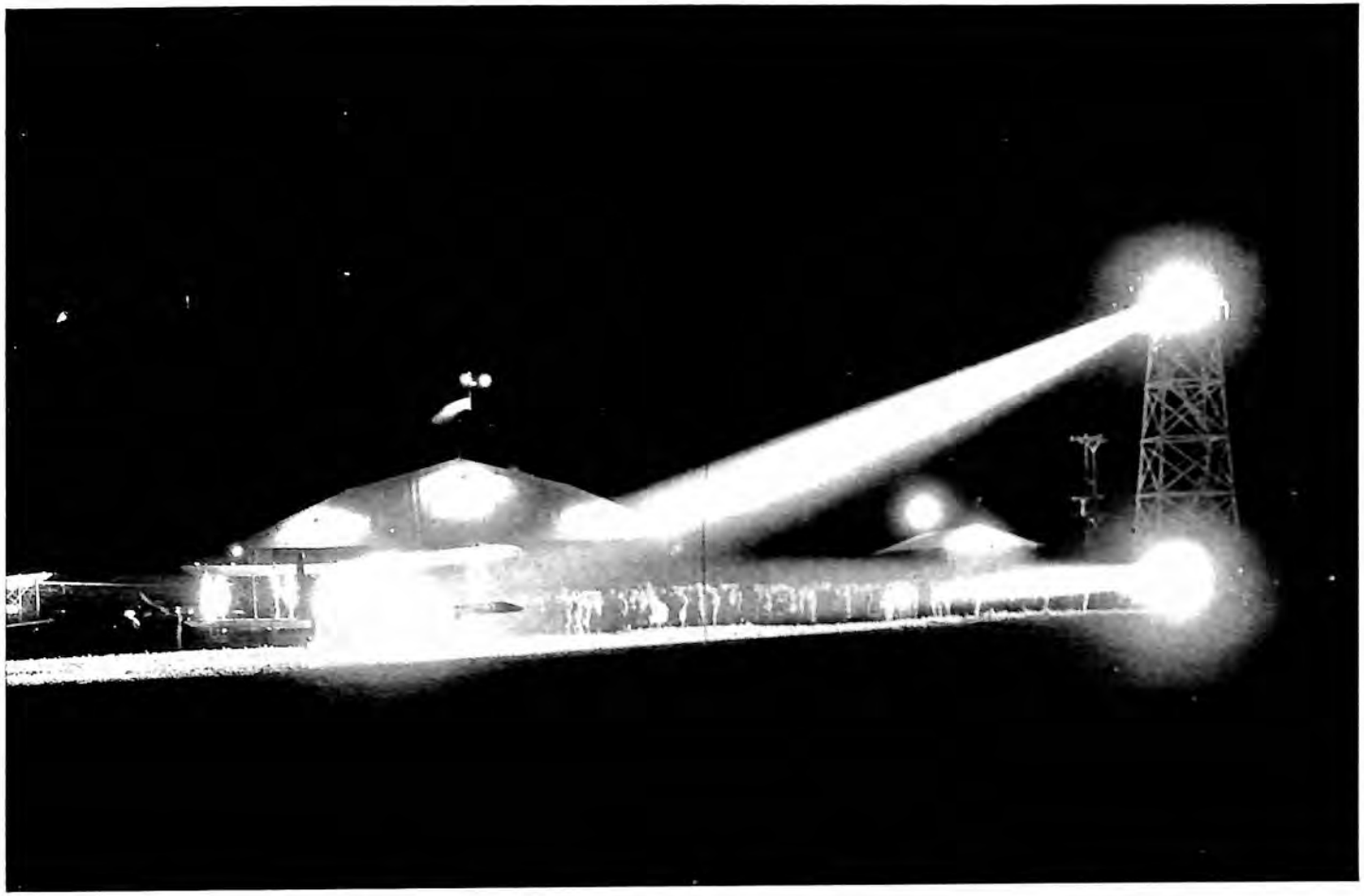
AIRCRAFT YEAR BOOK

1924

AIRCRAFT YEAR BOOK, 1924



The Air Mail Field at Fort Crook, Omaha, Neb., at night.—Photo by Dewell, Omaha.

AIRCRAFT YEAR BOOK

1924

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INTRODUCTION

THE Editors of the Aircraft Year Book are deeply indebted to the officers and personnel of the Information Divisions of the U. S. Air Service, Navy Bureau of Aeronautics and Air Mail, without whose assistance compilation of this volume would have been extremely difficult. Data and suggestions provided by these services, together with material from the Automotive Division, Bureau of Foreign and Domestic Commerce, and the National Advisory Committee for Aeronautics, combine to make the Aircraft Year Book for 1924 the most comprehensive and authoritative publication yet issued concerning aeronautics. In preparing the review of activities in foreign countries, invaluable help was provided by the American Air, Military, Naval and Commercial Attachés abroad, and the Foreign Air Attachés accredited to the United States Government. The Chapter on Technical Developments in Aircraft Construction in 1923 was contributed in its entirety by Dr. George W. Lewis, Executive Officer, National Advisory Committee for Aeronautics.

AERONAUTICAL CHAMBER OF COMMERCE OF AMERICA, INC.

New York City, May 10, 1924.

CHAPTER I

AMERICAN AVIATION IN 1923 AS CONTRASTED WITH DEVELOPMENT ABROAD

AS a science and as an art, American aviation in 1923—the twentieth year of mechanical flight—rose to unparalleled achievements.

As an industry, it passed perceptibly nearer that point where it must inevitably—unless a definite national policy is adopted and adhered to—cease to exist as a practical factor in our national defense.

This Year Book, as its pre-title indicates, endeavors to present a picture of *"The World in the Air."* The following pages contain the essential aviation facts covering the United States and fifty-five other countries. These facts speak for themselves. The reader must, in the main, draw his own conclusions.

The close of 1923 saw thirty-three out of forty-two world records credited to American pilots in aircraft and engines designed and constructed by the American aircraft industry. Yet when the French Under-Secretary of State for Air was informed that the United States had established a new speed of nearly five miles a minute, he was quoted in the press as saying: "Records, yes, but they are a facade; back of them there is nothing!"

This was an epigrammatic way of expressing what has been repeatedly said by American military and naval officers, more recently, as noted in this volume, by the former Assistant Secretary of War, Hon. J. Mayhew Wainwright, now Representative in Congress; the present Assistant Secretary of War, Col. Dwight F. Davis, and by the Lassiter Board of the General Staff.

It is disturbing to contemplate the truth. There is no doubt in the minds of those engaged in American aviation that ultimately we shall establish our actual, as we already have demonstrated our theoretical, superiority in the air. But the way could be made much shorter, and the cost lessened very greatly, were thought taken now and, upon the foundation of our unassailable conception of aircraft as useful vehicles instead of instruments of destruction, were the art and the industry to be supplied with those commercial advantages which foreign governments, for military motives, have long since provided.

The Leading Military Flying Nations

The four leading military flying nations of the world today are: France, Great Britain, Italy and Germany, with Russia and Japan as significant potential powers, looming more clearly in the near background. The commercial fields into which this policy has led are to be found in all the markets of the world, not even excluding the United States, as is seen by the following:

Countries into Which French, British, Italian and German Aviation Has Penetrated

France

Argentina	China	Guatemala	Poland
Austria	Czecho-Slovakia	Japan	Roumania
Belgium	Denmark	Jugo-Slavia	Russia
Bolivia	Ecuador	Mexico	Siam
Brazil	Greece	Peru	Spain
			United States

Great Britain

Argentina	China	Japan	
Australia	Czecho-Slovakia	Lithuania	Russia
Brazil	Ecuador	New Zealand	Spain
Canada	Egypt	Peru	Switzerland
Chile	India	Roumania	United States

Italy

Argentina	Guatemala	Peru	Spain
Brazil	Jugo-Slavia	Russia	United States

Germany

Argentina	Finland	Japan	Russia
Austria	Guatemala	Latvia	Sweden
Colombia	Hungary	Mexico	Switzerland
Denmark	Italy	Norway	United States

Although American commercial aviation has made numbers of attempts at exporting, in not a single country of the world has it had even the passive assistance of its own Government, while in at least one region—Asia—it has been specifically barred, although the industries of France, Great Britain, Italy and Germany have been permitted to enter.

Furthermore, our own Government, through military purchases, has, possibly unwittingly, assisted foreign aircraft manufacturers to penetrate the coveted American field and actually to establish themselves in this country.

Sixteen of the fifty-five nations, the aviation activities of which

are recorded in this volume, are pursuing a deliberate policy of establishing air transport. Just as Great Britain, by means of preferential laws, mail contracts and grants built up a preponderance in merchant shipping, which in turn became the bulwark of seapower; and just as Germany, by means of tariffs and dumping, constructed an enormous world-wide trade machine, which, in the late war, was the severest obstacle to allied victory, so France, Great Britain, Italy and Germany, among others, are extending air lines, like an invisible web, across Europe and into Africa, Asia and South America.

AIR LINES OF THE WORLD, 1923, EXCLUSIVE OF THE UNITED STATES

Contracting or Operating Nation	*Route*	*Civil Air Funds or Subsidies by Each Nation*
Argentina	Buenos Aires-Montevideo (twice daily)	$4,500 Monthly
Australia (British)	Geralton-Derby (weekly) Charleville-Cloncurry (weekly)	Substantial
Austria (Germans and French)	Vienna-Budapest (daily)	
Belgium	Brussels-Paris (daily) Brussels-London (daily) Brussels-Amsterdam (daily) Congo River, Belgian Congo (mail schedule)	8,100,000 fr.
Brazil	Rio de Janeiro-Porto Alegre	
Colombia (Germans)	Magdalena River between Barranquilla and Cartagena (several times a week)	$100 a trip
Denmark (Germans)	Copenhagen-Hamburg (occasional)	
Esthonia (Russians and Germans)	Reval-Helsingfors (frequent) Reval-Riga (frequent)	$14,700
Finland	Helsingfors-Reval (occasional)	
France (Poles, Czechs, Jugo-Slavs and Roumanians)	Paris-London (daily except Sunday) Paris-Brussels (daily except Sunday) Paris-Strassbourg-Prague-Warsaw (daily except Sunday)	179,963,550 fr.

Contracting or Operating Nation	*Route*	*Civil Air Funds or Subsidies by Each Nation*
France *(Continued)*	Paris-Strassbourg-Prague-Vienna-Budapest-Belgrade-Bucharest-Constantinople (daily to Vienna; thence twice or thrice weekly) Antibes-Ajaccio (thrice weekly) Marseilles-Toulouse (mails) Toulouse-Barcelona-Alicante-Malaga-Rabat-Casablanca (frequent, mails) Casablanca-Oran (frequent) Algiers-Biskra (frequent, mails military) Biskra-Touggourt (occasional) Touggourt-Ouargia (occasional) Dakar-Kayes (frequent) Saigon-Canton (frequent)	
Germany (Russians, Dutch, English, Poles, Finns, Letts, Swiss and Hungarians)	Hamburg-Copenhagen (occasional) Berlin-Hamburg-Bremen-Amsterdam-London (daily) Koenigsberg-Smolensk-Moscow (daily, mails) Koenigsberg-Memal-Riga-Reval-Helsingfors (frequent) Munich-Zurich-Geneva (several times a week) Munich-Vienna-Budapest (daily) Danzig-Warsaw-Lemberg-Warsaw (frequent)	Indirect but Generous
Great Britain	London-Manchester (daily) London-Paris (daily) Paris-Basle (occasional) Basle-Zurich (occasional) London-Brussels (daily) Brussels-Cologne (daily) London-Rotterdam-Hanover-Berlin (daily) Southampton-Guernsey (frequent) Cairo-Bagdad (frequent, military and mails)	£571,000
Hungary) (Germans and French)	Budapest-Vienna (daily)	45,000,000 kr.
Italy	Milan-Rome (frequent) Rome-Ancona (frequent) Rome-Brindisi (frequent)	£34,000
Japan	Tokio-Osaka (daily, experimental mail) Osaka-Shikoku Island (intermittent)	$300,000

Contracting or Operating Nation	*Route*	*Civil Air Funds or Subsidies by Each Nation*
Netherlands (British)	Amsterdam-London (daily) Amsterdam-Hamburg-Copenhagen (frequent)	1,400,000 fl. 1923-1926
Poland	Warsaw-Cracow (intermittent)	Slight
Russia (Germans)	Moscow-Koenigsberg (daily, mails) Moscow-Riga (experimental) Moscow-Rostov-Tiflis (experimental) Moscow-Baku (experimental)	Heavy
Siam (French)	Korat-Roi Ech-Ubon (weekly, mail)	
Spain	Continental Spain-Canary Islands (experimental) Seville-Larache-Morocco (daily)	$235,000
Sweden	Malmo - Copenhagen - Warnemunde - Berlin - Hamburg (experimental)	
Switzerland (Germans and British)	Geneva-Munich (several times a week) Zurich-Basle-Paris-London (occasional)	450 fr. each Flight Geneva-Munich.

American Aircraft Are Being "Put to Work"

By the close of 1923 the American aircraft industry, through the lack of orders from the War and Navy departments, could not be regarded as a munitions industry. The very lack of military and naval orders, however, had but emphasized the fact that *it is a key industry*—and that the only hope of its proper development is through the commercial and civil use of aircraft. The ambition and hope of the industry has always been directed by a realization of this truth. Our knowledge that the basis of all aviation is *aircraft,* has made the industry constantly hold to the idea that the only ultimate and satisfactory development must come through *"putting aircraft to work,"* as was so aptly expressed by Postmaster-General New, Secretary of Agriculture Wallace, Secretary of the Interior Work, the Commandant of the Coast Guard, and by bankers and business men in messages to the symposium of the National Air Institute of the Aeronautical Chamber of Commerce, held in St. Louis, Mo., on October 2nd, 1923.

THE WHITE HOUSE
WASHINGTON

December 20, 1923.

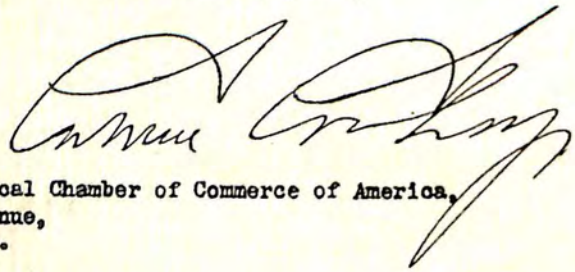
Gentlemen:

It is gratifying to learn of the appreciation which commercial aviation feels for my recommendations to the Congress, that this art be regulated and encouraged, and that our defenses in the air be made more secure.

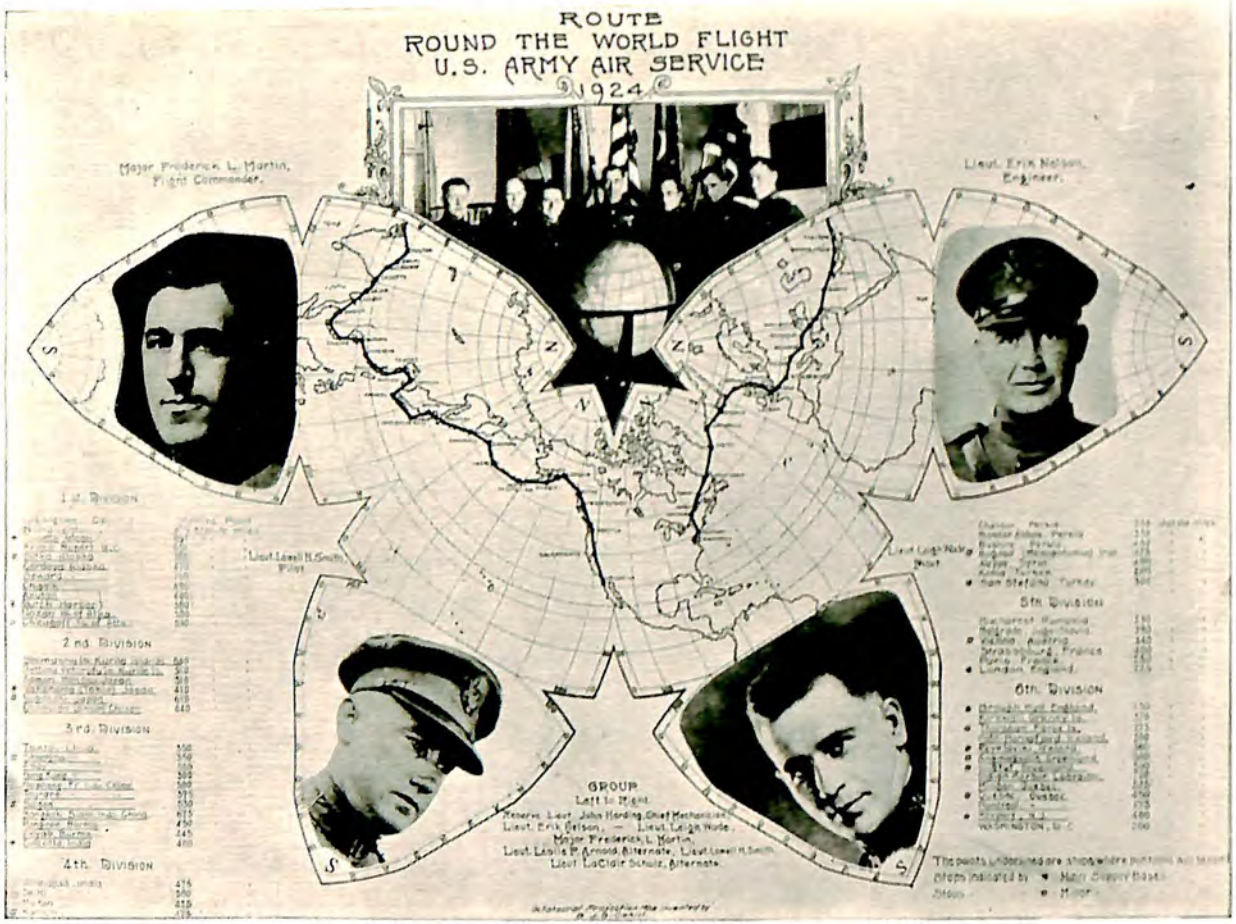
Aviation is a problem of lively concern to every nation. Having given the world the practical knowledge of flight, a serious responsibility rests upon us to see that air transport be developed along constructive, economic lines.

Organization to this end is indispensable, and I trust that the efforts of the Aeronautical Chamber of Commerce will be successful. Aircraft are vehicles of peace, and I can conceive of no more beneficial service to commerce and industry than their use in speeding up the mails, which has proved practical, by the Post Office Department. I shall examine your Air Mail report with much interest.

Most sincerely yours,



The Aeronautical Chamber of Commerce of America,
501 Fifth Avenue,
New York City.


ROUTE
ROUND THE WORLD FLIGHT
U.S. ARMY AIR SERVICE
1924
Major Frederick L. Martin,
Flight Commander.
Lieut. Erik Nelson,
Engineer.
Lieut. Lowell H. Smith,
Pilot
Lieut. Leigh Wade,
Pilot
1st. Division
2nd. Division
3rd. Division
4th. Division
5th. Division
6th. Division
GROUP
Left to Right
Reserve Lieut. John Harding, Chief Mechanician
Lieut. Erik Nelson, — Lieut. Leigh Wade,
Major Frederick L. Martin,
Lieut. Lesley P. Arnold, Alternate, Lieut. Lowell H. Smith
Lieut. LaSalle Schulz, Alternate.

Douglas World Cruiser No. 4 on field of the Douglas Co. at Santa Monica, Cal.

American aircraft are being "put to work" in many ways, among which are the following:

Transportation in co-ordination with or supplemental to Railways and Steamship lines	Passengers. Mails. Express matter and Merchandise. Bank service. Negotiable paper or gold itself.
Agriculture, Forestry, Mining, Marine, etc.	Extermination of insect pests and plant diseases, such as cotton boll weevil and leaf worm, gypsy moth and locust. Crop survey and estimating. Forest patrol and timber cruising. Reclamation. Mine rescue. Life saving at sea and on lakes.
Photographic	General surveys. Engineering and construction projects. Mapping. Revision of tax assessment. Rights of way for railways and power transmission lines. City planning. Harbor improvement. Rail terminal studies. Street traffic problems. Surveys of urban fire hazard. Real estate development.
Advertising and Publicity	Photographs from the air. Skywriting. Illuminated signs at night.
Policing and Discipline	Curbing of smuggling of liquors and aliens.

What American Aviation Needs Is Public Support as Well as Interest

American aviation needs no direct subsidy. It needs and expects only the help given any business, the development of which, for the common welfare and security, is a national responsibility. The industry suffered through war expansion. It has been denied the assistance of law and forms of natural encouragement long accorded to other means of transport. Its liquidation may have to proceed further. Such contraction will gravely affect our aerial defenses. It certainly will make more difficult the practical application of commercial flying.

But the idea of aircraft performing economic service is right, and, soon or late, will be demonstrated through public support.

As soon as public opinion imposes upon those in authority the fact that both our political and economic independence demands prompt and intelligent action, just so soon will we begin to realize our destiny.

CHAPTER II

RECORD OF FLYING BY FIXED-BASE OPERATORS—IN THREE YEARS 8,767,893 MILES FLOWN, 278,668 PASSENGERS AND 442,186 POUNDS OF FREIGHT CARRIED—FIGURES FOR 1923 SHOW ENCOURAGING INCREASE

THERE was more flying—and better flying—by the fixed-base operators during 1923, as reported to the Aeronautical Chamber of Commerce, than in 1922 or 1921. Actually, fewer operators submitted records, but their mileage was greater and the duration of their flights longer than in either of the two previous years. The number of flights made and passengers carried was considerably in excess of the number in 1922 and rivalled the number in 1921, when "joy flights" were much more popular. There was about double the amount of freight carried in 1923, as compared with 1922 and 1921. The average charge per short flight was greatly reduced, and the average charge per pound per mile for freight, and per passenger mile for inter-city flying, was somewhat higher. Here are the comparative figures:

COMPARISON OF FLYING BY FIXED-BASE OPERATORS IN 1921, 1922, 1923

	1921	*1922*	*1923*	*1921–1923*
Operators reporting.....	125	129	124	126 av.
Landing fields.....	116	107	132	118 av.
Seaplane stations.....	30	26	30	28 av.
Public terminals.....	16	10	11	12 av.
Total air ports.....	146	133	162	147 av.
Planes (land).....		450–500	374–500	
Planes (water).....		80–100	55–100	
Amphibious		1		
Balloons		4		
Estimated total aircraft..	600	650	429–600	600 av.
Number of flights made..	130,736	89,936 (120 reports)	106,838 (116 reports)	327,510
Average duration of flights	21 min.	26–30 min.	30+min.	26+min.
Total miles flown.....	2,907,245	2,846,037 (119 reports)	3,014,611 (117 reports)	8,767,893
Total passengers carried..	122,512	75,268 (110 reports)	80,888 (105 reports)	278,668
Freight carried (by pounds)	123,221	110,663 (21 reports)	208,302 (23 reports)	442,186
Average charge per short flight	$9.00	$7.00	$5.50	$7.16 av.

	1921	1922	1923	1921–1923
Charge per lb. per mile for freight	.33	.036 (10 reports)	.104 (15 reports)	.15 +av.
Charge per mile per inter-city flight	.55	.428 (58 reports)	.46 (67 reports)	.479+av.

Note.—Certain of the above reports made only by a portion of the operators listed and allowance should be made for this deficiency.

Initiative Under Severe Handicaps

It is suggested that the reader, on tracing the comparative results of fixed-base flying during the last three years, bear in mind the fact that these commercial operations were carried on, not only without the slightest assistance from the Federal Government, such as is given, either indirectly through routes, terminals, night lighting, etc., or directly through subsidies, by various foreign nations, but actually under the severe handicap of public timidity and indifference by capital, due to the lack of Federal air law. Whatever has been accomplished, therefore, is but an indication of the far greater achievements which could be reasonably expected were the proper encouragement provided by Congress.

Passengers Fly for Business, Not Merely Pleasure

In 1921, public curiosity was still keen and hope still mounted high among hundreds of young ex-war pilots who felt that, somehow or other, picking up $10 here and $5 there, for this or that occasional service, they would be able to establish themselves. This phase has long since passed. The 2,907,245 miles flown in 1921 represented much propaganda or demonstration flying. The 3,014,611 miles flown in 1923 represented for the most part, it is believed, actual paid work. Of the 80,888 passengers which 105 operators reported flying in 1923, it is certain that the great majority paid. Of the 122,512 reported carried in 1921, it is doubtful if a considerable portion represented profitable load.

Freight, Merchandise and Mail Transportation

Again, there is an interesting comparison seen in merchandise or freight carried. In 1921, there were 123,221 pounds, mostly of material, the movement of which meant more in publicity than it did in economic service. In 1922 the amount diminished to 110,663 pounds as reported by 21 operators. Last year, 23 operators carried a total of 208,302 pounds, of which 40,172 pounds were mail under contract with the Post Office Department. Operators carrying merchandise or freight in 1921 reported charging .33 cents per pound per mile. A year later ten stated that they charged an average of

.036 cents. In 1923, the average crept up to .104 cents. So, too, with inter-city flying. The average in 1921 was .55 cents per mile; in 1922, according to 58 operators, it was .428 cents, and in 1923, according to 67 aircraft owners, it was .46 cents.

Getting Down to Business Management

It would seem to be clear from the foregoing that fixed-base operators are getting down to business management. The fact that ordinary business rules were not applied before was the fault, not so much of the operators, as of the absolute lack of any previous experience upon which to arrange a schedule of charges. Those, who, after learning what it costs to operate, are able to get patronage sufficient to pay a modest profit, are still in business. Those who overlook the hidden costs, which only appear when available cash runs out, cease operating as their equipment becomes unfit for use.

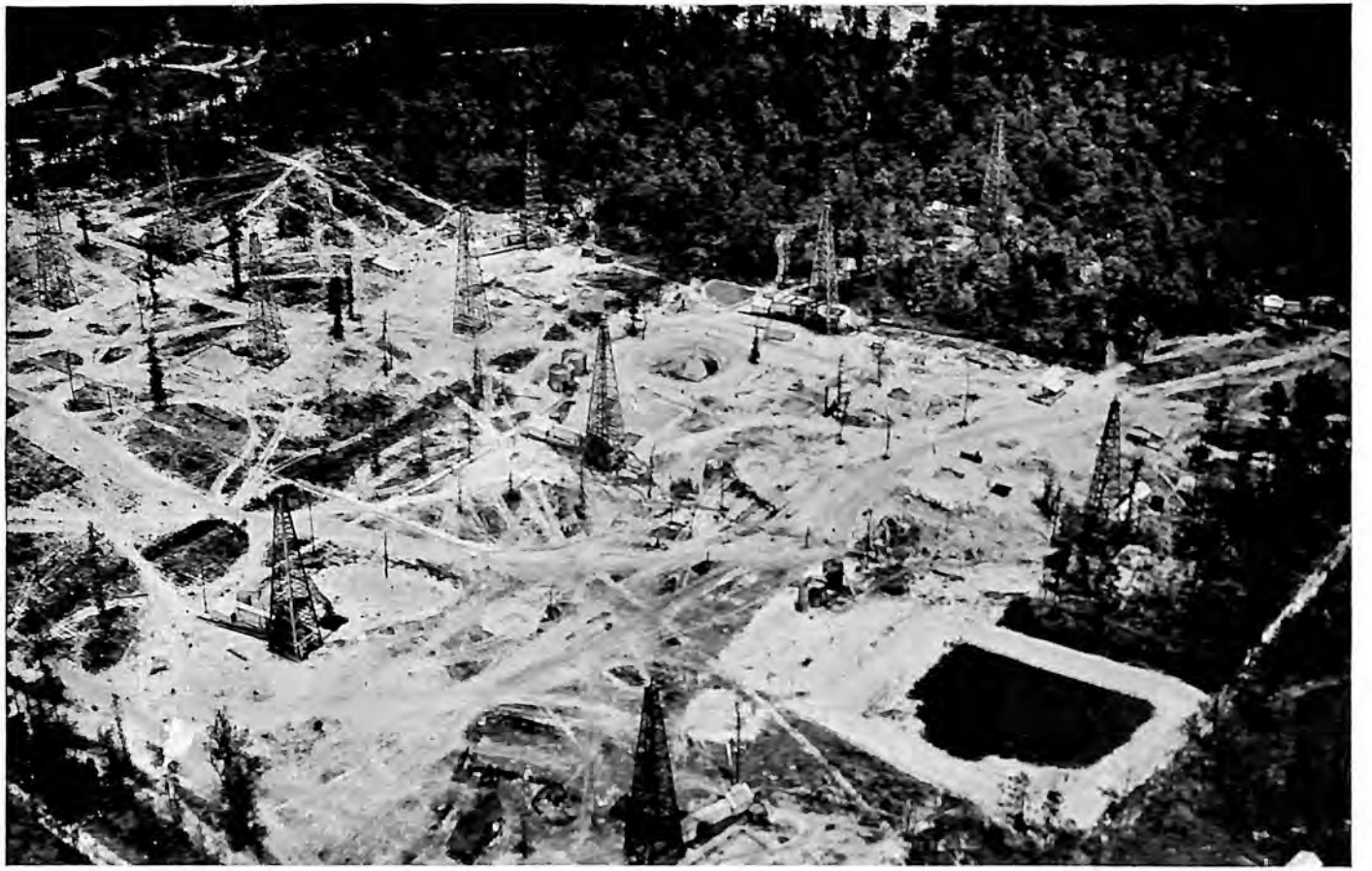
States in Which There Was Fixed-Base Flying

Although the number of fixed-base operators reporting has slightly diminished, the number of states in which fixed-based flying is being done is 33 as compared with 31 in 1922 and 34 in 1921.

States in Which Fixed-Base Flying Is Carried On

	1921	*1922*	*1923*	*Increase or Decrease as of 1922*
Alaska	0	1	1	
California	10	11	10	−1
Colorado	1	1	0	−1
Connecticut	1	0	0	
Florida	3	4	4	
Georgia	0	0	1	+1
Idaho	1	0	0	
Illinois	8	12	14	+2
Indiana	1	1	2	+1
Iowa	4	3	4	+1
Kansas	6	10	4	−6
Kentucky	1	1	2	+1
Louisiana	1	0	1	+1
Maine	1	3	4	+1
Maryland	0	1	0	−1
Massachusetts	3	2	1	−1
Michigan	0	5	7	+2
Minnesota	2	2	2	
Mississippi	0	0	1	+1
Missouri	6	9	5	−4
Montana	2	4	1	−3
Nebraska	3	1	0	−1
Nevada	1	1	1	

The Loening Air Yacht.



The famous oil fields at Smackover, Ark.—Photo by Hamilton Maxwell, Inc.

	1921	1922	1923	Increase or Decrease as of 1922
New Hampshire	1	2	1	−1
New Jersey	5	4	3	−1
New Mexico	0	0	1	+1
New York	15	17	13	−4
North Dakota	1	1	2	+1
Ohio	6	4	4	
Oklahoma	5	3	4	+1
Oregon	1	0	0	
Pennsylvania	4	5	9	+4
South Carolina	1	0	1	+1
South Dakota	5	5	4	−1
Texas	12	4	7	+3
Vermont	1	1	0	−1
Virginia	2	0	0	
Washington	6	7	5	−2
West Virginia	1	0	1	+1
Wisconsin	3	2	3	+1
Wyoming	0	1	1	

States operating in 1921—34.
States operating in 1922—31.
States operating in 1923—33.
States showing *decrease* compared with 1922—14.
States showing *increase* compared with 1922—17.

Increase in Private Terminals

Probably the most significant fact about these reports for 1923 is to be found in the increase in the number of private terminals actually in use, and in the spread of night flying. Millions of miles may be flown over a field and hundreds of thousands of people carried out of curiosity. But this will never mean any more to American aviation than the driving of an automobile up and down a single boulevard meant to the motor car industry of twenty years ago.

Examination of Table No. 1 at the end of this chapter, listing the activities of 124 aircraft operators during 1923, will reveal that, although their home stations were to be found in 33 states, their activities extended over every part of the United States and Alaska, and also the islands of the Caribbean Sea. In 1921 there were 146 fields or seaplane stations for 125 operators; in 1922, 133 for 129 operators, and in 1923, there were 162 terminals for but 124 operators.

Judging from the number of terminals utilized, overwater flying is now about as extensive as it was three years ago. It is a curious fact, also, that there has been a net decrease of five in public terminals used by these fixed-base operators since 1921. This apparently

has been due to the fact that these terminals were not located at such points as to work satisfactorily into the scheme of inter-city flying.

Longer Flights Now Being Made

In three years the average duration of flights has increased from twenty-one minutes to over one-half hour. In many of the reports submitted cross-country flights of three to five hours are common.

Great Need for Aids in Night Flying Cross-Country

Three years ago, the operator who flew at night was literally a dare-devil more careless of his life, in public opinion, than the wing-walkers of today. Now, in the course of inter-city air travel night flying is not only desirable, but necessary. Except in such rare instances, however, when the operator finds himself supplied by natural beacons from towns and villages, so located as to provide the key to emergency fields, this experiment is still quite an adventure. That night flying is increasing is due, partly to the growth of operating experience and partly to the fact that the public which is patronizing the operators, being educated by the Air Mail to an appreciation of night flying, requires that this service be supplied. Here is another illustration of the extreme need for a national aviation policy which will provide for aviation the beacons, charts, communications and other safeguards and facilities such as have been supplied marine navigation for years.

Aeromarine Airways Corp. of New Jersey

Scanning the list of operators reporting, the name of Aeromarine Airways is among the first in extent and continuity of service. Aeromarine maintained its service in Florida and Caribbean waters, and on the Great Lakes, in 1923 covering a total of 165,750 miles, and transporting 4,500 passengers. Early in 1924 this company was reorganized as the Aeromarine Airways Corporation of New Jersey with C. F. Redden continuing as President and General Manager, and with W. A. Buckner as Secretary. Mr. Buckner is associated with Barron G. Collier, capitalist and sportsman. Flying operations in the South are being co-ordinated with rail and water transportation systems in which Mr. Collier is interested.

Aeromarine Airways contemplates the purchase of special new equipment to operate a daily mail and passenger line, 12 months in the year, between Key West and Havana. Also between Miami, Palm Beach and Nassau during the winter season. This company has completed its fourth year of continuous service; and has carried over 30,000 passengers with only one serious accident. Its operations have covered the Great Lakes, the Atlantic Coast, the

Mississippi River, the Hudson and the St. Lawrence, as well as the Gulf of Mexico. These operations have been such that they have encountered almost every possible condition, favorable and otherwise. The fact that they continue to carry on their operations successfully year after year under these various conditions is a convincing proof that properly regulated flying has been made safe and practical.

Notable Instances of Air Transport

Then there are the G. D. Arnold Aircraft Supply Co., of Ft. Worth, Tex., flying 12,000 miles and carrying 1,000 passengers; V. V. Ayers of Walla Walla, Wash., flying 51,310 miles through the northwestern states, and carrying some 2,500 passengers; and the C. C. Cannan Aviation Field, at Houston, Tex., carrying freight and 2,200 passengers 75,000 miles among the oil fields.

The Curtiss Exhibition Company, with bases at Garden City and Buffalo, N. Y., and Dallas, Tex., probably carried on the most widespread operations. Mileage totalled 166,000 and passengers numbered 3,200. Aerial services were performed in all parts of the United States, and in Canada. Their excellent facilities at their several bases for keeping craft in condition, put them in position to respond to calls for cross-country taxi service over considerable distances, by day or by night. And this sort of service, it appears, is the sure forerunner of operations over established routes and upon regular schedule.

The Curtiss Metropolitan Airplane Company, of New York, and the Earl S. Daugherty School of Aviation at Long Beach, Cal., operating on the two seaboards, present an interesting parallel of profitable flying with safety and convenience to patrons. Curtiss Metropolitan report mileage of 15,400 and 328 passengers; Daugherty 18,000 miles and 1954 passengers. Curtiss Metropolitan did much flying between New York and Florida.

Growing Activity in the Middle West

The growing activity around Chicago is typified by the Heath Airplane Company, with 35,000 miles and some 500 passengers. G. Sumner Ireland, of the Curtiss Eastern Aircraft Corp., Clementon, N. J., performed many special services, such as aerial photography and writing with smoke, in addition to carrying 860 passengers. His mileage was 14,000.

In the Middle West there are two impressive examples. Johnson Airplane and Supply Co., of Dayton, in addition to much long-distance transportation, introduced a special "educational flight" at $3. This was so popular in Dayton that a field has been taken at Buffalo.

Altogether, 23,292 miles were flown and 3,328 passengers were carried by the Johnsons. The thriving city of Monmouth, Ill., which got started right in aviation several years ago, presents the Midwest Airways Corp. During 1923, this company flew 16,000 miles and carried 960 passengers. Their services are to be expanded so as to meet the spreading demand for commercial flying. Mundale & Tennant, operating from Sioux Falls, S. D., report 30,000 miles flown and 1,000 passengers carried.

Loening Service Between New York and Newport

The New York-Newport Air Service, Inc., flying for a portion of the year—during the season at the Rhode Island resort—covered 12,000 miles and carried 160 passengers, including many persons socially and financially prominent. This service, offering such a tremendous saving in time, is to be resumed and probably extended, using the 1924 Loening Air Yacht.

Much cross-country work and training of civilian pilots was done during the course of 170,000 miles flying reported by the Oakley-Askew Aerial Service of Ardmore, Okla. The Overcashier Aviation Co., of Highland Park, Mich., flying 60,000 miles, transporting 1,400 passengers; and the Parker Engineering Co., Bartlesville, Okla., flying 175,000 miles and carrying 5,432 passengers, are among other operators helping to provide service for which the public will pay.

The Robertson Aircraft Corp., of St. Louis, in 12 months covered 33,705 miles and carried 1,200 passengers. To their constructive activity may be attributed much of the preparation for the National Air Races at St. Louis. In the state of Washington, engaged both in field and cross country jobs, is the Foster-Russell Aviation Company, whose mileage totalled 66,000 and passengers 600. The Shank-McMullen Aircraft Co., operating in territory but poorly served by railway, have their base at Huntington, W. Va. They report 37,000 miles and 2,700 passengers. On the Pacific Coast, Walter T. Varney, with headquarters in San Francisco, states that his cross-country taxi flying plus field flights amounted to 220,000 miles. John P. Wood, as in 1922, was stationed at Louisa, Ky., whence he carried on a profitable and popular air taxi service to the surrounding oil fields. He flew 60,000 miles and carried 3,000 people.

The Wright Flying Company

Entrance by the Wright Aeronautical Corp. into the manufacture of airplanes, as well as engines was followed in 1923, by the formation of the Wright Flying Co., with terminal facilities at Port Wash-

ington, L. I. In 1923 considerable experimental flying was done and studies of transportation service are under way.

Three Private Operators Carry U. S. Mail

The Alaska Airways Co., of Seattle, Wash., the Gulf Coast Air Line, Inc., of New Orleans, La., and the Farthest North Airplane Co., of Fairbanks, Alaska (see Chapter III Air Mail), are in a special class. Of the 208,302 pounds of freight carried by air in 1923, they accounted for 40,172 pounds, all of it being United States mails.

Skywriting—New and Spectacular Use

Aerial advertising came into great prominence during 1923, when the Skywriting Corporation of America introduced this new and spectacular use of the airplane to this country. In 1923, the Skywriting Corporation of America gave demonstrations over some three hundred of the principal cities. The area of operations comprised the territory from Portland, Me., to Jacksonville, Fla., and from San Antonio, Tex., to Minneapolis, Minn., and the western coast was covered from Los Angeles and San Diego, Cal., to Seattle, Wash. It is estimated that fifty million people have at some time seen Skywriting. Twelve airplanes were in use throughout the season.

The main base is Curtiss Field, Garden City, L. I. Other permanent bases are at Framingham, Mass., and Kirkwood, N. J., where the Company has leased fields and erected their own hangars. They also have hangars at Ashburn Field, Chicago, and San Diego, Cal., the latter two places being supply depots as well. Semi-permanent bases are located at Detroit, Cleveland, Baltimore, St. Louis, Birmingham and various other places throughout the country. The log books show the flying time to be approximately 2,500 hours and the distance flown 263,000 miles.

The Night Aero Advertising Corporation also entered the field of sky publicity. They have equipped the lower wings of several planes with electrically illuminated words and are flying at night.

Among Operators Carrying Merchandise and Freight

Of the rest of the operators carrying freight, Aeromarine Airways reported 1,000 pounds, V. V. Ayers, 9,000 pounds, mostly newspapers out of Portland, Ore.; C. C. Cannan, 20,000 pounds of oil machinery and supplies; W. H. Conner, Topeka, Kan., 15,000 pounds miscellaneous merchandise; Curtiss Exhibition Co., 5,000 pounds, mostly films; Curtiss Metropolitan, 5,200 pounds of newspapers along the Florida coast; Earl S. Daugherty, 15,000 pounds;

D. Hamilton, Dallas, Tex., 4,000 pounds; Tex LaGrone, Kansas City, Mo., 2,000; N. B. Mamer, Spokane, Wash., 2,000; New York-Newport Air Service, 7,700 pounds, mostly personal baggage of members of the Newport social colony; Oakley-Askew Aerial Service, 2,000; Parker Engineering Co., 1,600; Foster Russell Aviation Company and field tenants, 75,000 pounds of merchandise over the northwestern states; Harold B. Snow, Louisville, Ky., 3,000 pounds, and John P. Wood, Louisa, Ky., 12,000 pounds oil drilling machinery and supplies.

Impressive Total for Three Years

Summing up three years operations, as reported by an average of 126 fixed-base operations, it is found that the average of equipment in use and in reserve remained about 600 airplanes, probably one-fifth water types and four-fifths land craft. Altogether, 327,510 separate flights were made, 8,767,893 miles flown, 278,668 passengers carried and 442,186 pounds of freight transported.

TABLE OF AIRCRAFT OPERATORS IN THE UNITED STATES

The following pages represent data submitted to the Aeronautical Chamber of Commerce by aircraft operators. Efforts have been made wherever possible to check these figures but the Chamber can assume no responsibility for errors in reports made to it.

Name of Owner or Operator	*Address*	*Air Port Facilities*	*Shop and Repair Facilities*	*Equipment*
Addems & Shreffler	Manteno, Ill.	Field (leased) 50 acres	Field Repairs	1 J.N.-4-D. (OX5) 1 T. M. (80 Le R.) 1 An.-5 pass. (300 F.)
Aero Club of Minneapolis	Minneapolis, Minn.	Twin City Airport (leased) 4600 ft. x 3000 ft., 4 60 x 120 hangars	Emergency	1 J.N.-4
Aero Service Corporation	531 Real Estate Trust Bldg., Philadelphia, Pa	Field (leased) 55 acres, 3—50 x 30 hangars	Shop	1 L.S. (W) 1 J.N.-4 1 Fk; 1 S.J.-1
Aeromarine Airways Corp.	220 West 42nd Street, New York City	Terminals (owned) New York, Key West, Miami, Havana, Detroit, Cleveland	Complete at Key West	5 F.-5-L, 13 pass. 6 H.S.-2-L, 6 pass. Flying Boats
Aircraft Club of Peoria, Ill.	408 Fulton Street, Peoria, Ill.	Field (leased) 45 acres, 1—50 x 60 hangar	Slight	3 J.N.-4 belonging to students
Alaska Airways Co.	629 Pioneer Bldg., Seattle, Wash.	Terminals (leased) Seattle, Wash., and Victoria, B. C. Dock at Victoria, hangar at Seattle	Repair Shop	1 B.-1 (400 h.p.L.)
G. D. Arnold Aircraft Supply Co.	Camp Bowie, Ft. Worth, Tex.	Field (owned) 80 acres, 3 warehouses	Good	2 S.J.-1 (OX5) 1 S.J.-1 (150 h.p.W.) 3 pass. 1 S.J.-1 (220 h.p.W.) 5 pass. 3 Can.J.N.
Atlantic Airways, Inc.	Hingham, Mass.	Terminal (leased) slipway and moorings	Well Equipped	2 H.S.-2-L. 6 pass. Flying Boats. 1 M.F. (OX5) Flying Boat 1 A (OX5)
Aurora (Ill.) Aviation Co.	Aurora, Ill.	Field (leased) 45 acres, 1—30 x 48 hangar	Minor	1 J.N.-4-D (OX5)
Aviation Garden	Fort Worth, Tex.	Field (leased) 208 acres, 1—90 x 120 hangar	Complete	2 S.J.-1 (150 h.p.W.) 2 S.J.-1 (OX5) 1 Can.J.N. (OX5)
V. V. Ayres	Walla Walla, Wash.	Fields (public) Walla Walla, Wash.; Medford, Ore.; River and Seashore, Seaside, Ore.; hangars (3 ships each), hangar, seaplane	Good	1 S.J.-1 (W) 2 J.N.-4-D (OX5) 3 D.H.-6 (OX5) 1 Flying Boat 1 Seagull (C.-6)
B. B. and B. Aerial Co.	603 W. B Street, Marshfield, Wis.	Field (leased) 30 acres		1 S.J.-1 1 J.N.-4
Beach and Hume	Arkansas City, Kas.	Field (leased) 134 acres 10 ship hangar now building		
Blackstone Hill Aero Club	404–29th Street, Oakland, Cal.	Terminal (leased) 76 x 35, 1 hangar	Slight	1 H.-4-H Seaplane (H.S. 175 h.p.)
Bloomington Airways	Bloomington, Ill.	Field (leased) 65 acres		
L. C. Brand	Glendale, Cal.	Field (owned) 15 acres, 3 plane hangar	Slight	1 J.N. (W. 150 h.p.) 1 Fk. (200 h.p.H.S.) 1 LeP. (L. 400 h.p.)
W. F. Bridgeman	Ottumwa, Ia.	Field (leased) 35 acres		1 Can. J.N. (OX5)

Above—Army Transport Coast-to-Coast Non-Stop Plane. *Below*—Martin Bomber which carried cotton from Augusta, Ga., to Wamsutta Mills, New Bedford, Mass.—Photos, U. S. Air Service.

Plant of General Electric Co., Schenectady, N. Y.—Photo by Fairchild Aerial Camera Corp.

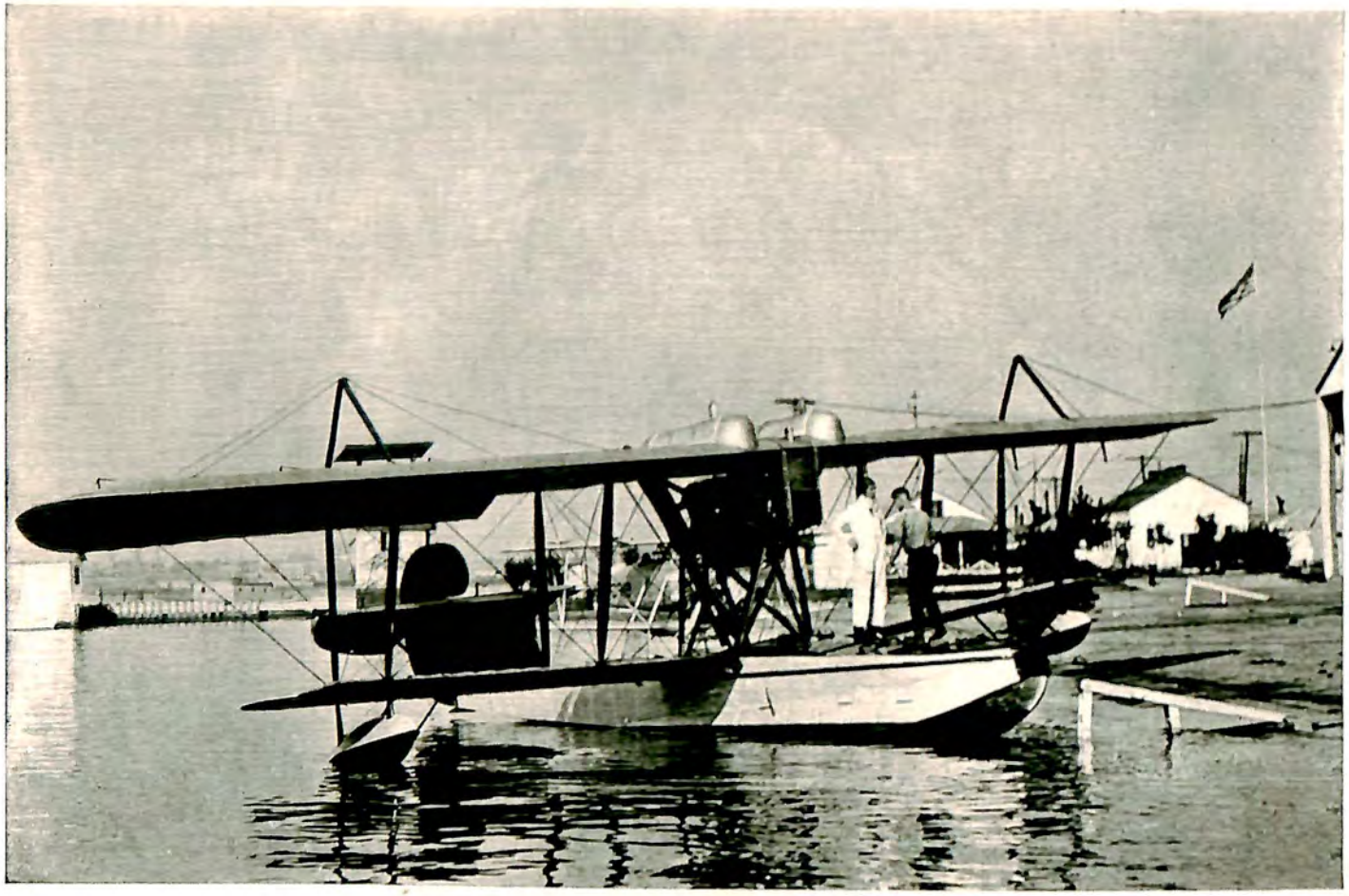
Total No. Flights	Average Duration of Flights	Total Mileage	Passengers Carried	Lbs. of Freight	Charge per Short Flight	Charge per lb. of Freight	Charge per Mile Inter-city Flights	Operating Territory
750	30 min.	22,500			$ 5.00		$ 0.50 in 2 seaters .20 in 5 seaters	
300	20 min.	8,000						Used to instruct club members.
300	2 hrs.	21,000			10.00		1.00	EasternPennsylvania,New Jersey, Delaware
1440	50 min.	165,750	4,500	1,000	10.00	.005 per mi.	.25 to .30	Detroit-Cleveland; Key West-Havana; Miami-Nassau and Atlantic Coast ports
275	1 hr.	16,500	200		5.00		.75	One hundred mile radius of Peoria
Short 30	20 min.	600	75	16,672 Mail	5.00			Since July 1, 1923, mail flights Seattle-Victoria only.
Round Trips 42	2 hrs.	7,560	10					
1,500	20 min. to 4 hrs.	12,000	1,000		5.00			Houston, San Antonio, etc., Texas
649	15 min.	9,535	1,701	1,500	5.00		.55	Hingham, Nantasket, Swanscott, Boston, Mass.; Newport, R. I., New York
400	20 min.	10,000	250		10.00		.75	
700	30 min.	25,000	900		5.00		.50 one .65 two .75 three	Central and Northern Texas and Oklahoma
4,400	12 min.	51,310	2,500	9,000 Newspapers	2.50		.30 per 100 mi. up	Western Washington, Oregon, Southern British Columbia
500	10 min.	5,000	125		5.00		.50 two	Marshfield, Wausau, Chippewa Falls, Wis.
40	24 min.	1,015	36					San Francisco Bay Counties
1,800	40 min.	35,000	1,500		5.00			Peoria, Bloomington, Springfield, Chicago, Ill.; St. Louis, Mo.
50	10 min. to 4 hrs.	5,000						Pleasure trips to Riverside, San Diego and San Francisco
160	15 min	2,800	100		5.00			Des Moines, Ia. and Kansas City, Mo.

Name of Owner or Operator	*Address*	*Air Port Facilities*	*Shop and Repair Facilities*	*Equipment*
Brotz Air Port	Kohler, Wis.	Field (leased) at Sheboygan, 31 acres; 1—48 x 48 hangar	Slight	1 S.J.-1 (OX5) 1 J.N.-4-D (OX5)
Wm. A. Burke	Okmulgee, Okla.	Field (leased) 60 acres, 1—80 x 90 hangar		1 *Swallow* (W. 150 h.p.)
B. D. Burley	Chicago, Ill.	Ashburne Field		1 Can. J.N.-4 (OX5)
Burns Flyers	809 S. Leroy Street, Fenton, Mich.	Field (leased) 30 acres		3 S.J.-1 (OXX, OX5, K6) 1 LeP (W. 220 h.p.)
C. C. Cannan Aviation Field	517 Mason Bldg., Houston, Tex.	Field (leased) 34 acres, 1—60 x 140 hangar	Good	1 S.J.-1 (OX5) 1 S.J.-1 (W. 150 h.p.) 1 S.J.-1 Special (W. 150 h.p.)
Cantwell Aircraft Co.	Bucklin, Mo.	Field (leased) 65 acres	Good	1 Can. J.N. (OX5) 1 S.J.-1 (W. 150 h.p.) 1 J.N.-4-D (OX5)
✓ Chamberlin Aircraft Co.	Hasbrouck Heights, N. J.	Field, 80 acres		31 in stock; several in use
Cochrane Aviation Co.	Caspar, Wyo.	Field, (leased) 40 acres, 1—40 x 30 hangar		1 L. S. *Tourabout* (W. 150 h.p.)
✓ Concord Aircraft Co.	Concord, N. H.	Fields and terminal (leased) Concord, Manchester, Bethlehem, N. Conway, Franklin, The Weirs	Good	1 M. F. Flying Boat (W. 150 h.p.) 1 M.T. 2 (W. 150 h.p.) 1 S.J.-1 (W. 150 h.p.) All 3 passengers
W. H. Connor	1510 W. 8th Street, Topeka, Kans.	Field (leased) 80 acres		1 Can. J.N. (OX5)
H. E. Cornell	Winter Haven, Fla.	Field (leased) 20 acres, Lakeland, Fla.		1 J.N.-4-D
E. C. Curran	Spearfish, S. D.	Field (leased) 80 acres, 1 hangar		1 S.J.-1 (OX5)
✓ Curtiss Exhibition Company	Garden City, N. Y.	Field (owned) 1 mile sq., 18 hangars	Complete	5 S.J.-1 (C.-6 160 h.p.) 10 J.N. (OX5) 12 *Orioles* (C.-6 160 h.p.) 1 H.P. (R.R. 350 h.p.) 1 C.P. (C.D.-12 400 h.p.) 1 J.N. C.-6 (160 h.p. C.-6) 2 Night Mail (C.-6) Total 32 planes
Curtiss Exhibition Company	Buffalo, N. Y.	Field (leased) 100 acres, 2—60 x 60 hangars	Complete	1 *Oriole* (C.-6) 1 S.J.-1 (K.-6) S.J.-1 (OX5)
Curtiss Exhibition Company	Dallas, Tex.	Field (public) 80 acres, 6 hangars	Minor	2 S.J.-1 (C.-6) 1 J.N.-4-C 1 J.N.-4-D 1 *Oriole*
Curtiss Florida Flying Camp	Hialeah (near Miami), Fla.	Field (owned) 40 acres, 1 municipal hangar 65 x 140	Good	2 J.N.-4-D (OX5) 1 *Oriole* (K.-6)
X ✓ Curtiss Metropolitan Airplane Co. Phone - Port Wash 364	Port Washington, L. I.	Terminals (leased) Port Washington, L. I. and West Palm Beach, Fla., 2 hangars at Pt. Washington for 6 Flying Boats	Complete	2 *Seagulls* (K.-6) 1 M.F.

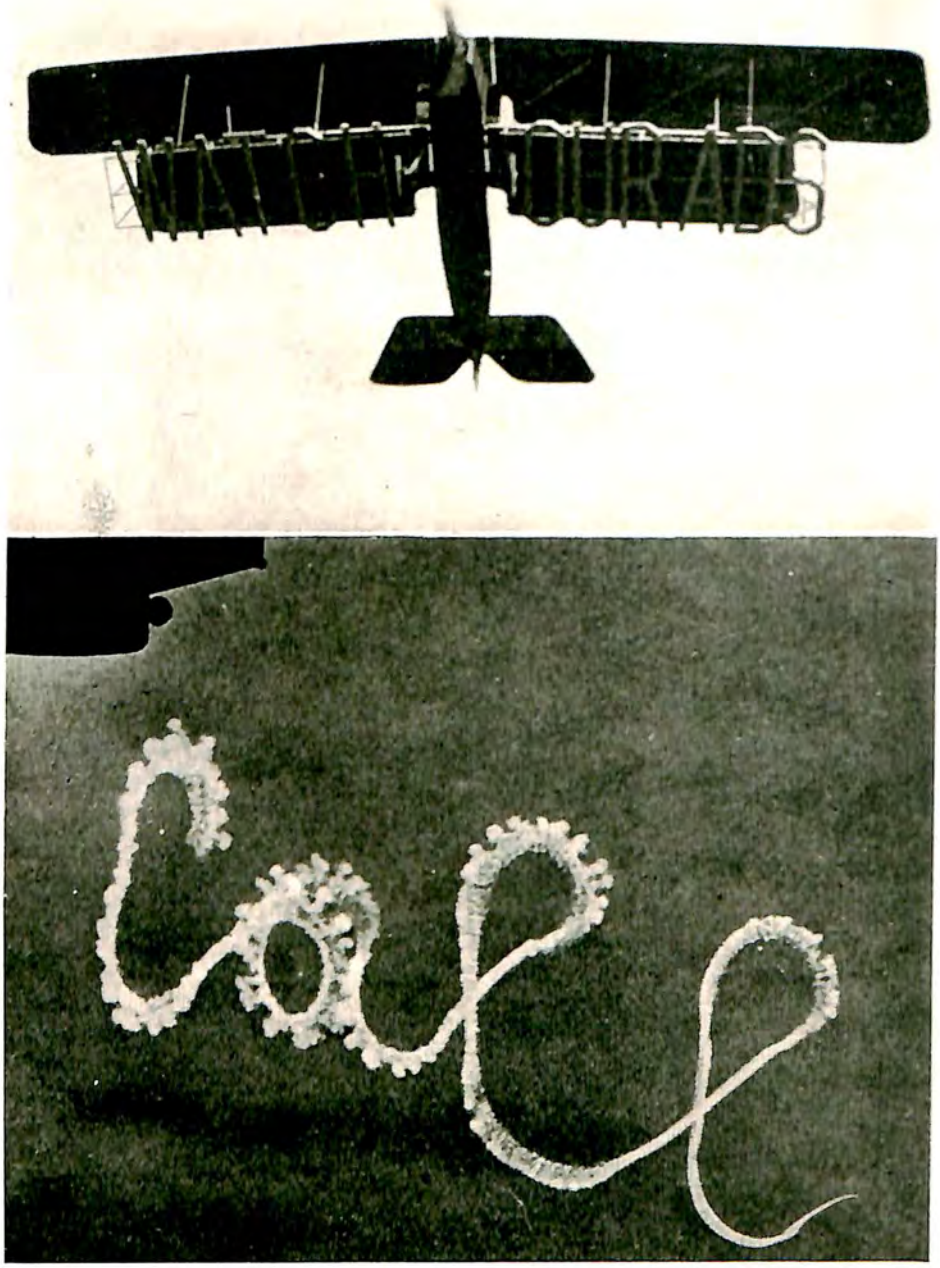
NO. 1—Continued

Total No. Flights	*Average Duration of Flights*	*Total Mileage*	*Passengers Carried*	*Lbs. of Freight*	*Charge per Short Flight*	*Charge per lb. of Freight*	*Charge per Mile Inter-city Flights*	*Operating Territory*
350	15 min.	6,000	350		$ 5.00			Milwaukee and Chicago
200	30 min.	8,500	40		5.00			Personal business and pleasure flights
150	1 hr.	9,000	104					Personal business and pleasure flights
1,000	20 min.	20,000	722		5.00		$ .35	Central Michigan
1,500	45 min.	75,000	2,200	20,000	5.00	.01½ per lb. per mile and up	.30	Between Houston and Texas Oil Fields
1,000	20 min.	7,000	400		5.00		.20	
300	1 hr.	18,000	100		7.50		$1 per mi. for ship	New York, Philadelphia Baltimore, Boston
400	10 min.	5,000	100		7.50			Cheyenne, Denver
389	10 min.	3,300	601		5.00		.75	
300	20 min.	6,000	224	15,000	5.00	.15 per lb. per mile	.25	Eastern Kansas
60	1 hr.	4,000	20					Personal business and pleasure trips
25	30 min.	700	25		6.00			Western South Dakota and Colorado
1,400 hours	15 min. at field	120,000	2,500		10.00		.50	Anywhere throughout the Southwest
400	15 min.	25,000	200		7.50			
800	50 min.	21,000	500	5,000	2.50			
							.50	Throughout Florida
362	42 min.	15,400	328	5200 lbs. newspapers	10.00	¼c	.50	Florida Coast and region of New York

Name of Owner or Operator	*Address*	*Air Port Facilities*	*Shop and Repair Facilities*	*Equipment*
Earl S. Daugherty School of Aviation	431 E. Seaside Ave., Long Beach, Calif.	Field 20 acres (owned), 60 acres (leased), 4 hangars for 11 ships	Good	1 5 pass. *Orenco* (W.150 h.p.) 4 J.N.-4-D (OX5) 1 Can. J.N. (OX5) 2 Sp. (W. 180 h.p.) 1 N. (Gn. 160 h.p.) 1 Fk. (W. 180 h.p.) 1 Pol. (OX5) 1 T.M. (LeR. 80 h.p.) Total 12
W. H. Emery, Jr.	317 W. Corydon St., Bradford, Pa.	Field (owned) 20 acres, 1—50 x 30 hangar	Good	1 J.N.-4 (OX5)
Essington School of Aviation	Essington, Pa.	Terminal (leased) Delaware River, 2 hangars	Good	3 M.F. Flying Boats (OXX6) 2 A. Seaplanes (W.) 1 A. Seaplane (OXX-6) 1 C.F. Flying Boat (OXX6)
Fairchild Aerial Camera Corp.	136 West 52nd Street, New York City circle 4317	Rent facilities Curtiss Field, Garden City; Field-Grand Mere, Quebec (leased) in winter, in water in summer		1 Fk. (B.M.W. 185 h.p.) 1 M.F. Flying Boat (C.-6 160 h.p.) 1 S.J.-1 (C.-6 160 h.p.) additional planes leased
Farthest North Airplane Co.	Fairbanks, Alaska	Fields (leased) Fairbanks, Nenana, McGrath, 25 acres in each; 2—60 x 32 x 14 hangars	Fair	1 D.H.-4 (L. 400 h.p.) 1 J.N.-4-D (OX5)
Fenton Airways of Michigan, Inc.	Fenton, Mich.	Fields (leased) Fenton and Long Lake, 55 acres, 1 temporary hangar		3 S.J.-1 (OX5) 1 S.J.-1 (OXX6) 1 T.M. (Gn.)
Garver School of Aviation	Attica, Kas.	Field (owned) 40 acres; 1—46 x 30 hangar; Field (leased) Belleville, Kas.	Good	2 *Swallows* (OX5)
W. P. Goembel	Creston, O.	Field (leased) 20 acres	Limited	1 Waco 3-pass. (OX5)
Goldsberry Airplane Service	Chillicothe, O.	Field (owned) 100 acres		1 J.N.-4-D (OX5)
J. M. Gordon	Dawson, N. M.	Field near Colfax	Fair	1 S.J.-1 (W.150 h.p.)
Gulf Coast Air Line	515 Whitney Bldg., New Orleans, La.	Terminals (lent by city) New Orleans and Pilottown		2 H.S.-2-L Flying Boats (L. 400 h.p.) 2 M.F. Flying Boats (W) 3 other boats in stock
D. Hamilton	204 E. Jefferson St., Dallas, Tex.	Field (leased) 5 hangars	Good	1 S.J.-1 3-pass. (W. 180 h.p.) 1 Can. J.N. (OX5)
A. J. Hartman	1126 Doernland St., Burlington, Ia.	Field (leased) Davenport, Ia., 40 acres, 1—50 x 35 hangar	Fair	2 Can. J.N. (OX5)
Heath Airplane Co., Inc.	2846 Broadway, Chicago, Ill.	Field (leased) 21 acres, 1—80 x 70 hangar	Good	1 He. *Favorite* (OX5) 1 He. *Feather* (Motorcycle) 1 S.J.-1 (OX5)
Huff Daland Aero Corp.	Ogdensburg, N. Y.	Field (leased)	Excellent	1 *Petrel* (W)
G. H. Hutson	213 S. Sandy Street, Jacksonville, Ill.	Field (leased) 40 acres, 1 hangar	Complete	1 Can. J.N. (OX5) 1 S.J.-5-pass. Sedan (C) 1 T.M. (Gn.) 1 J.N.-4-D (St.)



Aeromarine Plane and Motor Company's all-metal hull flying boat at Naval Seaplane Station, Anacostia, D. C., Pilot Zimmermann on bow.



Signs of the Times in the Heavens. *Above*—Electrically illuminated plane of the Night Aero Advertising Corp. *Below*—The Skywriting Corp. of America advertises in letters a mile high.

NO. 1—Continued

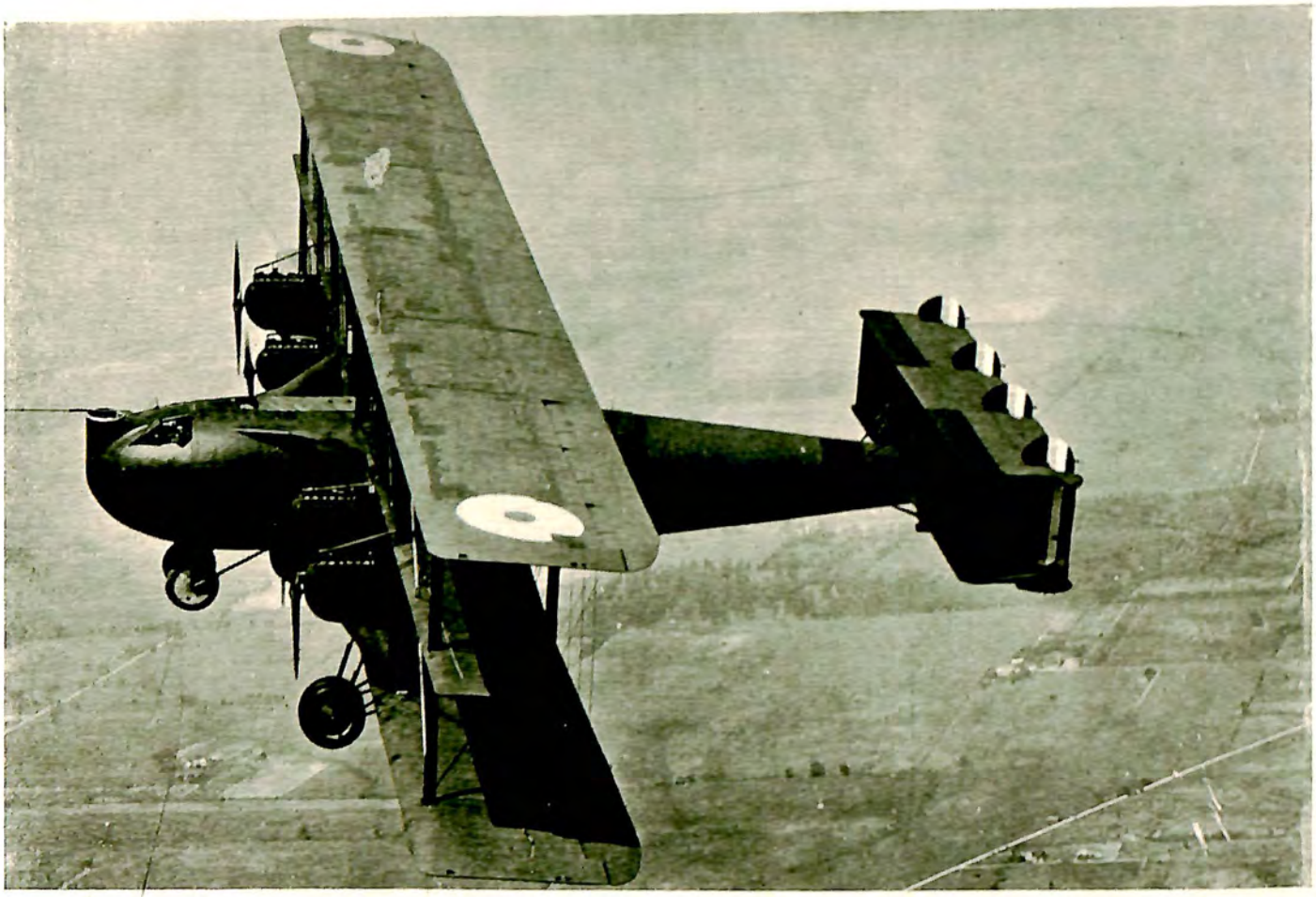
Total No. Flights	Average Duration of Flights	Total Mileage	Passengers Carried	Lbs. of Freight	Charge per Short Flight	Charge per lb. of Freight	Charge per Mile Inter-city Flights	Operating Territory
1,546	10 min.	18,000	1,954	1,500	$ 7.50			Southern California
175	30 min.	6,000	85		10.00			New York
2,000	15 min.	7,000	400		5.00		$ 0.50	Philadelphia, Cape May, N. J., Atlantic City, New York
249	80 min.	23,240						Aerial Photography in 16 states and Canada
400	25 min.	12,000	300	2,500 mail	15.00		1.00	Carries Mail—Fairbanks, Nenana, McGrath, Circle, Ft. Yukon, Livengood, Ft. Gibbons, Beaver
600	18 min.	15,000	450		5.00		.50	Flint, Detroit, Jackson, Battle Creek, and Lansing
2,000	20 min.	42,000	1,200		5.00		.20 one .25 two	Central and Western Kansas
1,500	10 min.	15,000	1,013		5.00		.50	Northern and Central Ohio
600	30 min.	1,800	200		5.00			Central Ohio
60 hrs.	5 min. to 3 hrs.	6,000	50		5.00		.25	New Mexico
220	70 min.	17,600	60	21,000 mail	5.00		.30	Mail route begun 4–16–23 New Orleans-Pilottown
300	2 hrs.	48,000	500	4,000	5.00	$ .50 per mi. load	.50	State of Texas
150	20 min.	1,500	150		5.00	.20 mi.	.20	Iowa and Illinois
1,000	25 min.	35,000	500		5.00	.25	.35	Illinois, Wisconsin, Missouri
100		2,500						Transportation of Personnel
500	90 min.	35,000	1,500		5.00		.50	St. Louis and Chicago

Name of Owner or Operator	*Address*	*Air Port Facilities*	*Shop and Repair Facilities*	*Equipment*
G. S. Ireland	Clementon, N. J.	Field (leased) Pine Valley, N. J., 100 acres, 2—50 x 75 hangars		2 J.N.-4-D 1 *Oriole* (L.6) 1 K.6 Standard
Johnson Airplane & Supply Co.	Dayton, Ohio	Field (leased) 25 acres, 3 hangars, 80 x 120, 75 x 75, 30 x 60	Excellent	1 Vt. (W.180 h.p.) 1 L.S. (W. 150 h.p.) 1 J.N.-4-D (OX5) 3-pass. 1 *Swallow* (OX5) 1 Hz. (OX5)
Kokomo Aviation Corp.	Kokomo, Ind.	Field (leased) 100 acres, 1 hangar	Good	17 J.N.-4-D 2 *Oriole* (C.-6)
Tex La Grone	4105 Brooklyn Ave., Kansas City, Mo.	Facilities leased from Air Terminal Association	Good	1 L.S. (W. 150 h.p.) 1 R.D. (OX5) 1 Can. J.N. (OX5)
Harry P. Land	Bradentown, Fla.	Uses golf course; 1 hangar		1 J.N.-4 (OX5)
Chauncey M. Larsen	Dell Rapids, S. D.	Field (leased) 5 acres, 1 hangar	Good	1 S.J.-1 (W) 1 T. M. (Gn.)
Roy O. Larsen	Larsen, Wis.	Field (partly owned)	Fair	1 Can. J.N. (OX5) 1 S.J.-1 (OX5) 1 S.J.-1 1 T.M. (LeR. 80 h.p.) 1 own built (motorcycle engine)
L. W. Leib	Volga, S. D.	Field (leased) 19 acres, 1 hangar	Fair	1 S.J.-1 (OX5)
Ludington Exhibition Co.	310 Atlantic Bldg., Philadelphia, Pa.	Field (leased)	Fair	1 Sport Fm. (An.)
N. B. Mamer	1623 W. Pacific St., Spokane, Wash.	Field (municipal) 800 acres, one 2 plane hangar		1 *Oriole* (K.-6) 1 S.J.-1 (W.)
Manchester Cigar Co.	York, Pa.			2 D.H.-6 (OXX6)
August Maross	22 E. 24th Street, Chicago Heights, Ill.	Field (leased) 30 acres	Fair	1 J.N.-4-D (OX5)
Maxim Air Service	78 Bay Street, Winslow, Maine	Field (leased) 80 acres, Terminal in river	Good	1 Can. J.N. (OX5) 1 S.J.-1 (OX5) 1 M.F. Flying Boat (OXX6) 1 H.S. Flying Boat (L. 400 h.p.)
Hamilton Maxwell, Inc.	6 East 39th Street, New York City			Equipment leased
Mayer Aircraft Corp.	Bridgeville, Pa.	3 Fields (leased) 40 acres, 75 acres, 150 acres, 2 50 x 112 and 100 x 150 hangars	Good	1 S.J.-1 (C.-6 160 h.p.) 1 S.J.-1 (Mer. 210 h.p.) 1 *Swallow* (OX5) 1 Avro 1 Mayer Flying Boat (2L.)
Michigan Airways	1141 Hillsdale Street, Lansing, Mich.	3 Fields (leased) 30 acres, 60 acres, 160 acres, 1 hangar	Good	2 S.J.-1 (OX5) 1 J.N.-4 (OX5) 1 Can. J.N. (OX5)
Midwest Airways Corp.	Monmouth, Ill.	Field (leased) 35 acres, 2—96 x 32 and 54 x 32 hangars	Good	1 5-pass. Br. (Ren. 300 h.p.) 1 S.J.-1 (K-6) 1 J.N.-4-D (OX5)
Millard Flying School	Palmyra, Pa.	Field (leased) 25 acres, 1—46 x 56 hangar		1 J.N.-4 (OX5) 1 Waco (OX5)
Missoula Aviation Co.	Missoula, Mont.	Field (leased) 160 acres		1 S.J.-1 (K-6)

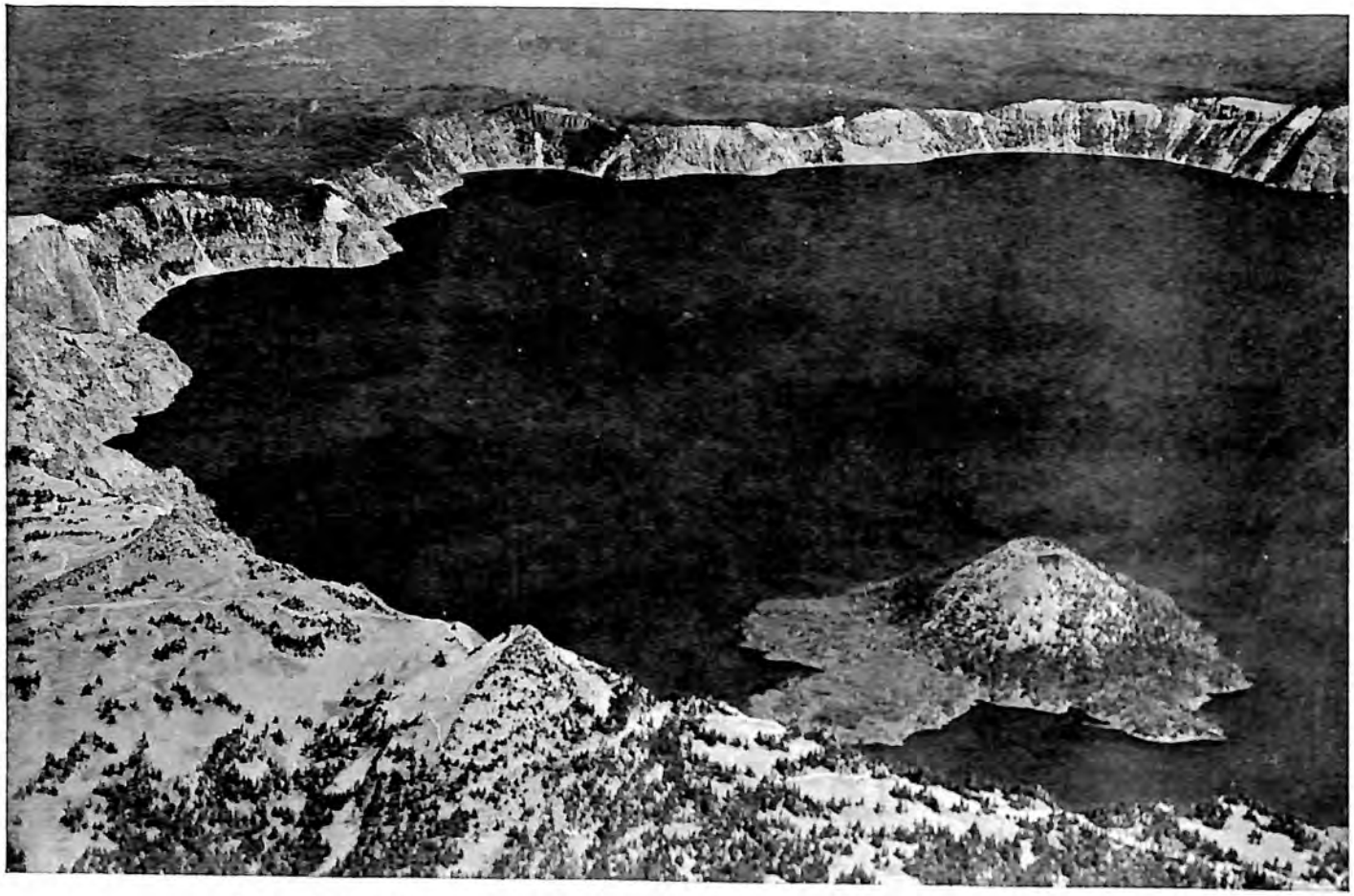
NO. 1—Continued

Total No. Flights	Average Duration of Flights	Total Mileage	Passengers Carried	Lbs. of Freight	Charge per Short Flight	Charge per lb. of Freight	Charge per Mile Inter-city Flights	Operating Territory
1,200	15 min.	14,000	860		$ 5.00		$0.50	Taxi service anywhere
2,550	8 min.	23,292	3,328		9.00		.50	Detroit, Indianapolis, Columbus
6,500	5 min.	45,000	6,000		5.00		.50	Indianapolis, Chicago, Dayton, Detroit, St. Louis
900	20 min.	24,000	1,200	2,000	5.00	$ .0025	.40	Missouri, Kansas and Eastern Nebraska
50	20 min.	1,000	30		7.50			Florida
400	10 min.	9,500	600		5.00		.25	Minneapolis, Sioux Falls
1,000	15 min.	15,000	500		5.00		.50	
400	10 min.	4,000	119		5.00			South Dakota and Minnesota
200	30 min.	7,000	60				.40	Eastern Pennsylvania, Southern New Jersey
1,600	18 min.	35,000	2,000	10,000	5.00		.40	Washington, Idaho, etc.
300	80 min.	22,000	100					Flights in 20 Eastern States for advertising
50	20 min.	1,200	40		5.00		.50	Vicinity of Chicago
300	10 min.	3,000	300		5.00 on water 10.00 on land		.75	State of Maine
94	2 hrs. 22 min.							Aerial photography in various parts of United States
1,000	15 min.	20,000			10.00		1.00	
3,000	10 min.	45,000	2,500		5.00	.50	.50	State of Michigan
760	20 min.	16,000	960		5.00		.15	
500	15 min.	7,500	200		5.00			Central and Eastern Pennsylvania
150	18 min.	1,700	100		5.00			Washington and Montana

Name of Owner or Operator	*Address*	*Air Port Facilities*	*Shop and Repair Facilities*	*Equipment*
Clifford C. Moran	Alhambra, Cal.			
Mundale & Tennant	Sioux Falls, S. D.	Field (leased) 40 acres, Terminal in river	Fair	2 S.J.-1 (OX5) 1 J.N.-4-D (OX5) 1 Can. J.N. (OX5) 1 Sop. (Cl.) 1 B.-1 Seaplane
A. R. Narrin	31 N. Leroy Street, Fenton, Mich.	Field (leased) 55 acres	Good	2 S.J.-1 3-pass. (OX5) 1 T.M. (OX5)
Jack V. Newland	900 S. 8th Street, Waco, Texas	Field (leased) 25 acres, 1 hangar	Good	1 S.J.-1 (W.)
New York-Newport Air Service, Inc.	New York City 420-E 31 Phone - Lexington - 9710	Terminals, Newport, R. I. (leased) and New York (owned)	Complete	3 Loening Air Yachts 5-pass. (L. 400 h.p.)
Nicholas Aerial Shows	Marshall, Mo.	Field (leased) 40 acres		2 J.N.-4-D 1 *Swallow*
North Central Aviation Co.	Marceline, Mo.	Field (leased)		1 Can. J.N. 1 J.N.-4 1 *Swallow*
Marvin A. Northrup	200 Builders Exch., Minneapolis, Minn.	Field (under purchase) 30 acres, 80 x 70 hangar	Good	1 T.M. 1 J.N.-4 1 S.J.-1 (W.)
Spencer Northrup Flying Field	Great Bend, Kansas	Field (leased) 50 acres, 1—34 x 48 hangar		2 Can. J.N. (OX5) 1 *Swallow* (OX5)
Northwestern Aircraft Co.	Linton, N. D.	Field (leased) 40 acres, 1—30 x 48 hangar		3 J.N.-4-D (OX5)
Oakley-Askew Aerial Service	Ardmore, Okla.	Field (leased) 40 acres, 1—60 x 90 hangar	Good	9 Can. J.N. (OX5) 1 S.J.-1 (W.) 2 S.J.-1 (L. 200 h.p.)
Oklahoma City School of Aviation	Oklahoma City, Okla.	Field (leased) 50 acres		1 *Oriole* (W.) 1 L.S. (W.) 2 *Swallows* (OX5) 1 J.N.-4 (W.) 2 J.N.-4-D (OX5)
Old Orchard Beach School of Flying	Old Orchard Beach, Me.	Field (leased); Terminal (leased) Sebago Lake, 1—50 x 50 hangar	Fair	1 S.J.-1 (OXX6) 1 J.N.-4-D (OX5) 1 M.F. Flying Boat (W. 180 h.p.)
Ontario Airport	Ontario, Cal.	Field (leased) 20 acres, 1—40 x 55 hangar	Fair	6 B.-1 (H.S.) 2 J.N.-4-D (OX5) 1 T.M. (LeR. 80 h.p.)
H. O'Neil	Bisbie, N. D.	Field (leased) 100 acres, 1—60 x 30 hangar	Fair	1 J.N.-4-D (OX5)
Karl S. Ort	Americus, Ga.			
Overcashier Aviation Co.	Highland Park, Mich.	Field (leased) 40 acres, 1—30 x 60 hangar	Good	3 Can. J.N. (OX5) 1 J.N.-4-D (OX5) 1 St. (St. 140 h.p.)
Parker Engineering Co.	Bartlesville, Okla.	Field (leased) 80 acres, 1 hangar	Good	2 Dewey (OX5) 1 *Swallow* (OX5) 1 Bs. 5 pass. cabin (S.P. 240 h.p.)
C. O. Prest	Las Vegas, Nev.	Fields (leased) Las Vegas, 40 acres and San Bernardino, Cal., 25 acres, 4 plane hangar at Las Vegas		1 S.J.-1 (OX5) 1 T.M.



The Barling Bomber, six 400 h.p. Liberties, largest airplane in the world.—Photo, U. S. Air Service.



Crater Lake, Oregon, showing Wizard's Island.—Photo by U. S. Air Service.

NO. 1—Continued

Total No. Flights	Average Duration of Flights	Total Mileage	Passengers Carried	Lbs. of Freight	Charge per Short Flight	Charge per lb. of Freight	Charge per Mile Inter-city Flights	Operating Territory
60	25 min.	1,200	10					Privately operated
1,500	15 min.	30,000	1,000		$ 6.00			North and South Dakota, Minnesota and Iowa
800	12 min.	10,000	1,300		5.00		$0.50	Michigan
	30 min.				5.00		.25	
80	90 min.	12,000	160	7,700	$1 min.	$0.25	.45	New York-Newport and other Atlantic Coast Ports
70	20 min.	1,500	25					Missouri, Kansas and Iowa
250 hrs.	5 min. to 2½ hrs.	15,000	300		5.00			Western Missouri
500	20 min.	12,000	100		5.00			
200	15 min.	3,500	300		5.00			Radius of 400 miles
100	20 min.	2,500	100		5.00		.25	North and South Dakota
3,000	45 min.	170,000	300	2,000	5.00	.006		Oklahoma, Kansas and Texas
		100,000	200				.25	Oklahoma, Kansas and Texas
2,000	10 min.	25,000	2,500		$1 min.			Maine
500	20 min.	12,000	200		5.00	.003	.35	Southern California
225	40 min.	10,000	200		5.00		1.00	North and South Dakota
2,500	50 min.	22,000 60,000	1,400		5.00			Michigan
2,500	45 min.	175,000	5,432	1,600	5.00		.50	Oklahoma City, Dallas Wichita, Denver
400	15 min. to 4 hrs.	7,000	100		5.00		.50	Nevada, Utah and California

Name of Owner or Operator	*Address*	*Air Port Facilities*	*Shop and Repair Facilities*	*Equipment*
Fred J. Probasco	Sault Ste. Marie, Mich.	Field (leased) 30 acres, 1—50 x 30 hangar		1 J.N.-4-D (OX5)
Rainbow Flyers	254 Giertz Street, Downers Grove, Ill.	Field (leased) 60 acres		1 S.J.-1 (OX5)
Rankin Aviation Co.	1150 W. Pine Street, Walla Walla, Wash.	Field (Municipal) 20 acres		1 J.N.-4-D (OX5) 1 Can. J.N. (OX5) 2 *Orioles* (K.-6)
Redfern Aviation Co.	Columbia, S. C.	Field (leased) 15 acres		1 J.N.-4-D (OX5) 1 T.M. (LeR. 80 h.p.)
Reed-Coats Co.	47 Monroe Avenue, Grand Rapids, Mich.	Field (leased) 40 acres, hangar for 5 planes	Fair	1 S.J.-1 (OX5)
Victor A. Rickard	512 Burnet Street, Utica, N. Y.			1 S.J.-1 (OX5) 1 Av. (Cl.)
Robertson Aircraft Corp.	Anglum (St. Louis County), Mo.	Field (facilities leased from Lambert-St. Louis Field) 4 hangars, 120 x 66	Excellent	35 planes in stock, 3 or 4 J.N's, S.J.-1's, etc., operating
Romkey Aircraft Co.	Burlington, Ia.	Field (leased) 20 acres, 1—50 x 30 hangar	Good	3 Can. J.N.-4-C 1 Romkey-Hartman Monoplane
Usher Rousch	Long Beach, Cal.	Field (leased) 26 acres, 2 hangars		1 J.N.-4-C (OX5)
Foster Russell Aviation Co., Inc., and field tenants	Spokane, Wash.	Field (leased) 50 acres, 1 four plane hangar	Good	4 J.N.-4 (OX5) 3 S.J.-1 (OX5) 1 S.J.-1 (K.-6) 1 S.J.-1 (W.150 h.p.) 1 S.J.-1 (W.180 h.p.) 1 S.J.-1 (Mer.) 1 Sport Fm. (LeR.)
Ryan Flying Co.	San Diego, Cal.	Field (leased) 40 acres, 1 hangar	Good	3 J.N.-4-D (OX5) and (OXX6)
DeNeal H. Samuel, Inc.	New York City	Terminal (leased) Long Beach		3 Flying Boats (one M.F.)
San Antonio Aviation and Motor School	509 Navarro Street, San Antonio, Tex.	Field (facilities leased) 200 acres, 3 hangars	Good	3 J.N.-4-D 3 S.J.-1 (W.) 2 J.N.-6-H 1 D.H.-4-B (L. 400 h.p.) 1 T.M. (LeR.) 1 T.M. (OX5)
R. W. Schroeder	207 E. Ohio Street, Chicago, Ill.	Field (facilities leased at Ashburn Field) hangars	Good	1 S.J.-1 (OX5) 1 J.N.-4 (OX5)
L. H. Scott Airplane Co.	328 Second Street, Marietta, O.	Field (leased) 15 acres, 1—50 x 60 hangar; terminal in Ohio River	Good	3 Can. J.N. (OX5)
Shank-McMullen Aircraft Co.	740 6th Ave., Huntington, W. Va.	2 Fields (leased), 1—3-ship hangar	Good	15 J.N.-4-D (OX5) 5 S.J.-1 (W. 150 h.p.) 1 T.M. (LeR.) 1 T.M. (OX5) 1 *Oriole* (C.-6) 1 M.F. Flying Boat (OX5) 3 H.S.-2-L Flying Boats (L. 400 h.p.)
R. V. Shores	Pound, Va.	Field (leased) 15 acres		1 J.N.-4-D (OX5)
Skylark Transportation Co.	302 Citizens National Bank Bldg., Los Angeles, Cal.	Field (facilities leased from U. S.)	Good	2 Liberty Sixes

NO. 1—Continued

Total No. Flights	Average Duration of Flights	Total Mileage	Passengers Carried	Lbs. of Freight	Charge per Short Flight	Charge per lb. of Freight	Charge per Mile Inter-city Flights	Operating Territory
	20 min.							Private operation
415	16 min.	6,400	506		$ 5.00	.002		
1,794	13 min.	29,104	2,290		5.00		$ .25	Oregon, Washington, Idaho, Montana
500	12 min.	8,000	400		7.50		.30	Throughout the South
500	60 min.	35,000	200		5.00		.35	Michigan
1,085	30 min.	32,500	1,500	30	5.00			Central New York
1,926	15 min.	33,705	1,200	100	4.00	.001635	.25	Chicago, Kansas City, Tulsa, Oklahoma City, Omaha, Little Rock
1,200	10 min.	15,000	1,100		5.00			Iowa, Illinois, Missouri
130	10 min.	2,000	50		5.00			
500 company	15 min.	6,000	600		5.00	.005	.50	Washington, Idaho, Montana, Oregon
1,000 hrs. tenants		60,000		75,000				
1,000	19 min.	22,000	550		5.00			Southern California
100	15 min.				5.00			
500	30 min.	10,000	500		5.00		.36	Radius of 350 miles San Antonio
25	60 min.	1,500	10					Plane used for pleasure 300 mi. radius of Chicago
2,800	5 min. to 5 hrs.	20,000	700		4.00		.25	Ohio and West Virginia
3,500	11 min.	37,000	2,700	500	10.00		.25	Ohio, West Virginia and Virginia
1,000	15 min.	20,000	150		5.00		.25	Virginia
20	30 min.	500	80					Southern California

Name of Owner or Operator	*Address*	*Air Port Facilities*	*Shop and Repair Facilities*	*Equipment*
Skywriting Corp. of America	50 E. 42nd Street, New York City	Hangars at New York, Framingham, Mass., Kirkwood, N. J., Chicago and throughout country (owned and leased)	Complete	12 S.E.-5 (H.S. 200 h.p.)
Otto C. Smith	Newcastle, Ind.			1 S.J.-1 (OX5)
Windy Smith, Inc.	Mansfield, Pa.			1 S.J.-1 (W.) 1 Can. J.N. (OX5)
Harold B. Snow	Sheldon, Ill., and Louisville, Ky.	Field (owned) at Sheldon and leased at Louisville; 1 hangar at Louisville	Good	1 Br. (350 h.p. Ren.) 1 S.J.-1 (OXX6) 1 J.N.-4-D (OX5) 1 T.M. (OX5)
Sparks and Fogg Airplane Co.	West Enfield, Me.			1 J.N.-4 (OX5)
Lawrence Sperry Aircraft Co.	Farmingdale, L. I.	Field (owned)	Complete	3 *Messengers* (W.) 1 Sperry Light Lift Monoplane (C.) 1 Av.
Turgeon Aircraft Service	Auburn, Maine	Temporary terminals 15 points in Maine (leased)	Good	2 J.N. 1 M.F. Flying Boat
Roscoe Turner & Co.	Corinth, Miss.	Field (leased) 50 acres		1 J.N.-4 (OX5)
Harold S. Vanderbilt	New York City	Private terminal and hangar at Port Washington, L. I.	Excellent	1 Lo. A.Y. (L. 400 h.p.)
Walter T. Varney	1512 Pine Street, San Francisco, Cal.	Field (leased) San Mateo, 130 acres; 8-ship hangar	Excellent	1 Bs. *Tourer* (S.P.) 2 Varney Standards (W. 150 h.p.) 1 Varney Standard (W. 180 h.p.) 2 J.N.-4-D (OX5)
Varney Aircraft Co.	Peoria, Ill.	Field (leased) 40 acres, 1—3-ship hangar, terminal in river	Good	1 A.39-B. (OXX6) 2 J.N.-4-D. (OX5)
William Westlake	Chicago, Ill.	Field (leased) 40 acres, 1 hangar		1 J.N.-4-D (OX5)
White's Aircrafts	Des Moines, Ia.	Field (municipal) 60 acres	Good	1 3-place White Special (OX5) 1 J.N.-4-D (OX5) 1 Can. J.N. (OX5) 1 White Sportster (W.)
Whitney, Speer & Co.	133 Washington St., Chicago, Ill.			1 J.N.-4 (OX5) 1 Ballila (S.P.A.)
Williams Bros. Aircraft Corp.	25th & Potrero Ave., San Francisco, Cal.	2 Fields (leased) Redwood City and San Carlos, 150 acres, hangar 80 x 75 Redwood, 250 x 75 San Carlos	Good	5 J.N's 3 Williams
Willoughby Aeroplane Co.	Port Sewall, Fla.	Terminals (leased) Sewall Point and Newport, R. I.		3 Seaplanes
John P. Wood	Louisa, Ky.	Fields (leased) Louisa and Blaine, Ky., 10 acres	Good	2 S.J.-1 (W.) 2 J.N.-4-D (OX5)

NO. 1—Continued

Total No. Flights	Average Duration of Flights	Total Mileage	Passengers Carried	Lbs. of Freight	Charge per Short Flight	Charge per lb. of Freight	Charge per Mile Inter-city Flights	Operating Territory
1,500	1½ hr.	220,000						Operating throughout United States
205	15 min.	4,000	195		$ 5.00			
500	10 min.	10,000	450		10.00 for two			New York and Pennsylvania
300	10 min.	3,500	200	3,000	10.00			Louisville and Chicago
670	25 min.	16,000	97		10.00			Maine, New Hampshire, Massachusetts
840	20 min.	71,400	110					Washington, Dayton, Hampton, Va.
860	20 min.	11,000	450		5.00			
200	15 min.	8,000	200		5.00			Mississippi and Alabama
85		8,000						Privately operated Atlantic Coast and Hudson River
		220,000	320		10.00		$ 0.40	Pacific Coast States
3,000	20 min.	15,000	650		5.00		.25	Northern Illinois
200	15 min.	4,000	150		7.50		.60 day 1.20 night	Chicago to Florida
472	28 min.	10,000	308		5.00		.25	
60	60 min.	5,000			10.00			
250	30 min.	12,000						Experimental and transportation of personnel
	30 min.							Privately operated for pleasure
2,500	20 min.	60,000	3,000	12,000	10.00		.75	Kentucky and West Virginia

Name of Owner or Operator	*Address*	*Air Port Facilities*	*Shop and Repair Facilities*	*Equipment*
Wright Flying Co.	Paterson, N. J.	Terminal (leased) Port Washington, Long Island, 1 hangar	Excellent	1 Lo. A.Y. (W.H.) 1 W.P.-1 (W.H.) 1 *Seagull* (W.E.-4)
Operators reporting: 124	States in which they operated: 33	Total terminals: 162; including 132 land, and 30 water. Of the 162 total, 11 were publicly owned or controlled		429 in actual service, 200 in reserve, of 429 in service, 374 land types, 55 water

KEY TO AIRCRAFT AND ENGINE TYPES

Airplanes and Seaplanes

A. ..... Aeromarine Plane & Motor Co., Keyport, N. J.
A.-Navy ..... Aeromarine Plane & Motor Co., Keyport, N. J.
A.-39B ..... Aeromarine Plane & Motor Co., Keyport, N. J.
A.-40 ..... Aeromarine Plane & Motor Co., Keyport, N. J.
A.-44 ..... Aeromarine Plane & Motor Co., Keyport, N. J.
An ..... Ansaldo (Italian)
Av ..... Avro
Br ..... Breguet (French)
Bs ..... Bristol (British)
B.-1 ..... Boeing Airplane Co., Seattle, Wash.
C.L ..... Boeing Airplane Co., Seattle, Wash.
C.F ..... Curtiss Aeroplane & Motor Co., Inc., Garden City, N. Y.
Canadian J.N ..... Curtiss Aeroplane & Motor Co., Inc., Garden City, N. Y.
C.P. (Curtiss Pursuit) ..... Curtiss Aeroplane & Motor Co., Inc., Garden City, N. Y.
D.-Pusher ..... Curtiss Aeroplane & Motor Co., Inc., Garden City, N. Y.
D.H ..... DeHaviland
Fm ..... Farman—W. Wallace Kellett, Philadelphia, Pa.
Fk ..... Netherlands Aircraft Mfg. Co. (Fokker) New York City
F.P ..... Dayton Wright Company, Dayton, O.
F.-5-L ..... Navy
He ..... Heath
H.P ..... Handley Page (British)
H.S ..... Navy
H.S.-1-L ..... Navy
H.N.-1 ..... Huff Daland Aero Corp., Ogdensburg, N. Y.
H.O.-1 ..... Huff Daland Aero Corp., Ogdensburg, N. Y.
Hz ..... Hartzell
J.N.-4-D ..... Curtiss Aeroplane & Motor Co., Inc., Garden City, N. Y.
J.N.-4-H ..... Curtiss Aeroplane & Motor Co., Inc., Garden City, N. Y.
J.N.-6-H ..... Curtiss Aeroplane & Motor Co., Inc., Garden City, N. Y
J.L ..... J. L. Aircraft Corp., New York City
K.T. (Dayton Wright Chummy) ..... Dayton Wright Company, Dayton, O.
LeP. (Lepere) ..... Packard Motor Car Co., Detroit, Mich.
L.S. Tourabout ..... Lincoln Standard; Nebraska Aircraft Corp., Lincoln, Neb.
Lo.A.Y. (Loening Air Yacht) ..... Loening Aeronautical Engineering Corp., New York City
L.W.F ..... L. W. F. Engineering Co., College Point, N. Y.
L.V.G ..... Johnson Airplane & Supply Co., Dayton, O.
L.H.-2 ..... Longren Aircraft Corp., Topeka, Kan.
L.A.K.-21 ..... Longren Aircraft Corp., Topeka, Kan.
M.F. Flying Boat ..... Curtiss Aeroplane & Motor Co., Inc., Garden City, N. Y.
M.T.-2 ..... Lawson
Messenger ..... Lawrence Sperry Aircraft Corp., Farmingdale, N. Y.
N ..... Nieuport (French)
N.-28 ..... Nieuport (French)
N.-9 ..... Curtiss Aeroplane & Motor Co., Inc., Garden City, N. Y.
Orenco ..... Curtiss Aeroplane & Motor Co., Inc., Garden City, N. Y.
Oriole ..... Curtiss Aeroplane & Motor Co., Inc., Garden City, N. Y.
Pack ..... Packard Motor Car Company, Detroit, Mich.
Petrel ..... Huff Daland Aero Corp., Ogdensburg, N. Y.
Pn ..... Pioneer
Pol ..... Polson
R. B. Airliner ..... Remington-Burnelli Aircraft Corp., New York City
R.D ..... Rogers Day
Seagull ..... Curtiss Aeroplane & Motor Co., Inc., Garden City, N. Y.
S.J.-1 ..... Curtiss Aeroplane & Motor Co., Inc., Garden City, N. Y.
S.H.-4-H ..... Curtiss Aeroplane & Motor Co., Inc., Garden City, N. Y.
St ..... Sturtevant Aeroplane Co., Hyde Park, Boston, Mass.

NO. 1—Continued

Total No. Flights	*Average Duration of Flights*	*Total Mileage*	*Passengers Carried*	*Lbs. of Freight*	*Charge per Short Flight*	*Charge per lb. of Freight*	*Charge per Mile Inter-city Flights*	*Operating Territory*
50	1 hr. 24 min.	7,000	25					Transporting personnel Atlantic Coast
Total number of flights, 106,838	Average time of each flight, 30 + min.	Total miles flown, 3,014,611	Total passengers carried, 80,888	Pounds of freight carried, 208,302	Average charge per short flight, $5.50	Average charge per pound per mile for freight, .104	Average charge per mile for inter-city flights, .46	

Sal	Salmson (British)
S.V.A	Ansaldo (Italian)
Sp	Spad (French)
Sop	Sopwith (British)
Swallow	E. M. Laird Co., Wichita, Kan.
T.A.-2	Huff Daland Aero Corp., Ogdensburg, N. Y.
T.A.-6	Huff Daland Aero Corp., Ogdensburg, N. Y.
Vt	Chance Vought Corp., Long Island City, N. Y.
V	Walter T. Varney, San Francisco, Cal.
Viking Amphibian	Vickers, Ltd., W. M. Huskisson, N. Y. C.
W.P.-1 (Wright Fighter)	Wright Aeronautical Corp., Paterson, N. J.
504-K	Avro (British)

ENGINES

An	Anzani.
At. Gall	Atlantic Galloway.
Bd	Beardmore.
B.M.W	German.
Bz	Benz.
C	Curtiss.
C.-6	Curtiss.
C.D.-12	Curtiss.
Cl	Clerget.
F	Fiat.
Gn	Gnome.
H.S	Hall Scott.
H.S. A.-5-A	Hall Scott.
I.F	Isotta Fraschini.
K.-6	Curtiss.
L	Liberty.
Law	Lawrance.
L.-6	Liberty.
LeR	LeRhone.
Mer	Mercedes.
N.L	Napier Lion.
OX5	Curtiss.
OXX3	Curtiss.
OXX6	Curtiss.
Pk. 825	Packard.
Pk. 1237	Packard.
R.R	Rolls Royce.
Ren	Renault.
S.J	Curtiss.
S.H	Curtiss.
S.P	Siddeley Puma.
V.-2	Curtiss.
W	Wright.
W.E.-2	Wright.
W.H.-3	Wright.

✓ – The possibilities of an eastern company

✓ – A company to look into for a job, but is not exactly in our line.

× – Asked for jobs in these companies.

? – Found company in telephone directory – took them up.

CHAPTER III

SUCCESSFUL NIGHT FLYING BY AIR MAIL REDUCES TIME BETWEEN OCEANS TO 26 HOURS AND 14 MINUTES—NATION-WIDE DEMAND FOR EXTENSION OF SERVICE

ON December 31, 1923, the Air Mail Service of the United States Post Office Department completed its fifth calendar year. The net results of its operations in that period may be summed up thus:

Demonstration to the World that aircraft can be properly and profitably put to economic use.

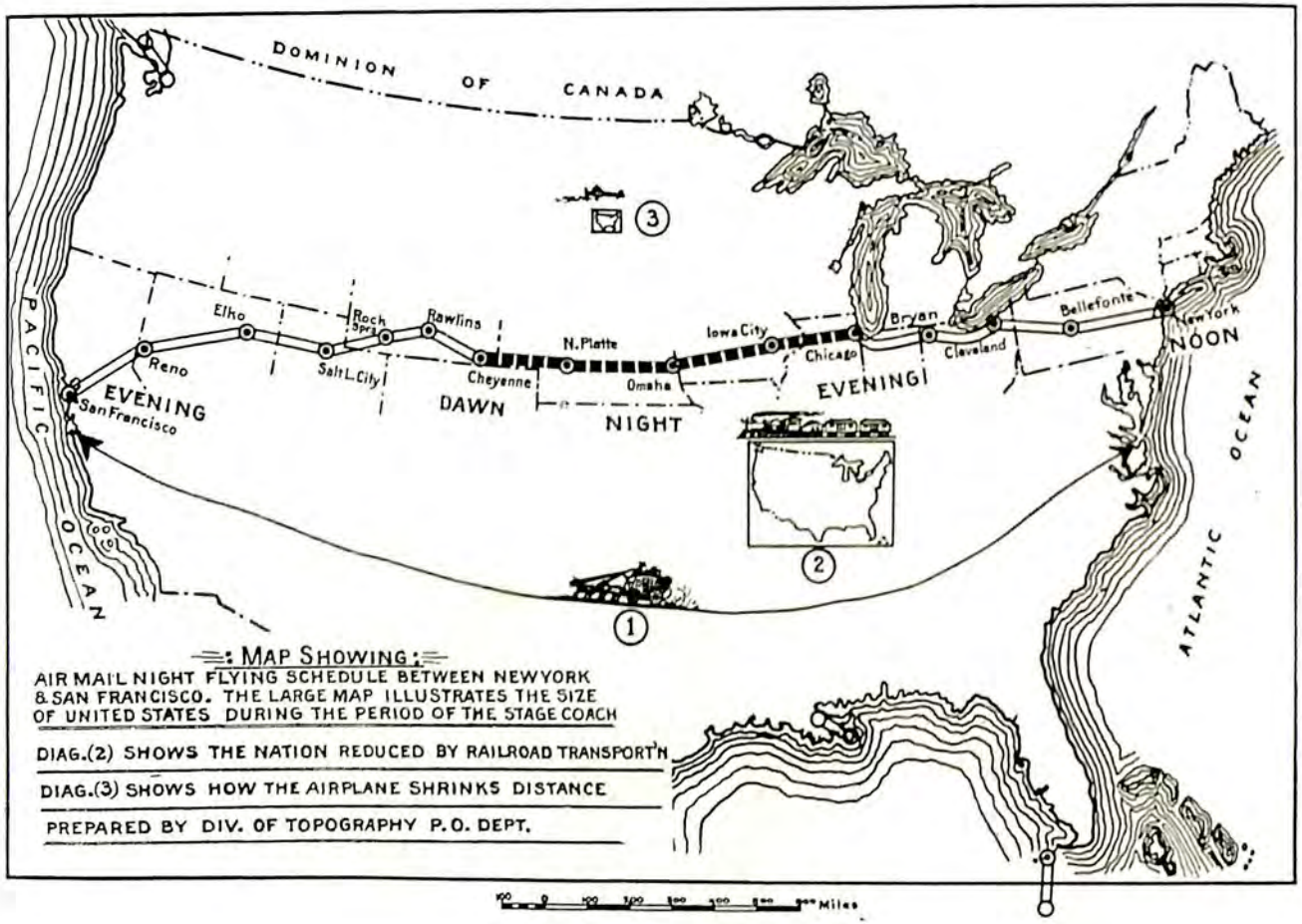
Establishment in the mind of the American public a genuine appreciation of and desire for the commercial utilization of aircraft.

Proof, beyond all question, that it is feasible to operate cargo-carrying aircraft on schedule time over vast distances, day and night, winter and summer.

Among those who may be justly regarded as pioneers in getting commercial aviation under way, it is impossible to place too much emphasis upon the importance of the Air Mail. It refutes the belief—which is aviation's worst enemy—that aircraft are solely or even primarily weapons of destruction. It appeals to patriotism, stimulates the imagination, and, through present demonstration, typifies all that is hoped for.

American Air Mail Service Unequalled

In Chapter XV, dealing with Foreign Aeronautics, it will be noted that nowhere else in the world has such a deliberate effort been made, as in the United States, to carry the mails by air. Indifferent attempts have been noted in various units of the British Federation of Commonwealths, in France, Germany, Russia, Italy and Japan, but nowhere, with the possible exception of Great Britain, has the approach to the experiment been made for the reasons which prompted the United States Government, on May 15, 1918, following joint recommendations by the aircraft industry, the Army Air Service and the Post Office Department, to establish an experimental route between Washington and New York. Those reasons may be summed up in the statement that America, looking beyond the period of the war, when flying necessarily was being developed to destructive ends, foresaw that if the art was to escape perversion and thus inevitable destruction through the revulsion of humanity against war, it must serve the ends of peace.



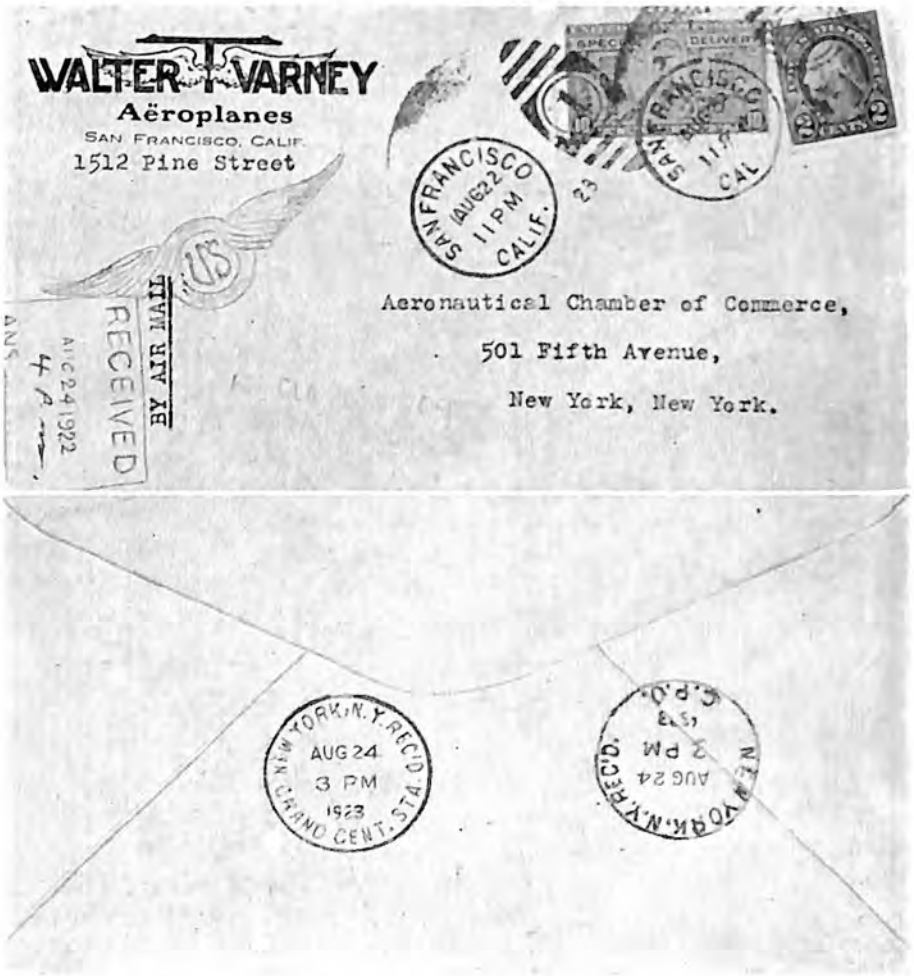
MAP SHOWING:

AIR MAIL NIGHT FLYING SCHEDULE BETWEEN NEW YORK & SAN FRANCISCO. THE LARGE MAP ILLUSTRATES THE SIZE OF UNITED STATES DURING THE PERIOD OF THE STAGE COACH

DIAG.(2) SHOWS THE NATION REDUCED BY RAILROAD TRANSPORT'N

DIAG.(3) SHOWS HOW THE AIRPLANE SHRINKS DISTANCE

PREPARED BY DIV. OF TOPOGRAPHY P.O. DEPT.



Completed correspondence, New York-San Francisco and back to New York, 72 hours and 13 minutes. The fastest mail train takes 91 hours for one way trip, terminal to terminal.

The European nations, with the general exception of the English-speaking Commonwealths in the British Empire, have approached the Air Mail from precisely the opposite standpoint. They regard it just as they regard air transport, which they have subsidized heavily, as a means to a military end. Air mail routes operated today by the French in North Africa, by the British between Cairo and Bagdad, by the Germans and Russians between Berlin and Moscow and on down through the Caucasus, as well as the recent trials in Japan are apparently, and in most cases, admittedly, an excuse for military training or occupation.

But it is not so with us. Our national security has been impaired through the neglect of Congress to define a national aviation policy. Among other things such a policy would conserve instead of permit the disintegration of the American aircraft industry. General commercial flying has been arrested and grave harm done the art through neglect by Congress to enact Federal regulatory and encouraging legislation. But in spite of this, and solely, it is believed, because it was established with the right concept in mind, the United States Air Mail is today not only unique in postal transportation, but it is actually the longest regularly operated airway in the world.

To the industry which has looked in vain for a conservative, constructive aviation policy, to the commercial operator shunned by capital because flying is un-legal (without law), the Air Mail is today the one encouraging sign that, notwithstanding legislative indifference or procrastination or departmental limitations, the American public wants aviation because it is useful and what it finds useful—if the industry can stick it out—it will pay for.

A Brief Survey Over Five Years

The New York-San Francisco Transcontinental line is 2,680 miles long. At various times since 1918, the Post Office Department has operated not only this line, but also the 218 mile section between Washington and New York, and the 630 mile route between the Twin Cities, Minneapolis and St. Paul, and St. Louis, via Chicago. Here is a recapitulation of the record, the complete tables of which will be found in the Appendix:

	1923	*1918–23 inc.*
Trips scheduled	8,072	33,060
Trips defaulted	225	2,157
Trips attempted	7,847	30,903
Trips uncompleted	111	984
Trips in fog, storm, etc.	3,745	12,118
Trips in clear weather	4,102	18,806
Miles scheduled	1,603,110	6,717,422
Miles flown with mail	1,545,280	6,168,395

	1923	*1918–23 inc.*
Miles test and ferry	325,142	983,850
Total miles flown	1,870,422	7,152,245
Percentage of performance	96.37	91.83
Number of letters carried	65,295,920	225,769,520
Cost of service	$1,910,422.54*	$6,204,643
Forced landings { Mechanical	175	1,549
Forced landings { Others	327	7,041

The percentage of efficiency during the five years has steadily increased. There have been times, especially in the winter of '23-'24, when the Air Mail planes operated on schedule in and out of Chicago on days when rail and water traffic was seriously interfered with and occasionally suspended.

In the first year 4,720,240 letters were transported over a route 218 miles long with flights of 2 hours duration. In the fifth year 65,295,920 letters were carried 2,680 miles, from Coast to Coast twice each day in elapsed time, during the night flying trials, of 26 hours. In the fiscal year, July 1, 1922-June 30, 1923, Air Mail pilots spent 18,907 hours 33 minutes in the air. All told, in the period 1918-1923, these pilots carried 225,769,520 letters, or nearly 3,000 tons.

This performance has not been equaled in any other country. It brought to the Post Office Department in 1922 and in 1923 the trophy established by Robert J. Collier, and awarded by the National Aeronautic Association, for the most notable contribution to the advance of aviation.

Private Operation of the Air Mail

Although the Air Mail has been operated by the Government, and probably will continue to be operated thus until the experimental period has been passed, it is the hope and expectation of Post Office Department officials and commercial aviation that, as soon as practicable, the service will be taken over by private operators. Two obstacles must be removed before this can be brought about.

First, there must be enacted by Congress, legislation regulating and encouraging the art (identified generally as the Winslow Bill) and also an act authorizing the Postmaster General to let contracts to private operators for the transportation of mail by air just as contracts are now made with the railroad and steamship companies.

Second, the physical appurtenances and safeguards to aviation, including air routes, terminals, communication, signaling and beacon devices, must be perfected and provided, together with facilities for dissemination of meteorological information, just as safeguards and certain common needs are supplied marine navigation as a national responsibility.

*Includes experimental night flying.

In the meantime, the Post Office Department is able only under clauses in the appropriations for the Foreign Mail Service and the Alaskan mails to let private contracts in a few instances and over comparatively short routes. The first contract was with Aeromarine Airways, Inc., for the 100 mile flight across the Florida straits between Key West and Havana. The second was with the Alaska Airways Company for the 84 mile trip between Seattle and Victoria, B. C., and the third, with the Gulf Coast Air Line, Inc., for service between New Orleans and Pilottown, La., a distance of 80 miles. The Alaskan experiment is conducted jointly by the Post Office Department and the Farthest North Airplane Company, 260 miles, between Fairbanks and McGrath.

The Seattle-Victoria Service

Operating Boeing flying boats, powered with the Liberty engine, the Alaska Airways Company between July 1 and December 31, 1923, made 42 round trips between Seattle and Victoria, making close connections with arriving or departing trans-Pacific steamers. Two hours were required for each round trip; 7,560 miles were flown, and 16,672 pounds of mail (666,880 letters) were transported. On July 26th a special mail trip was made to Vancouver to deliver official mail to President Harding, returning from Alaska on the U. S. S. *"Henderson."* The contract price of the Seattle-Victoria service is $159 a round trip, not exceeding an average of 12 a month.

New Orleans to Pilottown

The Gulf Coast Air Line, Inc., operating two HS-2-L and two Curtiss MF (Wright engined) flying boats, made 85 round trips from July 1 to November 30, 1923, between New Orleans and Pilottown, which is the quarantine stop for steamers. All told, the mileage has been 17,600. Twenty-one thousand pounds of mail (840,000 letters) was carried. The contract price of the New Orleans-Pilottown service is $90 a round trip, daily, except Sundays and holidays.

Many Days Saved on Foreign Mail

In both the New Orleans and Seattle services, trips are made according to train and steamer schedules. Connections are thus possible which sometimes save as much as five or six days in correspondence traveling to or from the Orient or Mexico and Central and South America. Both operators are permitted to carry passengers, 10 being carried on the Seattle route during the six months period and 60 on the New Orleans in five months.

Airplane vs. Dog-Team in Alaska

To illustrate that fame, and it is to be hoped ultimately fortune, comes to the pioneer first on the job, the case of C. B. "Benny" Eielson may be cited. Eielson appeared in Fairbanks, Alaska, with a Curtiss JN. He found both public interest and private capital and when the long-standing desire on the part of the Post Office Department to try the Air Mail in Alaska approached realization, Eielson naturally got the contract.

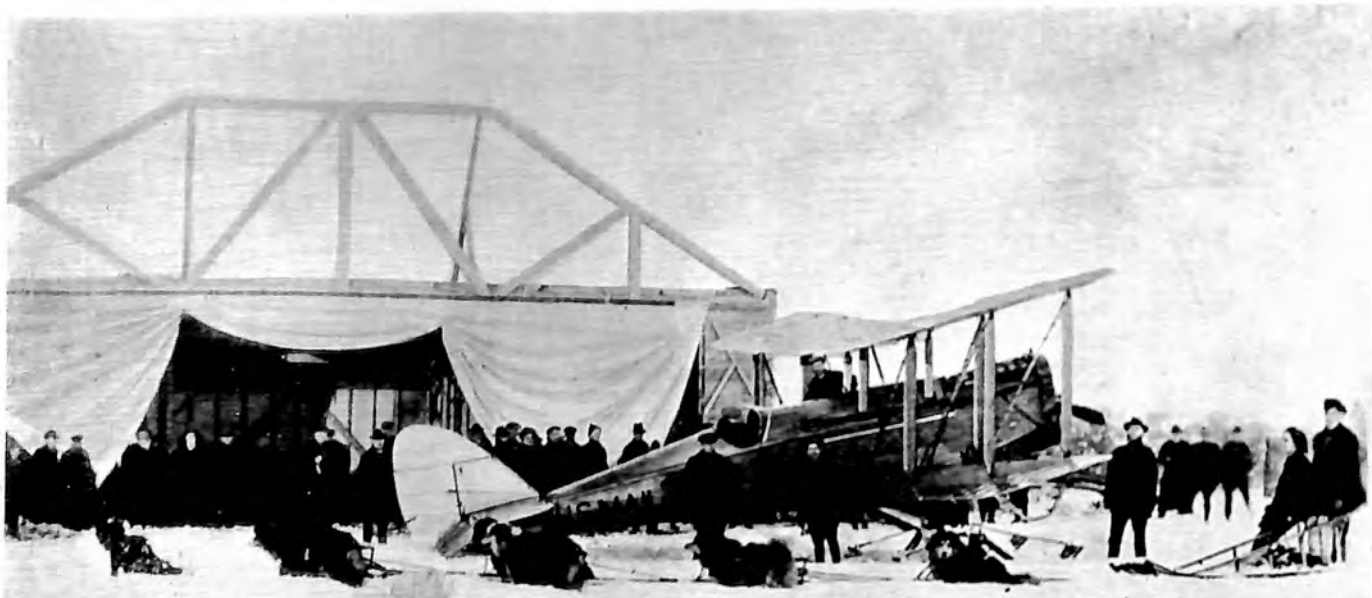
This was the situation. Alaska, with its sparse population, great distances over rough terrain and severe climatic conditions presented a serious problem insofar as economical, swift and regular mail delivery was concerned. From seaports or, more recently, from points on the Government railroad, dog team mail routes wandered forth into the winter storms, to reappear weeks later after having delivered and received a maximum team load of 800 pounds of mail. In the summer, transportation overland or by water route was even more precarious.

One such dog-team route was between Fairbanks and Iditarod, 421 miles. Every seven days teams would leave and in thirty-five days, if all went well, they would return. The contractor received $1,022 for each round trip. About 50 miles from Iditarod is the important settlement of McGrath and it was determined by the Post Office Department to make its flying experiment between this point and Fairbanks, 371 miles by dog-team, 260 miles by air.

Skiis Replace Wheels on Airplanes

The Department shipped a standard Air Mail De Haviland, 400 h.p. Liberty to Eielson at Fairbanks. The plane was set up on February 20, 1924, and at 8:45 a.m. on February 21, Eielson took off. In his report to the Department Eielson gives a picturesque account of the difficulties encountered. It was 5 degrees below zero. His field was three feet deep with fine, powdery snow. Although loaded with only 164 pounds of mail, the plane made a long run before leaving the ground. The skiis dug into the snow a foot and a half and the engine was turning 1450 r.p.m. (over 400 h.p.) before the plane actually arose.

Eielson took with him ten days' provisions, a mountain sheep sleeping bag, five gallons of oil, snow shoes, a gun, an axe and a quantity of repair parts for his ship and engine. He wore two pairs of heavy woolen hose, one pair of caribou socks, moccasins extending over the knees, one suit of heavy underwear, khaki breeches, heavy trousers of Hudson Bay duffle, heavy shirt, sweater, marten skin cap, goggles, a loose reindeer skin parka, with a hood of wolver-



ALASKA'S MAIL SERVICE
YESTERDAY AND TODAY

Aviator Eielson with Alaska's First Air Mail
Fairbanks-McGrath 300 miles
Feb. 21st, 1924

Twelve hours by air; 35 days by dog team. Example of what Air Transport means to Alaska.

ine skin, the fur of which does not frost, woolen gloves and fur mittens. "But I soon found," he wrote, "that I was dressed for 40 below instead of five."

Eielson knew the country well. For the first fifty miles he followed the Tanana river, then set a straight course overland. Magnetism in his engines, which he subsequently corrected, put his compass out 40 degrees, so that for the first trip the instrument was useless. Two hours and 50 minutes after leaving Fairbanks, or at 11:35 a. m., he landed on the Tacotna river at McGrath. After lunch he loaded on 60 pounds of mail—all that there was—fuel, oil, etc. There being no mechanic at the settlement, he had to swing the propeller of the Liberty himself—a stiff job, with a little precarious assistance from volunteer helpers.

Lost in the Arctic Darkness

In February, in that part of Alaska, dusk gathers at 5:10 p. m. It was, consequently, comparatively late, when, at 2:35 p. m., he took off for Fairbanks. Night came even earlier, and, with his compass wrong, he got off his course. Unable to distinguish landmarks familiar by day he became completely lost. After hours of flying he saw a tiny point of light. Dipping low he recognized it as coming from a trapper's cabin on the Chatanika river, but it was impossible to land there. After more blind flying he saw on the horizon a dim glow and drawing nearer he found that it was a flare on his Fairbanks field. Wind conditions were bad and the field was so poorly illuminated that on landing, he broke a skid and his prop.

"As in McGrath," he wrote the Department, "the whole town was waiting for the return mail. It was 6:45 when I landed at Fairbanks, having been 4 hours and 10 minutes coming in. Altogether that day I was in the air seven hours, flying a distance equal to that from Fairbanks to Siberia. What this meant to Alaska, where it requires a month at least to travel by dog from Fairbanks to Nome, is easy to realize."

Eielson's next trip was March 1st—zero in Fairbanks and 5 below at McGrath. He took off at 8:15 a. m. with 252 pounds of mail and in 3 hours and 15 minutes, or 11:30 o'clock, he landed at McGrath. From McGrath he received 154 pounds of mail, taking off at 12:55 and arriving at 5:15. His third trip ten days later (his contract calls for trips every ten days) required 2 hours and 55 minutes out from Fairbanks and 3 hours and 40 minutes back—a consistent reduction in time. For each trip, Eielson receives $920, a slight saving on the cost of the dog service but an almost incredible reduction in time—six or seven hours for the round trip by air as

contrasted with 35 days by sledge—with the plane on its three trips a month capable of carrying three times as much weight as one dog-sledge.

Three distinct honors—each in its way the highest which it was in the power of the donors to confer—have been received by Eielson. The Indians, who came from many miles, christened him "The Moose Ptarmigan." The business men gave him a gold watch and elected him an honorary member of the Fairbanks Igloo of Pioneers, the last previous honorary member being President Harding. President Coolidge, after Postmaster General New had read Eielson's report at a Cabinet meeting, wrote as follows:

"I congratulate you on the conspicuous success of your undertaking. Your experience provides a unique and interesting chapter in the rapidly developing science of aerial navigation."

The Night Flying Experiment

Upon accepting the office of Second Assistant Postmaster General, Col. Paul Henderson requested the Aeronautical Chamber of Commerce to make suggestions. The principal and most obvious recommendation was that, although the Air Mail justified itself from the standpoint of national aviation, it could not command recognition as a commercial means of transportation until it operated by night as well as by day. This was precisely the conclusion at which the Second Assistant Postmaster General, who for some years was engaged in surface transport, had arrived. From that time on the energies of the Air Mail Service were directed toward night flying.

Colonel Henderson's first act was to engage, as special assistant to Carl F. Egge, the General Superintendent, an engineer, in the person of J. V. Magee and make him responsible for the study of the problems presented. A pilot and plane were assigned to Mr. Magee, whose initial step was a Coast to Coast trip for the purpose of selecting that portion over which night flights should be attempted.

The transcontinental route in the course of its 2,680 miles crosses three mountain ranges, the Alleghenies on the Eastern Seaboard, the Rockies and the Sierra Nevada, on the Pacific Coast. Daylight flying had demonstrated that a thousand mile flight from either Ocean would carry the mail to the verge of the Mississippi Valley, on the plains and prairies of which countless natural landing fields were to be found. This, clearly, was the section to be traversed by night, as several years previous, during the administration of Second Assistant Postmaster General Otto Praeger, a night flight had been successfully made between Cheyenne and Chicago by Pilot Jack Knight.

Laboratory Work and Construction of New Equipment

The principal tasks confronting the Department may be summarized thus:

1. Laboratory and research work on illuminating apparatus.
2. Survey and actual illumination of the airway.
3. Design and construction of new flying equipment.

It is a curious and significant fact that the first task involved, on behalf of commercial aviation, a reversal of military aviation as practised during the war. Aircraft flying at night on a mission of destruction operate without lights from a darkened field. Aircraft flying at night on business require the scientific application of illumination.

The Department called upon the General Electric Company, Sperry Gyroscope Company and the American Gas Accumulator Company for technical assistance and also obtained valuable data from the laboratories of the Army Air Service at Dayton, O., and the National Advisory Committee for Aeronautics at Hampton, Va.

The Aeromarine Plane and Motor Company, Curtiss Aeroplane and Motor Company, the Glenn L. Martin Company and the Wright Aeronautical Corporation designed and manufactured three new types of mail aircraft and engine. In addition, at the Department repair depot at Maywood, Ill., a standard De Haviland was modified in an effort to meet the new and more exacting requirements.

The Night Flying Section

Before attempting a detailed description of the equipment there should be visualization of the 885 mile section, between Chicago, Ill., and Cheyenne, Wyo., over which it was determined to fly at night. Early in February, 1923, experimental flying was begun at the North Platte, Neb., field of the Central Division, which is under the direction of Superintendent D. B. Collyer. Utilizing lighting equipment then available, volunteer flights were made back and forth, without publicity, without boast, without promise, even, of success. Pilot H. T. Lewis, long familiar with the Allegheny section; J. H. Knight, who was the first night pilot in the Department, and Pilots Frank R. Yager, J. F. Moore, E. F. White and E. M. Allison were the mainstays at this period and their enthusiasm and energy were further supplemented by the devotion of the mechanics who, with little public commendation, worked long hours for many weeks before the final successful flights in August.

The Air Mail route between Chicago and Cheyenne is almost a

straight line. Regular established fields, in addition to Chicago and Cheyenne, include Iowa City, Ia., and Omaha and North Platte, Neb. Distances between these five main stations are: Chicago-Iowa City, 195 miles; Iowa City-Omaha, 230; Omaha-North Platte, 245; North Platte-Cheyenne, 215.

Every 22 to 25 miles were established emergency fields, as follows: In Illinois—North Aurora, McGirr, Franklin Grove, Rock Falls, Cordova; in Iowa—Dixon, Atalissa, Williamsburg, Montezuma, Reasoner, Des Moines, Earlham, Casey, Atlantic, Oakland; in Nebraska—Yutan, Wahoo, David City, Osceola, Central City, Grand Island, Shelton, Kearney, Elm Creek, Lexington, Gothenburg, Paxton, Ogallala, Big Spring, Chappell, Dix; in Wyoming—Pine Bluff, Burns. These total 34. Of these Rock Falls, Des Moines, Grand Island and Sidney were equipped with supplies.

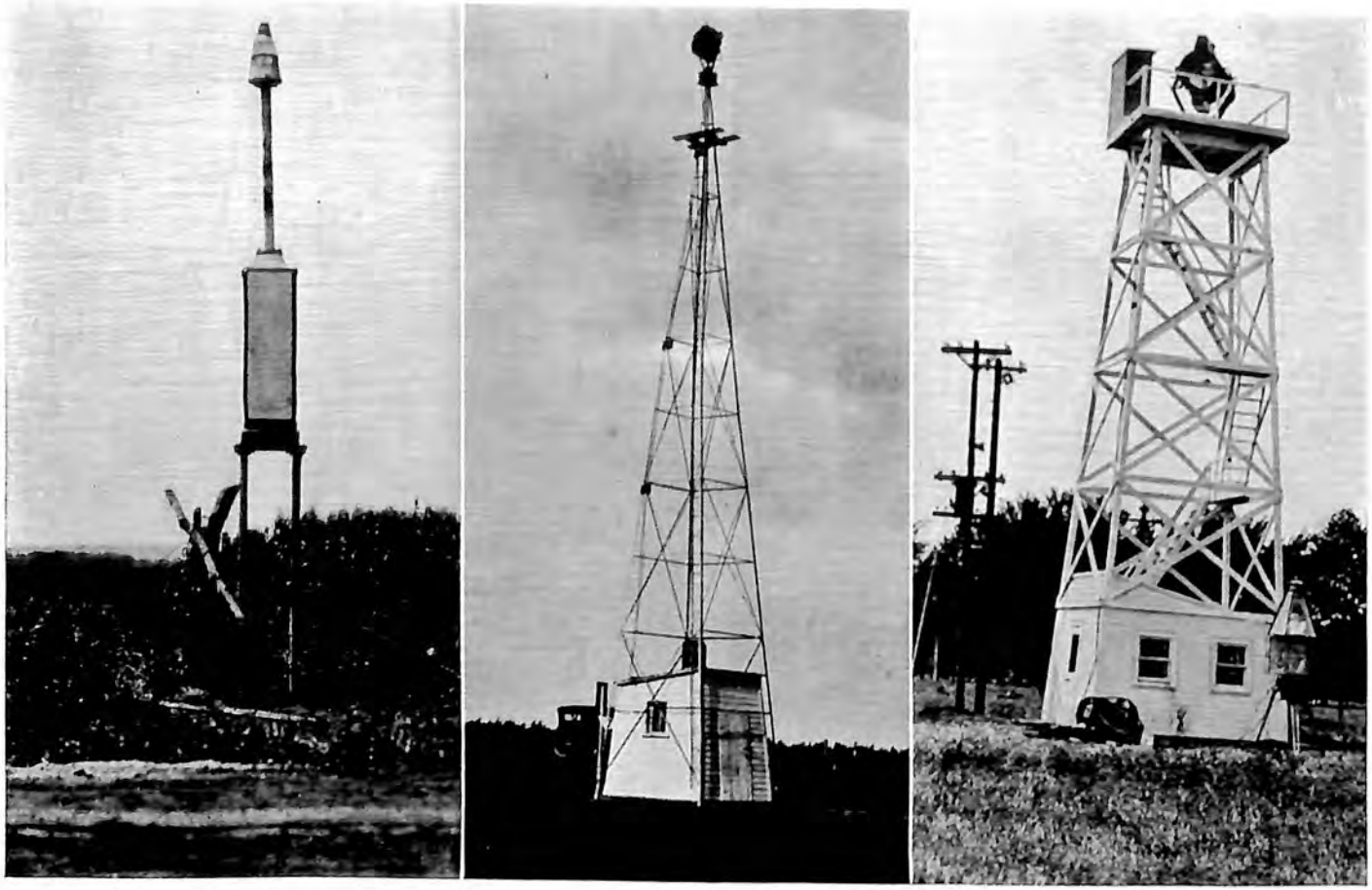
Gas and Electric Lighting Equipment

At each of the five main fields, 36-inch electric arc Sperry beacons on 50-foot towers, revolved completely around the horizon three times a minute, casting a 450,000,000 candle power beam 150 miles into the darkness. Another Sperry light of similar type flooded the runways of the field, in the center of which, flush with the surface of the ground, but protected by an iron grill, was a cluster of piercing red lamps. Upon the roof of the hangar, so lighted as to be visible a thousand feet or more, floated the fabric wind cone. Other buildings, radio towers and the boundaries of the entire reservation were outlined.

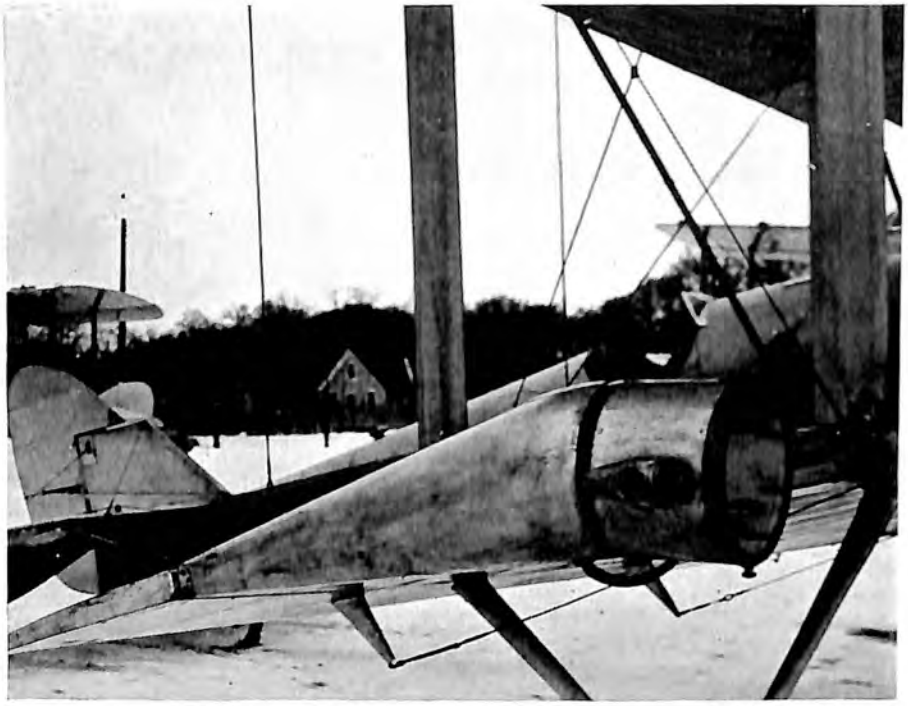
At the 34 emergency fields 18-inch incandescent General Electric beacons, mounted on fifty-foot towers, cast a 5,000,000 candle power beam completely around the horizon every ten seconds. All emergency fields were equipped with the bundary limitation lights of the American Gas Accumulator Company. These lights of acetylene gas, and of 5,000 candle power, flashed automatically 150 times a minute. In addition to the 260 beacons thus used on the fields, 273 more flashed every three miles along the entire course from Chicago to Cheyenne.

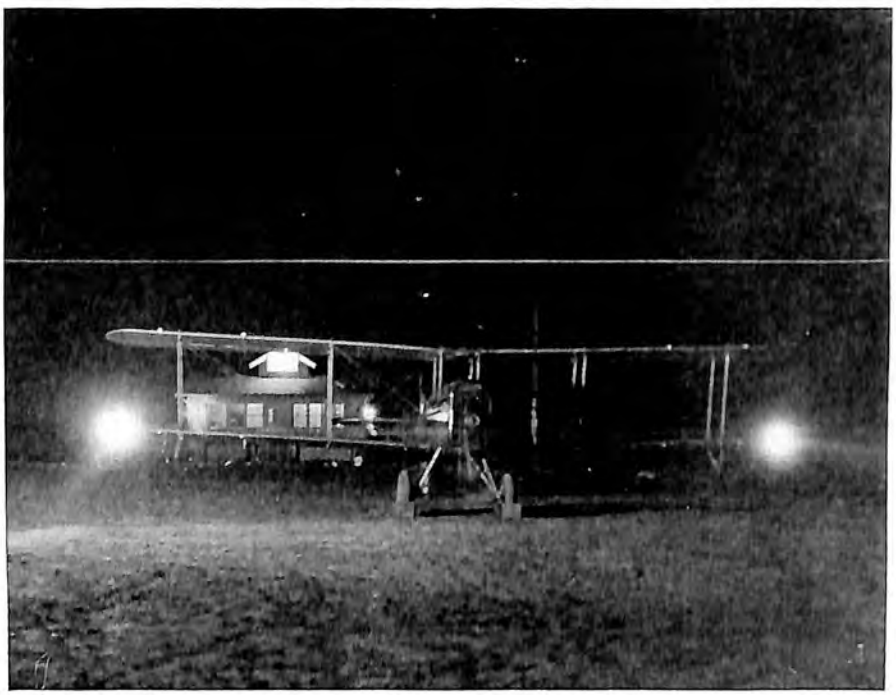
The Great Sperry Beacon

The great beacon of the Sperry Gyroscope Company was set to revolve a fraction of a degree above the horizon. Pilots have picked up this light at 130 to 150 miles, which probably establishes a record for range for a navigating beacon of any sort. This beacon, equipped with a special dispersing lens front door which spreads the light over 3,000 feet of ground but to a depth not greater than several feet, was also used as a landing light. Here are the comparative figures:



Types of lights illuminating the Night Air Mail between C hicago and Cheyenne. *Left to right*—American Gas Accumulator Flash; General Electric 5,000,000 candlepower beacon; Sperry Gyroscope 450,000,000 candlepower beacon.





Above—Type of General Electric wing tip lights for landing at night. *Below*—Air mail plane with wing tip lights burning.—Photos, Dewell, Omaha.

	Beacon	*Landing Light*
Source of light	Sperry High Intensity Arc.	Sperry High Int. Arc
Current	150 Amps. D. C.	150 Amps. D. C.
Arc voltage	75	75
Candle power	450,000,000	10,000,000
Angle of spread beam	2 degrees	2 degrees vertical 40 degrees horizontal
Size of reflector	36 inches	36 inches

AGA Beacons Mark the Course

The AGA acetylene beacons of the American Gas Accumulator Company astonished the pilots by demonstrating visibility up to 10 miles. Being stationed only three miles apart, the effect of these beacons, showing a flash of one-fifteenth of a second at intervals of one-third of a second, was to supply a constant glow, close to the ground which was demonstrated of great help on nights of low visibility. The AGA beacons are a development of a Swedish light applied by the British Air Ministry to the London-Paris route. An ingenius contrivance shuts off the light by day and releases it at night or during very dark days. The lights require attention only at five-month periods.

General Electric Resources Called Upon

The General Electric Company made available to the Department its engineering and laboratory facilities at Schenectady, at the Edison Lamp Works in Harrison, N. J., and at Nela Park, Cleveland. Pilot Lewis spent much time with General Electric engineers who, in addition to the 18-inch electric beacon, devised and produced a new and satisfactory type of wing head light for the use of planes about to make a landing.

Each G. E. incandescent revolving 5,000,000 candle power beacon, at the 34 emergency fields, is mounted on a fifty-foot tower. It has a capacity of 900 watts. A 28-32 volt lamp is used. The visibility, which because of the close location of the fields, could have safely been as low as 30 miles, actually was demonstrated to be from 50 to 80 miles. The beam of this light has a divergence of 2 degrees or 150 feet per mile. Sixty-five miles distant, this beam is 10,000 feet in diameter. The length of flash in the center of the beam is one-twelfth of a second. Pilots operating at night have commented on the peculiar brilliancy of this light, its regularity and the alternate dim and bright period of the flash. As most of these beacons were at remote spots where no commercial current was available, a 32 volt 1250 watt farm lighting set was operated in the base of the tower, which also served as shelter for the caretaker.

The Flying Equipment

The experimental orders given aircraft and engine manufacturers by the Department involved such engineering, at a time when military requirements commanded much of the factory resources, that none of the special equipment could be put through its test-flying period in time to be used in the August experiment, although the Aeromarine, Curtiss and Glenn L. Martin types, together with the Departmental job from Maywood, were shortly afterward placed in active night commission.

The Aeromarine Plane

The Aeromarine Plane and Motor Company designed and built around the standard 400 h.p. Liberty, an all metal ship which had many novel features and rugged strength of appeal to the pilots. Delivery was made in 122 days from the signing of the contract. Its outstanding characteristics are the uniform use of steel and duralumin, freedom of mail cockpit from control wire interference, the Aeromarine high-lift wind and many detailed refinements in the application of metal, in the reduction of fire hazard and in the normal safety of the pilot.

Specifications of the Aeromarine are: span, 50 ft.; length overall, 32 ft. 11 in.; height overall, 12 ft. 9 in.; wing area, 540 sq. ft.; mail compartment capacity, 45 cu. ft.; gas tank (2), 100 gal.; oil tank capacity, 12 gal.; weight (with water, 2875), (with full load, 4450 lb.); normal loads, (mail 600), (gas and oil 665), pilot 180, fire fighting equipment, 35, electrical equipment, 95, (total normal load 1575); high speed, 116 m.p.h.; low speed, 44 m.p.h.; climb with 600 lbs. of mail, 6500 feet in ten minutes; service ceiling, 17,000 feet.

The Curtiss Night Mail Plane

In undertaking the design and construction of a night mail ship, the Curtiss Aeroplane and Motor Company placed safety as the first requirement, safety being, in the last analysis, the key to reliability. The engineers were justified, for trial flights demonstrated that the ship, purposely high in its factor of safety, exceeded also its estimated performance. Although designed to carry but 300 pounds of mail, 500 actually were carried. Designed for low landing speed—44 miles an hour—in flight the plane actually developed a high speed fully loaded of 106 m.p.h. That this should have resulted may be attributed to the generally clean design, to the installation of wing-type radiators and the use of the Curtiss-Reed duralumin one-piece propeller and the Curtiss C-6 engine which, with its 163 h.p., was

capable of carrying the plane, loaded, for five hours, or 425 miles, at cruising speed.

General specifications of the Curtiss night mail plane are as follows: total length, 26 ft. 11 in.; span, 33 ft.; chord, 6 ft.; gap, 6 ft.; height overall, 10 ft. 3 in.; total wing surface, 364.84 sq. ft.; dihedral, 1½ deg.; sweepback, 5 deg.; incidence, 2 deg.; weight empty, 1704 lb.; useful load (mail or passengers), 300-500 lbs.; fuel and crew, 520 lb.; weight loaded, 2524 lb.; weight of plane per b.h.p., 10.45 lb.; total load per b.h.p., 15.5 lb.; weight carried per square foot of wing surface, 6.91 lb.; propeller dimensions, 9 ft. diam.; maximum speed, 106 m.p.h.; minimum speed, 44 m.p.h.; climbing speed, 5600 ft. in 10 min.; service ceiling, 12,000; gliding angle, 1 in 8; type of motor, C-6 (163 h.p.); number of hours service before overhaul, 100; approximate life of motor, 500; capacity of fuel tanks, 48 gal.; range of action, 3½ hr. full throttle, 5 hr. cruising.

The Glenn L. Martin Night Mail Plane

The Glenn L. Martin Company designed and constructed a ship around the Wright E-4 200 h.p. engine. Demonstration flights at Omaha proved that this plane, lifting 4361 pounds, of which 715 pounds were mail, climbed 3600 feet in 10 minutes. Over a measured course a high speed of 105.5 m.p.h., developed, with a landing speed of 38 m.p.h. The Martin ship employed the new Martin wing curve and embraced other original features.

Characteristics of the Martin plane follow: span, 42 ft.; length overall, 28 ft.; height, 12 ft. 1 in.; gap, 6 ft.; chord, 5 ft. 4 in.; wing area, including ailerons, 430 sq. ft.; stabilizer, 30 sq. ft.; elevator, 25 sq. ft.; rudder, 12 sq. ft.; fin, 10 sq. ft.; high speed, 105.5 m.p.h.; low speed, 38 m.p.h.; motor, Wright E-4, 200 h.p.; altitude in 11 min., 6,000 ft.; absolute ceiling, 17,000 ft.; weight, empty, 2,020 lbs.

The Week of Experiment

The Department, in the course of the year's development, organized the following corps of expert night pilots: Ernest M. Allison, L. H. Garrison, W. C. Hopson, J. H. Knight, Harold T. Lewis, James F. Moore, Dean C. Smith, Frank R. Yager, R. G. Page and E. F. White. Page and White were in reserve. Each plane of the above ten pilots was equipped with headlights, adjusted to the angle desired by the pilot, flying lights of red and green and a piercing white tail light wired for flashing in the Morse code.

The experiments, so long and eagerly looked forward to, began on Aug. 21st. As dusk gathered that evening between the Great Lakes and the Rockies, illumination of the first night airway in the

history of the world was begun. Gathered on the great field at Fort Crook, some 12 miles from Omaha, were several thousand spectators, including the official delegation of Post Office and military officials, representatives of the aircraft firms constructing special equipment, officials of the Aeronautical Chamber of Commerce and the mail and express traffic managers of the New York Central Lines, the Pennsylvania Lines, the Chicago, Burlington & Quincy and the Union Pacific. With Col. Henderson were General Superintendent Egge, Mr. Magee and Division Superintendent Collyer.

The scene was impressively beautiful—the orderly stillness of the military post, the emptiness of the vast field and vaster sky, the busy workers on parachutes, planes and lighting apparatus about the hangars, the powerful sweep of the huge beacon, the twinkle of boundary and obstacle lights, the soft flapping of the wind cone, and, more than all, the confident expectancy of the officials and men, from Henderson down to the mechanics solicitously inspecting the relay planes due to leave the instant the mail had been transferred.

All of those in the little official group could visualize the scene along the entire 885 mile stretch. As the shadows gathered the five big beacons, the 34 lesser ones and the hundreds of blinking gas posts, one after the other, had been set into operation. These beams, from the nine mile radius of the littlest to the 150 mile range of the largest, crossed and recrossed each other's path, silently, accurately registering in the heavens the route of the Night Air Mail.

Into this path of light two planes had entered at twilight. About midnight, if all went well, they should pass each other somewhere in the region of Fort Crook, hence the concentration of the official party at that point. And from this path of light they should emerge at dawn. Those were long hours between dinner and midnight for the watchers at Fort Crook, for on this experiment depended a practical demonstration of the true utility of aircraft. But of those present apparently the least concerned were the men who were doing the job. They knew what they were about.

The Tentative Schedule Set Up

Col. Henderson had set up a tentative schedule of operations which called for 28-30 hour transcontinental flights.

Westbound
(Day)

Leave		*Arrive*	
New York	11:00 a. m. ET	Cleveland	3:45 p. m. ET
Cleveland	4:00 p. m. ET	Chicago	6:45 p. m. CT

Left—"Dinty" Moore, winner Detroit News Air Mail Trophy, St. Louis. *Right*—Plaque given by Detroit Aviation Society to the Air Mail Service.

(NIGHT)

Chicago	7:00 p. m. CT	Omaha	11:45 p. m. CT
Omaha	12:01 a. m. CT	Cheyenne	4:15 a. m. MT

(DAY)

Cheyenne	4:30 a. m. MT	Salt Lake City	9:45 a. m. MT
Salt Lake City	9:00 a. m. WT	Reno	2:00 p. m. WT
Reno	2:15 p. m. WT	San Francisco	4:15 p. m. WT

Eastbound

(DAY)

Leave		*Arrive*	
San Francisco	6:00 a. m. WT	Reno	8:00 a. m. WT
Reno	8:15 a. m. WT	Salt Lake City	2:15 p. m. MT
Salt Lake City	2:30 p. m. MT	Cheyenne	6:30 p.m. MT

(NIGHT)

Cheyenne	6:45 p. m. MT	Omaha	12:45 a. m. CT
Omaha	1:00 a. m. CT	Chicago	5:30 a. m. CT

(DAY)

Chicago	5:45 a. m. CT	Cleveland	10:15 a. m. ET
Cleveland	10:30 a. m. ET	New York	3:15 p. m. ET

THE ACTUAL PERFORMANCE

At about 10 o'clock the military guard set at the entrance to the field parted the crowd of spectators and opened the gates for the mail truck from the Omaha postoffice. A lookout was kept on the Sperry tower. This watcher was the first to discern the navigating lights of the westbound plane when it was still possibly twenty miles distant, flying a thousand feet or so over the farmlands of western Iowa. Swiftly, steadily, with the sureness of an arrow, the plane approached as if there was some irresistible power in the white shaft of light to draw the pilot, like a night bird, straight into its blazing pit. The rhythmical hum of the motor became louder, clearer, nearer, then the outline of the ship against the darker sky was discerned. By signal, and as if by simultaneous movement, the beacon was shut off and the landing arc on its mobile platform spewed out a flood of light. Then this, too, was darkened, and the pilot, switching on his headlights and throttling his motor, glided confidently down toward the ruddy bowl of electricity which he knew marked the exact center of the field. He made a perfect three-point landing and taxiied amid a swirl of grass and dust to the relief plane and truck.

With admirable discipline and dispatch free from confused haste, the cockpit was opened, the mail bags tallied out by clerks who

called the destinations just as they are called by the sorters in the Railway Mail Service. The outgoing mail was checked into the new plane whose prop was slowly turning. At a word, the engine roared, the exhausts spat fire, the blocks were jerked from beneath the wheels and in scarcely three minutes from the time one plane arrived from Chicago the relay plane was up and out of sight in the darkness to the west.

With the exception of the daylight plane fogbound at Laramie, which caused a corresponding delay on one eastbound night trip, this was the record on each of the four nights of the experiment. Here are the times:

Eastbound

Aug.	*21*	*22*	*23*	*24*	
Left	5:59 A	5:26 A	6:00 A	5:28 A	San Francisco, Cal. W. T.
Arrived	7:46 A	7:07 A	8:06 A	7:19 A	Reno, Nev.
Arrived	10:14 A	9:24 A	10:29 A	9:37 A	Elko, Nev.
Arrived	12:13 P	11:15 A	12:26 P	11:28 A	Salt Lake City, Utah
Arrived	3:00 P	1:51 P	3:01 P	1:54 P	Rock Springs, Wyo. M. T.
Left	8:34 P	4:20 P	5:27 P	4:05 P	Cheyenne, Wyo.
Arrived	12:02 A	7:26 P	8:39 P	7:09 P	North Platte, Neb.
Arrived	3:16 A	10:21 P	11:27 P	10:29 P	Omaha, Neb.
Arrived	6:22 A	12:50 A	1:44 A	12:35 A	Iowa City, Ia. C. T.
Arrived	8:40 A	3:00 A	3:50 A	2:28 A	Chicago, Ill.
Arrived	....[1]	....[1]	....[1]	....[1]	Bryan, O.
Arrived	12:59 P	8:27 A	7:46 A	8:10 A	Cleveland, O.
Arrived	....[1]	10:19 A	....[1]	....[1]	Bellefonte, Pa. E. T.
Arrived	4:14 P	12:21 P	11:14 A	11:17 A	New York, N. Y.
Elapsed Trip Time:	Incomplete	27:55	26:14	26:49	

Westbound

Aug.	*21*	*22*	*23*	*24*	
Left	11:01 A	11:01 A	10:56 A	11:04 A	New York, N. Y.
Arrived	1:23 P	1:27 P	1:16 P	1:17 P	Bellefonte, Pa. E. T.
Arrived	4:14 P	3:53 P	3:34 P	3:41 P	Cleveland, O.
Arrived	5:05 P	....[1]	....[1]	....[1]	Bryan, O.
Arrived	6:50 P	6:09 P	5:59 P	6:17 P	Chicago, Ill.
Arrived	8:47 P	8:07 P	8:05 P	8:26 P	Iowa City, Ia. C. T.
Arrived	11:02 P	10:45 P	10:50 P	11:12 P	Omaha, Neb.
Arrived	1:29 A	1:22 A	1:40 A	1:47 A	North Platte, Neb.

[1]No stop.

Westbound

Aug.	*22*	*23*	*24*	*25*	
Arrived	2:50 A	2:54 A	3:34 A	3:38 A	Cheyenne, Wyo.
Arrived	11:16 A	7:00 A	6:46 A	6:52 A	Rock Springs, Wyo. M. T.
Arrived	12:53 P	8:33 A	8:24 A	8:31 A	Salt Lake City, Utah
Arrived	2:00 P	9:33 A	9:30 A	9:37 A	Elko, Nev.
Arrived	4:32 P	11:48 A	11:46 A	11:52 A	Reno, Nev. W. T.
Arrived	6:24 P	1:45 P	1:34 P	1:44 P	San Francisco, Cal.
Elapsed Time:	34:23	29:44	29:38	29:40	

26 Hrs. 14 Min. Eastbound; 29 Hrs. 38 Min. Westbound

"You will note," Col. Henderson wrote in his report to the Postmaster General, "that with the exception of the eastbound movement on the first day of the test, all of the schedules actually maintained are better from the point of view of speed than those which were tentatively established. As far as the night flying part of our test flights is concerned, our operation was 100 per cent. satisfactory. There were no forced landings, no defaults, no accidents, in fact, no near-accidents. The best time made eastbound on any of the four days was 26 hrs. and 14 min. The best time westbound was 29 hrs. and 38 min. Too much credit may not be given to the pilots and mechanics of the entire service, and particularly of the Central Division, for their enthusiasm, industry and intelligent co-operation during all four days of this test."

72 Hrs. 13 Min. for Completed Transcontinental Correspondence by Air

The Post Office Department reports numbers of instances of business mail making the round trip in an almost unbelievably short space of time. The Aeronautical Chamber of Commerce on Tuesday, August 21st mailed a business letter to Walter T. Varney, one of its members in San Francisco. The letter left New York at 11 a. m. Tuesday and was received by Mr. Varney in San Francisco at 6 p. m. Wednesday. Mr. Varney placed his answer in the plane leaving for the east at 6 a. m. Thursday and on Friday afternoon it was delivered to the Chamber's Executive Offices in New York. The elapsed time for the completed correspondence was 72 hours and 13 minutes. The fastest possible mail time by train one way is 91 hours; the average being from 100 to 120 hours. *The air time for the round trip across the continent—including 11 hours and 36*

min. lay-over in San Francisco—was thus actually 18 hours and 47 minutes shorter than the minimum time required for a letter to travel by train one way.

Congratulations from the President

Postmaster General New, members of Congress and other men in official life wired congratulations to Col. Henderson. President Coolidge himself, on receiving the reports from Mr. New expressed his gratification over the success and was declared to be in complete agreement with the Department's proposal to extend the delivery of Air Mail over long distances by means of night flying.

Col. Henderson's Recommendations

In his recommendations to the Postmaster General and in his address at the National Air Institute at St. Louis, Col. Henderson said:

"I think that the one outstanding conclusion arrived at is that it is feasible and practical to operate aircraft at night over properly lighted and prepared airways. I think that it is safe to conclude that speed practically equal to that made during the daylight hours may be maintained at night.

"I recommend to you that the Air Mail Service be authorized to open up this transcontinental service on a schedule not unlike that proposed for the test operation, at as early a moment as may be consistent with sound preparation. The first thirty days of this operation should, I suggest, be termed a thirty-day test, which would give opportunity for a recess in operation should there be developed during those thirty days details needing further correction.

"I recommend that the Post Office Department's air activities be confined to this route for a period of not less than one year, in order that the unknown factors of risk and hazard at night be determined.

"I recommend that postage be charged just as was originally planned, on the basis of three zones, with stamps for the first zone at 8 cents, for the second zone at 16 cents and for the third zone at 24 cents.

"It is impossible to forecast the revenue which may be derived from such a service. No sound estimate may be made now as to the volume of mail which will be offered for transport. Only the experience of several months will give us the figures upon which to base a statement as to the probable income from such a service. With the service established, it is necessary that the public be made aware of its reliability, its regularity and its advantages."

Effort to Determine Public Interest

Shortly before the night flying demonstration, and when questions of public interest and support were very much to the front, Col. Henderson addressed the following letter to the Aeronautical Chamber of Commerce:

"There come to the Post Office Department conflicting reports as to the value which the public is placing upon the Air Mail Service, and the data collected by the Department on such definite questions as the amount of interest

Above—Curtiss Night Mail Plane, Curtiss engine. *Below*—Glenn L. Martin Night Mail Plane, Wright engine.

Above—Aeromarine all-metal night mail plane. *Below*—Arrival of first night mail in New York.—Photos, Underwood and Underwood.

which might be saved by more expeditious handling of mail, etc., is very confusing. It has occurred to the writer that your association might be able to collect definite information as to what may be the business man's view of the Air Mail Service, and that your association might be able to clarify the more or less chaotic data which is now on file in the Department in the matter of definite savings on interest, etc. I will appreciate any information which you may be able to furnish on this subject."

In pursuance with this request, the Aeronautical Chamber of Commerce distributed the following questionnaire:

1. Have you given consideration to the way in which the United States mails can be further accelerated by the Air Mail Service and how your city may be benefitted thereby?
2. With what cities is the most of your commercial, industrial and financial business conducted? Give distances.
3. Approximately what is the weight, in an average month, of your *first* class mail? (a) Incoming: (b) Outgoing:
4. List the more important industries or commercial or professional activities in your city that are heavy users of the mails;
5. What was the amount of special delivery stamps sold in your city in 1922, or latest 12 month period for which records or estimates are possible?
6. Give approximate volume of parcel post business going from your city in 1922, or latest 12 month period? (a) Number of parcels: (b) Average size of each: (c) Average weight of each:
7. In terms of dollars, what is approximate annual business transacted by the banks of your city with cities enumerated in reply to question 2?
8. What is average amount of daily "float"?
9. If transportation were speeded up 50 per cent. by use of air mail, how much would be saved daily in (a) Reduction of "Float"? (b) Interest charges? (c) General business improvement?
10. Reliability of service by Air Mail has been demonstrated. Do you believe that, reliability assured, the merchants, manufacturers and bankers of your city would immediately recognize the advantages of the Air Mail?
11. It has been proposed that an immediate and practicable way to increase the usefulness of the mails would be to provide for a "Special Speed Postage Stamp," the affixing of which to a letter would assure its transmission and delivery by the fastest available means, aircraft, express train, motor car or fast steamer. Do you think such a service would appeal to your city?

The foregoing questionnaire was sent to 570 municipal chambers of commerce or boards of trade in continental and insular United States, all of which are fellow-organization members of the Chamber of Commerce of the United States. The list thus was placed directly before business men in cities ranging in size from New York and Chicago to remote towns in the sparsely settled states and territories.

Although examination and analyses of the replies have not yet been completed, it may be stated that 237, or 42 per cent., reported and of those reporting only nine cities (none of very considerable commercial importance) revealed themselves as being insensible to speeding up business by carrying more mail by air. In the case of New York, Chicago, Boston, Los Angeles, Atlanta, etc., efforts were made by the local organizations to obtain accurate data on "float," interest charges, etc. Analysis of the replies was proceeding at the time of publication of this book and it was expected that a complete report would be made by the Aeronautical Chamber of Commerce to the Second Assistant Postmaster General before night flying is resumed upon a permanent schedule.

Nation-Wide Support from the Press

It has been truly said that: "Nothing is easier to get than publicity for flying but nothing is harder than to get the right sort of publicity." There have been aeronautical events that were far more widely advertised *in advance,* than the night flying experiments, but certainly none got more of the *right sort* of news attention than did the Post Office Department's reduction to 26 hours of air mail time from Coast to Coast.

During the week that the trials were conducted, the Air Mail was on the first page of every newspaper in the United States. Thousands of words were handled by wire by the various press associations. Special correspondents were assigned to the various controls and public comment, while enthusiastic over the tremendous speed, looked beyond the mere fact that the postal map had shrunk to one-quarter its size scaled to railway schedules and discerned what great things this new art of commercial flying held in store for the nation.

Out of 650 editorials examined but six were critical or grudging in their praise. These 650 editorials came from newspapers and periodicals in 250 cities in all parts of the country. They proved that there was an overwhelming public demand for the Air Mail Service. They acknowledged that aircraft had demonstrated their utility. They gave wings to patriotism and, what is of much significance if one recalls that the fundamental mission of aircraft is to serve and not destroy, they commended the experiment as a constructive example to the world.

Space will permit selection of but a few excerpts:

"The practical value of the new service cannot easily be overestimated. For a great deal of correspondence, the saving of a few days may not mean so much, but when time is the essence of the contract—whether it be personal or business—it makes an enormous difference. On the business side it means

millions and millions of dollars. . . . Money will be quicker, the wheels of industry will be speeded up and trade in general will be greatly increased."—*San Francisco Bulletin.*

"The Air Mail Service, by keeping its planes flying in all seasons and in all kinds of weather, is quietly, and with scant governmental encouragement, developing air transit into a stable and effective medium of fast communication. Instead of the hostility of Congress, it should receive its full support for a transportation service of great potential usefulness."—*New York World.*

"In connection with the Air Mail subject, no more striking facts were deduced than that the cost of laying out a modern airway, complete with terminals, radio signals, lights and ground equipment, will not be more than $500 a mile. As against this, a modern railroad over the same stretch, from Chicago to Cheyenne, would cost not less than $75,000 a mile and would probably cost more. Some day we will get our mail delivered much more economically than now and the railroads will be limited to live stock, mine products and the like." —*Joplin, Mo., Globe.*

"That this new fleet of planes and flyers will come to the nation through the processes of peaceful developments, will be an additional satisfaction to all Americans. We are not building and maintaining a mighty air fleet of destruction as a threat to other nations. At the same time, should a foreign nation attempt an attack on our rights and liberty, the efficient air fleet of the United States Post Office Department would be available as a very effective first-line defense."—*Los Angeles, Cal., Times.*

"From Frisco to New York in 29 hours . . . right now Atlanta is just as far away from New York as Frisco . . . we must get a move on us." —*Atlanta, Ga., Georgian.*

"The sooner it is put on a basis of regular operation and the more rapidly it is extended to other routes besides the coast to coast route, the better for the nation."—*Chicago, Ill., Tribune.*

"The feasibility of fast air mail service has been demonstrated. As the utility of it shall become more fully realized, the service undoubtedly will be extended greatly until the *Journal* believes, all important centers will be reached by it. Distance may continue to lend enchantment to the view, but it will lose further its formidable aspect."—*Dallas, Tex., Journal.*

"The two oceans are brought only one day apart for purposes of written communication. Similar air service would reduce the communication distance of the northern and southern extremities of the country to half a day. The importance of this, in binding together distance in opposite sections of a great country can hardly be exaggerated. It will operate immediately for better business co-operation and that will mean increased prosperity, since the prosperity of the United States depends mainly on doing business with itself on a bigger scale. It will mean, too, better understanding and closer co-operation in matters more vital than business."—*Waukesha, Wis., Freeman.*

"The success of the transcontinental air mail will surely lead to the establishment of air mail routes between all leading centers of population."—*Portland, Ore., Oregonian.*

"The time is coming when the country will be crisscrossed with aerial mail routes and Evansville will be three hours from Chicago instead of three times that number, so far as the dispatching and receipt of important mail is concerned. The day is not far distant when it is probable that all first class mail will be carried by airplane, leaving only the bulkier and more unimportant mail to be transported by train."—*Evansville, Ind., Courier.*

"When history recording the event that transpired in 1923 is written, it

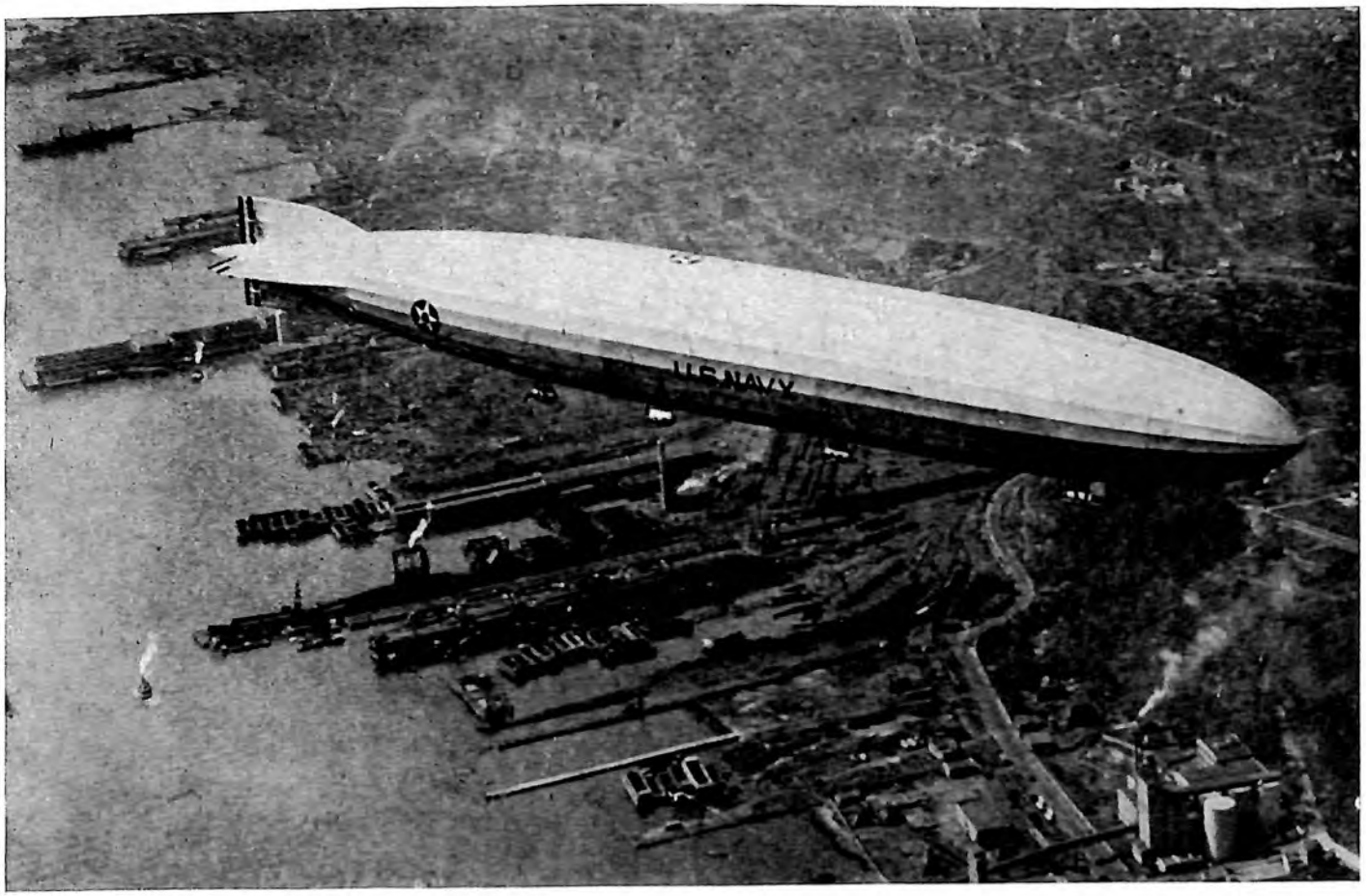
will contain the story of the evolution of the United States mail service." —*Christian Science Monitor, Boston, Mass.*

"The attempt of the Air Mail Service to demonstrate that a 30-hour schedule can be maintained between the Atlantic and the Pacific Coast has an epic character. A few staccato lines in news dispatches tell of feats of courage and fortitude great enough for an ode."—*Philadelphia, Pa., Public Ledger.*

Truly, the drama of peaceful evolution, for within the memory of thousands living this has been our progress in the transportation of transcontinental mail:

1850 *3 days by rail; 21 days by stage.*
1860 *2½ days by rail from New York to St. Joseph, Mo., and 8 days by Pony Express.*
1876 *100 hours by special train.*
1923 *91 hours Standard time, by train.*
1923 *Air Mail—26 hours, 14 minutes.*

Gulf Coast Air Line carries the mails 80 miles from New Orleans (*above*) to Pilottown (*below*).



U. S. S. "*Shenandoah*" over Hudson River.—Photo, U. S. Navy.

CHAPTER IV

SUCCESSFUL FLIGHTS OF THE U. S. S. *"SHENANDOAH"*—COMPLETION OF GERMAN "REPLACEMENT" SHIP, THE *ZR-3*—PURCHASE BY GOODYEAR OF ZEPPELIN PATENTS—CONTRIBUTIONS TO LIGHTER-THAN-AIR BY GOODRICH, AIRSHIPS INCORPORATED, AND AIRCRAFT DEVELOPMENT CORPORATION.

THE year 1923 was the most important that the world has witnessed in lighter-than-air development, since Count Zeppelin made his first experimental flights over the waters of Lake Constance. It witnessed the successful launching and operation of the U.S.S. *"Shenandoah"* and this remarkable achievement, together with the acquisition of Zeppelin patent rights by the Goodyear Tire and Rubber Co., marked the establishment in the United States upon a permanent basis of the rigid airship designing and manufacturing industry.

The World War had not been under way two years before aeronautical officers in the American Navy convinced their department (in 1916) that development of this phase of flying must be undertaken. Germany at that time possessed what amounted to a monopoly of knowledge, concerning especially the composition of essential alloys and the fabrication of this metal into parts sufficiently strong and light for safety and utility. Experiments had been made elsewhere, it is true, in the design and operation of rigid airships, but Germany was then—and so remained up to the day the *"Shenandoah"* was launched—supreme in lighter-than-air. Today, with one great vessel in the hangar at Lakehurst, and another, built by the Germans, about to be delivered to the United States, it is well to remember that our fortunate position is due to the forethought and persistence which led the Navy, fully a year before we entered the war, to begin the slow laboratory, engineering and fabricating experiments out of which there was created for us a new art as promising to peaceful commerce as it is significant to power on the sea.

Aluminum Company of America Develops Duralumin

The Navy Department, first through Rear Admiral D. W. Taylor, Chief of the Bureau of Construction and Repair, and later upon the organization of the Bureau of Aeronautics, through Rear Admiral W. A. Moffett, called to its assistance the American aircraft

and allied industries. Aside from the question of design, there were three great problems. The first had to do with the quantity production of duralumin, the second with fabric and kindred matters and the third with motive power. It was tedious work and had it not been for the generous co-operation of the Aluminum Company of America, proffered largely as against faith in the future, the expense might have been prohibitive. It required three years for the Aluminum Company engineers to develop an aluminum alloy which was, if anything, superior to that originated by the Germans. Later, the Baush Machine Tool Company developed a similar alloy.

Duralumin at last made available, there was presented the problem of its fabrication into channels, angles and other shapes entering into the intricate rings, lattices and girders of a rigid airship. Out of the ensuing experimentation there grew a new phase of metal-working of tremendous value to the entire art.

Fabric Work and Cement Formula by Goodyear

Design studies, under the immediate charge of Commander J. C. Hunsaker, led the Navy engineers into new paths. The gas cells which, when inflated, sustain the ship, consist of very light cotton cloth to which is cemented a layer of goldbeater's skin. The production of this kind of fabric had never been attempted in this country, and the cement, by which the skins were attached, was unknown. All efforts to duplicate this cement failed and it was finally necessary to use rubber cement as a substitute. The contract for the construction of the gas cells was left to the Goodyear Tire and Rubber Company to which the Bureau of Aeronautics gave complete information regarding the methods used abroad in the fabrication of similar cells. The Goodyear Company obtained the goldbeater's skins for use on this contract from Armour and Company. The fabric was supplied by W. Harris Thurston & Co., Inc., and Wellington, Sears & Co.

Packard Designs and Constructs New Airship Engines

In July, 1919, shortly after the successful compounding and production of duralumin, the Navy Department authorized the construction of a rigid airship, the *ZR-1,* as it was first technically designated, and later christened the *"Shenandoah."* At that time, although metal and fabric were available, there were no airship engines in this country. Information regarding the engines used on the German rigid airships showed that they were intermediate between the airplane and automobile type, having a weight which was somewhat greater per unit of power than the airplane engine, but possessing greater

endurance. It was anticipated that design and production would require years, but the Packard Motor Car Co., with its vast automobile experience and with the background of Liberty engine production under Col. J. G. Vincent during the war, rose equal to the demand, and in the exceedingly short time permitted, laid out, built and put through 50 hour acceptance tests, 300 hour endurance runs, hundreds of hours of special marine service in a speed boat, 24 hour car tests and tests in the altitude chamber, six six-cylinder engines, each of which delivered 50 more horsepower than their rated 300.

Problem of Supply and Use of Helium Gas

Up to the time of the *"Shenandoah's"* successful demonstration, the public had heard much of helium, of which we possess a monopoly, but its recollection of gas for airships was associated principally with disaster. A fourth job by the Navy, therefore, was to see that sufficient of this non-inflammable by-product of our oil fields was made available. But helium being of somewhat less buoyancy than hydrogen, new obstacles were met. One of the chief of these, which was overcome, was to keep the weight of the ship constant. This was necessary in order that the loss of gas from valving might be prevented. Under previous conditions of operation the burning out of the fuel caused the ship to grow lighter and hence to rise. As the ship rose the gas in the cells expanded and finally reached a pressure at which it was necessary to permit it to escape. This was particularly undesirable with helium on account of increased cost of operation. A condenser was devised which made possible the recovery of water from the engines and as a result it was proved possible to hold the ship at almost any altitude desired, below that at which the cells became full, without loss of gas.

Precautions Taken for Security

The fabrication of the duralumin into shapes necessarily awaited the design. The Navy had before it the tragic examples of British failure in the *ZR-2,* which it had purchased, and which broke in two over the River Humber and then fell in flames, and of the Italian constructed semi-rigid *"Roma"* which the Army Air Service bought and which crashed and burned at Langley Field. *The Naval officers knew that one more disaster at that time meant loss of public faith in the airship.*

The German war-raiding Zeppelin, the *L-49,* had been brought down in France, and we obtained a copy of the elaborate technical report, measurements, etc., which the French made. In designing the *"Shenandoah"* the Navy incorporated as many of the Zeppelin

details as seemed useable but the ship is in no sense a copy of the *L-49* as additional information was obtained from every possible source. Theories of design were developed and then tested. Some idea of the thoroughness with which this part of the work was done may be had from the fact that 150 girders, as well as countless smaller individual parts, exactly as installed in the ship were destroyed to determine allowable stresses and safety factors. As a further precaution and at the request of the Navy Department, the National Advisory Committee for Aeronautics appointed a special committee of nationally known engineers to check up on the design and material. Fabrication of parts was done principally at the Naval aircraft factory under the manager, Captain G. C. Westervelt, and erection and assembly at Lakehurst under the manager of construction, Commander R. D. Weyerbacher.

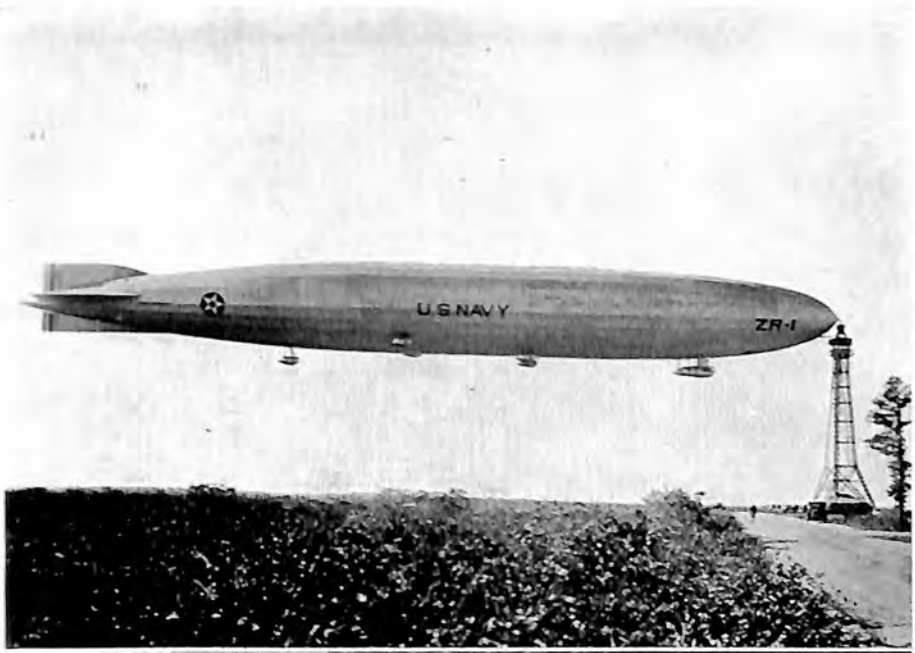
Description of the *ZR-1* ("Shenandoah")

Following is a description of the *"Shenandoah":* It is 680.15 feet long, 78.74 feet in diameter and from the bottom of the engine cars to the topmost observation post amidships is 93.18 feet. Within this enormous structure are 20 gas cells, lined with goldbeaters skins. Portions of the intestines of 900,000 cattle were used. Around each gas cell is a net, and in the manufacture of these nets Airships Incorporated used 20 miles of ramie cordage. The 20 gas cells are of 2,115,000 cubic feet gas capacity. The dead weight of the ship, exclusive of water ballast, is 76,400 pounds. Beneath the bag or hull are suspended six power cars. In each car is a 350 h.p. Packard engine. Car No. 1 is farthest aft, next are 2 and 3 abreast, next 4 and 5 abreast, while far forward is No. 6, which also houses the radio equipment, and, at the forward end, the control station of the officers in command.

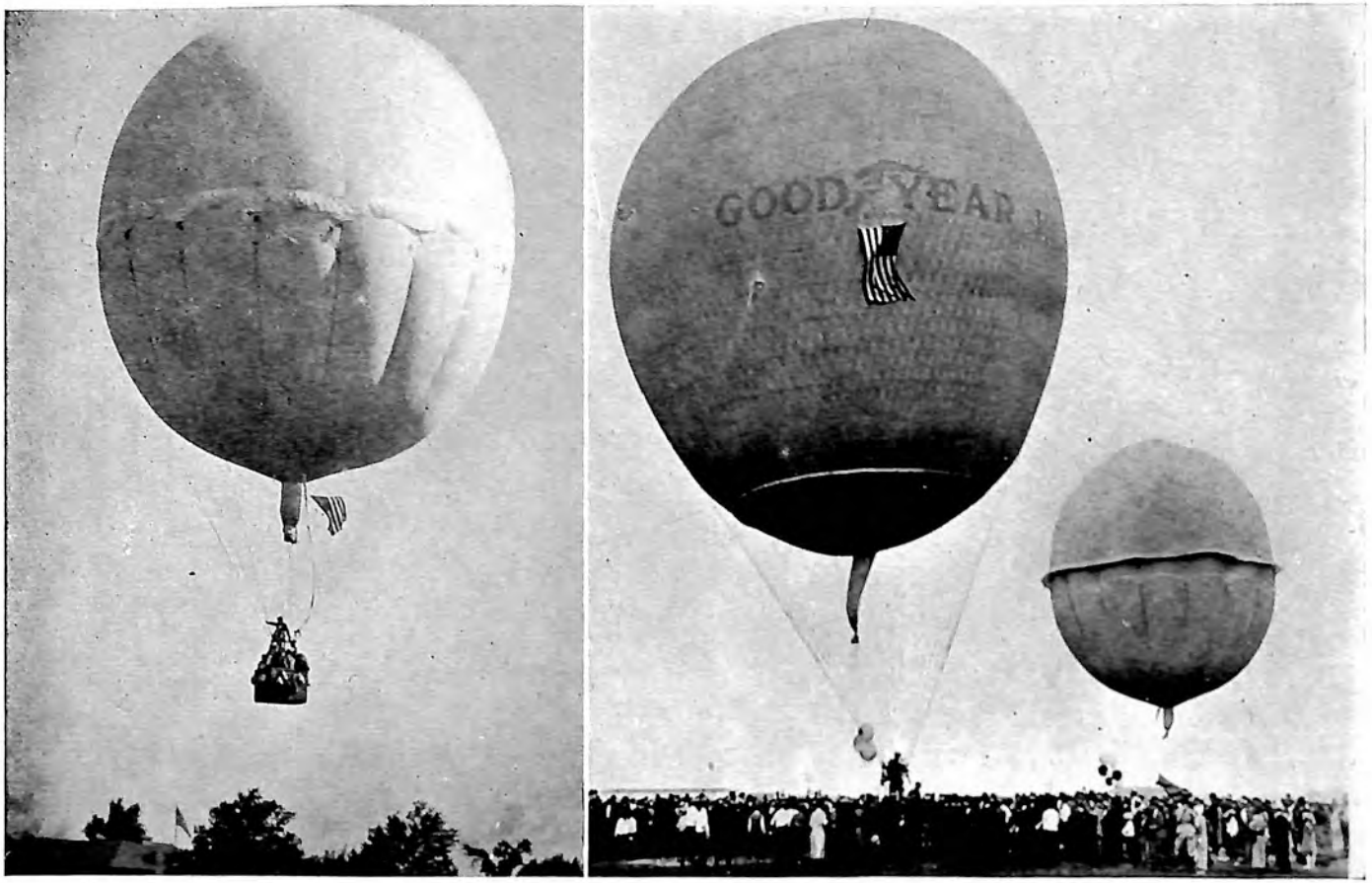
The power equipment of the *ZR-1* gives it an estimated cruising range of 5,000 miles, with four of the six engines at half speed, or between 40 and 50 miles an hour. All six engines running full speed will drive the ship at 52 knots, or approximately 60 miles an hour. The engine in car No. 1 is geared to give a propeller speed of about 550 r.p.m. for an engine speed of 1400 r.p.m., as is also that in the control car. Cars 4 and 5 have direct drive, while Nos. 2 and 3 are fitted with both reduction and reverse gearing, permitting the propellers to be used to drive the ship both ahead and astern.

What It Looks Like Inside the Hull

The interior of the hull presents a bewildering contrast in perspective and detail. Entrance may be had only through ports above



Above—U. S. S. "*Shenandoah*" moored to mast at Lakehurst. *Below*—At the St. Louis Air Meet.—Photos, U. S. Navy.



Left—Ralph H. Upson in free balloon of Aircraft Development Corp. *Right*—Goodyear Tire and Rubber Company's free balloon, winner of 1924 National Races.

the power cars or through two hatches amidships. The duralumin ladder leading from the control car into the bow has a windshield forward, with canvas sides laced to a point aft. The ladders from the five other stations are entirely unprotected and up and down these the mechanics clamber as the ship is speeding along thousands of feet in the air.

Entering the hull one is impressed with the apparently interminable vista of lace-like girders and rings and countless cables. From end to end the *ZR-1* is equal to nearly three average city blocks and at its fattest portion there is sufficient space to house a five story building with a frontage of 50 feet and a depth of 100. The bone and sinew of the airship are duralumin and steel wire. In the lower portion is the keel, which is in the general shape of an isosceles triangle whose sides measure about eight feet. Each point of the keel consists of a triangular girder. From this keel are suspended all the heavy weights and in the middle of its base is a fore and aft girder carrying a ten inch "plank" of Haskelite veneer. The flooring in the control car and in the crew's and officers' quarters is also of this veneer. Communication is over this 10-inch "plank," with a slender cord on either hand to steady the body.

There is no room for luxury. The crew's quarters are amidships, consisting of bunks and lavatory and toilet accommodations. Officers quarters of generally similar character were to be constructed forward.

Control Car Is the "Bridge"

The control car is the bridge of the airship. The cabin is but 18 or 20 feet long, 10 feet wide and 9 feet high. In this small space are the captain, the executive officer, the officer of the deck, the steering coxswain and the elevator coxswain. The cabin is fitted with cellon windows. Immediately in front is the directional wheel controlling the rudder; to the left is the elevator wheel. Running through the ship for nearly 700 feet are the control wires, four for each control. The factor of safety is further increased by the location, three-quarters aft, of a duplicate set of controls. All controls are balanced, making it possible, with very slight human effort, to guide the great ship up or down, to starboard or to port. The captain's position is at the right of the directional wheel. To his left is that of the executive officer. To the right of the captain is the chart board, and round about are the instruments, not only the ones used in ordinary marine navigating for making calculations of position, but ones especially developed for the air. There are five inclino-

meters to reveal whether the ship is headed up or down, and there are instruments to show whether she is on an even keel and whether she is holding to her course or drifting in a cross wind. There are compasses and thermometers showing maximum and minimum temperatures; also devices to show the pressure and temperature of the gas in the cells. There are the fixed signals for the direction of the engine men and eventually there will be radio telephone. To the right are the control valves for the water ballast and controls for docking lines. To the left are the controls leading to 16 gas valves, with an arrangement by means of which, if quick action becomes necessary to force a descent, the gas can be evenly valved throughout the ship. Two altimeters record the height—one, very accurate for landings, extends only to 1,200 feet; another records up to 30,000 feet, though the normal height at which the airship will fly except in war stress probably will not exceed 15,000 feet. There are indicators to reveal whether the controls are operating properly and there are special instruments to show the rate of ascent or descent. Of course there is the air speed indicator, operated by a tiny wind-driven propeller.

Ordinarily the ship carries 4 to 5 officers and about 25 enlisted men.

Completely equipped, the ship costs about $2,000,000, which sum includes research and experimental work extending over many years. The 2,150,000 cubic feet of helium gas required fully to inflate the gas cells represents an additional cost of a quarter of a million dollars.

The air station, airship shed, mooring mast, gas plant, etc., at Lakehurst, represent probably $3,000,000 investment.

Airship's First Flight September 4th, 1923

Between seven and eight years after our naval rigid airship program had been laid down, or, to be exact, on September 4th, 1923, the *"Shenandoah"* was launched at Lakehurst, N. J. It was a truly historic occasion. There were present a distinguished group of officials and civilians—Rear Admiral W. A. Moffett, Chief of the Navy Bureau of Aeronautics, Col. Chalmers G. Hall, representing the Chief of the Army Air Service, Major Wm. N. Hensley, Jr., Commandant of Mitchel Field, who was a passenger on the second trans-Atlantic airship flight from the United States to Great Britain, that of the *R-34,* and who was the first American officer to negotiate with the Zeppelins immediately after the Armistice. There were representatives of the Aeronautical Chamber of Commerce and of the various industrial units privileged to share in the construction

of the great craft, or in other phases of our military airship work—Goodyear, Goodrich, Airships Inc., Aircraft Development Corp., Packard and the Aluminum Company of America.

The colossal naval airship shed, towering 208 feet in the midst of a 1400 acre reservation which extends through the New Jersey pine barrens for 14 miles to the sea, was the magnet which drew thousands of curious spectators from New York, Philadelphia and Washington. On the day of the first flight fully 15,000 people were present, although this multitude, pressing about the vast doors or permitted occasionally to enter, was literally lost within the cavernous depths of the shed, measuring 803 feet long, by 256 feet wide, by 208 feet high.

It was an anxious moment for all, but for none more than for Admiral Moffett who on several occasions had had to fight, both within his Department and before Congress, for the retention of the airship program and the completion of the *ZR-1*. "Sick whales" is the term which some of the conservatives termed airships, but certainly that was not the opinion of the enthusiastic thousands who, in the fading light of that September day, saw the majestic craft slowly rise, as lightened, from its cradles, float out of the shed, guided by 398 sailors and marines, and, under perfect control every moment, cast off, with throbbing engines, and sail away into the evening sky. It was a sight that thrilled, that summoned tears as well as applause.

At 6:54 that night, after a flight of exactly 59 minutes, the *ZR-1* safely docked. Darkness had gathered and the vessel was slowly walked into her berth along flood lines of light playing upon the field from the roof of the hangar and the 165 foot mooring mast. Subsequent inspection of the ship showed that she was sound in every part.

Visions of World-Wide Aerial Commerce

The flight was reported in the press throughout the world. To look at the *ZR-1* was to see the biggest object ever placed in the air in this country. To talk with the men who built her and who operated her was to see back of their labor and devotion an idea so big that it does not falter at visioning the commerce of the world moving swiftly over land and sea—unbroken flights between continents and journeys around the world in days as compared with months; naval warfare in transition, carried on below and above the surface as well as on it, and decisive battles fought far in advance of and high above hostile capital ships moving slowly and cautiously toward each other.

Marine Power Passing from Sea to Air

Naval officers present said that marine power is in a period of transition from the sea to the air. They pointed out that the rigid airship promises to displace the scout cruiser as the advance line of the fleet. "Admiral Jellicoe," said one, "has declared that one rigid airship is equal in tactical value to three scout cruisers. The scout cruisers cost $11,000,000 each and the airships less than $2,000,000. Scout cruisers, such as the Omaha, have a speed of 30 to 35 knots; the *ZR-1* of 60 to 70 knots. Their cruising range is about equal. The cruiser commands at the most 150 feet elevation for observation; the airship at least 15,000. The cruiser strikes and flees; the airship can strike with bombs and escape by altitude or can retreat rapidly to the cover of the aircraft carriers."

"New Phase of Transportation"—Admiral Moffett

Admiral Moffett expressed intense gratification. In a statement to the Associated Press he said:

"By what we have done today we have demonstrated that the Navy can design, construct and operate its airships. The success of today's flight may well be said to mark the completion of a new phase of world transportation. What the American Navy is most interested in is the commercial aspect. Airships in my opinion, are justified to the degree that they work while they protect. We are going to try to make the airship work for commerce and industry. On subsequent flights careful check will be made on performance with especial reference to operation costs and these will be made public. We believe that by designing, constructing and operating the *ZR-1*, in the face of not a little criticism and certainly much skepticism, we have justified our faith. First and last, the Navy feels that, by its initiative in airships, when Germany was stopped by the Treaty and France and England hesitated, it has contributed materially to the stimulation of the aircraft industry in the United States which offers much in the relief of transportation problems and which certainly is the basis of our defense in the air."

Many Long Successful Flights

Between September 4th, 1923, and January 17th, 1924, the *"Shenandoah"* made between ten and fifteen flights, the longer ones being to New York, Boston, Philadelphia, Washington, the Shenandoah Valley and to St. Louis, Mo., via Pittsburgh and Chicago. The distance covered, including the trial flights, totalled possibly 10,000 miles.

The trip to St. Louis during the National Air Races was a triumphal tour. City after city paid tribute and countless thousands saw in this inland voyage the word of prophecy come true. The ship reached St. Louis before dawn and at sun up there she lay, motionless as if at anchor, a silvered Leviathan, full of beauty and

power, making literally of this old river trading post, and modern metropolis a seaport on the coast line of the air. On the return to Lakehurst via Chicago she carried Admiral Moffett—the first time in the history of the world, it is believed, that an admiral's flag had been taken into the skies.

Safely Riding Out a 70-Mile Gale

On the night of January 16th a gale blew in from the sea. Commander F. R. McCrary, then captain of the *"Shenandoah"* and commandant of the station, had the ship moored to the mast. Commander M. R. Pierce, Junior Executive officer and a small crew, were on board. Shortly after 6 o'clock, when the gale had risen to 70 m.p.h. the ship's nose was wrenched out of the mooring mast. Quick as thought, she was lightened and as she plunged and rolled in the darkness of the storm, almost sweeping the tops of the trees, her engines were started and she was put under control. It was a superb test for men and material. The ship was blown about one hundred miles and from a point over Staten Island, worked her way back to the station by dawn. What saved the *"Shenandoah"* was, first of all, the presence of mind of her officers and the devotion of her crew. Next was the performance of her Packard engines. Had they faltered, all might have been lost. "Whoever heard," said one aeronautical engineer, "of a surface ship with her rudder injured, her bow crushed and two compartments flooded putting to sea in a 70-mile hurricane and, after riding it out, return to port under her own power! Yet that is just what the *'Shenandoah'* did."

"Shenandoah" Daughter of the Stars!

"Shenandoah"—Daughter of the Stars! Never was a name more fairly earned than on that wild, starless night when American engineering, construction and navigating skill proved themselves superior to the elements. The moment the ship broke away, the Navy Department sent out radio warnings. The commercial broadcasting stations were hushed and millions of persons in all parts of the nation listened anxiously through the long hours of the night for news of safety or disaster. And great was their joy to learn from the operator on board and then from the Lakehurst station, of the *"Shenandoah's"* return. What finer way than this could be imagined for reversing skepticism, awakening indifference and arousing enthusiasm for American rigid airships!

Upon completion of repairs thus made necessary, the *"Shenandoah,"* now under command of Lieut.-Commander Zachary Lansdowne, will probably operate with the United States surface fleets.

The Lakehurst Station, the base of the *"Shenandoah"* and other Navy rigid airships, is now under command of Commander J. H. Klein, Jr., who was formerly senior executive officer of the dirigible.

The German "Replacement" Airship and Goodyear-Zeppelin

It is impossible to discuss the facts leading up to the procurement and construction at the Zeppelin plant in Friedrichshafen, for the United States Government, of a commercial rigid airship, without considering also the purchase by the Goodyear Tire and Rubber Company, of the good will and patent rights in the United States of the Zeppelin corporation. By the first, our Government obtains the most modern example of airship development. By the second, the American aircraft industry draws freely upon the vast and long-established engineering resources and experience of the Germans. And by this arrangement, too, it must not be forgotten, destruction of the airship industry in Germany, which was almost inevitable under the terms of the Versailles Treaty, is averted and the industry finds itself succored by one of the German nation's late enemies and thus provided with incomparable advantages.

Under the terms of the Versailles Treaty, all the rigid airships in the possession of the German government were to be delivered to the Allied and Associated Powers. Following the destruction of some of these ships by their crews in their sheds, the Allied and Associated Powers took the position that Germany must replace these ships either in kind or by equivalent material. Most of the European powers chose to take their share of the destroyed ships in some other material, but each also received one or two rigid airships in acceptable condition. The United States, however, having announced at the outset that it did not wish any airship, was not allotted one of the ships which was in flying condition. Its share was represented by damaged ships for which it might receive equivalent material if it desired.

Commercial Airship Desired of the Zeppelins

With the development of the interest in rigid airships, due to the approaching completion of the *"Shenandoah,"* it was believed desirable to obtain a sample of the rigid airships built by the Zeppelin Company. It was accordingly requested that the German Government be directed to replace the two rigid airships to which the United States was entitled by a single one of the same volume as the two which were destroyed. This was objected to, but it was finally agreed among the Powers, that the United States should receive, as

a replacement for the ships to which it had been entitled and which had been destroyed in the German sheds, one large rigid of the very latest construction of which the Germans might be capable. It was laid down, however, that this ship should be a civil type and not a military one. This ship is sometimes referred to as a "reparations" ship, but, as has just been explained, it is properly a replacement of the craft to which we were entitled as spoils of war in accordance with the Versailles Treaty.

Contract Details Completed in June, 1922

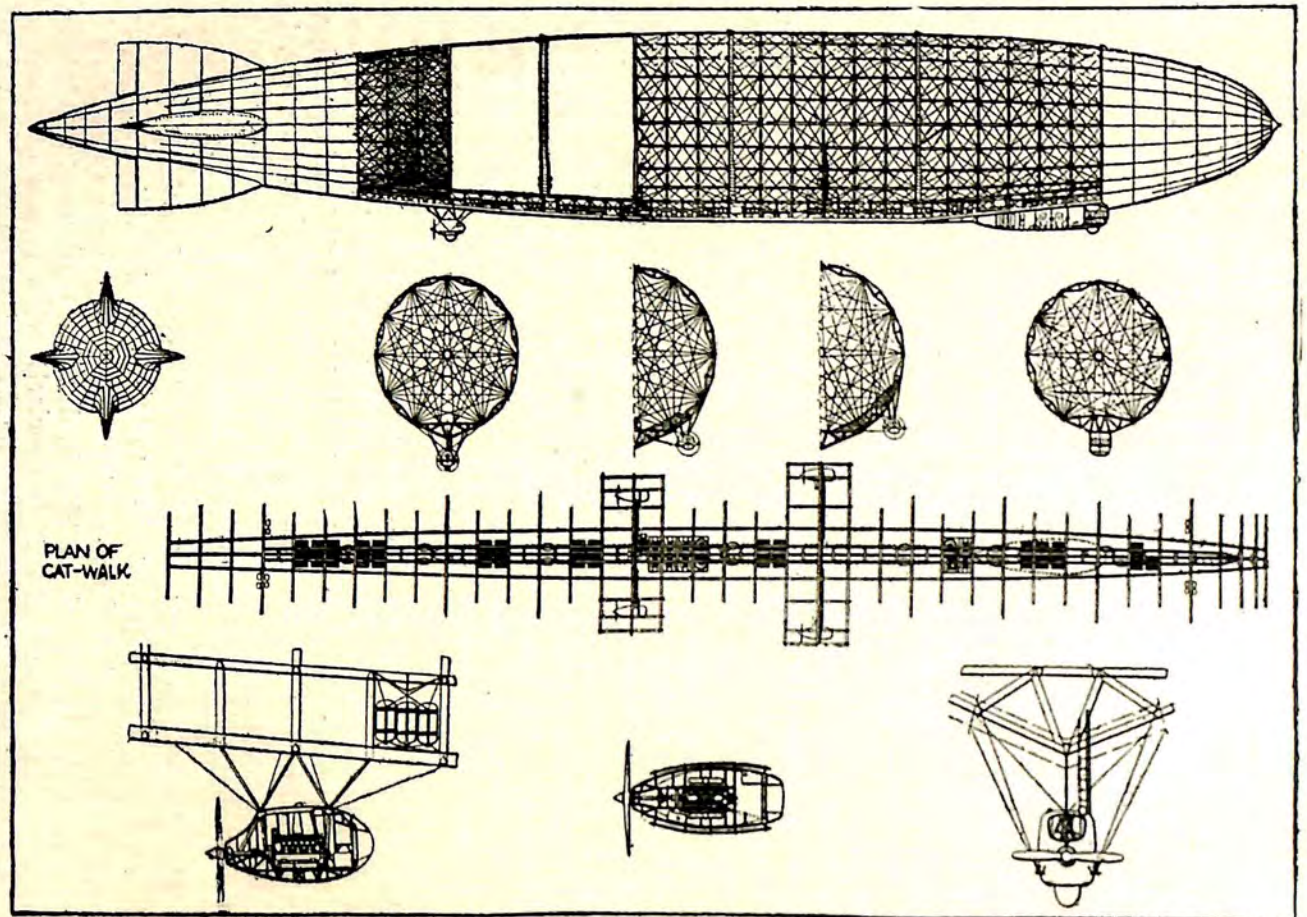
All details in connection with these contracts were completed the latter part of June, 1922. The Navy Department was appointed to represent the United States Government in the inspection of this ship and to pass on its construction and details. Representatives of the Army Air Service were also assigned to the construction sheds at Friedrichshafen.

Although the Allied and Associated Powers, in consenting to the manufacture of this airship, had stipulated that it must be a commercial type, this was a stipulation precisely in line with the predominant American thought that aerial navigation must be developed primarily upon a commercial basis. Our desire, also, was to have a ship of at least 100,000 cubic meters gas capacity, as this size was felt more practicable in long distance operation, especially over the sea. To this, however, the other Powers objected, and as none had received a ship of more than 70,000 cubic meters capacity the latter figure was finally determined upon as the size of the American craft.

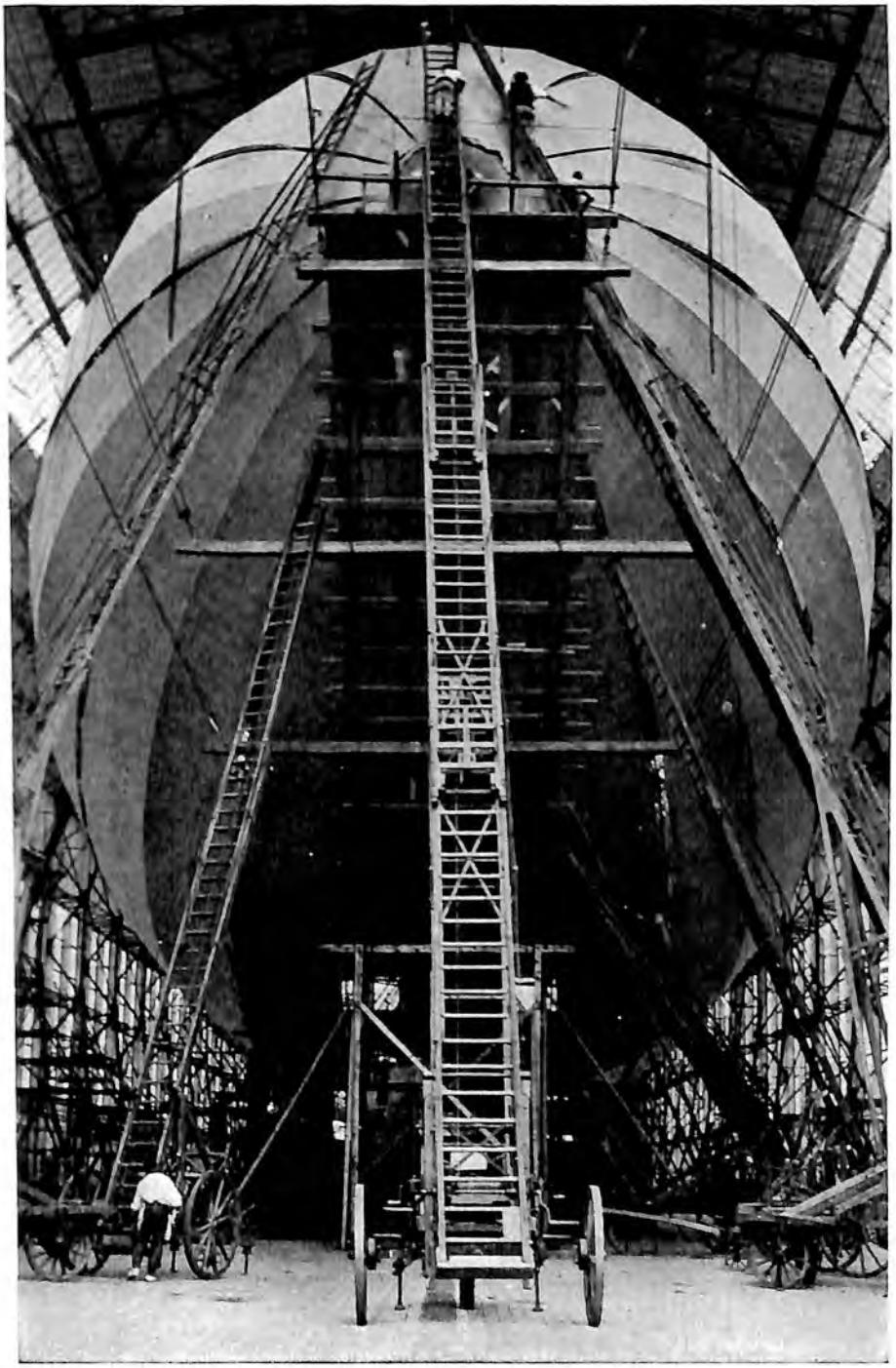
Diplomatic details out of the way, the German Government and the Zeppelin Corporation both exhibited great willingness to cooperate with the Americans and to provide us with the best that was to be had, both in skill and in material. At the time of publication, the *ZR-3,* for so this replacement ship has been designated, was entirely complete and was undergoing brief trial flights in anticipation of delivery, under her own power, and by a German crew, to the United States.

Description of the *ZR-3*

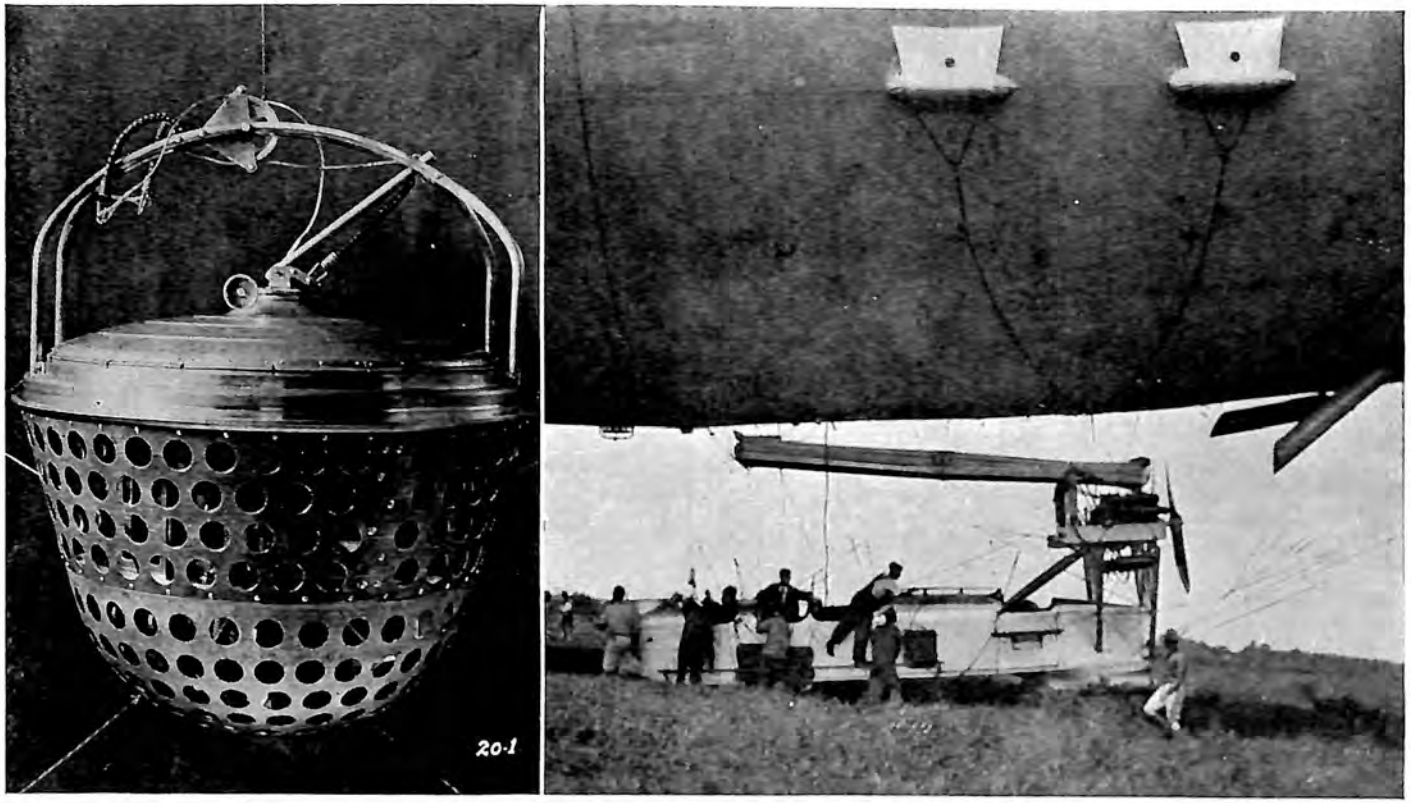
The *ZR-3* has a length of 656 feet, diameter of 90.66 feet, and a height of 101.68 feet. It is designed to be inflated with hydrogen gas, having a capacity of 2,472,000 cubic feet. In general appearance it is similar to the *"Shenandoah,"* but in detail of equipment it is totally different. The *"Shenandoah"* is precisely what it was intended to be—a military flying laboratory. The *ZR-3* is a commercial vessel, capable of transporting at least 20 passengers and a liberal quantity of cargo for distances as far as across the Atlantic—or farther.



Above—ZR-3 in longitudinal view, showing stern with cover on, network, gas cells, etc. *Cross Section*—Showing rings, plan of cat-walk, suspension of power cars.



U. S. Government's German "Replacement" rigid airship *ZR-3* under construction in Zeppelin shed at Friedrichshafen, Germany.—Photo, Goodyear-Zeppelin Corp.



Left—B. F. Goodrich Rubber Company's Airship Valve. *Right*—Bureau of Standards' device to recover water ballast from engine exhaust, an extremely valuable addition to lighter-than-air technical advance.

The hull consists of the familiar structure comprising main ring members, intermediate rings and longitudinal girders. Metals used are duralumin, chiefly, with some steel. The main rings in general are 49.2 feet apart. The accompanying etching visualizes the construction of the ship. In the upper drawings the ends of the ship are shown in side view. In the next rear compartment the outer cover is taken off showing the network of wire bracing and narrow network of cords, the latter steadying the gas cells. The two next compartments—going forward—are shown in longitudinal section through the center, illustrating the arrangement of the keel corridor in the lower part of the hull. This corridor is situated partly inside, partly outside, the hull structure. It has the purpose of strengthening the hull, supporting the useful load, fuel and ballast, of distributing these weights, and of serving as a means of communication between the different parts of the ship. The other illustrations show the keel, or cat-walk, in greater clearness and also details of the power cars.

The ship has five power cars, each of which is fitted with a 12-cylinder, 400 h.p. specially designed Maybach motor, of 1500 r.p.m. No gearing is used between motor and propeller. Starting is accomplished by means of compressed air.

The fabric of the gas cells and the outer fabric of the hull are in general similar to that on the *"Shenandoah."*

Comfort for 20 Passengers in the Cabin

Underneath the bow of the ship the main car or cabin is situated close against the hull—in contrast with the power cars, which are some distance down, in order to permit the passage of air. This cabin consists of a smaller forward part forming the control car and a larger main part for passenger accommodations.

The control car includes every modern device for the operation of airships, wheels for elevators and rudders, engine telegraph, switchboard for operating gas valves and ballast tanks, all the instruments necessary for navigation; also the wireless station. The latter has a radius of about 1560 miles for telegraph and 315 miles for telephone. The electric current is supplied by a generator driven by an air propeller, making 3,000 revolutions a minute. The sender comprises waves from 500 to 3000 meters. The antenna consists of three wires each of about 390 feet length. Sender and receiver are arranged within a special sound proof and gas proof cabin at the rear of the control car.

The passenger accommodations remind one of a cross between railway sleeping coach and steamer. The main room is subdivided

into five separate compartments, each of which has two sofas oppositely arranged, as in a Pullman car. The sofas are 6½ feet long, giving ample room for two people. Each double sofa, or berth section, accommodates four people. The backs comprise upper berths, the seats lower berths, and curtains give complete privacy at night. During the day tables can be put up between the sofas.

The accompanying etching illustrates the appearance of this remarkable cabin. In it will be noted kitchens, pantries, storage rooms, and toilets and lavatories for men and women.

Total Lift of Ship 180,000 Pounds

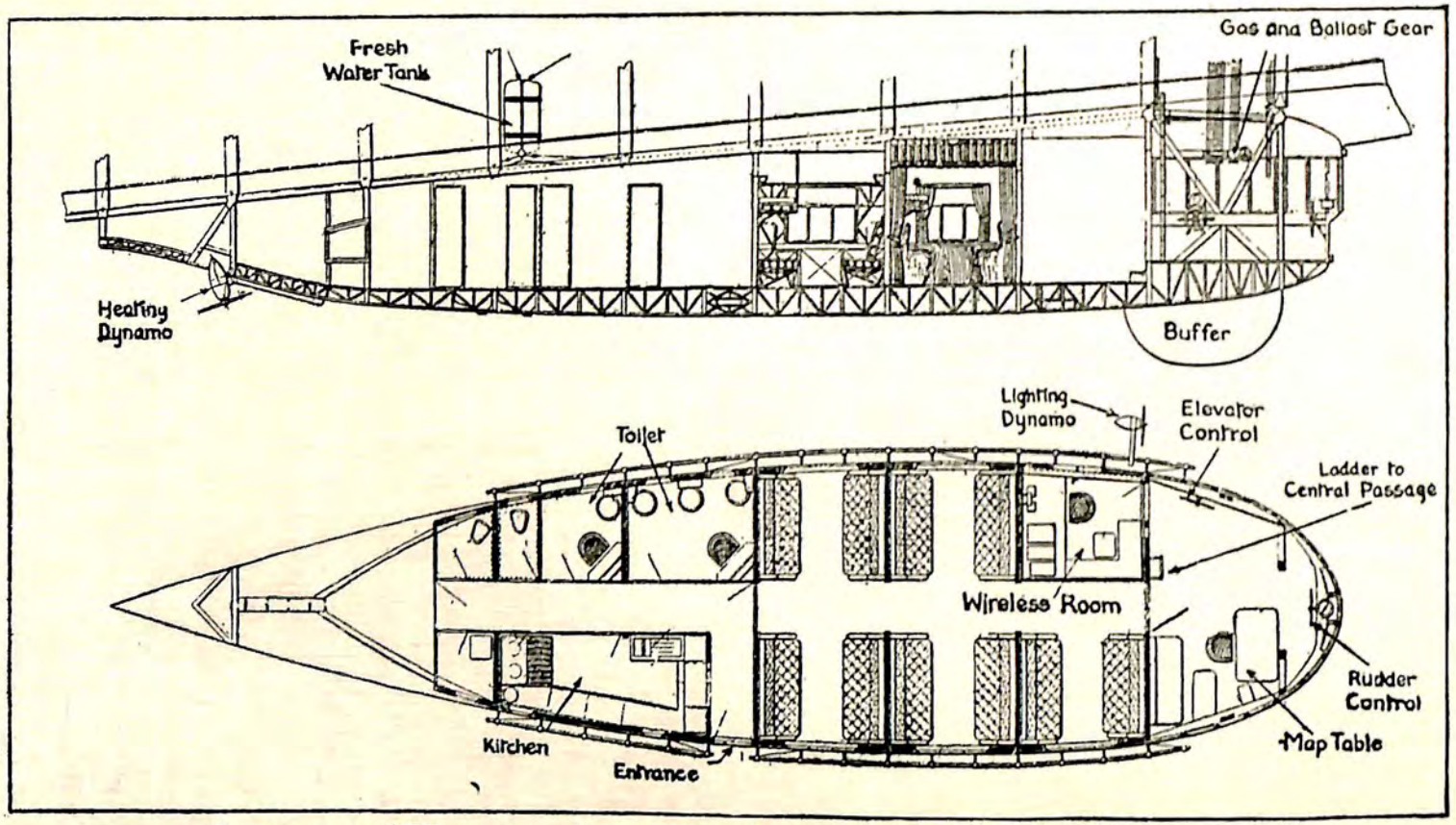
The total lift of the ship, weight of gas subtracted, is about 87,300 kilos, or 179,240 pounds. Weight of the hull, with fins, rudders and elevators, inside arrangements, outer cover, gas cells, valves, rooms for useful load within corridor, rooms for control and passengers, is 28,200 kilos, or 62,170 pounds. Weight of engines and fuel and fuel tanks, ballast tanks, special devices and instruments, electrical equipment and landing arrangement is 13,100 kilos or 28,880 pounds. Under such conditions the useful load will be 40,000 kilos, 88,190 pounds, guaranteed. Useful load in this case means all the lift after the dead weight of the ship has been deducted from the total lift. It comprises gasoline, oil, spare parts, crew, passengers and freight. The speed of the craft is to be not less than 76 m.p.h., with all motors running full, and a cruising speed with 5 motors of 68, with 4 motors, 63; and with 3 motors, 56 m.p.h. With the normal fuel supply of 21.2 decimal tons of gasoline and 2.4 tons of oil, the ship's radius of action will be as follows:

1. With 5 motors, full speed, 46 hours, 3500 miles.
2. With cruising speed, 78 hours, 5280 miles.

The influence of the wind's direction and strength also will have to be considered. But careful calculations show that the *ZR-3* will be capable of cruising not only the ocean of atmosphere over the United States, but far out into either the Atlantic or Pacific Ocean as well.

Time and Date of Delivery

The exact date and route of delivery of this ship to the United States will be known by the time of publication of this volume, or shortly thereafter. The *R-34,* in its famous trans-Atlantic voyage, flying the British flag, in 1919, covered 3,225 miles. The most direct air line from Friedrichshafen to the eastern coast of the United States is about 4000 miles. If storms seem to threaten this route, however,



Passenger car of *ZR-3* accommodates 20 persons in comfort equal to steamship or Pullman car

when the ship is ready for the trip, the route probably will be laid down to the south, via the Azores and either Bermuda or the Bahamas, a distance of probably 5,200 miles. Mark ships stationed along the route by the United States Navy will supply the *ZR-3's* commander with weather data. Fuel and gas can also be supplied at sea, in case of necessity. How long the trip will require is conjectural. Recalling the range at various speeds, it is seen that it probably will take 95 or 100 hours. Certainly no time record is to be attempted with this—the world's first real commercial airship.

Net Cost of Ship Alone to United States Is $50,000

As to cost. This being "replacement" for destroyed spoils of war, the major cost is borne by the German Government. The only charge to the United States in connection with the construction, has been $50,000 worth of spare parts supplied on our order by the Zeppelin Corporation.

Goodyear Negotiates with Zeppelin

The Goodyear Tire & Rubber Company, whose contributions to airship development and construction, have extended over a long period of years, was approached by the Zeppelins immediately after the Armistice with a view to entering into some sort of arrangement whereby our extensive financial and industrial resources, and above all our free political action, might be joined, in this country, with the prestige and skill of the Germans. Harry Vissering, of Chicago, acting on behalf of the Zeppelins, contributed much to the protracted and at times very difficult negotiations over the "replacement" ship. Construction and delivery of such a ship was mutually desired by the Americans and the Germans, but it is not quite certain that this arrangement met at all times with the hearty support of the other Allied and Associated Powers, intent upon their own airship programs.

At length, following a visit to Friedrichshafen by E. G. Wilmer, chairman of the board of the Goodyear Tire & Rubber Company, P. W. Litchfield, Vice President, and W. C. Young, manager of the aeronautics department, together with Mr. Vissering, the Goodyear Company, made this statement:

"The Goodyear Tire & Rubber Company makes the following announcement with reference to negotiations just concluded with the Zeppelin Company. A new company, subsidiary to Goodyear, will shortly be organized for the purpose of manufacturing lighter-than-air ships and all requirements of that branch of aviation. The new company will be managed and controlled by Goodyear, and the Zeppelin interests will receive a minority interest in the

Boston from the Air.—Photo by Fairchild Aerial Camera Corp.

Shoshone Falls, Idaho.—Photo by U. S. Air Service.

company in exchange for their patent rights and the services of their technical staff. There has been no payment of cash by Goodyear to Zeppelin, and no cash consideration is involved in the acquisition of patent rights. The sole compensation to Zeppelin is a minority interest assuring to them an equitable share in the results of the business.

"The Goodyear Tire & Rubber Company has long been the leading producer in this country of lighter-than-air craft, and the principal source from which the Government has obtained its non-rigid and semi-rigid ships. The company is in fact today serving both the Army and the Navy in this capacity. With the advent of the full-rigid airship, and the results accomplished over the world with this type of vehicle, Goodyear resolved that its ability to maintain its position as leading producer of lighter-than-air craft would depend on its ability to successfully produce full-rigid ships. In the spirit also of keeping this country fully abreast with world-development in lighter-than-air rigids, Goodyear resolved to supplement its own technical staff with the best technical experience obtainable in the world.

"The Zeppelin Company which is now building a reparation ship at Friedrichshafen for this Government, seemed unquestionably to offer an opportunity which could not be duplicated elsewhere. They had pioneered lighter-than-air development for over twenty years, and had studiously built up a volume of technical experience and a staff of experts superior to any other. Their achievements received world recognition just prior to and during the last war when many ships were turned out and operated with outstanding successes, including the commercial and safe transportation of many thousands of passengers.

"The Treaty of Versailles makes it impossible to continue either the construction or commercial exploitation of airships in Germany and the negotiations just concluded by Goodyear make it possible to transfer to America all the benefits and experience attained by the Zeppelins during their long struggle in experiment and research.

"The practical successes of lighter-than-air aviation are more readily accepted in Europe because of its closer contact with the startling results already achieved. Confidence in this country is rapidly growing with the performance of the *'Shenandoah'*, and there is every reason to hope that America may now assume a leading and perhaps a dominant position in the introduction of rigid airships for both military and commercial use. The arrangement just consummated assures to Goodyear exclusive rights in the United States and Canada and therefore does not preclude formation of a similar industry elsewhere. The question as to whether we shall lead in this line therefore depends on the aggressiveness with which the American industry is launched and conducted.

"Goodyear management is confident that the day of aerial transportation is at hand and that rigid airships will soon demonstrate their practicability for long distance use on both land and sea, and with that confidence is now preparing itself to meet the country's requirements for that type of craft. A thoroughly balanced and experienced technical staff will be at work at Akron within sixty days prepared to co-operate with the authorities at Washington and any other responsible interests who may desire to embark upon definite constructive projects. Goodyear intends to advance the cause of this new industry along sound, conservative lines, and it will be enlarged just as far and just as rapidly as responsible interest in this country will permit."

In accordance with the above, the Goodyear-Zeppelin Corporation has been formed, with the following officers: E. G. Wilmer, Chairman of Board; G. M. Stadelman, President; P. W. Litchfield, First Vice President; E. A. Lehman, Vice President in Charge of Engineering; P. H. Hart, Treasurer, and C. A. Stillman, Secretary.

Aircraft Development Corporation

The Aircraft Development Corporation, of Detroit, Mich., was organized in June, 1922, for the purpose of developing, manufacturing and operating lighter-than-aircraft. The activities of the organization were directed primarily to the development of a commercial airship in which the public would have confidence.

Such an airship must be: (1) Fireproof; (2) Weatherproof; (3) Durable and permanent in structure; (4) Navigable in practically all kinds of weather; (5) Economical in the use of buoyant gas and ballast.

Realizing that the problem presented is not one of production or one of sales, but a problem of a strictly engineering nature, the corporation secured the services of leading lighter-than-aircraft talent in the country, headed by Ralph H. Upson, former chief engineer of Goodyear Aeronautical Department, and four times winner of national and international balloon races.

Around Mr. Upson has been built an engineering staff comprising some of the foremost engineers in the country. With the most expert engineering skill as a basis on which to build, and assured of financial support, the engineering staff was given free rein to design an all-metal airship answering all of the requirements specified above.

After two years of experimentation, much progress has been made in mastering the engineering details of America's first all-metal airship. "The Engineering Department," reports Mr. Upson, "is now prepared, so far as design is concerned, to build and deliver within one year, a small metal-clad airship, less than one-twentieth the size of the *"Shenandoah."* It will be capable of employment for mail service or pleasure, over useful distances with loads of respectable size, at an operating cost for fuel comparing favorably with a seven-passenger automobile. This announcement is the result of the following progress:

1. "The general theory of the metal-clad airship has been mathematically and experimentally proved. Metal construction is apparently superior in almost every respect, both for ships filled with hydrogen and with the non-inflammable helium.

2. "The preliminary design of an express airship of 1,600,000 cubic feet capacity, showed greater load carrying efficiency and much better

speed than the somewhat larger *'Shenandoah'*. With standardized construction, the cost would be not more than one-tenth that of the big Navy airship.

3. "The design for a blimp size (80,000 cubic feet capacity) metal-clad, rigid airship shows a performance better in most respects than a similar size non-rigid fabric ship. It has been decided to proceed with the construction of this size ship.

4. "The stress analysis of the structure of this ship has been worked out and checked by practical water-inflated tests of a small scale model. The average safety factor is three times greater than that of the *'Shenandoah.'*

5. "Aerodynamic qualities, tested in the Navy wind tunnel at Washington, showed marked improvement over the best figures previously known. The stability is nearly double, and the hull resistance (which decreases speed) is about half that of the *'Shenandoah'* in proportion to size."

Following are the officers and directors of the Aircraft Development Corporation: President, Harold H. Emmons, President, Detroit Board of Commerce; First Vice-President, C. S. Mott, Vice-President, General Motors Corp.; Second Vice-President, Wm. B. Mayo, Chief Engineer, Ford Motor Company; Secretary, Charles A. Parcells of C. A. Parcells & Company; Treasurer, Eugene W. Lewis, President, The Industrial Bank; Chief Engineer, Ralph H. Upson; General Manager, Carl B. Fritsche; Alex Dow, President, Detroit Edison Company; Edsel B. Ford, President, Ford Motor Company; C. F. Kettering, President, General Motors Research Corporation; Mason P. Rumney, Vice-President, Detroit Steel Products Company; William B. Stout, President, Stout Metal Airplane Company.

Airships Incorporated

As has been stated, Airships Incorporated, of Hammondsport, N. Y., contributed to the construction of the U.S.S. *"Shenandoah."* In addition to the cordage nets around the balloonettes, they were commissioned, after the trip in the January storm, to construct four new gas cells for the Navy Department.

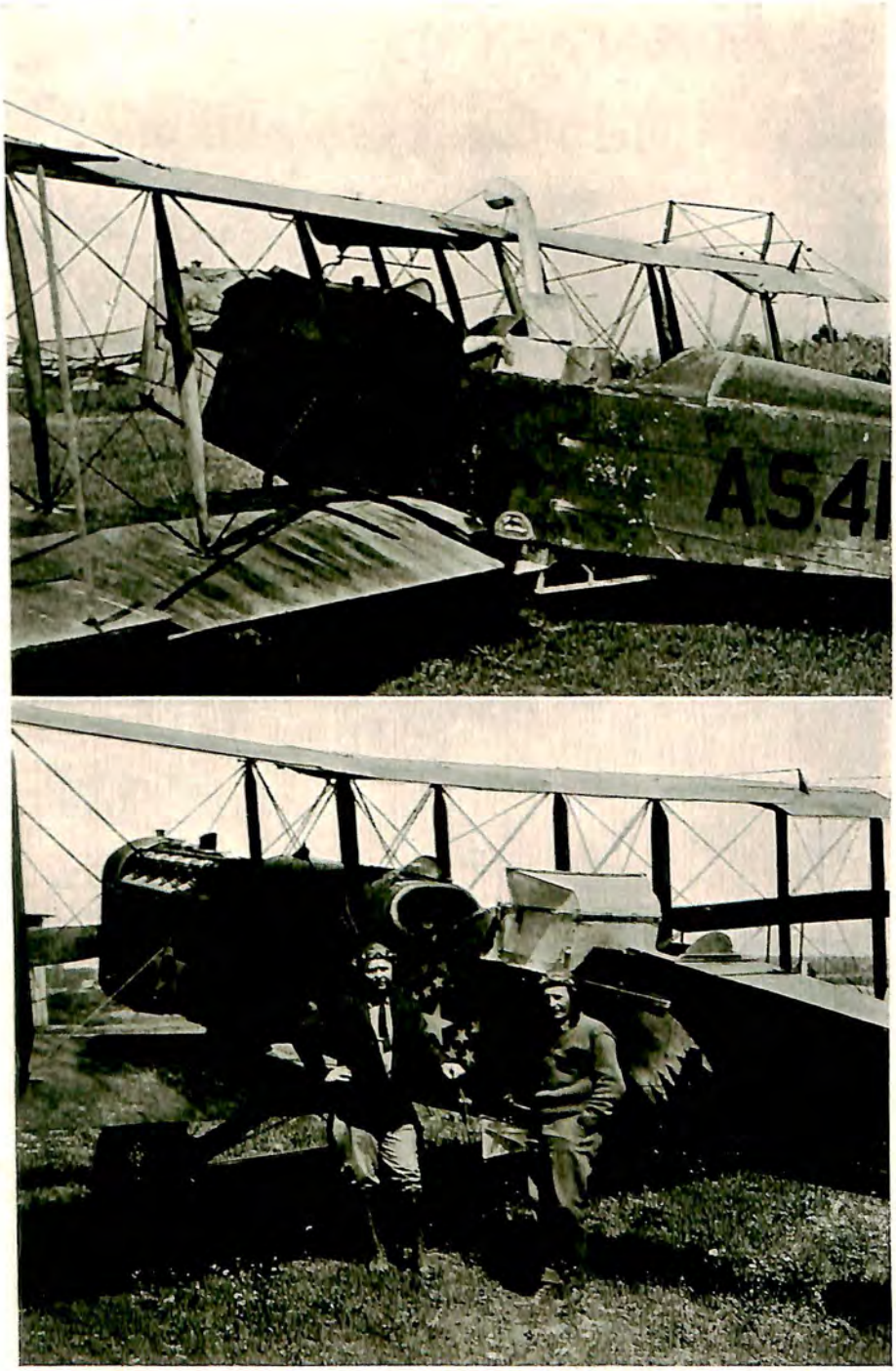
For the Air Service of the Army, Airships Incorporated completed in 1923 the largest non-rigid airship in the world. It is known as the *RN-1*. It is 262 feet long and more than 48 feet in diameter. It has a gas capacity for hydrogen or helium of 325,000 cubic feet, can lift 21,000 pounds and maintain an altitude of 10,000 feet. It is primarily a fighting ship; and is equipped with bombs and machine guns. From the cabin, which is 55 feet in length, a gun tunnel extends upward through the hull to a fighting platform on top. This platform accommodates a machine gunner and two observers. A

crew of twelve officers and enlisted men will operate the *RN-1*. The *RN-1* is powered with two 400 horsepower Liberty engines, which give it a speed of 60 miles an hour. The envelope of the airship is made of special 3-ply rubberized balloon fabric with an outer coating of aluminum—in all 6,000 yards of fabric were used, together with 300 gallons of special rubber cement, 60,000 feet of tape and 5,000 feet of steel cable.

Airships Incorporated, as is narrated more fully in Chapter V, also during 1923 built and flew a motor balloon which was used effectively in interesting experiments in combating the gypsy moth. This is the smallest twin-engined dirigible in the United States, being but 108 feet long and 30 feet in diameter at the largest section. Power is provided by two 75 h.p. Wright radial engines, fitted on outriggers. It contains 50,000 cubic feet of gas.

B. F. Goodrich Rubber Company Activities

An important contribution to lighter-than-air development was embraced in the Gammeter Airship Valve. The mechanism is automatic. Action is sensitive, since practically all friction is eliminated by use of rocker arms. An emergency closing device, positive in action is provided for, so that the pilot can hold or close the valve from the control board of the airship. It is manufactured of magnesium alloy developed by the Aluminum Company of America. The total weight, with magnetism, is about 17 lbs.



Above—Curtiss airplane, showing hopper with which first cotton dusting was done. *Below*—B. R. Coad, head Delta Laboratory, Southern Field Crop Investigations, and Master Sergeant W. M. McConnell, U. S. A. S., chief dusting pilot.

Above—Dusting cotton fields with calcium arsenate. *Below*—Note how dust envelops the plants.—Photos, B. R. Coad.

CHAPTER V

AIRPLANES AND AIRSHIPS "PUT TO WORK" COMBATING COTTON BOLL WEEVIL, GYPSY MOTH AND LOCUST—ASSURANCE OF SAVING AGRICULTURE MILLIONS OF DOLLARS—PROSPECTIVE SERVICE IN CROP ESTIMATING

COLLABORATING with the Army Air Service, the Department of Agriculture has made impressive progress in the utilization of aircraft. The cotton boll weevil and leaf worm in Texas, the gypsy moth in New England, and the locust in the Phillippine Islands are being successfully attacked from the air. Aircraft at the same time give promise of extending the scope of the crop estimator and making his reports more accurate.

Spread of the Cotton Boll Weevil

In 1893 the boll weevil appeared in the cotton fields near Brownsville, Tex. Year by year it has spread until today its harmful effects are to be noted practically throughout the South. During the last six years, loss to the cotton planters through the boll weevil and its companion pest, the leaf worm, has averaged $600,000,000 annually.

From the Delta Laboratory of the Bureau of Entomology, Department of Agriculture, at Tallulah, La., the Southern Field Crop Investigations, under direction of B. R. Coad, has been endeavoring to find an effective means of controlling, if not exterminating these pests.

The compounding and wholesale manufacture of calcium arsenate, together with the development and production in quantity of ground distributing machinery, placed in the hands of the planters a fairly effective weapon. Mule-drawn machines, operated by negroes, plodded through the fields at night and dusted the plants when the foliage was wet with dew. Wherever the poison adhered, it did the work, but there was much wastage and the high cost of the powder—20 cents a pound—together with the slowness of the process and the growing scarcity of labor—turned the thought of the Government scientists to discovering more practical means of wholesale application.

Scientists Turn to Air Service for Help

The experiments of the United States Air Service in Ohio in 1921, when the dusting from the air of a catalpa grove destroyed a

plague of caterpillars, prompted Mr. Coad to request assistance. Accordingly, August 1st, 1922, two Curtiss planes, with Wright engines were obtained from Maxwell Field, Montgomery, Ala. These were piloted by Lieuts. G. L. McNeil and Charles T. Skow, the latter being shortly replaced by Lieut. L. C. Simon. For a time a photographic plane piloted by Lieut. L. P. Arnold, with Lieut. J. N. McDonnell as photographer, was also assigned to Mr. Coad.

Scientists in the Department of Agriculture, upon whose conclusions rest the guidance and protection of agriculture, must be conservative and Mr. Coad's plan was to determine, first, if dusting from airplanes was effective, and second, if it was practicable, from both the standpoint of economy and human safety. That the Department, after two years of careful experimentation, has actually purchased specially designed and constructed planes of the Huff-Daland type and is extending its aerial dusting operations is proof of primary success and would certainly seem to hold interesting prospects for the application of aircraft in a new and useful field of vast extent.

Aviation Makes an Economic Contribution

The comprehensive account of the trials, as set forth by Mr. Coad in Bulletin No. 1204 of the Department of Agriculture, constitutes an important addition to the literature of aviation as an economic factor. Mr. Coad's first problem was to devise an effective hopper. His second attempt, while sufficient for immediate purposes, is now being improved upon and with its development, along with the procurement of a new type of plane, it is expected that the possibilities of aerial dusting will be greatly increased.

Experimental flying was continued on into 1923. Mr. Coad at first rode in the planes as a passenger and operated the hopper, but he felt that he could study the problem better if he were able to pilot, so he learned how to fly. Operations during 1923, therefore, were under his personal direction. The Air Service detachment at the station included Lieut. John B. Patrick, Master Sergeant William M. McConnell and Privates W. D. Bridges and J. W. Holley. Mr. Coad also had the assistance of E. Johnson, a mechanical engineer attached to the Department of Agriculture, who applied himself to the problem of designing and installing hoppers for the poison.

Flying in the Heart of the Cotton Country

The Mississippi Delta region is the heart of the cotton country. The great plantations are operated in many instances by small tenant farmers, who alternate corn with cotton. Much of the area is

drained swamp land and thus, with the remnant of standing cypress and other timber, presents a real problem to the flier. As against this handicap to treatment from the air, there is the fact that ground dusting can be done only at night, when the dew is on the foliage. In wet weather, the machine cannot be dragged through the heavy fields. In wet weather, also, both the weevil and the worm flourish. But the airplane, independent of earth, requiring only a good landing field, and operating effectively between dawn and 8 o'clock in the morning, under all the wind conditions yet noted, seems to have far the greater worth.

Given the proper machine and engine of sufficient power, Mr. Coad found it to be safe and feasible to fly back and forth across the fields at heights of 25 to 50 feet. There was a question as to whether the powder would settle, even from this low altitude, and, if it settled, whether it would stick. "The first flights," he writes in his report, "furnished an absolute surprise. It was found that when the calcium arsenate was dropped from the plane it was immediately broken up into a circular cloud which was quickly blown down among the plants. This was obviously due to the tremendous rush of air past the plane and the additional blast created by the propeller." From the results of analyses, it was proved that "an astonishing amount of the poison adhered to the plants over a very wide path under atmospheric conditions such that it would be considered absolutely impossible to make the dust stick to the plants with the present ground dusting machines."

Comparative Costs the Same—Plane More Efficacious and Economical

The average ground dusting machines, drawn by one mule and operated by a negro laborer, cost $300 each. One machine, under the most promising conditions, can dust only 75 to 100 acres during the three-months' season. The useful life of this machine is from three to three and one-half years. Mr. Coad has worked out his aerial dusting with a unit of three airplanes, an average of one and one-half being in the air four hours a day, five days a week for three months, and one and one-half on the ground in reserve. This unit, in a single season, will dust 15,000 acres. One airplane thus replaces 50 ground machines, representing an initial investment of $15,000.

A careful check-up by Mr. Coad indicates that the life of the plane and the ground machine will be about the same and that maintenance and repairs on an airplane will be no more than on the ground machine it displaces. But it is in the economy of operating costs, both as to motive power and distribution of poison, that the

airplane excels. Mr. Coad in experiments with Army planes, first Curtiss JN's and later DeHavilands, extending over two years, has found that the cost of fuel, etc., and pay of pilot and mechanic, total one-half of the man-hire and mule value required by the 50 ground machines.

Of greater importance than the above is the labor feature. In order to operate 50 ground machines, the farmer must keep 108 to 110 mules, representing an investment of $10,000 to $15,000, and 54 laborers, one on each machine and four on supply wagons. It is growing increasingly difficult to obtain this labor, and due to its unsatisfactory character, more costly to supervise it effectively.

$16,000,000 in Season's Dusting Could Be Saved by Using Airplanes

In economy of poison distribution the airplane excels. Three-fourths of the total expense of dusting is represented by the cost of the poison. The airplane uses only three-fourths the quantity used by the equivalent in ground machines, and distributes it more effectively. Calcium arsenate costs 20 cents a pound on the farm. Four applications are made during the season. In 1923 2,000,000 acres were dusted. Airplanes could thus have effected a total saving of 80,000,000 pounds costing $16,000,000.

Mr. Coad states that the utility of the airplanes has so impressed the farmers and bankers in the region of his experimental station that a number of proposals have been made for commercial backing. The Department of Agriculture, however, desires to experiment further with special flying equipment, which is now called for, before mapping out an operating plan for civilians.

Of the 38,000,000 acres of cotton planted in 1923 it is estimated that about one-half could have been effectively dusted from the air. The other half is in hilly country and in narrow valleys and can best be dusted from the ground. There is thus no conflict between the manufacture of ground equipment and air equipment. As a matter of fact, the farmers have been unable to obtain ground equipment fast enough, although the 2,000,000 acres dusted in 1923 represented the purchase of several millions of dollars worth of ground machines. There is thus apparent a prospective market for dusting planes running into considerable sums.

Experimenting with Airships to War on the Gypsy Moth

Just as the boll weevil, crossing the Texas border worked its destructive way north and east, so another alien pest, the gypsy moth, has spread south and west from the New England States.

The Department of Agriculture in 1923 sought to utilize aircraft in combating this menace which in but a few states had already cost the public many millions of dollars, $15,000,000 having been spent for protection in Massachusetts alone.

The Air Service detailed to the Department the U. S. Motor Balloon, constructed by Airships Incorporated, of Hammondsport, N. Y. Experiments with planes in the caterpillar infested catalpa groves of Ohio and in the Louisiana cotton fields had established the effectiveness of the plane, but it was felt that the ability of the airships to hover should be utilized when dusting the "top center" of orchard and wood lot trees in which the gypsy moth had appeared. The U. S. M. B. was assembled at McCook Field, Dayton, O., and was flown to Hammondsport where it was equipped by Airships Incorporated, on July 3rd. On July 4th it was flown to Henniker, N. H., where Department experiments were undertaken.

"Gypsy Moth" Balloon Smallest Twin-Engined Dirigible

The U. S. Motor Balloon is the smallest twin-engined dirigible in the United States, being 108 feet long and 30 feet in diameter at the largest section. Power is provided by two 75 h.p. Wright radial engines, fitted on outriggers between which is installed the hopper containing 400 pounds of insecticide. A fan operated by the engine blows the poison out and down as the ship hovers or moves slowly over the tops of the trees. The Motor Balloon contains 50,000 cubic feet of hydrogen gas and is equipped with telephone cable for communication between the pilot and the entomologists on the ground. The shape of the bag is new, the envelope being especially designed so as to afford easier control with smaller surfaces. The passenger and cargo car is swung in the center. It is 16 feet long, 4 feet deep and 2¼ feet wide. The trip of 400 miles from Dayton was made in 9 hours flying time. Major H. A. Strauss was the pilot.

D. F. Barnes and L. J. Briggs, of the Bureau of Entomology, established a base at Henniker, where the Air Service also had airship fuel and supplies, including containers of hydrogen gas. The experiments continued over several weeks. Trouble was experienced with the hopper, but the adaptability of the airship to travel slowly over an orchard and dust the moths in their nests was thoroughly demonstrated. The Department is continuing its attacks on the gypsy moth in collaboration with the Air Service. The trials impressed the Entomological bureaus of the state governments in New York and New Jersey, the latter so much so that Thomas J. Headlee, entomologist, is planning to use aircraft against the gypsy moth.

Fighting the Philippine Locusts from the Air

The latter part of 1923, a plague of locusts visited the Philippine Islands. Crops in which millions of dollars of American capital are invested were threatened. The insular government seized at once upon the instrument best-suited to combat the insect horde—the airplane.

Once again the Air Service was asked to help. A co-operative arrangement was entered into by the Air Service, the civil government and the Philippine Trust Co., as trustee for the Mindoro Sugar Co. Experiments were conducted under the direction of Lieut. Harry Weddington, near San Jose, Mindoro, about 190 miles south of Manila.

Operations were started October 15th, 1923. Six fields were established, covering a radius of approximately 100 square miles. The entire area was first photographed using an oblique camera. Camps were established at each field and personnel detailed for insect control to work in conjunction with the airplane. Supplies and quantities of the poison powder—calcium arsenate—were on hand at each camp.

Thorough Destruction by Winged Plague

Lieut. Weddington's report is fascinating. From Camp Nichols, Rizal, he obtained a DeHaviland for photographic purposes, and a Curtiss JN-4-D, with OX-5 engine, which latter plane he equipped with a hopper for scattering the powder. When he got his equipment ready he found that 24 different sectors were affected with the plague, the locusts ranging in all stages from eggs in the ground to fully matured insects. Neither he nor his men knew anything about entomological work and neither the locust inspector of the insular Department of Agriculture nor the chief engineer of the Mindoro Sugar Company knew anything about flying. So first of all there had to be mutual study.

For those who have never seen a plague of locusts it is difficult to appreciate how thoroughly effective is the work of destruction. In the Philippines the pests breed in the mountains. Four days after they hatch out they move down, eating as they go. They remain in one spot until every vestige of vegetation is gone. Then they sometimes lay their eggs, if the location suits their instincts, or continue their travels. The locusts, being swiftly moving, and traveling literally in clouds, the Philippine planters had been unable in the past to make much headway in their efforts to counteract the insects. When in mountainous territory, the locusts breed in grassy knolls;

when in the lowlands, they select open flats. Rarely do they breed in brush or timber country, but frequently in tall cogan grass, which makes more difficult surface methods of combating them, but which facilitates use of the airplane.

Every Insect Killed in Dusted Area

Lieut. Weddington's report indicates that three trials with hoppers and blowers to distribute the calcium arsenate were made before the right equipment was devised. This was a combination of a McCook Field design, the practical suggestions of the sugar plantation engineer, and the officer's own ideas. A wind driven propeller was substituted for an electric motor and this was found much more effective.

Dusting was carried out under various conditions and at various hours. Aerial scouts reported the location of the insects and also the period of their development. When the poison was distributed at evening, after the pests had settled for the night, only 50 per cent. destruction resulted. But when their next day's flight was anticipated and the vegetation thoroughly dusted, every insect was killed.

Flying conditions were not easy. Dusting had to be windward, and, as in the case of cotton field dusting, the plane sometimes had to fly low. But there was no trouble and practical results were obtained of great financial value to the planters and scientific worth to the government.

Finds Airplane Effective Aid to Sugar Planter

Lieut. Weddington summarizes his conclusions thus:

"The airplane can be used effectively against the locust, when it is in the hopper stage.

"A slow plane is the most effective due to the terrain.

"The airplane is invaluable for transportation of men, food, supplies and poison to isolated points in a few minutes, whereas it requires days with the carabou, the usual method of transportation.

"The airplane is very effective for patrol duty in covering large areas and locating the locust.

"The majority of breeding places can be located from the air.

"The airplane can distribute poison more thoroughly, covering large areas much more economically than can be accomplished by other means."

Aircraft as an Aid to Crop Reporting

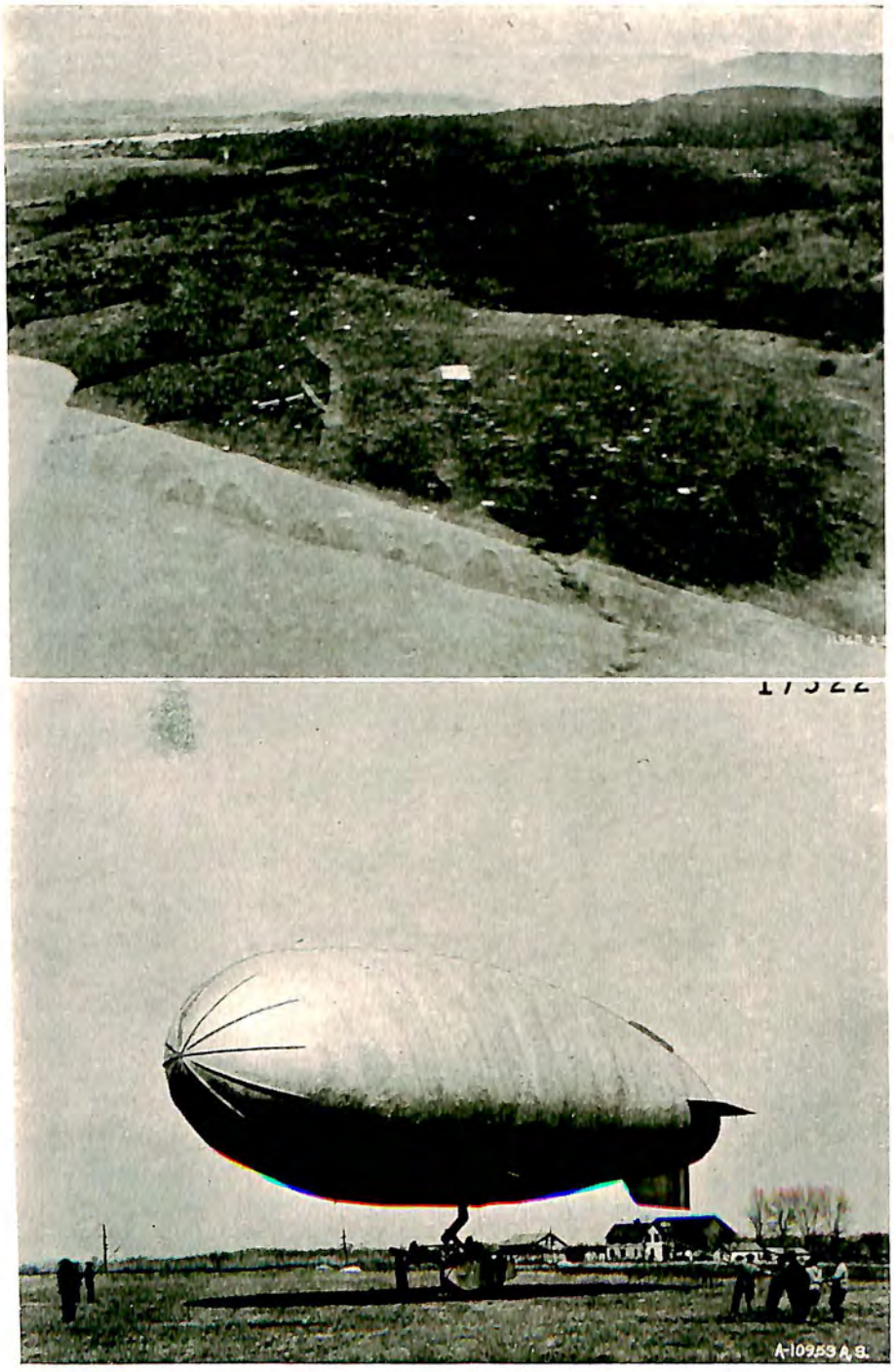
Closely allied to the phases of entomological work, presented above, is the use of aircraft as an aid to crop reporting. The successful application of flying at the Delta Laboratory led Charles E. Gage, in charge of Field Service, Division of Crop and Live Stock Estimates, to undertake investigations.

"The first suggestion to use airplanes in crop reporting work was made by Colonel Cochrun, Field Agent for Ohio, after his return from France," writes Mr. Gage. "The Colonel made a flight in Ohio to observe the condition of winter wheat and rye. My recollection is that he suggested the use of photographs. The whole proposition to use airplanes in our work caused the Washington office to smile, as the human race has always smiled at new ideas it was not prepared to appreciate. I am convinced that there was absolute merit in Col. Cochrun's suggestion, but we did not wake up to that fact until within recent months."

In April, 1923, Mr. Gage visited Mr. Coad at Tallulah and made a number of flights. "Most of the fields," he reported, "could be determined without difficulty from the 5000 foot level and with fair results at 7000." In September other flights were made, this time in company with K. B. Gardner, of the Cost of Marketing Division. Cotton, corn, hay and pastureland could be identified. By knowing the altitude at which photographs are taken and the focal length of the camera, and with the aid of a planimeter, which measures in hundredths of an inch the area photographed, the scientists are able to calculate crop acreages. In a three hours' flight it was possible to observe 400 to 500 square miles of crops. Viewing fields over considerable territory has led to the conclusion that air travel affords unequalled possibilities in getting first-hand impressions of stand and condition. The fields lie spread out before the crop observer, as the pages of an open book, and are easily read. Looking down on the crops the observer is impressed not only by the condition and stand, but by the cleanness or otherwise of cultivation and the moisture condition of the soil. With these things in mind and considering the great amount of territory that can be covered in a day, the possibilities of airplane travel may be understood. On one trip Mr. Gage proceeded in an indirect way from Tallulah to Greenville, Miss., and return. The first half of the trip was made over the delta country between the Yazoo and Mississippi rivers. The return was over the southeast corner of Arkansas and northeast Louisiana. The distance travelled was about 250 miles and the time consumed 3 hours, including a stop at Greenville. "It would seem," states Mr. Gage, "that this mode of field inspection should be particularly useful in connection with crop damage investigations, such as flood, hail, insect, etc."

In commenting on the results thus far obtained, Mr. Gage reports: "The possible application of aerial photography to acreage estimating is of interest from several standpoints. First and most important, is the fact that the lens has no personal bias. It records

Huff-Daland *"Petrel,"* forerunner of the special planes designed for dusting cotton fields.



Above—Locust infested sugar plantation territory in Philippines dusted by army airplanes. *Below*—Motor Balloon of Airships, Inc., Hammondsport, N. Y., used in air war on gyspy moth.—Photos, U. S. Air Service.

the facts presented to it, without recourse to a more or less fickle memory and without prejudice. The lens is not concerned with the future course of prices or the possible effect of its verdict on those prices, nor is it hampered by any unconscious tendency to over or under-state the facts. Whatever information it may be found practicable to obtain with the camera therefore may be considered free from that troublesome factor known to the statistician as 'bias.'

"Of equal importance is the rapidity with which a photographic 'sample' may be taken. Modern air craft cameras take films in rolls of 75 feet. Flight is maintained at 80 to 100 miles per hour, so that in a relatively short space of time a State may be photographed in cross-section, the width of the cross-sectional view depending upon the focal length of the camera and the altitude maintained. These same factors, likewise, determine the scale upon which fields are shown and which must be used in computing areas."

CHAPTER VI

FOREST AIR PATROL IN FOUR YEARS DISCOVERS NEARLY 4000 FIRES IN CALIFORNIA AND OREGON AND THUS SAVES MILLIONS OF DOLLARS—NEW AIDS IN MAKING TOPOGRAPHIC MAPS—AIRPLANES IN MINE RESCUE WORK—PRACTICAL WORK FOR FEDERAL RESERVE BOARD BY CARRYING GOLD TO THREATENED BANK—AIRCRAFT TO COMBAT AIRCRAFT USED IN SMUGGLING RUM AND ALIENS—LIFE SAVING PATROL ON LAKE WASHINGTON.

ON February 6th, 1924, the Forest Service, Department of Agriculture, advised the Chamber:

"An appropriation of $50,000 for airplane patrol was asked by the Forest Service last year, but this was stricken out by the Budget Committee. We were, therefore, unable to carry on this work. Our appropriations for next year also included $50,000 for this purpose, but it was again stricken out by the Budget Committee."

For the lack of $50,000, the public consequently has had to pay millions of dollars through the loss of standing timber in fires which the Forest Air Patrol could have observed soon enough to have enabled the ground crews to get them under control.

Forest Fires Destroy Millions of Dollars' Worth of Timber

For the following review of the Forest Air Patrol, the Aeronautical Chamber of Commerce is indebted to Major H. H. Arnold, who, as Air Officer of the Ninth Corps Area, had general supervision of this work for a number of years:

The forests of the United States cover approximately 550,000,000 acres. The estimated total stand of this timber is 2,800,000,000 board feet. Approximately 27 per cent. of the total forest area of the United States is under Government ownership and comprises the National Forest, National Parks, etc. Within these National Forests there are some 21,179,000 acres under private ownership. The timber, itself, together with the income received from pasturing millions of cattle, horses, sheep and goats, makes the National Forest and the other timbered reservations one of the greatest natural resources possessed by this country. The total value of the timber in the forested areas of the United States is estimated at $6,000,000,000. The annual revenue from the National Forest is approximately $4,000,000.

The United States leads all other countries in the number of its forest fires, for there are more than 28,000 fires annually in our country. In addition to the loss of life incident to these disasters, many millions of dollars worth of timber, crops, live stock, buildings and improvements are lost therefrom. Depending upon the kinds of trees, fifty to sixty years are required for reforestation of areas stripped of their timber. Forest fires if not immediately and effectively dealt with may develop into genuine appalling calamities.

Forest Air Patrol Started in 1919

In 1919 the District Forester in California requested the Air Service to co-operate by establishing aerial lookouts. In spite of unsatisfactory flying equipment, regular patrols were carried out from Mt. Larsen to the Mexican border. Here is the summary for 1919:

Distance covered	235,000 miles
Fires discovered and reported	550
Planes in use daily	12

So gratifying were the results in 1919 that both the forestry experts and the Air Service hoped to continue the work along the entire West coast in 1920. But permission and funds were available only for California. However, fires in Oregon became so disastrous that air protection was summoned and by the close of the year the following record had been established for 1920 in the two states:

Total number of patrols	1,301
Number of fires discovered	1,632
Fires reported by airplane before any other source	818
Fires reported within half mile of their actual location	80%
Fires reported by airplane to Forestry Officials within 20 minutes after they had been located	83%
Total number of square miles patrolled	16,300,000
Total mileage covered	467,000
Number of airplanes in use	37

Air Service Prepares Forest Fire Patrol Manual

When the aerial patrols had terminated in 1920, it became apparent that special provisions must be made in order to insure that the efficiency of the airplane patrol would continue to increase during the 1921 season at the same rate it had during the past season. Accordingly, a special Forest Fire Patrol Manual was prepared which covered in detail the duties of the Commanding Officers, pilots, radio mechanics. It outlined routes of patrols being sent out from each base, gave methods of spotting and reporting fires, went into details as to the duties of the Liaison Officers from the Forestry Service, and in addition contained instructions with regard to means of se-

curing and expending supplies, and making the reports required by both the Forestry Service and the War Department. Further, during the winter 1920-1921 a special course of instruction for both forestry officials and Air Service officers was conducted at Mather Field. This course lasted six weeks and went thoroughly into the best means of operating the patrols. During this course the men from the two services became better acquainted and got to know just how the other men were thinking. The result was better co-operation than ever before.

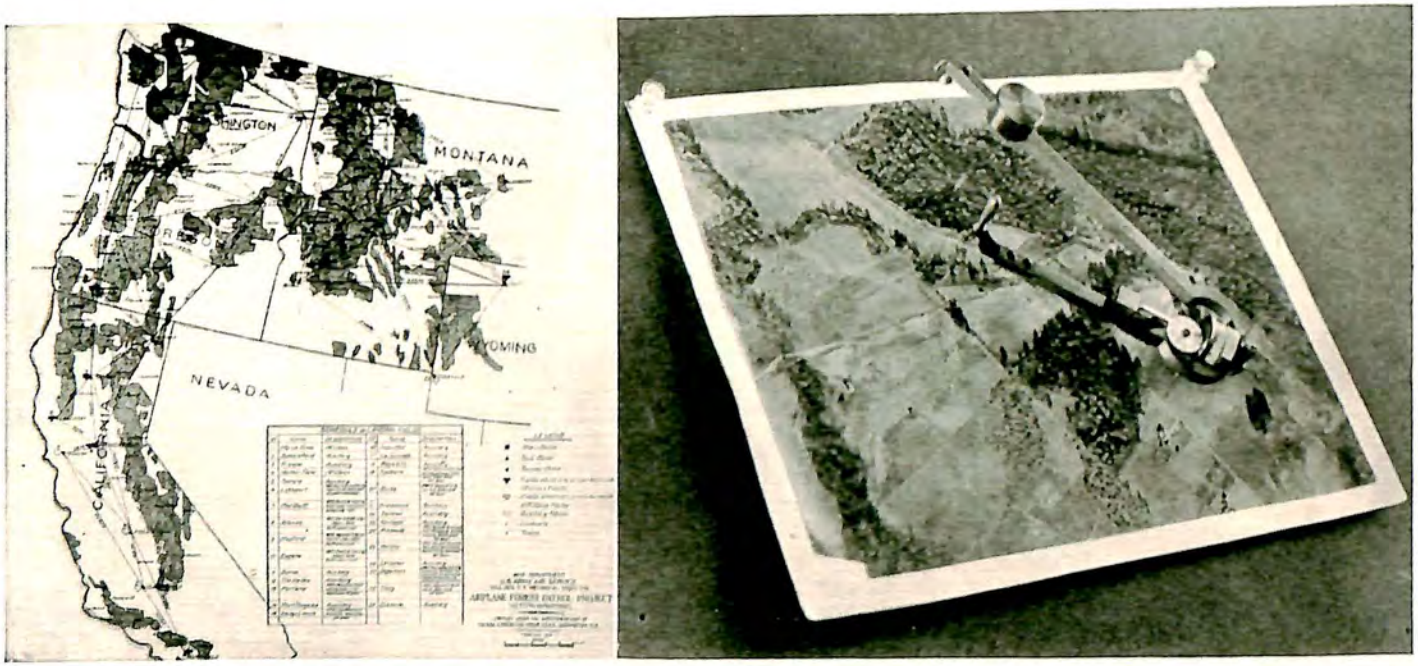
With the experience of two seasons of Forest Fire Patrol in back of it, the Air Service saw that the aerial patrol was of great benefit not only in saving one of the greatest natural resources of the country, but also in direct training of its personnel. The mechanics were required to keep the airplanes, engines and radio apparatus in first class condition while serving in the field. The excellent condition in which the equipment was maintained was demonstrated by the small number of forced landings—total 13, compared with the number of hours flown—2779, which would give an average of one forced landing for every 200 flying hours, and this over some of the worst country for forced landings in the United States.

Radio Replaces Messages by Pigeon and Parachute

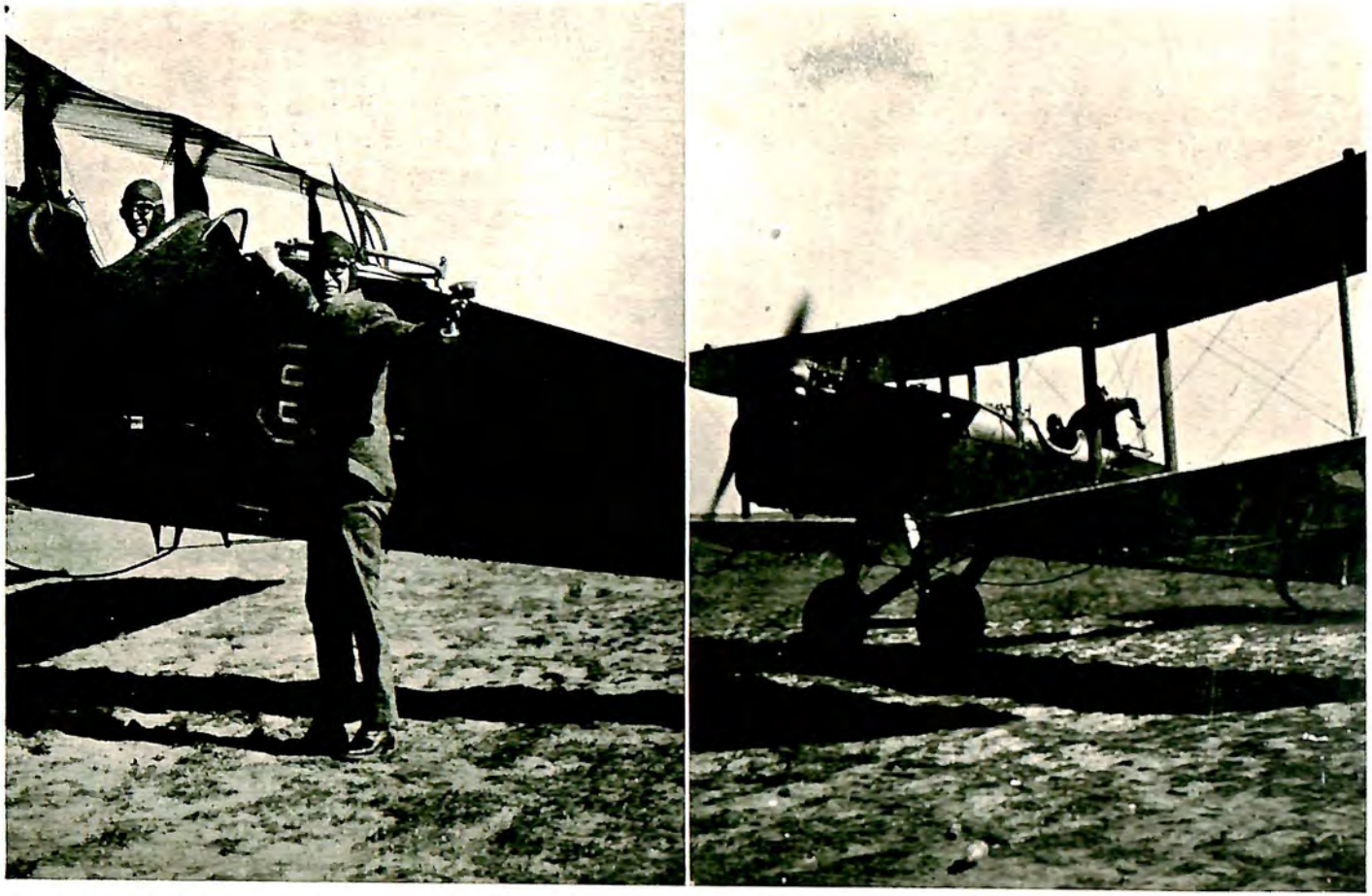
Both the Forestry Service and the Air Service were short of funds. The air patrol, consequently, had to shift along as best it could. But whereas, in 1919, messages attached to parachutes had to be dropped out, or be borne by pigeons, it was possible, in 1921, to use radio, though amateurs had to be employed at the ground stations. During the 79 days of fire patrols flown, five stations were manned by amateurs who received a total of 704 messages reporting fires. These messages were received from airplanes, from 35 to 150 miles distant from the receiving station.

It was very unfortunate that, owing to lack of appropriations during the period of greatest fire hazard it was necessary to suspend the patrols for a period of three weeks due to shortage of gasoline, and for this reason, it can readily be seen that the aerial patrols were unable to make as good a showing as they should have that year. They were well equipped, had two years' experience in back of them and were all eager for the work. However, when the greatest number of fires were burning and the airplanes could have done the most good, for three weeks not a patrol was sent out. But even so, the 1921 record was:

Total number of patrols	746
Total number of fires discovered	1,284



Left—U. S. Air Service Map of Forest Patrol in Northwest and on Pacific Slope. *Right*—Planimeter by which Department of Agriculture measures fields of crops from aerial photographs.



Airplane equipped for mine rescue.—Photos, Bureau of Mines.

Percentage of fires first reported by airplanes	49%
Fires reported within half mile of their actual location	85%
Square miles covered	12,076,000
Number of miles flown	280,000

In 1922, due again to lack of Forestry or Air Service funds, no patrols were planned, but once again the service, out of sheer necessity, had to be resumed. The total area observed was about 2,153,370 square miles; the total number of miles flown, 36,121, and the actual flying time 361 hrs. and 50 min. Two hundred and ninety-four patrols were flown. Of the 458 fires discovered, approximately 114 were discovered first by airplane. Fires were located with an average accuracy of 95 per cent.

Unparalleled Means for Discovery of Fires

One of the reasons why aerial patrol has proved of such great value to the Forest Service lies in the fact that it provides an unparalleled means for the discovery of fires. The aerial observer by the very reason of his position, is not only able to discover in their incipiency fires in the open country, but is also able to detect in obscure places small fires which, due to their location, could not possibly be visible to the ground lookout until they had reached sufficient proportions to represent a genuine menace. When a lookout's territory becomes obscured by a smoke screen, his value as a fire detection agency is either nullified altogether or rendered negligible. For instance, this season an aerial observer discovered within four miles of a lookout a 400 acre fire, which had been burning for at least two days, but which, due to smoky atmospheric conditions, had been entirely invisible to the lookout on the mountain top.

When a fire has gained sufficient headway to necessitate the organization of a fire-fighting force for its suppression, the use of the airplane for reconnaissance purposes is invaluable. A proof of the more effective fire suppression, resulting from the intelligent and comprehensive view of fire situations made possible by the reconnaissance airplane, is established by the fact that, although there were only 24 more fires in Oregon in the three years preceding aerial fire patrol than in the three subsequent years, the territory burned over was reduced from 459,412 acres to 166,137 acres, or by 62 per cent. In California for the same periods there was a reduction of 27 per cent. in territory burned over, the acreage having been cut down from 763,391 to 562,315.

Moral Value in Preventing Fires Through Carelessness

The moral value of air patrol on those persons (campers, tourists, hunters, fishermen, stockmen, etc.) whose carelessness or wil-

fulness in disregarding laws is responsible for such a large number of fires, is shown in the reduction of the number of fires resulting from lumbering and brush-burning. With special patrols that hover around a new fire soon after it starts, to investigate the probable cause, it shows conclusively to the general public that Uncle Sam has his eyes open, and the effect is beneficial. In one district three convictions were secured as a result of information obtained by the District Warden while on air patrol. It is the amazing reduction in the number of incendiary fires which proves the morally prohibitive effect of airplane patrol. The number of fires in California resulting from this cause has been reduced from 556 during the years 1916 to 1919, inclusive, to 187 for 1919 to 1921, inclusive. In Oregon, for the same period, the number has been lowered from 599 to 185, making an average reduction for these two States of 70 per cent. in the number of incendiary fires since aerial patrol has been in operation. The almost total absence of aerial patrol in California for the past year was, in the opinion of the California Forester, responsible for an increase of 23 per cent. in the number of incendiary fires in that State during 1922 over the number in 1921.

In urging that the War Department, if possible, continue the Forest Patrol, should the Forestry Service's recommendations continue to be stricken out by the Budget Committee, Lt. Col. Wm. E. Gillmore, who succeeded Maj. Arnold as Ninth Corps Area Officer, says:

"The average person's mind cannot conceive a million acres, or a million board feet of lumber or even a million dollars. But anyone who can conceive a careless camp fire in the woods, or a careless cigarette stub thrown away, and then takes an airplane ride over one of those tornadoes of flame and smoke, politely called a 'forest fire,' taking everything before it, including thousands of acres of fine standing timber, sometimes human life, darkening the sun by day and lighting the whole country at night, and then realize that all this could have been averted by a single airplane flight of two men, at no great expense, he can be readily converted to the value of forest patrol. A person never seeing a large forest fire, which has burned for weeks and gotten under real headway, cannot have an idea as to their real character or the damage they cause. All big fires were originally small and preventable. It is no idle boast that if the entire airplane patrol of 1922, or any other year, was instrumental in preventing one, it would reimburse the nation for the aggregate cost of all forest patrol since 1919 out of the money saved in timber conservation. The tragedy lies in the fact that the public cannot be educated up to the point of demanding annual forest patrol over the Western States."

Private Timber Associations Interested in Aircraft

In 1923 the Potlach Timber Protective Association and the Coeur d'Alene Timber Protective Association, covering Clearwater, Benewah and Latah counties of Idaho, contracted with Nicholas

Mamer of Spokane, Wash., for preliminary survey and protective patrols. Mamer, at latest accounts, was preparing two planes for service.

Fairchild Forestry Work in Canada

The Canadian branch of the Fairchild Aerial Camera Corporation—the Canadian Fairchild Company—is doing much forestry work. Their operations in summer are by flying boat or seaplane and in winter with land planes equipped with skiis. Much of the operating was around 40 degrees below zero. It was not the cold so much as the high wind, that bothered the pilot and photographer. The holes in the fuselage of the plane were carefully plugged and in the camera compartment where the camera points down toward the floor, a cone was built around the instrument. This cone had a skirt attachment which prevented the wind from blowing into the operator's face. The problem of the water freezing in the radiator was easily solved. For the first time in flights of this kind, it is declared, kerosene was successfully used in the radiator as a substitute for water. Getting the motor started was another difficulty but this was overcome by using a blow torch on the crank case.

Air Data Necessary to Western Topographic Mapping

The U. S. Geological Survey of the Department of the Interior continued in 1923 its close co-operation with the Air Service. Large additional areas have been photographed by the Army fliers and the data thus obtained by the military is incorporated by the Geological Survey into topographical maps for the use of science, commerce and industry.

Los Angeles County, Cal., was photographed for use in connection with the topographic mapping of the country on a large scale; also 500 square miles in the vicinity of Paxton and Gibson City, Ill., and 500 square miles in the vicinity of Columbus, O. A large area in the vicinity of St. Joseph, Mo., is now being photographed, and early this spring the photographing of Cook County, Ill., will be completed for use in connection with the resurvey of Chicago and vicinity. Plans are being perfected for the use of airplane photographs in connection with extensive surveys that are being made in Texas under the supervision of the Geological Survey for the investigation of flood control. All of these photographic data are being secured by the Army Air Service strictly for use of the Geological Survey, and these data will save approximately 25 per cent. of the expense of surveying these areas.

"It is believed that in the near future," writes George Otis Smith, Director of the Geological Survey, "this method of securing a cer-

tain class of data will be considered necessary whenever topographic mapping is planned, especially for areas of low relief."

In northern Tennessee, close to the Mississippi River and near the Kentucky border is Reelfoot Lake—a great swampy region which owes its existence to seismic disturbances many years ago. Geologists had obtained as much data as was possible operating in boats on the winding channels or stumbling through the bayheads. In 1923, Captain A. W. Stevens and Lieut. G. W. Polk, Engineering Division, U. S. Air Service, photographed the entire area. Aside from the unique advantage of height, data of comparative formations and details which cannot escape the camera's lens were obtained and are now being eagerly studied by scientists in other departments of the Government.

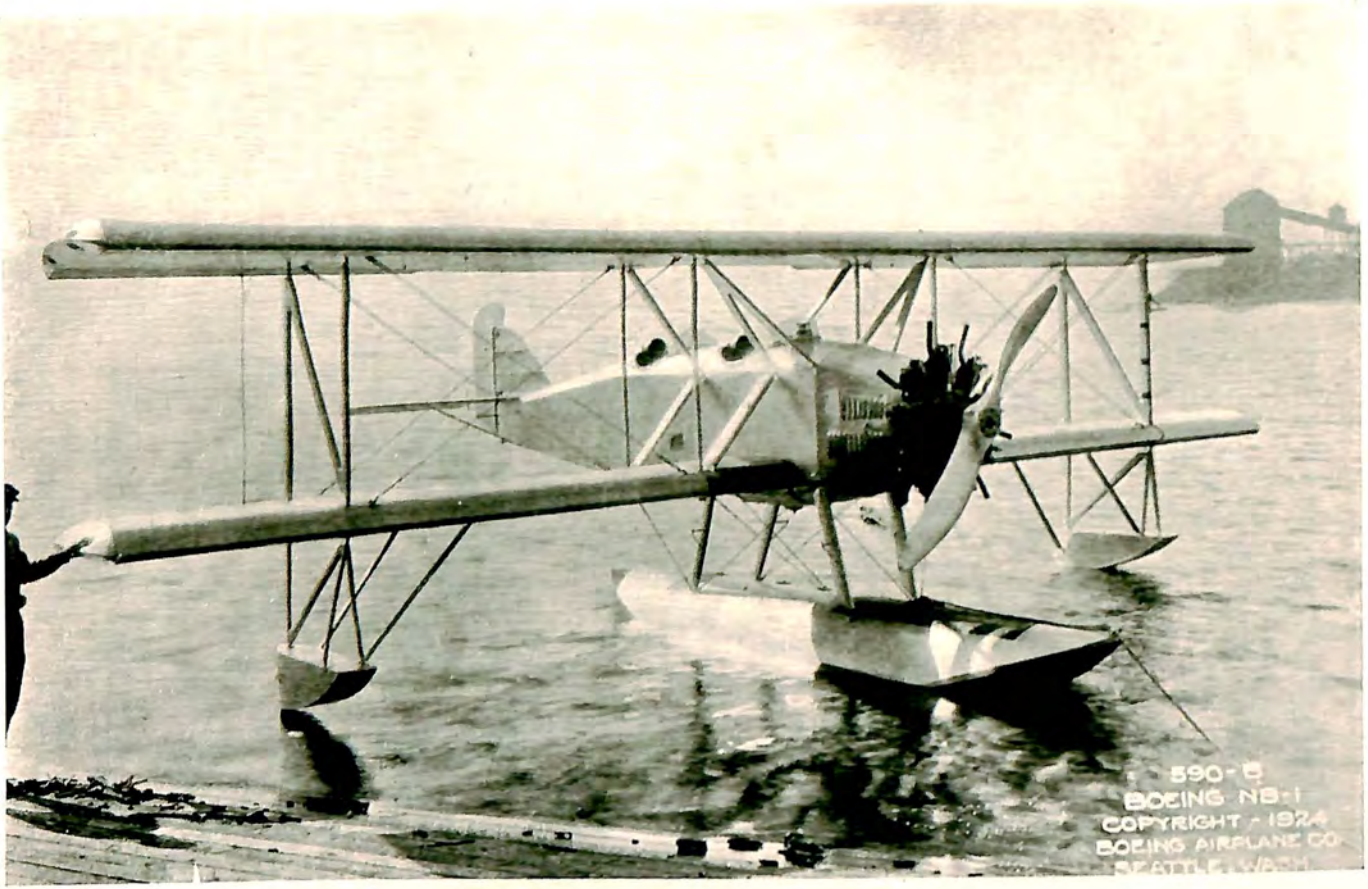
Airplane of Practical Assistance in Mine Rescue Work

Experiments in using aircraft in mine rescue work, begun by the Bureau of Mines, Department of Interior, in 1920, were thrice successfully applied during 1923. At the time of the Argonaut disaster in California, the Army Air Service placed planes at the disposal of the rescue forces and these were used in transporting oxygen and first aid supplies from San Francisco to the mine. In Alabama, one of the Bureau's men twice has used an airplane in making a hurried trip to one of the nearby mines, where an accident had occurred, carrying the necessary supplies.

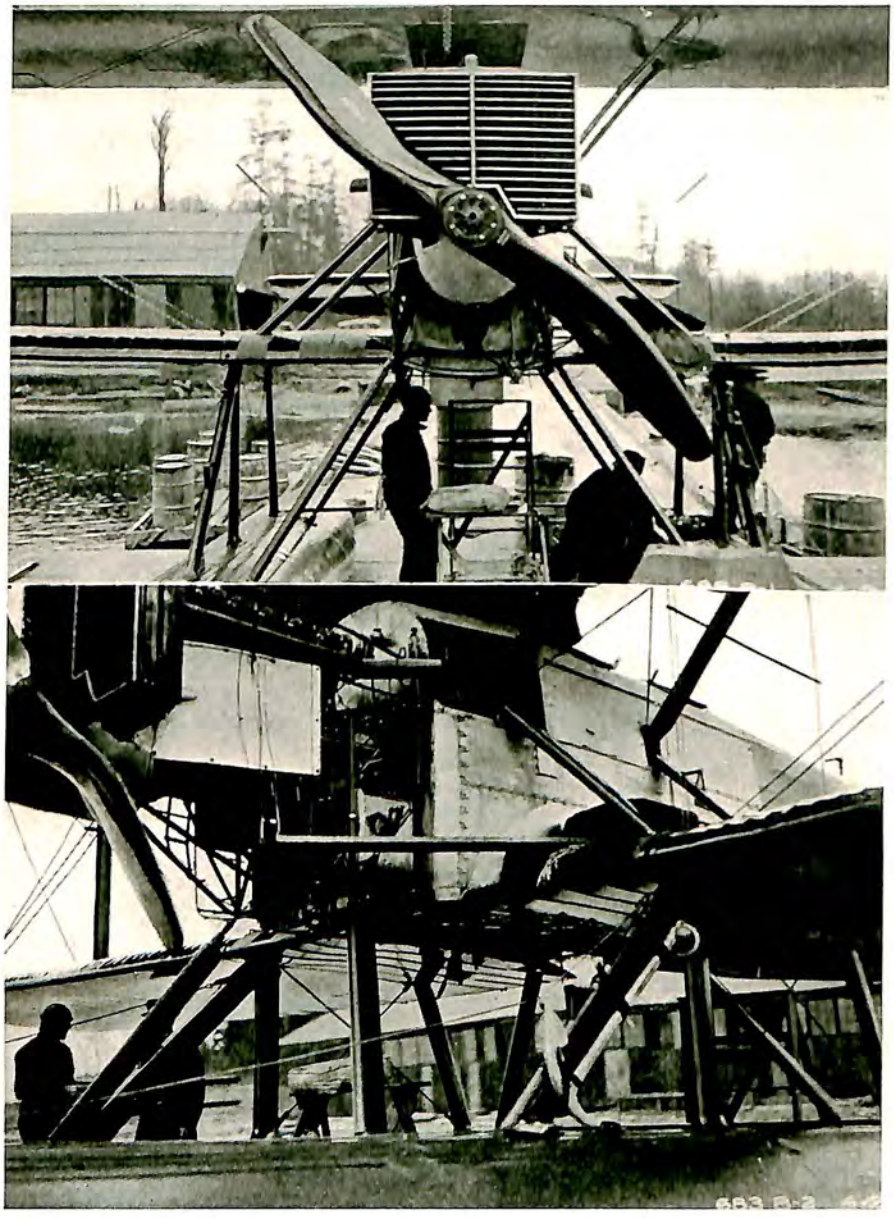
Additional trials were made in Denver, Colo., and at Carbon Hill, a mining settlement near Birmingham, Ala. A landing field has been located at Carbon Hill and other fields will be located at mining towns within reasonable flying range of the mine-rescue station of the Bureau of Mines at Birmingham. Trial flights of planes carrying Bureau of Mines trained men equipped with oxygen breathing apparatus have been made between Roberts field, Birmingham and Carbon Hill.

Two planes of the Alabama National Guard, each carrying a National Guard pilot and a Bureau of Mines engineer, transported five sets of rescue apparatus from Birmingham to Carbon Hill, a distance of 60 miles, in 46 minutes, or at the rate of 80 miles an hour. It is estimated that the minimum time that would have been required by a special railroad engine to cover the distance with a clear right-of-way would have been three hours, while an automobile truck proceeding over the roundabout public roads would have required four hours.

In ordinary rescue work following explosions and fires, it is standard practice to use not less than five sets of oxygen breathing



Boeing Training Seaplane for U. S. Navy.



Douglas World Cruiser being fitted with pontoons by Boeing Airplane Co., Seattle, Wash.

apparatus for the rescue of possible entombed miners and in the recovery of bodies. It is necessary to use oxygen breathing apparatus in the poisonous and irrespirable atmospheres which are generally found after explosions and fires. The apparatus used in the airplane test weighed approximately 200 pounds and the weight of the two pilots and passengers aggregated about 780 pounds. The Bureau of Mines at present maintains 10 railway cars and 7 automobile trucks, equipped for mine-rescue purposes, but it often requires considerable time to send these cars or trucks to remote mining camps. It is hoped to demonstrate the value of the airplane in supplementing the work of these mine-rescue cars and trucks, especially in reaching camps where landing fields are available. The speed and mobility of the airplane and its independence of railway schedules and bad roads are also valuable factors in the consideration of its adaptability to mine-rescue purposes.

Aircraft Put to Work by Federal Reserve Bank

Significant of the future service which aircraft can supply to our national banking system is the following letter to the Chamber from Walter L. Eddy, Secretary of the Federal Reserve Board:

"Recently a bank located in the State of New Mexico which was experiencing a run on its deposits found its cash on hand approaching depletion, and so advised the Branch Federal Reserve Bank at El Paso, Texas. Officials of the Branch Reserve Bank, through the courtesy of United States Army officials, procured the use of an airplane and dispatched half a million dollars in currency to the bank in New Mexico, thus enabling it to continue meeting depositors' demands with cash."

Aircraft and the Smuggling of Rum and Aliens

The Commandant of the Coast Guard, Rear Admiral F. C. Billard, succeeding Admiral Reynolds, and W. W. Husband, the Commissioner General of Immigration, recognize in aircraft smuggling a problem which must be met. According to newspaper reports—and the boasts of bootleggers themselves—aircraft are valuable as scouts to warn "rum row" of the approach of coast guard cutters or police patrol boats, and also to carry liquor itself. Admiral Billard is studying the problem and it is anticipated that the Coast Guard will eventually take to the air in emulation of the bootleggers. To repeat a military maxim, the Coast Guard has begun to realize that "the only defense against aircraft is aircraft."

Commissioner General of Immigration W. W. Husband, in his last annual report states:

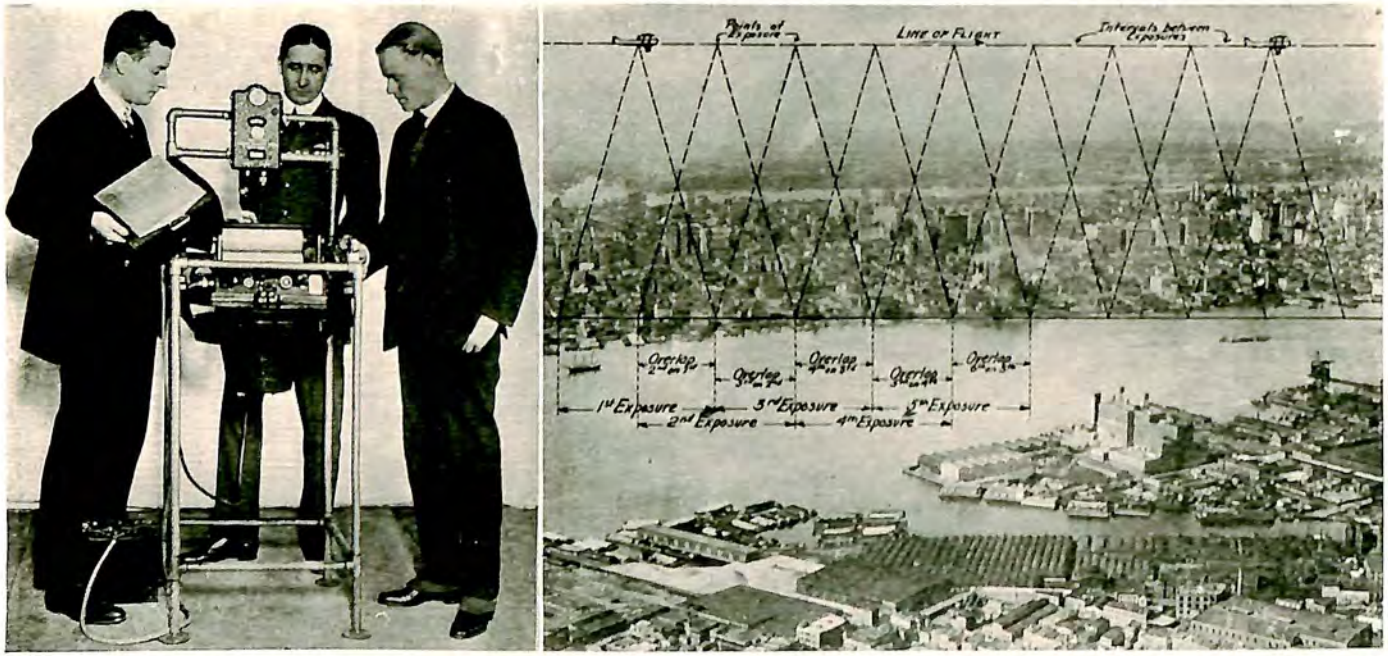
"Another disturbing development of the year was the discovery that airplanes are undoubtedly being used to convey inadmissible aliens from Mexico to points several hundred miles into the interior of this country. It is not

believed that this method has reached any alarming proportions, mainly for the reason that it is of necessity an expensive and somewhat dangerous means of transportation, though one smuggler, using this means of transportation, is alleged to have boasted that he had successfully landed over 200 contraband Chinese. The almost limitless number of landing fields, natural and artificial, make it impossible to defend against this airplane smuggling without swift pursuit planes manned by the Government's own officers. After money and men have been supplied to defend against automobile and boat smuggling, the acquisition of defense scout planes will have to be considered. The practical answer to all this, of course, is that a border patrol, a coast guard, and airplane equipment should be organized and financed, the whole to be directed by a single Government agency for the enforcement of all Federal statutes relating to the importation of aliens, merchandise, intoxicating liquors, and narcotics."

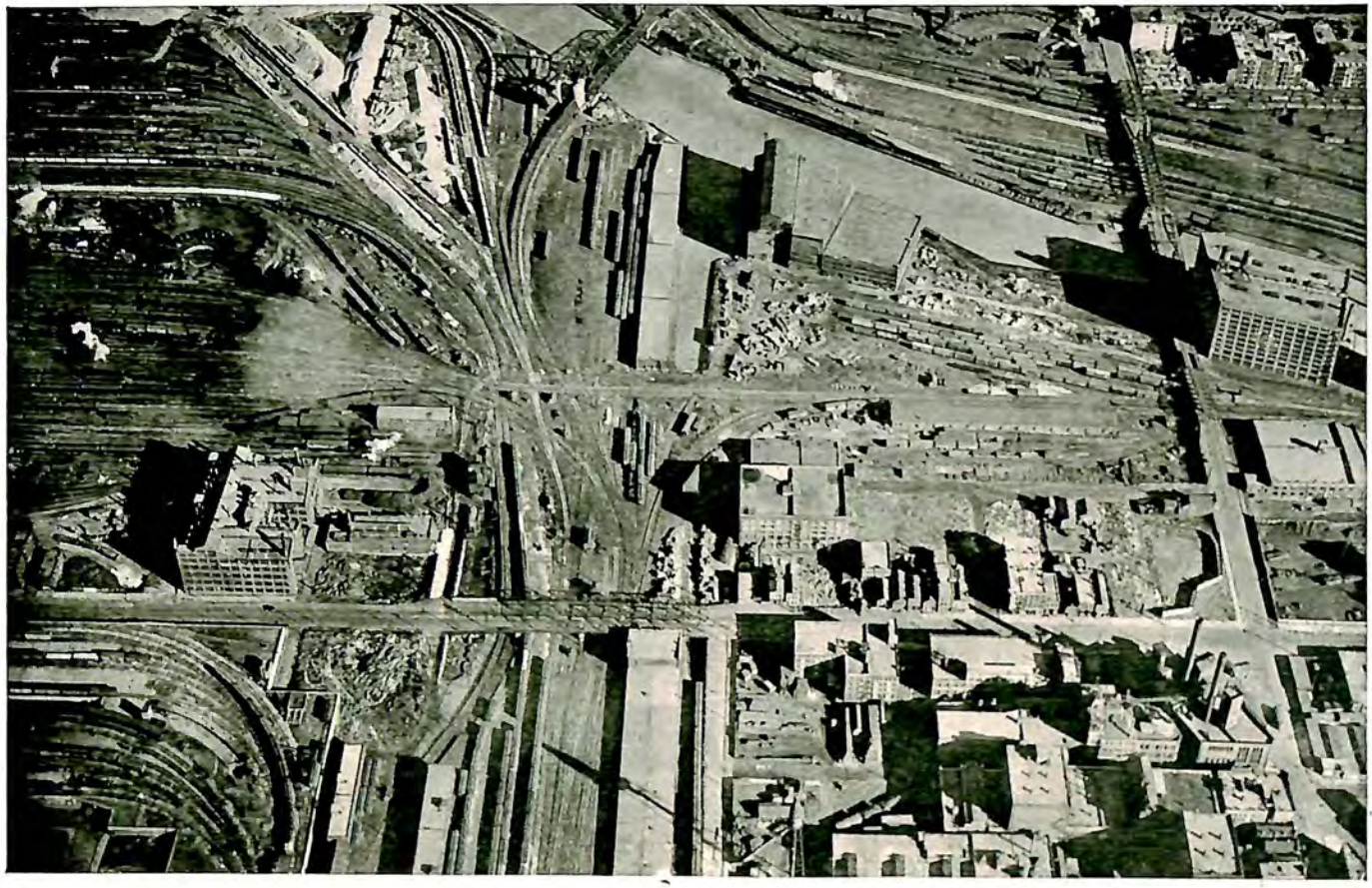
Seaplane Life-Saving Patrol on Lake Washington

Although the United States Coast Guard has been prevented through lack of appropriations from extensively applying aircraft to the saving of life and property at sea—a service for which their fitness has been thoroughly demonstrated—the North Seattle Harbor Patrol, with the co-operation of the Boeing Airplane Company, has established a seaplane patrol on Lake Washington.

According to Captain Van Riper, in charge of life saving, capsized canoes were chiefly responsible for the many drownings that occurred. Owing to the extreme length of Lake Washington—some nineteen miles—it was difficult and frequently impossible to reach the scene of disaster in surface boats in time to be of service. "Now," says Capt. Van Riper, "we maintain a three-shift patrol with an airplane which can get under way in half a minute. The plane carries life rings, body drag and a pulmotor. When news of a canoe upset is telephoned in from any part of the lake we go out in the plane and drop the lifebuoys within easy reach of the people in the water. This gives them assistance until we are able to pull them out."



Left—The Duke of Sutherland, British Under-Secretary of State for Air (at right), Capt. M. G. Christie, British Air Attaché (center), and S. M. Fairchild inspecting the Fairchild Aerial Camera. *Right*—How an aerial photo map is taken. Photos by Fairchild Aerial Camera Corp.



Chicago Railroad Yards. This visualizes what aerial photo can do to assist engineers seeking to correct congestion. Seven railroads use this crossing at the same grade.—Photo, Fairchild Aerial Camera Corp.

CHAPTER VII

AERIAL PHOTOGRAPHY IN CITY PLANNING—MAPPING THE 620 SQUARE MILES OF GREATER NEW YORK—RIGHTS-OF-WAY FOR HIGH TENSION LINES—INDUSTRIAL AND ADVERTISING DEMANDS KEEP MANY FLIERS BUSY.

IN the practical application of aerial photography there has been much progress. The three principal organizations engaged in developing this branch of aviation—Eastman Kodak Company, Fairchild Aerial Camera Corporation, and Hamilton Maxwell, Inc. —have provided scores of small commercial operators with the means by which a continuous profitable use may be made of their aircraft. Aerial photography, being a service which a municipality, business corporation or individual can buy with knowledge beforehand that satisfactory results are assured, is performing its own sales extension in a remarkable manner. Pictures, maps and surveys from the air literally sell themselves.

During 1923, the Fairchild Corporation began the mapping of New York City and executed similar commissions in other municipalities, including Kansas City, Mo., New Britain, Conn., and Worcester and Boston, Mass. Their commercial business, by means of working arrangements with fliers in many localities has steadily increased until it is being carried on today in many parts of the United States and Canada, while a branch is being opened in England.

The Eastman Kodak Company does not operate, but has confined itself to scientific contributions, both as to aerial cameras and supplies. One of the most important recent forward steps has been the introduction of the hyper-sensitized pan-chromatic film manufactured by the Eastman Kodak Co. Though definition obtainable through its use is a vast improvement over the earlier work, the chief advantage of the new film is its greater sensitiveness, making possible the taking of clear and sharp exposures at all hours when good sunlight is available. Aerial work, therefore, is no longer limited to the few hours in the middle of the day as was the case several years ago.

Hamilton Maxwell, Inc., like Fairchild, are effecting flying connections in many parts of the country. They are specializing in mapping and have completed very important contracts in half a dozen states, among them being transmission line rights of way for

the Detroit Edison Co., Ohio Power Co., Rochester Telephone Corp., and Penn Central Power Co. of Altoona. The Rochester Telephone Corp. had an air map made of 80 square miles so as to visualize expansion during the next decade. During the year, planes in Maxwell service flew about 15,000 miles.

Use of Air Photography in City Planning

One of the interesting jobs performed by Fairchild was for the Russell Sage Foundation, which desired a plan of New York. The Department of Recreation of the Sage Foundation, commented on the uses of aerial photography as follows:

"Aerial photography has enabled the city planner to see a city exactly as it is. Before the advent of this aid to the visualization of an entire city, the only way to obtain an idea of the topography of a place was by survey—an expensive and sometimes a lengthy process. The city planner needs to know not only the streets, parks, railroads and other physical features as shown on a city map, but also how these actually look at the present moment; the extent of building in certain districts, the commercial development of waterfronts, the extent of wooded areas as possible park sites, etc.

"Before the city planner began to make use of aerial photography all this had to be obtained by actually visiting the territory. But now with the city and its suburbs laid out before him in a photograph he can see at a glance the actual division of the land into blocks, streets and open spaces. He can also see exactly what portions are built on and more or less the density of building. Many times the aerial photograph of a city will show how the railroad lines draw industries around them in contrast to another section which is unbuilt and without railway facilities. Thus with the actual conditions of the plan before him, the planner can discover trends in housing and industry and develop an idea of improvement, even before he actually visits the ground."

It took almost a year for Fairchild to complete this contract. Soft coal smoke in the industrial area around Manhattan forced operations to 15,000 feet.

Mapping the City of New York

The most ambitious aerial photographic work ever attempted is now under way over Greater New York. In 1921, New York City needed a quick belt line survey. Fairchild secured and executed this contract. A year later Manhattan Island was photographically mapped on a small scale. In 1923, Fairchild was commissioned to map all five boroughs, 620 square miles. It was expected this would be completed by July 1st, 1924.

Rights-of-Way for Tension Lines

In planning rights-of-way for high tension transmission lines, aerial photographs have become extremely valuable. The Public

Service Corporation of Michigan, the Pennsylvania Water and Power Company of Baltimore, the Duquesne Light and Power Company of Pittsburgh, and the Ohio Public Service Corporation of Cleveland, have used Fairchild aerial photographs and found them accurate and a great help in their work.

One of the most interesting jobs done in Texas was the photographing of a 100 mile right-of-way for survey purposes. This work was done in co-operation with the engineers of the Texas Light and Power Company. No Government maps were available. The engineers found that aerial photographs covering the proposed rights-of-way were valuable in determining transmission line locations.

The transmission line maps are made at various scales. It is possible to determine the location of the line with very little, if any, surveying in the field up to the time of purchasing the right-of-way. It is also possible to use the photographs or photographic map to determine the outlines of properties, names of owners, etc., and have complete record of the area to be crossed over by the line without the owners of the property being aware of any intention on the part of a company to construct such a transmission line. Considerable progress has been made in evolving new methods for greater accuracy in the construction of these photographic maps and the construction of photographic maps for transmission line purposes has passed far beyond the experimental stage.

Aerial Photos for Tax Assessment Purposes

The Fairchild Company also has evolved a system of making and using aerial photographs for tax assessment purposes. In very few parts of the country are land values properly assessed, and in country areas especially, throughout nearly the whole country, reassessment is necessary and this can only be done by the aid of maps to show locations and areas of properties, and classification of the various kinds of land in these properties. The aerial photograph shows everything on the ground surface as it exists, and paying due consideration to the differences between an aerial photograph and an exact plan of any property, it is possible to determine nearly all of the information required for tax assessment purposes. This is considered to be one of the largest fields for the application of aerial photography and is being rapidly developed.

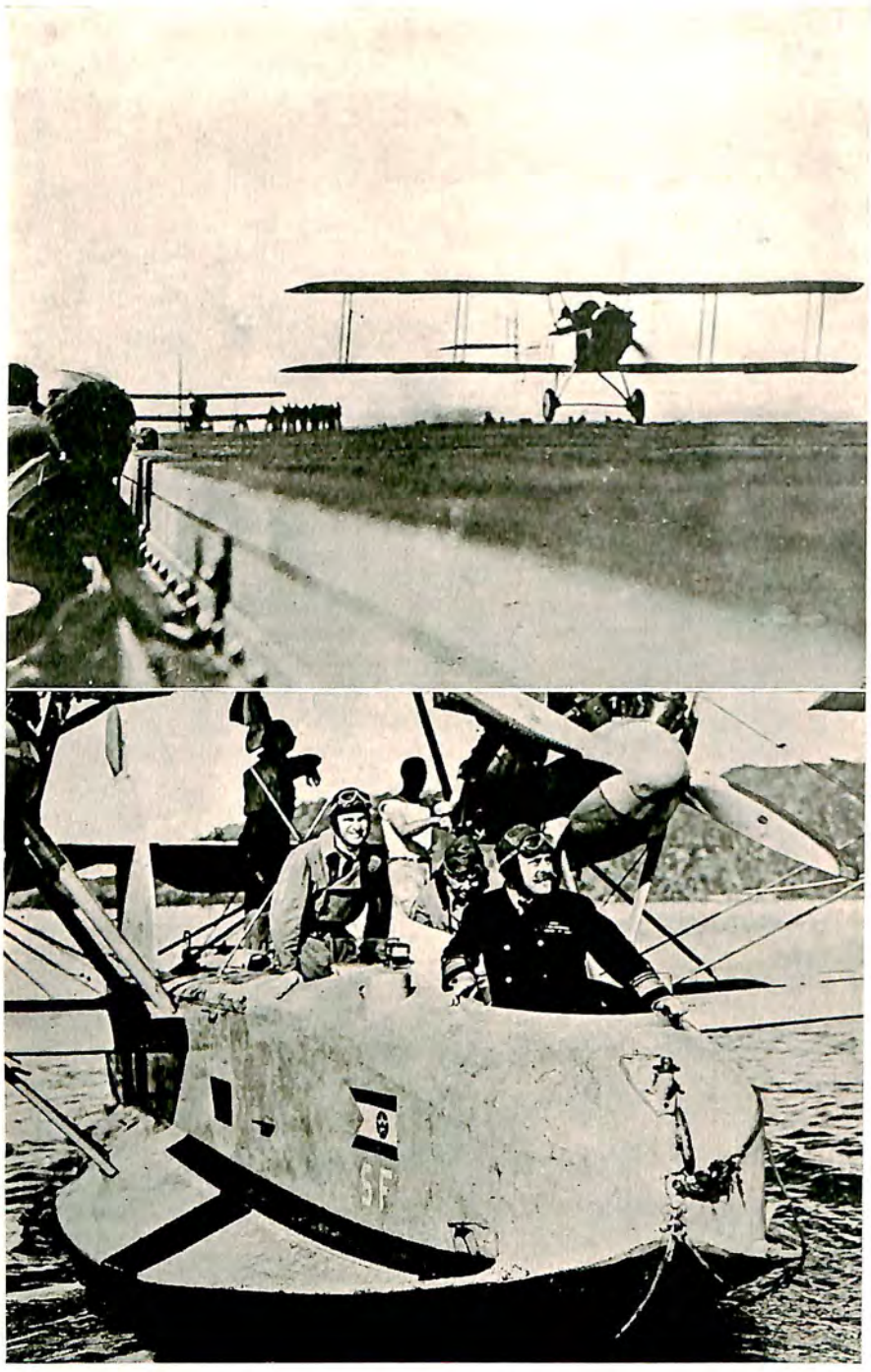
Industrial and Advertising Uses

For industrial and advertising purposes, the aerial photograph is proving of great value. Among the corporations thus served by

Fairchild in 1923 were: In New York State: Brown-Lipe-Chapin (General Motors Subsidiary); Cohoes Light and Power Co.; Endicott Johnson; General Electric Co.; Ingersoll Rand; Rome Wire Co.; Syracuse Post-Standard; Utica Gas & Electric Co. and Weber Electric Co. In Connecticut: Bryant Electric Co.; Royal Typewriter Co. In Massachusetts: Boston Chamber of Commerce; Stevens Arms Co. In Ohio: Cleveland Illuminating Co.; Goodyear Tire & Rubber Co.; National Tube Co.; Ohio Leather Co.; Public Iron & Steel Co.; Timken Axle Co.; West Penn Power Co.; White Motor Car Co.

During the year many improvements to the Fairchild camera were devised including a high efficiency shutter, automatically operated. The complete camera weighs but 46 pounds. Another invention is the stereoscope through which aerial photographs are seen in relief.

Lieut. David Rittenhouse and Navy-Curtiss Seaplane Racer in which he won Schneider Trophy at 177.38 m.p.h.



Above—Plane landing on deck of U. S. S. *"Langley,"* aircraft carrier. *Below*—Vice-Admiral N. A. McCully and Capt. W. R. Gherardi in *PN-7*. This boat has two 550 h.p. Wright T engines.—Photos, U. S. Navy.

CHAPTER VIII

VALUABLE SERVICE PERFORMED BY AIRWAYS SECTION IN GATHERING DATA ON ROUTES AND FIELDS—METEOROLOGICAL WORK IN CO-OPERATION WITH SIGNAL CORPS AND WEATHER BUREAU.

OF the six requisites for safe flying, as enumerated for several years by the Aeronautical Chamber of Commerce, three concern the inspection and certification of craft, engines and pilots, and three involve the establishment of terminals, the laying out of air routes and the nation-wide availability of meteorological information.

While satisfactory realization of all these factors must necessarily await the formulation of a national air policy and its expression through the establishment of a Bureau of Aeronautics or similar agency, much can be done—and is being done—in the meantime by the Air Service, the Air Mail, the Bureau of Aeronautics and by civilian fliers reporting to the Aeronautical Chamber of Commerce.

The Airways Section, Office of Chief of Air Service, is performing a most valuable task. With but slight funds and inadequate personnel, it has been able, nevertheless, to chart a considerable number of routes, publish flying maps and issue at frequent intervals condensed data covering landing fields and airways. In the excellent service that it has performed, it is an augury of the good which will ensue upon a far greater scale when we are successful in having an air policy formulated and the necessary legislation enacted by Congress.

The Airways Section has been in charge since its establishment in 1921, of Capt. B. S. Wright, assisted by Capt. St. Clair Streett. Upon Capt. Wright's detail with troops, early in 1924, Capt. Streett was to assume direction.

Proposed Airways System

One of the first results of the organization of the Airways Section was the issuance of a map of a proposed or probable airways system for national defense or coming commercial aviation. Through numerous reports from various sources, the airways system, connecting in the main the principal cities of the United States, was revised from time to time and a map of the routes published and distributed to the aviation interests in 1923.

In the publication known as the Aeronautical Bulletin, first issued in the spring of 1923, the Airways Section has been attempting to cover the sections of the proposed airways system for the benefit of the aviator in a manner similar to the method of describing the highways of the United States for the use of the motorist. This information was termed the Route Information Series of the Aeronautical Bulletin, and was secured by dividing the 30,000 miles of the proposed airways system into approximately 200 sections and issuing orders for their description, in both directions, by the Army Air Service fields throughout the United States, indicating the manner in which these investigations should be carried out and defining the form in which the data should be furnished for publication. At the close of 1923 approximately 120 of these sections had been covered. These bulletins provide data on mileage and descriptive sentences enabling the pilot to fly with reasonable assurance from point to point.

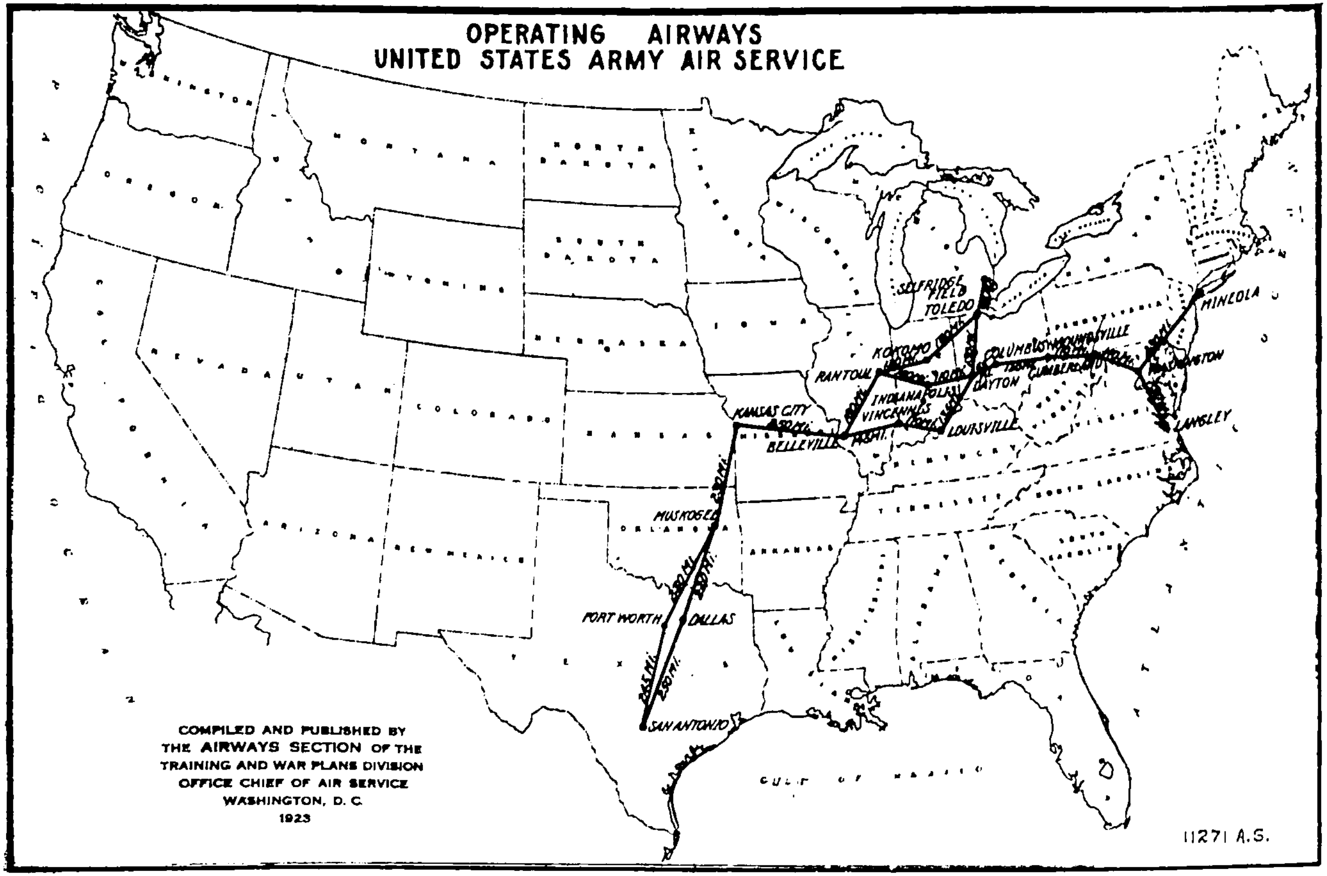
Marking of Airways

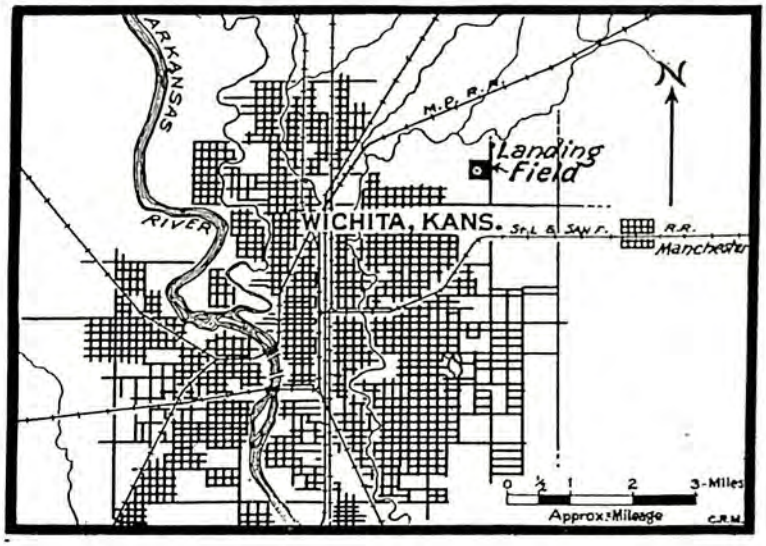
In further study of the identification of airways, a section of the Model Airway System between Washington and Dayton was completely marked, the line of flight covering 104 cities and towns whose names were painted on the roofs of prominent buildings adjacent to the railroad. In addition, a section from Dayton to Mt. Clemens, Mich., was similarly marked, and from the experience gained in the work on these two sections a pamphlet of instructions as to the identification of airways is being compiled.

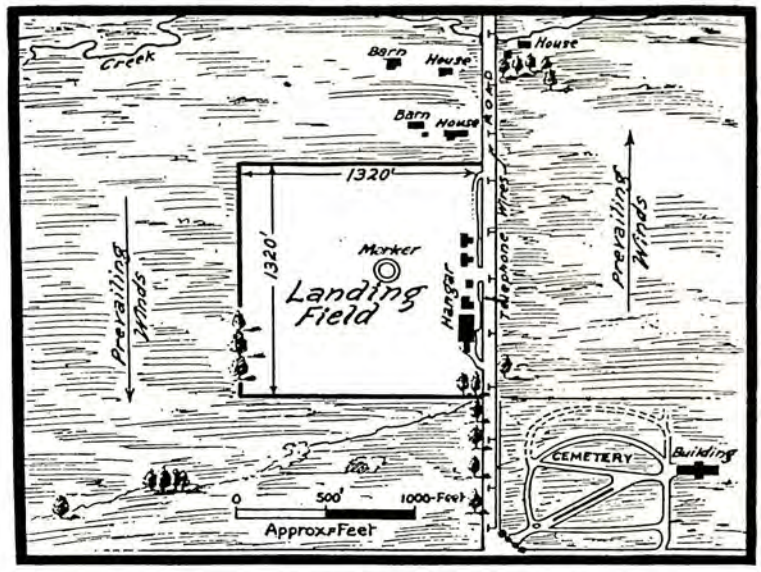
The marking of emergency fields has been continued and the means to be employed in this work have been studied and been made the subject of recommendations to localities considering the marking of their fields. It is the hope of the Air Service that it may be possible to have, throughout the airways system, emergency fields at 25 miles intervals, set aside and marked by the community concerned.

Information on Landing Facilities

There has been a desperate need for a central source of information of landing facilities. This need obviously cannot be met, on behalf of civilian aviation, until a proper civilian authority is established. But, lacking this, the War and Navy Departments with the Aeronautical Chamber of Commerce, are doing what they can. The Navy has been disseminating information, particularly on seaplane facilities, through its "Notice to Aviators." It was found impracticable, however, for this publication to present sketches of landing facilities. An agreement was therefore entered into between the


OPERATING AIRWAYS
UNITED STATES ARMY AIR SERVICE
SELFRIDGE FIELD
TOLEDO
MINEOLA
KOKOMO
RANTOUL
COLUMBUS
MOUNDSVILLE
CUMBERLAND
DAYTON
INDIANAPOLIS
VINCENNES
LOUISVILLE
WASHINGTON
LANGLEY
KANSAS CITY
BELLEVILLE
MUSKOGEE
FORT WORTH
DALLAS
SAN ANTONIO
COMPILED AND PUBLISHED BY
THE AIRWAYS SECTION OF THE
TRAINING AND WAR PLANS DIVISION
OFFICE CHIEF OF AIR SERVICE
WASHINGTON, D. C.
1923
11271 A.S.





Landing Fields.

War and Navy Departments whereby the "Notice to Aviators" would, in the main, carry data on seaplane facilities for the United States, and seaplane and land plane facilities for the nearby foreign countries, and with the understanding that the Aeronautical Bulletin, published by the Airways Section, should carry information on the domestic landing facilities. A loose-leaf publication was therefore issued, called the State Series of the Aeronautical Bulletin, and, through the co-operation of the Army Air Service with the Bureau of Aeronautics of the Navy Department, the Aviation Section of the Marine Corps, the Air Mail Division of the Post Office Department, the Aeronautical Chamber of Commerce, and municipal or civic organizations, the data necessary for this bulletin began to arrive in the Airways Section. The Aeronautical Bulletin carries a sketch showing the relation of the field to the city and other prominent land marks in the vicinity and also a sketch giving the details of the field itself, and, further, descriptive information upon the facility. In 1923 approximately 150 landing facilities were covered.

It has been found, through the card index system maintained by the Airways Section, that the amount of information being received has increased until the localities at which facilities of some nature are reported number approximately 5,000. The data on the greater majority of these facilities was not sufficient for the publication of individual bulletins, and accordingly arrangements were made for the publication of an Aeronautical Bulletin of the State Series on each state, summarizing the available information on each facility in the state. The entire set of states is practically complete.

Changes in New Map of Airways and Landing Fields

In the revision of the Landing Facility and Proposed Airways System Map—a publication first compiled by the Airways Section in 1923 graphically to give the locations of the landing facilities on which reports are available in this office—the following changes were found necessary: addition of commercial fields, newly reported in 1923, 39; elimination of such fields abandoned in 1923, 39; addition of municipal fields reported as organized or, in many instances, merely set aside for aviation use, 54; elimination of those abandoned or no longer set aside, 27; addition of Army fields, organized or set aside on military reservations for aviation purposes, 10; elimination of Army fields abandoned or no longer available for aviation use, 17; addition of Navy fields, organized or for which terrain was set aside on Naval reservations for aviation purposes, 3; elimination of those abandoned, none; addition of Air Mail fields, organized (this including emergency fields obtained on the night flying section be-

tween Chicago and Cheyenne), 33; elimination of Air Mail fields, abandoned, 4; addition of emergency fields reported as available in 1923, and not previously reported, 442; elimination of those abandoned—on which reports are received that they are no longer available for use—or on which checking indicates that former reports were inaccurate, 287.

Aerial Navigation Maps

The Chief of the Air Service, realizing the lack of a Government organization in this country—other than that of his office—for the specific purpose of compiling necessary information for aviators, continued, during 1923, his policy in producing special aerial navigation maps on a limited scale. These maps, for the purposes of convenience and economy, are published as strips, but in general conform to the requirements of the Aerial Navigation Convention of Paris, 1919. At the close of 1923, the work in the production of these maps by the Air Service, through the utilization of the services of the Geological Survey of the Interior Department and the Engineer Reproduction Plant of the Army Engineer Corps, had progressed to the point where special maps had been compiled and published on the Air Mail Route from New York to Chicago, on the Model Airway from New York and Norfolk to Dayton, and along the southern proposed airway across the State of Texas from Beaumont, via San Antonio and Sanderson, to El Paso. These maps carry, in general, the following characteristics:

1. The altitude of the terrain included in the map is represented by the hypsometric tint process; that is, all country between sea level and 500 feet above sea level is in fairly dark green; between 500 and 1,000 feet, in lighter shade of green; between 1,000 and 1,500 feet, in a still lighter shade of green; between 1,500 and 2,000 feet, in a light yellow. From 2,000 feet to higher altitudes yellow shades into the darker shades of brown. This affords opportunity for the pilot to know within a few hundred feet the altitude of the country at any point on the map.
2. Railroads are shown in black, differentiation being made between the various numbers of tracks.
3. Highways are in white, differentiation being made between main and minor roads.
4. Towns are blocked in in red, according to shape.
5. Rivers are shown in blue.
6. Compass course for each direction of flight shown in dotted red lines, with the mileage every ten miles.
7. Location of landing fields, reports on which are available in the Airways Section, shown by symbols on the map in red, the symbols being explained by a key on the side of the map, defining the information that the map carries on the landing fields. Sketches of the landing facilities represented by the symbols are carried on

the landing fields. Sketches of the landing facilities represented by the symbols are carried along the border of the map.

8. Maps less than 37 inches in length are printed on paper backed with linen, and those of greater length are printed on heavy chart paper similar to that used for hydrographic charts.
9. The scale of the map is 1:500,000, that is about 8 miles to the inch, conforming to the base map series published by the Geological Survey on the various states of the United States.
10. The map covers a strip on an average of about 250 miles in length and 80 miles in width, giving the pilot approximately 40 miles on either side of the route on which he is to fly.

Army Air Service Operating Airways

The Model Airway as originally organized in 1922, at that time connecting New York, Norfolk, Washington and Dayton, has been extended during 1923 to include Selfridge Field at Detroit, Mich., Chanute Field at Rantoul, Ill., Scott Field, near St. Louis, and Bowman Field at Louisville, Ky. In addition, a section has been established from Kelly Field, San Antonio, Texas, to St. Louis, where a connection is made with the eastern division of the airway. Seven fields participating on a bi-weekly schedule on the eastern airway and Kelly and Brooks Fields, on a weekly schedule on the Kelly Field-Scott Field Section, total now about 7,000 miles a week of organized flying on schedule. To date it is estimated that between three and four hundred thousand miles have been flown by the planes operating on the Model Airway of the Army Air Service, and no casualities or even injuries to personnel assigned to the scheduled flying have resulted.

The purposes of these operations, carried out by the pilots of the fields accomplishing this work, may be briefly summarized as:

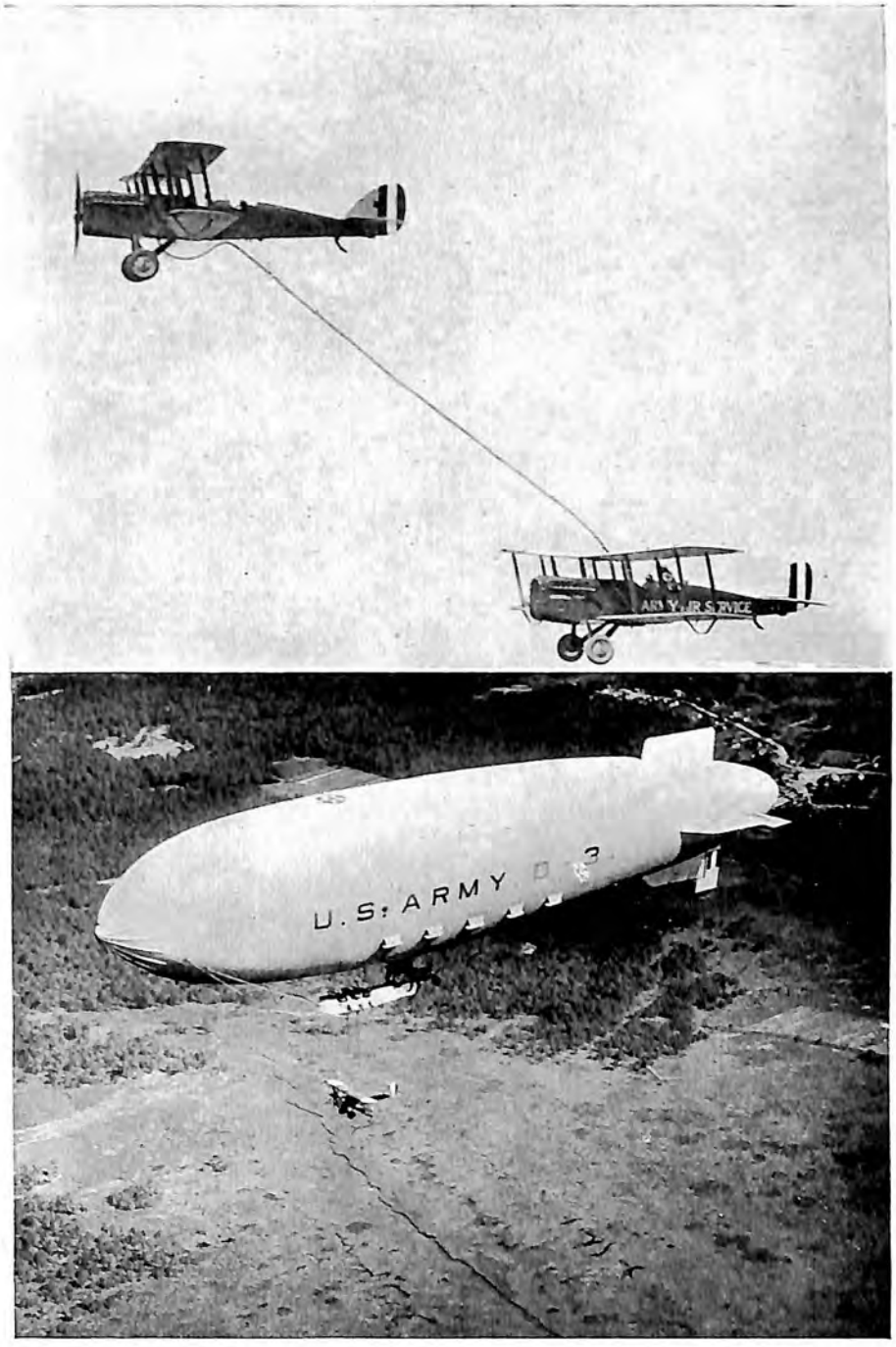
1. The study of the needs of aviation in the United States in its utility as a medium of transportation.
2. The training of the pilots of the various fields in cross-country flying under regulations and schedule.
3. The development of, and the carrying out of tests with, various aerial navigation instruments and aids.
4. The careful detailed study of the present system of weather forecasting and the dissemination of weather information as relating to aviation.
5. The rapid transportation of official personnel, equipment and mail.

Meteorology—The Weather Bureau, Signal Corps and the Airways Section

The Weather Bureau, of the Department of Agriculture, Charles F. Marvin, Chief, and the Airways Section, maintain liaison. Forecasts by the Bureau are now designed, in so far as development will permit, to meet flying needs. In addition to the 200 regular stations, observations of upper wind direction and speed are made

at 16 Weather Bureau stations by means of pilot balloons, and also at some 20 stations maintained at flying fields by the War and Navy Departments. The data from all of these observations are telegraphed in code to District Forecast Centers and are there used as a basis for weather bulletins, forecasts and warnings. Weather bulletins are distributed by radio from Arlington, Va., Chicago, Ill., and San Francisco, Cal. They contain, for selected stations, the state of the weather; barometric pressure; amount, kind and direction of clouds; and wind direction and force at the surface and at various levels in the upper air; also, a synopsis of general weather conditions; wind and weather forecasts; and flying weather forecasts for certain zones into which the country has been divided. Special forecasts are issued, when requested, for aircraft contests, balloon races and long distance cross-country flights.

Extremely close co-operation has been received by the Airways Section in meteorological work from the Signal Corps of the Army, and meteorological sections of this corps are now stationed at practically all of the operating fields, their work tieing in with the airway organization throughout the United States. Detailed studies are being made at numerous points in contemplation of affording information, over an extended period, to those who may engage in commercial aviation in the future. A new duty—that of airway meteorological control officer—has sprung up in the Meteorological Section of the Signal Corps, and for over a year an officer has been stationed in this capacity at Bolling Field, co-ordinating the work of the meteorological sections of the eastern stations of the United States, and preparing data obtained from this work for the benefit of the pilots flying the schedule. Arrangements were carried out during the year 1923 for the stationing of such an officer at Crissy Field, San Francisco; at Kelly Field, San Antonio, Texas; and at Scott Field, near St. Louis.



Above—First refueling in air by Army Air Service.—Photo by Aircraft Squadrons, Battle Fleet. *Below*—Goodyear non-rigid used in first contact between airplane and airship in flight.—Photo, U. S. Air Service.

The Death Shroud of the Battleship. Smoke screen released by Martin Bomber over the *"New Jersey"* just before it was bombed and sunk.—Photo by U. S. Air Service.

CHAPTER IX

ITINERANT ACCIDENTS INCREASE—MAJORITY OF SUCH CASUALTIES IN LAST THREE YEARS ATTRIBUTED TO LACK OF FEDERAL CONTROL—CONTINUED RELEASE OF OLD GOVERNMENT EQUIPMENT ADDS TO RECORD OF CRASHES.

IN the three years that have elapsed since 1921, when an effort was first made to obtain accurate data on the hazard of flight in this country, there have been 470 civilian aviation accidents, involving death to 221 persons and injury to 391.

Most of these casualties having occurred—and to a steadily increasing degree—among the irresponsible itinerant class of fliers, they may be justly attributed to the failure of Congress to enact regulatory legislation which, in addition to corrective measures including inspection of equipment and certification of pilots and navigators, would have provided such indispensable assistance to American aviation as the establishment of legal authority to operate, of marked and illuminated airways and the dissemination of route and meteorological information.

In the three-year period named, there were but 51 accidents among those individual or incorporated operators who, having a fixed base, were financially liable and who, consequently, imposed upon themselves a form of discipline such as would uniformly be applied through Federal air law. These 51 accidents resulted in the death of 25 persons and in injury to 40. This record, as will be shown later, could have been very materially reduced had national regulation been in effect.

Six Requisites for Safe Flying

As has been stated in previous issues of the Aircraft Year Book, there are six requisites for safe flying, all of which must be approximated 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 fliers.
6. Adequate charts of air routes.

Examination of the record of accidents among itinerant fliers will first be undertaken. At the outset it should be reiterated that, in the gypsy flier, American aviation finds at once elements of strength and weakness. The *gypsy* is the pioneer. Good or bad, he is all of aviation that hundreds of communities have ever seen. His intentions are commendable and if, in his operations, he prejudices opinion, it may be said with equal justice that, in other phases of operations, he has made a contribution. That is, in all phases except where casualities are concerned. Extravagant promises, disappointed hopes, financial disaster—these may be condoned. But death or injury cannot be forgotten. What is said of the itinerant flier by the Aeronautical Chamber of Commerce, therefore, is out of an earnest desire to assist, not merely to condemn.

Heavy Increase in Gypsy Accidents in 1923

Based upon newspaper reports, many of which were probably incomplete, 179 serious accidents occurred among itinerant fliers in the calendar year 1923. In these accidents, 85 persons were killed and 162 injured. This is an increase of 65 accidents over 1921 and 53 over 1922. Fatalities in 1923 increased 36 over 1921 and 23 over 1922. Injuries were 73 in excess of 1921 and 62 over 1922. It will be noted upon examination of the following table that the rate of increase of 1923 over 1922, as compared with 1922 over 1921 was this much greater: over 400 per cent. in total number of accidents, nearly 200 per cent. in fatalities and nearly 600 per cent. in the number of persons injured.

Comparative Table of Serious Accidents Among Itinerant Fliers During Three Year Period—1921-1923

		1921	*1922*	*1923*	*Total 3 Years 1921-1923*
Number of serious itinerant accidents recorded		114	126	179	419
Total number of itinerant fatalities		49	62	85	196
Total number of itinerant injuries		89	100	162	351
Causes	Error in piloting	49	46	87	182
	Field or terminal	20	14	15	49
	Lack of weather data	4	1	1	6
	Lack of route data or flying rules	10	9	16	35
	Inspection: Faulty craft	4	22	42	68
	Inspection: Faulty engine	9	11	27	47
	Inspection: Faulty accessory	9	4	9	22
	Stunting	29	39	30	98
	Collision in air	2	0	0	2
	Carelessness on field	8	11	13	32
	Unknown	8	17	17	42

The record in 1923 is so much worse than in any preceding year that, upon scanning the record of the 179 accidents (see Table No. II), one naturally concludes there must have been a tremendous expansion of flying. This was not the case.

Many Crashes Due to Deteriorated Military Surplus Equipment

In the first few years following the Armistice many hundreds of war-built planes and engines were released to the civilian public. It has been conservatively estimated that, in 1921, probably 1,000 to 1,200 aircraft were in operation, half being in the hands of *gypsies* and half flown by fixed-based operators. While the proportion of equipment controlled by the fixed-base operators, has slightly increased, the machines of the itinerant pilots have, if anything, diminished in number. In 1922 and 1923 there was only a small amount of new commercial aircraft construction in the United States, but in each year a considerable quantity of military equipment, some of which had been in storage since the latter part of 1917, was released through auction. These planes and engines thus came into the possession of individuals of varying degrees of competence and responsibility. When equipment, either of a design unsuited to the average pilot engaged in passenger carrying or in cross country work, or of inferior quality, due to deterioration and age, got into the hands of unskilled persons accidents were certain to ensue. But as these accidents occurred, and the machines were destroyed, more equipment was released to take its place, so that the level of approximately 1,200 planes in each of the three years under discussion is believed to have been maintained.

Of the 419 itinerant accidents recorded in 1921-1923 inclusive, these were found to be the principal causes or combinations of causes:

Error in piloting	182
Improper inspection (craft, engine, accessory)	137
Stunting	98

Of the 196 fatalities recorded among itinerant fliers in the above period, these were found to be the principal causes or combinations of causes:

Error in piloting			70
Field or terminal			9
Lack of weather data			2
Lack of route data or flying rules			12
Inspection	Faulty craft	55	84
	Faulty engine	14	
	Faulty accessory	15	

Stunting 56
Collision in air 3
Carelessness on field 8
Unknown 32

Co-operation Requested in Controlling Release of Equipment

On May 14th, 1923, following accounts in the press of itinerant flying accidents in what may be termed "rum row" off the New Jersey coast, the Aeronautical Chamber of Commerce sent the following telegram to the Secretaries of War and Navy:

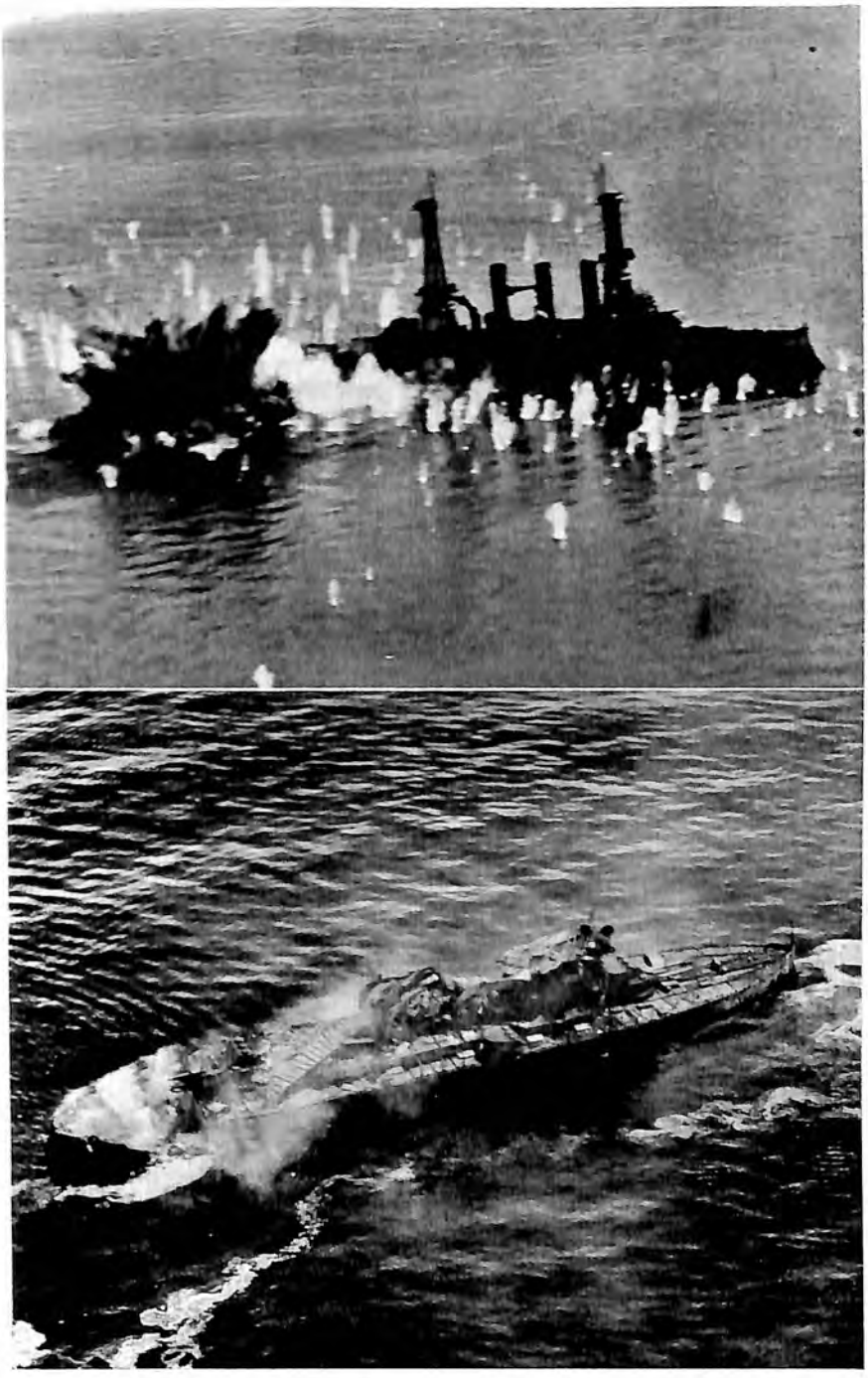
"Following recently reported accidents to commercial aircraft we are asked for information regarding attitude of department toward sale surplus equipment to civilians with particular reference to condition in which they are released and uses to which they are put. Responsible, reputable concerns in the aircraft industry feel commercial aviation is suffering irreparable harm on account of unregulated, irresponsible flying. We place at your disposal all resources at our command in an effort to correct this situation pending enactment of Federal law."

In subsequent letters to the Chiefs of the Army and Navy Air Services the Chamber recommended:

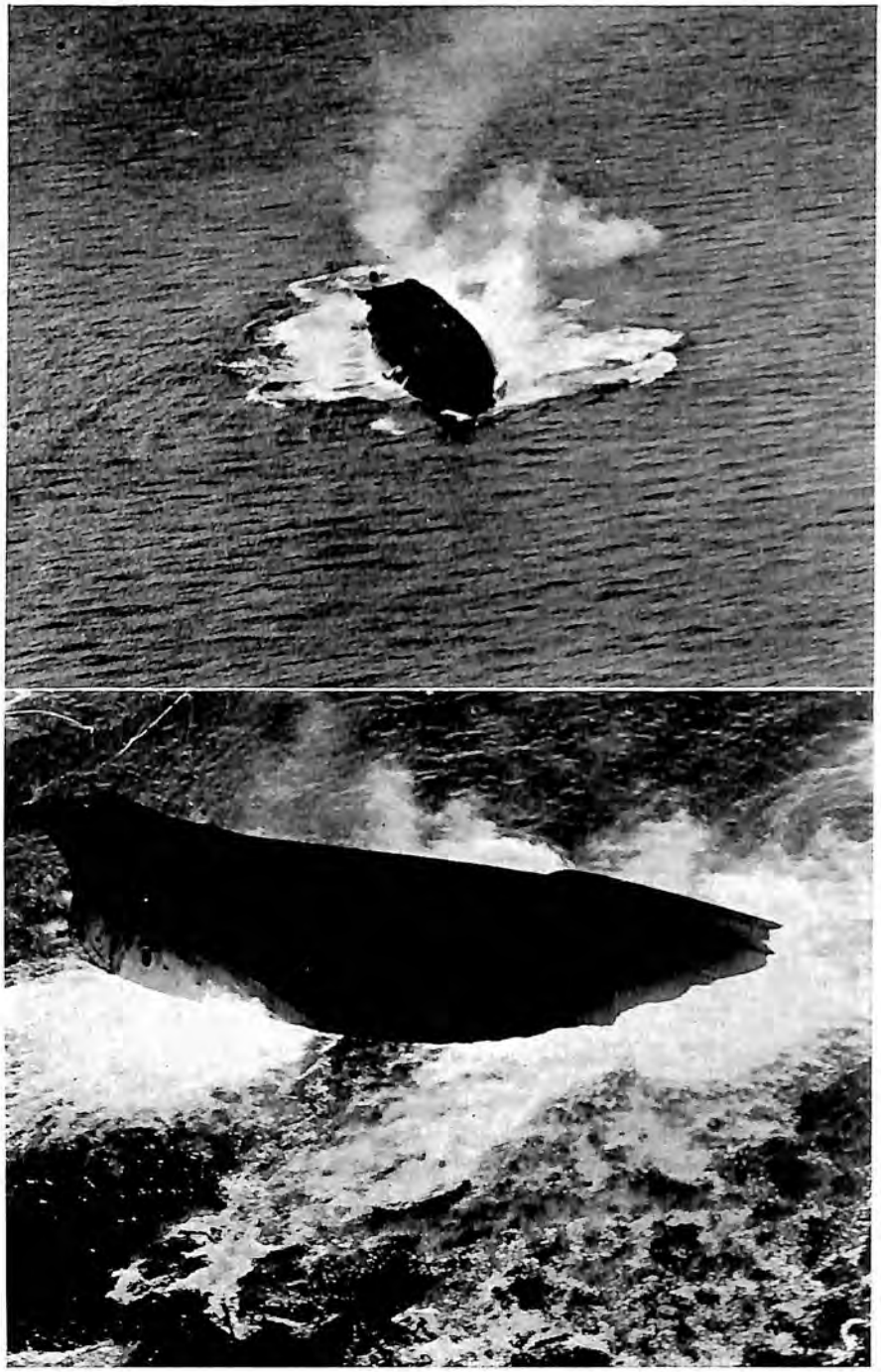
1. No aircraft or engines should be sold unless they have first been placed in complete airworthy condition.
2. Such aircraft or engines declared surplus, and not airworthy, should be disassembled and sold as parts, so as to prevent flight in unairworthy condition.
3. In so far as possible, no sales of equipment, either complete units or parts, should be made except to individuals or organizations able to satisfy the Department as to their character and competency.

Both the Army and Navy Air Services responded to this appeal. Steps were taken—in fact already had been begun—by the Army along the lines proposed and further effort was made to check up results at the various sales depots. The situation in the Navy appeared to be more difficult and in both departments precedent and red tape made it difficult for quick, positive action looking toward the protection of human life. Both departments agreed to supply the Chamber with the names of purchasers, so that educational work in safe, responsible flying could be undertaken. But this fell far short of satisfactory accomplishment, as in many cases jobbers bought the surplus material and resold it. The itinerants into whose hands much of this equipment eventually passed soon disappeared only to be traced now and then, in the press, through occasional accounts of casualties.

One has only to scan the list of 179 crashes during 1923 to be impressed with the overwhelming number of preventable accidents. Errors in piloting were held responsible in 87 instances; improper



Above—Direct hit, 600 lb. bomb, on *"New Jersey."* *Below*—Battered, helpless hulk of *"Virginia."*—Photos, U. S. Air Service.



Above—The *"New Jersey"* with her keel to the skies. *Below*—The *"Virginia"* going down.—Photos, U. S. Air Service.

fields in 15; lack of weather data in 1; lack of route data or flying rules in 16; improper inspection of equipment (craft 42, engine 27, accessory 9) in 78; stunting in 30; carelessness on the field in 13 and unknown factors in 17.

In a great majority of cases, accidents are preventable. Especially is this true if they are due to incompetent piloting, improper equipment or to deliberate disregard of the ordinary rules of common sense which is so often noted in exhibition stunting with passengers. It is not a surprising thing to learn of "homemade" or assembled craft coming to pieces, or of war-worn obsolete engines failing at a critical moment. But it is little less than shocking to contemplate the results in the last three years of attempting to fly aged, surplus military equipment.

First Aid to Bootlegging Seaplanes in "Rum Row"

In this depressing picture there is a gleam of ironical humor. If joyriding with the *gypsies* is not as profitable as it used to be (the price has slumped from $25 right after the Armistice to as low as $2.50), there are new activities that compensate. That aircraft have been used to smuggle aliens over the Mexican border is noted in the report of the Commissioner General of Immigration. That aircraft are used in many parts of the country for bootlegging is common knowledge. In the daily press there have been accounts of decrepit seaplanes being forced to land in "rum row" and then when deserted being gallantly rescued by Coast Guard cutters, charged at the same time with enforcing the prohibition law.

Some idea of the damaging effect which newspaper accounts of certain itinerant crashes have on the public conception of *all aviation*, may be had by noting the following excerpts from remarks explaining a few of the 1923 crashes: "Inexperienced pilot misses field, leaps boulevard and crashes on beach." "Flying at 100 foot altitude when engine failed." "Pilot tries first flight in pursuit type plane sold by Government." "War type seaplane lost on flight to Bimini." "Flying boat from Government surplus repaired by boys who intended to carry passengers." "Flies low over parade, lands in city park and hits spectators taking off." "Wings crumple while stunting." "Stunt flier drowns when wing of 10-year-old plane collapses." "Victims warned that this old plane, rebuilt several times, was a death-trap." "Fabric on wings so rotten it broke at finger touch." "Mystery seaplane believed to have been used by bootleggers." "Government surplus plane of pursuit type." "Stunt fliers crash at night into crowded state fair building." "Flying 50 feet over football field." "One of Government surplus flying boats featured

in accidents in April, August, September and twice in December, most of these accidents off the New Jersey and New York coasts."

Far Greater Safety Demonstrated by Fixed-Base Operators

The other side of the picture—that of the greater safety of flight among fixed-base operators—is far more encouraging. Operating in 1921-1923, inclusive, some 600 planes a year, or about the same number credited to the *gypsies,* the more responsible pilots return records which should afford the public a more reassuring sense of flying. In these three years, with an average of 126 operators reporting, there were but 51 serious accidents, resulting in death to 25 persons and injury to 40.

Comparative Table of Serious Accidents Reported Voluntarily During Three-Year Period, 1921-1923, by Operators with Established Bases

		1921	*1922*	*1923*	*Total 1921-1923*
Number of operators reporting		125	129	124	
Total number of accidents		24	12	15	51
Total number of fatalities		6	7	*12	25
Total number of injuries		21	7	12	40
Causes	Error in piloting	5	5	6	16
	Field or terminal	2	5	2	9
	Lack of weather data	0	1	1	2
	Lack of route data or flying rules	1	0	0	1
	Faulty craft	1	0	1	2
	Faulty engine	3	0	1	4
	Faulty accessory	5	0	0	5
	Stunting	3	0	3	6
	Collision in air	0	0	0	0
	Carelessness on field	7	5	3	15
	Unknown	0	1	2	3

Of the 51 accidents reported voluntarily by these operators, the following were the major causes or combinations of causes:

Error in piloting 16
Improper inspection (craft, engine, accessory) 11
Carelessness on field 15

Major Causes of Fatal Accidents

The 25 fatalities reported by these operators in the three-year period were attributed to the following causes or combination of causes:

Error in piloting 4
Field or terminal 3

*Five of the 1923 fatalities may more properly be regarded as marine casualties.

Lack of weather data			1
Lack of route data or flying rules			0
Inspection	Faulty craft	2	
	Faulty engine	4	*6
	Faulty accessory	0	
Stunting			5
Collision in air			0
Carelessness on field			5
Storm on field			1
Unknown			2

Fixed-Base Record in 1923

The fixed-base accident record during the period Oct. 1, 1922-Nov. 1, 1923 (see Table No. III), like that of the itinerants, far exceeded the two previous periods. There were fifteen serious crashes, resulting in death to 12 persons and injury to 12. In these 15 accidents errors in piloting are held accountable in 6 cases, poor fields in 2, lack of weather data in 1, faulty craft and faulty engine in 1 each, stunting in 3, carelessness on the field in 3 and unknown causes in 2. Of the 12 persons the loss of whose lives was directly attributable to flying, not more than four or five should properly be regarded as public passengers. The others were pilots, mechanics or students. It is an unfortunate fact that all but 3 fatalities and 5 injuries could have been avoided had the operators been assisted through Federal air law which would have supplied them with advantages and safeguards provided marine navigation, as a public duty and without which sea disasters would be inconceivably worse. For instance, in accident No. 1 four passengers were drowned. Minor motor trouble forced the plane to alight at a time when it entered a gale area, with very high seas running, and of which the operators had not means of knowing in advance. This is more properly regarded as a marine accident and the public which has continued to patronize the service offered by these operators apparently so regards it.

In accident No. 2, the control stick came out during instruction of a student. In Nos. 4 and 5 stunting at low altitudes was responsible. In No. 7 a bad landing was followed by fatal sickness. In No. 9 a passenger jammed the controls. In No. 10 a plane jumped the blocks while the engine was being warmed up. Accident No. 11 was a movie stunt and No. 15 was an error in piloting.

In each of the foregoing instances, four of the six essential requisites for safe flying are involved and it would appear that, as has been stated, Federal regulation and encouragement would at

*The four fatalities to which minor engine trouble contributed may properly be regarded as marine casualties.

least have reduced, if not altogether eliminated, the resultant casualties.

Flying, Properly Regulated, Is Not Unsafe

The Aeronautical Chamber of Commerce has frequently asserted that "flying, when properly regulated, is not unsafe." The figures obtainable substantiate this conviction.

It is estimated that there have been in operation each year for the last three years an average of about 1,200 aircraft, 550 to 600 being in the hands of fixed base operators and the rest in the hands of the itinerants. It is known how many flights were made, passengers carried and miles flown by the fixed-base operators reporting. It can safely be assumed that the itinerants, flying mostly from town to town, and specializing in exhibition work, covered as many if not more miles. Here is how the comparative record appears for the years 1921-1923:

	Fixed-Base Flying	*Itinerant Flying*
Mileage (known)	8,767,893	Estimated 9,000,000
Mileage per accident	171,919.47	21,479.71
Mileage per fatality	350,715.72	45,918.36
Mileage per injury	219,197.325	26,210.82

Ratio of Fixed-Base Accidents for Three Years

Mileage, flights and passengers carried, together with accidents, have been voluntarily reported by an average of 126 fixed-base operators for the years 1921-1923, as follows:

Total mileage	8,767,893
Total number of flights	327,510
Total number of passengers carried	278,668

Applying the accidents, deaths and injuries to the above it is seen that in three years of fixed-base flying, there was:

One accident per	171,919.47 miles 6,421.76 flights 5,464 passengers carried
One fatality per	350,715.72 miles 13,100 flights 11,146 passengers carried
One injury per	219,197.325 miles 8,187.75 flights 6,966 passengers carried

Ratio of Fixed-Base Accidents in 1923

In the period Oct. 1, 1922-Nov. 1, 1923, fixed-base operators reported 3,014,611 miles flown, 106,838 flights and 80,888 passengers

carried. Fifteen accidents, 12 fatalities and 12 injuries show the following ratio:

One accident per.....	200,974.06 miles 7,122.52 flights 5,392 passengers carried
One fatality per.....	251,217.58 miles 8,903.16 flights 6,740 passengers carried
One injury per.....	251,217.58 miles 8,903.16 flights 6,740 passengers carried

By eliminating those accidents reasonably regarded as preventable under the proper provision through Federal air law, of airways, equipment, inspection and general discipline—a total of 9 accidents involving 9 fatalities and 7 injuries—the ratio for 1923 is as follows:

One accident per.....	502,435.16 miles 17,806.33 flights 13,481 passengers carried
One fatality per.....	1,004,870.33 miles 35,612.66 flights 26,962 passengers carried
One injury per.....	602,922.2 miles 21,367.6 flights 16,177 passengers carried

The foregoing figures speak for themselves. Sustained by such a record flying can fearlessly invite scrutiny and in confidence await ultimate patronage. "The moral of all this," observes the Scientific American, "is the urgency of the call for Federal regulation. Year after year our Congressmen have been urged to pass laws for the regulation of flying and the licensing of pilots, etc., and year by year they have been neglecting this duty which they owe to the nation. It is not only that there is a deplorable and unnecessary loss of life, but these ever-recurring tragedies disturb the public mind and prevent people from investing in a system of transportation which they wrongly believe to be not yet safe and practicable. No thoughtful person who contemplates the achievements in aviation can doubt that it is destined to prove as serviceable in peace as it did in the World War; but its extensive commercial development will never be assured until Congress is aroused from its present indifference. This awakening will come just as soon as constituents bring pressure to bear upon their representatives to pass the greatly needed legislation."

TABLE No. II.—ACCIDENTS RECORDED IN PRESS, AS OCCURING AMONG ITINERANT OR GYPSY FLIERS

JANUARY 1 TO DECEMBER 31, 1923

(Prepared for the Secretary of Commerce, by the Aeronautical Chamber of Commerce of America, Inc., 501 Fifth Avenue, New York City)

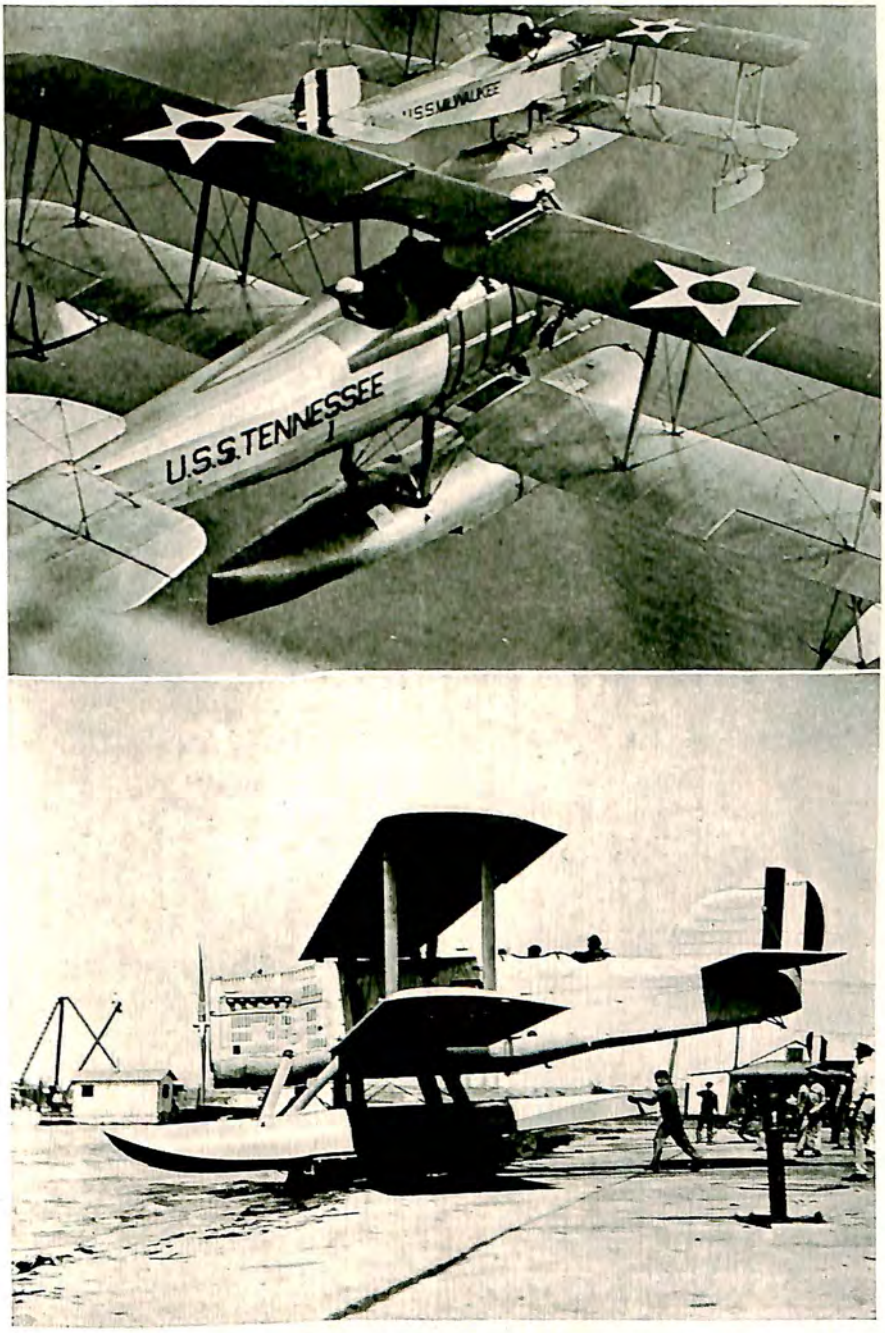
Number	Date	Locality	Killed	Injured	Causes											Remarks
					Pilot	Field	Lack of Weather Data	Lack of Route Data or Flying Rules	Faulty Craft	Faulty Engine	Faulty Accessory	Stunting	Collision in Air	Carelessness on Field	Unknown	
	1923															
1	Jan. 20	San Francisco, Cal.....	2		1				1							Dives into San Francisco Bay from 2,000 feet. Probably fault of pilot and plane.
2	Feb. 1	Americus, Ga.	2												1	
3	Feb. 10	Santa Barbara, Cal.....			1			1								Inexperienced pilot misses field, leaps boulevard and crashes on beach.
4	Feb. 10	St. Joseph, Mo.....		1	1			1		1						Flying at 100 feet altitude when engine failed.
5	Feb. 14	Modesto, Cal.			1						1					Watered gas stops engine; pilot fails to make "dead stick" landing.
6	Feb. 23	Stuart, Fla.	2						1	1						War-type seaplane lost on flight to Bimini.
7	Mar. 2	McComb, Miss.	1											1		Mechanic struck by propeller.
8	Mar. 4	Houston, Tex.	1		1											Pilot tries first flight in pursuit type plane sold by Government.
9	Mar. 10	Argo, Ill.	1	1											1	Instructor killed; student injured.
10	Mar. 25	Kokomo, Ill.	2		1											Banks plane too low. Fourth fatality at same field in twelve months.
11	Mar. 26	San Diego, Cal.....			1			1								Low flying over city. Plane hits radio antennae.
12	Mar. 28	Atlantic City, N. J.....		2	1											Probably faulty piloting.
13	Mar. —	St. Petersburg, Fla.....		1								1				Parachute jumper blown out to sea.
14	Apr. 4	Pinehurst, N. C.....		1			1									Plane caught in severe electrical storm.
15	Apr. 7	Santa Rosa, Cal.....		2	1				1							Low flying in an improperly cared for plane.
16	Apr. 8	Los Angeles, Cal.....	1	1							1	1				Amateur wing acrobat grasps control wire and plane crashes; said also to lack exhausts.
17	Apr. 11	Jacksonville, Ill.			1	1										Itinerant flier uses salt field for passenger work.
18	Apr. 22	Asbury Park, N. J.....								1						Two war-type flying boats sold by Government met with trouble on flight from Florida; 9 people rescued.
19	Apr. 22	New York City.....									1					
20	Apr. 29	San Francisco, Cal.....			1											Movie plane flying low over San Quentin prison, California, shot down by guards.
21	Apr. 29	Grand Rapids, Mich....		1										1		Plane being warmed up in city alley; pedestrian walks into propeller.
22	May 12	Bryan, O.	1	1								1				Stunting at low altitude.

Table No. II.—*Continued*

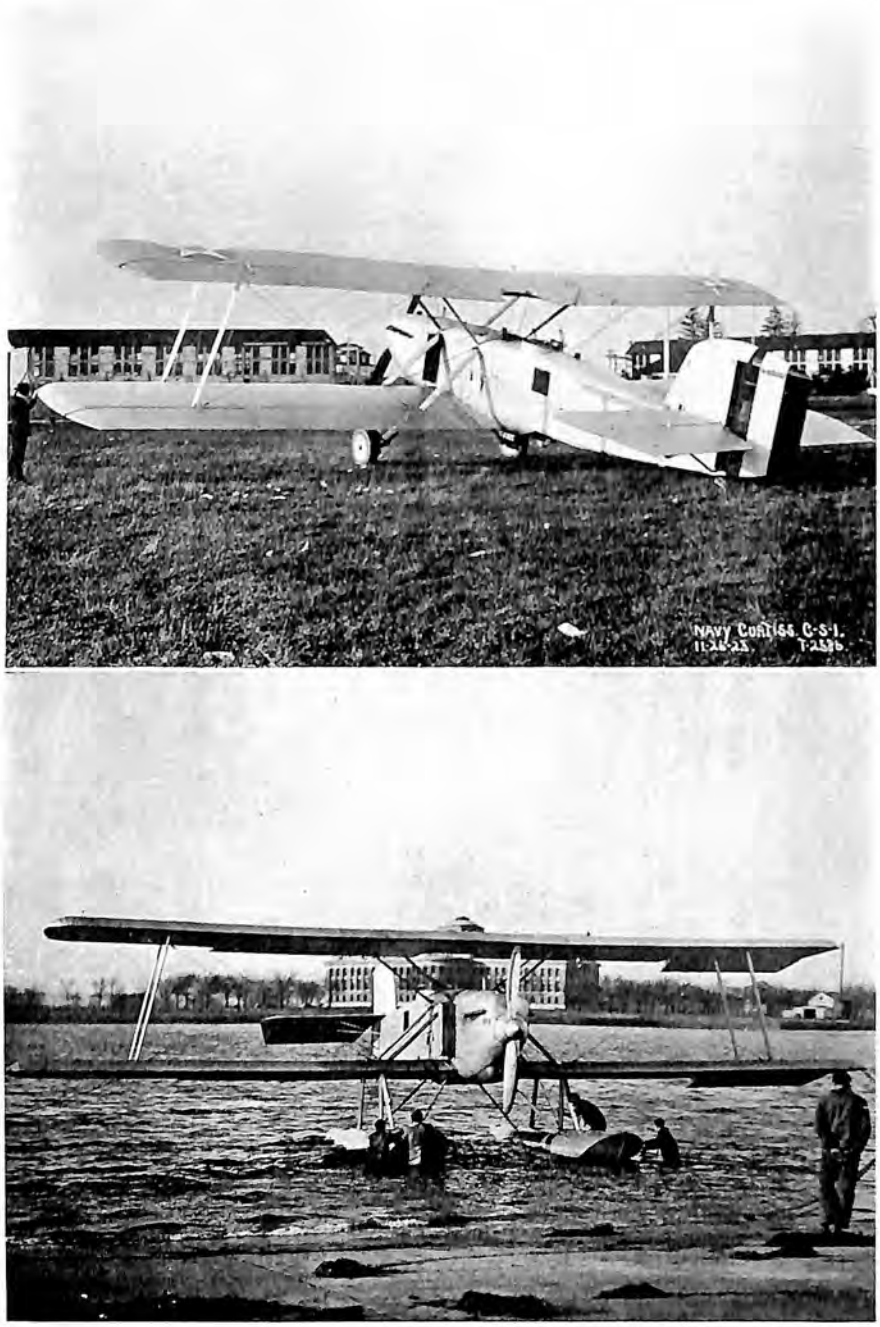
Number	Date	Locality	Killed	Injured	Causes											Remarks
					Pilot	Field	Lack of Weather Data	Lack of Route Data or Flying Rules	Faulty Craft	Faulty Engine	Faulty Accessory	Stunting	Collision in Air	Carelessness on Field	Unknown	
23	May 13	Medford, Ore.												1		Plane, abandoned while warming up, jumps block.
24	May 17	El Paso, Tex.....	2	1	1											Incompetent pilot.
25	May 18	Bellefontaine, O.	1	1	1							1				Pilot of this plane a stunt flier.
26	May 20	Norfolk, Va.		1	1							1				Looping at 250 feet.
27	May 21	Houston, Tex.	1		1											Probably incompetent pilot.
28	May 22	Cumberland, Md.	1	1											1	
29	May 26	Charlotte, N. C.....	1	1	1											Probably incompetent pilot in a borrowed plane.
30	May 27	Fowler, Cal.			1	1										Plane strikes high tension wires taking off.
31	May 28	Key West, Fla.....		1	1				1	1						Flying boat from Government surplus repaired by boys who intended to carry passengers.
32	May 30	Danbury, Conn.		2	1							1				Stunt fliers.
33	May 31	Warren, O.	1	1	1											Probably unskilled piloting.
34	May 31	Chicago, Ill.		6	1	1		1								Passenger plane flies low over parade; lands in city park and hits spectators taking off.
35	June 3	Harrodsburg, Ky.			1			1								Ignorance of route and probably poor piloting.
36	June 8	Glencoe, Minn.			1											Second accident to same pilot in three days.
37	June 8	Minneapolis, Minn.		1	1				1			1				Control stick comes out as plane is at top of loop; plane not inspected before stunting.
38	June 8	Peoria, Ill.	2						1			1				Control stick apparently drops out at top of loop.
39	June 10	Beach Haven, N. J.....								1	1					Government surplus flying boat has two accidents on first flight.
40	June 10	Vallejo, Cal.		2	1											Gas supply exhausted, plane crashes into house.
41	June 10	Columbia City, Ind.....						1		1						Engine goes dead over city street.
42	June 11	Danville, Ill.			1											Pilot attempting landing, crashes into automobile on highway.
43	June 11	Oketo, Kas.				1										No field properly prepared.
44	June 12	Austin, Tex.		2	1											Plane crashes into house.
45	June 12	Livingston, Mont.		3	1	1										Bad take-off at field; obstructed by wires.
46	June 15	Ponca City, Okla.....		2	1											Pilot had been in air almost entire day; crash on take-off.
47	June 16	Marietta, O.				1										Poor field; plane plunges over bank almost to river.
48	June 16	Cotati, Cal.			1				1							This plane and another apparently uninspected. Pilot alleges deliberate tampering with controls.
49	June 19	Island Pond, Vt.....		2						1						Engine goes dead.

Table No. II.—*Continued*

Number	Date	Locality	Killed	Injured	Causes											Remarks
					Pilot	Field	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	
50	June 20	North Hatley, Vt.		2	1											Bad take-off.
51	June 20	St. Louis, Mo.		1	1											Plane crashes into barn.
52	June 20	Angola, N. Y.		1	1					1						Engine goes dead; plane turns over.
53	June 21	Phillipsburg, Pa.			1											Pilot attempts flight over Pennsylvania mountains and exhausts oil supply.
54	June 23	Denver, Colo.	2						1			1				Wings crumple while stunting.
55	June 24	Camden, N. J.		1	1											Bad take-off.
56	June 24	Schenectady, N. Y.		1								1				Parachute catches in landing gear; jumper drops into river.
57	June 27	Davenport, Ia.			1											Pilot, in landing on good field, crashes into hanger.
58	June 30	Tarrytown, N. Y.							1	1						Bad engine and leaky pontoons force seaplane to land.
59	June 30	Media, Pa.			1				1					1		Government surplus ship did not respond to controls; pilot to miss crowd, lands in side wind and crashes.
60	June 30	Bartlesville, Okla.		1	1											Hits telephone wires in landing; second crash in 2 weeks.
61	June —	New York City		1					1							"Flivver" plane crashes into pavement.
62	July 2	San Francisco, Cal.		1	1	1										Pilot leaps to safety as plane strikes high tension wires; passenger burned in cockpit.
63	July 3	New York City		2	1				1							16 and 18 year old boys "make" and wreck own plane.
64	July 4	Los Angeles, Cal.	2						1			1				Wings collapse during loop.
65	July 4	Charleston, S. C.	1									1				Parachute jumper whose stunt was to set plane afire, then leap, does not jump in time.
66	July 4	Mt. Ayr, Ia.		1		1										Crash in night flight due to poorly lighted field.
67	July 4	Bloomfield, Ia.												1		Plane wrecked to avoid women and children on field.
68	July 4	Moline, Ill.			1			1								Low flying airplane crashes into tree in crowded city park.
69	July 5	Franklin, Pa.			1					1						Pilot could not shut off power; 5 people in plane escape serious injury.
70	July 6	Newhall, La.			1			1								Low flying plane wrecks barn and itself.
71	July 6	Galva, Ill.			1	1										Bad take-off; plane strikes high tension wires.
72	July 7	Chicago, Ill.	1		1											Pilot banks plane at 200 feet altitude; plane set on fire by wires.
73	July 8	Columbus, O.	2		1											Probably too low flying with student.



Above—Vought *UO-1* Shipboard Planes (Wright Engines). *Below*—Scout Douglas-Wright (Wright T-3 engine). This plane can make 2,400 miles non-stop.—Photos, U. S. Navy.



Navy-Curtiss Scout 1 as landplane and seaplane; Wright T engine.
Photos, U. S. Navy.

Table No. II.—*Continued*

Number	Date	Locality	Killed	Injured	Causes											Remarks
					Pilot	Field	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	
74	July 8	Bethany, Conn.		4	1	1										Probably overloaded; take-off from bad field.
75	July 14	Newark, N. J.....			1	1										Bad landing on bad field.
76	July 16	Santa Monica, Cal.....	2		1				1							Low flying in defective plane which crashes into sea.
77	July 16	Saugerties, N. Y.....		1	1											Pilot on cross country flight exhausts gas.
78	July 19	Truckee, Cal	1					1								Plane strikes peak in mountains.
79	July 19	Boston, Mass.	1						1			1				Stunt flier drowns when wing of 10-year old plane collapses.
80	July 20	Des Moines, Ia.....		2											1	
81	July 21	Windsor(Ont.)nr. Detroit	2								1					Ignition failure; both victims Americans.
82	July 21	Houston, Tex.		1	1									1		Volunteer mechanic whirls propeller when ignition is turned on.
83	July 22	Santa Fe Springs, Cal..	2							1						Woman passenger seizes control stick in forced landing; plane hits automobile.
84	July 22	Sacramento, Cal.		2	1				1							Probably faulty piloting of machine reported nose-heavy.
85	July 22	Danville, Ill.		2											1	
86	July 23	Fairplay, Colo.	1	2										1		Bad landing near crowd; splinter from propeller kills spectator.
87	July 24	Boston, Mass.	1		1											Third accident in week (two fatal); plane taken up with only pint of gas.
88	July 25	Washington, D. C.....	1	1											1	Machine crashes on test flight after overhaul.
89	July 26	Dickerville, Mich.	1	1						1						
90	July 27	Hasbrouck Heights, N. J.		1						1						Victim was a parachute jumper.
91	July 27	Cheyenne, Wyo.	1									1				Stunt flier killed when parachute fails to open.
92	July 28	Rockford, Ill.		6					1							Rudder fails to function.
93	July 28	Manheim, Pa.	1	1											1	
94	July 29	St. Louis, Mo.....	1											1		Passenger steps from plane into propeller.
95	July 31	Niagara Falls, N. Y....		2						1						
96	Aug. 1	Poughkeepsie, N. Y....		1										1		Propeller severs mechanic's leg.
97	Aug. 5	Lake George, N. Y....	1	2	1											Woman passenger's skirt entangled with control stick of seaplane.
98	Aug. 5	New York City.....		3	1											War type machine.
99	Aug. 5	Benton, Ill.	2						1							Victims warned that this old plane, rebuilt several times, was a death trap.
100	Aug. 7	St. Louis, Mo.....	1	1	1				1							Fabric on wings so rotten it broke at finger touch.

Table No. II.—*Continued*

Number	Date	Locality	Killed	Injured	Causes											Remarks
					Pilot	Field	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	
101	Aug. 7	Estes Park, Colo.....	1		1											Passenger apparently not strapped in, leaps from plane in forced landing.
102	Aug. 8	Chester, Pa.		1	1											Test flight of recently purchased plane.
103	Aug. 11	Rochelle, Ill.		1								1				Stunt flier's parachute fails to open.
104	Aug. 12	Dallas, Tex.		1											1	
105	Aug. 12	Los Angeles, Cal.....		1						1						
106	Aug. 14	Spokane, Wash.		1	1											Probably misjudged direction of wind, in landing.
107	Aug. 14	Venice, Cal.	2						1							Plane declared to have been unsafe; crashes on pier.
108	Aug. 14	Sylvan Beach, N. Y....			1											Seaplane strikes pier landing; this pilot was killed August 20th.
109	Aug. 15	Washington, D. C.....	2		1				1							Control stick came out. This crash second fatal one for pilot who had been twice rejected by Air Mail as incompetent to fly.
110	Aug. 15	Binghampton, N. Y.....	1	1											1	
111	Aug. 16	Manasquan, N. J.....													1	Mystery seaplane believed to have been used by bootleggers.
112	Aug. 17	Chattanooga, Tenn.		1	1				1							Cross country flier loses wheel; hits electric lines on landing.
113	Aug. 18	Kenton, O.		2	1				1							Home-made plane.
114	Aug. 19	Detroit, Mich.	1	1											1	
115	Aug. 19	San Jose, Cal.....		2										1		Military aviators; accident included here because they wrecked plane on civilian field trying to avoid crowds.
116	Aug. 19	New York City.....						1	1							One of the two Government surplus boats figuring in similar accidents in April.
117	Aug. 19	Pensacola, Fla.	5						1		1					Propeller breaks and cuts controls of flying boat.
118	Aug. 19	Newport, Ore.			1				1	1						Sight seeing airplane falls into sea; pilot killed August 30th.
119	Aug. 19	San Francisco, Cal.....	2		1				1			1				Stunt flier ignores warning and flies into fog; controls fail and he crashes into bay.
120	Aug. 20	Auburn, N. Y.....	1		1					1						Same pilot who crashes in seaplane August 14th. Fatal accident due to turn with motor dead.
121	Aug. 21	Camp Bragg, N. C.....	2												1	
122	Aug. 26	Waterloo, Ia.		2	1	1										Strikes telephone wires in take-off.
123	Aug. 26	Atlantic City, N. J.....	2								1					Propeller of seaplane said to have broken and severed controls.

TABLE No. II.—*Continued*

Number	Date	Locality	Killed	Injured	Causes											Remarks
					Pilot	Field	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	
124	Aug. 26	Lizard Lake, Iowa.....	2		1					1						Probably bad judgment on part of pilot.
125	Aug. 29	Portland, Ind.		2						1						
126	Aug. 30	Albany, Ore.	1	1	1											Second plane to be wrecked in 10 days by this pilot.
127	Sept. 2	New York City.....		15	1					1						Engine trouble; seaplane strikes crowded launch.
128	Sept. 2	Los Angeles, Cal.....		2								1				Wing walkers; plane with man on wing falls into city street.
129	Sept. 3	Lake Geneva, Wis.....		1				1				1				Plane trying to snatch man from motor boat, strikes boat.
130	Sept. 3	San Francisco, Cal.....		2								1				Wing walkers.
131	Sept. 3	Albuquerque, N. M....			1											Pilot, while flying low with passengers, runs out of gas.
132	Sept. 4	Charlotte, N. C.....		1							1	1				Reported water in gas; accident occurs during loop.
133	Sept. 6	Medford, Wis.	1	1					1			1				Declared to be faulty controls.
134	Sept. 8	Atlantic City, N. J.....		2	1											Pilot of seaplane under instruction.
135	Sept. 9	Canton, O.							1							Government surplus plane of pursuit type.
136	Sept. 10	Flora, Ill.		1	1											Crashes in front of City Hall.
137	Sept. 10	Bakersfield, Cal.		2				1								Flying over mountains; unfamiliar wind currents.
138	Sept. 11	Olney, Ill.		2								1				Stunting at low altitude.
139	Sept. 12	Bristol, Va.		2	1											Woman passenger reported to have seized controls.
140	Sept. 13	Grand Junction, Colo...				1						1				Stunt flier looking for landing field.
141	Sept. 14	Highlands, N. J.....							1	1						Government surplus flying boat that featured in accidents during April and August.
142	Sept. 14	Houston, Tex.	1									1				Stunting 40 feet over city park.
143	Sept. 15	New York City.....		1								1				
144	Sept. 16	Belmar, N. J.....													1	Believed to be bootlegging seaplane.
145	Sept. 18	Norwich, N. Y.....		2					1			1				Government surplus craft used for stunting; crashes in flames.
146	Sept. 21	Atlantic City, N. J.....			1											Inexperienced pilot stole plane and crashed it.
147	Sept. 22	Manitowoc, Wis.			1				1							Home-made plane.
148	Sept. 23	Muskogee, Okla.			1				1							Government surplus plane being flown at low altitude.
149	Sept. 23	Madison, Wis.			1				1							Home-made seaplane.
150	Sept. 23	International Falls, Minn.	1	2	1											Passengers get excited and jam controls.
151	Sept. 26	Amarillo, Tex.			1							1				Parachute fails to open.

TABLE No. II.—*Continued*

Number	Date	Locality	Killed	Injured	Causes											Remarks
					Pilot	Field	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	
152	Oct. 5	Kansas City, Mo.....		2	1			1						1		One ship flies in front of another on landing.
153	Oct. 5	Lansing, Mich.										1		1		Stunt fliers crash at night into crowded state fair building.
154	Oct. 5	Bruneau, Idaho	1	1						1						
155	Oct. 6	Port Jervis, N. Y.....	1											1		Passenger gets out of plane and walks into propeller.
156	Oct. 6	San Jose, Cal.....			1											Pilot says passenger seized controls.
157	Oct. 8	Minneapolis, Minn. ...	1						1							Home-made monoplane.
158	Oct. 9	Keyser, W. Va.....		2	1			1		1		1				Flying 50 feet over football field.
159	Oct. 13	Toronto, O.		1		1										Night flying from improper field.
160	Oct. 18	Watertown, N. Y.....			1				1							Flying cross country at 200 feet altitude in 8-year old British war plane.
161	Oct. 20	Detroit, Mich		3											1	Crash near school.
162	Oct. 21	Port Coden, N. J.....	1											1		Pilot seizes propeller of runaway plane to save spectators.
163	Oct. 31	Providence, R. I.....		1				1								Low flying; plane crashes into house.
164	Nov. 2	Elma, Wash.		1					1							Controls failed.
165	Nov. 3	Philadelphia, Pa.	1	1					1							Plane had just been overhauled.
166	Nov. 3	Springfield, Ill.		2											1	
167	Nov. 4	Napa, Cal.		2						1						
168	Nov. 11	Port Jefferson, N. Y...		1								1				Stunt fliers and wing walkers.
169	Nov. 11	Syracuse, N. Y.....		2						1						
170	Nov. 21	Waukegan, Ill.			1	1		1								Three fliers arrested after crash and fined for trespassing.
171	Nov. 23	Italy, Tex.	1	1											1	
172	Nov. 26	Wichita, Kan.	2		1											Probably bad piloting.
173	Nov. 26	Sebastopol, Cal.	1	1					1							Control stick broke; second crash for same pilot in six weeks.
174	Dec. 6	New York City.....		2							1					Broken propeller.
175	Dec. 9	Washington, D. C.....	1	1					1							Possibly broken control wires.
176	Dec. 13	New York City.....							1	1						One of Government surplus flying boats featured in accidents in April, August and September.
177	Dec. 16	Fairfield, Ia.		1	1											15 year old boy tries to fly.
178	Dec. 20	New York City.....							1	1						One of Government surplus flying boats featured in accidents in April, August, September and December 13th.
179	Dec. 22	Dallas, Tex.	1	1											1	

TABLE No. III.—SERIOUS ACCIDENTS REPORTED BY 124 ESTABLISHED AIRCRAFT OWNERS OR OPERATORS

OCTOBER 1, 1922, TO NOVEMBER 1, 1923

(Prepared for the Secretary of Commerce, by the Aeronautical Chamber of Commerce of America, Inc., 501 Fifth Avenue, New York City)

Number	Fatalities	Injuries	Causes											Remarks
			Pilot	Field or Terminal	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	
1	4				1			1						A marine, not an air accident. Minor motor failure caused forced landing. Passengers became panic stricken and were drowned.
2	2		1				1							Instructor and student killed. Control stick came out of socket as plane winged over.
3		1										1		Mechanic struck by propeller.
4	1		1							1				Stunting at low altitude.
5		1								1				Stunting at low altitude.
6		1	1	1										Pilot took off in cross wind from small field.
7		1	1											Faulty landing of seaplane. Passenger's leg broken. While in hospital contracted blood poisoning and died.
8	1	1											1	Occurred at flying school.
9		2												Excited passenger in dual controlled ship jammed controls.
10		2										1		Plane, while being warmed up, jumped blocks and ran into crowd. One man's arm cut off; another's collarbone broken.
11	1	1								1				Plane only 45 feet from ground in "movie" work when it was hit by violent downward gust of wind.
12		2	1	1										In mountainous territory.
13	1												1	Forced landing in water. Pilot drowned after abandoning plane, which was later recovered intact.
14	1											1		Mechanic struck by propeller.
15	1		1											Collided with tree on landing.

TABLE No. IV.—MINOR ACCIDENTS REPORTED BY 124 ESTABLISHED AIRCRAFT OWNERS OR OPERATORS

OCTOBER 1, 1922, TO NOVEMBER 1, 1923

(Prepared for the Secretary of Commerce, by the Aeronautical Chamber of Commerce of America, Inc., 501 Fifth Avenue, New York City)

Number	Causes											Remarks
	Pilot	*Field or Terminal*	*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*	
1			1									Forced to land in Puget Sound in 72 mile gale. Punched hole in hull of flying boat.
2	1											
3	1											
4		1										No field. Plane hit tree in landing.
5	1											Pilot did not inspect strange field. Taxied into ditch taking off.
6	1											Picked bad landing place in open prairie.
7										1		Plane hit fence in take-off to avoid hitting child on field.
8	1											Student fell. Great lack of landing fields and night facilities.
9							1					Dirty gasoline.
10		1										Improper field; plane hit stump.
11						1						Valve failure, gas pump failure, oil pump failure. In two cases pilots were over bad country. In third case, forced landing was made at night.
12							1					
13							1					
14										1		Plane landed at night and hit another ship taxing to hangar.
15	1											Students stalled. One hit high tension wires.
16	1											
17	1											
18	1											One pilot deliberately flew into storm; another side slipped into small field. Magneto loose in third accident while plane was 150 feet above center of town.
19	1											
20	1						1					
21	1	1										Inexperienced pilot, taxied into ditch.
22	1											New pilot flew into a storm. Incompetent pilot made bad landing. In third case, inexperienced pilot and faulty engine combined to cause crash.
23	1											
24	1					1						
25							1					Ignition trouble.
26							1					Choked gas line.
27							1					Of these five accidents, three were due to leaks in the gas lines and two to faulty take-offs.
28							1					
29							1					
30	1											
31	1											

TABLE No. IV.—*Continued*

Number	Causes											Remarks
	Pilot	Field or Terminal	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	
32		1				1						Motor failure taking off.
33	1	1				1	1					Pilot flew into night over strange country and crashed.
34					1							Flying boat too long in water; planking torn on landing.
35						1	1					Dirty gas; forced landing in stumpy field.
36						1						Improperly fitted engine.
37	1	1										Pilot in night flight in fog hit high tension line.
38						1						Motor missed on taking off.
39										1		Spectator ran in front of plane as it was taking off.
40		1										No available field.
41	1			1		1						In these three accidents, operator indicated poor pilots, poor ships and dirty gas. "We need inspection and licensing," he reported.
42	1			1		1						
43	1			1		1						
44	1	1										
45		1										
46			1									Forced landing in storm at night on desert.
47							1					Plugged water pipe.
48	1					1						
49		1										
50		1										
51		1										
52						1						Dirty gas in one instance; motor car drove on field when plane was landing.
53							1					
54										1		
55		1										These occurred in mountainous country where air routes and landing facilities are sorely needed.
56		1										
57	1											
58							1					
59					1							Fabric on wing rotten and tore on take off; other two of these three accidents due to bad fields.
60		1										
61		1										
62							1					Magneto failure each time.
63							1					
64		1										Crashed landing gear; no field.
65					1							Wheel lost 1000 ft. in air.
66							1					Dirty gasoline.
67							1					Propeller blades came off pusher flying boat.
68	1											Private seaplane makes bad landing.
69		1				1						Flying boat damaged in landing; probably faulty engine.
70	1											Plane overloaded.
71		1										Flying boat takes off in narrow space and in cross wind.

CHAPTER X

FIVE YEARS HAVE PASSED AND CONGRESS REMAINS INDIFFERENT TO NATIONAL DEMAND FOR AIR LAW BOTH FOR REASONS OF PUBLIC SAFETY AND AVIATION DEVELOPMENT.

MORE than five years have passed since the close of the World War and the United States has not yet enacted any form of Federal law for the regulation and encouragement of aviation. The effect of this delay is seen on the one hand in the alarming increase in fatal accidents among itinerant fliers, with the consequent solidifying of public fear and prejudice; and, on the other, in the indefinite postponement of commercial operations upon a sound basis, thus depriving us as a nation of the economic benefits possible to be conferred through air transport and substantially weakening our national security in the air.

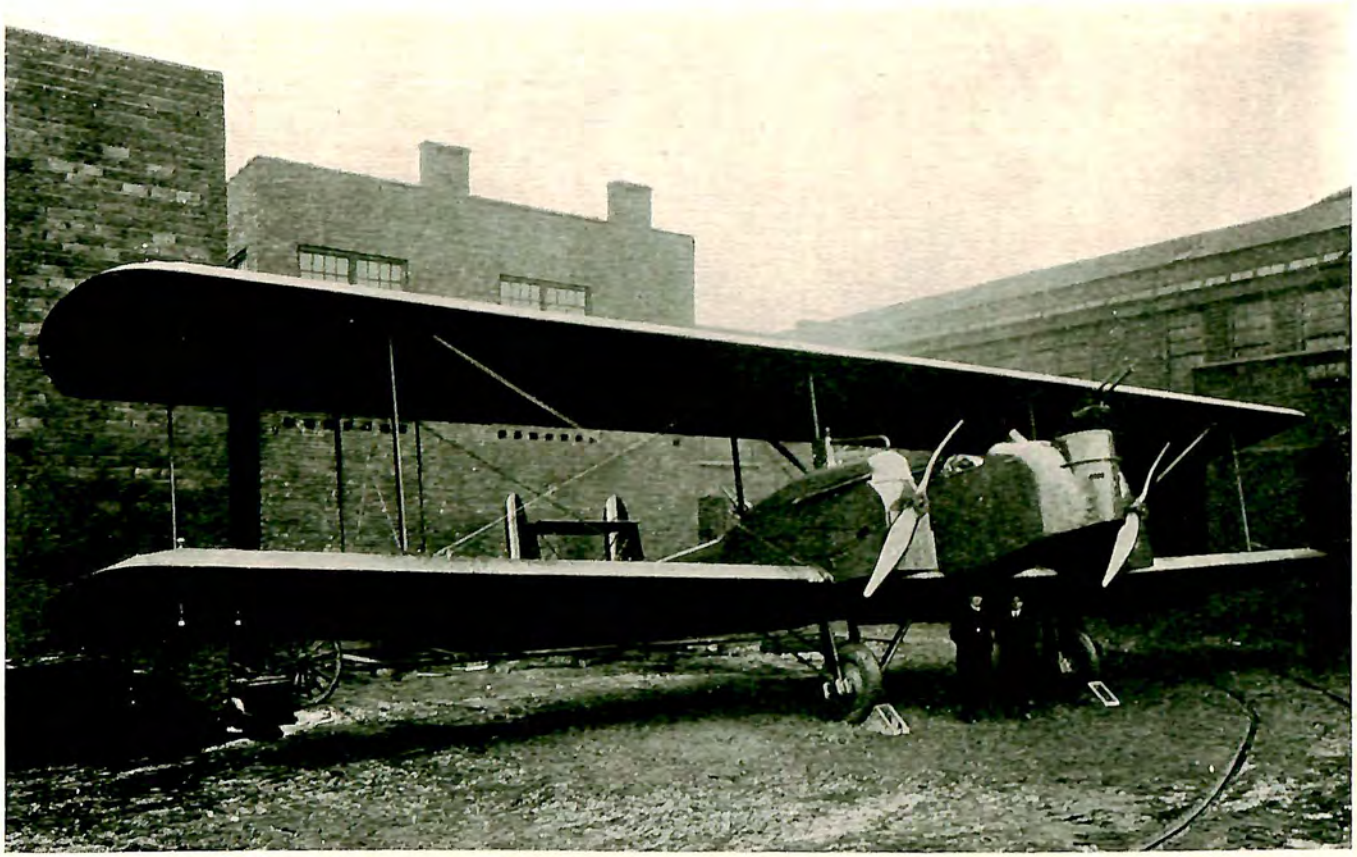
It is somewhat difficult to understand the causes for this procrastination in the United States while other countries of the world, far more distraught in their political and industrial affairs, have yet found time to provide regulatory law which is recognized everywhere as being the very foundation upon which to build air power. To this political attitude, which is due rather more to indifference than to ignorance of essential facts, must be attributed the extremely unsatisfactory condition of American aviation today.

Fifteen Nations Adhere to International Air Convention

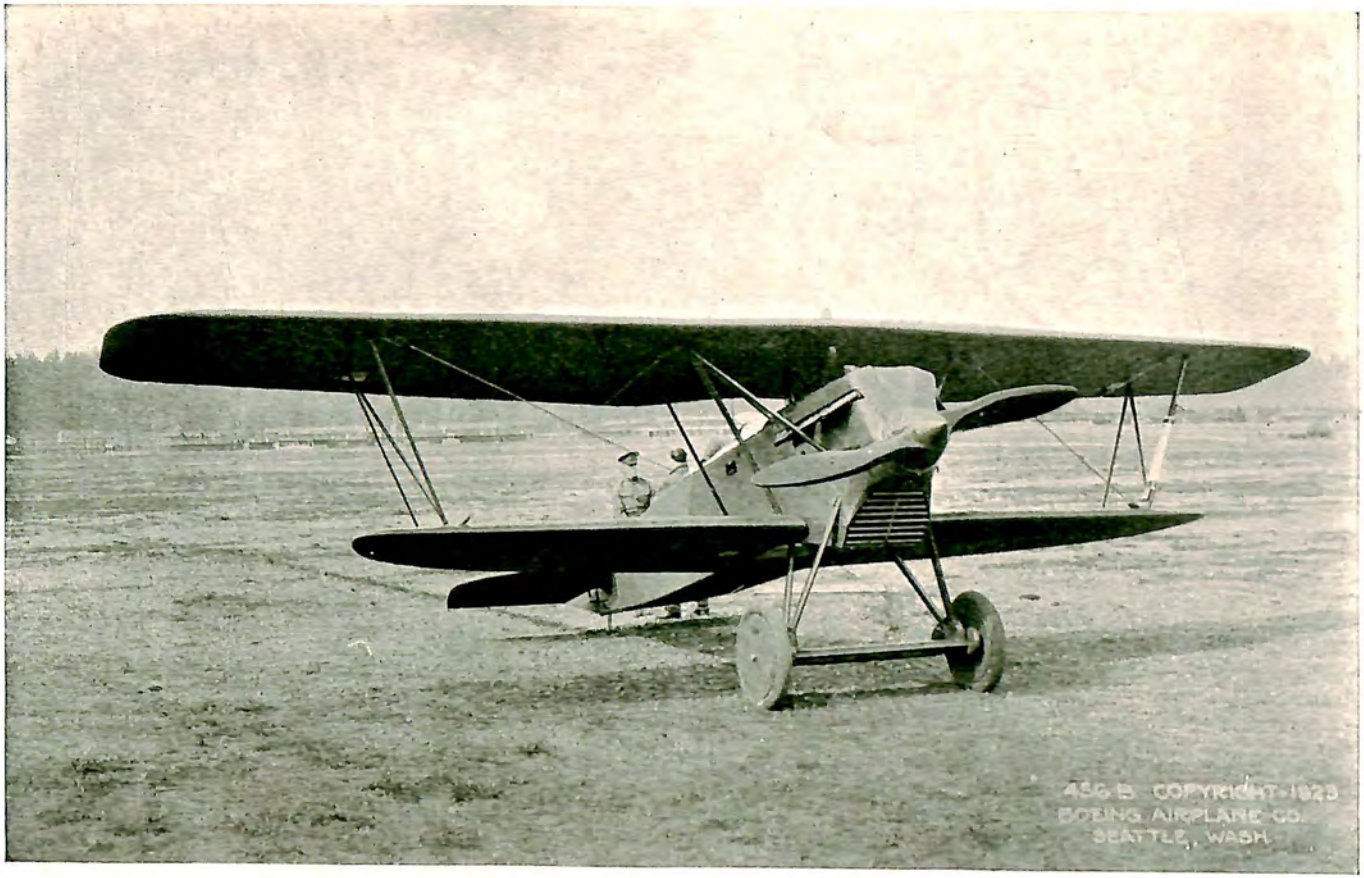
The Convention for the Regulation of International Air Navigation, *dated October 13th, 1919, was presented to the Associated Powers as part of the League of Nations Covenant. The following is a list of the nations that signed the Convention between the above date and June 1st, 1920. The United States signed May 31st, 1920.

United States	Ecuador	Poland
Belgium	France	Portugal
Bolivia	Greece	Roumania
†Brazil	Guatemala	Serbs-Croats-Slovenes
British Empire	Italy	Siam
China	Japan	Czecho-Slovakia
Cuba	Panama	Uruguay

*The text of the International Convention was printed in the Aircraft Year Book, 1921.
†Brazil adhered to but did not sign the Protocol.



G. Elias & Bro. Night Bomber.



Pursuit Plane of the Boeing Airplane Co., Curtiss D-12-A engine.

To date, according to a report prepared by the United States Senate Legislative Drafting Service, Frederick P. Lee, Chairman, fifteen nations have either ratified or adhered to the Convention, as follows:

Belgium	June 1, 1920	Japan	June 1, 1920
Bolivia	June 1, 1920	Liberia	Mar. 29, 1922
British Empire	June 1, 1920	Nicaragua	Dec. 31, 1920
Bulgaria	July , 1923	Persia	Apr. 9, 1920
France	June 1, 1920	Peru	June 22, 1920
Greece	June 1, 1920	Serbs-Croats-Slovenes	June 1, 1920
Italy	Apr. 10, 1923	Siam	June 1, 1920

On December 18th, 1922, the Council of Ambassadors requested the German Government to apply for admission as a member of the Convention.

Reservations by the United States

At the time of signing the Convention, the United States made the following reservations:

"The United States expressly reserves, with regard to Article 3, the right to permit its private aircraft to fly over areas over which private aircraft of other contracting States may be forbidden to fly by the laws of the United States, any provision of said Article 3 to the contrary notwithstanding.

"The United States reserves complete freedom of action as to customs matters and does not consider itself bound by the provisions of Annex H or any articles of the Convention affecting the enforcement of its custom laws.

"The United States reserves the right to enter into special treaties, conventions and agreements regarding aerial navigation with the Dominion of Canada and/or any country in the Western Hemisphere if such Dominion and/or country be not a party to this Convention."

On signing the additional Protocol, the United States made the following reservations:

"The United States signs the above Protocol with the understanding that its construction and enforcement shall in no way derogate from the entire freedom of the United States to negotiate with non-contracting States of the Western Hemisphere as regards the regulation and control of aerial navigation as set forth in the Third Reservation of the United States to the Convention."

A Score of Bills Before Congress

As above stated, the United States signed the Convention on June 1st, 1920, and the Additional Protocol on October 31st, 1921, Ambassador Wallace acting as the representative of this country for that purpose. Neither the Convention nor the Additional Protocol has been submitted by the President to the Senate for the advice and

consent of that body to their ratification, nor has the President or the State Department made any official statement as to the reasons for this failure. No agreements have been entered into, as to air regulation, between the United States and Canada or any other Dominion or State in the Western Hemisphere, the nearest approach to negotiations being public notice by the American State Department that certain requirements of the Canadian air authorities must be respected.

In this five-year period since the Armistice, probably a score of bills and resolutions affecting the regulation and encouragement of American aviation have been before Congress.

As was related in the Aircraft Year Book for 1923, the Wadsworth Bill (S. 3076), creating a Bureau of Civil Aeronautics in the Department of Commerce, passed the Senate in February, 1922. On reaching the House it was referred to the Committee on Interstate and Foreign Commerce. Col. Samuel E. Winslow, chairman of this Committee, realizing the importance of the subject and appreciating, further, that some members of the House were not fully informed, proceeded with care and deliberation, and after prolonged conferences with the Department of Commerce and other departments, evolved a new bill (H. R. 13715). This bill he introduced on Jan. 8, 1923, but due to legislative congestion, he was unable to get it out of his committee, to which it had been referred, before the 67th Congress adjourned.

Winslow-Wadsworth Bills Again Before Congress

On December 6th, 1923, immediately after the 68th Congress convened, Senator Wadsworth reintroduced his old bill as S. 76 and on January 8th, 1924, following earnest support of Senator Jones and other members of the Committee on Commerce, the bill, with slight amendments, was passed. It then went to the House and was referred again to Mr. Winslow's committee.

Col. Winslow on December 13, 1923, reintroduced his old bill, with the new number (H. R. 3243) which, upon being referred back to the Committee on Interstate and Foreign Commerce, was given into the hands of a special subcommittee consisting of the following:

Col. Winslow, Chairman, ex-officio; Everett Sanders, Indiana; Schuyler Merritt, Connecticut; Carl E. Mapes, Michigan; Homer Hoch, Kansas; Charles F. Lea, California, and Harry B. Hawes, Missouri.

H. R. 3243 is in substance the same as H. R. 13715, the text of which was printed in the Aircraft Year Book, 1923.

In opening Committee consideration, Col. Winslow said:

"Representatives of the Commerce, War, Navy, Treasury, Post Office and Labor Departments, National Advisory Committee for Aeronautics, and such civilian organizations as the National Aeronautic Association, Aeronautical Chamber of Commerce, Society of Automotive Engineers and National Aircraft Underwriters Association, as well as the Aviation Committee of the American Bar Association and the Commissioners on Uniform State Laws have participated in the discussions.

"The Act, in brief, provides for the establishment in the Department of Commerce of a Bureau of Civil Aeronautics. The act is divided into five parts and establishes authority for the inspection and licensing of aircraft and pilots, establishing and certifying air routes and terminals, as well as rules of the air and their administration, and so co-operating with our Military, Naval, Postal and Commerce air activities that the whole can literally be co-ordinated into the Air Power of the United States. Aviation is, perhaps, the most significant mechanical development of this generation, contributing as it does, to the speeding up of transportation and forming the key of our national defense on land and sea.

"In their several messages, both President Harding and President Coolidge have urged legislation for the regulation, relief, and encouragement of aviation. The establishment and development of civil aeronautics has the endorsement of the administration. The basis of Air Power must be a healthy, self-supporting aircraft industry. Among the needs of this industry are increased public confidence, increased capital, and more favorable insurance rates. Public confidence will expand with the increase of operating efficiency. Capital will undoubtedly enter the field as soon as our basic law governing the operation of aircraft is established upon a sound and broad basis, and under responsible management and direction and reduced hazards, reasonable insurance rates will follow."

"The Freedom of the Air"

In 1923, the demand for Federal regulation and encouragement of aviation became more general and public interest was further aroused through a significant court decision on the "freedom of the air," and through resolutions and action taken by the American Bar Association, the Chamber of Commerce of the United States and the National Aeronautic Association.

An airplane leaving a Twin Cities field made a forced landing on private property. The owner of the land brought action to recover damages and to enjoin the defendant fliers from again flying over the plaintiff's premises, regardless of the altitude of such flights. In his opinion, Judge John C. Michael of the District Court of Minnesota, said:

"This presents a new question, so far as court decisions are concerned, and there is a singular lack of legislation, both federal and state, in any attempt to define or regulate the right of air navigation.

"The only legislation on the subject in this state is Chapter 433, Laws 1921, which goes no further than to forbid all trick flying or aerial acro-

batics, or any flight at a less altitude than two thousand feet, over any city of the first class.

"The act impliedly recognizes the rightful existence of air navigation by this limited regulation, but no attempt is made to define the respective rights and liabilities of such navigators and the owners of the land over which air flights are made.

"In the present undefined state of the law upon this subject the plaintiff invokes the old common-law maxim, 'Whose the soil is, his it is from the heavens to the depths of the earth,' and claims that airplane flights over the plaintiff's land, no matter how great the altitude, constitute actionable trespass. If this is a fixed, unalterable rule of property not subject to modification or exception, then the plaintiff's contention must be upheld.

"This rule, like many aphorisms of the law, is a generality, and does not have its origin in legislation, but was adopted in an age of primitive industrial development, by the courts of England, long prior to the American Revolution, as a comprehensive statement of the landowner's rights, at a time when any practical use of the upper air was not considered or thought possible, and when such aerial trespasses as did occur were relatively near to the surface of the land, and were such as to exercise some direct harmful influence upon the owner's use and enjoyment of the land.

"A wholly different situation is now presented. We are passing through an age of marvelous achievements in the way of useful mechanical inventions, with the result that practical air navigation is now an accomplished fact. Its possibility of great public usefulness in rapid communication and transportation seems to already be well demonstrated.

"The upper air is a natural heritage common to all of the people, and its reasonable use ought not to be hampered by an ancient artificial maxim of law such as is here invoked. To apply the rule as contended for would render lawful air navigation impossible, because if the plaintiff may prevent flights over his land, then every other landowner can do the same.

"Condemnation of air lanes is not feasible, because aircraft cannot adhere strictly to a defined course.

"Common-law rules are sufficiently flexible to adapt themselves to new conditions arising out of modern progress, and it is within the legitimate province of the courts to so construe and apply them. This very rule has been modified by our Supreme Court in respect of subterranean waters. Erickson v. Crookston, etc., 100 Minn. 481.

"When it is sought to enforce such a rule of law, the extent of the public interests involved on one side, as against the probable substantial injury to the private property owner on the other, is an important element of consideration by the courts. It is elementary in this country that private property is entitled to a full measure of protection.

"The air, so far as it has any direct relation to the comfort and enjoyment of the land, is appurtenant to the land, and no less the subject of protection than the land itself; but when, as here, the air is to be considered at an altitude of two thousand feet or more, to contend that it is a part of the realty, as affecting the right of air navigation, is only a legal fiction, devoid of substantial merit. Under the most technical application of the rule, air flights at such an altitude can amount to no more than instantaneous, constructive trespass. Modern progress and great public interest should not be blocked by unnecessary legal refinements.

"The accident in this case has been emphasized as evidence of a great

menace from aircraft to persons and property upon the land, and as furnishing a sufficient reason for banishing air flights altogether.

"True, there is some danger from this source; but such accidents are infrequent, and this hazard is infinitely less than is constantly encountered in every walk of life from various other causes. An occasional accident has never been considered a sufficient reason for suppressing a useful industry, but may justify reasonable legislative regulation.

"Failure to sustain the plaintiff's contention, relative to upper air trespasses, does not deprive him of any substantial rights, or militate against his appropriate and adequate remedies for recovery of damages and injunctive relief, in cases of actual trespass or the commission of a nuisance; hence the scope of the temporary injunction has been limited to enforcing compliance with the Minnesota law already mentioned."

Indorsed by Chamber of Commerce of the United States

At its eleventh annual meeting held in New York in May, 1923, the Chamber of Commerce of the United States adopted the following resolution:

"Aviation has demonstrated great possibilities for the addition of new services to commerce and important means of national defense. That these possibilities may be developed, and their national benefits obtained, commercial aviation should receive prompt and sustained encouragement. As requisite to this end, suitable legislation should immediately be enacted by Congress to govern the flight of aircraft and the airways over which they operate."

In notifying its organization membership of the above resolution, the Department of Transportation and Communication of the National Chamber stated:

"The National Chamber stands for the enactment of suitable enabling legislation by Congress to govern the flight of aircraft and the airways over which they operate, thus encouraging aviation in the development of new services to commerce and as an important means of defense. Given this, the designation of air routes and the assignment of air terminals will naturally follow. Such legislation will not only make for greater safety in flying by eliminating the irresponsible element, but should tend to stimulate commercial aeronautics in all its phases."

American Bar Association Again Indorses Federal Air Law

At its annual meeting in Minneapolis, Minn., August 29th, 30th and 31st, 1923, the American Bar Association again indorsed the principle of Federal air regulation by adopting the following recommendations of its Committee on the Law of Aeronautics:

1. "That the special committee be either continued or made a standing committee of the American Bar Association.
2. "That the American Bar Association indorse the enactment by Congress of legislation fostering and regulating aeronautics substan-

tially as set forth in H. R. 13715 introduced by Hon. Samuel Winslow at the fourth session of the Sixty-seventh Congress.

3. "That the members of the American Bar Association assist in procuring the enactment of legislation, both state and federal, which will encourage the development of commercial aeronautics in the United States.
4. "That the attention of the membership be called to the international problems connected with aeronautics and particularly to the necessity for the codification of rules governing aerial warfare."

Wm. B. MacCracken of Chicago, is chairman of the above committee. Other members are: George G. Bogert of Ithaca, N. Y.; Phillip A. Carroll of New York; W. Jefferson Davis of San Diego, Cal.; and Daniel W. Iddings of Ohio.

Congressional Indifference Seems Incredible

Upon considering the impressive influence which recommendations of the American Bar Association and the Chamber of Commerce of the United States have on general matters of law and business, Congressional indifference to the need for air law seems inexplicable.

Further, when one considers the rising toll of deaths and injuries due to unregulated flying, this indifference seems incredible.

CHAPTER XI

THE SECOND NATIONAL AIR INSTITUTE OF THE AERONAUTICAL CHAMBER OF COMMERCE—"PUTTING AIRCRAFT TO WORK" THEME OF SYMPOSIUM BY CABINET OFFICERS, BANKER, CONGRESSMAN AND OTHERS.

THE Second National Air Institute of the Aeronautical Chamber of Commerce, a symposium built around the theme, "Putting Aircraft to Work," was held at the Hotel Statler, St. Louis, 10 a. m., October 2nd, 1923, the papers in permanent printed form being presented by Dr. George W. Lewis, Executive Officer, of the National Advisory Committee for Aeronautics.

Following was the program:

"Introduction" (Arthur B. Birge, General Manager, St. Louis Aeronautic Corporation).

"Aircraft as a Constructive and Profitable Economic Force" (Hon. Harry S. New, Postmaster General).

"Aircraft in the Department of the Interior" (Dr. Hubert Work, Secretary of the Interior).

"Use of Airplanes in the Work of the U. S. Department of Agriculture" (Hon. Henry C. Wallace, Secretary of Agriculture).

"The U. S. Mail Night Flying Experiments" (Col. Paul Henderson, Second Assistant Postmaster General).

"Peacetime Aviation in the U. S. Coast Guard" (W. E. Reynolds, Rear Admiral, U. S. Coast Guard, Commandant).

"The Army Air Service and Industrial Preparedness" (Major General Mason M. Patrick, Chief, U. S. Air Service).

"Naval Aviation and the Civilian Reserve" (Rear Admiral William A. Moffett, U.S.N., Chief, Bureau of Aeronautics, Navy Dept.).

"The Economy of Aerial Defense" (Hon. Frank Murphy, Congressman from Eighteenth Ohio District, and Member Appropriations Committee).

"Dependence of Successful Aircraft Design upon Scientific Investigation" (Dr. Joseph S. Ames, Chairman, Executive Committee, National Advisory Committee for Aeronautics).

"The Renaissance of Rigid Airships" (Commander J. C. Hunsaker, C. C., U.S.N., Design Section, Bureau of Aeronautics, Navy Department).

"Banking Future—As Seen from the Air" (John G. Lonsdale, President, National Bank of Commerce, St. Louis, Mo.).

"The Airman's Progress" (Coker F. Clarkson, General Manager, Society of Automotive Engineers).

There could scarcely have been a better illustration of the underlying purpose of the National Air Races than that provided by the Air Institute. The military and naval competitions were designed

to stimulate interest in aeronautics as a national heritage, but the emphasis, first and last, was on commercial flying. The Air Institute, through the words of its distinguished contributors, interpreted this desire and by judicious presentation of facts conveyed to the public the message that the primary mission of aircraft is to serve, not destroy.

Keynote by Postmaster General New

The keynote was given by the Hon. Harry S. New, Postmaster General of the United States. "It is apparent to all," he said, "that the American people are by character non-militarists. They do not care to think of war, the possibility of it, or even insurance against it, or to pay the slightest attention to the requirements for protection until war is actually upon them. They placidly regard the country's economic resources as sufficient to protect them. They dislike large non-productive military or naval establishments, preferring to regard their natural strength as sufficient. This may be unwise, and I think it is, but it is a fact.

"Applied to aviation, this means that our aircraft industry, born of the war as a military adjunct, can not hope to survive, if compelled to look solely to the military, and in this is included the naval market. The United States is today in a cruelly paradoxical position with regard to aircraft. America was the birthplace of the airplane, yet we have seen Europe surpass us. It is true that in records we lead the world, but in quantity of supply we are lamentably and almost pathetically deficient, as contrasted with most of the other first-class powers.

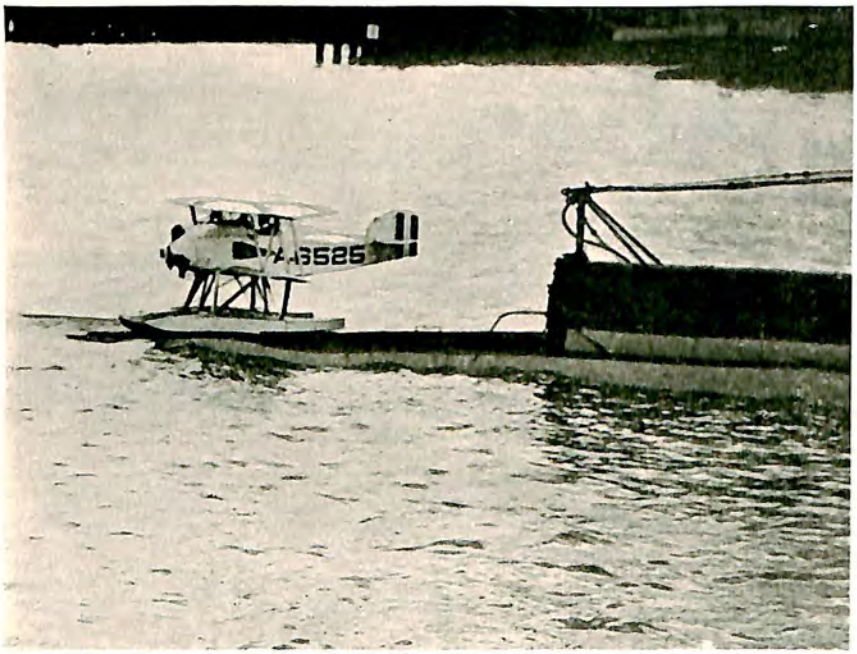
"The air forces of the Army and Navy must be placed upon a sound and effective basis, both as to existing equipment and personnel, and also as to future production and the training of reserves. But back of the demand for aeronautical development for both Army and Navy lies the need for the development of commercial aviation, which shall be a constructive and profitable economic force, and at the same time function as a reserve for the nation's defenses in production facilities and primary trained personnel. *Aircraft should be put to work.*"

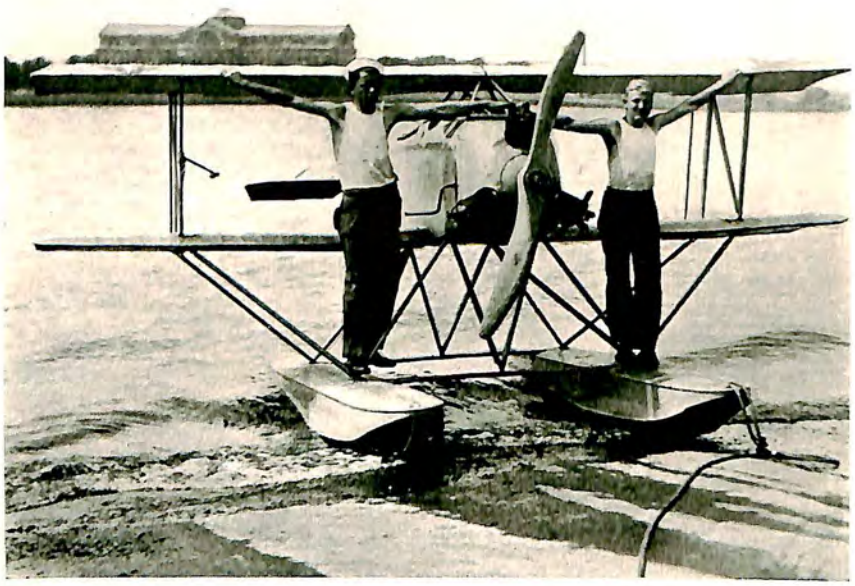
Aircraft in Interior Department

Dr. Hubert Work, Secretary of the Interior, expressed his conviction that aircraft are destined to perform invaluable service for the diversified activities of his department.

"In rushing mine rescue apparatus to the scene of disaster," he said, "in mapping from the air the immense reservoirs and extensive canal systems of Reclamation projects, in photographing inaccessible

Above—Curtiss Pursuit Plane (Curtiss D-12A engine). *Below*—Lieut. R. L. Maughan and his Dawn-to-Dusk Curtiss Pursuit Ship.





Types of Submarine Planes. *Above*—Glenn L. Martin *MS-1*. *Below*—Cox-Klemin. Both have Wright radial 60 h.p. engines.

to complete topographical features of the land for the Geological Survey and in the transportation of passengers to the National Parks, these are some of the possible developments of the future.

"The airplane already had been used by our Bureau of Mines in its rescue work following mine accidents. The adaptability of the airplane to this novel use is being tested by the Department at Birmingham, Alabama. The speed and mobility of the aeroplane and its independence of railway schedules and bad roads are valuable factors in the consideration of its adaptability to mine rescue purposes.

"Recently the Project Manager of the Rio Grande reclamation project was furnished with an aerial photographic mosaic map of the Rio Grande within his territory made by the Aviation Section of the United States Army at Fort Bliss, Tex. Mr. Gerrard H. Matthes, for many years one of the hydrographers of the United States Geological Survey and later with the Bureau of Reclamation, has been developing map making for reservoir sites, drainage basins, and other purposes by aerial methods. This was primarily in connection with the work for the United States Engineer Office at Chattanooga, Tenn. The method has been found particularly useful in the surveys of reservoir sites; for locating routes for transmission lines; for studying timber holdings by revealing kinds and quantities of species; for planning improvements in irrigated areas; for showing exact location of ditches, headgates; system of distribution used on various tracts; location of buildings; nature of crops grown; also for studying reclamation and drainage projects, for city maps; and for harbor surveys. He states that it is easy to put contours on a good aerial photograph with the plane-table; that the difficulties that hampered the early attempts have been overcome; and that the old-time surveying methods will be forced into the background by the new methods which are being found practical and economical.

"The application of photography to Geological Survey mapping has been studied and experimented with since 1910. The transformation from the horizontal to the vertical view made possible through the use of the aeroplane closely followed through further experiments and inventions by one of the Geological Survey engineers. This work has probably been the greatest factor in developing the practical aeroplane photograph, and for at least five years the Geological Survey has been carrying on specific tests and experiments in the use of airplane photographs in connection with field surveys. It has been demonstrated that such photographs, when secured promptly, have been of the greatest benefit in executing

topographic surveys, and the same can be said of geological surveys. So much of the time of the topographers and geologists may be thus saved that I have no hesitancy in saying that the use of aeroplane photographs can be used to advantage in connection with all classes of mapping and in the case of topographic mapping they can be used for all cultural features of the maps, and especially in the revision of the old maps, thereby bringing the culture of them up-to-date at relatively small cost."

Important Service to Agriculture

"Although the use of aircraft by the United States Department of Agriculture is hardly beyond the experimental stage," declared Secretary H. C. Wallace, "enough success has attended the trials to indicate their importance.

"The Bureau of Entomology has been one of the most liberal experimenters with the airplane in its work. An interesting use was to ascertain how far rust spores were distributed by air currents. This investigation was made possible by the co-operation of the Air Service of the Army, which furnished planes and pilots. Spores of stem rust were found in the air at altitudes of from 1,000 to 10,000 feet. It is significant that the number of spores caught in the air decreases rather rapidly as the distance from rust grains and grasses increases. Under the supervision of the Department of Agriculture the use of airplanes for dusting cotton was tried in a preliminary way during the summer of 1922 in certain areas of northern Louisiana and Mississippi. Although the insect in these tests was not the cotton boll weevil but the cotton leaf worm, which was particularly bad at that time the results showed that a very even distribution of dust could be obtained. For these tests three machines were loaned to the department by the War Department. Congress has appropriated $40,000 for carrying on the experimental work. Calcium arsenate dusting has been found the most efficient method of controlling the cotton boll weevil, but methods of spreading the dust have been limited to ground machines. The territory covered is therefore very small in comparison to what can be reached by the airplane, and the process consequently is somewhat costly. It is estimated that at present less than 10 per cent of the cotton area is effectively treated.

"The airplane has been used with success by the Forest Service in its fire-control work in the big forests of the west. In certain features of the work it is a very valuable adjunct. The airplane furnishes a means of direct vertical view of any fire situation without the distortion of angular view or without interference from intervening ridges. It is mobile and can go directly to the fire, circle

above it gathering information, determining the exact status of the fire, its location and character of material in which it is burning. During the period of smoke blanket when the country is completely overcast with smoke, the view from the airplane is not so seriously hampered as that of the lookout. The speed of the air patrol, promptness in reporting, and general utility are shown by the fact that the Oregon Patrol sighted 720 fires out of a possible 1,100, and that of the 720 sighted 465 received credit for first report.

Aviation in the Coast Guard

"Peacetime possibilities of aircraft are looming each year larger on our horizon as practical aids to the commercial, scientific and humanitarian work of civilization," said Rear Admiral W. E. Reynolds, Commandant of the U. S. Coast Guard. "The United States Coast Guard has found aviation a great possibility for more effectively carrying out its peacetime duties. Almost eight years ago Congress authorized the Coast Guard to construct and maintain ten aviation stations for the purpose of aiding in the national defense in war-time and of assisting commerce along the coasts in peace-time. Although Congress *authorized* these ten stations and the necessary personnel, it has never *appropriated money* with which to build a station or to carry on the work. It was only through the courtesy of the Navy, permitting the transfer of surplus aircraft, that we were able to get started.

"The scope of work of Coast Guard aircraft was comprehended as follows:

(a) Locating vessels in distress at sea in waters contiguous to the coasts, and carrying such assistance to them as practicable.
(b) Locating derelicts at sea within the practical cruising radius of the aircraft.
(c) Carrying life-saving line from shore to a vessel stranded near the beach beyond reach of line-throwing gun.
(d) Assisting various units of the government to more quickly and efficiently perform certain duties by carrying their representatives in aircraft to isolated points.
(e) Assisting fishing industries by locating schools of fish.
(f) Providing rapid transportation for emergency medical aid to persons at remote sections.
(g) Patroling territories for the enforcement of federal laws and co-operating in the enforcement of state and local laws.
(h) Assisting aircraft in distress.

In addition, any direct or indirect assistance rendered civil aviation was considered an encouragement to aviation in general and a proper function of the station.

"The aviation work of the coast guard was stopped on July 1, 1921. A necessity for strict economy in government expenditures

required the Coast Guard to limit its personnel, place many of its ships out of commission, close many of its life-saving stations, and observe the most rigid care in expenditures. No new work could be continued. This required the closing of its aviation station, which was done with the deepest regret by headquarters and the personnel of the station. As yet Congress has been unwilling to grant the coast guard funds to continue its aviation program. With sufficient funds to maintain at least two stations having adequate personnel, shops, and equipment, and suitable planes, exceptional beneficial work can be rendered by Coast Guard aviation."

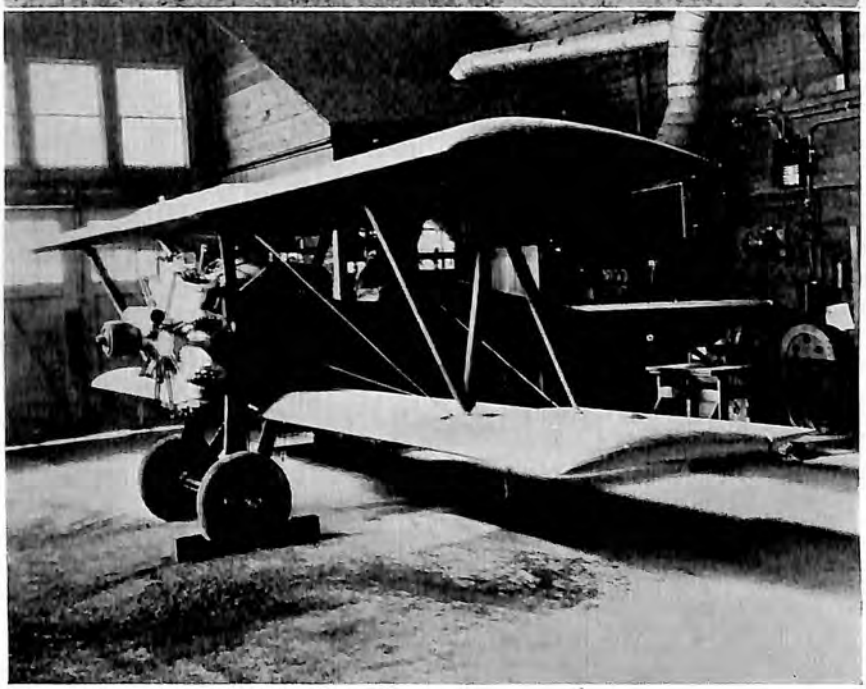
Congressman Urges Economy of Preparedness

The Hon. Frank Murphy, Representative in Congress from the 18th Ohio District, and member of the Committee on Appropriations, said: "In view of world conditions and the position of some of our Allies by reason of their intense development of Aeronautics, it is my judgment that America should not be caught napping, but should be quite alert and as strong in the air as any nation of the earth. The reasons for this opinion are so numerous that I scarcely know which one to advance first. However, I will just call your attention to the results in the naval tests recently held by our own Government, when great battleships were completely at the mercy of a boy in an airplane. The next war, which God forbid shall ever happen, will be fought in the air, but America is indeed, careless if she does not already see this condition, and, as we boast of our wonderful ability, we should now, in the days of plenty, prepare to take care of this country, which is looked upon with covetous eyes and distrust by other nations of the earth, and we might just as well understand that the best way to avoid war is to be prepared to take care of our Nation in the most modern way, which is by Aeronautics, at an expense that will be very moderate indeed, as compared with the tremendous cost of other fighting material, which is now almost obsolete."

Banker's View of Flying

John G. Lonsdale, President, National Bank of Commerce of St. Louis, saw in air transport a valuable adjunct to finance. He said:

"In speeding up the actual transaction of exchange, you correspondingly decrease the amount of money on deposit where the volume of trade is equal. Seemingly, then, the speed-up would work to the advantage of the section or community with the greatest trade volume. A review, however, of the gold settlement fund —the basis upon which the Federal Reserve equalizes trade balance



Above—Loening Monoplane, 300 h.p. Packard engine. *Below*—Loening Single-Seater Pursuit, Wright Radial 350 h.p. engine.

The Leviathan of merchant ships and the Leviathan of skyscrapers. View of New York.—Photo by Fairchild Aerial Camera Corp.

—shows that the advantage of trade is pretty equally distributed over the United States. From a dollar and cents standpoint, then, this most obvious reason for greater dispatch is minimized.

"Just to show the volume of business that would be involved from St. Louis alone, that would be at least speeded up, if not specific interest saving were eventually shown, C. C. Attebery of the St. Louis Federal Reserve Bank has gathered some interesting figures. The average daily amount forwarded from St. Louis over a given week was as follows:

Boston	$ 261,000.00	Baltimore	$ 145,000.00
New York	2,630,000.00	New Orleans	367,000.00
Philadelphia	305,000.00	Detroit	204,000.00
Cleveland	170,000.00	Minneapolis & St. Paul	130,000.00
Pittsburgh	188,000.00	Dallas	350,000.00

"Even the novice could visualize the advantages to be gained by the community first transporting its exchange checks aerially, and yet its immediate adoption, once started, by all large centers would soon overcome this temporary benefit.

"Mr. Attebery also compiled a table showing comparative transportation time on the amounts quoted in the above table:

	(Days) Time required for clearance by rail transportation.	*(Days) Time required by aeroplane transportation.*	*(Days) Saving by Air line.*
Boston	3	2	1
New York	2	1	1
Philadelphia	2	1	1
Cleveland	2	1	1
Pittsburgh	2	1	1
Baltimore	2	1	1
New Orleans	2	1	1
Detroit	2	1	1
Minneapolis	2	1	1
St. Paul	2	1	1
Dallas	2	1	1

"As an indication of the freightage involved, and the fact that in volume the loss to the rail carriers would be negligible, the amounts named in the first table would weigh as follows:

Boston	2 lbs., 10 oz.	New Orleans	6 lbs., 9 oz.
New York	13 lbs.	Detroit	1 lb., 5 oz.
Philadelphia	3 lbs., 8 oz.	Minneapolis	5 lbs.
Cleveland	3 lbs., 7 oz.	St. Paul	5 lbs.
Pittsburgh	2 lbs., 13 oz.	Dallas	9 lbs.
Baltimore	2 lbs.		

"On a basis of 6 per cent on the volume shown above, aeroplane transportation in saving on the average of one day to all points

named would mean an economy of nearly $800 a day in interest. A saving, however, that would not be fully realized on when all points began using planes.

"Whether the aerial service should be a Federal Reserve function is subject to discussion. Many favor the individual bank assuring the volume, dispatched through the central agency of the Reserve Bank. This detail is entirely parenthetical to the utilization of this faster means for transportation of exchange items.

"So far, the seemingly readily apparent gains from the more modern air carrier are partially reduced or eliminated upon analysis: One city using airplanes could reap a decided financial gain in the time saved, but no one could so monopolize the situation once the departure was inaugurated; the saving in interest days would secure also advantageously if trade balances were not so evenly distributed, and the quicker disposal of interest did not correspondingly decrease bank deposits.

"What, then, are the promises for considering the airplane's use for banks? First, because it is a proven modern carrier—Charlie Schwab says, 'Our children will fly'—and so they will, and we do not want banks to be the last in this vision. Aviation, therefore, is an economic factor to be developed not only through the resources of banks, but with their help where applicable.

"In this business congestion, set up and added to daily by man's ingenuity, the greatest avenue for development lies in the dispatch with which business is transacted. Air mail represents the last word in shortening distance and the commercial possibilities of the air are only now dimly imagined. *Buckling wings of Mercury to the interest-bearing bank mail represents greater business service—the keynote of our national progress.* Whether the banker gains directly or not, the greater efficiency and turnover it would represent to the dealer, the merchant, the bank customer, makes it a desirable course of development.

"Incidentally, and purely so, to the last paramount reason of service of greater dispatch is the added stability it would lend to the credit fabric of the country. The time of suspense when the payees' responsibility is being established is an accountable factor commercially. The 'float' of bad checks, the use of 'float' by some to temporarily increase their working capital and a hundred and one abuses of the 'float' system, all dangerous, costly and adding to the uncertainty of safe business practices, could be reduced, if not eliminated, under more expeditious methods of air transportation for exchange items."

CHAPTER XII

THE NATIONAL AERONAUTIC ASSOCIATION ENTERS SECOND YEAR—FREDERICK B. PATTERSON ELECTED PRESIDENT—NATION-WIDE MEMBERSHIP DRIVE BEGUN.

AS was narrated in the Aircraft Year Book for 1923, formation of the National Aeronautic Association of the United States of America was completed at the Second National Aero Congress, held in Detroit, Mich., October 12, 13 and 14, 1922. Organization was attended with many problems incidental in getting under way such an ambitious movement. Progress was necessarily slow and the first half of 1923 was occupied with establishing contact in the various corps areas. The one activity taken over intact from the Aero Club of America—representation in the United States of the International Aeronautique Federation and the consequent supervision of the technical features of record competitions and other sporting aviation events—occupied much of the attention of the temporary executive organization at Washington, especially subsequent to July, when the Contest Committee became intensively engaged in preparation for the St. Louis races.

The delegates to the Third National Aero Congress who gathered in the Hotel Statler, St. Louis, Mo., on the morning of October 1, 1923, were representative of practically every part of the United States. In number and enthusiasm they greatly exceeded those attending the Second Aero Congress in Detroit, but in many ways their problems were more perplexing. If it had been found difficult, during 1922, to bring about the formation of even the outline of an organization, the executive officers elected at Detroit found it much more difficult to co-ordinate a hitherto scattered group of units and, working from these, to lay the foundations of membership.

"I think we can safely say," said Howard E. Coffin, the retiring president, in his remarks at the Congress, "that progress in this organization has been fully in keeping with the progress in aeronautics since our previous meetings. Certainly, America stands in a much different position to-day in regard to aviation development and in regard of the world toward our achievements in aviation development than at these previous meetings, and I think we may be justly proud of that record. We must not think, however, that because we have pinned a few records at the top of our mast, we are achieving world supremacy in aviation, because it will not be until we have

made a commercial and practical application of the technical achievements in the service of the people of this country that we can feel that we really are on the way toward any degree of supremacy or even of equality in air development."

Resolutions Adopted

At the several business sessions, resolutions were adopted of which the following are the more important:

Establishment of Public Landing Fields: Resolved, That municipalities should recognize as a public duty the establishment and maintenance, at public expense, of landing fields, both permanent and emergency, and of such size, equipment and location as to be conveniently accessible to centers of population for air mail, passenger, interurban, express and light freight service.

Fuel and Oil at Government Stations: Resolved, That it is the sense of this convention that facilities for the purchase of gasoline and oil by commercial and sportsmen pilots be made available at Army, Navy and Air Mail Aerodromes.

Disarmament Movement Not Opportune: Resolved, That it is the sense of the National Aeronautic Association that this is not an opportune time to propose in this country an international conference for disarmament in the air.

Uniform State Aviation Laws: Resolved, That the National Aeronautic Association in convention assembled, recommend to the Legislative Committees in the respective states that if their state legislatures are intent upon enacting laws dealing with aeronautics, such committees use their best efforts to the end that enactment of the Uniform State Aviation Law, as drafted by the Conference of Commissioners on Uniform Laws, and approved by the American Bar Association, be passed without amendment.

Need of Federal Regulatory Legislation: Whereas, the development of commercial aeronautics has been greatly retarded by the lack of Federal legislation designed to foster and make safe civilian flying: now, therefore

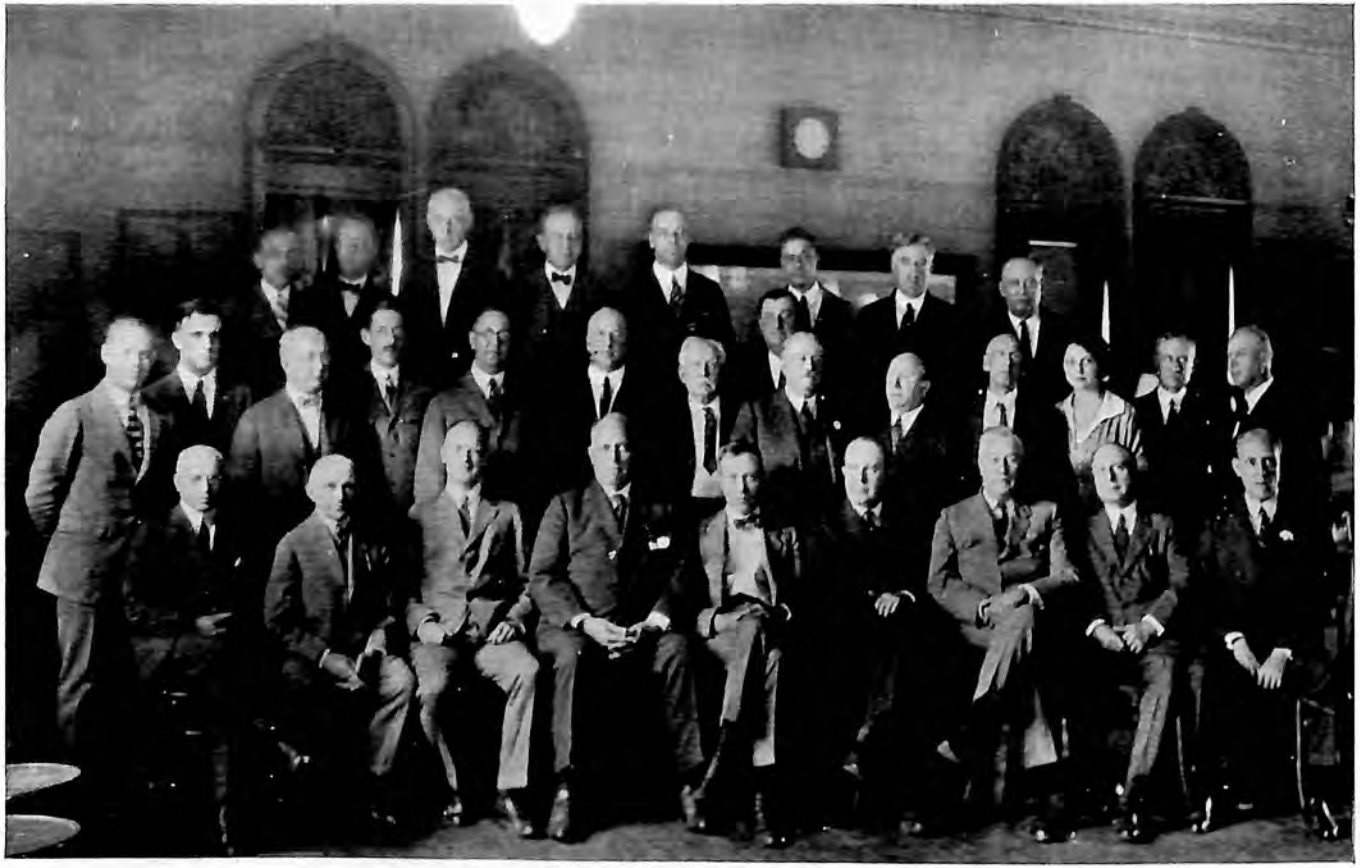
Be It Resolved, by the National Aeronautic Association in Convention assembled, That the next Congress be urged to enact legislation tending to accomplish these ends; and

Be It Further Resolved, That the National Aeronautic Association recommend the introduction and passage of the Civil Aeronautics Act, popularly known as the Winslow Bill, substantially as introduced in the last Congress.

After expressing appreciation for the administration of Mr. Coffin, the Congress unanimously re-elected him to the Presidency, despite his requests to be permitted to turn over the responsibility to some one else. Ralph W. Cram, editor of *The Democrat,* Davenport, Ia., was elected Vice-President, and D. M. Outcalt, former officer in the Army Air Service, Secretary. Colonel B. F. Castle, formerly of the Air Service, was re-elected Treasurer.

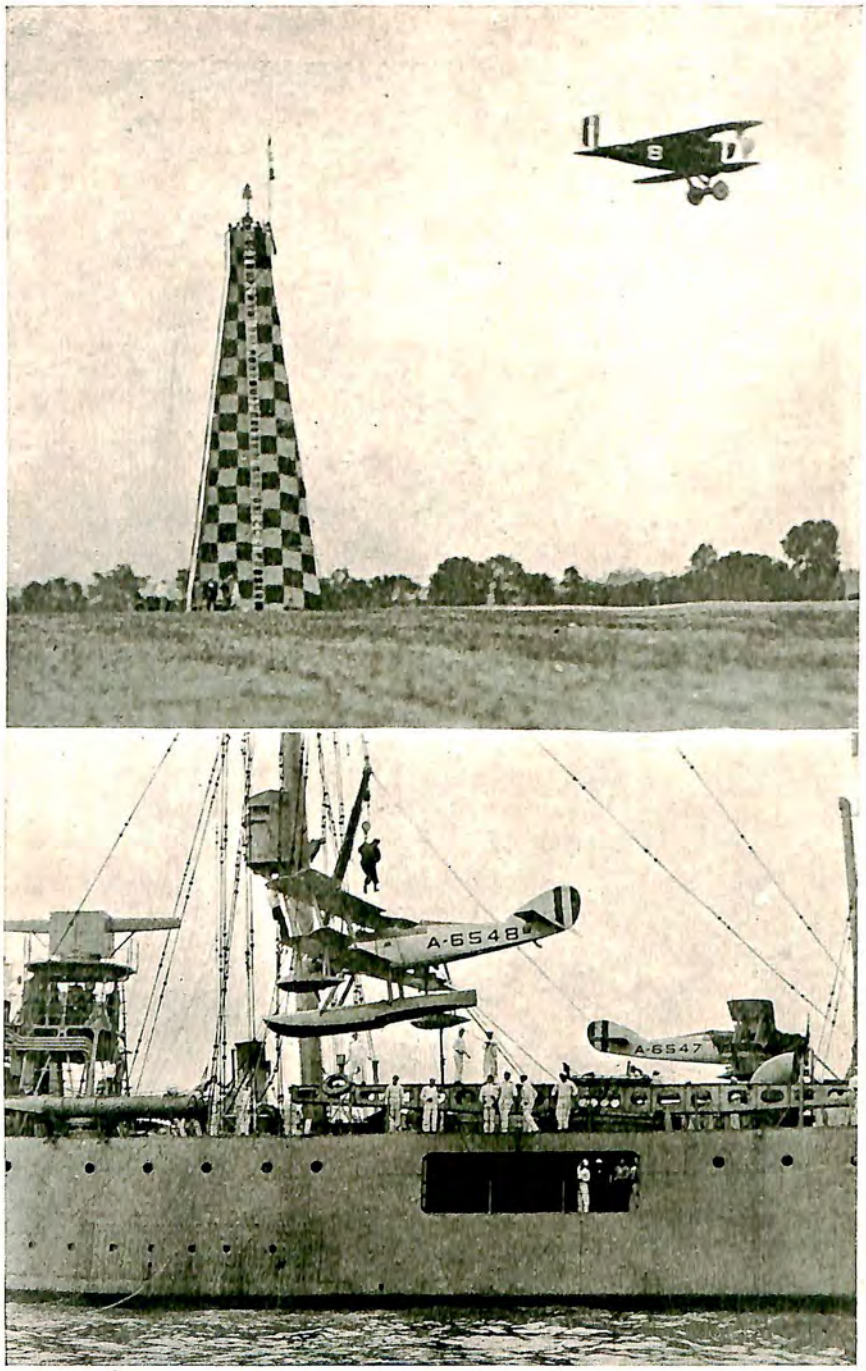
Frederick B. Patterson Elected President

At a subsequent meeting of the Board of Governors, Mr. Coffin insisted upon his resignation being accepted, and the Board there-



OFFICERS AND DIRECTORS, ST. LOUIS AERONAUTICAL CORPORATION

Botton Row, left to right—Maj. Albert Bond Lambert, Aaron Waldheim, Col. Albert T. Perkins, B. F. Bush, W. Frank Carter, Carl F. G. Meyer, M. E. Singleton, W. Palmer Clarkson, J. L. Johnston. *Middle Row*—R. B. McAdams, Randall Foster, John B. Strauch, John M. Drescher, Col. Phil H. Brockman, Arthur B. Birge, James E. Smith, Joseph Rankin (in rear), George S. Johns, Col. Martin J. Collins, Barney W. Frauenthal, Mrs. Elsa Schreiber, John F. Shepley, A. T. Terry. *Back Row*—T. Preston Sultan, Raymond F. McNally, Maj. J. A. Paegelow, Col. C. S. Thornton, E. J. David, Judge William T. Jones, Charles F. Hatfield.



Above—Navy-Wright Racer (Sanderson, pilot) rounding pylon at St. Louis.
Below—Vought shipboard plane (Wright radial engine) being hoisted aboard U. S. S. *"Richmond."*—Photos, U. S. Navy and J. A. Davis.

upon unanimously elected to the office Frederick B. Patterson, President of the National Cash Register Company of Dayton, O.

The selection of Mr. Patterson, while providing the National Aeronautic Association with a capable leader and generous patron, also had the interesting and very timely effect of concentrating the attention of the aviation world upon Dayton—the Birthplace of the Airplane. It had been Mr. Patterson's privilege—and before him his father's, John H. Patterson, founder of the company—to know the Wright Brothers intimately, to assist them and to appreciate in a way which few except the personal friends of the Wrights understand, the struggles which accompanied the early American experiments resulting on December 17, 1903, at Kitty Hawk, N. C., in Orville Wright making the first successful piloted mechanical flight in the history of the world. Mr. Wright attended the St. Louis Congress. Mr. Patterson, at the time of his election, was in Canada, but after conferring with Mr. Wright he accepted the presidency of the National Aeronautic Association as an opportunity to do the work which his father had hoped to do and accordingly arranged to devote a considerable portion of his time to the task of further assisting American development in the air.

Two Big Objectives

The grave deficiency of most previous aeronautic organizations in the United States had been that they were national in name only, were localized in membership, and dependent much of the time upon personal contributions. While ready to assist in every necessary way, Mr. Patterson as a business man recognized that, before the National Aeronautic Association could fulfill its mission to arouse patriotic America to a full realization of the necessity of adequate aerial security, it must first represent those Americans who, by organization, would be able to give voice to the common desire for the United States to utilize, for reasons of national security and commerce, the heritage bequeathed by the Wrights.

The first act of the new President was to call a meeting of the Executive Committee. As a result of suggestions developed at this conference, Mr. Patterson decided that if the National Aeronautic Association could accomplish two outstanding things during 1924 it would have made a big step toward placing itself upon a sound foundation. These two objects were first, to get behind the Winslow Bill and push it through Congress; and second, to increase the membership of the Association. Arrangements accordingly were made for the Legislative Committee, through its Chairman, William B. MacCracken, of Chicago, who is also Chairman of the Aviation

Committee of the American Bar Association, to spend much of its time in Washington.

Membership Appeal by Mr. Wright

It was of tremendous advantage to the membership campaign to have Mr. Wright, who has spoken in public very seldom, consent to broadcast the National Aeronautic Association's appeal on December 17, 1923—the Twentieth Anniversary of his famous flight. After reviewing some of his early experiences, Mr. Wright said:

"At a Congress in Detroit in October, 1922, the National Aeronautic Association was organized. Prior to that time there was no organization in America which adequately represented the aeronautic interest as a whole. Some of the objects of the Association are these: To encourage and advance the science and art of aeronautics; to aid and encourage the establishment of uniform and proper state and national laws to regulate aerial navigation; to supervise aeronautical sports; to establish the authenticity of air records; and to organize into a patriotic body the national sentiment supporting a comprehensive, definite, and orderly commercial and military-naval aeronautic program. The National Aeronautic Association is the American representative of the Federation Aeronautique Internationale. A nation-wide campaign for membership is now being inaugurated. If you are interested in the sport, art, or science of aeronautics, or in keeping our country's air program abreast of our economic and national activities for purposes of national security, you will be welcomed as a member."

One of the first moves in the membership campaign was to act upon authority given by the Board of Governors for the organization of Chapters upon a state and local unit rather than upon a district plan.

Nation-Wide Lecture Tour

When the tentative organization was being constructed prior to the meeting in Detroit, a successful tour of the country was made by Rear Admiral W. F. Fullam, U.S.N., Retired, a distinguished and forceful advocate of the necessity for air defenses. The services of Admiral Fullam were again enlisted by Mr. Patterson, and an itinerary mapped out from Coast to Coast. With the assistance of the Army and Navy Services, the Air Mail and the Aeronautical Chamber of Commerce, a motion picture film was prepared to enable the Admiral's audiences to visualize the importance of military and commercial aviation.

The message which is being carried over the country by Admiral Fullam has been epitomized by Mr. Patterson: "The World War demonstrated that the airplane is an absolute necessity in national defense, as well as a most effective messenger of peace. By conquering the air, all nations soon will have been brought into a single

neighborhood with a common economic interest. You should be an active member of the National Aeronautic Association because you are a patriotic citizen, because you want your country and your home made safe and because the United States should lead instead of lag in the development of this new power which it was the first to practically apply."

CHAPTER XIII

ASSISTANT SECRETARY OF WAR AT N. A. A. BANQUET WARNS COUNTRY OF WEAKENED AIR SECURITY—"WE ARE LITERALLY STARVING TO DEATH THE MOST VITAL BRANCH OF OUR NATIONAL DEFENSE."

THE annual banquet of the National Aeronautic Association, held on the Evening of October 1, at the Hotel Statler, St. Louis, was the occasion for the first public pronouncement, since the Armistice, of what might be regarded as a foundation for a definite American air policy.

The setting was appropriate. The races had called into the city several hundred military and naval air officers and civilians interested in aviation and as many of these as could be crowded into the grand ball room heard Col. Dwight F. Davis, Assistant Secretary of War, first extend greetings on behalf of the President of the United States, and of his chief, the Secretary of War, and then plunge into what he characterized as a serious discussion of a subject vital to every American—the question of patriotism and national defense.

A Distinguished Assemblage

On the dais were a number of distinguished individuals. Hon. Selden P. Spencer, United States Senator from Missouri, was toastmaster. In addition to Colonel Davis, those who spoke or were introduced to the assemblage were: The Air Attaches of Great Britain, France and Italy, respectively—Group Captain M. G. Christie, Captain Georges Thenault and Wing Commander Mario Calderara; the following representatives from Japan—Major General H. Haraguchi, Major N. Ohtsuka, Captain Osami Nagene and Lieut. Munetaka Sakamaki; Squadron Leader W. Hume, Canadian Air Force; Lieut. Virginius de Lamare, Brazil; Dr. S. F. Bedoya, Secretary of the Peruvian Legation; Major General Mason M. Patrick, Chief U. S. Air Service; Read Admiral W. A. Moffett, Chief Navy Bureau of Aeronautics; Col. Paul Henderson, Second Assistant Postmaster General; Commander F. C. Billard, representing the U. S. Coast Guard; Arthur M. Hyde, Governor of Missouri; Orville Wright; Harry B. Hawes, Congressman from Missouri; Pedro Guerera, Congressional Delegate from the Philippine Islands; Henry W. Kiel, Mayor of St. Louis; W. Frank Carter, Chairman of the St. Louis Air Board, and Howard E. Coffin, retiring President of the National Aeronautic Association.

In Radio Communication with Airship

While the dinner was in progress, the Navy dirigible, *"Shenandoah,"* was sailing westward to attend the St. Louis meet. Earlier in the evening Admiral Moffett had dispatched wireless orders to the commanding officer of the airship and a thrill went through the gathering when the toastmaster arose, and with the Admiral's permission, read the following dispatch, received through the Army Radio station at Scott Field:

"The Commanding Officer's compliments to Admiral Moffett. Your wishes will be complied with."

Colonel Davis, speaking as a representative of the Administration, and having in mind the fact that the St. Louis meet had resulted in the most extensive mobilization of American aircraft since the war was declared:

Colonel Davis' Speech

"If Macaulay is right: 'Of all inventions, those that have shortened distance have done the most for humanity,' the effect of aircraft in bringing the world ever closer together will be tremendously beneficial to mankind. But the future alone will show whether the airplane is a great factor in the progress of civilization, or whether it will be the most powerful instrument that man has ever devised for its destruction. I want to speak to you particularly, tonight, about the development of the airplane and the aviation industry from the standpoint of national defense. In the past, we have always been in the habit of thinking, and quite properly, that our physical isolation from the rest of the world has been a great bulwark of safety, with the two great oceans on either side.

"That was true in the days of the sailing ship, when it took six weeks or so for an invading force to reach our shores, but, today, the modern bombing plane can fly from Europe to these shores in about thirty hours, and the modern airship, like the *ZR-1* [*'Shenandoah'*], in say forty hours. See the difference that makes. An attacking force of very small size, a few thousand men, with an adequate accompaniment of bombing planes and airships, could reach our shores within forty hours, could hold our Atlantic seaboard at their mercy, strike a terrific blow at our whole industrial district, from Pittsburgh, East, striking at the very heart of the nation. That is physically possible unless we have an air force capable of meeting them and beating them down.

"I could not attempt to paint the horrors that such an invading air fleet could perpetrate on this country. Those of you who were abroad and saw the terrible damage done by the small bombs then

in use, can have some faint conception of this, and we must remember that the two hundred pound bomb which was then used has been replaced by the two thousand pound bomb, and I think they are now developing the four thousand pound bomb.

No Non-Combatants in the Future

"Just recently, within the last two weeks, I saw a huge powerful armored battleship literally reduced to a helpless ruin of tangled iron and steel by a single bomb dropped from the air. The damage to life and property which such a bomb would do if dropped upon a great city crowded with men, women and children, staggers the imagination. But we must remember that if there is another war—I hope to God there never will be—the Army and the Navy may not be alone on the firing line, there may be no such thing as a non-combatant, and women and children, far from the battlelines, may have to suffer the full horrors of war. I leave to your imagination the desolation, the ruin, the anguish that such an invading air fleet could bring to this country within a very short space of time. I am speaking of what is physically possible under modern conditions, even though we do not think that is probable.

"What are we doing to meet this menace? I mean 'we' as a nation, not the War Department. Unfortunately, we are doing pitifully little, we are going backwards. Congress has reduced our air force below the safety point of national defense. I think today, we have only about 915 officers and 8,600 enlisted men in our air service, and we have failed to provide even that meager force with the proper equipment for training, much less for a war reserve or for combat needs.

"I want to give you just a few figures, tonight, if you will permit me, because I think they are very significant. In 1922, due to the fact that we had a large number of planes on hand after the Armistice, we had a surplus of 2,125 planes—when I speak of surplus, I mean for purely training purposes; in 1923, that surplus was reduced to 768; in 1924 we have an actual shortage of planes needed to train our aviators. In 1925, if our preparations are not increased, that shortage will be about 628 planes. In 1926, we will have a shortage of 1,468 planes.

Starving Aviation to Death

"What we are doing is literally starving to death the most vital branch of our national defense. If Congress does not make adequate appropriations in the near future, our air service will be rendered absolutely impotent.

"Even a more serious situation than this—if there can be a more serious situation—is the fact that our commercial aviation industry is also being starved to death. One thing we learned in the World War, that it is absolutely impossible to build up a great industry, to meet a war emergency, over night. As a matter of fact, during the war, although all the energies of the country were bent toward production, the first American plane did not reach the French front until August, 1918, sixteen months after the declaration of war. That is no criticism upon the people who were handling that problem, because they had a very serious problem to deal with.

Time Required for Manufacture

"We are in a little better situation, today, but to meet the program of the War Department, in the case of an emergency, it would take the following time to manufacture the planes:

Training planes	eleven months
Observation planes	nine months
Attack planes	seventeen months
Bombing planes	seventeen months
Pursuit planes	eighteen months

"When you take those figures in connection with the length of time it would take an attacking force to reach these shores, when you consider the immeasurable damage that could be done to this country within forty hours after war was declared, I think you will realize we are faced with a serious situation.

"One of the lessons of the World War was the fact that aircraft are absolutely indispensable in modern warfare, and the nation which is not provided with adequate air forces is almost certainly doomed to defeat.

"What should we do under these circumstances? Personally, I do not believe in building up a great air fleet. Certainly not to enter into competition with other nations along that line. But I do feel that it is important that we develop some sort of a program, say a ten year building program, not for the purpose of aggression, not in competition with other nations, but to give us some basis on which to work, and to give our airplane manufacturers some basis on which to figure they can stay in business.

"It need not be a large amount of money, we do not want a great number of planes, but I think we should give our air forces at least a chance to protect us; and we should give our aviation industry a chance to exist. Other nations are alive to this problem. Great Britain, for example, has an air force of 31,000 officers and men, thoroughly equipped and trained, where we have 915 officers

and 8,600 men. Their budget, last year, was something like twelve million pounds, where our army budget was twelve million dollars.

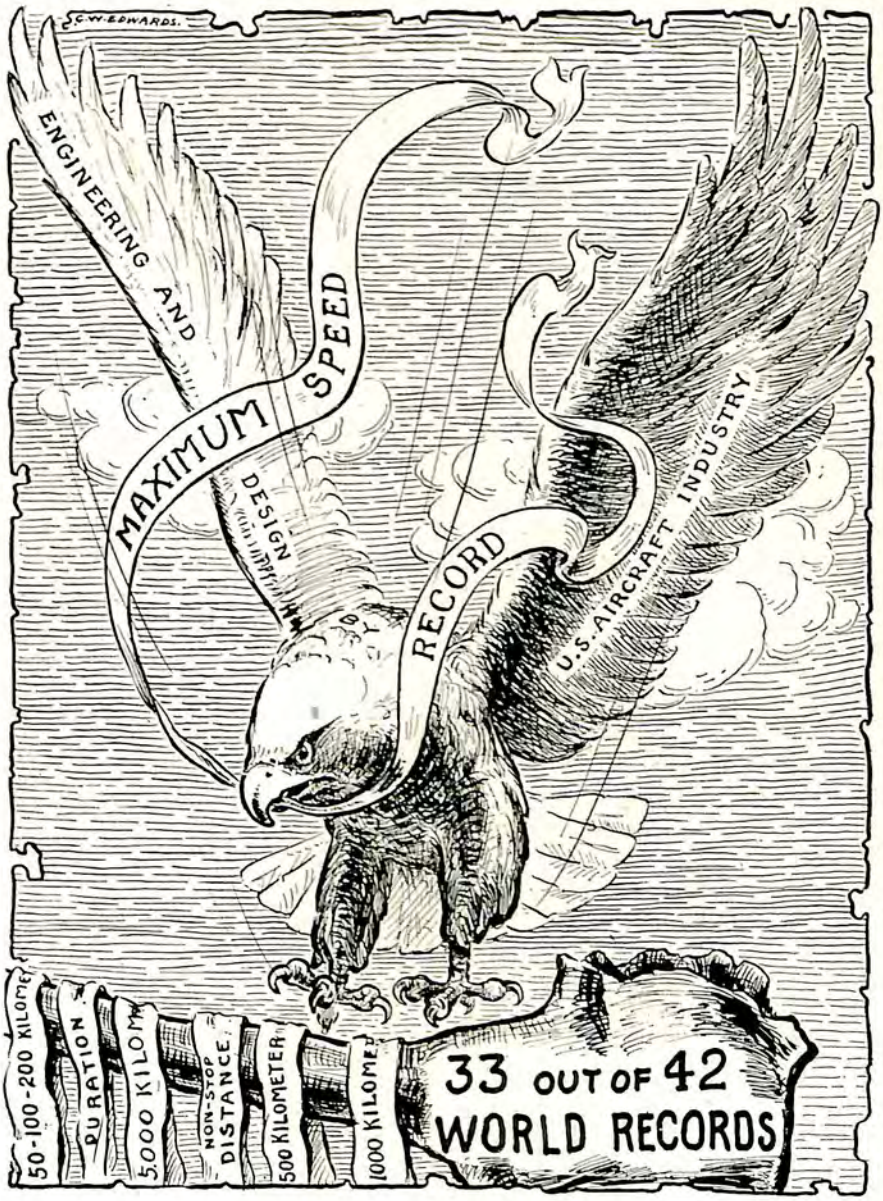
Air First Line of Defense

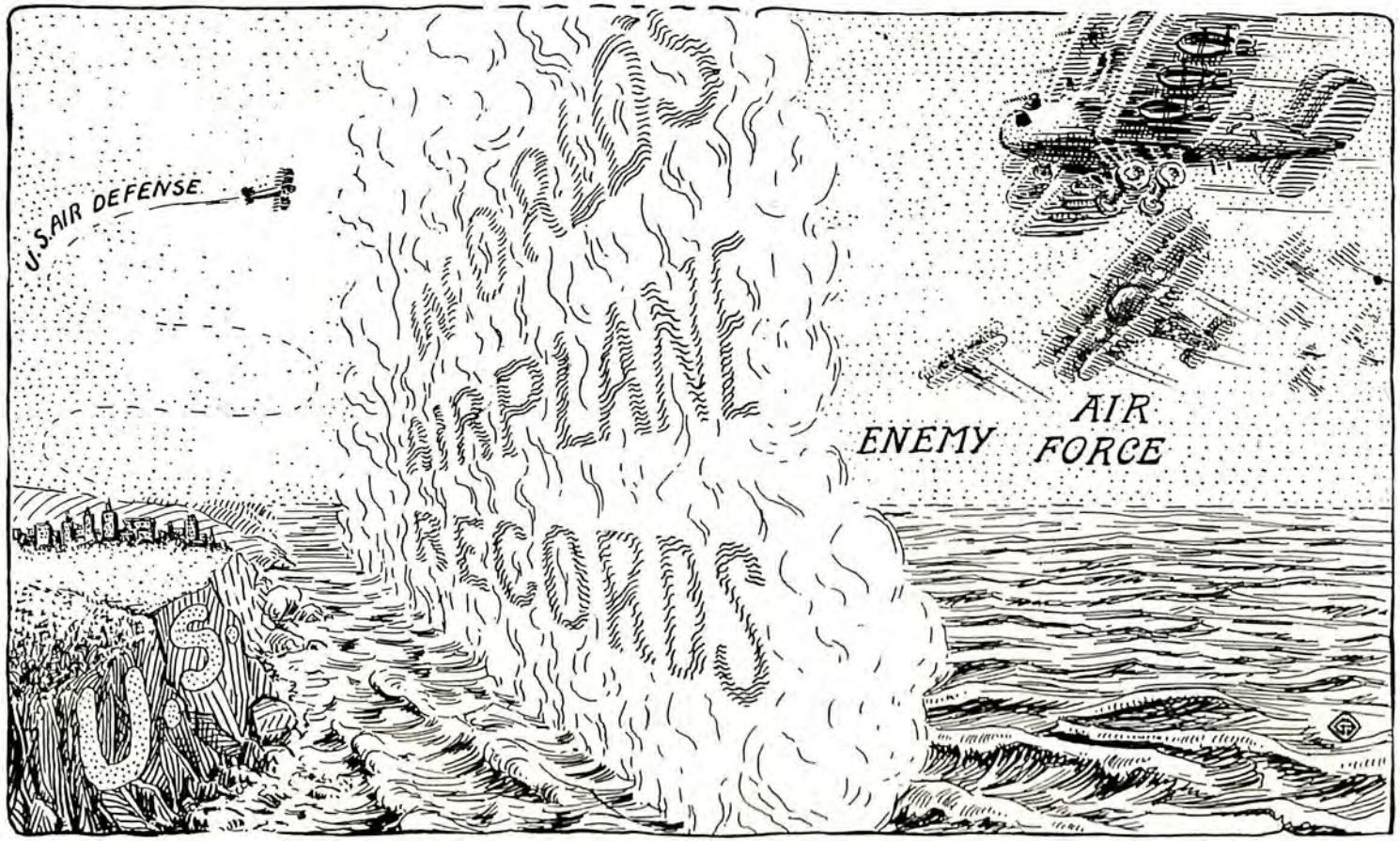
"France has made her airplanes her first line of defense. She has some 1,400 airplanes in commission and something like that in reserve. Her air budget was 247,000,000 francs. Italy is building up her fleet, and all the nations of the world are realizing this serious problem which confronts the world, all except America. America must wake up to this serious problem which is confronting her.

"We have a wonderful air force, both in the Army and the Navy, splendid young men, red-blooded, keen, brave and very wisely led by older heads, such as General Patrick and Admiral Moffett, but the country itself must back them up if it expects them to save the country in time of need.

"We are not in any sense a militaristic nation, we have never been, we never will be; it is contrary to all our thoughts, all our desires. We hate, loathe and fear war, but merely repeating, parrot-like that 'we hate, loathe and fear war,' unfortunately, does not mean that war will be impossible. We should always, in my opinion, be eager and anxious to make war unlikely, but we must not forget the lessons of the last war. The nation which sends its boys into battle as we did in the last war, untrained, unequipped, is guilty of nothing short of murder.

"The one thought I want to leave with you, tonight—I hope I have not kept you too long—is this: We must see to it—we, particularly, the men who were in the service during the last war—that American boys are never again sacrificed unnecessarily, as many of our comrades were sacrificed in the last war, because in times of peace we did not have the intelligence to prepare for possible war."


J.C.W. EDWARDS.
ENGINEERING AND
MAXIMUM SPEED
DESIGN
RECORD
U.S. AIRCRAFT INDUSTRY
50-100-200 KILOMETER
DURATION
5000 KILOM
NON-STOP
DISTANCE
500 KILOMETER
1000 KILOMET
33 OUT OF 42
WORLD RECORDS


U.S. AIR DEFENSE
ENEMY AIR FORCE

CHAPTER XIV

THE NATIONAL AIR RACES AT ST. LOUIS—FOUR MILES A MINUTE!—130 CIVILIAN PLANES PARTICIPATE—375 AIRCRAFT ON THE FIELD—374,000 MILES OF SAFE FLYING.

THREE factors combined to make the National Air Races, held in St. Louis, October 4, 5 and 6, 1923, the greatest event of the kind in the history of aviation. The first was the geographical location of the city; the second, the history of transportation in the Mississippi Valley; and the third, the spirit and character of St. Louisans themselves.

St. Louis, as the emblem of its Chamber of Commerce aptly expresses it, is "The City Surrounded by the United States." Not even excepting Chicago, it is the most centrally located of all the larger municipalities. Sufficiently close to New York to share in the stability of the East, it is essentially of the West and Southwest, and from these vast regions it draws its vigor and strength.

As the rivers were the first natural highways from the seaboard into the interior of the continent, the Mississippi for many years was an important artery of commerce and St. Louis its chief trading post. The elaborate system of turnpikes conceived in 1807 by the Federal Government regarded St. Louis as the *Western* terminus. The pioneer railway constructors in the period immediately following the Civil War saw in this city the *Eastern* terminus of extensions North, South and West. But these extensions, which made St. Louis for a time the center of transportation worked also to the diminishing of the river traffic, which had hitherto been the source of the city's greatness and resulted in the upbuilding of rival municipalities.

St. Louis's Early Interest in Aviation

Less than four years after the first Wright flights were made at Kitty Hawk, the St. Louis Chamber of Commerce, at an expense of $25,000, brought to the city the International Balloon Race, which, in 1906, had been won by one of her own sons, Lieut. Frank Lahm, U.S.A. In 1909 and 1910 there were more balloon races and in the latter year there was also conducted what is declared by Major A. B. Lambert to have been the first large meet for airplanes held in the United States. At the expense of the public, and in the interest of public education, a field was prepared and grandstand erected. It

was at this meet that a flight for Ex-President Roosevelt with the pilot Hoxey was arranged.

During the World War, under the sponsorship of the Missouri Aeronautical Society, St. Louis operated a training school for balloon pilots. Three hundred and fifty-four were qualified and more than 1,500 ascensions were made. In 1918, the City of St. Louis, through the Chamber of Commerce, the Missouri Aeronautical Society and the municipal legislature, raised $28,000 for the grading of a field and the erection of a hangar for the Air Mail Service between St. Louis and the Twin Cities, connecting at Chicago with the Transcontinental Route.

Citizens Move to Obtain Pulitzer Race

With this aeronautical background and generous precedent it was natural, following the two successful contests for the PulitzerTrophy in 1920 and 1921, for there to be a general movement to bring this important event to St. Louis. The fact that Joseph Pulitzer, President of the St. Louis *Post-Dispatch,* was one of the donors of the trophy, presented a common point from which to start. Early in 1922, when Detroit was preparing for the races to be held in the Fall of that year, a resolution was adopted by the Flying Club of St. Louis urging that an effort be made to conduct the events in St. Louis in 1923. On November 14, at a luncheon at the Noonday Club, given by Mr. Pulitzer and George S. Johns, Editor of the *Post-Dispatch,* a Citizens Committee was formed consisting of the following:

W. Frank Carter, chairman
M. L. Wilkinson
Albert T. Perkins
Phil Brockman
John G. Lonsdale
Aaron Waldheim
Albert B. Lambert
W. B. Weisenburger
F. W. A. Vesper
George S. Johns
L. P. Aloe
Benjamin F. Bush
Festus J. Wade
John L. Johnston
Frank O. Watts
Randall Foster
Lyman T. Hay
Roy F. Britton
Joseph Pulitzer

Early in 1923, the National Aeronautic Association awarded the races to St. Louis. The meet was then sanctioned by the Aeronautical Chamber of Commerce and given the support of the organized aircraft industry.

Organizing for the Meet

The Citizens Committee, having achieved its object, was superceded by an unincorporated body known as the St. Louis Air Board,

which attended to the preliminary organization, and which, in turn, was succeeded in the actual financial and legal details by the St. Louis Aeronautic Corporation, with the following officers and directors:

President, Benjamin F. Bush, Chairman, Board of Directors, Missouri Pacific Railway.
Vice-President, Carl F. G. Meyer, President, Meyer Bros. Drug Company.
Vice-President, W. Frank Carter, of Carter, Nortoni & Jones.
Treasurer, R. F. McNally, Vice-President, National Bank of Commerce.
General Counsel, Judge Wm. T. Jones, Carter, Nortoni & Jones.
General Manager and Secretary, Arthur B. Birge.
Assistant Secretary, Elsa Schreiber.
W. Palmer Clarkson, President, Pioneer Cooperage Company.
Major A. B. Lambert, President, Lambert Pharmacal Company.
Col. Albert T. Perkins, Manager for Receiver, United Railways Co.
M. E. Singleton, President, Missouri State Life Insurance Company.
J. L. Johnston, President, Liberty Central Trust Company.
John G. Lonsdale, President, National Bank of Commerce.
Aaron Waldheim, President, May Stern & Company.

The following committee chairmen were appointed: Concessions, James E. Smith; Convention, Charles F. Hatfield; Finance, Carl F. G. Meyer; Grounds, Albert T. Perkins; Medical, Dr. M. B. Clapton; Organization, Judge Wm. T. Jones; Program, John M. Drescher; Policing, Philip H. Brockman; Publicity, George S. Johns; Railroad Transportation, B. F. Bush; Reception and Entertainment, Martin J. Collins; Reserve Unit, Louis P. Aloe; Speakers, Frank Swann; Tickets and Admissions, B. W. Frauenthal; Traffic, Joseph Rankin; Technical and Contest, A. B. Lambert.

The Financial Plan

Organization headquarters were established in the Chamber of Commerce Building. The first problem was that of finance. The St. Louis Aeronautic Corporation was incorporated to own property, acquire leaseholds and otherwise transact business. It had an authorized capital of $200,000, divided into 4,000 shares of no-par value, non-assessible stock. Stock was offered to the public at $50 a share. More than 800 individuals and corporations subscribed and these subscriptions formed the basis from which the ambitious project was financed. More than $300,000 had to be raised—and was raised—in order to purchase and lease land, grade, sow and roll it,—erect hangars, construct grand stands, build fences and do the many other jobs involved on an increasing scale as the extent of the meet became broader.

Only when the public appreciation of the geographical location and the transportation history of the city is borne in mind can it be

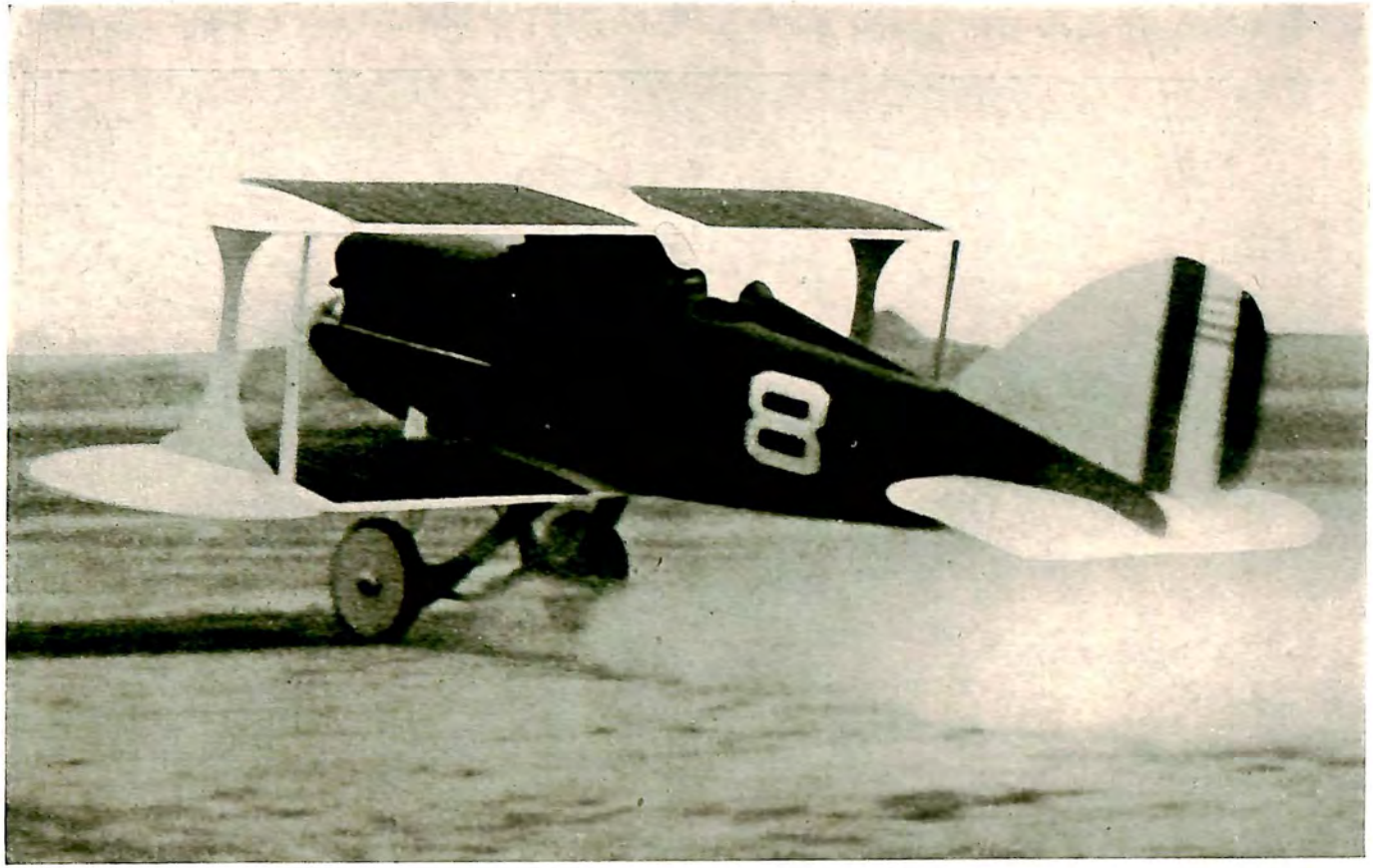
understood how it was possible, in the heat of the summer and in a comparatively short space of time to provide sufficient funds for the undertaking. The people had vision and it was this vision which Mr. Meyer capitalized. It was impracticable to organize a large working force to place the stock broadcast. Instead, the 105 commercial subdivisions of St. Louis were invited through their separate organizations to place an allotment of stock with the members of their particular branch of business, starting with the clearing house, banks, Retail Merchants' Association, Merchants' Exchange, Real Estate Exchange, Automobile Dealers' Association, Lumbermen's Association, Hotel Men's Association, and so on through the entire list.

Construction of Permanent Field

About twelve miles from the heart of the city is Bridgeton (St. Louis County), Mo. Here there was a small field which was being used as a commercial base by the Robertson Aircraft Corporation. About 35 miles from St. Louis, near Belleville, Ill., is Scott Field, an Army Air Service Post. It would have been cheaper and easier to have selected Scott Field as the site for the races, but the St. Louis business men felt that to do so would be to forfeit in advance most of the advantages which the meet should bring to the city in the way of establishing it as a permanent commercial air center. So, regardless of labor and expense, it was decided to develop the Bridgeton site.

Lambert Field, as it was then known, was but little more than a meadow. Those who viewed it in early spring could with difficulty visualize what actually was to be accomplished—the grading and preparing of 170 acres in permanent form and 316 additional acres under lease. Under the personal direction of Colonel Perkins, tractors and teams literally by the score were kept at work, day and night, for weeks. Three runways, each a mile long and 1,000 feet wide, were constructed and in so doing it was necessary to remove 200,000 cubic yards of earth. A sewer one mile long and five feet square was built, but while it was being built torrential rains several times wrought damage which it took many days to repair and at heavy additional expense. Four steel hangars and as many supplementary sheds, a machine shop, water system and electric light and power facilities also had to be created. The grand-stand plans were gradually enlarged so that, when completed, they accommodated 30,000 people. Bleachers to seat 15,000 more were put up. Pylons, press and administration buildings were erected, seven miles of fence strung and a 5,000 gallon gasoline tank sunk in front of

Navy-Curtiss Racer in which Lieut. A. J. Williams won the Pulitzer Race at 243.68 m.p h. Later Lieut. Williams established a new world record of 266.6 m.p.h. for three kilometers straightaway.—Photo, U. S. Navy.



Navy-Wright Racer in which Lieut. L. H. Sanderson won third place in the Pulitzer Race at 230.06 m.p.h.
Photo, U. S. Navy.

the service hangars. It was a tremendous job, but splendidly and permanently done.

Governmental and Civilian Co-operation

While financial and engineering problems were being met, organization and co-ordination of all features were being carried on at Mr. Birge's headquarters. Major M. F. Scanlon, followed by Major H. M. Hickam, handled the Air Service end, Lieutenant B. R. Holcomb was the representative of the Navy on the ground until Commander M. A. Mitscher arrived. Evan J. David and W. M. Ledbetter conducted an energetic and comprehensive publicity campaign in which they were assisted by the information officers of the Army, Navy and Postal air services, by the National Aeronautic Association and by the Aeronautical Chamber of Commerce. Mr. Johns, as Chairman of the publicity committee, gave to the meet all the tremendous support of the *Post-Dispatch.* Through the generosity and far-sightedness of the publishers of the other St. Louis newspapers, the *Globe-Democrat, Star* and *Times,* the columns of the local press were thrown wide-open and this led naturally to recognition of the meet in other cities as an event of international importance.

Technical Arrangements

The technical problems were simplified through the existence of the St. Louis Flying Club. The Race Committee consisted of 128 members of the club who placed themselves at the disposal of the St. Louis Aeronautical Corporation. Randall Foster, as president of the club, became chairman of the Race Committee. John M. Drescher was named Vice-Chairman. The following active officials were designated:

Contest and Technical Committee: A. B. Lambert, Chairman, St. Louis; Wm. B. Stout, Vice-Chairman, Detroit; R. W. Schroeder, Chicago; G. W. Lewis, Washington, D. C.; Geo. P. Dorris, St. Louis; L. H. Littlefield, St. Louis; B. Russell Shaw, Washington, D. C.

Race Executive, B. Russell Shaw, Washington, D. C.; Referee, Caleb Bragg, New York; Chief Timer, Odis Porter, Indianapolis; Chairman of Judges, Victor C. Houser, St. Louis; Assistant Chief Timer, Harry H. Knepper, Detroit; Starter, T. P. Sultan, St. Louis; Alternate Starter, Howard Wehrle, Kansas City; Chairman of Scorers, Carl J. Schiller, St. Louis; Chairman of Assistant Timers, Charles S. Powell, St. Louis; Badges and Arm Bands, Richard L. McAdams, St. Louis.

Mr. Shaw, as Vice-Chairman of the Contest Committee of the

National Aeronautic Association, had general executive supervision over the technical arrangements. Timing, Signalling and other methods of control were excellently planned and so perfectly co-ordinated that there was a minimum of confusion and error.

The Course and Program of Events

The course was triangular, measuring 50 kilometers, or 31.07 miles. From the field at Bridgeton it was laid out northeasterly, across the Missouri River to a point near Texas Junction, then southwesterly to a point known as Seeberger, almost on the banks of the Mississippi River, thence back across the Missouri to Bridgeton.

Following is the program of events beginning Wednesday, October 4:

No. 1. On to St. Louis Race, September 20-30, for mileage and points; Senior and Junior St. Louis Chamber of Commerce Trophies.
No. 2. Flying Club of St. Louis Trophy; 150 kilometers (93.21 miles), three laps; total prizes, $1,000.
No. 3. Liberty Engine Builders Trophy; 300 kilometers (186.42 miles), six laps; total prizes, $1,500.
No. 4. Aviation Country Club of Detroit Trophy; 250 kilometers (155.34 miles), five laps; total prizes, $2,000.
No. 5. Merchants Exchange of St. Louis Trophy; 300 kilometers (186.42 miles), six laps; total prizes, $2,000.
No. 6. Mulvihill Model Trophy; duration contest for model airplanes driven by rubber strand motors; total cash prizes, $300.
No. 7. Detroit News Air Mail Trophy; 300 kilometers (186.42 miles), six laps; total prizes, $1,500.
No. 8. Pulitzer Trophy; 200 kilometers (124.27 miles), four laps; total prizes, $4,000.
No.8-A. John L. Mitchell Trophy; 200 kilometers (124.27 miles), four laps.

On to St. Louis

There were 27 entries in the On to St. Louis Race. They came from fifteen or twenty states, and all but two actually participated. Requirements were that the entrant must fly from a distance 200 miles or more between September 20th and 30th. This race, which was originated at the Detroit meet in 1922, was designed to encourage pilots to fly to the races and without doubt was responsible for a considerable portion of the fleet of civilian aircraft assembled at St. Louis, although only one-fifth of those thus attending actually bid for the prizes.

The rules of the On to St. Louis Race were devised so as to credit the participant for distance flown, passengers carried and speed, but to penalize him for excessive horse-power. It is quite

obvious that a successful contestant would thereby demonstrate efficiency, economy and safety. First place was awarded to C. S. Jones, manager of the Curtiss Exhibition Company, who flew from Garden City, Long Island, 900 miles distant. His Curtiss *"Oriole"* was equipped with the standard Curtiss OX-5, 98.5 h.p. engine. His average speed based on total elapsed time, was less than 50 miles an hour, for which no points were recorded. For distance, there were 40 points; for one passenger, 10 points; for engine, 166 points, or a total of 216.

Second place, with a total of 215 points, went to H. F. Cole, flying the Thomas-Morse Aircraft Corporation's *54-C,* from Minneapolis, Minn., also 900 miles distant. Cole's plane, entered by the Aero Club of Minneapolis, carried no passenger, but his Le Rhone motor, being only 80 h.p., was credited with 175 points.

Third and fourth places, respectively, were taken by W. W. Meyer, flying a biplane of the Heath Airplane Company, 262 miles from Chicago; and Lawrence P. Sperry, flying a Sperry *"Messenger"* 700 miles from Farmingdale, N. Y. Meyer's rating was raised, through the carriage of four passengers, to 213 points. Sperry's 207 points were gained mainly through the low power of his engine (56.5 h.p. Wright L-4, of the Wright Aeronautical Corporation). This Wright L-4 engine, because of its small size (being the smallest aviation engine made in America) was rated with 187 points, or 12 greater than its nearest competitor. Although Sperry actually flew from Long Island, he gave his official starting point as Washington, where he stopped to call on some officials. If he had made his official start from Long Island, it would have counted 20 points more and he would have won first place.

Cash prizes totalling $1,000 were distributed among the first four pilots. In addition, Mr. Jones received the Senior St. Louis Chamber of Commerce Trophy. Jones and Cole were tied for the Junior St. Louis Chamber of Commerce Trophy, which was awarded to Mr. Cole, when Jones withdrew.

Flying Club of St. Louis Trophy

The race for the Flying Club of St. Louis Trophy was the first one on the opening day, October 4th. In addition to the trophy, there were cash prizes totalling $1,000. Entries were limited to planes with engines of 90 h.p. or less. Of the seven participating, five were Curtiss OX-5s, one a Wright L-4 and one an Anzani. The contest consequently depended upon the racing lines of ships themselves, and upon the skill of the pilots. The distance was 93.21 miles, or three laps around the course. Walter E. Lees, an old-time

flier, who is credited with having trained Brigadier General William Mitchell, Assistant Chief of Air Service, was fifth to take off, but speedily overtook and passed his rivals and came in the winner in a total elapsed time of 62 minutes, 52.35 seconds, or 89.3 miles an hour. Lees flew the Hartzell FC-1, entered by the Johnson Airplane and Supply Company. His plane, like those taking second, third, fourth and fifth places, had an OX-5 engine.

There was but 1 minute, 52 seconds difference in the mile per hour speed made by Perry Hutton, flying a Laird *"Swallow"* for the Sterling Oil and Refining Company, who took second, and C. S. Jones, in his Curtiss *"Oriole,"* who took third. Hutton's elapsed time was 64 min. 26.17 sec.; Jones, 65 min. 34.59 sec. Lawrence Sperry, until he landed for a few minutes to make a minor adjustment on the last leg of the third lap, was pressing close upon the winner.

Liberty Engine Builders Trophy

Eight planes from the Army Air Service and one from the Marine Corps took places in the Liberty Engine Builders' Trophy Race on October 4th. Regulation two-seater planes of the services, with a speed in excess of 90 miles an hour were eligible. The race was for 186.42 miles, or six times around the course. In addition to pilot, observer and fuel, each plane had to carry 0.85 lb./h.p. of ballast.

The race for this trophy in 1922 in Detroit was over 257.74 miles. All planes finishing then were equipped with 400 h.p. Liberties. Of the nine planes completing the St. Louis race, seven had Liberties, one a 300 h.p. water-cooled Wright and one a 200 h.p. Wright air-cooled. In 1922 the first four speeds were as follows: 128.8, 126.5, 121.88, and 118 m.p.h. As was the case in 1922, the Liberty which won first place in 1923 was constructed by the Packard Motor Car Company. It was super-compressed and equipped with a metal propeller. It drove the *CO-4,* piloted by Lieut. C. McMullen, U.S.A. S., at 139.03 m.p.h. The De Haviland *4-BL,* equipped with super-compressed Liberty and reversible propeller, with Lieut. H. K. Ramey, U.S.A.S., at the stick, finished second, but 1 minute 49 seconds slower than the Fokker. The *CO-5,* flown by Lieut. L. H. Smith, U.S.A.S., was third, at 135.27 m.p.h. It was equipped with super-compressed Liberty and metal propeller.

In a race dominated by water-cooled engines of 400 h.p. or more, the performance of the 200 h.p. air-cooled Wright *J-1* in Lieut. G. B. Hall's Navy Vought, *UO-1,* was especially interesting. This standard observation plane of the Chance Vought Corporation with only a 200 h.p. air-cooled engine and a wooden propeller, was piloted

Above—Johnson-Hartzell in which Walter E. Lees won Flying Club of St. Louis Race.—Photo, U. S. Air Service. *Below*—C. S. Jones and Curtiss *"Oriole,"* winner On to St. Louis Race.

Above—Bellanca Sedan in which Jack Atkinson won Aviation Country Club of Detroit Race. *Below*—Lieut. C. McMullen, U. S. A. S., winner Liberty Engine Builders Race.—Photo, U. S. Air Service.

to fourth place at the rate of 132.27 m.p.h.; beating all of the Liberty planes except those with super-compression and metal propellers.

Aviation Country Club of Detroit

In 1922 the race for the Aviation Country Club of Detroit Trophy was over 257.74 miles; in 1923, over 155.34 miles. In 1922, four planes, three of military type, entered, and three, including the one commercial type—a Curtiss *"Oriole"*—finished. Of the seven starters on October 5th, 1923, only one could be regarded as adapted from the military. Of these seven, three finished, and the performance thus recorded justifies the assertion that events requiring that reliability and utility be demonstrated confer immediate practical benefits upon aviation. In proof, compare the records of this race in 1923 with that in 1922. Jack Atkinson, flying a sedan monoplane built by the Bellanca Airplane Company, and carrying weight equivalent to four passengers, covered the course at the rate of 94.28 m.p.h. His engine was a 95 h.p. Anzani. The winner in 1922, flew a De Haviland cabin job, with a 440 h.p. Liberty, recording a speed of 134.9 m.p.h. The figure of merit was arrived at by a formula $\frac{w}{h.p.} \times$ m.p.h. The Bellanca efficiency thus worked out 674.8468.

Perry Hutton's Laird *"Swallow"* achieved a figure of merit of 300.4180 and C. S. Jones' Curtiss *"Oriole,"* 285.5527. Hutton's speed was 87.03 m.p.h., and Jones', 82.69. In 1922, Jones' *"Oriole"* had a 160 h.p. C-6 engine; in 1923, the Standard OX-5 of 98.5 h.p. His speed in 1922 was 109.4 m.p.h. In other words, in 1923, with 39 per cent. less horse power, he made only 25 per cent. less speed. This is in large part attributed to his use in 1923 of the Curtiss-Reed duraluminum propeller.

Merchants' Exchange Trophy

The Merchants' Exchange of St. Louis offered a prize for large planes capable of carrying 2000 pounds or more load. Lacking cargo carriers, entries were made up solely of military and naval types. The entries on October 5th were five twin Liberty-engined Martin Bombers; two Navy DT-4 Douglas-Wright torpedo planes, used as bombers, and the Fokker Transport. The navy planes were powered with the Wright T-2 heavy-duty engines and had been flown to St. Louis from Anacostia, Washington, D. C. The Fokker had one regulation Liberty.

The winner, a Martin Bomber, piloted by Lieut. H. L. George, U.S.A.S., made a speed of 114.29 m.p.h. for the 186.42 miles. A cheer rose from the spectators when it was announced through the

loud speaker from the timers' stand that this was the same plane built by the Glenn L. Martin Company for the Air Mail in 1919 and which, after 126,000 miles in the postal service, was turned over to the Army, converted into a bomber and carried one of the 2,000 pound bombs which sank the *"Ostfriedsland"* 100 miles off the Virginia capes in 1921. In 1923 this ship was reconverted to cargo use and conveyed a bale of cotton from Georgia to Massachusetts and then the cotton manufactured into Masonic aprons back to the Shriners' convention in Washington. Shortly before the St. Louis races the plane participated in the Army air maneuvers from Virginia to Maine. Then, after flying to St. Louis, it won the race. Unofficially, the speed set is believed to be a record. Certainly the performance of this craft, in all sorts of weather, in many lines of duty, for probably three hundred thousand miles, would be hard to parallel in the history of aviation.

Douglas-Wright Fastest Plane

The fastest plane in the race was the Douglas-Wright (DT-4), piloted by Bsn. E. E. Reber, U.S.N., with high compression Wright T engine. With heavy bomb load this plane made the fastest lap of the race, 115.9 m.p.h., and would have won but for a minor mishap, a small bolt in the tail letting go. Lieut. M. A. Schur, U.S.N., in another DT-4, with a low compression Wright T engine, finished second, beating all of the standard Martin Bombers with their twin Liberty engines.

These flights of the Douglas-Wrights were the first public demonstration of American single-engined bombing planes and their high speed with heavy loads was noted with interest by both the military fliers and the civilians foreseeing larger commercial planes. The performance of the big Wright T engines in these single-engined bombers was carefully noted because Wright T engines were to fly the next day in the Pulitzer race and it was such a new thought for the same engine to be capable of powering a big bombing plane and also to be a contender in a single seat fighting plane. Both these Douglas-Wright planes demonstrated their good characteristics for cross-country flying in their trip from Washington to St. Louis and return.

Mulvihill Model Trophy

A significant interlude was the duration contest between model airplanes driven by rubber strand motors for the Mulvihill Trophy and cash prizes totalling $300. Twenty-seven boys and young men from half a dozen cities made entries, but only twelve participated.

The largest delegation came from Chicago, where interest in model plane construction has been greatly stimulated through the personal interest of Terence Vincent and his aviation articles in the Chicago Daily News. All of the prize money went to the Chicago delegation, principally those from the Illinois Model Aero Club, which is the junior organization of the Aero Club of Illinois. For a number of years Walter Brock has been instructing a few of these lads in the fine points of making and flying miniature planes. Brock was one of the first London to Paris fliers. The quality of the planes participating indicated that much more real engineering is required in model construction and flying than is apparent to the onlooker. First and second prizes, respectively, were taken by Edward G. Lange, age 16, and Robert Jaros, both of Chicago. Lange's model remained up 4 minutes, 22.6 seconds, and Jaros' 3 minutes, 59.2 seconds.

Detroit News Air Mail Trophy

The Detroit News Air Mail Trophy Race in Detroit in 1922 was an anomaly. The deed of gift required that entries be twin-engined. There are no mail planes with twin engines. So in Detroit the mail planes rested on the line while Army bombers competed. In St. Louis this error was rectified, and the mail pilots had their show to themselves.

As is narrated more fully elsewhere in this chapter, the sixteen mail planes, representing fields from Coast to Coast, attracted wide attention and there was great enthusiasm when the De Havilands, in gleaming Haskelite veneer, taxied up for the start. The race was for 186.04 miles. Fifteen planes got away at the drop of the flag, on October 6th. Of the twelve pilots who finished practically all had participated in the recent night flying experiments and consequently their names were known to the spectators.

It was supposed by many that, all being De Havilands with 400 h.p. Liberties, there would be no race. But there was, and it was a thriller. Each pilot who, on his regular flights sees that his ship is properly serviced, and consequently appreciates its fine points and knows (though secretly) its imperfections, had made various attempts to increase the normal speed. The winner was J. F. (Dinty) Moore, whose plane was equipped with a Westinghouse all-metal propeller. His speed was 124.98 miles an hour. D. C. (Dean) Smith, another night owl, who rose to fame during the Chicago-Cheyenne demonstrations, was second at 120.83 m.p.h. Smith's plane had the standard Air Mail propeller. P. F. Collins was third at 118.6 m.p.h. Altogether, it was a superb exhibition of flying, a

practical illustration to the thousands present of the workaday performance of the mail planes.

John L. Mitchell Trophy

The trophy offered by Brigadier General William Mitchell, Assistant Chief of Air Service, in memory of his brother, John L. Mitchell, also an aviator, who was killed in the war, is competed for only by the First Pursuit Group. In 1922 and 1923 the distance flown was the same—124.274 miles. As in 1922, the ships participating were Thomas-Morse MBs, constructed by the Boeing Airplane Company, powered with Wright H-3 300 h.p. engines, and equipped with Boeing propellers.

In 1922, the first five planes averaged 136.3 m.p.h.; in 1923 the first five averaged 141.76 m.p.h. The St. Louis winner was Captain B. E. Skeel, whose speed was 145.8 m.p.h. Winner of second place was Lieut. G. P. Tourtellot, at 141.8 m.p.h. Tourtellot's plane ran out of gas but he held his place and glided over the line with a dead motor.

The Pulitzer Race

The high speed race of 124.27 miles for the Pulitzer Trophy and $4,000 in cash was participated in by only six pilots—four representing the Navy Bureau of Aeronautics and two representing the U. S. Air Service. Like all contests promising a thrill, the race was awaited as the climax of three days of exciting entertainment. Yet to the Services and to the constructors of the planes and engines it was simply the occasion for a public demonstration of the performance of new types featuring the characteristics of great speed and maneuverability which are fundamental requirements in aerial warfare. Certainly in all that great field there was least excitement in the Army and Navy hangars when the entries were given their final inspection, and on the starting line itself, when the planes rolled easily under their own power to their allotted places.

If for weeks in advance of the meets rains had discouraged the generous St. Louis business men who saw the results of a week's grading washed away overnight, and if harsh and wet weather had required the original dates to be postponed, the clear atmosphere and brilliant sunshine of Saturday, October 6th—the day of the Pulitzer classic—more than compensated for loss and delay. To those few who were fortunate enough to cover the course by air shortly before the start, the scene can never be forgotten. The brilliantly marked pylons, the alert soldiery and officials, the miles upon miles of policed highway and thousands upon thousands of

Above—Navy Pulitzer Pilots, Lieuts. L. H. Sanderson and S. W. Callaway; Navy-Wright Racer in background. *Below*—Navy Pulitzer Pilots, Lieuts. H. J. Brow and A. J. Williams; Navy-Curtiss Racer in background.—Photos, U. S. Navy.

Above—Navy-Wright, Lieut. S. W. Callaway, fourth in Pulitzer Race. *Below*—Navy-Curtiss, Lieut. H. J. Brow, second in Pulitzer Race.—Photos, U. S. Navy.

22,500 motor cars in this field at St. Louis Pulitzer Race.—Photo, *St. Louis Post-Dispatch.*

Aviation in the eyes of the multitude; St. Louis Air Races.—Photos, *St. Louis Post-Dispatch.*

spectators constituted such a setting as was never before witnessed in the comparatively brief history of American flying. Motor cars were parked by the acre. Gay sport clothes and banners were whipped in the fresh October breeze. In the long promenade extending from the grand-stand boxes, past hundreds of airplanes, great and small, held motionless for the big event, yet forming a massive background, there walked ceaselessly back and forth the restless fringe of the multitude.

Progressive Development of Types

At the beginning of the World War our Air Service had neither production nor types. At the end of the war, by requirement of the Allies, we had production, but only of European types. By 1919 the Thomas-Morse Aircraft Corporation had developed the MB pursuit, the type participating in 1922 and 1923 in the John L. Mitchell Trophy Races. In the first Pulitzer Race in 1920, Lieut. C. C. Mosely flew an Air Service plane, with newly developed Packard engine, at 156.5 miles an hour, or approximately 30 miles an hour faster than the fastest pursuit plane in service at the time of the Armistice.

In 1921, at the Omaha Pulitzer Race, the Curtiss Aeroplane and Motor Company, as a result of engineering begun at the time of the Armistice, put a Navy racing (or pursuit) plane in the air to victory at 176.7 m.p.h. In 1922, the Army, impelled by knowledge of European progress brought back by the Assistant Chief, General Mitchell, encouraged the private constructors to greater efforts, with the result that a Curtiss plane and engine, under the piloting of Lieut. Russell L. Maughan, in this classic at Detroit, made the astounding speed of 205.8 m.p.h.

The Navy Department in 1922 had commissioned both the Curtiss Company and the Wright Aeronautical Corporation, among others, to develop types and these commissions, with the two companies mentioned, were responsible directly for the almost unbelievable speeds set in 1923, at St. Louis, when the fourth fastest ship in the race was more than eleven miles an hour faster than the winner of the cup in Detroit.

Comparison of Speeds in Four Years of Racing for the Pulitzer Trophy

Year	*Miles per hour*
1920	156.5
1921	176.7
1922	205.8
1923	243.68

The Army Air Service at St. Louis made no attempt to produce new models, but took the Detroit ships and, with slight improvements, re-entered them with full knowledge—a truly sporting thing to do—that, barring accident to the Navy's craft, there was scarce a chance for winning.

Brilliant, Vibrant Scene

The six entries on the line were colorful and vibrant with energy as they were warmed up. The two new Navy-Curtiss racers were painted a royal blue with silvered propeller. The Navy-Wright Fighters were brilliant red, with silvered propellers. The Army-Curtiss Racers were lustrous black, with golden propellers. All planes were equipped with the wing-type radiator, whose fluted panels of burnished brass shone like gold. Upon their respective entries were the seals and insignia of the War and Navy departments.

The essential characteristics of the ships will be found in the following table:

Characteristics of Entries in Pulitzer Race, 1923, as Given by the Constructors

Plane	*Engine*	*H.P.*	*Propeller*	*Radiator*	*Span*	*Length*	*Height*	*Wing Area sq. ft.*	*Gross Weight lbs.*	*Pilots*
Navy Curtiss Racers	Curtiss D-12-A	500	Curtiss-Reed Dura-lumin 2 Blades	Curtiss Wing Type	22'0"	19'8½"	6'9¼"	144¼	2112.3	#9 Lt. A.J. Williams, U.S.N. #10 Lt. H. J. Brow, U.S.N
Navy Wright Fighters	Wright T-3	750	Duralum-in 3 Blades	Wright Wing Type	22'6"	21'4"	7'11½"	174	2858	#8 Lt. L.H. Sanderson, U.S.M.C. #7 Lt. S.W. Callaway, U.S.N.
Army Curtiss Racers	1 Curtiss D-12-A 1 Curtiss D-12	500 460	Curtiss Wooden 2 Blades	Curtiss Wing Type	19'0"	18'11"	7'11"	133	2110	#49 Lt. Walter Miller, U.S.A.S. #50 Lt. J. D. Corkille, U.S.A.S.

The Navy-Wright Fighters, being equipped with the Wright T-3 engine of 750 h.p., were the largest but had the lowest frontal area per horsepower. The new Navy-Curtiss Racers had greater wing span and greater length than the 1922 Army-Curtiss Racers, but stood over a foot lower and actually weighed two pounds less. The engines, Curtiss D-12-A type were rated at 500 h.p., an increase of 40 horse power over 1922. The propellers of all four Navy ships were of forged duralumin, the Curtiss being of the two-blade Curtiss-Reed type, and the Wright three-blades, made to their own design. One Army ship had a Curtiss-Reed duralumin propeller; the other was of wood.

Sanderson in Navy-Wright, 230.6 M.P.H.

In order to avoid, as far as possible, any chance of accident, it was decided to pair the contestants and to fly the race in heats. Sanderson in Navy-Wright No. 8 was first off, quickly followed by Corkille in Army-Curtiss No. 50. Sanderson completed the first lap (31.07 miles) in a fraction over 8 minutes, his 230.4 m.p.h., leaving Corkille, flying as the latter was at 210.6 m.p.h., in a trail of smoke. On the succeeding three laps Sanderson flew steadily, his average for the race being 230.6 m.p.h. Corkille improved his rate, finishing with an average of 216.44 m.p.h. Although Corkille was sixth at St. Louis, his speed was within two miles of Maughan's fastest straightaway time at Deroit—showing what can be done in "cleaning up" the same ship by refinement of detail. Sanderson made a magnificent zoom at the close and sped away to the shouts of the throng, having broken all existing speed records for distance from 3 km. to km. and this, too, with a Wright T engine which had flown the fastest in the race for big bombing planes the previous day.

Williams in Navy-Curtiss Flies Against Time

Williams, whom no rank in the Navy is likely ever to rob of the name "Al," and the recollection among his friends of the days when he played big league ball, was paired in the Navy-Curtiss No. 9 with Lieut. A. Pearson, U. S. A. S., flying the Army Verville-Sperry. Pearson failed to start, however, and while Williams was flashing over the course—a roaring streak of brilliant blue against the colder curtain of the Missouri autumn sky—the contest committee decided to start the third and final heat between Callaway in Navy-Wright No. 7 and Miller in Army-Curtiss No. 49, and Brow in Navy-Curtiss No. 10. As they took off Williams finished. His first lap was made in 245.2, or within less than three miles an hour as fast as the straightaway speed record set in 1922 by Maughan at Dayton, subsequent to the Detroit meet. The other three laps were not quite so fast, so that the race average worked out at 242.9 m.p.h.

The last heat was, therefore, not only a race between Callaway, Miller and Brow, but between the three of them and Williams' time. Callaway's first lap was also his fastest—231.7 m.p.h. His average for the race was 229.99.

Lieut. Brow was a favorite. In all the preliminary trials it was a question as to which had the faster ship—Brow or Williams. Both were rated as of equal piloting ability; both knew their ships, had confidence in them and could whip them around the pylons at a speed and an angle that made the spectators gasp. Brow flew a

beautiful race. His speed varied but little, though the fastest lap was the second when he was clocked at 243.5 m.p.h. His average for the race was 241.77 m.p.h.

Miller's fastest lap was the third, 220 flat, and his average for the race, 218.89, or about 13 miles an hour faster than Maughan made with the same ship at Detroit. Miller's better time was credited to the Curtiss D-12-A 500 h.p. motor and the Curtiss-Reed duralumin propeller.

Navy-Curtiss Establishes Two World Records

Although Williams on completing his race—he went five laps just to be sure, instead of four—pulled his tiny blue plane up, straight up, until it seemed almost merged in the zenith of the sky, and had drawn a roar of applause, he was not known to be the winner until the time for Callaway and Miller had been announced.

Then, as Rear Admiral W. A. Moffett, Chief of the Navy Bureau of Aeronautics, grasped his hand, friends and strangers alike sought to reach the spot near the home pylon where Williams stood. For he not only had won the race, but in so doing he had brought to America two new world records:

World Records Established During Meet

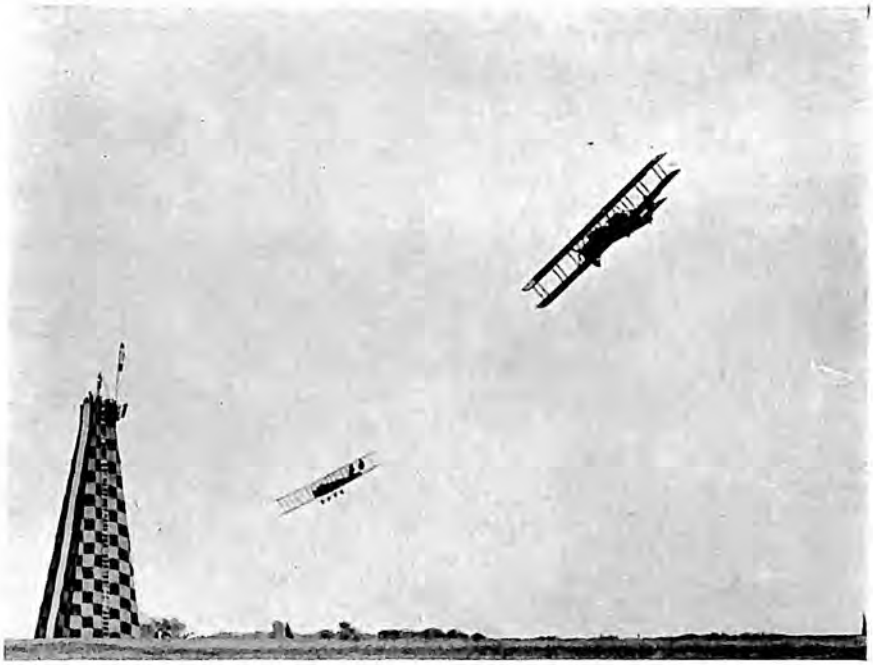
(Recorded by National Aeronautic Association but Subject to Ratification by the F. A. I.)

Distance	*Plane*	*Pilot*	*Time*	*Speed M.P.H.*	*K.P.H.*	*Engine*
100 Kilometers (closed circuit)	Navy-Curtiss #9	Lt. A. J. Williams, U.S.N.	15 Min. 17.48 Sec.	243.812	392.379	Curtiss D-12-A (500 h.p.)
200 Kilometers (closed circuit)	Navy-Curtiss #9	Lt. A. J. Williams, U.S.N.	30 Min. 36.01 Sec.	243.673	392.154	Curtiss D-12-A (500 h.p.)

Note: The above records for 100 kilometers and 200 kilometers were made during the Pulitzer Trophy Race and consist of laps 1 and 2 for 100 kilometers and laps 1, 2, 3 and 4 for 200 kilometers.

The two Navy-Curtisses were first and second, and the Navy-Wrights, third and fourth. Less than 1 minute and 50 seconds difference was recorded in the time made by first and fourth—and fourth made nearly 25 miles an hour greater speed than did the 1922 winner.

Lambert-St. Louis Field during the 1923 races. Note a few of the 125 civilian planes at top.
Photo, *St. Louis Post-Dispatch.*



Above—Navy Martin Bombers rounding pylon in Merchants' Exchange Race. *Below*—Douglas-Wright 4 (Wright T engine), fastest plane in Merchants' Exchange Race.—Photos, N. S. Navy.

THE PULITZER TROPHY

Position	*Airplane*	*Pilot*	*Speed (M.P.H.)*
First	Navy-Curtiss Racer # 9	Lt. A. J. Williams, U.S.N	243.68
Second	Navy-Curtiss Racer	Lt. H. J. Brow, U.S.N.	241.77
Third	Navy-Wright Fighter	Lt. L. H. Sanderson, U.S.M.C.	230.06
Fourth	Navy-Wright Fighter	Lt. S. W. Callaway, U.S.N.	229.99
Fifth	Army-Curtiss Racer	Lt. W. Miller, U.S.A.S.	218.89
Sixth	Army-Curtiss Racer	Lt. J. D. Corkille, U.S.A.S.	216.44

Over four miles a minute! To the officers charged with the aerial security of the nation, it meant fighting equipment swifter and more powerful than any yet revealed. To the St. Louisan on his weary way home that night, it meant hopping the twelve miles from the field to the center of the city in three minutes, whereas by motor car over choked roads it took him three hours. To the Chicagoans it meant commuting ten miles to Evanston in the time a surface car could reach Chicago river from the Loop. To the New Yorker it visualized week-ends a thousand miles away instead of 50 or 100.

81,408 PAY TO SEE RACES

When the business men of St. Louis took inventory, this is what they found: Altogether, 81,408 persons had paid the admission price to see the races. Of this number, 14,361 attended on Thursday, October 4; 18,670 on Friday; and 48,377 on Saturday.

One hundred and fifty-five acres of pasture land was given over to parking space, and in this area 6,200 motor cars were registered on Thursday, 6,900 on Friday and 22,500 on Saturday—a total of 35,600 during the three days of the meet.

The United Railways ran a close schedule service and reported that, during the three days, a daily average of 40,000 persons—20,000 each way—were handled between St. Louis and Bridgeton. No record is available as to the number of passengers carried on the special trains of the Wabash Railroad, one branch of which ran almost to the gates of the field. If no more than two persons were carried by each automobile, at least 70,000 spectators must have reached Bridgeton in this manner. These added to the 60,000 reported by the United Railways shows a total estimated attendance, excluding the unknown thousands carried by the Wabash, of 130,000. The difference between this figure and the 81,000 odd who entered by turnstile way may be found in those who, through the very pressure of numbers broke down the fence and poured out into the field, willing enough to pay, but in their eagerness, unwilling to wait.

Commercial Features Outstanding

As spectacular as was the speed established by the Navy and Army pilots, the phenomenal performance in the Pulitzer race was not the feature. This statement is deliberately made after a careful balancing of all elements involved and weighing them against all that American aviation regards as its future. Speed was the drawing card for curious thousands, but it was not the animating motive of the St. Louis business men who spent liberally of their money and gave liberally of their time. Their service was for commercial aviation first and, growing therefrom, national security in the air. Their gross expenditures were $315,000; their gross income, $330,000. But in addition to the $15,000 that remained in the bank to the credit of the St. Louis Aeronautic Corporation, there was at Bridgeton, St. Louis County, connected with the city by highways, surface car and steam railway lines, 486 acres of land, partly owned, partly under leasehold, which constituted beyond all doubt the largest and best equipped public landing terminal in the United States dedicated, in the name of Lambert-St. Louis Field, to the development of air transport.

128 Private Aircraft Flew to St. Louis

It was this commercial field—with the whole city behind it—that drew to St. Louis from seventeen states, 128 privately owned aircraft, some of them flying a total of 2,500 miles. One hundred and three of these aircraft actually were registered with Lieutenant Hugo Mueller, whose tabulation of planes, pilots and mileage is appended.

TABLE No. V—CIVILIANS FLYING TO ST. LOUIS AIR RACES, 1923

(Compiled for the Areonautical Chamber of Commerce of America, Inc., by Lieutenant Hugo Mueller of St. Louis.)

Pilot	*Plane and Engine*	*Passengers*	*Starting Point*	*Total Mileage*
Adams, Walter J.	———	–	Manteno, Ill.	100
Applegate, R.P.	M.F.; OX5	1	Chicago, Ill.	650
Atkinson, Jack	Bl; An	2	Omaha, Neb.	900
Backstrom, A.M.	J.N.; OX5	1	Westbury, L. I.	2,200
Ballough, E.	S.J.-1; W	2	St. Paul, Minn.	1,200
Bartow, Jack	T.M.	–	Minneapolis, Minn.	1,200
Beach, W.H.	Swallow; W	3	St. Joseph, Mo. (2 trips)	1,200
Beeck, Walter H.	Swallow	1	St. Joseph, Mo.	600
Bell, L.D.	———	3	Cleveland, O.	1,200
Bennett, Harold	———	–	———	———
Blevins, Beeler	L.S.	2	Olathe, Kan.	650
Block, H.C.	S.J.-1	3	Houston, Tex.	1,500

TABLE No. V—*Continued*

Pilot	*Plane and Engine*	*Passengers*	*Starting Point*	*Total Mileage*
Brock, Billy	Can.J.N.; OX5	1	Springfield, Mo.	250
Brown, A.C.	J.N.	1	Mt. Vernon, Ill.	250
Bruckner,C.J.	J.N.-4; OX5	2	Troy, Ohio	700
Burdick, W.L.	J.N.	1	Dixon, La.	380
Burke, Wm.A.	Swallow; W	3	Okmulgee, Okla.	800
Burns, J.L.	LeP.	4	———	———
Campbell, E.K.	J.N.	3	Waterloo, Ia.	800
Cantwell, R.W.	J.N.-4; OX5	1	Perry, Okla.	800
Carlson, Fred.	J.N.-4	2	Davenport, Ia.	450
Cecil, Eugene	J.N.-4	1	Willow Grove, Fla.	1,500
Chester, A.C.	S.J.-1; OX5	1	North Judson, Ind.	800
Cole, Thomas F.	T.M.	1	Pembina, N. D.	1,900
Connor, W. H.	J.N.; OX5	1	Topeka, Kan.	600
Cramer, P.D.	S.J.-1	1	Clarion, Pa.	1,500
Crewsdan, H.B.	L.S.	3	Iola, Kan.	700
Curran, James	L.S.; W	2	Chicago, Ill.	500
Dobbs, D.C.	———	–	———	———
Dunn, F.T.	S.J.-1; OX5	1	Laclede, Mo.	350
Emery, L.H., Jr.	Can.J.N.; OX5	1	Bradford, Pa.	1,400
Fowler, Chas. L.	S.J.-1; W	4	Macon, Mo.	400
Good, B.	S.J.-1	1	Dallas, Tex.	1,200
Gower, T.H.L.	L.S.	1	Kansas City, Mo.	600
Hamilton, E.G.	Can.J.N.	1	Detroit, Mich.	1,000
Harris, Harold	H.D.	1	Chicago, Ill.	500
Heath, E.B.	He.	2	Chicago, Ill.	600
Hewitt, Bob. P.	F.M.	1	New York, N. Y.	2,200
Holman, Chas.W.	T.M.	–	Minneapolis, Minn.	1,200
Horchem, Bertha	J.N.-4	3	Tampico, Ill.	600
Horwitz, Will, Jr.	S.J.-1	2	Houston, Tex.	1,400
Hoyt, H.H.	J.N.-4	1	Chicago, Ill.	600
Hunter, I.	J.N.-4; OX5	1	———	———
Hurst, James W.	J.N.-4; OX5	1	Terre Haute, Ind.	300
Hutson, G.H.	J.N.-4; OX5	1	———	———
Hutton, Perry	Swallow	1	Tulsa, Okla.	800
Jengwith, J.J.	Can.J.N.	1	Dubuque, Ia.	1,700
Johnson, E.A.	Hz.	–	Dayton, O.	684
Johnson, E.G.	Can.J.N.	1	Ardmore, Okla.	1,100
Jones, C.S.	Oriole	1	Garden City, N. Y.	2,400
Kelley, J.B.	J.N.	1	Cleveland, O.	1,200
Kelley, T.N.	J.N.	3	Cleveland, O.	1,200
Kisir, Daniel	Can.J.N.	1	Milwaukee, Wis.	850
LaGrone, Tex.	R.D.	2	Kansas City, Mo.	650
Laird, E.M.	Swallow	4	Wichita, Kan.	900
LaParle, E.E.	J.N.; OX5	1	Chicago, Ill.	650
Lees, Walter E.	Hz.-F.C.-1	1	Dayton, O.	850
Leib, L.W.	J.N.-4	1	Minneapolis, Minn.	1,100
Lindbergh, C.A.	J.N.-4	1	Minneapolis, Minn.	1,200
Livingston, John A.	Br.	5	Chicago, Ill.	650

TABLE No. V—*Continued*

Pilot	*Plane and Engine*	*Passengers*	*Starting Point*	*Total Mileage*
Long, H.G.	L.S.	2	Independence, Mo.	550
Mack, R.W.	S.J.-1	1	———	———
McClure, J.	S.J.-1; OX5	1	Kansas City, Mo.	600
McIntyre, I.A.	S.J.-1	3	Springfield, Mo.	280
Merriam, A.C.	Swallow; W-150	2	St. Joseph, Mo.	600
Metzger, Johnnie	J.N.-4	1	Chicago, Ill.	450
Meyer, Walter	He.	1	Chicago, Ill.	450
Miller, A.H.	L.S.	1	Kansas City, Mo.	600
Musick, Harry T.	S.J.-1	3	Terre Haute, Ind.	400
Neville, Wayne S.	Swallow	2	St. Joseph, Mo.	600
Northrup, Marvin A.	S.J.-1	1	Minneapolis, Minn.	1,500
Obenauer, V.J.	J.N.-4	1	———	———
O'Neil, Frank N.	———	1	Winona, Minn.	706
Parker, Fred.	J.N.-4	2	Chicago, Ill.	600
Partridge, E.L.	Part.	3	Chicago, Ill.	500
Phillipps, T.B.	Swallow	2	Eldorado, Kan.	800
Plummer, Geo. C.	OX5	1	———	———
Portras, Anna M.	J.N.-4; OX5	1	St. Anne, Ill.	300
Post, Geo. B.	H.D.	2	Ogdensburg, N. Y.	1,796
Robb, L.M.	A.	1	Parkesburg, Pa.	1,400
Robinson, Chas. E.	J.N.-4	1	Metamora, Fla.	400
Romkey, G.J.	J.N.-4	1	Burlington, Ia.	400
Ruddell, F.M.	J.N.-4	1	Kokomo, Ind.	280
Simpson, C.W.	L.S.	1	Carterville, Ill.	250
Sinclair, C.R.	Can.J.N.	1	Alexandria, Ill.	400
Smith, H.G.	Bl.	1	———	———
Smith, J.W.	Can.J.N.	3	Moline, Ill.	450
Smith, Leslie	J.N.	1	Memphis, Mo.	350
Sperry, Lawrence B.	Messenger	–	New York, N. Y.	2,500
Sterling, M.	———	–	———	———
Summer, J.A.W.	J.N.-4	1	Springfield, Ill.	300
Truxhorn, J.	S.J.-1; OX5	1	Kansas City, Mo.	600
Waite, R.H.	J.N.-4	1	Chicago, Ill.	450
Wallace, F.C.	J.N.-4	2	Davenport, Ia.	500
Weaver, Buck	Br.	5	Chicago, Ill.	500
Weaver, Goodwin	Can.J.N.	1	Indianapolis, Ind.	600
Weick, Fred E.	J.N.-4	1	Chicago, Ill.	400
Were, B.B.	S.J.-1	1	Dallas, Tex.	1,200
Westlake, William	Can.J.N.	1	Chicago, Ill.	400
Williamson, Harry	L.S.	2	Carterville, Ill.	190
Willingham, G.H.	S.J.-1	2	Frankford, Mo.	350
Webber, Thos.	Can.J.N.	2	Kirksville, Mo.	400

TABLE No. V—*Continued*

KEY TO AIRCRAFT AND ENGINES

A. .....Aeromarine Plane and Motor Company, Keyport, N. J.
Bl. .....Bellanca.
Br. .....Breguet.
Can.J.N. .....Canadian Curtiss, Curtiss Aeroplane and Motor Co.
FM. .....Farman, W. Wallace Kellett, Philadelphia, Pa.
H.D. .....Huff Daland Co., Ogdensburg, N. Y.
He. .....Heath.
Hz. .....Hartzell-Johnson, Johnson Airplane & Supply Co., Dayton, O.
Hz-F.C.-1 .....Hartzell-Johnson, Johnson Airplane & Supply Co., Dayton, O.
J.N. .....Curtiss Aeroplane & Motor Company.
J.N.-4 .....Curtiss Aeroplane & Motor Company.
LeP. .....LePere, Packard Motor Car Co., Detroit, Mich.
L.S. .....Lincoln Standard, Nebraska Aircraft Corp., Lincoln, Neb.
M.F. .....Flying Boat, Curtiss Aeroplane & Motor Co., Garden City, N. Y.
Oriole .....Curtiss Aeroplane & Motor Co.
Part. .....Partridge.
R.D. .....Rogers-Day.
S.J.-1 .....Curtiss Standard.
Swallow .....Laird Co., Wichita, Kan.
T.M. .....Thomas-Morse Aircraft Corp., Ithaca, N. Y.
Messenger .....Lawrence Sperry Aircraft Corp., Farmingdale, L. I.

ENGINES

OX5 .....Curtiss Aeroplane & Motor Co.
AN .....Anzani.
W .....Wright Aeronautical Corp.
MER .....Mercedes.

RECAPITULATION

Total number of pilots	103
Total planes and engines	103
Total number passengers carried	152
Starting point (States)	17
Total mileage	75,934 mi.
Average mileage per plane	735.518 mi.

It is estimated that 25 planes were not registered. If account is taken of these and the ten planes whose starting point is not listed, but whose mileage is assumed to be the average, the total civilian mileage is estimated at 101,679.3 miles.

STATES AND CITIES FROM WHICH AIRCRAFT FLEW

State	*City*	*State*	*City*
FLORIDA	Metamora	MISSOURI	Frankford
	Willow Grove		Independence
			Kirksville
			Kansas City
ILLINOIS	Alexandria		Macon
	Carterville		Memphis
	Chicago		St. Joseph
	Mt. Vernon		Springfield
	Moline		
	Manteno	NEBRASKA	Omaha
	St. Anne		
	Springfield	NEW YORK	Garden City
	Tampico		New York
			Ogdensburg

States and Cities from Which Aircraft Flew—*Continued*

State	*City*	*State*	*City*
Indiana	Indianapolis		Westbury
	Kokomo	North Dakota	Pembina
	North Judson	Ohio	Cleveland
	Terre Haute		Dayton
Iowa	Burlington		Troy
	Davenport	Oklahoma	Ardmore
	Dubuque		Okmulgee
	Watertown		Perry
Kansas	Eldorado		Tulsa
	Iola	Pennsylvania	Bradford
	Olathe		Clarion
	Topeka		Parkesburg
	Wichita	Texas	Dallas
Louisiana	Dixon		Houston
Michigan	Detroit	Wisconsin	Milwaukee
Minnesota	Minneapolis		
	St. Paul		
	Winona		

Cities Reporting More Than One Plane

Chicago, Ill.	15	Springfield, Mo.	2
Terre Haute, Ind.	2	New York, N. Y.	2
Davenport, Iowa	2	Cleveland, O.	3
Minneapolis, Minn.	5	Dayton, O.	3
Kansas City, Mo.	5	Dallas, Tex.	2
St. Joseph, Mo.	2	Houston, Tex.	2

It is a most impressive showing. Some of the craft carried as many as four passengers; some pilots came alone, but many carried at least one other with them. The reported mileage of the 103 planes registered shows a total of 75,934. Mueller reports that 25 to 30 got away, due to postponement of the races, without being registered, and if account is taken of these, it may be conservatively estimated that the total cross country mileage to and from St. Louis by civilians was 101,679.3 miles.

At the first Pulitzer Race held in 1920 on Long Island and at the 1921 event in Omaha, probably not more than a score of civilians attended by air. At Detroit the estimate may be raised to forty or fifty, at the most, though no registration was undertaken there. The impressive fact about the St. Louis meet is that the conception of

the meet was civilian and commercial, not military, that civilian fliers were expected, and that these expectations were fully justified. So far as available reports go, all these 125 planes came and went without a single serious mishap.

204 Army and 25 Navy Aircraft in Attendance

At the meet there were 204 Army aircraft, including the huge six-engined 40,000 pound Barling Triplane and the two non-rigid airships from Scott Field. As the appended report from Majors Scanlon and Hickam shows, 180 of these craft flew to St. Louis. They came from 13 states and some traveled nearly 6,000 miles before they returned to their home stations. Altogether, these visitors had a record of 177,925 miles, cross country. Twenty-four military planes participated in the races, with a total mileage of 4,697.26 at the field.

TABLE No. VI—MILEAGE BY ARMY AIRCRAFT CROSS COUNTRY AND DURING THE ST. LOUIS MEET, 1923

(Compiled for the Aeronautical Chamber of Commerce of America, Inc., by Major M. F. Scanlon, Commanding Officer, and Major Horace M. Hickam, Operations Officer, representing the Army Air Service)

Aircraft

Army airplanes participating in races	24
Army airplanes flying to races	178
Army airships flying to the races	2
Total Army aircraft at the meet	204

Mileage

Cross Country—Mileage of Visiting Aircraft

A total number of 177,325 miles was covered by military airplanes traveling from various sections of the country to St. Louis, piloted by aviators who were either participants or spectators, according to a report submitted by Major H. M. Hickam, Air Service, Operations Officer of the Races. Three planes which came from Crissy Field, Presidio of San Francisco, Calif., covered the longest distance—2,300 miles each. One plane from Rockwell Field, San Diego, Calif., covered 1,800 miles. Kelly Field and Brooks Field, San Antonio, Texas, jointly had the largest representation at St. Louis, there being a total of 46 planes from these two fields. McCook Field and Wilbur Wright Field, Dayton, Ohio, came next with a joint representation of 36 airplanes. Altogether a total of 178 military airplanes were flown to St. Louis. The following tabulation will prove of interest:

Home Station	*No. of Planes*	*Distance to St. Louis*	*Mileage*
Kelly and Brooks Field, Texas	46	850 miles	39,100
Aberdeen Proving Grounds, Md.	4	1,150 "	4,600
McCook and Fairfield, Ohio	36	525 "	18,900
Fort Riley, Kansas	4	400 "	1,600
Rockwell Field, Calif.	1	1,800 "	1,800
Crissy Field, Calif.	3	2,300 "	6,900
Chanute Field, Ill.	15	250 "	3,750
Langley, Quantico and Bolling, Va.	27	1,100 "	59,400
Selfridge Field, Mich.	13	650 "	8,450
Mitchel Field, N. Y.	15	1,350 "	20,250
Schoen Field, Ind.	1	325 "	325
El Paso, Texas	2	1,350 "	2,700
Pope Field, N. C.	2	1,150 "	2,300
Maxwell Field, Ala.	4	500 "	2,000
Post Field, Okla.	5	650 "	3,250
Total	178		177,325

The flying time of the above ships while enroute to St. Louis totaled 1,895 hours and 30 minutes. The flying time of these ships since their arrival at St. Louis totaled 679 hours and 25 minutes, making a grand total of 2,574 hours and 55 minutes.

Total mileage, cross country by visiting aircraft	177,325
Total mileage, including racing mileage of Army airplanes at St. Louis field	3,697.26
Racing mileage at field (approximately)	1,000
Total at field	4,697.26
Mileage of Army airships, to, from and at field	600
Grand total Army mileage	182,622.26

States from Which Army Aircraft Flew

Alabama, California, Illinois, Indiana, Kansas, Maryland, Michigan, Ohio, Oklahoma, New York, North Carolina, Virginia, Texas. Total 13.

The Navy Flies Overland

Most of the Naval flying was likewise cross-country. According to the appended tabulation by Commander Mitscher, five states and Haiti and Santo Domingo were represented. Fifteen planes flew overland; nine participated in the races. Cross-country flying by the Navy totaled 51,301 miles, and, at the field, 7,886.

TABLE No. VII—MILEAGE BY NAVAL AIRCRAFT CROSS COUNTRY AND DURING THE ST. LOUIS MEET, 1923

(Compiled for the Aeronautical Chamber of Commerce of America, Inc., by Commander M. A. Mitscher, in Command of Naval Aircraft)

AIRCRAFT WITH NAVY RACING DETACHMENT

Aircraft	*Mileage*
2—C2R (Curtiss racers)	796
2—F2W (Wright racers)	796
1—18T (Curtiss observation)	350
1—UO-1 (Vought observation)	350
*2—DT's (Douglas Torpedo)	6,796
*1—DH (used for pilot and practice)	2,798
Total	11,886

VISITING AIRCRAFT

*1—DH—Port au Prince	4,500
*1—DH—Santo Domingo	4,600
1—DH—Anacostia	1,750
1—DT—Quantico (Marines)	1,798
8—DH—Quantico (Marines)	14,384
2—F5H seaplanes—Pensacola	4,536
1—DH—San Diego	3,780
1—ZR-1—Lakehurst	1,953
Total	37,301
Grand total	49,187 miles

The mileage, as shown under the heading "Aircraft with Navy Racing Detachment," was all piled up at St. Louis, with the exception of that listed under the DT planes and the DH. These planes flew to St. Louis from Anacostia, and in return made a circuit to Cleveland and other points; and in the case of the DH, to Oklahoma and return to Anacostia. At least 4,000 miles, therefore, of the 11,886 could be regarded as cross country.

The planes listed under "Visiting Aircraft" flew from the points indicated and returned to their home base. With the exception of the two DH's from Port au Prince and Santo Domingo, the mileage listed was the mileage up to the time they left St. Louis. From that time on they attended the American Legion Convention at San Francisco and then crossed the continent again. There could thus be added 10,000 miles to cross country total.

Grand total mileage with above modifications 59,187

STATES AND INSULAR POSSESSINS FROM WHICH NAVAL AIRCRAFT FLEW

California, Florida, New Jersey, Maryland, Virginia, Haiti, Santo Domingo. Total—7.

FLIGHT OF THE "SHENANDOAH"

On the Tuesday preceding the opening of the meet, the Navy airship, *"Shenandoah,"* arrived over the city of St. Louis on its first

long flight out of Lakehurst, N. J. This trip of 2,500 to 3,000 miles, made smoothly and without incident, was epochal. As described more fully in Chapter IV, it marked the successful establishment, on a national scale in America, of the lighter-than-air phase of aeronautics. To those who, at daybreak on October 2, saw the graceful outline of the *ZR-1* against the morning light, there came a thrill of patriotism, that time can never diminish. No sight could be more beautiful; none more prophetic.

Air Mail Demonstrates Night Flying

St. Louis lays claim in aviation, among other things, to having established the first air mail route. That was in 1911, at the time of a flying meet. The service was between Kinloch, Mo., and Fairgrounds Park, St. Louis. During the week 100,000 pieces of mail matter were carried under a special stamp of the Post Office Department marked No. 1. Again in 1918, the city supported in various ways the St. Louis-Twin Cities Air Mail Service.

The night flying experiments (see Chapter III) were held when arrangements for the big meet in St. Louis in 1923 were at a critical point. In response to an invitation from the St. Louis Aeronautical Corporation, postal officials and officials of the Aeronautical Chamber of Commerce addressed meetings of the Executive Committee, with the result that Lambert-St. Louis Field, while being prepared for "Four Miles a Minute," was also prepared, by means of electric and gas lighting, for the permanent "Night Air Mail," which St. Louis looks forward to having in the near future.

Without the Air Mail, the St. Louis meet would not have achieved complete success. Second Assistant Postmaster General Paul Henderson, as recognition for the conscientious efforts in connection with the transcontinental night flying experiments, ordered sixteen mail planes, with full crews, to St. Louis. Their cross-country flying—they came from seven states from Coast to Coast—measured 24,929 miles; their day flights at the meet, 3,780.

TABLE No. VIII—MILEAGE BY U.S. AIR MAIL PLANES CROSS COUNTRY AND DURING THE ST. LOUIS MEET, 1923

(Compiled for the Aeronautical Chamber of Commerce of America, Inc., by C. F. Egge, General Superintendent of the U.S. Air Mail Service)

Number of mail planes visiting Meet 16

Mileage to and from St. Louis

Station	*Number of planes*	*Miles*
San Francisco	1	4,104
Reno	1	3,724

Station	*Number of planes*	*Miles*
Salt Lake City	1	2,821
North Platte	1	1,383
Omaha	8	7,344
Chicago	1	674
Cleveland	2	2,665
New York	1	2,214
Total		24,929

MILEAGE DURING PERIOD OF MEET

	Miles
Day Flights	3,780
Night Flights	450
Total	4,230

Total Mileage Incidental to Meet ..... 29,159 miles

STATES FROM WHICH MAIL PLANES FLEW

California, Illinois, Nebraska, Nevada, New York, Ohio, Utah. Total 7.

Friday night the pilots who had operated between Chicago and Cheyenne gave a special demonstration for the thousands who remained over, despite hunger and the chill air. The boundary lights, beacons and floodlights were switched on and a practical test of loading, unloading, taking off and landing, in simulation of regular service, was staged. The papers devoted columns of space the following morning, and months after the races, this event was declared by business men of St. Louis to have been one of the most fascinating, and certainly the most significant, of all the features given during that tumultuous week.

374,107.82 MILES OF SAFE FLYING

To recapitulate: The St. Louis meet attracted 375 aircraft—204 military, 130 (including St. Louis) civilian, 25 naval and 16 postal. Altogether, 355,834.3 miles were flown cross-country and 18,273.52 at the field, making a total for the meet of 374,107.82 miles. Aircraft came from twenty-five states and from Haiti and Santo Domingo. In all this flying, at speeds of 40 miles an hour to 240, and from one side of the continent to the other, across stretches of sea, leagues of forests, mountain ranges and great cities, there was not a single serious accident, not a person seriously hurt.

TABLE No. IX—RECAPITULATION OF FLYING CROSS COUNTRY AND DURING ST. LOUIS MEET, 1923

AIRCRAFT

	Cross Country Planes	*Participating Planes*	*Airships*	*Totals*
Army Air Service	178	24	2	204
Navy Bureau of Aeronautics	15	9	1	25
U. S. Air Mail Service	16	15 (all c.c.)		16
Civilian Aircraft	128	15 (all c.c.)		128
Civilian Aircraft at St. Louis.		2		2
Totals	337	65	3	375
Grand Total of Aircraft at Meet				375

MILEAGE

	Cross Country Planes	*Participating Planes*	*Total*
Army Air Service	177,925	4,697.26	182,622.26
Navy Bureau of Aeronautics	51,301	7,886	59,187
Air Mail Service	24,929	4,230	29,159
*Civilian Aircraft	101,679.3	1,460.26	103,139.56
Totals	355,834.3	18,273.52	374,107.82
Grand Total Mileage			374,107.82

STATES AND INSULAR POSSESSIONS FROM WHICH AIRCRAFT—MILITARY, NAVAL, POSTAL, AND CIVILIAN—FLEW

States		*Possessions*
Alabama	Nebraska	Haiti
California	Nevada	Santo Domingo
Florida	New Jersey	
Illinois	New York	
Indiana	North Carolina	
Iowa	North Dakota	
Kansas	Ohio	
Louisiana	Oklahoma	
Maryland	Pennsylvania	
Michigan	Texas	
Minnesota	Utah	
Missouri	Virginia	
	Wisconsin	

As Major General Mason M. Patrick, Chief of Air Service, after congratulating the Navy, said: "Truly a remarkable record. It shows that aviation is not only more efficient, but safer than ever."

Rear Admiral W. A. Moffett, Chief of the Navy Bureau of Aeronautics, said: "This has been a great day for American avia-

*This does not include mileage on Sunday, Oct. 7 when civilian planes participated in a carnival under the auspices of the Flying Club of St. Louis.

tion. Every American can take pride in what the Navy has accomplished. This meet has been the greatest and most successful ever held in the world."

West and Southwest Want Commercial Aviation

W. Frank Carter, upon whom as general chairman of the Air Board, lay most of the responsibility for the meet, and to whose abounding energy and unfaltering conviction in the commercial utility and national necessity of aviation may be attributed much of the success, summed up the results of the great meet in these words:

"St. Louis showed the world that a successful air meet can be held without a financial deficit. From this meet we expect to see, and are already witnessing, a greater interest in aeronautics among the people of the West and Southwest. We expect, as a direct result of this interest, to see the Air Mail Service extended to St. Louis at no distant time. We hope, as a further result, to find a more liberal spirit among members of Congress toward adequate appropriations for the air service of the Army and Navy for the purpose of national defense."

To conclude. The St. Louis meet marked the transition of flying demonstrations from military to commercial and, through the leadership of St. Louis, set an example for other municipalities to improve the new transportation opportunities in the air.

CHAPTER XV

REVIEW OF AERONAUTICS, NATION BY NATION, THROUGHOUT THE WORLD.

THE following information has been compiled from reports received from representatives and correspondents of the Aeronautical Chamber of Commerce; from the Air Service, U.S. Army; Bureau of Aeronautics, U.S. Navy; commercial attaches, Department of Commerce, and the Pan-American Union. Special assistance has been provided by the air attaches of Great Britain, France and Italy, stationed at Washington, D. C. Grateful acknowledgment is also made to General A. Guidoni of the Italian Air Ministry. Unless otherwise indicated, all dates are for the calendar year 1923.

ARABIA (British)

The British Royal Air Force uses the air base at Aden as a service station for airplanes flying throughout Arabia on official business, carrying dispatches, mails and officers.

ALGIERS (French)

The French Government is doing everything possible to develop its colonial aerial defenses and to establish commercial air lines on a paying basis. Subsidized lines operate to all the North African possessions. A thrice a week service has been operated since 1922 between Oran, Western Algeria, to Casablanca on the west coast of Morocco, a distance of 430 miles. During the year a new line was projected between Marseilles and Algiers, via Barcelona and the Balearic Islands and from Oran to Alicante. The Latecoere Air Lines operate the daily route from Toulouse to Barcelona, Alicante, Malaga, Rabat and Casablanca, where the branch line extends to Oran, Algeria.

ARGENTINA

Both federal and commercial aviation in Argentina lead all other countries in South America, due to the long distances between important centers. All branches of the Government now consider aircraft important instruments in the constant work of extending communication facilities.

The principal company is the Curtiss Aeroplane Export Corporation, which has its base at San Fernando, a suburb of Buenos Aires. Army and navy aviators and civilian students are trained. Of the twenty machines taking part in the annual derby held August 5th, ten of them were Curtiss. A cash prize of a thousand dollars and a silver cup were won by Lawrence Leon, manager of the Curtiss corporation in Argentina.

The Compania Rio Platenoe de Aviacion, S.A., which operates the Buenos Aires passenger and mail service, using a Vickers-Viking amphibian, accommodating seven persons and making the trip vetween Buenos Aires and Montevideo, Uruguay, in an hour and a half. Out of 63 trips scheduled in one month, 61 were made, two being suspended owing to bad weather. Two hundred and twelve passengers and 48 bags of mail were carried in that period.

Late in the year the President authorized the War Department to purchase eleven Curtiss planes to be used on a model commercial airplane service. Seven portable steel hangars were to be erected at various terminals.

The first airplane built in the Republic was flown by a Swiss engineer who designed the machine in Buenos Aires. A propaganda flight throughout the Republic was made by Capt. Udet, former military aviator. The Government voted $60,000 and $25,000 was raised by popular subscription to finance a flight around the world, projected by an army and a navy aviator. The Navy Department was authorized to buy four Vickers amphibians for coast patrol service. Subsidies of $4,500 a month were appropriated during 1923. Work is progressing favorably on the establishment of airdromes throughout the country. The federation of Argentine Aero Clubs has undertaken to popularize commercial aviation; and for this purpose receives a substantial subsidy from the Government.

Italy, France, England and Germany maintain aviation missions in Argentina, through both their regular consular offices and special officials appointed from the air forces of the respective countries. South America is recognized as one of the most important fields for exploiting European aircraft and disposing of the surplus from the various industries; and Argentina is believed to be the most important section of the continent for creating an early market for large numbers of machines.

AUSTRALIA (British)

The Government is co-operating heartily with English firms and the British Air Ministry in supporting commercial aviation projects. There are two important reasons why Australia is building up her

aerial reserve, one is to make it an important unit in the new defense system which is designed to embrace the entire continent and to act as a patrol force in times of peace. The other reason is to quicken communications both in Australia and to other parts of the British Commonwealth.

In 1923 airlines were established throughout all the inhabitable regions, forming actually or prospectively aerial communications between Brisbane, Sydney and Adelaide on the southeast coasts to Perth on the west and Derby on the northwest.

The Western Australian Airways operates the Geralton-Derby line weekly, receiving, as do other services, substantial subsidies based on the quantities of mails carried and the regularity of operations. Since April, 1922, that line has had a record of 97 per cent. in efficiency and performance, for the route of 1,995 miles.

In November, 1922, the Charleville-Cloncurry service was started over a 560-mile route. The Larkin Aircraft Supply Co., Ltd., projected lines from Sydney to Adelaide, 760 miles, and from Sydney to Brisbane, 550 miles, each a weekly service.

The British Government supplied the Air Force with 128 planes in 1923.

The High Commissioner of Australia in London announced that steps have been taken by the Commonwealth Government to establish a permanent air force of both civil and military character.

Austria

Three commercial air lines were operated between Vienna and Budapest, with projects for extending them to various other European centers either directly or by branch lines. The Austrian Government had delegates in Italy concluding negotiations with the Italian Government relative to the establishment of an aerial service between Vienna and Trieste.

The three operating lines included the French-Roumanian Company, the Austrian Aerial Transport Company and the Hungarian Aerial Transport Company. The Austrian concern has operated a passenger service from Munich, Bavaria, to Budapest via Vienna. Planes leave Munich at 9 a.m. and reach Vienna at 11, leaves Vienna at 12:30 p.m. and arrives at Budapest at 2:15 p.m.

Belgium

The Ministry of National Defense had an appropriation of 8,100,000 francs for new equipment, 6,000,000 of which were guaranteed to the S.A.B.C.A., the only airplane works in Belgium, for all sorts of new machines and balloons. The three organizations in Belgium possessing aircraft are: The Ministry of National Defense,

having about 100 planes in active service and 100 in reserve. "Societe National pour l'Etude des Transports Aeriens" operated twelve Farman passenger planes and ordered three more. The "Ecole d'Aviation de Gosselies," an independent flying school, has seven planes of which four are French and three British.

Total subsidies from the Government amount to 8,100,000 francs for the fiscal year. Total appropriations, including all subsidies, amounted to 31,750,000 francs. The size of Belgium makes few airdromes necessary. Only four are in operation. The close political relations between France and Belgium give France the preference in the purchase of aviation supplies.

The commercial aviation company is commonly termed the "Sabena." It was organized early in 1923 to absorb the old transport company the "Sneta" which with the Belgian Government and the Belgian Congo controls all the shares. The continental routes are operated in co-operation with French companies. Those routes extend from Brussels to Paris and from Brussels to Amsterdam. The London-Brussels route is operated by the Belgian concern independently. The operations in the Belgian Congo include a route of 500 kilometers along the Congo river. Two flights are made each month on schedules calculated to handle all important mails either way.

The Compagnie Aerienne Belge has been organized for aerial photography and survey work in Belgium and the Belgian Congo.

Belgian military planes flew some 2,000,000 miles in 25,000 hours of flying time in 1923. The Belgian air force is now an air brigade of three regiments, comprising in all six squadrons of divisional aircraft, three observation squadrons, three engineering squadrons, three pursuit squadrons and three training squadrons, in addition to four balloons and airship squadrons. In all there were 21 airplane squadrons for a country of 6,000,500 inhabitants, against the 34 squadrons in the U. S. Army Air Service.

Bolivia

The Government is co-operating with a French mission in establishing flying services between important communities. Late in 1923 the pilot Dechert, employed by the Government, flew over the Cordilleras of the Andes at an altitude of 6,000 meters from Las Paz to Potosi. He used a Morane-Saulnier parasol type plane with Clerget 130 h.p. motor.

Brazil

The Curtiss Aeroplane Export Corporation conducts a flying school and sightseeing service in Brazil, the Government of which

rivals that of Argentina in developing military, naval and commercial aviation. Airplanes were used to explore the prospective route of a railway line from Bazil to Paraguay. Spruce and ash were purchased from the United States for repair work on planes of American manufacture.

Military aviation is directed by the French mission charged with training pilots. That mission arrived in Brazil in 1918 with a two-years renewable contract and 90 French planes. A squadron equipped with Breguet 14 A 2 machines has been formed on the frontier of Uruguay at Elegrete and another at Santa Maria with Breguet and Spad planes. The stations are commanded by Brazilian officers but the mechanicians are French.

The Naval aviation school is on the bay at Rio de Janeiro. It was equipped with 30 hydroairplanes of Italian and American construction. The Government was planning late in 1923 to buy about a million dollars worth of planes in the United States. Its predominant idea is to arm itself on the sea so as to be able to defend attacks on its shores. The Navy also has some 20 Italian and English seaplanes at l'Ilha de Governador. The Budget of January 1, 1924 contained authorization from the Brazilian Minister of War for purchases aggregating $360,000 for airplanes and parts and for landing fields for both a military aviation school and an aerial navigation line between Rio de Janeiro and Porto Alegre.

CANADA

Late in the year, Canada, which spends about $1.46 per capita on national defense as against the $18 per capita of England, was making ready to establish Canadian aviation on a much larger scale than ever before. Aviation appropriations, 1922-1923, were $1,064,-467. That policy was determined, first, as a result of the Imperial Conference in London, where it was decided that all the dominions should assume their share of the defense and commercial burdens of the Commonwealth. Secondly, Canada has found that the airplane may be used to great advantage. Over the vast areas throughout the Dominion planes may carry and have carried for several years, quantities of mail and parcel freight far more economically than surface facilities can transport them.

The Canadian Air Force and private companies proved the value of airplanes in forest fire patrol, geological surveys, and mail transport, and customs service. Major General J. H. O'Brien, Chief of Staff of the Department of National Defense, announced that a permanent Canadian air force would be established in 1924. He explained that it was proposed to station squadrons of airplanes at

Vancouver, B. C., Winnipeg, Man., and Dartmouth, N. S., while flying fields would be located at other strategic points. The central airplane depot would be located at Long Branch near Toronto.

In 1923 the Royal Canadian Air Force purchased 8 amphibian flying boats. A British firm is said to contemplate starting a factory in the Dominion. On June 1 an agreement was reached with the United States whereby pilots desiring to fly over Canada must notify the Air Board in advance. Military and Naval pilots receive permission through their departments. Civil pilots must satisfy the Canadian inspectors as to their responsibility and ability. Canadian pilots put in 725 hours on forest fire patrol during the year.

Chile

Under the stimulus of pioneering efforts both on the part of the Curtiss Aeroplane Export Corporation and the British Mission the Government developed a fairly strong nucleus for an air force. Flying meets were held at Santiago during the year. The Chilean Congress adopted a strong policy supporting commercial aviation.

China

The various factions in China have turned to aircraft both for military and commercial work. The Peking Government has a military airdrome at the capital and an aeronautical bureau in charge of a director-general. Planes of British design are being constructed at Linghau. A Government bulletin states that Lin Er-chia, a capitalist of Fukien, is promoting a North and Central China air service, Tientsin-Urga, for the carriage of mail and passengers, another line between Hankow and Woosung which requires four and a half days by river boats and six hours by air; extensions on to Chungking and Chentu. The boat trip from Hankow to Chentu requires 6 weeks. It is 12 hours by air.

Other lines projected include Peking-Hankow, Fukien-Formosa. An aviation establishment at Canton, including 11 American planes, was destroyed by fire. The Yuman Government purchased 10 French planes from a French mission in Indo-China. On April 5, 40 aviators were graduated by the Government school near Peking, where there is stored about $8,000,000 worth of British aircraft material. Former British officers are in charge of several aviation services.

The North China Government asked the United States for an aviation mission in 1922 and when this mission failed to arrive, it turned to the British who were already there. The Chinese

make good pilots. Foreigners patronize the commercial air service between Peking and Tientsin because of the greater safety afforded by airplanes in comparison with railroads which are often attacked by bandits.

American planes received at Canton by forces of Sun Yat Sen were being assembled late in the year. Twelve French bombing planes were delivered to the provincial government in Manchuria. The Peking Government late in 1923 projected a line between Peking and Tihua, capital of Sinkiang. At the same time Americans and Chinese interests, the latter headed by Lin Er-chia, contracted for the delivery of 24 Curtiss airplanes within the next five months. The company is to be known as the Great China Airways Company.

A total of 127 aircraft were registered in the Chinese Republic during the year—2 at Hankow, 37 at Mukden, 3 at Nanking, 42 at Peking, 9 at Pao Tingfu, 25 at Shanghai and 9 at Yunnanfu.

Colombia

The Colombo-Alemana de Transports Aeroes has been operating German flying boats and airplanes for several years now. It is said to have realized profits of 100 per cent. on the original investment. There is reported to be a Government subsidy of $100 per trip. On one route, that between Barranquilla and Cartegena on the Magdelena River, an average of 200 passengers, 56,000 kilograms of merchandise and 30,000 letters have been flown monthly. The merchandise is valued at approximately $2,000,000. Much of it is insured by English companies.

The inaccessible frontier region between Colombia and Venezuela in the Catatumbo River valley was surveyed by airplane, about 10,000 square kilometers being mapped.

Late in the year the company projected further plans which include new types of planes in a service between Giradot and Barranquilla. The rates were to be lowered considerably, i.e., from $150 to $50 for passengers. Under the new plans the passenger will be permitted to carry a trunk without charge.

Czecho-Slovakia

During the year the Government established a policy of building up its own aviation industry within its borders. Military aircraft shops at Kbely co-operating with that at Prague, were building 10-passenger airplanes designed for commercial service. A flying school for cadets was to be opened at Kbely in 1924. The Government had 300 serviceable planes operating during the year. The budget estimates for 1924 provided 145,000,000 Czech crowns for aviation purposes.

In the State airplane factory at Letna, employing 150 men, ten each of 10 different types of planes were being built. About 100 machines were completed in 1923. Factories are also located at Breitfield, Denken and at the former Austrian munition works at Pilsen. The French have opened a sail plane and gliding school at Prague.

Arrangements were being made with British firms to establish the London-Prague air service, by way of Eger and Cologne, cutting the time of travel from 31 to 8 hours. The reciprocal aviation agreement between the Government and France whereby the latter has much to do with Czech technical facilities practically excludes Germany from the market.

The Franco-Roumaine Aviation Company which for sometime has operated a seasonal service between Paris, Prague and Strassbourg, Prague and Warsaw, and Prague, Vienna, Budapest, established new rates as follows: Paris-Prague, 1330 crowns; Strassbourg-Prague, 950 crowns; Prague-Warsaw, 380 crowns; Prague-Vienna, 380 crowns; Prague-Budapest, 600 crowns; Prague-Belgrade, 855 crowns; Prague-Bucharest, 1,235 crowns. Negotiations were under way at the close of the year between France and Czecho-Slovakia, providing for the Franco-Roumaine Aviation Company to operate independently of Government control; and further providing that six new lines should be established, linking together all the important cities of Central Europe, including those nearby centers in Russia. The Paris-Prague line was to be extended to Constantinople and Angora, Turkey. In 1921-1922 the Czecho-Slovakian Government paid the Franco-Roumaine Company a subsidy of 6,000,000 C.Z. kr.

Denmark

From April 17 to October 17 the Danish Air Traffic Company operated the Copenhagen-Hamburg route with an efficiency of 93 per cent. In all 414 passengers, and 40,589 kilograms of mail and freight were carried over a total of 90,000 kilometers. The company operated with little material, having only 3 airplanes at its disposal, they being British D.H. types and part of the war surplus. This line is run in co-operation with the Deutscher Aero-Lloyd.

The army and navy aviation branches acquired numbers of foreign machines in 1923, the navy constructing part of its own equipment, but toward the end of the year that policy was abandoned for reasons of economy. The Rohrbach Metal Airplane

Company of Copenhagen was the only civil airplane works. It was in charge of Dr. Rohrbach, formerly an engineer employed by the Zeppelin Company in the development of all-metal construction. His factory was undertaking the construction of all-metal monoplanes.

The Rohrbach factory late in the year turned out a large passenger airplane, all-metal, accommodating twelve passengers, a pilot and a mechanician. It is powered with two Rolls-Royce engines, wing-mounted. The factory was negotiating with Soviet Russia, Japan and traffic companies in South America and Japan for orders for that type of machine.

The Danish army ordered 10 French Potez reconnaissance planes. The machines were flown to Denmark by Danish pilots. A special air commission has charge of all aviation matters in the country. While the air forces of both army and navy are small, they are maintained at a high state of efficiency.

Dutch East Indies (Netherlands)

To secure information as to the possibility of establishing permanent aerial communication between the Dutch East Indies and the Netherlands, the Government subsidized a private company to undertake a flight of 15,000 kilometers, by way of Prague, Constantinople, Aleppo, Karachi, Calcutta, Rangoon, Bangkok, Sengora, Muntok, and Batavia.

Ecuador

British and French aviation missions have been co-operating with the Government in training cadets at the schools of El Condor and Duran, the object being to supply the Government with planes of British and French construction.

Egypt (British)

The British Royal Air Force has a depot at Aboukir, near Alexandria, with seven troop-carrying planes transporting 17 men each. The 54 officers and 450 men usually on duty at the station serve that section of the Cairo-Bagdad mail route, via Transjordania, for 836 miles, with one intermediate stop. Several planes were constructed at Aboukir during the year. According to C. H. Gowans, Assistant Editor of the Egyptian Gazette: "England is preparing to turn over Egypt to the Egyptians That means relinquishment of military control. It does not mean abandonment of our air stations."

Esthonia

The Esthonian Government in August, 1923, agreed to subsidize the Aeronaut A. G. Company, to the extent of $14,700 to maintain its terminus at Reval. There the company operates two passenger, mail and express lines, one between Reval and Helsingfors, Finland, the other from Reval to Riga, Latvia. Efforts were being made toward the end of the year to establish an Esthonian-Russian company to create a line between Reval, Petrograd and Moscow. Further plans contemplate lines from Reval to Koenigsberg. The Aeronaut Company, which is financed by Germans, offers the sole means of direct communication between Reval and Helsingfors. The fare is about $11 or 400 Finnish marks each way. An average of 65 passengers were carried monthly after the service started.

Airplane connections can be made from Reval to Riga and from Riga to Koenigsberg, the flight being accomplished during the same day. The planes make connections at Koenigsberg with the Berlin express leaving at 7 p.m. and arriving in the German capital at 8 o'clock the next morning. By way of Berlin both London and Paris may be reached from Helsingfors in 36 hours, whereas the surface journey throughout requires between four and five days.

Finland

The Government enacted an aviation law regulating all flying, the President signing the decree in May, 1923. Finland averages about 200 good flying days each year. This with poor surface facilities and the thousands of lakes throughout the country make possible wide expansion of the aviation which Finnish business men are trying to develop with the aid of the Government. The one airplane factory is located at Sveaborg, near Helsingfors, and is producing planes of German design. French and Italian planes have been purchased by the Government. The German enterprise, Aeronaut Company, with headquarters in Reval, Esthonia, operates a mail and passenger service to Helsingfors.

The German company, Deutscher Aero Lloyd, A.G., has approached the Finnish Government with a proposal to extend a line between Helsingfors and Stettin, Germany, with an intermediate stop on the Swedish island of Gotland, in the Baltic.

France

In 1923 France became the strongest aeronautical power. Not only were the French air forces maintained at the highest possible strength and efficiency, but the subsidized civil lines were operat-

ing throughout many European countries; and French manufacturers ably supported by official Government missions were disposing of new and old machines in more than a score of foreign countries. The French colonies were being linked up with the Republic. Young Frenchmen were being trained to fly. The factories were maintained in operation on a steady production basis. All the civil activities, therefore, provided the Government with an aeronautical reserve on which it could depend in any emergency. In that month it was officially announced that French factories had produced 3,300 planes for military and civil purposes during the year 1922. These new machines gave France her lead in aerial preparedness, for the majority of nations were still using the surplus war material, that or a relatively few experimental machines produced since the armistice. It seems, however, that France managed to establish her aviation policy before other nations had begun to realize the necessity for such action.

The Government was moved to do this for three reasons:

First. France shall require protection from all possible enemies and the Government has not yet concluded that conditions are favorable for reduction in world armament.

Second. Germany, Russia and their potential allies are still mistrusted by the French who feel they must keep ahead of those Powers in order to maintain their nation intact from the invader.

Third. The French were the first to recognize, publicly at any rate, that the naval limitations treaty would not determine the relative strength of belligerents in time of war; for with air strength decisive battles might be waged before the conflict had fairly begun on the surface.

France therefore set out to attain superiority in the air, her policy evidently being to make such rapid strides that she could secure the position in the air that Great Britain had held on the sea. France as mistress of the air would have two strikingly important results. She would be invulnerable against an enemy providing, of course, that she could keep the enemy out of French skies; and in the struggle for world trade France would have the advantage because her civil craft would be able to transport passengers, mails and express more quickly and more economically than competitors lacking aerial facilities.

Then, too, with such prestige, France could dispose of her surplus material in foreign countries, particularly South America and Asia, thereby keeping her engineering, technical and skilled labor personnel active and efficient.

The foregoing no doubt accounts for French aerial prowess. In

the Chamber of Deputies is what is known as the "air party," headed by Deputy Rene Fonck, ace of aces in the World War, and aside from being a great fighting airman, one who knows enough about aerial strategy to be able to advise the military and naval chiefs. Fonck and his "air party" keep the French policy of aerial preparedness constantly to the fore; and today that policy has the support of all France.

If France had 123 completely equipped fighting squadrons, as reported, early in 1923, then her program for 196 squadrons with 100 per cent. reserves in 1925 seems capable of realization.

In September, 1923, it was reported that there were 1,050 planes actively in service among the squadrons, which averaged 9 planes each. Of the 123 squadrons, 99 were on duty in the Republic and 24 in the colonies.

There were 8 French airplane squadrons maintained in the Levant in 1923. In Syria were 3 bombing squadrons with 30 planes serviced at Rayneck.

There were 25 balloon companies with three balloons each. The air force was said to include 1,350 officers and 20,000 men; other figures however placing those totals much higher in view of the personnel assigned to civil and semi-civil duties but subject to recall on notice. Including the 600 commercial planes operated by civil transport companies there were altogether in France 2,297 machines, including 1,300 service planes and 400 training machines. And there were 3,000 pilots in the Air Force.

In 1921-1922 appropriations for aviation aggregated 435,917,595 fr. of which amount 189,510,970 fr. were paid in subsidies. In 1922-1923, appropriations totalled 947,352,550 fr., including 179,963,550 fr. subsidies. Fifteen per cent. of the total was for the purchase of new equipment.

The Minister of War and the Minister of the Navy were authorized by law to enter into contracts in the second half of 1923 for aircraft to be delivered in 1924 and to be paid from the 1924 appropriations aggregating not more than 50,000,000 fr. for the Army and 13,000,000 fr. for the Navy.

While the Air Force was training 50 new pilots a month, it was said that the factories were producing about 100 planes each month; and after six months of war, they could produce 1,000 planes monthly. At the end of a year, they could turn out 2,500 planes every thirty days. The factories have a normal peacetime production capacity of 500 planes a month.

The aircraft industry includes 29 aircraft factories, 2 airship plants and 11 engine manufacturing plants. At the national aero-

nautical show in 1923 there were 43 military and 13 commercial machines displayed. In May, 1923, when the Chamber of Deputies voted 1,000,000 francs for a subsidy to promote and popularize commercial aviation, it was announced that there were 8 civil flying schools with about 40 students each. The French industry was reported building 40 planes for Spain, 4 for the Japanese, 6 for the Greeks and numbers of military craft for other countries, including Russia and Brazil. One manufacturer had orders for 175 planes, 100 of which were for Poland, 8 for Denmark and others for Roumania and Czecho-Slovakia. Japan bought an Astra type airship. Aircraft exports for the year were valued at more than 20,000,000 francs.

Prizes totalling 4,262,000 francs were offered for aviation development. The French Government recognizes as a primary principle of aeronautical development that it must first establish its aeronautical industry on a firm, self-supporting basis. For that reason alone there is the closest co-operation between the Government and the manufacturers of machines, engines and parts, more than 200 separate organizations. The Government does not compete with the industry in engineering, design or manufacture. Instead, it provides liberal subsidies, carries out such general research and experimental work as night flying tests, highway lighting, aerial beacons, projection of new routes, meteorological data and the procuring of information concerning development in other countries. This sort of support leaves the commercial operator free to develop his own business which after all is but a unit in the French aeronautical reserve. The Government provides the finances and supervises the conduct of all military and naval tests with the new inventions as they are developed by civilians.

The effect of this may be seen in the efficiency of the trans-European lines maintained by the French companies. Meanwhile, Poland, Czecho-Slovakia and other friendly countries are kept close to Paris, literally as well as politically.

For that matter the French are not as eager to patronize their lines as some other nationals. Of the passengers embarking from Le Bourget (Paris) flying field during November, 1923, 37 per cent. were British, 28 Americans, 12 French, 2.5 Swiss, 5.5 Dutch and 15 per cent. other nationals. The French do not hesitate to use the air mail, however. It costs about thrice the ordinary rates for postage. During the month of September, 1923, the Latercoere Lines carried 9,885 pounds of mail between France and Morocco and 740 pounds between France and Algiers, which was twice the quantity for the corresponding period the year before.

During the first six months of 1923 French commercial planes carried 6,858 passengers, 854,125 pounds of freight and 73,650 pounds of mail. Those routes considered were between Paris and London, Paris and Brussels, Paris-Warsaw, and Paris-Prague and Belgrade, and the Franco-Morocco routes with the branch to Algiers. In addition a seaplane service was operated across the Mediterranean from Antibes to Tunis, to be linked up later with the Marseilles terminal of the Morocco service. It was reported that the value of air merchandise passing through a single French airport had tripled yearly for three years. A branch post office was opened at Le Bourget airport (Paris) in May.

The Messageries Aeriennes and the Grands Express formed a combine in 1923 known as L'Air Union. The State in April agreed to subsidize the Paris-London route, 2 round trips daily except Sunday from January 1 to May 1 and from October 1 to December 31; 3 round trips daily except Sunday from May 1 to October 1. On the Paris-Brussels line 6 round trips a week. Under the subsidy the company was to provide 33 planes and 17 pilots, and have one mechanic for each 300 h.p. engine in use.

That month the State also made an agreement with the Compagnie Aero-Navale for routes as follows: Antibes-Ajaccio, 3 round trips weekly starting March 12, 1923; Ajaccio-Tunis, 1 round trip weekly from July 1 to December 31, the company to maintain 7 seaplanes, 4 pilots and a mechanic for each engine.

On July 14 Latecoere opened the Marseilles-Perpignan line, joining at Marseilles with the main line from Toulouse to Casablanca. On October 14 an extension to Barcelona, Spain, was started. The Compania Latecoere in 1923, between Toulouse and Casablanca, via Barcelona, Alicante and Malaga, transported 1,600 passengers and 3,200,000 pieces of mail. Latecoere also proposed to extend their service to the Canary Islands, using amphibian machines carrying 10 passengers.

Early in the year the Compagnie Atlantique had received a concession to operate from Dakar, Senegal, in West Africa, to Kayes, capital of the French Soudan and also a terminus on the Senegal river.

At Le Bourget airport in July, 1923, 580 planes arrived and departed, carrying 2,500 passengers, 62 tons of baggage and 974 pounds of mail. In a similar period the French-Roumanian company carried 126 passengers from Bucharest to Paris. That company is now using three-engined planes.

About 3,000 civilians, all of them reserve pilots, are given training monthly at the great air centers of Orly, Angers, Bordeaux,

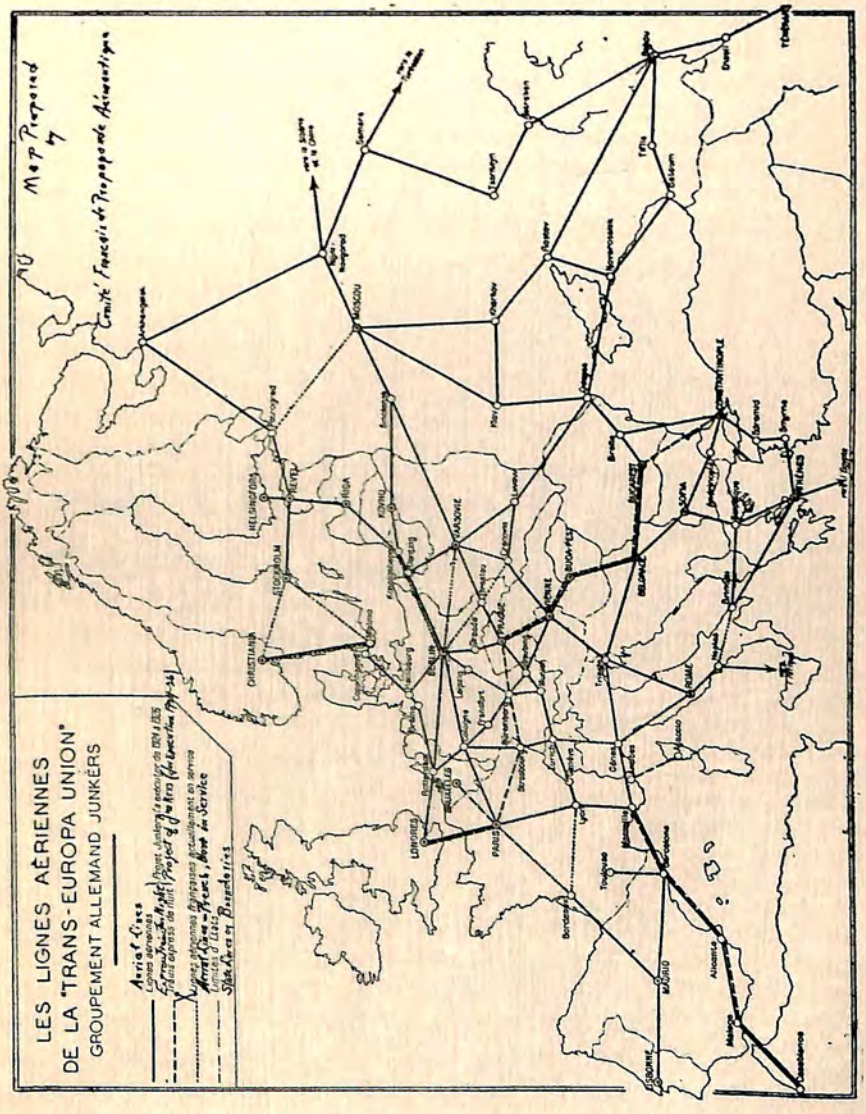
Clermont-Ferrand and Lyons. These are private fields, where the State pays from 380 to 730 francs an hour for the use of planes. At the end of the year France had 1,386 officers and 31,676 men in aviation, not including others such as technicians, mechanics and special duty men assigned to other branches temporarily.

She had 1,260 service planes in commission and 4,000 in reserve, 160 training planes in commission and 2,000 in reserve. In all her total air equipment was about 8,000 planes, including civilian, and 75 airships and balloons.

At the meeting of the International Air Traffic Association, held in London, July 9-10, 1923, the Compagnie Franco-Roumaine reported that its service for 1923 was opened February 15th. The subsidy given by the French Government for 1923 was much lower than 1922 and consequently, daily service was started only April 1st. This service began to run on the air lines Paris-Warsaw and Paris-Budapest; the stretches Budapest-Belgrade-Bucharest were only taken in exploitation on March 25th. The re-exploitation of the stretch Bucharest-Constantinople has been delayed by difficulties raised by the Angoran Government. The traffic has been intensive on the lines Paris-Prague, Prague-Vienna and return. The need was expressed for larger planes as the company could accept only one-third of the freight actually offered. At Vienna especially, nearly every day eight passengers out of ten were refused. If subsidies had permitted, the company could have doubled and tripled the daily journeys on the stretch Vienna-Prague, but under the circumstances it would have been ruinous to run two, three or four airplanes daily over the same stretch, at a cost of 12 francs per km. Difficulties in transport arose over the Bucharest-Belgrade line as to which cities should be permitted the larger assignment of loads. It was found necessary not only to have bigger airplanes, but to have multi-engined airplanes, and to fly at night. The Franco-Roumaine has instituted night flying on the stretch Belgrade-Bucharest. It uses Caudron planes fitted with 3 180 h.p. Hispano engines. The percentage of absolute regularity in 1922 was 89 per cent. Of the 11 per cent. of interrupted flights, 5 9-10 per cent. was due to bad weather causes and 5 1-10 per cent. to lack of material. The aerial fleet of the Franco-Roumaine Company at the end of June numbered 80 planes, using a total of 29,150 active horse power, to which are to be added 19,100 h.p. represented by reserve motors. There are 28 pilots and altogether 435 persons employed in the organization. The number of kilometers daily flown from Paris to Warsaw and Prague to Constantinople is 3,264.

The records of Le Bourget, the Paris airport, show that 3,333

commercial planes arrived and departed during the year, carrying 11,605 passengers, 667,372 kilograms of merchandise and 2,261 kilograms of mail. The question of larger machines carrying a score or more passengers was receiving attention in all quarters. The Air Union late in the year had been dissolved and a new company, with Jacques Level, Louis Bleriot, Louis Breguet and M. Caudron as directors, was to operate the Paris-London route. The Farman Company was to operate the Paris-Brussels-Amsterdam route.



Following are the principal French air transport companies, together with the lines which they operate, in conjunction with the French Government, and with the support of subsidies:

Air Union (fusion of the Compagnies des Messageries Aeriennes ana and the Grands Express Aeriens).
Paris-London, twice daily, except Sunday.
Paris-Brussels, daily, except Sunday.

Compagnie Franco-Roumaine.
Paris-Strassbourg-Prague-Vienna-Budapest-Bucharest-Constantinople, daily to Budapest; from there bi-weekly.
Paris-Prague-Warsaw, daily except Sunday.

Compagnie Generale d'Entreprises Aeronautiques (Latecoere).
Toulouse-Barcelona-Alicante-Malaga-Rabat-Casablanca, daily.
Casablanca-Rabat-Fez-Oran, thrice weekly.
Marseilles-Perpignan-Barcelona-Balearic Islands-Algiers.
Alicante-Oran.
Bordeaux-Madrid-Lisbon (in preparation).

Aero-Navale.
Antibes-Ajaccio, occasional.

Compagnie Atlantique de Navigation Aerienne.
Dakar-Kayes, bi-weekly.

Compagnie des Reseaux Aeriens Transafricains.
Algiers-Biskra-Touggourt, thrice weekly.
Tulear-Antsiraba (Madagascar).

The following services, operated in 1922, were discontinued in 1923: Paris-Havre, Paris-Lyons-Marseilles; Paris-Lausanne, Cayenne-St. Laurent-Inini (French Guiana).

According to a report issued by the Comite Francaise de Propagande Aeronautique, the following was the extent of the French air traffic in 1923:

Route	*No. of Flights*	*Km. Flown*	*No. of Passengers*	*Kgs. of Freight*	*Kgs. of Mail*
Paris-London	1,023	384,228	2,303	436,927	769
Paris-Brussels	537	150,529	1,409	69,611	649
Paris-Strassbourg-Prague-Warsaw .	254	139,645	212	14,030	847
Paris-Strassbourg-Prague-Vienna-Budapest-Belgrade-Bucharest-Constantinople	2,646	1,009,731	2,093	112,688	3,154
Antibes-Ajaccio	201	47,072	231	508	.....
Marseilles-Toulouse.	416	107,557	55	4,509	1,486
Toulouse-Barcelona-Alicante-Malaga-Rabat-Casablanca	3,897	1,342,495	1,069	56,580	60,423
Casablanca-Oran ...	622	156,905	292	9,284	6,244

Route	No. of Flights	Km. Flown	No. of Passengers	Kgs. of Freight	Kgs. of Mail
Algiers-Biskra	80	31,356	96	112	1.4
Biskra-Touggourt ..	32	6,354	41	4	.....
Touggourt-Ouargia .	6	990	10	.....	.....
Dakar-Kayes	4	4,813	....	.....	.....
	9,718	3,381,675	7,811	704,253	73,573.4

M. Laurent Eynac, the Under-Secretary of State for Aeronautics, at a press luncheon explained the Government program for 1924, partly as follows:

The general budget was to be similar to that for 1923. France fearing that Great Britain would succeed in establishing air monopolies over all countries between London and India was to do everything possible to develop commercial aviation. Air attaches were to be sent into South America to aid in creating a market for French machines. Subsidies for certain companies would be increased, with the consent of the Government. The French-Roumanian company and Latecoere would both both increase operations in their respective fields. Night commercial service would be established over the Central Europe routes. A new bureau of design was to be created in the technical service, to select from all designs submitted by the industry; but in no way would it compete with the organization of any manufacturer.

The Government planned to offer the following prizes in 1924: 140,000 francs for an airplane bringing back to France the speed record now held in the United States. 100,000 francs for a seaplane restoring to France the international record for seaplanes, held by the United States; 50,000 francs for an airplane establishing a new international record for distance; 50,000 francs extra if the duration record, now held by the United States is also broken.

Germany

Notwithstanding the restrictions imposed by the Conferences of Ambassadors and administered by the Inter-Allied Commission of Control, the Germans have not relinquished hope of establishing themselves in the air. Their technicians have worked industriously during the five years since the war perfecting airplanes and engines, projecting commercial routes and determining the most economical methods by which those routes may be operated.

Because of the treaty terms practically all German aviation is civilian and even that is handicapped by restrictions sufficient to discourage a less resourceful race. Germany made such progress during the war, however, that the industry and allied trades have been

encouraged to continue in the face of the regulations imposed by the conquerors. The airplane and airship industry at the end of the war was most efficiently organized; and today, while it has undergone many transformations, the nucleus remains. Furthermore, it is active. There are 25 manufacturing concerns.

While many of the concerns transferred their technical staffs to other countries and there opened up branch factories to escape the Allied restrictions, it goes without saying that they have remained essentially German, the while they have received substantial support in the form of subsidies from the Governments under which they happened to be operating. For example, Dornier, metal airplane expert in charge of that branch of the Zeppelin works, transferred his staff to Italy, and Fokker to Holland. Junkers opened a branch in Moscow, Russia, as did Albatross and the L.F.G. Rohrbach went to Denmark, Brandenburg to Finland, Sabatnig to Latvia and others to Switzerland.

In January, 1923, there were eight airplane transport organizations in Germany, some of them manufacturers who were also operators. With the final delivery of reparations material during the first quarter and withdrawal of restrictions which forbade international air service with Germany, the eight companies formed two large and powerful groups, powerful in the sense that they had the personnel and the technique, the completed systems and the unqualified support of the Government, which poor as it was, managed to render financial aid in the form of subsidies. The two combinations were the Junkers Luftverkehr and the Aero-Lloyd.

Then, too, was the independent line known as the German-Russian Aerial Transport Company, operating between Koenigsberg and Moscow. That company is managed by a director representing the Soviet Government which holds 50 per cent of the capital shares and really maintains the line to facilitate official communication with the outside world. The majority of passengers are Soviet couriers and others entering or leaving Russia at the express invitation of the Soviet. Mail and merchandise are carried; practically all of it official.

During the year an average of eight planes were in service. They made 168 regular flights, covering a distance equal to thrice the circumference of the earth and carried 651 passengers and more than 70 tons of mail and freight. The machines were flown over a route of 825 kilometers without a stop, as they were not permitted to land in Latvia or Lithuania. The following table of operations indicates how this German-Russian service runs:

Koenigsberg-Moscow	*Km. Flown*	*No. of Trips*	*Regularity in %*	*No. of Passengers*	*Total Weight Useful Load Carried*	*Type of Machine*
Month of May....	26,660	44	98%	137	14,844.18	Fokker
Month of June....	32,700	45	100%	62	8,964.7	Fokker

After Germany had signed the International Air Convention early in 1923, the two large groups operated lines to other countries as follows:

Hamburg-Copenhagen	German and Danish operated.
Berlin-Hamburg-Bremen-Amsterdam-London	German, Dutch and British operated.
Koenigsberg-Smolensk-Moscow	German and Russian operated.
Koenigsberg-Memel-Riga-Reval-Helsingfors	German and Finnish operated.
Munich-Zurich-Geneva	German and Swiss operated.
Munich-Vienna-Budapest	German and Swiss operated.
Danzig-Warsaw-Lemberg-Warsaw	German and Polish operated.

The Junker Company also operated the line from Berlin to Munich, Bavaria, by way of Dessau, Junker headquarters, Leipsig and Furth. The Aero-Lloyd operated the route from Berlin to Danzig and to Koenigsberg. The two concerns operated a total of 111 airplanes of 30 different types. The Junkers company also participated in a share of the business on the routes between Reval and Helsingfors, Munich to Geneva, Munich to Budapest and Koenigsberg to Riga and the experimental route between Danzig and Tiflis, by way of Crakow, Grasnig and Baku. Its machines carried a total of 17,750 passengers and 85,776 kilograms of mail and freight. The Aero-Lloyd participated in the business between Hamburg and Copenhagen and operated the Berlin-Amsterdam leg of the route to London. Its machines flew 274,465 kilometers during the year, and carried 2,528 passengers and 1,415,600 kilograms of mail and freight, including newspapers, to and from England.

In the middle of the year a scheme was initiated by Dr. Hugo Junkers, head of the noted concern bearing his name, calculated to unite all Europe and parts of Asia and Asia Minor in a system of commercial air lines which virtually would serve to link all large communities by daily air routes. The project was the organization of the Trans-Europe Union. The first meeting was held in Munich which was attended by representatives of Aero-Lloyd, Rumpler and Junkers, all three from Germany; the Bavarian Luftlloyd of Munich; the Ad Astra Aero of Zurich, Switzerland; the Austrian Aerial Transport Company and the Aero Express of Hungary. They signed an agreement to combine as the Trans-Europa Union; and work toward the establishment of all proposed routes by 1926. The work was to start immediately.

The scheme involves four sections of the continent and extensions elsewhere, as follows:

The Section including London and the Continent:
- (a) London-Hamburg-Copenhagen-Petrograd.
- (b) London-Berlin-Koenigsberg-Moscow-Petrograd.
- (c) London-Zurich-Geneva-Rome-Athens-Smyrna (with branch lines to Africa and Egypt).

The Section of Central Europe and the Balkans:
- (a) Rotterdam-Vienna-Constantinople-Athens.
- (b) Bordeaux-Munich-Warsaw-Moscow.

The Section of the South toward the East:
- (a) Lisbon-Trieste-Braila.
- (b) Lisbon-Trieste-Warsaw-Moscow.
- (c) Lisbon-Paris-Berlin.

The Section of Russia:
- (a) Archangel-Moscow-Constantinople-Smyrna.
- (b) Moscow-Rostov-Bakou-Teheran.
- (c) Archangel-Nijni-Novgorod-Astrakan-Teheran.

All kinds of airplanes and hydroplanes are to be used, those of such power and capacity as cannot be built in Germany, will be constructed in the other countries. Night flights are planned for 1924 on the route to London, Cologne, Furth, Straubling, Bavaria. Another night flight is projected between London and Belgrade, using airplanes over land and hydroplanes over the Danube. Night flying tests between Straubling and Budapest were made in October.

Following are members of the Board of Directors of the Trans-Europe Union: Colonel Schwarzenbach, Dr. Wirth, Director Pillichody, for the Ad Astra Aero-Zurich; Dr. Rumpler of Augsburg and Director Schleissing of Dessau and Dr. Coblenzer of Munich for the Bayerische Luftlloyd; Dr. Heinsheimer and Dr. van Bardas, both of Vienna for the Austrian Luftverkehrs-A.G.; Director Hans Sachsenberg of Dessau and Count Jankovich of Budapest for the Aero Express R.T. Hungary; Dr. von Miller and Reichstags Deputy Dr. Kuhlenkampf of Berlin for the Aero-Lloyd, Berlin; Professor Dr. Junkers of Dessau and Director Gotthard of Sachsenberg-Berlin for Junkers Werks.

At Tempelhof, a suburb of Berlin, a flying field was built late in the year for international air traffic. The industrial situation made it possible to secure 400 laborers to level the ground and put up the necessary buildings. Tempelhof will be Berlin's principal airport.

The Germans say that they have been able to accomplish more profitable flying than either Great Britain or France, notwithstanding that Great Britain's subsidies are five times as large and France's elevenfold. A program was completed late in the year for a series

of courses to be offered in all universities and high schools, covering both scientific and practical aviation.

At the International Air Traffic Association meeting in London, July 9-10, 1923, the representative of Deutscher Aero-Lloyd A.G. reported that the 1923 service was opened May 7th, but owing to the extraordinarily bad financial situation in Germany, the German government only granted subsidies for a service from Berlin to London, via Amsterdam, and a service from Berlin to Koenigsberg. The London service, it was reported, was continual, with Daimler Hire Ltd. service—the German machines running between Berlin and Amsterdam, the English machines linking up in Amsterdam. Once weekly a machine is sent through to London, and Daimler Hire sends one through weekly to Berlin. Owing to the 9 rules of restrictions laid down following the war, the Germans have a comparatively small supply of modern machines at their disposal. This handicapped them greatly and they had to cancel many flights for lack of spare parts, etc. Another handicap was that English machines carry nine passengers from London to Amsterdam, while German machines from Amsterdam to Berlin can carry only four or five. The results on the line Berlin-Koenigsberg, in spite of the difficulties with spare engines, were good.

Gibraltar (British)

Gibraltar is a British Naval station at the entrance to the Mediterranean. It is being transformed into a formidable aircraft base. Underground hangars of huge dimensions are being constructed, with elevators for hoisting and lowering aircraft to flying-off platforms at the top where they are shielded from the observers of an attacking enemy.

Great Britain

The year was marked by two distinct advances in British aviation. The industry gained ground steadily in manufacturing, selling and operating fields. The Government concluded that France had far surpassed Great Britain as far as aerial preparedness was concerned; and thereupon introduced a policy tending to equalize the air strength of the two nations, even if Great Britain had to increase her strength tenfold. The Dominions were notified that they would be expected to handle their own share in future defensive measures, that is, they would be responsible for providing adequate defense in their respective lands. A more definite policy was formed at the annual conference of Empire heads, it being agreed that development of airlines linking together all parts of

the Commonwealth should be immediately undertaken. The defences of London were to be increased.

When the Labor Government took office early in 1924, it concurred in the aerial policy of its predecessors, with the result that Great Britain possibly has the most comprehensive expansion scheme of any nation. The foundation for this was laid in 1923.

British firms built about 24 different types of military and naval aircraft, including fleet spotters, bombers, fighters, scouts and torpedo planes. Two different types of troop carrying planes were produced, each carrying 25 persons. Those machines are also part of the development in large cargo-carrying and passenger planes. At the end of the year England had more naval aircraft in serviceable condition than all other nations together. Her efficient Air Ministry, which co-operates to the fullest extent with the industry, had proved three points which had once been disputed.

They proved by small detachments in Egypt, Iraq and other parts of the Near East that a region may be actually controlled without occupation. In other words, land forces are not required to dominate a country. The tribes and other peoples living in the regions under control were influenced simply by the knowledge of an air force which could fly over head day or night instantly ready to fight.

At the Royal Air Forces Pageant held at Hendon Airdrome in July the aircraft shown were post-war products. Many scores of planes were exhibited about which little had been divulged by the Air Ministry. None of those machines had been produced at the time of the armistice. Two of the machines had been especially built to ascend from and alight on the decks of aircraft carriers as well as on land. There were large bombing craft carrying three and four engines aggregating 3,000 horsepower, and light sport and commercial planes as low in power as 7 h.p. motorcycle engines. There were armored planes bristling with machine guns and cannon more than 2 inches in diameter. Wireless equipment for planes, aerial beacons and many devices for long distance navigation made the new machines of interest to the representatives of the dominions gathered to witness the spectacle. Some of the new engines were of 1,600 horsepower, the largest of their kind yet produced.

British missions throughout the world were busily selling English airplanes, both new and old. They were active in Asia and South America. Late in the year the Aircraft Disposals Company, Ltd., handling Britain's surplus war equipment, announced that it had "sold to all countries on earth, aircraft amounting to several millions of pounds sterling." It was this company that tried unsuccessfully several years ago to dump millions of dollars' worth

of this military surplus into the United States at junk prices, but was prevented from so doing by American basic airplane patents.

The British air appropriations for 1922-1923 totalled £15,666,500, including £571,000 for civil aviation and subsidies. The air estimates for the fiscal year, 1923-1924, aggregated £18,605,000. This is a net increase of £2,938,500 over the previous year. Included in this amount is £506,000 for subsidies and civil aviation. The strength of the Air Force was the subject of considerable debate in Parliament. Lieut. Col. Sir Samuel Hoare, then Secretary of State for Air, explained in giving the estimates early in the year that Britain's air forces were becoming lamentably weak due to enforced economical policies which were not logical in view of what certain other nations were accomplishing.

He said that at the end of the war the Royal Air Force numbered 30,122 officers, 263,410 men and 3,300 service airplanes. Early in 1924 it included 3,166 officers, 28,077 men and 371 first line planes, that number excluding reserve and training equipment. Two-thirds of the British service planes were on duty overseas. Of the 34 British service squadrons, 18 were in Egypt, the Mediterranean and the Near East, 6 in India, 4 allotted to Naval work and one to the Army at home, leaving only 5 service squadrons in Great Britain for home defense—one attack squadron and 4 bombardment squadrons.

He compared the British strength with that of the French, saying that the French program contemplates 2,180 service planes in 1925 while the British, even with the fifteen additional regular squadrons authorized late in 1922 would have but 575 service planes in 1925.

The estimates for the new fiscal year included £5,144,500 for airplanes, seaplanes, engines and spare parts, an increase of £1,524,500 over the previous year. Of that amount it was planned to spend £2,789,700 on new complete machines and £1,450,700 on engines. It was said that 83 per cent. of the new equipment would be new types.

The Special Committee on Home Defense reporting late in May recommended that London's air defenses be expanded to provide all possible protection for the metropolitan area, including barrage balloons, fighting squadrons, searchlights, anti-aircraft batteries so placed as to cover all approaches to the city and an increasing number of personnel competent to handle all those defenses immediately on notice. It was estimated that the new defenses for London would cost approximately $40,000,000 during the next five years. The Conservative Government accepted the report, which was later endorsed by the Labor Government.

Early in 1923 the Royal Air Force had 15 squadrons stationed temporarily at Constantinople and vicinity. This force cost the Government approximately £615,000 during the year.

Seventeen battleships, 4 battle cruisers and 7 light cruisers had been equipped with flying platforms to accommodate scouting and pursuit planes. The aircraft carriers *"Argus"* and *"Pegasus"* were in commission. The aircraft carrier *"Hermes,"* the first of its class especially designed and built, was completed in 1923. It has 10,950 tons displacement, carries ten 5.5-inch and four 4-inch anti-aircraft guns and has two hangars, each accommodating 20 planes which are lifted by elevators to the flying platforms. The *"Eagle"* and *"Furious"* were being completed. The carrier *"Royal Ark"* was held in reserve.

In August experiments in airplane bombing were conducted off the Isle of Wight. The battleship *"Agamemnon"* was placed under radio control and maneuvered at a speed of 14 knots. Only smoke bombs were dropped. Royal Air Force bombers flew at an altitude of 8,000 feet and against heavy winds. 100 bombs were dropped, two of them making direct hits and ten others striking within 20 feet of the ship.

A very clear idea of Britain's aviation policy was conveyed by the Duke of Sutherland, Under-Secretary of State for Air, during his visit to the United States in January. He said:

"England looks upon flying as an economic contribution as essential to commerce as shipping. Aviation should not be regarded as a menace, to be curbed. Application of aircraft shall be according to national motives. Aviation has ended England's insularity. England is now as much a part of Continental Europe as France or Germany. Her effort is now to develop commercial flying and at the same time provide for her air defenses in proportion to the size and importance of the British Empire. Her only thought of competition is commercial competition."

In July, 1923, the Prime Minister announced in the House of Commons the Government's policy for expanding the air forces. He said:

"In the first instance the Home Defense Force should consist of 52 squadrons and the Secretary of State for Air has been instructed to take the preliminary steps for carrying this decision into effect. The result will be to add 34 squadrons to the authorized strength of the Air Force.

"It is estimated that this expansion will cost £500,000 this year and later not more than £5,000,000, including both capital and maintenance. This maximum expenditure, however, is not estimated to be reached for three years."

Following is the official organization of aviation in Great Britain:

Air Council: Brigadier General the Right Honorable Lord Thomson, P.C., C.B.E., D.S.O., Secretary of State for Air, President of the Air Council; William Leach, Esq., M.P., Under-Secre-

tary of State for Air, Vice-President of the Air Council; Air Chief Marshal Sir H. M. Trenchard, Bart., G.C.B., D.S.O., A.D.C., Chief of the Air Staff; Air Vice Marshal P. W. Game, C.B., D.S.O., Air Member for Personnel; Air Vice Marshal Sir W. Goeffrey H. Salmond, K.C.M.H., C.B., D.S.O., Air Member for Supply and Research; Air Commodore J. M. Steel, C.B., C.M.G., C.B.E., Deputy Chief of the Air Staff. Additional Member: Sir W. F. Nicholson, K.C.B., Secretary of the Air Ministry.

Under the *Air Ministry,* of which Lord Thomson is Secretary and Mr. Leach, Under-Secretary, there are: Department of the Under-Secretary, Sir W. S. Brancker, Air Vice Marshal, K.C.B., A.F.C., Director of Civil Aviation; Department of the Chief of Air Staff, etc.

According to information supplied by Group Captain M. G. Christie, British Air Attaches at Washington, the following air routes were operated during 1923 or during some part of that year:

Route	*Miles*
London-Manchester	173
London-Paris	225
Paris-Basle	280
Basle-Zurich	25
London-Brussels	200
Brussels-Cologne	110
*Amsterdam-Bremen	175
*Bremen-Hamburg	67
*Hamburg-Berlin	168
London-Rotterdam	228
**Rotterdam-Hanover	230
**Hanover-Berlin	230
Southampton-Guernsey	115

Captain Christie reports total mileage in air transport during 1923 to be 943,000 miles; total passengers carried in air transport flights, 15,552; fatal accidents, two pilots and three passengers killed.

The following statement from Lloyd's List and Shipping Gazette indicates the tremendous growth which has taken place in the use of aviation between the United Kingdom and the Continent:

"By the end of last year, 45,531 passengers had been carried to or from the Continent by air. Out of this total, 33,362 passengers (73 per cent. of the total) traveled in British aircraft. The increase in traffic which took place in 1923 more than maintained the rate of increase noted in the previous year. A total of 15,137 passengers and over 800 tons of goods were carried as compared with 12,359 passengers and 477 tons of goods in 1922. The proportion of pas-

*This route operated for a time, then suspended in favor of **.

sengers carried in British machines was 79 per cent. in 1923 against 77 per cent. in 1922.

"An indication of the increasing use made of the British cross-channel air lines is given by the average load carried on each flight. In 1922, the average load was about 810 lb. (three or four passengers and about 150 lb. of goods). In 1923, the figure increased to 1,200 lb. (four or five passengers and about 270 lb. of goods), an increase of 50 per cent. The value of merchandise imported and exported by aircraft, British and foreign combined, reached at the end of 1923 the high total of £3,180,319. The total for 1923 exceeded three-quarters of a million sterling. One Saturday 5 cwt. of silver, in ingots, and one ton of furs were carried by air to France.

"The mileage flown in 1923 by British aircraft engaged in air transport was 943,000 miles (equal to about 38 circuits of the world), an increase of 226,000 miles over the corresponding figure for 1922. The reliability of the British air lines in 1923 was maintained at about the same level as in 1922 in spite of the fact that new routes were opened and longer flights were made. Whereas in 1922, on the London-Paris route, which has been in operation since 1919, the flights completed within the time limits fixed under the subsidy scheme amounted to 92.5 per cent. of the total commenced, the corresponding figure for all routes in 1923 reached 91 per cent."

Merchandise valued at £3,180,319 Sterling has been transported on English and Continental planes over the channel since the war, £776,251 worth having been carried to and from London in 1923. In that one year there were 4,575 flights, of which 2,559 were made by the English planes and 2,016 by the foreigners. Fifteen thousand one hundred and thirty-six passengers traveled on the planes, 11,947 on the British and 3,189 on the others. Eight hundred and five tons of cargo were carried, 306.5 by British and 498.5 by the foreign planes.

In the Aircraft Year Book for 1923 the position of the principal air transport companies under the Government subsidy was outlined. In spite of the satisfactory year reported by Instone, Daimler Hire, Handley-Page and British marine, the tendency in France and Germany toward combination of services, forced similar action in Great Britain.

In December the four British air transport lines were combined through efforts of the Air Ministry. They were to form one huge operating organization, known as the Imperial Air Transport Company. The old routes were to be maintained including the lines,

London-Paris-Zurich
London-Brussels-Cologne
Manchester-London-Amsterdam-Berlin
Southampton-Channel Islands

The directors included Sir Eric Geddes as chairman of the board, Sir George Beharrell and Lord Invernairn. The Air Ministry appointed two directors to represent the Government. Col. Frank Searle, formerly Managing Director of Daimler Hire, was expected to become Managing Director of that new combine. The British Foreign and Colonial Corporation guaranteed the working capital, but in January, 1924, a public issue of shares was made. According to the official announcement, the Imperial Air Transport Company is to operate a heavier-than-air transport service in Europe, including the Mediterranean and the Black Sea. The agreement deals only with heavier-than-air transport and guarantees that no subsidy shall be given to any heavier-than-air transport firm other than the I.A.T. Co. The right to subsidize lighter-than-air transport lines is expressly reserved. The initial share capital of the Company will be one million shares of £1 each and the British Foreign and Colonial Corporation, Ltd., guarantee the subscription of half the shares. The first object is the acquisition of the business of Handley Page Transport, Ltd., the Instone Air Line, Ltd., the Daimler Airway (Branch of Daimler Hire, Ltd.) and the British Marine Air Navigation Co., Ltd. (allied to the Supermarine Company of Southampton).

The Government guarantees a subsidy of one million pounds to be spread over ten years. For the first four years the Treasury is to give a subsidy of £137,000 per annum subject to a minimum yearly mileage of 1,000,000. In the fifth year the subsidy will be £112,000; in the sixth year, £100,000; in the seventh, £86,000; in the eighth, £70,000; in the ninth, £52,000, and the tenth, £32,000. The profits of the Company (if any) are to be distributed thus: (a) 10 per cent. on the paid-up capital to the shareholders; (b) one-third of the balance for the repayment of the subsidy, one-third for the development and improvement of the service and of British civil air transport and the remainder for the shareholders. The services are to be continued until the subsidy has been completely repaid. Further services may be operated and agreements made with foreign companies.

The aircraft used are to be British-built and registered in Great Britain. The pilots employed are to be enrolled in the Royal Air Force Reserve or the Auxiliary Air Force and the technical and administrative personnel are to be British subjects or subjects of British Protectorates or mandated territories. All the directors and shareholders of the I. A. T. Co. must be British subjects and the

Secretary of State for Air shall nominate on behalf of the Government two directors who shall not be required to hold qualification shares.

All aircraft airdromes and bases of the Company shall be available for the Government in a national emergency. The Company agrees to test experimental types of commercial aircraft which have passed their tests at the Government establishments and to carry out at cost price such experimenal work as the Government wishes. Construction and repair of machines is to be carried out in British territory by British manufacturers. But with the permission of the President of the Air Council orders may be placed elsewhere if British manufacturers refuse reasonable data as to costs. The Company agrees to allow a rebate of 10 per cent. on the advertised fares to officials of His Majesty's Government, including members of the fighting and civil services, when traveling on duty.

Following the agreement between the four British lines to amalgamate, it was announced that "the largest air station in the world" would be established at Croyden, London's terminus, by the Air Ministry. The scheme involves building an electric railway spur direct to the field on which a station will be constructed, whence passengers may go direct into the city.

Greece

Greece first used airplanes during the Balkan War of 1912, several types of French planes being employed for observation purposes. In 1923 Greece had about 50 airplanes in her army and navy forces.

Guatemala

The Government has an aeronautical school and good flying field near the capital. In November the newspapers announced that an air mail and passenger service would be started by a private company between Puerto Barrios and Puerto Cortez. Late in the year a German group proposed to start an air mail service between several countries in Central America. Italian and French missions were trying to sell airplanes to the Government.

Holland (See Netherlands)

Honduras

The national flying school at Tegucegalpa is operated also for civilians. The Government has had several aviators trained in the United States. In August the Government granted a concession to Marco A. Portin and Bernardo Appel to import aeronautical material into the country and to use the field at Toncontin. They will undertake to carry the mails for the same price as they are now carried overland. The first hydroairplane to make a landing in the

Bay of Puerto Cortez, Honduras, arrived there December 27, 1923, with an all-American crew, including Capt. Harrison Estep, manager of the Huber Honduras Company of San Pedro Sula, who was in charge. He was accompanied by Mrs. Estep, R. P. Applegate, the pilot, and A. W. Lea, mechanician. They had flown from Washington, D. C., to Puerto Cortez, 1,883 miles, in 29 flying hours. The plane with three others due to arrive later were purchased by a company to operate a mail service along the north coast of Honduras to Guatemala.

Hungary

The Hungarian passenger and mail plane line from Budapest to Vienna was started early in 1923. It maintained a daily service the entire season, carrying 1,630 passengers up to October 20th. It is known as the Hungarian Aero Express and is one of the companies having membership in the Trans-Europa Union organized late in 1923 by Dr. Hugo Junkers. Aside from experimental craft produced by inventors, Hungarian aviation consisted of machines purchased in other countries. For the year 1922-1923, 45,000,000 kr. subsidies were voted.

India (British)

The Royal Air Force maintains 10 airdromes, 18 secondary airdromes, 20 civil airdromes and 35 emergency landing fields in India, at which are stationed an average of 60 airplane squadrons. Various British commercial projects include the overland route from London to Calcutta. There has been much agitation for an air mail service between that city and Bombay. A British mission late in 1923 was investigating the possibilities for other civil air routes. Many important routes now require 24 or 36 hours to negotiate overland whereas airplanes could make the trips in two or three hours. Air appropriations increased from 66,000 rupees in 1921-1922 to 631,893 rupees in 1922-1923. Estimates for 1923-1924 total 875,740 rupees.

Indo-China (French)

Several commercial air lines were to be organized in French Indo-China by the French Eastern Aeronautical Company. At first an experimental service was to be run between Saigon and Canton, in Cochin, China, a distance of 120 kilometers, after which it was planned to organize lines between Saigon and Pnone-pene; Saigon and Penang, Saigon and Hongkong. French planes were to be used.

Ireland

The Irish Free State maintains a flying corps for patrol and observation purposes. The pilots are for the most part English trained.

British planes are used. Aircraft were used to good advantage in the early days of the Free State when troops were called to quell recurrent attacks by the Irish "Republican" army under de Valera. Complete information concerning the movements of the rebel forces was supplied by aerial observers.

Iraq (British)

The British Royal Air Force maintains 8 squadrons at the Hinaidi airdrome near Bagdad. There are facilities there for the squadrons, 4 battalions of infantry, 3 armored car companies and a battalion of field artillery. The Cairo-Bagdad mail route operates fortnightly. Under the administration of Air Vice Marshal Sir John Salmond, the Air Forces had 100 planes in service with an equal number in reserve. The Air Force detachments were said to have performed most exacting duties at one-fifth of the cost which ground troops would have necessitated. For the first time in history an air officer had charge of all the troops, surface, air and water, in an expeditionary assignment.

Italy

"We must have enough planes by next year to hide the sun. We must fly! We will fly!" Thus Premier Mussolini addressed his cabinet at Rome after witnessing a flight of 300 Italian airplanes in a demonstration over the Eternal City. Mussolini's plan, as announced by the Government, was to triple the Italian air strength, develop commercial aviation with both airplanes and airships, and link Italy with all countries of Europe and the East.

In 1923 the Army had 650 service planes, including 250 pursuits ships, 300 scout planes and 100 heavy bombers, among them several large Caproni machines. There were 400 officers and 4,250 enlisted men, including 300 officer pilots and 250 enlisted pilots. They operated from 37 military airdromes.

The Navy had 200 service planes and an air force of 80 officers and 1,100 enlisted men, including 60 officer pilots and 30 enlisted pilots. There were 16 naval aviation stations and 3 more being equipped. Private aircraft builders operated 5 others.

Premier Mussolini had dissolved the Air Ministry and established a new department, with himself personally in charge. He drafted the plan to combine military, naval and civil aviation under one branch which should be equal to the other branches. Work was begun on two large dirigibles and several smaller ones were produced. Approximately 42,000 cubic meters of helium were produced in Italy by chemical processes which were so costly that a special

committee was exploring in certain parts of the country for helium deposits, traces of which had already been found.

Appropriations for the fiscal year aggregated 220,000,000 lire; and the Government announced that in 1924 three times that amount would be appropriated. On December 20th the new airplane carrier, *"Giuseppe-Miraglia,"* was launched from the yards at Spezzia. It has 4,500 tons displacement and makes 22 knots an hour. The superstructure is arranged for hangars and they have accommodations for 9 battle planes.

Each of the 72 provinces has undertaken to supply one or more airplanes to the Government, produced through voluntary contributions. Altogether there were reported to be 1,382 airplanes in Italy at the end of the year, including training planes. By June, 1924, it was planned to have 1,600 machines in operation with 600 more on order. Seventy pilots were being trained monthly, with plans for 140 monthly in six months and a rate of 205 pilots monthly at the end of the year—a rate similar to that at the time of the armistice. In November the Government offered 1,000,000 lire in prizes for new designs for planes.

The Department of Aviation has six main objects in view:

1—To keep an up-to-date inventory of all aviation and replenish supplies as they are threatened with deterioration.

2—To supervise all civilian aviation by laws and by providing necessary assistance such as weather data, night flying facilities, etc.

3—To devise a plan to dispose abroad of all surplus equipment from Italian factories which can now produce 500 planes a month, and if necessary 750 a month after the first year.

4—To formulate a policy of awarding contracts for construction to the end that the industry may thrive and produce Italian planes equal to those of foreign makers.

5—To maintain strict contact with the industry so that the needs of the Government may be anticipated and provided for as occasion requires.

6—To establish air routes, as follows:

(a) Between Milan and Rome.
(b) Between Rome and Ancona.
(c) Between Rome and Brindisi.
(d) To help exploit a line between Rome and Constantinople to be operated by the Italian Aero-Express.

The important Italian banks are taking great interest in the development of commercial aviation. According to the *Critica* of March 8, 1924, a company named "Aero Espresso Italiana" has been organized at a capital of 1,000,000 lires. Among the subscribing

banks are: Banca Commerciale, Credito Italiano, Banca Nazionale di Credito, Lloyd Triestino and Credito Industriale (Venice).

In 1923 one manufacturer sold 100 airplanes to Soviet Russia and another sold 18 reconnaissance planes to Brazil. Air attaches are stationed at Washington, D. C., London, Paris and Berlin. Italian missions are training students in Jugo-Slavia and the countries of Central and South America.

French and English civil aviation promoters visiting Italy to secure concessions for proposed airlines to Rome were told by Premier Mussolini that any line entering Rome would be operated in part, at least, by Italian pilots, directors and mechanics employing Italian equipment.

JAPAN

Under the direction of the Government Japanese children are being taught the supreme value of aviation both in peace and in war. Schools send their weekly quota to the air stations, where they are guided about the factories and hangars, allowed to sit in the machines and familiarize themselves generally with the mechanism. This far sighted policy maintains public interest in aviation. In 1923 both the army and navy were equipped with relatively complete air units. Scout machines had been assigned to the principal battleships. Each army corps had its unit of pursuit, reconnaissance, and bombing planes. Some of the planes carry bombs as heavy as 1,500 pounds.

Seventeen British officers and 12 non-commissioned officers on leave of absence from the Royal Air Force spent three years in Japan helping to develop aircraft factories and special Japanese types of planes. Late in 1923, progress had been so rapid that all excepting eleven of the British mission were withdrawn.

Determined, however, to keep abreast of other Powers in the air, the Government kept several Japanese missions abroad. One of these missions visited the United States during the year. Another was assigned to France, where the Japanese Government had established a technical station close to the French technical station at Orly. Japan also employed French technicians to visit the United States and secure all information concerning late technical progress.

For the fiscal year 1922-1923, $16,200,000 was appropriated for the naval air service and $5,000,000 for the army air service. These sums do not represent total expenditures. The Department of Communications, Bureau of Education, the Imperial Aviation Society and the Imperial Police spend various sums on aviation development. In 1922 it was reported that for a period of 7 years, 1922-1929, Japan had set aside $200,000,000 for the promotion of aeronautics.

In 1923 the army had about 250 service planes, some of which

were pursuit types, British, French and German, including a few of the products from the new domestic factories. One of these, the Mitsubishi Aviation Works at Nagoya, launched its first battle plane, which has 40 feet wing spread, is powered with a 450 h.p. Napier-Lion (British) engine and carries several Lewis machine guns. The Government appropriated $400,000 for foreign air experts. The navy had 128 service planes during the year.

Twenty thousand dollars was spent on aviation meets during 1923. Early in the year the navy held its annual exercises, planes operating from the mother ship *"Hosho"* flew 1,700 miles in those maneuvers and were directed by radio communications. Under the arms limitations treaty the *"Amagi"* and *"Okagi"* were converted from battle cruisers into airplane carriers. During the earthquake the *"Amagi"* was so badly damaged that she was condemned to be scrapped. The *"Okagi"* was to be launched in 1924 and construction started on another carrier to replace the *"Amagi."* Those ships have a displacement of 27,500 tons. Each will accommodate 50 planes. The *"Hosho"* mother ship is also a carrier, accommodating 20 planes. The *"Hosho"* has a sister ship going into commission, known as the *"Ho Ka Ku."*

While the Government appropriations for the year aggregated $22,000,000, that amount was not sufficient for the expansion program outlined by Japan's aeronautical experts, who have not been slow to realize the tremendous importance of commercial aviation. In fact, it was their influence which had the Board of Aviation transferred from the Army to the Department of Commerce, a significant act in view of the program as outlined in the 1923 Aircraft Year Book.

Ten students were sent to the German Rohrbach factory in Copenhagen, Denmark, to study all-metal plane construction, with a view toward purchasing several large passenger carrying metal planes from that factory, planes capable of transporting 25 persons. An Astra type airship was purchased from the French.

Immediately following the earthquake Japanese planes flew low over the stricken areas, taking motion pictures and photographs of all salient points. These were returned to the authorities, with the result that they knew the extent of the damage and where to begin the task of re-establishing surface communications. At one period when fires were making observation impossible the planes flew over the district and officers helped direct the operations of dynamiting certain sections to prevent the flames spreading.

The Imperial Police which are held responsible for maintaining order among the warlike and half-civilized tribes on the Island of

Formosa have been using airplanes for some time. They have found that their duties can be performed more economically by planes than by surface facilities.

An interesting experiment was carried on in 1923. The newspaper *"Asahi"* published in Tokio and Osaka, organized an air mail service with the support of the War Department which granted a subsidy of 15,000 yen. Twenty flights were made in January between the two cities, a distance of 500 kilometers; 16 in February and 16 in March. Nine planes were used the first month, and six thereafter. They made one stop at Nigatagahara. The Imperial Aviation Society gave prizes of 3,000 yen for each round trip completed. Their service had a record of 89 per cent. efficiency during the three months.

The Army proposed to use all-metal planes in 1924 to extend the air mail service to the following projected routes: Tokorozawa-Kagamigahara; Kagamigahara-Tachiarai; Kyashu-Tachiarai; Heijo-Korea. The Japanese Aerial Transport Company operates an intermittent service between Osaka and the Island of Shikoku. Four German Junker all-metal planes are used. Freight and newspapers are carried, the trip requiring 1½ hours.

A syndicate has asked for a subsidy of $25,000,000 to establish the Tokio-Fukuoka air route. In June, 1923, the Osaka-Beppu Airways were started, the first test flight being made in 6 hours by one Junker and 2 Japanese planes. Another company has asked the Government for a subsidy of $6,000,000 annually for a line to be established between Tokio, Osaka and Yokahama.

Jugo-Slavia

France in 1923 extended the Government credit for the purchase of 150 airplanes from French manufacturers. French pilots are instructing military aviators.

Latvia

While aviation in Latvia as well as other Baltic States has been of a military nature since the armistice, a certain impetus has been given commercial flying by German concerns. In two years air lines were established between Riga, Memel and Koenigsberg and between Riga, Reval and Helsingfors. Another line is planned between Riga, Revel and Petrograd.

Lithuania

Under Air Marshal Krancevicius, the Lithuanian air service has 100 service planes, mostly British and Dutch. The Government pro-

duced a new military plane in 1923, known as the Dobkevicius, a two-place monoplane with 200 h.p. Benz (German) engine.

Malta (British)

Two squadrons of the Royal Air Force are maintained at the air station in Malta.

Mexico

In December, 1923, President Obregon sent three airplanes against the rebels fortified in Puebla. Light bombs were dropped, which so disorganized the defenders that the federal troops were able to take the city. The Government then purchased quantities of aviation supplies in the United States. The budget of the War Department for 1924 contained a large item for the purchase of new airplanes. The Government has an airplane factory at Balbuena with a production capacity of five planes a month. Both French and German companies have had missions in Mexico, where they made many pioneering flights. There are said to be 100 airplanes in the country. General Salinas, chief of aviation, is reported to be planning to use planes in mapping various inaccessible regions of the Republic. Three seaplane bases were to be established on the West Coast. Sixteen landing fields have been established since 1920.

Netherlands

The Royal Dutch Air Traffic Company, organized with Government assistance in October, 1919, opened its first passenger service in May, 1920, between Amsterdam and London. A mail service to England was added in July of that year. In September that year the Amsterdam-Hamburg-Copenhagen line was opened, at first for tests and later on schedule. In 1922 the Bremen-Hamburg line was opened. From June, 1922, the company operated the Amsterdam-Brussels service and in June, 1923, a direct service to Paris was started. The London route was extended to Manchester, England. Fokker planes are used throughout the service, some of them powered with American Liberty and others with British engines.

Government appropriations for military aviation in the 1924 budget aggregated 2,860,630 florins of which 1,700,350 florins were for maintenance and new equipment. Fifteen training planes were to be purchased, 10 combat planes and 12 scouting planes. The Transport company receives a subsidy of 400,000 florins annually in 1923 and in 1924; and 300,000 florins in 1925 and 1926.

An air conference to discuss European civil air routes was opened at the Hague in November. Great Britain, Germany, Denmark, Holland, Norway and Sweden were represented. The civilian

industry now centers about the Fokker plant which has supplied numbers of airplanes to Russia. The plant has a capacity of producing 300 airplanes at a time.

During the season of 1923 the Transport Company carried 2,996 passengers, thrice the number carried in 1922; and 98,925 kilograms of merchandise compared with 62,889 kilos the previous year. There were no accidents. Fares from Rotterdam to Amsterdam were reduced from $28.50 to $18.75; and from Rotterdam to Brussels from $13.30 to $8.77.

Six Fokker metal flying boats were produced for use in the Dutch colonies. The Dutch East Indies Military air service ordered 15 scout planes late in the year. There are now 14 military planes in Java. The Government has a committee investigating a projected air route to the Dutch East Indies, a route of 15,000 kilometers extending via Budapest, Constantinople, Aleppo, Bunder Abbas, Karachi, Calcutta, Rangoon, Bangkok, Medan, Padand and Batavia.

New Zealand (British)

New Zealand organized her territorial air force in 1923, establishing a key airdrome at Tamaki, West Aukland. The Government also purchased the land and equipment of a private company at Christchurch, and will use it as a training depot. The New Zealand flying school and the New Zealand Aero Transport Company carried about 2,000 passengers during the year.

Norway

In May, 1923, the Government signed a supplemental agreement with Great Britain to promote aviation. The company formed to conduct an air mail passenger and freight service between Christiania, Gothenburg, Sweden; and Copenhagen, Denmark; plans to use all metal planes and employ Norwegians. Representatives of the Government were conferring with British companies on plans to start a similar line between Christiania and England, by way of Holland.

Palestine (British)

The Royal Air Force maintains a small station at Jerusalem which is connected by air routes between Cairo and Bagdad.

Panama

The importance of creating a well equipped airway from the United States to the Canal Zone is obvious. Plans for such a route, as an important part of the defense system of the Canal, have been held up for more than two years because of severed diplomatic relations with Mexico. Now that the Mexican government has been

recognized, it is said in Washington to have indicated its willingness to permit American planes to fly over that country and that it would favorably consider the establishment of an air mail service between the United States and Mexico City.

The recognition of the Obregon Government has caused the Post Office and War Departments to study the possibilities of such a route. The War Department plans will be undertaken with great earnestness, while American business men are urging the Post Office to cement better feeling by perfecting an air mail service. The expense of such a service, Post Office officials say, however, would be so great as to make it doubtful whether Congress would favor it.

In mapping out plans for an air route from the United States to Panama, three possible courses have been considered. The first of these, and the one which is regarded by experts as the most desirable, is the Central route, leading from Kelly Field, San Antonio, Texas, to Laredo, and through the central part of Mexico, following in general the line of the railway. This route not only has the advantage of being the shortest, with stops at some of the most important cities of the Southern Republic, but it also would afford a number of good landing places. As a matter of fact, landing fields already have been established at some points along this route by the Mexican authorities.

The second route is along the eastern coast of Mexico and the Gulf, with a flight across the Yucatan Peninsula. This route has the advantage of being much shorter than that followed by Capt. Thomas G. Lanphier, A.S., in charge of a squadron of six DH-4-B's last April, when they flew from San Antonio, Texas, via Florida, Cuba, Haiti, San Domingo and Porto Rico. While this expedition did not attempt to complete the flight from Porto Rico to the Panama Canal, Army Air Service experts were confident that the distance could be easily negotiated. The third route suggested is from San Diego, California, along the West Coast of Mexico. It is open to the slight objection of being somewhat rough and mountainous in places, especially along the coast of Lower California, but air experts say it is entirely practicable.

Paraguay

During the year airplanes were used to explore the route of the projected railway between Brazil and Paraguay.

Peru

In 1923 the Peruvian air force numbered 27 planes purchased from Americans, British, French and Italians. One of the features of the celebration commemorating the Battle of Tarapaca, held

November 28, 1923, was the formal opening of the Chavez, named in honor of the noted Peruvian aviator who first flew the Andes mountains. Elmer J. Faucett has established an aviation service at Bella Vista, Peru, using Curtiss *"Orioles."*

Poland

During the year an air service was established between Warsaw and Cracow, planes leaving Warsaw thrice weekly. The Franco-Roumanian company operates the Paris-Warsaw line via Prague. It receives a subsidy from the Polish Government. Late in the year the Polish Aero-Lloyd, operating between Warsaw and Cracow, lost all its equipment in a fire which also destroyed the hangars. The French Government had an aviation mission in Poland, where the Government placed orders for 100 French planes. French manufacturers and French aviators are practically in charge of the organization of the Polish Air Force.

Porto Rico (United States)

Aeromarine Airways operated a flying boat service out of San Juan, Porto Rico.

Portugal

The Government projected around the world flight for 1924. The air force of Angola Province had a field at Huambo, using from 20 to 30 French planes.

Roumania

The Roumanian air force has 240 officers and 5,000 men. The Director of Civil Aviation is a graduate of a French engineering school. The first plane designed in Roumania was completed during the year. Appropriations for 1923 totalled 80,000,000 lei, of which 18,000,000 were for construction of new equipment and 30,000,000 for commercial subsidies. A British mission gave several demonstrations in Roumania in 1923. Early in 1924 the War Department asked for bids from American concerns and others for aircraft. The Franco-Roumanian company operated the principal passenger and mail service out of Paris eastward. During the year the company's planes made 1,191 flights over a total distance of 628,900 kilometers, in 4,915 hours of flying time. The company's Paris-Constantinople branch booked 672 passengers, 3,121 kilograms of mail, and 6,018 kilograms of merchandise.

Russia

The Government made every possible effort in 1923 to build up its air fleet. Minister of War Trotsky in the official Soviet organ the *Pravda* said:

"The Soviet Air Fleet will not only protect our liberty, but perhaps help the 'colonies' to emancipate themselves. Let us construct airplanes for the oppressed; let us make aviation part of the country's daily life. Aviation is not an amusement, but the great instrument of the future. Aviation is now Imperialism's weapon. We must popularize flying among the masses."

Trotsky's appeal was in behalf of "Air Fleet Week" in May. He announced that the Soviet intended to build up its force until it had 5,000 first class airplanes ready for any emergency. The public was asked to contribute generously. Lectures were read in the schools. Flying demonstrations were held throughout the country. The result was not as great as Soviet officials expected; but it was productive of certain sums of money, sufficient to enable the Soviet to increase their orders with foreign nations. Orders were placed in England, France, Italy, Germany and Holland.

It was reported that several hundred planes were ordered from Fokker in Holland; and possibly a hundred or more flown from the Netherlands to Moscow for delivery. Junkers and Dornier-Zeppelin in Germany delivered 50 planes each during the year; and had orders for as many more. A hundred planes were purchased from Italian manufacturers. Fifty-four Hanriot school machines were bought in France; and orders placed for 100 military and 50 new commercial craft. The company handling England's surplus war stock sold many old planes to Soviet officials.

During the year air lines were established as follows: a branch of the Moscow-Koenigsberg line extended to Riga, under joint operation by Junkers and the Soviet. Moscow-Rostov and Tiflis, operated by the Bureau of Posts and Telegraphs, Moscow-Baku and other points.

The Government planned to establish these new routes in 1924: Moscow-Tashkent-Bukhara. Moscow-Teheran, Persia; Petrograd-Riga, via Reval; Moscow-Chita; Petrograd-Stockholm. The majority of the proposed lines were to be operated by the Trans-Europa Air Union of which Dr. Junkers is the head.

During the year the Government endeavored to improve its military force and no doubt did improve it to considerable extent. Civil aviation schools were being organized, along with those of military character. The Red Air Fleet in July possessed about 500 planes, 60 per cent. of them scout machines and 40 per cent. training, reconnaissance and bombardment types. The equipment included Sopwith, Farman, Voisin, DH-4's, and DH-9 and DH-11, powered with American Liberty engines. Ninety per cent. of those planes were obsolescent, having been in use since or during the war. The other types included Nieuport, and the Russian built machines Dux, Stchetinin, Lebedev, Moskva. There were also 45 other serviceable

planes at Moscow and 18 others without engines. There was a detachment of 12 seaplanes and a squadron of 10 large *"Ilya Murmetz"* machines intended for commercial air routes.

A later Soviet program contemplated 1,150 fighting machines and reserves by January, 1924, and for 2,000 active and 250 reserves by January, 1925.

Facilities provided by the Government for commercial flying during the year included a central airdrome at Moscow which was fitted with wooden hangars, signal equipment, etc., under the direction of the Chief of the Red Air Fleet. Aidromes were also being prepared at Petrograd, Smolensk, Kharkov, Kiev, Odessa, Simferopol, Rostov, Tiflis and Tashkent. In July, 1923, training schools for the Red Air Fleet included the Moscow Aviation School, Theoretical School for Pilots at Yegorevsk in Riazan Province, First Military School for Pilots in Sevastopol, Second Military School for Pilots in Tambov Province, First Senior School for Pilots at Moscow, Second Senior School for Pilots at Lipetsk, Trotsky Naval Aviation School at Sevastopol, Senior School for Aerial Gunnery and Bomb Dropping at Serpokkov, Senior School for Observers at Petrograd, Senior School for Ballooning at Velkovo Polyo, Petrograd, Military Technical School of the Red Air Fleet at Petrograd; Senior School for Pilot-Aeronauts, near Moscow. The total number of students attending these schools in 1923 was said to be 1,500. In addition there are aviation sport centers in the military districts intended for preconscript training of young men. The Government supplies these centers with airplanes, equipment and instructors.

There were six airplane factories in Russia, including the State Aviation Works "Ikar" at Moscow, which was making spare parts for certain French engines and the American Liberty motor, the State Aviation Works No. 4 "Motor" at Moscow which repairs all Russian machines; State Aviation Factory No. 5 at Moscow for making spare parts and repairing machines; the State Aviation Factory "Dux" at Moscow, repairing all British machines; State Aviation Factory "Avio-Rabotnick" at Petrograd, and State Aviation Factory "Krasny Letchik" at Petrograd, those last named two repairing and manufacturing parts for the *"Ilya Murmetz"* types of planes. In some instances German technicians aided in the management of the works. The "Dux" Factory had a capacity of ten planes a month. The Soviet has a system of air laws, modelled after the English system. Military craft of the Red Air Fleet carry a great five-pointed red star on the wings. The German Company known as Dietrich-Gobiet have established a commercial line with a branch factory at Odessa. The plan to operate a commercial line from

Sweden to Persia by way of Moscow was in charge of Dr. Junkers and the Trans-Europa Union. The "Dobroljot," the abbreviated name for the Russian company charged with creating commercial aerial fleets, was thought to be 100 per cent. Russian. It was using Junkers planes in test flights, among them a survey of the route between Petrograd and Vladivostok.

The "Dobroljot" is conducting extensive propaganda in all cities to raise funds for creating lines and buying new planes. The company when first organized in June, 1923, 90 per cent. of the initial stock had been subscribed and the company was later authorized to increase its capitalization to 5,000,000 gold rubles. The "Dobroljot" plans to establish six lines at first, the one to Vladivostok, three toward Central Asia and two lines toward the Kirghize Republic. The line from Moscow to Novgorod was opened in July with two Junker and two English machines. The line from Odessa to Kharkow was opened in August.

Within a few days after the Russian mission to France had formally accepted the Hanriot school machines after tests at Orly, Paris, French police arrested three Russians, two men and a woman, working in a French airplane factory. It was claimed that many designs had been found in their rooms. The woman was arrested as she left the factory carrying a score or more of plans of the latest French types. Prior to that a Russian had tried to buy a set of Nieuport plans from a designer in that factory.

Russian and German designers were said to be collaborating in the design of a troop carrier accommodating 30 passengers. The machine was to be of all-metal construction. Another all-metal type was being planned, a tremendous flying boat to have three hulls, and weight, fully loaded, more than a thousand tons. The power plant was to consist of four units of Junkers semi-Deisel engines, giving the plane a speed of 100 miles an hour. Reports from Germany would seem to substantiate these statements.

Russia spent 36,000,000 gold rubles (about $18,540,000) in 1923 on her entire aviation program. The Red Air Fleet is divided into squadrons, of which there were twelve fully equipped in 1923. The 1924 program was for 40 squadrons each having 36 planes. The Soviet construction program centers about Moscow, with large orders placed in the Netherlands and Germany.

The Koenigsberg-Smolensk-Moscow line reporting for 1923 stated that it had made 160 regular flights, and 110 exhibition flights, covering a total mileage of 212,000 kilometers. It carried 651 passengers and 54.3 tons of freight, with one minor accident. Six flights were delayed for a few hours, one to lack of fuel because

of strong headwinds, three to fog and two to the arrest of planes by the Lithuanian authorities at Kovno. The reports state that Lithuanian and Latvian authorities obstruct the line in every possible way, forcing the machines to fly one leg of 510 kilometers, from Smolensk to Koenigsberg without landing. Intermediate stations are being laid out at Polotz. The line completed the season of 1923 with 12 of its 13 planes in perfect working order.

San Salvador

In May, 1923, the Government promulgated regulations whereby all aviation of a civil nature should be regulated by the Minister of War.

Siam

Siam provides a remarkable example of the adoption by the East of Western ideas of progress, as related to aviation. Flying was introduced in 1911. The aviation corps was established in 1913. After the war this was reconstituted as the Royal Aeronautical Service. Following instruction of Siamese pilots in France, the French manufacturers equipped the Siamese Aeronautical Service. A scheme of landing fields has been devised, with particular reference to the commercial centers and political needs. Eighteen such airdromes have been completed and seven more are being built. A weekly air mail service is operated between Korat, Roi Ech and Ubon.

Between July, 1922, and January, 1923, 47,258 letters, 33,497 papers and 1,597 parcels were carried. Appropriations in 1922-1923 were 1,600,000 ticals (about £160,000), and for 1923-1924, 2,200,000 ticals.

South Africa (British)

An air service for passengers has been started between Cape Town and Johannesburg. Another service from Pretoria and Durban was in preparation. Royal Air Force planes have flown from Cape Town to Pretoria, a distance of 1,000 miles, in 10 hrs. and 5 min. as against 36 hrs. by train.

Spain

The American consul at Madrid, in a report to the Department of Commerce, has the following to say of the much-announced Seville-Buenos Aires airship service:

"The proposition is yet in a purely formative stage. All Spanish entities at all interested, have expressed the most entire approval of the scheme but up to the present no funds have been appropriated. Major Emilio Herrera, of the Engineer's Corps, Spanish Army, is the father of the project. The

only actual accomplishment is the contract for a landing field at Seville and a number of interviews with the Luftschiffbau-Zeppelin people at Friedrichshafen. These latter are apparently unwilling to go into the thing until they see where the money is coming from, as well as a completed study of the technical aspects."

A royal decree of October 4 authorized the appointment of a commission to study possibilities of co-ordinating military, naval and civil aeronautics. This commission has recommended that officials from military, naval and civil branches meet with delegates of the Spanish aeronautic industry and of companies having aeronautic concessions, to study possibilities of forming a financial group which will assure the manufacture of aviation material in Spain. This recommendation followed the purchase by the Government of 126 planes and engines from France and England.

The experimental expedition for studying the practicability of establishing commercial air service of 1,618 km. between continental Spain and the Canary Islands was successfully completed on January 18, 1924, when three biplanes and one hydroairplane arrived in Las Palmas over the Cadiz-Larache-Casablanca-Agadir-Cape Juby route. The total flying time was only about thirteen and one-half hours.

The Penya del Aire Company of Barcelona in the 8 months since its formation, has organized an International Aerial Photography Exhibition (the first in Spain), a poster competition to advertise the circular flight round Catalonia, flying meetings at Vich, Figueras, Sitges, Villafranca and other towns, and also a big meet at the Prat del Hobregat airdrome.

The only commercial air line out of Seville is heavily subsidized. It carries mail and passengers between Seville and Larache, Morocco, the route being over Jerez, Tarifa, and Tangier. Daily round trip flights are made in De Haviland planes with British and Spanish flyers. Passenger rates are 200 pesetas each way or 300 pesetas round trip. In 500 round trip flights only one accident has occurred. The Spanish government subsidy of 3,000 pesetas per round trip enables this company to operate, passengers being few and mail negligible.

Appropriations in 1922-1923 totalled 48,569,630 pesetas ($7,456,000), of which $235,000 was for mail subsidies.

Sweden

The exposition at Gothenburg provided an incentive to Swedish aviation. The Svenska Lufttrafik Aktiebolaget (Swedish Aerial Navigation Company) has operated trial service between Malmo, Copenhagen, Warnemunde, Berlin and Hamburg. The company is

capitalized at a million crowns. Further operations await a government subsidy. The new Government airdrome has been opened at Stockholm. Appropriations in 1922 for military purposes and material alone amounted to 821,200 kr. Early in 1924, the Rigsdag considered the problem of defense. The Conservatives, citing the example of Bolshevik Russia, urged that special emphasis be laid upon the air.

Switzerland

There are 60 fighting planes and 160 reconnaissance planes in the Air Force.

Air appropriations in 1922-1923 totalled 4,322,000 fr. The Society Ad-Astra Aero, Zurich, in 1921-1922 received a subsidy of 6,500,000 marks from the German Government. The Society also receives a subsidy of 450 Swiss fr. for each completed flight between Geneva and Munich.

The following notes on Air Mail in Switzerland come from a bulletin of the German Department of Air and Transportation: On April 30th, 1919, Air Mail service was begun between Zurich and Lausanne. This was operated up to October 31st of that year; in 1922, the Swiss established an Air Mail line between Geneva and Nurnberg; in 1923 there was a considerable development in the use of the Air Mail between Geneva and Munich and Geneva and Paris. The Swiss Post Office has Air Mail agreements covering transportation out of the country. In 1920 the service from Strassbourg to Prague with an extra charge of 3 francs per letter, was not much used. In 1922, 763 pieces of mail were sent from Switzerland to points outside via Air Mail; and in 1923, 2,471 pieces. In 1920, 247 pieces were sent from Switzerland over the Toulouse-Casablanca Air Line and in 1921, 726. In 1922, 4,300 pieces of mail were sent from Switzerland over the Paris-London air route. In addition there were also heavy shipments to Russia and the Cairo-Bagdad Air Line.

The first plane of the Handley Page Transport Company, Limited, on the London-Paris-Basle-Zurich Air Line reached Basle on August 15, 1923, carrying passengers and mail. Thereafter regular flights were to be made three times a week.

CHAPTER XVI

CHRONOLOGY OF AERONAUTICAL EVENTS DURING 1923

1 Km.= ..... 0.621 mile
1 Kilo= ..... 2.20 lbs.

(See Amplification at End of Chronology.)

Jan. 5 — Prof. W. D. Bancroft of Cornell University and Air Service pilots make artificial rain over McCook Field, Dayton, O.

Jan. 9 — Losing vertical control at 1,000 feet, Lt. James L. Grisham, U.S.A.S., brings Bomber safely to earth by using adjustable stabilizer and turning on and shutting off the engines.

Jan. 29 — Alexis Manyrol in Peyret Glider makes record flight at Vauville, France, 8 hrs. 4 min. 50.4 sec.

Feb. 1 — Mackay Trophy for outstanding flight of 1922 awarded to Lts. J. A. Macready and Oakley G. Kelly, U.S.A.S., for record endurance flight of 35 hrs. 18 min. in 1922.

Feb. 1 — Collier Aeronautical Trophy for 1922 awarded to Air Mail Service for greatest achievement that year.

Feb. 6 — New Army Airship *D-2* makes successful test flight at Scott Field, Ill.

Feb. 7 — E. Descamps in Dewoitine Glider makes record altitude gliding flight 1,787.6 ft. at Biskra, Algeria.

Feb. 8 — Walter Hinton and others arrive at Rio de Janeiro, Brazil, from New York, 5,880 miles, in 100 hrs. 21 min. flying time.

Feb. 9 — Army airplane carried surgeon to woodsman seriously injured in log jam on Beaver Island, Mich.

Feb. 15 — Sadi Lecointe in Nieuport Delage Sesquiplane makes speed record, 234⅔ m.p.h. at Marseilles, France.

Feb. 21 — De Bothezat helicopter remains in air 2 min. 45 sec. at McCook Field, Dayton, O.

Mar. 1 — Goodyear Tire and Rubber Company delivers to Army Air Service *TC-1*, largest American non-rigid dirigible.

Mar. 1 — Brig. Gen. Wm. Mitchell, Assistant Chief of Air Service, completes 5,000 mi. inspection trip by airplane.

Mar. 3 — Six Army airplanes in command of Capt. Thomas G. Lamphier, U.S.A.S., leaves San Antonio, Tex., for a flight to San Juan, Porto Rico, and return.

Mar. 8 — Lt. Frank W. Seifert, U.S.A.S., Rockwell Field, San Diego, Cal., with Russell M. Otis, meteorologist, in a DH-4-B airplane, reaches an altitude of 19,000 ft. while taking lunar radiation observations.

Mar. 8 — Lawrence B. Sperry in Sperry *"Messenger"* plane makes contact with Army DH machine, at Mitchel Field, N. Y.

Mar. 10 — New type of Pony Blimp, the *A-5*, with Maj. H. A. Strauss, U.S.A.S., as pilot, makes non-stop flight from Dayton, O., to Belleville, Ill., 350 miles, in 9 hrs.

Mar. 26 Lt. R. Maughan, U.S.A.S., flies 1 km. at 236.587 m.p.h. in Curtiss-Army Racer at McCook Field, Dayton, O.

Mar. 29 Lt. Alexander Pearson, U.S.A.S., makes record 500 km. flight, 167.8 m.p.h. in Verville-Sperry, with Wright 350 h.p. engine, at McCook Field, Dayton, O.

Mar. 29 Lt. L. J. Maitland, U.S.A.S., at McCook Field, makes record speed flight in Army-Curtiss Racer, 239.95 m.p.h.

Mar. 29 Lt. H. R. Harris, U.S.A.S., in *DH-4-B* at Dayton, O., establishes world record for 1,000 km., 127.4 m.p.h. Harris also sets record of 114.35 m.p.h. for 1,500 km.

Apr. 2 Wright Aeronautical Corporation all-metal pursuit monoplane, Wright *H-3*, 400 h.p. engine, makes initial flight at Curtiss Field

Apr. 3 The six U. S. Army Air Service DH planes which started from San Antonio for Porto Rico March 3rd, land at Bolling Field, D. C., one month later, accomplishing one of the most remarkable flights in the history of American aviation—6,000 mi. Only one minor accident occurred during this long journey.

Apr. 3 Phi Delta Kappa fraternity erects memorial to Wright Brothers at city of Newcastle, Ind.

Apr. 16-17 Lts. John A. Macready and Oakley C. Kelly, U.S.A.S., in Army *T-2* Fokker, Liberty 400 h.p. engine, make duration record 36 hrs. 4 min. 34 sec. at McCook Field, Dayton, O. In this flight also make speed records for 2,500 km. (71.83 m.p.h.), 3,000 km. (71.62 m.p.h.), 3,500 and 4,000 km. (70.79 m.p.h.).

Apr. 17 Lt. Rutledge Irvine, U.S.N., makes record weight carrying altitude flight, 2,422 lbs. to 11,609 ft. over Dayton, O.

Apr. 17 Lt. H. R. Harris and Ralph Lockwood, U.S.A.S., make record 2,000 km. flight, 114.22 m.p.h. in *DH-4*, with Liberty 400 h.p. engine at McCook Field, Dayton, O.

Apr. 19 U. S. Navy Bureau of Aeronautics develops portable mooring mast 115 ft. high for rigid airships.

Apr. 19 Eleven persons marooned and reported starving on South Fox Island, 20 miles off Northport, Mich., afforded relief by Army and civilian pilots carrying food and clothing.

Apr. 20 Record for speed for dirigibles established by Army Airship *TC-1*, flying 148 miles,, Scott Field, Ill., to Chanute Field, Ill., in two hours.

Apr. 20 Nine seaplane scouts of Atlantic Fleet arrive at Hampton Roads, Va., after 7,000 mi. cruise to Panama Canal Zone.

Apr. 26 Ordnance Department, U.S.A., conducts night bombing tests at Aberdeen Proving Grounds, dropping ten 50 lb. bombs from 8,000 ft. altiude.

May 1 Wright Aeronautical Corporation starts construction of airplanes.

May 1 U. S. Navy Bureau of Aeronautics develops smoke screen for seaplanes.

May 1 London-Berlin commercial air line opened.

May 1 Ability of airplane to render prompt aid in emergency demonstrated in Chiriqui, Panama, when a woman who was accidentally shot was carried to the Canal Zone hospital.

May 2 Non-rigid airship *AC-1* flies 800 miles, Langley Field, Va., to Scott Field, Ill., in 17 hrs. 24 min., non-stop.

May 2 — U. S. Army Air Service and Department of Agriculture sow seeds from airplanes in Hawaii.

May 2-3 — Lts. J. A. Macready and Oakley Kelly, U.S.A.S., make record non-stop flight, New York to San Diego, Cal., 2,516.35 mi., in 26 hrs. 50 min., in Army *T-2* Fokker transport, Liberty 400 h.p. engine.

May 14 — Lt. Chas B. Austin, U.S.A.S., pilots Loening Air Yacht 300 miles, Mitchel Field, L. I., New York, to Langley Field, Va., in 2½ hrs., or a speed of 120 m.p.h.

May 15 — U.S. Air Mail Service completes fifth year of operations.

May 17 — Maj. Thomas Scott Baldwin, one of earliest pioneers in world of aeronautics, originator of the parachute and the first man in the United States to descend in a parachute from a balloon, died at Buffalo, N. Y. Aged 69.

May 26 — Lt. H. G. Crocker, U.S.A.S. makes non-stop flight from Gulf of Mexico to Canadian border, 1,200 miles, in 11 hrs. 55 min.

May 31 — Army airship *TC-2* makes 6½ hr. night flight.

June 1 — Aeromarine Airways extends West Indies operations to Porto Rico out of San Juan.

June 1 — North Seattle harbor patrol adopts seaplanes for rescue work.

*June 4 — Two Army Air Service Martin Bombers transport two bales of cotton from Augusta, Ga., to New Bedford, Mass., 1,000 mi. in 10 hrs. 15 min.

June 6 — Lt. M. A. Schur, U.S.N., makes world speed record (72 m.p.h.) for seaplane flight of 500 km. in Douglas, at San Diego, Cal. Schur also establishes world seaplane speed record of 70.49 m.p.h. for 1,000 km.

June 6 — Lt. H. T. Stanley, U.S.N., at San Diego, makes world duration record of 10 hrs. 23 min. 58 sec. for seaplane carrying useful load of 250 kilos. Stanley also makes world distance record for seaplane carrying 250 kilos, 574.75 mi.

June 6 — Lt. H. E. Halland, U.S.N., at San Diego, makes world duration record of 7 hrs. 35 min. 54 sec. for seaplane carrying 500 kilos useful load. Halland also makes world distance record of 466 mi. for seaplane carrying 500 kilos.

June 6 — Lt. R. L. Fuller, U.S.N., at San Diego, makes world duration record of 2 hrs. 45 min. .9 sec. for seaplane carrying 1,000 kilos useful load. Fuller also makes world distance record of 205.2 mi. for seaplane carrying 1,000 kilos useful load.

June 7 — Lt. E. B. Brix, U.S.N., at San Diego, makes world altitude record of 10,850 ft. for seaplane carrying 250 kilos useful load.

June 7 — Lt. Fuller, as above, makes world altitude record of 8,438 ft. for seaplane carrying 500 kilos useful load.

June 7 — Lt. E. E. Dolecek, U.S.N., at San Diego, makes world altitude record of 7,979 ft. for seaplane carrying 1,000 kilos useful load.

June 7 — Lt. Stanley, as above, makes world duration record of 2 hrs. 18 min. for seaplane carrying 1,500 kilos useful load. Stanley also makes world altitude record of 5,682 ft. for seaplane carrying 1,500 kilos useful load.

June 7 — Lt. Halland, as above, makes world duration record of 51 min. for seaplane carrying 2,000 kilos useful load. Halland also makes world altitude record of 4,885 ft. for seaplane carrying 2,000 kilos useful load.

June 7 — Lt. C. F. Harper, U.S.N., makes seaplane altitude world record in Douglas plane, Liberty 400 h.p. engine, 13,898 ft. over San Diego, Cal.

June 12 — Lt. M. A. Schur, U.S.N., makes duration seaplane flight, 11 hrs. 16 min. 59 sec. at San Diego, Cal. Schur also makes distance seaplane record of 792.25 miles.

June 13 — Lt. R. A. Ofstie, U.S.N., at San Diego, in TS seaplane, Wright *J-1*, 275 h.p., makes world speed records of 121.95 m.p.h. for 100 km. and 121.14 m.p.h. for 200 km.

June 23 — Lt. Longton in Sopwith GNU plane wins Grosvenor Challenge Cup race in England.

June 25 — First International Air Congress opens in London, England; 450 delegates from 17 nations attend.

June 25 — U. S. Army Air Service plane piloted by Lt. Lowell H. Smith refueled in flight over San Diego, Cal.

June 26 — Maj. Gen. Mason M. Patrick, Chief of Air Service, at the age of 60, receives "wings" as qualified military airplane pilot.

June 27 — New York-Newport Air Service opens with 3 Loening Air Yachts.

June 30 — Zdenke Lhota of Czecho-Slovakia wins Belgium commercial plane competition in Avia *BH-5* monoplane, Anzoni 70 h.p. engine.

July 1 — Airships Incorporated, of Hammondsport, N. Y., launches twin engined blimp NOMB, at Dayton, O.

July 1 — Air Mail service started between New Orleans and Pilottown, La.

July 4 — Lt. Robert S. Olmstead, U.S.A.S., wins National Balloon races from Indianapolis to Marilla, N. Y., 449.5 mi.

July 5 — Mrs. Bertha Horchem, of Ranson, Kan., makes record altitude flight for women, 16,300 ft. over St. Louis, Mo.

July 6 — Wesley L. Smith in Curtiss Oriole leads fleet of planes with Dempsey-Gibbons fight pictures, Shelby, Mont., to New York, 2,040 mi. in 40 hrs.

July 10 — Dedication Wold-Chamberlain Twin Cities Airport, Minneapolis-St. Paul. Ninety aircraft participate.

July 14 — Frank T. Courtney wins King's Cup race at London, England, in Siddeley Siskin pursuit plane *"Jaguar,"* 325 h.p. engine, 800 mi. in 5 hrs. 25 min. 20 sec. flying time.

July 15 — Lucien Coupet wins light plane race at Paris, in Farman machine with Salmson 15 h.p. engine.

July 19 — Lt. R. L. Maughan, U.S.A.S., in Curtiss Army pursuit plane flies from Mitchel Field, L. I., N. Y., to Rock Springs, Wyo., 1,930 mi. in 15 hrs. elapsed time.

July 26 — Eddie Stinson in *JL-6* monoplane and two passengers makes non-stop all night flight from Chicago to New York, 750 mi. in 8 hrs. 31 min.

Aug. 1 — Airplane transport mine rescue apparatus and crews from Birmingham to Carbon Hill, Ala., 60 mi. in 46 min.

Aug. 1 — New York City photographed from the air by Fairchild Aerial Camera Corporation.

Aug. 4 — International Flying Exposition opened at Gothenburg, Sweden.

Aug. 6 — Lawrence L. Carter wins Eighth English Aerial Derby at 192.4

	m.p.h. over 200 mi. course in Gloster plane, *"Napier Lion,"* 450 h.p. engine.
Aug. 7	Airplane forest fire patrol started over timber tracts in northern Idaho.
Aug. 21-25	U. S. Air Mail Service conducts successful night flying tests between Chicago and Cheyenne, Wyo., flying 7,500 mi. at night.
Aug. 22	U. S. Air Service tests Barling Bomber, world's largest airplane, at McCook Field, Dayton, O.
Aug. 23	Lts. A. W. Stevens and J. A. Macready, U.S.A.S., fly 8,000 mi. and take 1,700 aerial photographs over Western states.
Aug. 25	Alexis Manyrol at Vauville, France, makes light plane record in Peyret machine.
Aug. 27-28	Lts. Lowell H. Smith and J. P. Richter, U.S.A.S., make world record endurance flight 37 hrs. 15 min. 14 sec. over Rockwell Field, San Diego, Cal., refueling D.H. plane in air. On this flight Smith and Richter also establish world records for 5,300 km. (3,293.26 mi.); and world speed records as follows: 100 km., 87.59 m.p.h.; 200 km., 88.41 m.p.h.; 500 km., 89.15 m.p.h.; 1,000 km., 89.82 m.p.h.; 2,000 km., 89.48 m.p.h.; 2,500 km., 88.72 m.p.h.; 3,000 km., 88.15 m.p.h.; 3,500 km., 88.34 m.p.h.; 4,000 km., 88.23 m.p.h.; 4,500 km., 88.45 m.p.h.; 5,000 km., 88.55 m.p.h.
Sept. 4	U. S. Navy rigid airship *"Shenandoah"* launched at Lakehurst, N. J. Naval Air Station, using helium gas for first time in rigids.
*Sept. 5	U. S. Army Air Service planes bomb battleships "Virginia" and "New Jersey" off Cape Hatteras. "New Jersey" sunk in 7½ min. by bombs dropped at 6,000 ft. altitude. The "Virginia" sank in 4 min.
Sept. 5	French dirigible *"Dixmude"* flies 4,500 mi. in record endurance flight, in 118 hrs. 41 min.
Sept. 6	A unique cross-country flight, McCook Field, Dayton, O., to Boston, Mass., made by Lt. Albert F. Hegenberger, pilot, and Bradley Jones, navigation engineer, the greater part of the aerial journey being made completely out of sight of land, due to heavy fogs. Ship was flown at 10,000 ft., navigation instruments being used entirely.
Sept. 8	Boston, Mass., airport dedicated.
Sept. 10	Sixteen Naval planes flying at 16,000 ft. altitude used at San Diego to obtain photographs of total eclipse of sun.
Sept. 11	U. S. S. airship *"Shenandoah"* visits New York.
Sept. 23	Start of International Balloon Race for Gordon-Bennett Cup from Brussels, Belgium. Won by Lt. Demuyter, of Belgium, 1,155 km. in 21 hrs.
Sept. 23-30	French rigid airship *"Dixmude"* makes duration flight of 118 hrs. 14 min. in France.
*Sept. 28	Lt. David Rittenhouse, U.S.N., wins Schneider Cup Race for seaplanes at Isle of Wight, England, at 177.38 m.p.h. in Curtiss-Navy Racer with Curtiss D-12, 460 h.p. engine; world record for 100 and 200 km. Lt. Rutledge Irvine, U.S.N., second with similar plane and engine.
Oct. 1	National Aeronautic Association of U.S.A. holds annual convention in St. Louis, Mo.

Oct. 1	Goodyear Tire and Rubber Company acquires Zeppelin rights for manufacture of rigid airships.
Oct. 1	Second National Air Institute of Aeronautical Chamber of Commerce held at St. Louis, Mo.
Oct. 1-3	U. S. S. *"Shenandoah"* makes 2,200 mi. flight, Lakehurst, N. J., to St. Louis, and return in 47 hrs. 49 min.
Oct. 1-6	National Airplane Races held at St. Louis, Mo.
Oct. 6	Lt. A. J. Williams, U.S.N., in Navy-Curtiss Racer, makes record 100 km. (243.81 m.p.h.) and 200 km. (243.67 m.p.h.) flight, winning Pulitzer Trophy Race at St. Louis, Mo., at 243.67 m.p.h.
Oct. 11	Lts. Victor E. Bertrandias and Kenneth Garrett, U.S.A.S., fly from New York to Seattle, Wash., and return; 6,500 mi. in 83 hrs. flying time.
Oct. 8-13	Light plane meet at Lympne, England, with 28 entries, winners flying 87.5 miles on a gallon of gasoline.
Oct. 15	France Field-Balboa Transcontinental Air Mail Service on the Panama Canal Zone inaugurated. Daily flights scheduled for delivery of mail, the flight from Atlantic to Pacific Coast and return requiring less than 50 minutes.
Oct. 15	Two F-5-L seaplanes return to Pensacola, Fla., after over-water flight to St. Louis, via New Orleans.
Oct. 23	C. J. Zimmermann rises 13,500 ft. with six others in Aeromarine metal hull flying boat, with Liberty engine.
Oct. 25	Lts. Lowell H. Smith and John P. Richter in *DH-4-B* Special fly from Canadian to Mexican border, 1,280 mi. in 12 hrs. 13 min. 40 sec. refueling in air three times.
Oct. 26-30	Fifth session of International Commission for Aerial Navigation held at Rome. Italian Air Service presents airplane spectacle with 262 planes and 4 dirigibles.
Oct. 29	Lt. H. R. Harris, U.S.A.S., in Barling Bomber, 6, 400 h.p. Liberty; Dayton, O., establishes world duration record of 1 hr. 19 min. 11.8 sec. with useful loads of 250, 500, 1,000, 1,500, 2,000 and 3,000 kilos (6,612 lbs.). Harris also establishes altitude record for last weight of 5,344 lbs.
Oct. 30	Sadi Lecointe in Nieuport Delage plane, *"Hispano,"* 300 h.p. engine, makes world altitude record at Issu-les-Moulineaux, France, 36,555 ft., breaking record made Sept. 28, 1921, by Lt. J. A. Macready, U.S.A.S., in Lepere biplane, supercharger Liberty, 400 h.p., 34,508 ft. over Dayton, O.
Oct. 31	Adjt. Bonnet in Nieuport-Delage biplane wins Lamblin Cup for French aviators over Paris-Strassbourg course, 745 mi. at 122 m.p.h.
Nov. 2	Lts. F. O. Rogers and H. D. Palmer, U.S.M.C., arrive at Washington, D. C., after 8,600 mi. flight in two *DH-4-B* planes from Haiti to San Francisco and return to Washington without a forced landing.
*Nov. 4	Lt. A. J. Williams, U.S.N., in Curtiss-Navy Racer, Curtiss D-12 engine, makes world speed record for 3 km. course, 266.59 m.p.h. at Mitchel Field, Long Island. Lt. Harold J. Brow, U.S.N., in twin plane, establishes on one flight of the four required a speed mark of 274.2 m.p.h.
Nov. 6	Air Carnival at Mitchel Field, L. I., New York, for benefit of Army Relief Society.

Nov. 6	Lt. A. J. Williams, U.S.N., in Curtiss-Navy Racer, climbs 5,000 ft. in 1 min., believed to be world record. Best previous reported climb, 2,000 ft. in 1 min.
Nov. 19	Kelly Field, San Antonio, Tex.-Scott Field, Belleville, Ill., sector of Model Airways put into operation.
Nov. 23	Aeromarine all-metal flying boat launched at Keyport, N. J.
Nov. 29	Pescara helicopter flies maximum height, 6½ ft.
Nov. 30	M. F. Laporte in France makes record altitude flight with FBA flying boat, 19,024 ft.
Dec. 7	Lt. John A. Macready, U.S.A.S., in attempt to regain the world's altitude record forced to land after 1 hr. 28 min. in air. He reached an altitude of 32,000 ft.
Dec. 8	Four Marine Corps aviators finish second largest flight, 10,953 mi. from Port au Prince, Haiti, to Pacific Coast and return.
*Dec. 13	Lawrence B. Sperry, one of the foremost and brilliant figures in American aviation, and a Governor of the Aeronautical Chamber of Commerce drowned in attempting flight over the English Channel.
Dec. 17	The 20th anniversary of the first flight of an airplane was marked at Dayton, O. Orville Wright was the recipient of many congratulations and a banquet was tendered in his honor. Mr. Wright was presented with a bronze medal by the National Aeronautic Association.

Cotton Transported by Airplane

In 1923, for the first time in history cotton was transported through air from the fields where it is grown to the mills where it is made into cloth and thence direct to the consumer. This event was made possible through the co-operation of the Army Air Service, the Board of Commerce of Augusta, Ga., the Wamsutta Mills of New Bedford and the Aeronautical Chamber of Commerce of America. The Martin Bombing Airplanes left Augusta at 4:45 A. M. June 4th with two bales of cotton consigned to the Wamsutta Mills at New Bedford. They arrived at New Bedford at 4:39 P.M. actual flying time for 1,000 miles being ten hours and fifteen minutes. Immediately the raw cotton was rushed to the Wamsutta Mills where it was prepared for weaving on the looms. Next morning the two planes took off from New Bedford at 5:45 A.M. arriving in Washington at noon. The occasion for this historic flight was brought about by the Shrine Convention in Washington. The flyers carried as souvenirs Masonic aprons made by the Wamsutta Mills from Georgia cotton, delivering them in record time. While waiting at New Bedford, the flyers were entertained at a dinner presided over by Oliver Prescott, President of the Wamsutta Mills. The Aeronautical Chamber of Commerce was represented by its first president, Grover G. Loening.

Lieut. R. L. Maughan's Dawn-to-Dusk Flight

When, on July 19th, Lieut. Russell L. Maughan, U.S.A.S., made his second attempt at a Dawn-to-Dusk Flight across the Continent in a Curtiss pursuit plane, a metropolitan newspaper commented as follows: "Failure? A flight of 1,925 miles in 13 hours elapsed. All that is necessary to realize the startling progress in aviation is to contrast this 'failure' of today with the 'successes' of yesterday."

Maughan, former holder of world's speed records for 200 kilometers, closed course, and 1 kilometer straightaway, and winner of the 1922 Pulitzer Race, made two attempts. On his first, July 9th, a good landing at St. Joseph, Mo., was made bad by the strolling of a cow into his path. On the second an accessory difficulty forced discontinuance at Rock Springs, Wyo., at 5:08 p.m. Mountain time.

Maughan took off from Mitchel Field, New York, at 4:08 a.m. Eastern time, on July 19th. His aim was to do something which a few years ago would have been impossible under any circumstances—fly from ocean to ocean in a fighting plane, and that from daylight to dark of the same day. He made his first lap of 570 miles to Dayton, O., in 4 hrs. 27 min., flying most of the time at 155 m.p.h. Breakfasting and refueling, he took the air at 8:53 a.m. At 11:25 he reached St. Joseph, Mo., having covered 1,140 miles, or nearly half the distance. He was off again at 12:03 for Cheyenne, Wyo., where he landed at 2:32 p.m. Mountain time. An oil leak troubled him, and he suffered also from nausea, but he determined to keep on. Hastily soldering the leak, he hopped off at 3:27 p.m.

From Mitchel Field to Cheyenne is 1,680 miles. His average speed for this distance was 135.6 m.p.h. For the next 245 miles, to Rock Springs, Maughan's speed jumped to and remained at 170 m.p.h. He had gotten some distance beyond Rock Springs when oil trouble forced him to return and land. He was within 645 miles of his goal.

Frank H. Russell, Vice-President of the Curtiss Aeroplane & Motor Company, designers and builders of the plane, in interpreting the significance of the attempt, just before Maughan made his second trial, said:

"When the War ended, we turned our attention to what must be the key to all military aviation—the pursuit plane. We developed the fastest plane in the world. But that wasn't all. The strategic problem, so far as the United States is concerned, involved the necessity of getting this fastest pursuit plane in sufficient numbers to any point on either seaboard or either boundary, where they might be needed. As pursuit planes were then, their cruising radius was not over 300 miles. That meant that adequate forces of

pursuit planes should be stationed every three hundred miles all round the ring. When they came to figure that up in terms of annual appropriations it was congressionally impossible. So we turned to the development of a pursuit plane that could be stationed at some central point and dispatched as the need arose to the point where needed, arriving there ready for flight."

That expresses the real reason back of Lieut. Maughan's flight.

Airplanes Bomb Battleships

In the summer of 1921 (see Aircraft Year Book 1922) it was first demonstrated that battleships could be sunk from the air. The Army Air Service attacked and quickly sank, one after the other, a fleet of surrendered ex-German war vessels, anchored off Cape Hatteras.

On September 5th, 1923, the Army Air Service, in pursuance of the responsibility for coast defense, with which it is charged by law, undertook a second demonstration, or, as it was officially termed, "bombing exercises," wherein the obsolete American battleships *New Jersey* and *Virginia* were made the target.

The 1923 bombing, like that of 1921, was presented by the War Department in such a manner as to avoid recurrence of the controversy as to the superiority of air power over sea power. Nevertheless, the mission with which the Army bombers were charged was the sinking of surface capital ships. The facts were in themselves sufficient upon which to base a conclusion. The *New Jersey* and the *Virginia* were anchored 16 miles off Cape Hatteras, just south of Diamond Shoals Light. The day was clear. Clouds were at 10,000 feet. The condemned ships were surrounded by a circle of mine planters and destroyers, while reaching toward Cape Hatteras, for use in case of emergency, was another column of destroyers. The official party was on board the Army transport *St. Mihiel.* It included General Pershing, General Patrick, Admiral Shoemaker and General Coe, in addition to some half hundred newspaper correspondents, news photographers, and representatives of Congressional and civil life. Brigadier-General Mitchel, Assistant Chief of Air Service, was in immediate charge of the attack, as was the case also in the demonstrations in 1921. He was in the air constantly, directing operations from his plane. The 19th Airship Co. had the airships *D-3* and *TC-2* 6,000 ft. overhead. Four or five photographic planes were also in the air.

The scene of the bombing was 180 miles from Langley Field, Hampton, Va. In order the better to simulate war-time conditions, the Second Heavy Bombardment Group—the only group of its kind in the Service, and at that far under authorized strength—estab-

lished an emergency airdrome on the coast at Cape Hatteras, where two officers and fifty men, with supplies, etc., were stationed.

The type of airplanes used throughout the exercises was the Martin Bomber and the bombs ranged in size from 600 lbs. to 2,000. The first attack began at 9 A.M., when six Martin Bombers, under command of Lieut. Austin, appeared at an altitude of 11,000 ft. They had flown direct from Langley Field. Each Bomber carried four 600-lb. demolition bombs. The explosives were released from between 10,000 and 11,000 ft. Eighteen were dropped, of which a number were for sighting purposes. Of the total, two were "duds." There were four direct hits, two of these exploding simultaneously. Three other bombs, including two "duds," dropped within the 20-ft. zone, any one of which under war conditions would have been fatal to a capital ship. Seven destructive hits out of eighteen bombs dropped gave a percentage of 40, which is much higher than any record ever yet officially announced.

The second test was conducted by seven Martin Bombers under Captain Harvey, each carrying one 2,000 lb. bomb. This flight came from the temporary base at Cape Hatteras. The bombs were released at 6,000 ft., but all fell 200 yards astern. Following this attack, however, the *New Jersey* in spite of the fact she was equipped with 33 water-tight compartments, began to list distinctly to port. There was visible to the observers a huge hole torn in her side amidship and a gash aft of the stern fighting mast.

Lieut. Crocker, commanding another flight of seven Martin Bombers, each carrying two 1,100 lb. bombs, attacked from 3,000 ft. The first bomb was dropped at 11:54 A. M., but contrary to the expectations of the party on board the *St. Mihiel,* was directed not at the *New Jersey* which was already in distress, but at the *Virginia.*

There was much interest in the *Virginia* aside from the practical demonstration of the theory of air bombing. It was the *Virginia* that served as Admiral Evans' flag ship on his historic trip around the world with the American fleet during the Roosevelt administration. Both the *Virginia* and the *New Jersey* were completed in 1904, or practically the same time when the Wright brothers were publicly demonstrating what they had proved in practical flight on the sand dunes of North Carolina, December 17th, 1903. Each was of 16,000 tons displacement and each cost $6,318,000.

The fourth bomb dropped by Lieut. Crocker's squadron hit squarely on the stern of the *Virginia* just aft of the firing mast and penetrated the protective decks, as was indicated by photographs

taken at that instant. A column of smoke shot for 1,000 or 1,500 feet and when this cleared away it was seen what terrific destruction had been inflicted. Both masts and all three stacks, together with accompanying superstructure, had been swept aside. Nothing remained standing above deck except the crane and the turret. All the rest was junk.

Shot five and six fell to port and starboard. Number seven grazed the starboard side and plunged deep into the water, directly alongside of the ship. This provided the fatal blow, as an underwater explosion has a far more crushing effect upon the hull of a vessel. Instantly the *Virginia* began to list, and as it was apparent that she was soon to go down, only thirteen bombs were dropped. In four minutes she was under the water, making the period of her actual sinking only 26 minutes from the time the first bomb was dropped.

Further attacks were suspended until 3:30 in the afternoon, when another flight of seven Martin Bombers, each carrying one 2,000 lb. bomb dropped their cargo 3,000 feet over the *New Jersey*. None, however, fell in the direct danger zone. At 4:00 P.M. two Martin Bombers, each carrying 1,100 lb. bombs and flying at about the same altitude, attacked. Bomb number three fell directly alongside the *New Jersey*, plunged far under the water and resulted in a fatal explosion. Seven minutes from the time bomb number three dropped the *New Jersey* had turned over, first on her side, then keel to the sky, just as the *Virginia* had done, and went down.

In a statement issued to the press, General Pershing declared:

"The results of the test again demonstrate the utility of aircraft in coast defense operations. . . . . Our Air Service is to be congratulated on the splendid showing made at these exercises."

Schneider Cup Race

The international race for the Schneider Maritime Cup, flown off Cowes, Isle of Wight, England, on September 28th, was won by Lieut. David Rittenhouse, U.S.N., in a Curtiss-Navy seaplane, at a speed of 177.38 m.p.h. Lieut. Rutledge Irvine, also flying a Curtiss-Navy seaplane, was second at 173.46 m.p.h. The only other contestant to finish was the British entry, Capt. H. C. Biard, whose Supermarine flying boat made 157.17 m.p.h.

The United States Navy entered four seaplanes. Great Britain entered three and France four. Italy was to have entered two, but both were withdrawn a week before the race. Of the British entries, the Sopwith-Hawker biplane, with 450 h.p. Napier engine, was crashed by its pilot, Flight Lieut. Longton, during test as a

land machine. The Blackburn *"Pellett,"* 450 h.p. Napier, was crashed by its pilot,Mr. Kenworthy, during navagability trials. Of the French entries, one CAMS, 300 h.p. Hispano Suiza fouled a mooring line. One of the Latham flying boats, with two 400 h.p. Lorraine-Dietrich engines, had engine trouble. The other, piloted by Lieut. Benoist was crashed on arriving at Cowes.

The American entries—in addition to the Curtiss-Navy seaplanes, included one *TR-3-A,* built by the Naval Aircraft Factory, and one Navy-Wright-2, built by the Wright Aeronautical Corp. The *TR* had a Wright E-4, 265 h.p engine, and the *NW* had one Wright T-2, 650 h.p. engine. The Navy-Wright Racer was piloted by Lieut. A.W. Gorton, U.S.N. It has a wing span of 28 ft., height of 11 ft. 7½ in. and length of 28 ft. 4½ in. It is a biplane, with twin pontoons. It has wing type radiators and three-bladed duraluminum propeller. The *TR* was built by the Navy for scouting purposes.

The Curtiss-Navy seaplanes are the same ships which, as land planes, won the Pulitzer Race of 1921, and finished third and fourth in the 1922 race. Practically the only change was the substitution of pontoons for wheels and the installation of the Curtiss *D-12,* 400 h.p. engine. It is equipped with the Curtiss wing radiator and the Reed duralumin propeller. In trials at Port Washington, before being shipped to England, both planes recorded speeds of around 194 m.p.h.

The Navy-Wright in preliminary flights was checked at 194 to 197 m.p.h. Unfortunately, however, during the navigability trials, the Navy-Wright suffered a broken propeller blade, which tore the pontoons and thus forced a bad landing.

Irvine was the first to take off in the race, followed by Rittenhouse. The *TR,* piloted by Lieut. F. W. Wead, was scheduled to start third but did not get off. As Irvine completed his first lap, Biard, in the Supermarine, took off. The next and last starter was the Frenchman Hurel in *CAMS-38.* Hurel had engine trouble and was out in the second lap, but as his speed was only 130.4 m.p.h. he would not have been a serious contender. The Britisher stayed throughout, but at a speed which left the race actually one between Rittenhouse and Irvine. Here are the performance figures:

Navy-Curtiss Racers Establish New World Straightaway Speed Record

At Mitchel Field, L. I., on November 2nd and 4th, Lieuts. A. J. Williams and Harold J. Brow, U.S.N., winners of first and second places, respectively, in the 1923 Pulitzer Race, flew their Navy-

PERFORMANCE FIGURES OF SCHNEIDER CUP RACE, 1923

Country	No.	Pilot	1st Lap Time m.s.	1st Lap mi./hr.	2nd Lap Time m.s.	2nd Lap mi./hr.	3rd Lap Time m.s.	3rd Lap mi./hr.	4th Lap Time m.s.	4th Lap mi./hr.	5th Lap Time m.s.	5th Lap Time mi./hr.	Total Time h.m.s.	Mean Speed mi./hr.
America	3	Irvine	15-27⅗	166.25	14-43	174.6	14-42	174.8	14-43	174.6	14-29⅗	177.3	1-14- 5⅕	173.46
"	4	Rittenhouse	15-06⅗	170.1	14-22⅕	178.8	14-24⅘	176.2	14-22⅕	178.8	14-11	181.1	1-12-26⅗	177.38
Great Britain	7	Biard	17-11⅕	149.5	16-13⅘	158.3	16-12⅕	158.6	16-09⅘	159.0	15-59	160.8	1-21-46	157.17
France	9	Hurel	19-42⅗	130.4										

WINNERS OF THE SCHNEIDER CUP RACES, 1914-1923

Year	Place	Type of Plane	Motor	Speed mi./hr. (km./hr.)	Winner of Cup	Name of Pilot
1913	Monaco	Deperdussin float monoplane	Gnôme 160 h.p.	44.7 (72)	France	Prevost
1914	Monaco	Sopwith float biplane	Gnôme 100 h.p.	55.3 (89)	England	Howard Pixton
1919	Bournemouth, England	Savoia biplane flying boat	Issota-Frash. 260 h.p.	124.9 (201)	No award	Janello
1920	Venice, Italy	Savoia biplane flying boat	Ansaldo 450 h.p.	102.5 (165)	Italy	Ed. Bologna
1921	Naples, Italy	Macchi biplane flying boat	Fiat 300 h.p.	117.4 (189)	Italy	De Briganti
1922	Naples, Italy	Supermarine biplane flying boat	Napier-Lion 450 h.p.	146.5 (235)	England	Capt. H. C. Biard
1923	Cowes, England	Navy-Curtiss float biplane	Curtiss D-12 465 h.p.	177.38 (328)	United States Navy	Lt. D. Rittenhouse

Curtiss Racers over a marked straightaway, three-kilometer course in successful attempts to lower the world speed record.

The previous record was held by Lieut. Russell L. Maughan, U.S.A.S. It was 236.58 m.p.h. made at Dayton, O., in the Army-Curtiss Racer in which he won the 1922 Pulitzer Trophy. In two days' trial—November 2nd and 4th—Williams and Brow four times exceeded Maughan's figure. Maughan's record had been made over a 1 kilometer course.

The speed trials were held under the rules of the Federation Aeronautique International, and were observed officially by Major W. N. Hensley, Jr., Commandant, Mitchel Field, and by C. F. Schory, representing the Contest Committee of the National Aeronautic Association. Rules established provided for four flights, two with, and two against the wind. The course was electrically timed. It extended from the southeast corner of Mitchel Field to the northwest corner of Curtiss Field. Five hundred meters beyond each control, observation posts were established to see that the pilots did not dive, and thus artificially increase their speed. Furthermore, they were required to fly no higher than 50 meters, or about 164 feet.

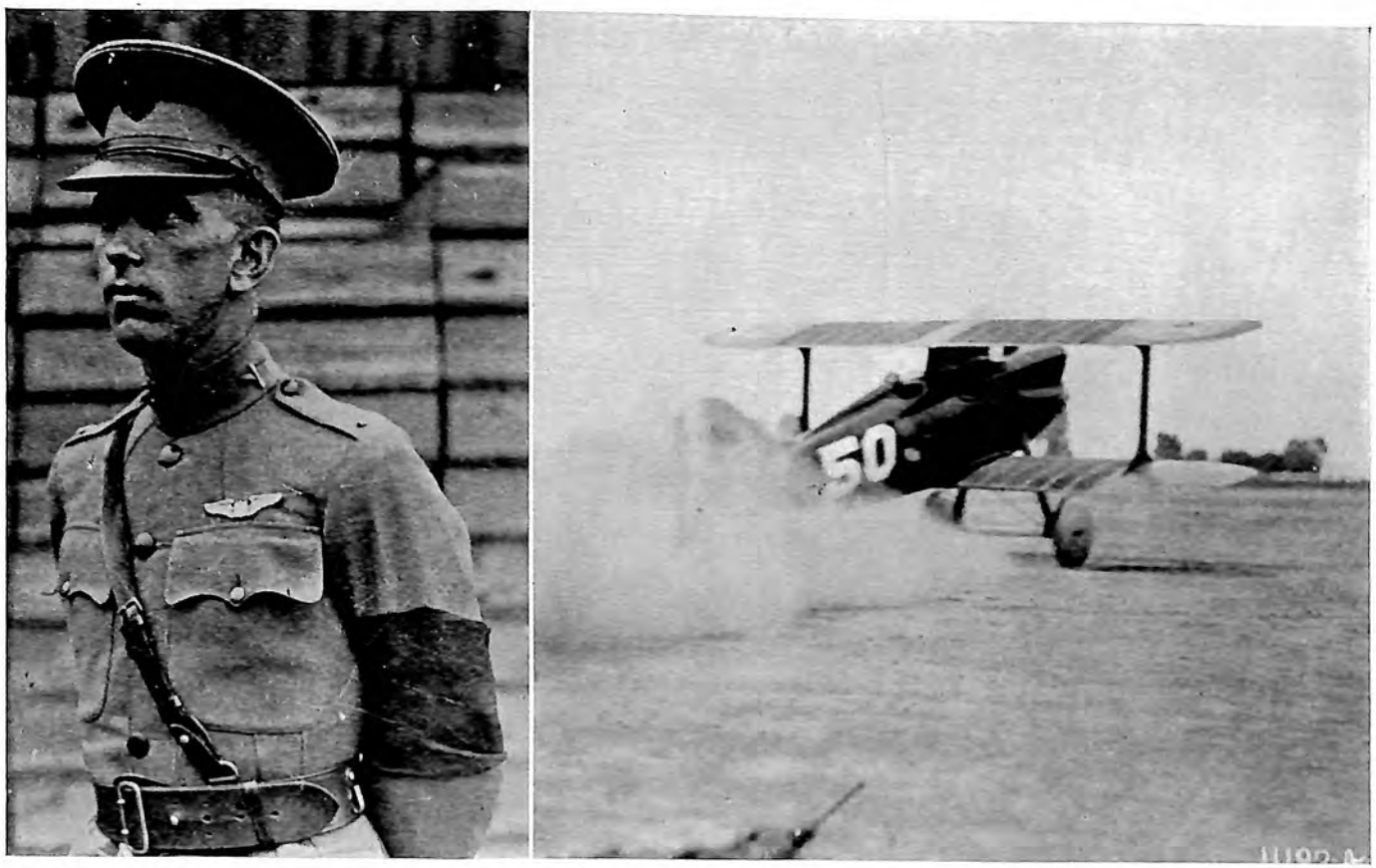
On the first day Lieut. Brow made 257.42 m.p.h. Williams going up immediately after registered 258.61. Williams had no sooner landed than Brow was again in the air and the electrical timing device reported a speed for him of 259.15 m.p.h. Williams wanted to go up a second time but was prevented by the lateness of the hour.

On November 4th Williams went up first. Twelve times he covered the course. His best four consecutive trips were the 5th, 6th, 7th and 8th, which gave him an average of 263.3 m.p.h. and thus set up a new world record.

Brow returned to the contest, but flew the course only four times. On his last flight he traversed the three kilometers in 24.4 seconds, or a speed of 274.2 m.p.h. His average for the four trips was 265.69, or about two miles an hour faster than Williams.

Once again Williams took off. From an altitude of 9,000 feet, he came down, straightened out his plane in ample time to observe the rules of the 500 meter posts, and covered the course hardly more than 30 feet above the ground. Back and forth he flew six times. On his fifth trip his speed was 266.4 m.p.h. On the sixth trip, despite the approach of a squadron of Martin Bombers coming in to participate in the air carnival the following Sunday, Williams increased his speed to 268 m.p.h. flat. His average worked out at 266.6 m.p.h.

Thomas-Morse Pursuit Plane (built by Boeing Airplane Co)., winner Mitchell Trophy Race, St. Louis.
Photo, U. S. Air Service.



Lieut. Walter Miller, U. S. A. S., whose Army-Curtiss Racer was fifth in the St. Louis Pulitzer Race. *Right*—Army-Curtiss Racer No. 50, piloted by Lieut. J. D. Corkille to sixth place.—Photos by U. S. Air Service.

The following tables show the time and speed by the two pilots on November 4th:

WILLIAMS—FIRST FLIGHT

Attempts	*Seconds per Leg*	*Speed on Leg (mi./hr.)*
1	26.0	258.1
2	25.0	268.4
3	26.2	256.2
4	24.8	270.5

Average speed, 263.3 mi./hr.

BROW

1	26.2	256.2
2	25.0	268.4
3	25.5	263.1
4	24.4	274.2

Average speed, 265.69 mi./hr.

WILLIAMS—SECOND FLIGHT

1	25.5	263.1
2	25.0	268.4
3	25.2	266.4
4	25.0	268.4

Average speed, 266.6 mi./hr.

RESOLUTION TO THE MEMORY OF LAWRENCE B. SPERRY, ADOPTED BY THE BOARD OF GOVERNORS OF THE AERONAUTICAL CHAMBER OF COMMERCE

The following resolution of affection and respect to the memory of Lawrence B. Sperry has been adopted by the Board of Governors of the Aeronautical Chamber of Commerce of America, of which Board Mr. Sperry was a member:

"RESOLVED: That we, the Officers and Governors of the Aeronautical Chamber of Commerce of America, on behalf of the members of said organization and as representatives of the aeronautical industry, desire to express to the family and friends of Lawrence B. Sperry our deep sympathy and bereavement over the loss of our friend, associate and counsellor.

"The art and science of aviation, representing as it does the mechanical mastery by man over the most difficult and stubborn forces of nature, is requiring for its ultimate achievement sacrifices that are indeed hard to bear—none more so, however, than the loss of LAWRENCE SPERRY, with all his name leaves as a stimulating example of the highest order of progress, skill, integrity and enthusiasm.

"The world has lost another great genius and pioneer in aviation whose sacrifice, however, strongly fixes the determination of his associates in aviation and particularly those who had the advantage of being associated with him on this Board to achieve mastery of the elements that have caused so great a loss."

33 Out of 42 World Records

Of the thirty-three world records, twenty-two are credited to the Naval Bureau of Aeronautics and eleven to the Army Air Service. Of the twenty-two by the Navy, three—the world's fastest speeds—were made in land planes. The outstanding records in speed were 266.59 miles an hour for 3 kilometers (1.864 miles); 243.81 m.p.h. for 100 kilometers (62.14 miles) and 243.67 m.p.h. for 200 kilometers (124.27 miles), all made by Lieut. A. J. Williams, U.S.N., the first on November 4th at Mitchel Field, Long Island, and the other two in the Pulitzer Race at St. Louis, October 6th. Lieut. David Rittenhouse, U.S.N., on September 28th, at Cowes, England, established a new world speed record for seaplanes of 177.38 m.p.h. He won the Schneider Trophy from French and English competitors.

The Army Air Service achievements are notable for having been made mostly with obsolescent craft improved and operated with greater skill. Records for 500, 1,000, 1,500, 2,000, 2,500, 3,000, 3,500, 4,000, 5,000 and 5,300 kilometers were made at Dayton, O., and San Diego, Cal. They were accomplished, for the longer distances, through refueling in full flight, a gas tank plane passing the new supply through a hose to the lower ship. A world's duration record of 36 hrs. 4 min. 31 sec. was made over Dayton, O., April 16-17, by Lieuts. Oakley Kelly and J. A. Macready, U.S.A.S. But Lieuts. Lowell H. Smith and J. P. Richter, U.S.A.S., on August 27-28 at San Diego, Cal., established a new duration record of 37 hrs. 15 min. 43.8 sec. This was made in an Army observation plane, seven years old in design, refueled in flight. Another performance by the Army Air Service which, although not a record, constituted an unrivaled performance, Lieut. Russell L. Maughan, U.S.A.S., on July 19, flew 1,925 miles, Mitchel Field, L. I.-Rock Springs, Wyo., in a new type pursuit plane. He made three stops. His elapsed time was 15 hours, or an average of nearly 130 miles an hour.

Of the eighteen other records established by the Navy, three covered distance with seaplanes or flying boats, one a duration of 11 hrs. 16 min. 59 sec., another altitude of 13,898 feet, and the remainder special performances in speed, duration and altitude with added weight.

In the case of both the Army and the Navy, every record was made with a plane and engine American in design and manufacture.

Facts About Army Air Service's Round the World Flight

Although not begun until 1924, the Round the World Flight of the U. S. Army Air Service was planned and charted and the Douglas World Cruisers were actually flown in 1923. For this rea-

son as well as through a desire to assist Year Book subscribers intelligently to follow the progress of the flight as noted in the daily press, the following facts are given:

Purpose of the Flight

The purpose of the United States Air Service in attempting to fly around the world is to point the way for all nations to develop aviation commercially and to secure for our country the honor of being the first to encircle the globe entirely by air. The experience thus gained and the information gathered will be applied toward making America the leading power in the peace-time application of flying.

Date of Start and Itinerary

The expedition started from Santa Monica (Los Angeles), Cal., March 17th, 1924. The itinerary measures between 25,000 and 26,000 miles.

First Division

	Statute Miles
*Seattle, Wash.	
Prince Rupert, B. C.	650
†Sitka, Alaska	300
Cordova, Alaska	475
Seward, Alaska	135
Chignik, Alaska	450
*Dutch Harbor, Unalaska, Alaska	400
Nazan, Island of Atka	350
†Chicagoff, Island of Attu	530

Second Division

Kashiwabara Bay, Paramushiru, Kuriles	860
Bettobu, Yetorofu, Kuriles	510
Minato, N. E. Coast Honshu, Japan	475
(Aomori to be used as Supply Base)	
Kasumiga Ura, Japanese Air Station	395
*(Yokohoma to be used as Supply Base)	
Osaka, Japan, Japanese Air Station	360
Kagoshima, Kyushu, Japan	380
†(Nagasake to be used as Supply Base)	

Third Division

†Shanghai, China	610
Amoy, China	555
Hong Kong, China	300
Haiphong, French Indo-China	500
Tourane, French Indo-China	395

Note: The points indicated are stops where pontoons will be used. Stops indicated by * are radio supply bases. Stops indicated by † are minor supply bases.

†Saigon, French Indo-China	530
Bangkok, Siam	675
Rangoon, Burma	450
Akyab, Burma	445
*Calcutta, India	400

FOURTH DIVISION

Allahabad, India	475
Delhi, India	380
Multan, India	425
†Karachi, India	475
Charbar, Persia	330
Bandar, Abbas, Persia	330
Bushire, Persia	400
†Bagdad, Irak	475
Aleppo, Syria	480
Konia, Turkey	285
*San Stefano, Turkey	300

FIFTH DIVISION

Bucharest, Roumania	290
Belgrade, Serbia	290
Budapest, Hungary	220
†Vienna, Austria	140
Strassbourg, France	400
Paris, France	250
*London, England	225

SIXTH DIVISION

*Brough (Hull), England	155
Kirkwall, Orkney Islands	370
†Thorshaven, Faroe Islands	275
Hofn, Hornafjord, Iceland	260
†Reykjavik, Iceland	339
†Angmagsalik, Greenland	500
†Ivigtut, Greenland	500
Indian Harbor, Labrador	572
Cartwright Harbor, Labrador	40
Hawkes Bay, Newfoundland	290
Pictou Harbor, Nova Scotia	420
Boston, Mass.	520
Mitchel Field, L.I., N.Y.	175
Washington, D.C.	220

TO AVOID BAD WEATHER

The following schedule of movement will allow the minimum of bad weather, taking into consideration the fact the flight must be completed within a period of six months at the longest:

1st Division—Seattle to the Island of Attu, including the first portion of 2nd Division (through the Kurile Islands)—April and May.

Note: The points indicated are stops where pontoons will be used. Stops indicated by * are radio supply bases. Stops indicated by † are minor supply bases.

2nd Division—Japan proper and Chosen—May and June.
3rd Division—Kagoshima, Japan, to Calcutta—May, June, July.
4th Division—Calcutta to Constantinople—June, July, August.
5th Division—Constantinople to London—July, August.
6th Division—London to the United States—August and September.

Where Engines Were to Be Changed

Engines were to be changed at Kasumigaura on Choshi Ko. At Calcutta, India, new wings will be fitted, new motors installed and pontoons replaced with landing gears. At San Stefano, motors will be changed if necessary. Arriving at Brough, near Hull, England, the engines will be changed for the last time and landing wheels replaced with pontoons for the final and perhaps most dangerous lap, the hop across the northern Atlantic by way of Iceland and Greenland.

Flight Personnel

The following personnel was selected to set out from Los Angeles, Cal., March 17th, in four U. S. Army Air Service World Cruisers:

Major Frederick L. Martin of Indiana, Flight Commander; Lieut. Erik Nelson, who was born at Stockholm, Sweden, Engineer Officer; Lieut. Lowell H. Smith of California; Lieut. Leigh Wade of Michigan; Lieut. Leslie P. Arnold of Connecticut, and Lieut. LaClair D. Schulze of California, alternates, all of whom are pilots. The mechanicians are Reserve Lieut. John Harding, Jr., of Tennessee; Technical Sergeant Arthur H. Turner of California; Staff Sergeant Henry H. Ogden of Mississippi, and Staff Sergeant Alva L. Harvey of Texas.

Description of the Flying Equipment

The airplanes and engines are all-American in design, material and construction. The airplanes were designed by Donald Douglas and constructed entirely at the plant of the Douglas Company, Santa Monica, Cal. In the Round the World squadron were four Douglas Cruisers. Scattered at various points around the globe were the equivalent, in parts, of 15 extra Liberty engines and about 200 per cent. replacements in the airplanes themselves. At points along the route where flying will be entirely over water, 14 extra sets of pontoons have been stored.

Following is a general description of the World Cruisers: The fuselage is made in three detachable sections: Engine Section, Mid-Section, and Rear Section. All sections are made of steel tubing. The wings are of standard box beam and built-up rib construction.

The upper wing is made in three panels. The lower wing is made in two panels. The wings may be folded, thus requiring small storage space. The vertical fin and horizontal stabilizer are of standard I-beam and built-up rib construction. The elevator and rudder are made of steel tubing. The axles are made of alloy steel tubing, heat treated after fabrication. The struts are steel tubes, streamlined with wood. The landing gear (water type) consists of twin floats of built-up wood construction. The top covering is three-ply veneer, the bottom planking being two-ply mahogany.

The World Cruisers are biplanes. As a seaplane, empty, the Cruiser weighs 5,100 lbs. As a land plane, empty, it weighs 4,300 lbs. As a seaplane it has a disposable load (men, equipment, gasoline, fuel, oil, etc.) of 2,615 lbs. As a land plane it has a disposable load of 2,615 lbs. Its gross weight as a seaplane is 7,715 lbs. As a land plane it has a gross weight of 6,915 lbs. Its speed as a land plane, therefore, will be faster than as a seaplane. It has a gasoline capacity of 450 gallons; a wing loading of 10.9 lbs. per square foot as a seaplane and of 9.7 per sq. ft. as a land plane. It has a load as a seaplane of 18.3 lbs. for each horsepower, and as a land plane of 16.3 lbs. per horsepower.

The Liberty engine is of the usual 400 h.p. The wing span, both upper and lower, is 50 ft. The span of the airplane with wings folded is 20 ft. 2 in. The height over all is 13 ft. 7 in. The length over all is 35 ft. 6 in. As a seaplane it has a normal ceiling of 7,000 ft., a normal maximum speed of 100 miles an hour and a landing speed of 35 miles an hour. As a land plane it can climb to 10,000 ft., travel 103 miles an hour, and land at 53 miles an hour.

Navigating Instruments

The Round the World Flight is essentially navigating. Following is a description of the instruments which are in almost constant use by the Round the World fliers:

Engine instruments: Boyce Model C Moto-Meter which records the temperature of water and oil. Oil pressure gauge. Fuel pressure gauge. Tachometer.

Magnetic compass: The standard compass with which planes have been equipped for a number of years. Designed and made by the General Electric Co.

Air speed indicator, showing rate of flight in miles per hour.

Altimeter, showing height at which plane is flying.

The flight indicator is a combination instrument, which consists of a gyroscopic turn indicator, a bank indicator, and a gyroscopic fore-and-aft inclinometer. This is the instrument upon which the

pilot depends to guide him through fog or clouds and without which flight under such conditions is practically impossible. The turn indicator tells the pilot if he is flying straight or in a circle, which he could not know in the fog by any other means. When flying straight the bank indicator shows when his ship is level laterally, and when turning it indicates the proper angle of bank. The fore-and-aft inclinometer shows the longitudinal attitude of the airplane, and the pilot can therefore keep level in this direction also.

These instruments enable the pilots to fly safely under all conditions, but do not help him to get anywhere. For this purpose they use the new Earth Inductor Compass, developed and manufactured by the Pioneer Instrument Co. The ordinary magnetic compass consists of one or more magnetized needles supported on a pivot in such a way that they may align themselves with the earth's magnetic lines. The earth inductor compass operates by the rotation of a coil in the earth's field with the resulting generation of electric potential. The new compass thus depends for its directive sense upon the same magnetic lines of the earth as the old magnetic compass, but here ends all similarity.

The earth inductor compass consists of three essential parts: a generator, a controller and an indicator. The generator is driven by a small propeller and is mounted in the tail of the airplane. It is similar in principle to any electric generator, having an armature, commutator and brushes, but it depends upon the earth's magnetism for a field. The electricity generated is therefore dependent upon the position of the brushes in respect to the earth's magnetic lines. As these run north and south, the generator provides a means of accurately finding any direction.

The controller is simply an angle indicator, having a dial similar to an ordinary compass card and a crank for rotating the dial. A small inner dial permits very accurate setting. The controller is mechanically connected to the brush gear of the generator, the rotation of the controller moving the brushes through the same angle as that through which the controller card is turned. The indicator is similar to a volt meter and is electrically connected to the brushes of the generator.

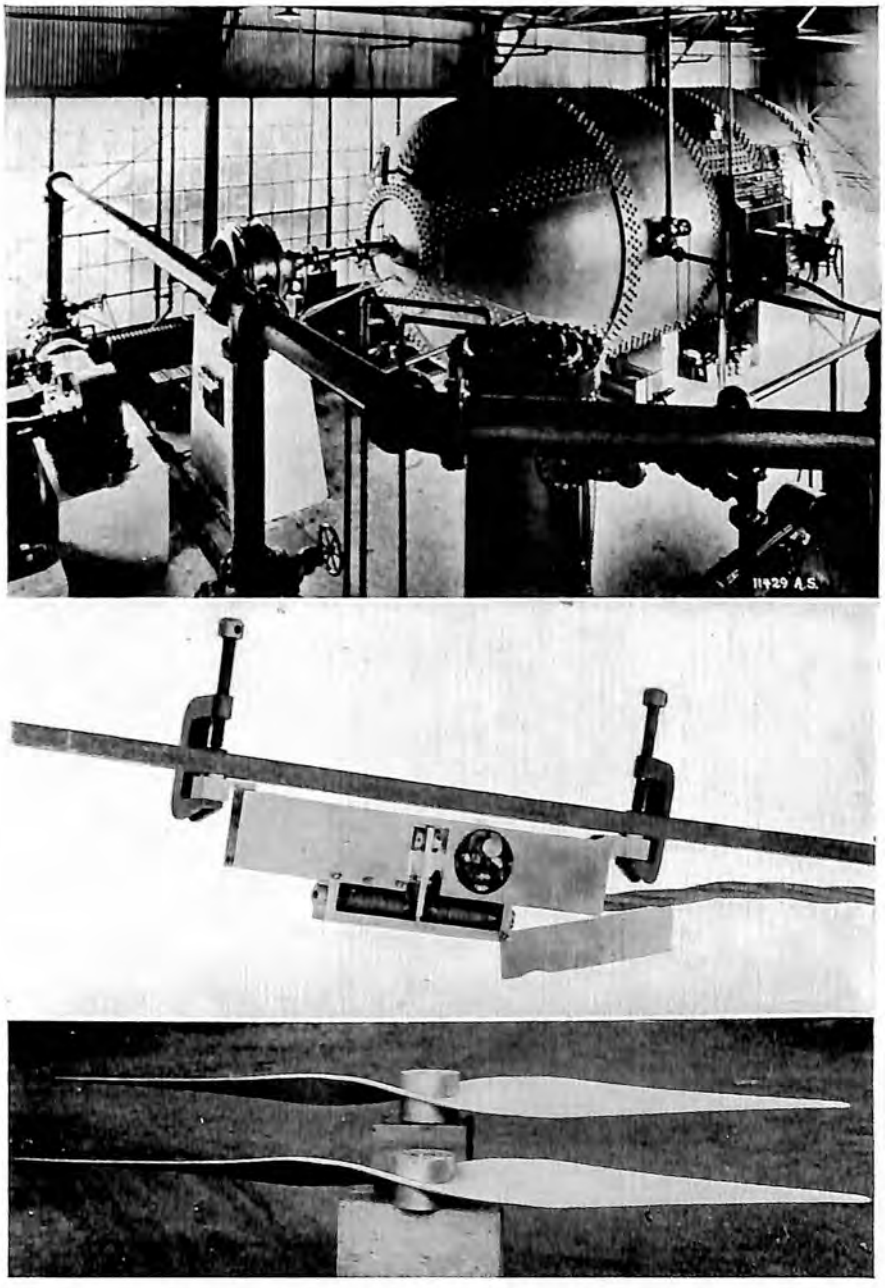
The operation of the earth inductor compass is simple. The controller is rotated to indicate the desired heading. This rotates the brushes of the generator into such a position that there will be no flow of current when the aircraft is headed in the direction indicated. The pilot accordingly turns his ship until the indicator hand comes to zero. By steering so as to keep the hand on zero the proper heading is maintained. To change to a new course, the

controller is rotated so that the proper heading is indicated on the dial, and the pilot then turns the aircraft until the indicator hand again comes to zero.

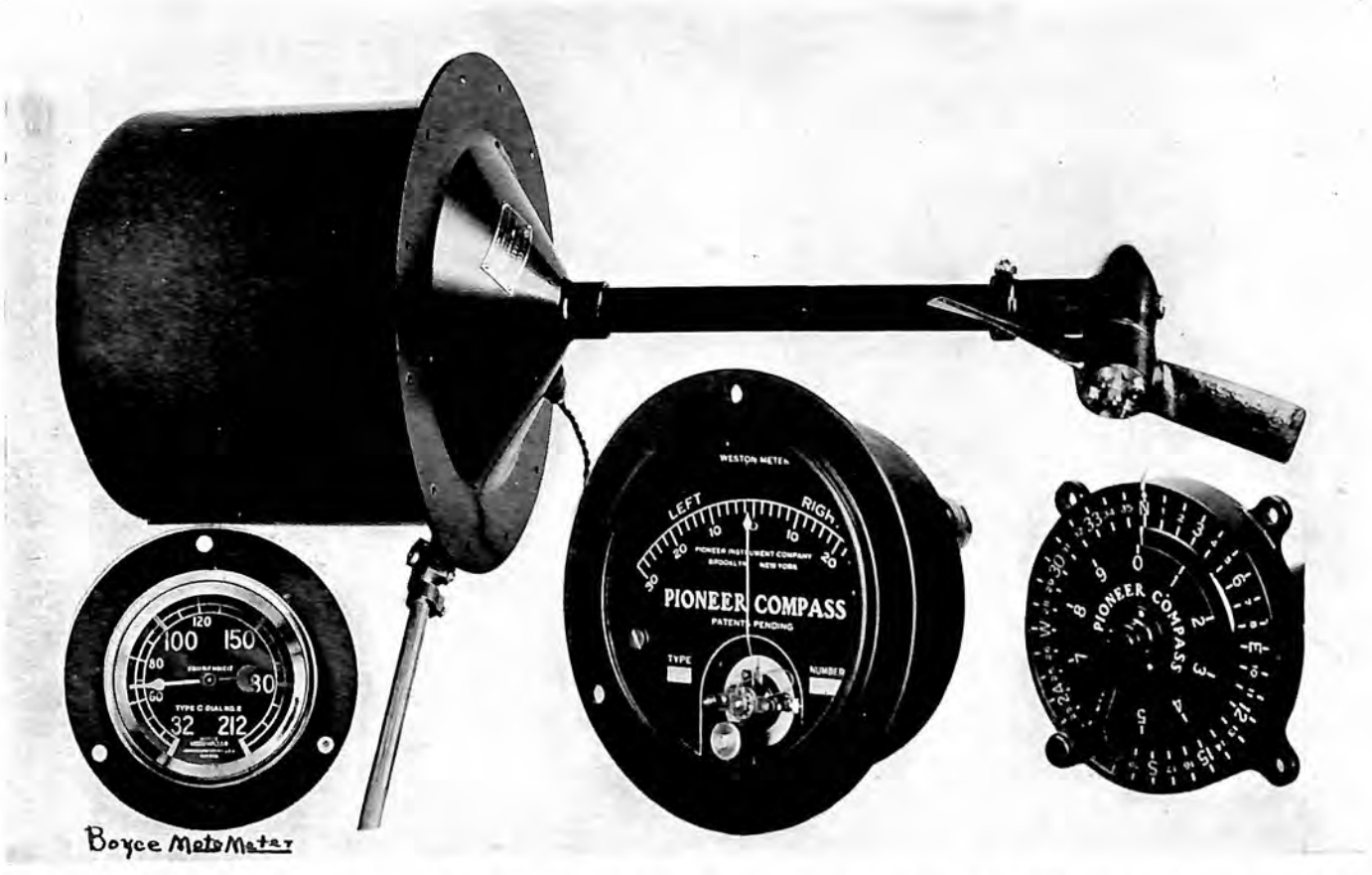
Sextant. In addition to the foregoing, the cockpit of the flag plane flown by Lieut. Smith carried a sextant with which the Commanding Officer ascertained his astronomical position.

Advance Preparations for the Flight

The most careful preparations for the flight around the world were made by the Army Air Service. It was assisted by the Aeronautical Chamber of Commerce. Through the Chamber several score American business corporations with representatives abroad have cordially lent their assistance by providing letters of credit or personal letters of introduction which will facilitate the advance officers or the actual pilots themselves in case of emergency. F. P. Small, president of the American Express Company, extended official co-operation through all American Express offices along the route.



Above—General view of Variable Density Wind Tunnel, National Advisory Committee for Aeronautics. *Center*—Bureau of Standards' Electric Strain Gage. *Bottom*—Curtiss-Reed Duralumin Propeller.



Some of the instruments on Douglas World Cruisers. *Bottom Left*—Boyce Moto Meter. Others are parts of Earth Inductor Compass, invented and manufactured by the Pioneer Instrument Co. and which made world fliers independent of sun, earth or sky.

CHAPTER XVII

TECHNICAL DEVELOPMENTS IN AMERICAN AVIATION DURING 1923

THE story of the outstanding technical achievements for the year 1923 is largely reflected by the wonderful performance made by the successful contestants in the Pulitzer and Schneider Trophy Races.

The Navy-Curtiss Racer with a record of 243.67 m.p.h. for the St. Louis closed course and 266.6 m.p.h., the world's record for three kilometers, was made possible by the efforts of the Curtiss Aeroplane and Motor Company. Straight research and experimental engineering is responsible for the success. The design and construction of aircraft has now reached the point where technical progress is recorded by perfection and development of fundamentals.

This fact is exemplified in the design of the Navy-Curtiss racer which raised the world's speed record 30 m.p.h. The D-12 Curtiss engine, the Curtiss C-62 airfoil section, the wing type radiator, the Curtiss-Reed one-piece metal propeller, the fully streamlined wheel and shock absorber, the cellular wooden wing construction and the general aerodynamic improvements in designs, all contributed to the success of this airplane and all were the result of painstaking research and engineering development.

The successful operation of the U.S.S. *"Shenandoah"*; the wonderful night flying performance of the Air Mail Service and the demonstration of the possibility of a thirty hour air mail service between New York and San Francisco; the completion and operation of the Barling bomber, the largest airplane ever built in America; the world's records established by the Army Air Service for 100, 500, 1,500 and 2,000 kilometer courses; the non-stop flight of the *T-2* airplane from New York to San Diego by Lt. Kelly and Lt. Macready establishing the world's endurance record; all these are achievements that mark our technical advancement for the year 1923.

FRUITFUL IN AERODYNAMIC RESEARCH

In aerodynamic research the year 1923 was most fruitful and the results hold much promise for more efficient and safer aircraft. The investigation of pressure distribution by the National Advisory Committee for Aeronautics on airplanes and airships give for the first time a knowledge of the distribution as well as the magnitude

of the aerodynamic loading. This information will not only make for safer aircraft but lighter aircraft.

The variable density wind tunnel of the National Advisory Committee for Aeronautics is now in operation and the results so far fulfill all expectations. It will now be possible to obtain full scale performance results from model tests.

In Europe, the building up of large air forces has hampered research and experimental development and Major Mayo in a paper before the Royal Aeronautical Society, says:

"By her vigorous technical policy America has placed herself well ahead of any other nation in the design of high-speed aeroplanes and the development of suitable engines, and her position as the leading air power is secure for some time to come."

Europe, however, has made marked progress in the development of commercial types of airplanes. Their effort has resulted in safer airplanes, airplanes with a larger speed range, lower land speeds, control at low speeds and the development of multi-engined airplanes capable of sustained flight with the failure of one engine.

Airplanes

There has been a substantial improvement in the technical knowledge of aerodynamics during the past year, which is reflected not only in the new types of military aircraft that have been produced in 1923, but also in the new commercial types, such as produced by the Curtiss Aeroplane and Motor Company, the Glenn L. Martin Company, and the Aeromarine Plane and Motor Company for the Air Mail Service, and such as produced by the Stout and Aeromarine Companies for commercial use. The United States is now the possessor of the fastest fighting airplanes in the world. This is the result of the far-sighted policy of the Army and Navy in engaging in racing contests by placing orders for experimental racing airplanes with manufacturers, giving them a free hand to produce the best they could. This policy so stimulated the engineering talent of the various manufacturing companies that the results obtained were far beyond expectation.

Two new types of pursuit airplanes are now in production as the result of the technical development of 1923. These types, so far as we know, are the best pursuit airplanes in the world. The Curtiss Army pursuit airplanes has been improved and refined to such an extent that a speed of 180 miles per hour will be realized. This airplane is equipped with a D-12 engine, and is a modification of the Army Pulitzer racer of 1922. The Schneider Cup racer of the Navy, so successful in England, is a modification of the Navy Pulitzer racer of 1921.

Work of Boeing and Douglas

The Boeing Airplane Company during the year 1923 designed and constructed the Boeing pursuit airplane. This airplane is designed for either the Packard 1,500 engine or the Curtis D-12, and has a top speed of 160 to 175 miles per hour, depending upon the engine installation. It has a service ceiling of 28,000 feet and a speed of 135 miles per hour. The Boeing Company has also designed and constructed the Boeing Navy training seaplane known as the *NB-1,* which was recently adopted as a standard training seaplane for the U. S. Navy. The *NB-1* is designed for either the Lawrance J-3, 220-horsepower or the Wright E-4, 200-horsepower engine. This seaplane has a performance of 100 miles per hour, a low speed of 48 miles per hour, and a service ceiling of 11,000 feet.

The *DT-2* torpedo airplane, constructed by the Douglas Company, has proved most satisfactory. The Navy *CS* type airplane, which is a modified *DT,* has been constructed by the Curtiss Company, and is used as either a land or sea plane, and is readily converted into a torpedo airplane, a bomber, or a scout. In a recent flight test at Anacostia, a *CS-1* airplane, with full load, including torpedo, 186 gallons of gasoline, and radio equipment, remained in the air five hours and forty-five minutes, which was twenty minutes longer than the flight radius for which the airplane was designed. From an aerodynamic standpoint the design of the *CS* is particularly clean, the airplane carrying a useful load of about 40 per cent. of the total weight.

Navy *PN-7* With Wright T Engine

A new scouting boat-type seaplane developed by the Navy known as the *PN-7* is the development of the sound construction of the *F-5-L* type. This seaplane has recently given a very good demonstration of its adaptability to the naval service in completing a 2500-mile flight from Philadelphia to Culebra with no attention to the airplane or the engines. The *PN-7* cruises at 78 knots, and has a high speed of 98 knots. The wing span is 25 feet shorter than that of the *F-5-L,* and the Wright T engine is used instead of the Liberty engine.

The Glenn L. Martin Company designed an experimental night flying Air Mail airplane, with a speed range of 38 to 106 miles per hour. The airplane was to be used in connection with the night-flying experiments of the Air Mail Service, and was designed to carry a useful load of 752 pounds and have a low landing speed, less than

40 miles per hour. The Martin Company has modified this airplane as a Navy training airplane, and its latest modification is a Martin commercial airplane. The Company has also designed and completed six *MS*-1 small scout metal airplanes for use on submarines.

Aeromarine All-Metal Development

The Aeromarine Plane and Motor Company has developed a flying boat known as the Model *AMC*. The hull and tail surfaces of this seven-passenger flying boat are designed and constructed entirely of metal. The *AMC* is equipped with Liberty engine and has a high speed of 98 miles per hour and a landing speed of 50 miles per hour. The hull is by far the most interesting feature, and it is constructed entirely of aluminum alloy. The framework of the hull is such as to provide for five complete watertight bulkheads, all the frame work and stiffeners being made of U-shaped sections. The covering is of $\frac{3}{64}$-inch thickness aluminum alloy, the bottom ahead of step being $\frac{1}{16}$-inch thickness same material. In the design of a boat-type seaplane it is necessary, if we expect a high performance, to use a boat of material other than wood. The excellent work of the Aeromarine Company in the development of the *AMC* is a real advance in commercial and military application of the boat-type seaplane.

Extensive contributions in all-metal work were also made by Charles Ward Hall.

The Aeromarine Company also designed and constructed for the U. S. Air Mail Service a night airplane equipped with a Liberty engine, with a speed range of 44 to 116 miles per hour and a mail load capacity of 600 pounds. The principal features are the location of the gasoline tanks in the upper wing and the use of aluminum alloy in many of the parts, especially of the tail surfaces.

The Curtiss Air Mail night-flying airplane was designed and operated with a Curtiss C-6 horsepower engine. It has a speed range of 44 to 106 miles per hour, and a mail load capacity of 300 to 500 pounds

The Loening Aeronautical Engineering Corporation has further developed the Loening Air Yacht, and has constructed Air Yachts for the Army Air Service for use in the Philippines, Hawaii and at Langley Field and Selfridge Field.

Photographic Apparatus

The Eastman Kodak Co. have produced the Bogley tri-lens camera, the four-lens camera and the 36-inch tessar type lens for high altitude work.

The Fairchild Aerial Camera Corp. has further improved its camera of the between-the-lens type. The necessity for a large high speed between-the-lens shutter resulted in the design of the Fairchild high efficiency shutter. The camera is automatic in its action after the first preliminary setting. It carries 75 feet of roll film capable of taking 115 exposures 7″x9⅛″ without reloading. The intervalometer or timing device is set by the operator to continually operate the camera during any period of time from 7½ seconds to 90 seconds. The shutter is always in a position ready for tripping. The camera weighs only 46 pounds.

The Fairchild Automatic Camera as used in high altitude mapping requires a lens of F5-50 cm. proportions working at all times at full aperture. The shutter must be capable of opening to a diameter of approximately 4″ and closing in 1-100 of a second. The most remarkable part of the Fairchild high efficiency shutter is that it opens and shuts with three distinct periods to its cycle. It attains its full opening in only 8% of its total opening time, remains fully open 85% of the time, and takes but 7% of the time to close—thus giving percentage of 85% efficiency. In general the shutter consists of 5 flat steel leaves located between the lens elements and driven by a powerful helical spring which in making a complete revolution carries the leaves outward inward thereby opening and closing the lens aperature.

With the Fairchild high efficiency shutter as used with the 50 cm. lens it is possible to obtain two speeds, 1-100th and 1-50th parts of a second. These speeds are obtained by a single angular movement of a lever on the outside of the shutter casing. This lever in turn operates a special ratchet retard that controls and holds these fractional speeds to exactness. The shutter is of exceptional rugged construction, and on a recent break-down test has stood up for over 20,500 shots, losing only a negligible percentage of its speed exactness and efficiency.

Materials

The outstanding development in the use of materials for aircraft has been the success attained by the Reed-Curtiss one-piece duralumin propeller and the duralumin propeller developed by the Standard Steel Products Company. Progress has been made during the past year in metal construction and the use of light alloys in airplane construction. The Aluminum Company of America has co-operated to the fullest extent in answering the demands of the aircraft industry, supplying all the duralumin and aluminum alloys for parts of the *"Shenandoah"* and for airplanes manufactured during the

year by the various companies, especially the Aeromarine Plane and Motor Company and the Stout Metal Airplane Company. Progress in metal construction for aircraft is necessarily hampered by the high cost of metal construction and the various problems incidental to this type of construction.

The Thomas Morse Aircraft Corporation has concentrated on metal construction during the past year; the Boeing Company has done some excellent work in building a metal fuselage for the *DH-4-B* airplane. The Engineering Division of the Army Air Service at McCook Field has built up a number of experimental designs which have been very satisfactory, and has also developed an aluminum casting alloy with a tensile strength of 45,000 pounds per square inch. The Engineering Division is now using magnesium alloy having two-thirds the weight of aluminum for instrument cases and for specal castings on the airplane where corrosion is not of importance.

There has been an increase in the use of plywood in the construction of airplanes, for wing covering, leading edge, bulkheads, pontoons, wing beams, etc. The New Jersey Veneer Company and the Haskelite Manufacturing Corporation have supplied a great deal of this material, the latter having made up plywood panels as large as 54 feet by 7½ feet.

Accessories

Aeronautic Instruments. The outstanding technical development in the aeronautic instrument field for the year 1923 has been the perfection and adoption of various standard types of aircraft instruments. The Pioneer Instrument Company has perfected air-speed indicators for balloons and gliders with ranges of 40 to 80 miles per hour, and for racing airplanes to measure speeds up to 250 miles per hour.

The Bureau of Standards has completed the following special instruments for the *"Shenandoah":* A temperature-compensated altimeter, a sensative landing altimeter, a rate of climb indicator, an electric turn indicator, and a fabric-tension meter. The Bureau of Standards has also continued its work on the body of diaphragms for aeronautic instruments and the study of aerial navigation instruments, the report of which was completed and will be issued by the National Advisory Committee for Aeronautics.

The Pioneer Instrument Company, in co-operation with the Army Air Service, re-designed many of the old instruments, so that in their new form they are more compact and more easily installed.

Rate-of-climb indicators, air-speed indicators, tachometers, and engine gauges have been built in standard vertical cases with narrow vertical dials occupying only a fraction of the space occupied by the same instruments with round dials.

The earth inductor compass and the flight indicator have been further developed by the Pioneer Instrument Company to the point where the Air Service has recently reported that they are now deemed satisfactory for general use. The flight indicator as developed by the Pioneer Instrument Company combines a turn indicator, a bank indicator, and a gyroscopic fore-and-aft inclinometer. The simplifying and condensing of all the instruments needed by the pilot have been given serious attention. Complete instrument boards are developed by the Pioneer Instrument Company, and it is expected that this type of board will be adopted for all aircraft.

Ground Equipment. The success of the Air Mail Service in its night flying experiments in 1923 was largely due to its wonderful ground organization and equipment. The Sperry Gyroscope Company started experiments in 1922 on ground lights for the Air Mail Service, and the Sperry lights played an important part in the success of the night-flying experiments. A beacon light was developed, of 450 million candle power, with a 36-inch reflector. Tests of the range of this light have proved that it can be picked up in case of rain or fog at a distance of 100 miles, and in some cases 130 miles. The Sperry Company also developed a landing light which is used at terminals having ten million candle power and a 36-inch reflector. Appreciating the necessity of unattended beacon lights along the airway, the Sperry Company has developed an automatic electric beacon which will light itself at a stated hour and rotate automatically, swinging a horizontal light of five million candle power. In the event of failure of this lamp, a second lamp is automatically swung into place, and the beacon continues to function without interruption. The failure of the first lamp is also indicated by the burning of an auxiliary red lamp, which warns that the beacon has no reserve lamp.

Engineers of the General Electric Company at Harrison, N. J., Cleveland, Ohio and Schenectady, N. Y. went thoroughly into the problems of illumination in connection with night flying and made extensive laboratory experiments on behalf of the Air Mail. They installed five million candle power beacons at 34 points along the night-flying route between Chicago and Cheyenne. The quality of the lens and of the lamp itself was such as to provide the flash with a peculiar brilliancy which penetrated as far as 80 miles or nearly 100 per cent. further than was thought possible. General Electric

engineers working with air mail pilots also devised types of wing lights to be used on landing.

In laying out the night-flying airway, the Air Mail Service provided American Gas Accumulator Company's automatic acetylene gas lights as routing beacons. A total of 270 routing beacons were supplied between Chicago and Cheyenne, and a total of 132 field limitation lights, for indication of emergency landing fields, were installed. The routing beacons furnished have an optical range of approximately eight miles in clear weather and are placed at a maximum of three miles apart. A device was also developed to indicate the direction of the wind at each emergency field, consisting of a long metal tee illuminated through three lenses from an acetylene flame operated by an A. G. A. marine flasher set. The unattended apparatus supplied by the American Gas Accumulator Company is equipped for an operation period of six months.

Aircraft Power Plants

The advance in technical development in aircraft engines during the year 1923 has been increasing the dependability and reducing the weight per unit power. The outstanding engine development is the Packard model 1A-1500 engine. This is a 12-cylinder engine, 5-inch bore by 5½-inch stroke and rated at 500 h.p. at 2000 r.p.m. The engine weighs 709 lbs. and the weight per horsepower is slightly over 104 lbs. The extreme light weight is largely due to a new type of cylinder construction which has proved successful in the 50-hour endurance test. The design of the ignition unit is novel and is the result of co-operation between the Packard and Splitdorf Companies. The dependability of the performance of this engine is the result of painstaking care in the design, two of the important features being the positively cooled exhaust valves and multiple valve springs.

The Packard Company has also developed its model 1A-2500 engine. This engine has 12 cylinders, 6⅜-inch bore and 6½-inch stroke and is rated at 800 h.p. at 2000 r.p.m. The weight per brake horsepower is slightly over 1.4 lb.

Last year the Bureau of Aeronautics set a new standard of service acceptability of 300 hours at full throttle without failures of such a nature as would force a termination of a flight under service conditions. The Wright model E-4 engine has completed such a test and ran a total of 572 hours at full throttle, with voluntary stops for adjustments.

In 1923 the Bureau of Aeronautics of the Navy adopted another rather startling policy in abandoning definitely the use of water-

cooled engines of less than 300 h.p. in future naval aircraft construction. The success of the development of the Lawrance-Wright model J-1, 200 h.p. air-cooled engine is responsible for this decision. The new model, the J-3, 200 h.p. at 1800 r.p.m. is now standard equipment for certain types of naval aircraft.

The Wright model P-1, nine cylinder air-cooled engine, 6-inch bore by 6½-inch stroke, was developed during 1923 and will be ready for tests the early part of 1924. This engine is rated at 400 h.p. at 1650 r.p.m. The importance of this new development in air-cooled engines cannot be over-estimated when it is realized that the cooling system of the water-cooled type of an aircraft engine usually amounts to 25 per cent of the weight of the engine itself. The problem now is to improve the dependability of air-cooled engines to equal that of the best water-cooled types.

The Curtiss D-12 was further refined and the cylinder diameter and compression ratio increased, with the result that this engine contributed largely to the success of the Pulitzer and Schneider Cup winners and the excellent performance of the Curtiss and Boeing pursuit airplanes. The new model D-12 engine develops 500 h.p. at 2300 r.p.m.

The Wright model T-2 engine is now in service and has performed very satisfactorily and proved itself exceptionally durable. The new models have been refined and with a compression ratio of 7 to 1 develop 780 h.p. at 2250 r.p.m. Some of the new models are also being equipped with reduction gears.

The Engineering Division of the Army Air Service have developed a new model of the Alman barrel type engine, and the experimental results look very promising. A great deal of experimental research has been done on air-cooled cylinders at McCook Field, the result of which will be incorporated in a large 9-cylinder air-cooled engine under construction.

A new side type of turbine supercharger has been brought out and is considered the most important development along this line. The design provides for a much cleaner installation, is better cooled and greatly reduces head resistance. A geared type turbine supercharger, adaptable to pursuit airplanes has also been developed.

Records of the past show that by far the greater proportion of power plant failures are due to failures of accessories. The progress of accessory development in overcoming these difficulties has been an important factor in the increasing dependability of aircraft engines. Through the co-operation of Splitdorf, the A.C. and Mosler Company with the Army and Navy technical sections, the defects due to ignition troubles have been largely eliminated. There have

been no outstanding individual developments but the result of the minor improvements on fuel systems, cooling systems and ignition systems has been marked by a freedom from power plant failures of these parts in 1923.

Investigations in the use of light alloys in engine construction have been conducted by the Army and Navy with the co-operation of the Aluminum Company of America. Marked progress has been made in the development of magnesium alloys for aluminum alloys in engine parts that are not highly stressed, such as the crankcase and similar castings. By substituting magnesium alloy for aluminum alloy a saving of approximately thirty per cent in weight will be effected. The American Magnesium Corporation has successfully cast engine crankcases of magnesium alloy, but it remains to be seen whether the metal will prove as satisfactory in service as an aluminum alloy. Indications are that the use of magnesium will be very largely adopted in connection with aircraft engine construction.

The effort to substitute forged duralumin for steel parts in engines has been continued. Results have been promising, and so far a number of parts formerly made of steel, such as connecting rods and propeller hubs, are now made of forged duralumin in some engines. The dependability of the airplane engine is largely dependent upon proper materials for intake and exhaust valves, and the Rich Tool Company has continued to improve the well-known tungsten valve and chromium silicon valve.

Airships

The progress in airship development during 1923 has been largely in connection with what has been learned in the operation of the U.S.S. *"Shenandoah"* and the experimental research carried on in connection with the construction of the Army semi-rigid airship *RS-1*. The construction of the keel of the *RS-1* will be of duralumin built-up sections, and will be a departure from the European designs of this structure. The *RS-1* will have a volume of 700,000 cubic feet, a lift of 42,800 pounds, and a carrying capacity of 17,675 pounds. The airship will be completed in the near future, and is being constructed entirely by the Goodyear Tire and Rubber Company.

The Goodyear Company, in 1923, has designed and constructed for the Army its TC type non-rigid airship. The TC airship has a volume of 200,600 cubic feet, a total useful load of 4,117 pounds, and a maximum speed of 60 miles per hour. At the cruising speed of 47 miles per hour it has a range of 830 miles. This company has also developed the Army type TA non-rigid airship for training

purposes, having a five-passenger car with a wing type outrigger on which are mounted two Curtiss OX 90-horsepower engines. The airship is designed for the use of helium, and has a volume of 130,-600 cubic feet and a useful load of 1,870 pounds. The maximum speed is 50 miles per hour, the crusing speed 40 miles per hour, and the range at cruising speed is 720 miles.

The Goodyear Company has also made, in connection with the construction of these airships, improvements in the fabrication of duralumin, in airship fabrics, in compounds for rubberized fabrics, and in the method of applying goldbeater's skin to gas cell fabric.

The B. F. Goodrich Rubber Company during the past year developed an exceptionally efficient and light automatic airship valve. This valve has a large discharge capacity, which is obtained by permitting an opening of 4 inches. The metal used is magnesium, which is largely responsible for the light construction. Provision is made to indicate pressure settings on a dial and for an emergency closing device positive in action, so that the pilot can hold or close the valve from the control board. The valve is so designed that it is attached to the envelope without the use of wing nuts, a specially constructed manhole gasket being provided.

The Bureau of Aeronautics has had built a J-1 class airship, which is a modification of the C class non-rigid airship. The J-1 has about the same envelope capacity as the C class, but is of shorter and fatter form and is fitted with but a single balloonette. It has a capacity of 173,000 cubic feet, and is powered with two Union 125-horsepower engines.

Work of the Bureau of Standards

The work of the Bureau of Standards of which Dr. George K. Burgess is Director, during the year 1923 in connection with aeronautics has covered a wide variety of tests and investigations. Nearly all this work has been conducted with the co-operation and often with the financial assistance of the Army, Navy, National Advisory Committee for Aeronautics, Post Office Department, etc.

Apparatus has been perfected for the condensation of engine exhaust water as ballast for airships. This device, which was developed for the Army Air Service, makes it possible to maintain the constant buoyancy of the ship without "valving" gas due to loss in weight as gasoline is consumed.

The altitude laboratory was continued in service throughout the year on aeronautic engine investigations. Tests of the performance of the Wright H-3 engine and carburetion characteristics of the Wright air-cooled engine, were among the investigations carried on.

Measurements which were made of airflow through radiators when placed in a free air stream by means of pitot tube and hot wire anemometer substantiate the previous contention that the air flow constant does not change at high speeds. The range of speed employed was from 50 to 140 miles per hour.

A hot-wire anemometer was developed and a method devised for measuring average air flow through radiator cores. The instrument is reliable to 5 per cent. and could be used to an accuracy of 2 or 3 per cent. A series of corrections were determined enabling a true measure of air flow through the cell of a radiator core by means of a fine pitot tube. Flight tests of radiators were conducted at the U. S. Naval Air Station at Anacostia, D. C. Additional data which are needed before an accurate comparison can be made between the merits of mounting a radiator in the nose, or in some position on the wing of an airplane are now being collected from experimental work. This is being carried out in the 10-foot wind tunnel and involves determinations of head resistance and velocity distribution of a nose radiator mounted in a Vought VE-7 fuselage.

An extensive series of tests and measurements are being made on representative types of ignition systems.

The Aeronautic Instrument Section has been engaged in research on aeronautic instruments and in the development of special instruments for the Army, the Navy, and the National Advisory Committee for Aeronautics. Bourdon tubes, metallic and non-metallic diaphragms and sylphon diaphragms have been studied extensively since these elements are used so widely in aeronautic instrument design. Special attention has been given also to sextants, compasses, and other instruments employed in aerial navagation. A number of special instruments were developed for the U. S. Navy rigid dirigible *"Shenandoah,"* including a landing altimeter, an electric turn meter, a temperature compensated altimeter, a rate-of-climb meter, and two special airspeed indicators which may be temporarily suspended below the ship in order to obtain a true airspeed independently of any disturbances set up around the hull of the ship.

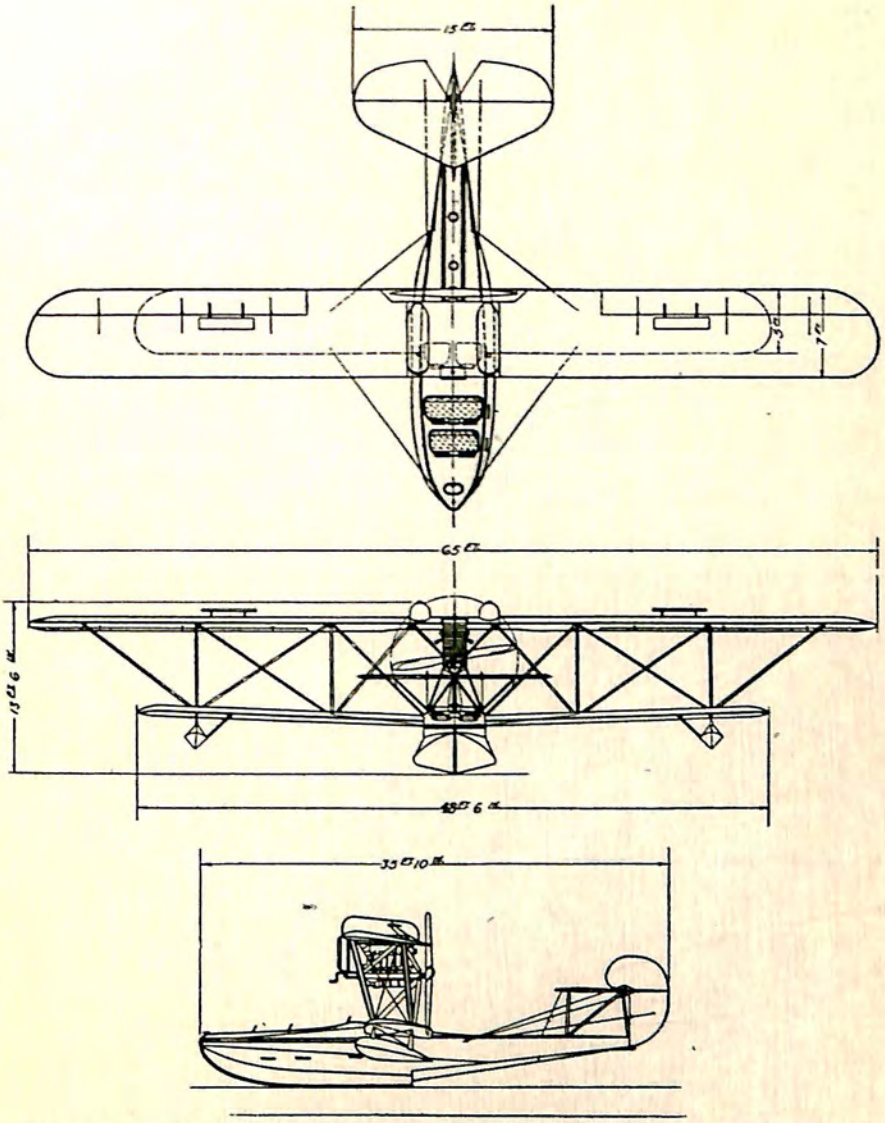
The Aerodynamical Physics Section, has been engaged in a cooperative program with the Engineering Division of the Air Service, U. S. A., Ordnance Department, U.S.A., and the National Advisory Committee for Aeronautics. The Bureau is equipped with three wind tunnels, one ten feet in diameter with a maximum working speed of 100 feet per second, and two smaller tunnels in one of which the maximum speed of 250 feet per second can be obtained. Most of the wind tunnel work in connection with the lighter-than-air program was carried out at the Bureau, involving tests of models

of existing airships and in addition a long program of research in connection with the design of a 700,000 cu. ft. semi-rigid airship. The work for the Ordinance Department related to the stability of aircraft bombs, while the work for the National Advisory Committee for Aeronautics consisted of special researches on some of the fundamental problems relating to wind tunnel techinque and to the science of aerodynamics.

One of the sections of the electrical division, has developed a successful remote reading and recording strain gauge. It has proved especially useful in indicating and recording the stresses in aircraft members during flight. Several hundred balloon fabrics have been tested for various properties, particularly for permeability to gases.

Over 100 samples of airplane dopes, besides miscellaneous materials have been tested.

AIRCRAFT AND ENGINE DESIGN
SECTION

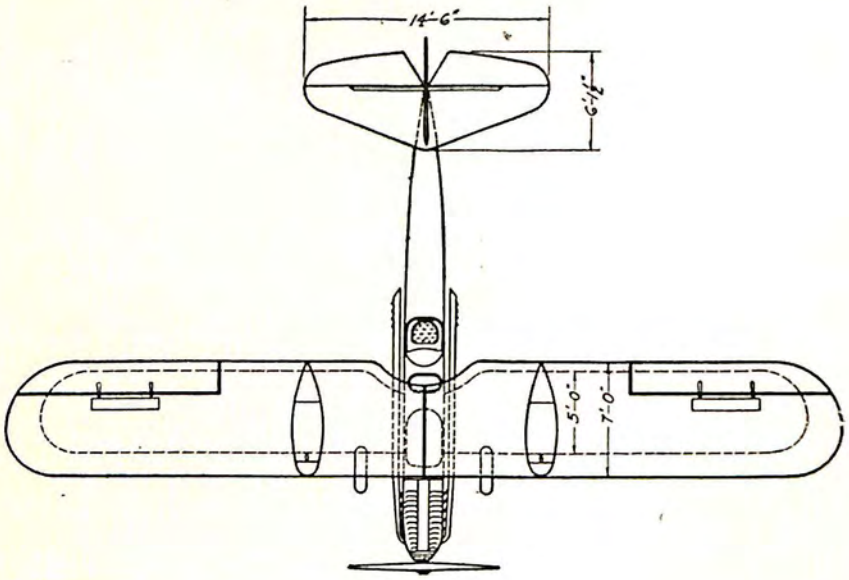


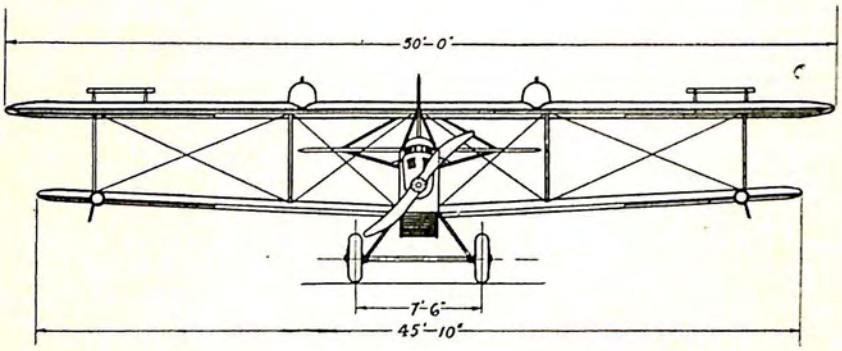
AEROMARINE PLANE AND MOTOR COMPANY

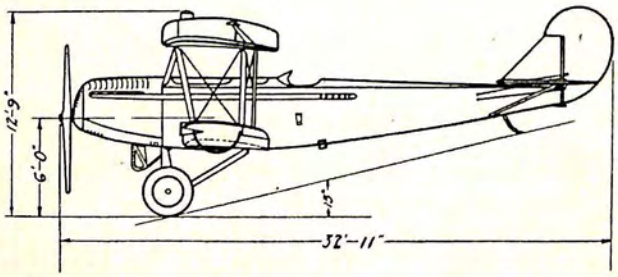
KEYPORT, N. J.

TYPE: COMMERCIAL PASSENGER MODEL: A.M.C.

ENGINE: LIBERTY 400 H.P. SPEED: 50-95 M.P.H. CLIMB: 33000 FT. IN 10 MIN.





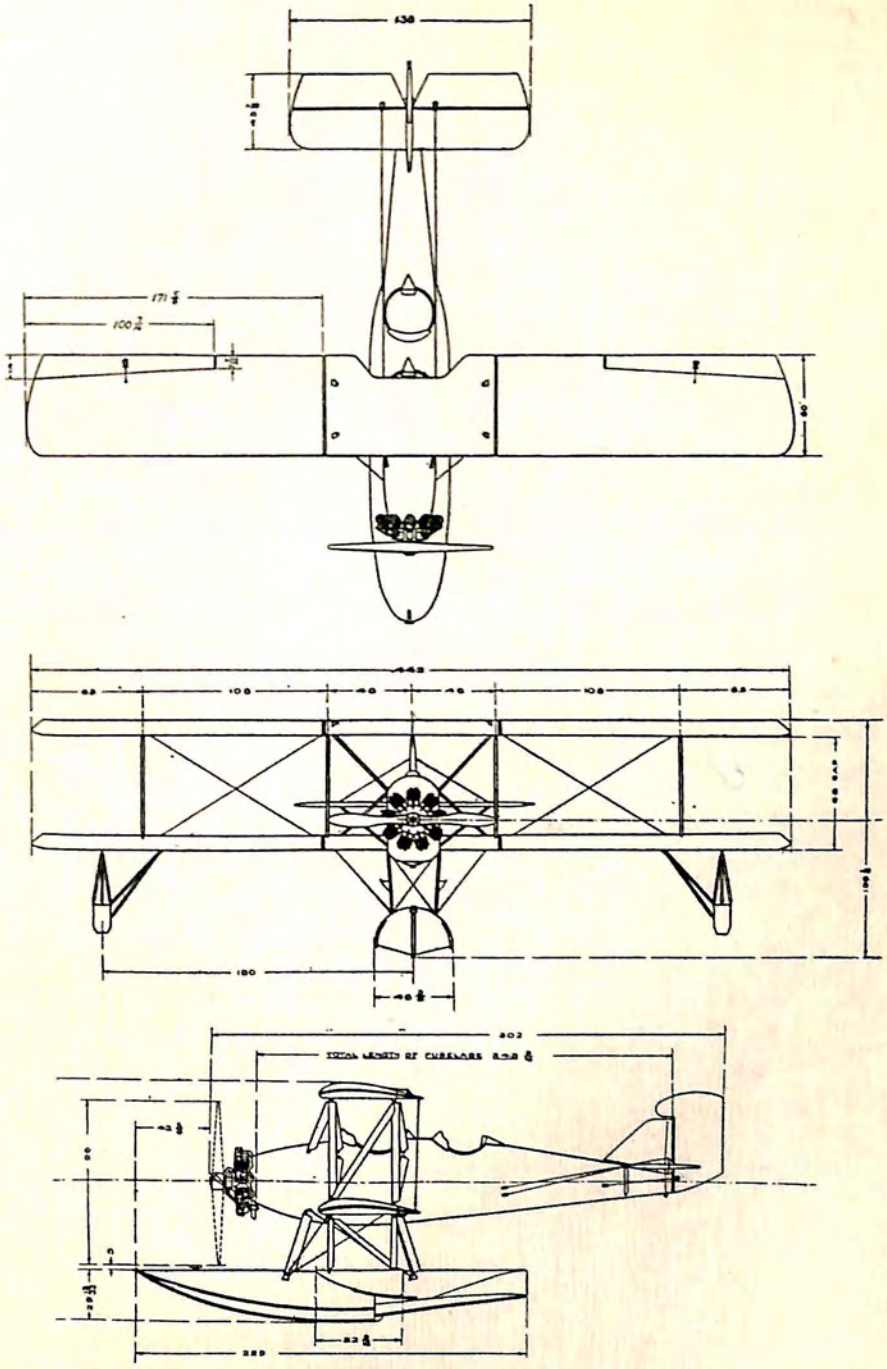


AEROMARINE PLANE AND MOTOR COMPANY

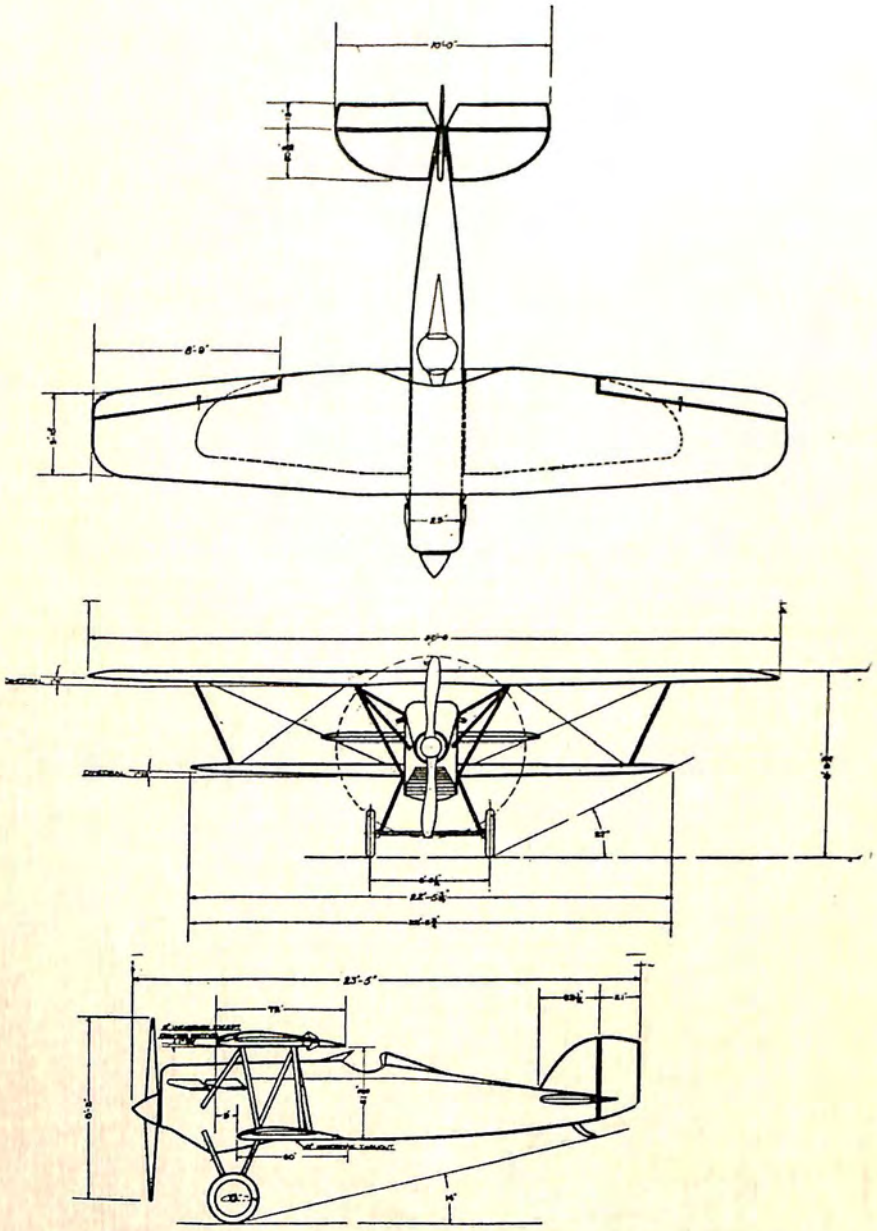
KEYPORT, N.J.

TYPE: NIGHT AIR MAIL CARRIER MODEL: A.M-2

ENGINE: LIBERTY 400 H.P. SPEED: 45-115 M.P.H. CLIMB: 8000 FT. IN 10 MIN.



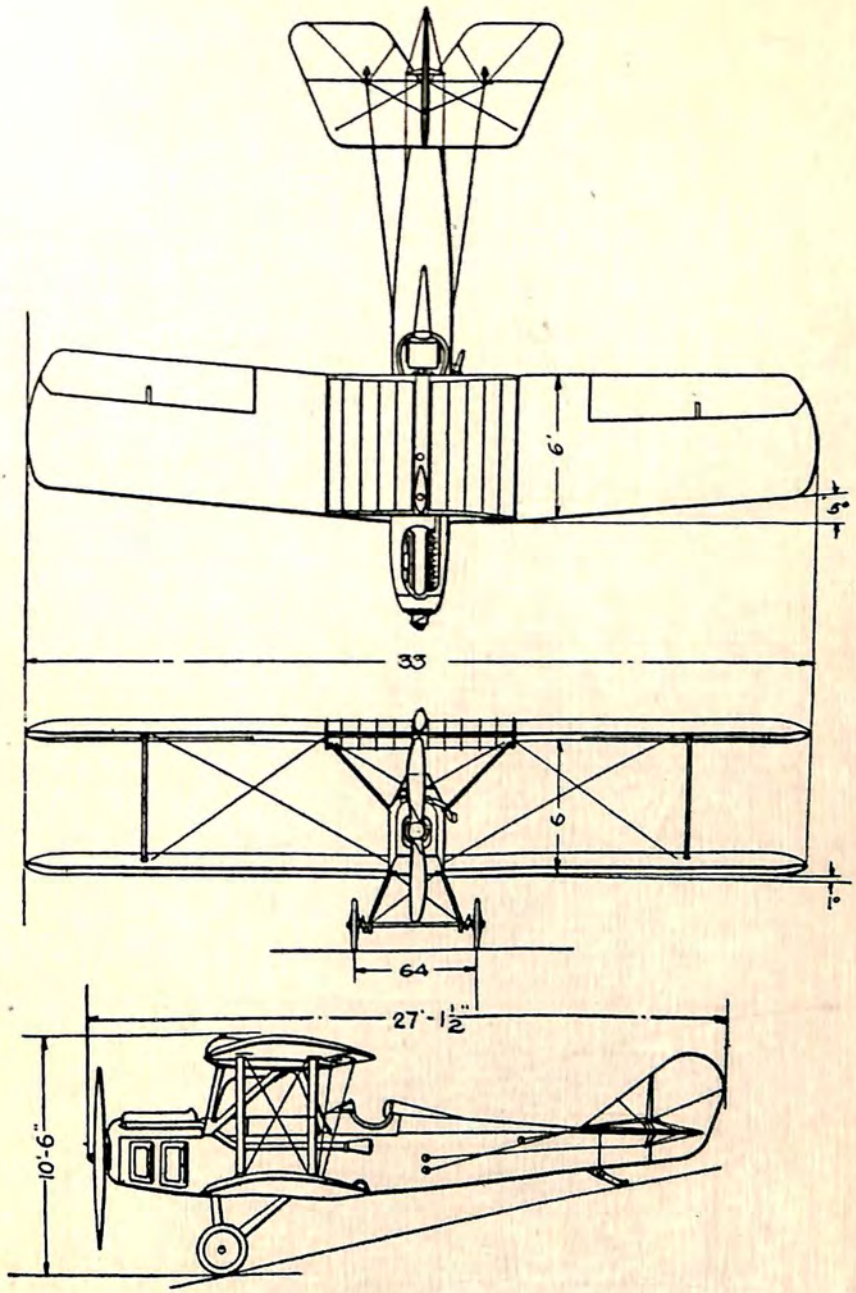
BOEING AIRPLANE COMPANY
SEATTLE WASH.
TYPE: TRAINING ENGINE: WRIGHT J-3 – 200 H.P.



BOEING AIRPLANE COMPANY

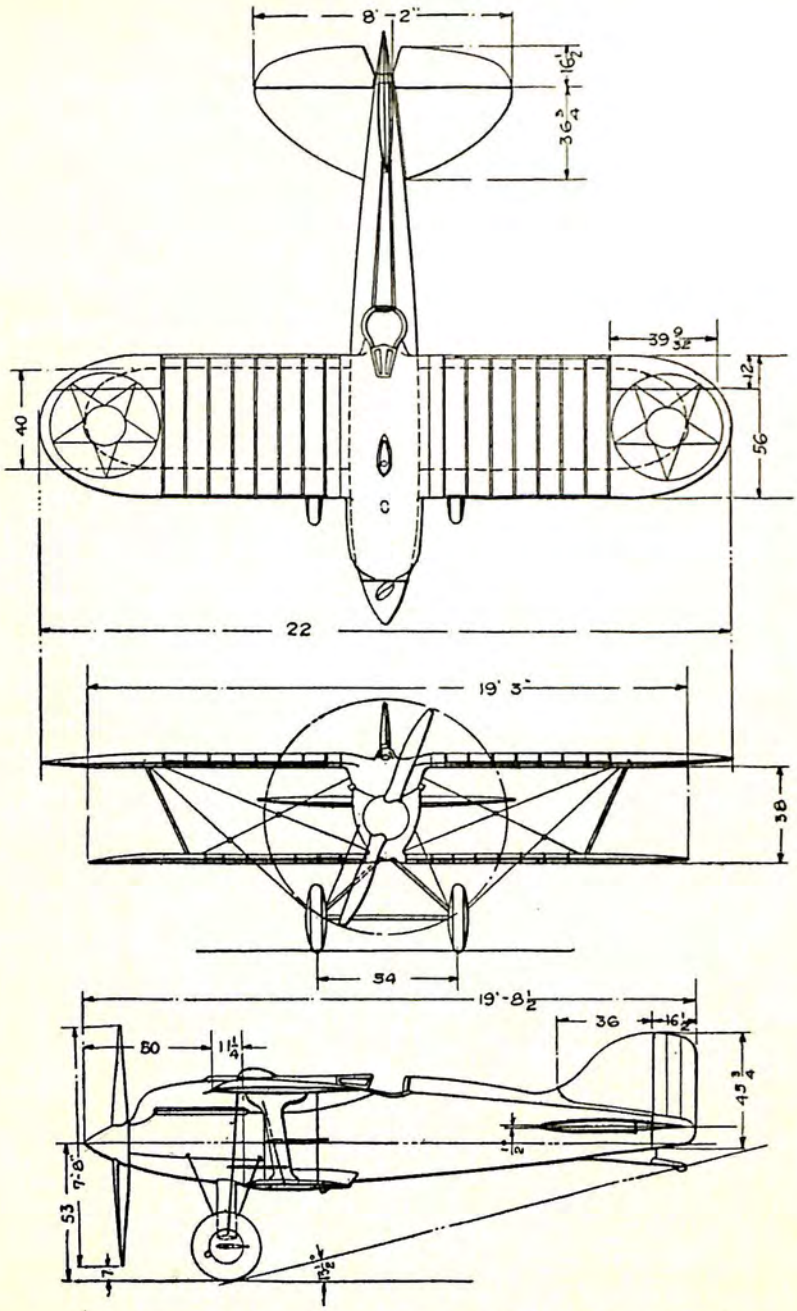
SEATTLE WASH.

TYPE: PURSUIT. ENGINE: CURTISS D-12-375 H.P.

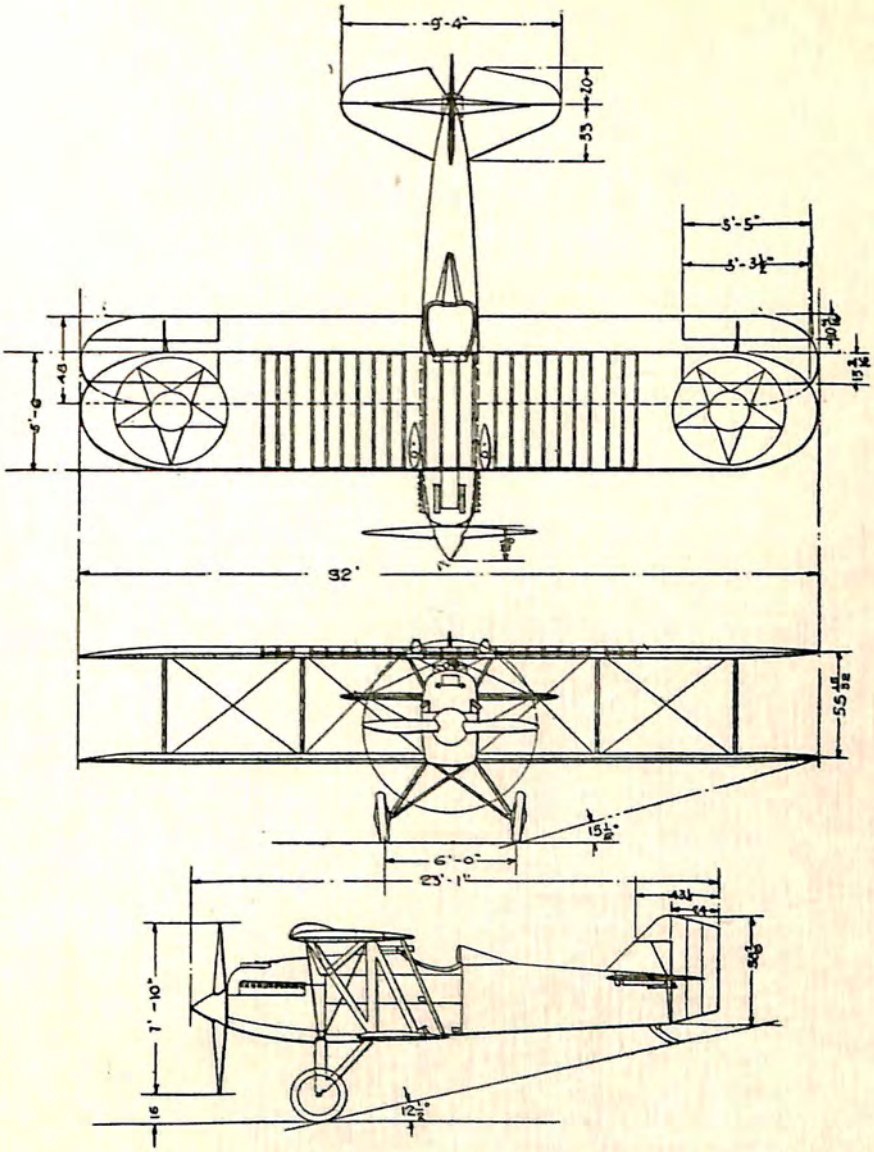


THE CURTISS AEROPLANE AND MOTOR COMPANY INC.
GARDEN CITY, L.I.N.Y.

CURTISS NIGHT MAIL PLANE - CURTISS C-6 MOTOR
160 H.P. — 106 M.P.H.
ENDURANCE — 3.8 HRS.



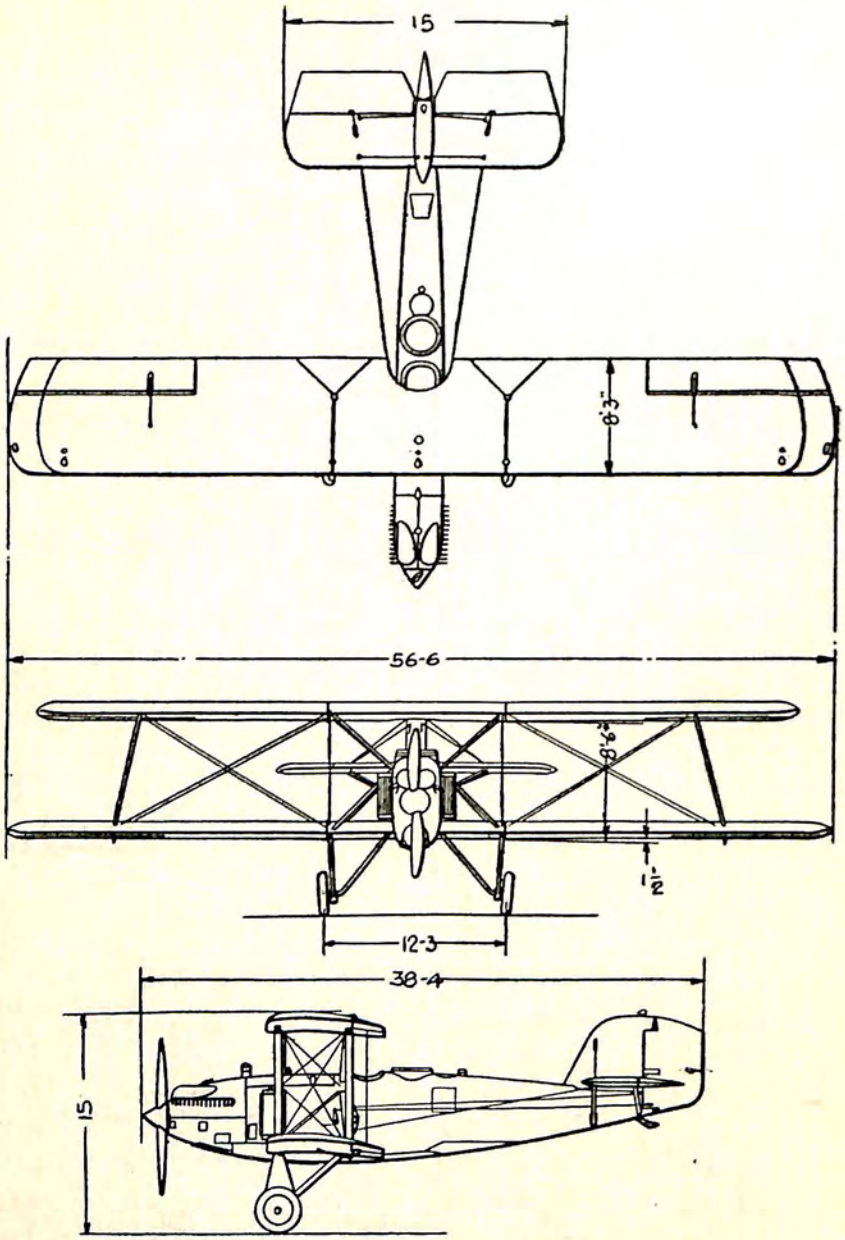
THE CURTISS AEROPLANE AND MOTOR COMPANY INC.
GARDEN CITY L.I.N.Y.
1923 NAVY-CURTISS RACER-CURTISS D-12 MOTOR
500 H.P.
OFFICIAL SPEED FOR 3 KILOMETERS 266.59 M.P.H. (WORLDS SPEED RECORD)
WINNER OF PULITZER RACE AT 243.67 M.P.H.



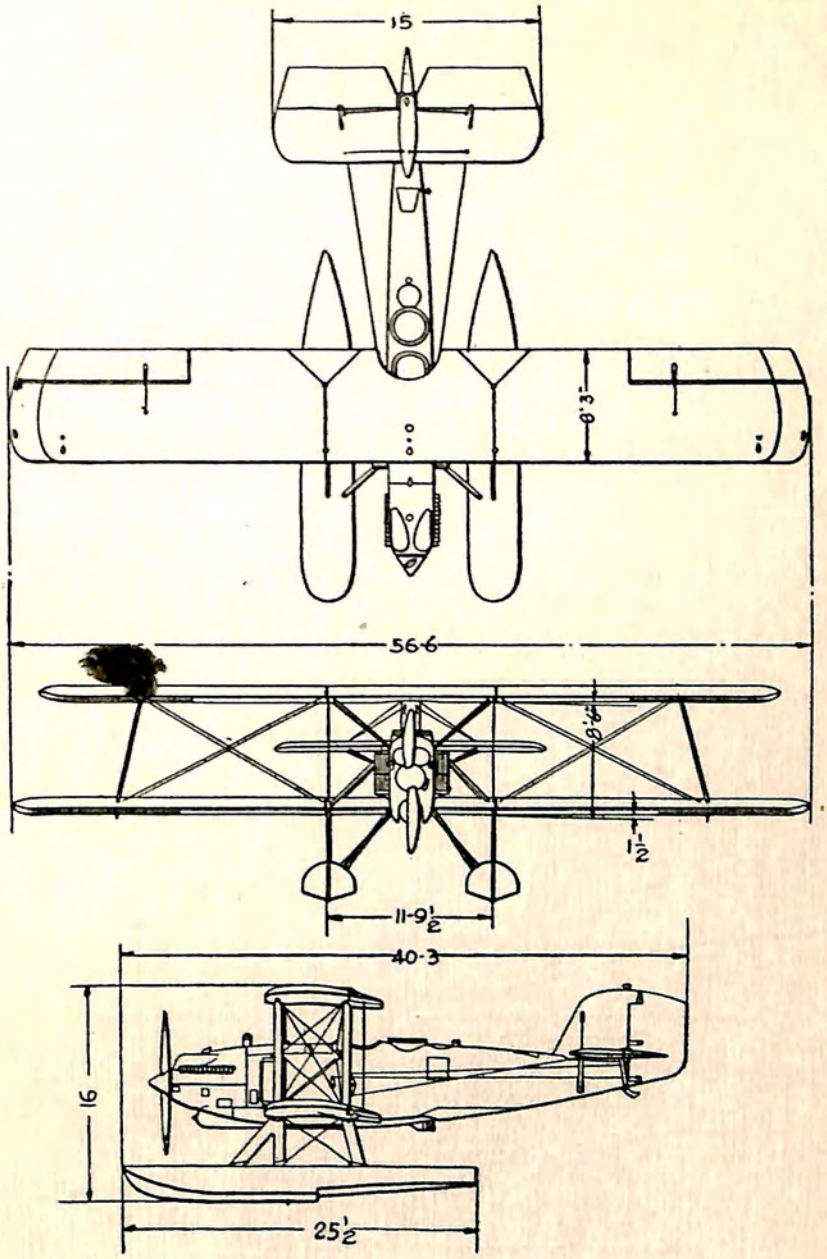
THE CURTISS AEROPLANE AND MOTOR COMPANY INC.
GARDEN CITY, L.I.N.Y.

1923 CURTISS-ARMY PURSUIT PLANE - D-12 MOTOR

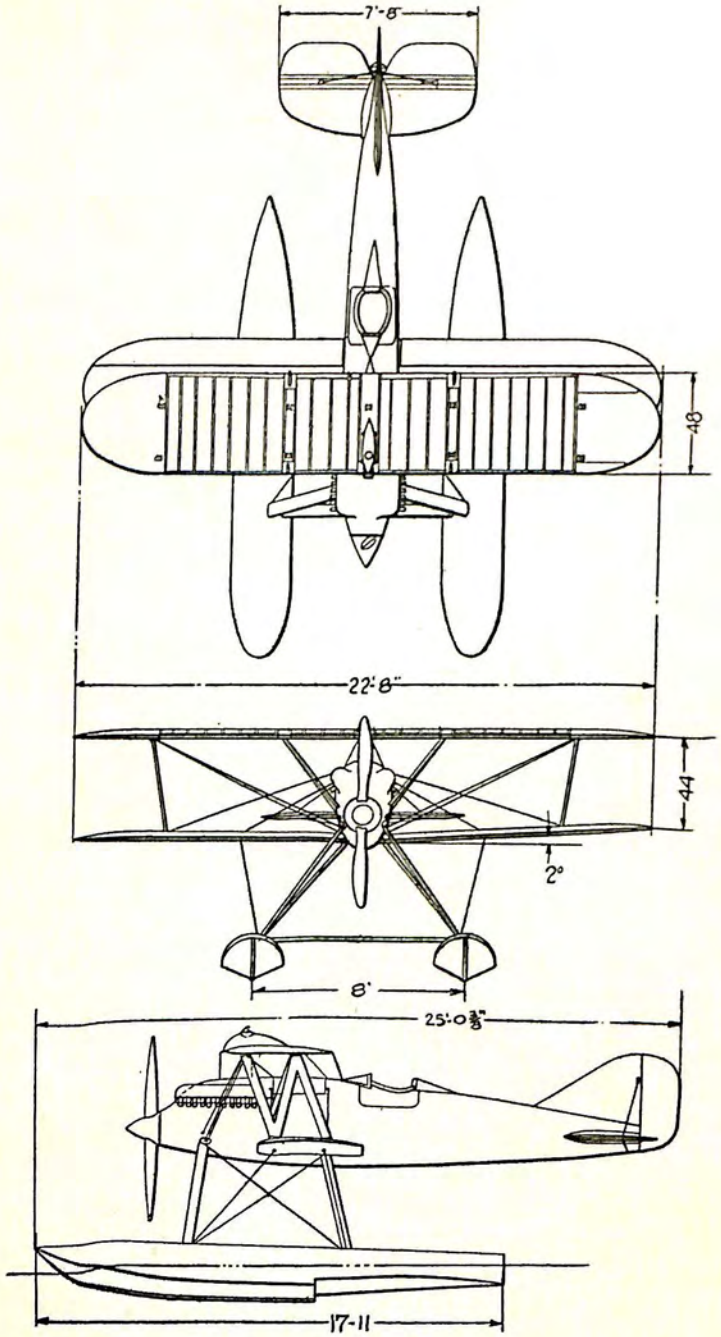
HIGH COMPRESSION MOTOR	LOW COMPRESSION MOTOR
460.H.P. — 178 M.P.H.	420 H.P. 169 M.P.H.
24,000 FT. SERVICE CEILING	20,500 FT. SERVICE CEILING
25,400 FT. ABSOLUTE CEILING	21,800 FT. ABSOLUTE CEILING



THE CURTISS AEROPLANE AND MOTOR COMPANY INC.
GARDEN CITY, L.I.N.Y.
NAVY CURTISS CS-1 — WRIGHT T-2 MOTOR
530 H.P. — 105 M.P.H.

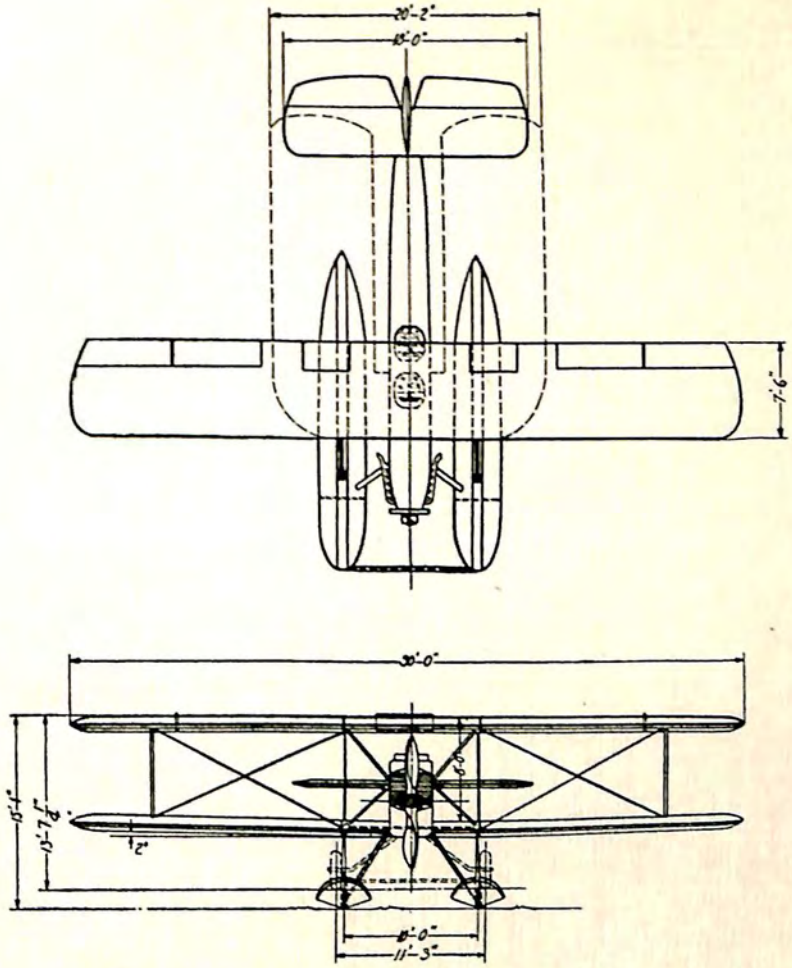


THE CURTISS AEROPLANE AND MOTOR COMPANY INC.
GARDEN CITY, L.I.N.Y.
NAVY CURTISS CS-1 - WRIGHT T-2 MOTOR
530 H.P. — 102 M.P.H.



THE CURTISS AEROPLANE AND MOTOR COMPANY INC.
GARDEN CITY, L.I. N.Y.

NAVY CURTISS SEAPLANE RACER - D-12 MOTOR
460 H.P. — 194 M.P.H.

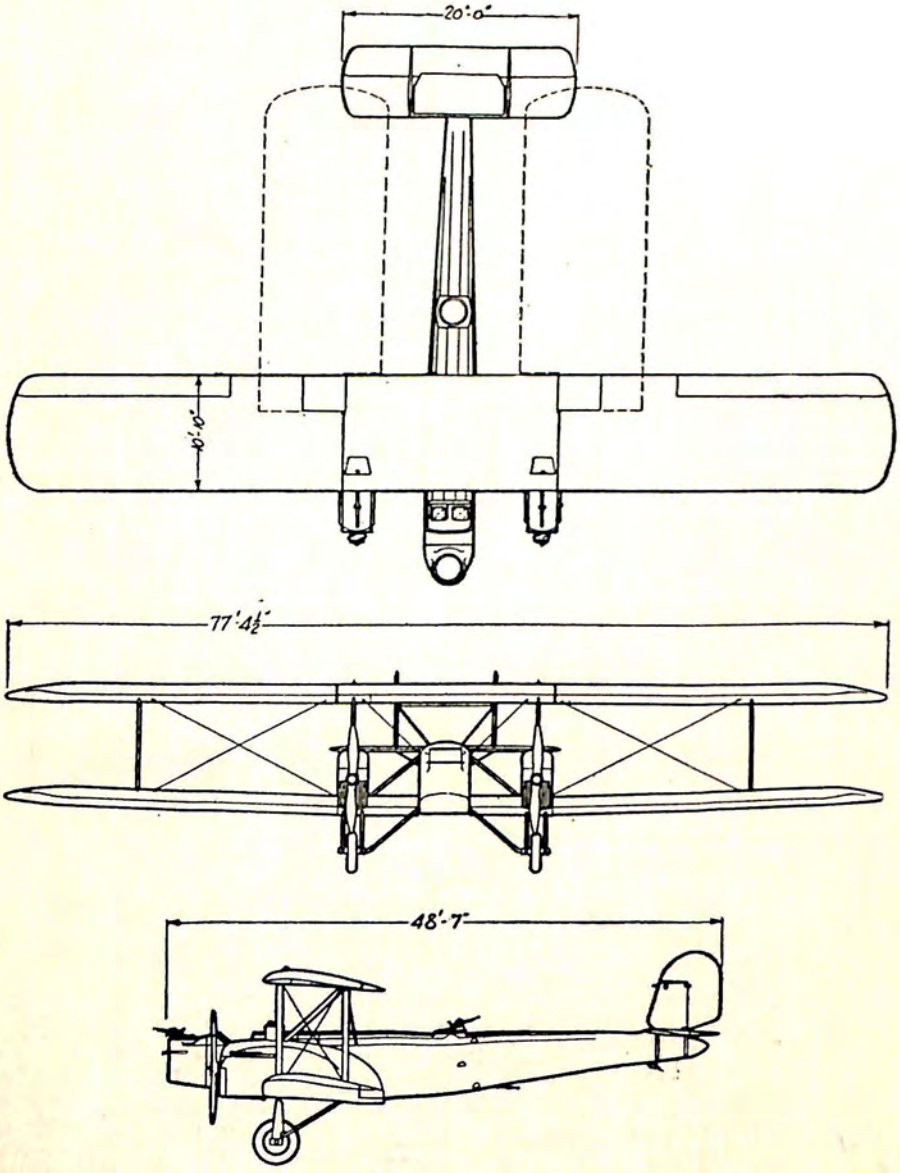


THE DOUGLAS CO.

SANTA MONICA, CAL.

TYPE: WORLD CRUISER MODEL: DW-C

ENGINE: LIBERTY 400 H.P.



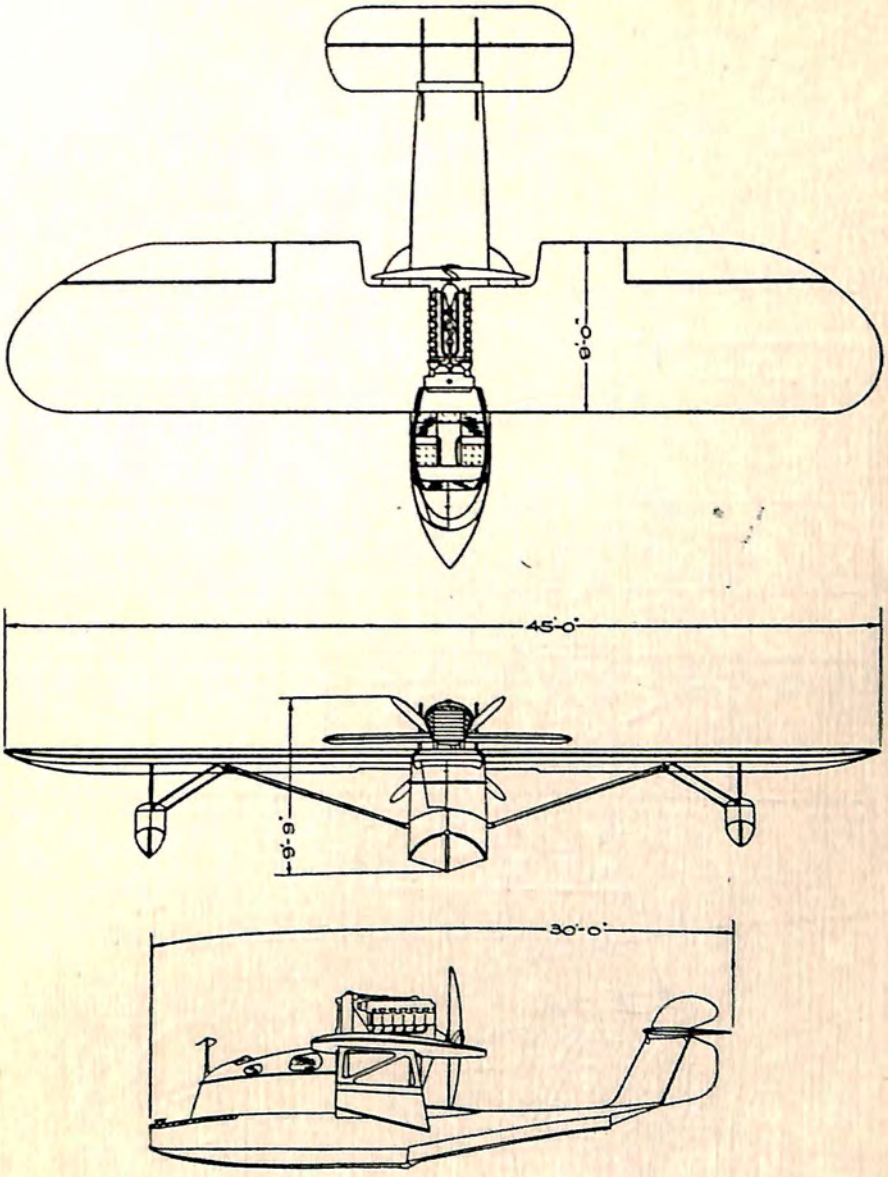
G. Elias & Bro., Inc.

AIRCRAFT DEPT.

BUFFALO, N. Y.

Type--N. B. S.-3.
Engines--Liberty "12"

Speed 105 M. P. H.
Ceiling 12000 feet

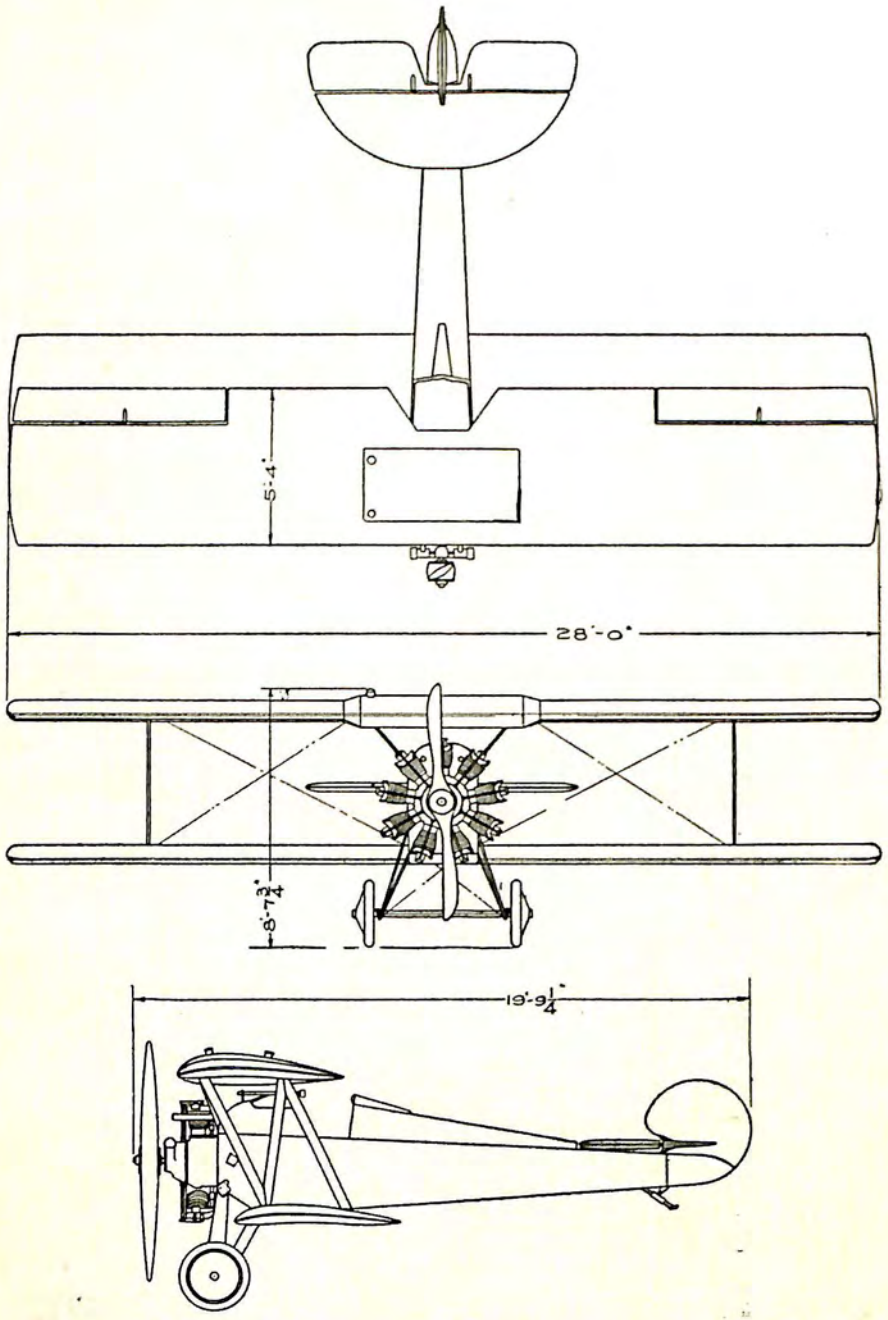


LOENING AERONAUTICAL ENGINEERING CORPORATION

NEW YORK, N.Y

TYPE. FIVE SEATER AIRYACHT 1924 MODEL

ENGINE LIBERTY-12 400 H.P SPEED 135 M.P.H.

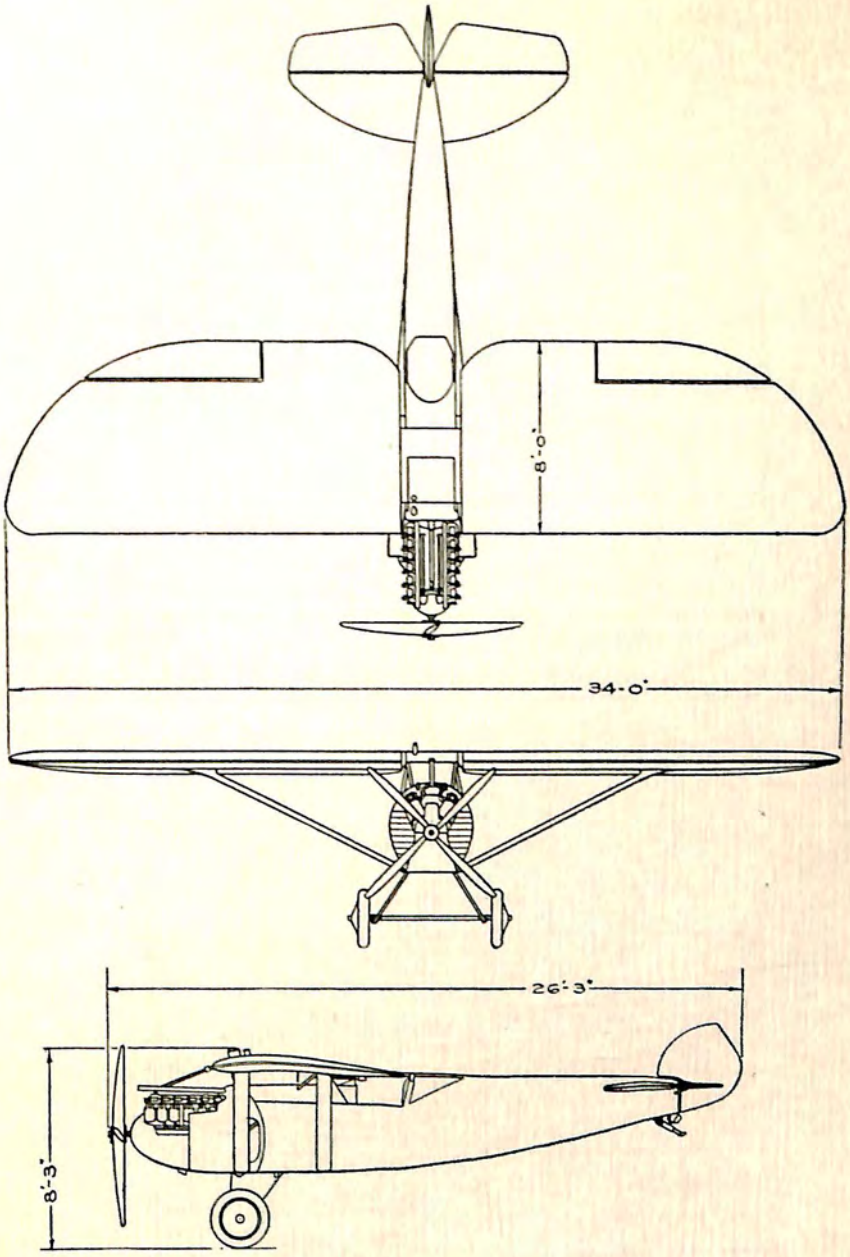


LOENING AERONAUTICAL ENGINEERING CORPORATION

NEW YORK, N.Y.

TYPE- PURSUIT, TYPE III MODEL PA-1

ENGINE WRIGHT R-1, 350 H.P. SPEED: 145 M.P.H. CLIMB: 10000 FT. IN 8 MIN.

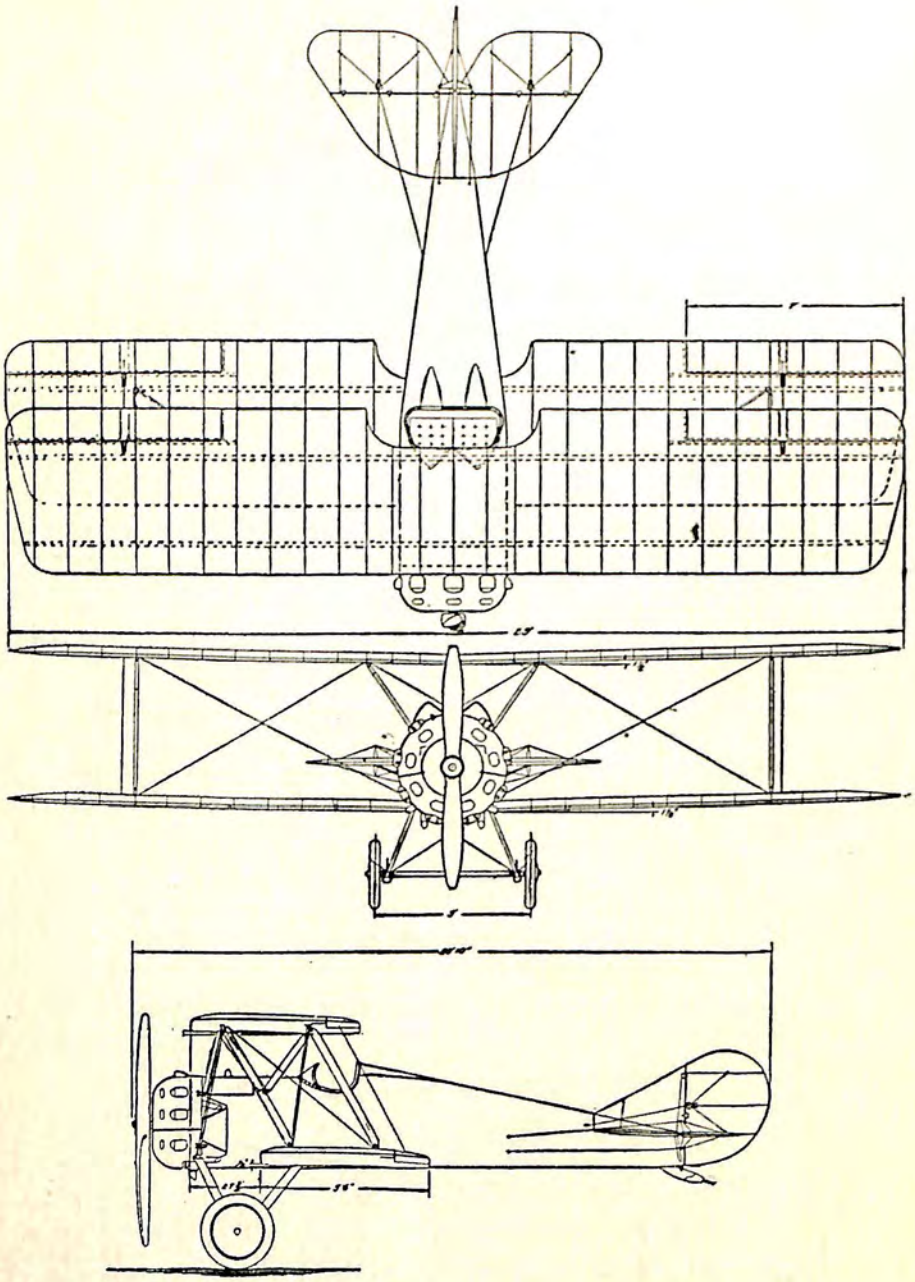


LOENING AERONAUTICAL ENGINEERING CORPORATION

NEW YORK, N.Y

TYPE: PURSUIT PW2B MODEL 25

ENGINE: PACKARD 300 H.P. SPEED: 145 M.P.H. CLIMB: 10000 FT. IN 10 MIN.

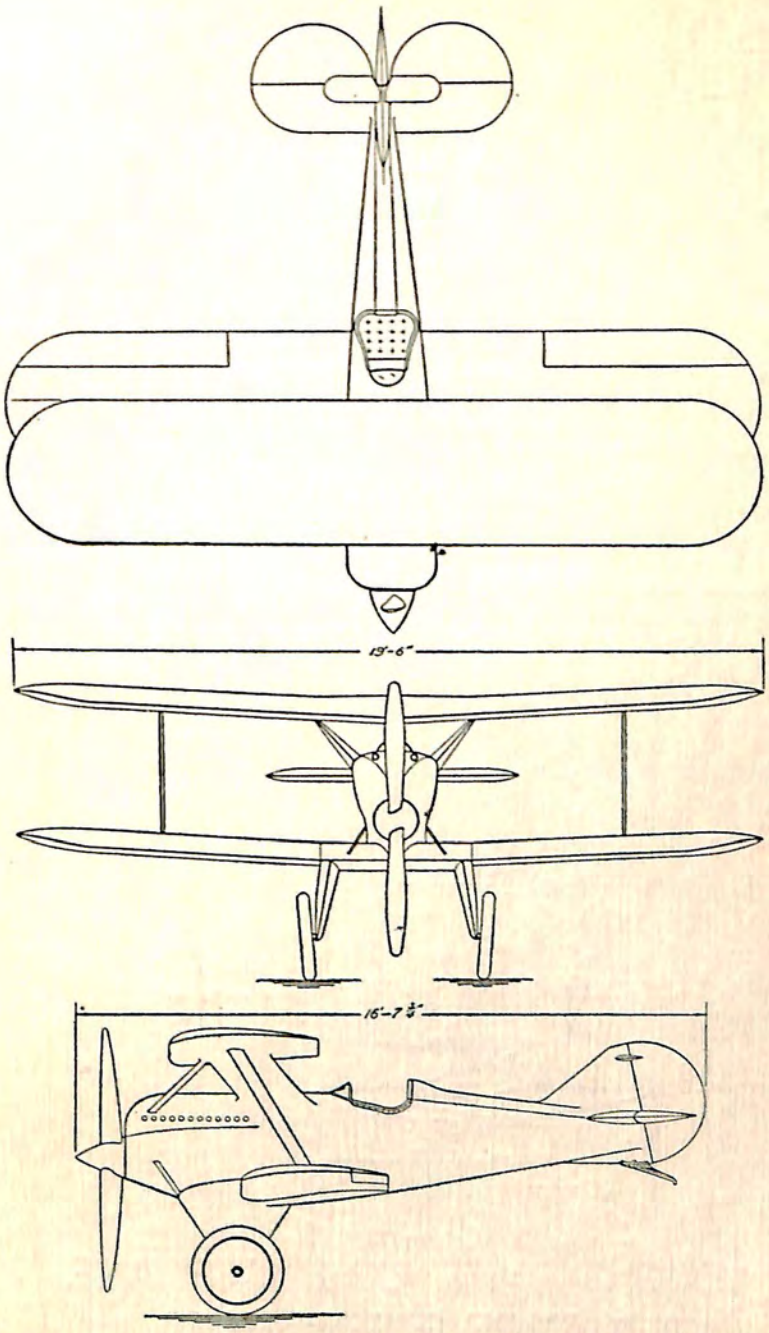


THOMAS MORSE AIRCRAFT CORPORATION

ITHACA N.Y.

TYPE: TRAINING MODEL: S-9 SEMI-METAL

ENGINE: LAWRANCE 200 H.P. SPEED: 50-118 M.P.H. CLIMB: 1120 FT./MIN.

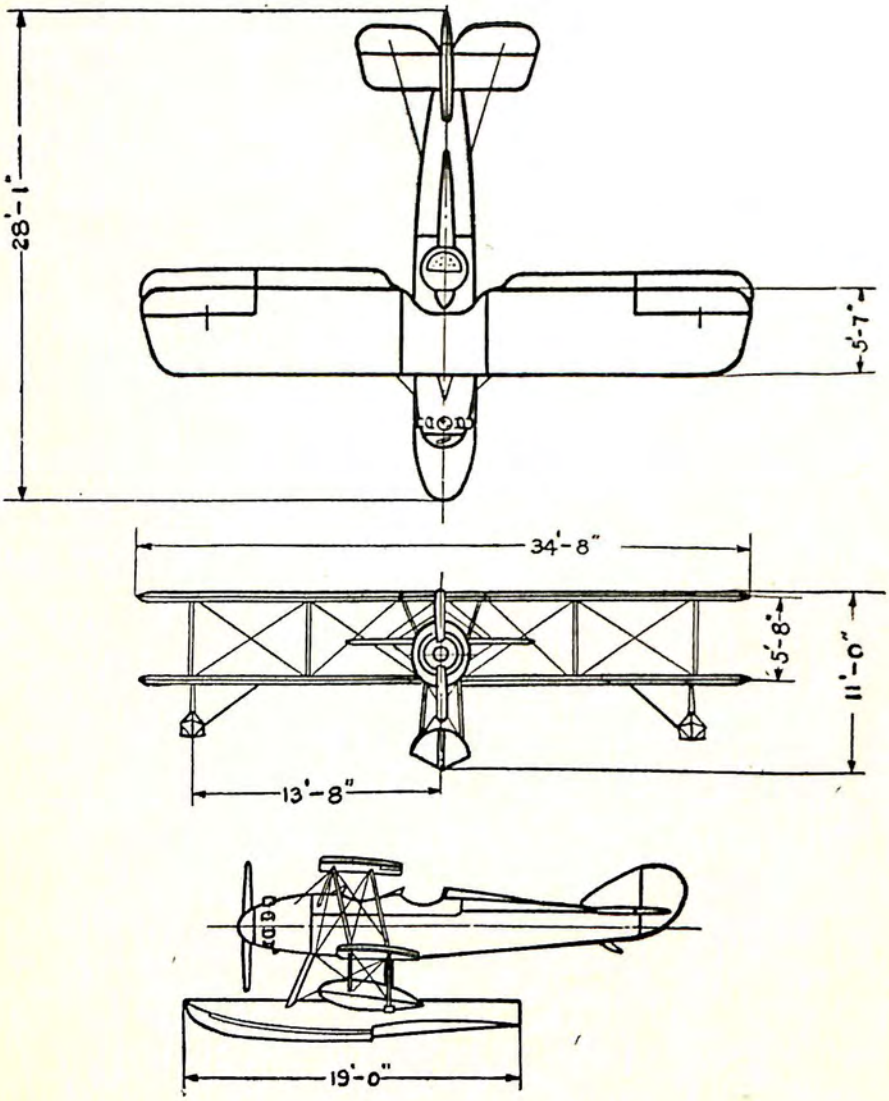


THOMAS MORSE AIRCRAFT CORPORATION

ITHACA N.Y

TYPE: PURSUIT MODEL: TM-23 ALL METAL

ENGINE: CURTISS 375 H.P.



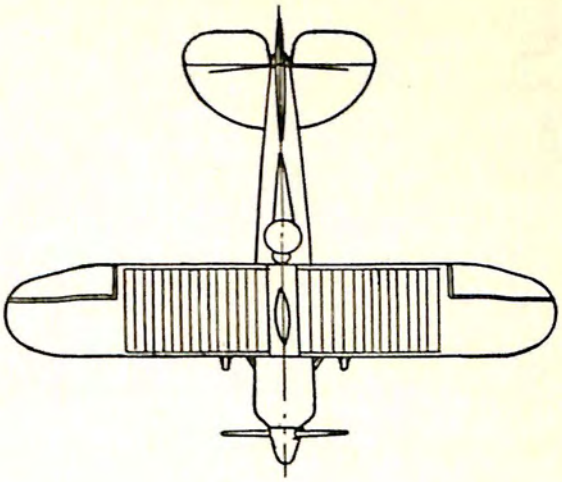
VOUGHT TYPE UO-1 AIRPLANE

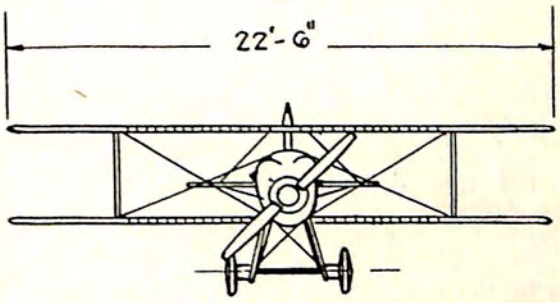
DESIGNED AND CONSTRUCTED BY

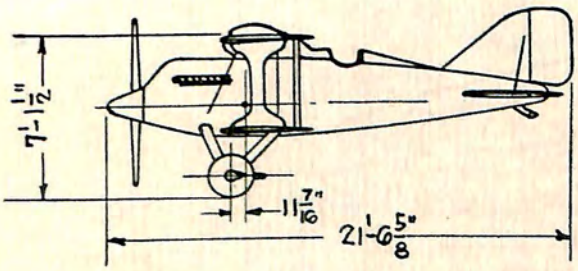
THE CHANCE VOUGHT CORPORATION

LONG ISLAND CITY, N.Y.

FOR THE BUREAU OF AERONAUTICS, U.S. NAVY

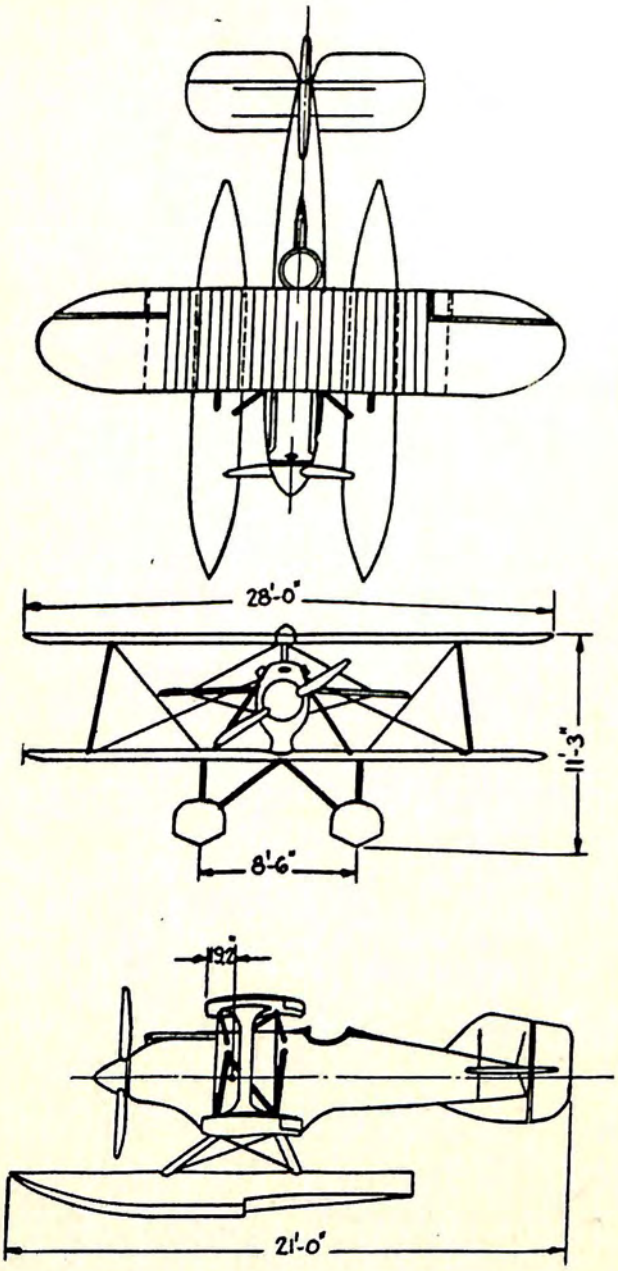






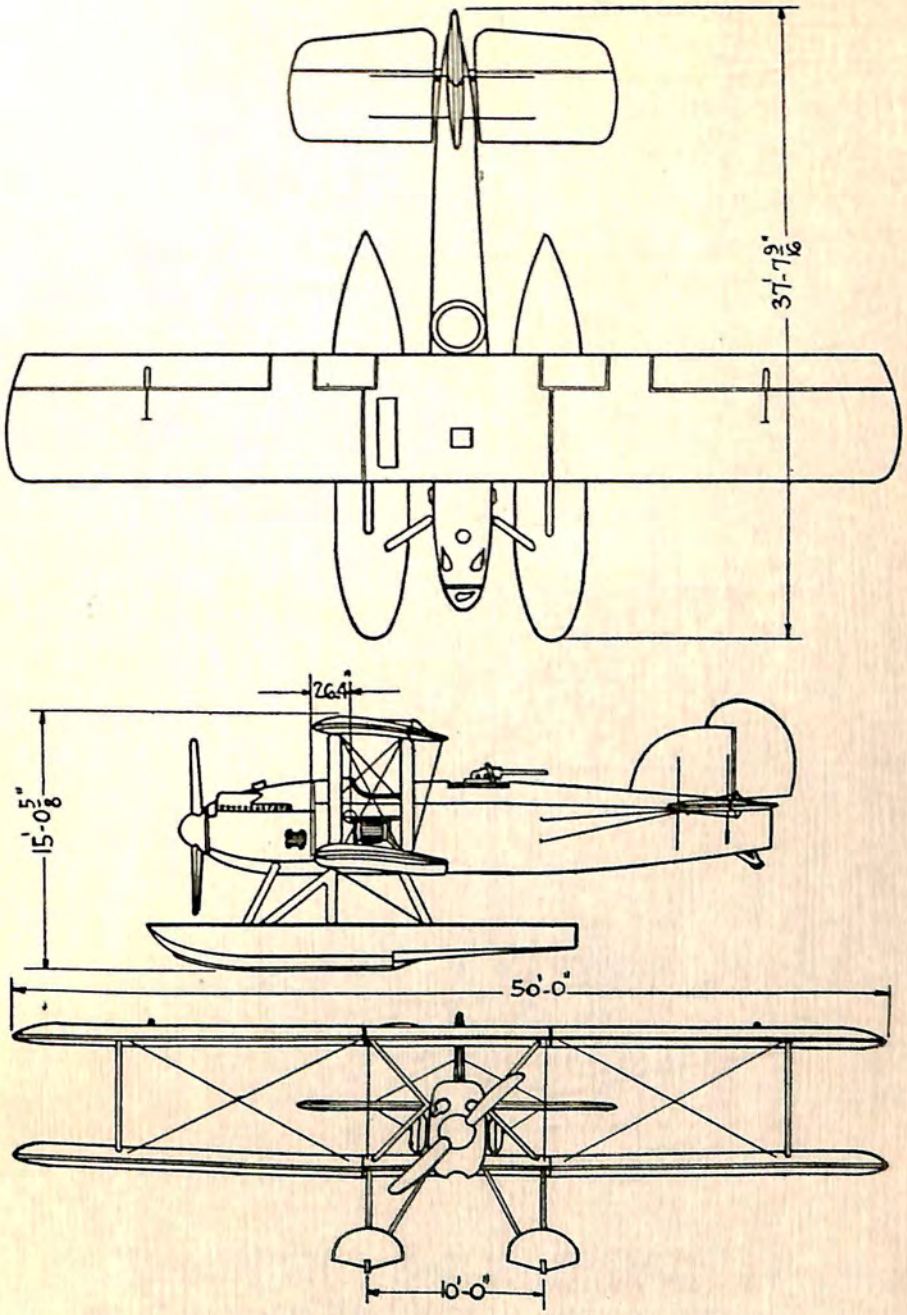
WRIGHT AERONAUTICAL CORPORATION
PATERSON N.J.

NAVY-WRIGHT FIGHTER F2W
WRIGHT T-3 ENGINE

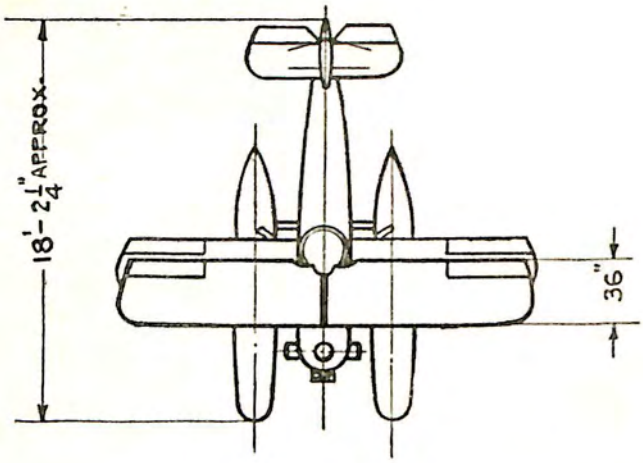


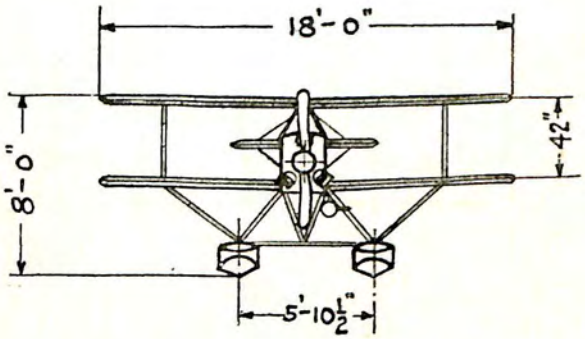
WRIGHT AERONAUTICAL CORPORATION
PATERSON N.J.

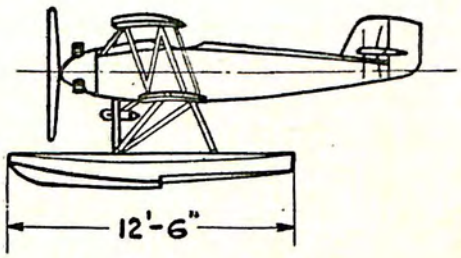
NAVY-WRIGHT SEAPLANE. NW-2
WRIGHT T-2 ENGINE



WRIGHT AERONAUTICAL CORPORATION
PATERSON N.J.
DOUGLAS-WRIGHT SCOUT PLANE DT-4
WRIGHT T-2 ENGINE

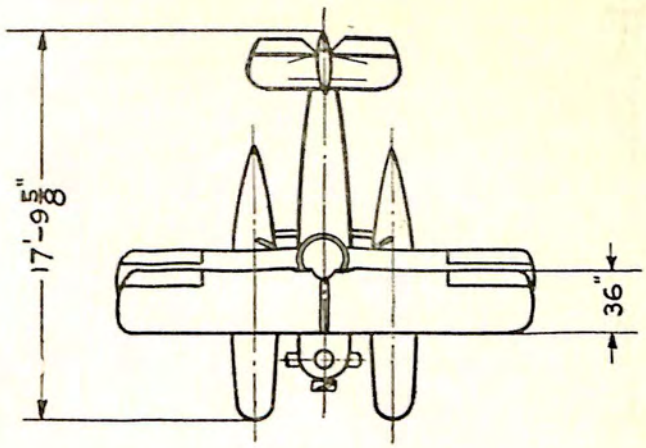


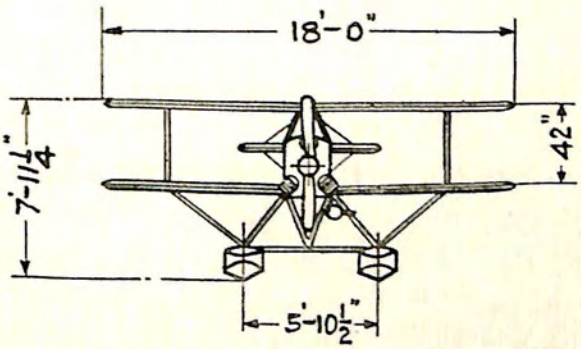


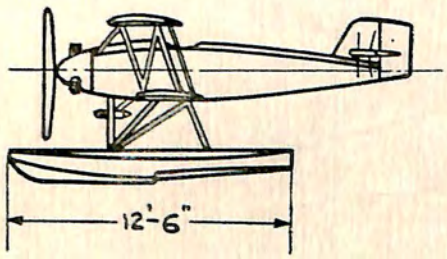


TYPE XS-1 AIRPLANE

DESIGNED BY THE BUREAU OF AERONAUTICS
AND CONSTRUCTED BY
THE COX-KLEMIN AIRCRAFT CORPORATION
COLLEGE POINT, L.I.

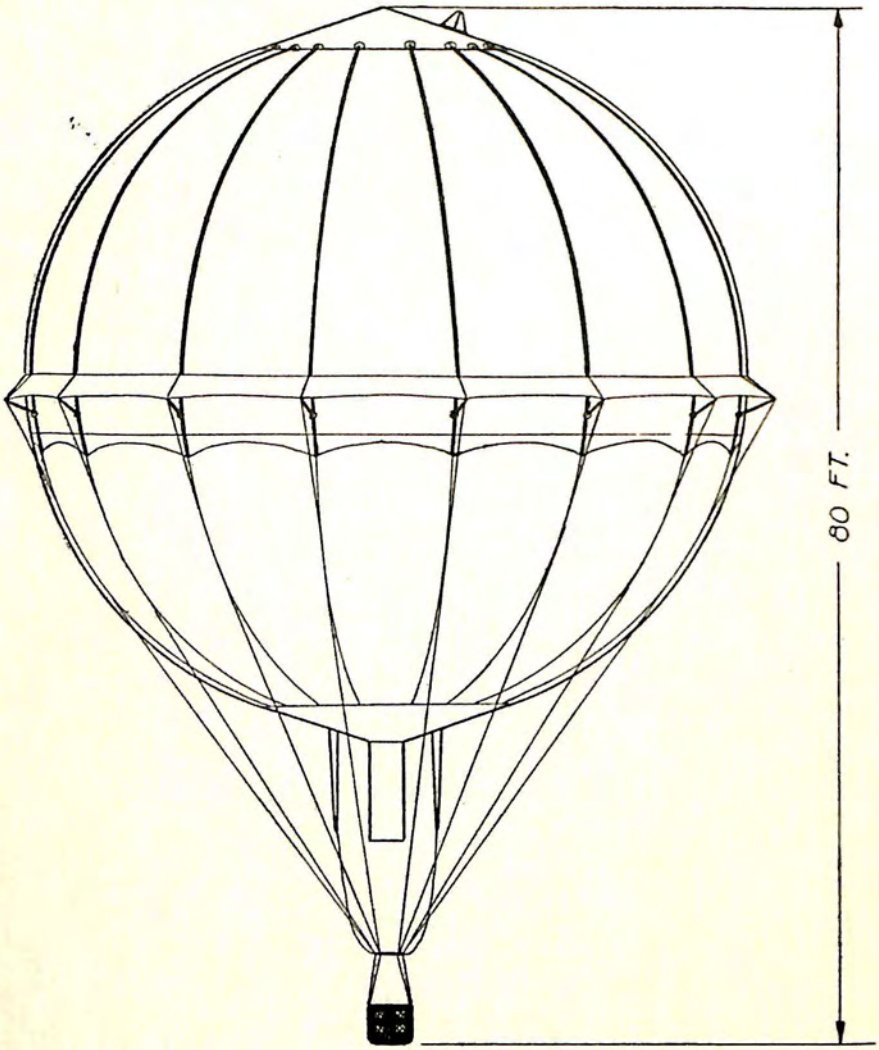






TYPE MS-1 AIRPLANE

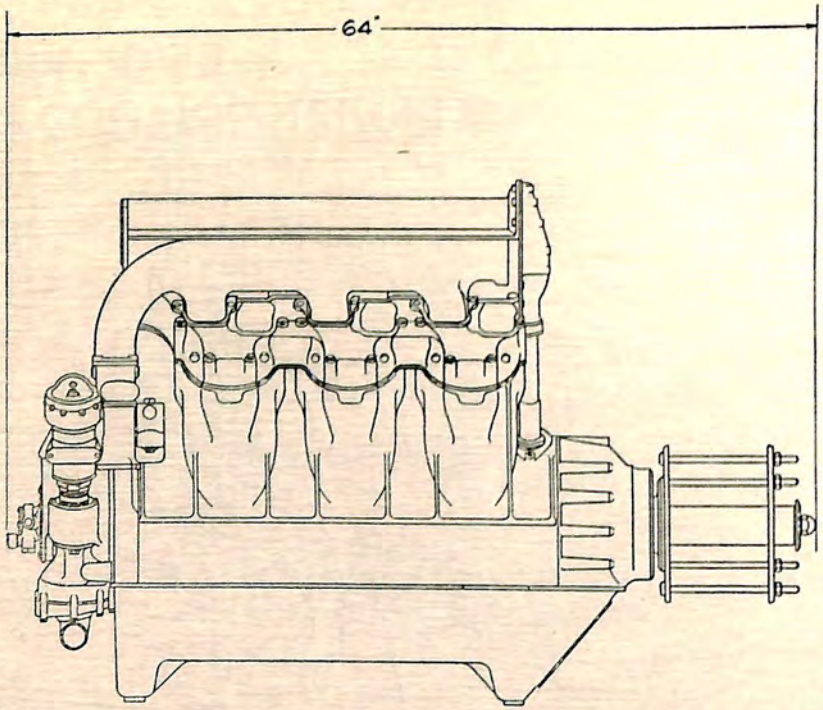
DESIGNED BY THE BUREAU OF AERONAUTICS
AND CONSTRUCTED BY
THE GLENN L. MARTIN CO.
CLEVELAND, OHIO

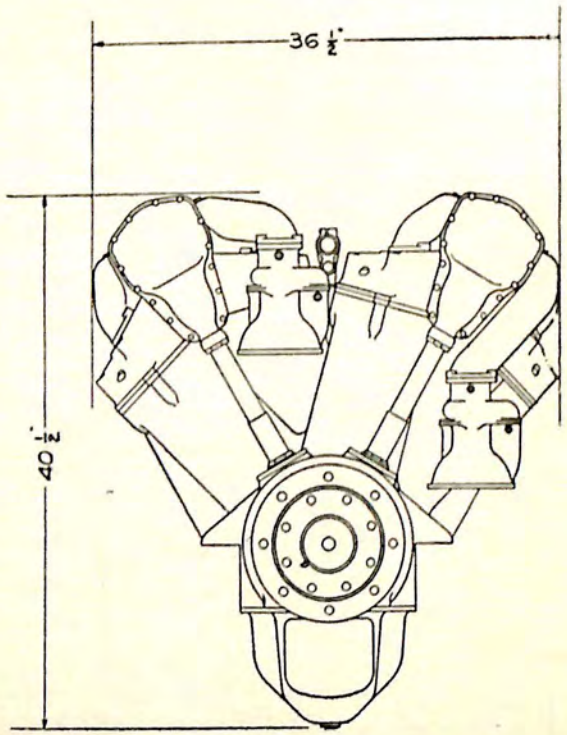


AIRCRAFT DEVELOPMENT CORPORATION

DETROIT, MICHIGAN.

80,000 CU. FT. RACING FREE BALLOON

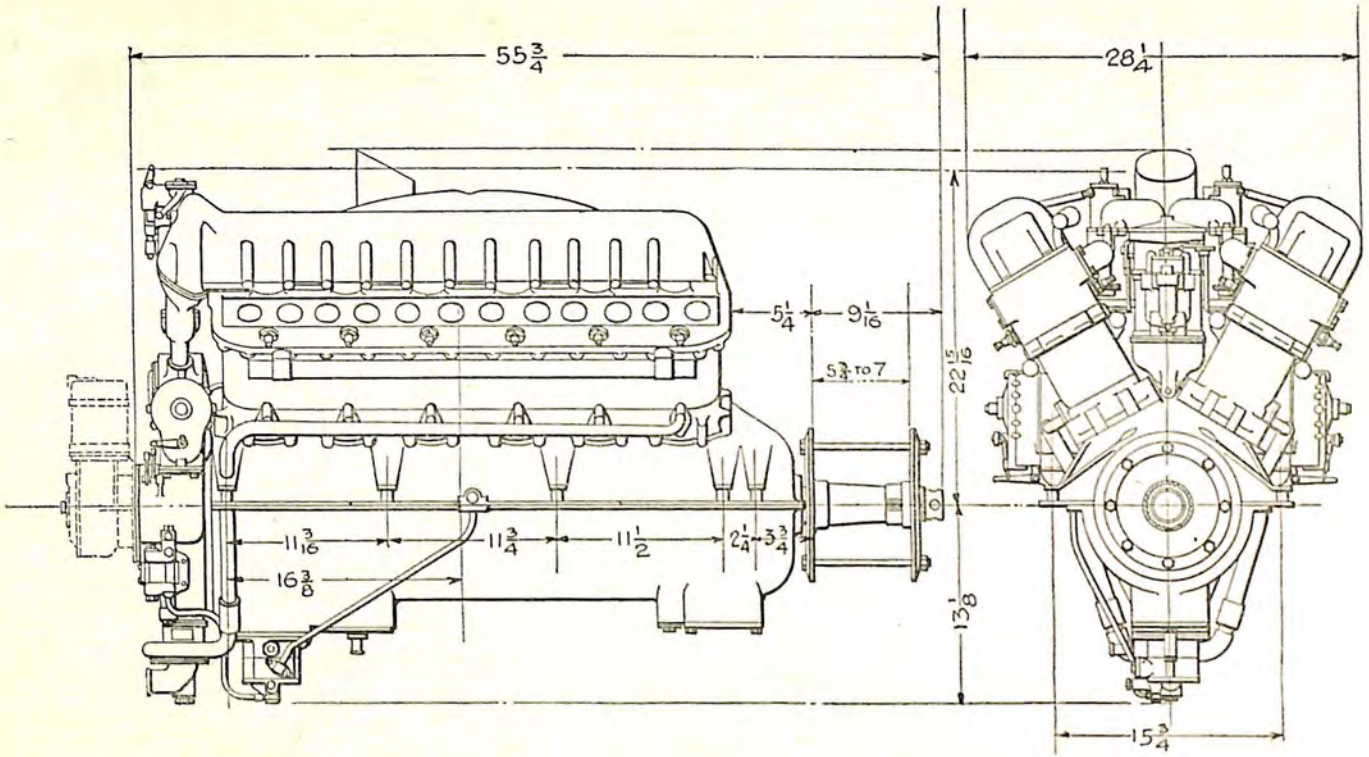




AEROMARINE PLANE & MOTOR COMPANY — KEYPORT, N.J.

MODEL: S-12 | 12 CYLINDERS | WATER COOLED

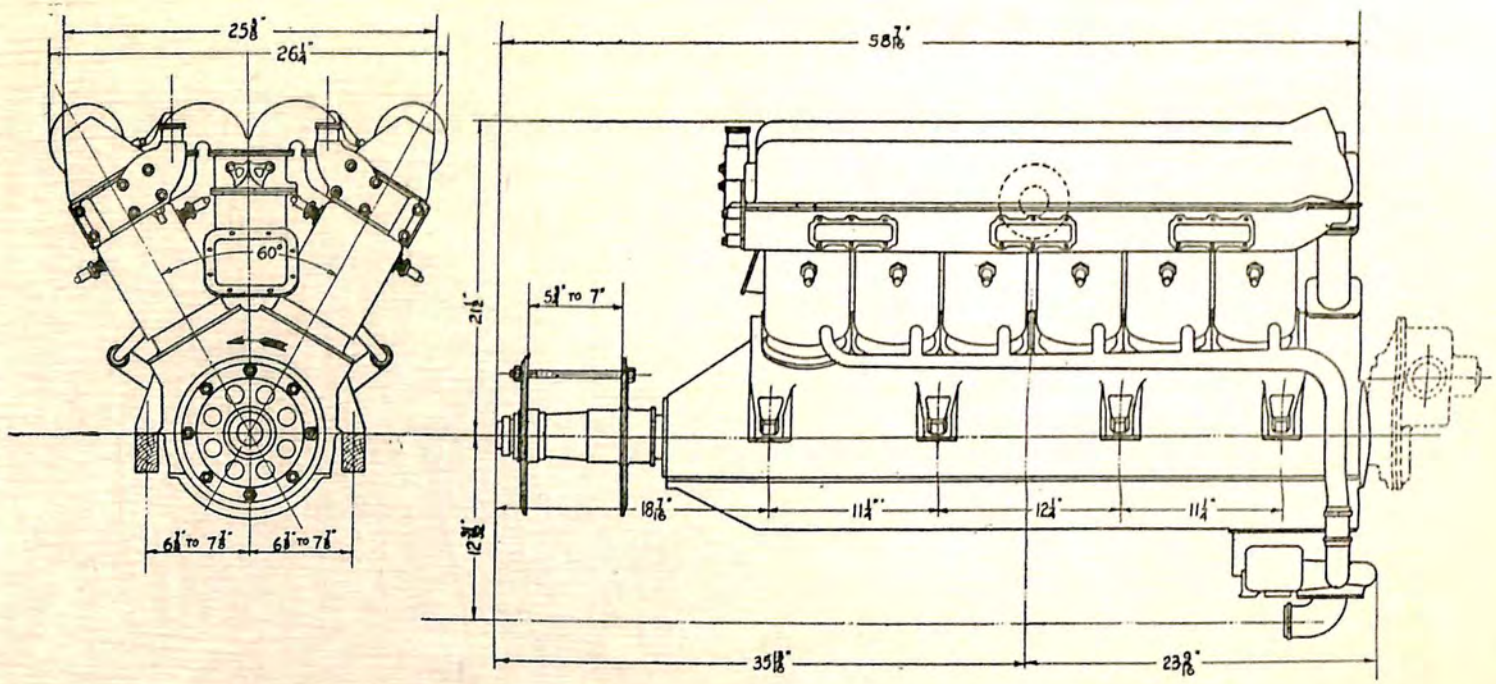
622 H.P. AT 1650 R.P.M. | 1150 LBS. DRY | 55 LBS. WATER



THE CURTISS AEROPLANE & MOTOR COMPANY, INCORPORATED.

MODEL D-12-A. 12 CYLINDERS. WATER COOLED.

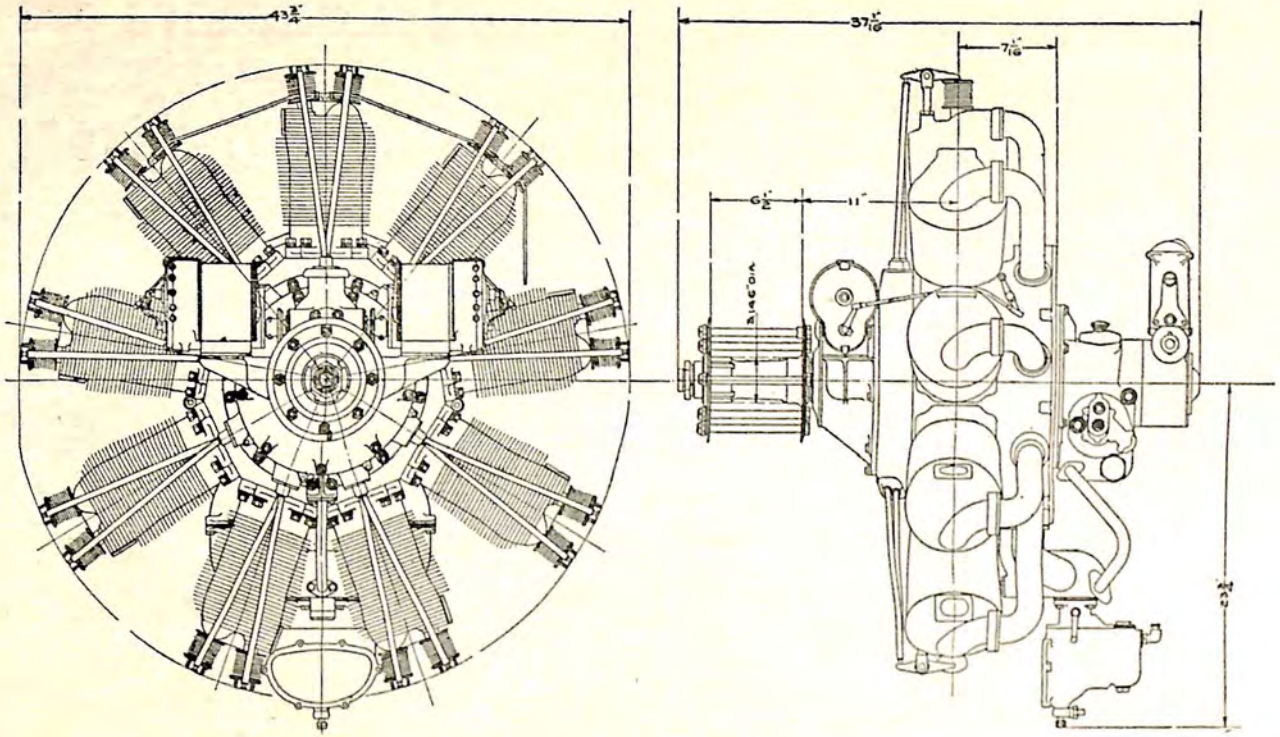
510 B.H.P. AT 2300 R.P.M. HIGH COMPRESSION. WEIGHT 670 LBS. DRY.



PACKARD MOTOR CAR COMPANY ~ DETROIT. MICH.

MODEL: 1-A-1500 12 CYLINDERS WATER COOLED

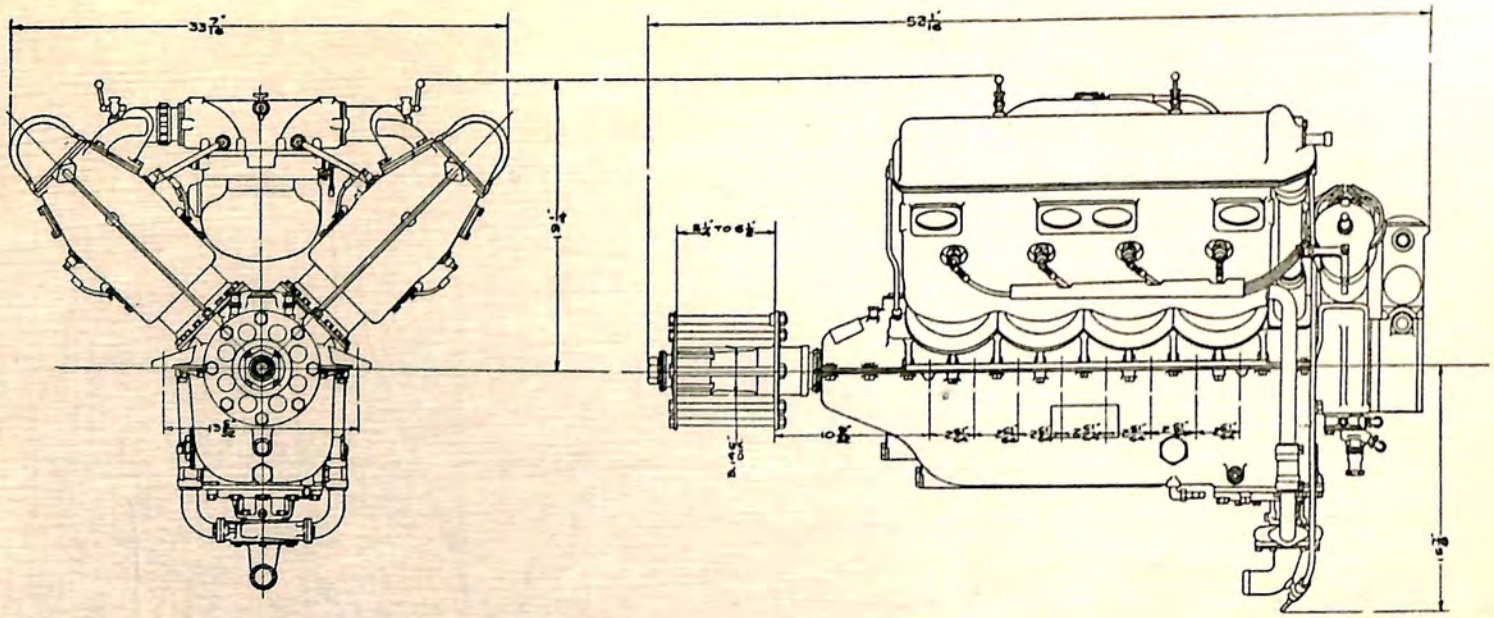
500 B.H.P. AT 2000 R.P.M. 710 LBS. DRY 30 LBS. WATER



WRIGHT AERONAUTICAL CORPORATION – PATERSON, N.J.

MODEL - J3 9 - CYLINDERS AIR COOLED.

STANDARD 200 - B.H.P. AT 1800 - R.P.M. 470 - LBS. COMPLETE.

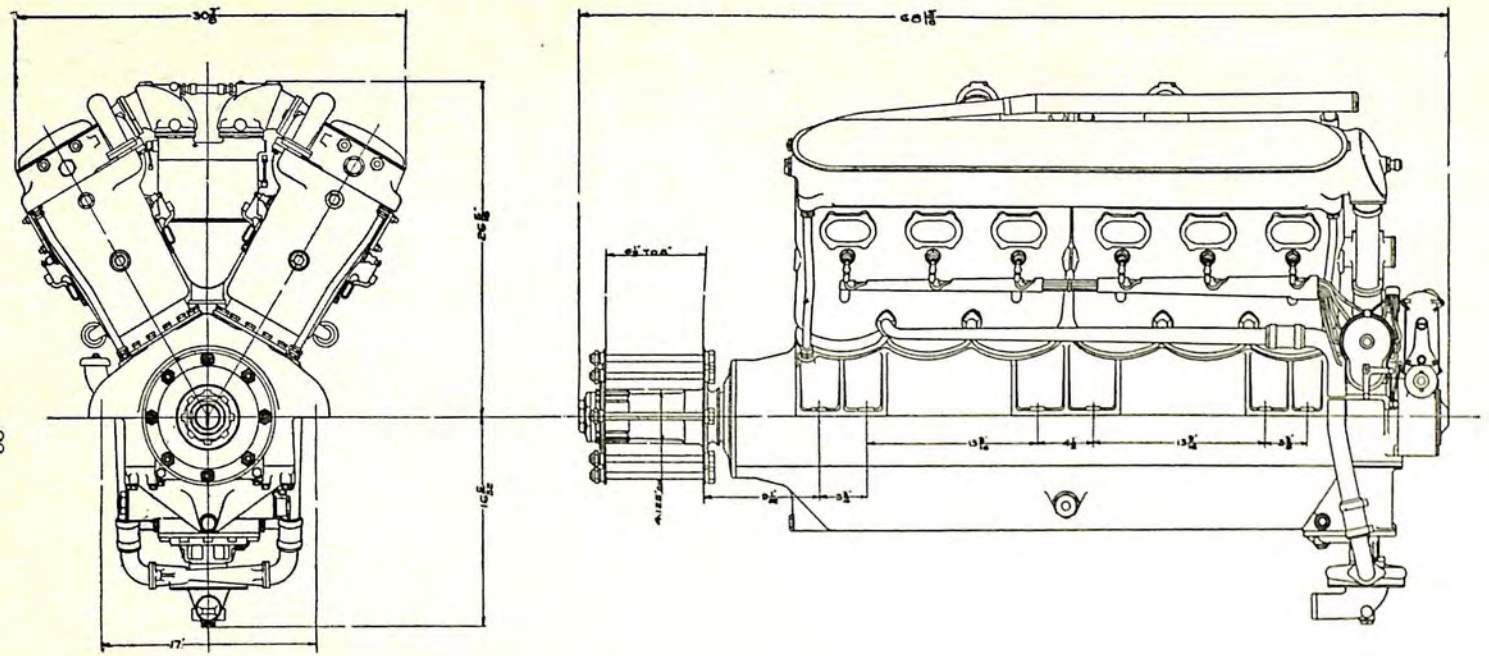


WRIGHT AERONAUTICAL CORPORATION – PATERSON, N.J.

MODEL - E4 8-CYLINDERS WATER COOLED.

STANDARD -200-B.H.P. AT-1800-R.P.M 485-LBS. DRY

ALERT -240-B.H.P. AT-2100-R.P.M. 485-LBS. DRY.



WRIGHT AERONAUTICAL CORPORATION – PATERSON, N J.

MODEL-T3 12-CYLINDERS WATER COOLED

STANDARD-675-B.H.P AT-2000-R.P.M. H.C. 1160-LBS DRY

STANDARD-600-B.H.P AT-1900-R.P.M. L.C. 1160-LBS. DRY

APPENDIX

COMMERCIAL SECTION

AERONAUTICAL CHAMBER OF COMMERCE OF AMERICA, INC.

501 Fifth 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.

GOVERNORS

Samuel S. Bradley.
Charles H. Colvin.
Donald Douglas.
Sherman M. Fairchild.
Allan Jackson.
J. M. Johnson.
J. M. Larsen.
Grover C. Loening.
F. B. Rentschler.
F. H. Russell.
B. D. Thomas.
George P. Tidmarsh.
Inglis M. Uppercu.
J. G. Vincent.
W. C. Young.

OFFICERS

President ..... F. H. Russell.
First Vice-President ..... Allan Jackson.
Second Vice-President ..... Sherman M. Fairchild.
Third Vice-President ..... Donald Douglas.
Treasurer ..... Charles H. Colvin.
General Manager and Ass't Treasurer ..... Samuel S. Bradley.
Secretary ..... Luther K. Bell.
Ass't Secretary ..... Owen A. Shannon.

COMMITTEES

Executive

F. H. Russell, chairman.

S. S. Bradley. F. B. Rentschler.
C. H. Colvin. G. C. Loening.

Airship

W. C. Young, chairman.

Henry Wacker. Ralph Upson.
Harry Vissering. Beckwith Havens.

Operators and Terminals

C. S. Jones, chairman.

J. M. Johnson. R. H. Depew.
C. F. Redden. G. S. Ireland.

Aircraft Standardization

F. H. Russell, chairman.

Ralph Upson. A. H. Flint.
Grover C. Loening. S. S. Bradley.

Membership

F. B. Rentschler, chairman.

C. H. Colvin. L. D. Gardner.

Patents

Stephen H. Philbin. J. P. Tarbox.

Trade Practice

Grover C. Loening, chairman.

C. L. Lawrance. C. H. Colvin.
J. L. Callan. G. S. Ireland.

Flying Meet and Show Committee

F. H. Russell, chairman.

G. C. Loening. W. C. Young.
C. L. Lawrance. S. S. Bradley.

State Committeemen

California—Donald Douglas, Los Angeles.
Delaware—E. R. Armstrong, Wilmington.
Illinois—Allan Jackson, Chicago.
Maryland—Temple N. Joyce, Baltimore.
Massachusetts—E. P. Warner, Cambridge.
Michigan—J. G. Vincent, Detroit.
Missouri—W. B. Robertson, St. Louis.
New Jersey—G. S. Ireland, Pine Valley.
New York—A. J. Elias, Buffalo.
Raymond Ware, Ithaca.
Ohio—J. M. Johnson, Dayton.
Pennsylvania—W. Wallace Kellett, Philadelphia.
Texas—S. C. Coon, Dallas.
Washington—E. N. Gott—Seattle.
Washington, D. C.—George P. Tidmarsh.
Wisconsin—T. F. Hamilton, Milwaukee.

MEMBERS AND SUBSCRIBERS

Pioneers

Orville Wright, Dayton, Ohio.
Glenn H. Curtiss, Garden City, N. Y.

Manufacturing and Engineering

Aeromarine Plane & Motor Company, Keyport, N. J.
Aircraft Development Corp., Detroit, Mich.
Airships Incorporated, Hammondsport, N. Y.
Boeing Airplane Company, Seattle, Wash.
Cox-Klemin Aircraft Corp., College Point, N. Y.
Curtiss Aeroplane & Motor Co., Garden City, N. Y.
The Douglas Company, Santa Monica, Calif.
G. Elias & Bro., Inc., Buffalo, N. Y.
B. F. Goodrich Rubber Co., Akron, O.
Goodyear Tire & Rubber Co., Arkon, O.
J. L. Aircraft Corp., New York City.
Loening Aeronautical Engineering Corp., New York City.
Manufacturers Aircraft Association, Inc., New York City.
Packard Motor Car Company, Detroit, Mich.
Remington-Burnelli Airplane Co., New York City.
Lawrence Sperry Aircraft Corp., Farmingdale, N. Y.
Thomas-Morse Aircraft Corp., Ithaca, N. Y.
Chance Vought Corp., Long Island City, N. Y.
Wright Aeronautical Corp., Paterson, N. J.

Operators and Distributors

Aeromarine Airways, Inc., New York, Key West and Havana.
S. C. Coon (Curtiss Aircraft Corp.), Dallas, Tex.
Curtiss Aeroplane Export Corp., New York City.
Curtiss Metropolitan Airplane Co., New York City.
Orton Hoover (Curtiss Aeroplane Export Corp.), Rio de Janeiro, Brazil.
Huff-Daland Aero Corp., Ogdensburg, N. Y.
W. M. Huskisson (Vickers, Ltd.), New York City.
G. Sumner Ireland, Pine Valley, N. J.
Johnson Airplane & Supply Co., Dayton, O.
Temple N. Joyce (Morane-Saulnier), Baltimore, Md.
W. Wallace Kellett (Farman), Philadelphia, Pa.
Lawrence Leon (Curtiss Aeroplane Export Corp.), Buenos Aires, Argentina.
Ludington Exhibition Co., Inc., Philadelphia, Pa.
R. B. C. Noorduyn (Fokker), New York City.
Robertson Aircraft Corp., St. Louis, Mo.
Foster Russell Aviation Co., Spokane, Wash.
Daisy Smith, Spokane, Wash.
Triangle Airways, Inc., Chicago, Ill.
Walter T. Varney, San Francisco, Calif.
P. J. Williams (Williams Bros. Aircraft Corp. of Calif.), San Francisco.
John Perry Wood, Louisa, Ky.

Accessories and Supplies

A. C. Spark Plug Co., Flint, Mich.
Aero Supply Mfg. Co., New York City.
Aluminum Company of America, Pittsburgh, Pa.
American Gas Accumulator Co., Elizabeth, N. J.
American Hammered Piston Ring Co., Baltimore, Md.
Armour & Co., Chicago, Ill.
Brewster & Co., Long Island City, N. Y.
Dayton Wire Wheel Co., Dayton, O.
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Valentine & Co., New York City.
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Sky-Writing Corp. of America, New York City.

Aerial Photography

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Fairchild Aerial Camera Corp., New York City.
Hamilton Maxwell, Inc., New York City.
Photomap Co. (Leon T. Eliel), Pasadena, Calif.

Publications

American Machinist (Fred H. Colvin), New York City.
Army and Navy Journal (H. J. Reilly), New York City.
Aviation and Aircraft Journal (L. D. Gardner), New York City.
Cine-Mundial (A. J. Chalmers), New York City.
Class Journal Company (David Beecroft), New York City and Chicago.
U. S. Air Service Magazine (Earl N. Findley), Washington, D. C.

Insurance

H. Barber, Underwriting Agent, Hartford Fire Insurance Co. and Hartford Accident & Indemnity Co., New York City.
National Aircraft Underwriters' Assn., New York City.
J. Brooks B. Parker, Philadelphia, Pa.
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U. S. AIR SERVICE, WAR DEPARTMENT
Munitions Building, Washington, D. C.

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In the organization of the Chief of Air Service five main divisions are provided: Personnel, Information, 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, Material Disposal and Salvage Section, Director of Aircraft Production (Spruce Production Corporation), Legal Advisor 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. The Information comprises the Library Section, Special Section and Reproduction Section. 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 Division embraces Property Requirements and Procurement Sections.

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*Maj. Alfred H. Hobley, Ass't Chief of Division.

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First Corps Area—Includes Maine, New Hampshire, Vermont, Massachusetts, Connecticut and Rhode Island; headquarters, Army Base, Boston 9, Mass. Air Service Officer, *Capt. Louis R. Knight.

Second Corps Area—Includes New York, New Jersey and Delaware; headquarters, Governors Island, N. Y. Island of Porto Rico, with islands and keys adjacent thereto, is for administrative purposes attached to Second Corps Area. Air Service Officer, †Col. Theodore A. Baldwin, Jr.

Third Corps Area—Includes Pennsylvania, Maryland, Virginia and District of Columbia; headquarters. Standard Oil Building, Baltimore, Md. Air Service Officer, *Capt. Charles T. Phillips.

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* Pilot.
† Airship Pilot.
‡ Observer.

FOURTH CORPS AREA—Includes North Carolina, South Carolina, Georgia, Florida, Alabama, Tennessee, Mississippi and Louisiana; headquarters, Ft. McPherson, Ga. Air Service Officer, ‡Capt. Otto G. Trunk.

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SIXTH CORPS AREA—Includes Illinois, Michigan, Wisconsin and Jefferson Barracks, Mo.; headquarters, 6th C. A., 1819 W. Pershing Road, Chicago, Ill. Air Service Officer, *Maj. Harold S. Martin.

SEVENTH CORPS AREA—Includes Missouri, Kansas, Arkansas, Iowa, Nebraska, Minnesota, North Dakota and South Dakota; headquarters, Army Building, Omaha, Nebr. Air Service Officer, *Maj. Lawrence S. Churchill.

EIGHTH CORPS AREA—Includes Texas, Oklahoma, Colorado, New Mexico and Arizona; headquarters Ft. Sam Houston, San Antonio, Texas. Air Service Officer, *Lt. Col. Clarence C. Culver.

NINTH CORP. AREA—Includes Washington, Oregon, Idaho, Montana, Wyoming, Utah, Nevada and California; headquarters, Presidio, San Francisco, Cal. Air Service Officer, *Lieut. Col. William E. Gillmore.

HAWAIIAN DEPARTMENT—Includes Hawaiian Islands and dependencies; headquarters, Honolulu, Hawaii. Air Service Officer, *Maj. Arnold N. Krogstad.

PHILIPPINE DEPARTMENT—Includes all of Philippine Achipelago and troops in China; headquarters, Manila, Philippine Islands. Air Service Officer, *Maj. George E. A. Reinburg.

PANAMA CANAL DEPARTMENT—Includes entire Canal Zone; headquarters, Quarry Heights, Balboa Heights, Canal Zone. Air Service Officer, *Maj. Raycroft Walsh.

STATIONS AND ACTIVITIES UNDER JURISDICTION OF CHIEF OF AIR SERVICE

Station	*P. O. Address*	*Activity*
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 Hdqrs. 46th & 47th School Sqdns. 24th Photo Section. 62d Service Sqdn. Primary Flying School. Flying Cadet Attachment.
†Chanute Field	Rantoul, Ill.	Technical School. School Troops.
†Fairfield Air Intermediate Depot (and Wilbur Wright Field)	Fairfield, Ohio	Supply & Repair Depot. Property, Maintenance & Cost. Compilation Section.
§Kelly Field	Kelly Field, Tex	1st Wing Hdqrs. 3d Attack Group Hdqrs. 8, 13, 26 & 90th Attack Sqdns. 10th School Group Hdqrs. 40th 41st, 42d & 43d School Sqdns. 60th & 68th Service Sqdns. 22d Photo Section. Flying Cadet Detachment. Flying Field. Advanced Flying School.
Langley Field	Hampton, Va.	2d Wing Hdqrs. 50th Obs. Sqdn. (R.S.). 19th Airship Co. 2d Bomb. Group Hdqrs. 11th, 20th & 96th Bomb. Sqdns. 58th Service Sqdn. (R.S.). 2d & 20th Photo Section. Tactical School. Flying Field.
Little Rock Air Intermediate Depot	Little Rock, Ark	Supply Depot.
McCook Field	Dayton, Ohio	Engineering Division. Engineering School.
Middletown Air Intermediate Depot	Middletown, Pa.	Supply Depot. Industrial War Plans Section.
†Mitchel Field	Mitchel Field, L. I., New York	School of Aviation. Medicine.

‡ Observer.
* Pilot.
† See stations under jurisdiction of Corps Area, Dept. or Dist. Commander.
§ Detachment 8th, 13th, 26th & 90th Attack Sqdns. on duty at airdromes, McAllen, Laredo, Del Rio and Sanderson, Texas.

Station	*P. O. Address*	*Activity*
New York, N. Y.	Room 808	District Property & Survey Officer.
	Room 807, 39 Whitehall St., New York, N. Y.	District Office Procurement Section. Supply Division.
Rockwell Air Intermediate Depot	Rockwell Field, Coronado, Calif.	Supply & Repair Depot. Flying Field.
San Antonio Air Intermediate Depot	San Antonio, Tex.	Supply & Repair Depot.
Scott Field	Scott Field, Ill.	8th, 9th & 12th Airship Co's. 21st Airship Group Hdqrs. 21st Photo Section. 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.

Stations and Activities Under Jurisdiction of Corps Area Department or District Commander

Station	*P. O. Address*	*Activity*
§Bliss, Ft., Texas	El Paso, Texas	1st Photo Section. 12th Obs. Sqdn. (R.S.). 32d Air Intell. Section. Border Patrol.
†Bolling Field	Anacostia, D. C.	Hdqrs. Detach. 3d Photo Section. 99th Obs. Sqdn. (R.S.). 56th Service Sqdn. (R.S.). Flying Field.
Boston Air Port	Boston, Mass.	Corps Area Hdqrs. Flight.
Bowman Field	Louisville, Ky.	Intermediate Landing Field.
Brown, Ft.	Ft. Brown, Tex.	Border Patrol Station.
*Chanute Field	Rantoul, Ill.	5th Photo Section. 15th Obs. Sqdn. (R.S.).
Clark Field	Camp Stotsenburg, P. I.	3d Pursuit Sqdn.
Clover Field	Santa Monica, Calif.	Airdrome.
Crissy Field	Presidio of San Francisco, Calif.	33d Air Intell. Section. 91st Obs. Sqdn. 15th Photo Section. Aerial Coast Defense. Forest Patrol.
Crook, Ft.	Ft. Crook, Nebr.	Corps Area Hdqrs. Flight.
Douglas, Ft.	Ft. Douglas, Utah	Intermediate Landing Field.
*Fairfield Air Intermediate Depot (and Wilbur Wright Field)	Fairfield, Ohio	88th Obs. Sqdn. (R.S.). 7th Photo Section.
France Field	Panama, C. Z.	6th Composite Group Hdqrs. 7th Obs. Sqdn. 12th Photo Section. 40th Air Intell. Section. 63d Service Sqdn. 24th Pursuit Sqdn. 25th Bomb. Sqdn. Aerial Coast Defense.
Grisard Field	Cincinnati, Ohio	Intermediate Landing Field.
Kindley Field	Ft. Mills, P. I.	2d Obs. Sqdn.
Langin Field	Moundsville, W. Va.	Intermediate Landing Field.
Logan Field	Dundalk, Md.	Intermediate Landing Field.

§ Detachments 12th Obs. Sqdn. on duty at airdromes, Nogales, Douglas, Arizona, and Camps Bierne and Marfa, Texas.
† Correspondence through C. G., District of Washington.
* See stations under jurisdiction of Chief of Air Service.

Station	*P. O. Address*	*Activity*
Luke Field	Honolulu, Hawaii	5th Comp. Group Sdqrs. 6th Pursuit Sqdn. 65th Service Sqdn. 11th Photo Section. 41st Air Intell. Section. 23d Bomb. Sqdn. Aerial Coast Defense. 72nd Bomb. Sqdn. 19th Pursuit Sqdn.
‡Mather Field	Mills, Calif.	Detachment 91st Obs. Sqdn (see Crissy Field).
Maxwell Field	Montgomery, Ala.	22d Obs. Sqdn. 4th Photo Section.
*Mitchel Field	Mitchel Field, L. I., New York	9th Obs. Group Hdqrs. 8th & 14th Photo Section. 1st Obs. Sqdn. (R.S.). 5th Obs. Sqdn. (R.S.). 31st Air Intell. Section. 61st Service Sqdn.
Nichols, Camp	Rizal, P. I.	4th Comp. Group Hdqrs. 66th Service Sqdn. 6th Photo Section. 42d Air Intell. Section. 28th Bomb. Sqdn. Philippine Air Depot.
Norton Field	Columbus, Ohio	Corps Area Hdqrs. Flight.
Pittsburgh Air Port	Pittsburgh, Pa.	Intermediate Landing Field.
Post Field (see Ft. Sill).		
Richards Field	Kansas City, Mo.	Intermediate Landing Field.
‡Ross Field	Arcadia, Calif.	Detachment 91st Obs. Sqdn. (see Crissy Field).
Sand Point	Sand Point, Wash.	Intermediate Landing Field.
Selfridge Field	Mt. Clemens, Mich.	1st Pursuit Group Hdqrs. 57th Service Sqdn. 17th, 27th, 94th & 95th Pursuit Sqdns.
Sheridan, Ft.	Ft. Sheridan, Ill.	Corps Area Hdqrs. Flight.
Shoen Field	Ft. Benj. Harrison, Ind.	Intermediate Landing Field.
Wheeler Field	Schofield Barracks, Honolulu, Hawaii	4th Obs. Sqdn. Aerial Coast Defense Hdqrs.

Stations Under Jurisdiction of Post Commanders at Which A. S. Organizations Are on Duty

Station	*P. O. Address*	*Activity*
Phillips Field	Aberdeen Proving Ground, Md.	18th Airship Co. (R.S.). 49th Bomb. Sqdn. 59th Service Sqdn. Ordnance Proving Ground.
Pope Field	Fayetteville, N. C.	Detach. 22d Obs. Sqdn. Artillery Firing Center.
Riley, Ft.	Ft. Riley, Kansas	16th Obs. Sqdn. (R.S.). 9th Photo Section. Cavalry School.
Sill, Ft.	Ft. Sill, Okla.	44th Obs. Sqdn. (R.S.). 23d Photo Section. Field Artillery School. Flying Field.

‡ Inactive.
* See stations under jurisdiction of Chief of Air Service.

Report of Lassiter Committee Appointed to Consider Needs of Air Service, Dated October 11, 1923

The Secretary of War has authorized publication of the following statement relative to the report of a committee which was appointed to investigate and report upon the present status and future condition of the Air Service. This committee, composed of Maj. Gen. William Lassiter, Brig. Gen. Briant H. Wells, Brig. Gen. Hugh A. Drum, Brig. Gen. Stuart Heintzelman, Col. Irvin L. Hunt, Lieut. Col. John W. Gulick, Lieut. Col. Frank P. Lahm and Maj. Herbert A. Dargue, recorder, after an exhaustive study of the situation have reported that an alarming condition exists due to shortage of flying personnel and equipment, which, if allowed to continue, will very soon cause this important combatant arm, whose aerial tactics and strategy of aerial warfare, particularly in its offensive phases, are now recognized as being as important as the tactics of the ground and sea forces, to reach a condition which will cause it to be negligible as a factor in national defense.

The failure of the aircraft industry to develop commercially has resulted in many aircraft manufacturers being solely dependent on the Government for their existence. Government orders have been limited, due to lack of appropriations and the fact that airplanes manufactured during the war must be used up before any large amount of new aircraft can be purchased. This war equipment is rapidly deteriorating and becoming unsafe to fly. The strength of the Air Service authorized in the amendment to the National Defense Act, approved June 4, 1920, in the Regular Army of 18,000 officers and 280,000 enlisted men, was 1,516 officers and 16,000 enlisted men, including 2,500 flying cadets. Since that date the committee report states that "the peace strength of the Regular Army has undergone several reductions. There are now authorized 12,000 officers and 125,000 enlisted men, of which the Air Service allotment is 1,061 officers and 8,764 enlisted men (including 190 flying cadets). Of these only 880 officers and 8,399 enlisted men and 91 flying cadets are now available (February 28, 1923). In view of the limitations imposed by law on the strength of the Regular Army in time of peace and the small percentages of officers and enlisted men allotted to the Air Service, the peace organization of the Air Service now bears no relation to the war requirements and affords little or no foundation upon which war requirements in either personnel or material can be built."

The equipment situation is so critical that, with a continuance of appropriations at the present rate, by July, 1926, there will be available less than 300 serviceable airplanes to meet a requirement of over five times that number for the present small Air Service. In this regard the report continues that: "The larger part of the aircraft now on hand is war produced and is deteriorating rapidly. Furthermore, 80% of these airplanes are of an obsolescent training type or are unsuitable for combat use. It is essential that new aircraft be provided to replace that built during the World War, and that additional aircraft be purchased to make up the deficit that is increasing rapidly. Since it now requires about eighteen months to secure delivery of aircraft after the contract has actually been executed, it is evident that no relief can be expected for the present situation before 1926. Appropriations now being made for the Air Service for the purchase of new aircraft are inadequate for the requirements of the existing reduced peace establishment of the Air Service or even for the necesssary annual replacements therefor." A comparison of requirements and the amount of equipment on hand two years hence clearly indicate "that unless steps are taken to improve conditions in the Air Service it will in effect be practically demobilized at an early date. The aircraft industry in the United States at present is entirely inadequate to meet peace and war requirements, it is rapidly diminishing and under present conditions will soon practically disappear. It depends for its existence almost wholly upon orders placed by Governmental services. A graphic representation of the state of the aircraft industry shows how far the industry falls short of being able to meet war requirements and that planes in sufficient quantities would not be produced under present conditions until nearly two years after the war had begun. The development of commercial aviation will stimulate the aircraft industry, but orders from the military services must be depended upon, at least for the immediate future, if this industry is to be kept alive. Should a national emergency confront this country within the next few years the Air Service would not be able to play its part in meeting it."

The Committee recognizes the necessity for the adoption of a continuing program similar to that suggested by Mr. Wainwright, former Assistant Secretary of War, as the only practical solution of the equipment problem. The Committee's opinion on this is that "The most practicable way in which the peace requirements in material can be met is to adopt a continuing production program extending through a period of approximately ten years with adequate annual appropriations and authorizations to make the program effective. It is estimated that the annual appropriations required to make this program effective, exclusive of pay, upkeep and housing of personnel, will be approximately $25,000,000, of which approximately $10,000,000 would be for operating expenses and $15,000,000 for purchase of new aircraft, the first amount increasing and the second decreasing as the program develops—the total remaining at about the sum stated."

The acute shortage of flying personnel caused by inadequate procurement facilities and high rate of casualty among the flying officers, due to aircraft accidents, have reduced the flying personnel of the Air Service to such a small nucleus that the committee finds a continuing personnel program extending over a period of approximately ten years should parallel the production program. Concerning this the Committee recommends that "the personnel required for the peace establishment in excess of that now allotted to the Air Service should be in addition to the present authorized strength of the Regular Army. It is impracticable to secure from the present authorized strength the personnel needed for

this expansion of the Air Service without taking the additional strength from one or more of the other combatant arms which are already unduly reduced, and, therefore, the Committee is of the opinion that Congress should be asked to provide additional personnel for this requisite expansion of the Air Service."

The personnel and equipment situation is summarized by the Committee in the following statement:

> "The Committee finds our Air Service to be in a very unfortunate and critical situation. Since the World War aviation has come to play an increasingly important part in military operations, but measures have not been taken in our country to keep step with this evolution. Due to the reduction of the Army the personnel of the Air Force has been diminished; moreover, aircraft have not been manufactured to replace the types produced during the World War. For lack of business our aircraft industry is languishing and may disappear. It requires time to begin production of airplanes and it takes time to train personnel. We cannot improvise an Air Service and yet it is indispensable to be strong in the air at the very outset of war. Therefore, it is the opinion of the Committee that our peace-time Air Service have a strength and an organization permitting rapid expansion to meet the first requirements of a war and then be capable of steady expansion to meet the ultimate requirements of the war. It is impossible under present conditions to pass at once from our present peace status to the peace status desired, and hence we should have a development program extending over a period of years, providing for yearly increments in both personnel and material, and adopted by Congress as a continuing project."

Many points hitherto undecided as to the tactical organization and function of Air Service and Air Force are definitely defined by the Committee in the following statements:

> "Observation Air Service should be an integral part of divisions, corps and armies, with a reserve under General Headquarters.
>
> "An Air Force of attack and pursuit aviation should be an integral part of each Field Army, with a reserve under General Headquarters.
>
> "An Air Force of bombardment and pursuit aviation and airships should be directly under General Headquarters for assignment to special and strategical missions, the accomplishment of which may be either in connection with the operation of ground troops or entirely independent of them. This force should be organized into large units, insuring great mobility and independence of action."

Concluding its report and making final recommendations, the Committee recommends that:

> "In order to avoid duplication, and to insure the most economical development of adequate production facilities to meet war-time requirements, a well balanced Joint Army and Navy program, extending through a period of years, covering the requirements of both the Army and the Navy, should be formulated. The Navy program, together with the Army program herein recommended, should be referred to the Joint Army and Navy Board for consideration and for the formation of a Joint Army and Navy program.
>
> "The Joint Army and Navy program, formulated as indicated in the preceding paragraph, should be submitted to Congress at its next session, accompanied by a special message from the President, setting forth its importance, and embodying a recommendation that it be adopted."

Early action is urged in order that the present deplorable conditions in the Air Service may be remedied as soon as possible and the adoption of a project for an expansion of the present inadequate Air Force to over three times its present strength is strongly recommended. The Secretary of War, after reviewing the report, has approved it in principle and referred it to the Joint Army and Navy Board for further study, in order that recommendations for the re-organization of the Air Service may be submitted to the next Congress.

Final Report of the Retiring Assistant Secretary of War, J. Mayhew Wainwright

The following are extracts from the final report of the retiring Assistant Secretary of War, J. Mayhew Wainwright, dealing particularly with the problem of industrial mobilization. It is dated March 7, 1923.

* * * * * * *

The problem. The problem is to insure, so far as foresight may provide, that our industrial establishments and factories may be prepared, upon the outbreak of war, to turn, as rapidly as possible, from their peace-time tasks to the production and creation of those things that shall have the primary call and preference upon their facilities for production. This call and the load so placed should be, however, so nicely adjusted that the essential needs of the people shall be disturbed only so far as is necessary. Much of these requirements can be met without great dislocation of business or industry—that is

to say, the clothing, subsistence and other elements of supply which do not differ essentially from the peace-time requirements of the people generally.

But with munitions and aircraft and related supplies—that is to say, with those elements of supply furnished principally by the Ordnance and the Air Service, it is another matter—those being all of a special nature and requiring the diversion, transformation or the great extension of existing or the creation of new facilities. Here, as well as elsewhere, difficult and complex problems arise. The effort must be to insure the acceleration of production to the utmost extent conformable with the size and rate of mobilization of the man-power. Every factory, every industrial establishment must be induced to get into its stride of maximum production at the earliest possible moment; thus, and thus alone, can the new levies be expedited through the training camps and forwarded to the theater of operations—equipped to meet the needs of the military situation, and thus alone can the necessary flow of munitions and material be maintained to the commanders in the field.

Roughly there are three great elements of supply:

1. Those things which the ordinary or current productive capacity of the country can be relied upon to furnish.
2. Technical supplies, such as munitions and aircraft.
3. The strategic materials—namely, those not produced in sufficient quantity within the continental limits of the United States, such as nitrate, metal-alloy, tin, rubber, plantinum, tungsten and the like.

The end to be sought must be to insure that the production curve in each or as many as possible of the essential elements of supply shall meet the curve of the induction of man-power into service at the earliest point of time.

It may be interesting to note, indeed it is of almost ominous import, to have had revealed that in several essential features of the Ordnance program it will be many, far too many, months after the declaration of war before we can hope that the production curve will meet the mobilization curve; also it is probably needless to say that a far more serious situation confronts us with regard to the production of aircraft and their accessories. Indeed, the cold fact is revealed that it may happen that it will be many months after the declaration of hostilities before we may reasonably hope to cope successfully with a more enterprising or provident foe.

Our most notable deficiency at the present time is the matter of aircraft. The situation in the Army Air Service is most critical. Up to the present time this Service has been using very largely equipment produced during the war. This supply is now practically exhausted. What there is left of it is rapidly disappearing, due to deterioration and to the inevitable losses while in actual use. The amounts appropriated for the purchase of new aircraft are insufficient to provide what is necessary for even the normal peace-time equipment of the present small Air Service organization. The aeronautical industry in the United States, built up to large proportions during the war, has shrunken rapidly and is now practically facing extinction. Until commercial aerial transportation becomes a fact, the only demand for such equipment originates with the military branches of the Government. Unless the Government places with aircraft manufacturers sufficient orders to enable them to continue in operation, the industry as such will disappear.

The Army Air Service is faced with this condition of affairs: Its war-time manufactured equipment has been practically used up. The amounts of money appropriated for new aircraft are so small that within two years it will have on hand less than one-half the number of aircraft necessary for its normal peace-time work. There will be no aircraft to equip and expand the Air Service in time of emergency, no reserve on hand, and it will be impossible in less than a year to expand the remnant of the aircraft industry which may be left or to create it anew so that this material can be manufactured in sufficient quantity for use in such an emergency. This situation is not only serious, but it is actually alarming. As an economic measure and likewise in the interest of national preparedness, the aeronautical industry in this country should be maintained in such condition that it can supply our peace-time needs and be prepared to expand adequately to meet a war-time demand.

The Army Air Service should be large enough and adequately equipped so that it would be prepared instantly to meet any air force which an enemy might bring against us. The importance of the rôle which the Air Service will play in national defense should be thoroughly understood, and this component of the Army should be increased to its proper strength. The Air Service should then have a definite procurement program which would insure its proper equipment, replacements, and a reserve supply of aircraft for use in an emergency, and until war-time requirements could be met by increased production. Such a program would call for an average expenditure of approximately $15,000,000 per year for the next five years. Thereafter this annual expenditure could no doubt be decreased. In addition to this expenditure for new aircraft there will be required approximately $10,000,000 for operating the Service.

While the sums just named are large, they are not incommensurate with the actual benefits which would follow their expenditure. It is strongly urged that the War Department and Congress should give serious consideration to this matter and that this necessary expenditure be authorized. It is necessary if we are to be properly prepared to meet a war-time emergency, and at the same time it is of economic importance in order that the aircraft industry in this country may be kept alive, ready to respond not alone to a war-time demand, but to the demand for aircraft for commercial purposes which will inevitably eventuate within the next few years.

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.

OFFICERS ON DUTY IN WASHINGTON

Office of the Chief

†Rear Admiral W. A. Moffett.....Chief of Bureau of Aeronautics.
Capt. A. W. Johnson.....Assistant Chief.
*Lieut. G. D. Price.....Aide to Chief.

Administration Division

Lieut. L. T. DuBose.
†Lieut. T. T. Patterson.

Plans Division

*Lieut. Comdr. M. A. Mitscher.
*Lieut. Comdr. H. T. Bartlett.

Flight Division

*Lieut. Comdr. H. B. Cecil.
*Lieut. F. W. Wead.

Material Division

†Capt. (CC) E. S. Land.
*Comdr. (CC) H. C. Richardson.
†Comdr. (CC) W. W. Webster.
Lieut. Comdr. E. E. Wilson.

MARINE AND COAST GUARD OFFICERS ON DUTY IN BUREAU OF AERONAUTICS

Administration Division

Capt. G. W. Martin, USMC.

Plans Division

*Lieut. Col. T. C. Turner, USMC.

Material Division

*Lieut. E. F. Stone, USCG.
Capt. W. H. Sitz, USMC.

OFFICERS ON AVIATION DUTY IN OTHER BUREAUS IN NAVY DEPARTMENT

*Lieut. Comdr. V. D. Herbster.....Board of Inspection and Survey.
Lieut. Comdr. L. Scheibla.....Bureau of Ordnance.
*Lieut. H. C. Rodd.....Bureau of Engineering.

OFFICERS ON DUTY AT NAVAL AIR STATION, ANACOSTIA, D. C.

*Lieut. W. D. Thomas.....Commanding Officer.
*Lieut. C. A. F. Sprague.....Executive Officer.

OFFICERS ON DUTY AT NAVAL AIRCRAFT FACTORY, PHILADELPHIA, PA.

Capt. (CC) G. C. Westervelt.
Comdr. R. W. Cabaniss.
Lieut. Comdr. H. F. Davis.
Lieut. Comdr. (CC) S. J. Zeigler.
Lieut. Comdr. (SC) J. E. McDonald.
Lieut. Comdr. (SC) R. S. Chew.

MARINE OFFICERS ON DUTY AT NAVAL AIRCRAFT FACTORY

Capt. C. P. Matteson, USMC.

OFFICERS ON DUTY AT NAVAL AIR STATION, PENSACOLA, FLA.

Capt. J. J. Raby.....Commandant.
Lieut. R. Kiely.....Aide.

Comdr. (SC) G. R. Crape.
*Lieut. Comdr. D. W. C. Ramsey.
Lieut. Comdr. A. H. Douglas.
Lieut. Comdr. (MC) H. W. Cole.

MARINE OFFICERS ON DUTY AT PENSACOLA, FLA.

2d Lieut. S. E. Ridderhoff.
2d Lieut. F. G. Cowie.
*1st Lieut. H. J. Norton.

† Observer.
* Pilot.

Officers with the Fleets

Scouting Fleet—Atlantic

Capt. W. E. Gherardi.....Comdr. Aircraft Sqdns., Scouting Fleet.
*Lieut. Comdr. W. Capehart.....Aide to Commander.
*Lieut. P. Cassard.....Comdr. Torpedo and Bombing Plane Sqdn. No. 1.
*Lieut. Comdr. J. C. Monfort.....Comdr. Scouting Plane Sqdn. No. 1.
*Lieut. Comdr. C. P. Mason.....Comdr. Scouting Plane Sqdn. No. 3.
*Lieut. Comdr. A. E. Montgomery....Comdr. Observation Plane Sqdn. No. 6.

Battle Fleet—Pacific

Capt. A. W. Marshall.....Comdr. Aircraft Sqdns. Battle Fleet.
*Lieut. Comrd. R. A. Burg.....Aide to Commander.
*Lieut. Comdr. M. B. McComb.....Comdr. Observation Plane Sqdn. No. 1.
*Lieut. Comdr. R. R. Paunack.....Comdr. Observation Plane Sqdn. No. 2.
*Lieut. Comdr. H. C. Wick.....Comdr. Fighting Plane Sqdn. No. 1.
*Lieut. Comdr. R. P. Molten.....Comdr. Fighting Plane Sqdn. No. 2.
*Lieut. Comdr. A. R. Simpson.....Comdr. Torpedo and Bombing Plane Sqdn. No. 2.
*Lieut. Comdr. H. C. Frazer.....Comdr. Division No. 3 (Honolulu Detachment). Torpedo and Bombing Plane Sqdn. No. 2.

Asiatic Fleet

*Lieut. Comdr. G. D. Murray.....Comdr. Torpedo and Bombing Plane Sqdn. No. 20.

Officers Assigned to U. S. S. Shenandoah

(Naval Air Station, Lakehurst)

Lieut. Comdr. Zachary Lansdowne.....Commanding Officer.
*Lieut. Comdr. J. P. Norfleet.
Lieut. R. F. Tyler.
Lieut. C. E. Rosendahl.
*Lieut. R. J. Miller.
Lieut.(jg) E. W. Sheppard.

Officers Assigned to U. S. S. Langley

Capt. S. H. R. Doyle.....Commanding Officer.

*Comdr. K. Whiting.
Lieut. Comdr. H. V. McCabe.
Lieut. Comdr. (SC) F. C. Bowerfind.
*Lieut. Comdr. V. C. Griffin.
Lieut. Comdr. (MC) G. C. Rhoades.

Officers Assigned to U. S. S. Wright

Comdr. L. R. Leahy.....Commanding Officer.
*Lieut. Comdr. P. N. L. Bellinger.
*Lieut. Comdr. C. Y. Johnston.
Lieut. Comdr. L. N. Linsley.

Officers in Command of Naval Air Stations

Capt. T. T. Craven.....Naval Air Station, San Diego, Calif.
Capt. J. J. Raby.....Naval Air Station, Pensacola, Fla.
Capt. H. E. Yarnall.....Naval Air Station, Hampton Roads, Va.
Comdr. J. H. Klein, Jr.....Naval Air Station, Lakehurst, N. J.
*Comdr. J. Rodgers.....Naval Air Station, Pearl Harbor, T. H.
*Lieut. Comdr. R. F. Wood.....Naval Air Station, Coco Solo, C. Z.
*Lieut. W. D. Thomas.....Naval Air Station, Anacostia, D. C.

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

* Pilot.
† Observer.

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, and one kite balloon squadron; Observation Squadron No. 1 at Santo Domingo City; 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. George W. Martin.
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 T. Archibald.
Capt. Lewie 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, Santo Domingo, D. R.
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

(As of December 31, 1923)

	Officers	*Aviators*	*Students*	*Enlisted Men*	*Civilians*	*Total*
Army	928	903	223	10,143	1,824	14,021
Navy	537	456	31	3,712	2,008	6,744
Marine	67	45	8	766	....	866

Air Equipment, United States

Army (July 1, 1923)

Type	*Number*
Pursuit	99
Bombardment	44
Observation	330
	473

Navy (January 1, 1924)

Type	*Number*
Fighting	80
Observation	201
Torpedo	83
Patrol and Scouting	252
	616

Army	473
Navy	616
Grand Total	1,089

Diplomatic Service of the United States

Brazil	Comdr. T. Ellyson, Member Naval Mission to Brazil.
France	Maj. Carlyle H. Wash, Army Air Service Attaché, Paris.
Germany	Lt. Col. B. D. Foulois, Army Air Service Attaché, Berlin.
	Maj. Harold Geiger, Army Air Service Attaché, Berlin.
Great Britain	Maj. Howard C. Davidson, Army Air Service Attaché, London.
	*Comdr. John H. Towers, Naval Air Attaché, London.
Italy	Maj. James E. Chaney, Army Air Service Attaché, Rome.
Peru	Lieut. Comdr. H. B. Crow, Member Naval Mission to Peru.

* Denotes that Comdr. John H. Towers represents the Naval Air Service at Paris and Rome in addition to his duties in London.

Diplomatic Service to the United States

France	Capt. Georges Thenault, Air Attaché, Washington, D. C.
Great Britain	Capt. M. G. Christie, Air Attaché, Washington, D. C.
Italy	Capt. Mario Calderara, Air Attaché, Washington, D. C.

Aeronautical Board

(As of December 31, 1923)

Munitions Building, Washington, D. C.
(For function, see "Year Book," 1921)

Navy

Rear Admiral W. A. Moffett, U. S. N., chairman.
Comdr. N. E. Nichols, U. S. N.
Capt. E. S. Land, U. S. N.

Army

Maj. Gen. Mason M. Patrick, U. S. A.
Lieut. Col. J. E. Fechet, U. S. A.
Maj. W. G. Kilner, U. S. A.

Working Committee

Lieut. Comdr. M. A. Mitscher.
Capt. Robert E. Oldys.

Secretary

Capt. D. S. Seaton.

Helium Board

(As of December 31, 1923)

Capt. E. S. Land, U. S. N. (CC), chairman.
Lieut. Col. Ira F. Fravel, ASUSA.

Alternates

Lieut. Comdr. A. H. Gray, U. S. N.
Capt. R. E. O'Neil, U. S. A.

Engineers

Mr. C. E. Earle, Navy Department.
Mr. J. H. Luening, War Department.

Dr. S. C. Lind, Chief Chemist of the Bureau of Mines and in his absence Mr. H. S. Milliken, Chief of War Mineral Section of Bureau of Mines representing the Department of Interior in matters in which that department was involved. The responsibility of the operation of the U. S. Helium Production Plant is borne by the Navy and the operation is carried on in accordance with the rules and regulations governing the Navy. However, all matters involving expenditures of funds, extension of activities, developments (both commercial and experimental) are subject to the approval of the Helium Board. Research has been carried on under the jurisdiction of the Director of the Bureau of Mines in a laboratory known as the Cryogenic Laboratory, the funds for which were supplied by the Army and Navy jointly in equal amounts. Research activities are subject to the approval of the Helium Board. During the calendar year 1923—6,278,405 cubic feet of helium of an average of 95% purity were produced. All of this amount was compressed in high pressure (1800 lbs. per inch) cylinders holding 178 cubic feet per cylinder and shipped to the various Army and Navy Air Stations. The cost of production per 1,000 cubic feet was in the neighborhood of $85.00. The cost is being steadily reduced.

Experiments conducted on the Government reservation by a Board of Helium Engineers, operated by the Helium Board and functioning under the jurisdiction of the Director of the Bureau of Mines, have proved conclusively that it is possible to produce helium for $30.00 per 1,000 cubic feet. Plans have been initiated to provide for the installation of at least one unit of a capacity of 8,000 cubic feet of helium per day during the calendar year 1924. The operation of this unit will be under the Naval organization at Fort Worth, and this unit will be operated simultaneously with the present units but as a separate system.

Board of Surveys and Maps

(Department of the Interior)

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. In February, 1923, a standing committee on aerial navigation maps, whose duties comprised investigation and reporting to the Board on matters relating to the preparation and publication of aerial navigation maps, was organized. The personnel of this committee included the following:

Lieut. Burdette S. Wright, A. S. of the Army, chairman.
Mr. A. F. Hassan, of the Geological Survey.
Capt. R. McK. Herrington, of the Army Engineering Corps.
Mr. C. V. Hodgson, of the Coast and Geodetic Survey.
Lieut. Gail Morgan, of the Bureau of Aeronautics, Navy Department.

The Committee plans the following activities: The study of existing aerial navigation maps; the obtaining of information, prepared in text form, with reference to the requirements of aerial navigation maps; the preparation of a tentative list of characteristics of maps for the United States; the recommending of means of embodying characteristics in the maps and of methods of compilation and production and of the maintenance of stock and the dissemination of the maps upon completion. Several meetings of the Committee were held in connection with the development of aerial navigation maps being carried on by the Airways Section of the Army Air Service.

AIR MAIL SERVICE, POST OFFICE DEPARTMENT

Executives

Hon. Harry S. New.....Postmaster General.
Col. Paul Henderson.....Second Assistant Postmaster General.
Carl F. Egge.....General Superintendent.
J. W. Sutherin.....Chief Clerk.

Division Superintendents

J. E. Whitbeck, Eastern Division, from New York, N. Y., to Chicago, Ill. Headquarters, Hazelhurst Field, Long Island, N. Y.
D. B. Colyer, Central Division, from Chicago, Ill., to Rock Springs, Wyo. Headquarters, Omaha, Nebr.
A. C. Nelson, Western Division, from Rock Springs, Wyo., to San Francisco, Cal. Headquarters, Salt Lake City, Utah.

Repair Depot and Warehouse

E. C. Richard, Superintendent, Maywood, Ill.

Air Mail Fields

*New York, N. Y.
*Bellefonte, Pa.
*Cleveland, Ohio.
*Bryan, Ohio.
*Chicago, Ill. (Gov't owned).
*Iowa City, Ia.
*Omaha, Nebr. (Gov't owned).
*North Platte, Nebr.
*Cheyenne, Wyo.
Rawlins, Wyo.
*Rock Springs, Wyo. (Gov't owned).
*Salt Lake City, Utah.
*Elko, Nev.
*Reno, Nev.
*San Francisco, Cal. (Gov't owned).

Emergency Fields

North Aurora, Ill.
McGirr, Ill.
Franklin Grove, Ill.
†Rock Falls, Ill.
Cordova, Ill.
Dixon, Ill.
Atalissa, Iowa.
Williamsburg, Iowa.
Montezuma, Iowa.
Reasnor, Iowa.
†Des Moines, Iowa.
Earlham, Iowa.
Casey, Iowa.
Atlantic, Iowa.
Oakland, Iowa.
Yutan, Iowa.
Wahoo, Nebr.
David City, Nebr.
Osceola, Nebr.
Central City, Nebr.
†Grand Island, Nebr.
Shelton, Nebr.
Kearney, Nebr.
Elm Creek, Nebr.
Lexington, Nebr.
Gothenburg, Nebr.
Paxton, Nebr.
Ogallala, Nebr.
Big Springs, Nebr.
Chappell, Nebr.
†Sidney, Nebr.
Dix, Nebr.
Pine Bluffs, Wyo.
Burns, Wyo.

Transcontinental Controls

Hazelhurst Field, L. I., N. Y.		Rawlins, Wyo.	134 miles
Bellefonte, Pa.	225 miles	Rock Springs, Wyo	106 miles
Cleveland, Ohio	210 miles	Salt Lake City, Utah	155 miles
Bryan, Ohio	160 miles	Elko, Nev.	205 miles
Chicago, Ill.	175 miles	Reno, Nev.	235 miles
Iowa City, Iowa	195 miles	San Francisco, Cal.	190 miles
Omaha, Nebr.	230 miles		
North Platte, Nebr.	245 miles	Total	2,680 miles
Cheyenne, Wyo.	215 miles		

Pilots in Air Mail Service

Name	*Division*	*Flying Time Hours—Minutes*	*Miles*
‡Allison, E. M.	Central	1,790:09	162,811½
Ames, C. H.	Eastern	892:13	85,158
Barker, Hugh	Western	44:10	3,835
Bishop, L. F.	Western	1,039:18	93,441
Blanchfield, W. F.	Western	1,404:22	133,460
Boonstra, H. G.	Central	1,210:24	108,254
Burnside, F. H.	Repair Base	93:05	8,273
Chandler, H. A.	Central	1,761:70	154,830
Collins, P. F.	Eastern	1,340:50	129,613
Collison, H. A.	Central	1,526:34	140,419½
Ellis, R. H.	Western	1,759:34	156,860
‡Garrison, L. H.	Central	1,883:47	169,152
‡Hopson, W. C.	Central	2,127:22	210,381
Huking, H. W.	Western	1,600:49	139,024
Johnson, C. E.	Eastern	1,301:04	125,366
‡Knight, J. H.	Central	2,179:06	197,571
Lange, C. C.	Central	1,340:03	122,606
Lee, E. H.	Central	2,271:00	189,616

* Denotes radio station.
† Denotes supplies at these fields.
‡ Indicates pilots who participated in the night flying experiments.

Levisee, R. B.	Western	1,389:05	127,673
‡Lewis, H. T.	Central	1,769:18	162,842
Marshall, Tex.	Central	1,771:38	154,832
Mouton, E. E.	Western	1,964:24	184,384
Murray, J. P.	Central	2,112:52	187,641
Myers, G. I.	Eastern	349:26	34,538
‡Page, R. G.	Central	954:36	77,622
Scott, P. P.	Western	1,680:24	149,792
Sharpnack, J. W.	Western	560:07	51,183
Short, S. J.	Eastern	470:16	45,614
Smith, A.	Eastern	489:02	47,932
‡Smith, D. C.	Central	1,732:30	159,561½
Smith, H. G.	Central	1,884:07	175,494
Smith, W. L.	Eastern	1,938:06	178,331
Unger, K. R.	Western	1,386:53	136,865
Vance, C. K.	Western	1,222:57	119,260
Wagner, R. L.	Central	401:04	38,874
Ward, E. F.	Eastern	38:18	3,925
‡White, E. F.	Central	621:56	57,453
Williams, W. D.	Eastern	1,944:33	178,789
Winslow, B. H.	Western	1,280:49	113,349
‡Yager, F. R.	Central	1,978:52	182,125

Number of Employees

(As of December 31, 1923)

Headquarters	24
Repair Depot and Warehouse	110
Fields:	
Supervisors	19
Pilots	41
Radio Operators	28
Mechanics	115
Helpers	38
Clerks	26
Etc.	29
Grand total	430

Planes in Service

Number of planes on hand January 1, 1924:	
Serviceable	69
Undergoing repairs	25
Number of Liberty Motors:	
Serviceable	114

An inventory of the total property owned by the Air Mail Service as of July 1, 1923, showed an amount of $2,861,492.00.

‡ Indicates pilots who participated in the night flying experiments.

AIR MAIL SERVICE

Statement of Performance for 1923

Month	Trips Possible	Trips Attempted	Trips Defaulted	Trips Uncompleted	Weather		Mileage Possible	Miles Traveled with Mail	Ferry and Test	Total Miles Traveled	Per cent of Performance	Mail Carried, No. of Letters	Cost of Service	Forced Landings	
					Trips in Fog, etc.	Trips Clear								Mechanical	Other Causes
1923															
Jan.	702	662	40	20	382	280	139,360	129,289	12,665	141,954	92.77	5,695,960	$ 146,067.44	14	36
Feb.	621	583	38	13	292	291	123,280	114,424	14,749	129,173	92.81	4,921,920	100,319.45	22	34
Mar.	729	705	24	22	356	349	144,720	137,200	16,768	153,968	94.80	6,537,720	177,965.95	12	38
April	675	652	23	9	323	329	134,000	128,483	11,290	139,773	95.88	6,118,120	235,219.01	12	24
May	702	698	4	3	312	386	139,360	138,085	16,759	154,844	99.08	5,599,200	173,723.59	13	19
June	702	700	2	4	312	388	139,360	138,272	31,919	170,191	99.21	5,738,720	213,975.76	17	14
July	675	674	1	1	229	445	134,000	133,550	21,698	155,248	99.66	5,151,400	236,160.54	24	9
Aug.	674	674	0	0	312	362	134,470	134,470	81,048	215,518	100.00	5,751,480	153,820.74	16	15
Sept.	648	636	12	8	379	257	128,640	125,265	33,184	158,449	97.37	5,145,920	130,415.38	11	40
Oct.	729	716	13	9	362	354	144,720	141,058	46,436	187,494	97.47	5,618,240	128,964.50	11	40
Nov.	675	657	18	9	265	392	134,000	128,938	21,421	150,359	96.22	5,092,920	100,218.52	14	26
Dec.	540	490	50	13	221	269	107,200	96,246	17,205	113,451	89.78	3,924,320	113,571.66	9	32
Total	8,072	7,847	225	111	3,745	4,102	1,603,110	1,545,280	325,142	1,870,422	96.25 av.	65,295,920	1,910,422.54	175	327

Summary—1918-1923

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
Total	33,060	30,903	2,157	984	12,118	18,806	6,717,422	6,168,395	983,850	7,152,245	91.34 av.	225,769,520	6,204,643.00	1,549	2,041

NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS

3441 Navy Building, Washington, D. C.

Charles D. Walcott, Sc.D., Chairman.
David W. Taylor, D.Eng., Secretary.
Joseph S. Ames, Ph.D., Chairman, Executive Committee.
George K. Burgess, Sc.D.
William F. Durand, Ph.D.
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Charles F. Marvin, M.E.
Lawrence W. McIntosh, Major, United States Army.
William A. Moffett, Rear Admiral, United States Navy.
Mason M. Patrick, Major General, United States Army.
S. W. Stratton, Sc.D.
Orville Wright, B.S.
George W. Lewis, Executive Officer.
John F. Victory, Assistant Secretary.

Subcommittees

Aerodynamics.
Governmental Relations.
Materials for Aircraft.
Personnel, Buildings and Equipment.
Power Plants for Aircraft.
Publications and Intelligence.

Through the personal contact of responsible officers of the Army and Navy serving on the three standing technical subcommittees, a knowledge of the aims, purposes, and needs of each service in the field of aeronautical research is made known to the other. The cordial relations that invariably flow from such personal contact are supplemented by the technical information service of the committee's Office of Aeronautical Intelligence, which makes available the latest technical information from all parts of the world. While a healthy rivalry exists in certain respects between the Army and Navy, there is at the same time a co-ordination of effort in experimental engineering and a mutual understanding that is productive of the best results.

As a rule, the technical subcommittees, including representatives of the Army and Navy Air Services, prepare programs of research work of general use or application, and these programs, when approved by the National Advisory Committee for Aeronautics, furnish the problems for solution by the Langley Memorial Aeronautical Laboratory. The cost of this work is borne by the committee out of its own appropriation. If, however, the Army Air Service or the Naval Bureau of Aeronautics desires specific investigations to be undertaken by the committee for which the committee has not the necessary funds, the committee's regulations as approved by the President provide that the committee may undertake the work at the expense of either the Army or the Navy.

The investigations thus undertaken by the committee during the past year may be outlined as follows:

Development of Roots type supercharger, including the design, construction, testing, and development of the Roots type supercharger for application to the TS and DT airplanes.

Investigation in free flight of the comparative stability, controllability, and maneuverability of several types of airplanes, including the VE-7, the SE-5, the Fokker D-VII, the Spad VII and the MB-3.

Investigation in free flight of the effect of dihedral angle on lateral controllability.

Investigation and development of a solid-injection type of areonautical engine.

Flight tests of BR-1 racer, including performance tests, with a view to obtaining information for making any changes in the aerodynamic properties of the airplane that may be found desirable.

Investigation of taking off and landing, including the determination of the air and water speed and the angle of attack, on landing, of various types of seaplanes.

Investigation of the pressure distribution over the C-7 airship, including flight tests to determine the pressure distribution over the envelope and the fins and rudders; tests in the compressed-air wind tunnel on a model of the C-7 to check the information obtained in free flight; and a study of the equipment and installation necessary for the determination of the pressure distribution over the control surfaces and envelope of the U.S.S. *"Shenandoah."*

Investigation of landing on the U.S.S. *Langley,* including the development of instruments for the determination of the decelerations and speed of an airplane when landing on the *Langley.*

Flight tests of superchargers, including flight and performance tests of the DH-4 and DT airplanes equipped with Roots type superchargers, and of the TS airplane equipped with a supercharged Lawrance J-1 air-cooled engine.

Full-scale investigation of different wings on the Sperry Messenger airplane, including flight tests of six different sets of wings, each to be flown at about six air speeds.

Investigation of the efficiency of propellers when used in front of obstructions as found in bombing airplanes, including tests at Stanford University on models of bombardment airplanes tested with four different arrangements of propeller with thick wing section, engine housing and radiator.

Report on the determination of the characteristics of the pressure distribution over the surfaces of the Thomas Morse airplane under various conditions of flight.

In addition to the investigations enumerated above, theoretical investigations were undertaken for the Army and the Navy, first on the design and calculations of the Navy rigid airship U.S.S. *"Shenandoah,"* formerly known as the *ZR-1,* and second, on the Army semi-rigid airship *RS-1.*

A complete report prepared by the special subcommittee on design of Navy rigid airship *ZR-1* has been submitted by the National Advisory Committee for Aeronautics to

the Bureau of Aeronautics, Navy. The report contains a complete analysis of the methods of calculating stresses in airships; a discussion on the proper design for horizontal and vertical fins and control surfaces; analyses of maximum unit stresses and factors of safety in longitudinal girders, transverse frames, and shear wires. In all twenty-seven appendices were prepared in addition to the main report.

The committee again recommends the creation by law of a Bureau of Civil Aeronautics in the Department of Commerce for the regulation and licensing of aircraft, airdromes and aviators, and the general control and encouragement of commercial flying.

The increasing relative importance of aircraft in warfare is alone sufficient to justify the Federal Government in taking proper cognizance of the problem of commercial aviation and aiding its development. It has been the history of civilized nations that governments have found it necessary and advantageous to aid in the development of means of transportation. The wonderful growth of transcontinental railroads in America was greatly aided by land grants from our Government. Progressive European nations are spending public funds through direct and indirect subsidies for the promotion of civil and commercial aviation. It is essential to the practical development of aviation in America that the Federal Government give intelligent support and effective aid, through Federal legislation outlined above, and by co-operation with the States in the establishment of airways and landing fields.

NATIONAL AIRCRAFT UNDERWRITERS ASSOCIATION

120 West 42d Street, New York City

Officers

Ambrose Ryder (General Accident).....President.
Herbert P. Stellwagen (N.A.U.A.).....Secretary.

Members

Aetna Life Insurance Co.
Commercial Union Assurance Co., Ltd.
Hudson Insurance Co.
Insurance Co. of North America.
Liverpool London & Globe Ins. Co.
General Acc. Fire & Life Assur. Corp.
Maryland Casualty Co.
North British & Mercantile Co.
Royal Indemnity Co.
Union Central Life Ins. Co.
Zurich Gen. Acc. & Liab. Ins. Co.

The National Aircraft Underwriters Association completed the fourth year of its existence in March, 1924. 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.

After a time the companies became convinced that most of the hazards of commercial air navigation could not be written at any set of rates. Lack of Government regulation concerning the fitness of pilots and the airworthiness of planes made possible the operation of a number of inferior planes by incapable operators. Because of these unsettled conditions, the insurance companies have been obliged to retire from the field until Congress enacts such legislation as is proposed in the Winslow Bill, for example. A few companies—not members of the Association at present—are still writing certain of the aircraft coverages.

Until commercial aviation revives, the National Aircraft Underwriters Association is continuing as an insurance point of contact with the aircraft industry and with the Government. Relations are still maintained with the Underwriters Laboratories of Chicago, which has been designated by the insurance companies as the authority on the inspection of aircraft and the examination of airmen. The Association is collecting data from foreign and domestic sources bearing on the aircraft hazards, and is keeping abreast with the mechanical advances in the field of flight, so that when it becomes possible to write aircraft insurance again, the companies will be equipped to take up the work immediately.

AIRCRAFT EXPORTS

Exports (U. S.) 1923

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
January	12	$203,010	.....	.....	3,974	$1,885	5	$1,200
February	2	5,802	.....	.....	6,520	6,193	1	12,000
March	3	10,818	.....	.....	4,561	2,941	.....	.....
April	4	4,300	.....	.....	61,912	4,952	3	517
May	1	300	.....	.....	1,277	960	1	250
June	5	4,500	.....	.....	9,681	3,310	10	7,060
July	9	32,521	1	$500	4,974	3,036	4	2,025
August	3	7,200	.....	.....	46,430	11,225	6	4,205
September	3	31,700	1	400	91,751	2,703	7	6,500
October	2	5,000	.....	.....	29,081	11,849	5	7,860
November	.....	.....	.....	.....	12,700	8,951	32	10,152
December	2	3,000	.....	.....	2,215	946	6	13,789
Total	46	$308,151	2	$900	275,076	$58,951	80	$65,558

AIRCRAFT AND AIRCRAFT ENGINE EXPORTS BY COUNTRIES

1916-1923

Countries	*1916*	*1917*	*1918*	*1919*	*1920*	*1921*	*1922*	*1923*	*Total 1916-1923*
France	.....	.....	.....	$15,000	$42,600	.....	.....	$ 1,450	$ 59,050
Netherlands	.....	.....	$76,226	.....	.....	.....	.....	55,239	131,465
Norway	.....	.....	.....	22,000	.....	.....	$ 3,000	.....	25,000
Spain	$ 37,980	.....	.....	.....	.....	.....	.....	.....	37,980
Sweden	.....	.....	$44,239	.....	.....	.....	.....	.....	44,239
United Kingdom	1,964,094	$ 170,954	27,775	.....	.....	$10,000	.....	.....	2,172,823
Canada	95,046	616,068	6,500	28,200	27,160	5,000	2,230	6,015	786,219
Mexico	.....	.....	.....	.....	28,000	98,165	20,250	5,850	152,265
Nicaragua	.....	.....	.....	.....	.....	25,000	.....	.....	25,000
Cuba	.....	.....	.....	5,000	15,500	8,000	500	.....	29,000
Jamaica	875	.....	.....	.....	.....	.....	.....	.....	875
Argentina	5,000	.....	.....	.....	38,050	79,500	.....	30,639	153,189
Bolivia	.....	.....	.....	.....	25,180	.....	.....	.....	25,180
Brazil	20,000	.....	34,500	18,000	109,000	1,396	108,700	229,200	520,796
Colombia	.....	.....	.....	10,000	10,100	5,000	.....	.....	25,100
Peru	.....	.....	.....	4,500	272,750	5,000	.....	10,317	292,567
Uruguay	.....	.....	.....	.....	.....	.....	5,000	.....	5,000
Guatemala	.....	.....	.....	.....	.....	.....	.....	1,400	1,400
Honduras	.....	.....	.....	.....	.....	.....	.....	6,100	6,100
Dominican Republic	.....	.....	.....	.....	.....	.....	.....	1,102	1,102
New Zealand	.....	.....	.....	.....	.....	.....	.....	565	565
British South Africa	.....	.....	.....	.....	.....	.....	.....	200	200
Italy	.....	.....	.....	.....	.....	.....	.....	1,600	1,600
Salvador	.....	.....	.....	.....	.....	.....	.....	5,802	5,802
Chile	.....	.....	.....	.....	.....	.....	.....	8,210	8,210
Belgium	.....	.....	.....	.....	.....	.....	.....	400	400
China	.....	.....	.....	.....	.....	.....	.....	.....	37,820
Dutch East Indies	27,000	145,000	.....	.....	20,220	.....	17,600	.....	172,000
Hongkong	.....	.....	.....	.....	.....	.....	.....	.....	11,800
Japan	8,400	52,520	16,880	.....	.....	1,800	.....	10,000	98,514
Australia	.....	17,000	.....	.....	5,714	15,000	.....	.....	37,520
Philippine Islands	.....	.....	.....	20,000	.....	.....	.....	520	157,679
				92,600	4,000	61,079	.....	.....	
Totals	$2,158,395	$1,001,542	$ 206,120	$ 215,300	$598,274	$314,940	$157,280	$374,609	$ 5,026,460
Parts of Airplanes	4,843,610	3,133,903	8,877,977	3,249,226	554,375	157,608	265,231	55,948	21,137,878
Complete Airplanes	269	135	20	44	65	48	42	46	669

AIRCRAFT APPROPRIATIONS, UNITED STATES

1898 to 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	175,000		*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	$590,992,877	*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, FOREIGN—(Also See Previous Aircraft Year Books)

Country	1920–1921		1921–1922		1922–1923	
	Total	Part Devoted to Civil and Subsidy	Total	Part Devoted to Civil and Subsidy	Total	Part Devoted to Civil and Subsidy
Argentina	$2,000,000		$964,800			$4,500 monthly
Australia		£25,000	£654,000	£154,000		
Belgium	23,525,000 fr.	10,745,000 fr.	38,700,000 fr.	13,100,000 fr.	31,750,000 fr.	8,100,000 fr.
Brazil	$905,000	$25,000	$250,000		$360,000	
Canada	$2,000,000	$850,000	$1,626,000	$700,000	$1,064,467	
Chile	2,941,303 pesos					
China	$2,000,000		Indeterminate amounts from warring factions		Indeterminate amounts from warring factions	
Colombia		$100 per trip on Magdalena route		$100 per trip on Magdalena route		$100 per trip on Magdelena route
Czecho-Slovakia	6,800,000 Cz. kr.	4,400,000 Cz. kr.	9,680,000 Cz. kr.	6,000,000 Cz. Kr.	*150,000,000 Cz. kr.	
Denmark			110,000 cr.			
Ecuador	20,000 sucres					
Esthonia						$14,700
France	445,114,856 fr.	179,101,512 fr.	435,917,595 fr.	189,510,970 fr.	947,352,550 fr.	179,963,550 fr.
Germany		21,000,000 marks		22,000,000 marks		
Great Britain	£23,406,695	£1,004,282	£16,394,680	£1,060,000	£15,666,500	£571,000
Hungary						45,000,000 kr.
India			66,000 rupees		631,893 rupees	
Italy	75,000,000 lire	27,000,000 lire	112,760,000 lire	25,060,000 lire	220,000,000 lire	£34,000

* Proposed.

AIRCRAFT APPROPRIATIONS, FOREIGN—(Also See Previous Aircraft Year Books)—*Continued*

Country	*1920-1921*		*1921-1922*		*1922-1923*	
	Total	*Part Devoted to Civil and Subsidy*	*Total*	*Part Devoted to Civil and Subsidy*	*Total*	*Part Devoted to Civil and Subsidy*
Japan	43,000,000 yen		$21,600,000	30,000 yen	$21,200,000	$300,000
Jugo-Slavia					Air credits extended by French	$20,000 annual subsidy to French line
Mexico	(6 mos.) 6,000,000 pesos		$1,495,500			
Netherlands	5,074,108 fl.	1,300,000 fl.	4,823,516 fl.	1,735,000 fl.		1,400,000 fl 1923-26 subsidies
Peru	$500,000					
Portuguese East Africa		100,000 escudes				
Poland						Pays subsidy to French line
Roumania	35,000,000 leis	9,000,000 leis (6,500,000 subsidy to French line)			80,000,000 leis	30,000,000 leis
Russia					36,000,000 gold rubles ($18,540,000)	
Serbia	12,000,000 dinars		$300,000			
Siam					1,600,000 ticals (£160,000)	
Spain			14,000,000 pesetas		48,569,630 pesetas ($7,456,000)	$235,000
Sweden	170,000 kr.		821,200 kr.			
Switzerland	2,133,000 fr.		4,024,000 fr.	1,150,000 fr.	4,322,000 fr.	450 fr. each flight Geneva-Munich

OFFICIAL WORLD RECORDS

Recognized by

THE INTERNATIONAL AERONAUTIC FEDERATION

May 1, 1924

Translated and compiled by the Contest Committee of the National Aeronautic Association of U. S. A.

CLASS A. (SPHERICAL BALLOONS)

1ST CATEGORY (600 CUBIC METERS)

DURATION	(France) Gaston Fleury and George Fleury, August 15-16, 1923.	19 hrs. 43 min.
DISTANCE	(France) Georges Cormier, July 1, 1922.	804.173 km. 499.69 miles
ALTITUDE	No record.	

2ND CATEGORY (601-900 CUBIC METERS)

DURATION	(France) Jules Dubois, May 14-15, 1922.	23 hrs. 28 min.
DISTANCE	(France) Georges Cormier, July 1, 1922.	804.173 km. 499.69 miles
ALTITUDE	No record.	

3RD CATEGORY (901-1,200 CUBIC METERS)

DURATION	(France) Jules Dubois, May 14-15, 1922.	23 hrs. 28 min.
DISTANCE	(France) Georges Cormier, July 1, 1922.	804.173 km. 499.69 miles
ALTITUDE	No record.	

4TH TO 8TH CATEGORIES, INCLUSIVE

DURATION	(Germany) H. Kaulen, Dec. 13-17, 1913.	87 hrs.
DISTANCE	(Germany) Berliner, Feb. 8-10, 1914.	3052.7 km. 1896.9 miles
ALTITUDE	(Germany) Suring and Berson, June 30, 1901.	10,800 meters 35,424 feet

CLASS B. (DIRIGIBLES)

DURATION	(Italy) Castracane and Castruccio, P-5, June 25, 1913.	15 hrs.
DISTANCE	(Italy) Castracane and Castruccio, P-5, July 30, 1913.	810 km. 503.3 miles
ALTITUDE	(France) Cohen, at Conte, June 18, 1912.	3080 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	(United States) Lts. Kelly and Macready, U. S. Army, T-2 Liberty, 375 h.p., at Wilbur Wright Field, Dayton, O., April 16-17, 1923.	36 hrs. 4 min. 34 sec.
DISTANCE	(United States) Lts. Kelly and Macready, U. S. Army, T-2 Liberty, 375 h.p., at Wilbur Wright Field, Dayton, O., April 16-17, 1923.	4050 km. 2516.55 miles
ALTITUDE	(France) Sadi Lecointe, Nieuport Delage, Hispano 300 h.p., at Issy-les-Moulineaux, France, Oct. 30, 1923.	11,145 meters 36,555 feet

CLASS C. (SPEED)

MAXIMUM SPEED	(United States) Lt. A. J. Williams, U.S.N., Curtiss Racer R-2C1, Curtiss D-12a, 500 h.p., at Mitchel Field, Mineola, L. I., Nov. 4, 1923.	429.025 k.p.h. 266.59 m.p.h.

"Returning to point of departure"
Without Refueling

100 km. (62.14 miles)	(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. 243.81 m.p.h.
200 km. (124.27 miles)	(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. 243.67 m.p.h.
500 km. (310.69 miles)	(United States) Lt. Alex. Pearson, U.S.A., Verville Sperry R-3, Wright 350 h.p., at Wilbur Wright Field, Dayton, O., March 29, 1923.	270 k.p.h. 167.8 m.p.h.

1000 km. (621.37 miles)	(United States) Lt. Harold R. Harris, U.S.A., and Ralph Lockwood, DH-4B, Liberty 400 h.p., at Wilbur Wright Field, Dayton, O., March 29, 1923.	205 k.p.h. 127.43 m.p.h.
1500 km. (932.05 miles)	(United States) Lt. Harold R. Harris, U.S.A., DH-4B, Liberty 375 h.p., at Wilbur Wright Field, Dayton, O., April 17, 1923.	184.03 k.p.h. 114.35 m.p.h.
2000 km. (1242.74 miles)	(United States) Lt. Harold R. Harris, U.S.A., DH-4B, Liberty 375 h.p., at Wilbur Wright Field, Dayton, O., April 17, 1923.	183.83 k.p.h. 114.22 m.p.h.
2500 km. (1553.42 miles)	(United States) Lts. Kelly and Macready, Army, T-2 Liberty 375 h.p., at Wilbur Wright Field, Dayton, O., April 16-17, 1923.	115.60 k.p.h. 71.83 m.p.h.
3000 km. (1864.11 miles)	(United States) Lts. Kelly and Macready, Army, T-2 Liberty 375 h.p., at Wilbur Wright Field, Dayton, O., April 16-17, 1923.	115.27 k.p.h. 71.62 m.p.h.
4000 km. (2174.79 miles)	(United States) Lts. Kelly and Macready, Army, T-2 Liberty 375 h.p., at Wilbur Wright Field, Dayton, O., April 16-17, 1923.	113.93 k.p.h. 70.79 m.p.h.

CLASS C. WITH USEFUL LOAD OF 250 KILOGRAMS (551 LBS.)

DURATION	(United States) Lt. H. R. Harris, U.S.A., TP-1 Liberty 400 h.p. (Supercharged), at McCook Field, Dayton, O., March 27, 1924.	1 hr. 48 min. 19.4 sec.
DISTANCE	No record.	
ALTITUDE	(United States) Lt. H. R. Harris, U.S.A., TP-1 Liberty, 400 h.p. (Supercharged), at McCook Field, Dayton, O., March 27, 1924.	8,980 meters 29,462 feet

CLASS C. WITH USEFUL LOAD OF 500 KILOGRAMS (1102 LBS.)

DURATION	No record.	
DISTANCE	No record.	
ALTITUDE	(Argentine) Otto Ballod, Fokker C-IV Napier Lion 450 h.p., at El Palomar Field, Buenos Aires, Jan. 19, 1924.	6,485 meters 21,276 feet

CLASS C. WITH USEFUL LOAD OF 1000 KILOGRAMS (2204 LBS.)

DURATION	No record.	
DISTANCE	No record.	
ALTITUDE	(France) Jean Casale, Bleriot biplane, 4 Hispano 180 h.p. engines, at Buc, France, June 1, 1923.	4,990 meters 16,367 feet

CLASS C. WITH USEFUL LOAD OF 1500 KILOGRAMS (3306 LBS.)

DURATION	(Great Britain) Capt. C. T. R. Hill, Handley Page W-8, 2 Napier Lion 450 h.p., at Cricklewood, May 4, 1920.	1 hr. 20 min.
DISTANCE	No record.	
ALTITUDE	(Great Britain) Capt. C. T. R. Hill, Handley Page W-8, 2 Napier Lion 450 h.p., at Cricklewood, May 4, 1920.	4,267 meters 13,996 feet

CLASS C. WITH USEFUL LOAD OF 2000 KILOGRAMS (4408 LBS.)

DURATION	(United States) Lt. H. R. Harris, U.S.A., Barling Bomber, 6 Liberty 400 h.p., at Wilbur Wright Field, Dayton, O., Oct. 27, 1923.	1 hr. 19 min. 11.8 sec.
DISTANCE	No record.	
ALTITUDE	(United States) Lt. H. R. Harris, U.S.A., Barling Bomber, 6 Liberty 400 h.p., at Wilbur Wright Field, Dayton, O., Oct. 25, 1923.	2,049 meters 6,722 feet

CLASS C. WITH USEFUL LOAD OF 3000 KILOGRAMS (6612 LBS.)

DURATION	(United States) Lt. H. R. Harris, U.S.A., Barling Bomber, 6 Liberty 400 h.p., at Wilbur Wright Field, Dayton, Ohio, October 27, 1923.	1 hr. 19 min. 11.8 sec.
DISTANCE	No record.	
ALTITUDE	(United States) Lt. H. R. Harris, U.S.A., Barling Bomber, 6 Liberty 400 h.p., at Wilbur Wright Field, Dayton, Ohio, October 27, 1923.	1,629 meters 5,344 feet

CLASS C. REFUELED IN FLIGHT

"Returning to point of departure"

New Category recognized by the F. A. I.

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.	37 hr. 15 min. 14.8 sec.

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. 3,298.26 miles

CLASS C. SPEED

Refueled in Flight

2500 km. (1553.42 miles)	(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.
3000 km. (1864.79 miles)	(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.	141.37 k.p.h. 88.15 m.p.h.
3500 km. (2174.79 miles)	(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.
4000 km. (2485.48 miles)	(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 k.p.h. 88.23 m.p.h.
4500 km. (2796.16 miles)	(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. 88.45 m.p.h.
5000 km. (3106.85 miles)	(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. 88.55 m.p.h.

CLASS C-1. (SEAPLANES)

"Returning to point of departure"

DURATION	(United States) Lt. M. A. Schur, U.S.N., Davis-Douglas seaplane, Liberty 400 h.p., at San Diego, Cal., June 12, 1923.	11 hrs. 16 min. 59 sec.
DISTANCE	(United States) Lt. M. A. Schur, U.S.N., Davis-Douglas seaplane, Liberty 400 h.p., at San Diego, Cal., June 12, 1923.	1,275 km. 792.25 miles
ALTITUDE	(France) Sadi Lecointe, Nieuport Delage, Hispano 300 h.p., at Meulan, March 11, 1924.	8,980 meters 29,462 feet

CLASS C-1. SPEED

MAXIMUM SPEED	(Italy) Alexander Passaleva, Marchetti-Savoia seaplane, Hispano 300 h.p., at Milan, Italy, Dec. 28, 1922.	280.155 k.p.h. 174.07 m.p.h.

"Returning to point of departure"

100 km. (62.14 miles)	(Italy) Capt. Biard, Supermarine, Napier Lion 450 h.p., at Naples, Aug. 12, 1922.	208.818 k.p.h. 129.75 m.p.h.
*200 km. (124.27 miles)	(Great Britain) Lt. D. Rittenhouse, U.S.N., Curtiss CR-3, Curtiss D-12, 465 h.p., at Cowes, England, Sept. 28, 1923.	273.411 k.p.h. 169.89 m.p.h.
500 km. (310.69 miles)	(United States) Lt. M. A. Schur, U.S.N., Davis-Douglas seaplane, Liberty 400 h.p., at San Diego, Cal., June 6, 1923.	115.87 k.p.h. 72 m.p.h.
1000 km. (621.37 miles)	(United States) Lt. M. A. Schur, U.S.N., Davis-Douglas seaplane, Liberty 400 h.p., at San Diego, Cal., June 12, 1923.	113.74 k.p.h. 70.49 m.p.h.

CLASS C-1. WITH USEFUL LOAD OF 250 KILOGRAMS (551 LBS.)

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.	10 hrs. 23 min. 58 sec.
DISTANCE	(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.	925 km. 574.75 miles
ALTITUDE	(United States) Lt. E. B. Brix, U.S.N., Davis-Douglas seaplane, Liberty 400 h.p., at San Diego, Cal., June 7, 1923.	3,307 meters 10,850 feet

CLASS C-1. WITH USEFUL LOAD OF 500 KILOGRAMS (1102 LBS.)

DURATION	(United States) Lt. H. E. Holland, U.S.N., F-5-L flying boat, 2 Liberty 400 h.p., at San Diego, Cal., June 6, 1923.	7 hrs. 35 min. 54 sec.

*This flight was timed over three laps of the Jacques Schneider course, which totaled 206.9 km. (128.58 miles), but the speed was calculated by assuming the distance as exactly 200 kilometers.

CLASS C-1. (SEAPLANES)

DISTANCE	(United States) Lt. H. E. Holland, 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) Chief Mechanician Rene, Farman-Goliath seaplane, 2 Salmson 260 h.p., at St. Raphael, Apr. 4, 1924.	3,353 meters 11,000 feet

CLASS C-1. WITH USEFUL LOAD OF 1000 KILOGRAMS (2204 LBS.)

DURATION	(United States) Lt. R. L. Fuller, U.S.N., Davis-Douglas seaplane, Liberty 400 h.p., at San Diego, Cal., June 6, 1923.	2 hrs. 45 min. 9 sec.
DISTANCE	(United States) Lt. R. L. Fuller, U.S.N., Davis-Douglas seaplane, Liberty 400 h.p., at San Diego, Cal., June 6, 1923.	325 km. 205.2 miles
ALTITUDE	(France) Chief Mechanician Rene, Farman-Goliath seaplane, 2 Salmson 260 h.p., at St. Raphael, Apr. 4, 1924.	3,353 meters 11,000 feet

CLASS C-1. WITH USEFUL LOAD OF 1500 KILOGRAMS (3306 LBS.)

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.	2 hrs. 18 min.
DISTANCE	No record.	
ALTITUDE	(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.	1,732 meters 5,682 feet

CLASS C-1. WITH USEFUL LOAD OF 2000 KILOGRAMS (4408 LBS.)

DURATION	(United States) Lt. H. E. Holland, U.S.N., F-5-L flying boat, 2 Liberty 400 h.p., at San Diego, Cal., June 7, 1923.	51 min.
DISTANCE	No record.	
ALTITUDE	(United States) Lt. H. E. Holland, 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

CLASS D. (GLIDERS)

DURATION	(France) Alexis Manyrol, Peyret Glider, at Vauville, France, January 29, 1923.	8 hr. 4 min. 50.4 sec.
DISTANCE	(France) Lt. Thoret, Bardin Glider, at Vauville, France, August 26, 1923.	8,100 meters 26,568 feet
ALTITUDE	(France) E. Descamps, Derwoitine Glider, at Biskra, February 7, 1923.	545 meters 1,787.6 feet

FORMER AMERICAN WORLD RECORD HOLDERS WHOSE PERFORMANCES HAVE BEEN EXCEEDED

CLASS C. (AIRPLANES)

ALTITUDE	Lt. J. A. Macready, U.S.A.S., Lepere biplane, (Supercharged) Liberty 400 h.p., at McCook Field, Dayton, Ohio, Sept. 28, 1921.	10,518 meters 34,508 feet
MAXIMUM SPEED	(a) Brig. Gen. Wm. Mitchell, U.S.A.S., Curtiss R-6, at Selfridge Field, Detroit, Mich., Oct. 18, 1922.	358.836 k.p.h. 222.87 m.p.h.
	(b) Lt. R. L. Maughan, U.S.A.S., Curtiss Racer R-6, Curtiss 465 h.p., Wilbur Wright Field, Dayton, Ohio, March 29, 1923.	380.751 k.p.h. 236.58 m.p.h.
	(c) Lt. H. G. Brow, U.S.N., Curtiss Racer R-2C1, Curtiss D-12, 500 h.p., at Mitchel Field, L. I., Nov. 2, 1923.	417.59 k.p.h. 259.15 m.p.h.
SPEED 100 km. (62.14 miles)	Lt. R. L. Maughan, U.S.A.S., Curtiss R-6, 465 h.p., at Selfridge Field, Detroit, Mich., October 14, 1922.	330.406 k.p.h. 205.8 m.p.h.
SPEED 200 km. (124.27 miles)	Lt. R. L. Maughan, U.S.A.S., Curtiss R-6, 465 h.p., at Selfridge Field, Detroit, Mich., October 14, 1922.	331.465 k.p.h. 205.9 m.p.h.

CLASS C. WITH USEFUL LOAD OF 1000 KILOGRAMS

ALTITUDE	Lt. Rutledge Irvine, U.S.N., Davis-Douglas Torpedo-plane, High Comp. Liberty 420 h.p., at McCook Field, Dayton, Ohio, April 17, 1923.	3,539 meters 11,609 feet

CLASS C-1. (SEAPLANES)

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

CLASS C-1. WITH USEFUL LOAD OF 500 KILOGRAMS (1102 LBS.)

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

CLASS C-1. WITH USEFUL LOAD OF 1000 KILOGRAMS (2204 LBS.)

ALTITUDE	Lt. E. E. Dolecek, U.S.N., F-5-L flying boat, 2 Liberty 400 h.p., at San Diego, Calif., June 7, 1923.	2,432 meters 7,979 feet

OFFICIAL AMERICAN RECORDS

January 1, 1924

CLASS A. (SPHERICAL BALLOONS)

All Categories

DURATION	C. B. Harmon, St. Louis to Edina, Mo., Oct. 4, 1909.	48 hr.26 min.
DISTANCE	A. R. Hawley, St. Louis to Lake Tchotogama, Oct. 17-19, 1910.	1,887.6 km. 1,172.9 miles

CLASS B. (DIRIGIBLES)

DURATION	T. A. Baldwin, Fort Meyer, Va., to Cherrydale and return. Aug. 14, 1908.	2 hrs. 1 min. 50 sec.
DISTANCE	No record.	
ALTITUDE	No record.	
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, O., April 16-17, 1923.	36 hrs. 4 min. 34 sec.
DISTANCE	Lts. Kelly and Macready, U.S.A., T-2, Liberty 375 h.p., at Wilbur Wright Field, Dayton, O., April 16-17, 1923.	4,050 km. 2516.55 miles
ALTITUDE	Lt. J. A. Macready, Lepere Biplane, (Supercharged) Liberty 400 h.p., at McCook Field, Dayton, Ohio, Sept. 28, 1921.	10,518 meters 34,508 feet

CLASS C. (SPEED)

MAXIMUM SPEED	Lt. A. J. Williams, U.S.N., Curtiss Racer R-2C1, Curtiss D-12a, 500 h.p., at Mitchel Field, Mineola, L. I., Nov. 4, 1923.	429.025 k.p.h. 266.59 m.p.h.

"Returning to point of departure"
Without Refueling

100 km. (62.14 miles)	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. 243.81 m.p.h.
200 km. (124.37 miles)	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. 243.67 m.p.h.
500 km. (310.69 miles)	Lt. Alex. Pearson, U.S.A., Verville Sperry R-3, Wright 350 h.p., at Wilbur Wright Field, Dayton, Ohio, March 29, 1923.	270 k.p.h. 167.8 m.p.h.
1000 km. (621.37 miles)	Lt. Harold R. Harris, U.S.A., DH-4B, Liberty 400 h.p., at Wilbur Wright Field, Dayton, Ohio, March 29, 1923.	205 k.p.h. 127.42 m.p.h.
1500 km. (932.05 miles)	Lt. Harold R. Harris, U.S.A., DH-4B, Liberty 375 h.p., at Wilbur Wright Field, Dayton, Ohio, April 17, 1923.	184.03 k.p.h. 114.35 m.p.h.
2000 km. (1242.74 miles)	Lt. Harold R. Harris, U.S.A., DH-4B, Liberty 375 h.p., at Wilbur Wright Field, Dayton, Ohio, April 17, 1923.	183.83 k.p.h. 114.22 m.p.h.
2500 km. (1553.42 miles)	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.
3000 km. (1864.11 miles)	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.
4000 km. (2485.48 miles)	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 LBS.)

DURATION	Lt. H. R. Harris, U.S.A., TP-1, Liberty 400 h.p. (Supercharged), at McCook Field, Dayton, O., March 27, 1924.	1 hr. 48 min. 19.4 sec
DISTANCE	No record.	
ALTITUDE	Lt. H. R. Harris, U.S.A., TP-1, Liberty 400 h.p. (Supercharged), at McCook Field, Dayton, O., March 27, 1924.	8,980 meters 29,462 feet

CLASS C. WITH USEFUL LOAD OF 500 KILOGRAMS (1102 LBS.)

DURATION	Lt. H. R. Harris, U.S.A., Barling Bomber, 6 Liberty 400 h.p., at Wilbur Wright Field, Dayton, O., Oct. 27, 1923.	1 hr. 19 min. 11.8 sec.
DISTANCE	No record.	
ALTITUDE	Lt. Rutledge Irvine, U.S.N., Davis-Douglas Torpedo Plane, Liberty 420 h.p., at McCook Field, Dayton, Ohio, April 17, 1923.	3,539 meters 11,609 feet

CLASS C. WITH USEFUL LOAD OF 1000 KILOGRAMS (2204 LBS.)

DURATION	Lt. H. R. Harris, U.S.A., Barling Bomber, 6 Liberty 400 h.p., at Wilbur Wright Field, Dayton, O., Oct. 27, 1923.	1 hr. 19 min. 11.8 sec.
DISTANCE	No record.	
ALTITUDE	Lt. Rutledge Irvine, U.S.N., Davis-Douglas Torpedo Plane, Liberty 420 h.p., at McCook Field, Dayton, Ohio, April 17, 1923.	3,539 meters 11,609 feet

CLASS C. WITH USEFUL LOAD OF 1500 KILOGRAMS (3306 LBS.)

DURATION	Lt. H. R. Harris, U.S.A., Barling Bomber, 6 Liberty 400 h.p., at Wilbur Wright Field, Dayton, O., Oct. 27, 1923.	1 hr. 19 min. 11.8 sec.
DISTANCE	No record.	
ALTITUDE	Lt. H. R. Harris, U.S.A., Barling Bomber, 6 Liberty 400 h.p., at Wilbur Wright Field, Dayton, O., Oct. 25, 1923.	2,049 meters 6,722 feet

CLASS C. WITH USEFUL LOAD OF 2000 KILOGRAMS (4408 LBS.)

DURATION	Lt. H. R. Harris, U.S.A., Barling Bomber, 6 Liberty 400 h.p., at Wilbur Wright Field, Dayton, O., Oct. 27, 1923.	1 hr. 19 min. 11.8 sec.
DISTANCE	No record.	
ALTITUDE	Lt. H. R. Harris, U.S.A., Barling Bomber, 6 Liberty 400 h.p., at Wilbur Wright Field, Dayton, O., Oct. 25, 1923.	2,049 meters 6,722 feet

CLASS C. WITH USEFUL LOAD OF 3000 KILOGRAMS (6612 LBS.)

DURATION	Lt. H. R. Harris, U.S.A., Barling Bomber, 6 Liberty 400 h.p., at Wilbur Wright Field, Dayton, O., Oct. 27, 1923.	1 hr. 19 min. 11.8 sec.
DISTANCE	No record.	
ALTITUDE	Lt. H. R. Harris, U.S.A., Barling Bomber, 6 Liberty 400 h.p., at Wilbur Wright Field, Dayton, O., Oct. 27, 1923.	1,629 meters 5,344 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.	37 hrs. 15 min. 14.8 sec.
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
ALTITUDE	No record.	

CLASS C. (SPEED)

Refueled in Flight

2500 km. (1553.42 miles)	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.
3000 km. (1864.11 miles)	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.
3500 km. (2174.79 miles)	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.
4000 km. (2485.48 miles)	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. 88.23 m.p.h.
4500 km. (2796.16 miles)	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. 88.45 m.p.h.
5000 km. (3106.85 miles)	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. 88.55 m.p.h.

CLASS C-1. (SEAPLANES)

"Returning to point of departure"

Without Refueling

DURATION	Lt. M. A. Schur, U.S.N., Davis-Douglas seaplane, Liberty 400 h.p., at San Diego, Cal., June 12, 1923.	11 hrs. 16 min. 59 sec.
DISTANCE	Lt. M. A. Schur, U.S.N., Davis-Douglas seaplane, Liberty 400 h.p., at San Diego, Cal., June 12, 1923.	1,275 km. 792.25 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 102.57 m.p.h.
MAXIMUM SPEED	Bo'sn. E. E. Reber, U.S.N., Davis-Douglas seaplane, Liberty 400 h.p., at San Diego, Cal., June 7, 1923.	13,898 feet 165.08 k.p.h

CLASS C-1. SPEED

"Returning to point of departure"

Without Refueling

100 km. (62.14 miles)	Lt. R. A. Ofstie, U.S.N., T-S seaplane, Lawrance 275 h.p., at San Diego, Cal., June 13, 1923.	196.27 k.p.h. 121.95 m.p.h.
200 km. (124.27 miles)	Lt. R. A. Ofstie, U.S.N., T-S seaplane, Lawrance 275 h.p., at San Diego, Cal., June 13, 1923.	194.95 k.p.h. 121.14 m.p.h.
500 km. (310.69 miles)	Lt. M. A. Schur, U.S.N., Davis-Douglas seaplane, Liberty 400 h.p., at San Diego, Cal., June 6, 1923.	115.87 k.p.h. 72 m.p.h
1000 km. (621.37 miles)	Lt. M. A. Schur, U.S.N., Davis-Douglas seaplane, Liberty 400 h.p., at San Diego, Cal., June 12, 1923.	113.74 k.p.h. 70.49 m.p.h.

CLASS C-1. WITH USEFUL LOAD OF 250 KILOGRAMS (551 LBS.)

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.	10 hrs.23 min. 58 sec.
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. 574.75 miles
ALTITUDE	Lt. E. B. Brix, U.S.N., Davis-Douglas seaplane, Liberty 400 h.p., at San Diego, Cal., June 7, 1923.	3,307 meters 10,850 feet

CLASS C-1. WITH USEFUL LOAD OF 500 KILOGRAMS (1102 LBS.)

DURATION	Lt. H. E. Holland, U.S.N., F-5-L flying boat, 2 Liberty 400 h.p., at San Diego, Cal., June 6, 1923.	7 hrs. 35 min. 54 sec.
DISTANCE	Lt. H. E. Holland, 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

CLASS C-1. WITH USEFUL LOAD OF 1000 KILOGRAMS (2204 LBS.)

DURATION	Lt. R. L. Fuller, U.S.N., Davis-Douglas seaplane, Liberty 400 h.p., at San Diego, Cal., June 6, 1923.	2 hrs. 45 min. 9 sec.
DISTANCE	Lt. R. L. Fuller, U.S.N., Davis-Douglas seaplane, Liberty 400 h.p., at San Diego, Cal., June 6, 1923.	325 km. 205.2 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

CLASS C-1. WITH USEFUL LOAD OF 1500 KILOGRAMS (3306 LBS.)

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.	2 hrs. 18 min.
DISTANCE	No record.	
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

CLASS C-1. WITH USEFUL LOAD OF 2000 KILOGRAMS (4408 LBS.)

DURATION	Lt. H. E. Holland, U.S.N., F-5-L flying boat, 2 Liberty 400 h.p., at San Diego, Cal., June 7, 1923.	51 min.
DISTANCE	No record.	
ALTITUDE	Lt. H. E. Holland, 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

CLASS D. (GLIDERS)

DURATION	No record.
DISTANCE	No record.
ALTITUDE	No record.

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 (1470 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: 1021 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.

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.

EVENT No. 1

ON TO ST. LOUIS RACE

September 20-30

Senior St. Louis Chamber of Commerce Trophy
†Junior St. Louis Chamber of Commerce Trophy

Cash Prizes: First prize, $500.00; Second prize, $250.00; Third Prize, $150.00; Fourth prize, $100.00

Entrant	*Airplane*	*Pilot*	*Point of Departure*	*Average Speed*	*Points*	*Distance, Miles*	*Points*	*Number of Passengers*	*Points*	*Engine*	*H.P. Normal*	*Points*	*Total Points*
1 Curtiss Ex. Co.	Curtiss Oriole	C. S. Jones	Garden City, N. Y.	Below 50	0	900	40	1	10	Curtiss OX-5	98.5	166	216
†2 Aero Club of Minn.	Thomas Morse 54-C	H. F. Cole	Minneapolis, Minn.	Below 50	0	900	40	0	0	Le Rhone	80	175	215
3 Heath A. Co.	Heath Biplane	W. W. Meyer	Chicago, Illinois	57.3 M.P.H.	7	262	0	4	40	Curtiss OX-5	98.5	166	213
4 Lawrence B. Sperry	Sperry Messenger	L. B. Sperry	Farmingdale, L. I., N. Y.	Below 50	0	700	20	0	0	Wright Radial L-4	56.5	187	207
5 W. A. Burke	Laird Biplane	W. A. Burke	Okmulgee, Okla.	96.1 M.P.H.	46	375	0	2	20	Wright	154	138	204
6 Bertha Horchem	Laird Swallow	B. Horchem	Ransom, Kansas	Below 50	0	225	0	3	30	Curtiss OX-5	98.5	166	196
6 Tex LaGrone	Curtiss	Tex LaGrone	Pine Grove, N. J.	Below 50	0	800	30	0	0	Curtiss OX-5	98.5	166	196
7 Sterling Oil Ref. Co.	Laird Swallow	P. Hutton	Wichita, Kansas	67.2 M.P.H.	17	390	0	1	10	Curtiss OX-5	98.5	166	193
8 Huff Daland A. Co.	Petrel Model 4	G. B. Post	Ogdensburg, N. Y.	97.9 M.P.H.	48	232	0	2	20	Wright	190	120	188
9 Johnson A. & S. Co.	Hartzell FC-1	W. E. Lees	Dayton, Ohio	60.1 M.P.H.	10	325	0	1	10	Curtiss OX-5	98.5	166	186
10 R. R. Ferguson	Lincoln Standard	J. Curran	Chicago, Illinois	56.8 M.P.H.	7	262	0	2	20	Wright	154	138	165
*11 C. L. Fower	Standard J-1	C. L. Fower	Macon, Missouri	66 M.P.H.	16	140	0	1	10	Wright	154	138	164

† Junior St. Louis Chamber of Commerce Trophy for pilot flying greatest distance.

* Disqualified—Rules required starting point to be 200 miles or more from St. Louis.

First and second places were tied for this trophy. C. S. Jones withdrew in favor of H. F. Cole.

Note—Average speed based on *total* elapsed time.

EVENT No. 2

FLYING CLUB OF ST. LOUIS TROPHY

LAMBERT—ST. LOUIS FLYING FIELD

Total Distance, 150 Kilometers (93.21 Miles). Three Laps of 50 Kil. (31.07 Miles). Cash Prizes: First, $500.00; Second, $300.00; Third, $200.00

Thursday, October 4, 1923—Time 11:00 a. m.

Contestants Finishing Race

Position	*Airplane*	*Number*	*Pilot*	*Entrant*	*Engine*	*H.P. Rated*	*Contest Load (Pilot & Passenger)*
FIRST	Hartzell FC-1	59	Walter E. Lees	Johnson Airplane Co.	Curtiss OX-5	90	340 lbs.
SECOND	Laird Swallow	61	Perry Hutton	Sterling Oil & Refining Co.	Curtiss OX-5	90	340 lbs.
THIRD	Curtiss Oriole	2	C. S. Jones	Curtiss Exhibition Co.	Curtiss OX-5	90	340 lbs.
FOURTH	Robertson Special	28	W. B. Robertson	Robertson Airplane Co.	Curtiss OX-5	90	340 lbs.
FIFTH	Rogers Day	66	"Tex" LaGrone	"Tex" LaGrone	Curtiss OX-5	90	340 lbs.
SIXTH	Farman Sport	1	R. P. Hewitt	Ludington Exhibition Co.	Anzani	60	340 lbs.
*SEVENTH	Sperry Messenger	14	Lawrence Sperry	Lawrence Sperry	Wright Radial L-4	60	340 lbs.

* Forced landing near end of third lap—ignition trouble.

EVENT No. 3

LIBERTY ENGINE BUILDERS' TROPHY

LAMBERT—ST. LOUIS FLYING FIELD

Total Distance, 300 Kilometers (186.42 Miles). Six Laps of 50 Kil. (31.07 Miles). Cash Prizes: First, $800.00; Second, $500.00; Third, $200.00

Thursday, October 4, 1923—Time 2:00 p. m.

Contestants Finishing Race

Position	*Airplane*	*Number*	*Pilot*	*Total Elapsed Time* Min.	Sec.	*Speed (M.P.H.)*	*Engine*	*H.P.*	*Contest Load* Crew	Ballast
FIRST	CO-4	32	Lt. C. McMullen, U.S.A.S.	80	26.84	139.03	Liberty-Packard	*400	340 lbs.	340 lbs.
SECOND	DH-4-L	36	Lt. H. K. Ramey, U.S.A.S.	81	18.84	137.54	Liberty-Lincoln	*400	340 lbs.	340 lbs.
THIRD	CO-5	33	Lt. L. H. Smith, U.S.A.S	82	38.12	135.27	Liberty-Ford	400	340 lbs.	340 lbs.
FOURTH	Vought UO-1	4	Lt. G. B. Hall, U.S.M.C.	84	42.18	132.05	Wright Radial J-1	210	340 lbs.	162.67 lbs.
FIFTH	DH-4-B	38	Lt. W. H. Bleakley, U.S.A.S.	87	26.79	127.90	Liberty-Ford	400	340 lbs.	340 lbs.
SIXTH	XB-1-A	34	Lt. V. J. Meloy, U.S.A.S.	88	08.86	126.88	Wright H-3	300	340 lbs.	232-75 lbs.
SEVENTH	DH-4-B	39	Lt. J. G. O'Connell, U.S.A.S	89	36.62	124.82	Liberty	400	340 lbs.	340 lbs.
EIGHTH	DH-4-B	40	Maj. R. S. Brown, U.S.A.S.	91	30.27	122.24	Liberty-Ford	400	340 lbs.	340 lbs.
NINTH	CO-4	31	Capt. Robt. Oldys, U.S.A.S.	94	40.38	118.14	Liberty	400	340 lbs.	340 lbs.

EVENT No. 4

AVIATION COUNTRY CLUB OF DETROIT TROPHY

LAMBERT—ST. LOUIS FLYING FIELD

Total Distance, 250 Kilometers (155.34 Miles). Five Laps of 50 Kil. (31.07 Miles) Cash Prizes: { *Speed, First, $500.00; Second, $300.00; Third, $200.00* / *Efficiency, First, $500.00; Second, $300.00; Third, $200.00*

Friday, October 5, 1923—Time 11:00 a. m.

Contestants Finishing Race

Position	*Airplane*	*Number*	*Pilot*	*Entrant*	*Total Elapsed Time* Min.	Sec.	*Speed (M.P.H.)*	*Engine*	*H.P. Normal*	*Contest Load* Pilot	Passenger	*Figure of Merit*
FIRST	Bellanca	12	L. H. Atkinson	Bellanca Airplane Co.	98	51.51	94.28	Anzani	95	170	680	674.8468
SECOND	Laird Swallow	61	Perry Hutton	Sterling Oil & Refining Co.	107	05.84	87.03	Curtiss OX-5	98.5	170	340	300.4180
THIRD	Curtiss Oriole	2	C. S. Jones	Curtiss Exhibition Co.	112	42.44	82.69	Curtiss OX-5	98.5	170	340	285.5527

EFFICIENCY FORMULA

$\frac{W}{H.P.} \times M.P.H. =$ Figure of merit. W = Weight of load passengers. H.P. = Horsepower of engine at normal R.P.M.

M.P.H. = Average speed of completing race in miles per hour (must not be less than 80).

The contest load consisting of passengers, or 170 pounds ballast in lieu of each passenger.

Event No

Pulitzer Tr

Lambert—St. Louis

Total Distance, 200 Kilometers (124.27 Miles). Four Laps of 50 Kil. (31.07 Mi

Saturday, October 6, 192

Contestants Finish

Position	Airplane	Number	Pilot	F.A.I License	Entrant	First Lap Min. Sec.	First Lap Speed (M.P.H.)	Second Lap Min. Sec.	Second Lap Speed (M.P.H.)	Third Lap Min. Sec.	Third Lap Speed (M.P.H.)	Fourth Lap Min. Sec.	Fourth Lap Speed (M.P.H.)	Total Elapsed Time Min. Sec.	Total Elapsed Time Speed (M.P.H.)	Engine	H.P.	Ignition	Ba-
First	Curtiss R2C1	9	Lt. A. J. Williams	119	U. S. Navy	7 36.02	245.2	7 41.46	242.4	7 40.36	242.9	7 38.17	244.2	30 36.01	243.68	Curtiss D-12	460	2 Splitdorf Mag.	N
Second	Curtiss R2C1	10	Lt. H. S. Brow	123	U. S. Navy	7 41.44	242.4	7 39.15	243.5	7 43.61	241.3	7 46.19	239.9	30 50.39	241.77	Curtiss D-12	460	2 Splitdorf Mag.	N
Third	Wright T-3	8	Lt. L. H. Sanderson	124	U. S. M. C.	8 05.58	230.4	8 07.73	229.3	8 05.58	230.3	8 05.70	230.3	32 24.59	230.06	Wright T-3	700	2 Splitdorf Mag.	N
Fourth	Wright T-3	7	Lt. S. W. Callaway	118	U. S. Navy	8 02.64	231.7	8 04.74	230.7	8 06.54	229.8	8 11.22	227.7	32 25.14	229.99	Wright T-3	700	2 Splitdorf Mag.	N
Fifth	Curtiss Racer	49	Lt. W. Miller	181	U. S. A. S.	8 32.06	218.4	8 31.18	218.8	8 28.45	220.0	8 32.04	218.4	34 03.73	218.89	Curtiss CD-12	400	2 Splitdorf Mag.	N
Sixth	Curtiss Racer	50	Lt. J. D. Corkille	180	U. S. A. S.	8 51.15	210.8	8 31.96	218.5	8 31.08	218.8	8 32.71	218.2	34 26.90	216.44	Curtiss CD-12	400	2 Splitdorf Mag.	N

Contestant Failing to Start

Position	Airplane	Number	Pilot	F.A.I License	Entrant	Engine	H.P.	Engine	H.P.	Ignition	Battery	Spark Plugs	Carburetor	Starter	Fuel	Oil	
	Verville Sperry	48	Lt. Pearson	22	U. S. A. S.	Curtiss D-12, Spec	500	Curtiss CD-12	400	2 Splitdorf	None	B.-G., IXA.	Stromberg	Booster Mag.	50% Benzol, 50% Shell	Mobile B	Curtiss

Event No

Merchants Exchange C

Lambert—St. Louis

Total Distance, 300 Kilometers (186.42 Miles). Six Laps of 50 Kil. (31.07 Mi

Friday, October 5, 192

Contestants Finish

Position	Airplane	Number	Pilot	F.A.I. License	Entrant	First Lap Min. Sec.	First Lap Speed (M.P.H.)	Second Lap Min. Sec.	Second Lap Speed (M.P.H.)	Third Lap Min. Sec.	Third Lap Speed (M.P.H.)	Fourth Lap Min. Sec.	Fourth Lap Speed (M.P.H.)	Fifth Lap Min. Sec.	Fifth Lap Speed (M.P.H.)	Sixth Lap Min. Sec.	Sixth Lap Speed (M.P.H.)	Total Elapsed Time Min. Sec.	Total Elapsed Time Speed (M.P.H.)	E
First	Martin Bomber	44	Lt. H. L. George	176	U. S. A. S.	16 21.42	113.9	16 10.01	115.3	16 19.79	114.1	16 22.54	113.8	16 18.43	114.3	16 20.02	114.1	97 52.21	114.29	2 Libe
Second	Douglass-Wright 4	5	Lt. M. A. Schur	120	U. S. Navy	17 29.79	106.6	17 18.64	107.7	17 20.85	107.5	17 14.43	108.1	17 13.96	108.2	17 17.68	107.8	103 55.35	107.63	Wrigh
Third	Martin Bomber	58	Lt. W. S. Hallenberg	198	U. S. M. C.	17 13.87	108.2	17 41.34	105.4	17 48.32	104.7	17 44.01	105.1	17 46.03	104.9	17 51.21	104.4	106 04.78	105.44	2 Libe
Fourth	Martin Bomber	45	Lt. R. F. Cole	151	U. S. A. S.	19 03.10	97.8	18 52.27	98.8	18 52.03	98.8	18 48.88	99.1	18 46.97	99.3	18 42.31	99.7	113 05.56	98.90	2 Libe
Fifth	Martin Bomber	47	Capt. E. C. Black	173	U. S. A. S.	19 21.94	96.3	19 18.10	96.8	19 05.40	97.6	19 08.85	97.4	19 08.27	97.4	19 07.29	97.5	115 09.85	97.12	2 Libe
Sixth	T-2	43	Lt. H. G. Crocker	177	U. S. A. S.	19 46.19	94.3	19 46.87	94.2	19 42.55	94.6	19 46.10	94.3	19 44.55	94.4	19 38.23	94.9	118 24.49	94.46	Libert

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ophy

Flying Field

es). Cash Prizes: First, $2000.00; Second, $1500.00; Third, $500.00

3—Time 2:30 p. m.

ing Race

EQUIPMENT

TERY	SPARK PLUGS	CARBURETOR	STARTER	FUEL	OIL	PROPELLER	RADIATOR TYPE	THERMOMETER	TACHOMETER	COMPASS	AIR SPEED INDICATOR	ALTIMETER	TIRES	SIZE
one	B.-G., IXA.	Stromberg	None	50% Benzol, 50% Shell	Gulf 90-95	Curtiss M-16	Curtiss-Wing		Jones	None	Pioneer Inst. Co.	None	Goodrich	26x3
one	B.-G., IXA.	Stromberg	None	50% Benzol, 50% Shell	Gulf 90-95	Curtiss M-16	Curtiss-Wing		Jones	None	Pioneer Inst. Co.	None	Goodrich	26x3
one	A. C.	2 Stromberg	None	50% Benzol, 50% Shell	Castor A	Wright Special, 3-Blade, All Metal	Wright-Wing						Goodyear Cord	105x460 m/m
one	A. C.	2 Stromberg	None	50% Benzol, 50% Shell	Castor A	Wright Special, 3-Blade, All Metal	Wright-Wing						Goodyear Cord	105x460 m/m
one	B.-G., IXA.	2 Stromberg	None	50% Benzol, 50% Shell	Mobile B	Curtiss-Reed, All Metal	Curtiss-Wing		Type "C"		Pioneer Inst. Co.	None	Goodyear Cord	26x3
one	B.-G., IXA.	2 Stromberg	None	50% Benzol, 50% Shell	Mobile B	Curtiss-Wood, 7 ft. 10 in.	Curtiss-Wing		Type "C"		Pioneer Inst. Co.	None	Goodyear Cord	26x3

The Contest Committee believes this equipment report to be accurate, but as much of the information contained herein had to be obtained from the contestants, mechanics, etc., there may be some errors. We request anyone finding any errors in the report, or having additional information not contained herein, to notify us in order that we may, at a later date, issue a supplementary report.

PROPELLER	RADIATOR TYPE	THERMOMETER	TACHOMETER	COMPASS	AIR SPEED INDICATOR	ALTIMETER	TIRES	SIZE	REMARKS
M-18, All Metal	Special Wing	Boyce Motometer	Van Sicklen	None	Pioneer Inst. Co.	Taylor Inst. Co.	Goodyear	26x4	Forced Landing. Crankshaft sprung, causing extreme vibration.

. 5

f St. Louis Trophy

Flying Field

les). Cash Prizes: First, $1000.00; Second, $700.00; Third, $300.00

3—Time 2 p. m.

ing Race

EQUIPMENT

NGINE	H. P.	CONTEST LOAD Pilot	CONTEST LOAD Passenger	IGNITION	BATTERY	SPARK PLUGS	CARBURETOR	STARTER	FUEL	OIL	PROPELLER	RADIATOR TYPE	THERMOMETER	COMPASS	TIRES	SIZE
rty	400	340 lbs.	1600 lbs.	Delco	2 Willard	Mosler M. I.	Zenith	None	H. T. Shell	Liberty	McCook, Martin Bomber	Martin, Nose	Boyce		Goodyear	4—800x150
T-2	520	340 lbs.	946 lbs.	Splitdorf Mag.		A. C. Ignition Co.	Stromberg	None	H. T. Shell	Mobile "B"	Hamilton	Water-Oil, Lamblin Wright Fin. Oil	National Gauge	U. S. Navy, Aircraft Factory	Goodyear	38x8
rty	400	340 lbs.	1600 lbs.	Delco	2 Willard	B. G.-I. X. A.	Zenith	Bijur	H. T. Shell	Liberty	Wood, M. B., McCook	Gurney, Nose	Boyce		Goodyear	750x125
rty	400	340 lbs.	1600 lbs.	Delco	2 Willard	Mosler M. I.	Zenith	Bijur	H. T. Shell	Lakeside Aviation	Curtiss, Martin Bomber	Martin, Nose	Boyce		Goodyear Cord	44x10
rty	400	340 lbs.	1600 lbs.	Delco	2 Willard	B. G.-I. X. A.	Zenith	Bijur	H. T. Shell	Lakeside Aviation	Curtiss, Martin Bomber	Curtiss, Nose			Goodyear Cord	44x10
	400	340 lbs.	1600 lbs.	Delco	2— {Cincinnati & Exide	Mosler M. I.	Zenith	Bijur	H. T Shell	Liberty	McCook, Martin Bomber	Fokker and McCook Boosters			Goodyear Cord	44x10

EVENT No. 7

DETROIT NEWS AIR MAIL TROPHY

LAMBERT—ST. LOUIS FLYING FIELD

Total Distance, 300 Kilometers (186.04 Miles). Six Laps of 50 Kil. (31.07 Miles). Cash Prizes: First, $800.00; Second, $500.00; Third, $200.00

Saturday, October 6, 1923—Time 2.00 p. m.

Contestants Finishing Race

Position	*Airplane*	*Number*	*Pilot*	*Total Elapsed Time* *Min.*	*Sec.*	*Speed (M.P.H.)*
FIRST	DH-4	17	J. F. Moore, U.S.A.M.	89	29.63	124.98
SECOND	DH-4	18	D. C. Smith, U.S.A.M.	92	34.04	120.83
THIRD	DH-4	67	P. F. Collins, U.S.A.M.	93	08.12	120.09
FOURTH	DH-4	23	E. M. Allison, U.S.A.M.	94	18.40	118.60
FIFTH	DH-4	20	J. H. Knight, U.S.A.M.	94	27.86	118.40
SIXTH	DH-4	21	W. C. Hopson, U.S.A.M.	95	12.02	117.49
SEVENTH	DH-4	68	W. S. Smith, U.S.A.M.	95	54.84	116.61
EIGHTH	DH-4	16	E. F. White, U.S.A.M.	96	12.40	116.26
NINTH	DH-4	66	W. D. Williams, U.S.A.M.	97	00.24	115.32
TENTH	DH-4	71	R. H. Ellis, U.S.A.M.	98	47.02	113.22
ELEVENTH	DH-4	22	L. H. Garrison, U.S.A.M.	98	49.92	113.17
TWELFTH	DH-4	24	R. J. Page, U.S.A.M.	100	13.73	111.59

All contesting planes were equipped with 400 h.p. Liberties.

EVENT No. 8-A

MITCHELL TROPHY

LAMBERT—ST. LOUIS FLYING FIELD

Total Distance, 200 Kilometers (124.27 Miles). Four Laps of 50 Kil. (31.07 Miles). Cash Prizes: First, Second, Third

Thursday, October 4, 1923—Time 12:45 p. m.

Contestants Finishing Race

Position	*Airplane*	*Number*	*Pilot*	*Total Elapsed Time* Min.	Sec.	*Speed (M.P.H.)*	*Engine*	*H.P.*
FIRST	MB-3 (Thomas Morse-Boeing)	65	Capt. B. E. Skeel, U.S.A.S.	50	54.95	146.44	Wright H-3	300
*SECOND	MB-3 (Thomas Morse-Boeing)	55	Lt. G. P. Tourtellot, U.S.A.S.	52	04.24	143.21	Wright H-3	300
THIRD	MB-3 (Thomas Morse-Boeing)	53	Lt. T. W. Blackburn, U.S.A.S.	52	51.07	141.08	Wright H-3	300
FOURTH	MB-3 (Thomas Morse-Boeing)	57	Lt. J. T. Johnson, U.S.A.S.	53	34.18	139.18	Wright H-3	300
FIFTH	MB-3 (Thomas Morse-Boeing)	56	Capt. V. B. Dixon, U.S.A.S.	53	40.22	138.92	Wright H-3	300

* Ran out of gas near finishing line, but crossed line in a glide with dead motor.

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