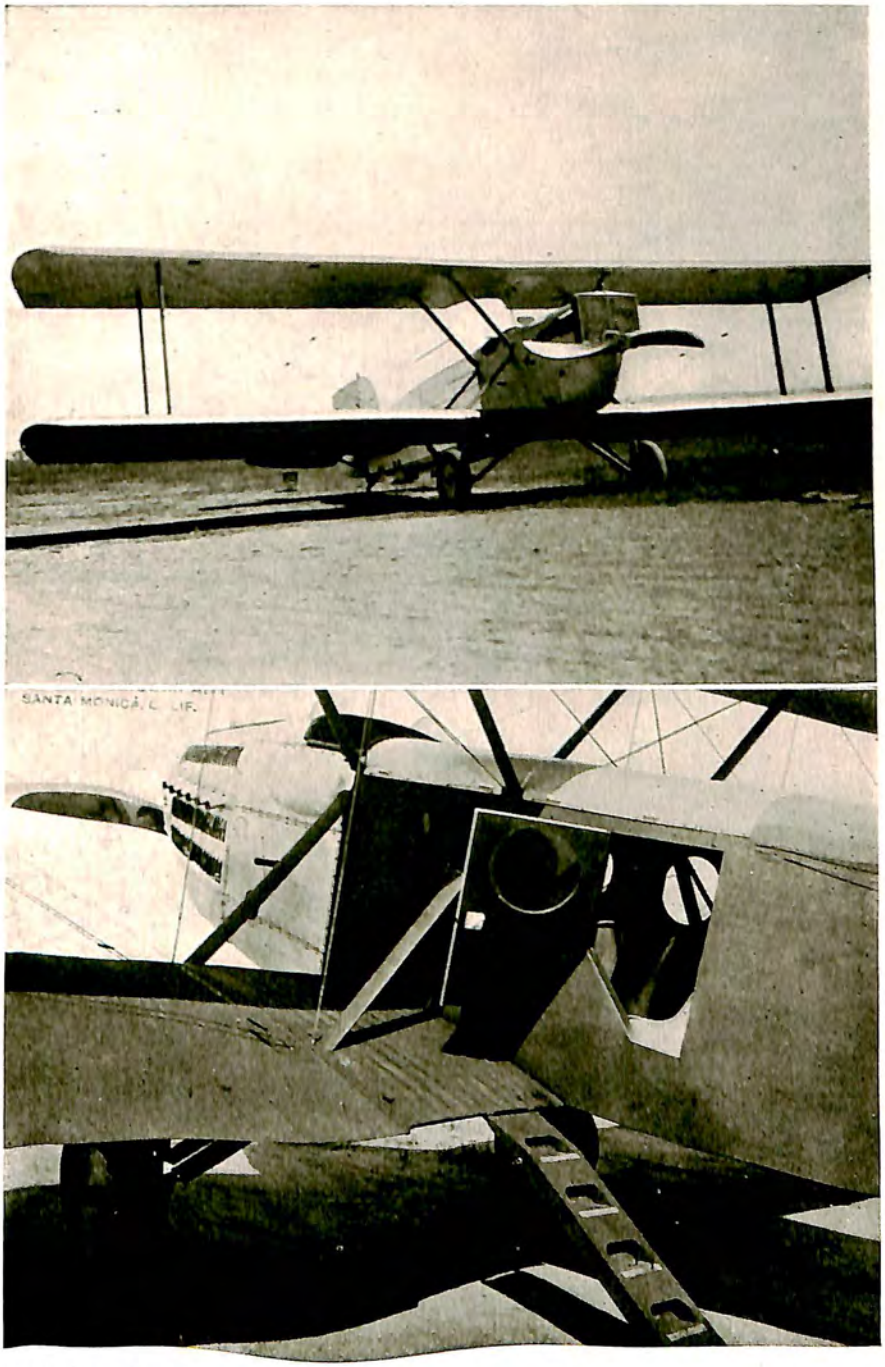
FORT WORTH FLYING CO., Fort Worth, Tex.
One machine. 6,000 miles, 250 passengers, 100 lbs. freight. Cross Country.

K. R. GARVER, Attica, Kas.
Four machines. 60,000 miles, 5,000 passengers. Sight Seeing.

OLIVER F. GIES, Great Falls, Mont.
One machine. Sight Seeing.

PHIL GOEMBEL, Chippewa Lake, Ohio.
One machine. Sight Seeing.

GOLDSBERRY AIRPLANE SERVICE, Chillicothe, Ohio.
One machine. 10,000 miles, 500 passengers. Sight Seeing.
A. J. HARTMAN, Burlington, Ia.
Four machines, 5,000 miles, 250 passengers, 300 lbs. freight. Sight Seeing. Instruction.
HEATH AIRPLANE CO., Chicago, Ill.
Three machines. 20,000 miles, 500 passengers. Sight Seeing. Aerial Photography.
EDWARD HUBBARD, Seattle, Wash.
Two machines. 22,000 miles, 60,000 lbs. mail. Cross Country.
HUFF, DALAND AERO CORP., Ogdensburg, N. Y.
Three machines. 8,000 miles. Cross Country.
HUTSON AUTO & AERO CO., Jacksonville, Ill.
Four machines. Sight Seeing. Cross Country.
N. B. ISON, Houston, Tex.
Three machines. Aerial Photography.
JOHNSON FLYING SERVICE, INC., Dayton, Ohio.
Nine machines. 38,000 miles, 8,566 passengers. Sight Seeing. Cross Country.
CHAUNCEY M. LARSEN, Dell Rapids, S. D.
One machine. 18,000 miles, 380 passengers. Sight Seeing.
ROY O. LARSON, Larsen, Wis.
Four machines. 10,000 miles, 300 passengers. Sight Seeing. Cross Country.
LAURENTIDE AIR SERVICE, LTD., Montreal, Can.
Seven machines. 66,000 miles, 1,004 passengers, 60,000 lbs. freight, including 1,500 lbs. mail. Aerial Photography. Cross Country.
LUDINGTON EXHIBITION CO., Philadelphia, Pa.
Four machines. Cross Country. Instruction.
R. W. MACKIE, Houston, Tex.
One machine. 45,000 miles, 500 passengers. Cross Country. Aerial Photography.
N. B. NAMER, Spokane, Wash.
Three machines. 26,640 miles, 2,094 passengers. Sight Seeing. Cross Country. Aerial Photography.
AUGUST MAROSS, JR., Chicago Heights, Ill.
One machine. 1,600 miles, 150 passengers. Sight Seeing.
DAVE MATTHEWS, Santa Barbara, Calif.
One machine. 39,000 miles, 3,500 passengers. Sight Seeing.
MUNDALE & TENNANT, Sioux Falls, S. D.
Seven machines. 35,000 miles, 800 passengers. Sight Seeing. Cross Country. Aerial Photography. Instruction.
N. W. AIRCRAFT CO., Linton, N. D.
Three machines. 1,500 miles, 92 passengers. Sight Seeing.
NICHOLAS-BEAZLEY AIRPLANE CO., Marshall, Mo.
Thirty-two machines in stock. 4,000 miles, 150 passengers. Sight Seeing.
JACK V. NEWLAND, Waco, Tex.
One machine. Sight Seeing.
NEW ORLEANS AIR LINE, New Orleans, La.
Six machines. 40,000 miles, 50 passengers, 27,000 lbs. mail. Cross Country.
MARVIN A, NORTHROP, Minneapolis, Minn.
Thirty machines in stock. 53,000 miles, 2,000 passengers. Cross Country.
OAKLEY & ASKEW, Ardmore, Okla.
Five machines. Cross Country. Instruction.



(Top) Douglas Company's DT2B Torpedo Plane, Wright engine. (Bottom) Douglas Company's 6 passenger Air Transport.

(Top) Hartzell Walnut Propeller Company's F.C.2, Prize Winner St. Louis and Dayton Air Races. (Bottom) Remington-Burnelli Aircraft Corporation's *Air Transport*. Completely loaded, this plane weighs 17,000 lbs.

ONTARIO AIRCRAFT CORP., Ontario, Calif.
Eight machines. 20,000 miles, 1,500 passengers. Sight Seeing. Cross Country.
PHILLIPS & BOWMAN, Tulsa, Okla.
Three machines. Cross Country. Aerial Photography.
PITCAIRN AVIATION CO., Philadelphia. Cross Country. Aerial Photography.
CLARENCE O. PREST, Arlington, Calif.
Five machines. 7,500 miles, 1,000 passengers. Sight Seeing.
ROBERTSON AIRCRAFT CORP., Anglum (St. Louis County) Mo.
250 machines in stock. Cross Country. Aerial Photography.
E. M. RONNE, Buffalo, N. Y.
Five machines. Cross Country. Aerial Photography.
S. & A. FLYING FIELD, Manteno, Ills.
Nine machines. 20,000 miles, 1,500 passengers. Cross Country. Aerial Photography.
SEATTLE-VANCOUVER AIRWAYS, Seattle, Wash.
Two machines. 25,000 miles, 150 passengers, 500 lbs. freight. Cross Country.
SHELDON AIR LINE, Sheldon, Ill.
Three machines. 9,750 miles, 500 passengers, 2,000 lbs. freight. Cross Country. Aerial Photography.
R. V. SHORIS, Pound, Va.
Two machines. 6,000 miles, 300 passengers. Sight Seeing.
HENRY TONCRAY, Lone Oak, Tex.
One machine. Sight Seeing.
WALTER T. VARNEY, San Francisco, Calif.
Three taxiplanes. Sight Seeing. Cross Country. Aerial Photography.
VARNEY AIRCRAFT CO., Peoria, Ill.
Three machines. 1,100 passengers. Sight Seeing. Aerial Photography. Cross Country.
WILLIAM WESTLAKE, Chicago, Ill.
One machine. 20,000 miles, 2,000 passengers. Sight Seeing.
WHITES' AIRCRAFTS, Des Moines, Ia.
Two machines. 22,528 miles, 512 passengers, 450 lbs. freight. Cross Country. Aerial Photography. Instruction.
YACKEY AIRCRAFT CO., Maywood, Ill.
Nine machines, 42,180 miles, 2,813 passengers, 8,000 lbs. freight. Cross Country.

CHAPTER V

THE ROUND-THE-WORLD FLIGHT

ON the night of April 5, 1924, President Coolidge sent the following message to the United States Army Air Service's Round-the-World Flight Expedition:

"More than 400 years ago men first circumnavigated the world. Two years were required, in which many hardships were encountered. Now men travel around the earth by land and water in twenty-eight days. You are going to demonstrate the practicability of making such a voyage by air. Before another 400 years this may be the safest and most comfortable way. Your countrymen will watch your progress with hope and record your success with pride."

Late in the afternoon of Sept. 9, President Coolidge and a distinguished throng stood in the mist at Bolling Field, Washington, awaiting the World Flyers' return. To them as they stood before him he said:

"It is with a renewed faith in America that I welcome you. A new record of achievement has been made in the last six months in the domain of aviation. It has been made by men who wear the American uniform. It has been your skill, your perseverance, your courage, that have brought this great honor to our country. In what is probably the greatest opportunity for future scientific development of transportation, your enterprise has made America first. I trust the appreciation of your countrymen will be sufficient so that in this field America always will be kept first."

Starting from Seattle, Wash., at 8:47 a.m., April 6, the World Flight returned to Seattle at 1:30 p.m., Sept. 28, having flown around the globe in 371 hrs. 11 min., actual time in the air, during which they traversed 27,553 miles of arctic and tropic ocean, glacier and forested peak, desert and jungle. One hundred and seventy-five days had elapsed since they set out into the West. Four machines started, three returned, and of the three two had flown completely around the world.

The World Flight was a tribute to American persistence, skill in a new art, and resourcefulness in time of emergency. But it also was a triumph for organization. Without organization, Smith, Nelson and Wade might have flown around the earth, but the achievement would have been only a brilliant sporting example.

With organization, with a definite procedure of preparation in advance, which meant also accumulation of benefits resulting, the World Flight took its place among the most remarkable of all studied efforts in the history of the human race.

In engineering, navigation, construction, operation, the World Flight crystallized into one daring success all of the extravagant promises that aviation has held out in the way of literally diminishing the bonds of time and space. But, most of all, in inspiration it pointed the way toward the peaceful, constructive manner in which aircraft can be applied for international amity.

Origin of and Preparation for World Flight

The thought of a Round-the-World Flight first began to assume definite form in the minds of Air Service Officers in the Spring of 1923, after there had been much talk of such a project among foreign air services and after one or two such attempts had ended in failure. On June 23 of that year the Adjutant General issued authority for two officers to go over those parts of the proposed route, the North Atlantic and North Pacific oceans, which were believed to present a difficult, if not insuperable obstacle. On Dec. 3, that year, following favorable reports from the various advance officers, the entire project was formally indorsed by the War Department.

Maj. Gen. Mason M. Patrick, Chief of Air Service, explained the purpose of the undertaking as follows: "The purposes of the proposed flight are to gain for the Air Service added experience in long distance flying and particularly in the supply problem connected therewith; to complete an airplane flight round-the-world in the shortest practicable time; to demonstrate the feasibility of establishing an airway round the globe; and incidentally to secure for the United States, the birthplace of aeronautics, the honor of being the first country to encircle the world entirely by air. A great deal of valuable information, especially the difficulties of operating aircraft in various climates will also be obtained."

The task was approached through two major channels. The first concerned the selection of a proper type of aircraft and the proper personnel. The second concerned advance preparations and the service of supply. General supervision of the flight came naturally within the province of the Training & War Plans Division, Office of the Chief of Air Service. Within this Division a World Flight Committee was formed, as follows: Capt. William F. Volandt—transportation and finance; 1st Lt. St. Clair Streett—route, maps, general organization and information; 1st Lt. Robt. J.

Brown, Jr.—Chairman, organization and co-ordination; 1st Lt. Erik H. Nelson—equipment and engineering; 1st Lt. Clarence E. Crumrine—equipment, engineering and route advance officer; 1st Lt. Elmer E. Adler—supply; Capt. Lorenzo L. Snow—diplomatic arrangements. The personnel eventually selected to attempt the flight were: Maj. Frederick L. Martin, commanding officer; 1st Lt. Lowell H. Smith, 1st Lt. Erik H. Nelson, 1st Lt. Leigh Wade.

With Martin was to go as mechanician, Sgt. Alva L. Harvey; with Smith, 1st Lt. Leslie P. Arnold; with Nelson, 2nd Lt. John Harding, Jr.; and with Wade, Sgt. Henry H. Ogden.

Of the fifteen men thus made primarily responsible for the great effort, four had been members of the famous Alaska Flying Expedition which Lieut. Streett commanded in 1920. In addition to Streett, the others were Lieuts. Nelson, Crumrine and Nutt, the latter being a World Flight advance officer.

The Committee on Plans had, it is true, all the power and prestige of the Air Service—which meant the United States Government—at their command. But their problem was none the less perplexing and their responsibilities no less great. A route had to be selected, a route that could be flown. This route had to pass through countries where satisfactory diplomatic arrangements were assured. The time of flight had to be arranged so as to cross the various zones of temperature at the best possible time. The hops had to be arranged so as to be always within reasonable distance of a supply station. To each of these supply stations had to be transported gasoline and oil, new engines, spare parts and accessories and materials of all sorts. Weather reports over many years, ocean charts and topographic maps of known—and frequently comparatively little known regions—had to be studied. And from all this studious effort, in the offices of the Chief of the Army Air Service, Washington, had to be evolved—was evolved—the plan which sent our Flyers successfully around the earth.

In mapping out the route, six divisions were designated, Seattle-Attu, Lieut. Clayton L. Bissell, Advance Officer; Attu-Kagoshima, Lieut. Clifford L. Nutt, Advance Officer; Kagoshima-Calcutta, Lieut. Malcom Lawton, Advance Officer; Calcutta-Constantinople, Lieut. Harry A. Halverson, Advance Officer; Constantinople-London, Maj. Carlyle Wash, Advance Officer; London-Washington, Lieut. C. E. Crumrine, Advance Officer.

Capt. Snow had an inconspicuous, but delicate and highly important task. All the world knew that to whichever nation went the honor of being first to fly around the earth went also invaluable aeronautical knowledge—invaluable in war as well as in peace.

The Wings of the American Eagle encompass the World. *Reproduced through courtesy A. P. Adams and New York American.*

Round-the-World Flyers at Rockwell Field after completion of flight. (Left to Right) 1st Lt. Leigh Wade, 1st Lt. Leslie P. Arnold, Capt. Lowell H. Smith in command, Lt. Henry H. Ogden, 1st Lt. Erik H. Nelson, Lt. John Harding, Jr.—*U. S. Air Service.*

Finally, permission was obtained for our air passage from 28 nations, protectorates and mandates, controlled by fifteen separate governments. While courtesy was met with everywhere, except in an isolated Siberian point in Soviet Russia, the Air Service is especially grateful to the Governments of Japan, France and the United States. Realizing the significance of the event, and showing every private and official desire to be properly understood, the Japanese sped the Americans on their way, honored them, emulated them. Financial arrangements and the physical concentration of supplies presented many difficulties. One oil company did agree to distribute lubricating oil throughout the world, but gasoline had to be purchased locally. Some idea of the magnitude of these arrangements may be had from knowing that, scattered along the route, at pre-determined points (see World Flight Itinerary and Time and Distance Table) were 91,800 gallons of gasoline and 11,650 gallons of oil. Due to the dropping out of one plane, there were actually consumed only 68,950 gallons of gasoline and 8,738 gallons of oil.

Assistance by Aeronautical Chamber of Commerce

The Aeronautical Chamber of Commerce was privileged to assist in preparing for the World Flight by arranging with corporations of world-wide activity for information to be supplied to advance officers and to members of the flight itself. Among the firms thus co-operating were Ford Motor Co., Packard Motor Co., Hudson Motor Car Co., American Express Co. and General Motors.

Personnel of Round-the-World Flight

The record of the six men who took their airplanes around the world speaks for itself. It spoke for itself before they hopped off from Sand Point, Seattle, Wash. All were experienced cross country flyers, experts on engine and plane construction, all gifted with that rare combination of discipline when flying as a unit and initiative and self-reliance when left on their own responsibility. Left to their own responsibility they were hundreds of times and each time they rose, when humanly possible, to the demands placed upon them. In age, at the time of the flight, they ranged from 28 to 36 years, Nelson being the "daddy" of the sextet. Following is a biographical sketch:

First Lieut. Lowell H. Smith, Commanding Officer and Pilot Flagplane *Chicago* No. 2. Born, Santa Barbara, Cal., Oct. 8, 1892. Enlisted as private in Signal Enlisted Reserve Corps. Instructed in flying and commissioned First. Lieut. in Dec., 1917; Capt. in

October, 1918, and commissioned First Lieut. in Regular Army, July, 1920. Won second place in Transcontinental Reliability and Endurance Contest, New York to San Francisco, in 1919. Particularly distinguished himself in the work of the airplane forest-fire patrol carried out through California and Washington during the fire seasons of 1920 and 1921. Was practically in charge of this work, which, in one year saved more in standing timber than the total millions appropriated by the United States Congress for all aviation. Up to beginning of World Flight Smith's total flying time was 1,700 hours, of which over 1,000 hours were cross country. He had flown about 100,000 miles. Smith after World Flight was promoted to Captain.

First Lieut. Leslie P. Arnold, Alternate Pilot and Smith's Mechanician on *Chicago* No. 2. Born, New Haven, Conn., Aug. 26, 1893. In April, 1917, enlisted in Signal Enlisted Reserve Corps. Commissioned First Lieut. in Signal Corps, March, 1918; First Lieut. in Regular Army, July, 1920. Flying instructor, 3rd A.I.C., Issoudon, France. Sent to front with 1st Obs. Squad. Served in Occupied Area until July, 1919. Upon return to United States began special training in aerial photography, graduating from Air Service Photographic School in 1922. Up to time of World Flight Arnold had 1,500 hours in the air, of which 800 were cross country.

First Lieut. Erik H. Nelson, Engineer Officer and Pilot Plane *New Orleans* No. 4. Born, Stockholm, Sweden, June 12, 1888. On United States entry into World War enlisted in Signal Enlisted Reserve Corps and began flying training. Commissioned Sec. Lieut. April, 1918, and First Lieut. in Regular Army, June, 1920. Nelson has perhaps a greater amount of cross-country experience than any other Air Service officer. Among his important flights were: Gulf to Pacific, 1919; Alaska Flying Expedition, New York to Nome and return, 1920, on which flight he was engineer officer. San Antonio to Porto Rico flight in 1923, in which he again was engineer officer. Up to time of World Flight Nelson had 1,600 flying hours, of which 800 were cross country.

Sec. Lieut. John Harding, Jr (Reserve Corps), Nelson's Mechanician on *New Orleans* No. 4. Born, June 2, 1896, Nashville, Tenn. Oct. 25, 1917, enlisted in Aviation Section, Signal Corps. Promoted Master Elec. Sgt. July, 1919. Honorably discharged Jan. 5, 1921. Served as civilian, Air Service Engineering Section, Dayton, O. Commissioned Sec. Lieut. Air Service Reserve, March 21, 1922. Gained recognition as efficient mechanician after "Round the Rim" flight of Col. R. S. Hartz and Lieut. E. E. Harmon, July to November, 1919.

First Lieut. Leigh Wade, Pilot Plane *Boston* No. 3. Born, Cassopolis, Mich., Feb. 2, 1896. Private Michigan National Guard from 1916 to entry into World War, when he transferred to Signal Enlisted Reserve Corps. Commissioned First Lieut. Dec., 1917; First Lieut. in Regular Army, July, 1920. Flight training with Royal Air Force in Canada. Served as instructor in Canada, then in United States. From Aug., 1918, to July, 1919, served with A.E.F. as test pilot, instructor and commanding officer of 120th Aero Squadr., at one of the large American training centers in France. After Armistice served in Technical Information Section, Air Service, Paris. Upon return to U. S. served, from fall of 1919 to fall of 1923 as test pilot, McCook Field. Carried out air photography mission in White Mountains in 1921. Participated in successful bombing of ex-German warships off Virginia Capes.

Sgt. Henry H. Ogden, Wade's Mechanician on *Boston* No. 3. Born, Woodville, Miss., Nov., 1890. Enlisted in Air Service July 1, 1919. Assigned to repair depot, Montgomery, Ala. Re-enlisted, July 5, 1922. Promoted Sgt. First Class, Feb., 1922; Staff Sergeant, June, 1922; Sec. Lieut., June 5, 1924.

Major Frederick L. Martin, was originally designated as commander of World Flight. His mechanician was Sgt. Alva L. Harvey, a pilot as well as mechanic, who, upon termination of Martin's flight in original flagplane *Seattle* No. 1, was promoted to Lieutenant. Martin, up to time of World Flight, had 700 flying hours, of which 300 were cross country. Martin was originally an artillery officer. In the Air Service for the last two years he commanded a technical school.

The Douglas World Cruisers

Donald Douglas, head of the Douglas Company, Santa Monica, Calif., designed the World Cruisers. These remarkable ships are the natural evolution from the bombing types which Mr. Douglas received during his early connection with the Air Service engineering staff and his industrial activity prior to entering into business for himself. From the design of military bombers he turned to long distance torpedo planes for the Navy, and this improvement, to which was constantly added his desire to produce a type of plane capable of heavy, economical commercial duty, led to the laying down of the World Cruiser. In sheer ruggedness they may be said to have opened a new and very practical phase of aviation.

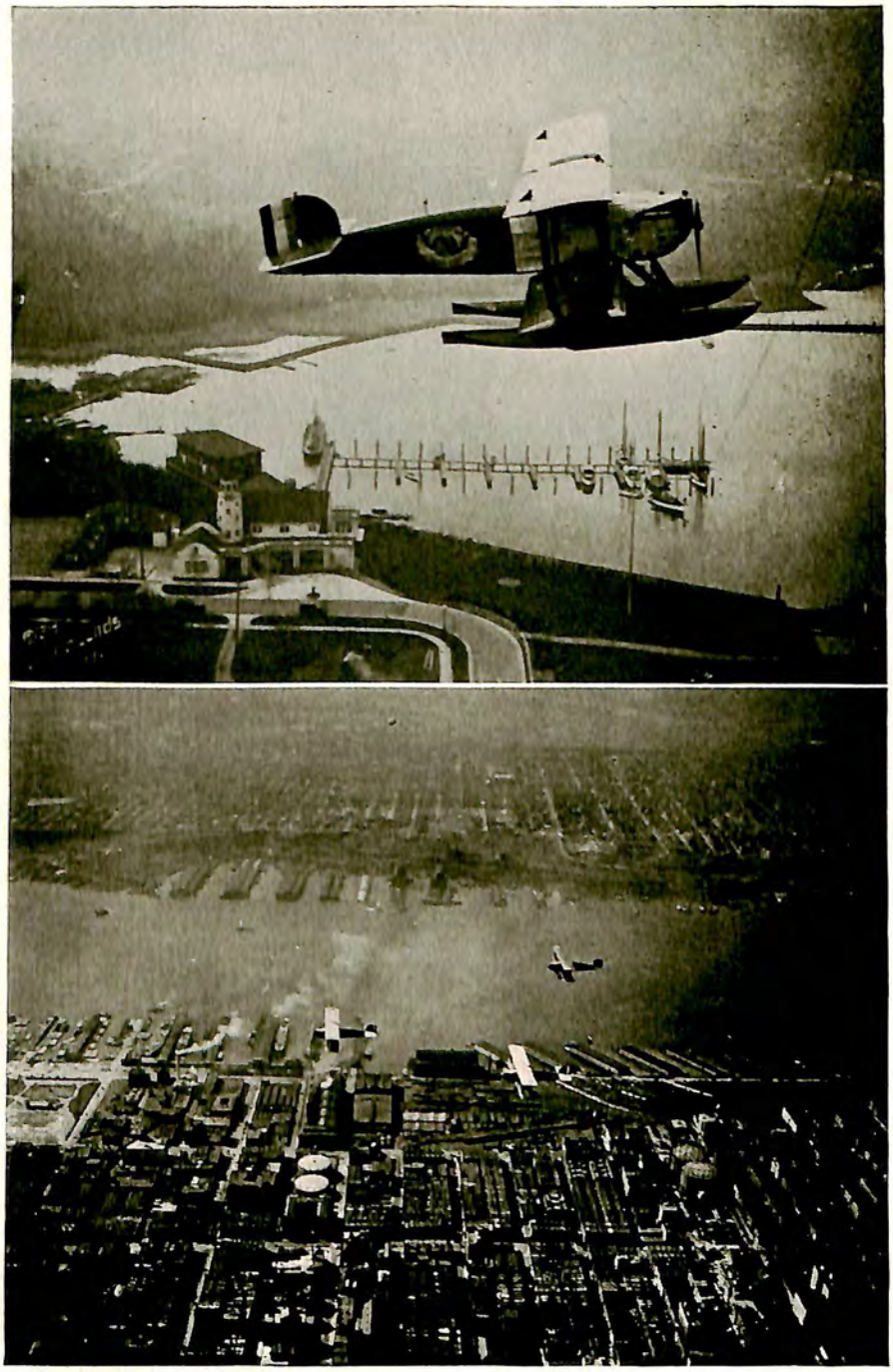
Mr. Douglas was confronted with certain fundamental problems. He had to build a plane heavy enough to carry all the fuel and

equipment necessary to such an ambitious venture as a world flight, yet he had to build it swift enough, and with sufficient climbing ability, to meet the unforeseen, yet inevitable emergencies. He had to construct it as light as possible, yet sufficiently staunch to withstand gale and pounding sea. In the selection of materials and in their assembly he had ever to keep in mind that the ships, if they were successfully to circumnavigate the world, would have to undergo the most cruel punishment ever experienced in aeronautics—bitter cold, the crushing weight of ice, the fiery heat of the sun, the rotting dampness of the tropics, and always, day and night, the strain of shifting winds.

That two of the four World Cruisers that took off from Seattle actually returned there, practically intact, with most of their original finish, and certainly as airworthy, almost, as when they left, is an achievement that speaks for itself. For one hundred and seventy-five days these planes underwent acute changes in temperature, buffeting at anchor in seas which made it impossible for light surface motor craft to go to them at their moorings, undergoing all the insidious stress and strain of mountain cold and jungle humidity, and during all this period for only *twelve days* were they under cover. The third plane of the globe-encircling trio—Lieut. Wade's—was lost through no weakness of its own. The forced landing was due to oil pressure failure in the engine and the subsequent wrecking of the plane to the solicitous but inexperienced efforts to hoist it aboard a warship for repairs. The fourth plane—Major Martin's—was the victim of storm and inescapable natural forces.

The Douglas World Cruiser is designed as a land or water type aircraft for long distance flying. The machine is readily convertible to either type by the interchangeable feature of land or water type landing gear. As a land plane it weighs, empty, 4,380 pounds, as a seapalne, empty, 5,180 pounds. In either state the maximum additional disposable load, pilot, fuel, food, clothing, supplies, is 3,000 pounds. The gasoline capacity is 450 gals. The maximum wing loading is 11.3 pounds per square foot as a seaplane and 10.2 pounds as a land plane. As a seaplane its maximum power loading is 19.5 pounds per horse power, and 17.5 pounds per horse power as a land plane. Its performance, according to its loading and according, also to whether used as land plane or seaplane, ranges from 53 m.p.h. landing speed to 103 m.p.h. top speed. The engine is the Liberty, 400 h.p.

The fuselage is made in three detachable sections—engine, mid and rear. All sections are made of steel tubing. The wings are of standard box beam and built up rib construction. The wings may



(Top) World Flyers westward bound from Seattle. (Bottom) World Flyers' triumphant return, passing over New York en route to Mitchel Field.—*U. S. Air Service.*

(Top) U. S. destroyer, *Billingsley* towing the *Boston* after forced landing off Iceland Coast. Shortly afterward the *Boston* was wrecked when the derrick with which she was being hoisted to the deck of the U. S. cruiser *Richmond* collapsed.—*Photo United States Navy.* (Bottom) President Coolidge and Secretary of War Weeks welcome World Flyers to Washington. (Left to right) Lts. Arnold and Smith, the President, Secretary Weeks, Lts. Wade, Nelson and Harding.—*U. S. Air Service.*

be folded. The elevator and rudder are made of steel tubing. The axles are of alloy steel tubing, heat treated after fabrication. The struts are steel tubes streamlines with wood. The tail skid is of steel tubing and can be steered. As a seaplane, twin floats are used. These are of built up wood construction. The top covering is three ply veneer, the bottom planking being two plies of mahogany.

Through original sturdy construction, and through constant watchfulness and careful servicing all through the long flight, the two planes that actually completed the circuit, returned to the Douglas plant in almost the condition they left. There were scars of battle with the elements, and the stress and strain of time, but so far as strength and dependability were concerned, they were in excellent shape. That this was true was due, not only to the builders, but to the makers and purveyors of the parts, materials and instruments that went into the aircraft.

Navigation presented a serious problem and there is unanimous agreement that the flight was made possible through use of the Pioneer Earth Inductor Compass, invented, developed and fabricated by the Pioneer Instrument Company and by the other improved types of compasses and instruments supplied by the General Electric Company. As the following "Honor Roll" shows, some half hundred firms in all parts of the United States share the glory of this American triumph. Among those that may be specially mentioned are the batteries, supplied by the Electric Storage Battery Company and the Willard Storage Battery Co., the Liberty starters by the Eclipse Machine Co.; tires and hose by the Goodyear Tire & Rubber Co., and the B. F. Goodrich Rubber Co.; wires and wheels by the Stewart Hartshorne Co., and the Dayton Wire Wheel Co. The Douglas World Cruisers' wings and fuselage were fabric and veneer covered. Titanine dope and Valentine Valspar carried the ships round the world, protecting these exceedingly vulnerable surfaces. Pontoons that withstood the pounding of seas and crushing blows of ice held veneer of the Haskelite Mfg. Company and the propellers were supplied by the Hamilton Aero Mfg. Company. It is a significant fact that the same design of propeller as developed by Hamilton for the Navy NC-4 Trans-Atlantic flight was used by the Army Air Service in the over-water flights on the round the world cruise. The Hamilton propeller placed on Lieut. Smith's plane in England was not removed until it had flown across the Atlantic via Iceland and Greenland to Boston, thence to New York and Dayton where it was changed for a land type propeller, only because it (the first propeller) was intended to fly over water.

The World Flight Roll of Honor

Following is a list of the American organizations contributing to the Round-the-World Flight through engineering, manufacturing or supply. It is an industrial roll of honor. Had design, material or workmanship in even the smallest detail of equipment failed, the whole great effort would have failed. To each of these purveyors, therefore, justifiably, goes a portion of the credit for the American success:

Airplane, design and construction—Douglas Co., Santa Monica, Cal.
Engine—the all-American Liberty.

Alemite lubricating system—The Basic Co., Chicago.
Altimeters—Taylor Instrument Co., Rochester, N. Y.
Batteries, ignition, 8-volt—Willard Storage Battery Co., Cleveland, O.
Batteries, storage, 12-volt—Willard Storage Battery Co., Cleveland, O.
Batteries, storage, Type A.S.-2, 12-volt—Electric Storage Battery Co., Philadelphia.
Bottles, Thermos—Universal Vacuum—Landers, Frary & Clark, New Britain, Conn.
Breeches, wadding—Goodyear Tire & Rubber Co., Akron, O.
Cameras—Eastman Kodak Co., Rochester, N. Y.
Coats, Kapok—A. G. Spalding & Bros., New York.
Compasses—General Electric Co., Schenectady, N. Y.
Compasses, earth inductor—Pioneer Instrument Co., Brooklyn, N. Y.
Compass, master—Sperry Gyroscope Co., Brooklyn, N. Y.
Cores, tire, valve—A. Schrader's Sons, Inc., Brooklyn, N. Y.
Dope—Titanine Co., Inc., Union County, N. J.
Ezy-Outs—Cleveland Twist & Drill Co., Cleveland, O.
Fire Extinguishers—Pyrene Mfg. Co., Newark, N. J.
Flashlights—Yale Electric Corp., Brooklyn, N. Y.
Gasket paper, Vellumoid—Fibre Finishing Co., Boston, Mass.
Glue, marine—L. W. Ferdinand & Co., Boston, Mass.
Goggles, aviaglass—American Optical Co., Southbridge, Mass.
Goggles, gogglette—E. B. Meyrowitz, Inc., New York.
Grinders, portable—American Grinder Mfg. Co., Milwaukee, Wis.
Hoists, chain—Yale & Towne Mfg. Co., New York.
Hose—B. F. Goodrich Rubber Co., Akron, O.
Indicators, air speed—Foxboro Co., Inc., Foxboro, Mass.
Indicators, flight—Pioneer Instrument Co., Brooklyn, N. Y.
Jacks, Badger—Walker Mfg. Co., Racine, Wis.
Lamps, bulbs—Western Electric Co., New York.
Oil—Vacuum Oil Co., New York.
Propellers—Hamilton Mfg. Co., Milwaukee, Wis.
Pullers, nail—Bridgeport Hardware Mfg. Co., Bridgeport, Conn.
Pumps, bilge—Wilcox Crittenden Co., Middletown, Conn.
Pumps, refueling—Blackmer Rotary Pump Co., Petoskey, Mich.
Pumps, tire—Frank Rose Mfg. Co., Hastings, Neb.
Radiator compound—X Laboratories, New York.
Spark plugs—B. G. Corp., New York.

Spark plugs—Mosler Metal Products Corp., Mount Vernon, N. Y.
Starters, Liberty—Eclipse Machine Co., Hoboken, N. J.
Tap and die sets—Greenfield Tap & Die Corp., Greenfield, Mass.
Tape, friction, Dutch brand—Van Cleef Bros., Chicago.
Thermometers, distance type—The Motometer Co., Long Island City, N. Y.
Tires—Goodyear Tire & Rubber Co., Akron, O.
Tubes, inner—Ajax Rubber Co., New York.
Unionalls—H. D. Lee Mercantile Co., Chicago.
Valves—Liberty engine—Steel Products Co., Cleveland, O.
Varnish, Valspar—Valentine & Co., New York.
Veneer—The Haskelite Mfg. Co., Chicago.
Wheels—Dayton Wire Wheel Co., Dayton, O.
Wires, streamline—Stewart Hartshorne Co., New York.

WORLD FLIGHT ITINERARY AND TIME AND DISTANCE TABLE

From Seattle to Calcutta as seaplanes.
From Calcutta to Brough as landplanes.
From Brough to Boston as seaplanes.
From Boston to Seattle as landplanes.

From-To	*Date*	*Off*	*Land*	*Flying Time Min.*	*Miles*
(First Division, Lieut. Clayton L. Bissell, Advance Officer.)					
	Apr.				
*Seattle-Prince Rupert	6	8:47	5:02	495	605
Prince Rupert-Sitka	10	9:20	1:46	266	385
†Sitka-Seward	13	8:25	4:09	464	625
Seward-Chignik	15	10:44	5:22	398	425
Chignik-Dutch Harbor	19	11:01	6:25	446	390
	May				
*Dutch Harbor-Nazan	3	10:56	3:15	259	365
Nazan-Attu	9	9:09	5:01	472	555
(Second Division, Lieut. Clifford L. Nutt, Advance Officer.)					
†Attu-Nikolski	15–16	11:25	4:50	325	350
Nikolski-Paramashiru	17	7:55	2:10	415	585
Paramashiru-Hittokappu	19	7:30	2:50	440	595
Hittokappu-Minato	22	5:25	10:30	305	485
Minato-Kasumigaura	22	12:40	5:35	295	350
	June				
*Kasumigaura-Kushimoto	1	5:50	10:25	275	305
Kushimoto-Kagoshima	2	12:50	7:01	371	360
(Third Division, Lieut. Malcom Lawton, Advance Officer.)					
†Kagoshima-Shanghai	4	7:05	4:15	550	550
†Shanghai-Tchinkoen Bay	7	7:50	12:20	270	350
Tchinkoen Bay-Amoy	7	2:48	5:35	167	250
Amoy-Hong Kong	8	10:11	1:35	204	310
Hong Kong-Haiphong	10	11:15	6:41	446	495

* = main supply base.
† = minor supply base.

From-To	*Date*	*Off*	*Land*	*Flying Time Min.*	*Miles*
Haiphong-Tourane	11	11:55	5:50	365	410
Tourane-Saigon	16	6:01	1:39	458	540
†Saigon-Kampongsana Bay	18	6:34	11:02	268	295
Kampongsana Bay-Bangkok	18	12:10	4:12	242	290
Bangkok-Tavoy	20	7:40	11:35	235	200
Tavoy-Rangoon	20	2:42	5:50	188	295
Rangoon-Akyab	25	8:48	2:26	338	480
Akyab-Chittagong	26	7:30	9:40	130	180
Chittagong-Calcutta	26	12:05	3:22	197	265
(Fourth Division, Lieut. Harry A. Halverson, Advance Officer.)					
	July				
*Calcutta-Allahabad	1	6:50	1:20	390	450
Allahabad-Ambala	2	7:25	1:50	385	480
Ambala-Multan	3	9:20	2:05	345	360
Multan-Karachi	4	6:10	1:18	428	455
†Karachi-Chahbar	7	7:45	12:35	290	410
Chahbar-Bander Abbas	7	2:35	6:40	245	365
Bander Abbas-Bushire	8	5:40	9:45	245	390
Bushire-Bagdad	8	11:25	5:55	390	530
†Bagdad-Aleppo	9	11:15	5:25	370	450
Aleppo-Constantinople	10	6:02	1:40	458	560
(Fifth Division, Maj. Carlyle Wash, Advance Officer.)					
*Constantinople-Bucharest	12	6:55	11:35	280	350
Bucharest-Budapest	13	6:00	12:50	410	465
Budapest-Vienna	13	2:20	4:20	120	113
†Vienna-Strasbourg	14	5:50	12:20	390	500
Strasbourg-Paris	14	1:20	5:15	235	250
Paris-London	16	11:00	2:07	187	215
(Sixth Division, Lieut. C. E. Crumrine, Advance Officer.)					
London-Brough	17	11:15	1:10	115	165
Brough-Kirkwall	30	10:15	3:45	330	450
	Aug.				
Kirkwall-HornaFiord	2	8:34	5:37	543	555
†HornaFiord-Reykjavik	5	9:12	2:15	303	290
†Reykjavik-Fredriksdahl	21	6:55	6:12	677	820
†Fredriksdahl-Ivigtut	24	10:55	1:07	132	165
†Ivigtut-Icy Tickle	31	8:25	3:20	415	560
	Sept.				
Icy Tickle-Hawkes Bay	2	11:10	5:06	296	315
Hawkes Bay-Pictou	3	11:10	5:44	394	430
Pictou-Mere Point	5	11:15	5:20	365	460
Mere Point-Boston	6	12:00	2:10	130	100
Boston-New York	8	12:00	3:40	220	220
New York-Aberdeen	9	9:35	1:15	220	160
Aberdeen-Washington	9	2:30	3:55	85	70

* = main supply base.
† = minor supply base.

From-To	*Date*	*Off*	*Land*	*Flying Time Min.*	*Miles*
(Last Division over Air Service Airways.)	*Sept.*				
Washington-Dayton	13	10:50	5:35	405	400
Dayton-Chicago	15	11:15	2:15	180	245
Chicago-Omaha	17	11:00	3:50	290	430
Omaha-St. Joseph	18	10:40	12:30	110	110
St. Joseph-Muskogee	18	1:25	5:20	235	270
Muskogee-Dallas	19	12:30	4:15	225	245
Dallas-Sweetwater	20	9:35	12:43	188	210
Sweetwater-El Paso	20	1:50	7:10	380	390
El Paso-Tucson	21	9:50	1:15	205	280
Tucson-San Diego	22	7:20	11:25	245	390
San Diego-Los Angeles	23	1:00	2:25	85	115
Los Angeles-San Francisco	25	9:55	3:12	307	365
San Francisco-Eugene	27	8:55	2:15	320	420
Eugene-Vancouver	28	9:55	11:15	80	90
Vancouver-Seattle	28	11:45	1:30	105	150
TOTALS	175 Days			23,918 or 371 hrs. and 11 min.	27,553

Average daily mileage, 156+. Average speed, 70—m.p.h.

THE START

Planes Nos. 1, 2, 3 and 4, piloted, respectively by Martin, Smith, Wade and Nelson concentrated at Sand Point, Seattle, on March 20, the first three having flown the 985 miles from Santa Monica in three days and the fourth having made it in two hops of less than two days. At Seattle No. 1 (Martin's) was christened the *Seattle,* No. 2 (Smith's) the *Chicago,* No. 3 (Wade's) the *Boston* and No. 4 (Nelson's) the *New Orleans.*

Final overhaul and the change from wheels to pontoons were made at the plant of the Boeing Airplane Co., and it was not until April 6, 8:47 a.m., that the squadron got away for Prince Rupert, B. C. From that moment, practically, they were on their own resources. Supply bases had been established and relief ships arranged for, but these, when the distance and the wilderness were considered, were few and far between. For two hours north of Vancouver the planes flew only 100 feet above the water because of fog. Then followed two hours of rain and then snow squalls. On this leg, *Seattle* No. 1 pancaked and broke two wing struts. Materials, except wood, were on board and when timber was cut new struts were soon installed and the flight resumed.

On the night of April 11 a furious storm blew in upon Sitka and *Boston* No. 3 dragged her anchor. All the planes were im-

periled and the entire personnel labored until 9 o'clock to get them secured.

Between Sitka and Seward there were almost constant snow squalls for the 625 miles. This leg turned out to be the worst of the entire world flight, except, possibly, that from Iceland to Greenland. The planes breasted headwinds all the way and for 7 hrs. and 44 min. they could scarcely see the water, so thick was the weather, unless they descended low. Although this was dangerous it enabled them to see the white line of the breakers through the snow and thus assisted them in their course. At Seward they reached the northernmost point on the Pacific part of the flight.

From Seward to Chignik, 425 miles, Nelson was designated as Flight Leader. The ships tried to keep together, but the *Seattle No. 1* several times dipped inland. The last time it veered off the compass course, the *Chicago, Boston* and *New Orleans*, having fought head winds, did not have enough gasoline to return and then get on into Chignik. They were thus compelled to go ahead, landing at Chignik at 4:25 p.m.

From this time on, Lieut. Smith became practically the commander of the expedition. By radio he requested the United States destroyers *Hull* and *Corey* to hasten from Seward to the region of Portage Bay. Martin in the *Seattle* was found on the water 110 miles northeast of Chignik, having lost oil from the crank case. The *Hull* landed Martin and Harvey and their plane at Kanatak. A new engine and supplies were brought from the base at Dutch Harbor by a Coast Guard cutter and finally, on April 25, they reached Chignik. On April 30 the *Seattle* left Chignik for Dutch Harbor, but again got off its course, became lost far inland and finally crashed into a snowy mountain peak. Martin and Harvey were unharmed. Taking emergency rations from the plane they tramped through the snow seven days to a trapper's cabin, where they recuperated two days, then walked on into Port Moller, where Martin communicated with Washington. In the meantime the Coast Guard cutters *Algonquin* and *Haida* had been searching the coast and a flying relief expedition was starting up from San Francisco.

Smith, Wade and Nelson were ready to leave Chignik on April 16, but did not do so, due to the *Seattle's* absence. On April 19, notwithstanding a rough sea that made it almost impossible to cast off the moorings, the *Chicago, Boston* and *New Orleans* got away for Dutch Harbor, reaching there after a flight of 7 hrs. and 26 min. At Dutch Harbor they awaited Martin, but on May 2, following

receipt by Smith of a telegram from Gen. Patrick authorizing him to do so, Smith took command and proceeded with Wade and Nelson.

At this point the co-operation of the Coast Guard and the Bureau of Fisheries' vessels, *Algonquin, Haida* and *Eider* became most helpful. The *Eider* sent in weather reports then sailed west to Attu, last of the Aleutians and the *Algonquin* and *Haida* left Dutch Harbor for Atka. It was on this leg that the flyers began to shift for themselves in food, preparing their own meals.

Storms of the North Pacific

From May 3 to May 9 the expedition was forced by stormy weather to lay over at Nazan, Atka, the Aleutian Islands. One storm was so severe that the *Haida* was forced to put to sea. The 55 mile hop to Chicagoff, Attu, was made in 7 hrs. 52 min. Attu, even in mid-May, was the bleakest of imaginable places. At that time the island was inhabited by only one man and 37 women, the rest of the men being away fishing. From the air these northern islands and seas present a strange and weird picture.

May 15 a flight of 350 miles was made to Komandorski Island, Soviet Russia. Immediately upon taking off at Chicagoff the flyers crossed the international date line and thus lost a day, that is, it became at once May 16. A landing was made on Soviet Russia in a snow storm. During the flight of 5 hrs. and 25 min. each of the three planes became heavily encrusted with ice. This excess weight, which on one plane approached half a ton, made a longer passage impossible. The inhabitants were courteous, but a dispatch from the Soviet Government requested the expedition to leave at once. This message was received just as the World Flight was ready to take off.

May 17 the flyers made the hop of the North Pacific, 585 miles, from Komandorski to Paramushiro, Kurile Islands, Japan. The take-off was in heavy swells. It was on this leg that the Pioneer earth inductor compass proved especially valuable. A course was set due west for the Kamchatka peninsula, and thence down the coast. The flight was made over fog, under fog and through snow storms. After 6 hrs. and 55 min. a landing was made during a rain and wind storm. At the destination, the flyers found welcome shelter and food on a United States destroyer and after one day's delay, caused by continued fierce storms, continued on to Hitokappu, a distance of 595 miles. At Hitokappu there were stationed a Japanese destroyer and the United States destroyer *Pope*. It was a holiday for the Japanese residents. Children sang the American and

Japanese anthems and the Americans were entertained with the best the Japanese possessed.

Royal Welcome in Japan

Two more stages found the expedition at Kasumigaura, where, 50 miles north of Tokio, is situated the Japanese naval air station, and here preparations were made for the long flight down the Chinese coast. Arrival at Kasumigaura marked complete circumnavigation of the world by airplanes of various nations, all other parts having been previously flown, at different times and under different circumstances. From the 23rd to the 31st of May the flyers changed motors, overhauled their ships, and, between times, attended as many of the functions and entertainments as was possible. On one occasion they were received by the Prince Regent. Of the crossing of the Pacific, Lieut. Smith said: "We knew the trans-Pacific leg would be the worst of our flight, but it was ten times worse than we expected. Fog, snow, hail, wind and more fog conspired to prevent us crossing the Pacific. The natives in the Aleutian Islands said it was the worst winter in ten years, and we believed them."

Throughout their stay in Japan, the American flyers were generously entertained by the Japanese government. At Kushimoto, where the sea was so choppy a landing had to be made on the beach, a feast was spread on tables in an airplane hangar. There were chestnuts, signifying triumph and dried fish, symbolizing good luck. On this occasion Gen. Yasumitsu, commander of the Army Air Service, said: "It is a great honor to welcome the aviators representing the American Army, who just have accomplished the great task of linking the hemispheres and establishing an aerial tie between the friendly nations. You already have gained a name comparable to Perry."

To the flyers, June 4 was indeed a "red letter day," for it was the first day of the flight in which good weather was experienced throughout. This was the day the 550 mile passage from Kagoshima to Shanghai was made, across the China Sea.

One of the greatest concerns of the Planning Committee was to get the expedition through the typhoon belt before the bad season began. Although there were delays all along, it seemed that the schedule adjusted itself and, whether it was arctic or tropic, the planes got safely through.

On June 7, between Shanghai and Tchinkoen Bay, China, the World Flight passed the Frenchman D'Oisy, who shortly afterward

Curtiss Hawk. Curtiss D12, 420 h.p. engine, high speed 178 m.p.h.

The world's fastest seaplane, Curtiss Navy R2C2 with which Lt. (j.g.) A. J. Williams won Pulitzer Trophy in 1923 at 243.67 m.p.h., fitted with pontoons. As a seaplane, this craft with Curtiss engine made average speed of 227.5 m.p.h. in 1924.

was wrecked. It was on this leg that the Americans first began to experience the tremendous heat of Southern Asia. Although their planes were equipped with extra large radiators, the engines became very hot and, one after the other, the exhaust pipes burned out and had to be replaced. The flyers who, in the North Pacific, were clad in furs to withstand the penetrating cold, began to discard their clothing and by the time they reached Southeastern Europe they had adopted a uniform of short trousers and thin shirt which afforded them greater comfort.

In Typhoon and Sunshine

The coast of China, between Shanghai and Hong Kong is well protected and afforded safe passage for the seaplanes, yet in the hop from Amoy to Hong Kong, for 100 miles the three planes fought a small typhoon. The day the flight was made to French Indo-China was the second complete day of sunshine since leaving continental United States.

On the morning of June 11 the planes could not take off from the river at Haiphong, due to the heat-lightened air and lack of wind, so they had to taxi to the mouth. There Smith was forced to land again, due to a cracked water jacket. A United States destroyer was at Saigon, capital of the French protectorate of Anam, 500 miles distant. Smith was towed by natives to anchorage, rode 20 miles by motor to Hue, then got in touch with the destroyer. Forty-seven hours afterward the new engine was installed and Smith was again in the air.

On reaching Saigon the expedition marked its southernmost point, the point nearest the Equator. Due to the increasing heat and consequent lightness of the air, the planes could not get off nearly so heavily loaded as in the north and more frequent fueling bases had to be provided. In the flight from Bangkok, Siam, to Tavoy, Burma, between the Gulf of Siam and the Bay of Bengal, mountains 4,000 to 6,000 feet high were encountered. At Tavoy the United States destroyer *Sicard* was awaiting the World Flight, with supplies, shelter and food.

In the busy Rangoon river, at Rangoon, Burma, during the night of June 20th, the *New Orleans* No. 4 was run down by a native sampan and one wing damaged. That night, too, Lieut. Smith became ill. But the following day all members set to work on Nelson's plane and, the damage repaired, got away for Akyab, Burma, 480 miles. It was on this stretch that the Americans passed over the British flyer MacLaren, who had landed in one of the

many protected harbors along the coast because of the typhoons. The Americans, although flying about on schedule, did not quite get out of the typhoon belt in time, and in the 180 miles between Akyab and Chittagong, Burma, on June 26, passed through several storms. But at Chittagong there was again awaiting them the welcome protection and friendship of the United States destroyer *Preston*.

Americans Their Own Mechanics

The six Americans were their own mechanics, riggers and enginemen. Rarely would they let others touch their planes. Guarding their craft while in port was their hardest task. At Calcutta, which they reached June 26, they found the main supply base of southern Asia. There they abandoned pontoons for wheels, installed new engines and generally overhauled their machines. This they accomplished in three days, the only misfortune being a fall which Smith suffered from the upper wing of the flagplane *Chicago* No. 2. Smith broke a rib, but, after having it set, he again went about his work.

Equipped as land planes the World Cruisers made better time. Leaving the Royal Air Force airdrome at Dum Dum, north of Calcutta, they set a course over British airways that carried them into the lowlands of the lower Ganges valley, across the paddy fields, over the rolling hills of northwestern Bengal, and then into the plains of Behar. At Allahabad, India, they were welcomed by the British air force and entertained at their airdrome. From Allahabad to Ambala the World Flight passed through a region subject to the southwest monsoon, accompanied by electrical storms and rains. In this bad region the *New Orleans* No. 4 cracked a water jacket.

At 9:20 a.m. July 3, as the expedition was taking off from Ambala for Multan, India, rain began to fall. The storm changed into a sand storm. An effort was made to rise above the dust, but after reaching an altitude of 5,000 feet this was found to be impossible. This occurred just at the edge of the Sind Desert. It then became necessary to fly just above the ground because the visibility had decreased so that it was like flying in a fog. At 2:05 the flight arrived at Multan, landing on the parade ground of the British cantonment, having covered only 360 miles in nearly six hours of flying. From Multan to Karachi is 455 miles. The compass course set was along the edge of the Great Indian Desert, and for 100 miles, the airplanes flew over this vast waste. The heat was intense and Nelson's plane, the *New Orleans* No. 4 again cracked a water jacket, necessitating change of engines at Karachi.

So much mechanical work had to be done at this point that all members worked 16 hours a day for three days.

July 7 the expedition flew for 8 hrs. and 55 min., traveling 775 miles from Karachi, India to Bandar Abbas, Persia. The first part of the flight was along the seacoast so rugged that an emergency landing would have been hard to find. The next day, July 8, was marked also by a long double flight of 10 hrs. and 35 min., in which time 920 miles were traversed from Bandar Abbas to Bagdad, Mesopotamia. At first it was again necessary to skirt the coast, thence across the desert to Basara, and up the Euphrates river to the airdrome of Squadron No. 8 British Royal Air Force.

Over the "Cradle of History"

For over six hours on July 9, the World Flight followed the Euphrates valley, the "cradle of history," and by early evening landed at Aleppo, where they were met by Gen. Billotte and a group of French aviation officers. This day the temperature rose, even in the air while flying, to 110 degrees. At Aleppo, after reception by the French, the Turks gave a dinner which lasted until 2 a.m., and at 6 a.m., July 10, the Americans were again on the wing, bound for Constantinople, where they arrived at 1:40 p.m., having again covered two legs in one day.

At the San Stefano airdrome they were welcomed by the Turks and yielded to requests to remain over so that the aviation officers could get a good look at the American planes. It was here that Smith was quoted in press dispatches as having said, presumably of the mountains encountered in Persia: "We had a thrilling experience. We had to fly single file through a canyon so narrow that frequently the wing tips almost touched the walls. Below was a torrent; above were thick clouds." Nelson said: "We have had to fight west winds almost everywhere."

From Constantinople on up through southeastern Europe to Bucharest, Budapest, Vienna, Strassburg, Paris, London and Brough it was straight, easy flying. It would have been a time of relaxation had not the flyers been anxious to make time so as to reach the last—and possibly most dangerous—section of their journey, that across the North Atlantic before the winter set in. From Constantinople to Paris they flew generally over the route originally laid out by the Franco-Roumaine Company. At Vienna there were many Americans in the huge crowd that welcomed the flyers. While there Lieut. Ogden said: "After each stop we have

about three hours' work, but we provide for everything ourselves. On the average we have about four hours' sleep daily."

The Flight arrived at Paris on July 14, French Independence day, and a vast multitude was assembled at Le Bourget airdrome to welcome the World Flyers. One hundred miles east of the city they were met by two flights of airplanes from the French army. They were escorted over the city, circled the Arc de Triomphe, out of respect to the heroes, living and dead, and came to rest at the airport. Among the official delegation were Gen. Niessel, hero of Chemin des Dames, representing the French military aviation department; Gen. Dumesnil, representing the fortified district of Paris and Laurent Eynac, Under Secretary for Air. Just before he landed, Smith unfurled from his fuselage the French tri-color. The first to greet him was Maj. Carlyle Wash, American air attaché, who had made arrangements for the flight through Europe.

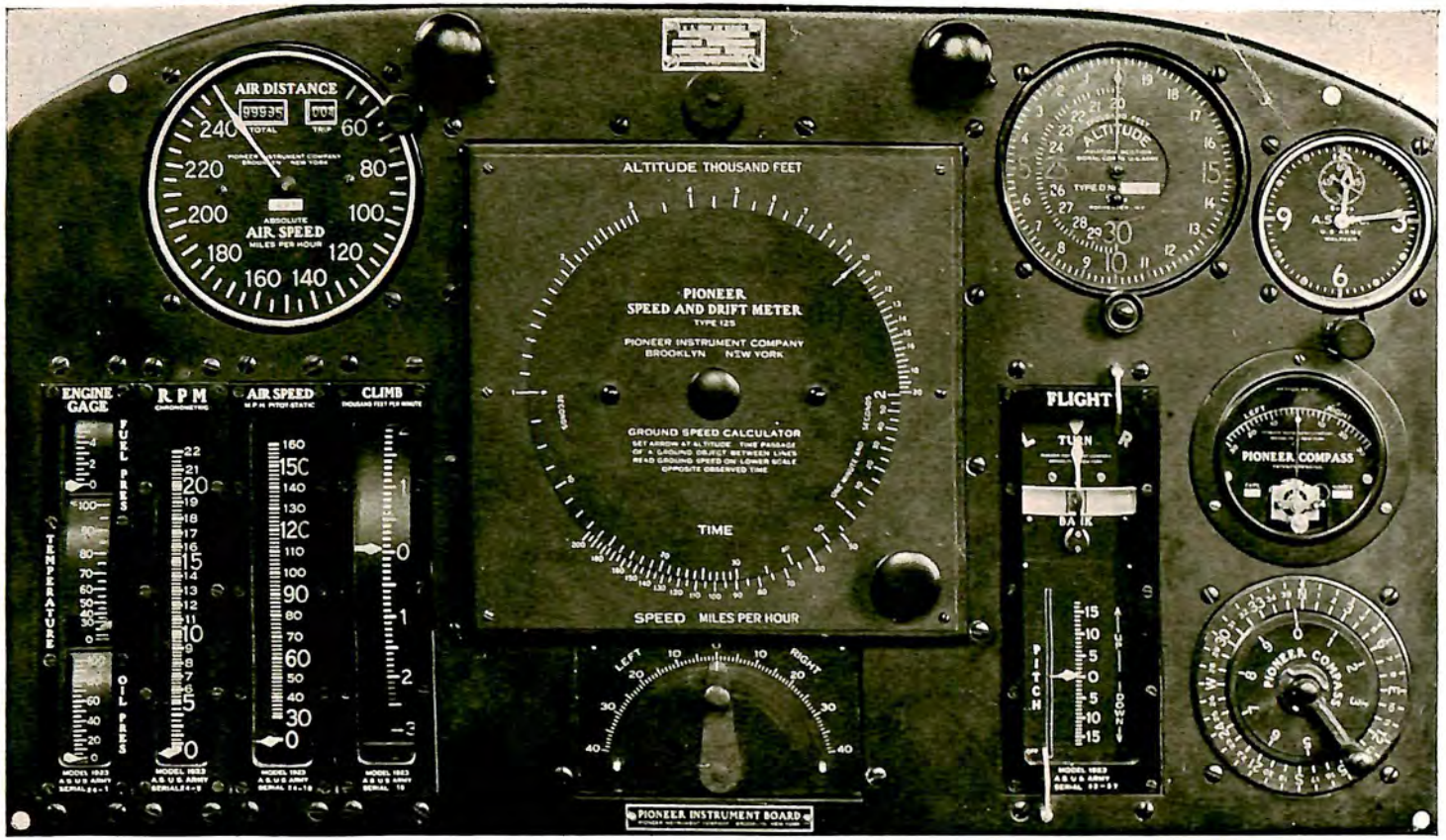
Congratulations from the French

Of the World Flight, Capt. Weiss, who commanded the French escort, said: "Think of it, strangers in a new atmosphere, yet they followed their maps with a precision that even to experienced French airmen must seem almost incredible. Ah, but they are fine flyers!"

M. Eynac said: "Just as France and the United States were united during the war, our flyers will be found working together in the cause of peace, working together towards the opening of new trade routes for the greater commercial prosperity of all the world. The way you have so magnificently blazed through the skies, we shall be only too glad to follow."

The flight from Paris to London, 215 miles, was like a homecoming. All the way there were escorting craft, French and English, military and civilian and photographic. The short flight was made July 16 over one of the commercial air routes in 3 hrs. and 7 min. On arrival at Croydon, there was an immense crowd waiting. Among them was Mrs. Stuart MacLaren and the Americans rejoiced with her on learning that her husband, at first reported lost, was safe. Welcome for the British Government was extended by the Air Ministry and the Royal Air Force. Among the Americans present were Maj. Howard C. Davidson, American military air attaché, and Commander J. H. Towers, American naval air attaché. The flyers were banqueted by the Royal Aero Club, guests assembled in their honor being the Rt. Hon. Lord Thomson, Air Minister,

Air photo of Washington. In upper center is Lincoln Memorial; then Washington Monument; then the White House; then the Capitol; (Lower Right) Senate Office Building. (Lower Left) House Office Building and Congressional Library (with dome).—*Fairchild Aerial Surveys, Inc.*



Typical airplane instrument board as produced by Pioneer Instrument Co.

Sir Hugh Trenchard, chief of Air Staff, Maj. Gen. Sir W. S. Brancker, director of civil aviation, and Ambassador Kellogg.

At Brough, on the River Humber, the planes were overhauled, new engines installed, and wheels displaced by pontoons. By that time it was well past the middle of July and all were getting anxious to cross the rigorous stretches to the north. The United States Navy had placed its scouting fleet, under Admiral Thomas P. Magruder, at the disposal of the World Flight and four vessels were stationed on every water hop from Europe to the American mainland.

Planes Just as They Left California

All of the planes were practically as they were on leaving California. Lieut. Smith said: "Our planes are in splendid shape. The storms we have encountered have knocked some of the gilt off their noses, but there is only a very slight depreciation in the wing fabric."

It was not until July 30 that the flight was made from Brough to Kirkwall, Orkney Islands, from whence the real start across the Atlantic was to be made. The events of the 555 mile hop from Kirkwall to Hornafiord can best be told in the official language of Lieut. Smith's own report:

"Fog in Kirkwall and along the route between Kirkwall and Iceland prevented the flight starting until the morning of Aug. 2. The flight started at 8:34. Fog was encountered within five miles after departure and finding it impossible to go under the flight climbed above the fog, continuing on the course for about 30 minutes when all three planes were trapped in a very heavy fog. It was impossible for the planes to see each other. The *Chicago* No. 2 and the *Boston* No. 3, using their instruments, climbed and turned back out of the fog, coming out at an altitude of 2,800 feet, where they circled for about 30 minutes looking for the *New Orleans*. Fearing some accident had befallen the latter, the two returned to Kirkwall, dropping a note at the hotel to immediately give out information regarding the separation. The *New Orleans* falling through the fog partially out of control, continued and reached Iceland safely. The cause of the separation of the Flight is best explained by the following radiogram from the pilot of the *New Orleans* to the Flight Commander:

"'Lieut. Lowell Smith, August 2, 1924.
Kirkwall, Scotland.

"'Got into propeller wash and near tail spin. Came out just above water past fog belt. Arrived five thirty-seven.

"'Nelson.'

Wade Loses His Machine

"On August 3, after following the same procedure for taking off as that of the previous day, the flight got under way at 9:30. The weather was excellent. The flight made good progress with a light wind helping along until a point over the North Atlantic Ocean about midway between the Faroe Islands and the Orkney Islands when the oil pressure on the *Boston* suddenly failed and forced Lieut. Wade to land. The water being too rough for a safe landing, the *Chicago* circled until it determined that the *Boston* was disabled and then continued on its course. Notes were prepared giving the location of the *Boston,* the wind direction and its probable drift, together with a warning that the sea was increasing and the personnel in danger. The first note dropped was on Sydero Island, at a telegraph station and was addressed to the U. S. *Richmond,* (Admiral Magruder's flagship) and with directions to also broadcast the message through the nearest radio station. The other message was dropped on to the U. S. destroyer *Billingsby,* a short distance west of Sando Island. The *Chicago* circled until it reached the signal (requested in the note) which would show that the captain of the destroyer had received and understood the message and that they had started on the search. The *Chicago* then continued to Hornafiord, flying through rain, with very poor visibility the entire distance of 250 miles. The destroyer *Reid,* which had a position half way between the Faroe Islands and Iceland, was not seen. It later developed that it was 32 miles south of its position, this being caused by their inability to make sun observation for several days. The cruiser *Raleigh* was passed 25 miles from Hornafiord. Excellent arrangements had been made at Hornafiord, including a temporary radio station, set up by the Navy in the building used for the quarters while there. (Nelson's time for the 555 miles was 6 hrs. 13 min.; Smith's, 9 hrs. 3 min.) No plans were made for departure the next day, the flight waiting to determine the extent of the damage to the *Boston.*

"On Aug. 4 the following radiogram was received from Lieut. Wade:

" 'For Lieut. Smith, U. S. S. *Raleigh.*

" 'Everything loosened and badly strained. All wings damaged. Propeller broken. New pontoons necessary. Center sections slightly damaged, repairs possible. New engine necessary. Upon arrival Faroes this morning will make further reports. Thanks for early message.

" 'Wade.'

"From the above radiogram and the fact that all supplies necessary to repair the plane were available, it was felt that the *Boston* would again join the flight. However, a few hours later, the same day, the following message was received:

"'From A9W-*Richmond.*
"'To *Raleigh*—GR—0004.
"'For Lt. Smith—Hornafiord.
"'Plane three total loss. Richmond sailing Reykjavik to arrive early afternoon Tuesday.

"'Wade.'

"After this radio message was received, all hopes were given up and plans made for the *Chicago* and *New Orleans* to continue immediately."

Unofficially, it was learned that, despite the rough sea, Wade and Ogden tried to repair the damage. But it was hopeless. Their landing had not wrecked the plane, but major repairs were necessary to the engine. The first craft to appear was an English trawler which, upon hearing a shot from the aircraft, went immediately to its assistance. In the meantime the destroyer *Billingsby* was hastening to the scene under forced draft. It took the *New Orleans* in tow to the lee side of the Richmond. Wade and Ogden tried to disassemble the plane in the water. Then the cruiser took the airplane in tow and finally attempted to hoist it aboard. The hoisting gear, weighing 5,800 pounds, broke under the heavy weight of the water-logged plane, and the whole tackle crashed down upon the aircraft.

The War Department, on learning of the loss, immediately made ready another Douglas cruiser for Wade and Ogden. Some days later, Wade, on seeing Smith at Reykjavik, burst into tears. Smith cabled the War Department, urging that the World Flight insignia and the original numeral 3, be placed on the new plane. "There is not one of the gang," he wired Gen. Patrick, that did not shed a few tears over Wade's disaster."

Italian World Flyer Rescued

Smith and Nelson on July 15 flew 290 miles from Hornafiord, Iceland, to Reykjavik, Iceland, where, on the sixteenth, there also arrived the Italian world aviator, Locatelli, who sought and obtained permission to fly one flight behind the Americans. Smith, however, generously obtained permission from Washington for the Italian to accompany him and Nelson.

At Reykjavik radical changes in flight plans had to be made. An

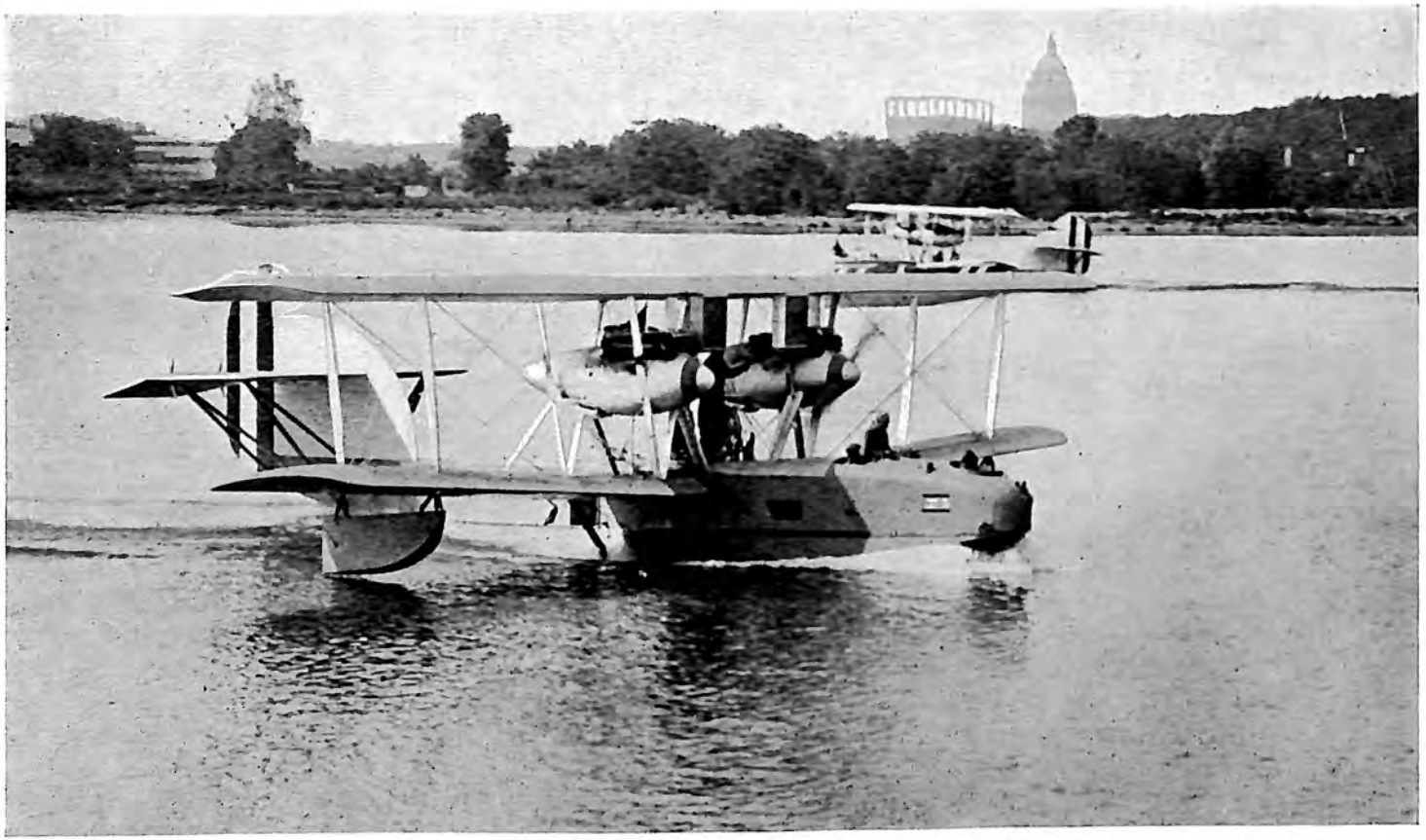
intermediary landing place in Greenland, as selected correctly by Lieut. Crumrine, became choked with ice. For ten days the Danish steamer *Gertrud Rask* had been unable to penetrate the ice barrier off the east coast of Greenland. The American naval vessels were in increasing peril of the ice and, what was worse, the fuel supply was running low. Lieut. Schulze, one of the World Flight alternates, and Lieut. Bissell, were called in. Admiral Magruder conferred with Smith and Crumrine and there were reports that the flight was to be called off, but the flyers refused.

Finally, at 10:15 a.m., Aug. 18th a start was made. Smith had been up all the night previous, going over charts. Harding, too, had been up, and early in the morning was out with his plane. The sea was rough and the *Chicago,* in attempting a take off broke her front spreader bar between the pontoons and the *New Orleans* broke her propeller. This necessitated a further delay of several days. Then, at 6:55 a.m., Aug. 21, both planes got safely away and set a direct compass course for Fredriksdahl, Greenland, 830 miles distant. This was by far the most dangerous part of the entire trip and it was felt that success had indeed been achieved when a landing was made at 5:30 p.m., the craft being 11 hrs. 17 min. in the air.

In the meantime the Italian Locatelli, with an assistant pilot and two mechanics in his two-engined German Dornier *Wal* flying boat, had started, but had been forced down by engine trouble. The American naval vessels started to search and three days later—Aug. 24—at midnight, to be correct, a sailor on the *Richmond* caught the faint glint of an electric torch and thus the Italians were saved. They had drifted 100 miles.

Joyful Welcome at Icy Tickle

From Fredriksdahl to Ivigtut and from Ivigtut to Icy Tickle, Labrador, the North American mainland, seemed a short, safe distance, in comparison with the dangers safely passed. The landing at Icy Tickle was indeed a homecoming, for there were gathered newspaper correspondents and photographers. The flyers arrived there Aug. 31. They had been preceded by the *Richmond* and they found awaiting them a radio which President Coolidge had sent through Admiral Magruder, and also one from Gen. Patrick, by way of a general broadcast in Washington. Patrick's may well be remembered. "There is one way," he said, "in which we may well imitate the great explorers and discoverers of the past. Without exception these daring men at the end of their voyage or expe-



Navy P.N.-7, Metal Hull Patrol Seaplane, 2 Wright engines, with which weight carrying records were made at Naval Air Meet, Bayshore Park, Md., October 25, 1924.—*Navy Bureau of Aeronautics.*

Thomas-Morse Aircraft Corporation's all metal observation plane.—*U. S. Air Service.*

dition, always drew apart, knelt in prayer, and thanked God for the privilege which had been bestowed upon them. All of us now, with bowed heads and humble hearts, offer up our thanks to the allwise Creator that this little band which we sent into the West has come to us safely out of the East, having been the first of all the generations of men to circumnavigate this terrestrial sphere by air."

The flight down the Atlantic Coast, thence West to the Pacific Coast and then back again finally to Dayton was literally a triumphal tour.

Engineering Log of the Flight

That the World Flight was successful was due to the element of competent service engineering—an element no less important than the most spectacular and envious one. Lieut. Erik Nelson was engineer officer. He it was who stayed at the Douglas plant day and night while the planes were being built. He watched their assembly, assisted Smith and Wade in their testing. To Nelson should go much of the credit. Well liked by his fellow officers and in the aircraft industry, it is commonly said that Nelson, of all the four officers originally starting, was probably the best qualified to "see it through" alone; that is, being a navigator, understanding construction, being a skilled engineer and mechanic and an excellent flyer, he was capable of taking care of himself under any conceivable emergency. Smith's, Wade's and Nelson's planes in their supplies and equipment reflected the personality of pilots and mechanics, but Nelson's was unique in the variety, number and assortment of light tools and supplies stowed away. Nelson was ready for pleasure or shipwreck.

The composite engineering log of the three successful planes impresses one who studies it with the astonishing fact that but a very, very small percentage of the elaborate supply system arranged beforehand by the United States Air Service was actually called upon. Altogether, only 20 Liberty engines were used by Smith, Wade and Nelson, including the second ship issued to Wade. The total mileage flown round the world and in the subsequent tour in the United States was 95,879, or an average of 4,794 miles per engine.

The World Cruisers left Santa Monica with wheels. At Seattle, where the flight officially started, they were equipped with pontoons. At Calcutta they returned to wheels; at Brough they became seaplanes again and at Boston the last change was made back to wheels. The following summary shows the astonishingly slight service the Round-the-World airplanes required.

"Chicago," No. 2—Smith

Dutch Harbor, 2430 miles from Seattle. Beached plane on runways and removed and repaired generator.

Kasumigaura, 3285 miles from Dutch Harbor. New engine, propeller and pontoons installed.

Shanghai, 1215 miles from Kasumigaura. Exhaust manifolds replaced by straight stacks. Copper strips on pontoons ripped off.

Hong Kong, 910 miles from Shanghai. One pontoon leaking badly. Plane lifted on dock. New pontoon installed. Propeller tipping repaired. Cylinder welded.

Hue, between Haiphong and Tourane, latter 905 miles from Hong Kong. Plane forced down. New engine installed. Lost water through cracked cylinder jacket.

Calcutta, 2545 miles from Tourane. Plane lifted out of water by crane. Pontoons removed. Landing gear and tail skid installed.

Karachi, 1745 miles from Calcutta. New engine installed. Plane thoroughly cleaned and inspected.

Brough, 4763 miles from Karachi. Landing gear, tail skid assembly, large radiator, M. B. propeller and engine removed. New pontoons and engine installed, also original Flexo radiator and N. C. propeller. Thorough inspection.

Reykjavik, 1295 miles from Brough. Front spreader bar cracked during attempted take off. New bar installed.

Ivigtut, 985 miles from Reykjavik. Plane pulled from water on runway on beach. Engine removed. New engine installed.

Icy Tickle, 560 miles from Ivigtut. On this leg the gasoline engine driven pump froze. Air driven pump stuck. Hand pump used. New engine pump and shaft installed.

Pictou, 745 miles from Icy Tickle. Rear spreader bar cracked during take off. Vibrated off during flight. New one installed.

Boston, 560 miles from Pictou. Pontoons removed. Landing gear, tail skid assembly and M. B. propeller installed. Thorough inspection.

San Diego, 3480 miles from Boston. New engine installed. Thorough inspection.

Altogether, Lieut. Smith in *Chicago* No. 2 had one forced landing, used six engines, three extra pontoons and one extra propeller in all the course of his World Flight proper, 27,553 miles.

"New Orleans," No. 4—Nelson

Dutch Harbor, 2430 miles from Seattle. Beached plane on runways. Thorough inspection plane and engine. Welded exhaust manifolds. Repaired earth inductor compass gears.

Paramashiru, 1855 miles from Dutch Harbor. New mooring bridles made and installed.

Hittokappu, 595 miles from Paramashiru. Battery removed, checked and charged.

Kasumigaura, 836 miles from Hittokappu. Taken out of water on dollies. Placed in hangar. New pontoons and engine installed.

Kagoshima, 665 miles from Kasumigaura. New propeller installed. Miscellaneous checking, inspection and work.

Shanghai, 550 miles from Kagoshima. Exhaust manifolds badly burned. Straight stacks installed.

Hong Kong, 910 miles from Shanghai. Propeller removed for repairs to tipping and balancing.

Bangkok, 2030 miles from Hong Kong. Water and wind gasoline pumps repacked.

Tavoy, 200 miles from Bangkok. Two right front vertical wires broken. Rough sea. Replaced.

Rangoon, 295 miles from Tavoy. Plane pulled up on runways. Right wing repaired. Damaged at anchor by boat. Pontoons painted.

Calcutta, 925 miles from Rangoon. Plane lifted out of water by crane. Pontoons replaced. Landing gear and tail skid installed.

Allahabad, 450 miles from Calcutta. Generator failed during flight. Replaced by spare one carried in plane.

Karachi, 1295 miles from Allahabad. During flight, exhaust valve dropped in cylinder, breaking piston and rod. Engine continued to run.

Brough, 4763 miles from Karachi. Landing gear tail skid assembly, large radiator, M. B. propeller and engine removed. Pontoons, new engine, cartridge cone radiator and N. C. propeller installed. Thorough inspection.

Reykjavik, 1295 miles from Brough. Oil pressure dropped from 60 to 27 pounds during flight. New oil pump installed. Plane beached, new propeller installed. This propeller damaged in attempted take off and a second new one installed.

Fredriksdahl, 820 miles from Reykjavik. Pontoons painted.

Ivigtut, 165 miles from Fredriksdahl. Plane pulled from water to runway on beach. Engine removed. New engine installed.

Boston, 1865 miles from Ivigtut. Pontoons removed. Landing gear, tail skid assembly and M. B. propeller installed. Thorough inspection.

Baltimore, 420 miles from Boston. Forced landing, dead stick, at Halethorp, Md. Gears sheared. New engine installed.

Sweetwater, Tex., 1940 miles from Baltimore. Exhaust valve spring broken. Changed.

San Diego, 1060 miles from Sweetwater. New engine installed. Thorough inspection.

Altogether, Lieut. Nelson, in *New Orleans* No. 4, had one forced landing, and used four new engines, three extra propellers and two extra pontoons in the entire World Flight of 32,948 miles.

"Boston" and "Boston II" No. 3—Lieut. Wade

Dutch Harbor, 2430 miles from Seattle. Lifted plane on docks. Changed engine. Lowered into water, beached on runways, thorough inspection.

Paramashiru, 1855 miles from Dutch Harbor. New mooring bridles made and installed.

Hittokappu, 595 miles from Paramashiru. Battery removed for checking and charging.

Kasumigaura, 835 miles from Hittokappu. Taken out of water. Placed in hangar. New pontoons and engine installed.

Kagoshima, 665 miles from Kasumigaura. Forced to land during flight to refill radiator. Engine overheated.

Shanghai, 350 miles from Kagoshima. Exhaust manifolds replaced by straight stacks.

Hong Kong, 910 miles from Shanghai. Propeller removed. Tipping soldered and propeller balanced.

Calcutta, 3450 miles from Hong Kong. Lifted out of water by crane. Pontoons removed. Landing gear and tail skid assembly installed. New generator installed. Thorough inspection.

Karachi, 1745 miles from Calcutta. New engine installed. Plane thoroughly cleaned and inspected.

Constantinople, 2705 miles from Karachi. Front main gasoline tank changed. Crack in bead, leaking.

Brough, 2058 miles from Constantinople. Landing gear, tail skid assembly, large radiator, M. B. propeller and engine removed. Pontoons, new engine, original Flexo radiator and N. C. propeller installed. Thorough inspection, servicing.

HornaFiord, 600 miles from Brough. Forced to land at sea. Oil pressure dropped to 0. Plane wrecked in attempt to save it. Sank off Sydere Island, 6 a. m., Aug. 4.

At Pictou the flight was resumed in *Boston II.*

Boston, 560 miles from Pictou. Pontoons removed. Landing gear, tail skid assembly and M. B. propeller installed. Thorough inspection.

Dayton, 850 miles from Boston. New engine installed. Plane painted and varnished to match *Chicago* and *New Orleans.* Twelve-volt ignition system installed. Short exhaust stacks and new propeller installed.

San Francisco, 3050 miles from Dayton. Forced landing at South San Francisco. Short circuit near battery. New engine installed.

Lieut. Wade, in original *Boston* No. 3, flew 19,428 miles. In this distance he had two forced landings, used four engines and two extra pontoons. For 2985 miles he was out. Then in *Boston II* No. 3 he flew 5120 miles, in which distance he had one forced landing and used two engines.

Recapitulation of Mileage

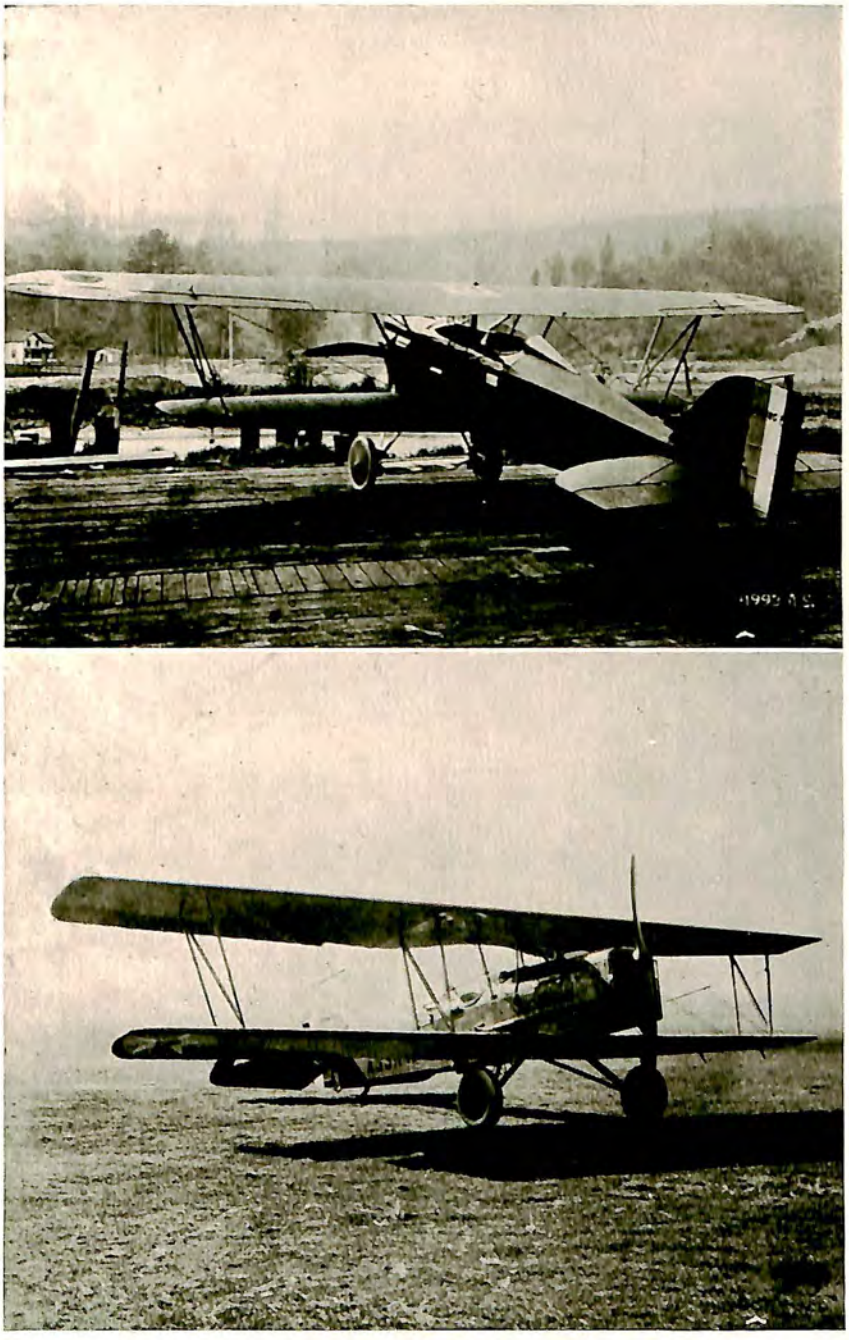
The flying incidentals to the Round-the-World Flight was in three major stages: Santa Monica to Seattle, Seattle to Seattle and Seattle back to Dayton, O. Here is the recapitulation.

	Chicago No. 2		*Boston No. 3*	*New Orleans No. 4*
Santa Monica-Seattle	985		985	965
Seattle-Seattle	27,553	(HornaFiord)	19,428	27,553
Seattle-Dayton	4,430		...	4,430
	32,968		20,413	32,948

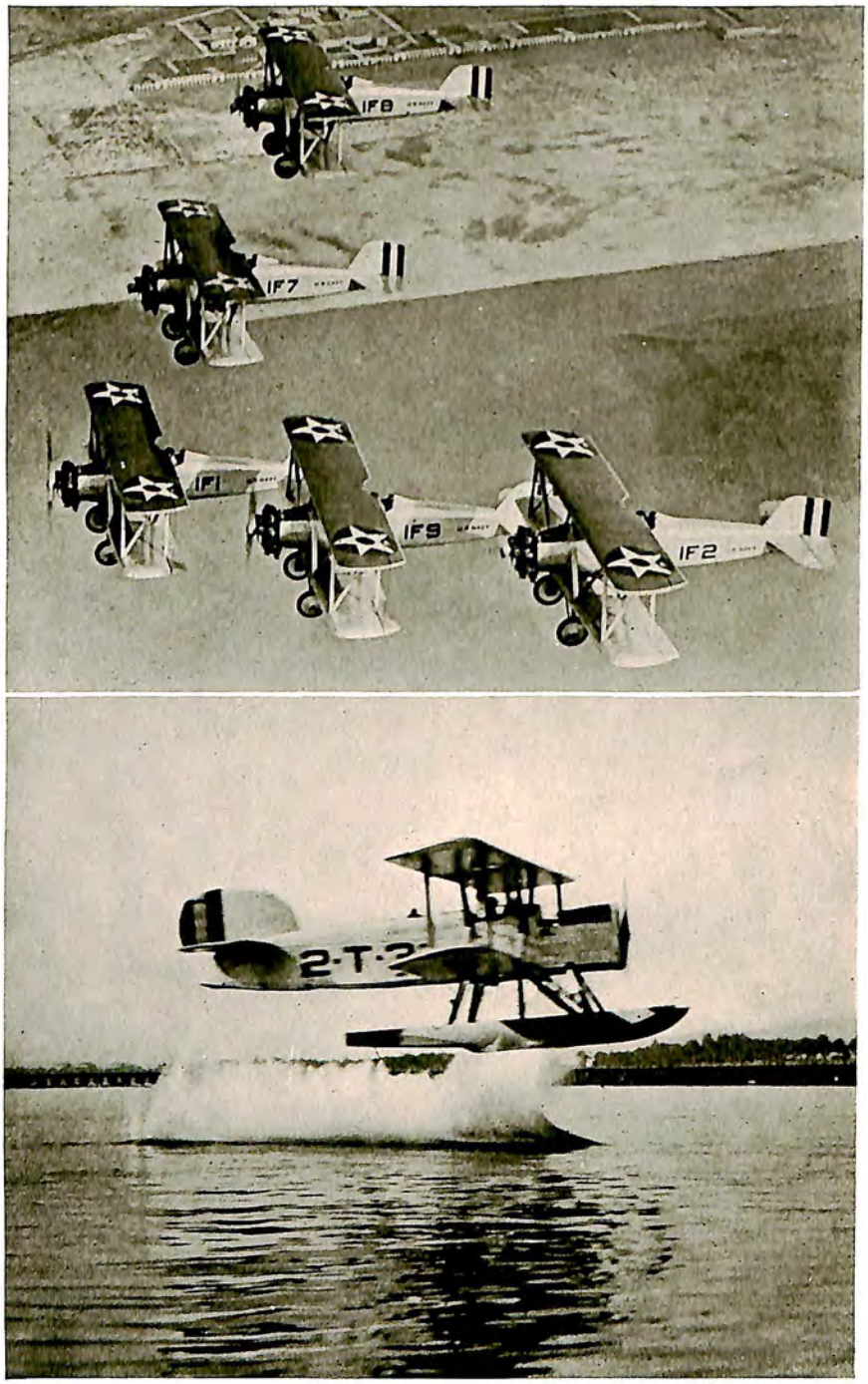
	Boston II No. 3
Pictou-Seattle	5,120
Seattle-Dayton	4,430
	9,550

In the total mileage, the *Chicago* No. 2 was equipped with seven engines, the seventh having been installed at San Diego on the final return lap to Dayton. This made an average of 4709⅐ miles to each engine.

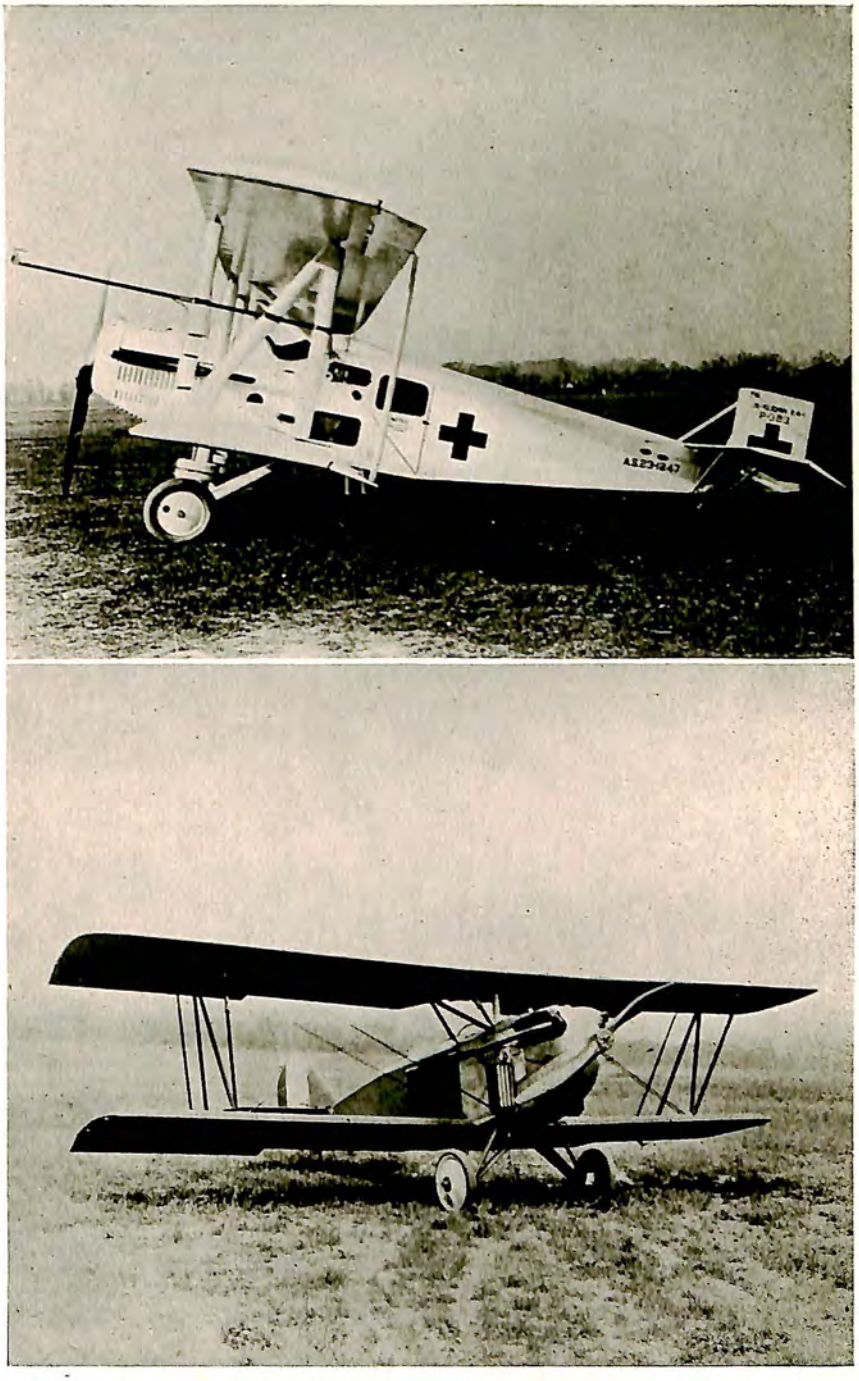
For the first two stages, *Boston* No. 3 used five engines, one on the Santa Monica-Seattle flight, making an average of 4082⅗



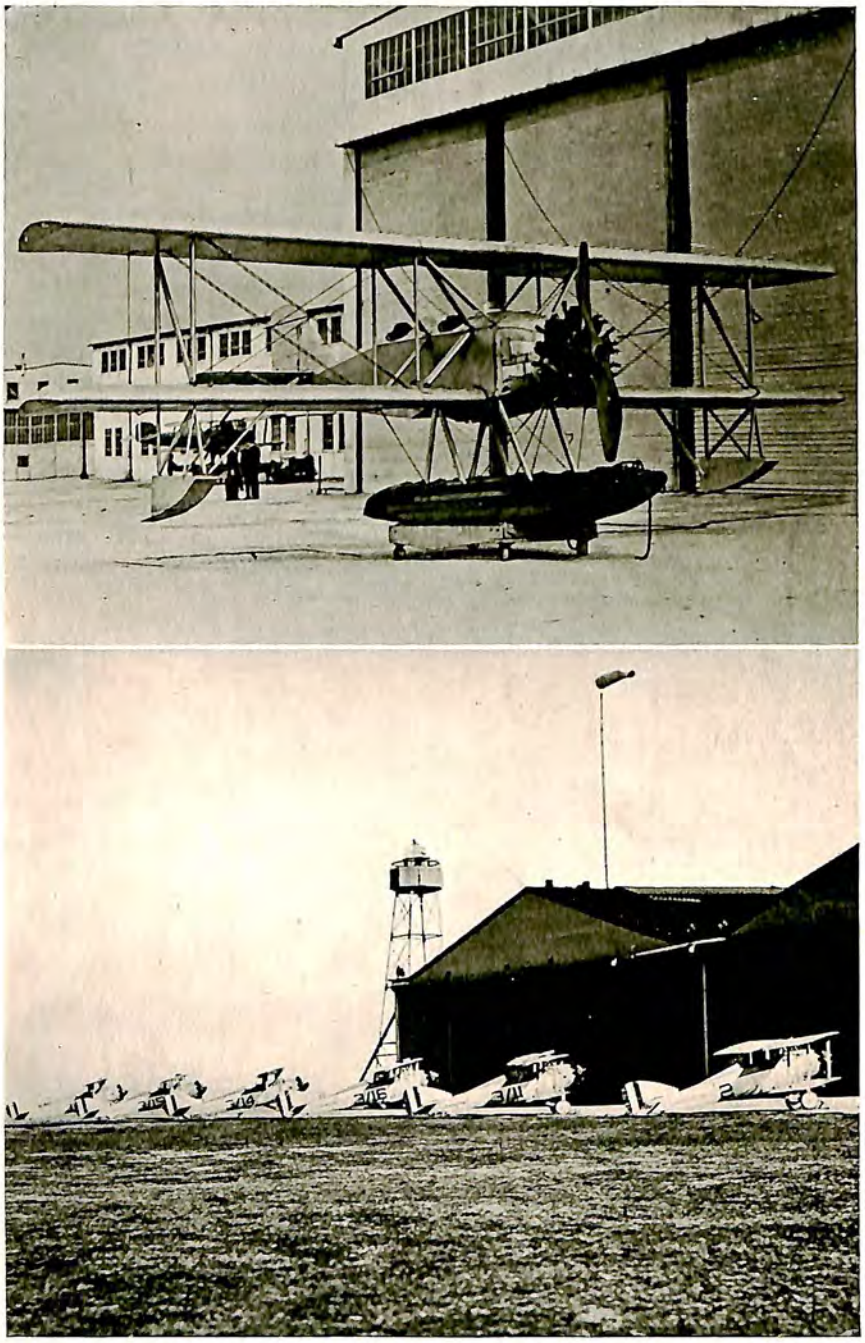
(Top) Boeing Airplane Company's PW9 Pursuit Plane, Wright engine. (Bottom) Boeing Airplane Company's observation plane.—*U. S. Air Service.*



(Top) Formation of TS1 Fighting Planes, Wright engine, attached to aircraft squadrons battlefleet U. S. Navy. (Bottom) Navy Douglas DT2 Torpedo Plane, Wright engine, launching torpedo.—*Navy Bureau of Aeronautics.*



(Top) Cox-Klemin Aircraft Corporation's Ambulance Plane. (Bottom) Cox-Klemin Type 2A.



(Top) Training Plane NB1, developed by Boeing Airplane Co. for the Navy Department. It is equipped with Wright engine. (Bottom) Line-up of Chance Vought Corporation's UO1 Planes, Wright engines, attached to light cruisers at Naval Air Station, Hampton Roads, Va. Note beacon for night flying in center of picture.—*Navy Bureau of Aeronautics.*

miles for each engine. *Boston II,* No. 3, in its two stages used three engines, a third having been installed at San Diego on the return to Dayton. This was an average of 3183⅓ miles to each.

The *New Orleans* No. 4 had, all told, five engines, the fifth having been installed at San Diego on the return to Dayton. The average per engine was thus 6589⅗ miles, by far the best for the entire expedition.

How the Air Service Was Aided

Next to the Army Air Service, that American organization which did most toward making the World Flight a success was the Bureau of Aeronautics, Navy Department. And after the Navy Department comes the Coast Guard and the Department of Commerce. The World Flight was a dramatic illustration of success eventuating from co-operation. While it would have been possible, of course, for the War Department to have operated independently of all other Government agencies, it would have been impracticable. In the first place the Navy Department, the Coast and Geodetic Survey and the Coast Guard possessed, through actual nautical experience, much of the information needed by the aviators. Then, too, there was the distribution of supplies. This complicated work was put through with the assistance of the United States Shipping Board, every pound of equipment and supply going forward in American bottoms. Coast Guard vessels, patrolling the deserted and dangerous waters of the north, were indispensable. Bureau of Fisheries vessels were utilized and in every part of the water sections—Seattle to Calcutta and Brough to Boston, Navy destroyers, cruisers and tenders stood by. They provided weather information, carried ground officers, transported supplies and offered grateful food and shelter to the weary men of the World Flight Expedition when the day's work was done. It is, perhaps, not too much to say, that the final hops over the ice-strewn and desolate reaches of the North Atlantic, delayed until winter seemed at hand, might not have been made had it not been for the stimulus of the very presence of the Naval craft, not to mention the practical service they gave. As already mentioned, the Aeronautical Chamber of Commerce assisted in gathering information when the flight was in preparation.

Counting the Cost and Distributing the Honor

It would be just as impossible to figure closely the cost of the Round-the-World Flight as it would be to figure the cost of the

Trans-Atlantic Flight made by the Navy in 1919. Direct expenses of the World Flight are given as $177,481.35. Of indirect costs, such as assistance furnished by other Departments, there is no estimate. But whatever the total, public and Congress alike, appear unanimous in the conviction that—success having been achieved—no sum would hardly have been out of reason to pay for such an achievement.

When the World Flight started, some members of the expedition were only non-commissioned officers. This was rectified by promotions to second lieutenant. Congress passed a law enabling the War Department to credit the world flyers with so many points, which, it was declared, was a promotion in their case equal, proportionately, to the promotion of General Pershing during the World War. By special act of Congress, Distinguished Service medals also were conferred upon all eight members of the original expedition. This was the first time such honors had been accorded for military services in a period of peace. The flyers also were permitted to accept foreign decorations.

The Rival World Flights

Of the five rival world flight attempts, one each made by representatives of Great Britain, France, Portugal, Argentine and Italy, the most meritorious of commendation and sympathy was undoubtedly that of the Englishman, MacLaren. The Frenchman D'Oisy made a brilliant and spectacular dash, the Portuguese, having completed their original flight, were not so badly disappointed. The Argentine, flying in a Dutch ship, and the Italian were typical of afterthoughts in a race already begun. For the defeated Englishman, the American World Flyers felt sympathy that was expressed wherever feasible in practical assistance of supply. That word supply—the outgrowth of organization—explains, possibly more clearly than any other word, the difference between the American achievement and the British trial.

Following is a summary of world flight attempts, other than American:

Great Britain. The first gesture toward an attempt to fly around the world was made by Sir Ross Smith and his brother, Sir Keith Smith, after their magnificent flight from England to Australia. They were ready to start on April 25, 1922. Sir Ross was killed in a crash at Brooklands, Eng., April 13, 1922. The effort was taken up by Major W. T. Blake, Capt. Norman MacMillan and Lieut. Col. Broome, who started May 24, 1922, in a De Haviland 9. Blake fell ill at Calcutta. MacMillan and Broome continued until they crashed at Akyab, India, Aug. 24, that year. The third English

effort was begun March 15, 1924, when Capt. Stuart MacLaren left Calshot, Eng., in a Vickers *Vulture*. The flight was financed by private aircraft, engine and oil companies. It had the sympathy of the British Government, but not its active support. MacLaren's effort was a splendid sporting attempt. His organization and supply arrangements were necessarily inadequate. That he got as far as he did was regarded as remarkable, under the circumstances. He was trapped in a dense fog while attempting to fly from Petropavlovsk, Kamchatka to Nikolski, in the Komandorski Islands of the North Pacific, and upon landing near the shores of Behring Island his plane was hopelessly damaged. An American destroyer hastened to his assistance with an extra plane, but the season was then too far advanced to permit continuance across the rigorous stretches of the lower Arctic.

FRANCE. Capt. Peltier D'Oisy and Sergt. Besin, mechanic, left Paris on April 24, 1924, in a Breguet. The original intention seems to have been to fly only into northern Asia, but D'Oisy made such good progress, and the features of his trip through the tropics were so spectacular, that the purposes were expanded to include circumnavigating the world. D'Oisy, like his British rival, made a fine showing. In trying to land on a golf course near Shanghai, May 20, he wrecked his machine, after having covered 10,580 miles in 26 days.

PORTUGAL. Major Brito Paes and Major Sarmento Beires left Lisbon April 2, 1924, on a projected trip around the world, the first leg of which was to be to the Portuguese possession Macao. Macao was reached June 20. While preparing to continue, their machine was wrecked. The total distance covered by the Portuguese expedition was 11,000 miles.

ARGENTINE. Major Pedro Zanni and his mechanician Felipe Beltrame left Amsterdam, Holland, July 22, 1924, on a flight around the world. Aug. 19, Zanni crashed while taking off at Hanoi, French Indo-China. They awaited a new plane in Tokio till Aug. 23, when the attempt was called off, owing to the lateness of the season.

ITALY. When the American flight was nearing completion, an Italian aviator, Lieut. Antonio Locatelli, decided to make the attempt and endeavored to accompany the American expedition across the North Atlantic. He left Pisa July 25, 1924, in a German Dornier *Wal*, powered with two Rolls-Royce, British, engines. He overtook the Americans in Iceland and started with Nelson and Smith from Reykjavik. He had a forced landing and drifted in the ice strewn sea for three days, when he was picked up on Aug. 24 by the U.S.S. *Richmond*.

CHAPTER VI

AMERICA'S AIRSHIPS—THE *SHENANDOAH* AND *LOS ANGELES* —GOODYEAR-ZEPPELIN PLANS.

PROBABLY the simplest way to describe the peculiarly dominant position which the United States occupies in lighter-than-air navigation is to state that we today possess the world's only modern rigid airships and that we possess what amounts to a world monopoly of helium, the non-inflammable lifting gas, without which commercial lighter-than-air development can scarcely hope to progress.

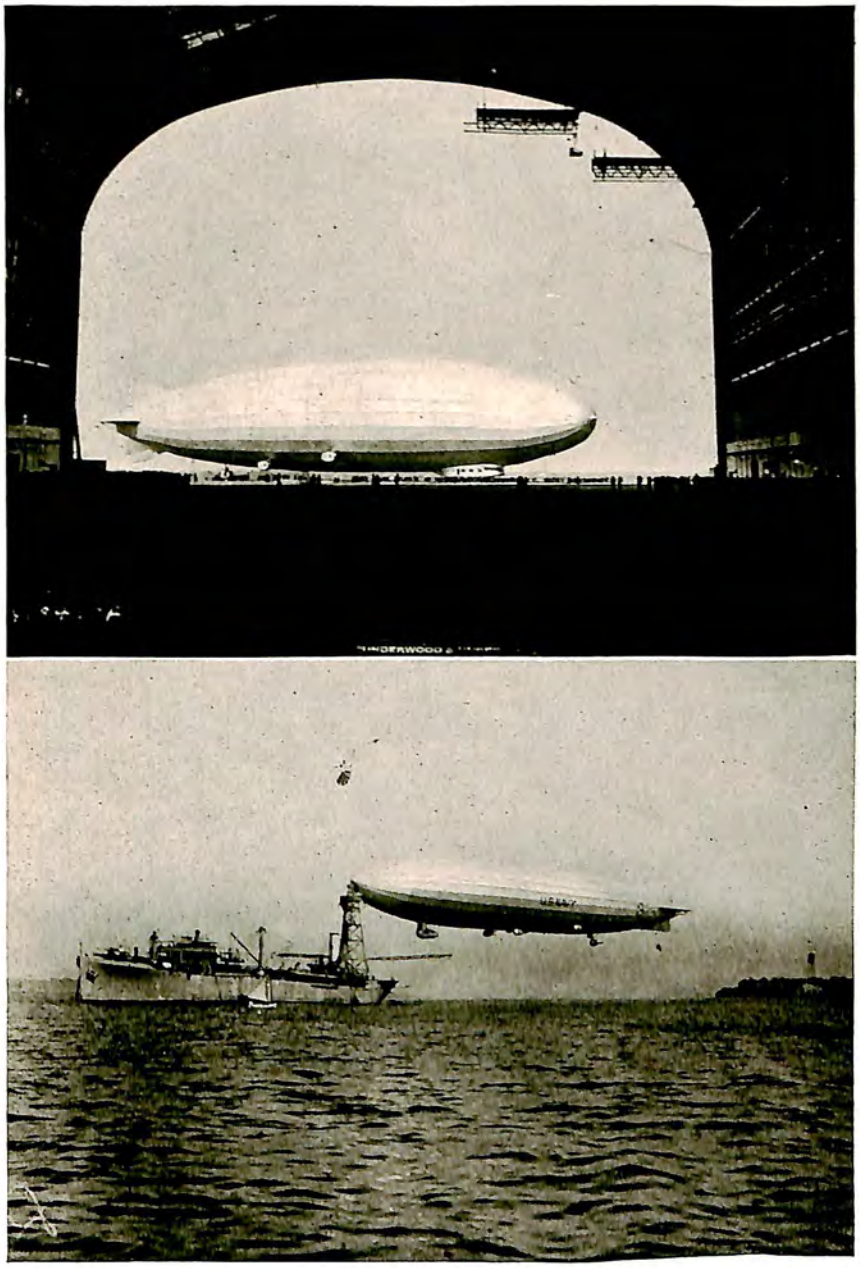
Of these two biggest rigid airships flying the American flag, one, the *Shenandoah,* was designed, manufactured and erected by Americans and the other, the *Los Angeles,* represents the highest skill which long years of experience have made the German Zeppelin organization capable of demonstrating.

DELIVERY OF THE *Z.R.-3* (*LOS ANGELES*)

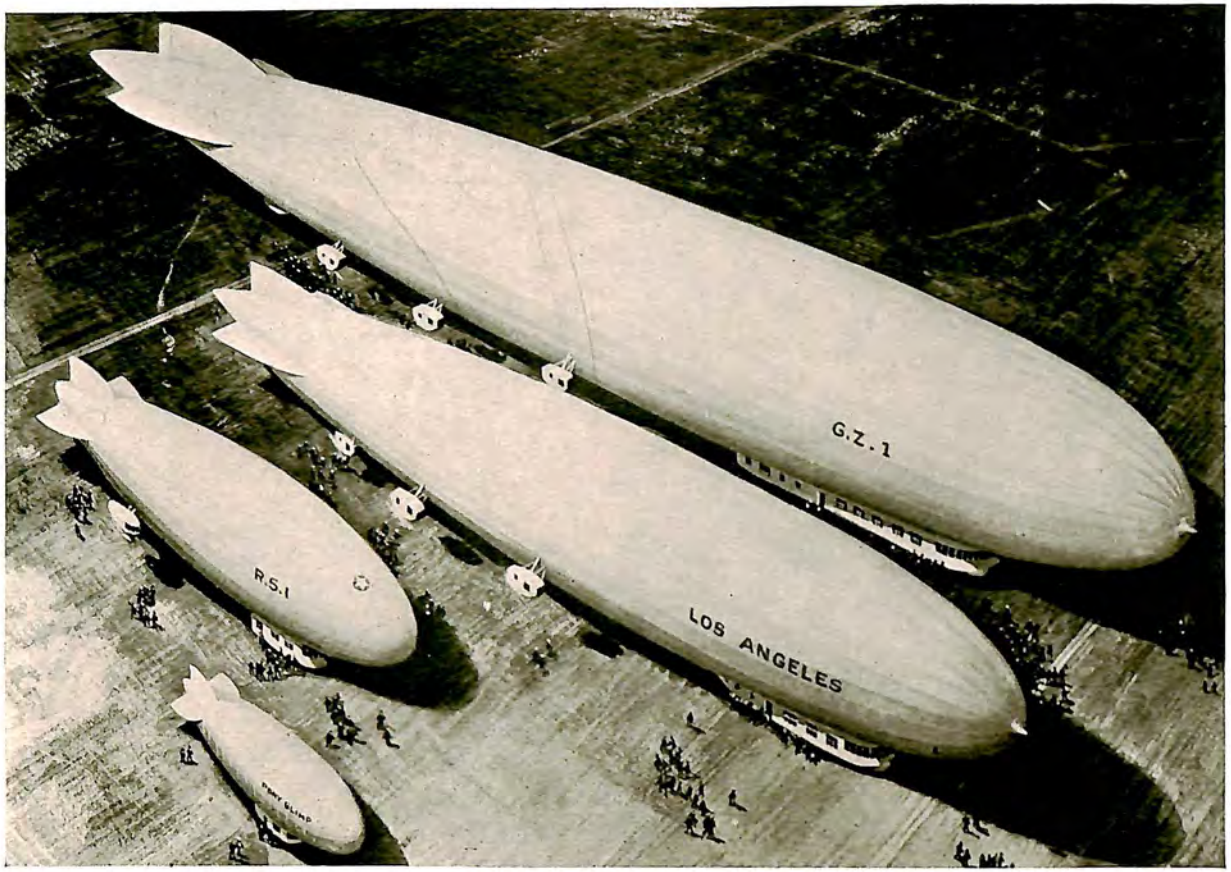
Two of the most far-reaching effects of the victory by the Allied and Associated governments over Germany was the placing of aeronautical restrictions upon the German aircraft industry. These restrictions resulted in challenging German genius to circumvent, in various ways, what they were told they might not do. Aeronautical engineering could not be stopped. Manufacture could be moved to friendly neutral nations. And capital, if lacking at home, was not impossible to obtain abroad.

Thus, through the combination of delivery to the United States of what is commonly though erroneously termed the "reparations" airship, the Z.R.-3, hereafter called the *Los Angeles,* and the acquisition of Zeppelin patent rights by the Goodyear Tire & Rubber Company, there was thus literally transplanted to American soil a very large per cent of the rigid airship industry, in which Germany had previously held a monopoly.

In the Aircraft Year Book for 1924 are related the steps leading up to our procurement of the *Los Angeles.* While this great ship was under construction at Friedrichshafen, the United States Government had present the following observers: Representing the Navy Depart-



(Top) Airship *Los Angeles* on entrance to Lakehurst Hangar. (Bottom) Airship *Shenandoah* moored to U. S. S. *Patoka.—Underwood and Underwood.*



Comparative drawing of commercial airship development. *Pony Blimp* and RS1 constructed by Goodyear Tire & Rubber Co. *Los Angeles* built by German Zeppelin Co. Type GZ1 Super-Commercial-Dirigible under designs by Goodyear-Zeppelin Corp.

ment—Lt. Comdr. S. M. Kraus, Lt. R. G. Pennoyer, Lt. Karl Schmidt. Representing the War Department—Maj. Harold Geiger, Maj. Frank M. Kennedy. Shortly before the departure of the *Los Angeles* for Lakehurst, Capt. George W. Steele, U.S.N., who ultimately took over the command, and Comdr. J. H. Klein, Jr., arrived and these two, together with Comdr. Kraus and Maj. Kennedy were passengers on her during her memorable flight.

Leaves Friedrichshafen Oct. 12

After many postponements, the *Los Angeles* was at last made ready and early Sunday morning, Oct. 12, arose through a deep mist from the shed grounds near Berlin and in 25 feet was lost from view. Dr. Hugo Eckener, president of the Zeppelin Co., was captain in command. Ernst A. Lehmann was executive officer and Lt. Hans C. Flemming, navigator and watch officer. Altogether there were on board 32 persons.

A course was set which carried the *Los Angeles* over Basle, between the Alps and the Black Forest, into France, across Burgundy, over the sea to the coast of Spain, thence directly to the Azores, to Cape Race, thence down the North American Coast, over Boston and New York to Lakehurst. The distance, 5,066 miles, non-stop, was covered in 81 hr. 17 min., in which time 24½ tons of fuel and lubricating oil were consumed. At the start, including fuel and oil, the airship carried 95,000 pounds of freight. The highest speed attained was 80 miles an hour, and the average 55. Throughout the voyage the ship was in constant radio communication, either with the station at Berlin, Lakehurst, the cruisers *Detroit* and *Milwaukee* stationed by the American Navy Department off the Grand Banks, or with passing surface ships.

Capt. Steele, fortunately for the eagerly curious world, combines naval skill with the ability to tell others what he himself saw and experienced. No better description of this most remarkable voyage can be afforded than that to be found in the Captain's log which is quoted in part:

"The 12th of October came in, a foggy day. The ship had been carefully trimmed and the temperature was better; that is, colder (at 6 a.m.). At 6:25 the ground crew started to take the ship out; and at 6:35 the engines were started and we were off. There was a great cheer from the crowd; the band played the national air, and there was much fluttering of handkerchiefs. Several thousand people were on the field, but their view of the ship was brief; she at once rose into the fog and disappeared from sight.

"When the clouds at last permitted a view of the ground, we saw France. We had gone through the pass near Belfort, and were heading for the Bay

of Biscay. There were not any large towns on our route. We passed some distance from Belfort, Besançon, Manlin and Rochefort. But we made a slight deviation to pass over Cognac! As seen from the air, however, the home of cognac was not impressive. At half-past three, we passed over the mouth of the Gironde River to the Bay of Biscay, averaging over 60 miles an hour.

"While over the land, flying low, an airship is subject, to some extent, to the motions of the various air currents through which she passes. The reflection of the hot sunlight from a light-colored surface, like a plowed field, will set up a rising current of air, and on the other hand, downward currents are found over woods, lakes and streams. The sun was shining brightly and we were passing over varied country, so the ship felt the effect of the conflicting currents of air. In addition, we were near the ground—500 or 600 feet—and the movement of air, or wind, across the hills—which were quite prominent—caused additional eddies. The result was a gentle roll and pitch, but not uncomfortable, and, what is more, the passenger cabin is practically free from vibration. When we reached the sea, the air above it being still, the bumpy motion ceased.

For a Good Night's Rest

"At 4 o'clock, when the watch was relieved, the men stretched out comfortably and began to bank up sleep against their night watches. Some of the more energetic ones played a tune on the phonograph, but this met with disapproval. Evening fell over a calm sea, with a clear sky, with just enough red in the west to be a 'sailor's delight.'

"The course was laid for Cape Finisterre, but darkness fell before we sighted the Spanish coast. While Dr. Eckener and I were in the dining room, about 7 o'clock, the ship began to jump about. We looked out of the window and there under a full moon lay the precipitous coast of Spain. At 7:40 we had La Estacada lighthouse abeam, and the course was laid for the Azores. During the night the course and speed were checked occasionally by sighting on torch bombs dropped from the ship.

"When the end of our watch periods came we found our berths very comfortable, and enjoyed undisturbed sleep. On the morning of the thirteenth we passed directly above a British steamer headed for the opposite direction. By radio tht *ZR-3* inquired the steamer's position, and reply was received indicating that we had been drifted about sixty miles southward of our assumed position. Course was accordingly changed and at 11:40 San Miguel Island was sighted on the port bow.

"At 2:30 we reached the southeastern end of Tercevia Island and traversed its south coast. Never have I seen a sight to equal that part of this island; the fields for several square miles are laid out in a patch-work fashion, separated by walls, and as no two adjacent fields are planted, or cultivated, alike, or are the same shape, the whole forms a mosaic of marvelous beauty. But you must be in the air to see it!

Blowing Off Gas for Safety

"After leaving Tercevia, the ship was driven to a height of about 5,000 feet, in order to lift the safety valves and lose lifting gas to compensate for the loss of weight of gasoline used.

"At a height of 5,000 feet, down to 2,000 feet, we were approaching Pico

Island, and all we could see of the island was its peak, triangular in outline, projecting above the clouds. From 3:20 on we were passing through and over the islands of the Azores, which lay along our course. They were all lovely.

"Calamity in another form overtook us earlier in the day; the wash water gave out! We have joined the ranks of the unwashed and unshaved. The Commissary Officer promises to ration sufficient drinking water for a shave apiece just before landing, if we land soon enough. He is meanwhile furnishing good, hot meals, and we are at least well fed. We are well housed, too; that is, our living quarters are comfortable. Any one who will make a couple of trips a day through the corridor, from the tip of the nose back and down to the depths of the lower fin, need not complain of lack of exercise. (The ship is 660 feet long.)

"The night of the thirteenth was marked by adverse winds of considerable strength. As soon as the weather reports came in, next morning, it was decided to head up to the northwest. In the meanwhile a steamer seen on the horizon was asked for her position and the *ZR-3* found herself, according to the steamer, about 120 miles to the northward of her assumed position. Communication was also established with the cruiser *Detroit,* and with all the available data as a guide, the course was laid northwest. (It should be interpolated that ascertaining position by means of solar observation, easy from the deck of a surface ship, is exceedingly difficult from an airship, as the navigating and control quarters are *beneath* the huge hull or bag.)

Above the Clouds to Keep Cool

"At about half past nine we passed directly above the steamer *Robert Dollar.* She hoisted her number, in flags, and ran up the British ensign. The *ZR-3* then began to climb, and rose to a height of about 8,000 feet. This was to lift the safety valves again, and the result was about 5 per cent. loss of hydrogen from the gas cells, leaving them 80 per cent. full. About half of the fuel supply remains, enough for fifty-six hours running with four of the five engines at 1250 r.p.m., which gives about 57 knots. The trip above the clouds gave temporary relief from the summer temperature we have had. It was 70 degrees in the cabin last night and continued warm today. Early in the afternoon fog was encountered and for several hours the ship ran close to the surface of the sea, the better to judge the direction and force of the wind by observing the waves. Then she climbed above the fog, which was only 500 or 600 feet high, and ran thus until darkness obscured the surroundings. We felt a sympathy for the vessels in that fog; we have been there, in surface ships, ourselves, and this fog extended over 400 miles.

"When I came on watch at midnight, the *ZR-3* was skirting the southeast coast of Nova Scotia. It was a cold, bright night, a decided change from the night before. At ten minutes past one, Seal Island was passed and the ship headed across the Gulf of Maine towards Boston. The position was occasionally checked by bearings from radio compass stations along the shore.

"Cape Cod Light was passed abeam at 3:15 a.m., Eastern Standard Time, and soon afterwards the ship was sailing over Boston. It was a sight to swell the bosom of a returning American, and one never to be forgotten. Millions of lights! If one looked closely downward one could see the buildings, but looking slantwise, nothing but lights."

The Welcome from New York

As the five or six million people in Greater New York were at breakfast, the *Los Angeles* came sailing down Long Island Sound. Word of her approach sped faster than the sound of her four throbbing motors and long before she had reached the outer edge of the Metropolitan area, building roofs, parks and streets were thronged with cheering crowds. So vast is the size of the ship, and so intense was the interest of the spectators, that Naval officers report hearing from no one who could not say—and believe it—that the airship passed *directly* over him.

At 9:52 a.m. Thursday, October 15, the *Los Angeles* anchor line was caught by the landing crew and she was brought to earth at Lakehurst. One hour and six minutes later she was in the hangar.

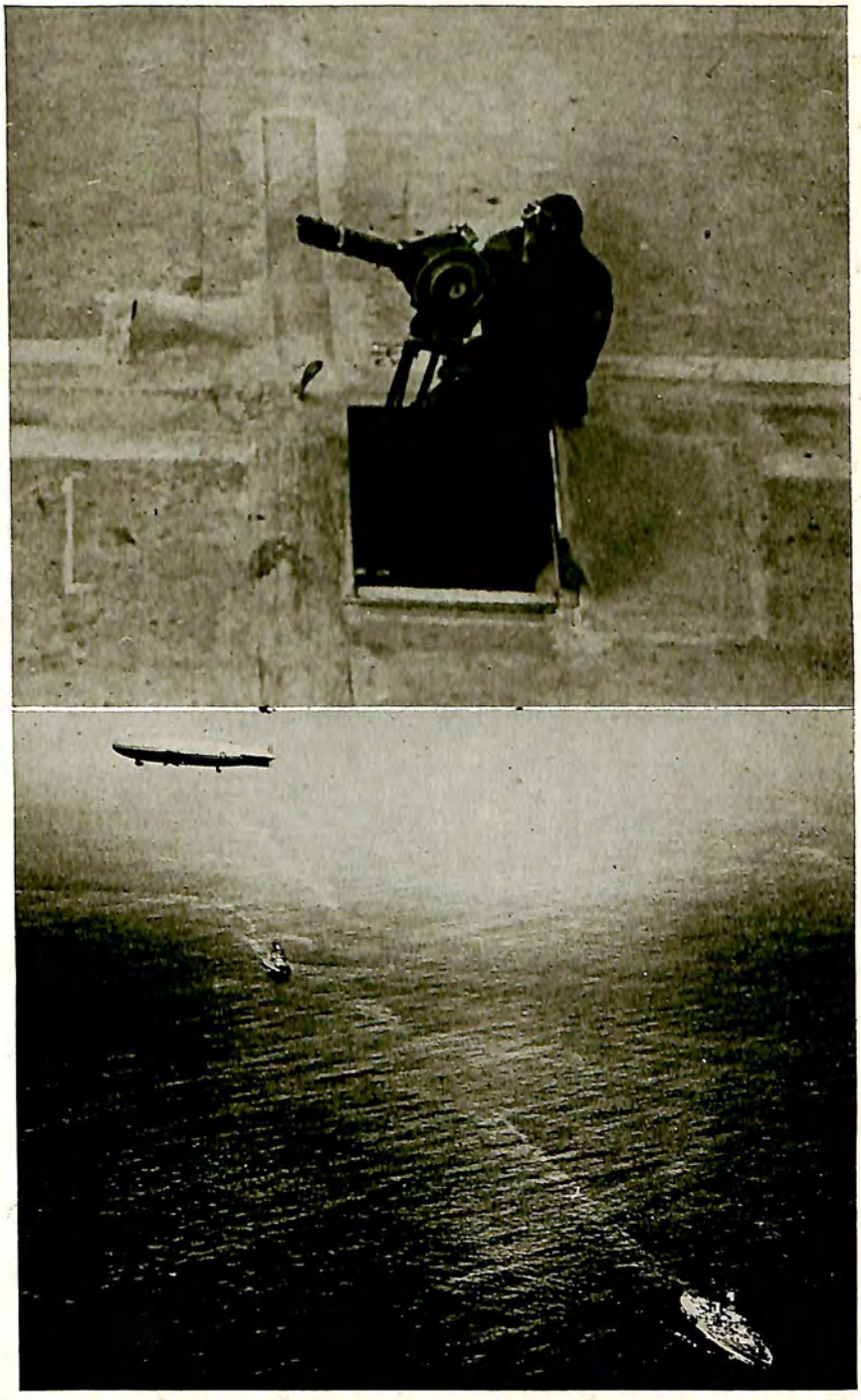
The *Los Angeles* subsequently made many flights, the most notable of which were those to Bermuda and Porto Rico. Due to a scarcity of helium the *Los Angeles* and *Shenandoah* had not, at the time of writing, both been in commission at the same time.

Dimensions of the *Los Angeles*

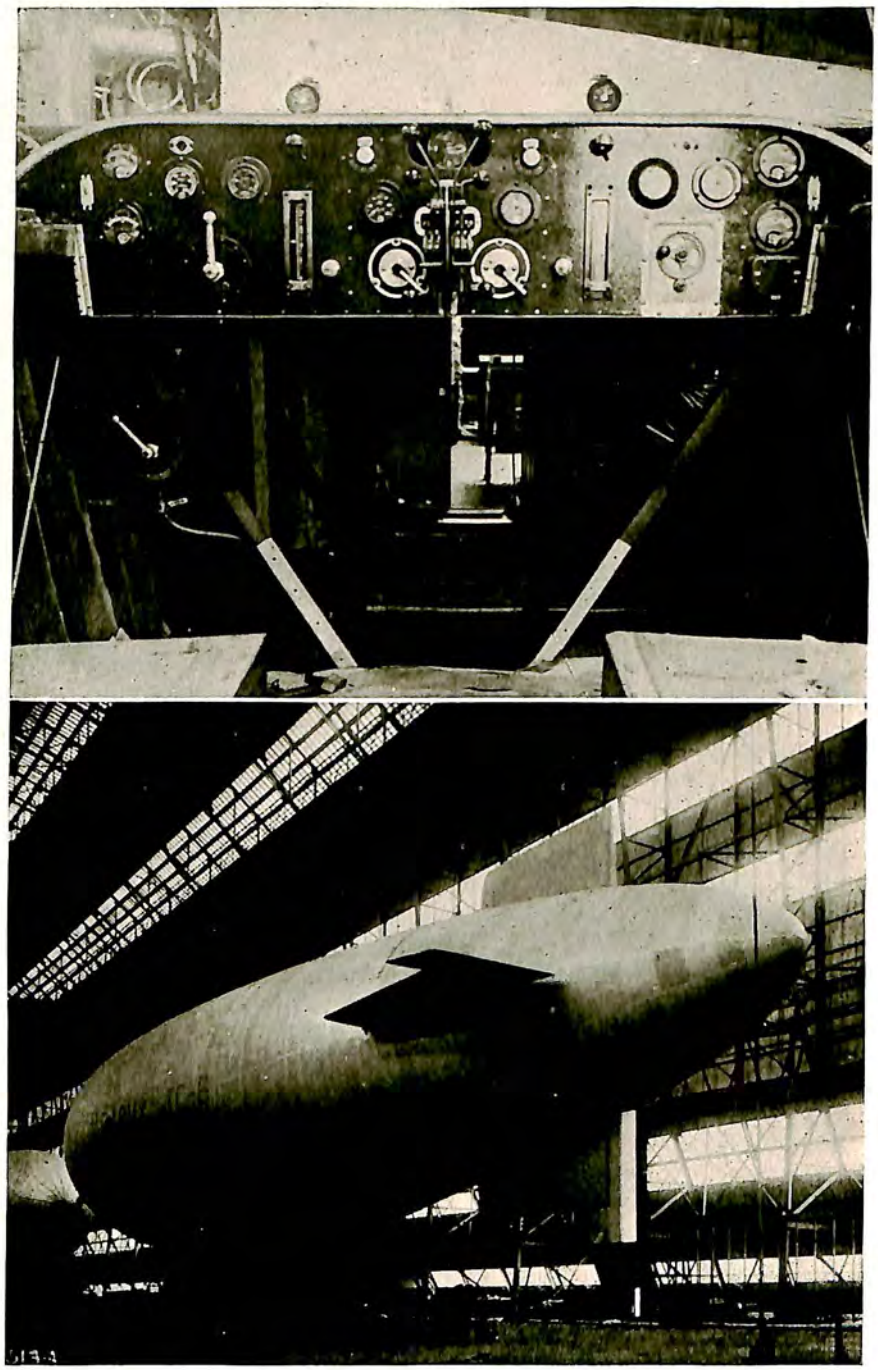
Although of about 250,000 cu. ft. greater gas capacity than the *Shenandoah,* the *Los Angeles* has not the former's beauty of symmetry. The *Los Angeles* is 660.2 feet long, 20 feet shorter than the Shenandoah. Her diameter is 90.7 feet, thirteen feet thicker. Her height is 101.6 feet, 5½ feet greater than the *Shenandoah.* Gas capacity is 2,400,000 cu. ft. Her dead weight is 91,000 pounds, 16,000 pounds heavier. Filled with hydrogen, the *Los Angeles* can lift 153,000 pounds. The *Shenandoah,* filled with helium, can lift 130,000 pounds. Helium has only 85 per cent. the lifting power of hydrogen, so it will be seen that, with both ships filled with helium, there is not much difference in performance. Five engines on the *Los Angeles* provide 2,000 horse power; five on the *Shenandoah* 1,500, which is to be increased to 2,100. Speed of the *Los Angeles* is rated at 76 m.p.h. and the *Shenandoah* at 70 m.p.h.

Goodyear-Zeppelin Corporation

In 1923, while the *Los Angeles* was under construction, the Goodyear-Zeppelin Corporation was formed to undertake the manufacture of rigid aircraft in America with the assistance of the technical staff of the Zeppelin Company, in Germany. Arrangements were made by E. G. Wilmer, Chairman of the Board and P. W.



(Top) A. K. Paterson, Chief Navy Photographer with motion picture camera on top of airship *Los Angeles* to make motion pictures of solar eclipse, Jan. 24, 1925. (Bottom) Airship *Shenandoah* over battlefleet off California Coast during transcontinental flight, October, 1924.—*Navy Bureau of Aeronautics.*



(Top) Instrument board TC6 built by Airships Incorporated. (Bottom) TC6 built by Airships Incorporated in her hangar at Scott Field, Belleville, Ill.

Litchfield, Vice President and General Manager of the Goodyear-Zeppelin Corp. to start operations as soon as the *Los Angeles* had left for America.

E. A. Lehmann, expert in operation and second in command of the *Los Angeles* during the trans-Atlantic flight, and also Dr. Karl Arnstein, designer of the *Los Angeles,* were made vice presidents of the Goodyear-Zeppelin Corporation. An engineering staff of twelve of the oldest and most experienced specialists from the personnel of the German Zeppelin Corporation was selected and brought to America in November, 1924. This staff immediately went to work studying certain major problems in the building of large rigid airships. The *Los Angeles* was the 126th airship built by the Zeppelins. Its size was arbitrarily limited by international agreement, but it was known that by being lengthened 100 feet, with a corresponding increase in volume of about 500,000 cu. ft., it could operate a trans-Atlantic mail and passenger service with comfortable quarters for 20 passengers.

Since helium gas will be available in the United States, the first task of the Goodyear-Zeppelin engineering organization was to study how helium airships could be made satisfactory for commercial operations. Several important technical improvements have already been worked out and have been found sufficient to give the helium airship a definite place in commercial operations.

Simultaneously with this, a great number of studies of sizes and types of airships in relation to their application to various over-land and over-seas routes were made, resulting, finally, in the adoption, as a basis for further detail work, of a type of 6,500,000 cu. ft. capacity primarily designed for transoceanic operations. The principal dimensions of this ship are: length, 870 ft.; diameter, 128½ ft. Eight motors of 600 h.p. each, totalling 4,800 h.p., will give a maximum speed of 85 m.p.h. With helium inflation the ship will carry 80 passengers, two tons of mail and an amount of freight varying with the flying conditions at the start. The fuel includes a reserve of 50 per cent.

The Goodyear-Zeppelin Corporation has also been studying the not less important hangar and mooring problems. A new design of airship hangar has been worked out and various old and new systems of mooring and handling airships of all sizes are being followed through in detail.

The most important of the other studies which are now going on is one concerning the details of various types of military airships, for example, a patrol vessel, a transport for troops, and, most important of all, an airplane carrier. A 6,500,000 cu. ft. ship, for instance,

could transport 20 airplanes over a distance of 3,500 miles, if inflated with helium and operating on gasoline only. With a small additional amount of other fuel-gas, it could go 4,500 miles with the same load.

The Inland Cruise of the *Shenandoah*

Five days before the *Los Angeles* left the Zeppelin sheds at Friedrichshafen on her long cross-sea delivery journey to the United States, the *Shenandoah* started on an inland voyage which, if less spectacular than that of the *Los Angeles,* was without doubt of greater significance, for whereas it had already been proved that the easiest field for airship operation lay over the *water,* it had yet to be learned, whether it was even possible to navigate for long distances over *land,* including such obstacles as extreme changes in temperature, cities, mountains, valleys and deserts.

In discussing this remarkable 8,000-mile voyage of the *Shenandoah,* it must be remembered that she is the product of American engineering and production. Up to the day the United States Navy, with the assistance of the civilian aircraft industry, undertook to design and fabricate this craft, Germany possessed an undisputed monopoly of the airship business. Now—early in 1925—after there has been sufficient opportunity to test out both the *Shenandoah* and the *Los Angeles,* it is a question whether the *Shenandoah,* experimental as she is, is not superior to the *Los Angeles.*

The round trip to the Pacific Coast, according to Rear Admiral W. A. Moffett, Chief of the Navy Bureau of Aeronautics, was undertaken as a test of material, motive power, maneuverability and endurance. There were also the allied problems of personnel and the testing out of servicing and possible repairs at mooring masts located thousands of miles apart.

Shenandoah Starts Oct. 7

Long before dawn on October 7, the *Shenandoah* was walked out of the Lakehurst hangar, fueled and provisioned and by the time the sun was up was moored at the mast. Officers on board were: Rear Admiral W. A. Moffett, observer and passenger; Captain Zachary Lansdowne, commanding officer; Lt. Comdr. L. Hancock, executive officer; Lt. J. B. Lawrence, watch officer; Lt. A. R. Houghton, watch officer; Lt. R. G. Mayer, repair officer; Lt. (jg) C. E. Bauch, watch officer; Lt. (jg) E. W. Sheppard, engineer officer; Chief Machinist S. S. Halliburton, assistant engineer officer; Lt. (jg) C. D. Palmer, radio officer; Lt. J. B. Anderson, aerological officer.

The first scheduled stop was Ft. Worth, Tex., 1,450 miles dis-

tant. Weight was scrutinized accordingly. Even the officers were permitted to bring aboard only a small cotton bag of luggage, equivalent to one-half of a suitcase. Provisions, water, clothing and equipment up to 450 pounds was allotted to each man—and this allotment included also his weight. There were taken aboard 20,000 pounds of gasoline, 2,500 pounds of water, necessary for the first long leg. The ship was only 85 per cent. full of helium, as a new supply had failed to arrive. Helium has a lifting power somewhat less than hydrogen, so there were serious handicaps confronting Capt. Lansdowne at the very start, as he cast off at 10 a.m.

Reports showed favorable weather east of the Allegheny and Appalachian mountains, so a course was set southward. At Washington a tail wind developed which helped the progress. Engines were kept at two-thirds speed in order to conserve fuel. At nightfall the ship was over Charlottesville, Va. It was clear and the ship proceeded steadily on her way through the calm, quiet star-lit night.

Due to the fact that the *Shenandoah* was of experimental military construction no provision had been made for creature comforts. Consequently the only food taken consisted of sandwiches, beans, fruit, chocolate and hot coffee, the latter being made over a gasoline stove, whose weight, grudgingly consented to, was more than compensated for by the cheer which the hot drink afforded.

At Dawn Over Atlanta

Midnight found the voyagers at Spartanburg, S. C., and dawn at Atlanta. Throughout the night watches had been kept, just as on ships at sea and radio communication maintained (as throughout the entire voyage) with Naval Headquarters in Washington, and also with civilian stations in cities passed over. Birmingham was reached at 8 a.m. and Greenville, Miss., at noon. For hundreds of miles head winds were encountered, which reduced the actual speed greatly.

At dusk the ship passed over Dallas, 40 miles beyond which was Ft. Worth, where the Navy had erected a 160-foot mooring mast, where there was a helium gas plant, and where there were other special and greatly needed facilities. Capt. Lansdowne had never been there, but in the rapidly fading light he brought his ship down quickly and safely and was soon moored for the night.

Every city over which the *Shenandoah* flew turned out a noisy and enthusiastic welcome. There were thousands on hand at Ft. Worth and although the ship had to leave early the next day, Admiral Moffett and Capt. Lansdowne were compelled to attend a banquet at 1 a.m.

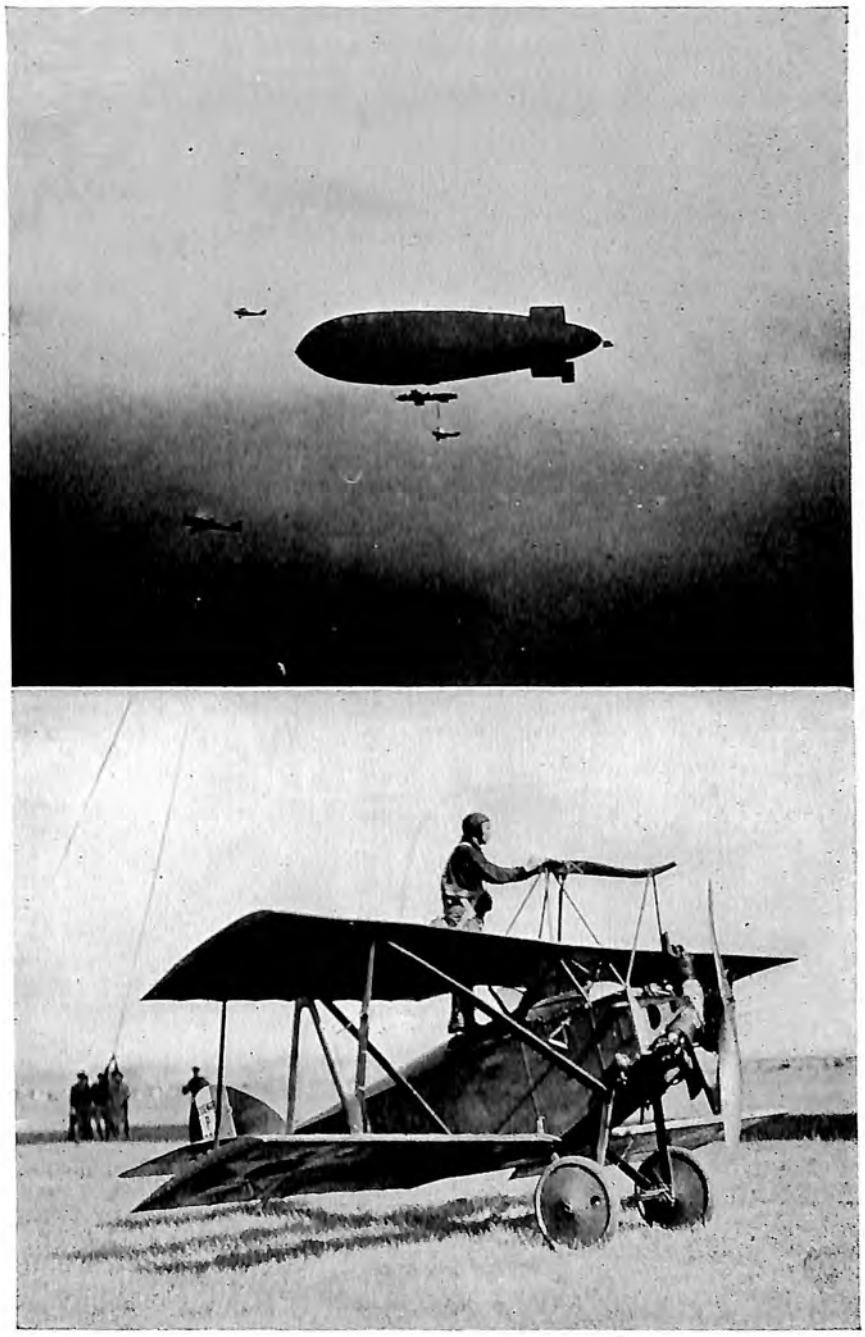
At 9:45 a.m., Oct. 9, the *Shenandoah* got under way, spent the day traveling steadily south-westward across the plains and by dark was among the foothills. Here was presented the first problem to give the navigators real concern. The *Shenandoah* loaded has a ceiling of but 7,000 feet. At night, as the gas cools and contracts, the ship becomes heavier. This is what happened as the vessel approached the Guadaloupe Mountains. It was wisely decided to follow the Southern Pacific Railway tracks and thus to thread a way through the passes. This, while it assured against being lost, carried the *Shenandoah* into close and uncomfortable quarters, requiring sharp turns, sometimes of 180 degrees in very narrow canyons.

Seeing the Mountains by Moonlight

By 9 p.m. the divide had been cleared and the ship dropped down toward El Paso. The night was clear, with a brilliant moon, so that visibility extended far along the Rio Grande River and into the mountains of Old Mexico. Leaving El Paso at 11:30 p.m., the *Shenanoah* encountered head winds and was confronted with another mountain range far loftier than the one just passed. During this trying period there were in the control car only Admiral Moffett, Capt. Lansdowne, the navigator, officer of the watch, and the horizontal and vertical rudder men, both of whom had been trained in England on the Z.R.-2. Steadily the water ballast was released until the tanks were empty. The ship rose to an altitude of 6,500 feet, but this was not sufficient. She was given all possible elevation and Lansdowne gave orders to be ready to let go the gas tanks. Slowly the great vessel was borne up to 7,200 feet. The mountain peaks closed in about her, but the navigation was faultless, the steering perfect and the power unfailing, so that she quickly passed successfully on her way.

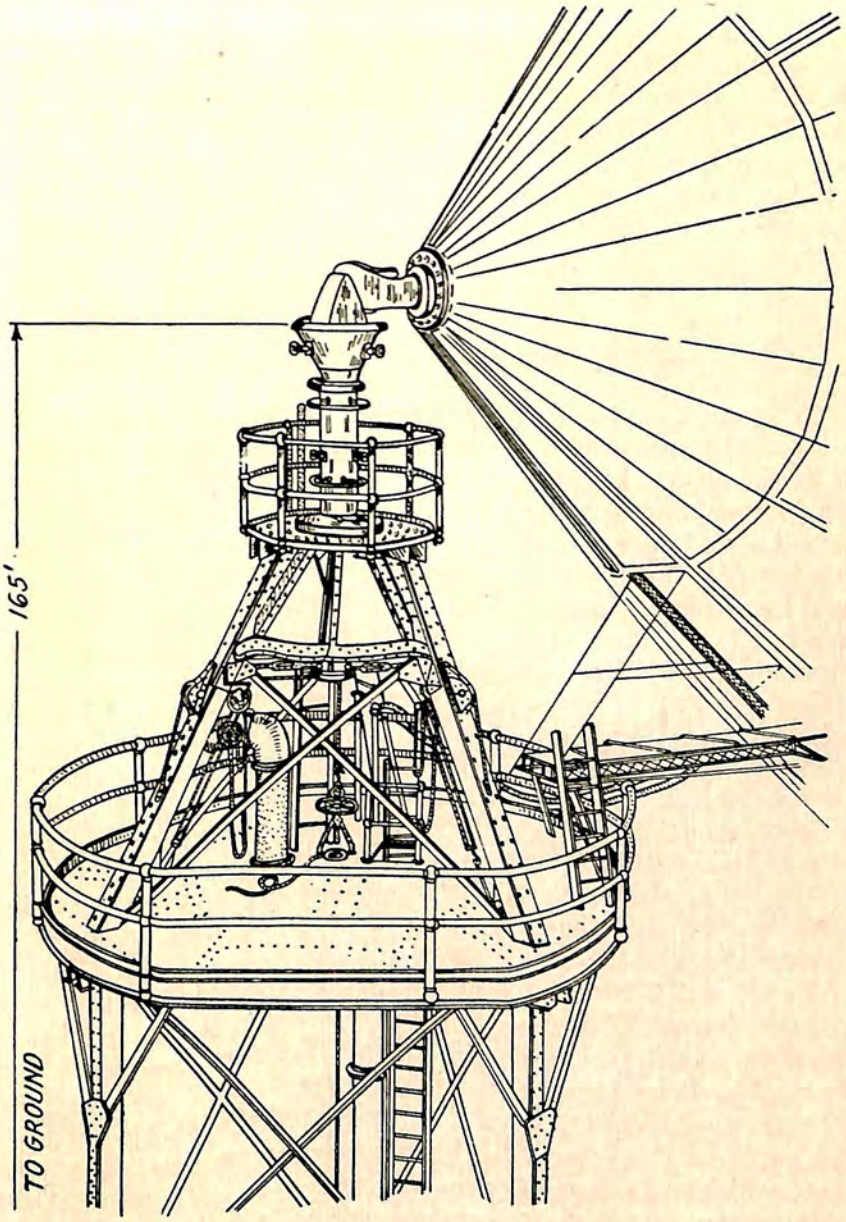
Once through the range, the lights of Tucson, Ariz., twinkled like an oasis in the desert, and in the early dawn on Oct. 10, this city was passed. A course was set for Yuma. Again head winds were encountered and although relief was sought at 5,000 feet none was found. At noon, while in the region of Yuma, the ship entered a violent sand storm which slowed down her speed to 12 knots or sea miles an hour. This forced a change of course to the northward, leading the ship to the south of San Bernardino.

As the *Shenandoah* passed over the Salton Sea there was seen to be a violent wind on the surface, although 2,000 feet up it was calm. The ship entered Black Pass, through the Lower Sierra Nevada, at 30 miles an hour. A dark bank of nimbus and cumulus clouds



(Top) Army Air Service Blimp TC5 with Sperry-Messenger airplane that was launched while airship was in full flight. (Bottom) Close-up of Sperry-Messenger, Wright engine.—*U. S. Air Service.*

Skyscrapers at lower end Manhattan Island, New York City.—*Fairchild Aerial Surveys, Inc.*



MOORING MAST

NAVAL AIR STATION — LAKEHURST N.J.

just ahead forecast heavy weather, possibly snow. Just at sunset, with 12,000 foot mountains to one side the ship encountered a gale, then suddenly all lights below and even the dim sky were blotted out. They were in the midst of a snow storm. Descending quickly 3,000 feet they found they had actually come within 500 feet of the surface of the ground as their radio antenna had been carried away. But they circumvented the storm and soon afterward sailed over Riverside and the beautiful Los Angeles Valley into the mild warmth of Southern California.

Emergency Repairs at Mooring Mast

Going out over the Pacific at Oceanside, the *Shenandoah,* aided by favoring winds, sped southward at 60 miles an hour to the Naval Air Station, North Island, San Diego. The ship was brought to earth by a landing crew, but in so doing the after control car struck and strained a girder. Here was a problem. The ship was 3,000 miles from her "dry dock." Could repairs be made at the mooring mast? Capt. Lansdowne thought they could. Accordingly the ship was made fast to the 160-foot tower and in 24 hours, riggers and metal workers had located and corrected the trouble.

From Oct. 11, in the evening, until 10 a.m. Oct. 16, the *Shenandoah* lay over at San Diego, then started up the Coast. Hardly had she cleared when she sighted eight battleships of the Pacific Fleet maneuvering off Catalina Island. A course was set directly over the fleet, although when sighted the sea ships were 100 miles distant. Each craft could be identified by name and compliments from the Admiral in the air to the Admiral upon the sea were extended in passing. It was a spectacular and impressive illustration of the domination of air power over water.

The trip northward was most difficult. Terrific headwinds were encountered most of the way. At Santa Barbara air speed was reduced to 20 miles an hour and at night fall the *Shenandoah* had only reached Point Conception Light House.

Three a.m., Oct. 17, found the airship off Point Montara, 40 miles south of San Francisco. The whole region was submerged in fog, which made it useless to visit the city. At 2,500 feet the airship passed out of the fog, swung due west over the Farallone Islands, some 40 miles off the Golden Gate, thence to Cape Mendocino, Trinidad and so on out of the Sierra into the Siskiyous and out of the Siskiyous into the Cascade mountains. Admiral Moffett states he doubts whether in all the world there can be unfolded a

grander scenic panorama than that from the Farallones to Portland. The airship navigates steadily and smoothly (it is generally smooth in the air over the water) just off the coast. To the east are the magnificent timbered mountains, over which in the morning the sun pours its light and against whose slopes, in the afternoon, the shadow of the ship is cast and over which it travels, keeping silent company with the vessel itself.

Three a.m., Oct. 18, the *Shenandoah* turned inland and an hour later passed over Portland. The city was sound asleep. As dawn came the voyagers sighted the snow covered peaks, Mt. Baker, Mt. Rainier, Mt. Hood and Mt. Adams, and toward early afternoon slowed down directly over Camp Lewis. But there was almost 3,000 feet of fog. This, together with the desire to avoid valving helium, forced a delay in landing, but at length a line was dropped and the ship made fast to the mast.

Abandon Fuel to Make Altitude

The return trip was very similar. Leaving Camp Lewis Oct. 19, the *Shenandoah* was back at San Diego on the 21st and left the following day for Ft. Worth, which was reached on the 24th. Late on the 25th, the *Shenandoah* returned to Lakehurst. In crossing the Sierra, there was again trouble over altitude and Capt. Lansdowne this time, had to jettison, not only all his water ballast, but 1,400 pounds of gasoline as well.

The 8,100 mile voyage was remarkable because it was over land instead of over water; because it was made in the first American designed and constructed airship; because it was made in an airship filled with non-inflammable gas; because it was carried through by American personnel.

Capt. Hans Lehmann, executive officer of the *Los Angeles* on her flight across the Atlantic, had this to say to Capt. Lansdowne:

"The trip of the *Shenandoah* was the greatest achievement ever made by a rigid airship. It was a marvelous performance. Germans themselves never accomplished any such distance and the flight seems to me to be conclusive proof that an airship of this type is practical as a means of commercial transportation over any distance."

In its journey, the *Shenandoah* registered 235 flying hours at an average of about 40 miles an hour. The average air speed was 50 m.p.h. Here is the log:

Oct.		Flight Hours	Air Hours	Miles
7– 9	Lakehurst–Fort Worth	36.45	38.05	1,450
9–11	Fort Worth–San Diego	39.14	41.14	1,300
16–18	San Diego–Camp Lewis	47.15	57.55	1,300
19–21	Camp Lewis–San Diego	39.55	47.35	1,300
22–24	San Diego–Fort Worth	36.25	37.22	1,300
24–25	Fort Worth–Lakehurst	35.28	36.27	1,450
		235.02	258.38	8,100

(Difference between flight hours and air hours, time spent aloft before mooring.)

Honor Roll of the *Shenandoah*

The following individuals, corporations or organizations were privileged to contribute, either through engineering, manufacture or material, to the creation of America's first rigid airship, the U.S.S. *Shenandoah,* her hangar, mooring mast and gas plant, thus participating in the establishment of a new industry of vast importance to the nation's future welfare in peace and war:

Aëromarine Plane & Motor Co.
Airships, Inc.
Allison Engineering Co.
Aluminum Co. of America.
American Steel & Wire Co.
Baush Machine Tool Co.
Louis J. Berkholz.
Bethlehem Steel Bridge Co.
Burdette Manufacturing Co.
Chicago Bridge and Iron Co.
Concordia Electric Co.
Cruse-Kemper Co.
D and K Engineering Co.
Dayton Engineering Laboratories.
Donnell-Zane Co.
Electric Storage Battery Co.
Ft. Worth Power & Light Co.
General Electric Engineering Co.
George Construction Co.
Charles Gilpin Co.
Goodlatte & Sons.
B. F. Goodrich Rubber Co.
Goodyear Tire & Rubber Co.
Hamilton Aëro Mfg. Co.
Hall Rod Works.
Hughes-Fouldrod Co.
Irwin & Leighton.
Linde Air Products Co.
Lone Star Gas Co.
Milwaukee Electric Crane & Mfg. Co.
Lord Construction Co.
Packard Motor Car Co.
Pheoll Mfg. Co.
J. A. Roebling's Sons Co.
S. K. F. Industries.
W. Harris Thurston & Co.
Titeflex Metal Hose Co.
Valentine Varnish Co.
E. Van Norden Co.
Warner Elevator Co.

Material Used in *Shenandoah*

The principal private purveyors to the *Shenandoah* were Airships, Inc., Aluminum Company of America, B. F. Goodrich Rubber Co., Goodyear Tire & Rubber Co., and Packard Motor Car Co.

The following material was used in constructing the *Shenan-*

doah: duraluminum, 23,000 lbs.; steel wire, 7,000 lbs.; steel fittings, 1,000 lbs.; wood, 500 lbs.; paint and varnish, 500 lbs.; cloth for cover, 15,000 yards; cloth for gas cells, 32,000 yards; number of gold beaters' skins (ox gut), 460,000; approximate number of parts of ship, 3,500,000.

Characteristics of the *Shenandoah*

The airship measures, over all, 683 ft. 4½ in.; diameter of hull, 78 ft. 9 in.; width over all, 88 ft. ½ in.; height over all, 97 ft. 1 in.; number of gas cells, 20; inflating gas, helium; gas capacity, 2,115,000 cu. ft.; lift of gas per 1,000 cu. ft., 63 lbs. average conditions; total maximum lift of ship, 129,178 lbs. (average conditions at 95 per cent. capacity); total weight of ship's structure, 80,000 lbs., approximately.

Motive Power of the *Shenandoah*

The *Shenandoah* has five Packard engines, each 6 cylinders and 300 h.p. Each engine makes 1,400 revolutions per minute, as do the small propellers; large propellers revolve 556 times a minute. Diameter of small propellers is 12 ft.; large propellers, 17 ft. 6 in. There are 48 fuel tanks, with a maximum fuel capacity of 5,424 gallons. Maximum speed is 53 sea miles per hour, cruising speed 40 and radius at cruising speed, 4,500 sea miles.

How Airships are Moored

The Navy Department introduced the European idea of mooring masts for rigid airships, then greatly improved upon it. There are now four such masts in the United States, three Governmental, at Lakehurst, Fort Worth and Camp Lewis, and one, private, at Detroit. The Government masts are each 160 feet tall.

The method of mooring is to secure the airship's mooring cone into the mooring mast cup. In the airship, the mooring spindle is secured in the nose, in a roller thrust bearing, which allows the ship to rotate about the spindle and at the same time takes the thrust or pull of the airship due to its wind resistance. The mooring cup is free to rotate about its vertical axis, since it is secured to an inner tube which is mounted on ball bearings, thus allowing the airship to swing freely to the wind about the mooring cup as a center. The ship can roll about its own axis and change its angle of inclination. Thus the only strains put on the mooring mast or on the structure of the airship are those due to the wind resistance of the airship and to the ship's free lift or excess weight.

The practical future of the commercial operation of airships depends very largely upon docking facilities in the large business centers. It would be impracticable, of course, to construct a series of enormous sheds, such as those at Lakehurst and Belleville, Ill. Up to the time of the *Shenandoah's* great trip there was some question as to the practicability of the mast. This was raised following the breaking away of the *Shenandoah* from her Lakehurst mast on Jan. 12, 1924. The Navy Department, upon the ship's return after a splendid night-long fight against a 70-mile gale, began an intensive study of the nose structure, the mooring mast cup and all direct and indirect strains. As a result, extensive changes have been made in both, parts being strengthened and altered. A very important feature is the use of roller or ball bearings, which greatly reduce the strains, and in this work the S.K.F. Industries contributed generously.

In the development of the mooring mast, engineers for the Aircraft Development Corp. have been active. The new mast constructed for this company at Fort Airport is the only private equipment of the sort in the world. Detroit thus is the first to qualify as a major terminal for not only land and water heavier-than-air craft, but also for rigid airships of any size.

The Governmental Airship Program

The Army and Navy Air Services' airship programs unite in one particular—the production of the non-inflammable gas, helium. In 1924 the Helium Board reports production of 9,096,559 cu. ft. of helium of an average purity of 94 per cent. Plans were completed for the construction of a second production plant, under the direction of the Bureau of Mines. New processes looking toward reduction in production costs have been developed during the year, although the figure is still very high.

The Navy Department's lighter-than-air program consists essentially of the following:

Operation of the two rigid airships—*Los Angeles* and *Shenandoah* to determine their value for war purposes and for commercial transportation.

Operation of one non-rigid airship for training purposes.

Operation of observation and free balloons for training purposes and for testing parachutes and aeronautical instruments.

Operation of the *Shenandoah* consists largely of development of mooring masts on mother ships. To this end the U.S.S. *Patoka* has been fitted with a mast arrangement and has been successfully

used. Operation of the *Los Angeles* is almost entirely along a commercial line, serving also as a splendid means of education for the public.

In 1924 the airship section of the Army Air Service constructed at Scott Field, Belleville, Ill., the first American-built semi-rigid airship. This is known as the *R.S.-1.*

The first launching of an airplane from an airship in flight took place in October, at Dayton. This experiment was followed up practically in December, at Scott Field, when an airplane was attached to the airship *T.C.-3* while in full flight, and later successfully released, while in full flight. These trials are of great significance.

Aircraft Development Corp.

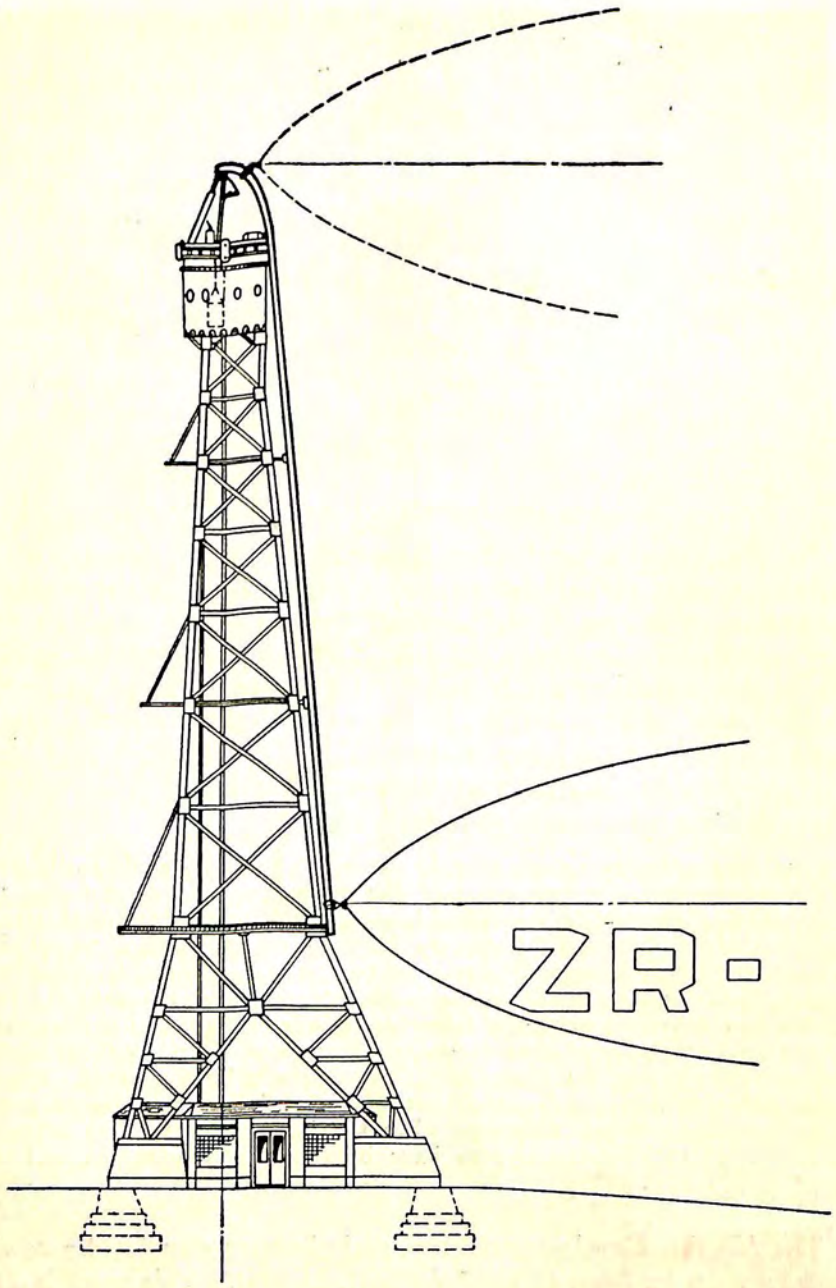
In 1924, the Aircraft Development Corp. of Detroit, made substantial progress in the extensive engineering incident to the production of a metal clad airship, the type originated by the corporation's chief engineer, Ralph H. Upson. As noted in the section under mooring masts, much attention has been given to the question of docking. At Ford Airport a plant for the Aircraft Development Corp. is being constructed.

Of the work which they are doing, as contrasted with contemporary fabric airship operation, Mr. Upson said:

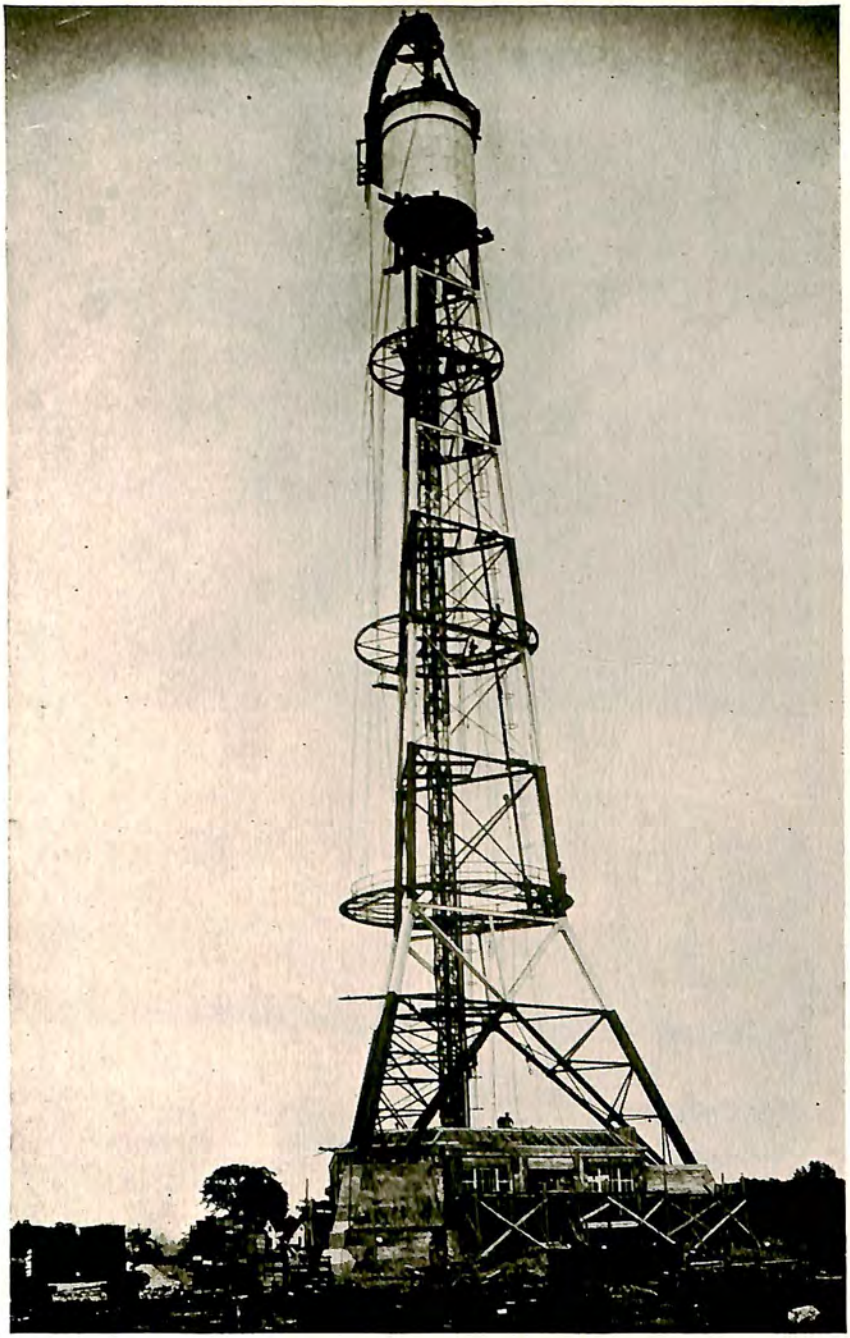
"The *Shenandoah* on its recent cruise around the country could easily have carried an average of 50 passengers. The use of mooring mast during the whole of this remarkable trip also demonstrates from a technical standpoint that an airship can be entirely independent of hangars except for overhaul and repair purposes. From an economic standpoint, however, the system of outside mooring is not yet satisfactory. This is due to the fact that the fast deterioration of the fabric parts, when exposed to the weather, make it very desirable to house the ships whenever possible. With metalclad airships of the future, this function for hangars will be eliminated. Recent improvements in the aërodynamic phases of the design also insure much greater stability and less resistance when moored to a mast, thus reducing the chance of such breakaways as have befallen the *Shenandoah* and the *R.-33.*"

The Aircraft Development Corp. early in 1925 completed a newly designed mooring mast at Ford Airport, Detroit. This mast is 210 feet high and has many novel features. The corporation has a contract to construct a similar mast for the U. S. Air Service at Scott Field, Belleville, Ill.

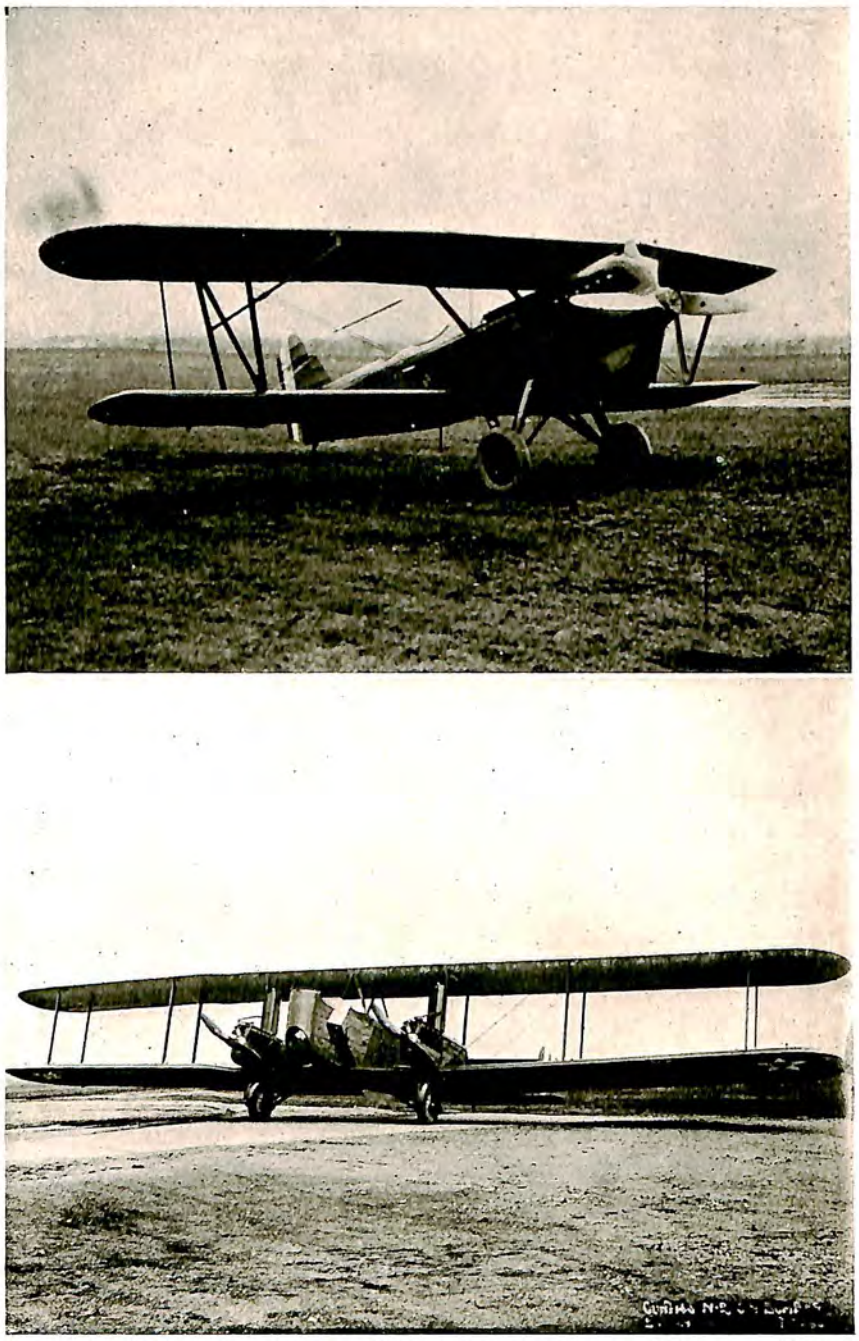
Officers of the Aircraft Development Corp. include Harold H. Emmons, President; C. S. Mott, First Vice President; William B.



FORD AIRSHIP MOORING TOWER
DEARBORN, MICHIGAN
BY
AIRCRAFT DEVELOPMENT CORPORATION
DETROIT, MICHIGAN



Two hundred and ten foot airship mooring mast designed and constructed by Aircraft Development Corporation at Ford Airport, Detroit, Mich. Similar mast being constructed by Aircraft Development Corp. for U. S. Army at Scott Field, Belleville, Ill.



(Top) Curtiss *Falcon* Corps Observation 400 H.P. Liberty. (Bottom) Curtiss *Condor* twin motor night bomber.

Mayo, Second Vice President; Carl B. Fritsche, General Manager, and Ralph H. Upson, Chief Engineer.

Airships Incorporated

At the plant of Airships Incorporated, at Hammondsport, N. Y., during 1924, three T.C. type non-rigid airships were completed. One, *T.C.-6,* was equipped with a new type outrigger to mount two Wright *Whirlwind* engines. Considerable engineering was done on this job, as it is the first time motors of this type have been used in these ships.

As the T.C. ships built at this plant were designed with a single balloonet, divided by a partition, instead of the old type two-ballonet system, it was necessary to develop an air manifold to fit. This was successfully accomplished.

Three gas cells of the gold beater skin type were constructed for the *Shenandoah,* one of these being in the craft during the transcontinental round-trip flight.

B. F. Goodrich Rubber Co.

The B. F. Goodrich Rubber Co. has designed and produced a new Gammeter airship valve, which, while involving the same fundamental principles as the first, has been so improved as to provide a capacity discharge of 10,000 cu. ft. per minute. The success of the new valve through its response to delicate fluctuations is due to its well balanced construction and the reduction of friction. Construction is mainly from aluminum alloy.

CHAPTER VII

ACCIDENTS—AND THE LACK OF AIR LAW

SINCE the Armistice, when airplanes were first made generally available and came into hands skilled and unskilled, responsible and irresponsible, it may be conservatively estimated that more than 300 persons have been killed and 500 injured—many of them fatally—in flying accidents which could have been prevented had there been in existence and enforced a statute regulating the operation of commercial aircraft in interstate commerce. The estimate is low. Through surveys made by the Aeronautical Chamber of Commerce, it is known that in the years 1921-1924 alone, 271 lives were lost and 442 persons more or less seriously hurt in so-called itinerant accidents.

Effects of this lamentable record are reflected today in the attitude of the public toward aviation. Indifference, procrastination, selfishness and even hostility played their several parts, year by year, in bringing about a condition which made it impossible to put through Congress any aviation regulatory act, the last effort having failed when the Sixty-eighth Congress adjourned on Mar. 4, 1925, with H.R. 10522—a Bill to Create a Bureau of Civil Air Navigation in the Department of Commerce, to Encourage and Regulate the Navigation of Civil Aircraft—still far down on the calendar.

This means that the difficult work of the past will, in large measure, have to be done over again.

Hazard of Obsolete Equipment

The very sharp decline in flying by fixed-base operators during 1924 was not accompanied by so marked a decline in the hazard attached to flying of a more or less permanent character. Of the fifty-eight or sixty operators reporting to the Aeronautical Chamber of Commerce, a considerable number express the intention of suspending activity until their equipment is renewed, and this would seem to indicate—in conjunction with corroborating facts—that obsolete equipment was probably responsible for two of the three fatalities reported by these fifty-eight operators in 922,048 miles of flying, Oct. 1, 1923–Nov. 1, 1924. The third accident was wholly

inexcusable, being due to stunting. A woman performer attached to what was represented to be a fixed base operator was killed when her parachute failed to open. If this stunt fatality is eliminated and only the two attributed to what may be regarded as true hazard considered, it will be seen that the mortality was one to 461,024 miles, unduly high in proportion to the limited operations. No injuries were reported, but the record is such as to impress upon the analyst's mind the imperative necessity for regulation applied to fixed-base as well as itinerant aviation.

In 1924 perhaps a majority of the itinerant flyers disappeared. Many of them were killed. More wrecked their equipment and their credit at the same time. Unquestionably there was very much less flying among the itinerants than among the fixed-base operators. Morbid public curiosity in stunts or thrills declined and with this declined also the available income. Following the procedure of previous years, in which the Aeronautical Chamber of Commerce estimated that flying was about equally divided between fixed-base and itinerant operators, it will be seen that, in 1924, probably a million miles were flown by the itinerants. In the flying of these million miles there were eighty-nine accidents, which resulted in seventy-five fatalities and ninety-one injuries, a ratio of one fatality to less than 13,500 miles and one injury to less than 11,000 miles. Truly a depressing record.

It may well be repeated at this point what has been emphasized in previous Aircraft Year Books. There are six requisites for safe flying, all of which must be approximate before aviation can hope to enlist practical business interest. These are:

1. A machine, sound aerodynamically and structurally.
2. A reliable engine of sufficient power.
3. A competent, conservative pilot and navigator.
4. Air ports and emergency landing fields, sufficiently close together to insure gliding to safety.
5. Nation-wide weather forecasts specialized and adapted to the need of flyers.
6. Adequate charting of air routes.

How the Accidents Happened

It will be appreciated, upon examination of the appended table of causes, how all-important are those features of the proposed regulatory legislation having to do with competency of piloting, restraint on stunting and airworthiness of craft. In going over the accident reports one is impressed with the number of disasters over-

taking student flyers taking their machines home *preparatory to undertaking the carriage of people and goods in interstate commerce.* Contributing incidents in some fatalities are as follows: lost wing in loop; three passengers riding in two-passenger machine; homemade plane burst apart in air, killing the maker, his wife and little son, also the pilot; too heavily loaded; overloaded, wings collapse; wing shattered in loop; parachute failed to open; parachute rope breaks; two fall exhausted from airplane trapeze and rope; first wife, then husband killed in stunt performances; first flights attempted in new kind of plane—and many just fly away and are never heard of again. Among the injuries and general accidents where no injuries resulted are noted the following: overloaded with stunt paraphernalia; collision in air while stunting; hit house; had plane three weeks, in business as common carrier; strikes power wires; knocks down nine telephone and power wires and plane lunges into parked automobiles.

There is a sinister significance to this excerpt from a news report from up-State New York:

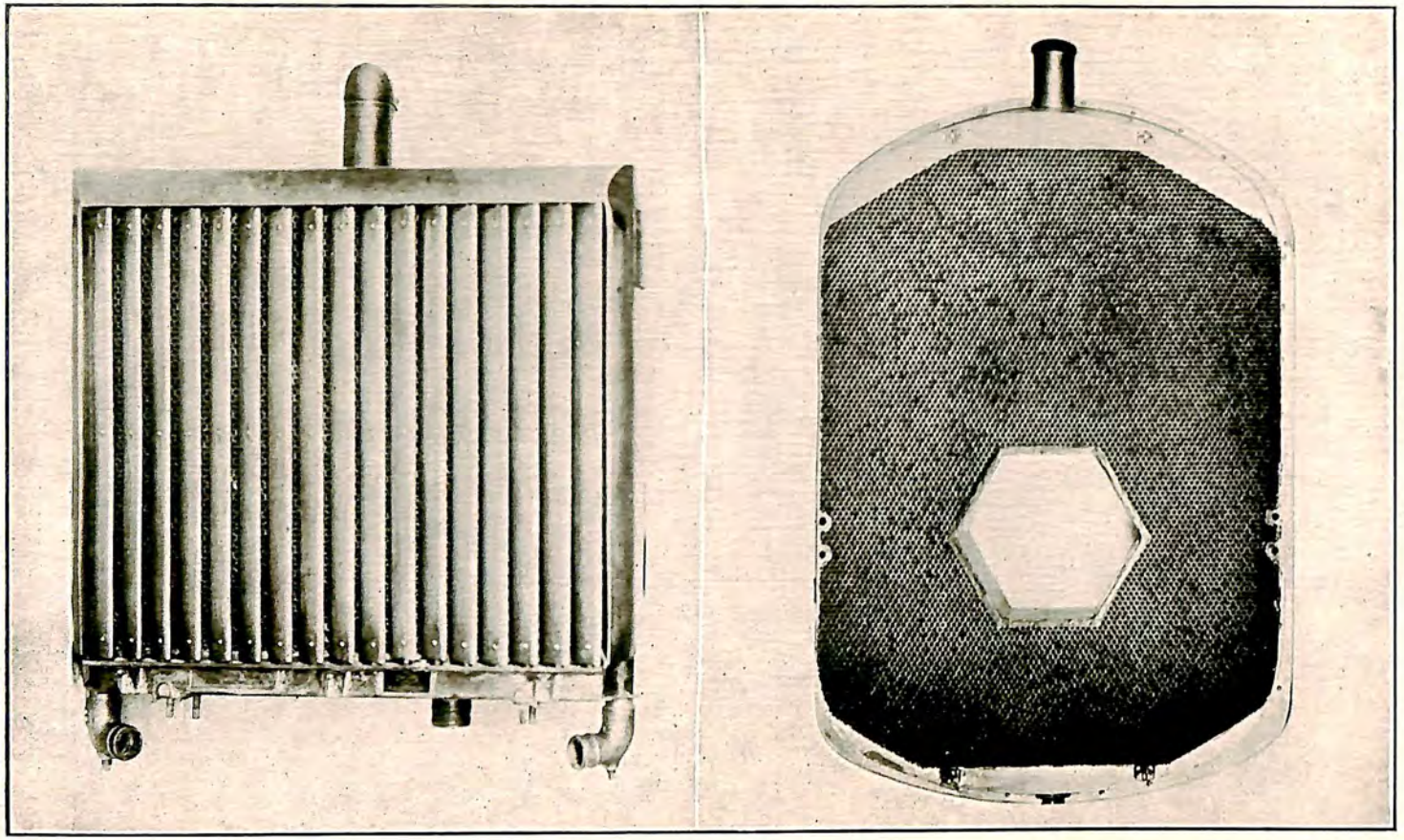
"A woman living in the vicinity had witnessed the fall of the plane and before they (the occupants) could get away they were met by a large group of residents of the vicinity including the coroner and the undertaker."

Unfortunately, as already stated, 165 other persons figuring in similar scenes were unable to "get away."

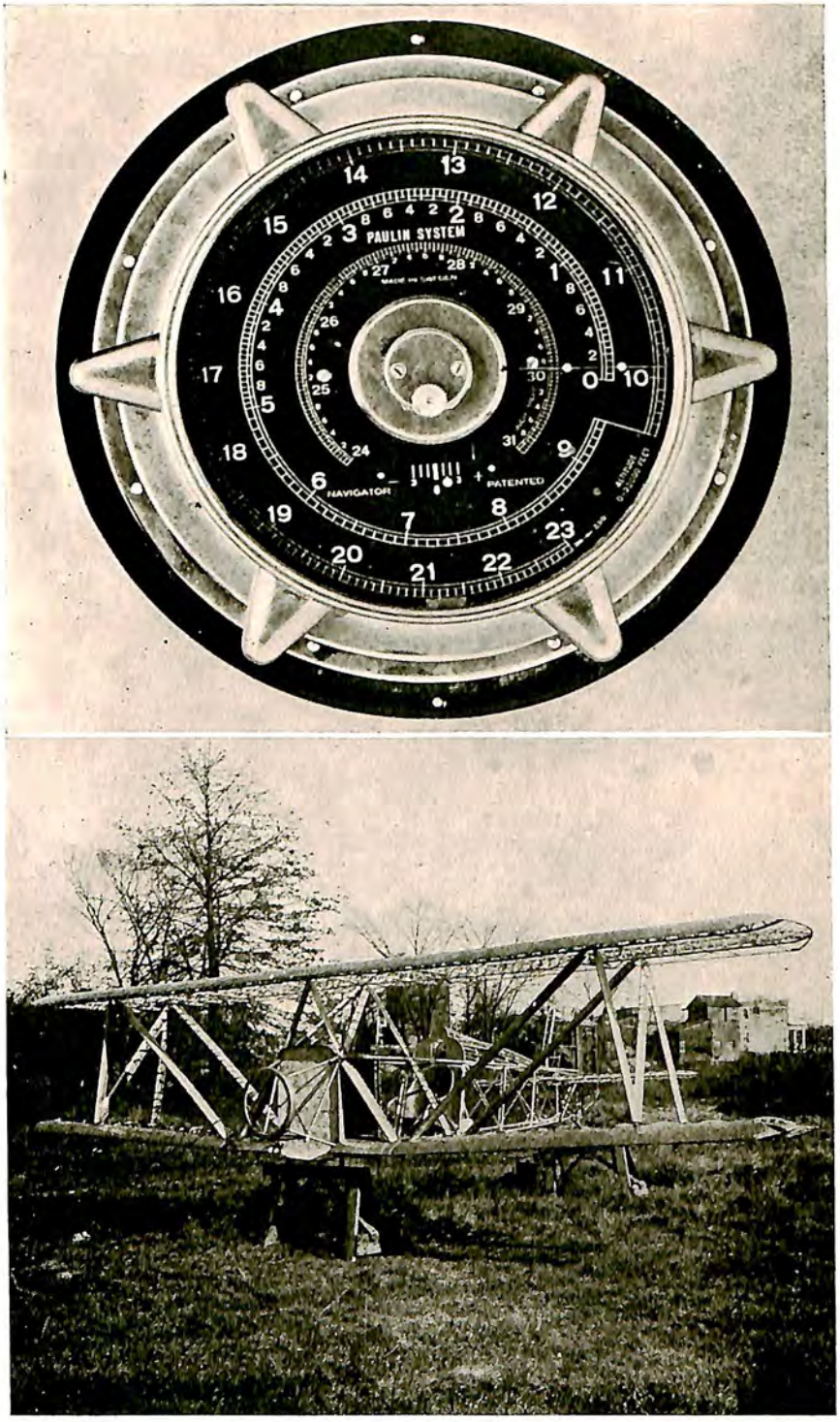
	Cause										
					Inspection						
	Error in Piloting	*Lack of Field or Terminal Facilities*	*Lack of Weather Data*	*Lack of Route Data or Flying Rules*	*Faulty Craft*	*Faulty Engine*	*Faulty Accessory*	*Stunting*	*Collision in Air*	*Carelessness on Field*	*Unknown*
Total Number of Accidents.89											
Number of Persons Killed..75	16	1	0	0	32	18	20	18	1	3	13
Number of Persons Injured.91	36	2	0	1	24	30	17	12	0	3	11

Air Law Again Fails to Pass

As introduced Dec. 9, 1924, by Hon. Samuel E. Winslow, Chairman of the House Interstate and Foreign Commerce Committee, H.R. 10522—A Bill to Create a Bureau of Civil Air Navigation in the Department of Commerce, to Encourage and Regulate the Navigation of Civil Aircraft, and for Other Purposes—did not differ materially from H.R. 13715, as printed in full in the Aircraft Year



(Left) Radiator developed by U. S. Cartridge Co. for Glenn L. Martin Bomber. (Right) Radiator developed by U. S. Cartridge Co. for Stout Metal Airplane Co.



(Top) Type F1 Airplane Altimeter made by Navigator Instruments, Inc.
(Bottom) Metal Airplane Construction developed by Charles Ward Hall, Inc.

Book, 1923, except that the provision for a Civil Aeronautics Consulting Board, which was eliminated. This Board, to be made up of commercial aviation and industrial representatives—the very ones for whom the legislation was being urged—was favored by the Department of Commerce, but was opposed by other departmental representatives.

On Dec. 17, 18 and 19 the Interstate and Foreign Commerce Committee held public hearings on H.R. 10522. The hearing of witness was prefaced by Col. Winslow in the following words: "There are many departments of the Government which are directly interested in the provisions of such legislation as we may propose. Their interests are no more conflicting than in respect of other matters affecting several departments. If we were to follow direct suggestions and perhaps pertinent suggestions on the part of several departments, we would not be able, I think, to bring out a bill for a long time. Each department has its own ambitions and its own purposes."

Testimony would seem to bear this out.

The criticisms of the bill by governmental representatives had only to do with reserving to the several departments the control which they now enjoy over various phases of aviation. All were in general favor of the legislation. Only one voice from civilian quarters was raised in opposition to the bill, this being based upon the belief that registration alone was sufficient. Of the dozen or so affirmative witnesses, the most significant were Hon. Herbert Hoover, Secretary of Commerce, and William P. MacCracken, of Chicago, chairman of the American Bar Association's aviation committee. Figures presented by the Department of Commerce and Mr. MacCracken were from surveys by the Aeronautical Chamber of Commerce. Mr. MacCracken repeated the indorsement of this legislation as several times expressed formally by the American Bar Association.

Secretary Hoover said, in part:

"Broadly, any method of transit which saves time has a very large economic importance. Our finest example is that of the more expeditious transmission of banking documents through the air mail. The saving in interest as the result of this establishment results in indirect saving of many times its cost. It is a good example of the values that come out of expedited transit in commercial life. How far this industry will be able to develop so as to give those advantages in a larger measure to goods and individuals is of course as yet problematical. We are, of course, at the very early stages of its development. As far as the Federal Government is concerned, commercial aviation, as you all know, is totally unregulated and unassisted, and whatever safeguards are provided for the nongovernmental services as to planes and pilots and for the safety of the general public are solely the

results of effort on the part of the industry itself. We have no branch of the Government authorized to investigate either the economic or actual development of the industry. So that such information as we have is largely the result of information compiled by operators of commercial services themselves."

After reviewing the sad effects of delays in establishing Federal regulation over flying, Mr. Hoover concluded:

"I have a feeling that the time has arrived when we certainly need legislation, first, to give some encouragement to the development of the industry and utilization of the craft for commercial purposes. I do not advocate subsidy. This bill properly covers all the phases of commercial aerial navigation. The bureau created under it, to be placed in the Department of Commerce, has thus two general functions: One of them is inspection from a life-saving, life-protecting point of view, and the other is the general promotion of the industry. . . . The legal phases of the bill have been subject to exhaustive study, some of them carried out in the Department of Commerce, some of them by informal agencies, and they mark a most constructive effort to take advantage of all the experience gained elsewhere, and give us an initial piece of legislation from which we can build a direct code affecting aviation over a long term of years. I have no doubt that as the years go by aviation will develop more and more as a method of transit and it will require additional legislation, but with the sound development of legal principles at the start we will profit a great deal over the way we have handled our other industries."

CHAPTER VIII

REVIEW OF AERONAUTICS THROUGHOUT THE WORLD, BY NATION

THE following data have been compiled from reports received from representatives or correspondents of the Aeronautical Chamber of Commerce; from the Air Service, United States Army; Bureau of Aeronautics, United States Navy; commercial attachés, Department of Commerce and the air attachés of England, France and Italy, stationed at Washington. The Editors wish to acknowledge gratefully assistance given by Capt. R. C. Wood, formerly of the U. S. Air Service, and now a resident of Paris. Operating reports of many of the foreign air transport corporations were obtained through Capt. Wood.

INTERNATIONAL

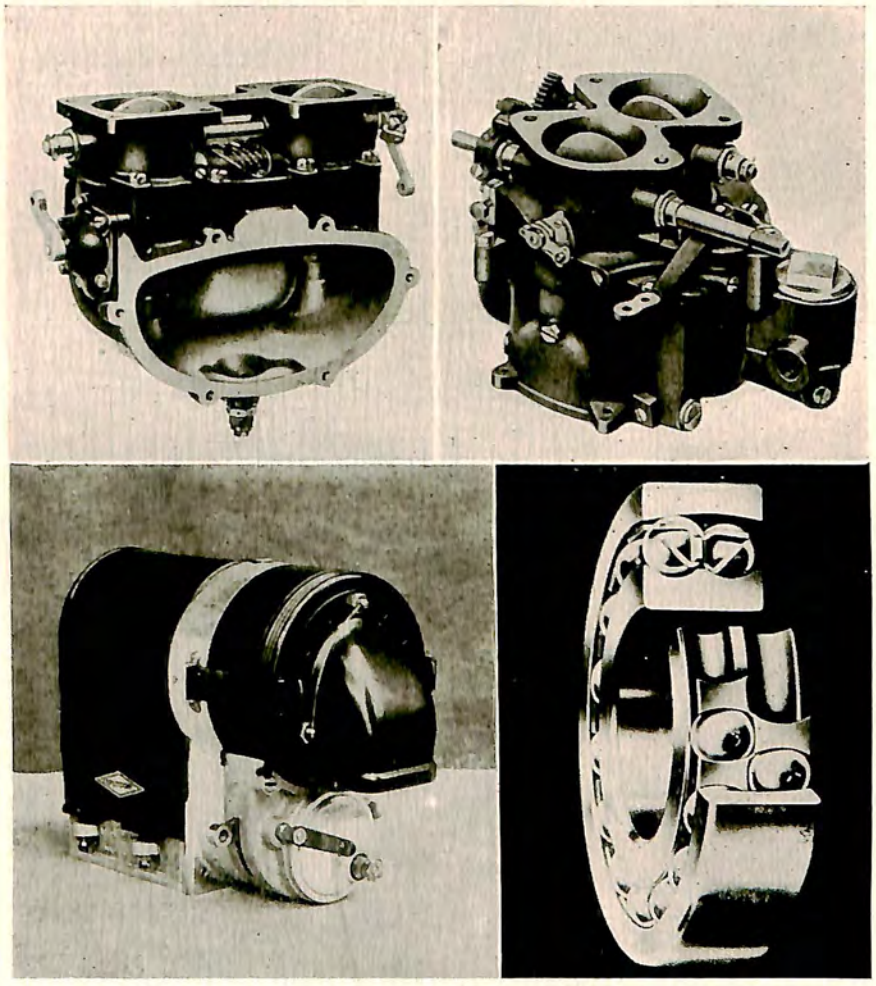
During 1924, three international conferences on aerial navigation, or kindred topics, were held in Europe: Sixth Congress on Aerial Legislation, Rome, April 22, attended by Capt. Geo. W. Steel, U.S.N., and Maj. Jas. E. Chaney, U.S.A.S., as representatives of the United States; International Commission for Aerial Navigation, Paris, October; and European Air Traffic Conference, Copenhagen, Dec. 1.

The International Commission for Aerial Navigation, which held its final session Oct. 14, was under the chairmanship of M. P. E. Flandin. Among the subjects discussed were: exchange between the contracting parties of all legislative documents concerning aerial navigation; drawing up of minimum conditions governing the issue of airworthy certificates; nature of medical examination for aircraft pilots; publication of charts for aerial navigation; transmission of meteorological information; unification of terms and signs employed in technical aeronautics organization of first aid in aircraft; lighting of airdromes at night; adoption of an international standard atmosphere for purposes of calculation; rules for air travel; merchandise which it is forbidden to transport by air; issuance of diplomas for navigators and meteorologists; and wireless regulations.

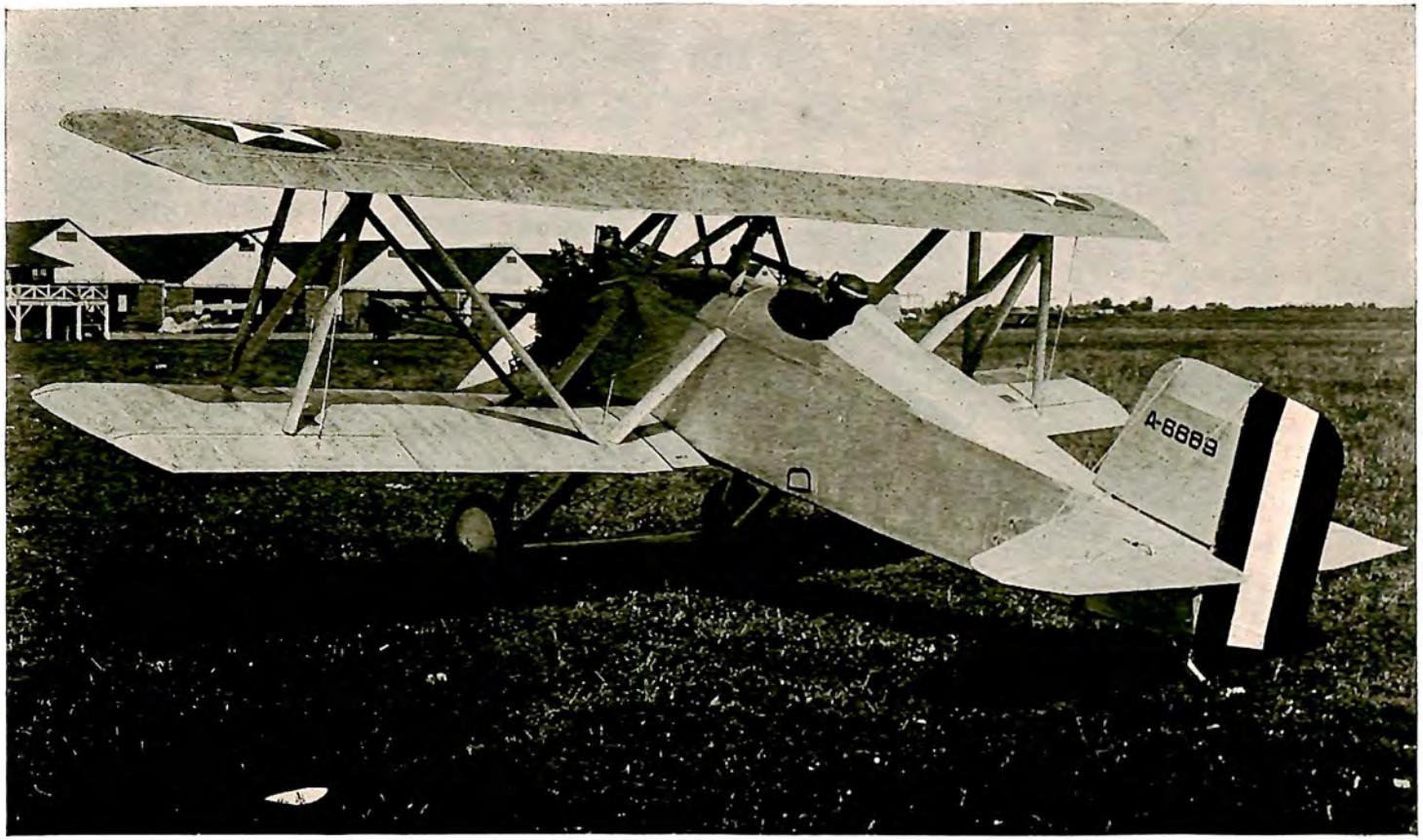
WORLD AIR TRANSPORT SERVICES OTHER THAN THOSE IN THE UNITED STATES SUMMER, 1925

(M=Air Mail; P=Passenger; F=Express or Freight Cargo.)

SERVICE AND FARE	*CLASS*	*Intermediate Stations*	*Operating Company*	*Frequency of Service*
			ENGLAND	
London-Paris ..... Single, £6.6.6. Return, £12.0.0.	M.P.F.	..	Imperial Airways, Ltd.	3 services each way daily (1 service each way on Sundays)
London-Cologne ..... Single, £6.0.0. Return, £10.10.0	M.P.F.	Brussels	Imperial Airways, Ltd.	3 services each way daily (except Sundays) (1 service is a non-stop London to Cologne)
London-Berlin	P.F.	Amsterdam Hanover	Imperial Airways, Ltd. (in conjunction with German Aero Lloyd).	1 service each way daily (except Sundays)
	Single. Return.			
London-Amsterdam	£4. 0.0. £ 8.0.0.			
London-Hanover	£7.10.0. £15.0.0.			
London-Berlin	£8. 2.6. £16.5.0.			
Southampton-Guernsey ..... Single, £3.0.0. Return, £5.10.0.	P.F.	..	Imperial Airways, Ltd.	2 services each way daily (1 service each way on Sundays)
			FRANCE	
Paris-London ..... Single, 400 frs. Return, 800 frs.	M.P.F.	..	French Air Union	2 services each way daily (1 service on Sundays)



(Top Left) Stromberg NAU5 Carburetor for Wright E4 and Wright-Lawrance J3 and J4 engines. (Top Right) Stromberg NAY5 Carburetor for Curtiss D12 and Packard 1A1500 engines. (Bottom Left) Splitdorf Magneto. (Bottom Right) Skayef self-aligning ball bearing.



Curtiss-Hall Light Pursuit. Wright J3 engine.

SERVICE AND FARE	*CLASS*	*Intermediate Stations*	*Operating Company*	*Frequency of Service*
			FRANCE (Cont.)	
Toulouse-Casablanca ..... Single, 924 frs. Return, 1,578.50 frs.	M.P.F.	Perpignan Barcelona Alicante Malaga Rabat	Cie. Generale des Entreprises Aeronautiques (Latecoere).	1 service each way daily
Branches:— Marseilles-Perpignan-Barcelona ... Single, 257,40 frs. ..... Return, 437.25 frs.	M.P.F.	..	Cie. Generale des Entreprises Aeronautiques (Latecoere).	1 service each way daily (except Mondays)
Alicante-Oran ..... (Passenger service pending).	M.F.	..	Cie. Generale des Entreprises Aeronautiques (Latecoere).	1 service each way daily (except Mondays)
(See also Casablanca-Oran under N. Africa).				
Antibes-Ajaccio ..... Single, 220 frs. Return, 352 frs.	P.F.	..	Cie. Aeronavale	Irregular
Paris-Bucharest (to be continued later to Constantinople) ..... Single, 1,350 frs. Return, 2,700 frs. .	M.P.F.	Strasbourg Prague Vienna Budapest Belgrade	Cie. Internationale de Navigation Aerienne	3 services each way weekly
Paris-Warsaw ..... Single, 900 frs. Return, 1,800 frs. ..	M.P.F.	Strasbourg Prague	Cie. Internationale de Navigation Aerienne	3 services each way weekly

SERVICE AND FARE	*CLASS*	*Intermediate Stations*	*Operating Company*	*Frequency of Service*
			BELGIUM	Daily
Rotterdam-Basle (to be opened for passengers on 15/6/24).	M.P.F.	Brussels Luxemburg Strasbourg	S. A. B. E. N. A.	
			HOLLAND	
Amsterdam-London ..... Single, 48 fl. Return, 96 fl.	M.P.F.	Rotterdam	Koninklijke Luchtvaart Maatschappij	1 service each way daily (except Sundays)
Amsterdam-Paris ..... Single, 48 fl. Return, 96 fl.	M.P.F.	Rotterdam	Koninklijke Luchtvaart Maatschappij	1 service each way daily (except Sundays)
			DENMARK	
Copenhagen-Rotterdam ..... Single, 165 Danish Kr. ..... Return, 330 Danish Kr.	M.P.F.	Hamburg Bremen Amsterdam	Danske Luftfartselskab (in conjunction with German Aero Lloyd and Dutch K. L. M.)	1 service each way daily
Copenhagen-Hamburg ..... Single, 80 Danish Kr. ..... Return, 160 Danish Kr.	M.P.F.		Danske Luftfartselskab in conjunction with German Aero Lloyd).	1 service each way daily
			GERMANY	
Berlin-Königsberg ..... Single, $16. Return, $32.	M.P.	Dantzig	Deutscher-Aero Lloyd and Junkers Werke A. G.	1 service each way daily (except Sundays)
Königsberg-Moscow ..... Single, £37. Return, £74	M.P.	Kovno Smolensk	Deutsche-Russische Luftverkehrs Gesellschaft (Aero Lloyd).	1 public service each way daily

SERVICE AND FARE	*CLASS*	*Intermediate Stations*	*Operating Company*	*Frequency of Service*
			GERMANY (Contd.)	
Konigsberg-Helsingfors	M.P.	Memel	*The Nord Europa Union;* composed as follows:	1 service each way daily (except Sundays)
Single, $38. Return, $76		Riga	*Germany* Junkers Luftverkehrs and Aero Lloyd, Berlin	
		Reval	*Dantzig* Danziger Luftpost G.m.b.h. Dantzig	
			Latvia Lettlandische Luftverkehrs A.G. Riga	
			Esthonia Aeronaut A.G. Reval	
			Finland Aero O.Y. Helsingfors	
Munich-Geneva	M.P.	Zurich	*The Trans-Europa Union;* composed as follows:	1 service each way daily (except Sundays)
Single, 100 gold mks. Return, 200 gold mks.			*Germany* Junkers Luftverkehrs, Berlin; Bayerischer Luft Lloyd, Munich; Aero-Lloyd, Berlin; Rumpler Luftverkehrs A.G. Munich	
			Switzerland Ad Astra Aero A.G. Zurich	
			Austria Osterreichische Luftverkehrs A.G., Vienna	
			Hungary Aeroexpress R.T., Budapest	

SERVICE AND FARE	*CLASS*	*Intermediate Stations*	*Operating Company*	*Frequency of Service*
			GERMANY (Contd.)	
Munich-Budapest	M.P.	Vienna	*The Trans-Europa Union;* composed as follows:	2 services each way daily (except Sundays)
Single, 98 gold mks.				
Return, 196 gold mks.				
			Germany Junkers Luftverkehrs, Berlin; Bayerischer Luft Lloyd, Munich; Aero-Lloyd, Berlin; Rumpler Luftverkehrs A.G. Munich.	
			Switzerland Ad Astra Aero A.G. Zurich.	
			Austria Osterreichische Luftverkehrs A.G., Vienna	
			Hungary Aeroexpress R.T., Budapest	
Munich-Frankfurt	M.P.	Nuremberg (Furth).		1 service each way daily (except Sundays)
Single, 70 gold mks.				
Return, 140 gold mks.				
			POLAND	1 service each way daily
Warsaw-Lemberg	M.P.F.	..	Polski Aero Lloyd	
Single, 80 gold frs.				
Return, 140 gold frs.				

SERVICE AND FARE	*CLASS*	*Intermediate Stations*	*Operating Company*	*Frequency of Service*
			POLAND (Contd.)	
Warsaw-Dantzig ..... Single, 70 gold frs. ..... Return, 140 gold frs.	M.P.F.	..	Polski Aero Lloyd	1 service each way daily
Warsaw-Cracow ..... Single, 55 gold frs. Return, 110 gold frs.	M.P.F.	..	Polski Aero Lloyd	2 return services weekly
			SPAIN	
Seville-Laraiche ..... Single, 200 ptas. Return, 300 ptas. ..	M.P.F.	..	Compañia Española de Trafico Aereo	1 service each way daily
			SWEDEN	
Malmö-Hamburg (to commence June 21st) ..... Single, 60 kr. Return, 120 kr.	M.P.		Aerotransport Aktiebolag (Florman)	
			N. AFRICA (*Morocco, Algeria and Senegal*)	2 services each way weekly
Casablanca-Oran ..... Single, 357.50 frs. Return, 660 frs. ..	M.P.F.	Rabat Fez	Cie. Generale des Entreprises Aeronautiques (Latecoere)	
			CENTRAL AMERICA	
Mexico City-Monterrey	M.P.	Tuxpan Tampico	Mexican Aerial Transport Co.	

SERVICE AND FARE	*CLASS*	*Intermediate Stations*	*Operating Company*	*Frequency of Service*
Colombia			*S. AMERICA*	
Barranquilla-Girardot	M.	Calamar Barranca-Bermeja Puerto Barrio (for Medellin) Honda	Sociedad Colombo-Alemana de Transportes Aeros	2 services each way weekly
Barranquilla-Cartagena	M.	..	Sociedad Colombo-Alemana de Transportes Aeros	1 service each way weekly
Barranquilla-Santa Marta	M.	..	Sociedad Colombo-Alemana de Transportes Aeros	1 service each way weekly
			EGYPT, ETC.	
Cairo-Baghdad	M.		British Royal Air Force	1 service each way fortnightly
Damascus-Palmyra	M.		French Military Air Service	1 service each way weekly
Latakia-Homs	M.		French Military Air Service	2 services each way weekly
Aleppo-Alexandretta	M.		French Military Air Service	3 services each way weekly
Damascus-Baghdad	M.	Deir-ez-Zor	French Military Air Service	1 service each way monthly
			ASIA-SIAM	
Korat-Ubon	M.	Roi-Et	National Air Service	Irregular

WORLD AIR TRANSPORT SERVICES OTHER THAN THOSE IN THE UNITED STATES SUMMER, 1925

(M=Air Mail; P=Passenger; F=Express or Freight Cargo.)

SERVICE AND FARE	*CLASS*	*Intermediate Stations*	*Operating Company*	*Frequency of Service*
			INDO-CHINA	
Saigon-Pnompenh	M.		French Military Air Service	2 return services weekly
Saigon-Cantho	M.		French Military Air Service	2 return services weekly
			AUSTRALIA	
Perth-Derby ..... Single, £28. Return, £56.	M.P.	Geraldton Carnarvon Onslow Roeburne Port Hedland Broome Derby	Western Australian Airways Ltd.	1 service each way weekly
Charleville-Cloncurry ..... Single, £25. Return, £50.	M.P.F.	Tambo Blackall Longreach Winton	Queensland and Northern Territory Aerial Services Ltd.	1 service each way weekly

At the Copenhagen conference there was much discussion of international air mail and it was decided to call another conference just as soon as the various European lines had made ready for the operation of postal routes. Among other matters, it was recommended that the Malmö-Copenhagen-Hamburg, Rotterdam line be extended to London and also from Brussels to Paris.

Argentina

The Government, the Military Air Service Directorate, and the Federation of Argentine Aero Clubs, which is subsidized by the government, are combining to encourage both civil and military aviation. The Military Air Service Directorate is distributing airplanes, presenting hangars and assisting in installing training schools for pilots, mechanics and carpenters throughout the country. Arrangements are also being made for the establishments of landing fields. The Senate and Chamber of Deputies have authorized a piece of land near the new harbor at Buenos Aires to be set aside for the Buenos Aires Airport, which will belong to the Ministry of War and be staffed by military personnel. For the laying out of this aerodrome $2,000,000 is to be set aside from the 1925 and 1926 budgets. A request has been made to the President of Argentina in the name of the Aero Club Argentino for the installation of four commercial air routes as follows:

Buenos Aires to Rio Gallegos (17 hours), with stops at Azul, Bahia, Blanca, Patagones, San Antonio Oeste, Trelew, Comodoro Rivadavia, Puerto Deseado, San Julian and Santa Cruz.

Buenos Aires to Asuncion (11 hours) with stops at Gualeguaychu, Concepcion de Uruguay, Colon, Concordia, Paso de los Libres, Posadas, Villa Encarnacion, Villa Rica and Paraguari.

Buenos Aires to Antofagasta (12 hours) with stops at Rosario, Galvez, Rafaela, Santiago del Estero, Tucuman, Salta, San Antonio de los Cobres, San Pedro de Atacama and Sierra Gorda.

Buenos Aires to Montevideo (85 minutes).

Financial support of the government is required to start these lines which the Aero Club is prepared to install without recompense to itself.

The Compañia Rio Platense de Aviacion operates a passenger and mail service between Buenos Aires and Montevideo. The subsidy to this company was withdrawn by the government in May, after it had been in operation five months. The Curtiss Aeroplane Export Co. has its base at San Fernando, a suburb of Buenos Aires, where army, navy and civilian students are trained. President

Alvear issued a decree in February for the purchase of nine Curtiss airplanes for the Army Air Service. Impelled by the number of German immigrants, German operators have been active in the Argentine. Seaplanes have been used on regular schedules on the River Plate and in January the German Junkers Co. started a passenger and mail service between Cordoba and Villa Dolores, using all metal monoplanes. This company is subsidized by the government of Cordoba.

Australia

An extensive plan for Air Defense is being followed in Australia, provision being made for the formation of Air Force Units as a permanent nucleus of one-third the total strength, the remaining two-thirds to be drawn from the citizen forces. This plan is to extend over seven years. Work has begun on the aircraft depot at Laverton, Victoria, and the Federal Public Works Committee has recommended the proposed Army Co-operation Flying Squadron for Richmond, New South Wales. A seaplane squadron is being organized at Sydney. Of a special defense grant, £232,000 was allocated to the Royal Air Force.

The exceptional value of commercial aviation in Australia is due to the fact that the population is less than that of London and is divided into two groups. The cost of an extensive system of railways is prohibitive. The Federal Ministry has decided to establish important extensions of the aerial mail service linking Northern Australia with the Southern States. The most important development includes the extension of the service in West Australia to Darwin. The original agreement between the Commonwealth Government and the Western Australian Airways, Ltd., provided for a service between Geraldton and Derby. When the agreement was renewed at the end of three years the service was extended to Perth and Wyndham. A new agreement with the Queensland and Northern Territory Aerial Services Ltd., provides for the extension of the service to Cloncurry and Camooweal, via Duchess and also for a branch service to the new silver and lead mining district of Mount Isa. Camooweal is the gateway to the most fertile portions of the Territory, wholly pastoral and mostly under absentee ownership, so that there is great need for faster communication between the resident managers in the north and owners in the south. The mail at present takes nine days by motor lorry and settlers drive 70 miles to send telegrams.

An air mail service between Adelaide and Sydney was begun in June. The company operating the planes receives a subsidy of

£19,000 for the first twelve months. When the service is extended to Brisbane the subsidy will be increased to £27,000.

Belgium

The 1925 budget in Belgium provides 22,210,000 francs for military aviation, including 1,810,000 francs for personnel and 20,400,000 francs for general expenses, supplies, material and aviation schools. The amount for civil aviation is 6,443,000 francs, 866,000 for personnel and 5,577,000 for the organization of air lines, subsidies for air navigation companies, for inventors, aviation schools, etc. During the first ten months of 1924 the personnel directing military aviation made 39,831 hours of flight in planes and 1200 hours in balloons.

Ordinary expenditures of the government in 1924 amounted to 25,513,000 francs and extraordinary to 6,870,000 of which 870,000 francs represented the participation of the State in the capital of an operating company. The state has contracted to give the Société Anonyme Belge des Constructions Aeronautiques, the "Sabena," a minimum of 6,000,000 francs yearly. This is the most important of the Belgian aeronautical industries, the others being Les Ateliers des Constructions Aeronautiques de Zeebrugge, interested in metal construction and the Stamp and Vertogen Company of Antwerp engaged in constructing school planes. The State during 1924 furnished military aviation and civil aviation with Bristol, Handley Page, Ansaldo and Nieuport airplanes built in the state workshops according to foreign licenses.

Four air lines pass over Belgian territory as follows:

1. London-Ostend-Amsterdam, operated by I. S. L., an English company.
2. Amsterdam-Brussels-Basle, operated by the Sabena.
3. London-Brussels-Cologne, operated by the I. A. L., an English company.
4. Paris–Brussels–Amsterdam, operated by a French company.

The "Sabena" began operating a line between Rotterdam, Brussels and Strasbourg April 1, 1924. This line was extended to Basle June 12 and to Amsterdam September 15. It was opened to passengers as well as merchandise on July 1. On August 11 the transportation of Holland post destined for Switzerland and Italy was begun, the company receiving 3 francs gold per kilogram for mail from Basle to Holland, France and Belgium each giving up the royalty of 1.50 francs due them had the mail been sent by railroad.

Brazil

Trial flights preparatory to the establishment of passenger and mail service between Pernambuco, Rio Janeiro, and Buenos Aires were successfully completed by the French corporation Latecoere, in January, 1925. Permanent service will depend upon subsidies from the French, Spanish, Brazilian and Argentine governments.

Canada

Control of civil aviation, lodged with the Air Board, under the act of 1919, passed in 1923 to the Minister of National Defense, under a law passed in 1922. In 1924 there were in existence in Canada three firms manufacturing aircraft, eight chiefly operating aircraft and two using aircraft as an auxiliary service. Three thousand seven hundred and seventy-six flights were made, a total of about 700 more than in 1923. Aircraft showed a total mileage of 294,778, or more than 100,000 miles in excess of the preceding year. Nine thousand no hundred and ninety persons (pilots, crew and passengers) were carried. There were transported 77,385 pounds of freight or express, in addition to 1,221 pounds of mail. In 1923 no mail was carried.

In 1924 there were in operation but three public airdromes, as compared with five in 1924 and nine private-commercial air harbors, as contrasted with 12. There was a total of 24 airports of all sorts, a decrease of seven from the 1923 figure. Thirty-two aircraft of all types were licensed in 1924; in 1923, 69. Licensed personnel in 1924 was 201, as against 230 the preceding year. An analysis of accidents shows that for every crash 294,778 miles were flown. Passengers killed per 1,000 passenger miles, .0036; passengers injured per 1,000 passenger miles, none; passengers killed per 1,000 passengers carried, .3764.

The chapter on aerial survey contains an account of this phase of aviation, as carried on in Canada. In addition to Fairchild Aerial Surveys (of Canada) as described, the principal operating concern was the Dominion Aerial Exploration Company, which is also engaged in work centering upon aerial photography.

The Government of Ontario in 1924 established an air forest patrol. The official Canadian air report indicates that the forest patrol has proved very valuable, especially in remote areas, where the alternative (highly unsatisfactory) is a canoe patrol. Extension of the application of aviation to forestry will come, it is declared, as the cost of operation diminishes.

The Royal Canadian Air Force, which for defensive purposes is still in the formative stage, during 1924 performed many useful missions on behalf of commercial aviation. These included aerial survey, aerial photography, forest patrol, fishery patrol, etc.

Chile

A French-Chilean group has been established in Chile by a French pilot, M. Deckert, under the direction of M. Testart, for the operation of air lines. The Chilean government has given the group the monopoly on air lines for 12 years. One of the lines to be established is that from Santiago to Buenos Aires.

China

Conditions in China at present preclude the possibility of any great development of aviation. The arms and munitions embargo enforced by the United States in concert with other powers expressly calls for a guarantee that any airplane exported will be used for commercial purposes only. This guarantee being impossible to furnish it is difficult to develop interest in aviation. Chang Tso-lin, the ruler of Manchuria has an air force as large as the rest of China. At present he has over 200 planes, mostly French. The Peking government protested to the French legation in October, 1924, concerning the sale of 20 planes to him and requested the Japanese government authorities at Dairen to hold up the planes if they arrived there.

Colombia

The Sociedad Colomba-Alemana de Transportes Aeros was founded by Germans in Barranquilla in December, 1919, to promote aerial communication in the interior of Colombia.

After thorough studies of the atmospherical and topographical conditions of the country the management of the Scadta adopted as a unit type the German Junkers seaplane. Barranquilla, situated at the mouth of the Magdalena River, offered special facilities for communication by seaplane with the interior cities, the river constituting the main commercial artery of Colombia, joining the Atlantic coast with the far away places of the interior and reaching indirectly Bogota, 750 miles inland, the capital of the Republic. Hitherto only small seagoing steamers had kept up communications between the Caribbean ports and the interior mountainous region of Antioquia and Bogota.

Regular service was established in Aug. 1921. Round trips were made between Barranquilla and Girardot (625 miles) and Girardot and Neiva (94) and later from Barranquilla to Cartagena (75 miles). In the spring of 1924 the company was making trips twice a week, leaving Barranquilla every Tuesday and Friday and arriving at Girardot the same day, delivering mail at Magangue, El Banco, Barranca-Bermeja, Puerto Barrios and Honda. The mail is taken by special messenger to Medallin, Manizales, Bogota, Ibague and Tunja. Trips are made each Thursday between Girardot and Neiva. The return trips from Girardot to Barranquilla are made Wednesdays and Saturdays, making connections with steamers so that New York mail is carried in 14 days from Bogota and London mail in 20 days. The mail between Barranquilla and Cartagena and return is carried every Thursday.

Mail entrusted to the Air Mail at Barranquilla consigned to Bogota is only in motion 17 hours, of which 8½ are used in transporting it 625 miles by seaplane and the other 8½ in going 100 miles by rail. As there are no night trains the mail is held over night making the total time 34 hours. The fast steamers leave Barranquilla Monday morning and under the most favorable conditions reach Girardot in 8 days. Often they are delayed from 4 to 8 days. The normal time for mail is 216 hours as compared with 34 by air mail. The Scadta supports 15 agencies in Colombia which take charge of receiving and distributing the mail and attend to passenger service.

The Scadta now owns 6 seaplanes with an organization at each port and workshops and hangars at Barranquilla and Girardot. The line has never had an accident on their regular service. Up to the end of December 1923, the company's machines had flown 368,530 miles in 4,521 hours of flight. They had carried 2,830 passengers and 14,522 kilograms of mail which with shipments of money and merchandise made a total of 219,567 kilograms of pay load. During the first half of 1924 the company covered 143,170 kilometers carrying 687 passengers and 4,826 kilograms of mail.

The government has been asked to pay a subsidy to the Scadta and a bill has been introduced providing for the sum of $27,000.00. The company is now in negotiation with the United Fruit Co. for the establishing of coastal service from Puerto Limon in Costa Rica to Santa Marta or possibly to Venezuela—Maracaibo and LaGuaira.

Czecho-Slovakia

The geographic location and the present international relations continue to encourage Czecho-Slovakia to become a solid and reliable link in the chain of flying nations. Remarkable progress has been made. At the close of the war there were in the country only 30 airplanes which the Germans had left at Cheb. In 1920 there were 150, of which 115 were French. In 1923 there were 250, of which 220 had been built by the Czecho-Slovakian aeronautical industry. Seven factories, with 1,000 workmen, had produced and tested 50 types of machines. In 1924 the Military Aircraft Shops employed 260 workers and 58 members of technical and clerical staff, the "Avia" employed 400 workers and 50 technical and clerical staff, the "Aero" employed 450 workers and 70 members of the technical and clerical staff. The types built were of great variety.

Aviation organization is still divided between military and civil authorities but has a tendency to become centralized, a bill for this purpose having been proposed. At present aviation is under two heads, the Ministry of National Defense and the Ministry of Public Works. The former contains an aeronautical section with a director and four departments. The present minister, M. Udrzal, is a firm believer in the importance of aviation, realizing the vital effect which a developed national commercial aviation has on purely military aspects of aeronautics. He therefore supports the Minister of Public Works in the establishment and development of Czechoslovak airways. The government appropriations for 1924 were 145,000,000 Kc. The appropriations for 1925 are, for the Ministry of Public Works, 21,868,340 Kc., for Air Service Dept. of the Ministry of National Defense, 120,220,740 Kc.

M. Janak, the head of the Civil Aviation Section of the Ministry of Public Works, is working along two lines, seeking to develop a purely national civil aviation and taking steps to insure that the country will be in a position to take its share in carrying out international communications. Civil air transport undertakings in Czecho-Slovakia are carried out by the Czechoslovenska Statni Aerolinia, a company owned by the government. This company has 15 Brandenburg type two-seaters, built by the Aero Aircraft factory and bought at cost from the Ministry of National Defense, and five limousines bought from the Aero factory. The personnel is supplied free of charge by the Ministry of Defense. A regular air service was established between Prague and Bratislava which was extended at the beginning of 1924, a further extension to Uzhorod via Kosice now being organized.

In March 1925 a meeting was attended by representatives of the Zivnobanks, the Credit Bank, the Czecho-Slovak Industrial Bank and the aviation factories of Skoda, Walter, Breitfeld-Danak, Laurin-Klement, the Bondy company and the Military Aviation Factory, to establish a joint company for the development of aeronautics. The state will subsidize the company and eventually take a part of the shares. Civil aerodromes are to be built immediately at Brunn and Uzhorod.

The Prague-Bratislava-Kosice-Uzhorod line, during eleven months of 1924, carried 426 passengers, 1,926 kilograms of goods and 160 kilograms of mails. 126,400 miles or 202,400 kilometers were flown with no accidents.

The third international Aero-Exhibition was held in Prague from May 31 to June 9, 1924, France, Great Britain, Germany and Italy being represented. In 1925 the International Aeronautical Federation will meet at Prague.

Denmark

The two Danish Air Traffic companies, Det Danske Luftfarselskab, the old organization, and the Danske Lufttransport, formed in January 1925, have been amalgamated, as a result of negotiations carried on by the Ministry of Public Works. The new organization is known as the Danske Luftfarselskab, the capital being half a million kroner. The company will be granted the subsidy recently arranged of half a million kroner covering a period of four years and concessions on the three air lines in the operation of which Denmark hopes to co-operate, the Copenhagen–Hamburg, Copenhagen-Berlin and the Copenhagen-Hamburg-Amsterdam. The Dansk Luftfartselskab, operating in 1924 covered a daily route of 2,000 km., carrying an average of 60 passengers, the expenses when flying over 2,000 km. being less than the preceding year when the route was 600 kilometers, the reduction being due to co-operation with Danish, German and Dutch traffic companies. The lines operated from April 24 to Oct. 4 were Copenhagen-Hamburg and Copenhagen-Hamburg-Amsterdam-Rotterdam, in connection with the German Aero Lloyd and the Koninklijke Luchtvaart Maatschappij. Two hundred and eighty-four thousand nine hundred and eighty-three kilometers were flown, 1,365 passengers were carried and 33,057 kilograms of letters and merchandise. Ninety-four and six-tenths per cent of flights scheduled were made, six Fokker planes being used. The tariff of fares is as follows: Rotterdam or Amsterdam to Copenhagen 6 pounds 5. Passengers are allowed 30 pounds

of luggage free and excess luggage from Amsterdam or Rotterdam to Copenhagen at the rate of 10d. per pound. The freight tariff from London to Copenhagen is 1s. 8d. per pound with a minimum of 5s. 7d. and reduced rates for over 100. The British postal authorities have shown interest in the service and have informed Denmark that the mail to Denmark will be forwarded by it.

FINLAND

Aviation progressed rapidly in Finland in 1924, the appreciation of the importance of the airplane as the best instrument of traffic of the future and the deciding weapon in war, becoming more and more general in the public mind. Early in the year a company was organized to operate commercial air lines between Helsingfors and Reval and Helsingfors and Stockholm. These lines were discontinued during the winter months but it is expected that yearly service will be established. The journey from Helsingfors to Reval by steamer takes four hours in summer and often more than 24 hours in winter, connection being made only once a week. The trip can be made by airplane in three-quarters of an hour. The distance from Helsingfors to Stockholm requires six hours in the train and seventeen hours on boat. The same journey takes from three to four hours by airplane, an ideal trip along the beautiful Finnish coast, with its many islands. Finland is to continue its policy of subsidizing civil aviation, 3,000 Finnish marks to be paid for each airplane flight on which mail is carried. Nov. 27, 1924, an appropriation of 180,000 Finnish marks was made for air traffic between Jan. 19 and April 1, 1925. Routes most desired are those between Finland and Sweden and Finland and Esthonia. In 1924, 706 passengers were carried between Helsingfors and Reval, the fare being 240 Finnish marks.

The program of development of the Finnish army is to establish a great air force, the character of the country making the airplane the best weapon for protection. During the summer of 1924 the government permitted a British Military, Naval and Air Mission to study the questions of the defense of the country. The commission attached great importance to the air force and the Parliament appropriated a large sum for development. The present force consists of 150 to 200 airplanes. Manufacture in Finland has not been entirely successful because of the inability to produce satisfactory motors. The government has a factory at Sveaborg.

France

The French air policy continued in 1924, as it did in 1923, to be the center of international political discussion. The reason was obvious. The strongest military power in the world, and especially strong in the dominant arm—the air—France pursued an aggressive defensive policy, excluding consideration either of her domestic financial problem or of the probable funding of her debts abroad, even at some remote and indefinite period. The result, in England and Germany, particularly, was to evoke criticism. Although, as is indicated in the data on Great Britain, the British parliament did not respond to extreme criticism in a section of the daily press, it *did* act along the most effective lines, that of strengthening the British air defenses at home to a figure more in keeping with the relative size of the two nations.

At the beginning of 1925, France was reported to have 1,962 first line airplanes, all of post-war design and construction, with production under way in such quantity as to assure the existence of 2,560 by the end of 1925. In addition to the above, there were 4,000 planes in reserve. The French air force totalled 33,024 officers and men, in addition to which there were 1,500 officers in the reserve. Air appropriations for 1925 were reported to be 713,349,565 francs. The civil aviation department of M. Laurent Eynac, Under Secretary of State for Air received a total of 155,329,000 francs, which was practically all that was asked for. Of this appropriation, made at a time when the French Government was in turmoil over excess of expenditures over receipts, M. Eynac said:

"This extra money will enable us to intensify the traffic on existing lines, and also to prolong them. Our Franco-Roumanian company has secured the concession for the Constantinople-Agora line, which the Germans tried to get exclusively into their hands. Our Nice-Antibes-Corsica line will be prolonged (extended) to Tunis, and if the northern lines from Holland and Great Britain meet at Marseilles the route will be extended. It will become the route to India. The France-Morocco line will be largely extended. From next year onwards we shall run from Barcelona via Palma to Algiers. We have a line from Alicante to Oran already, and a coastline between Tunis and Casablanca will complete this Mediterranean system. Then we shall have a main line from Toulouse by way of Dakar to Pernambuco and Buenos Aires, which will bring Paris within nine days of the Argentine capital, instead of 22 by the fastest steamers."

Total aids to civilian aviation, including subsidies, for 1924 and 1925, were 533,809 fr. and, for 25-26, 652,275 fr. The French system is most elaborate. First there is a premium on the purchase

of new equipment, at least one-half of the purchase price for new craft and engines being paid by the state. There is a 50 per cent. additional if the equipment is all metal. There is an extra allowance for two engine types, 12½% additional for three engine types and 15% additional for types with four engines or more. Next there is a system of payment for mileage flown, there being a rising scale for each additional fifty kilometers of useful load carried.

M. Eynac, in a recent interview, gave the French Government's position with regard to intensified aerial development. First, of course, the economic demand is desired in the establishment of an air line. Next, is the political appeal, the diplomatic reason for such line of communication. It is the French ambition to unite Paris by air to the great capitals of Europe and to organize a Mediterranean air network, with one branch leading into the Orient and another to South America.

In line with this operation, liberal orders given to the constructors have placed the aircraft industry in a most fortunate position. Too, orders are being placed by those countries which regard France as an aerial preceptor. The result has been that during the first nine months of 1924 aircraft imports amounted to only 4.6 metric tons as compared with 1,732.1 metric tons during the same period of 1923, while exports amounted, from January to September, 1924, to 924.8 metric tons, valued at 27,690,000 francs, compared with 715.4 metric tons, valued at 19,212,000 francs for the corresponding period in 1923.

Although M. Eynac is quoted as having referred to air records as being merely a "façade," when these records, several years ago, were captured wholesale by the United States, the French Government in 1924 spent large sums of money in encouraging engineers and pilots to design, construct and fly new craft and engines. The effect was to restore fifteen world records to France and consequently greatly to stimulate the popular interest in aviation. France thus, in 1924, may be said again to have become practically supreme in sporting aviation as she is unquestionably supreme in the military. Furthermore, this program of intensive stimulation of design is to be pursued in 1925, at the close of which many thousands of dollars will be distributed to the manufacturers and operations.

International policy, so marked in the projection of air lines, also influenced an amendment to the policy of subsidization, in a decree signed Sept. 8, 1924, reading as follows:

"The crews and mechanics (ground engineers) must be French, the flying material must have been constructed by a French firm established in

France, the French colonies or protectorates. Should, however, the enterprises be subsidized for the same service by countries other than France, certain derogations (subject to mutual agreement) may be permitted."

It is of especial interest to recall the above in connection with the reorganized Franco-Roumanian Company (now known as the International Air Navigation Company) which met with financial difficulties in Poland and Roumania, although both these Governments contributed to its support.

Le Bourget, the Paris airport, is undoubtedly the greatest in the world. Here center air lines, French, English, Belgian and Dutch, connecting Paris with London, Brussels, Amsterdam and Zurich. The operating sheets of Le Bourget, as obtained by the Aeronautical Chamber of Commerce, show the following:

1924	*Flights*	*Passengers*	*Cargo (kgs.)*	*Mail (kgs.)*	*French Line*	*Passengers to London or return*
Feb.	280	354	35,446	120	62	
Feb.	280	354	35,446	120	75	
Mar.	436	709	45,851	136	212	
Apr.	537	892	47,572	115	576	
May	694	1,177	94,123	235	502	
Jun.	935	2,164	116,618	239	606	
Jul.	1,337	3,796	145,710	341	1,129	
Aug.	1,099	3,568	134,386	401	1,051	
Sep.	1,039	2,193	135,697	400	570	
Oct.	836	1,540	99,550	293	495	
Nov.	501	581	58,750	163	87	
Dec.	256	363	35,155	86	87	
	8,178	17,556	971,894	2,617	5,576	

Probably the most curious elements of this report are the tremendous jump in passenger traffic during the summer tourist months and the very poor showing of air mail for the entire year.

The tendency in France, as elsewhere, has been to consolidate air operating activities. There are now but five groups in existence. Each is heavily subsidized, not only in cash allowances, but in such indirect but effective means of assistance as fields and meteorological and communicating services. These organizations are: Air Union, Farman, Latecoere, Aeronavale and International Air Navigation Company.

The Air Union is the oldest French air navigation company, dating back to 1919. During 1924 it reached its greatest development, traffic being more than double that in 1923. Its operation

of the Paris-London route has shown that aerial transportation can be carried on with almost perfect regularity and perfect safety. So successful has Air Union been, in spite of the vigorous competition of the British, that it is preparing to expand into Italy, Greece and across the Mediterranean. Operating figures for 1924 between Paris and London, as given by the French Committee of Aeronautical Propaganda, are as follows: Flights, 1,226; km. flown, 485,771; passengers transported, 5,622; kgs. of freight, 443,711; kgs. of air mail, 822.

Between Paris and Brussels and Amsterdam, the Farman company, aircraft and engine manufacturers, and the Dutch K. L. M. have been co-operating effectively, the Air Union giving commercial service to both Farman and K. L. M. on this route. During the year 1924 there were made: Flights, 571; km. flown, 138,-120; passengers carried, 1,362; kgs. of freight, 28,871; kgs. of air mail, 65. Extension of this activity into the Scandinavian countries is reported to be under way.

In bidding for English and American patronage on the above lines, Air Union issues most attractive advertisements, urging the visitors to "travel by air—safety, speed, pleasure, comfort." Aircraft utilized are twin-engined cabin ships. The cabins have large windows. There are upholstered armchairs. Radio telephone, newspapers, periodicals and other conveniences are provided. Luncheons are supplied on order. Accommodations within these great air liners are similar to those in a railway parlor car.

For the Paris-London trip the single fare is 400 francs; round trip, 750. Thirty pounds of luggage may be carried without charge. One way, Paris-Brussels, is 200 francs; round trip, 250. These fares include free motor car conveyance for passengers and hand baggage from the center of the city to the air terminal.

The air line in which the French government has been most interested politically in the last year is Latecoere—the Great Intercontinental Airways. M. Latecoere has had the ambition to penetrate through southern France, along the Spanish coast, over the Straits, and into the French possessions in North Africa. Early in 1925, when the Riffian rebellion, first against Spain, then France, commanded international attention, the Latecoere lines assumed an important part, especially in communications.

Operations in this sphere included the routes between Toulouse and Perpignan and Perpignan-Marseilles; Perpignan-Alicante; Alicante-Casablanca, one route via Malaga and Tangier and the other by Oran and Fez.

The Latecoere operations date from Sept., 1918, though flying was not begun until the following year. The impressive growth is shown by the following:

Year	*Km. Flown*	*Pass. Carried*	*Kgs. Cargo*	*No. of Letters*
1919	107,470	71	2,153	9,124
1920	366,049	614	38,703	176,191
1921	692,415	1,247	93,517	327,854
1922	1,102,961	3,338	181,567	1,406,352
1923	1,606,957	4,557	237,309	2,704,271
1924	1,830,560	7,255	335,303	4,026,572

At the close of 1924 Latecoere operated 120 machines and employed 50 pilots and 500 mechanics, etc.

M. Latecoere enjoys the sympathetic assistance of the French government in exploitation abroad. On Jan. 15, 1925, he opened an air line connecting Rio de Janeiro, Montevideo and Buenos Aires. He is ambitious to extend his Moroccan and South American lines until they meet, thus uniting France politically and physically with new commercial fields.

Aeronavale operates a short over water line between Antibes, on the mainland, and Ajaccio, Corsica. The intention is to extend this to Sardinia. Here is its operating record:

Year	*No. of Trips*	*No. of Passengers*	*Kgs. of Cargo*
1922	156	130	785
1923	222	203	508
1924	279	303	1,379

In Sept. 1924 the line took on a French air mail contract, but by the close of the year had carried only 1,467 letters.

The fifth and most commercially ambitious air transport undertaking is now known as Compagnie Internationale de Navigation Aerienne (International Air Navigation Company). It was formerly the Franco-Roumanian Aerial Navigation Company. It is not only subsidized by France, but also by the Governments of Roumania, Poland and Czecho-Slovakia, these nations being close political allies of France. Early in 1925 the company got into serious difficulties, due partly to harassing by the Germans and partly by the increased cost of operations in Poland, Roumania and Czecho-Slovakia. The Germans confiscated, it is reported, some 15 machines, and forced the company to get special equipment and fly into the Balkans over Switzerland and the Alps. The company applied to the French Government for additional subsidy

which, it is understood, was granted in part, notwithstanding the dire financial situation in which the Government found itself.

Starting in 1920, by 1924 the company had extended its operations over 3,694 kms. from Paris to Warsaw and from Paris to Angora. The great junction point is Prague. The International Air Navigation Company has head offices in Paris. Its principal operating stations are: Le Bourget (Paris), Prague, Budapest and Bucharest, where complete overhaul and repairs may be made. Minor service stations are maintained at Strasbourg, Warsaw, Vienna and Belgrade. At the major stations from 50 to 120 men are employed; at the minor, 25 to 30. The entire personnel numbers 500, including 30 pilots. The pilots fly approximately 400 hours per annum and their salary, dependent on their experience and number of hours of flight, is approximately 40,000 francs a year.

The long course, Angora-Warsaw, is divided into sections varying in length from 300 to 600 kms., to which are permanently assigned pilots and planes. In 1922 the average regularity of flight was 89%, in 1923, 94.8% and in 1924, 96%. Half of the interrupted flights were attributed to bad weather and half to mechanical difficulties. Flying as a rule has been only between February and October. In 1923 experimental night flights were begun from Paris to Strasbourg. Here is the operating record:

Year	*Kms. Flown*	*Kms. Per Pass.*	*Kilometric Tons*
1920	59,252	8,630	1,159
1921	606,514	794,497	105,722
1922	898,972	476,948	78,144
1923	1,313,735	972,011	184,704
1924	1,372,000	710,000	118,000

GERMANY

The air war between Germany and the nations allied against her did not end Nov. 11, 1918. One phase was simply superseded by another. German military aircraft construction and operation were forbidden and commercial construction and operation rigidly restricted and regulated by the Versailles Treaty (See Aircraft Year Book, 1923). Conditions imposed by the so-called Nine Rules were a challenge to German ingenuity to defeat the very ends they sought to accomplish. And today (January, 1925) it is a serious question whether Germany has not actually emerged the potential, if not the apparent victor.

The Nine Rules were reported to complete their agreed life

Jan. 1, 1925. At the time of this writing permission had been given to increase horsepower from 260 to 450. As 1924 drew to a close the French press renewed its attacks on what was declared to be secret German air power. The German press, more skilful since the chastening of war, entered categorical denials and then presented long and specious discussions of the necessity for "international co-operation" in the place of "national pools" if commercial aviation is to become established throughout the world. The significance of this plea is that the Germans base their air power on "international co-operation," and in such "co-operation" as has been established they are admittedly dominant. So even the neutral mind must feel considerable sympathy for the French view, which is summarized as follows by the air journal *Les Ailes:*

> Under the cloak of sporting aviation, Germany is working hard upon schemes which will give her 2,000 young pilots, all of them, after a brief final training, being available for war. Germany is nullifying the Allies' restrictions over her aircraft construction by the establishment of great factories for the mass production of metal warplanes in Denmark, Sweden, Russia and Italy.

Three hours by air from Berlin is the Rohrback works at Copenhagen; five hours distant is the Heinkel works at Stockholm; six hours distant is the Dornier works at Pisa and only 7 to 8 hours distant is the Junkers works near Kieff. Due to the not unnatural sympathy developed between militarily ostracized Germany and politically ostracized Soviet Russia, much importance is placed on the Junkers' constructing and operating activities radiating from Kieff.

To the above must in justice be added mention of the transfer of Zeppelin activities from Friedrichshafen to the United States. Although such arrangement constitutes protection against German airship activity it also assures the perpetuation of the German airship ideals and aspirations.

What does German air power consist of? The German air paper, *Deutscher Flugsport,* announces that one of the aviation associations has a great program to train 2,000 pilots within the next two years. Germany maintains her lead in motorless design and operation, which means progress in the underlying principles of aeronautic design. Due to the existence of factories abroad, there is no lack of commercial machines. And through persistent proselyting German air operations have been extended over the greater part of Europe, far into Asia, and, at this writing, are beginning to appear in South and Central America, with every indi-

cation of successful infiltration into the United States. To all the French charges, the Germans respond that, military aviation being suppressed, there exists only a shred of civilian activity, only 406 persons holding civilian pilots' licenses, and of these only 24 having been trained since the World War. There are said to be only 184 now in training.

In 1924 there was brought into being the Deutsche Luftrat, or German Air Council, a semi-official civil body, created to co-ordinate, centralize and direct the development of aviation in Germany. Its 35 members include six officers of the active army (two of them in the Ministry of War), one officer of the Air Police, and two from the air section of the Ministry of Transport. The Luftrat cannot be dissolved without authorization from the Ministry of Defense. Parallel with the formation of this interesting body is noted ambitious activity in Berlin, Hamburg, Cologne and other large cities to become centers, not merely of *intra-German* air transport, but of *international* air traffic. These aspirations do not find discouragement from the British who, through their Imperial airways pool, are ambitious to find several alternate air routes to India, and thus be protected against the closing of quick civil and military communications.

Out of the mass of propaganda appearing in the continental European press it seems that German air activity has been concentrated into three great enterprises, into all of which, to a greater or less degree enters the Junkers Company. These organizations are Deutscher Aero-Lloyd, A. G.; Junkers-Werke, A. G.; and the Europa System.

In the Aircraft Year Books, 1923 and 1924, it was shown how Junkers had successfully followed the policy of interesting other *nationals,* whether Government officers or local capitalists, in the idea of air transport, the general plan being for Junkers to supply the equipment and the other individuals or agencies the operating capital. Apparently this has been highly successful, for the Germans have penetrated throughout Russia, across into Persia, and, at latest accounts, are a most formidable rival to the former Franco-Roumanian Company for the political friendship of the Balkan states, and particularly the Turkish government. In this connection it may be remarked that the Germans have for the past several years carried on a private warfare with the French. The Franco-Roumanian Company, in getting into the Balkans, must either cross Germany or the Alps. In two years, it is stated, the company has lost fifteen transport planes through confiscation by the Germans. The French are now reported to be negotiating with Switzerland

for permission to pass over Swiss territory, and that special types of ships for high altitudes are being developed by the French.

Here is the list of German air lines, an asterisk indicating new ones:

DEUTSCHER AERO-LLOYD, A. G.

1. Berlin-Hanover-Amsterdam-London. (Deutsche Aero-Lloyd in conjunction with Imperial Airways, Ltd., of Great Britain.)
2. (Berlin)—Koenigsberg-Kovno-Moscow. (Deutsche-Russische Luftverkehrs Ges.)
3. Berlin-Copenhagen. (Deutsche Aero-Lloyd in conjunction with Danske Luftfartselskab of Denmark.)
4. * Berlin-Leipzig-Munich-Innsbruck. (Suddeutsche Aero-Lloyd, A. G.)
5. * Hamburg - Bremen - Dortmund - Frankfort - Mannheim - Stuttgart - Zurich. Wurtemberg Luftverkehr A. G. and Badisch-Pfalzische Luftverkehr Ges.)
6. * Bremen-Hanover-Leipzig-Chemnitz-Prague. (Mitteldeutsche Aero-Lloyd A. G.)
7. * Berlin-Dresden-Prague-Vienna. (In formation.)

JUNKERS-WERKE A. G.

8. Berlin-Malmö-Copenhagen (* Gothenburg-Oslo). Junkers Luftverkehr in conjunction with Scandinavian companies.)
9. (Berlin) - Koenigsberg - Memel - Riga - Reval - Helsingfors -(* Leningrad). (Junkers-Nord Europa Union.)
10. Berlin-Leipzig-Munich-Zurich-Geneva. (Junkers-Trans Europa Union.)
11. Frankfort-Furth-Nuremberg-Munich. (Junkers-Trans Europa Union.)
12. Munich-Vienna-Budapest. (Junkers-Trans Europa Union.)
13. * Berlin-Hanover-Ruhr. (Luftverkehrs Ges. Ruhrgebiet A. G., a Junkers subsidiary.)
14. * Frankfort-Karlsruhe-Zurich. (Badisch Luftverkehrs G.m.b.h.)
15. * Berlin-Dresden-(Prague-Vienna.) (Sachissche Luftverkehr A. G.)
16. * Berlin-Breslau-Gleiwitz. (Schlesschen Luftverkehrs A. G. and Gleiwitz Luftverkehrs A.G.)
17. * Berlin-Stockholm Overnight Service. (Experimental.)

EUROPA SYSTEM

The Trans-Europa System is incorporated with the Junker Air Traffic Company of Berlin as director of traffic operations. By it commercial airplane services in Germany, Austria, Switzerland, Denmark, Sweden, Danzig, Latvia, Esthonia, Finland and Russia are united under the general tutelage of the Junkers organization. Preliminary capital is placed at 5,000,000 marks, with an early increase to 10,000,000 marks. This Europa System takes over the Trans-Europa mentioned above and also the North European Union of Reval, Esthonia. Its practical effect is to give the Germans control over strategic air routes in middle Europe.

American Vice Consul Paul Bowerman at Berlin reports the following German air statistics:

	Number of flights		*Kilometers flown*	
	1923	1924	1923	1924
Junkers	3,554	5,742	870,694	1,322,720
Deutscher Aero-Lloyd	3,603	6,197	554,997	1,017,945
Total	7,135	11,939	1,425,691	2,350,665

	Number of passengers		*Freight baggage (kilograms)*		*Mail (kilograms)*	
	1923	1924	1923	1924	1923	1924
Junkers	8,149	12,674	50,750	83,750	5,700	15,000
D. Aero-Lloyd	2,423	8,195	36,800	53,810	3,711	9,000
Total	10,572	20,869	87,550	137,560	9,411	24,000

The line Berlin-Koenigsberg-Moscow is the most important, politically and commercially, of the German air enterprises. The line, Koenigsberg-Moscow, is 12,000 km. long and passes through the cities of Kovno, capital of Lithuania, and Smolensk, on the western frontier of Russia. Its flying season for the past three years has been, May 1st-November 1st. Equipment consists of ten Fokker planes, equipped with 360 h.p. Rolls-Royce engines. The passenger who leaves Moscow in the morning arrives the following morning in Berlin. In 1922 two flights were made each week in each direction. In 1923, beginning June 1st, three flights were made weekly in each direction. During the month of May, 1924, three flights were made weekly and beginning June 1st, daily service (Sundays and holidays excepted) was installed.

Here are the comparative results of operation:

	1922	1923	1924
Kilometers flown	152,980	192,680	346.040
Trips made	113	155	293
Passengers	286	352	522
Postal matter (in kilograms)	1,047	1,684	2,382
Merchandise " "	18,298	22,468	34,579
Total weight of cargoes "	42,225	50,550	78,982
Useful load (cargo) "			400
Regularity	96.5%	99.%	99.8%

According to a report from Nathaniel P. Davis, American consul in charge at Berlin, the cost of operating the private German air routes averages approximately 2 reich marks per kilometer (4.20 marks equalling one dollar). It has not been possible for the

German air lines to operate without a subsidy. This subsidy ranges from 50 to 75 per cent. of the operating expense. It is also stated that the routes to be flown are prescribed in advance by the Federal Traffic Bureau and for the total mileage flown a certain subsidy is granted from Government funds.

Great Britain

Lt. Col. The Rt. Hon. Sir Samuel John Gurney Hoare, Bart., C.M.G., M.P., is head of the administration of aviation in Great Britain, being Secretary of State for Air and president of the Air Council. Maj. Sir Philip A. G. D. Sassoon, Bart., G.B.E., C.M.G., M.P., is Under Secretary of State for Air and vice-president of the Air Council. Air Chief Marshal Sir H. M. Trenchard, Bart., G.C.B., D.S.O., is chief of the Air Staff and member of the Air Council. Sir W. S. Brancker, Air Vice-Marshal, K.C.B., A.F.C., is Director of Civil Aviation.

The policy laid down in 1923 of increasing as fast as possible the air force has been consistently followed, the principal advance being in the organization of the Home Defense Plan. According to Sir Samuel Hoare the British Ministry, "whilst earnestly desiring the further limitation of armament so far as it is consistent with the safety and integrity of the Empire, affirms the principle laid down by the late Government and accepted by the Imperial Conference, that Great Britain must maintain a Home Defense Air Force of sufficient strength to give adequate protection against air attack by the strongest air force within striking distance of her shores." The administration is working toward the figure of 52 squadrons for Home Defense within the next five years, of which 18 were to be complete by May 1925. By 1926 it is estimated that there will be 1,200 service machines in the British Isles alone. In 1925 it was admitted that French air strength was three times that of the British.

The appropriation for 1924 was £19,742,000. The Ministry has asked for an increase of £1,972,000 to cover the home expansion scheme and to replenish stocks due to the exhaustion of war surplus. This amount includes plans for forces in Iraq and Palestine and for the Fleet Air Arm.

The Home Defense Plan includes provision for the formation of non-regular Air Force Squadrons under the command of Air Commodore John G. Hearson. These non-regular units will be divided into two classes, the Special Reserve Squadrons and the Auxiliary Air Force Squadrons. Together these will total one-

fourth of the total strength of the Home Defense Arm, having seven Special Reserve and six Auxiliary squadrons. The latter are to be raised and administered by Territorial Associations and the Special Reserve through the Royal Air Service channels. These squadrons are to supplement the small number of highly trained regular units, there being no reserve at present in civil aviation.

The Auxiliary Air Force Squadrons have airdromes at Hendon, Glasgow and Edinburgh. The total strength will be 360 officers and 2,400 men, of which one-third were to be organized during 1925. The Special Reserve Squadrons first airdromes are being established near London and Belfast. Unity of command is assured by the appointment of Gen. Sir John Salmond as Air Officer Commanding. In matters relating to Home Defense this office is supreme over Army and Navy officers, the Air arm being recognized as the first in defense.

The present strength of the Royal Air Force apart from training units and establishments is the equivalent of 54 squadrons. Of these 43 and ⅔ are organized as such. 21 flights of ½ the strength of regular squadrons belong to the Fleet Air Arm. Eight squadrons belond to Iraq, 6 to India, and 4 and ⅓ to Egypt and Palestine. The personnel in 1925 is to be increased by 1,000, the present number being 3,262 officers and 28,337 men. At the end of 1925, fifteen squadrons of the Home Defense Service will be using war machines. The entire service will have 637 service machines, 166 training machines and 36 civil machines.

In April 1924, a new organization of commercial aviation became effective. The old system of subsidizing a number of companies was abolished and one large company, the Imperial Air Transport Company, Ltd., in which the existing companies were included, was formed. This company was required by the Air Ministry to have a capital of £1,000,000 of which £500,000 was subscribed in January. The Government guaranteed a subsidy, spread over ten years, of £1,000,000, payment during each of the first four years to be £137,000, thereafter being reduced to a final payment in the tenth year of £32,000. The main stipulation is that an average minimum of 1,000,000 miles per year must be flown. The government has the right to nominate one or two directors of the company and after the payment of a cumulative dividend of 10% per annum on the ordinary shares of the company the balance of the profits is to be divided equally between the shareholders and the government. When the government shall have received in dividends the amount of the subsidy without interest the government's share in the company shall belong to the stockholders.

The amalgamated company did not begin operations until May. During the year approximately 800,000 miles were flown, 18,000 passengers and 300 tons of freight were carried. The lines operated were:

London Paris-Basle-Zurich (525 miles).
London-Amsterdam-Hanover-Berlin (655 miles).
London-Ostend-Brussels-Cologne (315 miles).
Southampton-Guernsey (Seaplane service 112 miles).

Beginning April 20, 1925, the summer service includes three services daily in each direction on the London-Paris line, one service to Basle and Zurich, two in each direction to Cologne with one machine flying non-stop between the two towns and one stopping each way at Brussels, and two return services daily between London and Ostend. The machines link at Amsterdam with the Deutscher Aero-Lloyd for Hanover and Berlin, permitting passengers to take the night train from Berlin to Koenigsberg, leaving Koenigsberg the next morning by air and reaching Moscow in the afternoon. They also link at Amsterdam with the Swedish Air Line operating between Amsterdam-Hamburg-Copenhagen-Malmö, passengers leaving London at 8 o'clock arriving at Stockholm at 7 o'clock the following morning, having taken a night train at Malmö and saving 27 hours. Passengers for Vienna can take the service to Zurich and another machine to Vienna the following day. The traffic charges are:

London-Paris—Single, £6 6s; return, £11 5s. Excess luggage over 30 lbs. allowed free with ticket; 3d. per lb. up to 30 lbs.; 6d. per lb. above 30 lbs.

Paris-London—Single, 400 francs; return, 800 francs. Excess luggage, 1.50 francs per kilo up to 15 kilos; 3.00 francs per kilo over 15 kilos.

London-Brussels-Cologne: To Brussels—Single, £4 4s.; return, £8. Excess luggage, 6d. per lb. To Cologne—Single, £6; return, £10. Excess luggage, 6d. per lb. Brussels to Cologne—Single, 125 Bel. francs; return, 250 Bel. francs. Excess luggage, 2.00 Bel. francs per kilo.

Cologne-Brussels-London: To Brussels—Single, £2; return, £4. Excess luggage, 3d. per lb. To London—Single, £6; return, £10 10s. Excess luggage, 6d. per lb. Brussels to London—Single, 350 Bel. francs; return, 675 Bel. francs. Excess luggage, 3.00 Bel. francs per kilo.

London-Amsterdam-Hanover-Berlin: To Amsterdam—Single, £4; return, £8. Excess luggage, 5d. per lb. up to 100 lbs.; 4d. per lb. over 100 lbs. To Hanover—Single, £6 5s.; return, £12 10s. Excess luggage, 1s. per lb. To Berlin—Single, £8; return, £16. Excess luggage, 1s. per lb. Amsterdam to Hanover—Single, 40 Dutch florins; return, 80 Dutch florins. Excess luggage, .50 florins per kilo. To Berlin—Single, 60 Dutch florins; return, 120 Dutch florins. Excess luggage, .50 florins per kilo. Hanover to Berlin—Single, £2; return, £4. Excess luggage, 3d. per lb.

Berlin-Hanover-Amsterdam-London: Berlin to Hanover—Single, £2; return, £4. Excess luggage, 3d. per lb. To Amsterdam—Single, £5; return,

£10. Excess luggage, 6d. per lb. To London—Single, £8; return, £16. Excess luggage, 1s. per lb. Hanover to Amsterdam—Single, £3 5s.; return, £6 10s. Excess luggage, 5d. per lb. To London—Single, £6 5s.; return, £12 10s. Excess luggage, 1s. per lb. Amsterdam to London—Single, 48 Dutch florins; return, 96 Dutch florins. Excess luggage, .50 florins per kilo up to 50 kilos; .40 florins per kilo over 50 kilos.

Guernsey to Southampton—Single, £3; return, £5 10s. Excess luggage, 4d. per lb.

In May the Conference of Ambassadors decided to modify the rules controlling German aviation and the limit of engines to 260 horse power has been extended to permit building and flying machines up to 450 horse power. This ruling affects the Imperial airways which has hitherto been obliged to use small machines on flights to Germany but can now replace these with ten passenger planes. Agreements have also been reached with Germany by which the three monthly arrangement under which British airplanes are allowed to fly over Germany is done away with. An agreement has been signed for a period of five years allowing daily flights. Germany, however, refused to extend facilities to flights and destinations in other states which prohibits the contemplated British service to Prague and at the same time reserves such privileges to the Germans.

In 1924 the Imperial Airways, Ltd., had in service three Handley-Page W.8 planes, six D.H. 24s and two D.H. 50s. The Air Ministry has purchased from the Handley-Page Company a three-engined plane which it will loan to the company to try out on its commercial routes. This is another form of government aid in addition to the subsidy. Other such aids are the government owned and operated field at Croydon, the hourly meteorological service, special night lighting equipment and a radio finding system. The company itself does practically no experimental or development work.

At the time of the amalgamation of the companies the budget called for a total operating cost of 3s. 2.11d. per mile. After two months operating this was increased slightly more than 2 pence. Gasoline at 2s. and oil at 6s. are more expensive than in the United States. Salary scales are lower. Aviation insurance is at the rate of 22%. Maintenance has proven comparatively a low figure. The record of payments for lost or damaged cargoes is low, £500 having been allowed for legal expense for the year. Since January 1921 there has been no fatality on British Cross-Channel subsidized services. About 1% of the value of goods insured is claimed for loss.

New air liners ordered by the Imperial Airways, Ltd., include an Avro with a 600 H.P. Rolls-Royce "Condor" engine and a D.H. 54, a similar machine with the same type engine. It incorporates the automatic wing flaps which allow it to land at 52 miles per hour while it possesses a cruising speed of 100. It is also fitted with an under carriage which can be dropped allowing the machine (the lower portion of the fuselage of which is water tight) to alight in safety and remain afloat.

The letter air mail from London-Paris was 1,620 pounds in 1924 as compared to 1,550 in 1923. Air mail to and from Cologne declined from 9,700 to 5,700 lbs. due to the resumption of ordinary traffic. From June 10 to the close of the year (1924), the London-Hanover-Berlin air mail carried 1,350 pounds of letters for Germany and beyond. In the last three months an afternoon mail was established from London to Holland and during this period 84 pounds were carried.

The letter traffic to Holland totalled 975 pounds as contrasted with 1,470 in 1923, to Belgium 190 pounds as against 237. Through motor competition there was also a decline in the air mail to and from Iraq with 18,900 pounds in 1923 and less than 10,000 in 1924.

The air service to Morocco and Algiers increased from 1,137 to 1,740 pounds. From May 26 to early in October when it was closed for the winter, air mail facilities were offered during the day for Denmark and during the night from London to Hamburg and to Sweden and eastern Norway by use of the Rotterdam-Hamburg-Copenhagen air service combined with a supplementary morning air service from Hamburg to Copenhagen. Two hundred and seventy pounds of mail were carried.

The inland air mail operated for seven weeks in May and June and carried 1,000 pounds. The parcel post record shows an increase of 14% to Paris, being 27,000 pounds, to Holland a 20% increase to 14,250 pounds. The total quantity to Denmark, Norway and Sweden was 850 pounds, to Germany, from June to September, via Hamburg, 4,100 pounds, from October to December, via Cologne, 5,800 pounds. There is no parcel post from Paris to London but a freight service has been established insuring delivery the same day. Plans are being made for night service for the London-Paris air mail.

Col. Frank Searle, managing director of the Imperial Airways, Ltd., has said that "Unless aviation can be run on a paying basis it cannot be developed properly. If we are going to depend on subsidies, then commercial aviation is done for." F. Handley-Page is quoted to the same effect. The government holds the position

that after ten years the company will be self-supporting. Meanwhile the trend of policy seems to be toward operating as cheaply as possible the greatest number of miles and letting the traffic suffer. The only other operating line in Great Britain is the Northern Air Lines, Ltd., which is non-subsidized.

In November 20, 1924, Sir Sefton Brancker, Director of Civil Aviation with Mr. Alan Cobham as pilot left Croydon for Rangoon, returning March 17, 1925. The trip was made with a view of surveying the route for a commercial air service to India. Cities of Central Europe, Asia Minor, Iraq, the Persian Gulf, India and Burma were visited, 17,000 miles being flown. A reconnaissance of Mount Everest was made from 17,000 feet. The importance of the flight lies in the impetus given to the idea of imperial air routes linking the various parts of the Empire. Weather conditions in England retarding the progress of aviation, it is believed that the great future lies in routes to countries outside of Europe.

The Air Estimates for 1924-1925 provided £5,000,000 for the purchase of new aircraft and engines. The aircraft industry has been reduced or combined so that only 20 firms remain.

According to a plan laid down by the Government and announced by the Prime Minister in May 1924, the Air Ministry has sanctioned the construction of two airships, each of 5,000,000 cubic feet, or 150 tons, capacity. The program is in two parts which are to be carried out simultaneously:

(1) Airship development under direct control of the Air Ministry, comprising research, full scale experiments with existing ships at the Royal Airship Works, Cardington, erection of a shed in India, provision of mooring masts, gas plants, etc., at home and abroad, and construction at Cardington of a new airship of approximately 5,000,000 c. f. capacity to be designed with special reference to the requirements of Imperial defense, including Naval reconnaissance.

(2) Construction by a private firm of an airship of similar dimensions to be designed on commercial lines for commercial purposes. This ship will be built for the Air Ministry conditionally that the constructor may repurchase it for use on an approved British transport service at approximately half its actual cost and with the further proviso that the ship be available for use by the State as required.

The commercial ship is to be built by the Airship Guarantee Co., or the "Burney Group" at Howden. The two airships *R-33* and *R-36* are to be reconditioned for experimental work before work is begun on the new ship which will be known as the *R-101*. Experiments will be made in the line of estimation of stresses set

up by air pressure in various manœuvres and stresses of loads on various parts of the frame. Experimental flight will be made to Egypt. The British Government has approved a supplementary estimate of £350,000 for the year ending March 1925 which provides £150,000 for airships and £200,000 for airship development research and bases at home and abroad.

A three year program has been authorized. After allowing for the repurchase of the commercial airship it is estimated that the net expenditure involved during the period will not exceed £1,200,000. The prescribed trials of the commercial airship will include a series of tests in Great Britain and a voyage to India. The requirements are gas capacity 5,000,000 c. f., speed on trial flights at 5,000 feet not less than 70 miles per hour, total fixed weights not to exceed 90 tons. The price agreed upon is £300,000 with an additional payment of £50,000 as a contribution to the contractor's capital expenditure. Mooring masts and airship sheds will be built in Egypt and India. As soon as these have been prepared one of the reconditioned ships will proceed to Egypt and from there be used on a survey of the Egypt-India stage. On completion of the station in India the Air Ministry will conduct similar operations in the direction of Australia.

The specifications of the two ships are laid down as follows:

Air Ministry Ship R-101	*Commercial Ship*
Length, 720 feet.	Length, 695 feet.
Gas capacity, 5,000,000 c. f.	Height, 136 feet.
Maximum speed, 70 m. p. h.	Width, 138 feet.
Accommodation for 100 passengers.	Lift, 152 tons.
	Disposal lift, 75 tons.
	Power, 7 units, each of 550 h.p.
	Range, 9,000 miles at 50 m. p. h.; at full speed, 6,100 miles; with 120 passengers and 12 tons of luggage, food, water and fuel, 2,500 miles at 70 m. p. h.
	The gas is in 11 separate bags, being 2.08 times the size of the *Shenandoah*. The ship is planned on the streamline principle with passenger saloons in the body and control and observation cars in the nose.

The *R-101* is expected to be ready for trials by the end of 1926. It is to be made of stainless steel. It is expected to fly to Egypt in 2½ days, to Karachi in 5 days, to Johannesburg in 7 days and to Perth in 10½ days.

GREECE

The Minister of Communications of Greece has signed a convention with a French company providing for two aerial services each week and later a daily service, between Athens and Marseilles, with short stoppings at Corsica, Naples and Corfu.

GUATEMALA

Two French airplanes arrived in Guatemala City during the latter part of January, 1925, under the direction of the French Mission in Guatemala to be used in the establishment of air mail and passenger service between that city and the capitals of other Central American Republics.

HONDURAS

The E. E. Huber Honduras Co., Honduras, C. A., has created an aeronautical department with Harrison Estep as manager. Estep late in 1923 and early in 1924 flew from Washington, D. C., to Puerto Cortes, Spanish Honduras, in 29 flying hours or nine days elapsed time. Estep has had sent to Honduras 2 H. boats, 1 Curtiss M.F., 2 Aeromarine model 40s and 1 Curtiss J.N., in addition to several Wright and Curtiss engines. In December 1924 the Lincoln Standard Aircraft Corp., of Lincoln, Neb., shipped to the United Fruit Co. of Tela, Honduras, two Lincoln Standard Tourabouts, making the fourth plane delivered to the Fruit Co. during the past year and fifth to go to Honduras. These planes are used to transport officials of the United Fruit Co. from Tela, on the coast, to Tegucigalpa, 140 miles inland. This route is flown in about two hours while it takes five days to make the trip by any other means.

HUNGARY

On April 23, 1924, an air mail service between Vienna and Munich and Zurich was opened. The flights start from the aviation field at Aspern (Vienna). They leave the Austrian Verkehrsbureau, Friedrichstrasse, at 7:30 and 11:50 each morning and stop at the General Post Office to take in mails and passengers. The fare to Aspern is 60,000 crowns, and the fee for luggage is 12,000 crowns per 20 kilograms.

INDIA

Great enthusiasm was aroused in India by the British Government's proposal for imperial airplane and airship routes. The Indian

Government, after considering resolutions adopted by the Associated Chambers of Commerce of India and Ceylon, regarding the development of aviation, replied as follows:

"An imperial air mail service to India by airplane must develop by stages and it would be premature even to discuss the laying out or financing of the eastern link from Cairo to Karachi until the western link from London to Cairo comes into operation and enables conclusions to be drawn as to the practicability, financial and technical, of the major scheme. They (the government) propose, therefore, to concentrate their attention, and such financial assistance as it may be possible for them to give, upon the internal lines from Karachi to Bombay, Bombay to Calcutta, and Calcutta to Rangoon, which will be of immediate use and, if the major scheme eventuates, will form important links in the air route to the East."

As to the airship scheme itself, the standing finance committee of the legislative assembly has tentatively agreed to purchase an airship base at Karachi, to be leased, rent free, to the British Government, and for a subsidy of £26,666, spread over three years.

Italy

Premier Mussolini's vigorous pro-aviation policy, as noted in the Aircraft Year Book for 1924 (covering the calendar year 1923) bore fruit in 1924. Today the Italian air force has 11,000 officers and men. Its equipment has been brought up to date. There are 60 plane squadrons, with a total of 1,500 planes, of which 650 are listed as "first line, fighting." It was the plan to have a total of 2,000 by the summer of 1925, these to comprise 90 squadrons. Of the 2,000, 900 would be "first line, fighters."

The air budget for 1924-25 is 400,000,000 lire, approximately $20,000,000 at the present rate of exchange, but much more if the purchasing power of lira is considered. The budget is divided as follows: new equipment, 245 millions; pay of personnel, 78 millions; air stations, 30 millions; training, 18 millions; civil aviation, 10 millions. The total appropriation is about twice that of the Government when the Mussolini régime came into power.

The fight over a proposal for a separate air force has stirred Italian politics. Protests have been made in parliament over reduction in appropriations over actual promises made. The Fascist Party is on record as favoring a unification of Land, Sea and Air Forces into one great Department of National Defense. Aviation control is now under an independent comissariat.

In view of adverse criticisms, the Comissariat has issued a review of Italy's aeronautical progress, which shows that, whereas, in 1923, there were only 288 aircraft in commission, the Govern-

ment now has 700 in commission, not counting reserves. Late in 1924 press dispatches from Rome indicated that the proposed establishment of a consolidated Ministry of Defense was well under way.

Following the example set by Great Britain, Italy has formed a semi-official and heavily subsidized operating monopoly known as S. A. Aero Espresso Italiana, having offices at Rome, and possessing capital of 1,000,000 lira. To this corporation the state has granted a ten-year concession to establish and operate an air route between Italy, Greece and Turkey, via Brindisi-Athens-Smyrna, or in the event of this proving impossible, via Brindisi-Athens-Salonica-Constantinople. Either route is estimated as 1,512 km. long and the state is obligated to pay a subsidy of 16.80 lire per km. of actual flying. This subsidy is to be paid in monthly installments and represents 60 per cent. of the estimated total cost of operation which, on the basis of 315,000 km. flown annually, is counted as 28 lire per km. The state has the right to free transportation of postal matter up to 5,000 kilos per annum. The state will pay to the company 800,000 lira annually for maintaining the air fleet efficiency, it being implied that at least 50 per cent. will be ready to take the air in defense of the state.

Twelve air navigation companies are actively operating. Their names, together with their capital, are as follows: Compagnia Nazionale Aeronautica, Ltd., £1,000,000; Societa l'idrovolanti Alta Italia, Ltd., £2,000,000; Societa Anonima Gabardini per l'incremento dell-Aviazione, £2,000,000; Compagnia di Navigazione Aerea, Ltd., £1,300,000; Societa Aeronautica Meccanica, Ltd., £1,500,000; Societa Italiana sviluppo Aviazione, Ltd., £1,000,000; Cantiere Aeronautico Breda; Societa Anonima Rilievi Aerofotogrammetrici; Societa Aeronautica Italiana; Aero Espresso and Societa Aeronautica Macchi-Varese.

Under the direct encouragement of the Government, the Italian aircraft industry has made considerable progress. Not only is it extending its sales in foreign countries, such as Turkey, and the various nations of South America, but it is making experimental purchases abroad for the stimulation of Italian engineering. Such a purchase was that of engines from the Wright Aeronautical Corp. of Paterson, N. J. Aircraft missions from the Bolivian and Lettish governments visited Italy to inspect service methods and equipment.

To stimulate competition in design and operation, the Italian Aeronautical Committee offered a prize of 300,000 lira to pilots winning international or national records during 1924.

On April 22, the Sixth Congress of Aerial Legislation was held at Rome. The United States Government had three representatives.

JAPAN

The Japanese Government and the Japanese people are showing tremendous interest in the development of aviation, the newspapers giving much space to the discussion, from every angle, of aerial expansion, and the Imperial Civilian Aviation Association, as well as the Military Aviation Board receiving daily monetary contributions from people and students, these contributions being usually accompanied with applications for a positive step to be taken for the expansion of aviation. In order to maintain this popular interest the government gives exhibitions of flying.

For the year ending March 31, 1925, the air service appropriation was 25,000,000 yen. Four army divisions were abolished, resulting in the saving of 18,000,000 yen and 13,000,000 of this amount will be allotted to the establishment of twelve air squadrons, equally divided between pursuit, scout and bombing squadrons and certain ground units, anti-aircraft, etc. The navy department plans to add one flying corps in 1925, two in 1926, two in 1927 and one in 1928. This undertaking will be divided between the naval and communications services. A bureau will be created under the latter for the control of civilian aviation and the encouragement and protection of aeronautical undertakings and for the investigation of aerial enterprises of all kinds.

The Military Aerodromes are the Tokorozawa Army Flying School at Tokorozawa, Saitama-ken; the Shimoshizu Army Flying School at Yotsukaido, Chiba-ken; the Akeno Army Flying School at Akeno, Miye-ken; the First, Second Flying Battalion at Kagamigahara, Gifu-ken; the Third Flying Battalion at Yohkaichi, Shiga-ken; the Fourth Flying Battalion at Tachiarai, Fukuoka-ken; the Fifth Flying Battalion at Tachikawa, Tokyo-fu; and the Sixth Flying Battalion at Heijo, Chosen. The Naval Aerodromes are the Yokosuka Naval Flying Corps at Oppama, Kanagawa-ken; the Saseho Naval Flying Corps at Saseho, Nagasaki-ken; the Omura Naval Flying Corps at Omura, Nagasaki-ken; and the Kasumigaura Naval Flying Corps at Ami, Ibaraki-ken.

Besides the Army and Navy Aerodromes, there are ten civilian aerodromes and eleven civilian flying schools. Two aircraft manufacturers, the Japan Aeronautical Co. and the Japan Aerial Transportation Institute also possess flying schools. Civilian flying is permitted on most military aerodromes and army posts. These civilian schools train pilots eligible for the Flying Services and are a potential flying strength. Some of the civilian aerodromes in the Island of Formosa and in Korea are regarded as outposts of Jap-

anese power. The importance of the Naval Air Service is greatly emphasized and while the Army has depended largely upon French manufacture the Navy has bought the most modern equipment from every country in Europe. The great naval aerodrome at Kasumigaura is one of the best equipped aerodromes in the world. Here training is modeled on the British system and is under the supervision of British officers.

The Seiyukai, one of the strongest political parties in Japan, is formulating an elaborate legislative program including the organization of a special aerial defense committee, the encouragement of civilian aviation, further administrative readjustment for financing with better effect the proposed aerial defense program and a bold reduction in both the standing army and navy in order that money saved may be devoted to the nation's aerial service.

The Department of Communications has provided for 1,500,000 yen in Supplementary Estimates for 1924-1925 for the encouragement of civil aviation. Air routes between Tokyo and Osaka will be established besides the provision of subsidies for private aviation enterprises. Ambitious plans are being formulated by Tokyo business men for a $5,000,000 commercial aviation company to undertake freight and passenger services throughout the entire Japanese mainland and to carry out various other services such as forest patrol and spraying of crops. This plan has the support of the Aviation Bureau of the Department of Communications which proposes to introduce a subsidy bill in the present extraordinary session of the Japanese Diet in favor of the proposed enterprise. It is expected that the Diet in ordinary session will be inundated with bills concerning aviation projects, among them plans for a supplementary budget for the establishment of international aerial routes in Japan which would result in erection of air stations at Kagoshima and Osaka, the construction of aerial meteorological observatories, wireless stations, aerial signals and customs. Members of the Diet that belong to the Imperial Flying Association are expected to present a bill for the establishment of a great central aerodrome. A bill will be presented embodying a plan to create a new government department, the Department of Aviation similar to the British Air Ministry and to place under this one department all government aviation.

Commercial aviation in Japan is at present, however, a matter largely of future speculation, the development having been along military and naval lines. Japan is building up a strong manufacturing industry. Besides the two arsenals at Tokyo and Nagoya and

the two navy arsenals at Yokosika and Hiro, there are twenty-eight factories engaged in building airplanes or parts.

Each of the three large German aircraft works had a mission in Japan early in the year. It was reported that airplane service between Tokyo and Leningrad had been arranged by the German Junker Company. A flight organized by the Tokyo newspaper "Asahi" has been extended to London via Siberia. Two Japanese built Breguet biplanes will be used leaving Tokyo May 1 arriving London May 16. This route is held to be practical for commercial purposes by Colonel the Master of Semphill, head of the British Aviation Mission to Japan. He advocated traveling by way of Scotland, the west coast of Norway and the northern coasts of Russia, taking four days.

Mexico

The Mexican Government has signed contracts with the Mexican Aviation Co. for the establishment of airplane service between Mexico City and Tampico. The concession is for ten years. The same company also has concessions for mail and passenger lines from Vera Cruz to Progreso in Yucatan, via Puerto Mexico, Carmen and Campeche. Herr W. Kaemmerer, a German engineer who developed the Scadta service in Colombia, is at the head of this company. At the national aircraft factory there were recently designed and produced two new types of Mexican planes, one for the Liberty engine and one for the German B.M.V.

Netherlands

Military aviation in the Netherlands is under the War Department, naval aviation under the Naval Department and commercial aviation under a special aviation office of the Department of Public Works. There is one commercial operating company, the Royal Dutch Airlines, known as the K. L. M., working with a capital of 1,500,000 florins under a subsidy from the government of 300,000 florins a year by special contract ending Dec. 31, 1926. In 1924 this company operated from Jan. 1 to April 23 daily except Sundays, the following routes: Amsterdam–Rotterdam–London, and Amsterdam–Rotterdam–Paris. On April 23 a new line, Rotterdam–Amsterdam–Hamburg–Copenhagen was started. After June 3 the service to Paris was doubled. On Oct. 3 the Copenhagen service was stopped owing to bad condition of aerodromes. The company used ten Fokker planes, carrying one pilot and five passengers. During the summer the regularity of service was 95%. Exception-

ally bad weather reduced this to 83% during the winter. The traffic was as follows: Amsterdam–London, 1,523 passengers, 49,680 kgs. of goods, 490 kgs. of letter mail and 6,438 kgs. of parcel mail; Rotterdam–Copenhagen 859 passengers, 14,878 kgs. of goods, 762 kgs. letter mail, 4,070 kgs. parcel mail; Amsterdam–Rotterdam 211 passengers. The total passenger tariffs were 48 florins to and from London, 39.50 florins to Paris, 48 from Paris, 75 florins to and from Copenhagen. 48 florins to and from Hamburg, 12.50 florins between Amsterdam and Rotterdam. The goods tariff for London and Paris were .70 florin per kg., for Hamburg .80 florin per kg. and for Copenhagen 1.50 florins per kg. Letter mail was carried at a tariff of .10 florin above normal tariff for every 20 grams with destination for London, Hamburg and Paris and at a tariff of .15 above the normal tariff for every 20 grains with destination for Copenhagen.

Norway

A new Norwegian Air Traffic Company, the Norak Lufttrafik, has been formed in Christiania. The company will operate between Christiania and Copenhagen. Four seaplanes hired from the German Junker Co. will be used. The Norwegian Postal authorities have granted a subsidy of 500 kroner per flight and are allocating a total sum of 25,000 kroner for three months' experimental service.

Panama

An air mail service linking the capitals of the six Central American republics and Cuba with the United States is being discused by the Latin-American Governments with American officials. Joseph Magee, illumination engineer of the United States Air Mail Service and Vincent Burke of the Post Office Inspection Corps were appointed to visit the Central American capitals to make a preliminary investigation of the scheme. On the proposed route planes would leave Key West, go to Havana, thence westward across Cuba and the Yucatan Channel and southward to Guatemala City, the total distance being about 950 miles. From there the ships would go to San Salvador City, 110 miles. From there to Tegucigalpa, Honduras is 120 miles and from Tegucigalpa to Managua, Nicaragua, 260 miles. To San José, Costa Rica is 220 miles more and from there to Panama 330 miles. The entire route would cover 2,000 miles.

Persia

Great Britain, Germany and France are interested in aeronautical activities in Persia. At Teheran British machines are making daily

flights and passengers are carried between Teheran and Naku, Russia, at less cost than that of rail or motor. If mails are carried by this route and if extended, as intended, to Moscow and via Ispahan and Bushire to the Persian Gulf, Persia will be brought within one week's reach of India instead of almost a month and within ten days of England instead of eighteen. Persia has as yet no railroad system. In Persia the German Junkers Co. is active. Following visit to France of a Persian military mission, a French aviation Mission was sent to Persia to establish an aviation school at Teheran with six French machines.

Peru

The President of Peru issued a decree on August 15, 1924, authorizing the founding of an Aero Club in Peru, the principal purpose of which was to be the organization of civil aviation and the development of aviation in all its various phases, military and commercial and sporting.

Poland

Poland's civil aviation is under the direction of the Aviation Section of the Fourth Department of the Minister of Railroads, this department having charge of everything regarding the organization, the registration of machines, the granting of concessions to aerial companies and the instruction of pilots and mechanics. The Civil Aviation Body organized in 1923 acts as advisor to the Minister of Railroads on aviation questions. Aerial communication is in the hands of two companies, the Franco–Roumanian line, Paris–Strasbourg-Prague-Warsaw, and the Polish Aerial Co., Aero Lloyd, which operates lines between Warsaw–Danzig, Warsaw–Lwow, and Warsaw–Cracow. This company between 1922 and 1924 made 1,092 flights, totaling 644,365 km. The passengers carried numbered 2,193, the post 1,357.5 kgs. and the merchandise 52,106 kgs. The passenger tariff Warsaw and Danzig and Warsaw and Lwow is 65 gold francs. Between Warsaw and Cracow 50 gold francs. Twice the regular tariff is charged for letter mail and three times the regular tariff for packages. New lines to be put into operation immediately include lines from Cracow–Lwow, Danzig–Lodz–Kotowice–Cracow, an extension from Warsaw–Lwow to Bucharest connecting with the international line London–India, and an extension from Warsaw–Cracow to Vienna.

Portugal

Late in 1924 the Ministry of Commerce instructed the Commercial Aviation Commission to draw up conditions of a limited public competition regarding aerial postal routes, in particular Lisbon–Oporto, Lisbon-Madrid, and Lisbon-Madeira.

Roumania

Roumanian aviation, both civil and military working together are directed by the Crown Prince. The government is desirous of having a strong national industry and has formed a construction company which is reported to have made an agreement with a British firm for the erection of an aircraft factory in Roumania, the Roumanian government holding 60% of the stock and the Englishmen 40%. At present the government has renewed its war materials by orders in France or England, 500 aircraft having been ordered.

Soviet Russia

The evident exaggeration of facts and the desire to publish as already existing, achievements which are actually only planned, make an accurate summary of Russian Aviation difficult. Although many planes have been purchased, on account of the lack of funds for operations, and airdromes, there has not been much real progress. Poor organization and inadequate meteorological service have made systematic or successful flying impracticable. Reports as to the number of airplanes purchased by the Soviet government in 1924 vary from 400 for the entire year to 700 for the first six months. The plan of Trotsky provided for having 3,000 airplanes on hand. Much propaganda is carried on in Russia favorable to the establishment of a large air fleet.

The Friends of the Red Fleet Association had 963,000 members in April, 1924. During the year 3,500,000 rubles were collected and expended in the construction of 100 aircraft. In the streets and tramways of Moscow there are organized solicitors urging citizens to contribute for the aerial fleet. A circular urges peasants to contribute a part of the cereal harvest. Airplanes covered with posters inviting peasants and workers to join the group are exhibited in populous centers and frequently telescopes are placed to enable people to observe the performance of aircraft. The Russian air program for 1925 is said to provide for the purchase of 1,030 planes, 330 from Fokker in Holland and 200 from Italy and 500 to be

built in Russia, mostly by the Russian Junker Company. A large order for aero engines was placed in England.

The Soviet government has a plan to supplement the War Commissariat's airplane construction programme with aircraft to be constructed voluntarily by other commissariats. Each commissariat will have to build planes which will bear the names of the heads of the respective commissariat. Collectively they will bear the name of The Soviet People's Commissars of the Air. All Soviet institutions are to establish branches of the Aviation which all Red students must join. The Soviet Military authorities announce the establishment of new air bases at Proskuroff, Sebastopol, Rostoff sur Don, Kharkoff, Tsaritsin, Lyski, Fili, Tashkent and Omsk. Ten cannon and six engines of 620 horse power have been ordered from a British firm for dirigibles constructed in Russia. A military commission recently visited Austria where 200 airplanes were bought and sent to Russia.

In regard to civil aviation it was reported in the fall of 1924 that there were 22 aerial lines in existence when as a matter of record there were but two, the line between Koenigsberg and Moscow and the line between Moscow and Nijni-Novgorod. During 1924 the first of these lines, operated by the Russian–German company, Deruluft, made 137 flights covering a distance of 165,000 kms., carrying 214 passengers and 13,812 kilograms of freight. The second line was started in 1923 and in 1924 extended to Kazan. It is operated by the Soviet Society, Dobrolet. From 1923–1924 the distance flown by this line was 36,100 kilometers, passengers carried 103 and freight 2,987½ kilograms. In 1924 several new lines were planned but flights were made on only two of them, Kharkoff to Kieff, twenty flights, and Kharkoff to Odessa, 12 flights. Lines in the Crimea were planned by the Society Ukrvosduhput and Dobrolet and one all metal passenger plane was purchased but no confirmation is made of actual operation. Several lines were organized in the Transcaucasia by a Soviet Stock company as follows: Tiflis to Baku, 45 kms., Tiflis to Suran Suchem, 500 kms., and Tiflis-Baku-Enzelit-Teheran, 900 kms. In 1924, 185 flights were made, covering 26,440 kms.: 580 passengers were carried. The flights had no commercial purpose and were probably made for military reasons. The Soviet government having in mind the civil war in the middle Asiatic territories opened two new lines from Tashkent to Verny, 752 kms. and from Chiva to Buchara, 480 kms. These were operated by the Society Dobrolet with two German Junker machines.

An agreement has been made between Deruluft and the Dutch Aerial Communication Co. enabling the former to maintain services between Moscow and Paris, via Berlin and Amsterdam. The Deruluft, the Aero-Lloyd and the British Imperial Airway companies are planning night trips between Moscow and London. By co-ordinating day and night trips the distance could be made in one day. The Deruluft is said to have carried the same passenger between Koenigsberg and Moscow for fifty trips. The Russian Junkers company has bound itself to establish a line from Leningrad to Baku with connections with Stockholm and Teheran.

Two planes have been built by Russian engineers, Russian workmen and from Russian materials. Interest is shown in Russian aviation circles in the building of a large plane with several motors by the Russian engineer I. I. Sikorsky in America. It is believed the large plane will be the most practical for commercial use in Russia. In September, an all-Russian gliding competition was held near Feodosia in the Crimea. Of the 48 entries, 38 flew, the best record being made by Youngmeister, piloting a Moskvich glider. He remained aloft 5 hours and 15 minutes. An airplane crossed the Hindu Kush mountain range for the first time in 1924, flying at an altitude of 20,500 feet.

Siam

The aerial forces of Siam which include 70 pilots, in service, 200 reserve pilots and 300 airplanes, mostly French, are used by the Siamese government to develop the welfare of aviation and the country. The Service Royal Aeronautique has been organized to transport mail, passengers and merchandise. There are two aerial lines, the first from Korst to Ubol, through Roi Ech and the second from Korat to Huonghai. These cities have organized stations with hangars and repair parts. Aviation is very popular and subscriptions have been made by princes of the royal house and government members to donate airplanes to the Royal Air Force.

Spain

With a view to the regularization of aviation services in Spain, a Royal Order was published in October, 1924, to the effect that all Ministerial Departments must submit to the Central Aviation Commission all questions dealing with aeronautics. Commercial air services are as yet in the initial stage of development and although present transport conditions should favor their extension, up to the present very little has been actually accomplished. Military aviation

has undergone considerable development in connection with operations in Morocco. There are in operation in Spain three commercial air lines, the, Seville–Larache; in Morocco, the Barcelona–Alicante–Malaga, en route from Toulouse to Casablanca, and the Alicante–Oran. Of these only the first which is maintained by the Compañia Española de Trafico Aero, S. A. with the aid of a heavy subsidy from the government is controlled by a Spanish company. The other two are operated by the French Latecoere Company. The Seville-Larache line only exists by government aid and its traffic is largely military. The distance is 200 miles and the flight is made in two hours. A small quantity of mail and a number of military passengers are carried. It is reported that the government grants the line a subsidy of 3,000 pesetas for each day a complete trip is made. A concession has been granted by the government for the establishment of a new line from Barcelona to Seville. The government has advertised for bids from Spanish companies for the establishment of aerial postal service between Seville and the Canary Islands. Concessions for ten years with renewal for similar periods will be granted to the selected company. The Latecoere company (French) has also proposed a line connecting Spain with the Canary Islands, probably via Casablanca for mail and passenger service. It was reported in August, 1924 that two Junker (German) machines were stationed at Las Palmas to make the test of a new air line between the Canaries and Barcelona as a part of a line to unite Berlin to Buenos Aires, passing through Italy and Spain.

Sweden

The first regular air line in southern Sweden was inaugurated July 1, 1924, daily service between Malmö and Hamburg being started on that date and service between Malmö and Copenhagen a few days later.. The operating company is the Aktiebolaget Aerotransport, organized by the Florman Brothers. The service was continued for six months, arrangements being made with the Swedish Postal authorities to carry mail to Hamburg when it was marked and an extra fee paid. Plans for operations for 1925 include the reopening of the line to Copenhagen May 1 and the line to Hamburg May 15.

The company reports that the present lines had been run with a percentage of 95.5% in performance and that 3,100 passengers had been carried with no accidents.

The Swedish Cabinet is considering subsidies of 500,000 kroner for the support of regular air traffic, a grant of 128,000 kroner for

improving the airdrome at Malmö, a grant of 4,000 kroner for meteorological service and a special fund, known as the aviation loan fund granted for the purchase of aircraft amounting to 800,000 kroner for the coming year.

The Swedish Board of Trade in a report to the crown recommends that a special loan fund of 2,000,000 kroner ($563,000) be established for the operation of air services on the condition that the air lines should be sanctioned by the government, the materials sanctioned by the aviation authorities, the routes to be in accordance with a scheme sanctioned by the government, including the charges for mails, passengers and goods, and the whole of operations to be subject to control by an authority designated by the government. The operating company has used Junker (German) planes but a manufacturing company was to be started by the Florman Brothers in February, 1925. In January, 1925, there were 293 private individuals in Sweden in possession of licenses for the operation of airplanes.

Switzerland

The increasing importance of air transportation in Europe is shown in the recent action of the Council d'État of the Canton of Geneva in appointing an aviation commission to study ways and means of assisting the development of aerial transport lines now touching at Geneva and the feasibility of creating additional lines. The committee proposes to enlarge and modernize the present aviation field at Cointrin, Geneva, in order to induce new lines to come to that city and to make a careful study of time schedules of the various routes with a view to effecting transfers and connections at Geneva with the trans-European lines. A system of landing lights and signals is to be installed for night flying. All of the operating companies report a good season and most of them are building extensions. There is only one regular daily service owned and operated by a Swiss company, the Lyons–Geneva–Lausanne route, operated by the Aero Société Anonyme. This service has only one connection with other European services, the morning plane from Lyons connecting at Geneva with the daily German plane for Zurich, Munich and Berlin.

There are various foreign services touching at the cities of Switzerland. The Imperial Airways of London with the Belgian Society, S. A. B. E. N. A. operates between Berne and Basle where connections are made to Paris–London or Paris–Brussels–Rotterdam.

A sum of 70,000 francs has been provided in the Federal Budget

for 1925 for the promotion of civil aviation, this amount to be distributed in the form of grants. The sum set aside in 1924 was 50,000 francs.

From May 1 to Sept. 30, 348 landings and 347 departures were recorded at Basle, 193 being foreign planes and 155 Swiss machines. Two hundred and fifteen passengers alighted at Basle and 250 others passed through in transit from Zurich to Paris and London. Mail and goods carried totaled 2,919 kgs. to and 5,145 kgs. from Basle. Imperial Airways Ltd. carried 165 passengers and 880 kgs. of mail and goods in 86 flights, while the "Sabena" carried 261 passengers and 7,181 kgs. of goods and mails in 131 flights.

Turkey

The Turkish aviation service is in process of reorganization. Following a visit of a Turkish mission to France, 40 airplanes were purchased from French manufacturers and will be used in the school of instruction at Eski-Cher.

CHAPTER IX

CHRONOLOGY OF AERONAUTICAL EVENTS DURING 1924

1 km. = 0.621 miles
1 kg. = 2.20 pounds

(* For amplification, see end of Chronology. For additional airships and World Flight data, see Respective Chapters.)

Jan. 2 — Sociedad Rio Platense de Aviacion starts regular service, Buenos Aires-Montevideo.

Jan. 3 — Torpedo plane squadron leaves Naval Air Station on U.S.S. *Vega* to join Asiatic Fleet; formation of Aircraft Squadrons, Asiatic Fleet.

Jan. 11 — Burri in Blanchard seaplane (2 Hispano-Suiza 300 h.p.) establishes at Saint Raphael, France, new world altitude record of 12,283 feet for seaplanes carrying 2204.62 lbs. useful load.

Jan. 14
April 1 — Aircraft Squadrons of Scouting Fleet and Battle Fleet and Marine aviation units, participate in combined fleet maneuvers in Caribbean.

Jan. 16
May 27 — *Aeromarine all metal hull flying boat makes 15,000-mile flight, cruising in the West Indies, New York to Porto Rico and back, 200 hrs. flying time.

Jan. 16
Jan. 17 — U.S.S. *Shenandoah* breaks from mooring mast, Lakehurst, N. J., 6:45 p. m. in terrific gale. After drifting over Northern New Jersey and Staten Island, she is brought under control and returns, 3:56 a. m., under her own power.

Feb. 9 — National Aeronautic Assn. awards Collier Trophy to Air Mail Service for having made most notable advance in aviation in 1923.

Feb. 22 — *Lt. John A. Macready, U.S.A., takes off from McCook Field, Dayton, in Packard Le Pere airplane (400 h.p. Liberty, 35,000 ft. supercharger) and reaches indicated altitude of 41,000 feet. Break in supercharger forces descent.

Feb. 26 — *Army Air Service pilots under Major Roycroft Walsh from France Field, Panama Canal Zone, return from flight to Central American republics, stopping at capital of each.

Feb. 27 — Corp. C. E. Conrad, U.S.A.S., at Kelly Field, Tex., establishes what is believed to be record altitude jump from service ship not equipped with supercharger; jumps 21,500 ft. from D.H.-4-B piloted by Lt. L. S. Andrews.

Mar. 4 *Army Air Service planes fly over Platte River, between Columbus and Valley, Neb., and by dropping bombs clear channel in ice jam, thereby averting flood.

Mar. 5 Two South African Air Force planes fly, Pretoria-Capetown, 1,000 miles; 9 hrs. 45 min.

Mar. 7 *Lt. E. H. Barksdale, U.S.A.S., with Capt. Bradley Jones, A.S.O.R.C., flies D.H.-4-B from Dayton to New York, 575 miles, 3 hrs. 53 min., clipping 11 minutes off record made by Lt. Alex. Pearson, Jan., 1923. Greater part of distance flown above clouds, airmen being guided solely by navigating instruments.

Mar. 7
Mar. 8 *Seaplane races, Miami, Fla. Curtiss Marine Trophy won by Lt. V. F. Grant, U.S.N., flying a Vought (Wright E.-3 180 h.p.) at 116.1 m. p. h.

Mar. 11 Sadi Lecointe in Nieuport Delage (Hispano-Suiza 300 h.p.) establishes at Meulan, France, new world record of 29,462 ft. for seaplane altitude.

Mar. 15
Aug. 2 Maj. Stuart MacLaren in Vickers *Vulture* leaves Calshot, England, in attempt to fly around world; wrecked at Petropavlovsk, Komandorski Islands, North Pacific.

Mar. 27 New altitude record of 29,462 ft., carrying 250 kilos useful load for Class C airplanes established at Dayton by Lt. Harold R. Harris, U.S.A.S., in T.P.-1 (Liberty 400 h.p. supercharged).

Mar. 29 Lt. Vincent J. Meloy, U.S.A.S., with Lt. Williams, A.S. Tennessee Natl. Guard, flies from Nashville, Tenn, to Fairfield, O., 1 hr. 50 min.

April 2
June 20 Maj. Brito Paes leaves Lisbon in attempt to fly around world; wrecked at Macao.

April 6 Flying a Farman *Goliath* and carrying a load of 2204 lbs., the French pilot Coupet establishes new altitude record of 19,000 feet for this class.

April 6
Sept. 28 United States Army Air Service's three Douglas World Cruisers (Liberty 400 h.p.) leave Seattle in attempt to fly around world; return to Seattle Sept. 28, after having circumnavigated globe by air. (See World Flight Chapter.)

April 16 *Lt. H. C. Downey, U.S.A.S., and Bradley Jones, navigator, fly 600 miles above the clouds, Dayton, O.-Albany, N. Y., entirely directed by Pioneer earth inductor compass.

April 17 Naval Lt. Pelletier d'Oisy in Blanchard seaplane (2 Hispano-Suiza 300 h.p.) establishes at Saint Raphael, France, new world altitude record of 6,988 ft., for seaplanes carrying 3306.93 lbs. useful load.

April 18 Pescara in his helicopter, two propellers (Hispano-Suiza 180 h.p.) establishes at Issy-les-Moulineaux, France, world air line flight record of 2414 ft. for helicopters.

April 22 Capt. Geo. W. Steele, U.S.N., and Maj. James E. Chaney, U.S.A.S., represent United States at Sixth Congress of Aerial Legislation, Rome.

April 23 Flying around 45-mile course, Lt. E. M. Powers, U.S.A.S., at Kelly Field, Tex., piloting Thomas-Morse pursuit plane, attains speed of 174.7 m. p. h.

April 23 W. T. Van Orman, in *Goodyear III,* wins national balloon race, San Antonio, Tex.-Rochester, Minn.; duration 44 hrs. 4 min.; distance 1,072 miles.

April 24

May 20 Lt. Pelletier d'Oisy in Breguet leaves Paris in attempt to fly around world; wrecked at Shanghai.

May 2 *Lts. John A. Macready and A. W. Stevens, U.S.A.S., make unofficial two-man altitude record, 31,540 ft., over Dayton, in LePere.

May 6 Lucien Coupet, in Farman *Goliath* (Farman 600 h.p.) establishes at Toussus, France, new world altitude record of 18,868 ft. for airplanes carrying 2204.62 lbs. useful load.

May 11 Second German glider meet, held at Rossiten, near Koenigsberg, won by German school teacher Schulz, 8 hrs. 42 min. 9 sec., breaking all records.

May 17 Lucien Bossoutrot in Farman *Goliath* (Farman 600 h.p.) establishes at Toussus, France, new world altitude record of 6,371 ft. for airplanes carrying 6613.86 lbs. useful load.

May 19 Wing Comndr. J. S. Goble and Fly. Off. L. E. MacIntyre, Royal Australian Air Force, complete 9,000-mile flight around Australia. Start Melbourne Apr. 6; return in 44 days.

May 21 Lt. J. A. Macready, U.S.A.S., in LePere (Liberty 400 h.p. supercharged) establishes American altitude record of 35,239 feet, at Dayton, O.

May 22 Lt. H. R. Harris, U.S.A.S., in T.P.-1 (Liberty 400 h.p.) establishes at Dayton, new American altitude record, 16,732 ft., for airplanes carrying 2204.62 lbs. useful load.

May 31 *One hundred thousand attend air meet, Naval Air Station, Lakehurst, N. J.

May 31 International aerial exhibit, Prague, Czecho-Slovakia.

June 3–4 U.S.S. *Shenandoah* flies from Lakehurst to Albany and Buffalo and return. Message from President Coolidge broadcast over Albany. Water recovery apparatus used for first time.

June 9 Lt. Pelletier d'Oisy, French world aviator, covers 11,500 miles in attempted flight from Paris to Tokio, April 24th to June 9th, in 46 days. Plane crashes while attempting landing on golf course in Shanghai.

June 14 Adj. Burri eclipses world's altitude record for airplanes with 1,000 kgs. load, reaching altitude of 13,120 feet in 1 hr. 5 min.

June 15 Lt. Ernest de Muyter, Belgian Army, wins for third consecutive time, International Free Balloon Race, starting from Brussels, thereby winning permanently for his country the James Gordon Bennett Trophy.

June 22–23 *Lts. F. W. Wead and J. D. Price, U.S.N., in Curtiss C.S.-2 (Wright 585 h.p.) establish at Washington new world seaplane speed record of 74.17 m. p. h. for 1,500 kil.

June 23 Sadi Lecointe wins Beaumont Cup speed contest, Istres, France, and also breaks world's speed record over 500 km., held by Lt. Alex. Pearson, U.S.A.S. Lecointe's record for 300 km.

was 311 k. p. h., and for 500 km. 306 k. p. h. Pearson's record was 270 k. p. h.

June 23 *Lt. Russell L. Maughan, U.S.A.S., makes "Dawn to Dusk" flight from Atlantic to Pacific Coast. Flies 2540 miles, New York to San Francisco, in 21 hrs. 48½ min., in Curtiss pursuit plane.

June 28 Message from President Coolidge broadcast from U.S.S. *Shenandoah* over Philadelphia.

June 28 Royal Air Force Pageant, London.

June 28 Lt. L. G. Meister, U.S.A.S., in Martin bomber (2 Liberty 400 h.p.) establishes at Dayton new American speed record for 500 km., 74.90 m. p. h., for airplanes with 551.15 lbs. useful load.

June 28 Lt. Meister, as above, establishes new world speed record of 74.90 m. p. h., for 500 km. for airplanes carrying 1102.31 lbs. useful load.

June 28 Lt. L. H. Harris, U.S.A.S., in Douglas D.T.-2 (Liberty 400 h.p.) establishes at Dayton world duration record of 9 hr. 11 min. 53.48 sec. for airplanes with 1102.31 lbs. useful load, return to point of departure.

June 28 Lt. Harris, as above, establishes new world distance record of 590.3 miles.

June 28 Lt. Harris, as above, establishes new world altitude record of 28,143 feet.

June 28 Lt. R. Lockwood, U.S.A.S., in C.O.-5 (Liberty 400 h.p.) establishes at Dayton new American speed record for 100 km. of 112.346 m. p. h., for airplanes with 551.15 lbs. useful load.

June 28 Lt. Lockwood, as above, establishes new American speed record for 200 km. of 112.346 m. p. h.

June 28 Lt. Lockwood, as above, establishes new American speed record of 112.346 m. p. h. for 100 km. for airplanes carrying 1102.31 lbs. useful load.

June 28 Lt. Lockwood, as above, establishes new American speed record of 112.346 m. p. h. for 200 km. for airplanes carrying 1102.31 lbs. useful load.

June 28 Lt. H. R. Harris, U.S.A.S., in Douglas D.T.-2 (Liberty 400 h.p.) establishes at Dayton new world duration record of 9 hr. 11 min. 53.4 sec. for airplanes with useful load of 551.15 lbs., returning to point of departure.

June 28 Lt. Harris, as above, establishes new world altitude record of 29,462 feet.

June 28 Lt. Harris, as above, establishes new world distance record of 590.3 miles.

June 28 Lt. Arrachart, in Breguet I.'.B-2 (Renault), wins French Coupe Michelin, starting from Le Bourget, Paris; average speed 91.5 m. p. h.; distance 1770 miles; time 19 hr. 22 min. 26 sec.

June 29

Aug. 25 Summer maneuvers of Aircraft Squadrons, Scouting Fleet, off New England.

July 1 Post Office Department opens regular through day and night Air Mail Service between New York and San Francisco.

July 6 — Flying from Rockwell Field, San Diego, to San Francisco, Maj. H. H. Arnold, U.S.A.S., with Group Capt. M. G. Christie, British Attaché, as passenger, breaks all speed records between these points. Time: 4 hrs. 25 min. Distance: over 500 miles.

July 9–10 — Curtiss C.S.-2 (Wright engine) makes unofficial duration record of 20 hrs. 28 min., Anacostia, D. C.

July 11–12 — *Lts. F. W. Wead and J. D. Price, U.S.N., in Curtiss C.S.-2 (Wright 585 h.p.) establish at Washington new world duration record of 14 hrs. 53 min. 44.2 sec. for seaplanes, returning to point of departure without refueling.

July 11–12 — *Lts. Wead and Price, as above, establish new world distance record of 994.19 miles for seaplanes.

July 16 — New world duration record without refueling made when French aviators Coupet and Drouhin remain aloft in Farman for 37 hrs. 59 min. 19 sec. over a circuit between Etampes and Chartres, France. This betters endurance record of Lts. Oakley G. Kelly and John A. Macready of U.S.A.S., by 1 hr. 5 min. 36 sec. and by 44 min. the refueled world duration record made by Lts. Lowell H. Smith and John P. Richter, U.S.A.S.

July 22
Aug. 23 — Maj. Pedro Zanni in Fokker leaves Amsterdam in attempt to fly around world; wrecked at Hanoi, French Indo-China.

July 23 — Osaka *Mainichi* (a newspaper) promotes flight by Japanese pilot in Japanese plane around Hondo, southern island of Japan. Distance, 4,395 km.; flying time, 33 hrs. 52 min.

July 25
Aug. 17 — Lieut. Antonio Locatelli in German designed Dornier *Wal* leaves Pisa in attempt to fly around world; wrecked in flight from Iceland to Greenland.

Aug. 7 — Lt. Col. H. C. Brinsmead, Controller of Civil Aviation, Australia, starts from Melbourne on flight around Australia, completing it Aug. 29. Distance, 7,550 miles.

Aug. 8 — Non-stop flight of 1,118 miles made by Lt. W. R. Peck, U.S.A.S., from Kelly Field, San Antonio. Tex., to Kokomo, Ind. Time, 8 hrs. 20 min.

Aug. 8 — U.S.S. *Shenandoah* moored to U.S.S. *Patoka* in Narragansett Bay. First mooring of airship to mobile mooring mast.

Aug. 10–11 — G. Gourmier establishes in France world duration record, 22 hrs. 34 min., for balloons of 600 cu. m.

Aug. 12 — Annual British race for King's Cup, 952 miles, won by Alan J. Cobham, De Haviland 50 (Siddeley Puma 230 h.p.). Speed, 106 m. p. h.

Aug. 14 — Lt. James H. Doolittle, U.S.A.S., in D.H.-4-L, completes cross country flight of 6,755 miles, within 9 days. Actual flying time, 74 hrs. 36 min. Average speed, 90 m. p. h. Taking off from Dayton, O., Aug. 6, he flew to Omaha, Cheyenne, Salt Lake City, Harney, Walla Walla, Seattle, Red Bluff, San Francisco, Los Angeles and San Diego, which he reached Aug. 9. Returning, he made stops at Grand Junction, Denver, Fort Sill, San Antonio and Kansas City and reached Dayton on Aug. 14.

Aug. 15 U.S.S. *Shenandoah* in 40-hr. flight over Atlantic, scouting for units of Scouting Fleet.

Aug. 18 Lt. Berndt Krook, Heinkel S. I. (Rolls-Royce 360 h.p.) establishes at Stockholm new world altitude record of 18,671 ft. for seaplanes carrying 551.15 lbs. useful load.

Aug. 25
Sept. 12 Marine Corps aviation participate in fall maneuvers in Maryland.

Aug. 27 First trial flights of airship *ZR-3* in Germany.

Aug. 27 Italian constructed German Dornier *Wal* flies from Marina de Pisa to Melilia, in North Africa, 1,000 miles non-stop, in 10 hrs. 27 min., carrying 2⅓ tons.

Aug. 27 J. F. Laporte in Schreck seaplane F.B.A. (Hispano-Suiza 300 h.p.) establishes at Argenteuil, France, new world altitude record of 15,600 ft. for seaplane carrying 1102.31 lbs. useful load.

Aug. 29
Sept. 1 Flying meet, Old Orchard, Maine.

Aug. 30 Flight of four De Haviland planes, commanded by Maj. Junius W. Jones, U.S.A.S., and including Lts. Irvin S. Amberg, Wm. K. Moran and Edward M. Robbins, pilots; Lt. Charles T. Snow, radio officer, and three enlisted mechanics, left France Field, Panama Canal Zone, for Costa Rica, on visit of courtesy. Trip to San José, 350 miles, covered in 5 hrs. 40 min.

Sept. 1–2 Thirty-two airplanes attend air meet, Bartlesville, Okla.

Sept. 7 Aviation meet, Prague, Czecho-Slovakia.

Sept. 7 Capt. J. Kalla, Czecho-Slovakia, in Army A-12 (Maybach German 260 h.p.) establishes at Prague new world speed record for 100 km. for airplanes with 1102.31 lbs. useful load, returning to point of departure; 125.59 m. p. h.

Sept. 7 Sgt. Kaspar, as above, establishes new world speed record of 117.57 m. p. h. for 200 km.

Sept. 7 Sgt. F. Lehky, as above, establishes new world speed record for 100 km. of 140.6 m. p. h. for airplanes with useful load of 551.15 lbs.

Sept. 7 Sgt. Lehky, as above, establishes new world speed record for 200 km. of 126,13 m. p. h. for airplanes with 551.15 lbs. useful load.

Sept. 14 Oehmichen in his helicopter (Le Rhone 180 h.p.) establishes at Arbouans, France, world helicopter altitude record of 3.28 feet, carrying 220.46 lbs. useful load.

Sept. 14 Oehmichen, as above, establishes world helicopter altitude record of 3.28 feet carrying 440.92 lbs. useful load.

Sept. 20 Lympne, England, light airplane competition opens.

Sept. 27 Curtiss Navy Racer seaplane, at Port Washington, L. I., flies 227.5 m. p. h. Pilot, Lt. David Rittenhouse, U.S.N. This is the ship in which Rittenhouse, in 1923, won the Schneider Trophy in England.

Sept. 28 American Round-the-World Flyers return to Seattle, official starting point of the flight, thus terminating their epochal feat of circumnavigating the globe by air for the first time.

Sept. 29 Fairchild Aerial Camera Corp. presents aerial map of New York City to Mayor Hylan.

Sept. 30–31 H. Von Thaden and W. A. Morton, of Aircraft Development Corp., in balloon *Detroit,* establishes American duration record of 13 hrs. for balloons of 901-1200 cu. m. Flight from Washington Court House, O., to Gondola, Va.

Sept. 30–31 Von Thaden and Morton, in above flight, establish American distance record for balloons, 901-1200 cu. m., 305 miles.

Sept. .. Douglas T-2 torpedo seaplane, piloted by Lt. Ben H. Wyatt, U.S.N., refueled at sea from destroyer, off San Diego.

Oct. 1 Van Der Hoop (Dutch pilot), leaves Amsterdam in Fokker plane for Dutch East Indies.

Oct. 2, 3, 4 *Second annual convention, National Aeronautic Assn., Dayton, O.

Oct. 2, 3, 4 *National Air Races, Dayton, O.

Oct. 2 *Lt. John A. Macready, U.S.A.S., flying a supercharged N.B.S.-1 (Curtiss Martin bomber) with Jean Althoff as passenger, and carrying 1500 kilos or 3306.9 lbs. of dead weight, breaks world's altitude record, held by Sadi Lecointe, of France, by ascending 17,000 feet.

Oct. 2 *Lt. Macready in Curtiss Martin bomber, N.B.S.-1 (2 Liberty 400 h.p.) establishes at Dayton new world duration record of 2 hrs. 13 min. 49.6 sec. for airplanes carrying 2204.62 lbs. useful load, returning to point of departure.

Oct. 2 *Lt. Macready, as above, establishes new world duration record of 2 hrs. 13 min. 49.6 sec. for airplanes carrying 3306.93 lbs. useful load.

Oct. 3 *Lt. H. R. Harris, U.S.A.S., and Mech. Doug. Culver, in Barling Bomber (6 Liberty 400 h.p.) establishes at Dayton new world duration record of 1 hr. 47 min. 10.5 sec. for airplanes carrying useful load of 4409.24 lbs.

Oct. 3 *Lt. Harris, as above, establishes new world duration record of 1 hr. 47 min. 10.5 sec. for airplanes with useful load of 8818.48 lbs.

Oct. 3 *Lt. Harris, as above, establishes new world altitude record of 4472 feet for airplanes with useful load of 8818.48 lbs.

Oct. 3 *Godfrey Cabot of Boston, Maj. R. W. Schroeder of Chicago, Maj. Howard F. Wehrle of Kansas City and Col. B. F. Castle of New York, elected President, Vice President, Secretary and Treasurer, respectively, of National Aeronautic Assn.

Oct. 6 Glider meet in Sirdmola hills, near Asiago, Italy. Herr Martens remains aloft 4 min. 3 sec.

Oct. 7–25 Flight of U.S.S. *Shenandoah* from Naval Air Station, Lakehurst, N. J., with Admiral Moffett, to Camp Lewis, Wash., and return, via Fort Worth, Tex. 9,000 miles, twice across the Rockies; 258 hrs. flying time.

Oct. 9–10 *Unofficial records for seaplane endurance (20 hrs. 28 min.) and distance (1460 miles) made with Curtiss C.S.-2 seaplane (Wright engine) at Naval Air Station, Anacostia, D. C. Lts. Andrew Crinkley and R. G. Lyons, U.S.N., pilots.

Oct. 10 Callizo in Gourdou-Lesseure monoplane (Hispano-Suiza 300 h.p.) establishes at Villacoublay, France, world altitude record of 39,586 feet.

Oct. 10 *Eight Martin bombers, flown by Army Air Service pilots, make night flight, Langley Field, Va., to Mitchel Field, New York City.

Oct. 11–12 National Air Congress, Wichita, Kas.

Oct. 12–15 *Flight of airship *ZR-3* under Dr. Hugo Eckmer and German crew from Friedrichshafen, Germany, to Naval Air Station, Lakehurst, N. J., 5,066 miles, in 81 hrs. 17 min. Capt. Steele, U.S.N., official observer.

Oct. 14 International Commission for Aerial Navigation ends meeting in Paris.

Oct. 14 Army Air Service airship T.C.-5 completes successful flight, 940 miles, Scott Field, Ill., to Springfield, Mo., Tulsa, Okla., Wichita, Kas., and return to Scott Field. This flight believed to be longest made by non-rigid airship without mooring mast or hangar facilities en route.

Oct. 14–15 Douglas S.D.-W (Wright 675 h.p.) piloted alternately by Lts. Andrew Crinkley and R. D. Lyon, U.S.N., establishes new duration record, 20 hrs. 10 min. 10 sec. Average speed of 75 m. p. h. maintained for 1,500 miles.

Oct. 24 Karl Lesch in Rohrbach German metal seaplane (2 Rolls-Royce 360 h.p.) establishes at Sund, Denmark, new world distance record of 684.64 miles for seaplanes carrying 551.15 lbs. useful load.

Oct. 24 Karl Lesch, as above, establishes world speed record of 98.79 m. p. h. for 100 km.

Oct. 24 Karl Lesch, as above, establishes world speed record of 98.694 m. p. h. for 200 km.

Oct. 24 Karl Lesch, as above, establishes world speed record of 97.368 m. p. h. for 500 km.

Oct. 24 Karl Lesch, as above, establishes world speed record for 94.736 m. p. h. for 1000 km.

Oct. 25 *Naval Air Pageant, Bay Shore Park, Md. Seventeen world records for seaplanes established by Navy planes, including maximum speed record at 188.82 m. p. h. with Curtiss C.R.-3 seaplane, Lt. G. T. Cuddihy, pilot.

Oct. 25 *Lt. R. A. Ofstie, U.S.N., in Curtiss Navy Racer (Curtiss D.-12 450 h.p.) establishes at Baltimore new world speed record of 178.25 m. p. h. for 100 km., seaplanes.

Oct. 25 *Lt. Ofstie, as above, establishes new world seaplane speed record of 178.25 m. p. h. for 200 km.

Oct. 25 *Lt. Ofstie, as above, establishes new world seaplane speed record of 161.14 m. p. h. for 500 km.

Oct. 25 *Lt. Geo. R. Henderson, U.S.N., in Navy P.N.-7-1 flying boat (2 Wright 535 h.p.) establishes at Baltimore new American speed record of 78,507 m. p. h. for 100 km. for seaplanes with 551.15 lbs. useful load.

Oct. 25 *Lt. Henderson, as above, establishes new American speed record of 78.507 m. p. h. for 200 km.

Oct. 25 *Lt. Henderson, as above, establishes new American speed record

of 78.507 m. p. h. for 100 km. for seaplanes carrying 1102.31 lbs. useful load.

Oct. 25 *Lt. Henderson, as above, establishes new American speed record of 78.507 m. p. h. for 200 km.

Oct. 25 *Lt. Henderson, as above, establishes new world duration record of 5 hrs. 28 min. 45 sec. for seaplanes carrying 2204.62 lbs. useful load.

Oct. 25 *Lt. Henderson, as, above, establishes new world distance record of 466 miles for seaplanes carrying 2204.62 lbs. useful load.

Oct. 25 *Lt. Henderson, as above, establishes new world speed record of 78.507 m. p. h. for 100 km. for seaplanes carrying 2204.62 lbs. useful load.

Oct. 25 *Lt. Henderson, as above, establishes new world speed record of 78.507 m. p. h. for 200 km. for seaplanes carrying 2204.62 lbs. useful load.

Oct. 25 *Lt. O. B. Hardison, U.S.N., in equipment as above, establishes new world distance record of 62.137 miles for seaplanes carrying 3306.93 lbs. useful load.

Oct. 25 *Lt. Hardison, as above, establishes new world speed record of 68.4 m. p. h. for 100 km. for seaplanes carrying 3306.93 lbs. useful load.

Oct. 25 *Lt. Hardison, as above, establishes new world duration record of 1 hr. 49 min. 11.98 sec. for seaplanes carrying 4409.24 lbs. useful load.

Oct. 25 *Lt. Hardison, as above, establishes new world speed record of 68.4 m. p. h. for 100 km. for seaplanes carrying 4409.24 lbs. useful load.

Oct. 25–26 U.S.S. *Shenandoah* returns at midnight to Lakehurst, N. J., after completing round trip transcontinental flight.

Oct. 29 Herr Botsch flies from Babenhausen airdrome, near Darmstadt, to Berlin, in light airplane; distance, 310 miles; time, 3 hrs. 30 min.; non-stop.

Oct. 31 Australian prime minister makes notable flight, Winton to Longreach and return, on Queensland and Northern Territory Air Services.

Nov. 5 Zdenko Lhota, Czecho-Slovakian, leaves Prague Nov. 5, making 1,000 mile trip into Jugo-Slavia in monoplane with 60 h.p. engine.

Nov. 6 Van Der Hoep, Dutch pilot, leaves Aleppo and in 12 days covers 5180 miles to Bangkok.

Nov. 8 *Loening *Air Yacht* flown by Lts. Victor E. Bertrandias and G. C. MacDonald, U.S.A.S., establishes new seaplane record for 1,000 km. (621 miles) at Langley Field, Hampton, Va. Average speed, 102.642 m. p. h.

Nov. 11 Adjt. Chef. A. Bonnett, in Bernard monoplane (Hispano-Suiza 450 h.p.) at Istres, France, makes speed record of 389.89 k. p. h. (243.68 m. p. h.).

Nov. 20 Air Vice Marshal Sir W. Sefton Brancker, K.C.B., piloted by Alan J. Cobham, leaves Croydon (London) for Rangoon, returning Mar. 18, 1925, having flown 17,000 miles in 220 hrs.

Nov. 24 Van Der Hoep completes 15,000 mile flight, Amsterdam to Batavia.

Nov. 25 Rigid airship *ZR-3* renamed U.S.S. *Los Angeles* by Mrs. Calvin Coolidge, Ship leaves Lakehurst, N. J., 10 a. m., arriving at Washington 3 hrs. later.

Nov. 29 Adjt. Foiny in Potez type 15-A.-2 (Lorraine 400 h.p.) establishes at Villacoublay, France, new world speed record for 500 km. of 122.37 m. p. h. for airplanes with 551.15 lbs. useful load.

Nov. 30 Paumier in Schreck F.B.A. (Hispano-Suiza 350 h.p.) establishes at Argenteuil, France, new world speed record of 88.928 m. p. h. for 100 km. for seaplanes carrying 1102.31 lbs. useful load.

Nov. 30 Paumier, as above, establishes new world speed record of 88.626 m. p. h. for 200 km. for seaplanes carrying 1102.31 lbs. useful load.

Dec. 3 Representative C. F. Curry, of California, introduces H. R. 10147, a bill to create a Department of Aeronautics.

Dec. 5–21 Paris Aero Show under direction de la Chambre Syndicale des Industries Aeronautiques.

Dec. 9 Representative Samuel E. Winslow, of Massachusetts, reintroduces the Civil Aeronautics Act, proposing to establish a Bureau of Civil Aeronautics in the Department of Commerce.

Dec. 11 Warrant Off. Bonnett in Ferbois monoplane (Hispano-Suiza 550 h.p.) establishes at Istres, France, new world speed record of 278.48 m. p. h.

Dec. 11 Adjt. Chef. A. Bonnett in Bernard monoplane (Hispano-Suiza 450 h.p.) establishes at Istres speed of 448.17 k. p. h. (278 m. p. h.).

Dec. 14 New aviation field at Oklahoma City formally opened. Twenty-five thousand people attend. Army aviators from Post Field, Fort Sill, Okla., participate.

Dec. 17 Twenty-first anniversary of first successful airplane flight, made by Orville Wright, Kitty Hawk, N. C.

Dec. 18 German Junkers Co. obtains concession from Persian Government to operate tri-weekly air service, Teheran and Bagdad.

Dec. 26 Lt. Maurice Demblon, Belgian Army, makes gliding flight of 37 min. 7⅘ sec.

Aeromarine All Metal Hull Boat Cruise

The West Indian cruise of the Aeromarine Plane & Motor Co.'s all metal hull flying boat, from Jan. 16 to May 27, ranks as one of the most remarkable commercial aviation achievements yet recorded. The all metal hull boat was designed by Paul G. Zimmerman, chief engineer, as the result of experience gained in operating wooden hull boats by Aeromarine Airways, Inc., between Key West and Havana, and out of New York City and on the Great Lakes. It was designed for both airworthiness and seaworthiness.

The boat was named *Morro Castle II*. C. J. Zimmerman, chief test pilot, was pilot of the cruise. The start was made from Keyport, N. J., at 11 a.m., Jan. 16. In addition to Zimmerman there

were three others aboard. The boat, empty, weighed 3,600 lbs.; fully loaded for the cruise, 6,100 lbs. Such stiff head winds were encountered that only 270 miles were covered the first day, overnight stop being made at Manteo, N. C. At daybreak Jan. 18 they were off and 8 hrs. later had flown 600 miles to Dayton, Fla. Jan. 19 was spent in minor repairs and Jan. 20 they went on to Miami, where an oil tank was replaced. After five days in Miami, the flight was continued to Key West, where favorable weather was awaited before attempting the hop over the Florida Passage to Matanzas, Cuba. This was done Jan. 29.

The trip was undertaken upon the assurance that it would pay for itself, and immediately upon arrival in Cuban waters commercial flights were announced. Six days later $1,400 was transmitted to Keyport, in addition to a considerable sum held in reserve for going expenses. The cruise was continued down the northern coast of Cuba from Jan. 28 to Mar. 1. There was no trouble, though at Cardenas a new fuel tank and one cylinder were installed.

On Mar. 4 the *Morro Castle II* took off from the ocean in front of Baracoa Harbor at 7 a.m. and landed that evening in Lake Tortugas, 40 miles west of San Juan, Porto Rico. While cruising low, approaching the Porto Rican coast, racing against approaching darkness, the plane was banked sharply and the carburetors starved. This forced a landing in an 8 foot sea. The staunch hull met each impact sturdily and after reserve gas was drawn on took off safely. This over-ocean flight of 600 miles was made mostly against strong northeast trade winds.

On Mar. 5 they proceeded to San Juan harbor and from then until Apr. 2 made daily passenger flights, frequently operating to Culebra, where the Atlantic Fleet winter maneuvers were in progress. On Apr. 2, after the motor had had 157 hrs. in the air, the plane was lifted out of the water by derrick. The condition of the hull illustrated the value of metal instead of wood. In addition to barnacles there were full grown oysters attached aft the step. The hull had endured the pounding of seas and had been subjected to sharp changes of temperature. Yet after scraping and painting it was as good as new. The old motor was replaced with a new one, which was flown for 30 hours before the return flight was begun, on May 23. On this date the *Morro Castle II* left San Juan at daylight on the 700 mile hop to Antilla, Cuba. There was an hour's stop for lunch in the lee of Tortuga Island, off the northeast coast of Haiti. The entire flight to Cuba required 9 hours, elapsed time. There were no refunding facilities en route.

On May 24, just before leaving for Key West the collector

strainer on the rear carburetor sheared its bolt, forcing a landing behind the keys on the north coast of Cuba. Emergency repairs were made at sea and the flight continued 550 miles to Key West. May 26 the party headed north and in 12½ hrs. flying reached Southport, N. C., 800 miles distant. The start May 27 was made before breakfast, food being obtained at Manteo, N. C., after a 200 mile flight. At 11 a.m., they took off on the final leg, stopping briefly at Keyport, leaving there at 3:15 p.m., and coming to rest some twenty minutes later at the Aeromarine airport, 82nd St. and North River. On this journey the *Morro Castle II* was in the air 200 hrs. Average speed was 75 m.p.h. Fifteen thousand miles were flown and 3,000 passengers carried. When the boat was examined at the plant it was found to be in as good condition as when it started.

Macready's Altitude Flight

At 9:32 a.m., Feb. 22, Lt. John A. Macready, U.S.A.S., took off from McCook Field, Dayton, O., in an attempt to regain the world altitude record. He flew the same Packard Le Pere biplane (Liberty 400 h.p.) in which his previous record had been made. The supercharger with which his engine was equipped was a new development of the General Electric Co.'s laboratories and was built to function with sea level efficiency at 35,000 feet. At 11:22 Macready landed, his barographs showing an indicated altitude of 41,000 feet. The record as held by Sadi Lecointe, of France, is 36,564.8 feet. Macready's former record was 34,509.5 feet. Macready's new figure was subject, however, to subsequent reductions under the Bureau of Standards and F.A.I. calibrations. Intense cold was encountered during the flight, a strut thermometer having burst at 70 degrees below zero, Fahrenheit, while a cockpit thermometer registered 75 degrees below zero. Macready, although warmly clad, suffered keenly. He reported that at the peak of his climb there was a breakage which shook the ship badly, and which he believed to have been in the supercharger. This forced descent, when it was found that the trouble was caused when a cam shaft roller bearing gave way. In further contrasting Macready's splendid attempt to regain the record, it may be stated that the ship in which Lecointe flew weighed but 2,000 lbs., while the Le Pere weighed 4,600.

Central American Flight

Between Feb. 4 and Feb. 26 the Army Air Service conducted a courtesy flight into Central America. The trip was made in a

Martin bomber. Mileage was nearly 2,000; flying time about 26 hr. 20 min. The commanding officer was Maj. Raycroft Walsh. With him were Capt. A. W. Smith, Lts. L. L. Beery, P. Wainer, L. W. Miller and F. P. Albrook and Sgts. L. R. Crevier and R. Roesser. The report of Lt. Beery, the navigating officer, is regarded as of great value to future commercial operations in this difficult territory.

The expedition lacked maps, consequently had to explore its way. With ordinary commercial maps, and the findings of this expedition, however, it will be possible for other flights to be safely and expeditiously made. The start was from France Field, Panama Canal Zone. The first leg was 225 miles to David, which requires crossing the Veragua mountain range, through a pass requiring an elevation of about 3,000 feet on the Pacific course. The airline route down the Atlantic coast is shorter, but an elevation of 7,000 to 8,000 feet must be attained.

From David to San José, Costa Rica, is 160 miles, where a landing is possible in a long, narrow valley. From San José to Managua, Nicaragua, it is necessary to mount 5,500 feet through a mountain pass, or to go between the mountains and the Gulf of Nicoya. The distance is 215 miles. Landmarks to guide pilots are found in volcanic peaks. From Managua to San Salvador, 225 miles, the course follows the coast line and a government owned field affords satisfactory facilities. The shortest flight of the trip, 110 miles, from San Salvador to Guatemala City, is in some respects the most difficult, as it is necessary to attain an altitude of 8,500 feet to get over the mountains.

Bombing an Ice-Jam

Early in April the Union Pacific Railroad Company, which has frequently suffered from ice jams and floods in the Platte River, requested the assistance of the Army Air Service in averting another inundation. Two Martin bombers and two De Havilands were assigned, and fifty 300-lb. and three hundred 100-lb. bombs provided. The Air Force was "mobilized" at Fort Crook, near Omaha, on Feb. 27. March 3 it was reported that the Platte had formed an ice gorge near North Bend, Neb. An air base was established at Richland, Neb. Early in the morning of Mar. 4, bombing was begun and continued for six hours, when the jam was released. Further bombardment was made the next day. It was ascertained that the ice formations were in layers, which effectively restrained débris floating away unless the whole mass was dislodged to the

bottom of the river. It is not believed that the obstructions could have been successfully attacked in any other way than by air. Bombs dropped from an altitude of 1,000 feet penetrated to the bottom before exploding, thus opening up continuous channels. The success of the effort saved untold losses to the railroad and adjoining property.

Navigating Above the Clouds

Mar. 7 and Apr. 16 marked two remarkable illustrations of navigating above the clouds. On the first date, Lt. Hugh Barksdale, test pilot at McCook Field, with Bradley Jones, navigator, took off at Dayton in a cross country De Haviland for New York. The machine was equipped with navigating instruments, including the Pioneer earth inductor compass. Through the cumulus stratus clouds the plane rose rapidly to 7,000 feet. The ground was covered with snow, but only flashes of it could be seen and after Fairfield, O., no land check against navigation could be made. Jones measured the drift carefully, which, because of the tail wind, was at no time more than 3 degrees. Newark and Columbus were invisible. The Ohio river could not be spotted. After 100 miles of flying, the plane was forced, because of snow storms, to 13,000 feet, which was its ceiling. After the first 350 miles of flying, the wind, which at one time was 51 m.p.h. died out. For two and one half hours the path of the plane lay in and out of clouds. Finally descending in the clouds to 7,000 feet, the Susquehanna river was picked up, and the first land check after three hours of flying was Reading, Pa. New York harbor lay under a heavy fog, but so truly had the D.H. been held to its course, that it came out just above Manhattan. The distance of 575 miles was covered in 3 hrs. 45 min., the fastest time ever made for the trip.

On Apr. 16 1st Lt. H. C. Downey and Mr. Jones, navigator, flew from McCook Field to Albany, N. Y., 600 miles, 10,000 feet altitude, having navigated the entire distance with the aid of the Pioneer earth inductor compass. The next day the party continued on to New York without maps, using only their navigating instruments.

Curtiss Marine Trophy Race, Miami

Seaplane races under the jurisdiction of the National Aeronautic Association were held at Miami, Fla., Mar. 7 and 8. The first event was a civilian free for all race for the Miami Chamber of Commerce Trophy, six laps of the 25 km. triangular course (93.2 mi.). Three Curtiss *Seagulls,* one Curtiss M.F. boat and one Aero-

marine 39.-B participated. Harry Rogers, in a *Seagull* (Curtiss C.-6 160 h.p.) won at a speed of 69.6 m.p.h.

The Royal Palm Bombing Contest attracted seven Army and Navy entries. The target was thirty feet square and most of the bombs struck at most not more than fifty feet from the mark. First place was taken in a U. S. Air Service Martin bomber by Capt. E. E. W. Duncan and Lt. H. A. Craig. Second and third places were taken in Navy F.5-Ls, respectively by Lts. Harrell and Finch and Lt. Comm. Ramsey and Lt. Compo.

The Flamingo Handicap Trophy Race was eight laps of the course 124.27 miles, for Navy pilots only. Lt. Richard, piloting an H.N.-2 (Wright J.-1 200 h.p.) won. Time—1 hr. 16 min. 45.83 sec. Speed—97.05 m.p.h. The J.-1 is a radial type manufactured by the Wright Aeronautical Corp., Paterson, N. J. Second and third places were taken in F.-5-Ls, each equipped with two 400 h.p. Liberty engines. Lt. Harrell and Lt. Finch made 77 m.p.h., and Lt. Martin and Lt. Keene, 76.65 m.p.h.

The race for the Marine Trophy put up by Glenn H. Curtiss was flown on Mar. 8. Cash prizes totalled $1,500. There were five entries, all from the Navy Bureau of Aeronautics. The distance was 124.27 miles, or eight laps around the course. Lt. Grant, in a Vought V.E.-7 (Wright E.-3) was the winner. Lt. Murphy in an H.N.-2 (Wright J.-1) was first away. In the third lap Grant had overtaken him crossing the sighting wires one minute in the lead. On the fourth lap he had increased this to 2 min., on the fifth to 3 min. 15 sec., on the sixth to 4 min. 18 sec., and on the seventh to 5 min. 30 sec. His total time was 1 hr. 4 min. 11.18 sec., an average of 116.1 m.p.h. Lt. Sprague in T.S.-1 (Wright J.-1) was second at 102.2 m.p.h., and Murphy third, at 102 flat. Of the five entries all but one were equipped with Wright engines.

High Altitude—Enormous Aero Photo

On May 2, Lts. John A. Macready and A. W. Stevens, of McCook Field, the former famed for his altitude flights and the latter for his aero photography, took off from Dayton in Macready's altitude ship, a Le Pere, equipped with a supercharger. They reached an indicated altitude of 36,000 feet, later corrected to 31,500 feet, which is understood to be an unofficial two-man world record for height. From this vast height Stevens took air photos. The finished prints showed an area of about nineteen square miles, practically the entire city of Dayton. The value of such an achievement of the camera for war purposes is great. A plane flying at such an

altitude is beyond sight or hearing of those on the ground. It is far beyond the range or possible hope of range of anti-aircraft guns. Still, it was proved that a perfectly clear map of territory passed over can be secured, the topographical features of which can be brought out by enlargement processes. The camera used on this trip was the Fairchild Automatic K.-3, made by the Fairchild Aerial Camera Corp. of New York.

Naval Air Meet, Lakehurst, N. J.

Performance of the Navy's great rigid airship *Shenandoah* was the attraction which drew 100,000 spectators from Pennsylvania, New York and many New Jersey points to the Naval Air Station, Lakehurst, N. J., on May 31. It is estimated that this is the greatest number of persons ever assembled in one area on one day for any event in the United States. Automobiles were noted from fourteen states. When the *Shenandoah* made a flight toward evening all highways radiating from the station were choked for five to eight miles with a double line of cars. The program of events included formation flying and bombing with De Havilands, formation acrobatics with Voughts and a mock combat, free balloon flights, flight by the Navy non-rigid airship J.-1, parachute jumps and a mimic war staged by detachments of Marines from the Scouting Fleet. Marine Corps pilots from Quantico, Va., and Navy pilots from Anacostia provided the heavier-than-air entertainment, while lighter-than-air activities were conducted by the personnel of the Lakehurst station.

New World Seaplane Records

The new Curtiss C.S.-2, designed by the Curtiss Aeroplane & Motor Co., and equipped with the Wright Aeronautical Corp.'s 585 h.p. engine, was the means of bringing many new seaplane records to the United States.

Lts. Frank W. Wead and John D. Price, U.S.N., took off in a Curtiss C.S.-2 at 12:16 p.m., June 22, from the Potomac river, Anacostia (Washington) and when they landed at 1:39 a.m. the next day they had five world records to their credit. They raised the seaplane distance record from 792 to 963.12 miles; duration from 11 hr. 16 min. 59 sec. to 13 hr. 23 min. 15 sec.; speed (500 km.) from 72 to 73.41 m.p.h.; speed (1,000 km.) from 70.49 to 74.27 m.p.h.; and speed (1,500 km.) to a new record of 74.17 m.p.h. The old records had been made in June, 1923, in a Douglas seaplane, by Lt. M. A. Schur, U.S.N., at San Diego, Cal.

On this notable occasion the Curtiss C.S.-2 covered 31 laps of a 25 km. course, extending from Haines Point, near the Naval Air Station, to Marshall Hall, some nine miles down the Potomac river, with one elbow in the course, making it triangular. The breaking of the records was incidental to the real purpose of the test, which was to determine the duration and speed capabilities of the C.S.-2 for service operations. Important data on gasoline consumption and performance in the air was obtained.

The same pilots with the same plane at the same place went up on July 11 and 12 and increased their own distance record from 963.12 to 994.19 miles and their duration from 13 hr. 23 min. 15 sec. to 14 hr. 53 min. 44.2 sec. Upon landing fuel remained in the tanks sufficient for five more hours. The C.S.-2 was able to leave the water with 690 gallons of gasoline because of the installation of a third pontoon, which gave additional flotation. This third pontoon was dropped after the plane had taken the air.

On Oct. 9 and 10 Lts. Andrew Crinkley and Ross G. Lyons, U.S.N. in the same C.S.-2, with same Wright engine, made a new trial. Unfortunately this effort was not officially observed, for, taking off from Anacostia at 11:30 a.m. Oct. 9, they did not land until 7:58 a.m. the next day, thus making a non-stop flight of 20 hr. 28 min. and increasing the mileage to 1,460. The pilots alternated at the controls. So heavily loaded was the plane with gas that a three mile run was necessary to get off the water.

Oct. 25 the speed for seaplanes for 500 kil. was increased to 161.14 m.p.h. by Lieut. R. A. Ofstie, U.S.N., flying a Curtiss racing seaplane, with Curtiss 450 h.p. engine. Nov. 8 the seaplane speed for 1,000 km. was increased to 102.642 m.p.h., by Lts. Victor E. Bertrandias and G. C. McDonald, U.S.A.S., flying a Loening *Air Yacht* (Liberty 400 h.p.). The 1,500 km. speed record stands.

Maughan's "Dawn-to-Dusk" Flight

After two failures in preceding years, Lieut. Russell L. Maughan, U.S.A.S., succeeded, on June 23, in flying from New York to San Francisco between Dawn and Dusk. It was a most remarkable achievement, all the more so because of the equipment, which was a new-type standard Curtiss P.W.-8 pursuit ship, with Curtiss 450 h.p. engine—a type normally used for short flights at high speed.

The "Dawn-to-Dusk" flight was authorized by the Chief of Air Service to demonstrate: "that first, a standard pursuit airplane properly equipped was capable of withstanding such a severe grilling as

would be received on a flight of this nature; second, that a pilot was able to withstand the strain involved—some 18 hours flying in one day; third, to show commercial interests the possibilities of the pursuit type of airplane and its reliability; and, fourth, that it is possible to have an air force located somewhere in the middle west which can be transferred to any border of the United States within the span of a single day." Maughan's flight made a complete demonstration of these several propositions.

Maughan, who won the Pulitzer race at Detroit in 1922, left Mitchel Field at 2: 58 a.m., Eastern Standard time. The only difference between the Curtiss plane he used and the Curtiss pursuit planes now standard in the Army was the substitution of 80 gallons of gasoline for machine guns, ammunition and photographic material, making his total fuel supply 160 gallons. The flight could have been made with regular military equipment, but more frequent stops would have been necessary.

The morning was unfavorable. According to the almanac, dawn should have come at 2: 22, but 36 minutes were added due to low clouds. At Pittsburg it was necessary to fly through 75 miles of rain and dodge through, over and under 100 miles of fog. At Dayton there was an hour's unnecessary delay due to the over-haste of a mechanic in screwing a gasoline valve so tight it was sheared off. Between Dayton and St. Joseph the flight was uneventful and monotonous and it was with great difficulty that Maughan remained awake. The field at St. Joseph was waterlogged. Fifty pounds of gasoline were taken off, and even then the plane had difficulty in mounting through the mud.

At North Platte Maughan learned of a heavy head wind at 1,000 feet, offering resistance up to 50 miles an hour. He, therefore, in his flight to Cheyenne, in order to make time, was forced to fly very close to the ground. The flight from Cheyenne to Salduro was made at an average altitude of 10 feet above obstacles encountered, as head winds had increased in velocity to 63 miles an hour. A second factor entered into the flight from Cheyenne west. With a full load of gasoline a speed of 149 m.p.h. could be attained at 7,500 feet, but this speed was reduced to 127 m.p.h. at 9,000 feet. Maughan writes:

"As it was necessary to attain 9,000 feet altitude to clear the mountains, unless the valleys were followed, it can readily be seen that there was an ever-present dilemma as to whether to take the direct air line with its 127 miles per hour and its 50 mile wind or whether to take the lower altitude with its decreasing head wind.

The latter course was almost invariably chosen, as measurements previously made on the map had shown that slight variations from the direct air line added but little to the total mileage.

"It was known before I left Salduro that I would be hard pressed to reach San Francisco before dusk, but I was hardly expecting a heavy overhanging bank of clouds to shut off all light from above and at the same time have a ground fog shut off all light from below. . . . Sacramento was finally recognized and Mare Island was recognized by the ships in the bay. A course was chosen to the right of all the lights seen so as to insure not missing San Francisco in the fog. The lights mentioned consisted, not of individual lights, but simply of a dull glow which could be seen through the fog. Even from directly above no light could be seen—just the dull glow mentioned. Under these conditions, with only 20 minutes of gasoline left, is it any wonder that I was delighted to see the beam of the revolving flash on the prison at Alcatraz? Only then was I sure that the flight was a success.

"The wind coming in through the Golden Gate ahead formed a full eddy and split up the fog allowing the light to come through in spots so that it was possible to get below the fog without difficulty and make a landing in safety. The first flight over the field was made at 9:40, but one minute before the (official) arrival of dusk. The landing, however, was not made until some eight minutes later, as it was necessary to circle the field several times to be sure that the crowds had not encroached upon the airdrome."

Maughan's total time was 21 hr. 48 min. 30 sec. From New York to Dayton the motor was throttled to an average speed of only 140 m.p.h. Between Dayton and San Francisco, due to the hour's delay at Dayton, the stop at North Platte, which had not been counted on, and the 50-mile head wind for the last 1,200 miles of the flight, the motor had been run practically wide open, the speed varying from 165 miles from Dayton to Cheyenne to 130 miles from Cheyenne to San Francisco. The distance was 2,670 miles.

All along the route there was tremendous public interest. Even at the early hour of starting there were several hundred people on the field at New York. At St. Joseph there were 3,500; at Cheyenne, a city of 15,000, there were 2,500; and at San Francisco, 50,000 people had waited patiently in the fog for hours to give the flyer a welcome.

The Curtiss pursuit plane and engine stood the test magnificently. Except the inadvertent breakage by a mechanic at Dayton, no mechanical trouble whatever was experienced and Maughan shortly

afterward flew the same ship and engine back to New York, with slight adjustments at Dayton.

Second Annual Convention, National Aeronautic Association

The second annual convention of the National Aeronautic Association was held in Dayton, O., Oct. 2, 3 and 4, in conjunction with the Pulitzer race. Godfrey L. Cabot was elected president, succeeding Frederick B. Patterson, of Dayton. Maj. R. W. Schroeder, of Chicago, was elected Vice President, Maj. Howard Wehrle, of Kansas City, Secretary, and Col. Benjamin F. Castle, of New York, was re-elected Treasurer. Mr. Cabot is a manufacturer of carbon black and a producer of gas and oil. From April, 1916, until the close of the World War, he served in Naval Aviation, making his first flight as a pilot April 12, 1917. On April 16, he was made commanding officer, Marblehead Aviation Camp.

Maj. Schroeder has figured in aviation since 1908, when he began constructing gliders. It is safe to say that, among the flyers there is none better known or better liked than "Shorty" Schroeder. Schroeder learned to fly in 1910. He enlisted in the Aviation Section, U.S.A., Oct. 1916, attained the flying rating of R.M.A., the rank of major and from 1918 to 1920 was chief test pilot. On Sept. 18, 1918, he established a world altitude record of 28,900 feet; Jan. 13, 1920, two-man altitude record of 33,500 feet; and Feb. 27, 1920, just before his retirement from the army, established a new world altitude record (one man) of 38,150 feet. Schroeder upon resigning his commission became aviation engineer, Underwriters' Laboratories, Chicago. Early in 1925 he became manager of the Ford Airport, Detroit.

Maj. Wehrle is district manager, Kansas City office, Kinnear Mfg. Co., of Columbus, O. Wehrle entered the Curtiss aviation school in April, 1916 and on July 13, that year, was mustered into Federal service. He served at Mitchel Field, Kelly Field and Taliaferro Field, then went overseas with Handley-Page Training Station No. 1. He returned Dec. 1918, serving at Hazelhurst and Carlstrom Fields, and at St. Paul, when he resigned. Wehrle has been probably the most active aeronautical figure in the Middle West. In the Army he had the rating of R.M.A. He has participated in an official capacity in most of the aviation meets of any size held in this country since the Armistice.

Col. Castle, probably more than any other single individual, is responsible for the continuance of the N.A.A. upon a business basis.

Castle is a New York banker. He has served as Treasurer under the administrations of Howard E. Coffin and Mr. Patterson. Col. Castle is a graduate of West Point and from 1907 to Oct. 25, 1919, was an officer in the U. S. Army. In Aug. 1917, he became a major in the Air Service. In this capacity he selected and laid out many of the flying fields in the United States. From March to July, 1918, he was at Rockwell Field, California, for flying instruction. From July, 1919, to Feb., 1919, he was a member of the Control Board, Washington. From Feb. to July, 1919, he was attached to the U. S. Liquidation Commission as Air Service representative, Paris, and from July to Oct., 1919, was Air Attaché, U. S. Embassy, Paris. His flying rating is Junior Military Aviator.

In his final report, the retiring president, Mr. Patterson, said the Association had 7,000 members in thirty-four chapters representing every section of the country east of the Rocky Mountains.

The annual banquet was attended by 1,000 persons. Among those present were: the Chief of Air Service, Maj. Gen. M. M. Patrick and Mrs. Patrick; the Assistant Chief of Air Service, Brig. Gen. Wm. Mitchell and Mrs. Mitchell; the Assistant Secretary of War, Dwight Davis; Hon. Frank B. Willis, United States Senator from Ohio; Orville Wright, Miss Katherine Wright; Group Capt. M. G. Christie, British Air Attaché; Wing Commander Mario Calderara, Italian air attaché; Wing Comdr. L. S. Breadner, Royal Canadian Air Force; Ralph Pulitzer, donor of the Pulitzer Trophy; Capt. I. Shimono, Imperial Japanese Army; A. Kimura, secretary Japanese Embassy; Capt. Hasagawa, Japanese naval attaché; the American Round-the-World Flyers; Frank H. Russell, retiring President, Aeronautical Chamber of Commerce of America; Charles L. Lawrance, new President, Aeronautical Chamber of Commerce.

Col. Dwight Davis, Assistant Secretary of War, spoke. He said, in part:

"We should not enter into armament races with other nations. That is not the American policy. We need sufficient planes for training and the first shock of defense—sufficient pilots to man them and an efficient airplane industry to supply our wartime needs. Beyond that we should not go; less than this would court disaster. The annual cost of this insurance would not be great. It would be about equal to twelve hours' expenditures during a war."

General Mitchell made the principal address. He delivered a personal message from President Coolidge, which follows:

"It would have been a real satisfaction if I could have been present at your dinner. I trust, however, that sending General Mitchell and other representatives of the Government may indicate to you the great interest that

is felt in the admirable work which you are doing. The Federal Government is interested in the promotion of all commercial activities. They are an instrument of production and distribution of the wealth of our country for the welfare of the people. We ought especially to be interested in commercial aviation. It is not too much to say that on the whole America has led the world in transportation. There was a time when our commercial fleet, although not so large as that of some others, yet stood at the head of the list in actual accomplishments. Our railroad and street railway development is one of the marvels of the world. These methods still have their important uses, and are not likely soon to be superseded. But new opportunities have arisen through the development of aircraft. Your City of Dayton, because it was the birthplace of the Wright brothers, will always be associated with the first practical flight of machines that are heavier than air. Through your own efforts Dayton presented to the nation the largest and best equipped flying field in the United States. On account of past history and general interest you are providing a most interesting background for aircraft development. In addition to the commercial advantages likely to accrue from attention to aviation, we are of course aware also of the additions which will be made to our sources of national defense through increasing the number of skilled pilots and the number of aircraft. Our nation is decidedly for peace and opposed to aggressive war. But it is also in favor of such training in civilian occupations, and such preparation by civilians, as will render entirely unnecessary a large standing military force. The work which you are doing fits into this well established American policy in such a way that it is peculiarly a patriotic effort for peace. In that effort I extend to you every good wish for the success of your enterprise."

The Dayton Air Races

At the Air Races, held in Dayton, O., Oct. 2nd, 3rd and 4th, 121 commercial or privately owned aircraft were registered. As spectacular races, the Dayton events did not compare with those of preceding years; as signaling the trend of desire on the part of aviation and of interest on the part of the public to lay emphasis upon practical utility, they were significant.

Fifty-one planes entered the On to Dayton Race, but only 22 finished. These planes, in addition to the pilots, carried 26 people. Originating in Garden City, N. Y., Minneapolis, Dallas, Chicago, Minot, N. D., Warren, O., Lawton, Okla., Wichita, St. Joseph, Mo., Uniontown, Pa., Bridgeville, Pa., Kansas City, Nashville, Johnstown, Pa., and Three Rivers, Quebec, Canada, they flew a total of about 25,000 miles, before, during and after the races. First place with 239 points was taken by Charles S. Jones, manager, Curtiss Exhibition Co., Garden City, N. Y. Jones flew the same Curtiss *Oriole* (Curtiss C.-6) with which he won last year's similar event at St. Louis. The only change was a slight clipping of the wings. Jones flew 233 miles from Rantoul, Ill., with two passengers. Second place, with 228 points, went to Charles Holman, who, for the

Aero Club of Minneapolis, flew a Thomas-Morse S.4-C (Curtis O.X.-5) 1,020 miles from Minot, N. D. He carried no passengers. Third place went to M. M. Merrill who flew his own entry, a Canadian Curtiss (Curtiss O.X.-5) 810 miles from Dallas. He carried no passengers. He was credited with 216.7 points.

Eleven planes, all equipped with O.X. engines, finished in the National Cash Register Trophy Race, a distance of 90 miles. Walter Lees, flying the Hartzell F.C.-1, with which he won the Flying Club of St. Louis Trophy in 1923, was first, making 97.5 m.p.h., considerably faster than his previous time. Perry Hutton, in his Laird Commercial, made 93.2 m.p.h. Third place was taken by Randolph G. Page, an Air Mail pilot, flying, of course, as a civilian. His plane was a Yackey Sport, and his time 87.4 m.p.h. Lees for several days previous to the race had been trying out different wind levels and thus was able to take advantage of the most favorable.

C. S. Jones, in the same clipped-wing *Oriole* with which he won the On to Dayton Race, also won the contest for the Central Labor Union of Dayton Trophy. This was airplanes of two, three and four person capacity and engines of about 200 h.p. or less. It was for 120 miles. Throughout this distance the *Oriole* used but eleven gallons of gasoline. Jones' average time was 125.05 m.p.h. His nearest competitor made 107.22. This was J. C. Ray, also flying a Curtiss *Oriole*. Cyril C. Caldwell, flying a Glenn L. Martin 70, equipped with a Wright E.-4 engine, was third at 103.34 m.p.h.

Three races of especial interest to the Army Air Service, in that they placed a premium upon individual piloting, all the entrants, in each race, having the same type of equipment, were the contests for the Liberty Engine Builders Trophy, the John L. Mitchell Trophy and the Dayton Chamber of Commerce Trophy. The first called for De Havilands, the second for Curtiss P.W.-8 pursuit and the third for Martin bombers. Lt. D. G. Duke, winner of the Liberty Engine trophy, was credited with an average speed for 180 miles of 130.34 m.p.h. He had flown the course many times and was so familiar with it that he could take advantage of wind and altitude. Lt. A. E. Simonin, second place, made 128 m.p.h. flat and Lt. C. A. Cover, third, 124.13 m.p.h. In the Dayton Chamber of Commerce race the same Martin bomber that rolled up 128,000 miles in the Air Mail before being put to military uses, and which distinguished itself in St. Louis in 1924, came in first at 109.85 m.p.h. Lt. Dev. M. Myers was the pilot. Lt. C. F. Woolsey was second, at 107.98 and Lt. H. McClellan third, 104.59. In previous years the John L. Mitchell Trophy Race has been contested for by Thomas–Morse pursuit planes. It is a race closed to the Army First Pursuit Group. With

the introduction of the new Curtiss pursuit plane as the standard ship, average speeds jumped 29 m.p.h. Time made at St. Louis in 1924 by the winner was 146.44. Time in 1925 at Dayton by Lt. Cyrus Bettis, winner, was 175.45 m.p.h. for 124.27 miles. Second place at 173.70 m.p.h. was taken by Sec. Lt. D. F. Stace and third place by Lt. T. K. Matthews, at 173.32 m.p.h. All planes were equipped with the Curtiss D.-12 high compression engines.

Minor engine trouble deprived C. S. Jones flying the Curtiss *Oriole* from winning the Aviation Town and Country Club of Detroit Race, 120 miles. Finishing the first lap at 112 m.p.h flat, Jones increased his speed, until, in the seventh, just before he was forced down, he was making 122.5. First place then went to Basil L. Rowe, of Allaben, N. Y., flying an S.V.A. three seater, with Curtiss C.-6 engine. Rowe's average speed was 11.45 m.p. Second place was taken by J. G. Ray in a Curtiss *Oriole* at 107.5 and third by W. L. Stults in an Atlantic S.-3; speed 106.93. Stults' machine had a Wright motor, as did Cyril Caldwell's *Glenn L. Martin* 70, which came in fourth at 102.39. To Caldwell went the prize for efficiency.

The Dayton event was the first to pay attention to the light airplane. Two races were staged for airplanes with a pay load of 150 pounds and equipped with engines not to exceed 80 cu. in. displacement (about 20 h.p.). Most of the entries were built by the pilots. E. Dormoy, a plane designer at McCook Field, built a monoplane in which the fuselage was displaced by a nacelle, which earned it the name, "Flying Bath Tub." J. M. Johnson, of the Johnson Airplane & Supply Co., entered the Driggs-Johnson monoplane, which, loaded for the race, weighed just 490 pounds. Mr. Johnson and Mr. Dormoy were the only ones out of eight to finish. Both of their ships had Henderson motorcycle engines. Johnson in the Dayton Daily News Trophy Race for 5 miles, made an average speed of 64.07 m.p.h. Mr. Dormoy's time average was 50.05 m.p.h. In the race for the Dayton Bicycle Club Trophy and the Engineers Club of Dayton Trophy there were seven entries. This was for 50 miles and was won by H. C. Mummert in his Mummert Sport, with a Harley–Davidson motorcycle engine. His speed was 38.24. Close behind him came J. M. Johnson at the rate of 33.6. These two were the only ones to finish. Dormoy, in lieu of further attempts, to which he was entitled, was given third place.

The Mulvihill model trophy was won by Robert V. Jaros, whose miniature plane, powered with rubber strands, stayed up 10 min. 14.6 sec. Last year the winning model remained up only 4 min. 22 sec.

On the afternoon of Oct. 2, Lt. John A. Macready took up a supercharged N.B.S.-1, with John Althoff as passenger, and carrying 3306.9 lbs. of dead weight. He ascended 17,000 feet, thereby breaking by 3,000 feet the previous altitude record for ships of this class, held by Sadi Lecointe, France. Macready also established a new world duration record of 2 hr. 13 min. 49.6 sec. for airplane carrying 2204.62 pounds useful load. The same time also established a world duration record for planes carrying 3306.93 pounds useful load.

On the afternoon of Oct. 3 Lt. H. R. Harris and Mech. Douglas Culver took the six-Liberty-engined Barling bomber up and established three new world records, one duration of 1 hr. 47 min. 10.5 sec. for airplanes carrying useful load of 4409.24 lbs.; duration (same period) carrying 8818.48 pounds useful load; and altitude, 4472 feet, for airplanes carrying 8818.48 pounds useful load.

The Pulitzer Race, high speed for 124.27 miles, did not produce as good records as previous years. Foreign entries had been anticipated and announced, but failed to appear. Neither Army nor Navy undertook new construction. The Navy did not enter a ship. The Army for $1.00 purchased from the Navy one of the Curtiss planes which won the 1924 Pulitzer race but this was wrecked some days before the Dayton meet. This left but four entries, two Curtiss racers built for the 1922 Pulitzer contest in Detroit, the Verville-Sperry monoplane, built also for that event, and a new Curtiss P.W.-8 pursuit plane. Each of the first three was equipped with a 520 h.p. Curtiss engine and the latter with one of 460 h.p. The Verville-Sperry had been recently redesigned, wing radiators, new engine and new wing form being introduced, which increased efficiency 14 per cent.

The race was marred at the outset when Capt. Burt E. Skeel dove from a great height, and, in flattening out, to pass over the starting line, was instantly killed. Lt. H. H. Mills, in the Verville-Sperry finished first, 215.72 m.p.h.; Lt. Wendell H. Brookley, in the remaining Curtiss racer, second, 214.45 m.p.h.; and Lt. E. Johnson, in the Curtiss pursuit, 167.95. The time of the winner in Detroit in 1922 was 205.8; in St. Louis in 1923, 243.68.

Night Bombing Flight, Langley Field, Va., to New York

On Oct. 10 the Army Air Service flew eight Martin bombers at night from Langley Field, Hampton, Va., to New York City, a distance of about 500 miles. The flight was remarkable, as no night airway is laid out between these points and the heavy machines

had to be equipped to depend entirely upon themselves. Nine planes started, being taken from the 11th, the 20th and 96th Bombardment Squadrons, and all but one got through, seven of them actually in formation. The personnel in each plane consisted of two officers (pilot and navigator) and two enlisted men (mechanic and radio operator). The planes were equipped with regulation navigation lights, red and green on wing tips and white on tail; four parachute flares per plane, four wing tip flares per plane and two electric landing lights per plane. Signals within the three three-plane flights consisted of blinking navigation lights to indicate turns and other maneuvers. Communication within the formation was by radio. The leader of each flight and the group commander had receiving sets. One ship encountered motor trouble and returned for a new plane. The motors on the second ship began to miss, so the pilot headed for Lakehurst, N. J., where he spent the night. Another plane was forced to land at Cape May. The pilot sent out a radio to the other ships stating he would have to land. This message was picked up, not only by the rest of the flight, but by listeners on the ground who, to the number of 100 came out to the field to greet him when he landed. After adjustments he again took off and reached New York about an hour after the other seven ships. The flight from Langley Field to New York was made via Cape Charles, Cape Henlopen, Cape May and Sandy Hook.

Seventeen World Seaplane Records Established at Baltimore

The Wright Aeronautical Corporation, with its Wright T.-2, 535 h.p. engine; the Curtiss Aeroplane & Motor Co., with its seaplane racers and the Curtiss D.-12, 450 h.p. engine; and the Naval Aircraft Factory, with its all-metal hull P.N.-7 flying boat, made possible the establishment of seventeen world seaplane records on Oct. 25 at the air meet, Bay Shore Park, near Baltimore, Md. Of the seventeen, thirteen still stand.

The Baltimore meet was originally to have featured the Schneider Trophy Race, but the non-appearance of foreign competitors forced a postponement and the American entries had to content themselves with record flights. Lt. G. T. Cuddihy, flying a Curtiss C.R.-3 equipped with pontoons, raised the maximum speed mark from 174.07 to 188.08 m.p.h. Lt. R. A. Ofstie then took up another Curtiss C.R.-3 and made the following speed records: For 100 km., from 129.75 to 178.25 m.p.h.; for 200 km., from 169.89 to 178.25 m.p.h.; for 500 km., from 73.41 to 161.14 m.p.h.

The P.N.-7 has an all-metal hull, very similar in design to the wooden hull of the F.-5-L, which experience has proved to be very efficient. Metal has proved to be more satisfactory, more seaworthy and certainly capable of better performance in the air. This boat and others of its type are equipped with two 535 h.p. Wright T.-2 engines. Lts. George Henderson and O. B. Hardison flew this ship at different times. Henderson set up eight records: With 250 kgs. useful load—speed, 100 km., 78.507 m.p.h.; 200 km., same. With 500 kgs.—speed, 100 km., 78.507 m.p.h.; 200 km., same. With 1,000 kgs.—speed, 100 km., 78.507 m.p.h.; 200 km., same; duration, 5 hr. 28 min. 43 sec.; distance, 248.55 miles.

Lt. Hardison set up five records: With 1500 kgs. useful load—speed, 100 km., 68.4 m.p.h.; distance, 62.137 miles. With 2000 kgs.—speed, 100 km., 68.4 m.p.h.; duration, 1 hr. 49 min. 11.9 sec; distance, 62.137 miles.

Since that time four of Henderson's records have been surpassed, as shown in the Chronology and in the list of World Records in the Appendix.

The United States Navy now holds 21 out of 34 world seaplane records. Two land plane records are also held by the Navy, the speed marks for 100 and 200 km., set by Lt. (j.g.) A. J. Williams, in the Pulitzer race at St. Louis, in 1923. With these, the United States Navy thus holds 23 records out of a possible 78.

Loening *Air Yacht* Makes New Seaplane Record

A Loening *Air Yacht* flown by Lts. Victor E. Bertrandias and George C. McDonald, U.S.A.S., on Nov. 8 established a new seaplane record for 1,000 km. (621 miles). The time was 6 hr. 6 min. The average speed was 102.642 m.p.h. This is 28 miles an hour better than the former record made by Lts. Wead and Price of the Navy. The *Air Yacht* carried approximately one ton, including the crew, 185 gallons of gasoline and 20 gallons of oil. Grover C. Loening, designer and builder of the plane, said:

"This is a conclusive demonstration of the superiority of American seaplanes, particularly as this type of plane is now over three years old."

Loening Amphibians to the North Pole

On June 14th, 1925, the U. S. Navy–Donald B. MacMillan Expedition sailed for the Arctic to explore regions about the North Pole, utilizing aircraft from an advanced base on Axel Heiberg Land. It was not expected that the expedition would return, at the earliest, before September, 1925.

The aeronautical end of the party is in charge of Lt. Comdr. R. E. Byrd, U.S.N., who has under his command three amphibians designed and manufactured by the Loening Aeronautical Engineering Corp. The flagplane, N.A.-1 (N. A. signifying naval arctic), carries Comdr. Byrd and Av. Pilot Floyd Bennett. N.A.-2 carries Ch. Bsn. Earl E. Reber, pilot; Donald B. MacMillan, Navigator, and Av. Mach. Mate 1st Class, Chas. F. Rocheville. N.A.-3 is manned by Lt. M. A. Schur and Av. Pilot A. C. Nold. N.A.-1 and 2 will make the polar flight, while N.A.-3 will be held in reserve at the operating base, which will be in command of Lt. Schur, who also is engineer officer of the expedition. The National Geographic Society is sponsoring the flight, the Navy personnel and equipment being simply loaned for scientific purposes.

The Loening amphibian plane has been under development for two years. The principal idea in its design is the use of the inverted type of aircraft motor, placing the propeller thrust at the top of the body and thus including the entire body with the engine mount in the nose to form a unit compact hull, carrying passengers, load, gasoline, and all equipment. The landing gear, which is mounted to this hull, folds into it by the operation of an electric motor, switched on by the pilot. This hull body is made exceptionally strong, entirely covered with metal, and so shaped as to give remarkable seaworthiness. The Loening amphibian is fitted with an inverted 400 h.p. Liberty engine. It weighs 3,300 pounds empty, and carries a load of 2,200 pounds, including pilot, observer, cameras, radio and 250 gallons of gas, which is sufficient for a flight of over one thousand miles.

A comprehensive survey of the Arctic regions lying to the northward of the American Continent expresses in general terms the objects of the expedition. The prize in sight is the survey of the only remaining blind spot on the map of the world—a region of more than a million square miles in extent lying between Alaska and the North Pole.

Upon leaving Boston, the expedition proceeded northward, skirting the Maine coast to Labrador. From here Davis Strait was to be crossed to the Greenland shore. An interesting and important feature of the expedition will be the exploration of ancient Norse ruins in Labrador and Greenland. The Expedition will push northward through Baffin Sea and across the dread Melville Bay (where the worst ice conditions of the voyage are anticipated) to Etah. If ice conditions permit MacMillan will proceed through Smith Sound to Kennedy Channel and from this vicinity will base further operations. The air base will be established at approximately 250 miles

by air line from the probable location of the ship. Working from the advance base on Axel Heiberg the planes will fly out over the great unknown region of the Arctic.

Complete photographic equipment is included in the Expedition including motion picture cameras, still picture cameras and mapping cameras. The mapping cameras are capable of continuous running for two hours. They will make an accurate map of the territory over which they fly such as would probably never be made in the next century by other means. Baffin Land in the vicinity of the magnetic north pole will be mapped by this method as will also Ellesmere Land. Those regions have been the subject of laborious investigations by MacMillan for years, with particular reference to magnetic phenomena.

The radio equipment of the expedition will be of especial interest. Sets for transmitting on 20, 40, 80 and 180 meters are carried. With the 20 meter set the explorers expect to communicate with the outside world not only in code but by voice.

Comdr. Byrd, gave particular attention to the aerial navigation features. Byrd was assigned to this phase of preparation for the trans-Atlantic flight in 1919 and at that time developed a sextant for use in aircraft navigation which has been standard equipment in aviation units for the Navy for the past six years. The Byrd sextant makes use of a bubble to supply an artificial horizon. It may be used to take sights of the sun from aircraft at any altitude and is independent of the existence of a natural horizon. The area of operations of the Navy planes in the Arctic will extend between the magnetic north pole and the geographical north pole. In this area the navigators of the expedition will have the novel experience of making their calculations with the compass needle pointing south instead of north. In addition the twenty-four hours of daylight will provide a sun which never sets but which describes a circle about the observer every twenty-four hours. The Naval pilots will make use of this natural phenomenon by using a sun compass operating on the general principle of a sun dial. The sun compass will indicate the cardinal points of the compass by the shadow thrown by the sun at various times during the twenty-four hours. A small tent is carried in one of the planes and a portable boat is stowed in each plane.

CHAPTER X

TECHNICAL PROGRESS IN AIRCRAFT CONSTRUCTION DURING 1924

INTRODUCTION

THE advance in aircraft development during 1924 has been reflected in improved performance and operating characteristics of both service and commercial types.

It is difficult to present a satisfactory review of technical and engineering development, for the Year Book. The reasons for this are the following: 1. Many developments are held as secret or confidential and accurate data are not always available in time for use. 2. In some cases it is difficult to promptly determine the value of new developments. Some, while very radical and interesting, do not always prove to be useful in practice and others that do not seem to be of particular importance finally prove to be of great advantage.

Therefore, the most that may be attempted is to report the developments noted during the year. This record cannot be regarded as inclusive of all that has been done, nor can it presume to properly appraise its value. The work as a whole shows that we are making progress. Time will show us just how much.

Improvements are particularly typified in the exceptional high speed and maneuverability of the Curtiss and Boeing pursuit ships, both of which are in production. No other nation has anything comparable. A similar characteristic advance in performance and design is indicated in the new observation types submitted to the Army Air Service by the various manufacturers toward the close of the year. In this class the gain in speed and maneuverability was even more remarkable for the reason that these airplanes were built around the war-time Liberty engine.

The Navy's Pulitzer racer of 1923 was modified to compete as the Schneider Cup seaplane racer for the 1924 contest, and in preliminary trials showed a speed of 227 miles per hour, again demonstrating the high-grade design ability of the Curtiss staff.

The advance in the design of bombardment aircraft for the Army Air Service is exemplified in a new type of twin-engine night

bomber, the Curtiss NBS-4, of which greater visibility and increased bomb capacity are the outstanding features. For the Naval Bureau of Aeronautics the three-purpose bombing, torpedo, and scout airplane Curtiss CS-1 has been developed, and is now a fixed naval service type and in production at the factory of Glenn L. Martin Co. The new Vought UO-1 has also proved a very successful and effective scouting and spotting type of airplane.

During the year two new types of airplanes were developed for the Army Air Service. The first of these was the Douglas world cruiser, whose epochal flight around the world will go down in history as one of the most brilliant aeronautical achievements of the age. These airplanes were completed in a remarkably short time after the order was placed, owing largely to the close sympathetic liaison between the Engineering Division and the manufacturer.

The second new type of airplane developed for the Army Air Service was the Loening amphibian, which was built around the inverted Liberty engine. This airplane has shown exceptional adaptability for its class, and has also been taken up by the Navy, as it has excellent visibility and its performance is very satisfactory as a landplane or as a seaplane.

The Bureau of Aeronautics, in developing the large flying boat PN-7, and later the PN-9, powered with Wright and Packard engines, has accomplished two important steps: first, the substitution of the all-metal hull and the saving of five hundred pounds, dead weight, and second, the substitution of the Packard geared model 1500 engine, resulting in a cruising radius of over two thousand miles.

In the commercial field the outstanding features have been the successful operation of the Air Mail Service, especially over the night airways; the development and operation of the Stout all-metal airplane; the development of the Sikorsky transport airplane; and the development for the Air Mail Service of new types of air mail airplanes by the Curtiss Aerial Service, Elias, Boeing, Cox-Klemin and Douglas.

Airplanes

The year was marked by closer co-operative efforts of the aircraft industry and the Government Services in producing new experimental types of airplanes of truly remarkable performance. For the Army Air Service more than twenty-five new experimental airplanes of various types were built by the industry. Only one airplane, an observation type, was designed and constructed by the Engineering Division of the Army Air Service.

The Bureau of Aeronautics of the Navy Department further developed the PN type of seaplane, the new development being known as the PN-9. The performance of this seaplane far exceeded expectation. It is proposed to use this type during the summer of 1925 for continuous flights between the United States and the Hawaiian Islands.

Probably the most startling development of the year was the result of the Army Air Service corps observation competition. The success of the aircraft manufacturers in designing observation types of airplanes around a Liberty engine, and not only increasing the maneuverability but also obtaining substantial gain in speed, is proof of the engineering and design ability of the technical staffs of our aircraft manufacturers. The policy of the Government services in ordering new types of airplanes to carry along the development of two different types is to be commended. The steady engineering development of the pursuit type, both in performance and reliability, is exemplified by the Boeing PW-9 and the Curtiss PW-8, both of which are now in production. As a result of these developments, the United States now leads the world in the high speed and maneuverability of its pursuit type and observation type airplanes.

The Aerial Service Corporation has developed the aerial *Mercury* night mail airplane for the Air Mail Service. H. C. Mummert, the designer of the *Mercury,* was the designer of the light airplane which won the 1924 light airplane competition at Dayton. The *Mercury* was designed with the following objects in view: More than usual strength, so as to give continuous life of six to seven years; ease of servicing; ease of handling in the air and on the ground; low landing and high cruising speed with maximum load. As the *Mercury* was designed for use on the transcontinental Air Mail route, both over the night and day airways, a night airplane and a day airplane were provided. The day plane with full load has a maximum speed of 135 miles per hour, landing speed 55 miles per hour, and ceiling of 15,000 feet. The night plane has a high speed, with full load, of 125 miles, landing speed 50 miles per hour; ceiling of 17,000 feet; cruising range 500 miles.

An airplane which carries 1,000 pounds of mail at a high speed of 135 m.p.h., provides 65 cubic feet of cargo space, equipped for night flying and provided with the latest development in the way of mechanism for easily absorbing the shock incident to landing: this is the Boeing Airplane Company's air mail plane, equipped with the standard 400 h.p. Liberty engine, and incorporating a number of novel features of structure and arrangement that are believed to make it a highly desirable type for commercial purposes.

The fuselage is in three sections. The nose is a simple structure of steel tubing, which permits of easy access to all parts of the power plant. It can be quickly detached by the removal of a few bolts, thus facilitating replacement by another power unit. This engine section also carries the radiator, which is of the inclined underslung type developed by the Boeing Company and which originally proved its effectiveness on the Boeing pursuit airplane.

The mid section is the same construction that has been used so successfully in Boeing seaplanes for a number of years. This construction makes it possible to have two mail compartments that are clear of structural members and cross wiring. Two main gas tanks are under the mail compartments, while the oil tank is mounted just forward of the fire wall. The filler necks for these tanks project through the right hand side of the body, and, as the doors to the mail compartment open from the left hand side, it will be possible to service the airplane at the same time that mail is being loaded and unloaded,—a feature which is important in reducing the time for servicing the planes on the ground.

The section of the fuselage carrying the tail group and the tail skid is built of steel tubing, and is covered with an aluminum cowl which fairs into the elliptical central portion. The landing gear is of the split axle type and is provided with Boeing Oleo Shock Absorbers, developed through three years experimental work. It is small, and is mounted in the intersection of the main chassis strut. In this position, it offers less resistance than the standard rubber shock absorbing unit and in actual flight tests indicates high efficiency.

Following are the characteristics of the Boeing air mail plane: length, overall, 33′—2¼″; height, overall, 12′—2⅛″; span, upper wings, 44′—2¼″; span, lower, 44′—2¼″; chord, upper, 79″; chord, lower, 79″; gap, 77″; area of wings including ailerons, 547 sq. ft.; weight empty, 3,425; useful load, fuel and oil (750 lbs. gas + 100 lbs. oil) 850, crew 180, pay load 1,000, equipment & parachute 40, total weight, 5,495; endurance at cruising speed, 5½ hours; range, 550 miles; maximum speed, full load, 135; landing speed, full load, 50 (approximately).

The Consolidated Aircraft Corps is in production on its improved training plane designed by Col. V. E. Clark, Chief Engineer. Col. Clark and his associate, Maj. Reuben H. Fleet, are engaged in further developments of this type, looking to its commercial application.

The Cox-Klemin Company has developed a corps observation type known as the XO-4 when using the Liberty engine, and the CK-CO-1 when using the Napier "Lion" engine. The XO-4 is a

biplane having a useful load of 1,620 pounds and a gross weight of 4,410 pounds, a high speed of 135 miles per hour, a landing speed of 48 miles per hour, and a service ceiling of 20,000 feet. This company has also developed a two-passenger-and-pilot Amphibian known as the CK-18. This airplane, powered with a 130-h.p. Clerget engine, has a high speed of 80 miles per hour, and a landing speed of 45 miles per hour.

The Cox-Klemin training airplane was developed around a 180-h.p. Wright Hispano engine, and has demonstrated excellent flying qualities. It has a high speed of 110 miles per hour, a landing speed of 40 miles per hour, and a service ceiling of 13,300 feet.

The Curtiss Aeroplane and Motor Corporation developed during the year the Curtiss *Hawk* (PW-8B); the Curtiss *Falcon,* a new observation type airplane; the Curtiss *Carrier Pigeon,* a new Air Mail airplane; and the Curtiss Seaplane Racer constructed for the Schneider Cup Contest.

The Curtiss *Hawk* is a development of the PW-8 pursuit airplane. It is built with two different wing arrangements, the first being a single-bay biplane with straight wings using a thin, high-speed wing section. The second, also a single-bay biplane, but with tapered wings of thicker section and slightly higher lift. The airplane has pronounced stagger, which permits unusual vision for the pilot. This new development shows a marked improvement in performance and maneuverability over its predecessor, the PW-8. It has a high speed of 167 miles per hour, an initial climb of 1800 feet per minute, and a service ceiling of 21,400 feet.

The Curtiss *Falcon* is a high-performance corps observation single-bay biplane. It is intended for either the Curtiss V-1400, the Packard 1A-1500, or the Liberty engine. Structurally this airplane differs somewhat from usual Curtiss principles. The wings are of wood construction with duralumin fittings and cloth covering; the fuselage of duralumin tubing. The ailerons are also of duralumin, cloth covered, and are operated through an adjustable differential linkage. The landing gear is of the standard Curtiss split-axle type. The Curtiss *Falcon* has a remarkable performance and maneuverability for its type. This is largely due to its light weight, compactness, and clean design. Its speed of over 150 miles an hour and its ceiling of over 20,000 feet with the Liberty engine, places it more nearly in the pursuit than in the observation class, despite the fact that it carries nearly twice the useful load of the pursuit airplane.

The Curtiss *Condor* is a large two-engined night-bomber of simple arrangement and clean lines. It carries a normal load of 2,000 pounds of bombs, provision being made for a total load of 3,600

pounds. The wing structure is made in three main sections; the outer sections, which are two-bay, may be folded back parallel to the fuselage for storage. The fuselage is of steel tubing, braced with wire. At the extremities of the central wing section are the two engine nacelles, each housing a Liberty engine. Fuel tanks are carried directly in the rear of each engine, in the streamlined engine nacelle. The *Condor* has an excellent performance and easy flying qualities. It has an increased carrying capacity as compared with the previous night bombers, and also an increase in ceiling and speed.

The Curtiss *Carrier Pigeon* was one of the special mail airplanes developed for the Air Mail Service for use on the New York–Chicago night airway. A great amount of thought and study was given by the Curtiss Company to this project, including conferences with Air Mail officials and pilots. In the design of the *Carrier Pigeon,* three important qualities were kept in mind—adequate strength, serviceability, and ease of maintenance. It is believed that these qualities have been realized to a greater degree than has heretofore been approached in an airplane designed for commercial purposes. The engine used is the Liberty-12, with all the latest improvements. The radiator is of the under-slung type, and fairs directly into the body lines. In the design of the wings, tail surfaces, fuselage, and landing gear every factor for safety and serviceability has been considered. The high speed of the *Carrier Pigeon* is 128 miles an hour, with a rate of climb of 1100 feet per minute. It has a service ceiling of 15,200 feet. Carrying a useful load of 1,855 pounds, the total weight of this airplane is 5,064 pounds. Its maximum range is 500 miles. A most important feature of design is found in the fact that all wings, struts, control surfaces and landing gear parts are interchangeable. Replacement and storage of spare parts is thus easily solved and operating costs reduced.

The Douglas Company during the year developed an experimental observation type OX-2 to succeed the DH-4B. The design is a single-bay wire-braced biplane, marked by simplicity and accessibility, which are commendable features from the standpoint of production and maintenance. The airplane is very maneuverable, and, when powered with the Liberty engine, has a high speed of 137.2 miles per hour and a service ceiling of 16,900 feet.

The Douglas Company also developed for the Army Air Service the Douglas C-1 Transport, exceeding the performance required. Powered with a Liberty engine it carries a useful load of 2,400 pounds, has an actual speed of 110 to 120 miles per hour, a landing speed of 53 miles per hour, and a ceiling of 10,000 feet.

G. Elias and Brother developed during the year for the Air Mail

Service the *Elias M-1* mail airplane. In the design of this airplane, special attention was given to reliability and durability. The gross weight of the *Elias M-1* airplane, with full load of 1,000 pounds of mail, is 4,667 pounds; its high speed is 130 miles per hour, its landing speed 48 miles per hour; and its maximum range 450 miles.

The design of the Elias mail plane includes in addition to simplicity and special features intended to secure low maintenance and operating costs the following: new method of improved tubular construction, wide open cockpit and method of dropping fuel tanks in flight. With slight modifications this plane may be used in any class of straight commercial operations.

Charles Ward Hall, Incorporated, also confining operations to metal construction, produced during the year a two-seater sport flying boat with a 60-HP Wright *Gale* engine. The Curtiss-Hall pursuit type was developed for the Bureau of Aeronautics by the joint work of the two constructors. This type is similar to the TS Navy type airplane, a single-bay tractor biplane. The entire structure is of duralumin, the wings being covered with cloth. The remarkable characteristic of this airplane is that, although of metal construction, the framework weighs something less than half that of the framework of the TS, which is constructed entirely of wood.

Huff, Daland and Company, Inc., have developed during the year a modification of their training type, especially designed for "dusting" cotton fields and fruit orchards. Huff, Daland also produced an interesting ambulance plane and an advanced training plane for the army air service.

Among new developments the Loening amphibian has been markedly successful. This machine was developed for the Army Air Service for use in Panama, Hawaii, and the Philippines. Its performance and general usefulness, although designed for use in the tropics, resulted in its being selected as the type to be used on the MacMillan expedition to the Arctic. The type will also be used by the Navy and the Marine Corps. The principal idea in designing the amphibian was to place the propeller thrust at the top of the body by using the inverted type of Liberty engine. By doing this it is possible to include the entire body with the engine mount in the nose so as to form a compact hull, carrying passengers, load, gasoline, and all equipment. The landing gear, which is mounted on the hull, folds into it by the operation of an electric motor. The hull, exceptionally strong, is covered with metal, and shaped to give remarkable seaworthiness. The Loening amphibian as fitted with the inverted 400-h.p. Liberty engine weighs 3,300 pounds empty and carries a load of 2,200 pounds. Its capacity is 250 gallons of gaso-

line, sufficient for a flight of over one thousand miles. The official McCook Field test showed a high speed of 122 miles an hour and a ceiling of 14,000 feet.

The Glenn L. Martin Company as above noted has further improved the Navy three-purpose bombing, torpedo, and scouting plane, now known as the Navy-Martin SC-1. Mr. Martin also further improved the Martin *Commercial,* a type evolved from the Wright Air Mail plane produced in 1923.

The Remington-Burnelli Aircraft Corporation, in the development of its original multi-engined design, built and demonstrated a large new transport powered with two Atlantic Galloway engines of 500 HP each. The new model RB-2 is intended for freight carrying, and incorporates the original airfoil, fuselage, and general design features of the RB-1, including the refinements of design and construction which were suggested by an extensive test conducted with the first airplane of this type. Completely loaded, the plane weighs 17,000 pounds; has fuel and cargo capacity of 8,050 pounds; high speed of 100 miles per hour; landing speed of 55 miles per hour; and fuel capacity for six hours' flight.

Another important development was the construction of the Sikorsky twin-engined commercial biplane, entirely under the direction of Igor I. Sikorsky. Built throughout of steel and duralumin except for the fabric coverings of the wings and fuselage, it is powered with two Liberty engines. The entire power plant may be removed and replaced, the gasoline and oil tanks are in the engine nacelle, and the radiator is placed in the rear nacelle and is adjustable. All gasoline and all connections to the fuel tanks are located outside of the fuselage. The spacious cabin provides comfortable seats for 4 passengers and a crew of 3. It is claimed that this airplane, with two-thirds of its full load, will be able to fly with one engine. Its maximum speed is 115 miles per hour, and its landing speed 55 miles per hour.

The Stout *Air Pullman* is a new development for commercial service. The fundamental purpose of the designer has been to secure great utility with maximum comfort and safety. A number of factors have been incorporated in the design for the above purposes. The size of the airplane was chosen to fit the greatest range of commercial use, considering the present-day airways and landing fields. The *Air Pullman* is a seven-passenger-and-pilot-cabined transport designed for airline work, and has a fuel capacity for a six-hour flight. The main cabin provides for six passengers and dual control from the pilot's cockpit, with side-by-side seats. Constructed entirely of duralumin, and powered with a Liberty motor, many features have

been included to add to the comfort of the passengers, such as heated and ventilated cabin, muffled engine, and other details which point the way to commercial type airplanes. The development of the Stout *Air Pullman* is one of the big steps in developing commercial aviation in the United States.

The Thomas-Morse Aircraft Corporation has continued the development of its metal construction. In addition to considerable experimental work, it has completed and tested during the year an all-metal two-seater corps observation airplane (TM-24) for submission to the Army Air Service for tests. Fully loaded, ready for flight, this airplane weighs 3,470 pounds and has a wing spread of but thirty feet.

Relative to the metal construction which the Thomas–Morse Corporation has been carrying on the past four years, it is of interest to note that this corporation was the first constructor in this country to undertake the construction of airplanes built entirely of metal. As a result the use of wood has been abandoned in all its new designs.

Airships

The initial flight of the airship, *Los Angeles,* from Friedrichshafen to Lakehurst, a distance of 5,066 miles in 81 hours, may, in many respects, be considered the most outstanding and significant performance of the year. This flight together with the flight of the U.S.S. *Shenandoah* from Lakehurst across the continent to Camp Lewis, State of Washington, and return has greatly stimulated the interest in the operation of commercial airships.

The arrival of the U.S.S. *Los Angeles* (ZR-3) virtually transferred the Zeppelin operations from Germany to the United States. The Goodyear Zeppelin Corporation, a subsidiary of the Goodyear Tire and Rubber Company, started in November, 1924, the design of a rigid airship of 5,000,000 cu. ft. capacity. This airship would be more than twice as large as either the *Los Angeles* or *Shenandoah.* This work is being carried on under the direction of Dr. Karl Arnstein, former chief engineer of the German Zeppelin Company and he is assisted by a staff of twelve engineers selected from the Zeppelin organization.

The Army Air Service developed a simplified method of mooring and ground handling of airships by the construction of a "grab-winch," a caterpillar tractor vehicle capable of chasing the drag rope and thereby maneuvering the airship without the help of a large ground crew.

The Aircraft Development Corporation, of which Mr. Ralph H.

Upson is chief engineer, have designed and are now building a metal-clad airship. One of the principal requirements of an airship is that it must be weather-proof. All rigid airships built to date use a metal frame but depend upon fabric gas cells on the inside and a fabric covering on the outside. The airship designed by the Aircraft Development Corporation provides for a single metal covering, doing away with the fabric gas cells and the fabric covering on the outside. One of the principal problems confronting the engineers of this company was the riveting of the metal sheet and in solving this problem a riveting machine has been designed that stitches rivets as a sewing machine sews cloth. With this automatic machine 5,000 rivets can be inserted in an hour, thus reducing what would otherwise be the greatest cost in the production of an airship of this type. The engineers of this company have taken great pains to investigate the possible difficulties in the construction and operation of a metal-clad airship and important tests have been made by them in the laboratories of the company and at the Bureau of Standards.

Airships Incorporated, in addition to constructing three T.C. type non-rigid airships, carried on engineering research in the installation on outriggers of the new Wright *Whirlwind* engines. Airships Incorporated also successfully introduced the single balloonet type, divided by a partition, instead of the two balloonet type craft hitherto produced.

The B. F. Goodrich Rubber Company have continued the development of the Gammeter valve for airships. This valve is a further development of the exceptionally efficient and light, automatic, airship valve which was brought out by the Goodrich company last year. The improvements are principally in the moving mechanical difficulties which prevented a maximum opening. The solution of these difficulties in the new valve provides a capacity discharge of 10,000 cu. ft. per minute. The success of this new valve through its response to delicate fluctuations is due to its well-balanced construction and the reduction of friction in the mechanical parts. A new development of the Goodrich company is a hand-hole cover for pontoons and hydroplanes and streamline shields for airplane tires.

In 1924, the Goodyear company developed for the Army Air Service six non-rigid airships, three of the TC type and three of the TA type. The TC type airship is 198 ft. long, 48 ft. in diameter, and contains 200,000 cu. ft. of gas. The TA type airship is 160 ft. long, 39 ft. in diameter, and has a gas capacity of 130,000 cu. ft. Both were designed especially for the training of officers and men.

Goodyear also designed and brought to completion the semi-rigid airship, RS-1, for the U. S. Army Air Service. The RS-1 is the

largest semi-rigid airship built in this country. This airship, designed for the use of helium, has a volume of 720,000 cu. ft., is 282 ft. in length, its greatest width is 73 ft. and has a height of 93 ft. The total lift is 41,250 lb. of which 11,220 is useful load. The high speed is estimated at 70 miles per hour and the ceiling, 10,000 ft. It is powered by four Liberty engines geared to drive two seventeen and one-half foot Balsa propellers through dual unit transmission.

Aircraft Power Plants

The development of aircraft power plants for the Bureau of Aeronautics and the Army Air Service for the year 1924 has been carried out along two lines: first, increasing the dependability of existing engines; and second, developing new engines of low weight per horsepower. The adoption of this policy on the part of our military services has resulted in the development of reliable and efficient aircraft engines ranging from 60 HP to 800 HP, and has placed the United States in the forefront in aircraft engine development.

The Aeromarine S-12, developing 622 HP at 1650 r.p.m., has passed its type tests. This type is very promising since its novel cylinder arrangement gives the type very great possibilities in weight saving.

The new Aeromarine hand starter has been developed for the Navy. In this starter, a flywheel is cranked to high speed and the stored energy is then utilized to crank the engine. It has been a conspicuous success in service and has been generally adopted in engines for the Navy.

The Curtiss V-1400 engine has lately passed its tests with outstanding success. This engine develops 500 HP at 2000 r.p.m. on a dry weight of 670 lbs.—1.34 lbs. per HP. This engine is a development of the D-12 of lighter weight and increased power. It passed its 50 hour test on its first trial without difficulty.

One of the engine developments which has greatly improved the life between overhauls of engines is the new steel-backed bearing. These are being made by the Curtiss Aeroplane and Motor Company and the Allison Engineering Co.

The Engineering Division of the Army Air Service has fostered the development of the Curtiss Radial 1454. This engine develops over 400 HP at 1650 r.p.m. and is remarkable for its smooth running and light weight. It has not yet passed its tests. This engine is the first engine with a built-in rotary induction system.

The Packard 1A-2500 engine is a notable development in high

powered engines. This engine has twelve cylinders, 6⅜" bore, 6½" stroke, and develops 834 HP at 2050 r.p.m., on a dry weight per brake horsepower of about 1.4 lbs. A number of the Packard 1A-1500 engines have been flight tested with very satisfactory results. The 1A-2500 engine has not yet been flown.

The low weight per horsepower of air-cooled engines has forced water-cooled engines to higher crankshaft speeds. Since these speeds are limited by efficient propeller speeds, attention has been focused on reduction gears. The newer water-cooled engines utilizing higher crankshaft speeds now develop sufficient power when used with reduction gears to overcome the weight of the gears and even of the cooling system. Thus, the Packard 1A-1500, developing 600 h.p. at 2500 r.p.m. when geared 2 to 1, has approximately the same power plant weight as can reasonably be expected of an air-cooled engine of the same output. The tendency in aircraft engine development is toward a more general use of gearing and supercharging. It is expected that the life between overhauls of the newer engines will be at least three times that of the Liberty. Together with this, there has been continued improvement in the reliability of power plants brought about by the continued refinement and improvement in design.

The Wright Model "J" static-radial, 200 HP air-cooled engine has passed into the Model J-4. This engine has been adopted by the Navy for Shipboard, Observation, and Fighting planes. Numerous improvements have been made which have made this engine a thoroughly dependable one.

The Wright Model P-1 9-cylinder air-cooled engine, 6" bore by 6½" stroke, has lately passed its dynamometer tests and has been flown in an airplane. Preliminary tests indicate a very satisfactory performance.

The Wright Model "T" engine has passed into the Model T-3. This is a 600 HP engine used by the Navy in its Torpedo and Bombing planes. Seventy of these engines have been delivered and 100 more are on contract. The engine proved itself very dependable.

The Engineering Division of the Army Air Service has done some extensive development in connection with the air-cooled Liberty. This engine has lately passed its tests and promises to be the forerunner of a new engine of about 1200 HP.

The Moss type supercharger development has been fostered by the Air Service through the General Electric Company and it is now being employed for supercharging at high altitudes as well as for rotary induction for air-cooled engines. The Roots type blower for

supercharging has been developed by the National Advisory Committee for Aeronautics and has been flown with marked success.

The Stromberg Motor Devices Company designed and manufactured during 1924 carburetors for all the principal aircraft engines produced in the United States. Three very compact twin model carburetors for use in "V" engines with limited lateral space were produced. These carburetors have inter-connected floats; the mixture furnished the engine is not affected by variation in angle of flight. The new models are used on the Curtiss D-12, Packard 1A-1500, Curtiss V-1400, and Wright T-4 engines. The large single-barrel carburetor was designed particularly for use on air-cooled engines using the rotary induction system for the Curtiss radial motor. This carburetor has an oil jacket by which the heat in the outlet oil is utilized to prevent the formation of ice in the carburetor. This carburetor is used on the Curtiss 1454 and the McCook Field air-cooled Liberty engine.

The Splitdorf Electrical Company developed during the year the Splitdorf double aircraft magneto, which is designed for airplane engines of from four to eighteen cylinders. This instrument is of the inductor type, producing four double sparks per revolution. The factors influencing the design were light weight, mechanical strength, accessibility, and greater electrical efficiency. This new magneto marks a great advance in aircraft engine ignition, owing to the advantage of using a single rotor and field structure, and two sets of magnets; also the doubling of the other vital units, such as the high tension windings, condensors, contact breakers, distributors, and distributor spools.

Aircraft Materials

During the year 1924 there has been a decided increase in the use of metals in the construction of aircraft. The Aluminum Company of America, the Baush Machine Tool Company, and the American Magnesium Corporation have co-operated with the manufacturers of aircraft and the various Government agencies in the development of special light alloys for use in airship and airplane construction. The special light alloys now produced cover a wide range, including rolled sheet sections, high tensile strength aluminum tubings, light alloy castings of high tensile strength, and duralumin forgings for propellers, fittings, and connecting rods.

One of the most important contributions to the science of aeronautical engineering in recent years has been the development of the metal propeller. The Curtiss-Reed metal propeller now holds all the world's speed records for both landplanes and seaplanes, and was

recently adopted as standard equipment on the transcontinental mail airplanes of the Post Office Department as well as on all high performance ships of the Army and Navy. Forged duralumin propellers are now made by the Curtiss Aeroplane and Motor Company and the Standard Steel Products Company. Improvements have been made during the past year in some types, permitting interchangeability of the blades, which are of steel, micarta, or aluminum alloy.

The Hamilton Aero Manufacturing Company specializes in the manufacture of airplane propellers. This company has manufactured the largest propellers, both two and four blade, for single motors, that have ever been built in the United States. They built the propellers for the *Shenandoah,* which are 18′ in diameter, and also the large four blade propeller on the Boeing P.B-1 Patrol Boat, mounted on an 800 h.p. Packard motor. This company is making a thorough study of the metal propeller, having delivered its first metal propeller to the Air Service. Metal propellers of 20′ diameter are now being built by the Hamilton company for an experimental helicopter. A new type of metal pontoon is being experimented with and will be tested during 1925.

The Haskelite Manufacturing Corporation has continued the development of waterproof plywood. This corporation has also developed aluminum "Plymetl," which consists of a light plywood made waterproof by the cementing of a metal sheet to the surface. This new product has been found to have remarkable physical characteristics; for example, $\frac{5}{16}$-inch plywood faced with metal is over fifty to one hundred times as stiff and resistant to buckling as sheet steel of the same weight.

Accessories

Photographic Apparatus—For the first time in the history of aerial photography the Army Air Service successfully took a photograph with a single lens camera (the Fairchild) from an altitude of 32,200 ft. The value of this achievement at the high altitude, which is beyond the range of human sight, becomes of paramount importance from a military standpoint. This particular photograph includes 19 sq. mi. of territory, depicting with remarkable clearness almost the entire city of Dayton.

In connection with this achievement, an interesting comparison of aerial photographs by a single lens and multi-lens camera is presented. If the photograph had been taken from this altitude with the ingenious tri-lens (Bagley) mapping camera developed by the

Eastman Kodak Company, the aerial photograph would have included 92.2 sq. mi. of territory instead of 19 sq. mi. With a four lens camera, the area photographed would have been 130.6 sq. mi. and with the most recent development, the five lens camera, the area would have been 166 sq. mi.

The Eastman Kodak Company have further developed their model K-5 aero camera. This camera is recommended for mapping work as it can be used for either vertical or oblique work. In the K-5, as in other K cameras, the film is held flat in the vertical plane by air suction created with a Venturi tube which is included in the regular K-5 equipment. The Eastman Kodak Company has also developed a supersensitized panchromatic film which makes it possible to take pictures both earlier and later in the day than when using the plain pan film.

The Fairchild Aerial Camera Corporation has further developed their camera used in high altitude mapping. This camera is used as standard equipment by both the Army and Navy Air Services.

Aeronautic Instruments—During the year, 1924, the earth inductor compass has proved successful as a distance reading compass. The operation and reliability of this compass, which depends upon air currents induced by the interception of the earth's magnetic lines of force, has been established beyond question of a doubt by the Army Air Service on numerous cross-country flights and on the round-the-world flight. The slight defects which still exist are due to mechanical defects and great credit should be given to the Pioneer Instrument Company and the Army Air Service for the development of this device. The Army Air Service has found that with the use of the earth inductor type compass, supplemented by the use of a drift sight and flight indicator it would be possible to make long distance flights without recourse to the landmark navigation.

The Pioneer Instrument Company has developed a number of new instruments and has produced improved models of a number of other products which are already known. Progress has been made in the direction of standardizing a complete instrument board as is shown in the accompanying illustration. On the right of the photo of the instrument board will be seen the units of the Pioneer earth inductor compass; in the center is an optical type speed and drift meter. The cover which carries the calculating scale is raised when making the observation. In the scale area, the pilot sees before him a perfect picture of the ground over which he is flying and is enabled to determine accurately the angle of drift as well as his speed over the ground. In the upper left corner of the instrument board is the Pioneer combined indicator of absolute airspeed and air distance.

This instrument operates electrically from a small air impelled transmitter located on a wing strut.

Another instrument developed by the Pioneer Instrument Company during the past year is a navigating calculator with which it is possible to quickly solve any problem of aerial navigation involving the air speed, ground speed, wind speed, compass setting, drift angle, course and altitude. The Pioneer Instrument Company has also constructed for the Air Mail Service a number of landing lights and for the Army Air Service special gages for supercharged engines and a new type of fuel level gage.

The Navigation Instrument Corporation of San Francisco are agents for the Paulin system instruments in the United States. This company is specializing in the type F-1 airplane altimeter. This altimeter is claimed to be particularly useful in aerial survey due to its accuracy, dependability and sturdy construction.

The Bureau of Standards has developed during the past year for the Navy Department landing altimeters for use on the U.S.S. *Shenandoah*. This altimeter has an open scale up to 3,000 ft. and may be carried up to 18,000 ft. without injury. A combined altimeter and barograph and a camera sextant, which records photographically, provides from the readings a record which may be filed with the airship's log.

The Bureau of Standards has developed an electric gas and air thermometer and a fabric tension meter, both of which are of great value in airship operation. Other instruments completed for the U.S.S. *Shenandoah* includes a liquid rate-of-climb indicator and an improved bubble sextant and several liquid and mechanical type manometers. The Aeronautic Instrument Section of the Bureau of Standards has continued the fundamental research work for the simplification, improvement and standardization of instrument mechanisms; the improvement of instrument pressure elements; and the obtaining of performance data for various types of pressure elements, bearings, and mechanisms for use in the design of aeronautical instruments.

Equipment—The outstanding feature in the operation of airplanes in the year 1924, was the success of the Air Mail Service in operating over its night airways. The success of the Air Mail operation definitely establishes the fact that night flying is not only a commercial success but also a military necessity.

The success of the Air Mail Service in its night flying operations is largely due to the co-operation of the manufacturers in supplying lighting equipment. The Sperry Gyroscope Company has continued the development and improvement of ground lighting equipment for

the night airways. In the development of landing lights it has been found desirable to operate the lights with a high intensity arc into a fan of at least eighty degrees horizontal spread. The original forty degrees spread was found to illuminate too small a portion of the field. The opinion of the pilots on the night airways was that the area illuminated was more important than the intensity of illumination. The Sperry company has developed a landing light with an eighty degree spread lens which makes possible the illumination of practically the entire field including the objects or obstacles surrounding the field.

The Sperry company has also developed the Sperry eighteen inch incandescent beacon which has been used during the year at several fields and found to function perfectly as unattended beacons. The beacon is fitted with automatic lamp changing mechanism, automatically turning the spare lamp into focus when the first lamp is burned out. The failure of the first lamp is made known to the next pilot passing over by the burning of an auxiliary colored lamp mounted on the top of the beacon.

The American Gas Accumulator Company has brought out during the year a new design of routing beacon. The beacon is of the unattended automatic type operated by acetylene gas and set to flash from ten to one-hundred-fifty lights per minute by the addition of a sun relay, which is a device which functions by varying degrees of light and darkness and automatically opens the gas valve. The newly designed beacon operates for six months on one tank of gas instead of four months which was necessary for the beacon which was not fitted with the sun relay. This means a saving of more than $30,000 in the cost of maintaining the routing beacons of this type on the night airway.

The Interflash Signal Corporation has installed for the Army Air Service and the Post Office Department their new automatic flash beacon which uses acetylene gas as an illuminant. This beacon gives a powerful flashlight visible for 360 degrees and 180 degrees through the vertical. This beacon is so designed that it operates automatically for a period of one year without attendant.

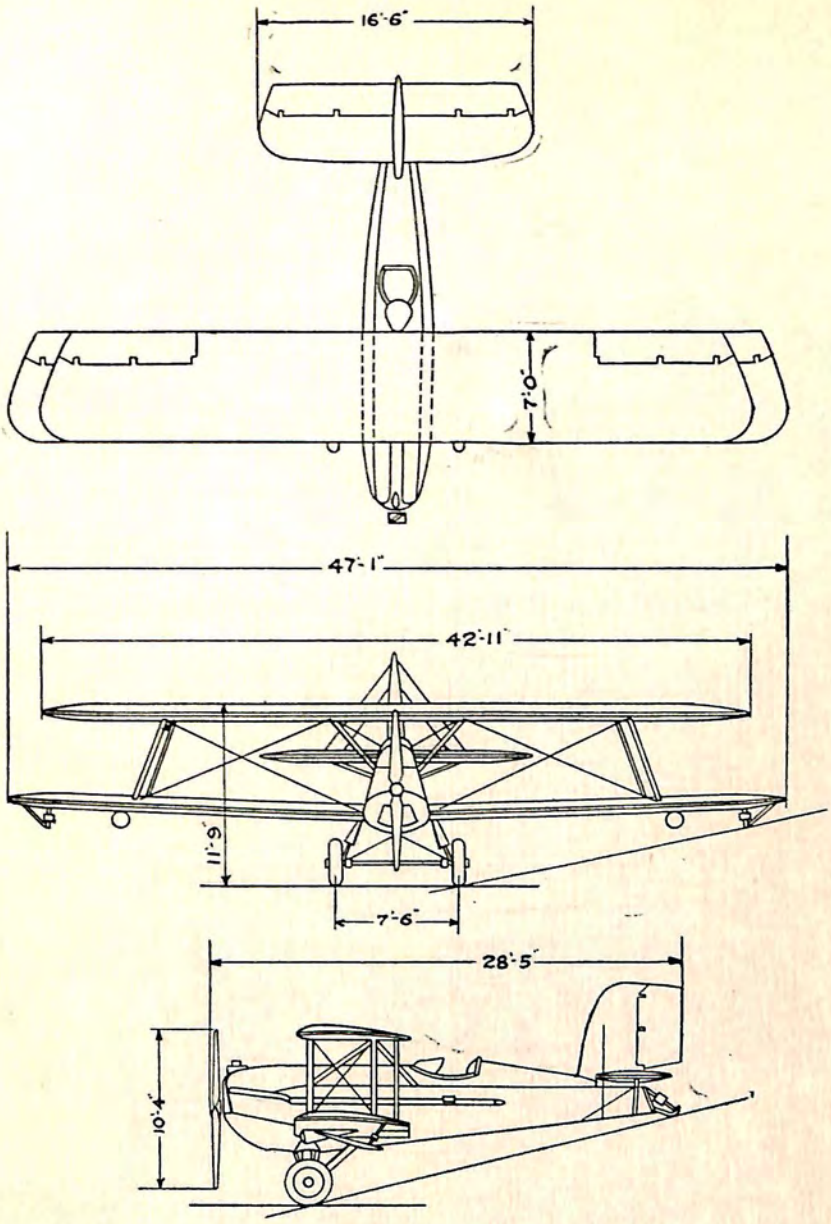
The B B T Corporation of America are agents for the Barbier, Bernard and Turenne flood light which has proved very successful in the lighting of landing fields for night flying in Europe. The B. B. T. light is standard at all the Air Mail terminal fields.

S K F Industries, Incorporated, co-operated with the Navy Department in providing suitable bearings in every important location on the *Los Angeles* and the *Shenandoah,* and supplied thrust bearings for the Army Air Service for use in the engine used by Lt. R. L.

Maughan in his dawn-to-dusk flight, and on the Douglas world cruiser on the round-the-world flight. The self-aligning bearings manufactured by this company are used in magnetos, crankshaft gears, water pumps, gasoline pumps, propeller thrust, automatic pilot control, and mooring gears for lighter-than-air craft.

The United States Cartridge Company developed during the war an extruded seamless copper tube, and succeeded in manufacturing long tubes by this method having uniform thickness and very few pits or other defects. Following the war, in 1920, the tubes made by this process were used in radiator construction, and radiators of this type have proved very satisfactory, as they are characterized by strength, water-flow capacity, ease of repair, and high cooling efficiency.

AIRCRAFT AND ENGINE DESIGN SECTION



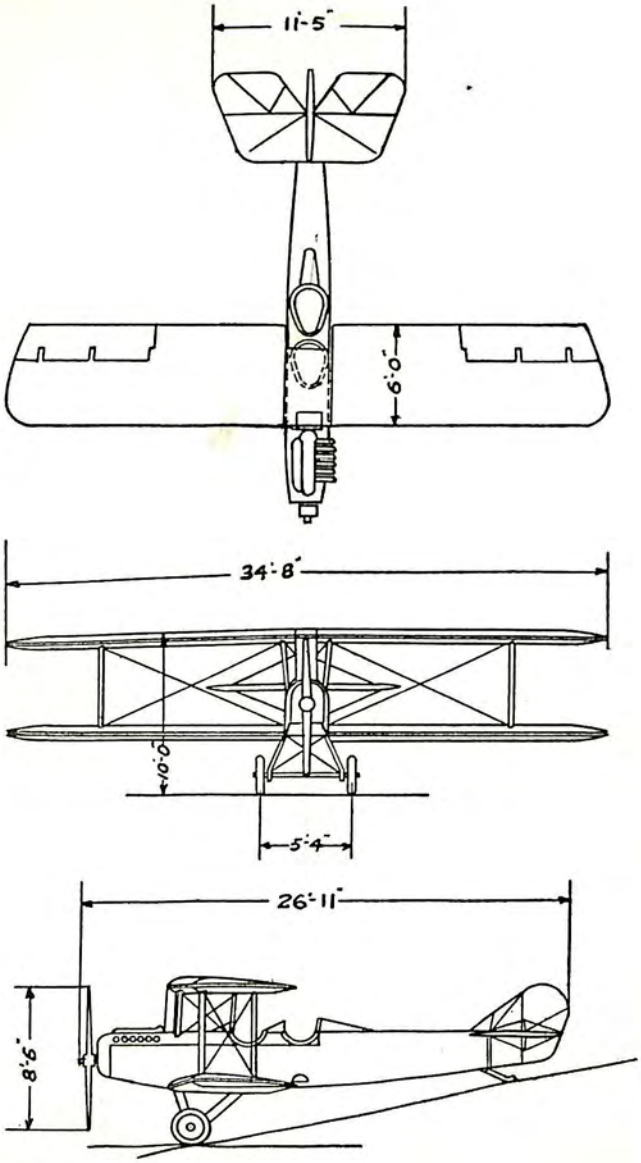
AERIAL SERVICE CORPORATION

HAMMONDSPORT. N.Y.

MERCURY' NIGHT AIR MAIL PLANE

ENGINE - LIBERTY 12: CAPACITY- 1000 LB:

SPEED- 51-125 M.P.H. CEILING-17000 FT.



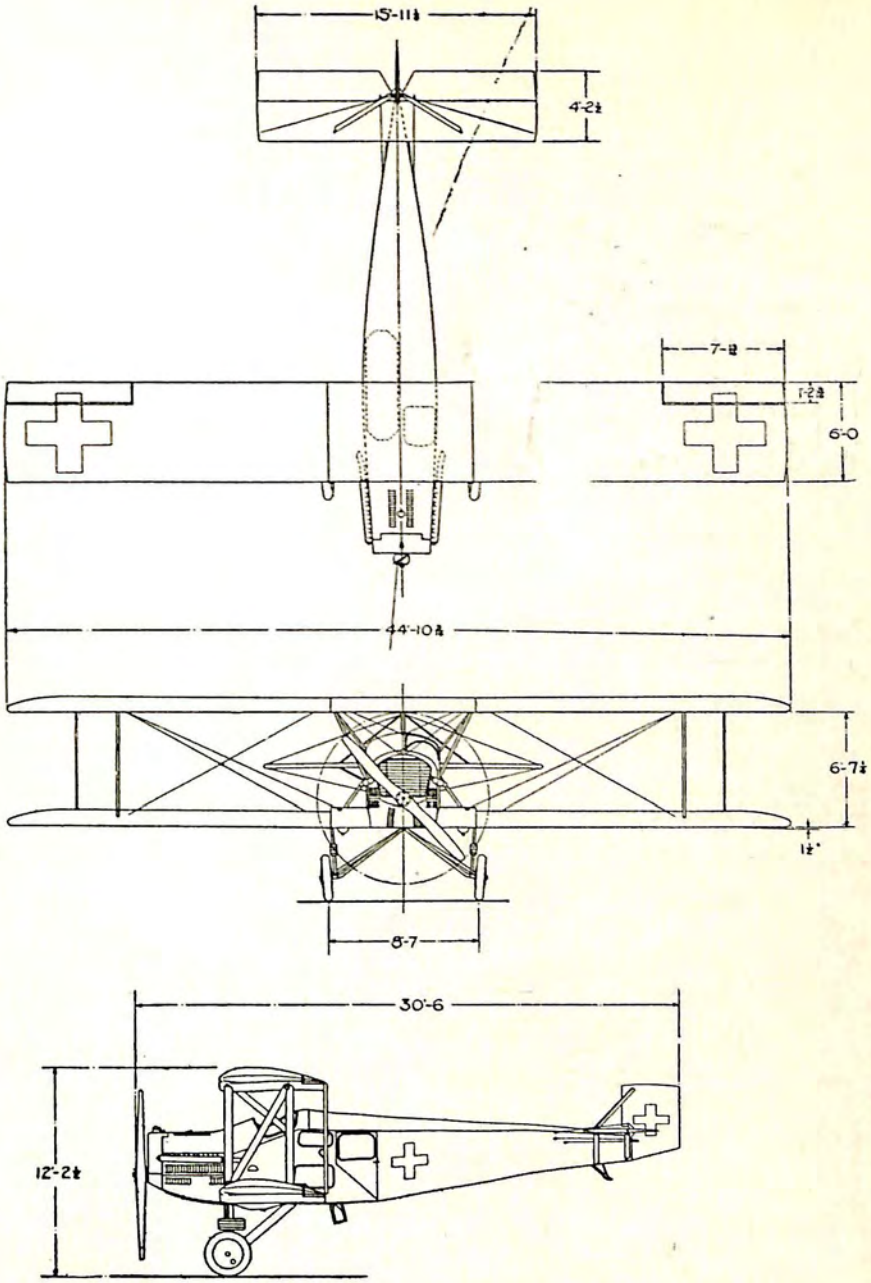
AERIAL SERVICE CORPORATION

HAMMONDSPORT.N.Y.

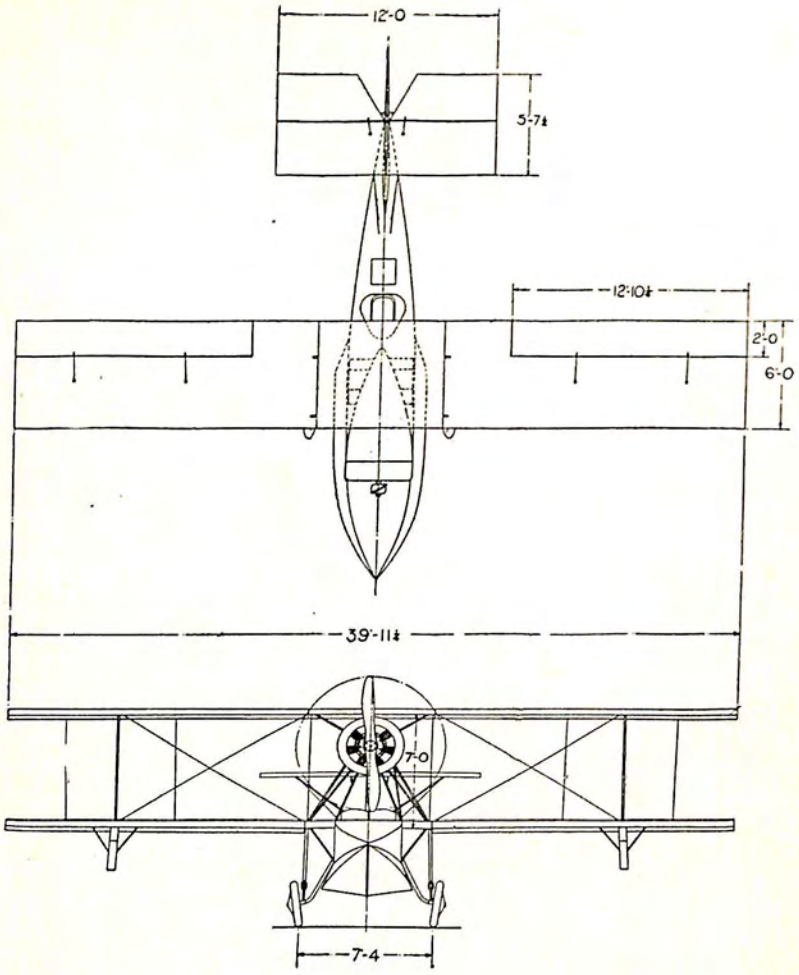
'MERCURY' TRAINING PLANE

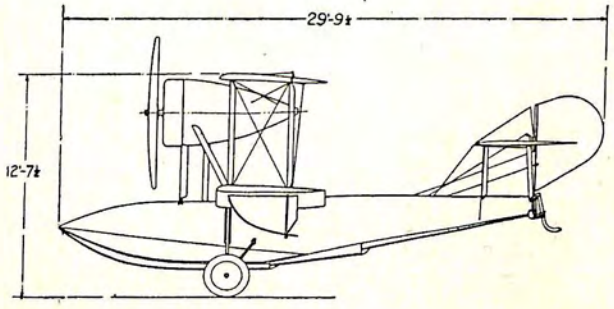
ENGINE - CURTISS C.6-A 160 H.P.

SPEED - 100 M.P.H. CEILING - 15000 FT.

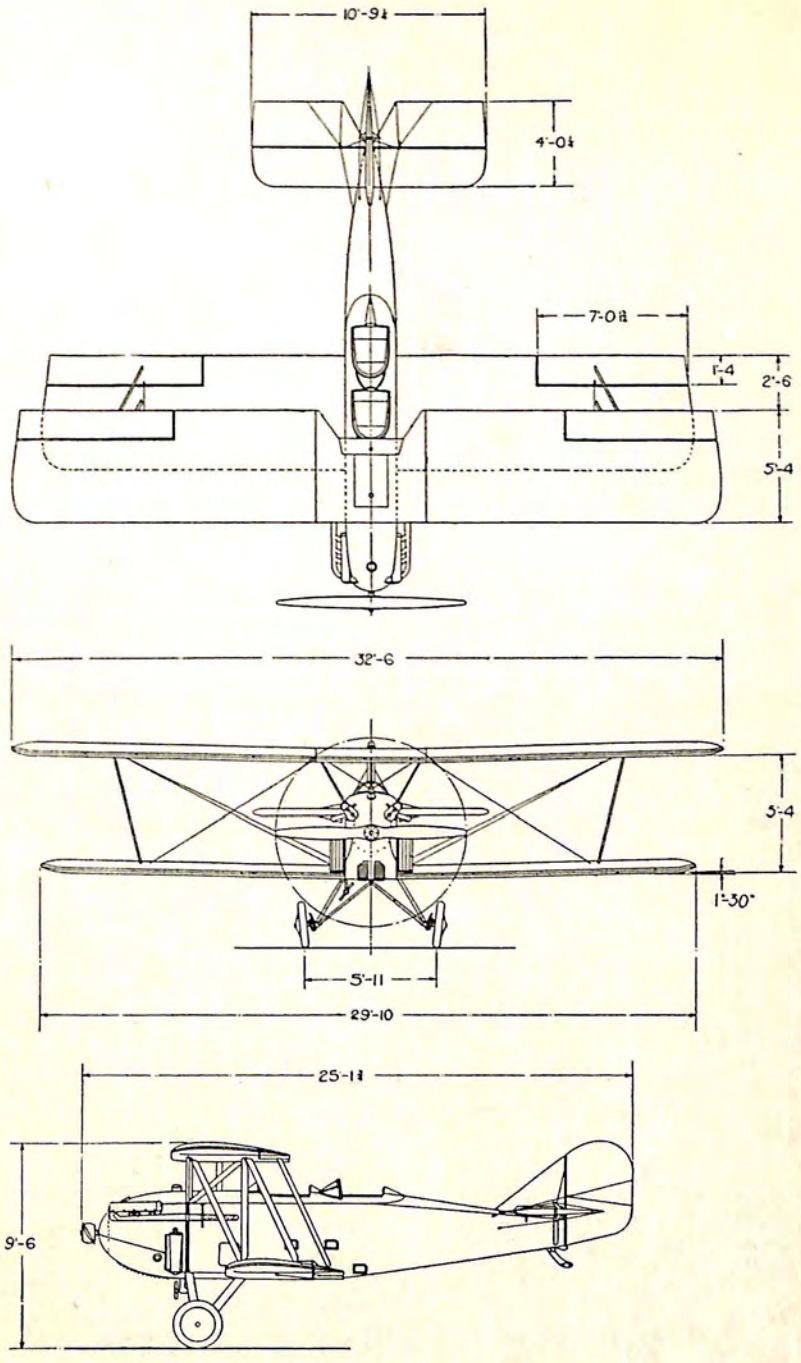


COX-KLEMIN AIRCRAFT CORPORATION.
BALDWIN, L.I., N.Y.
XA-1 AMBULANCE AIRPLANE.
TWO STRETCHER PATIENTS, SURGEON & PILOT

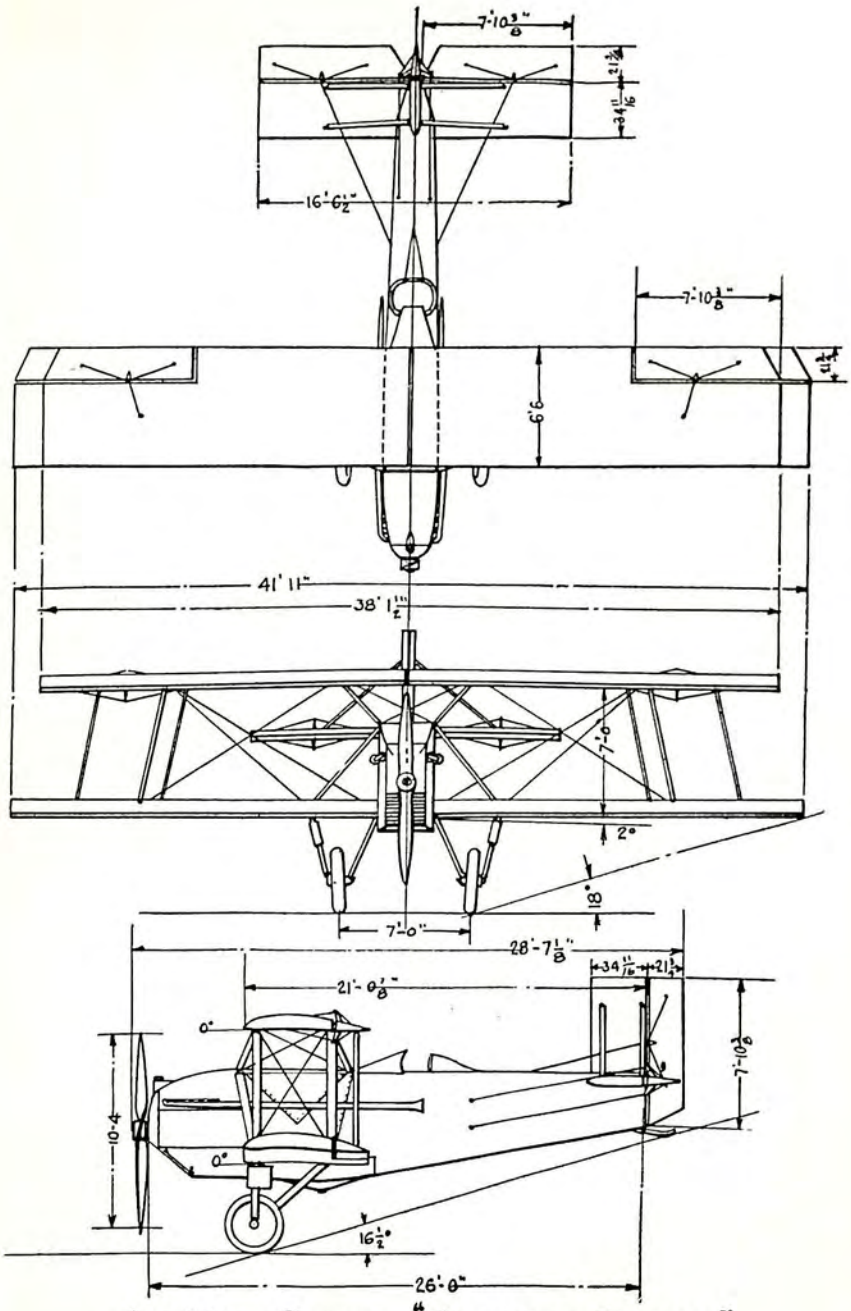




COX-KLEMIN AIRCRAFT CORPORATION.
BALDWIN, L.I., N.Y.
CK-18 AMPHIBIAN AIRPLANE.
TWO PASSENGERS & PILOT

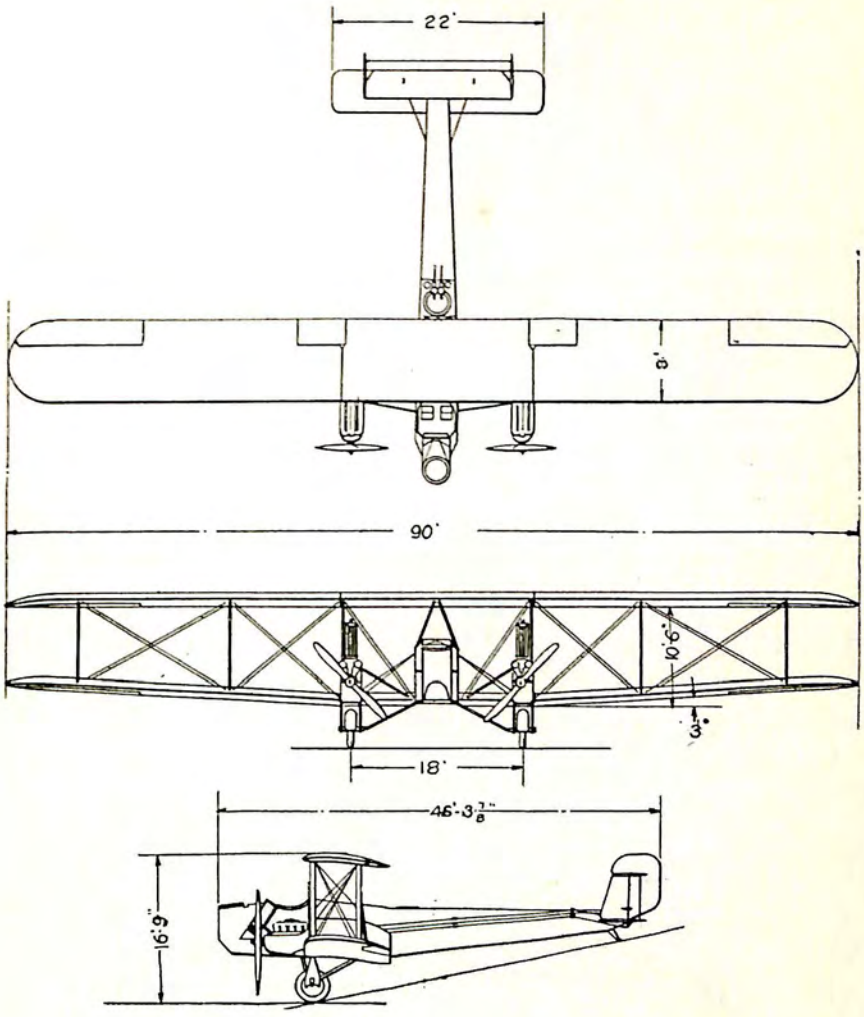


COX-KLEMIN AIRCRAFT CORPORATION.
BALDWIN, L.I., N.Y.
CK-2A TRAINING AIRPLANE.
STUDENT & INSTRUCTOR

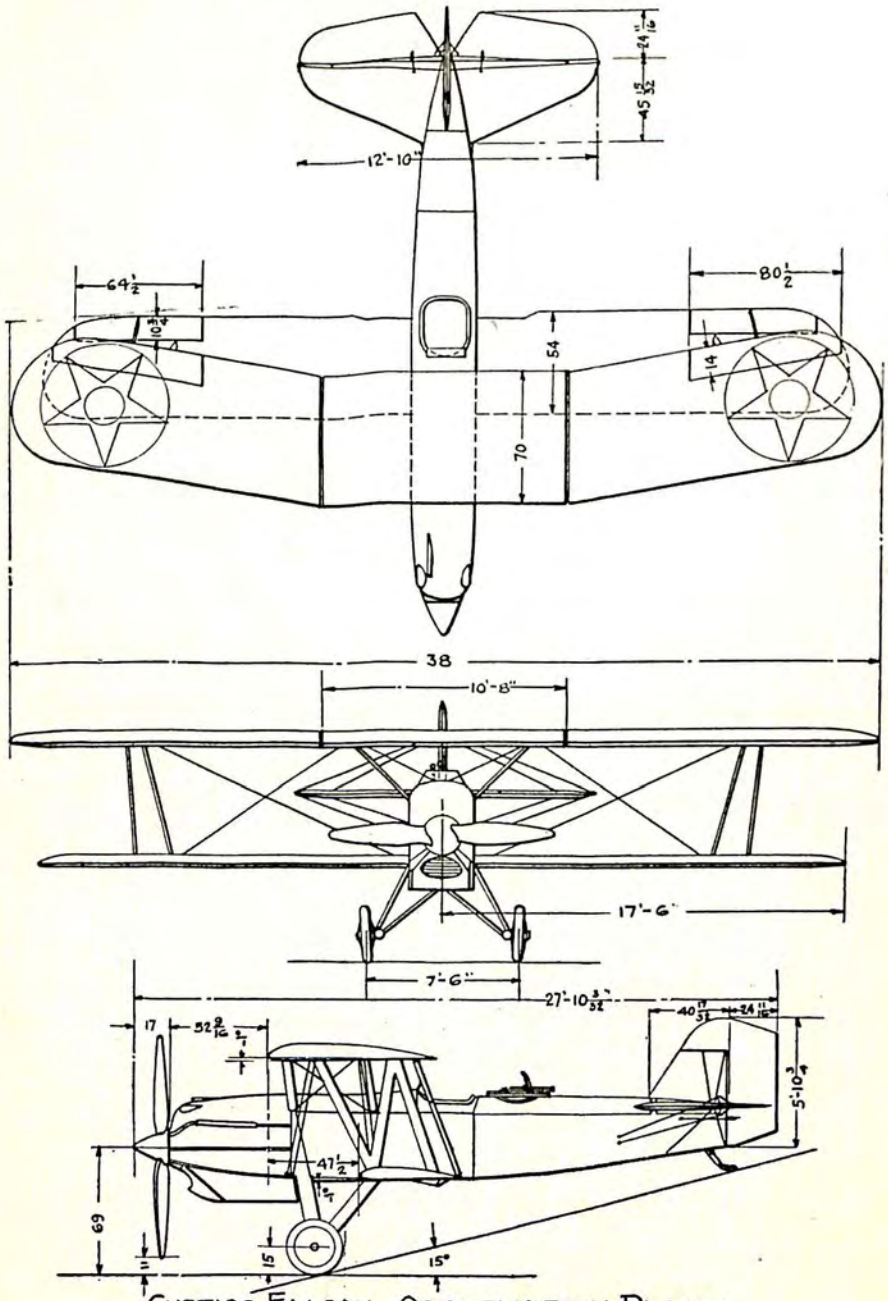


AIR MAIL PLANE - "CARRIER PIGEON"

THE CURTISS AEROPLANE & MOTOR COMPANY INC.



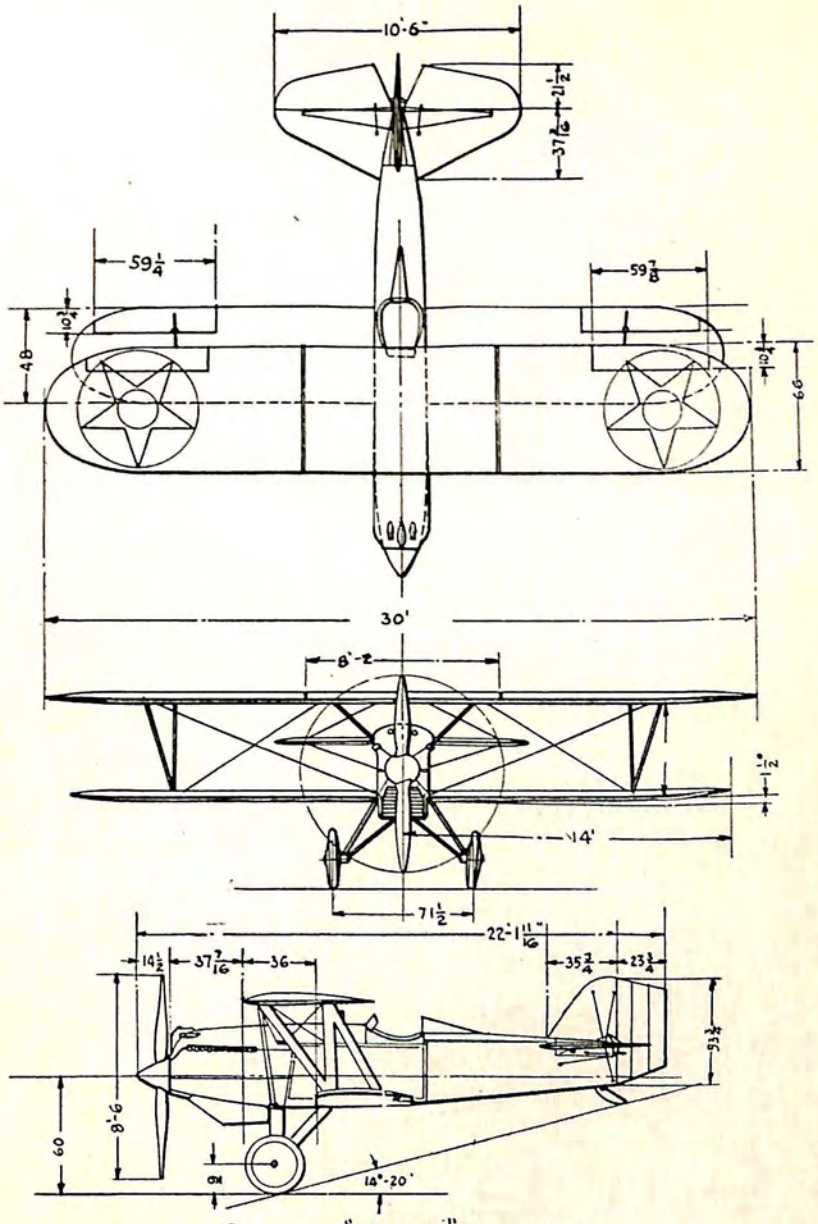
CURTISS "CONDOR" NIGHT BOMBER
(U.S. ARMY — N.B.5-4)
TWO LIBERTY 12-420 H.P. MOTORS
HIGH SPEED 103.5 M.P.H. — CEILING 13,400 FT
THE CURTISS AEROPLANE & MOTOR COMPANY, INC.
GARDEN CITY, N.Y.



CURTISS FALCON - OBSERVATION PLANE
(U.S. ARMY - XO-1)

LIBERTY 12 MOTOR 415 H.P. — PACKARD 1-A-1500 MOTOR 510 H.P.
HIGH SPEED 152 M.P.H. HIGH SPEED 158 M.P.H.
CEILING 20,300 FT. CEILING 24,800 FT.

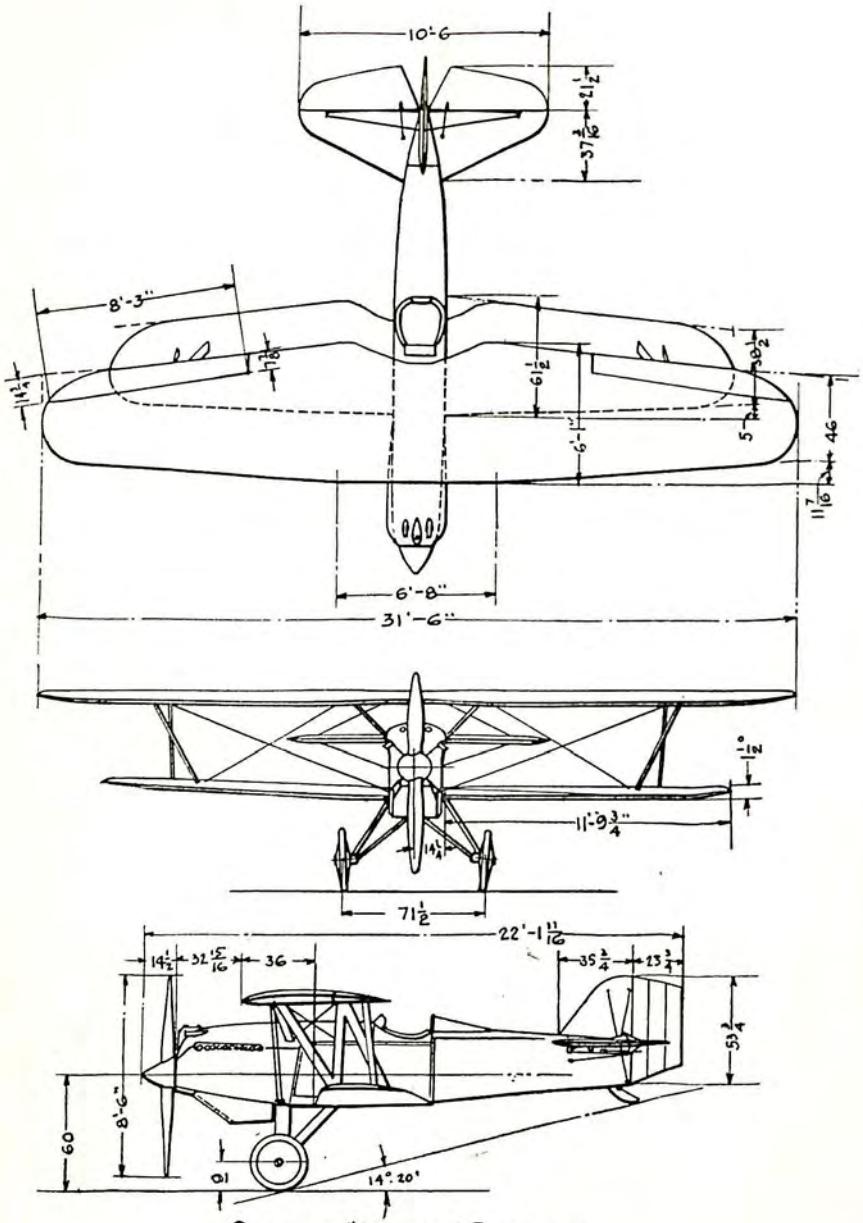
THE CURTISS AEROPLANE & MOTOR COMPANY INC.
GARDEN CITY, N.Y.



CURTISS "HAWK" PURSUIT
(U.S. ARMY — PW 8-A)

STRAIGHT WING — CURTISS D-12 MOTOR
HIGH SPEED 178 M.P.H. CEILING 23,400 FT.

THE CURTISS AEROPLANE & MOTOR COMPANY INC.
GARDEN CITY, N.Y.

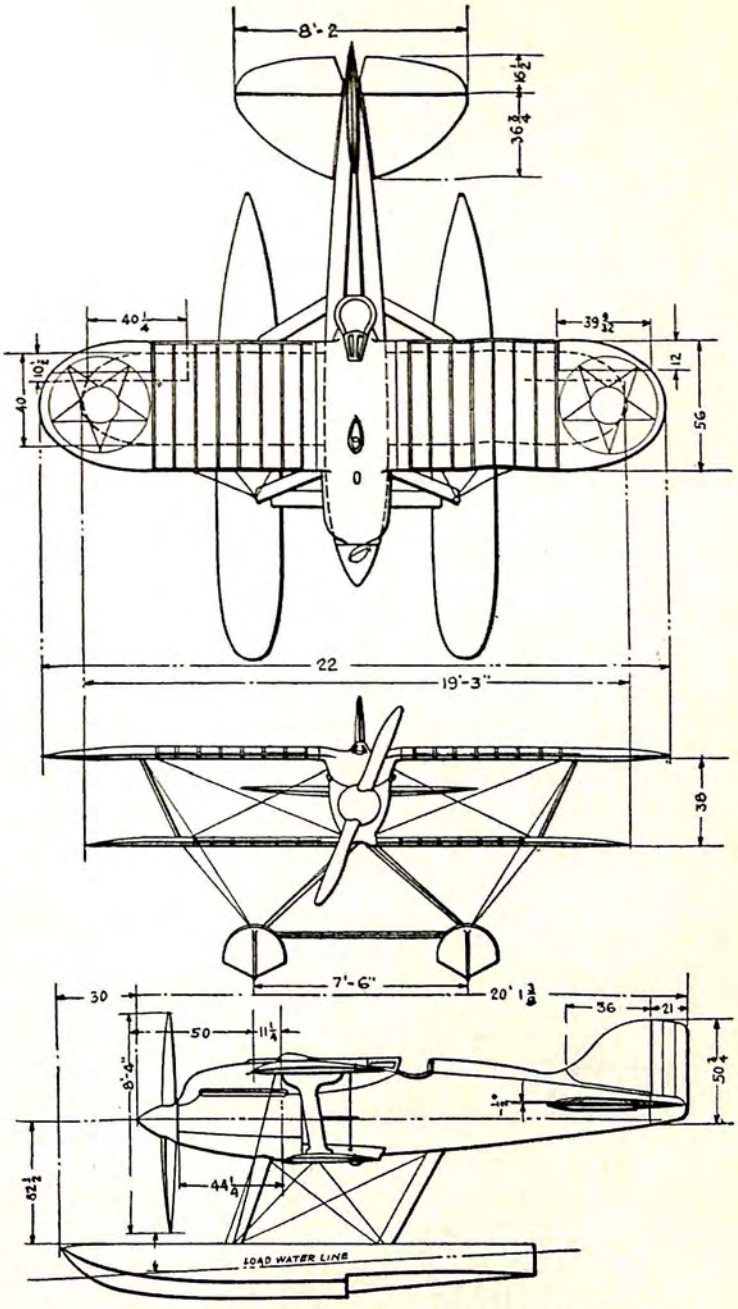


CURTISS "HAWK" PURSUIT
(U.S.ARMY – P.W.-8-B)

TAPERED WING – CURTISS D-12 MOTOR

HIGH SPEED 170 M.P.H. CEILING 24,250 FT.

THE CURTISS AEROPLANE & MOTOR COMPANY INC.
GARDEN CITY, N.Y.



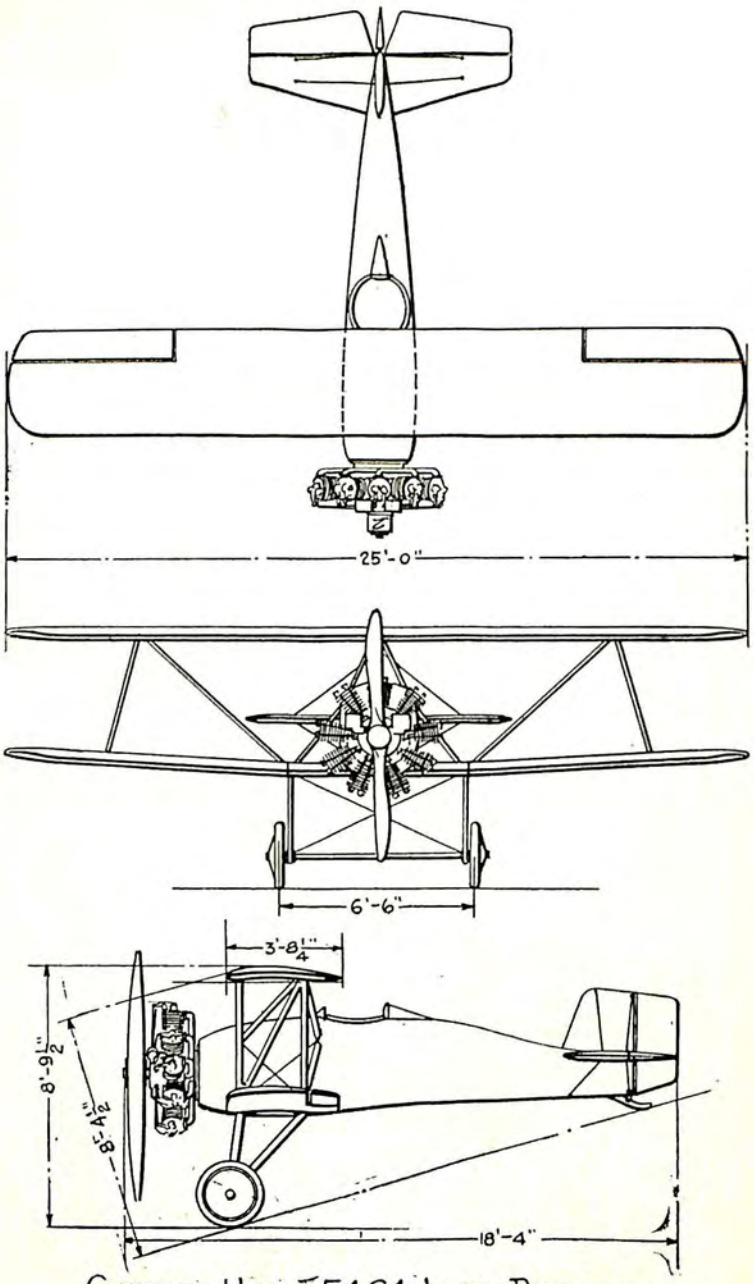
CURTISS R.2.C-2 SEAPLANE RACER

CURTISS D-12-A — 500 H.P. MOTOR

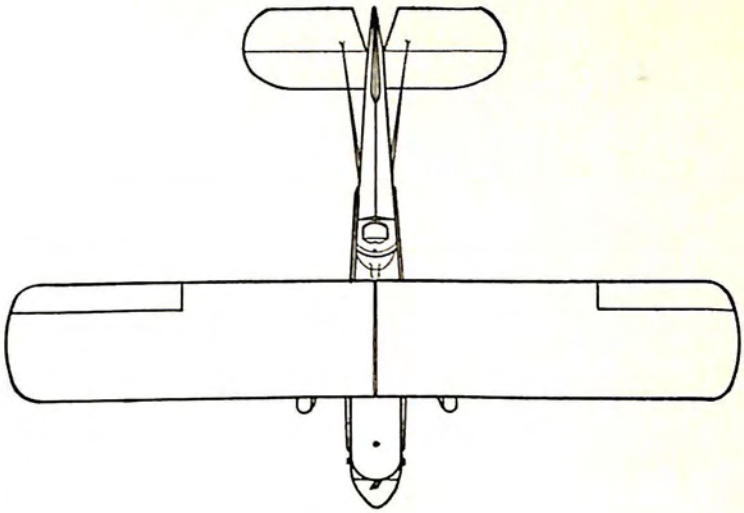
HIGH SPEED 226.9 M.P.H. — LANDING SPEED 80.0 M.P.H.

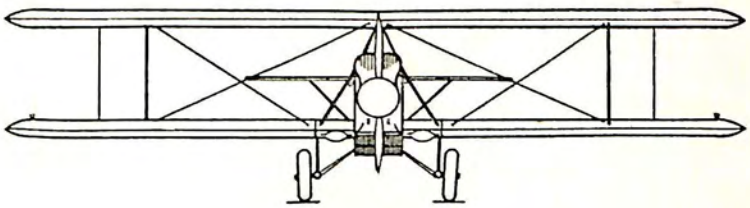
THE CURTISS AEROPLANE & MOTOR COMPANY INC.

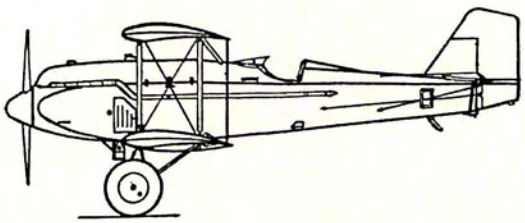
GARDEN CITY, N.Y



CURTISS-HALL-F4C-1-LIGHT PURSUIT
METAL CONSTRUCTION – WRIGHT J-3 MOTOR
HIGH SPEED 126 M.P.H. CEILING 21,200 FT.
THE CURTISS AEROPLANE & MOTOR COMPANY, INC.
AND CHARLES WARD HALL.







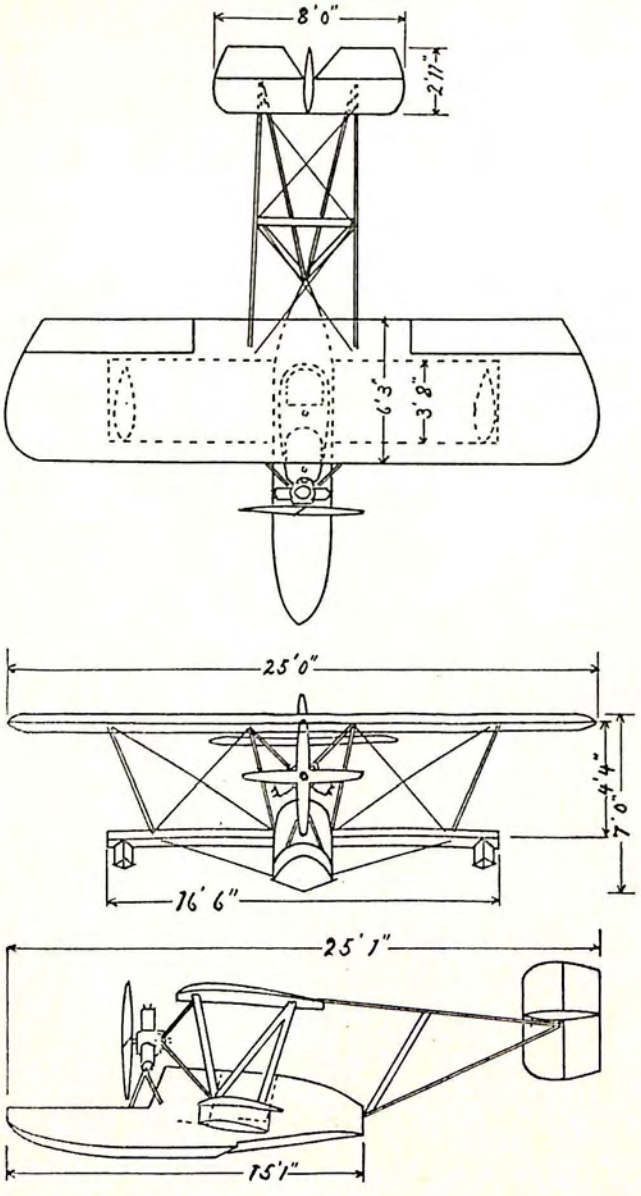
G. Elias & Bro., Inc.

AIRCRAFT DEPT

BUFFALO, N. Y

Type—Mail Plane
Speed—50—130 M. P. H.
Cruising Speed—105 M. P. H.

Capacity—1000 lbs.
Ceiling—17000 ft.
Range—450 Miles

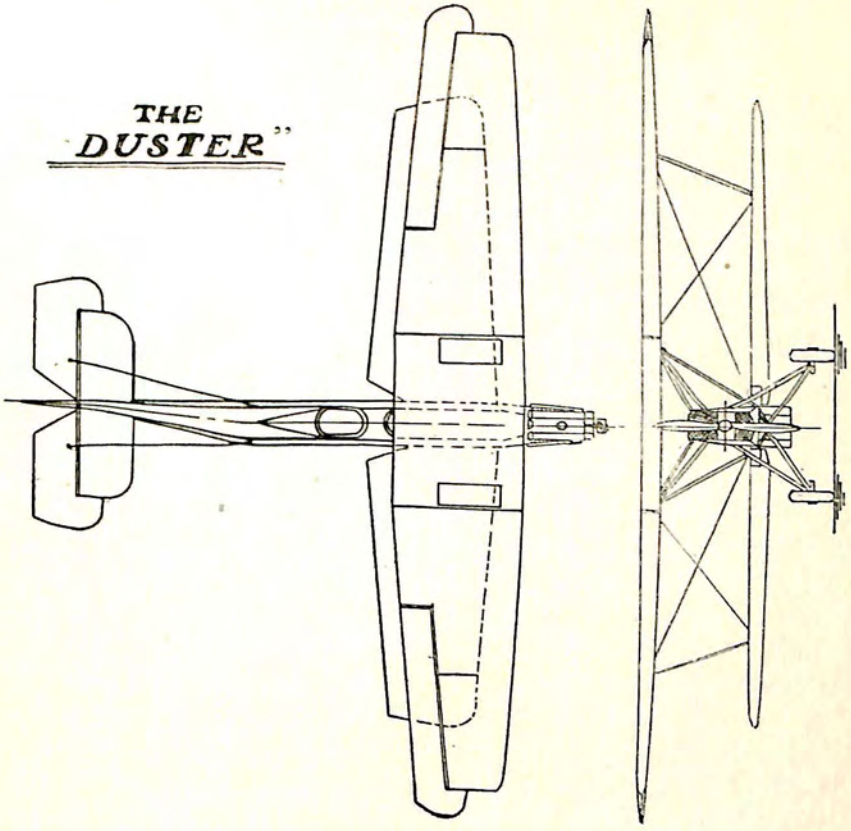


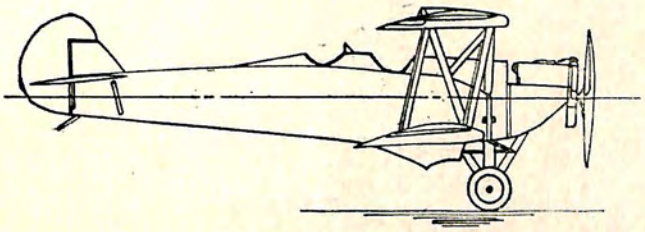
CHARLES WARD HALL. INC.

NEW YORK.

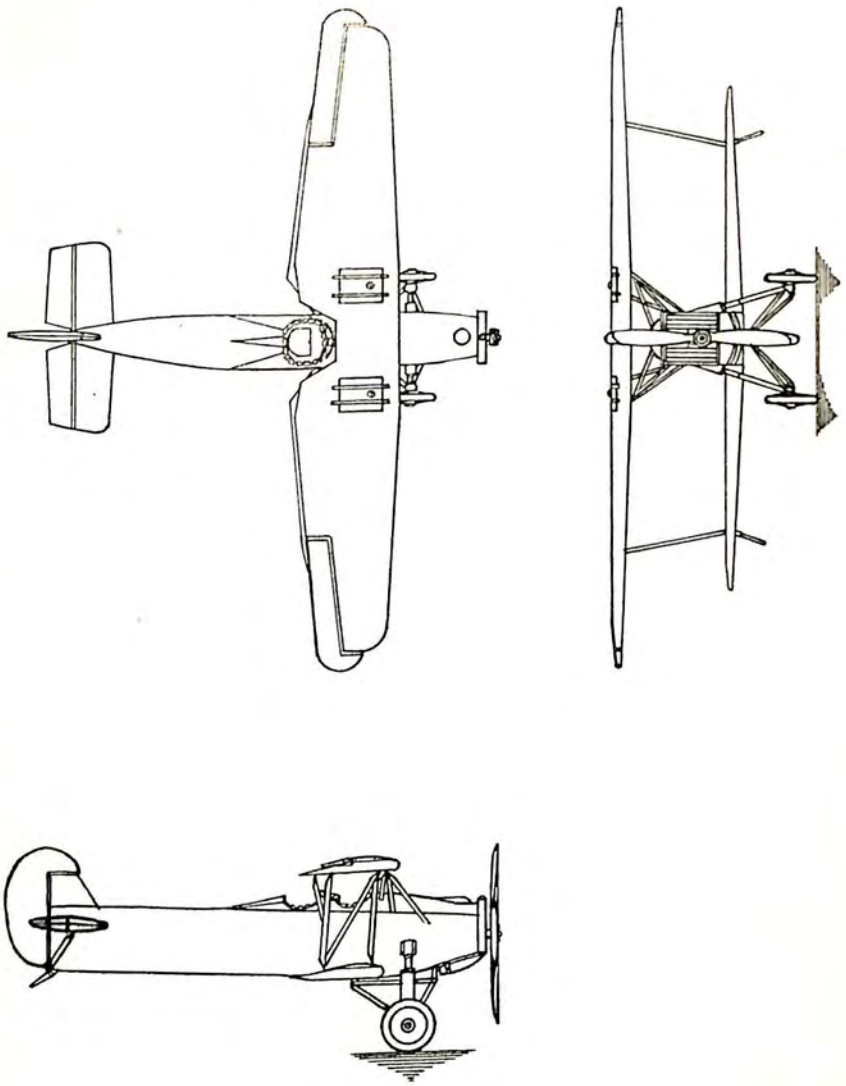
TYPE: TWO SEATER AIR YACHT.
WEIGHT EMPTY 530 LBS: FULL LOAD 950 LBS: ENGINE 60 H.P. WRIGHT: CRUISING RANGE 400 MILES.

THE
"DUSTER"



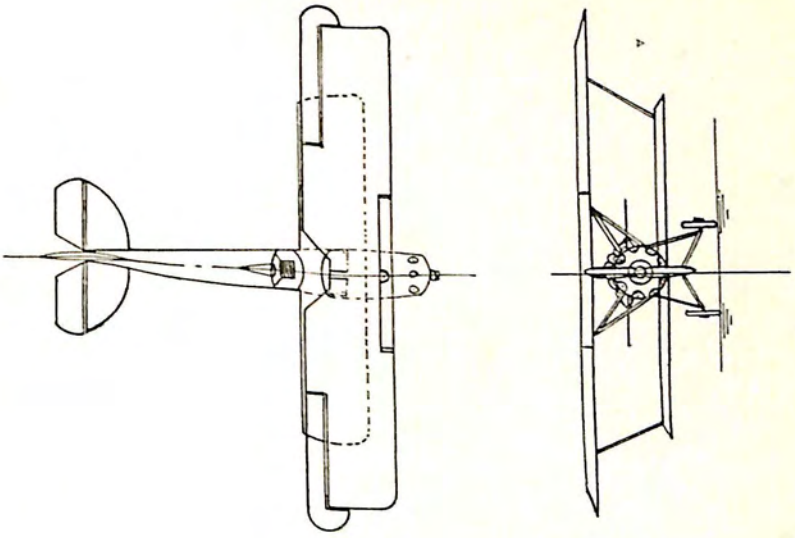


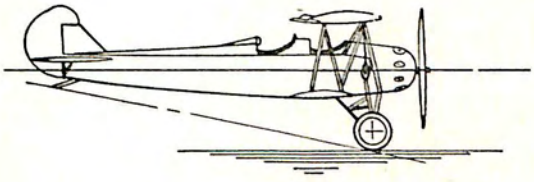
HUFF DALAND AERO CORP.
OGDENSBURG, NEW YORK.



PETREL
MODEL 4
ADVANCED TRAINING PLANE

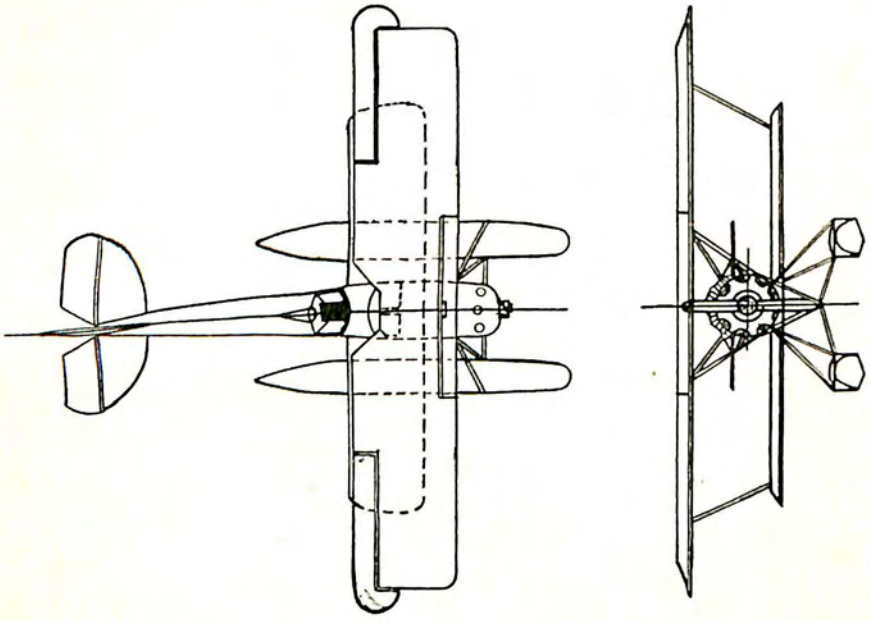
HUFF DALAND AERO CORP.
OGDENSBURG, N.Y.

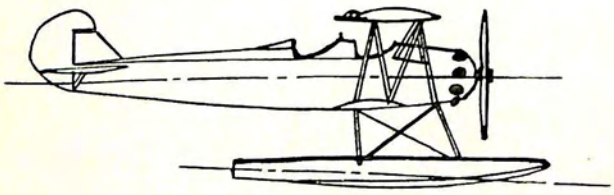




"PETREL"
MODEL 'O'

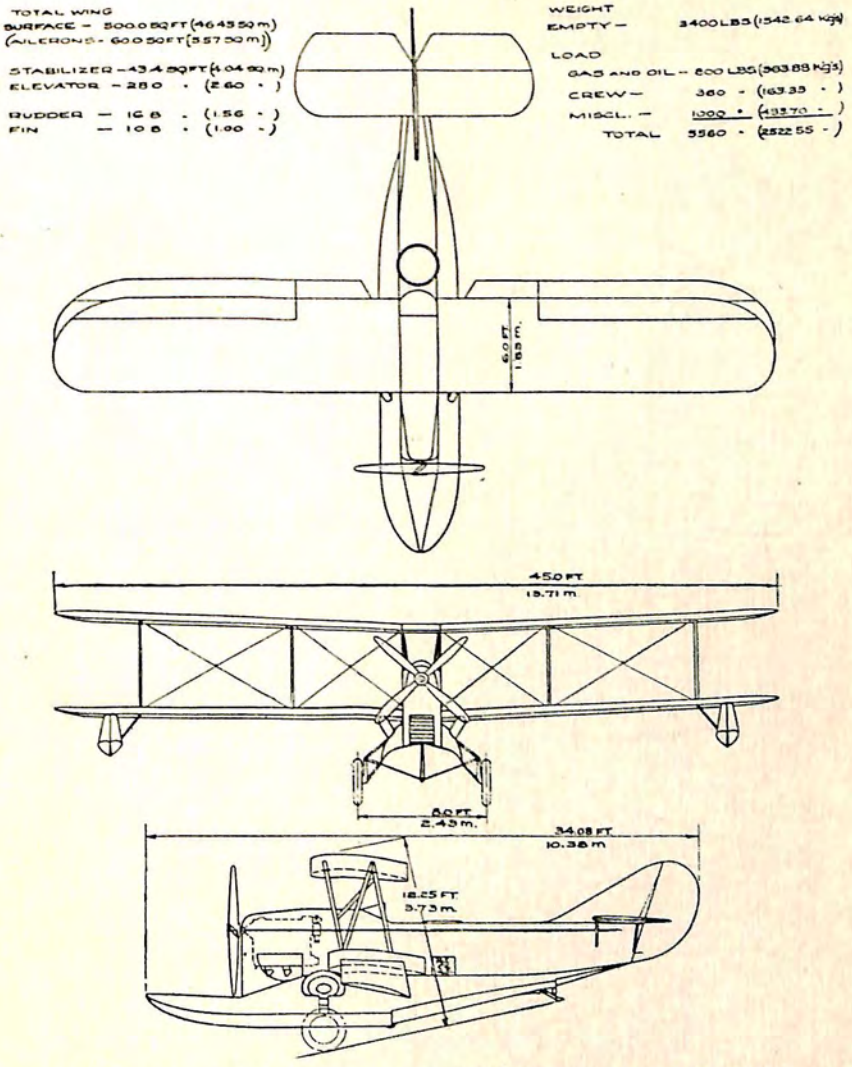
HUFF DALAND AERO CORP.
OGDENSBURG, NEW YORK.





PETREL
MODEL 5
SEAPLANE

HUFF DALAND AERO CORP.
OGDENSBURG, N.Y.

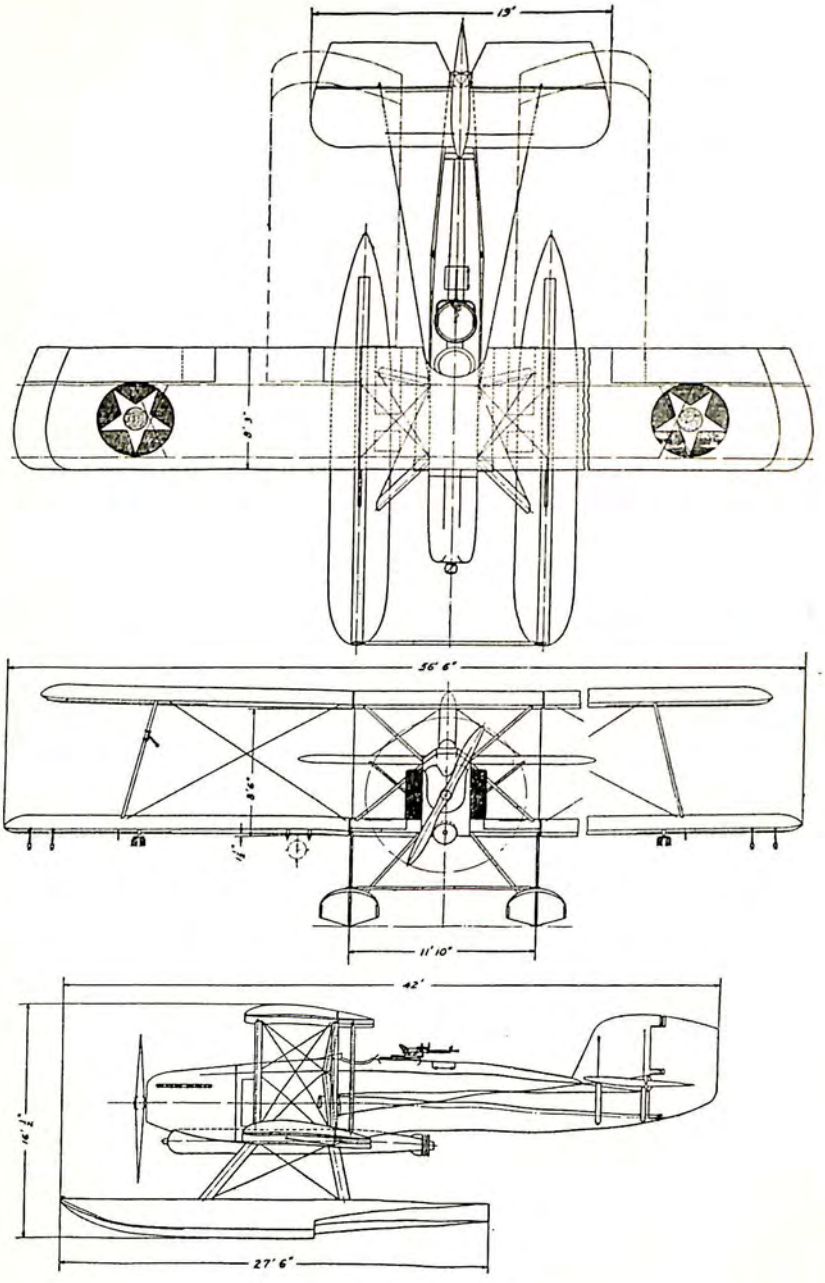


LOENING AERONAUTICAL ENGINEERING CORPORATION

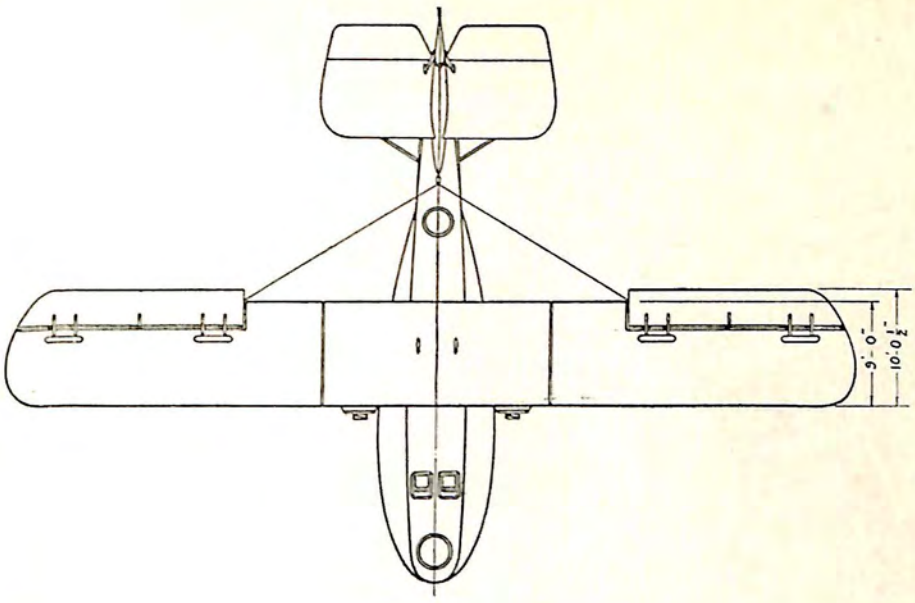
NEW YORK, N Y

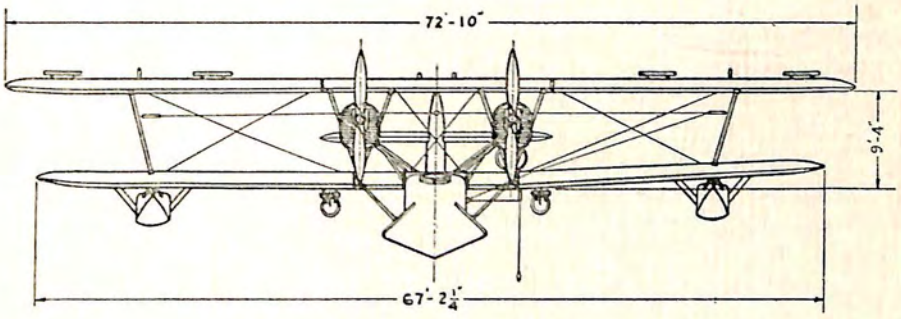
LOENING AMPHIBIAN MODEL 34

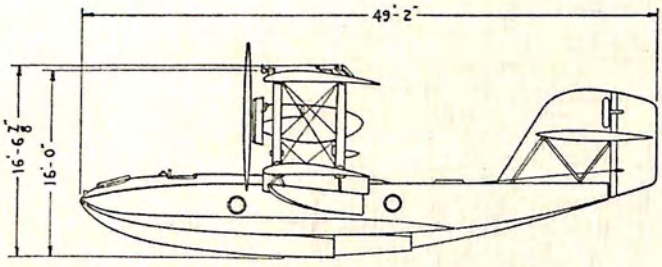
ENGINE: INVERTED LIBERTY-12 400 HP, SPEED: 122 M.P.H., CEILING: 13,500 FT



THE GLENN L. MARTIN COMPANY
CLEVELAND, OHIO, U. S. A.
NAVY-MARTIN SC-1 — WRIGHT T-2, T-3.
AND PACKARD 1A-2500 MOTORS

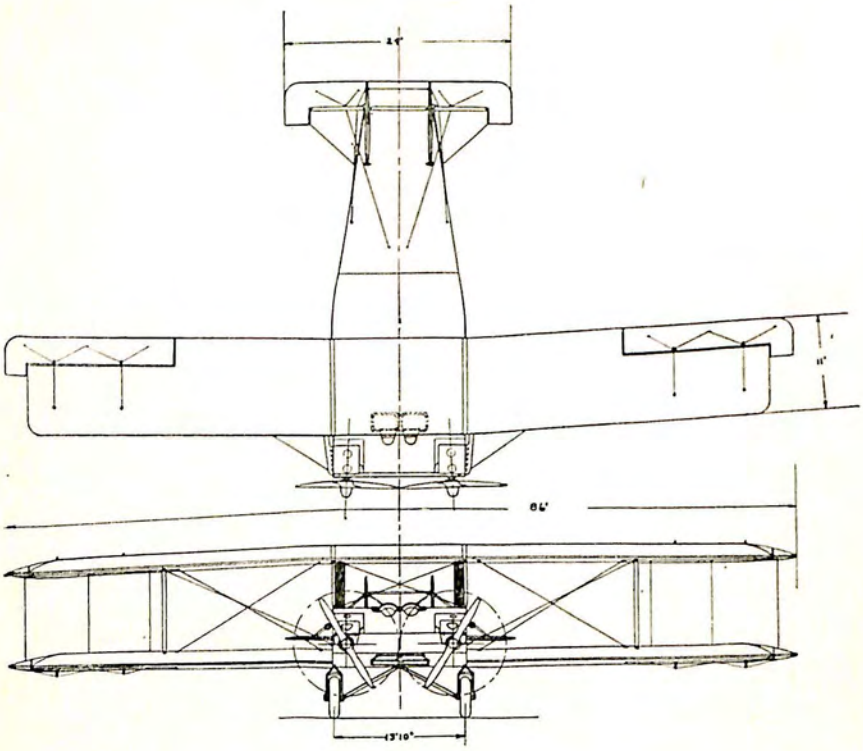


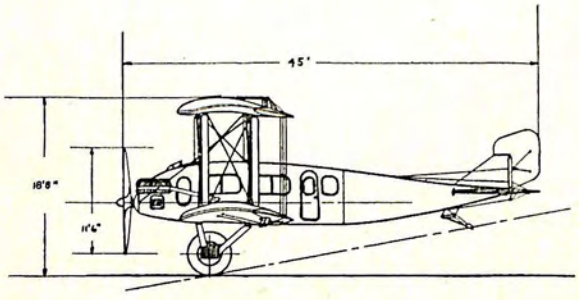




PN-9 AIRPLANE

DESIGNED BY THE BUREAU OF AERONAUTICS
AND CONSTRUCTED BY THE
NAVAL AIRCRAFT FACTORY, PHIA. PA.

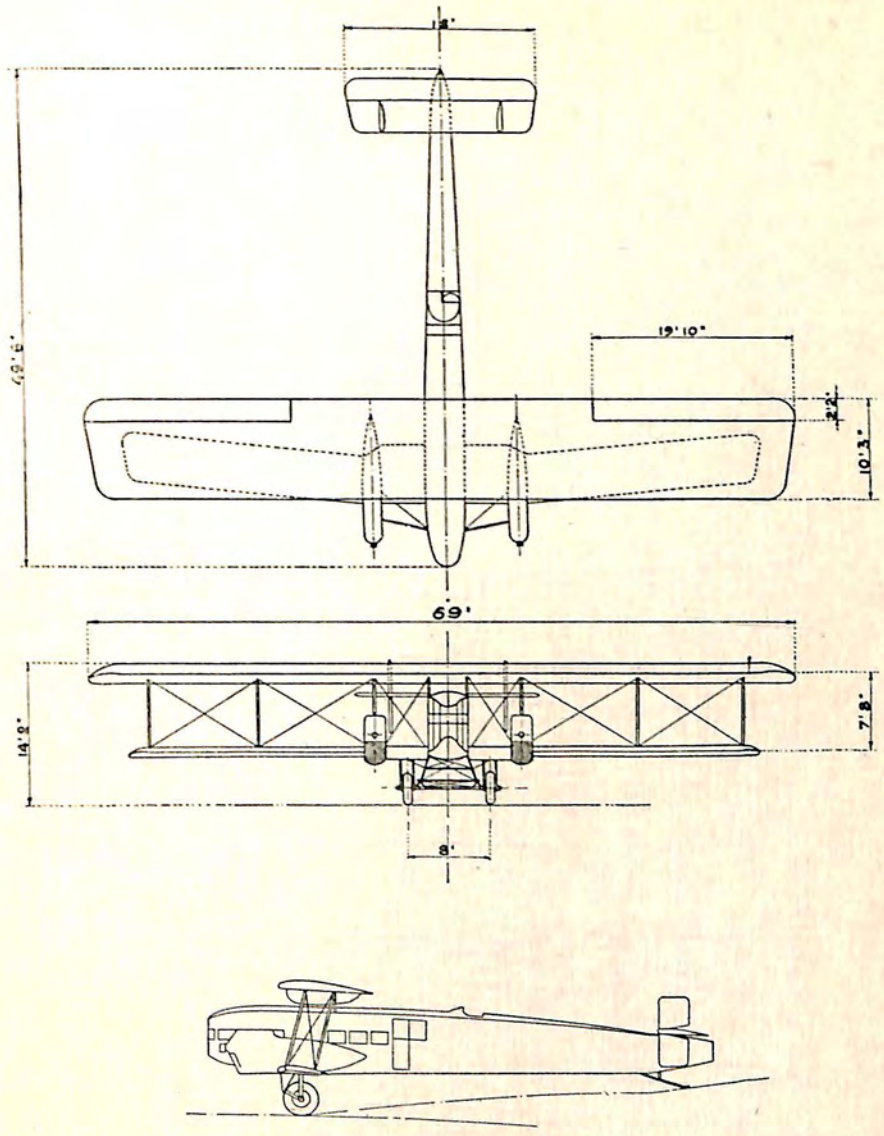




REMINGTON BURNELLI AIRCRAFT CORP.

NEW YORK NY

MODEL RB2 TRANSPORT ENGINES 2 ATLANTIC 500 HP.



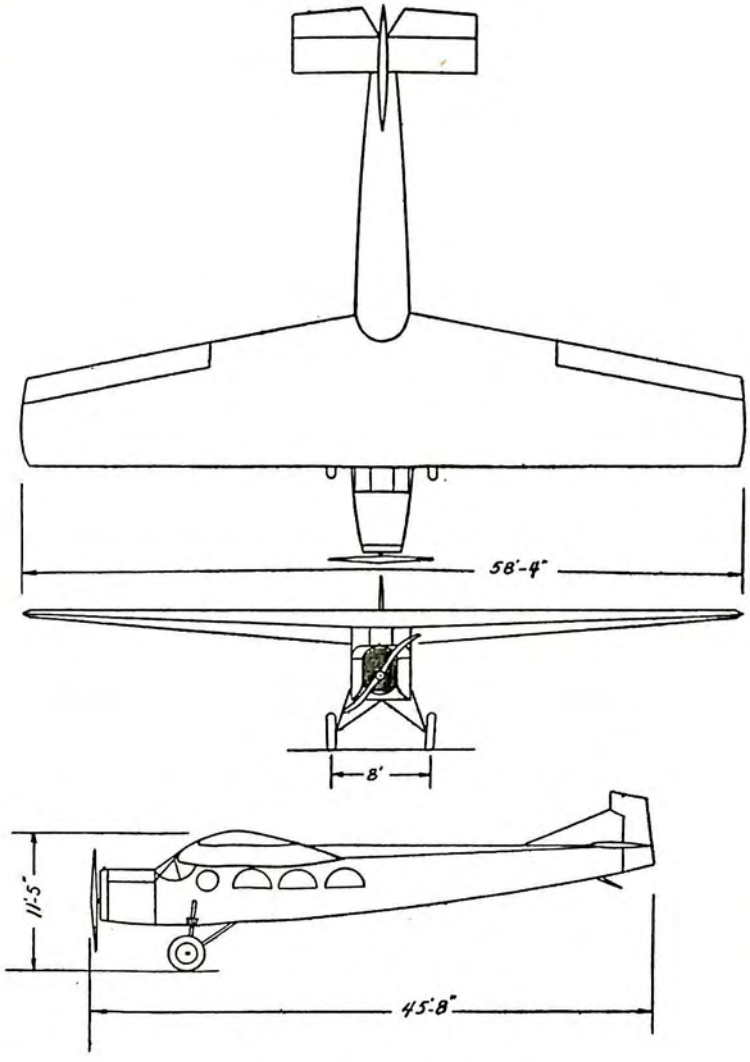
SIKORSKY AERO ENGINEERING CORPORATION

NEW YORK, N.Y.

SIKORSKY TWIN ENGINED TRANSPORT PLANE **S-29-A.**

ENGINES-LIBERTY "12"; SPEED 116 M.P.H., ON ONE MOTOR 75 M.P.H.

SERVICE CEILING 12500 FEET; CLIMB 5000 FEET IN 7 MIN 10 SEC

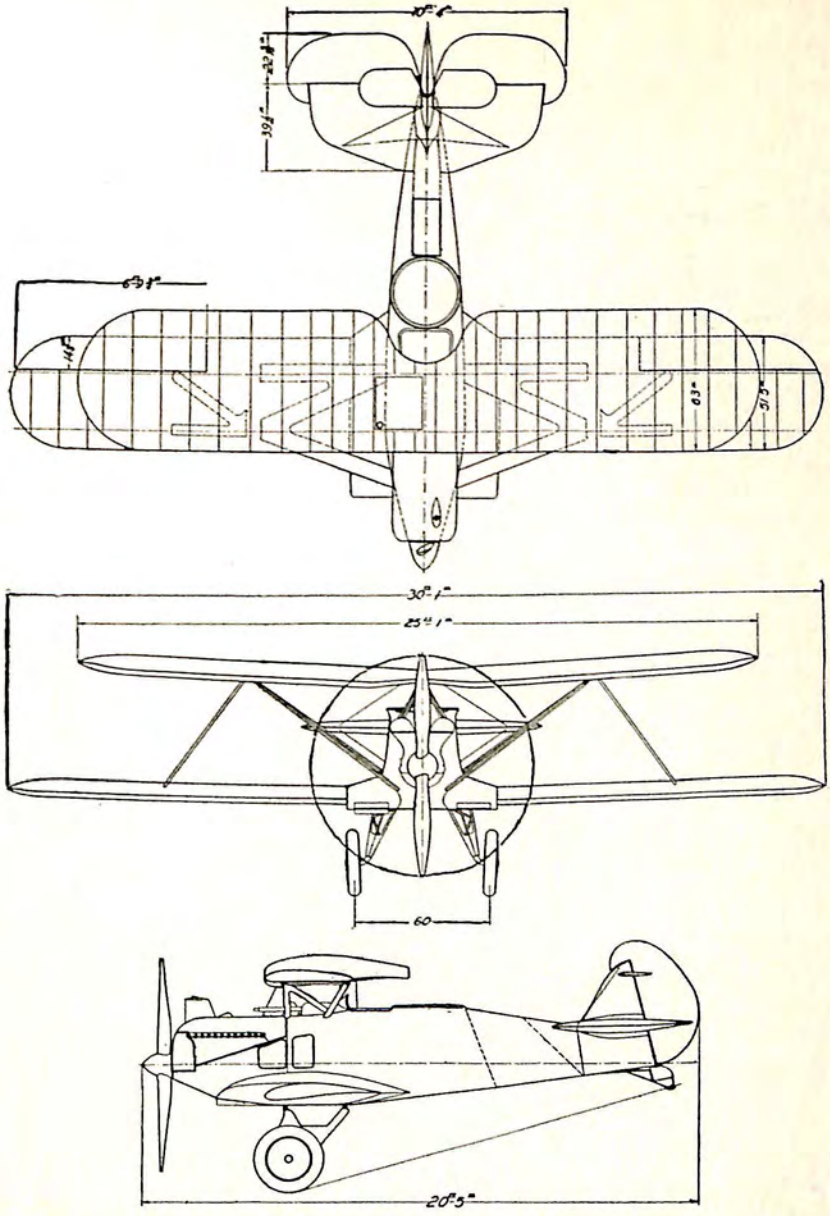


STOUT METAL AIRPLANE CO.

DEARBORN, MICH.

TYPE-AIR PULLMAN 400 H.P. LIBERTY.

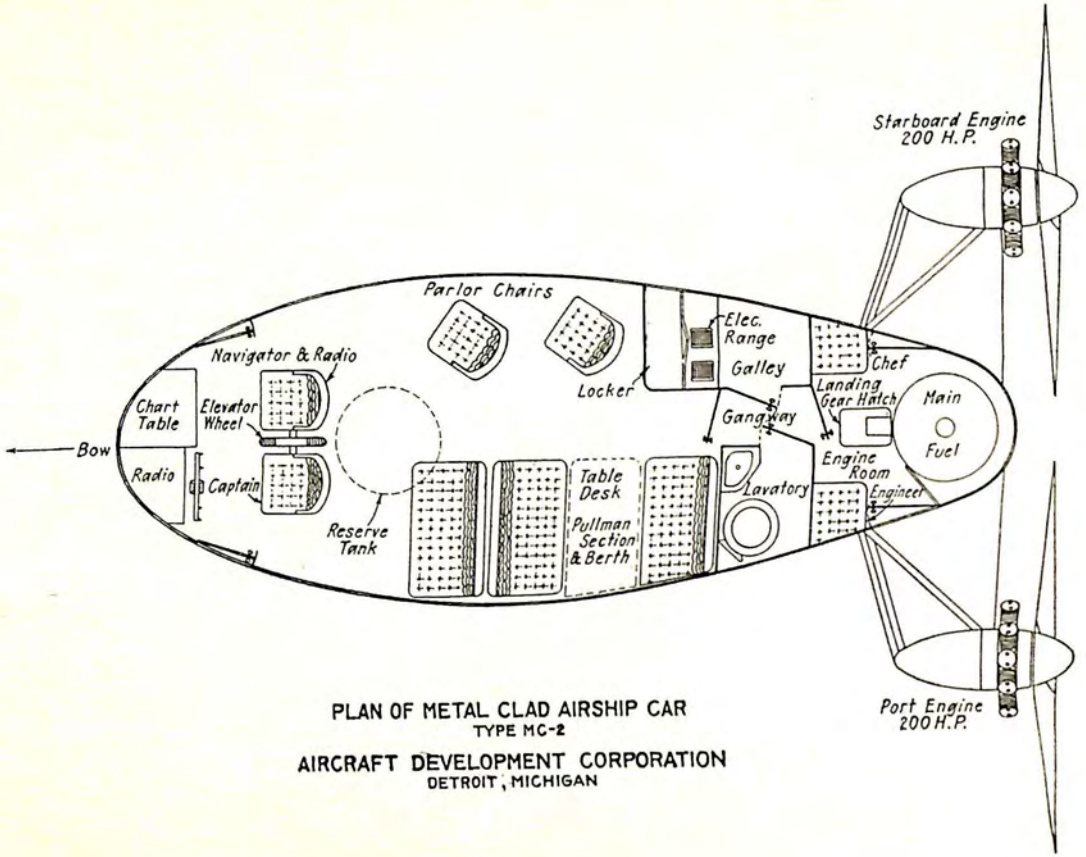
8 PASSENGERS MAX SPEED 116 M.P.H.



THOMAS MORSE AIRCRAFT CORPORATION

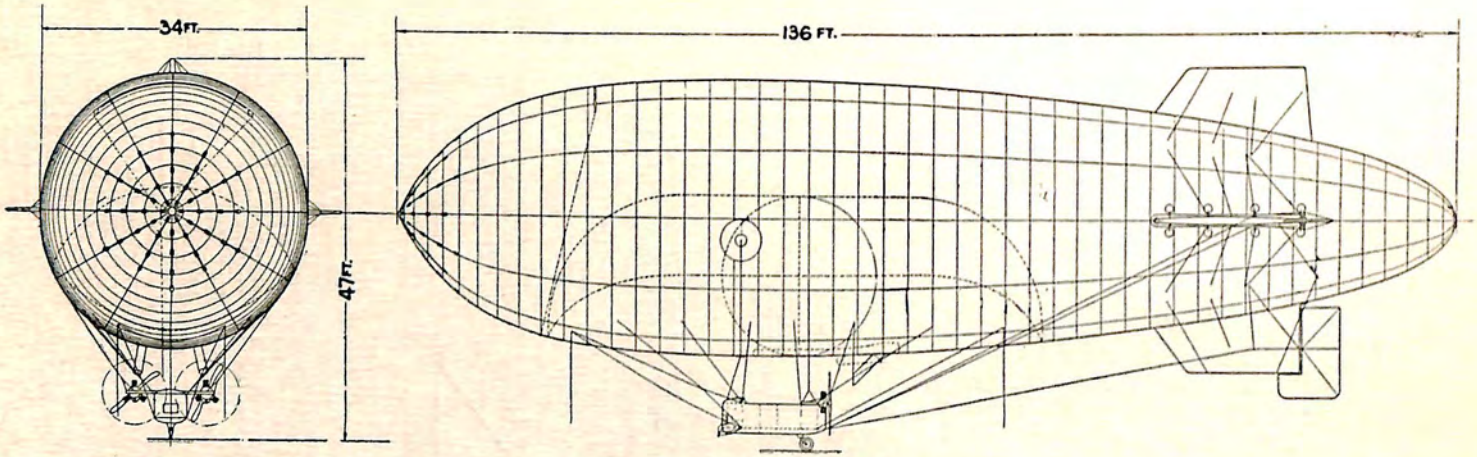
ITHACA, N.Y.

TYPE: CORPS OBSERVATION-MODEL: TM 24 ALL METAL
ENGINE: CURTISS CD12 SPEED: 63-143 M.P.H. CLIMB 1178 FT/MIN.



PLAN OF METAL CLAD AIRSHIP CAR
TYPE MC-2

AIRCRAFT DEVELOPMENT CORPORATION
DETROIT, MICHIGAN



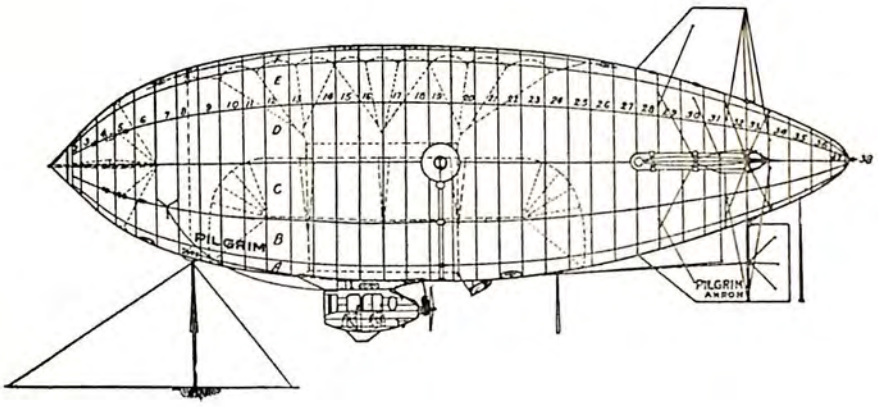
AIRSHIPS INCORPORATED

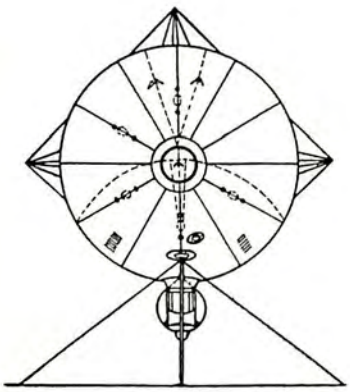
HAMMONDSPORT, N.Y.

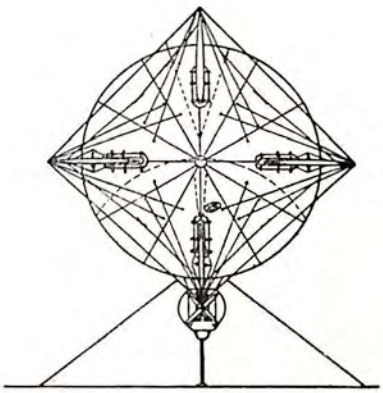
STANDARD ONE MAN TRAINING SHIP TYPE: TE

VOLUME 80,200 CU FT

ENGINES: 2-60H P WRIGHT GALE SPEED 45 M.P.H.







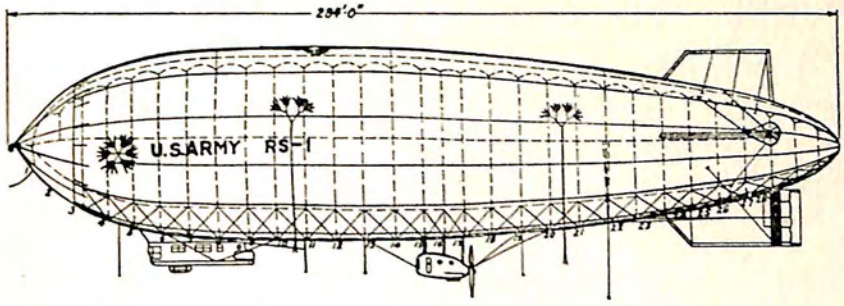
GOODYEAR ZEPPELIN CORP.

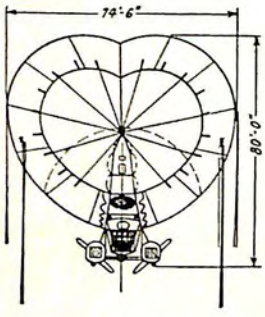
AKRON OHIO

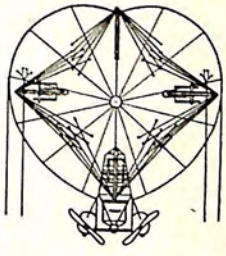
A.D. AIRSHIP

SPEED FULL POWER 50 M.P.H.

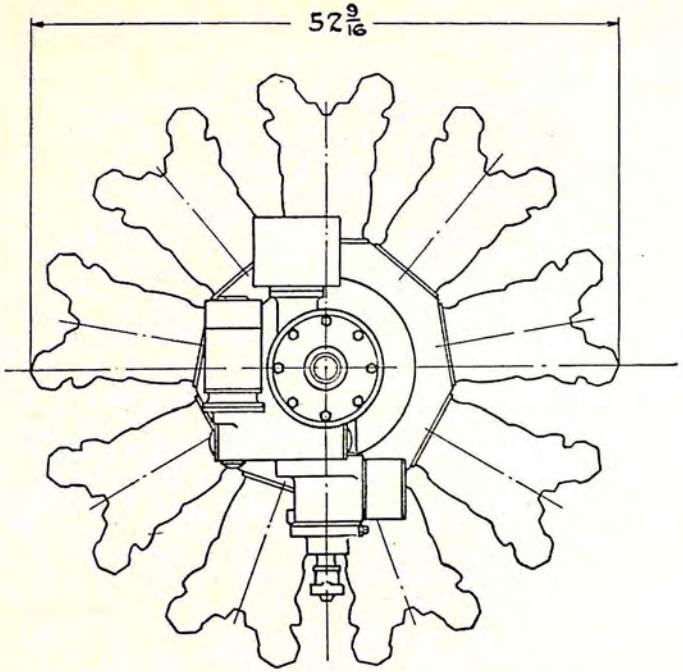
RANGE 330 MILES

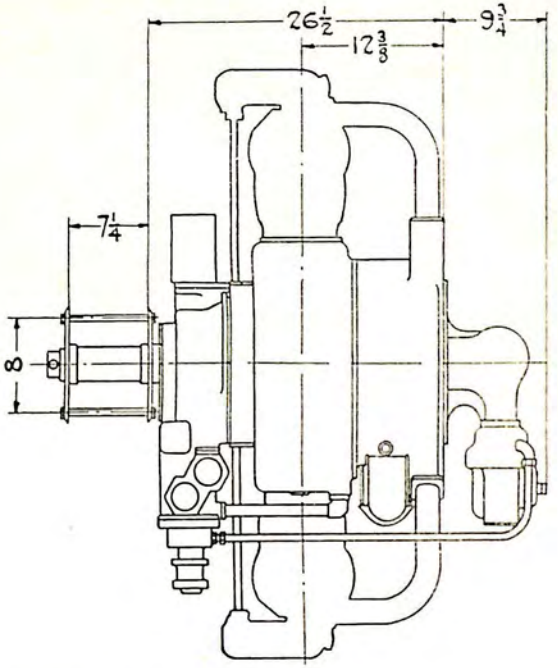






GOODYEAR ZEPPELIN CORP.
AKRON OHIO
RS-1
SPEED FULL POWER 70 M.P.H.
RANGE 658 MILES

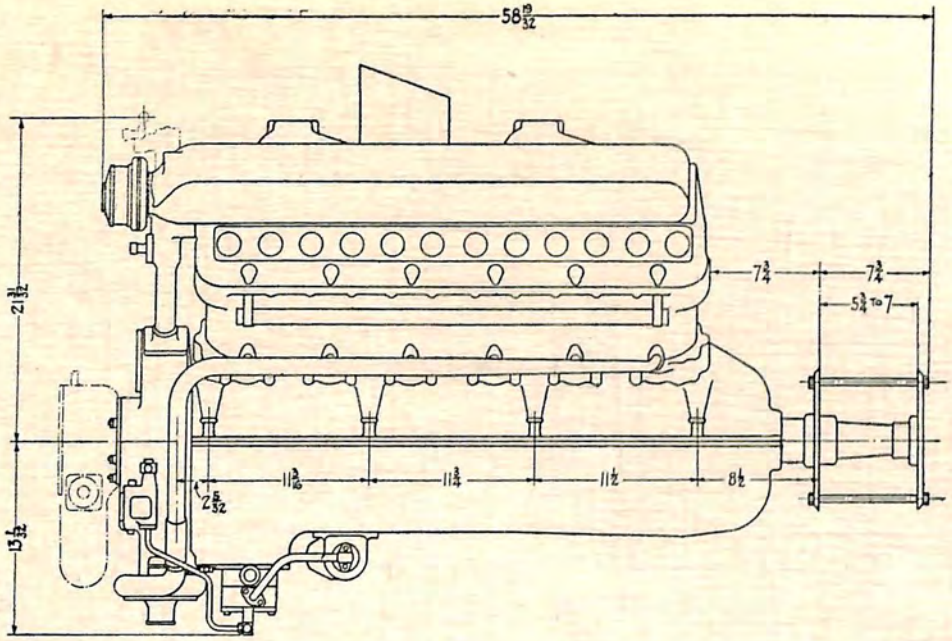


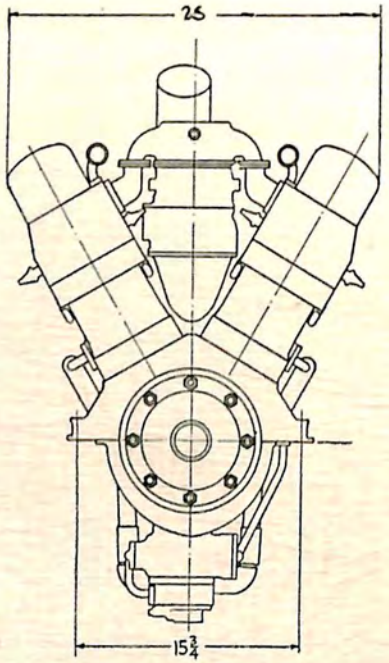


CURTISS AEROPLANE AND MOTOR COMPANY, INCORPORATED.

MODEL R-1454. 9 CYLINDERS. AIR COOLED.

400 B.H.P. AT 1700 R.P.M. WEIGHT 736 LBS.

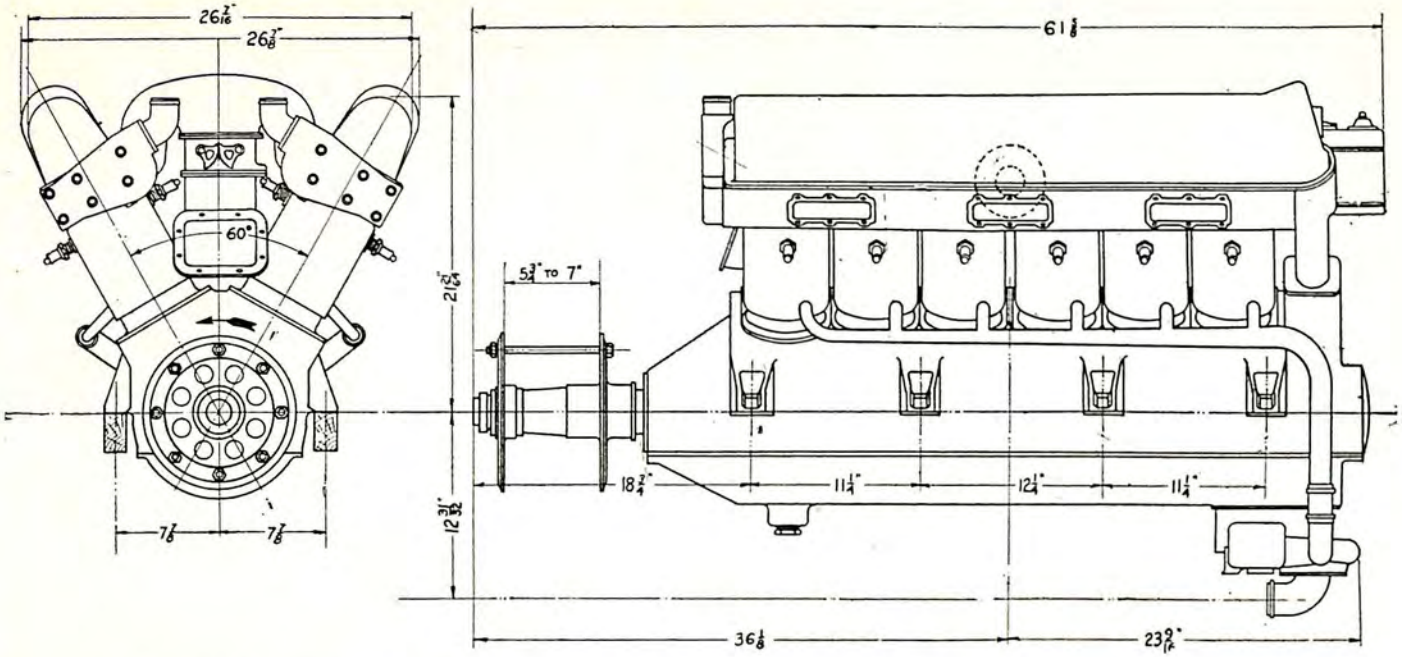




CURTISS AEROPLANE AND MOTOR COMPANY, INCORPORATED.

MODEL V-1400. 12 CYLINDERS. WATER COOLED.

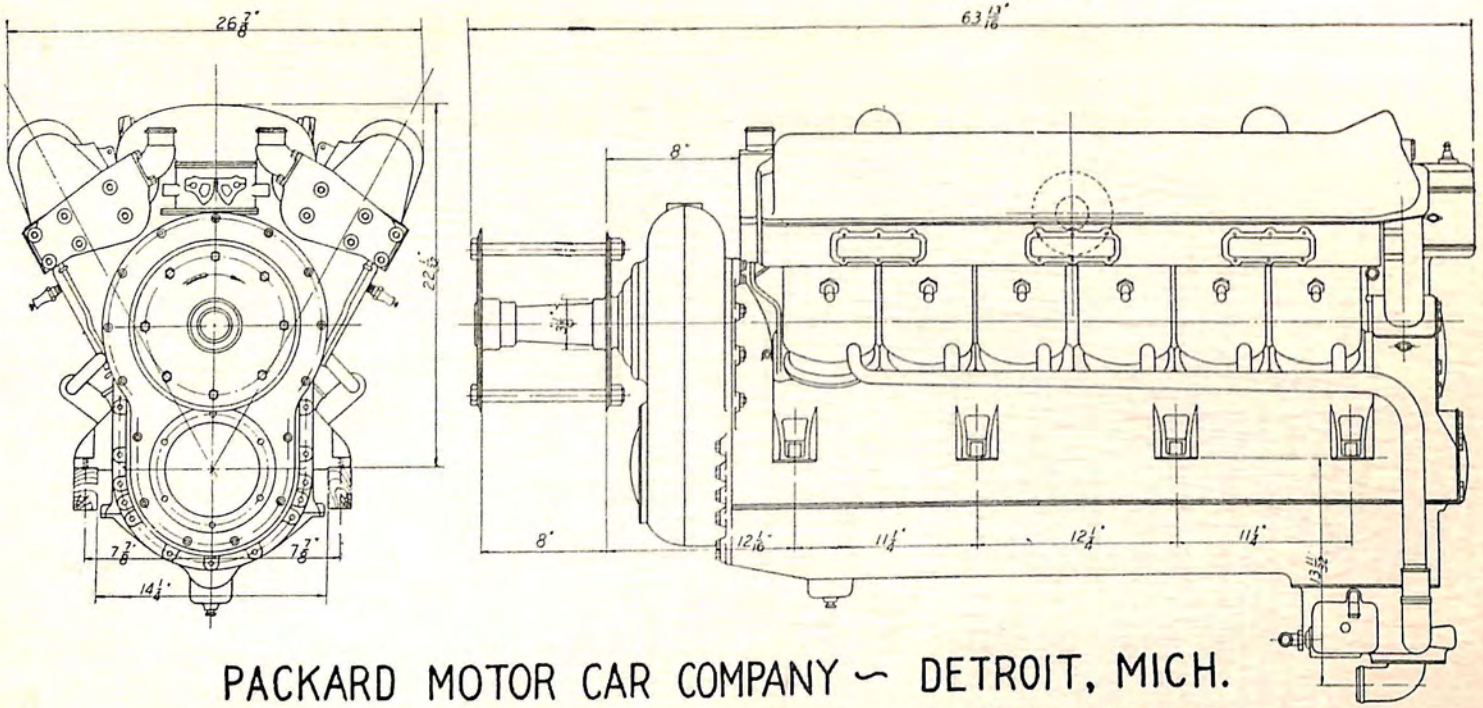
500 B.H.P. AT 2100 R.P.M. WEIGHT 660 LBS DRY.



PACKARD MOTOR CAR COMPANY ~ DETROIT. MICH.

MODEL: I-A-1500 12 CYLINDERS WATER COOLED

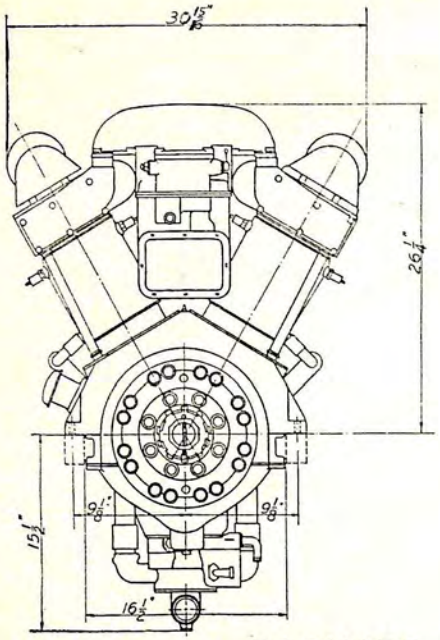
600 B.H.P. AT 2500 R.P.M. 720 LBS. DRY 30 LBS. WATER

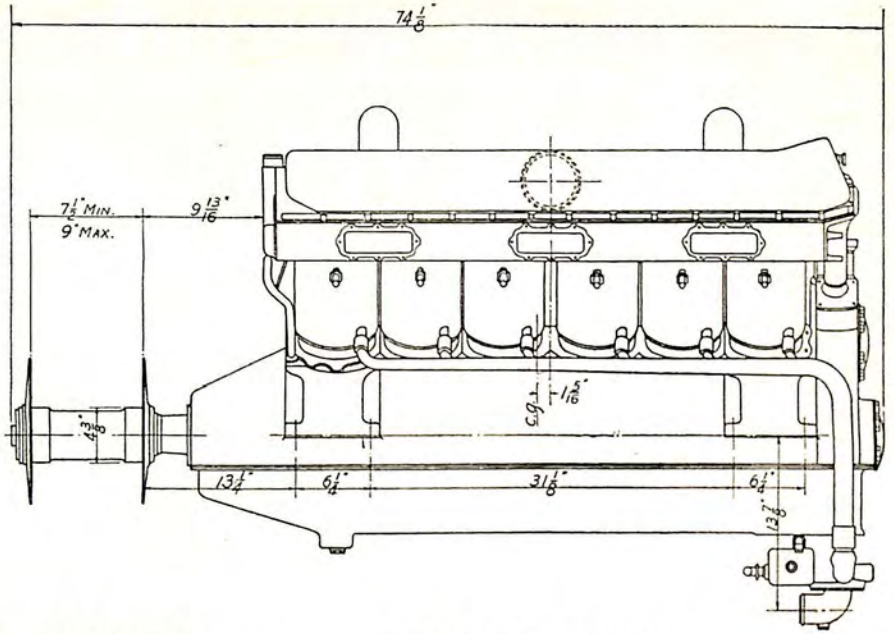


PACKARD MOTOR CAR COMPANY ~ DETROIT, MICH.

MODEL: I-A-1500 GEARED 2:1 12 CYLINDERS WATER COOLED

500 B.H.P. AT 2000 ENGINE R.P.M. 835 LBS. DRY 22 LBS. WATER

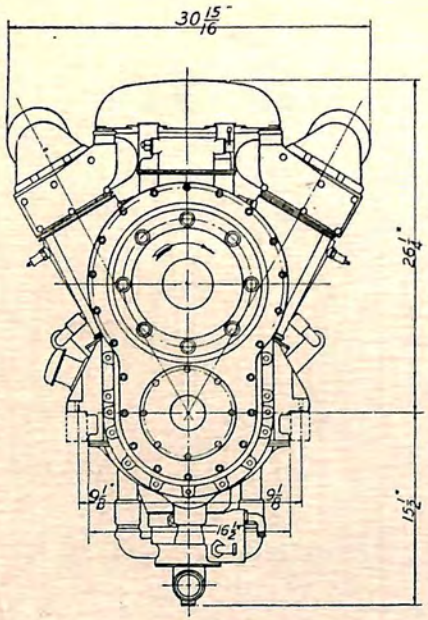


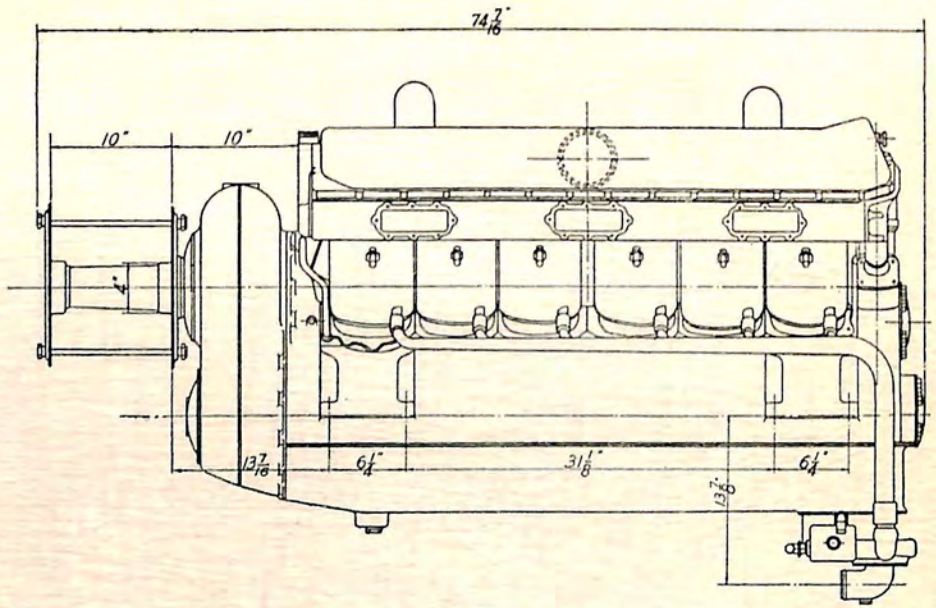


PACKARD MOTOR CAR COMPANY — DETROIT, MICH.

MODEL: I-A 2500 12 CYLINDERS WATER COOLED

800 B.H.P. AT 2000 ENGINE R.P.M. 1100 LBS. DRY 39 LBS. WATER

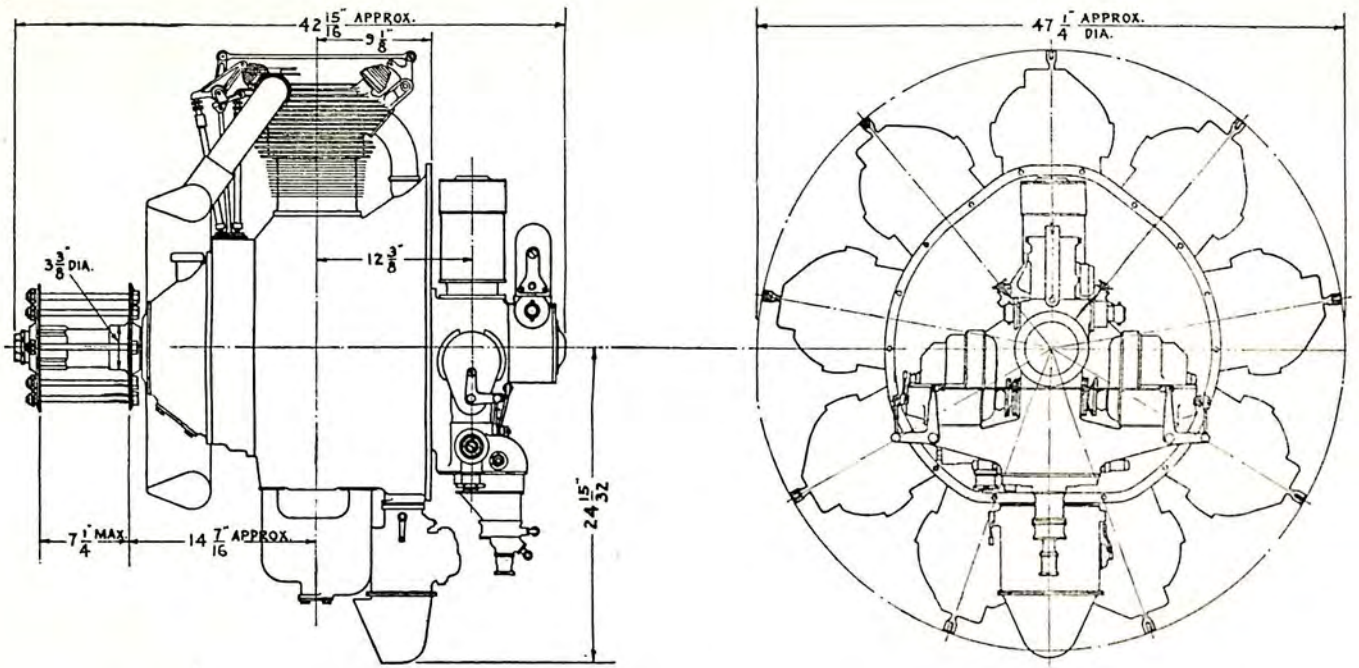




PACKARD MOTOR CAR COMPANY — DETROIT, MICH.

MODEL: I-A-2500 GEARED 2:1 12 CYLINDERS WATER COOLED

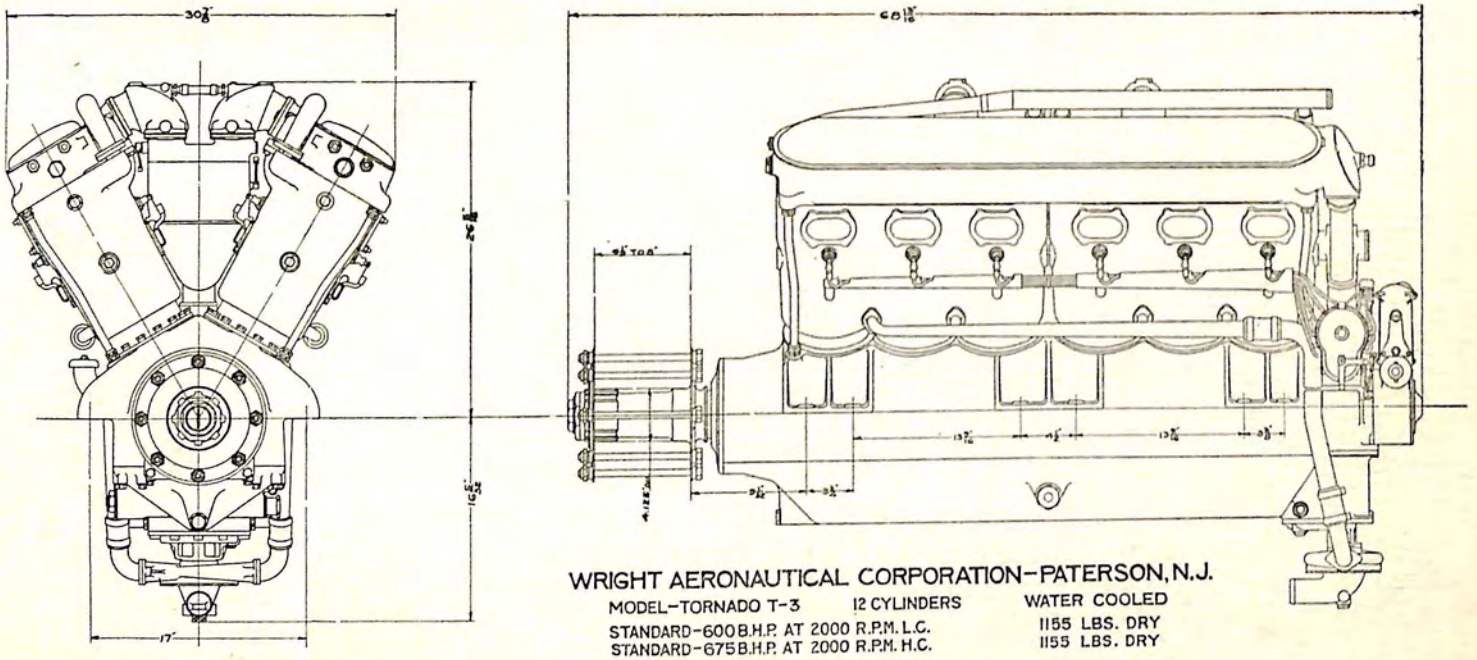
800 B.H.P. AT 2000 ENGINE R.P.M. 1300 LBS. DRY 39 LBS. WATER



WRIGHT AERONAUTICAL CORPORATION – PATERSON, N.J.

MODEL – P-1 | 9 CYLINDERS | AIR COOLED

STANDARD – 400 – B.H.P. AT 1650 R.P.M. | 840 LBS. COMPLETE

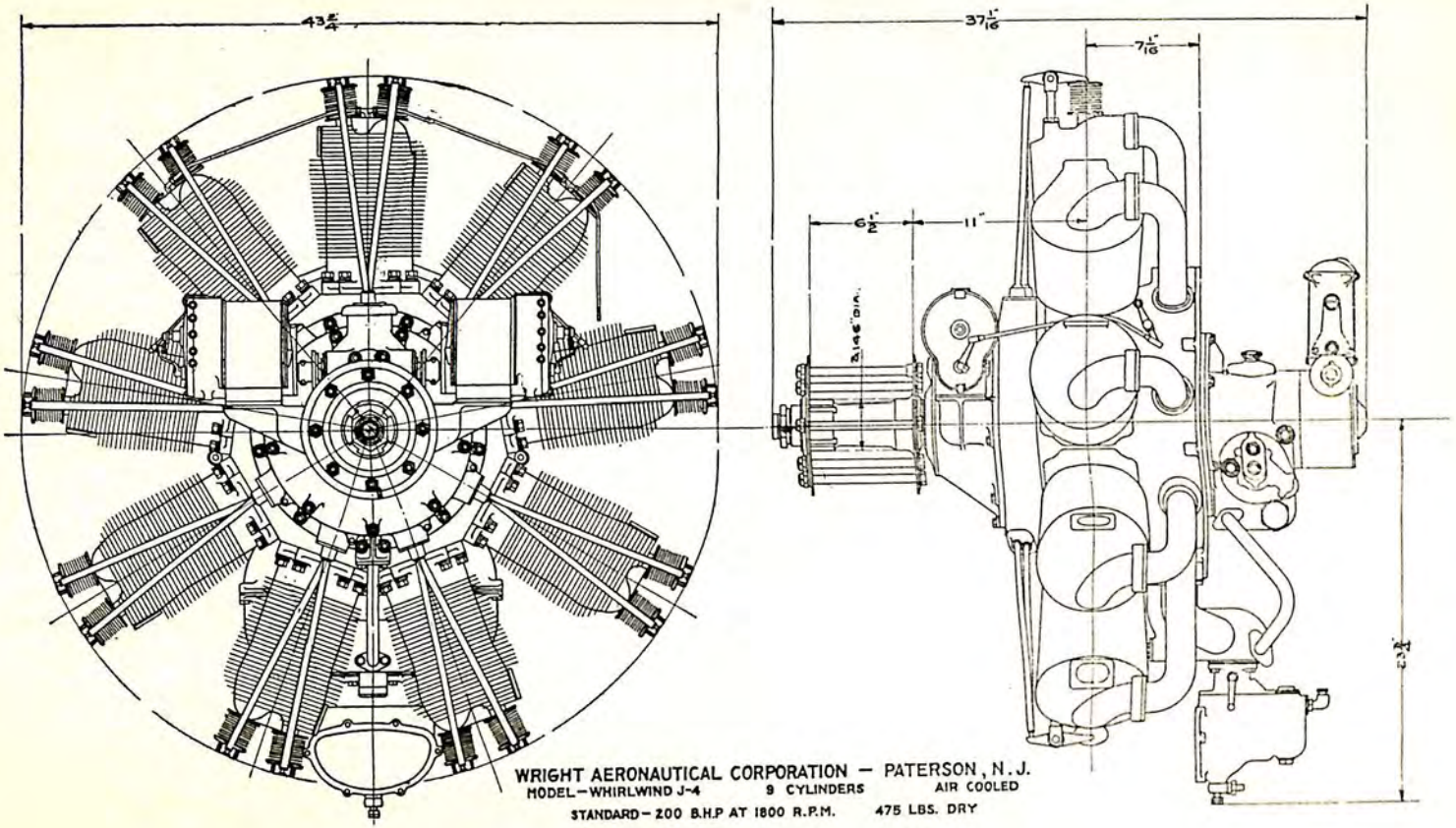


WRIGHT AERONAUTICAL CORPORATION–PATERSON, N.J.

MODEL–TORNADO T-3 12 CYLINDERS WATER COOLED

STANDARD–600 B.H.P. AT 2000 R.P.M. L.C. 1155 LBS. DRY

STANDARD–675 B.H.P. AT 2000 R.P.M. H.C. 1155 LBS. DRY


43 3/4"
37 1/16"
7 1/16"
6 1/2"
11"
WRIGHT AERONAUTICAL CORPORATION — PATERSON, N.J.
MODEL—WHIRLWIND J-4 9 CYLINDERS AIR COOLED
STANDARD—200 B.H.P AT 1800 R.P.M. 475 LBS. DRY

APPENDIX

AERONAUTICAL CHAMBER OF COMMERCE OF AMERICA, INC.

300 Madison Ave., New York, N. Y.

OBJECTS OF THE AERONAUTICAL CHAMBER OF COMMERCE OF AMERICA, AS SET FORTH IN THE ARTICLES OF INCORPORATION

TO foster, advance, promulgate, and promote trade and commerce. throughout the United States, its territories, possessions, and in foreign countries, in the interests of those persons, firms or corporations engaged in the business of manufacturing, buying, selling and dealing in aircraft, aircraft motors, and aircraft parts and accessories of every kind and nature.

To reform any and all abuses which may arise relative thereto.

To secure for its members and those persons, firms or corporations dealing with them, freedom from unjust or unlawful exactions of whatever description.

To diffuse among its members accurate and reliable information as to the standing of its members and those persons, firms or corporations engaged in similar lines of business.

To procure uniformity and certainty in the customs and usages of trade and commerce among its members and those persons, firms or corporations having a common trade, business or professional interest in all matters pertaining to aeronautics.

To aid and assist in mapping out air roads and lanes, the location of landing fields, airdromes, hangars, or such other structures as may be necessary for the advancement of aeronautics.

To advocate and promote in every lawful way the enactment of just and equitable laws, both national and state, pertaining to aeronautics.

To settle, adjust and arbitrate any and all differences which may arise between its members, and persons, firms or corporations dealing with them.

To promote a more enlarged and friendly intercourse between its members and persons, firms or corporations engaged in the business of, or dealing in aircraft, motors and aircraft parts and accessories.

To acquire by grant, gift, purchase, devise, bequest, and to hold and dispose of, such property or assets as the purposes of the corporation shall require, subject to such restrictions as may be prescribed by law, and

Generally to do every act and thing which may be necessary and proper for the advancement of the aeronautical art and industry and the accomplishment of the objects and purposes hereinbefore set forth; provided, however, that nothing herein contained shall authorize this corporation to engage in any business for pecuniary profit.

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Samuel S. Bradley.
J. L. Callan.
Charles H. Colvin.
H. M. Crane.
Donald Douglas.
Sherman M. Fairchild.
Allan Jackson.
E. A. Johnson
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George P. Tidmarsh.
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W. C. Young.

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First Vice-President..... Henry M. Crane.
Second Vice-President..... Allan Jackson.
Third Vice-President..... J. L. Callan.
Treasurer..... S. M. Fairchild.
General Manager and Ass't Treasurer..... S. S. Bradley.
Ass't Secretary..... Owen A. Shannon.

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Washington, D. C.—George P. Tidmarsh.
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Glenn H. Curtiss, Garden City, N. Y.

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Aircraft Development Corp., Detroit, Mich.
Airships Incorporated, Hammondsport, N. Y.
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Boeing Airplane Co., Seattle, Wash.
Cox-Klemin Aircraft Corp., Baldwin, L. I., N. Y.
Curtiss Aeroplane & Motor Co., Inc., Garden City, N. Y.
The Douglas Co., Santa Monica, Calif.
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Charles Ward Hall, Inc., New York City.
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Loening Aeronautical Engineering Corp., New York City.
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Thomas-Morse Aircraft Corp., Ithaca, N. Y.
Chance Vought Corp., Long Island City, N. Y.
Wright Aeronautical Corp., Paterson, N. J.

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Aeromarine Airways, Inc., New York, Key West and Havana.
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Cumberland Airways Development Co., Big Stone Gap, Va.
Curtiss Aeroplane Export Corp., New York City.
Curtiss Metropolitan Airplane Co., New York City.
Orton Hoover (Curtiss Aeroplane Export Corp.), Rio de Janeiro, Brazil.
G. Sumner Ireland (Curtiss Aeroplane & Motor Co., Inc.), Garden City, L. I.
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Ludington Exhibition Co., Inc., Philadelphia, Pa.
R. B. C. Noorduyn (Fokker), New York.
Marvin Northrup, Minneapolis, Minn.
Pitcairn Aviation, Philadelphia, Pa.
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Walter T. Varney, San Francisco, Calif.
P. J. Williams (Williams Bros. Aircraft Corp. of California), San Francisco.

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A. C. Spark Plug Co., Flint, Mich.
Aero Supply Mfg. Co., New York City.
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American Hammered Piston Ring Co., Baltimore, Md.
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Wellington Sears & Co., New York City.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
The Wood & Spencer Co., Cleveland, Ohio.
Wyman-Gordon Co., Worcester, Mass.
"X" Laboratories, New York City.

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Fairchild Aerial Camera Corp., New York City.

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American Machinist (Fred H. Colvin), New York City.
Aviation and Aircraft Journal (L. D. Gardner), New York City.
Class Journal Company (David Beecroft), New York City and Chicago.
U. S. Air Services Magazine (Earl N. Findley), Washington, D. C.

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Riis & Bonner, New York City.
Geo. S. Wheat, New York City.

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Duncan A. Woodman, New York City.

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S. S. Bradley.
Mrs. Geo. DeForest Brush.
Vincent J. Burnelli.
J. L. Callan.
Albert Champion.
Virginius E. Clark.
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300 Madison Ave., New York City

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Curtiss Engineering Corp., Garden City, N. Y.
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Gallaudet Aircraft Corp., East Greenwich, R. I.
L. W. F. Engineering Co., College Point, L. I., N. Y.
Glenn L. Martin Company, Cleveland, Ohio.
Packard Motor Car Company, Detroit, Mich.
Sturtevant Aeroplane Company, Boston, Mass.
Thomas-Morse Aircraft Corp., Ithaca, N. Y.
Chance Vought Corporation, Long Island City, N. Y.
West Virginia Aircraft Co., Wheeling, W. Va.
Wright Aeronautical Corp., Paterson, N. J.

Engel Aircraft Corp., Niles, O.; Springfield Aircraft Corp., Springfield, Mass.; St. Louis Aircraft Corp., St. Louis, Mo.; Standard Aircraft Corp., Elizabeth, N. J.; Standard Aero Corp., Plainfield, N. J., have ceased the manufacture of aircraft and withdrawn from the Association.

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Chas. L. Lawrance.
C. M. Vought.
Glenn L. Martin.
Donald Douglas.
Geo. P. Tidmarsh.
A. J. Elias.

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Treasurer.....C. L. Lawrance.
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General Mgr. & Ass't Treasurer.....S. S. Bradley.

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1623 H Street N.W., Washington, D. C.

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Neb.; W. F. Dillingham, T. H.; Donald Douglas, Calif.; Walker S. Estes, Okla.; Wm. B. Farnsworth, N. H.; R. R. Ferguson, Ill.; Carl B. Fritsche, Mich.; Edson F. Gallaudet, R. I.; W. H. Gannett, Me.; L. S. Horner, Conn.; Samuel Kaye, Jr., Miss.; Geo. W. Lewis, D. C.; W. F. Long, Tex.; C. T. Ludington, Pa.; Edwin B. Lyon, N. M.; Glenn L. Martin, O.; A. E. Merriam, Kan.; Carl S. Milliken, Colo; Harvey R. Ogden, Wash.; W. H. Oldfather, P. R.; C. G. Peterson, N. J.; Herbert E. Ross, Fla.; F. G. Smart, Jr., Ark.; Elmer A. Sperry, N. Y.; Elliott Springs, S. C.; E P. Warner, Mass.; H. J. Wilson, W. Va.; K. H. Woolson, Vt.

GOVERNORS AT LARGE—Porter H. Adams, Mass.; Howard E. Coffin, Mich.; Wm. P. MacCracken, Jr., Ill.; F. B. Patterson, O.; Carl H. Wolfley, Mo.

COMMITTEES: Executive Committee—*Chairman*, PORTER H. ADAMS, 1796 Beacon St., Boston, Mass. Finance Committee—*Chairman*, GODFREY L. CABOT, 1623 H St., N.W., Washington, D. C. Foreign Relations Committee—*Chairman*, SIDNEY B. VEIT, 42 Faubourg Poissonière, Paris, France. Contest Committee—*Chairman*, ORVILLE WRIGHT, Harmon and Park Aves., Dayton, Ohio. Program Committee—*Chairman*, HOWARD E. COFFIN, Hudson Motor Car Co., Detroit, Mich. Legislative Committee—*Chairman*, WM. P. MACCRACKEN, JR., 959 The Rookery, Chicago, Ill. Membership Committee—*Chairman*, CARL H. WOLFLEY, Chamber of Commerce, St. Joseph, Mo. Publicity Committee—*Chairman*, JOHN W. PATTISON, Union Central Life Ins. Co., Cincinnati, Ohio. Civic Organization Committee—*Chairman*, C. H. WOLFLEY, Chamber of Commerce, St. Joseph, Mo.

U. S. AIR SERVICE, WAR DEPARTMENT

Munitions Building, Washington, D. C.

ORGANIZATION

In the organization of the Chief of Air Service four main divisions are provided: Personnel, Training and War Plans, Industrial War Plans and Supply. The office of the Chief includes Assistant Chief and the Executive Office. Subordinates to the Executive Office are the Finance and Medical Sections, Information Section, Reproduction Section, Dissemination Section, War Claims and Material Disposal Section, and the Technical Advisor, who is a representative of the Engineering Division, McCook Field, Dayton, Ohio. The Chief Clerk conducts the routine administration of the civilian personnel on duty in the office of the Chief of Air Service in conformity with Civil Service Rules, existing War Department regulations and orders, and the announced policy of the Chief of Air Service. The Personnel Division is composed of two sections—Officers and Enlisted. Five sections comprise the Training and War Plane Division: Schools, Tactical Units, Reserve Officers Training Corps, National Guard and Officers Reserve, War Plans Section and Airways Section. The Industrial War Plans Division is divided into three branches—Requirements, Statistical and Planning. The Supply Divison embraces Property Requirements and Procurement Sections. The Director of Aircraft Production (Spruce Production Corp.) is co-ordinate with the Chief of his service.

OFFICERS ON DUTY IN WASHINGTON

*Major General Mason M. Patrick, Chief of Air Service.
*Brig. General James E. Fechet, Asst. Chief of Air Service.

Lt. Colonels—**Ira F. Fravel, *Wm. E. Gillmore.

Majors—*Henry H. Arnold, *Herbert A. Dargue, *Leonard H. Drennan, *Shepler W. FitzGerald (Student Army Industrial College), *Byron Q. Jones, **John H. Jouett, *Walter G. Kilner, †James A. Mars, *Douglas B. Netherwood (Student Army Industrial College), *Henry C. Pratt, *Ira A. Rader (Student Army Industrial College), **John D. Reardan, *H. H. C. Richards, *Raycroft Walsh.

Captains—*Byrne V. Baucom, *Arthur W. Brock, Jr., *Ralph P. Cousins, *Wm. H. Crom, *Ira C. Eaker, *Robert Oldys, **Raymond E. O'Neill, *Robert L. Walsh, *Donald Wilson, *Ralph H. Wooten, *Frank W. Wright.

1st Lieutenants—*Ames S. Albro, *Charles C. Chauncey, *Burnie R. Dallas, *Donald G. Duke, *Merrick G. Estabrook, Jr., *Harry A. Halverson, *Earl S. Hoag, *George E. Hodge, *Malcom S. Lawton, *David G. Lingle, *Corley P. McDarment, *John M. McDonnell, *Phillips Melville, *Reuben C. Moffat, †Harry G. Montgomery, *LaClair D. Schulze, *Charles W. Steinmetz (Student Army Industrial College), *St. Clair Streett.

*Airplane Pilot.
**Airship Pilot.
†Balloon Observer.

ENGINEERING DIVISION

McCook Field, Dayton, Ohio

Majors—*John F. Curry, Chief, Engineering Division, **Frank M. Kennedy, *Jacob M. Rudolph, **Harold A. Strauss, *Clinton W. Howard.

Captains—*Leo A. Walton, *Gerald E. Brower, *Frank H. Pritchard, *George C. Kenney.

Air Service Engineering School, McCook Field—*Major John F. Curry, Commandant; *Capt. Leo A. Walton, Asst. Comdt.; *1st Lt. Edwin E. Aldrin, Secretary.

*Airplane Pilot.
**Airship Pilot.

Army Corps Areas and Departments

First Corps Area—Includes States of Maine, New Hampshire, Vermont, Massachusetts, Connecticut, and Rhode Island, in so far only as coast defense and field operations incident thereto are concerned; that portion of State of New York which lies east or west longitude 72° 30′ is attached to First Corps Area; headquarters, Army Base, Boston 9, Mass. Air Service Officer, *Capt. Louis R. Knight.

Second Corps Area—Includes States of New Jersey, Delaware, and New York, except, for certain specific purposes only, that portion thereof which is attached to First Corps Area; headquarters, Governors Island, N. Y. Island of Porto Rico, with islands and keys adjacent thereto, is attached to Second Corps Area. Air Service Officer, Col. Theodore A. Baldwin, Jr.

Third Corps Area—Includes States of Pennsylvania, Maryland, Virginia and District of Columbia, except in so far as concerns troops and agencies of the Regular Army within the territorial limits of District of Washington; headquarters, Standard Oil Building, Baltimore, Md. Air Service, Officer, *Capt. Charles T. Phillips.

Fourth Corps Area—Includes North Carolina, South Carolina, Georgia, Florida, Alabama, Tennessee, Mississippi and Louisiana; headquarters, Red Rock bldg., Atlanta, Ga. Air Service officer, *Lieut. Col. C. H. Danforth.

Fifth Corps Area—Includes Ohio, West Virginia, Indiana and Kentucky; headquarters, Ft. Hayes, Columbus, Ohio. Air Service Officer, *Lieut. Col. Seth W. Cook.

Sixth Corps Area—Includes Illinois, Michigan, Wisconsin, the post of Jefferson Barracks, Mo., and Arcadia Target Range, Arcadia, Mo.; headquarters, 1819 W. Pershing Road, Chicago, Ill. Air Officer, *Major Harold S. Martin.

Seventh Corps Area—Includes Missouri, Kansas, Arkansas, Iowa, Nebraska, Minnesota, North Dakota and South Dakota; headquarters, Army Building, Omaha, Neb. Air Service Officer, *Maj. Lawrence S. Churchill.

Eighth Corps Area—Includes States of Texas, Oklahoma, Colorado, New Mexico, and Arizona, except that portion thereof west of west longitude 114° and south of north latitude 33°, which is attached to the Ninth Corps Area for purposes of administration, training, and tactical control in connection with Border Patrol and field operations incident thereto only; headquarters Ft. Sam Houston, San Antonio, Texas. Air Service Officer, *Col. William Mitchell.

Ninth Corps Area—Includes States of Washington, Oregon, Idaho, Montana, Wyoming, Utah, Nevada, and California, and that portion of Arizona which is attached for certain specific purposes only, headquarters, Presidio of San Francisco, Calif. The Territory of Alaska is attached to the Ninth Corps Area. Air Service Officer, *Lt. Col. Frank P. Lahm.

Hawaiian Department—Includes all islands belonging to the United States within area between 150° west longitude and 160° east longitude and between 15° south latitude and 30° north latitude; headquarters, Honolulu, Hawaii. Air Service Officer, *Major Robert E. M. Goolrick.

Philippine Department—Includes all islands of Philippine Archipelago; headquarters, Manila, P. I. Air Service Officer, *Major George E. A. Reinburg.

U. S. Forces in China—American Barracks, Tientsin, China.

Panama Canal Department—Includes entire Canal Zone; headquarters, Quarry Heights, Balboa Heights, Canal Zone. Air Service Officer, *Capt. Thomas S. Voss.

Stations and Activities Under Jurisdiction of Chief of Air Service

Station	*P. O. Address*	*Troops and Activities*
Akron, Ohio	c/o Goodyear Tire & Rubber Co., Akron, Ohio	District Office, Balloon. Production & Inspection Procurement Section.
Brooks Field	San Antonio, Tex.	11th School Group Hq. 46th, 47th School Sq. 62nd Service Sq., Primary Flying School, Flying Cadet Det.
Buffalo, N. Y.	398 Ellicott Square, Buffalo, N. Y.	Procurement Planning Representative.
*Chanute Field	Rantoul, Ill.	Technical School, School Troops.
Chicago, Ill.	1819 West Pershing Road, Chicago, Ill.	Procurement Planning Representative.
Detroit, Mich.	802 Farwell Bldg., Detroit, Mich.	Procurement Planning Representative.
*Fairfield Air Intermediate Depot (and Wilbur Wright Field)	Fairfield, Ohio	Supply & Repair Depot. Field Service Section.
Kelly Field	Kelly Field, Tex.	3rd Attack Grp. Hq., 8th, 90th Attack Sq., 10th School Grp. Hq., 40th, 41st, 42d, 43d School Sq., 60th, 68th, 70th Service Sq., 22d Photo Sec. Flying Cadet Det. Advanced Flying School. Flying Field.

*See stations under Corps Area, Dept., Dist. or Post Commanders.

Station	*P. O. Address*	*Troops and Activities*
Langley Field	Hampton, Va.	2d Wing Hq. 50th Obs. Sq. 19th Airship Co. 2d Bomb. Group Hq. 11th, 20th, 96th Bomb. Sq. 58th, 59th Service Sq., less det. at Aberdeen. 2d, 20th Photo Sec. Tactical School. Flying Field.
Little Rock Air Intermediate Depot	Little Rock, Ark.	Supply Depot.
McCook Field	Dayton, Ohio	Engineering Division. Engineering School. Procurement Planning Representative.
Middletown Air Intermediate Depot	Middletown, Pa.	Supply Depot, Industrial War Plans Section.
*Mitchel Field	Mitchel Field, L. I., New York	The School of Aviation. Medicine.
New York, N. Y.	39 Whitehall St. (Room 808) 39 Whitehall St. (Room 807)	Dist. Property & Survey Officer. Dist. Of. Procurement Sec. Sup. Div. Procurement Planning Representative.
Rockwell Air Intermediate Depot	Rockwell Field, Coronado, Calif.	Supply & Repair Depot. Flying Field.
San Antonio Air Intermediate Depot	San Antonio, Texas	Supply & Repair Depot.
San Francisco, Calif.	Room 624 Exchange Block, 369 Pine St.	Procurement Planning Representative.
Scott Field	Scott Field, Ill.	8th, 9th, 12th Airship Co. 21st Airship Grp. Hq. 21st Photo Sec. 24th Airship Service Co. Balloon & Airship School. Air Intermediate Depot.
Seattle, Wash.	District Manager, Air Service District Procurement Office, c/o Boeing Airplane Co., Georgetown Station, Seattle, Wash.	District Procurement Office.
Stinson Field	San Antonio, Tex.	Intermediate Landing Field.

Stations and Organizations Under Jurisdiction of Corps Area, Dept., Dist. or Post Commanders

Station	*P. O. Address*	*Troops and Activities*
Armstrong, Ft.	Honolulu, Hawaii	Air Depot.
Bliss, Ft.	Ft. Bliss, Texas	1st Photo Sec. 12th Obs. Sq. (less det. at Ft. Sam Houston) Border Patrol.
**Bolling Field	Anacostia, D. C.	Hq. Sq. 3rd Photo Sec. 99th Obs. Sq. 56th Service Sq. Flying Field.
Boston Air Port	Boston, Mass.	Corps Area Hd. Flight.
Bowman Field	Louisville, Ky.	Intermediate Landing Field.
Brown, Ft.	Brownsville, Tex.	Det. 12th Obs. Sq. (from Ft. Sam Houston) Border Patrol Station. Airdrome.
*Chanute Field	Rantoul, Ill.	5th Photo Sec. 15th Obs. Sq.
Clark Field	Camp Stotsenburg, P. I.	3rd Pursuit Sq.
Clark, Ft.	Brackettville, Tex.	Det. 12th Obs. Sq. (from Ft. Sam Houston) Border Patrol Station. Airdrome.
Clover Field	Santa Monica, Calif.	Airdrome.
Crissy Field	Presidio of San Francisco, Calif.	91st Obs. Sq., 15th Photo. Sec. Aerial Coast Defense. Forest Patrol.
Crook, Ft.	Ft. Crook, Neb.	Corps Area Hdqrs. Flight.
Douglas, Arizona	Douglas, Arizona	Det. 12th Obs. Sq .(from Ft. Bliss). Airdrome.

* See Stations under Chief of Air Service.
** Correspondence thru C.G. District of Washington.

Station	*P. O. Address*	*Troops and Activities*
Douglas, Ft.	Ft. Douglas, Utah	Intermediate Landing Field.
Dryden, Texas	Dryden, Texas	Det. 12th Obs. Sq. (from Ft. Bliss) Border Patrol Station. Airdrome.
*Fairfield Air Intermediate Depot (and Wilbur Wright Field)	Fairfield, Ohio	88th Obs. Sq. 7th Photo Sec.
France Field	Coco Walk, Cristobal, C. Z.	6th Composite Grp. Hdqrs. 7th Obs. Sq. 12th Photo Sec. 63rd Service Sq. 24th Pursuit Sq. 25th Bomb. Sq. Aerial Coast Defense.
Grissard Field	Cincinnati, Ohio	Intermediate Landing Field.
Houston, Ft. Sam	Ft. Sam Houston, Tex	24th Photo Sec. Det. 12th Obs. Sq.
Kindley Field	Fort Mills, Corregidor, P. I.	2nd Obs. Sq.
Langin Field	Moundsville, W. Va	Intermediate Landing Field.
†Leavenworth, Ft. (The Command and General Staff School)	Ft. Leavenworth, Kan	Air Service Det.
Laredo Airdrome	Laredo, Texas	Det. 12th Obs. Sq. (from Ft. Sam Houston).
Logan Field	Dundalk, Md.	Intermediate Landing Field.
Luke Field	Honolulu, Hawaii	5th Comp. Grp. Hdq. 6th Pursuit Sq. 65th Service Sq. 11th Photo Sec. 23rd Bomb. Sq. Aerial Coast Defense. 72nd Bomb. Sq. 19th Pursuit Sq.
Marfa, Camp	Marfa, Texas	Det. 12th Obs. Sq. (from Ft. Bliss). Airdrome.
Marshall Field	Ft. Riley, Kan	16th Obs. Sq. 9th Photo Sec.
Maxwell Field	Montgomery, Ala.	22nd Obs. Sq. less Det. at Ft. Bragg, 4th Photo Sec.
*Mitchel Field	Mitchel Field, L. I., New York	9th Obs. Grp. Hdqrs. 8th, 14th Photo Sec. 1st Obs. Sq. 5th Obs. Sq. 61st Service Sq.
Nichols, Camp	Maricaban, Rizal, Luzon, P. I.	4th Comp. Grp. Hdq. 66th Service Sq. 6th Photo Sec. 28th Bomb. Sq. Philippine Air Depot.
Norton Field	Columbus, Ohio	Corps Area Hdqrs. Flight.
Offutt Field	Ft. Crook, Neb	Corps Area Hdqrs. Flight.
†Phillips Field	Aberdeen Proving Ground, Md.	18th Airship Co., 49th Bomb. Sq. Det. 59th Service S. Ordnance Proving Ground.
Pittsburgh Air Port	Pittsburgh, Pa.	Intermediate Landing Field.
Pope Field	Fayetteville, N. C	Det. 22nd Obs. Sq. Artillery Firing Center.
†Post Field	Ft. Sill, Oklahoma	44th Obs. Sq. 23rd Photo Sec. Flying Field.
Richards Field	Kansas City, Mo	Intermediate Landing Field.
***Ross Field	Arcadia, Calif.	Det. 91st Obs. Sq. (See Crissy Field).
Sand Point Airdrome	Seattle, Wash.	Intermediate Landing Field.
Schoen Field	Ft. Benj. Harrison, Ind	Intermediate Landing Field.
Selfridge Field	Mt. Clemens, Mich	1st Pursuit Grp. Hdqrs. 57th Service Sq. 17th, 27th, 94th, 95th Pursuit Sqs.
Sheridan, Ft.	Ft. Sheridan, Ill	Corps Area Hdq. Flight.
Tucson Airdrome	Tucson, Arizona	Det. 12th Obs. Sq. (from Ft. Bliss).
Vancouver Barracks	Vancouver, Wash.	Intermediate Landing Field.
Wheeler Field	Schofield Barracks, Honolulu, Hawaii	4th Obs. Sq. Aerial Coast Defense.
Woodward Field	Salt Lake City, U	Intermediate Landing Field.

* See Stations under Chief of Air Service.
** Correspondence thru C.G. District of Washington.
*** Inactive.
† Under jurisdiction of Post Commander.

Work of Airways Section

Upon the generally accepted principle that commercial aviation is fundamental to air security, no more important work is being done than that by the Airways Section, Army Air Service, under the direction of Capt. St. Clair Streett. During 1924, Capt. Streett's division revised its map of proposed airways and, upon data gathered, it is indicated that there are available (as of March 1, 1925) 3,405 landing places for aircraft in the United States, classified generally as follows: Army, 95; Navy, 17; Air Mail, 45; Municipal, 250; Commercial, 225, and Emergency, 2,772.

At a considerable cost to the Air Service more than 150 cities were marked between Washington and Dayton and Dayton and Selfridge Field (near Detroit). An effort is being made now to encourage municipalities to provide these markings. Early in 1925 the Airways Section began the selection and identification of landing fields on an airway between San Antonio and San Diego. The reason is that this airway is heavily traveled by Federal aircraft and well marked landing facilities have been badly needed.

The publication of the Aeronautical Bulletin, which was started in 1923, has been continued. It is in increasing demand. Production of aerial strip maps is progressing slowly, there being available for this work only $25,000 per annum.

Capt. Streett's section operates a Model Airway between New York, Washington, Langley Field (Hampton, Va.), Dayton, O., Detroit, Rantoul, Ill., St. Louis, Kansas City, Muskogee, Dallas and San Antonio. Figures on operation since the opening of the first section March 1, 1923, are as follows:

No. of flights	480
Miles flown	692,700
Passengers carried	688
Express carried (lbs.)	56,282
Crashes	15
Injuries (not severe)	1
Deaths	0
Delays account of weather	136

BUREAU OF AERONAUTICS, NAVY DEPARTMENT

Organization

The Bureau of Aeronautics of the Navy Department was established August 10, 1921. The following organization carries on the duties of the bureau—the Chief of the Bureau, the Assistant Chief of the Bureau, and the four following divisions: (a) Plans, (b) Administration, (c) Material, (d) Flight. Duties have been distributed among these divisions as follows: The Planning Division deals with the planning of the work of the Bureau, the formulation of plans of war in conjunction with the Planning Sections of the office of Naval Operations, recommendations concerning types of aircraft which are necessary for Naval Aviation. The Administration Division handles all civilian personnel employed under the jurisdiction of the Bureau and keeps a record of and approves of the expenditure of funds allotted to the Bureau. The Material Division has under its jurisdiction all matters pertaining to the design of aircraft and matters pertaining thereto. The Flight Division has under its cognizance all matters pertaining to the operation of naval aircraft, training of personnel, aviation photographs and aerology.

[Explanation of Personnel Tables. All officers, unless otherwise indicated, are U. S. Navy. CC—Construction Corps, U. S. Navy. USCG—U. S. Coast Guard. USMC—U. S. Marine Corps. O—Observer. N.A.—Naval Aviator, Heavier than Air. N.A. (L.T.A.)—Naval Aviator, Lighter than Air. N.A. (L.T.A. and H.T.A.)—Naval Aviator, both Lighter than Air and Heavier than Air. F.O.—Flight Orders.]

Officers on Duty in the Bureau of Aeronautics, Navy Department

Rear Adm. W. A. Moffett, O. ..... Chief of the Bureau.
Capt. A. W. Johnson ..... Ass't Chief of the Bureau.
Lt. Comdr. R. E. Byrd, N.A. ..... Aide to Chief of the Bureau.

Administration Division—Lt. Comdr. L. T. DuBose; Lieut. T. T. Patterson, O.

Plans Division—Lt. Comdr. M. A. Mitscher, NA; Lt. Comdr. H. T. Bartlett, NA; Lieut T. P. Jeter, NA; Lieut. R. A. Ofstie, NA.

Flight Division—Lieut. Comdr. R. R. Paunack, NA; Lieut. B. R. Holcombe, NA; Lieut. W. M. Dillon, NA; Lieut. F. W. Reichelderfer, NA.

Material Division—Capt. E. S. Land, CCO; Comdr. H. C. Richardson, CCNA; Comdr. W. W. Webster, CCO; Comdr. E. E. Wilson; Comdr. G. Fulton, CC.

Unassigned—Comdr. Kenneth Whiting, NA.

Naval Air Stations

Pensacola, Fla., Training—Commandant, Capt. J. J. Raby, FO; Capt. of Yard, Lieut. Comdr. A. H. Douglas, NA; Operations Officer, Lieut. Comdr. V. C. Griffin, NA; Senior Squadron Comdr., Lieut. Comdr. D. C. Ramsey, NA. Marine Corps Officers, Flight Instructors—Capt. A. H. Page, USMCNA; 2nd Lieut. J. N. Smith, USMCNA.

San Diego, Calif., Fleet Base—Commanding Officer, Capt. T. T. Craven, FO; Squad. Comdr., Lieut. B. H. Wyatt, N.A.

Hampton Roads, Va., Fleet Base—Commanding Officer, Capt. H. C. Cocke, FO; Ex. Officer, Lieut, Comdr. P. Cassard, NA.

Lakehurst, N. J., Lighter-than-Air—Commanding Officer, Capt. G. W. Steele, Jr., NA; Ex. Officer, Comdr. J. H. Klein, Jr., NA(LTA).

Pearl Harbor, T. H., Fleet Base—Commanding Officer, Comdr. J. Rodgers, NA; Ex. Officer, Lieut. Comdr. H. C. Frazer, NA.

Coco Solo, C. Z., Fleet Base—Commanding Officer, Lieut. Comdr. R. P. Molten, NA; Ex. Officer, Lieut. G. R. Fairlamb, NA.

Anacostia, D. C., Experimental—Commanding Officer, Lieut. W. D. Thomas, NA; Ex. Officer, Lieut. G. T. Cuddihy, NA.

Squantum, Mass., Reserve Training—Commanding Officer, Lieut. Comdr. N. Davis, USNRFNA; Ex. Officer, Lieut. (jg) R. D. Thomas, USNRFNA.

Fort Hamilton, Brooklyn, N. Y., Reserve Training—Commanding Officer, Lieut. H. S. Kendall, NA; Ex. Officer, Lieut. J. W. Iseman, USNRFNA.

Great Lakes, Ill., Reserve Training—Commanding Officer, Lieut. Comdr. H. W. Schofield, USNRFNA.

Aircraft Squadrons

Aircraft Squadrons, Scouting Fleet—Commander, Capt. H. E. Yarnell, FO; Senior Aide, Lieut. Comdr. V. D. Herbster, NA.

Scouting Plane Squadron One—Squad. Commander, Lieut. Comdr. G. A. Smith, NA; Ex. Officer, Lieut. O. B. Hardison, NA.

Torpedo and Bombing Plane Squadron One—Squad. Commander, Lieut. Comdr. A. E. Montgomery, NA; Ex. Officer, Lieut. S. P. Ginder, NA.

Observation Plane Squadron Three (Light Cruisers)—Squad. Commander, Lieut. Comdr. B. G. Leighton, NA; Ex. Officer, Lieut. R. Wyman, NA.

Observation Plane Squadron Six (Battleships)—Squad. Commander, Lieut. Comdr. W. Masek, NA; Ex. Officer, Lieut. J. D. Small, NA.

U. S. S. *Wright* (tender) (Flagship)—Commanding Officer, Comdr. L. R. Leahy; Ex. Officer, Lieut. Comdr. P. H. Bastedo.

U. S. S. *Patoka* (airship tender)—Commanding Officer, Capt. G. J. Myers; Ex. Officer, Lieut. Comdr. W. H. Burtis.

U. S. S. *Sandpiper* (tender)—Commanding Officer, Lieut. H. A. Clough; Ex. Officer, Ch. Bosn. J. H. Kevers.

U. S. S. *Teal* (tender)—Commanding Officer, Ch. Bosn. P. J. Kelly; Ex. Officer, Ch. Bosn. A. Speaker.

Aircraft Squadrons Battle Fleet—Commander, Capt. S. E. Moses, FO; Senior Aide, Lieut. Comdr. M. B. McComb, NA.

Observation Plane Squadron One—Commanding Officer, Lieut. Comdr. A. R. Simpson, NA.

Observation Plane Squadron Two—Commanding Officer, Lieut. Comdr. M. B. McComb, NA; Ex. Officer, Lieut. A. W. Radford, NA.

Observation Plane Squadron Four—Commanding Officer, Lieut. D. C. Watson, NA.

Fighting Plane Squadron One—Commanding Officer, Lieut. Comdr. H. C. Wick, NA; Ex. Officer, Lieut. D. M. Carpenter, NA.

Fighting Plane Squadron Two—Commanding Officer, Lieut. Comdr. N. B. Chase, NA; Ex. Officer, Lieut. F. W. Wead, NA.

Scouting Plane Squadron Two—Commanding Officer, Lieut. Comdr. J. H. Strong, NA; Ex. Officer, Lieut. J. F. Moloney, NA (HTA & LTA).

U. S. S. *Langley* (aircraft carrier) (Flagship)—Commanding Officer, Capt. E. S. Jackson; Ex. Officer, Comdr. W. G. Child, NA (HTA & LTA).

U. S. S. *Aroostook* (tender)—Commanding Officer, Comdr. W. R. Van Auken; Ex. Officer, Lieut. Comdr. A. R. Mack.

U. S. S. *Gannet* (tender)—Commanding Officer, Lieut. W. R. Spear.

Aircraft Squadrons Asiatic Fleet—Commander, Comdr. A. C. Read, NA; Senior Aide, Lieut. Comdr. G. D. Murray, NA.

Torpedo and Bombing Plane Squadron Twenty—Commanding Officer, Comdr. A. C. Read, NA; Gunnery and Flight Officer, Lieut. J. G. Farrell, NA.

U. S. S. *Ajax* (tender) (flagship)—Commanding Officer, Comdr. A. C. Read, NA; Ex. Officer, Lieut. W. S. Hactor, NA. The U. S. S. *Ajax* was to be replaced by the U. S. S. *Jason* as tender with the Aircraft Squadrons Asiatic Fleet some time in June, 1925.

U. S. S. *Heron* (tender)—Commanding Officer, Lieut. J. G. Farrell, NA.

Airships

U. S. S. *Shenandoah*—Commanding Officer, Lieut. Comdr. Z. Lansdowne, NA (LTA); Ex. Officer, Lieut. Comdr. L. Hancock, NA (LTA).

U. S. S. *Los Angeles*—Commanding Officer, Capt. G. W. Steele, Jr., NA; Ex. Officer, Comdr. J. H. Klein, Jr., NA (LTA).

Aviation Duty Other than Department, Stations or Squadrons

Naval Aircraft Factory, Navy Yard, Philadelphia, Pa.—Manager, Capt. G. C. Westervelt; Chief Engineer, Lieut. J. R. Kyle, NA.

Naval Air Detail, Dahlgren, Va.—Officer in Charge, Lieut. J. J. Ballentine, NA.

Aviation Mechanics' School, Naval Training Station, Great Lakes, Ill.—Officer in Charge, Chief Carpenter W. E. Redfern, NA.

Torpedo Plane Detachment, Newport, R. I.—Officer in Charge, Lieut. C. A. Hawkins, NA.

MARINE CORPS, NAVY DEPARTMENT

Organization

Marine aviation is an integral part of the Marine Corps, and its mission is to furnish the air forces necessary to Marine expeditionary duty, Marine advanced base operations, and the defense of Naval bases outside the continental United States which are defended on shore by Marines. In peace time, in addition to training and preparation for these duties, the Marine Corps aviation carries on air operations similar to those of the Army Air Service. Its officers are detailed to aviation duty from permanent line officers of the Corps, and its enlisted men are Marines enlisted especially for aviation duty. The administration, training and operations of Marine aviation are directed by the Chief of Aviation, Headquarters U. S. Marine Corps, whose office constitutes a section of the division of Operations and Training of the Major General Commandant's Office. A new table for the aeronautic organization of the Marine Corps was approved by the Major General Commandant on July 30th and by the Chief of Naval Operations on August 3, 1922, and accordingly the aviation force of the corps has been redesignated and organized into the First Aviation Group, at Quantico, Va., consisting of one observation plane squadron, one fighting plane squadron, one service squadron, and one kite balloon squadron; Observation Squadron No. 1 at San Diego, Cal.; Observation Squadron No. 2 at Port au Prince, Haiti; and Scouting Squadron No. 1 at Sumay, Guam.

Officers

Lieut. Col. Thomas C. Turner.
Maj. Ross E. Rowell.
Maj. Edwin H. Brainard.
Maj. Roy S. Geiger.
Capt. Louis M. Bourne.
Capt. Ralph J. Mitchell.
Capt. Walter H. Sitz.
Capt. James E. Davis.
Capt. James T. Moore.
Capt. James F. Moriarty.
Capt. Robert E. Williams.
Capt. Francis P. Mulcahy.
Capt. Louis E. Woods.
Capt. Charles M. Jones.
Capt. Francis E. Pierce.
Capt. Walter E. McCaughtry.
Capt. Arthur H. Page.
Capt. Russell A. Presley.
Capt. Robert J. Archibald.
Capt. Lewis G. Merritt.
Capt. Clyde P. Matteson.
Capt. Harry H. Shepherd.
Capt. Harold D. Campbell.
Capt. William T. Evans.

Aviation Stations

First Aviation Group, Marine Barracks, Quantico, Va.
Observation Squadron No. 1, U. S. Marine Corps, San Diego, Cal.
Observation Squadron No. 2, U. S. Marine Corps, Port au Prince, Haiti.
Scouting Squadron No. 1, U. S. Marine Corps, Sumay, Guam, M. I.

Strength of U. S. Air Forces

	Officers	*Aviators*	*Students*	*Enlisted Men*	*Civilians*	*Total*
Army *	960	925	99	8,530	2,858	12,461
Navy **	605	111	..	3,534	2,500 †	....
Marine ***	65	43	6	908	None	973

* As of Dec. 31, 1924, for officers and men; Jan. 31, 1925, for civilians. ** As of April 1, 1925. *** As of March 3, 1925. † Estimated.

Air Equipment, United States

Army *
(Sept. 30, 1924)

Type	*Number*
Training	471
Observation	820
Bombardment	102
Pursuit	190
Attack	9
	1,592

Navy **
(March 1, 1925)

Type	*Number*
Fighting	72
Observation	83
Torpedo, Bombing, Scout	54
Training	49
	258

Army	1,592
Navy	258
	1,850

* In the Army list no differentiation is noted between service, obsolescent and obsolete types. The figures for the Navy are for *service* types only. In addition to the 258 *service* types listed, the Navy reports the following obsolescent types in use: patrol, 202; observation, 114; torpedo, bombing, scout, 9; training, 137. If account is taken also of these 462 obsolescent types in use, the Navy has a total of 761 heavier-than-air craft.

Diplomatic Service of the United States

Brazil .....Comdr. T. G. Ellyson, N.A., Aviation Officer, Naval Mission to Brazil.
France .....Comdr. J. H. Towers, N.A., Asst. Naval Attaché, London, Eng.
Major Carlyle H. Wash, Assistant Military Attaché for Aviation.
Germany .....Comdr. J. H. Towers, N. A., Asst. Naval Attaché, London, Eng.
Great Britain .....Comdr. J. H. Towers, N.A., Asst. Naval Attaché.
Major Howard C. Davidson, Assistant Military Attaché for Aviation.
Italy .....Major Martin F. Scanlon, Assistant Military Attaché for Aviation.
Lieut. Comdr. H. B. Cecil, N.A., Asst. Naval Attaché.
Peru .....Lieut. Comdr. H. B. Grow, N.A., Aviation Officer, Naval Mission to Peru.

Diplomatic Service to the United States

France .....Major Georges Thenault, Asst. Military Attaché for Aeronautics.
Great Britain .....Group Capt. M. G. Christie, Air Attaché.
Italy .....Wing Comdr. Signor Mario Calderara, Air Attaché.

The Aeronautical Board

On June 17, 1924, The Aeronautical Board, which had existed for some eight years prior thereto under various precepts, was reorganized. For the first time a definite precept was assigned and its jurisdiction and mission made clear. The purpose of The Aeronautical Board, as set forth in the joint order signed by the Secretary of War and the Secretary of the Navy, is to prevent duplication of effort and to secure a more complete measure of co-operation and co-ordination in the development and employment of the Army Air Service and Naval Aviation. The Board is required to investigate, study and report upon all questions affecting jointly the development and employment of the Army Air Service and Naval Aviation.

Specific questions requiring the action of The Aeronautical Board are the following: Policies and plans for the tactical and strategical employment of aircraft. The location of air stations. Preparation of annual joint Army and Navy Aircraft programs. Co-ordination of the activities of the Army Air Service and Naval Aviation with aeronautical activities of other branches of the Government and with civilian aeronautical organizations. Assignment of the development of new types of aircraft, motors, accessories and weapons to the Army or the Navy. Rendering available to either service, whenever possible, training, repair and other aviation facilities. Plans to prevent competition in procurement, and provide for use of surplus material. Consideration and recommendation in regard to all estimates for appropriations for the aeronautical programs of the Army and Navy. Cognizance of invitations of foreign governments and domestic civilian organizations for participation in aviation activities abroad and in the United States. The issuance of licenses to civilians to operate aircraft in time of war.

The membership of the Aeronautical Board is as follows:

Army

Chief of Air Service, Maj. Gen. Mason M. Patrick; Chief of Training and War Plans Division, Air Service, Major H. C. Pratt; Member of War Plans Division, General Staff, Lieut. Col. Edward M. Offley.

Navy

Chief of Bureau of Aeronautics, Rear Admiral, William A. Moffett; Chief of Planning Division, Bureau of Aeronautics, Lieut. Commander Marc A. Mitscher; Member of War Plans Division, Naval Operations, Commander Neil E. Nichols; Secretary, Jarvis Butler.

The Aeronautical Board holds regular monthly sessions on the first Thursday of each month in its office, Room 2644, Navy Department Building. In view of the joint character of the Board with equal representation between the Army and the Navy, the Board has no president or chairman and is provided with a permanent civilian secretary. For parliamentary purposes only the senior officer present presides at meetings whether he be of the Army or Navy and the action of the Board bears signature of the senior officer of the Army and the senior officer of the Navy present at the meeting at which the action was taken.

Helium Board

Capt. E. S. Land, U. S. N. (CC), Chairman.
Lieut. Col. Ira F. Fravel, AS, U. S. A.

Alternates

Lieut. Comdr. C. H. Gray, U. S. N.
Capt. R. E. O'Neil, U. S. A.

Engineers

C. E. Earle, Navy Dept.
George E. Erlandson, War Dept.

Progress during calendar year 1924: 9,096,559 cu. ft. of helium of average purity of 94% was produced during year. Plans completed for construction of production plant No. 2. All pieces of apparatus were purchased or built, and installation of plant equip-

ment started. This work under direction of Bureau of Mines. New processes have been developed in production plant No. 1 with resulting decrease in the cost of helium.

Progress in connection with helium operation in the Army during the calendar year 1924: Helium tank car of 200,000 cu. ft. capacity designed for transportation of helium from the production plant to the operating station. Construction of car well under way. Experiments with railway purification unit, using the charcoal absorption process, have been completed. The designing of a liquefaction unit of 5,000 cu. ft. per hour capacity has been completed and apparatus will be built for installation on the railway repurification car.

Board of Surveys and Maps

The Board of Surveys and Maps is a co-ordinating body and acts as an advisor on matters relating to all kinds of maps published by Government agencies. Eighteen government departments, services or bureaus are represented. The increasing importance of aerial navigation to mapping, and also the importance of maps to air navigation brought the Army and Navy Air Services into close activity with this Board.

Members

Lieut. St. Clair Streett, AS U. S. A. Chief Airways Section (Lieut. J. M. McDonnell, AS U. S. A. alternate).
Lieut. L. D. Webb, U. S. N., Bureau of Aeronautics (Lieut. W. L. Richardson, U. S. N. Alternate).

AIR MAIL SERVICE, POST OFFICE DEPARTMENT

Departmental Headquarters, Washington, D. C.

Hon. Harry S. New.....Postmaster General.
Col. Paul Henderson.....Second Assistant Postmaster General.
Luther K. Bell.....Traffic Manager.

Operating Headquarters, Omaha, Neb.

Carl F. Egge.....General Superintendent.
John W. Sutherin.....Assistant General Superintendent.

Supervisory Officials

J. E. Whitbeck,	Supt. Eastern Division	.....	New York–Chicago.
D. B. Colyer,	" Central "	.....	Chicago–Cheyenne.
H. W. Huking,	" Mountain "	.....	Cheyenne–Salt Lake.
W. E. LaFollette,	" Western "	.....	Salt Lake–San Francisco.
H. G. Smith,	" Development "	.....	Monmouth, Ill.
E. C. Richard,	" Air Mail Repair Depot	.....	Maywood, Ill.

Fields

T —Terminal.
ST—Semi-Terminal.
* —Radio Station.
** —Government owned.
All Undesignated Fields Emergency.

New York, N. Y. (Hadley Field), Cleveland, O.—410 Miles

T* New York { Curtiss Field, Garden City, L. I.
{ Hadley Field, New Brunswick, N. J.

T* Bellefonte, Pa.

13 Emergency fields yet to be designated every 17 miles between New York and Cleveland.

T* Cleveland, O.

Cleveland, O.–Chicago, Ill.—344 Miles.

North Ridgeville (Ohio).
Huron.
Vickery.
ST—Woodville.
Waterville.
Gerald.
T*—Bryan.

Ashley (Indiana)
Walcottville.
Goshen.
Lakeville.
ST—La Porte.
McCool.
Griffiths.

Harvey (Illinois).
T*–**—Chicago–Maywood.

Chicago, Ill.–Omaha, Neb.—426 Miles.

North Aurora (Illinois).
McGirr.
Franklin Grove.
ST—Rock Falls.
Cordova.
Dixon (Iowa).
Atalissa.
T*—Iowa City.
Williamsburg.
Montezuma.
Reasnor.
ST—Des Moines.
Earlham.
Casey.
Atlantic.
Oakland.
T*–**—Omaha (Nebraska).

Omaha, Neb.–Cheyenne, Wyo.—476 Miles.

Wann (Nebraska).
Valparaiso.
Ulysses.
Benedict.
Marquette.
ST—Grand Island.
Shelton.
Kearney.
Elm Creek.
Lexington.
Gothenburg.
T*—North Platte.
Paxton.
Ogallala.
Big Spring.
Chappell.
ST—Sidney.
Dix.
Pine Bluffs (Wyoming).
Burns.
T*—Cheyenne.

Cheyenne, Wyo.–Salt Lake City, Utah—471 Miles.

Federal (Wyoming).
ST—Laramie.
Bosler.
Rock River.
Medicine Bow.
Walcott.
T—Rawlins.
Cherokee.
Wamsutter.
Bitter Creek.
Salt Wells.
T*–**—Rock Springs.
T*—Salt Lake City (Utah).

Salt Lake City, U.–San Francisco, Cal.—630 Miles.

T*—Elko, Nev.
T*—Reno, Nev.
T*—San Francisco { Concord, Cal. / **Crissy-Field, Presidio.

Recapitulation, Mileage and Fields

	Miles
Total Transcontinental mileage (beacon to beacon)	2,697
Night Flying Sections, New York–Rock Springs	1,912
Terminal Fields	17
Semi-Terminal and Emergency Fields, Cleveland to Rock Springs	55
Semi-Terminal and Emergency Fields, New York to Cleveland	13
Total all Fields	85

Number of Employees

(as of December 31, 1924)

Omaha Headquarters	20
Pilots	46
Radio Operators	40
Supervisors	20
Beacon Caretakers	70
Mechanics, Helpers, etc., at Repair Depot and Fields	434
Total	630

Service Records of Pilots

Pilot	*Date of Appointment*	*Miles Flown to Dec. 31, 1924*
E. M. Allison	Aug. 23, 1920	217,147
C. H. Ames	Dec. 8, 1920	132,739
Hugh Barker	Jan. 4, 1924	38,391
J. M. Barnes	Aug. 24, 1924	15,245
L. W. Bertaud	Nov. 16, 1924	621
I. C. Biffle	June 9, 1924	32,875
L. F. Bishop	Dec. 27, 1918	132,042
H. G. Boonstra	Mar. 14, 1921	162,413

Pilot	Date of Appointment	Miles Flown to Dec. 31, 1924
F. H. Burnside	July 17, 1923	21,598
H. A. Chandler	Aug. 16, 1920	207,878
P. F. Collins	Feb. 12, 1921	176,733
H. A. Collison	May 27, 1921	190,828
R. H. Ellis	June 7, 1919	198,544
L. H. Garrison	July 31, 1920	217,758
W. C. Hopson	April 14, 1920	256,699
H. W. Huking	May 3, 1920	174,153
C. E. Johnson	Mar. 10, 1921	145,298
R. J. Johnson	Aug. 25, 1924	14,059
J. H. Knight	June 25, 1919	252,044
C. C. Lange	April 20, 1920	172,276
E. H. Lee	Dec. 29, 1918	237,601
R. B. Levisee	Feb. 24, 1921	174,704
H. T. Lewis	May 27, 1919	206,329
Tex Marshall	Sept. 21, 1920	191,645
J. F. Milatzo	Feb. 24, 1923	2,132
E. E. Mouton	Sept. 8, 1920	233,430
J. P. Murray	June 8, 1920	237,268
G. I. Myers	June 1, 1923	89,693
R. G. Page	July 9, 1919	124,595
P. P. Scott	May 22, 1920	190,041
J. W. Sharpnack	Sept. 8, 1920	84,276
S. J. Short	Mar. 2, 1923	100,719
A. Smith	April 1, 1923	102,735
D. C. Smith	May 21, 1920	205,840
W. L. Smith	Nov. 8, 1919	225,409
K. R. Unger	Oct. 8, 1920	174,188
C. K. Vance	April 22, 1920	153,756
R. L. Wagner	April 23, 1923	90,513
E. F. Ward	Dec. 21, 1923	47,194
E. F. White	June 7, 1919	105,273
W. D. Williams	Aug. 10, 1920	228,393
B. H. Winslow	Sept. 22, 1920	149,853
F. R. Yager	Aug. 10, 1920	230,317
J. D. Hill	July 1, 1924	28,198

Equipment and Inventory

(as of Dec. 31, 1924)

Planes in service	85
Undergoing repairs	5
Liberty motors in service	90
Unused Liberty motors in stock	100
Liberty motors used from 100 to 300 hours	350
Complete air mail inventory, land, buildings, equipment, stocks, etc	$3,612,423.05

Performance, July 1st—Dec. 31st, 1924

Due to experimental nature of service it was impracticable to keep detailed schedule of performance during the first six months of the through transcontinental day and night operations. Reckoning was further complicated, also by air mail being sometimes entrained from San Francisco to Reno and New York to Cleveland or vice versa. It is fair to state, however, that during July, August and September, efficiency was 85% and during October, November and December, 65%, making a six months' average of 75%.

Mail Carried

	Miles Flown			(Number of Letters)			Excess
Month	Day	Night	Total	West	East	Total	Postage
July	177,216	35,626	212,842	411,360	358,760	770,120	$51,622.05
Aug.	163,809	42,535	206,344	420,760	355,440	776,200	51,118.89
Sept.	156,519	49,334	205,853	414,960	367,280	782,240	48,494.23
Oct.	153,092	63,338	216,430	434,480	420,600	855,080	59,750.08
Nov.	152,462	72,574	225,036	397,840	370,200	768,040	50,586.33
Dec.	151,048	66,118	217,166	415,880	374,656	790,536	56,783.40
Total	954,146	329,525	1,283,671	2,495,280	2,246,936	4,742,216	* $318,354.98

* Subsequent corrections increased income to $320,529.73.

Report of Revenue and Expenditures for Six Months July 1—December 31, 1924

(Through Day and Night, Average 32-Hour Service)

Revenue (Excess Postage)			$320,529.73
Expenses			Per-centage
Maintenance of Way			
Fields	$114,481.52		
Lights	81,909.24		
Communication	82,292.15		
Motor Transport	39,865.77	$318,547.68	.2209
Maintenance of Equipment			
Rebuilding Ships	302,952.17		
Rebuilding Motors	61,244.00		
Repairing Field Equipment	64,971.50		
Warehouse	16,692.08	445,859.75	.3091
Transportation			
Pilot's Base and Mileage Pay and Travel Expense	143,364.61		
Gasoline	82,104.51		
Oil	17,294.21		
Forced Landings	459.96	243,223.29	.1686
Executive Overhead			
General Supt.'s Office	39,856.24		
Office of Four Div. Supt's	17,881.62		
Supt. of Repair Depot and Warehouse	10,947.21	68,685.07	.0476
Capital			
New Buildings	107,189.19		
New Lighting Equipment	141,192.82		
Ground Improvements	4,623.30		
New Flying Equipment	88,760.85		
New Miscellaneous Equipment	24,271.89	366,038.05	.2538
Grand Total		$1,442,353.84	1.0000

Note.—Maintenance of way (Fields), includes rent, fuel, salaries of office force, including manager, mileage scrip and expense accounts; (lights) includes salary of caretakers and miscellaneous equipment; (communication) includes: telephone, telegraph, radio supplies, salary of operators, mileage and expense accounts; (motor transport) includes gas and oil, tires, repairs to trucks, wages of auto mechanics and chauffeurs.

Maintenance of equipment (rebuilding ships), includes material and wages of airplane mechanics and helpers; (rebuilding motors) includes material and wages of motor mechanics; (warehouse) includes warehouse employees and stock clerks' wages.

Capital (lights), includes beacons, generators, searchlights and landing lights.

AIR MAIL SERVICE

Statement of Performance Jan. 1–June 30, 1924, Day Time Hops Only

Month	Trips Possible	Trips Attempted	Trips Defaulted	Trips Uncompleted	Weather Encountered		Mileage Possible	Miles Traveled with Mail	Miles Ferry and Test	Total Miles Traveled	Percentage of Performance	Mail Carried (No. of Letters)	Cost of Service	Forced Landings Due to	
					Trips in Fog, Etc.	Trips Clear								Mechanical Causes	Other Causes
January, 1924	702	649	53	16	342	307	139,360	127,422	15,964	143,386	91.43	4,733,800	$110,824.72	21	31
February....	648	602	46	14	305	297	128,640	117,793	15,356	133,149	91.57	4,373,520	103,747.62	10	37
March.....	702	653	49	17	432	221	139,360	127,402	15,222	142,624	91.42	4,730,880	104,735.87	7	57
April.....	702	685	17	6	275	410	139,360	134,926	12,479	147,405	96.82	5,312,200	102,362.35	8	24
May.....	702	688	14	2	298	390	139,360	136,078	20,971	157,049	97.84	5,409,360	103,758.18	11	18
June.....	615	610	5	4	214	396	121,315	119,615	29,504	149,119	98.60	4,757,320	107,416.25	12	24
Total.....	4,071	3,887	184	59	1,866	2,021	807,395	763,236	109,496	872,732	94.53	29,317,080	$632,844.99	69	191

SUMMARY—1918-1924

1918....	793	761	32	...	258	535	87,042	81,898	20,650	102,548	94.09	4,720,240	$ 76,616.59	22	24
1919....	1,761	1,674	87	...	603	1,060	430,275	393,066	68,229	461,295	91.35	17,669,700	320,647.70	69	97
1920....	4,941	3,932	1,009	328	1,614	2,318	1,107,266	864,128	184,316	1,048,444	78.04	30,975,500	979,997.25	445	385
1921....	9,202	8,690	512	400	2,963	5,727	1,846,072	1,713,934	198,799	1,912,733	92.84	46,620,280	1,499,584.10	632	841
1922....	8,291	7,999	292	145	2,935	5,064	1,643,657	1,570,089	186,714	1,756,803	95.52	60,487,880	1,417,374.82	206	367
1923....	8,072	7,847	225	111	3,745	4,102	1,603,110	1,545,280	325,142	1,870,422	96.39	65,295,920	1,910,422.54	175	327
1924....	4,071	3,887	184	59	1,866	2,021	807,395	763,236	109,496	872,732	94.53	29,317,080	632,844.99	69	191
Total..	37,131	34,790	2,341	1,043	14,984	20,827	7,524,817	6,931,631	1,093,346	8,024,977	91.82 av.	255,086,600	6,837,487.99	1,618	2,232

Schedule, Transcontinental Air Mail

West

Leave			*Arrive*		
New York	9.40 a.m.	E.T.	Bellefonte	11.30 a.m.	E.T.
Bellefonte	11.50 a.m.	E.T.	Cleveland	2.10 p.m.	E.T.
Cleveland	2.30 p.m.	E.T.	Bryan	3.00 p.m.	C.T.
Bryan	3.20 p.m.	C.T.	Chicago	5.40 p.m.	C.T.
Chicago	6.00 p.m.	C.T.	Iowa City	8.00 p.m.	C.T.
Iowa City	8.20 p.m.	C.T.	Des Moines	9.00 p.m.	C.T.
Des Moines	9.05 p.m.	C.T.	Omaha	11.00 p.m.	C.T.
Omaha	11.15 p.m.	C.T.	North Platte	2.00 a.m.	C.T.
North Platte	1.20 a.m.	M.T.	Cheyenne	4.10 a.m.	M.T.
Cheyenne	4.25 a.m.	M.T.	Rawlins	5.45 a.m.	M.T.
Rawlins	6.05 a.m.	M.T.	Rock Springs	7.40 a.m.	M.T.
Rock Springs	7.55 a.m.	M.T.	Salt Lake City	9.55 a.m.	M.T.
Salt Lake City	9.10 a.m.	P.T.	Elko	11.15 a.m.	P.T.
Elko	11.30 a.m.	P.T.	Reno	2.00 p.m.	P.T.
Reno	2.15 p.m.	P.T.	Sacramento	3.30 p.m.	P.T.
Sacramento	3.35 p.m.	P.T.	San Francisco	5.00 p.m.	P.T.

East

Leave			*Arrive*		
San Francisco	8.45 a.m.	P.T.	Sacramento	9.15 a.m.	P.T.
Sacramento	9.20 a.m.	P.T.	Reno	10.35 a.m.	P.T.
Reno	10.50 a.m.	P.T.	Elko	1.10 p.m.	P.T.
Elko	1.25 p.m.	P.T.	Salt Lake City	3.25 p.m.	P.T.
Salt Lake City	4.40 p.m.	M.T.	Rock Springs	6.00 p.m.	M.T.
Rock Springs	6.15 p.m.	M.T.	Cheyenne	8.40 p.m.	M.T.
Cheyenne	8.55 p.m.	M.T.	North Platte	10.30 p.m.	M.T.
North Platte	11.50 p.m.	C.T.	Omaha	2.10 a.m.	C.T.
Omaha	2.25 a.m.	C.T.	Des Moines	3.15 a.m.	C.T.
Des Moines	3.20 a.m.	C.T.	Iowa City	4.25 a.m.	C.T.
Iowa City	4.45 a.m.	C.T.	Chicago	7.35 a.m.	C.T.
Chicago	7.50 a.m.	C.T.	Bryan	9.25 a.m.	C.T.
Bryan	9.40 a.m.	C.T.	Cleveland	12.10 p.m.	E.T.
Cleveland	12.25 p.m.	E.T.	Bellefonte	2.15 p.m.	E.T.
Bellefonte	2.30 p.m.	E.T.	New York	5.00 p.m.	E.T.

Schedule, New York—Chicago Overnight Air Mail

Every Night, Except Saturday and Sunday

Rate—10 cents oz., or fraction thereof

New York—Chicago West

Leave New York Post Office	8.00 p.m.	
Leave New York Field	9.30 p.m.	
Arrive Bellefonte	11.30 p.m.	
Leave Bellefonte	11.50 p.m.	
Arrive Cleveland	2.20 a.m.	
Leave Cleveland	2.40 a.m.	—E. T.
Arrive Bryan	3.10 a.m.	—C. T.
Leave Bryan	3.30 a.m.	
Arrive Chicago Field	5.45 a.m.	
Arrive Chicago Post Office	6.45 a.m.	

Chicago—New York East

Leave Chicago Post Office	7.30 p.m.	
Leave Chicago Field	8.30 p.m.	
Arrive Bryan	10.10 p.m.	
Leave Bryan	10.30 p.m.	—C. T.
Arrive Cleveland	1.00 a.m.	—E. T.
Leave Cleveland	1.20 a.m.	
Arrive Bellefonte	3.30 a.m.	
Leave Bellefonte	3.50 a.m.	
Arrive New York Field	6.00 a.m.	
Arrive New York Post Office	7.30 a.m.	

Rates of Postage

Transcontinental

The Transcontinental line is divided into three zones: New York-Chicago, Chicago-Cheyenne, Cheyenne-San Francisco. The charge for domestic mail is 8 cents an ounce or fraction thereof for each air zone or part of zone, fully prepaid; such charge includes transportation to or from the Air Mail route, as well as transportation by air. The rates for foreign air mail are the same as those for domestic air mail for those countries having 2-cent postal conventions with the United States (Great Britain, Spain, the Central and South American countries); for all other countries, 3 cents in addition to Air Mail rate.

New York—Chicago Overnight

This is one zone. The charge is 10 cents an ounce or fraction thereof, fully prepaid, this charge including transportation to or from the Air Mail route, as well as the transportation by air.

General Regulations

(Applicable to both Transcontinental and New York-Chicago Overnight.)

Insurance.—You may insure Air Mail at ordinary rates.

Registry Service.—Any registered matter of nominal value and nonnegotiable securities and commercial paper, not easily realized upon by others than the rightful owners regardless of value, are acceptable for transportation by Air Mail Service. Other registered matter is not acceptable for transmission by Air Mail Service.

Special Delivery.—The use of special delivery stamps in addition to the Air Mail postage will insure prompt delivery at office of address.

Special Air Mail Stamps are issued but any stamps good for postage may be used.

Indorsement.—All mail matter intended for dispatch "via Air Mail" should be indorsed with those words to avoid possible errors in handling and dispatch.

Size and Contents.—Any mailable matter except that liable to damage from freezing will be carried by airplane, including sealed parcels, not exceeding 50 pounds in weight and not exceeding 84 inches in length and girth combined, with postage at the rate of 8 cents an ounce or fraction thereof for each zone or part of zone in which mail is carried by airplane.

NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS

3341 Navy Building, Washington, D. C.

Charles D. Walcott, Sc. D., chairman.
David W. Taylor, D. Eng., secretary.
Joseph S. Ames, Ph. D.
George K. Burgess, Sc. D.
Maj. John F. Curry, United States Army.
William F. Durand, Ph. D.
Capt. Emory S. Land, United States Navy.
Charles F. Marvin, M. E.
Rear Admiral William A. Moffett, United States Navy.
Maj. Gen. Mason M. Patrick, United States Army.
S. W. Stratton, Sc.D.
Orville Wright, B. S.

In his letter transmitting to Congress the 10th annual report (1924) of the committee, President Coolidge said:

"The attention of the Congress is invited to Part V of the committee's report, presenting a summary of the present status of aviation with reference to the existing governmental organization, the agencies for co-ordination, and the relation of aeronautical research, the aircraft industry, and commercial aviation to the problems of national defense. I concur in the committee's general recommendations, and agree that in the last analysis substantial progress in aviation is dependent upon the continuous prosecution of scientific research."

During the year the committee had available in appropriations a total of $307,000, of which amount $296,871.42 was expended.

An important part of the committee's activities has to do with aeronautical intelligence. During the year 37,209 copies of technical reports were distributed.

Technical investigations undertaken by the committee at the Langley Memorial Aeronautical Laboratory included the following:

For the Bureau of Aeronautics of the Navy Department

Investigation and development of a solid-injection type of aeronautical engine.
Development of aircraft engine supercharger.
Distribution of loading between wings of biplanes and triplanes.
Investigation of planing angles and get-away speeds of seaplanes.
Investigation of tail vibration and sluggish control of a Navy monoplane.
Flight tests of superchargers.
Investigation of landing speed of TS airplane.
Investigation of aerodynamic loads on the U. S. S. *Shenandoah.*
Investigations of accelerations and decelerations of airplanes.

FOR THE ENGINEERING DIVISION OF THE ARMY AIR SERVICE

Full-scale investigation of different wings on the Sperry messenger airplane.

Investigation of the efficiency of propellers when used in front of obstructions as found in bombing airplanes.

Investigation of the behavior of an airplane in landing and in taking off.

Investigation of pressure distribution along the chord of typical wing sections.

Investigation of pressure distributions and accelerations in order to determine the proper loading to be used in the design of airplanes.

In Part V, "The Present Status of Aviation," which President Coolidge referred to, the report says:

"Aviation has made itself indispensable to military and naval operations. Under our present organization, where the function of national defense is vested principally in the War and Navy Departments, we must look to those departments to develop the possibilities of aviation in warfare, whether to be used in conjunction with military and naval operations, or to be used independently for attacking distant points behind the enemy's lines, or elsewhere. The problem of the air defense of this country is worthy of most careful study.

"So long as the development of aviation continues from year to year, the military and naval policies and programs for our national security and defense are necessarily subject to change, as they are largely dependent upon the probable use of aviation in future wars. So long as other nations are seriously engaged in the development of aviation, America must at least keep abreast of the progress of aviation abroad and never permit itself again to fall behind as it did before the World War. Substantial progress in aviation, whether in America or elsewhere, is in the last analysis dependent upon aeronautical research. It is necessary that accurate information, which is the result of scientific research on the fundamental problems of flight, should be made continuously available to the Army and Navy; and those agencies desire from the National Advisory Committee for Aeronautics the fundamental aerodynamic information on which the design of new types of military and naval aircraft is based. It is the function of the Army and Navy then to check this information and apply it in an engineering manner to the design of aircraft."

Of the aircraft industry the report says:

"The present American aircraft industry is but a shadow of that which existed at the time of the Armistice. With the great stimulus in aircraft development and performance during the war, the aircraft manufacturers were hopeful that civil aviation would rapidly come into being with a resulting great demand for their product. Civil aviation has not developed as it was hoped it would, and this makes the present situation more difficult.

"These aircraft manufacturers have had to rely for orders upon Government agencies, and the limited amount of governmental purchases has forced a number of manufacturers to go out of the aircraft business. It is a matter of grave Government concern lest the productive capacity of the industry may become so far diminished that there may not remain a satisfactory nucleus. By a 'satisfactory nucleus' is meant a number of aircraft manufacturers, distributed over the country, operating on a sound financial basis, and capable of rapid expansion to meet the Government's needs in an emergency.

"After the very costly lessons of the war, it would be folly to say that the Government is not concerned with the state of the aircraft industry. It is concerned that there should be in existence, and in a healthy condition, at least an adequate nucleus of an industry. An aircraft industry is absolutely essential to national defense. One lesson of the war that will not be forgotten is that it takes a great deal of money to develop hastily an aircraft industry from almost nothing. The American people can ill afford to pay such a price a second time. To maintain a nucleus of an industry it has been proposed either that the Government substantially increase the volume of its orders for aircraft or devise a policy for the apportionment of orders at fair negotiated prices without regard to competition.

"Neither of these propositions, however, in the judgment of the National Advisory Committee for Aeronautics, goes to the root of the trouble. To substantially increase orders will require substantially increased appropriations. To increase appropriations for the Army and Navy Air Services because they need more aircraft is one thing, but to increase appropriations primarily to maintain an aircraft industry is something else. Furthermore, the maintenance of an industry in a healthy condition does not involve the maintenance of any manufacturer who has failed to liquidate or reduce his plant and overhead expenses to an appropriate peace-time basis.

"In the judgment of the committee, the existing bad situation in the industry should be substantially remedied. In an effort to help the situation, the committee suggests the following steps on the part of the industry and of the Government:

"Steps to be taken by the industry:

"First. Every manufacturer intending to remain in the aircraft business and who has not readjusted his war-time plant and overhead expenses to a peace-time basis should do so without further delay.

"Second. The firms comprising the aircraft industry should specialize in the production of various types of aircraft with a view to the more continuous development of types by the same plants and the gradual recognition of proprietary rights in new designs.

"Steps to be taken by the Government:

"First. The Army, Navy, and Postal Air Services should agree upon a balanced program setting forth from time to time the probable requirements of the Gov-

ernment for each type of aircraft for at least one year in advance, and should announce the same to the industry for its information and guidance.

"Second. Orders for the different types should be placed with the different manufacturers at such intervals as to insure continuity of production and the gradual development of special facilities and skill by each manufacturer in the production of a given type of aircraft.

"The committee does not attempt to say that the method proposed is the ideal solution, but it submits that if followed it would produce the following beneficial results:

"(*a*) It would insure the continuous development of types by the same firms which is the most rational method of improving the quality and performance of aircraft to meet special needs.

"(*b*) It would reduce the cost of aircraft.

"(*c*) It would provide all manufacturers with an adequate market to enable them to continue in the airplane business without the periodical menace of dissolution or bankruptcy heretofore caused by long gaps between orders."

Conclusions and general recommendations are as follows:

"1. *Scientific research.*—The continuous prosecution of scientific research on the fundamental problems of flight should be regarded as in the last analysis the most important subject in the whole field of aeronautical development, as substantial progress in aeronautics depends upon the continuous acquisition of knowledge which can be obtained only by long-continued and well-directed scientific research.

"2. *Air Mail Service.*—The Air Mail Service should be continued under the Post Office Department and its ground equipment for night flying should be extended to cover the entire route between New York and San Francisco. When this is done, overnight transportation of mail by aircraft between strategic points, as for example, between New York and Chicago, should be provided at rates that will make such service eventually self-supporting.

"3. *Commercial aviation.*—Rapid development of commercial aviation is primarily dependent upon increasing the reliability and economy of operation of aircraft. Other countries, notably England and France, have encouraged commercial aviation by direct subsidies, and their experience has indicated that unless governmental aid is given, directly or indirectly, commercial air transportation can not be financially successful in the present state of aviation development. Legislation providing for the reasonable regulation of aircraft, airdromes, and aviators, and affording necessary aids to air navigation along designated national airways would be most helpful. The establishment of landing fields generally would also stimulate improvement in the reliability and economy of aircraft operation and facilitate the development of commercial air transportation in this country on a sound basis.

"4. *Military and naval aviation.*—There should be continued study of the air defense problem of the United States, and continued support of aviation development in the Army and Navy.

"The investigation and study of the fundamental phenomena of flight is the most important subject in the whole field of aeronautic development and is the definite prescribed function of the National Advisory Committee for Aeronautics. It has been a great pleasure to the committee to note that the importance of scientific research is appreciated more generally, and that the Congress, the President, and the Bureau of the Budget have recognized the need for the effective prosecution of the research programs prepared for the advancement of the science of aeronautics."

The Committee issues, through its Office of Aeronautical Intelligence, three series of publications, namely, Technical Reports, Technical Notes, and Technical Memorandums. The Technical Reports contain the results of fundamental research in aeronautics conducted at various laboratories, including the Committee's own research laboratory at Langley Field. The Technical Notes contain the results of less fundamental researches or of specific detail investigations which form part of longer researches and are of immediate importance to airplane designers or others concerned with experimental and research problems in aeronautics. The Technical Memorandums contain translations and reproductions of important aeronautical articles of miscellaneous character. Following is a list of the publications issued by the Committee during the year 1924, which may be obtained by addressing the National Advisory Committee for Aeronautics, 3341 Navy Building, Washington, D. C.:

Technical Reports

The small angular oscillations of airplanes in steady flight. By F. H. Norton. T.R. No. 174.

Analysis of W. F. Durand's and E. P. Lesley's propeller tests. By Max M. Munk. T.R. No. 175.

A constant pressure bomb. By F. W. Stevens. T.R. No. 176.

The effect of slipstream constructions on air propellers. By E. P. Lesley and B. M. Woods. T.R. No. 177.

Relative efficiency of direct and geared drive propellers. By Walter S. Diehl. T.R. No. 178.

The effect of electrode temperature on the sparking voltage of short spark gaps. By F. B. Silsbee. T.R. No. 179.

The influence of the form of a wooden beam on its stiffness and strength—I: Deflection of beams with special reference to shear deformations. By J. A. Newlin and G. W. Trayer. T.R. No. 180.

The influence of the form of a wooden beam on its stiffness and strength—II: Form factors of beams subjected to transverse loading only. By J. A. Newlin and G. W. Trayer. T.R. No. 181.
Aerodynamic characteristics of airfoils—III: By the National Advisory Committee for Aeronautics. T.R. No. 182.
The analysis of free flight propeller tests and its application to design. By Max M. Munk. T.R. No. 183.
The aerodynamic forces on airship hulls. By Max M. Munk. T.R. No. 184.
The resistance of spheres in wind tunnels and in air. By David L. Bacon and Elliot G. Reid. T.R. No. 185.
Application of propeller test data to design and performance calculations. By Walter S. Diehl. T.R. No. 186.
Flame speed and spark intensity. By D. W. Randolph and F. B. Silsbee. T.R. No. 187.
The influence of the form of a wooden beam on its stiffness and strength—III: Stresses in wood members subjected to combined column and beam action. By J. A. Newlin and G. W. Trayer. T.R. No. 188.
Relation of fuel-air ratio to engine performance. By Stanwood W. Sparrow. T.R. No. 189.
Correcting horsepower measurements to a standard temperature. By Stanwood W. Sparrow. T.R. No. 190.
Elements of the wing section theory and of the wing theory. By Max M. Munk. T.R. No. 191.
Charts for graphical estimation of airplane performance. By Walter S. Diehl. T.R. No. 192.
Pressure distribution over the wings of an MB-3 airplane in flight. By F. H. Norton. T.R. No. 193.
Investigation of slipstream velocity. By J. W. Crowley, Jr. T.R. No. 194.
Standardization tests of N.A.C.A. No. 1 wind tunnel. By Elliott G. Reid. T.R. No. 195.
Comparison of model propeller tests with the airfoil theory. By W. F. Durand and E. P. Lesley. T.R. No. 196.
A new relation between the induced yawing moments and the rolling moments of an airfoil in straight motion. By Max M. Munk. T.R. No. 197.
Astronomical methods in aerial navigation. By K. Hilding Beij. T.R. No. 198.

Technical Notes

Significance of the expression CL^3/CD^2. By H. von Sanden. Translated from "Technische Berichte," Vol. III, No. 7. T.N. No. 173.
Airplanes in horizontal curvilinear flight. By Heinrich Kann. Translated from "Technische Berichte," Vol. III, No. 7. T.N. No. 174.
Tests on a model of the D airplane T 29 of the "Deutsche Flugzeug Werke" (German Airplane Works). By Wilhelm Molthan. Translated from "Technische Berichte," Vol. III, No. 7. T.N. No. 175.
Curvilinear flight of airplanes. By E. Salkowski. Translated from "Technische Berichte," Vol. III, No. 7. T.N. No. 176.
Note on the relative effect of the dihedral and the sweep back of airplane wings. By Max M. Munk. T.N. No. 177.
Triplane tests. By C. Wieselsberger. Translated from "Technische Berichte," Vol. III, No. 70. T.N. No. 178.
Practical method for balancing airplane moments. By H. Hamburger. Translated from "Technische Berichte," Vol. III, No. 70. T.N. No. 179.
Increasing the compression pressure in an engine by using a long intake pipe. By Robertson Matthews and Arthur W. Gardiner. T.N. No. 180.
Interference of multiplane wings having elliptical lift distribution. By H. von Sanden. Translated from "Technische Berichte," Vol. III, No. 7. T.N. No. 181.
Induced drag of multiplanes. By L. Prandtl. Translated from "Technische Berichte," Vol. III, No. 7. T.N. No. 182.
Static stability of seaplane floats and hulls. By W. S. Diehl. T.N. No. 183.
Note on vortices and on their relation to the lift of airfoils. By Max M. Munk. T.N. No. 184.
The influence of inlet air temperature and jacket water temperature on initiating combustion in a high speed compression ignition engine. By Robertson Matthews and Arthur W. Gardiner. T.N. No. 185.
Testing airplane fabrics. By A. Proll. Translated from "Technische Berichte," Vol. III, No. 7. T.N. No. 186.
The induction factor used for computing the rolling moment due to the ailerons. By Max M. Munk. T.N. No. 187.
Longitudinal oscillation of an airplane: Pt. I—Problem and method. By R. Fuchs and L. Hopf. Translated from "Technische Berichte," Vol. III, No. 7. T.N. No. 188.
Torsional strength of nickel, steel and duralumin tubing as affected by the ratio of diameter to gage thickness. By N. S. Otey. T.N. No. 189.
Comparing the performance of geometrically similar airplanes. By Max M. Munk and Edward P. Warner. T.N. No. 190.
The effect of wind tunnel turbulence upon the forces measured on models. By W. L. LePage and J. T. Nichols. T.N. No. 191.
Note on the pressure distribution over the hull of elongated airships with circular cross-section. By Max M. Munk. T.N. No. 192.
High altitude flying. By Paul B. King and Thomas Carroll. T.N. No. 193.

A method of determining the dimensions and horsepower of an airship for any given performance. By C. P. Burgess, Bureau of Aeronautics, Navy Department. T.N. No. 194.
On the distribution of lift along the span of an airfoil with displaced ailerons. By Max M. Munk. T.N. No. 195.
Remarks on pressure distribution over the surface of an ellipsoid moving translationally through a perfect fluid. By Max M. Munk. T.N. No. 196.
Some tables of the factor of apparent additional mass. By Max M. Munk. T.N. No. 197.
Micarta propellers: Pt. I—Materials. By F. W. Caldwell and N. S. Clay. T.N. No. 198.
Micarta propellers: Pt. II—Method of construction. By F. W. Caldwell and N. S. Clay. T.N. No. 199.
Micarta propellers: Pt. III—General description of the design. By F. W. Caldwell and N. S. Clay. T.N. No. 200.
Micarta propellers: Pt. IV—Technical methods of design. By F. W. Caldwell and N. S. Clay. T.N. No. 201.
Experimental investigation of the effect of an oscillating airstream (Katzmayr effect) on the characteristics of airfoils. By Toussaint, Kerneis and Girault. T.N. No. 202.
A short method of calculating torsional stresses in an airplane fuselage. By John E. Younger. T.N. No. 203.
A study of static stability of airships. By Frank Rizzo. T.N. No. 204.
The logarithmic polar curve—its theory and application to the predetermination of airplane performance. By Val Cronstedt. T.N. No. 205.
Structural weight of aircraft as affected by the system of design. By Charles Ward Hall. T.N. No. 206.
The simplifying assumptions, reducing the strict application of classical hydrodynamics to practical aeronautical computations. By Max M. Munk. T.N. No. 207.
Tests on duralumin columns for aircraft construction. By John G. Lee. T.N. No. 208.
Tests of rotating cylinders. By Elliott G. Reid. T.N. No. 209.
The testing of aviation engines under approximate altitude conditions. By R. N. DuBois. T.N. No. 210.

Technical Memorandums

Air Transport. By F. Handley Page. Reprint from "The Journal of the Institute of Transport," February, 1923. T.M. No. 244.
Investigations of aviation accidents and lessons to be drawn from them. By F. Devaluez. Paper read at the International Air Conference, London, June, 1923. T.M. No. 245.
Remarks on building of low-powered airplanes. By Werner v. Langsdorff. Translated from "Der Motorwagen," Nov. 10, 1923. T.M. No. 246.
Methods of experimentation with models and utilization of results. By Lt. Col. Robert. Paper read before the International Air Congress, London, 1923. T.M. No. 247.
Specializing for record-breaking. By Edward P. Warner. T.M. No. 248.
Aeronautic instruments. By E. Everling and H. Koppe. Translated from "Zeitschrift des Vereines deutscher Ingenieure," April 1, 1922, Vol. 66, No. 13. T.M. No. 249.
Magnan glider M-2. By M. Andre Lesage. Translated from "L'Air," Jan. 1, 1924. T.M. No. 250.
The vector ruling protractor. By A. F. Zahm. Taken from the "Journal of the Franklin Institute," February, 1924, Vol. 197, No. 2. T.M. No. 251.
Effect of changing the mean camber of an airfoil section. By A. Toussaint. Translated from "La Technique Aeronautique," Oct. 15, and Nov. 15, 1923. T.M. No. 252.
Voyage of the *Dixmude* over Northern Africa. By Lieut. Lemaire. Translated from "La Technique Aeronautique," Jan. 15, 1924. T.M. No. 253.
The practical difficulties of commercial flying. By F. T. Courtney. Paper read before the Royal Aeronautical Society (Scottish Branch). T.M. No. 254.
The Cathode oscillograph for the study of low, medium and high frequencies. By A. Dufour. Translated from "L'Onde Electrique," Nos. 11, Nov., 1922; 12, Dec., 1922; 13, Jan., 1923. T.M. No. 255.
Loss of the *Dixmude*. By Hugo Eckener. Translated from "Luftfahrt," Jan. 23, 1924. T.M. No. 256.
Motion of spheres in still fluids. By P. Hirsch. Translated from "Zeitschrift für Angewandte Mathematik und Mechanik," Vol. III, No. 2, April, 1923. T.M. No. 257.
New application of principle of variable-camber airfoil (Lachassagne system). By A. Toussaint. Translated from "Recherches et Inventions," July 21, 1922. T.M. No. 258.
Fatigue of internal combustion engines. By P. Dumanois. Translated from "La Revue des Combustibles Liquides," Jan., 1924. T.M. No. 259.
Air flow experiments. By C. Wieselsberger. From Report II of the Göttingen Aerodynamik Institute. T.M. No. 260.
Light airplanes which participated in contest at Lympne, England, Oct., 1923. Taken from "Flight," Sept. 20, 27, Oct. 4, 11, 18, 1923, and "The Aeroplane," April 4, Sept. 19, and Oct. 17, 1923. T.M. No. 261.
Ultra-light alloys and their utilization on aircraft. By A. M. Portevin and R. DeFleury. T.M. No. 262.
Wind tunnel tests of correction formula for wings of large span. By C. Wieselsberger. Translated from Report II of the Göttingen Aerodynamic Institute, 1923. T.M. No. 263.
A method for the instantaneous determination of the velocity and direction of the wind. By E. Huguenard, A. Magnan and A. Planiol. Translated from "La Technique Aeronautique," 1923, Nov. 15, Dec. 15; 1924, Jan. 15, Feb. 15. T.M. No. 264.

Development of wing-steered Messerschmitt gliders. Translated from "Flugsport," April 15, 1924. T.M. No. 265.

Device for measuring sound in airplane engines. By T. Bobrovsky. Translated from "L'Ala d'Italia," March, 1924. T.M. No. 266.

Air forces exerted on streamlined bodies with round or square cross-sections, when placed obliquely to the airstream. By C. Wieselsberger. Translated from Report II of the Göttingen Aerodynamic Institute. T.M. No. 267.

Velocity and pressure distribution behind bodies in an air current. By A. Betz. Translated from Report II of the Göttingen Aerodynamic Institute. T.M. No. 268.

Experiments on the resistance of airplane wheels and radiators. Translated from "Verslagen en Verhandelingen van den Rijks-Studiedienst voor de Luchtvaart," Amsterdam, Pt. II, 1923, Report A64. T.M. No. 269.

The problem of liquid fuels (for aircraft engines). By Gino Gallo. Summary of a lecture by Prof. Gallo before the Italian Aerotechnical Association. Translated from "L'Ala d'Italia," March, 1924. T.M. No. 270.

Balloon flight and atmospheric electricity. By Emilio Herrera. Translated from the German translation of the Spanish, in "Luftfahrt," April 15, 1924. T.M. No. 271.

Experiments with a device for shortening the glide and landing run of an airplane. Translated from "Verslagen en Verhandelingen van den Rijks-Studiedienst voor de Luchtvaart," Part II, 1923. T.M. No. 272.

Historical notes on aerodynamic research. By Charles Dollfus. Translated from "L'Aeronautique," April, 1924. T.M. No. 273.

Structural and economic limits to the dimensions of airships. By G. A. Crocco. Translated from "Note di Tecnica Aeronavale," 1923. T.M. No. 274.

Recent researches in airship construction: Pt. I—Forces of flow on a moving airship and the effect of the control surfaces. By H. Naatz. Translated from "Berichte und Abhandlungen der Wissenschaftlichen Gesellschaft für Luftfahrt" (a supplement to "Zeitschrift für Flugtechnik und Motorluftschiffahrt"), March, 1924. T.M. No. 275.

Recent researches in airship construction: Pt. II—Bending stresses on an airship in flight. By H. Naatz. Translated from "Berichte und Abhandlungen der Wissenschaftlichen Gesellschaft für Luftfahrt" (a supplement to "Zeitschrift für Flugtechnik und Motorluftschiffahrt"), March, 1924. T.M. No. 276.

Recent researches in airship construction: Pt. III—A new type of non-rigid airship. By H. Naatz. Translated from "Berichte und Abhandlungen der Wissenschaftlichen Gesellschaft für Luftfahrt" (a supplement to "Zeitschrift für Flugtechnik und Motorluftschiffahrt"), March, 1924. T.M. No. 277.

General rules for metal aircraft construction. By Alessandre Guidoni. Translated from "Rendiconti Tecnici della Direzione Superiore del Genio e delle Costruzioni Aeronautiche," March 15, 1924. T.M. No. 278.

Provisional rules for the inspection of aircraft adopted by the French Bureau "Veritas." Translated from the French. T.M. No. 279.

Effect of ratio between volume and surface area of airships. By G. A. Crocco. Translated from "Note di Tecnica Aeronavale," 1923. T.M. No. 280.

Combustion of liquid fuels in Diesel engine. By Otto Alt. Translated from "Zeitschrift des Vereines deutscher Ingenieure," July 14, 1923. T.M. No. 281.

Results of experiments with slotted wings. By G. Lachmann. Translated from "Zeitschrift für Flugtechnik und Motorluftschiffahrt," May 26, 1924. T.M. No. 282.

Mooring airships. By G. A. Crocco. Translated from "Note di Tecnica Aeronavale," 1923. T.M. No. 283.

Duralumin, its properties and uses. By R. Beck. Translated from "Zeitschrift für Metallkunde," April, 1924. T.M. No. 284.

Calculation of the hull and of the car-suspension systems of airships. By R. Verduzio. Translated from "Rendiconti Tecnici," March 15, 1924. T.M. No. 285.

The American airship ZR-3. By L. Dürr. Translated from "Zeitschrift des Vereines Deutscher Ingenieure," May 31, 1924, Vol. 68, No. 22. T.M. No. 286.

Effect of altitude on power of aviation engines. By Italo Raffaelli. Translated from "Rendiconti Tecnici," July 15, 1924. T.M. No. 287.

Stieber dynamometer hub for aircraft propellers. By W. Stieber. Translated from "Zeitschrift für Flugtechnik und Motorluftschiffahrt," April 26, 1924. T.M. No. 288.

Two-seat light airplanes which participated in contest held at Lympne, England, week of September 29 to October 4, 1924. Taken from "Flight," Sept. 25, Oct. 2 & 9, and from "Aeroplane," Sept. 24, Oct. 1, 8 & 15, 1924. Compiled by the N.A.C.A. T.M. No. 289.

Aviation engines in the endurance contest. By G. Lehr. Translated from "L'Aeronautique," July, 1924. T.M. No. 290.

Measuring vibration and torque with the oscillograph. By R. Elsasser. Translated from "Zeitschrift des Vereines Deutscher Ingenieure," May 17, 1924. T.M. No. 291.

The aerodynamic laboratory of the Belgian "Service Technique de L'Aeronautique." Translated from "Bulletin du Service Technique de L'Aeronautique," May, 1924. T.M. No. 292.

Momogram for correcting drag and angle of attack of an airfoil model in an air stream of finite diameter. Translated from Report A58 of the "Rijks-Studiedienst voor de Luchtvaart," reprinted from "De Ingenieur," Sept. 20, 1924. T.M. No. 293.

Motive power required to operate a wind tunnel. By S. Ziembinski. Translated from "L'Aerophile," Aug. and Sept., 1924. T.M. No. 294.

NATIONAL AIRCRAFT UNDERWRITERS ASSOCIATION

120 West 42nd Street, New York City

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The National Aircraft Underwriters Association completed the fifth year of its existence in March, 1925. The Association was formed originally for the purpose of collecting data on the aircraft hazards and recommending to its members standard rules and practices for underwriting those hazards. In May, 1921, the Association prepared a set of minimum advisory rates, a system of grading pilots, and a standard set of endorsements for providing the various coverages. The rates were established on the basis of experience developed on risks written by the member companies.

The members of the Association discontinued the writing of the aircraft coverage some time ago and still do not feel that the time has yet arrived when they can safely resume the business. Civil aviation has been slow in development and conditions are so unstable that the aircraft hazards can hardly be assumed with any degree of assurance.

The National Aircraft Underwriters Association has continued its relationships with the Underwriters Laboratories and with the Aeronautical Chamber of Commerce of America, thereby keeping in touch with the latest developments in the field of aviation.

AIRCRAFT EXPORTS

U. S.—1924

Month	*Airplanes and Seaplanes*		*Other Aircraft*		*Airplane Parts Except Engines and Tires*		*Airplane Engines*	
	No. U.	*Value*	*No. U.*	*Value*	*No. Lbs.*	*Value*	*No. U.*	*Value*
Jan.....	17	$164,000	..	.....	5,911	$ 5,736	16	$ 23,700
Feb.....	13	51,000	..	.....	16,172	5,517	23	46,100
Mar.....	7	19,670	..	.....	48,546	52,131	38	42,150
Apr.....	2	20,245	..	.....	7,130	7,724	11	20,200
May.....	1	7,500	..	.....	26,737	46,167	22	29,800
June.....	2	6,662	..	.....	7,814	10,502	2	1,006
July.....	1	600	1	$ 500	6,263	9,593	8	21,818
Aug.....	4	29,000	1	$ 500	8,075	4,481	1	375
Sept.....	..	.....	..	.....	29,249	14,673	12	18,050
Oct.....	5	59,000	..	.....	6,372	5,516	11	14,800
Nov.....	..	.....	1	280	3,043	2,981	1	110
Dec.....	4	53,781	..	.....	160	905	1	1,500
12 mos...	56	$411,458	3	$1,280	165,472	$165,926	146	$219,609

AIRCRAFT AND AIRCRAFT ENGINE EXPORTS BY COUNTRIES

1916–1924

Countries	*1916*	*1917*	*1918*	*1919*	*1920*	*1921*	*1922*	*1923*	*1924*	*Total 1916–1924*
France	.....	.....	.....	$ 15,000	$ 42,600	.....	.....	$ 1,450	$ 14,100	$ 73,150
Netherlands	.....	.....	$ 76,226	.....	.....	.....	.....	55,239	71,628	203,093
Norway	.....	.....	.....	22,000	.....	.....	$ 3,000	.....	26,000	51,000
Spain	$ 37,980	.....	.....	.....	.....	.....	.....	.....	.....	37,980
Sweden	.....	.....	44,239	.....	.....	.....	.....	.....	.....	44,239
United Kingdom	1,964,094	$ 170,954	27,775	.....	.....	$ 10,000	.....	.....	79,800	2,252,623
Canada	95,046	616,068	6,500	28,200	27,160	5,000	2,230	6,015	22,163	808,382
Mexico	.....	.....	.....	.....	28,000	98,165	20,250	5,850	228,220	380,485
Nicaragua	.....	.....	.....	.....	.....	25,000	.....	.....	1,530	26,530
Cuba	.....	.....	.....	5,000	15,500	8,000	500	.....	30,920	59,920
Jamaica	875	.....	.....	.....	.....	.....	.....	.....	.....	875
Argentina	5,000	.....	.....	.....	38,050	79,500	.....	30,639	66,184	219,373
Bolivia	.....	.....	.....	.....	25,180	.....	.....	.....	.....	25,180
Brazil	20,000	.....	34,500	18,000	109,000	1,396	108,700	229,200	60,273	581,069
Colombia	.....	.....	.....	10,000	10,100	5,000	.....	.....	1,334	26,434
Peru	.....	.....	.....	4,500	272,750	5,000	.....	10,317	68,461	361,028
Uruguay	.....	.....	.....	.....	.....	.....	5,000	.....	.....	5,000
Guatemala	.....	.....	.....	.....	.....	.....	.....	1,400	.....	1,400
Honduras	.....	.....	.....	.....	.....	.....	.....	6,100	11,550	17,650
Dominican Republic	.....	.....	.....	.....	.....	.....	.....	1,102	.....	1,102
New Zealand	.....	.....	.....	.....	.....	.....	.....	565	1,600	2,105
British South Africa	.....	.....	.....	.....	.....	.....	.....	200	.....	200
Italy	.....	.....	.....	.....	.....	.....	.....	1,600	22,716	24,316
Salvador	.....	.....	.....	.....	.....	.....	.....	5,802	6,100	11,902
Chile	.....	.....	.....	.....	.....	.....	.....	8,210	12,682	20,892
Belgium	.....	.....	.....	.....	.....	.....	.....	400	.....	400
China	.....	.....	.....	.....	20,220	.....	17,600	.....	4,590	42,410
Dutch East Indies	27,000	145,000	.....	.....	.....	.....	.....	.....	.....	172,000
Hongkong	.....	.....	.....	.....	.....	1,800	.....	10,000	.....	11,800
Japan	8,400	52,520	16,880	.....	5,714	15,000	.....	.....	46,597	145,111
Australia	.....	17,000	.....	20,000	.....	.....	.....	520	290	37,810
Philippine Islands	.....	.....	.....	92,600	4,000	61,079	.....	.....	.....	157,679
Russia in Europe	.....	.....	.....	.....	.....	.....	.....	.....	8,600	8,600
Trinidad and Tobago	.....	.....	.....	.....	.....	.....	.....	.....	63	63
Siam	.....	.....	.....	.....	.....	.....	.....	.....	1,497	1,497
Germany	.....	.....	.....	.....	.....	.....	.....	.....	11,000	11,000
Barbados	.....	.....	.....	.....	.....	.....	.....	.....	375	375
Totals	$2,158,395	$1,001,542	$ 206,120	$ 215,300	$598,274	$314,940	$157,280	$374,609	$796,273	$5,822,733
Parts of Airplanes (lbs.)	4,843,610	3,133,903	8,877,977	3,249,226	554,375	157,608	265,231	55,948	165,472	21,303,350
Complete Airplanes	269	135	20	44	65	48	42	46	59	728
Complete Engines	*	.....	.....	.....	.....	.....	.....	.....	146	146

* Not available prior to 1924.

AIRCRAFT APPROPRIATIONS, UNITED STATES

1898-1924

	America, North: United States		*Total*	*Increase or Decrease*	*Net*
1898	Army (allotted to Dr. S. P. Langley for experiments in aerodynamics)		$ 25,000		
1899	Army (allotted to Dr. S. P. Langley for experiments in aerodynamics)		25,000		
1908	Army (allotted for payment of Wright airplane)		25,000		
1909	Army (allotted for payment of Wright airplane)		5,000		†$ 20,000
1911–12	Army	$ 125,000		*$ 120,000	
	Navy	25,000	150,000	*25,000	*145,000
1913	Army	100,000		†25,000	
	Navy	10,000	110,000	†15,000	†40,000
1914	Army	175,00		*75,000	
	Navy	10,000	185,000		*75,000
1915	Army	200,000		*25,000	
	Navy	10,000			
	N.A.C.A.	5,000	215,000	*5,000	*30,000
1916	Army	800,000		*600,000	
	Navy	1,000,000		*990,000	
	N.A.C.A.	5,000	1,805,000		*1,590,000
1917	Army	18,081,666		*17,281,666	
	Navy	3,500,000		*2,500,000	
	Air Mail	1,060,000		*1,060,000	
	N.A.C.A.	87,515.70	22,729,181.70	*82,515.70	*20,924,181.70
1918	Army—less revocations	50,410,000		*32,328,334	
	Navy	61,133,000		*57,633,000	
	Air Mail	100,000		†960,000	
	N.A.C.A.	112,000	111,755,000	*24,484	*89,025,818

* Increase.
† Decrease.

AIRCRAFT APPROPRIATIONS, UNITED STATES—*Continued*

America, North: United States			*Total*	*Increase or Decrease*	*Net*
1919	Army—less revocations	$467,304,758		*$416,894,758	
	Navy $220,383,119; returned to treasury $97,000,000	123,383,119		*62,250,119	
	Air Mail	100,000			
	N.A.C.A.	205,000	$590,922,877	*93,000	*$479,237,877
1920	Army	25,000,000		†442,304,758	
	Navy	25,000,000		†98,383,119	
	Air Mail	850,000		*750,000	
	N.A.C.A.	175,000	51,025,000	†30,000	†539,967,877
1921	Army	33,000,000		*8,000,000	
	Navy	20,000,000		†5,000,000	
	Air Mail	1,250,000		*400,000	
	Forest Service	50,000		*50,000	
	N.A.C.A.	210,000	54,510,000	*35,000	*3,485,000
1921–22	Army	19,200,000		†13,800,000	
	Navy	13,413,431		†6,586,569	
	Air Mail	1,250,000			
	Forest Service	50,000			
	N.A.C.A.	200,000	34,113,431	†10,000	†20,396,569
1922–23	Army	12,895,000		†6,305,000	
	Navy	14,683,590		*1,270,159	
	Air Mail	1,900,000		*650,000	
	N.A.C.A.	210,000	29,688,590	*10,000	†4,374,841
1923–24	Army	12,426,000		†469,000	
	Navy	14,647,174		†36,416	
	Air Mail	1,500,000		†400,000	
	N.A.C.A.	283,000	28,856,174	*73,000	†832,416

* Increase.
† Decrease.

AIRCRAFT APPROPRIATIONS, UNITED STATES—*Continued*

America, North: United States			*Total*	*Increase or Decrease*	*Net*
1924–25	Army	$ 14,113,043.80		*$ 1,687,043.80	
	Navy	15,150,000		*502,826	
	Air Mail	2,750,000		*1,250,000	
	N.A.C.A.	470,000	$ 32,483,043.80	*187,000	*$ 3,626,869.80
1925–26	Army	14,700,000**		*586,956.20	
	Navy	14,790,000‡		†360,000	
	Air Mail	2,600,000		†150,000	
	N.A.C.A.	534,000	32,624,000	*64,000	* 140,956.20***

* Increase.
† Decrease.
** Plus $2,150,000 "contract authorizations" for additional purchases of aircraft.
‡ Plus $4,100,000 "contract authorizations" for additional purchases of aircraft.
*** Plus $6,250,000 "contract authorizations" for additional purchases of aircraft.

AIRCRAFT APPROPRIATIONS, FOREIGN—(Also See Previous Aircraft Year Books)

Country	1921–1922		1922–1923		1923–1924	
	Total	*Part Devoted to Civil and Subsidy*	*Total*	*Part Devoted to Civil and Subsidy*	*Total*	*Part Devoted to Civil and Subsidy*
Argentina	$964,800			$4,500 monthly		$2,000,000
Australia	£654,000	£154,000			£232,000	£19,000
Belgium	38,700,000 fr.	13,100,000 fr.	31,750,000 fr.	8,100,000 fr.	$4,940,150	$1,252,895
Brazil	$250,000		$360,000			
Canada	$1,626,000	$700,000	$1,064,467			
Chile						
China	Indeterminate amounts from warring factions		Indeterminate amounts from warring factions			
Colombia		$100 per trip on Magdalena route		$100 per trip on Magdalena route		$27,000 pending
Czecho-Slovakia	9,680,000 Cz. kr.	6,000,000 Cz. kr.	*150,000,000 Cz. kr.		154,000,000 crowns	4,000,000 crowns
Denmark	110,000 cr.					
Ecuador						
Esthonia				$14,700		
Finland						180,000 Finnish marks
France	435,917,595 fr.	189,510,970 fr.	947,352,550 fr.	179,963,550 fr.	$120,992,437	$25,765,943
Germany		22,000,000 marks				50 to 75% of operating expense
Great Britain	£16,394,680	£1,060,000	£15,666,500	£571,000	$90,541,233	$1,464,817
Hungary				45,000,000 kr.		
India	66,000 rupees		631,893 rupees			£26,666—three years
Italy	112,760,000 lire	25,060,000 lire	220,000,000 lire	£34,000	$57,915,000	16.80 lire per km.

* Proposed

AIRCRAFT APPROPRIATIONS, FOREIGN—(Also See Previous Aircraft Year Books)—*Continued*

Country	*1921-1922*		*1922-1923*		*1923-1924*	
	Total	*Part Devoted to Civil and Subsidy*	*Total*	*Part Devoted to Civil and Subsidy*	*Total*	*Part Devoted to Civil and Subsidy*
Japan	$21,600,000	30,000 yen	$21,200,000	$300,000	$19,920,000	1,500,000 yen (1925)
Jugo-Slavia			Air credits extended by French	$20,000 annual subsidy to French line		
Mexico	$1,495,500					
Netherlands	4,823,516 fl.	1,735,000 fl.		1,400,000 fl. 1923-26 subsidies		300,000 florins
Norway						500 kroner per flight
Peru						
Portuguese East Africa						
Poland				Pays subsidy to French line		
Roumania			80,000,000 leis	30,000,000 leis		
Russia			36,000,000 gold rubles ($18,540,000)		$18,540,000	Liberal grant
Serbia	$300,000					
Siam			1,600,000 ticals (£160,000)			
Spain	14,000,000 pesetas		48,569,630 pesetas ($7,456,000)	$235,000	$3,970,000	3,000 pesetas a trip
Sweden	821,200 kr.					
Switzerland	4,024,000 fr.	1,150,000 fr.	4,322,000 fr.	450 fr. each flight Geneva-Munich		70,000 francs

OFFICIAL WORLD AND AMERICAN AIR RECORDS

ESTABLISHED UNDER RULES AND REGULATIONS OF THE

FÉDÉRATION AÉRONAUTIQUE INTERNATIONALE JANUARY 1, 1925.

WORLD RECORDS

CONFIRMED BY THE

FÉDÉRATION AÉRONAUTIQUE INTERNATIONALE

CLASS A—BALLOONS

1ST CATEGORY (600 CUBIC METERS)

DURATION	(France) G. Cormier, Aug. 10-11, 1924.	22h. 34m.
DISTANCE	(France) Georges Cormier, July 1, 1922.	804.173 km. 499.69 miles.

2ND CATEGORY (601-900 CUBIC METERS)

DURATION	(France) Jules Dubois, May 14-15, 1922.	23h. 28m.
DISTANCE	(France) Georges Cormier, July 1, 1922.	804.173 km. 499.69 miles.

3RD CATEGORY (901-1,200 CUBIC METERS)

DURATION	(France) Jules Dubois, May 14-15, 1922.	23h. 28m.
DISTANCE	(France) Georges Cormier, July 1, 1922.	804.173 km. 499.69 miles.

4TH TO 8TH CATEGORIES, INCLUSIVE

DURATION	(Germany) H. Kaulen, Dec. 13-17, 1913.	87h.
DISTANCE	(Germany) Berliner, Feb. 8-10, 1914.	3,052.7 km. 1,896.9 miles.
ALTITUDE	(Germany) Suring and Berson, June 30, 1901.	10,800 meters. 35,424 feet.

CLASS B—AIRSHIPS

RETURNING TO POINT OF DEPARTURE

DURATION	(Italy) Castracane and Castruccio, P-5, June 25, 1913.	15 hours.
DISTANCE	(Italy) Castracane and Castruccio, P-5, July 30, 1913.	810 km. 503.3 miles.
ALTITUDE	(France) Cohen, at Conte, June 18, 1912.	3,080 meters. 10,102 feet.
MAXIMUM SPEED	(Italy) Castracane and Castruccio, P-5, July 30, 1913.	64.8 k.p.h. 40.26 m.p.h.

CLASS C—AIRPLANES

RETURNING TO POINT OF DEPARTURE WITHOUT REFUELING

DURATION	(France) Coupet and Drouhin, Farman Goliath, Farman 450 h.p., at Toussus, July 16-17, 1924.	37h. 59m. 10s.
DISTANCE	(United States) Lts. Kelly and Macready, U.S.A., T-2, Liberty 375 h.p., at Wilbur Wright Field, Dayton, Ohio, April 16-17, 1923.	4,050 km. 2,516.55 miles.
ALTITUDE	(France) Callizo, Gourdou-Lesseure monoplane, Hispano Suiza, 300 h.p., Rateau Super, at Villacoublay, Oct. 10, 1924.	12,066 meters. 39,586 feet.
MAXIMUM SPEED	(France) Warrant Officer Bonnett, Ferbois monoplane, Hispano Suiza, 550 h.p., at Istres, France, Dec. 11, 1924.	448.171 k.p.h. 278,480 m.p.h.

SPEED FOR SPECIFIED DISTANCES

SPEED FOR 100 KILOMETERS	(United States) Lt. A. J. Williams, U.S.N., Curtiss Racer, R-2C1, Curtiss D-12a, 500 h.p., at St. Louis, Mo., Oct. 6, 1923.	392.379 k.p.h. 243.812 m.p.h.
SPEED FOR 200 KILOMETERS	(United States) Lt. A. J. Williams, U.S.N., Curtiss Racer, R-2C1, Curtiss D-12a, 500 h.p., at St. Louis, Mo., Oct. 6, 1923.	392.154 k.p.h. 243.672 m.p.h.
SPEED FOR 500 KILOMETERS	(France) Sadi-Lecointe, Nieuport-Delage, Hispano-Suiza, 500 h.p., at Istres, June 23, 1924.	306.696 k.p.h. 190.567 m.p.h.
SPEED FOR 1,000 KILOMETERS	(United States) Lt. Harold R. Harris, U.S.A., and Ralph Lockwood, DH-4L Liberty 400 h.p., at Wilbur Wright Field, Dayton, Ohio, March 29, 1923.	205.06 k.p.h. 127.42 m.p.h.
SPEED FOR 1,500 KILOMETERS	(United States) Lt. Harold R. Harris, U.S.A., DH-4L, Liberty 375 h.p., at Wilbur Wright Field, Dayton, Ohio, April 17, 1923.	184.03 k.p.h. 114.35 m.p.h.
SPEED FOR 2,000 KILOMETERS	(United States) Lt. Harold R. Harris, U.S.A., DH-4L, Liberty 375 h.p., at Wilbur Wright Field, Dayton, Ohio, April 17, 1923.	183.83 k.p.h. 114.22 m.p.h.
SPEED FOR 2,500 KILOMETERS	(United States) Lts. Kelly and Macready, U.S.A., Army T-2, Liberty 375 h.p., at Wilbur Wright Field, Dayton, Ohio, April 16-17, 1923.	115.60 k.p.h. 71.83 m.p.h.
SPEED FOR 3,000 KILOMETERS	(United States) Lts. Kelly and Macready, U.S.A., Army T-2, Liberty 375 h.p., at Wilbur Wright Field, Dayton, Ohio, April 16-17, 1923.	115.27 k.p.h. 71.62 m.p.h.
SPEED FOR 3,500 KILOMETERS	(United States) Lts. Kelly and Macready, U.S.A., Army T-2, Liberty 375 h.p., at Wilbur Wright Field, Dayton, Ohio, April 16-17, 1923.	114.82 k.p.h. 71.34 m.p.h.
SPEED FOR 4,000 KILOMETERS	(United States) Lts. Kelly and Macready, U.S.A., Army T-2, Liberty 375 h.p., at Wilbur Wright Field, Dayton, Ohio, April 16-17, 1923.	113.93 k.p.h. 70.79 m.p.h.

CLASS C—WITH USEFUL LOAD OF 250 KILOGRAMS (551.15 lbs.)

RETURNING TO POINT OF DEPARTURE

DURATION	(United States) Lt. Harold R. Harris, U.S.A.S., Douglas DT-2, Liberty 400 h.p., at Wilbur Wright Field, Dayton, Ohio, June 28, 1924.	9h. 11m. 53.4s.
DISTANCE	(United States) Lt. Harold R. Harris, U.S.A.S., Douglas DT-2, Liberty 400 h.p., at Wilbur Wright Field, Dayton, Ohio, June 28, 1924.	950 km. 590.3 miles.
ALTITUDE	(United States) Lt. H. R. Harris, U.S.A., TP-1, Liberty 400 h.p. (supercharged), at McCook Field, Dayton, Ohio, March 27, 1924.	8,980 meters. 29,462 feet.
SPEED FOR 100 KILOMETERS	(Czecho-Slovakia) Sgt. F. Lehky, Army A-12, Maybach 266 h.p., at Prague, Sept. 7, 1924.	226,272 k.p.h. 140.60 m.p.h.

SPEED FOR 200 KILOMETERS	(Czecho-Slovakia) Sgt. F. Lehky, Army A-12, Maybach 266 h.p., at Prague, Sept. 7, 1924.	202.988 k.p.h. 126.13 m.p.h.
SPEED FOR 500 KILOMETERS	(France) Adjt. Foiny, Potez, type 15-A2, Lorraine 400 h.p., at Villesauvage, Nov. 29, 1924.	196.94 k.p.h. 122.37 m.p.h.

CLASS C—WITH USEFUL LOAD OF 500 KILOGRAMS (1102.31 lbs.)

RETURNING TO POINT OF DEPARTURE

DURATION	(United States) Lt. H. R. Harris, U.S.A.S., Douglas DT-2, Liberty 400 h.p., at Wilbur Wright Field, Dayton, Ohio, June 28, 1924.	9h. 11m. 53.4s.
DISTANCE	(United States) Lt. H. R. Harris, U.S.A.S., Douglas DT-2, Liberty 400 h.p., at Wilbur Wright Field, Dayton, Ohio, June 28, 1924.	950 km. 590.3 miles.
ALTITUDE	(United States) Lt. H. R. Harris, U.S.A.S., U.S. Army TP-1, Liberty 400 h.p., at McCook Field, Dayton, Ohio, May 21, 1924.	8,578 meters. 28,143 feet.
SPEED FOR 100 KILOMETERS	(Czecho-Slovakia) Capt. J. Kalla, Army A-12, Maybach 260 hp., at Prague, Sept. 7, 1924.	202,133 k.p.h. 125.59 m.p.h.
SPEED FOR 200 KILOMETERS	(Czecho-Slovakia) Sgt. Kaspar, Army A-12, Maybach 260 h.p., at Prague, Sept. 7, 1924.	189.219 k.p.h. 117.57 m.p.h.
SPEED FOR 500 KILOMETERS	(United States) Louis G. Meister, Martin Bomber, MB-2, 2 Liberty 400 h.p., at Wilbur Wright Field, Dayton, Ohio, June 28, 1924.	120.55 k.p.h. 74.90 m.p.h.

CLASS C—WITH USEFUL LOAD OF 1000 KILOGRAMS (2204.62 lbs.)

RETURNING TO POINT OF DEPARTURE

DURATION	(United States) Lieut. J. A. Macready, U.S.A.S., Curtiss (Martin) Bomber, NBS-1, 2 Liberty 400 h.p., at Wilbur Wright Field, Dayton, Ohio, Oct. 2, 1924.	2h. 13m. 49.6s.
ALTITUDE	(France) Lucien Coupet, Farman Goliath, Farman 600 h.p., at Toussus, May 6, 1924.	5,751 meters. 18,868 feet.

CLASS C—WITH USEFUL LOAD OF 1500 KILOGRAMS (3306.93 lbs.)

RETURNING TO POINT OF DEPARTURE

DURATION	(United States) Lieut. J. A. Macready, U.S.A.S., Curtiss (Martin) Bomber, NBS-1, 2 Liberty 400 h.p., at Wilbur Wright Field, Dayton, Ohio, Oct. 2, 1924.	2h. 13m. 49.6s.
ALTITUDE	(United States) Lieut. J. A. Macready, U.S.A.S., Curtiss (Martin) Bomber, NBS-1, 2 Liberty 400 h.p., at Wilbur Wright Field, Dayton, Ohio, Oct. 2, 1924.	4,953 meters. 16,250 feet.

CLASS C—WITH USEFUL LOAD OF 2000 KILOGRAMS (4409.24 lbs.)

RETURNING TO POINT OF DEPARTURE

DURATION	(United States) Lieut. H. R. Harris, U.S.A.S., and Mechanician Doug. Culver, Barling Bomber, 6 Liberty 400 h.p., at Wilbur Wright Field, Dayton, Ohio, Oct. 3, 1924.	1h. 47m. 10.5s.
ALTITUDE	(France) Lucien Bossoutrot, Farman Goliath, Farman 600 h.p., at Toussus, May 8, 1924.	4,475 meters. 14,682 feet.

CLASS C—WITH USEFUL LOAD OF 3000 KILOGRAMS (6613.86 lbs.)

RETURNING TO POINT OF DEPARTURE

DURATION	(United States) Lieut. H. R. Harris, U.S.A.S., and Mechanician Doug. Culver, Barling Bomber, 6 Liberty 400 h.p., at Wilbur Wright Field, Dayton, Ohio, Oct. 3, 1924.	1h. 47m. 10.5s.
ALTITUDE	(France) Lucien Bossoutrot, Farman Goliath, Farman 600 h.p., at Toussus, May 17, 1924.	1,942 meters. 6,371 feet.

CLASS C—WITH USEFUL LOAD OF 4000 KILOGRAMS (8818.48 lbs.)

RETURNING TO POINT OF DEPARTURE

DURATION	(United States) Lieut. H. R. Harris, U.S.A.S., and Mechanician Doug. Culver, Barling Bomber, 6 Liberty 400 h.p., at Wilbur Wright Field, Dayton, Ohio, Oct. 3, 1924.	1h. 47m. 10.5s.
ALTITUDE	(United States) Lieut. H. R. Harris, U.S.A.S., and Mechanician Doug. Culver, Barling Bomber, 6 Liberty 400 h.p., at Wilbur Wright Field, Dayton, Ohio, Oct. 3, 1924.	1,363 meters. 4,472 feet.

OFFICIAL WORLD AND AMERICAN AIR RECORDS

ESTABLISHED UNDER RULES AND REGULATIONS OF THE

FÉDÉRATION AÉRONAUTIQUE INTERNATIONALE

JANUARY 1, 1925.

AMERICAN RECORDS

CONFIRMED BY THE

CONTEST COMMITTEE

NATIONAL AERONAUTIC ASSOCIATION OF U. S. A.

CLASS A—BALLOONS

1ST CATEGORY (600 CUBIC METERS)

DURATION	(No record.)	
DISTANCE	(No record.)	

2ND CATEGORY (601-900 CUBIC METERS)

DURATION	(No record.)	
DISTANCE	(No record.)	

3RD CATEGORY (901-1,200 CUBIC METERS)

DURATION	H. V. Thaden and W. A. Morton, "Detroit," Washington C. H. Ohio to Gondola, Va., Sept. 30-31, 1924.	13h.
DISTANCE	H. V. Thaden and W. A. Morton, "Detroit," Washington C. H. Ohio to Gondola, Va., Sept. 30-31, 1924.	490.8 km. 305 miles.

4TH TO 8TH CATEGORIES, INCLUSIVE

DURATION	C. B. Harmon, St. Louis to Edina, Mo., Oct. 4, 1909.	48h. 26m.
DISTANCE	A. R. Hawley, St. Louis to Lake Tchotogama, Oct. 17-19, 1910.	1,887.6 km. 1,172.9 miles.
ALTITUDE	C. B. Harmon at St. Louis, Mo., Oct. 4, 1909.	4,876.6 meters. 15,997 feet.

CLASS B—AIRSHIPS

RETURNING TO POINT OF DEPARTURE

DURATION	Ens. Maytham, Navy A-236 at Miami, Fla., Dec. 24-26, 1918.	40h. 26m.
DISTANCE	(No record.)	
ALTITUDE	(No record.)	
MAXIMUM SPEED	(No record.)	

CLASS C—AIRPLANES

RETURNING TO POINT OF DEPARTURE WITHOUT REFUELING

DURATION	Lts. Kelly and Macready, U.S.A., T-2, Liberty 375 h.p., at Wilbur Wright Field, Dayton, Ohio, April 16-17, 1923.	36h. 4m. 34s.
DISTANCE	Lts. Kelly and Macready, U.S.A., T-2, Liberty 375 h.p., at Wilbur Wright Field, Dayton, Ohio, April 16-17, 1923.	4,050 km. 2,516.55 miles.
ALTITUDE	Lt. J. A. Macready, U.S.A.S., Le Pere Biplane, Liberty 400 h.p. (Supercharger), at McCook Field, Dayton, Ohio, May 21, 1924.	10,741 meters. 35,239 feet.
MAXIMUM SPEED	(United States) Lt. A. J. Williams, U.S.N., Curtiss Racer R-2C1, Curtiss D-12a, 500 h.p., at Mitchell Field, Mineola, L. I., Nov. 4, 1923.	429.025 k.p.h. 266.59 m.p.h.

SPEED FOR SPECIFIED DISTANCES

SPEED FOR 100 KILOMETERS	Lt. A. J. Williams, U.S.N., Curtiss Racer, R-2C1, Curtiss D-12a, 500 h.p., at St. Louis, Mo., Oct. 6, 1923.	392.379 k.p.h. 243.812 m.p.h.
SPEED FOR 200 KILOMETERS	Lt. A. J. Williams, U.S.N., Curtiss Racer R-2C1, Curtiss D-12a, 500 h.p., at St. Louis, Mo., Oct. 6, 1923.	392.154 k.p.h. 243.672 m.p.h.
SPEED FOR 500 KILOMETERS	Lt. Alex. Pearson, U.S.A., Verville Sperry R-3, Wright, 350 h.p., at Wilbur Wright Field, Dayton, Ohio, March 29, 1923.	270.06 k.p.h. 167.80 m.p.h.
SPEED FOR 1,000 KILOMETERS	Lt. Harold R. Harris, U.S.A., and Ralph Lockwood, DH-4L Liberty 400 h.p., at Wilbur Wright Field, Dayton, Ohio, March 29, 1923.	205.06 k.p.h. 127.42 m.p.h.
SPEED FOR 1,500 KILOMETERS	Lt. Harold R. Harris, U.S.A., DH-4L, Liberty 375 h.p., at Wilbur Wright Field, Dayton, Ohio, April 17, 1923.	184.03 k.p.h. 114.35 m.p.h.
SPEED FOR 2,000 KILOMETERS	Lt. Harold R. Harris, U.S.A., DH-4L, Liberty 375 h.p., at Wilbur Wright Field, Dayton, Ohio, April 17, 1923.	183.83 k.p.h. 114.22 m.p.h.
SPEED FOR 2,500 KILOMETERS	Lts. Kelly and Macready, U.S.A., Army T-2, Liberty 375 h.p., at Wilbur Wright Field, Dayton, Ohio, April 16-17, 1923.	115.60 k.p.h. 71.83 m.p.h.
SPEED FOR 3,000 KILOMETERS	Lts. Kelly and Macready, U.S.A., Army T-2, Liberty 375 h.p., at Wilbur Wright Field, Dayton, Ohio, April 16-17, 1923.	115.27 k.p.h. 71.62 m.p.h.
SPEED FOR 3,500 KILOMETERS	Lts. Kelly and Macready, U.S.A., Army T-2, Liberty 375 h.p., at Wilbur Wright Field, Dayton, Ohio, April 16-17, 1923.	114.82 k.p.h. 71.34 m.p.h.
SPEED FOR 4,000 KILOMETERS	Lts. Kelly and Macready, U.S.A., Army T-2, Liberty 375 h.p., at Wilbur Wright Field, Dayton, Ohio, April 16-17, 1923.	113.93 k.p.h. 70.79 m.p.h.

CLASS C—WITH USEFUL LOAD OF 250 KILOGRAMS (551.15 lbs.)

RETURNING TO POINT OF DEPARTURE

DURATION	Lt. Harold R. Harris, U.S.A.S., Douglas DT-2, Liberty 400 h.p., at Wilbur Wright Field, Dayton, Ohio, June 28, 1924.	9h. 11m. 53.4s.
DISTANCE	Lt. Harold R. Harris, U.S.A.S., Douglas DT-2, Liberty 400 h.p., at Wilbur Wright Field, Dayton, Ohio, June 28, 1924.	950 km. 590.3 miles.
ALTITUDE	Lt. H. R. Harris, U.S.A., TP-1, Liberty 400 h.p. (supercharged), at McCook Field, Dayton, Ohio, March 27, 1924.	8,980 meters. 29,462 feet.
SPEED FOR 100 KILOMETERS	R. Lockwood, Army CO-5, Liberty 400 h.p., at Wilbur Wright Field, Dayton, Ohio, June 28, 1924.	180,805 k.p.h. 112.346 m.p.h.
SPEED FOR 200 KILOMETERS	R. Lockwood, Army CO-5, Liberty 400 h.p., at Wilbur Wright Field, Dayton, Ohio, June 28, 1924.	180.805 k.p.h. 112.346 m.p.h.
SPEED FOR 500 KILOMETERS	Louis G. Meister, Martin Bomber, MB-2, 2 Liberty, 400 h.p., at Wilbur Wright Field, Dayton, Ohio, June 28, 1924.	120.55 k.p.h. 74.90 m.p.h.

CLASS C—WITH USEFUL LOAD OF 500 KILOGRAMS (1102.31 lbs.)

RETURNING TO POINT OF DEPARTURE

DURATION	Lt. H. R. Harris, U.S.A.S., Douglas DT-2, Liberty 400 h.p., at Wilbur Wright Field, Dayton, Ohio, June 28, 1924.	9h. 11m. 53.4s.
DISTANCE	Lt. H. R. Harris, U.S.A.S., Douglas DT-2, Liberty 400 h.p., at Wilbur Wright Field, Dayton, Ohio, June 28, 1924.	950 km. 590.3 miles.
ALTITUDE	Lt. H. R. Harris, U.S.A.S., U.S. Army TP-1, Liberty 400 h.p., at McCook Field, Dayton, Ohio, May 21, 1924.	8,578 meters. 28,143 feet.
SPEED FOR 100 KILOMETERS	R. Lockwood, Army CO-5, Liberty 400 h.p., at Wilbur Wright Field, Dayton, Ohio, June 28, 1924.	180.805 k.p.h. 112.346 m.p.h.
SPEED FOR 200 KILOMETERS	R. Lockwood, Army CO-5, Liberty 400 h.p., at Wilbur Wright Field, Dayton, Ohio, June 28, 1924.	180.805 k.p.h. 112.346 m.p.h.
SPEED FOR 500 KILOMETERS	Louis G. Meister, Martin Bomber, MB-2, 2 Liberty 400 h.p., at Wilbur Wright Field, Dayton, Ohio, June 28, 1924.	120.55 k.p.h. 74.90 m.p.h.

CLASS C—WITH USEFUL LOAD OF 1000 KILOGRAMS (2204.62 lbs.)

RETURNING TO POINT OF DEPARTURE

DURATION	Lieut. J. A. Macready, U.S.A.S., Curtiss (Martin) Bomber, NBS-1, 2 Liberty 400 h.p., at Wilbur Wright Field, Dayton, Ohio, Oct. 2, 1924.	2h. 13m. 49.6s.
ALTITUDE	Lt. H. R. Harris, U.S.A.S., U.S. Army TP-1, Liberty 400 h.p., at Wilbur Wright Field, Dayton, Ohio, May 22, 1924.	5,100 meters. 16,732 feet.

CLASS C—WITH USEFUL LOAD OF 1500 KILOGRAMS (3306.93 lbs.)

RETURNING TO POINT OF DEPARTURE

DURATION	Lieut. J. A. Macready, U.S.A.S., Curtiss (Martin) Bomber, NBS-1, 2 Liberty 400 h.p., at Wilbur Wright Field, Dayton, Ohio, Oct. 2, 1924.	2h. 13m. 49.6s.
ALTITUDE	Lieut. J. A. Macready, U.S.A.S., Curtiss (Martin) Bomber, NBS-1, 2 Liberty 400 h.p., at Wilbur Wright Field, Dayton, Ohio, Oct. 2, 1924.	4,953 meters. 16,250 feet.

CLASS C—WITH USEFUL LOAD OF 2000 KILOGRAMS (4409.24 lbs.)

RETURNING TO POINT OF DEPARTURE

DURATION	Lieut. H. R. Harris, U.S.A.S., and Mechanician Doug. Culver, Barling Bomber, 6 Liberty 400 h.p., at Wilbur Wright Field, Dayton, Ohio, Oct. 3, 1924.	1h. 47m. 10.5s.
ALTITUDE	Lt. H. R. Harris, U.S.A., Barling Bomber, 6 Liberty 400 h.p., at Wilbur Wright Field, Dayton, Ohio, Oct. 25, 1923.	2,049 meters. 6,722 feet.

CLASS C—WITH USEFUL LOAD OF 3000 KILOGRAMS (6613.86 lbs.)

RETURNING TO POINT OF DEPARTURE

DURATION	Lieut. H. R. Harris, U.S.A.S., and Mechanician Doug. Culver, Barling Bomber, 6 Liberty 400 h.p., at Wilbur Wright Field, Dayton, Ohio, Oct. 3, 1924.	1h. 47m. 10.5s.
ALTITUDE	Lt. H. R. Harris, U.S.A., Barling Bomber, 6 Liberty 400 h.p., at Wilbur Wright Field, Dayton, Ohio, Oct. 27, 1923.	1,639 meters. 5,344 feet.

CLASS C—WITH USEFUL LOAD OF 4000 KILOGRAMS (8818.48 lbs.)

RETURNING TO POINT OF DEPARTURE

DURATION	Lieut. H. R. Harris, U.S.A.S., and Mechanician Doug. Culver, Barling Bomber, 6 Liberty 400 h.p., at Wilbur Wright Field, Dayton, Ohio, Oct. 3, 1924.	1h. 47m. 10.5s.
ALTITUDE	Lieut. H. R. Harris, U.S.A.S., and Mechanician Doug. Culver, Barling Bomber, 6 Liberty 400 hp., at Wilbur Wright Field, Dayton, Ohio, Oct. 3, 1924.	1,363 meters. 4,472 feet.

CLASS C—REFUELED IN FLIGHT

RETURNING TO POINT OF DEPARTURE

DURATION	(United States) Lts. Smith and Richter, U.S.A., DH-4B, Liberty 400 h.p., at Rockwell Field, San Diego, Cal., Aug. 27-28, 1923.	37h. 15m. 14.8s.
DISTANCE	(United States) Lts. Smith and Richter, U.S.A., DH-4B, Liberty 400 h.p., at Rockwell Field, San Diego, Cal., Aug. 27-28, 1923.	5,300 km. 3,293.26 miles.
SPEED FOR 2,500 KILOMETERS	(United States) Lts. Smith and Richter, U.S.A., DH-4B, Liberty 400 h.p., at Rockwell Field, San Diego, Cal., Aug. 27-28, 1923.	142.78 k.p.h. 88.72 m.p.h.
SPEED FOR 3,000 KILOMETERS	(United States) Lts. Smith and Richter, U.S.A., DH-4B, Liberty 400 h.p., at Rockwell Field, San Diego, Cal., Aug. 27-28, 1923.	141.87 k.p.h. 88.15 m.p.h.
SPEED FOR 3,500 KILOMETERS	(United States) Lts. Smith and Richter, U.S.A., DH-4B, Liberty 400 h.p., at Rockwell Field, San Diego, Cal., Aug. 27-28, 1923.	142.17 k.p.h. 88.34 m.p.h.
SPEED FOR 4,000 KILOMETERS	(United States) Lts. Smith and Richter, U.S.A., DH-4B, Liberty 400 h.p., at Rockwell Field, San Diego, Cal., Aug. 27-28, 1923.	142.00 k.p.h. 88.28 m.p.h.
SPEED FOR 4,500 KILOMETERS	(United States) Lts. Smith and Richter, U.S.A., DH-4B, Liberty 400 h.p., at Rockwell Field, San Diego, Cal., Aug. 27-28, 1923.	142.36 k.p.h. 88.46 m.p.h.
SPEED FOR 5,000 KILOMETERS	(United States) Lts. Smith and Richter, U.S.A., DH-4B, Liberty 400 h.p., at Rockwell Field, San Diego, Cal., Aug. 27-28, 1923.	142.53 k.p.h. 88.56 m.p.h.

CLASS C-2—SEAPLANES

RETURNING TO POINT OF DEPARTURE WITHOUT REFUELING

DURATION	(United States) Lts. F. W. Wead and J. D. Price, Navy C S-2 seaplane, Wright 585 h.p., at Washington, D. C., July 11-12, 1924.	14h. 53m. 44.2s.
DISTANCE	(United States) Lts. F. W. Wead and J. D. Price, Navy C S-2 seaplane, Wright 585 h.p., at Washington, D. C., July 11-12, 1924.	1,600 km. 994.19 miles.
ALTITUDE	(France) Sadi Lecointe, Nieuport Delage, Hispano, 300 h.p., at Meulan, March 11, 1924.	8,980 meters. 29,462 feet.
MAXIMUM SPEED	(United States) Lt. George Cuddihy, U.S.N., Curtiss Navy C-R seaplane, Curtiss D-12, 450 h.p., at Bay Shore, Baltimore, Md., Oct. 25, 1924.	302.68 k.p.h. 188.08 m.p.h.

SPEED FOR SPECIFIED DISTANCES

SPEED FOR 100 KILOMETERS	(United States) Lt. R. A. Ofstie, U.S.N., Curtiss Navy C-R, seaplane, Curtiss D-12, 450 h.p., at Bay Shore, Baltimore, Md., Oct. 25, 1924.	286.86 k.p.h. 178.25 m.p.h.
SPEED FOR 200 KILOMETERS	(United States) Lt. R. A. Ofstie, U.S.N., Curtiss Navy C-R, seaplane, Curtiss D-12, 450 h.p., at Bay Shore, Baltimore, Md., Oct. 25, 1924.	286.86 k.p.h. 178.25 m.p.h.
SPEED FOR 500 KILOMETERS	(United States) Lt. R. A. Ofstie, U.S.N., Curtiss Navy C-R, seaplane, Curtiss D-12, 450 h.p., at Bay Shore, Baltimore, Md., Oct. 25, 1924.	259.33 k.p.h. 161.14 m.p.h.
SPEED FOR 1,000 KILOMETERS	(United States) Lieuts. Victor E. Bertrandias and George C. McDonald, Loening Air Yacht, Liberty 400 h.p., at Hampton Roads, Va., Nov. 7, 1924.	163.578 k.p.h. 101.642 m.p.h.
SPEED FOR 1,500 KILOMETERS	(United States) Lts. F. W. Wead and J. D. Price, Navy C S-2, seaplane, Wright 585 h.p., at Washington, D. C., June 22-23, 1924.	119.36 k.p.h. 74.17 m.p.h.

CLASS C-2—WITH USEFUL LOAD OF 250 KILOGRAMS (551.15 lbs.)

RETURNING TO POINT OF DEPARTURE

DURATION	(United States) Lt. H. T. Stanley, U.S.N., F-5-L flying boat, 2 Liberty 400 h.p., at San Diego, Cal., June 6, 1923.	10h. 23m. 58s.
DISTANCE	(Denmark) Karl Lesch, Rohrbach metal seaplane, 2 Rolls-Royce, 360 h.p., at Sund, Oct. 24, 1924.	1,102 km. 684.64 miles.
ALTITUDE	(Sweden) Lt. Berndt Krook, Heinkel S-1, Rolls-Royce, 360 h.p., at Stockholm, Aug. 18, 1924.	5,691 meters. 18,671 feet.
SPEED FOR 100 KILOMETERS	(Denmark) Karl Lesch, Rohrbach, metal seaplane, 2 Rolls-Royce, 360 h.p., at Sund.	159.151 k.p.h. 98.790 m.p.h.
SPEED FOR 200 KILOMETERS	(Denmark) Karl Lesch, Rohrbach, metal seaplane, 2 Rolls-Royce, 360 h.p., at Sund, Oct. 24, 1924.	158.834 k.p.h. 98.694 m.p.h.
SPEED FOR 500 KILOMETERS	(Denmark) Karl Lesch, Rohrbach, metal seaplane, 2 Rolls-Royce, 360 h.p., at Sund, Oct. 24, 1924.	156.699 k.p.h. 97.368 m.p.h.
SPEED FOR 1,000 KILOMETERS	(Denmark) Karl Lesch, Rohrbach, metal seaplane, 2 Rolls-Royce, 360 h.p., at Sund, Oct. 24, 1924.	152.335 k.p.h. 94.736 m.p.h.

CLASS C-2—WITH USEFUL LOAD OF 500 KILOGRAMS (1102.31 lbs.)

RETURNING TO POINT OF DEPARTURE

DURATION	(United States) Lt. H. E. Halland, U.S.N., F-5-L, flying boat, 2 Liberty 400 h.p., at San Diego, Cal., June 6, 1923.	7h. 35m. 54s.
DISTANCE	(United States) Lt. H. E. Halland, U.S.N., F-5-L, flying boat, 2 Liberty 400 h.p., at San Diego, Cal., June 6, 1923.	750 km. 466 miles.

ALTITUDE	(France) J. F. Laporte, Shreck, seaplane, FBA, Hispano 300 h.p., at Argenteuil, Aug. 27, 1924.	4,755 meters. 15,600 feet.
SPEED FOR 100 KILOMETERS	(France) E. Paumier, Schreck FBA, Hispano Suiza, 350 h.p., at Argenteuil, Nov. 30, 1924.	143.118 k.p.h. 88.928 m.p.h.
SPEED FOR 200 KILOMETERS	(France) E. Paumier, Schreck FBA, Hispano Suiza, 350 h.p., at Argenteuil, Nov. 30, 1924.	142.630 k.p.h. 88.626 m.p.h.

CLASS C-2—WITH USEFUL LOAD OF 1000 KILOGRAMS (2204.62 lbs.)

RETURNING TO POINT OF DEPARTURE

DURATION	(United States) Lt. Geo. R. Henderson, U.S.N., PN7-1, flying boat, 2 Wright T-2, 535 h.p., at Bay Shore, Baltimore, Md., Oct. 25, 1924.	5h. 28m. 43s.
DISTANCE	(United States) Lt. Geo. R. Henderson, U.S.N., PN7-1, flying boat, 2 Wright T-2, 535 h.p., at Bay Shore, Baltimore, Md., Oct. 25, 1924.	400 km. 248.55 miles.
ALTITUDE	(France) Burri, Blanchard, seaplane, a Hispano-Suiza, 300 h.p., at Saint Raphael, Jan. 11, 1924.	3,744 meters. 12,283 feet.
SPEED FOR 100 KILOMETERS	(United States) Lt. Geo. R. Henderson, U.S.N., PN7-1, flying boat, 2 Wright T-2, 535 h.p., at Bay Shore, Baltimore, Md., Oct. 25, 1924.	126.345 k.p.h. 78.507 m.p.h.
SPEED FOR 200 KILOMETERS	(United States) Lt. Geo. R. Henderson, U.S.N., PN7-1, flying boat, 2 Wright T-2, 535 h.p., at Bay Shore, Baltimore, Md., Oct. 25, 1924.	126.345 k.p.h. 78.507 m.p.h.

CLASS C-2—WITH USEFUL LOAD OF 1500 KILOGRAMS (3306.93 lbs.)

RETURNING TO POINT OF DEPARTURE

DURATION	(United States) Lt. H. T. Stanley, U.S.N., F-5-L, flying boat, 2 Liberty 400 h.p., at San Diego, Cal., June 7, 1923.	2h. 18m.
DISTANCE	(United States) Lieut. O. B. Hardison, U.S.N., PN7-2, flying boat, 2 Wright T-2, 535 h.p., at Bay Shore, Baltimore, Md., Oct. 25, 1924.	100 km. 62.137 miles.
ALTITUDE	(France) Naval Lt. Pelletier d'Oisy, Blanchard, seaplane, 2 Hispano-Suiza, 300 h.p., at St. Raphael, April 17, 1924.	2,130 meters. 6,988 feet.
SPEED FOR 100 KILOMETERS	(United States) Lieut. O. B. Hardison, U.S.N., PN7-2, flying boat, 2 Wright T-2, 535 h.p., at Bay Shore, Baltimore, Md., Oct. 25, 1924.	110.08 k.p.h. 68.4 m.p.h.

CLASS C-2—WITH USEFUL LOAD OF 2000 KILOGRAMS (4409.24 lbs.)

RETURNING TO POINT OF DEPARTURE

DURATION	(United States) Lieut. O. B. Hardison, U.S.N., PN7-2, flying boat, 2 Wright T-2, 535 h.p., at Bay Shore, Baltimore, Md., Oct. 25, 1924.	1h. 49m. 11.9s.
DISTANCE	(United States) Lieut. O. B. Hardison, U.S.N., PN7-2, flying boat, 2 Wright T-2, 535 h.p., at Bay Shore, Baltimore, Md., Oct. 25, 1924.	100 km. 62.137 miles.
ALTITUDE	(United States) Lt. H. E. Halland, U.S.N., F-5-L, flying boat, 2 Liberty 400 h.p., at San Diego, Cal., June 7, 1923.	1,489 meters. 4,885 feet.
SPEED FOR 100 KILOMETERS	(United States) Lieut. O. B. Hardison, U.S.N., PN7-2, flying boat, 2 Wright T-2, 535 h.p., at Bay Shore, Baltimore, Md., Oct. 25, 1924.	110.08 k.p.h. 68.4 m.p.h.

CLASS D—GLIDERS

DURATION	(France) Alexis Manyrol, Peyret Glider, at Vauville, France, Jan. 29, 1923.	8h. 4m. 50.4s.
DISTANCE—AIR LINE	(France) Lt. Thoret, Bardin Glider, at Vauville, France, Aug. 26, 1923.	8,100 meters. 26,568 feet.
ALTITUDE	(France) E. Descamps, DeWoitine Glider, at Biskra, Feb. 7, 1923.	545 meters. 1,788 feet.

CLASS G—HELICOPTERS

DISTANCE—AIR LINE	(France) Pescara, Pescara Helicopter, 2 propellers, Hispano-Suiza, 180 h.p., at Issy-les-Moulineaux, April 18, 1924.	736 meters. 2,414 feet.

CLASS G—WITH USEFUL LOAD OF 100 KILOGRAMS (220.46 lbs.)

ALTITUDE—ABOVE STARTING POINT	(France) Oehmichen, Oehmichen Helicopter, Le Rhone 180 h.p., at Arbouans, Sept. 14, 1924.	1. meter. 3.28 feet.

CLASS G—WITH USEFUL LOAD OF 200 KILOGRAMS (440.92 lbs.)

ALTITUDE—ABOVE STARTING POINT	(France) Oehmichen, Oehmichen Helicopter, Le Rhone 180 h.p., at Arbouans, Sept. 14, 1924.	1. meter. 3.28 feet.

CLASS C—REFUELED IN FLIGHT

RETURNING TO POINT OF DEPARTURE

DURATION	Lts. Smith and Richter, U.S.A., DH-4B, Liberty 400 h.p., at Rockwell Field, San Diego, Cal., Aug. 27-28, 1923.	37h. 15m. 14.8s.
DISTANCE	Lts. Smith and Richter, U.S.A., DH-4B, Liberty 400 h.p., at Rockwell Field, San Diego, Cal., Aug. 27-28, 1923.	5,300 km. 3,293.26 miles.
SPEED FOR 2,500 KILOMETERS	Lts. Smith and Richter, U.S.A., DH-4B, Liberty 400 h.p., at Rockwell Field, San Diego, Cal., Aug. 27-28, 1923.	142.78 k.p.h. 88.72 m.p.h.
SPEED FOR 3,000 KILOMETERS	Lts. Smith and Richter, U.S.A., DH-4B, Liberty 400 h.p., at Rockwell Field, San Diego, Cal., Aug. 27-28, 1923.	141.87 k.p.h. 88.15 m.p.h.
SPEED FOR 3,500 KILOMETERS	Lts. Smith and Richter, U.S.A., DH-4B, Liberty 400 h.p., at Rockwell Field, San Diego, Cal., Aug. 27-28, 1923.	142.17 k.p.h. 88.56 m.p.h.
SPEED FOR 4,000 KILOMETERS	Lts. Smith and Richter, U.S.A., DH-4B, Liberty 400 h.p., at Rockwell Field, San Diego, Cal., Aug. 27-28, 1923.	142.00 k.p.h. 88.28 m.p.h.
SPEED FOR 4,500 KILOMETERS	Lts. Smith and Richter, U.S.A., DH-4B, Liberty 400 h.p., at Rockwell Field, San Diego, Cal., Aug. 27-28, 1923.	142.36 k.p.h. 88.46 m.p.h.
SPEED FOR 5,000 KILOMETERS	Lts. Smith and Richter, U.S.A., DH-4B, Liberty 400 h.p., at Rockwell Field, San Diego, Cal., Aug. 27-28, 1923.	142.53 k.p.h. 88.56 m.p.h.

CLASS C-2—SEAPLANES

RETURNING TO POINT OF DEPARTURE WITHOUT REFUELING

DURATION	Lts. F. W. Wead and J. D. Price, Navy C S-2, seaplane, Wright 585 h.p., at Washington, D. C., July 11-12, 1924.	14h. 53m. 44.2s.
DISTANCE	Lts. F. W. Wead and J. D. Price, Navy C S-2, seaplane, Wright 585 h.p., at Washington, D. C., July 11-12, 1924.	1,600 km. 994.19 miles.

ALTITUDE	Lt. C. F. Harper, U.S.N., Davis-Douglas, seaplane, Liberty 400 h.p., at San Diego, Cal., June 7, 1923.	4,236 meters. 13,898 feet.
MAXIMUM SPEED	Lt. George Cuddihy, U.S.N., Curtiss Navy C-R, seaplane, Curtiss D-12, 450 h.p., at Bay Shore, Baltimore, Md., Oct. 25, 1924.	302.68 k.p.h. 188.08 m.p.h.

SPEED FOR SPECIFIED DISTANCES

SPEED FOR 100 KILOMETERS	Lt. R. A. Ofstie, U.S.N., Curtiss Navy C-R, seaplane, Curtiss D-12, 450 h.p., at Bay Shore, Baltimore, Md., Oct. 25, 1924.	286.86 k.p.h. 178.25 m.p.h.
SPEED FOR 200 KILOMETERS	Lt. R. A. Ofstie, U.S.N., Curtiss Navy C-R, seaplane, Curtiss D-12, 450 h.p., at Bay Shore, Baltimore, Md., Oct. 25, 1924.	286.86 k.p.h. 178.25 m.p.h.
SPEED FOR 500 KILOMETERS	Lt. R. A. Ofstie, U.S.N., Curtiss Navy C-R, seaplane, Curtiss D-12, 450 h.p., at Bay Shore, Baltimore, Md., Oct. 25, 1924.	259.33 k.p.h. 161.14 m.p.h.
SPEED FOR 1,000 KILOMETERS	Lieuts. Victor E. Bertrandias and George C. McDonald, Loening Air Yacht, Liberty 400 h.p., at Hampton Roads, Va., Nov. 7, 1924.	163.578 k.p.h. 101.642 m.p.h.
SPEED FOR 1,500 KILOMETERS	Lts. F. W. Wead and J. D. Price, Navy C S-2, seaplane, Wright 585 h.p., at Washington, D. C., June 22-23, 1924.	119.36 k.p.h. 74.17 m.p.h.

CLASS C-2—WITH USEFUL LOAD OF 250 KILOGRAMS (551.15 lbs.)

RETURNING TO POINT OF DEPARTURE

DURATION	Lt. H. T. Stanley, U.S.N., F-5-L flying boat, 2 Liberty 400 h.p., at San Diego, Cal., June 6, 1923.	10h. 23m. 58s.
DISTANCE	Lt. H. T. Stanley, U.S.N., F-5-L flying boat, 2 Liberty 400 h.p., at San Diego, Cal., June 6, 1923.	925 Km. 574.77 miles.
ALTITUDE	Lt. E. B. Briz, U.S.N., Davis-Douglas, seaplane, Liberty 400 h.p., at San Diego, Cal., June 7, 1923.	3,307 meters. 10,850 feet.
SPEED FOR 100 KILOMETERS	Lt. Geo. R. Henderson, U.S.N., PN7-1, flying boat, 2 Wright T-2, 535 h.p., at Bay Shore, Baltimore, Md., Oct. 25, 1924.	126.345 k.p.h. 78.507 m.p.h.
SPEED FOR 200 KILOMETERS	Lt. Geo. R. Henderson, U.S.N., PN7-1, flying boat, 2 Wright T-2, 535 h.p., at Bay Shore, Baltimore, Md., Oct. 25, 1924.	126.345 k.p.h. 78.507 m.p.h.
SPEED FOR 500 KILOMETERS	(No record.)	
SPEED FOR 1,000 KILOMETERS	(No record.)	

CLASS C-2—WITH USEFUL LOAD OF 500 KILOGRAMS (1102.31 lbs.)

RETURNING TO POINT OF DEPARTURE

DURATION	Lt. H. E. Halland, U.S.N., F-5-L, flying boat, 2 Liberty 400 h.p., at San Diego, Cal., June 6, 1923.	7h. 35m. 54s.
DISTANCE	Lt. H. E. Halland, U.S.N., F-5-L, flying boat, 2 Liberty 400 h.p., at San Diego, Cal., June 6, 1923.	750 km. 466 miles.
ALTITUDE	Lt. R. L. Fuller, U.S.N., F-5-L flying boat, 2 Liberty 400 h.p., at San Diego, Cal., June 7, 1923.	2,542 meters. 8,438 feet.
SPEED FOR 100 KILOMETERS	Lt. Geo. R. Henderson, U.S.N., PN7-1, flying boat, 2 Wright T-2, 535 h.p., at Bay Shore, Baltimore, Md., Oct. 25, 1924.	126.345 k.p.h. 78.507 m.p.h.
SPEED FOR 200 KILOMETERS	Lt. Geo. R. Henderson, U.S.N., PN7-1, flying boat, 2 Wright T-2, 535 h.p., at Bay Shore, Baltimore, Md., Oct. 25, 1924.	126.345 k.p.h. 78.507 m.p.h.

CLASS C-2—WITH USEFUL LOAD OF 1000 KILOGRAMS (2204.62 lbs.)

RETURNING TO POINT OF DEPARTURE

DURATION	Lt. Geo. R. Henderson, U.S.N., PN7-1, flying boat, 2 Wright T-2, 535 h.p., at Bay Shore, Baltimore, Md., Oct. 25, 1924.	5h. 28m. 43s.
DISTANCE	Lt. Geo. R. Henderson, U.S.N., PN7-1, flying boat, 2 Wright T-2, 535 h.p., at Bay Shore, Baltimore, Md., Oct. 25, 1924.	400 km. 248.55 miles.
ALTITUDE	Lt. E. E. Dolecek, U.S.N., F-5-L, flying boat, 2 Liberty 400 h.p., at San Diego, Cal., June 7, 1923.	2,432 meters. 7,979 feet.
SPEED FOR 100 KILOMETERS	Lt. Geo. R. Henderson, U.S.N., PN7-1, flying boat, 2 Wright T-2, 535 h.p., at Bay Shore, Baltimore, Md., Oct. 25, 1924.	126.345 k.p.h. 78.507 m.p.h.
SPEED FOR 200 KILOMETERS	Lt. Geo. R. Henderson, U.S.N., PN7-1, flying boat, 2 Wright T-2, 535 h.p., at Bay Shore, Baltimore, Md., Oct. 25, 1924.	126.345 k.p.h. 78.507 m.p.h.

CLASS C-2—WITH USEFUL LOAD OF 100 KILOGRAMS (2204.62 lbs.)

RETURNING TO POINT OF DEPARTURE

DURATION	Lt. H. T. Stanley, U.S.N., F-5-L, flying boat, 2 Liberty 400 h.p., at San Diego, Cal., June 7, 1923.	2h. 18m.
DISTANCE	Lieut. O. B. Hardison, U.S.N., PN7-2, flying boat, 2 Wright T-2, 535 h.p., at Bay Shore, Baltimore, Md., Oct. 25, 1924.	100 km. 62.137 miles.
ALTITUDE	Lt. H. T. Stanley, U.S.N., F-5-L, flying boat, 2 Liberty 400 h.p., at San Diego, Cal., June 7, 1923.	1,732 meters. 5,682 feet.
SPEED FOR 100 KILOMETERS	Lieut. O. B. Hardison, U.S.N., PN7-2, flying boat, 2 Wright T-2, 535 h.p., at Bay Shore, Baltimore, Md., Oct. 25, 1924.	110.08 k.p.h. 68.4 m.p.h.

CLASS C-2—WITH USEFUL LOAD OF 2000 KILOGRAMS (4409.24 lbs.)

RETURNING TO POINT OF DEPARTURE

DURATION	Lieut. O. B. Hardison, U.S.N., PN7-2, flying boat, 2 Wright T-2, 535 h.p., at Bay Shore, Baltimore, Md., Oct. 25, 1924.	1h. 49m. 11.9s.
DISTANCE	Lieut. O. B. Hardison, U.S.N., PN7-2, flying boat, 2 Wright T-2, 535 h.p., at Bay Shore, Baltimore, Md., Oct. 25, 1924.	100 km. 62.137 miles.
ALTITUDE	Lt. H. E. Halland, U.S.N., F-5-L, flying boat, 2 Liberty 400 h.p., at San Diego, Cal., June 7, 1923.	1,489 meters. 4,885 feet.
SPEED FOR 100 KILOMETERS	Lieut. O. B. Hardison, U.S.N., PN7-2, flying boat, 2 Wright T-2, 535 h.p., at Bay Shore, Baltimore, Md., Oct. 25, 1924.	110.08 k.p.h. 68.4 m.p.h.

CLASS D—GLIDERS

DURATION	(No Record.)
DISTANCE	(No Record.)
ALTITUDE	(No Record.)

CLASS G—HELICOPTERS

DISTANCE—AIR LINE	(No Record.)

CLASS G—WITH USEFUL LOAD OF 100 KILOGRAMS (220.46 lbs.)

ALTITUDE—ABOVE (No Record.)
STARTING POINT

CLASS G—WITH USEFUL LOAD OF 200 KILOGRAMS (440.92 lbs.)

ALTITUDE—ABOVE (No Record.)
STARTING POINT

WINNERS NATIONAL BALLOON RACES

National Championship Race (To Select Team for Gordon Bennett)

1909 Indianapolis, Ind., June 5. Won by John Berry, landing at Ft. Payne, Ala. Distance: 377.92 miles. Duration: ——. Contestants: 6.

1910 Indianapolis, Ind., Sept. 17. Won by Alan R. Hawley, landing at Warrenton, Va. Distance: 453 miles. Duration: 44:25:00. Contestants: 8.

1911 Kansas City, Mo., July 10. Won by Lt. Frank P. Lahm, landing at La Paz, Ind. Distance: 480 miles (772 kiloms.). Duration: ——. Contestants: ——.

1912 Kansas City, Mo., July 27. Won by H. E. Honeywell, landing near Manassas, Va. Distance: 914 miles (1,470 kiloms.). Duration: ——. Contestants: 7.

1913 Kansas City, Mo., July 4. Won by R. H. Upson, landing at West Branch, Mich. Distance: 685 miles. Duration: ——. Contestants: 5.

1914 St. Louis, Mo., July 11. Won by R. A. D. Preston, landing at Pt. Pleasant, Ky. Distance: 301.82 miles. Duration: ——. Contestants: 9.

1915 Wichita, Kan., Oct. 7. Won by William Assmann, landing at Prescott, Ark. Distance: 363 miles. Duration: ——. Contestants: 4.

1916 Muskogee, Okla., Oct. 7. Won by H. E. Honeywell, landing at Cascade, Iowa. Distance: 520 miles. Duration: ——. Contestants: 6.

1917-1918 No races held.

1919 St. Louis, Mo., Oct. 1. Won by Ralph Upson, landing at Stanbridge, Quebec, Can. Distance: 1,021 miles. Duration: 26:45:00. Contestants: 9.

1920 Birmingham, Ala., Sept. 25. Won by H. E. Honeywell, landing at Chatham, Ontario. Distance: 700 miles. Duration: ——. Contestants: 12.

1921 Birmingham, Ala., May 23. Won by R. H. Upson, landing at Stuart, Va. Distance: 425 miles. Duration: ——. Contestants: 9.

1922 Milwaukee, Wis., May 31. Won by Maj. Oscar Westover, landing at St. Jerome, Can. Distance: 866.5 miles. Duration: ——. Contestants: 12.

1923 Indianapolis, Ind., July 4. Won by Lt. R. S. Olmstead, U.S.A., landing at Marilla, N. Y. Distance: 449.5 miles. Duration: ——. Contestants: 13.

1924 San Antonio, Tex., April 23. Won by W. T. Van Orman, in Goodyear III, landing at Rochester, Minn. Distance: 1,072 miles. Duration: 44-4:00. Contestants: 7.

The 1913 Gordon Bennett Race was held in Paris, October 12th. R. H. Upson won first place; H. E. Honeywell, second place. Both represented the United States. Mr. Upson landed at Buckton Hall, near Bridlington, Yorkshire, England. Distance: 618 kiloms. (384 miles). Duration: 43:15:00. Contestants: 18.

RACE RESULTS, DAYTON AIR MEET, OCT. 2, 3, 4, 1924

"On to Dayton" Race Event No. 1, Sept. 20—Oct. 1

Dayton Chapter, N. A. A. Trophy and Prizes in Liberty Bonds: $1,000, $800, $500, $400, $300, $200, $150, $100, $50

	Entrant	*Airplane*	*Pilot*	*Point of Departure*	*Average Speed*	*Points*	*Distance Miles*	*Points*	†*Number of Passengers*	*Points*	*Engine*	**Credited (Formula) H. P.*	*Points*	*Total Points*
1	Curtiss Exhibition Co.	Curtiss Oriole	C. S. Jones	Rantoul, Ill.	135.72	85.7	233	0.0	2	20	Curtiss C-6	143.1	133.5	239.2
2	Aero Club of Minn.	Thomas-Morse S-4-C	C. Holman	Minot, N. Dak.	84.08	34.0	1,020	52.0	0	0	Curtiss OX-5	125.7	142.	228.0
3	M. M. Merrill	Curtiss JN4-D	M. M. Merrill	Dallas, Tex.	87.7	37.7	870	37.0	0	0	Curtiss OX-5	125.7	142.	216.7
4	W. A. Yackey	Yackey Sport	H. A. Hoyte	Chicago, Ill.	114.04	64.0	249	0.0	1	10	Curtiss OX-5	125.7	142.	216.0
5	W. A. Yackey	Yackey Sport	W. A. Yackey	Chicago, Ill.	113.18	63.0	249	0.0	0	0	Curtiss OX-5	125.7	142.	205.0
6	E. L. Partridge	Partridge Cabin	E. L. Partridge	Chicago, Ill.	96.5	46.5	242	0.0	4	40	Hispano-Suiza	179.72	115.	201.5
7	Basil L. Rowe	S-V-A	Basil L. Rowe	Warren, Ohio	87.5	37.5	204	0.0	2	20	Curtiss C-6	143.1	133.5	191.0
8	D. A. Askew	Spec. Canadian Curtiss	D. A. Askew	Lawton, Okla.		0.0	885	38.5	1	10	Curtiss OX-5	125.7	142.	190.5
9	A. E. Merriam	Swallow	A. E. Merriam	Wichita, Kan.	70.67	20.7	755	25.5	1	10	Curtiss OXX-6	142.	134.	190.2
10	City of St. Joseph, Mo.	Swallow 3 place	Irl Beach	St. Joseph, Mo.	56.3	6.3	595	9.5	2	20	Curtiss OX-5	125.7	142.	177.8
11	Swallow Airplane Co.	Swallow 3 place	Floyd Stearman	Wichita, Kan.		0.0	750	25.0	1	10	Curtiss OX-5	125.7	142.	177.0
12	Heath Airplane Co.	Heath 3 place	E. B. Heath	Chicago Air Park	59.1	9.0	242	0.0	2	20	Curtiss OX-5	125.7	142.	171.0
13	Ludington Exhib. Co.	Farman Sport	Robert Hewitt	Uniontown, Pa.		0.0	240	0.0	1	10	Anzani 6A-3	99.	155.5	165.5
14	Roy L. Ahern	Partridge Cabin	E. L. Partridge	Chicago, Ill., Ashburn Field		0.0	242	0.0	5	50	Hispano-Suiza	179.72	115.	165.0
15	Mayer Aircraft Corp.	Laird Swallow	E. W. Cleveland	Pittsburgh, Pa.	51.0	1.0	285	0.0	2	20	Curtiss OX-5	125.7	142.	163.0
16	Tex LaGrone	Rogers-Day	Tex LaGrone	Kansas City, Mo.		0.0	590	9.0	1	10	Curtiss OX-5	125.7	142.	161.0
17	C. G. Caldwell	Thomas-Morse	C. S. Caldwell	Three Rivers, Canada		0.0	760	26.0	0	0	Le Rhone	166.2	122.	148.0
18	Roscoe Turner	Curtiss JN4-D	Roscoe Turner	Nashville, Tenn.		0.0	300	0.0	0	0	Curtiss OX-5	125.7	142.	142.0
19	Swallow Airplane Co.	Swallow Special	Walter H. Beech	Wichita, Kan.		0.0	755	25.5	0	0	Hispano-Suiza	179.72	115.	140.5
20	Fairchild Flying Corp.	Fokker C-2	E. P. Lott	Johnstown, Pa.	107.6	57.6	282	0.0	2	20	B. M. W.	291.1	59.5	137.1
21	Sky'riting Corp., Amer.	SE5-A Pursuit	Chas. B. D. Collyer	Mineola, L. I., N. Y.	58.7	8.7	570	7.0	0	0	Hispano-Suiza	179.72	115.	130.7
22	Dr. R. R. Ferguson	Lincoln Speedster	Dr. R. R. Ferguson	Chicago, Ill.		0.0	242	0.0	1	10	Hispano-Suiza	179.72	115.	125.0
23	Marvin A. Northrop	Avro 504 K	U. V. Piersol	Robbinsdale, Minn.	58.44	8.4	600	10.0	1	10	LeRhone	230.57	90.	118.4
24	Eddie Stinson	Junker	Eddie Stinson	Detroit, Packard Field		0.0	180	Disqualified for failure to carry official log; also distance less than 200 miles.						
25	Curtiss Exhib. Co.	Curtiss Oriole	C. S. Jones	Detroit, Selfridge Field		0.0	196	Disqualified—Distance less than 200 miles. Made second attempt.						
26	E. S. Fitzgerald	Lincoln Standard	E. S. Fitzgerald	Detroit, Eastwood Field		0.0	180	Disqualified—Distance less than 200 miles.						

* Engine horse-power (at the rate of 4 cu. in. displacement per h.p.).
† Average weight—140 lbs.

Central Labor Union Trophy. Event No. 3

Free-for-all race for 2, 3 or 4-place airplanes. Standing start. Engines 800 cubic inches piston displacement or less. Distance 120 miles, 8 laps 15-mile course. Thursday, October 2, 1921. Prizes in Liberty Bonds: $1,000, $700, $600, $500, $400, $300.

Contestants Finishing

Position	Airplane	Pilot	Entrant	Total Elapsed Time Hr.	Min.	Sec.	Speed (M.P.H.)	Engine	Cu. In. Piston Displacement	Contest Load Pilot	Contest Load Pass
First	Curtiss Oriole	C. S. Jones	Curtiss Exhibition Co.		57	34.73	125.04	Curtiss C-6	572.5	141	210
Second	Curtiss Oriole	J. G. Ray	Curtiss Exhibition Co.	1	07	10.36	107.18	Curtiss C-6	572.5	164	182
Third	Martin Commercial	C. C. Caldwell	Glenn L. Martin Co.	1	10	40.61	101.87	Wright E-4	718.0	171	199
Fourth	Hartzell F-C-1	Walter Lees	Hartzell Propeller Co.	1	13	24.84	98.07	Curtiss OX-5	502.8	160	184
Fifth	Laird Commercial	P. Hutton	E. M. Laird	1	17	40.85	92.68	Curtiss OX-5	502.8	184	160
Sixth	Yackey Sport	W. A. Yackey	Yackey Aircraft Co.	1	18	00.18	92.30	Curtiss OX-5	502.8	147	200
Seventh	Swallow	A. E. Johnson	Johnson Airplane Co.	1	22	56.64	86.80	Curtiss OX-5	502.8	161	179

Pulitzer Trophy, Event No. 12

Race for high speed airplanes. Flying start. Distance, 200 km. (124.27 miles)—4 laps 50 km. (31.07 miles) course. Saturday, October 4, 1924. Prizes in Liberty Bonds: $5,000, $2,500, $1,500, $1,000.

Contestants Finishing

Position	Airplane	Pilot	First Lap			Second Lap			Third Lap			Fourth Lap			Total Elapsed Time			Engine	H.P.
			Min.	Sec.	Speed (M.P.H.)	Min.	Sec.	Speed (M.P.H.)	Min.	Sec.	Speed (M.P.H.)	Min.	Sec.	Speed (M.P.H.)	Min.	Sec.	Speed (M.P.H.)		
First	Verville-Sperry Racer	Lt. H. H. Mills, U.S.A.S.	8	41.37	214.52	8	34.58	217.35	8	33.89	217.65	8	36.09	216.72	34	25.93	216.55	Curtiss D-12-A. H. C.	520
Second	Curtiss R-6 Racer	Lt. W. H. Brookley, U.S.A.S.	8	47.20	212.15	8	40.94	214.70	8	39.36	215.35	8	39.05	215.48	34	46.55	214.41	Curtiss D-12-A. H. C.	520
Third	Curtiss PW-8-A	Lt. Rex Stoner, U.S.A.S.	11	12.27	166.37	10	03.13	168.66	11	12.34	166.35	10	56.42	170.39	44	24.16	167.92	Curtiss D-12 L. C.	375

Summary of Other Events

Event No. 2. *National Cash Register Trophy.* Free-for-all-race for 2-seater, low power airplanes. Standing start. Engines 510 cubic inches displacement or less. Distance 90 miles. Prizes in Liberty bonds: $1,000, $600, $500, $400, $300, $200. *First,* Hartzell F. C.-1 (Curtiss OX-5 engine), Walter Lees, pilot, Hartzell Propeller Co. entrant; total elapsed time 55 min., 25.75 sec. Speed 97.42 m.p.h. *Second,* Laird Commercial (Curtiss OX-5), Perry Hutton, pilot, E. M. Laird, entrant; total elapsed time 57 min., 59.67 sec., 93.11 m.p.h. *Third,* Yackey Sport (Curtiss OX-5), R. G. Page, pilot, Yackey Aircraft Co. entrant; total elapsed time, 1 hr., 1 min., 50.93 sec., 87.31 m.p.h.

Event No. 4. *Liberty Engine Bldrs. Trophy.* Race for observation type (2-place) airplanes. Standing start. Distance 180 miles, Thurs., Oct. 2. Prizes in Liberty bonds, $1,000, $800, $500, $400. All entries U. S. Air Service, De Haviland 4-Bs. *First,* Lt. D. G. Duke; total elapsed time, 1 hr., 22 min., 51.61 sec. Speed 130.34 m.p.h. *Second,* Lt. A. E. Simonin; total elapsed time, 1 hr., 24 min., 22.98 sec. Speed 127.98 m.p.h. *Third,* Lt. C. A. Cover; total elapsed time, 1 hr., 27 min., 02.25 sec. Speed 124.08 m.p.h.

Event No. 5. *Mulvihill Model Trophy.* Duration race for model airplanes. Rubber strand motors, Fri., Oct. 3. Eight cash prizes, $200 to $10. *First,* Robt. V. Yaros, Chicago, 10 min., 14.2 sec. *Second,* P. S. Smith, Chicago, 3 min., 20.4 sec. *Third,* W. E. Schweitzer, Chicago, 3 min., 9 sec.

Event No. 6. *Aviation Town and Country Club of Detroit Trophy.* Light commercial speed and efficiency race. Standing start. Distance 120 miles. Speed prizes in Liberty bonds: $1,000, $700, $300. Efficiency prizes in Liberty bonds, $1,000, $700, $300, Fri., Oct. 3d. *First in speed,* S.V.A. (Curtiss C-6), B. L. Rowe, pilot and entrant. Total elapsed time, 1 hr., 4 min., 37.55 sec. Speed 111.41 m.p.h. *Second in speed,* Curtiss *Oriole* (Curtiss C-6), J. G. Ray, pilot, Curtiss Exhib. Co. entrant. Total elapsed time, 1 hr., 6 min., 59.76 sec. Speed 107.47 m.p.h. *Third in speed,* Atlantic S-3 (Wright E), W. L. Stultz, pilot. Atlantic Aircraft Corp. entrant. Total elapsed time 1 hr., 7 min., 21.02 sec. Speed 106.90 m.p.h. *First in efficiency,* New *Swallow* (Curtiss OXX-6), W. H. Beech, pilot, Swallow Airplane Co. entrant. Fig. of merit 320.043. *Second in efficiency,* Glenn L. Martin Model 70 (Wright E-4), C. C. Caldwell, pilot. Glenn L. Martin entrant. Fig. of merit, 290.885. *Third in efficiency,* S.V.A. (Curtiss C-6), B. L. Rowe, pilot and entrant. Fig. of merit 264.706.

Event No. 7. *Dayton Chamber of Commerce Trophy.* Race for large capacity airplanes. Flying start. Distance 150 miles, Fri., Oct. 3d. Prizes in Liberty bonds: $2.000, $1,000, $700, $300. All entries Martin bombers from U.S.A.S. *First,* Lt. D. M. Myers. Total elapsed time 1 hr., 21 min., 57.33 sec. Speed, 109.81 m.p.h. *Second,* Lt. C. F. Woolsey. Elapsed time 1 hr., 23 min., 22.60 sec. Speed 107.94 m.p.h. *Third,* Lt. H. McClellan. Elapsed time 1 hr., 26 min., 3.32 sec. Speed 104.58 m.p.h.

Event No. 8. *Dayton Daily News Light Airplane Contest.* Race for light airplanes. Standing start. Engines 80 cu. in. displacement or less. Distance 25 miles, Fri., Oct. 3d. Prizes in Liberty bonds: $2,000, $750, $500. *First,* Driggs-Johnson (Henderson motorcycle engine). J. M. Johnson, pilot. Johnson Airplane Co. entrant. Total elapsed time 23 min., 23.13 sec. Speed 64.14 m.p.h. *Second,* Dorway (Henderson), E. Dorway, pilot and entrant. Total elapsed time, 29 min., 57.59 sec. Speed 50.07 m.p.h.

Event No. 9.—*Aerial gymkohana,* Sat., Oct. 4.

Event No. 10. *Dayton Bicycle Club Trophy* and *Engineers Club of Dayton Trophy.* Speed and efficiency race for light airplanes. Standing start. Engines 80 cu. in. piston displacement or less. Distance 50 miles, Sat., Oct. 4th. Speed prizes in Liberty bonds: $1,500, $1,000, $500, $200. Efficiency prizes in Liberty bonds: $800, $500, $300, $200. *First,* Mummert Sport (Harley-Davidson motorcycle engine). H. C. Mummert, pilot and entrant. Total elapsed time 1 hr., 18 min., 28.04 sec. Speed 38.23 m.p.h. *Second,* Driggs-Johnson (Henderson), J. M. Johnson, pilot. Johnson Airplane Co. entrant. Total elapsed time 2 hrs., 11 min., 40 sec. Speed 22.78 m.p.h. *Third,* Dorway (Henderson) E. Dorway, pilot and entrant. Could not finish, though ready, due to bombing demonstration and wrecking of Pylon No. 1. Given third place.

Event No. 11. *John L. Mitchell Trophy.* Race for pilots of First Pursuit Group only. Flying start. Distance 200 kil. (124.27 miles), Sat., Oct. 4th. Prizes, 3 cups. All entries Curtiss P. W.-8s equipped with Curtiss 460 h.p., D. 12 H. C. engines. *First,* Lt. Cyrus Bettes. Total elapsed time 42 min., 30.44 sec. Speed 175.41 m.p.h. *Second,* Lt. D. F. Stace. Total elapsed time 42 min., 55.93 sec. Speed 173.67 m.p.h. *Third,* Lt. T. K. Matthews. Total elapsed time 43 min. 1.48 sec Speed 173.30 m.p.h.

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