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PRELUDE TO THE AIR AGE:
CIVIL AVIATION IN THE UNITED STATES,
1919-1929

DISSERTATION

Presented in Partial Fulfillment of the Requirements for
the Degree Doctor of Philosophy in the Graduate
School of the Ohio State University

By

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* * * * * *

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Six decades after Kitty Hawk, the aerospace industry ranked as one of the two largest industrial employers in the United States. With 1,253,000 workers in 1963, it was rivaled only by the automobile industry. The aerospace industry accounted for 3.5% of the Gross National Product, 5.4% of American exports, and 17% of federal expenditures. More than 80% of its business activities related to space and military production. Although civil and military aviation are hard to separate, the emphasis of this study is on the development of civil aviation—which accounts for only 20% of the sales noted above.

Civil aviation, divided into two sectors, commercial (scheduled air transport) and general (private business flying, industrial utility, etc.), nevertheless boasts some impressive statistics of its own. Since 1947, airlines have been leading ships in ocean passenger travel; since 1957, domestic U. S. air carriers have been transporting more passengers than either bus or rail lines. In 1963 the scheduled airlines showed a profit of $81 million on revenues of $3.5 billion. The same year, American domestic and international airlines flew more than 350 million ton-miles of mail and 1.3 billion ton-miles of express and freight; 71 million passengers were carried for 50 billion passenger miles.

These statistics sometimes overshadow the liveliest sector of aeronautics—general aviation. General aviation accounts for more than 60% of all aircraft movements in the U. S., including military flights.
Ranging from Piper Cubs to $1.5 million executive jets, the general aviation fleet of 85,000 aircraft is forty times the size of the airlines and logs five times as many hours of flight time. Business flying has become an indispensable operation for scores of firms. A 1961 study by the Federal Aviation Agency in its eastern region alone showed that dozens of businesses chose to locate in municipalities that had airfields because the companies' executive aircraft were integral parts of business programs. Among other activities, general flying includes surveying for petroleum companies and fire patrol above national forests; in 1962, 65 million acres in the United States were treated by aerial application in agricultural work—the list could go on.¹

We live in an age of the airplane. When did this occur? Some would place the date in 1903, when man first flew. Lewis Mumford said that Blériot's flight across the English Channel in 1909, symbolizing an end to British insularity, marked a significant social effect in the history of aircraft;² many would place the date of the air age in that year. The sociologist William F. Ogburn placed the beginning in 1915³ after four decades of progress and two wars. The author feels that the


² Lewis Mumford, Technics and Civilization (New York, 1934), 236.

rapid development of aviation after World War I put the United States at
the verge of the air age by 1929.

The origin and development of commercial aviation has been ably
treated by Henry Ladd Smith. Scheduled airline operations began as
early as 1914 in Florida with the St. Petersburg-Tampa Air Boat Line,
but real progress was not made until after 1925 when the Kelly, or Air-
mail Act, provided private operators with an indirect subsidy in the
form of airmail contracts. The volume of airmail increased throughout
the period, yet scheduled passenger travel and air cargo grew slowly
until after 1928. Nevertheless, the basic framework of the airline
industry was set up, and most of the major airline systems such as
American, TWA, United, and Pan American had emerged by 1929-1930. The
airlines were small, but significant.

This study is primarily concerned with the ether branch of civil
aviation--general aviation. The purpose is to reveal the diversity of
the applications of aircraft to practical work in forestry patrol, agri-
culture, photography, and business. It also seeks to show the effects
of civil aviation on employment, engineering, meteorology, medicine,
insurance, and law. Together with the general sector, the evolution
of commercial aviation in the twenties set the mold for the future
development of aviation and its effect on society.

For the story of the growth of commercial aviation, see Henry
Ladd Smith, Airways; the History of Commercial Aviation in the United
States (New York, 1942), especially pages 163-16.
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CHAPTER I
INTRODUCTION

High over the prairies between Minneapolis and Chicago, a dozen airline patrons relaxed into cushioned seats to enjoy a motion picture. The passengers flying with Universal Air Lines, the innovator of this remarkable diversion to relieve the tedium of travel, had the opportunity to watch the picture to its finish before their arrival in Chicago. In an age of jets they would have landed long before the final scene. The year was 1929, a time when flying was a comparatively leisurely mode of travel. But like in-flight movies, many innovations of aeronautics were pioneered in the first decade after World War I.

On May 15, 1918, the United States Post Office Department marked the beginning of an epoch in aviation by inaugurating the first regularly scheduled airmail service in the world. The Post Office continued to operate the airmail until 1925, when the task was turned over to private contractors under the terms of the Kelly Act. General aviation, including business flying, aerial photography, and a multitude of other

1 New York Times, February 18, 1929.

2 In 1919 Dr. Robert H. Goddard, regarded as the founder of modern rocketry, wrote his historical treatise, A Method of Reaching Extreme Altitudes, and fired his first liquid-propellant rocket in 1926, at Auburn, Massachusetts. The Englishman Frank Whittle published his theory on jet propulsion in 1928. In a somewhat related development, the German Frits von Opel made the first rocket-powered plane flight in 1929. Claimants to the first jet flight include Italy, 1939; Germany, 1940; and England, 1941 (with a plane powered by a Whittle-designed engine).
services, rapidly developed in the postwar years—with some unevenness—until the Air Commerce Act of 1926 ensured the safe regulation of aviation and increased federal support to encourage passenger travel. The Daniel Guggenheim Fund for the Promotion of Aeronautics, established in 1926 to promote the development of aviation and make the public air-minded, eventually expended over $3,000,000 for a variety of basic programs that influenced the growth of aviation in every respect. The Army's round-the-world flight in 1924 and Richard E. Byrd's conquest of the Arctic in 1926 were striking demonstrations of endurance and reliability of aircraft for long range transportation.

The mid-twenties marked an interval of transition. For all of its shortcomings, the airplane, like the automobile, was accepted as a hallmark of progress; between 1925 and 1927, the stage was set for a period of unparalleled growth. Reviewing the first quarter of the 1900's, Mark Sullivan commented on the impact of aeronautics on the mind of man. Before the turn of the century, Sullivan recalled, the impossibility of human flight had been accepted as axiomatic—an unalterable fact of nature like the progression of winter and summer, the law of gravity, and the inevitability of death. An affirmation of God and the repudiation of flight contained the same unassailable, elementary truth. Thinking

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the unthinkable, the Wright brothers achieved the impossible in 1903. If flight were possible, Sullivan asked, what other sanctities might be liable to desecration? The achievement of flight was a landmark in freeing ordinary individuals from the limitations of the status quo, stimulating the free inquiry of the intellect. "Of all the agencies that influenced man's minds," Sullivan wrote, "that made the average man of 1925 intellectually different from him of 1900, by far the greatest was the sight of a human being in an airplane." This feeling may have been shared by many thoughtful people, although the actual capabilities of aviation were considerably short of Sullivan's pronouncement. One of the best selling books in 1927 was We, written by Charles Lindbergh after his conquest of the Atlantic in the "Spirit of St. Louis." The book was rather short, Lindbergh explained later, for several reasons; a feeling that he lacked ability to write a comprehensive story, his shyness, and the press of time. "Also," he admitted, "believing in aviation's future, I did not want to lay bare, through my own experience, its existing weaknesses."

Lindbergh's flight, however, signaled the beginning of meteoric progress. By the end of the twenties, aviation had achieved universal recognition and had proved itself to be an essential part of modern civilization. One barometer of value was the attitude toward pilots.

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Statisticians in the Census Bureau seem to have had trouble in classifying men who challenged the sky in flying machines; in the census of 1910 they were designated as "aeronauts" and appeared under the heading of "showmen," along with actors and acrobats. Lumped anonymously under "other professional pursuits" in 1920, ten years later the aviator had achieved the responsible status of social utility that entitled him to an independent category within "transportation and communication." A sociological study in 1928 substantiated the changing image of pilots from that of a daring young adventurer to a man performing a necessary and important function in modern society.

By 1929, aviation had matured, conforming to the general pattern of the growth of inventions. S. C. Gilfillan estimated that a period of twenty-four years was required for an invention to develop from the first working model to practical application, an additional fourteen years to commercial success, and twelve years more to important use—fifty years to complete utility. By way of comparison, the Wright brothers' first airplane climbed into the air above the sand dunes at Kittyhawk in 1903. In 1927, the same year Lindbergh conquered the

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7 Emory S. Bogardus, "Occupational Distance," Sociology and Social Research, XIII (September-October, 1928), 75-76.

Atlantic, it became possible for a traveller to make a continuous flying-trip across the United States from New York to San Francisco.\(^9\)

Citing the "Law of Growth" outlined by Raymond P. Prescott,\(^10\) one student of aeronautics tried to define the status of aviation at the end of the first decade following World War I. Aviation, he concluded, had passed through the initial stage of experimentation, and was entering an era where it would become a daily factor of social and economic contact.\(^11\)

In 1930, at the termination of the Daniel Guggenheim Fund for the Promotion of Aeronautics, Harry F. Guggenheim put it more succinctly. "The pioneering period," he said, "has come to an end."\(^12\)

\(^9\) U. S. Civil Aeronautics Board, Handbook of Airline Statistics (Washington, D. C., 1962), 457. Regular transcontinental air passenger service, which took nearly thirty-two hours, became available on September 1, 1927. The one-way fare was $400.00 in planes that accommodated two to four passengers, sometimes in an open cockpit. At that time, airmail was flown under contract to the government on a poundage basis. Carrying mail was more profitable than carrying people, so all tickets were sold with the proviso that patrons had to get out of the airplane anywhere along the route if there were enough letters to displace them.


\(^12\) Harry Frank Guggenheim, The Seven Skies (New York, 1930), 116.
PUTTING AIRPLANES TO WORK

An airplane can be used to do hundreds of things, and the men who did most of them first were the flying gypsies of the twenties. The gypsy was the offspring of the postwar demobilization, born in the spring and summer of 1919 when the government released its cadres of service fliers and hundreds of serviceable military aircraft. These aerial nomads were soon roaring over the length and breadth of America, "a lively example of a romantic profession unhampere
red by precedents and unrestricted by man-made law—a direct contradiction to the plea that romance no longer exists in our day."2

Gypsies gave thousands of people their first ride in an airplane, making a convincing demonstration of the flying vehicle so many had read about but never seen. The gypsies and their flying circuses provided spectacle and thrills, often gave flying a poor image, yet at least provoked speculation about the possibilities of aviation where no ideas existed before. When Eddie Stinson, "king of the loopers," passed through Lancaster, Pennsylvania, in the spring of 1919, his aerial circus left the town in a state of aerial intoxication described as "flying

1 Lester J. Maitland, _Knights of the Air_ (Garden City: 1929), 233.

"Eddie's troupe delivered newspapers by air, striking enough, but it was the experience of riding in a real plane that so excited everyone. Stinson had originally planned a two-day stand, but enthusiasm was so high that he stayed on to give rides at fifteen dollars a flight, twenty-five if the passenger wanted the added thrill of a little stunting. He had to resume his tour again before the week was out, but even at those prices, Stinson's crew had flown around 250 people. When crowds became blaze about simple tricks like loops and other gyrations in the air, promoters dreamed up new sensations to keep up a steady turn-over at the gate. Unfortunately, these new stunts often held unforeseen risks. At the critical moment in completing a mid-air transfer from one plane to the swinging ladder attached below the fuselage of another, the leading aerial stunter, "Duke" Krantz, was jolted by a charge of static electricity that almost made him let go. 4 Other incidents ended less happily, and as time passed, inexperienced pilots and rickety airplanes resulted in a growing number of fatalities. The military services began to sell aircraft that were obsolete and considered unusable, giving only vague admonitions about the necessity of a thorough overhaul. Anybody who could ante up the cash could own an airplane; there were no federal standards of proficiency and safety until the Air Commerce Act was passed in 1926. 5 In the absence of air laws there was no curb to shabby flying


4 Columbia University, Oral History Research Office, "Aviation Project" (1960), The Oral History Collection of Columbia University, Aron Krantz, III. Cited hereafter as OHC.

5 Elsbeth E. Freudenthal, The Aviation Business; from Kitty Hawk to Wall Street (New York, 1940), 67-68.
in run-down planes which ended in the death of too many pilots and too often, their patrons with them. "In each town visited by an aerial tragedy," Howard Mingos said regretfully, "the people buried their dead and consigned all flying contraptions to the devil." Although the gypsy was a picturesque figure, the sensational stunts and the fatalities involved in his activities created a misunderstanding and fear of aviation that took years to erase.\(^7\)

Some of the original gypsies, however, did a great deal to advance the cause of civil and commercial aviation. Before he took a steady job as an airmail pilot, Charles A. Lindbergh performed in Nebraska as a parachute jumper and wing walker while scraping together the $500 to buy his own Curtiss JN-4 "Jenny." When he took possession, Lindbergh had not had much instruction and had never soloed, but he did not have enough money for further lessons. There was no possibility of storing the plane, so he gamely clambered into the cockpit and the engine was started. In his first solo attempt, Lindbergh made an erratic climb to an altitude of four feet, thought better of it, and brought the Jenny down again on one wheel and the wing skid. A sympathetic pilot generously conducted a cram course of thirty minutes' instruction which launched the young flier into a new career.\(^8\) Some of the gypsies began

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\(^6\) Howard Mingos, "America Takes the Lead in Aviation," World's Work, LI (April, 1926), 636.

\(^7\) Maitland, 234-35.

\(^8\) Charles A. Lindbergh, We (New York, 1927), 39-42.
to settle down and base their activities in one spot. These men became the local "fixed-base" operators whose hangars, repair shops, and maintained runways laid the basis for general aviation and aviation services. An organization known as the Maycock Flyers, located in Michigan, lays claim to having begun non-scheduled flying service all over the country as early as March, 1919.9

The ex-gypsies worked with burning enthusiasm, in the belief they were helping to construct the foundations of a nascent technology.10 Their most important contribution to aviation was "aerial service"--imaginative application of the particular advantages of air craft in surveying, photography, dusting, emergency service, and so on, entirely apart from regularly scheduled mail, freight, and passenger service.11 One source reports that these local operators carried 80,888 passengers and 208,302 pounds of freight in 1923.12 The publisher of Aviation magazine used his mailing list to run a survey in 1925 that turned up 344 separate operators who flew 6,823,730 miles.13 Probably the most

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12 Albert E. Blomquist, Outline of Air Transport Practice (New York, 1941), 10.

13 Archibald Black, The Story of Flying (New York, 1940), 124-25. France, presumably the leader in aviation, recorded only 2,249,000 miles in 1925.
reliable statistics for 1925 are found in the Aircraft Yearbook, official publication of the Aeronautical Chamber of Commerce. The Yearbook received written reports from 290 operators, twenty-eight of whom said they flew only for pleasure. The 290 pilots were scattered around forty-one states and owned 676 airplanes. They flew 5,396,672 miles, carried 205,094 passengers, and delivered 112 tons of assorted cargo and mail. In retrospect, their reports show a remarkable variety of services performed in a routine, professional manner. By 1927, there were fifty million aircraft miles flown in the United States, with the military accounting for only slightly over half of this. Airmail accounted for about four and a half million, and aerial services flew over eighteen million miles. Remarking on this aspect, the New Republic observed that the "business side of flying" was in a better position than most people realized.

Although Bob Johnson did not start out as a gypsy, the Johnson Flying Service in Missoula, Montana, is representative of the regular fixed-base operator. Johnson was bitten by the flying bug in 1923, when an itinerant pilot brought his plane to Johnson's garage for repairs. The pilot gave Johnson a little instruction, and he bought his first plane, a ninety horsepower Swallow, in 1924. The plane earned a little money in scenic tours, carrying sportsmen to a remote forest area, some

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11 Aircraft Yearbook (1926), 43-65.

emergency work, and flying a photographer for the very first aerial camera shot of Missoula, the Garden City. Flying early morning fire patrols for the Forest Service in 1926, Johnson became even better known, and when he bought an enclosed cabin-four-place Travelair in 1929, all of Missoula turned out to see him bring it in. With a carpeted aisle, roll-down windows, and covered wicker seats, it was a luxurious contrast to the old two-place open cockpit Swallow. When the Swallow was later destroyed in a hangar fire, Johnson's business permitted him to replace it with two new planes. He continued his instruction services and commercial flights for local business men as well as other operations possible only by plane. A "snowline run" into the rugged back country maintained contact with ranchers who were running low on stock feed and delivered items like two 1600-foot metal cables to a snowbound goldmine in the high Cascades. Landing on skis, Johnson picked up a seriously injured Park Ranger and delivered him safely and quickly to the hospital, eliminating a four day ordeal by pack train through a wilderness in the dead of winter. 16

The airplane was a vital link of contact with civilization in Alaska, which was still very much a frontier in 1924. Noel Wien made the fifty-five mile run from Fairbanks to the mining town of Livengood in forty-five minutes. The same trip took two to three weeks by the next fastest route, the river, so the various ptomaine and pneumonia victims who traveled with Noel had good reason to be thankful for his

16 Marian Templeton Place, Tall Timber Pilots (New York, 1953), 15-33.
antique Hisso-Standard, even at a fare of fifty dollars one way. Wien later flew the old Stinson used by the famous Arctic pilot, Hubert Wilkins, and then piloted a Fokker F-3, which was shipped from the East Coast to Alaska by boat, via the Panama Canal. Noel Wien also has the distinction of being probably the first man in the world to herd reindeer by airplane.

Airplanes were obviously connected with marvellously inventive minds, and this association bloomed into all sorts of intriguing operations. In the blatantly commercial age of the twenties, the thrill of aviation lent itself to techniques of sensation and ballyhoo. Aviation was a bold and spectacular thing, a choice agent for splashy advertising in the form of skywriting in mile-high strokes. A dashing Englishman, Major Jack Savage, caught the eye of many advertising executives when he announced himself with a big "Hello U. S. A." scrawled in chemical smoke across New York's horizon. The Major was signed to a $1,000 dollar-a-day contract by the imaginative American Tobacco Company, who quickly sensed the colorful implications of having a smoky "Lucky Strike" inscribed in mid-air. In fact, the company was so delighted with this medium of advertising that they planned to have Major Savage puff his way across America, lettering the message over selected cities. Harassed citizens, irritated by this desecration of the daylight sky

17 Noel Wien, OHC, IV.

18 Ibid., attached MS, "Wien Alaska Airlines - Its History," 5.
were hounded into the night by flying neon signs. Having driven the consumer indoors, the unrelenting ad men finally resorted to airborne loudspeakers. 

Ever alert to ingenious methods of reaching the electorate, politicians quickly utilized the mobility of aircraft. The Missouri elections * 1920 were enlivened by the flying campaign of a gubernatorial candidate with the whimsical name of E. E. E. MoJimsey. Perhaps MoJimsey was ahead of his time—he lost—although Governor Walter J. Kohler of Wisconsin said that the use of an airplane allowed a wider exposure to voters and was a definite asset to his successful contest in 1929.

Confronted with the increasing difficulties of covering fast-paced news developments, the news media adopted the airplane to speed them to the scene of events. Clarence Jones flew photographers to the job and rushed back with pictures to make the early editions. When Jack Dempsey fought in Shelby, Montana, news services paid over $15,000 to have the fight pictures flown to the East and West Coast papers with an elaborate relay system of sixteen to eighteen planes. Jones and men

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like him did a considerable business in the twenties covering all the major news events from Wilson's funeral to Floyd Bennett's ordeal in Mammoth cave.22

A number of well known newspapers had their own aircraft in the twenties, and even earlier. The editor of the Detroit News bought a plane in 1912, and sometimes used it in the line of business. In the late 1920's the aviation editor of the paper, James Piersol, found it necessary to fly as much as 20,000 miles per year on commercial airlines; in 1929 the News finally purchased a Lockheed Vega to give Piersol more flexibility in making the paper's press deadlines.23 The Baltimore Sun acquired its own plane in 1920,24 and in 1928, the Des Moines Register paid $14,000 for a five-place Fairchild, which was appropriately christened "Good News." The red and white aircraft became a familiar sight all over Iowa and neighboring states as it carried photographers and reporters to cover stories of tornadoes, floods, and fairs; the paper's cartoonist, J. N. Darling, flew down to Kansas City to record the excitement of the Republican Convention. On Saturday mornings, the Fairchild dropped off photographers to cover the leading

22 Clarence Jones, OHC, II; Leroy Ponton de Arce, ibid., IV.


football games, picking them up late in the afternoon with their pictures for the big Sunday sports section. The newspapers with aircraft served a valuable function in promoting aviation as well as boosting their own prestige. Planes were new and imaginative, with an aura of drama and romance that was suited to news reporting. Until much of their utility was displaced by the wirephoto services, they turned in a colorful performance.

The airplane served as an agent of municipal government in a fast-paced age of urban civilization. Beginning in 1919, San Francisco's Fire Department used hydroplanes for an aerial fire patrol over the city. After experimenting with a volunteer flying patrol, in 1929 New York City equipped its police force with three planes for the work of law enforcement, including the control of reckless flying above the city environs. Bergen County, New Jersey, also used four planes to control flying activity over the county's airspace, and the Chief himself flew several missions in traffic control programs.

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27 "Fighting Forest Fires from the Skies," Scientific American, CXXII (August 2, 1919), 515.

Bergen County's flying policemen was Clyde E. Pangborn, who became a well known aviator of the thirties.29 Another unit of aerial enforcement was the U. S. Coast Guard Air Service, born in 1926 with three Loening amphibians. The Coast Guard's constant battle with violators of prohibition was aided by their three-plane aerial rum patrol. Seventy-five per cent of the Coast Guard's captured rum-runners were first spotted from the air, and smugglers came to identify the drone of the patrolling Loenings with dismay.30

The pioneering gypsies performed an essential educational function in demonstrating the actual existence of aviation. Those who settled down to fixed-base operations provided general service aviation that carried out a wide variety of practical operations. Harry Guggenheim, Chief of the Daniel Guggenheim Fund for the Promotion of Aeronautics, asserted in 1927 that aerial service was becoming a regular aspect of modern life in the twentieth century.31 The uses and flexibility of aviation were amply demonstrated throughout the twenties, becoming useful adjuncts of modern urban needs of communication and municipal regulation.

29 "Aerial Police Unit Starts Operation in New Jersey," American City, XLI (July, 1929), 86.

30 "Coast Guard Air Service Inaugurated," Aviation, XIII (December 20, 1926), 1033; A. G. West, "The Air Patrol of the Coast Guard," Aero Digest, XV (August, 1929), 57-58, passim.

31 Guggenheim, Bulletin, 3.
CHAPTER III
AERIAL AGRICULTURE

When the domestic cotton crop was threatened in 1918 by an invasion of the pink bollworm from Mexico, the Federal Horticultural Board of the Department of Agriculture tried to check the advance by enforcing a cotton-free zone along the United States border. Plagued by the persistent planting of small outlaw fields scattered along an extensive frontier with few roads and an effective camouflage of wild forest, the Board was intrigued by the proposal of an aerial patrol suggested by Lieutenant Harold Compere, an Air Service pilot stationed near Houston. Compere's recognized interest in science, plus the fact that his father was a well-known entomologist who had worked with the Board, made the idea seem plausible. The first trial was carried out in the fall of 1918, and eight new outlaw fields were spotted in a district that had just recently been scouted by horseback and foot. The initial success encouraged the Agriculture Department, which enlisted the support of the War Department for continued cooperation of the Horticultural Board and the Air Service. Regular patrols were inaugurated in the beginning of 1919, and plans were underway to map the area by aerial photography. ¹

From merely scouting the enemy, airplanes were next mobilized for direct attack. A twelve year old catalpa grove near Troy, Ohio, reaching maturity in 1921, was being defoliated by the catalpa sphinx and catalpa midge. Covering six acres and including nearly 5,000 trees, the grove had been started by H. B. Carver to yield post and pole timber; its defoliation not only meant a loss to the owner but indicated a serious threat to similar stands all over the state. The preliminary outbreak in the spring had been serious enough, but with the second crop of foliage beginning to appear at about the same time the second brood of caterpillars was due, it seemed likely that the second wave of caterpillars would finish the process of denuding the grove. J. S. Houser, of the Ohio Agricultural Experiment Station, accepted the idea of aerially distributed poison proposed by the city forester of Cleveland, C. R. Neillie. They cooperated with the Air Service personnel at McCook Field, Dayton, who furnished J. A. Macready, as pilot for the Curtiss JN 6, and designed the poison dust hopper for the experiment.

In August, a day before preparations were completed and the plane had flown from Dayton to Troy, the new caterpillars had already hatched and 75% of the catalpa leaves in Carver's grove had been destroyed. It would have taken hours for workers to drag tanks and hoses up and down the ranks of trees, spraying the insects in the usual fashion. After the plane was loaded with arsenate of lead powder, Lieutenant Macready levered himself into the Jenny, and took off. Trailing a swathe of lethal white dust, Macready made six passes of fifty-four seconds each and the job was finished. Later examination showed that 99% of the
caterpillars above ground succumbed to the aerial attack, and optimistic predictions were made for eventual use in other types of orchards.  

The successful experiments at Troy suggested the value of airplane dusting to control other insect pests, especially the cotton boll weevil. Typical cotton growing areas were located around the Delta Laboratory of the United States Bureau of Entomology at Tallulah, Louisiana, and in 1923 the first cotton dusting experiments were conducted there under the direction of Dr. B. R. Coad. Coad's experiments were again supported by the Air Service, which donated pilots and all maintenance personnel for its three Curtiss JN 6 planes. One of the planes was equipped for aerial photography; the aerial maps it furnished proved valuable aids for the pilots to locate and study their target areas beforehand. Coad's workers perfected dusting paraphernalia, formulas and techniques that allowed a confident prediction for the future value of airplane dusting on the basis of economy, effectiveness, and speed. Depending on the location of the various fields he had to cover, a pilot could dust from 240 to 500 acres per hour. 

Aerial dusting allowed the poison to be quickly applied at the most effective time just after a rain. Machines pulled by horses not only


got stuck in the mud, but damaged many plants, and managed to cover only thirty acres per hour. If an unexpected infestation of weevils was discovered, airplane dusting allowed immediate control in hours. One plane could do the work of fifty to seventy-five dusting machines at less cost for initial investment, operation, and depreciation, with the added advantage that normal farm work could continue with less interference during aerial dusting since there was no drain on a farm's regular resources of draft animals and manpower. Although aerial dusting proved valuable for applications to peaches, pecans, walnuts, wheat, alfalfa, tomatoes, and peppers, the cotton boll weevil remained the prime target for airborne operations that treated 500,000 acres of cotton in 1927.  

Commercial airplane dusting companies began operations around the mid-twenties. Huff-Daland, one of the earliest dusting organizations, was always closely associated with Dr. Coad's experiments at Delta Laboratory. Huff-Daland's men were working with Coad as early as 1923, and with Coad's encouragement, they developed a special airplane for the particular requirements of dusting work in hot climates. In addition, the plane was able to fly at controlled speeds close to the ground, with the capability to maneuver into and out of fields ringed with trees and other obstructions. Supported by Coad's endorsement

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and continuing recommendations, the Huff-Daland Dusters Incorporated located in Macon, Georgia, where an enthusiastic chamber of commerce provided them with an excellent flying field and hangar facilities. All together, Huff-Daland had eighteen planes located at nine flying bases operating on the principle of one plane in the air and one in reserve.

The company was certainly blessed by the good will of various groups which translated their feeling into very substantial support. Aid from Coad's Delta Laboratory and the Macon Chamber of Commerce was only a start. Recognizing that Huff-Daland's activities were "of vital importance both to aviation and to agriculture," the War Department released Lieutenant H. R. Harris, head of the flying section at McCook Field, to serve the fledgling company as chief of operations for the duration of one year. Moreover, Harris was allowed to take along no less than twelve other pilots and six mechanics picked from various army fields. With such solid credentials, the company's dusting tariff of $7.00 per acre for five applications guaranteed professional work. An affiliate of the Aetna Insurance Company was so impressed that it offered special cotton insurance policies not only against the boll weevil, but other entomological risks as well—provided, of course, that the dusting work was done exclusively by Huff-Daland. 6 There was no question that the group could do an effective job. The worthy president of the

Citizens' Bank of Greenville, Mississippi, F. H. Robertshaw, became alarmed when his cotton fields were suddenly subjected to an invasion of the army worm. After a swift counter-attack by the flying dusters of Huff-Daland, a grateful Robertshaw wired them a congratulatory message to the effect that his 1,078 acre battlefield had been rendered 100% secure.7

In addition to Huff-Daland, the Delta Aero Dusters of Monroe, Louisiana, operated twenty planes at ten bases. Their activities included dusting orchards as well as cotton, potato, watermelon, and tobacco fields. The Quick Aeroplane Dusters, Incorporated of Houston, Texas, started in 1925, flew ten aircraft and dusted 75,000 acres in 1928. Depending on the size of the field, prices varied from twenty-five to sixty cents an acre for each application—usually three to five.8 Although most of the work of aerial dusting was carried on by companies in the South, the Morse Agricultural Service of New York ranged as far afield as Indiana in search of dusting contracts.9

Aerial dusting was not an easy operation for the pilots. It demanded a high degree of skill to maneuver a heavily loaded plane at slow speed and low altitude, twisting and climbing for each run over the

7 Orville H. Kneen, "Poison from the Air," Airway Age, I (August, 1929), 1219.
8 Kneen, Airway Age, I, 1218-20.
field. There were other, more subtle dangers. While he was piloting one of the accompanying planes during Lindbergh's post-Atlantic tour of the United States, Philip A. Love circled over a spot near Atlanta, Georgia while he explained its significance to his passengers. He had once done some cotton dusting in the area, and during the work, was unaware of the accumulative effect of slow arsenic poisoning from the dust preparation. Precautions were taken later, but not before Love had finally passed out one day and crashed in his airplane.10

In 1923, aerial dusting proved effective against a locust plague in the Philippines;11 in the same year, air crews at the Delta Laboratory carried out promising experiments to combat the menace of malaria carrying mosquitoes.12 Malaria control was difficult in many areas where draining the swamps was impossible, when using oil to kill mosquitoes was slow and sometimes killed useful life. In 1927, poison dust was successfully tried in South Carolina in a malaria campaign carried out by the U. S. Navy and the Public Health Service.13

In an attempt to investigate the spread of plant diseases, the Department of Agriculture used aircraft in Texas, Nebraska, Minnesota


Illinois, Ohio, and Kentucky to capture spores carried aloft by wind currents, tracing wheat rust spores up to an altitude of several thousand feet. A similar program to follow the flight habits of insects captured various types at altitudes from 3,000 to 14,000 feet. Still another service of aircraft was a rush shipment of anthrax vaccine to California, where cattlemen were losing up to fifteen head a day at $150.00 in a serious epidemic.

In the spring of 1919, the Bureau of Crop Estimates of the Department of Agriculture first used an airplane to improve the procedures for crop estimates. J. L. Cochrun, a field agent in Montgomery County, Ohio, took to the air in order to check the progress of spring plowing and make estimates of the acreage to be under cultivation. Airmail also proved useful in allowing statisticians to get their reports in faster and keep crop estimates more up to date. The Department of


17 U. S. Department of Agriculture, Weekly Newsletter, VIII (October 22, 1919), 5.

18 Gore, National Aeronautics Association Review, III, 68.
Agriculture later experimented with aerial photography to give a more accurate and comprehensive estimate of acreages and types of crops. The ordinary procedure of relying on thousands of individual farmer correspondents in various districts had proved unsatisfactory because those doing the reporting usually gave estimates based on their own crops alone, and the estimates were discovered to be inaccurate in many cases. Accurate crop reporting was important because estimates had a bearing on the price of farm commodities. An airplane's speed and mobility made it valuable in making a rapid check of progress during the growing season, and its ability to make a quick survey of wind, hail, and flood damage by aerial photo when other modes of travel were disrupted, prevented wild estimates of weather damage that might have an unsettling effect on the market. Planes took off to assess the Louisiana rice fields, cotton in North Carolina and Mississippi, leaf worm epidemics in Arkansas, and wheat and rye damage in Ohio.

Under certain conditions, airplanes were useful instruments of agriculture for seeding. In 1929, when planes were used in an emergency to seed flooded rice fields in California, the results were so satisfactory that they were extensively employed thereafter with tremendous savings in time and labor. Aerial seeding was valuable in reclamation

20 Steele, cited in Literary Digest, LXXXV, 29.
21 Winters, cited in Literary Digest, CI, 60.
22 William F. Ogburn, The Social Effects of Aviation (Boston, 1946), 597.
projects as well. Flying over difficult terrain in the barren areas of the Hawaiian interior, the Army Air Service cooperated with the territorial Forestry Service to sow fig tree seeds to help in water preservation and drainage control. 23

Another proposal for aerial seeding had to do with logged-over areas in the Pacific Northwest, where thousands of acres lay idle. The land was in rough mountain areas and did not have a particularly high agricultural value. It was not only expensive to clear the debris and tangle that the loggers had left behind them, but the ground was too shallow for most crops. In order to be used as a stock range, the land needed to be extensively reseeded. To do the job by hand, however, required a great deal of seed, and cost $0.75 to $1.25 per acre. In that rugged country, a man could cover only five to eight acres in a full day's work. Aerial seeding could be more efficiently controlled to waste less seed than broadcasting by hand; it was estimated that a plane could cover up to 200 acres a day at a total cost of 0.40 to 0.60 cents an acre. An organization in the region of Coos Bay, Oregon, re-seeded one logged-over area as a grazing range for 5,000 head of sheep. Checking the project later, the Forest Service reported that the aerial seeding had achieved a very efficient distribution, resulting in a heavier stand of grass even though less seed was used. 24

23 "Sowing Seeds by Airplane," Aviation, XIV (May 21, 1923), 552.

Other forest areas were the object of air-borne operations designed to keep them intact. In 1925 when the hemlock spanworm threatened many American forests, the superintendent of Wisconsin's Peninsula State Park was dismayed to see a brown infection begin to spread through an especially fine stand of hemlock. The rapid progress of the spanworm attack soon accounted for a loss of 6,000,000 board feet of handsome timber. Heavily wooded with rugged bluffs, the Park's 3,733 acres were accessible for the most part only by bridle paths and hiking trails, so that spraying or dusting from the ground was entirely impractical. Officials of the Forest Service concluded that the cost of aerial dusting might be a valid objection in a commercial forest, but in order to preserve the recreational value and the beauty of the Peninsula Park, the expense was more than justified. After contracting for the application of 14,500 pounds of dust in strategic locations, Forestry officers were gratified at a 60% to 95% mortality of the spanworm and considered the operation to be quite successful.25

Aviation in the twenties was more extensively used by the Forest Service in forestry patrol. The first patrol group, going into operation at the start of the summer of 1919, consisted of half a dozen Curtiss "Jennies" and pilots supplied by the Air Service. Its task was to make twice a day patrols above 9,000,000 acres of mountainous wilderness contained in five different national parks. When the approach

of the hunting season increased the danger of forest fires, the original force was replaced by sixteen DeHavillands with longer range and greater speed to cover an increased territory of 16,000,000 acres in fifteen forests, plus an additional 5,000,000 acres of private timber lands. The Forest Service declared that air patrols were not only a valuable aid in discovering fires; the sight of the planes on constant patrols was an effective reminder of fire prevention helping to reduce the high rate of fire outbreak in populated districts. Out of 442 fires located by the air patrol during the season, twenty-seven were reported ahead of other observation units.

In order to lift part of the burden from the Air Service in 1920, Congress appropriated $50,000 for patrol operations to extend from California to Oregon. The Army still supplied the pilots and planes, but the Forest Service furnished observers and had charge of the reporting facilities. Paul G. Redington, District Forester in California, reported that airborne observers were able to give more accurate estimates of large fires than observers in fire control towers who had to cope with the distortions of distance and the obstacle of haze and smoke mantles from large fires. Moreover, the flexibility of aircraft proved invaluable. The Mill Creek fire in Lassen National Forest was located in such remote and inaccessible country that it was virtually impossible for the Ranger in charge to keep accurate check on all sides of the conflagration because it meant a three day trek on foot. A radio-

equipped plane reconnoitered the fire, cut days of travel time in
ferrying fire-crew leaders to the location from other forests, and saved
hundreds of dollars in after-fire surveillance and patrol that released
men for other emergencies. In addition to its value on the job, the
airplane gave a mobility to expertly trained crews all over the state
that was virtually non-existent before.\textsuperscript{27}

The Forest Service received no funds for the air patrol in 1922,
which caused some observers to criticize the false economy of Harding's
Director of the Budget, Charles G. Dawes. The Engineering News Record
pointed out that the air patrol had reported on more than 1,000 fires
in California and Oregon in 1921 and should be continued. People
acquainted with the program, said the Journal of Electricity and Western
Industry, realized that savings in reducing the loss of timber outweighed
the cost of patrol.\textsuperscript{28} The Forest Service regarded the air patrol highly
enough to persuade the Army to carry out some missions at its own ex-
 pense in emergencies in 1922. The air patrol was evidently discontinued
completely in 1923, although the Army again cooperated in some work the
following year.\textsuperscript{29}

\textsuperscript{27}{Ibid.; Paul G. Redington, "Airplanes and Forest Fires,"
Journal of Electricity, XLV (October 15, 1920), 366-67.}

\textsuperscript{28}{Cited in "Airplane Fire Patrol Abolished," Literary Digest,
LXXII (February 25, 1922), 26.}

\textsuperscript{29}{U. S. Civil Aeronautics Authority, Air Commerce Bulletin, I
(July 15, 1929), 12.}
Congress once more appropriated $50,000 for the air patrol in 1925, although the method of operations was changed. C. S. Lind, the District Forest Ranger at Duluth, Minnesota, questioned the effectiveness of the airplane in regular patrol work because the smoke pall still made it difficult for aerial observers to accurately pinpoint a fire, and procedures for reporting fires were not especially rapid. Airplanes were more useful, Lind said, for aerial photographs which could be studied at length in order to formulate more comprehensive prevention programs and fire fighting plans. Lind admitted that aerial patrol was probably more useful in the sparsely settled areas of the West. 30

In the western districts themselves, no regularly scheduled patrols were flown from 1925 to 1927. Only nine or ten Air Corps DeHavillands were on call each season in spite of the fact that their territory included forest ranges in Montana, Idaho, Washington, Oregon and California. The new role of aircraft was to fly reconnaissance missions after electrical storms and to make fast deliveries of equipment and men where they were needed. 31 Howard R. Flint, a District Inspector of the Forest Service, emphasized that the air patrol still served as a valuable arm of forestry. In Montana and northern Idaho, he pointed out, there were 20,000,000 acres of remote forests that could be


penetrated only by pack horse or by foot. One electrical storm moving through the area could touch off as many as 200 fires in a few hours. With only scattered observation towers and a small ground force it was hard to detect many fires which smouldered on in hundreds of canyons and hidden slopes. An aerial patrol was able to spot these hidden threats and return to drop a note to a ground station in five to ten minutes after the first discovery to send a crew on its way. In other cases, when fires raged out of control over thousands of acres of rough mountain territory, aircraft performed an invaluable function in reporting the fire and keeping contact with several hundred fire fighters. Flint praised the pilots who had made an admirable record in hazardous flying through severe heat and smoke conditions in adverse weather.

"The use of the airplane in forest fire control," he said, "is spectacular."  

After 1927, since the War Department was unable to furnish planes, patrol work was carried out through commercial contract by pilots who carried Forest Service Rangers as observers. Bob Johnson, of Missoula, Montana, had done similar patrol work for the Service as early as 1926. All through rainless weeks of August, 1928, as dry-lightning storms sparked dozens of fires in tinder-dry forests, Johnson and his observer flew daily fire patrols over the mountains.  

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33 U. S. Civil Aeronautics Authority, Bulletin, 13-14; Marion Templeton Place, Tall Timber Pilots (New York, 1953), 14, 17.
In 1925, photographic maps of uncharted forest regions were pioneered by Nick Mamer, a well known pilot in the Northwest, and Howard Flint of the Forest Service. Huge areas of unmapped forest were severe drawbacks in administration and protection for foresters who required a knowledge of the location of lakes, trails, and dead ends in fire fighting. Succeeding years witnessed increased use of aerial mapping to fill in gaps in foresters' charts and to survey burned over acreage and damage from forest enemies like the bark beetle.

Another service of aerial patrols was to spot schools of fish for the fishing fleets. First experiments along these lines were carried out in 1919 off Cape May, New Jersey, by the Naval Air Service. These trials had the support of the Bureau of Fisheries, and it was discovered that airplane spotting could be used successfully to locate menhaden, mackerel, bluefish, and other schooling species when they were invisible from a pier or even from the cross-trees of a ship at sea. Later in the same year, on the other side of the continent, aircraft were used to scout tuna and sardines off the coast at San Diego. Ships were thus able to stay at dock until a school of reasonable size was located and the air patrol ended the fruitless chase of a school of fish that turned out to be disappointingly small. Messages were radioed to the home port, or a fleet with no radio at sea could be appraised of a more promising hunting ground by means of a message dropped in a bottle. With the ability to range far over the water and determine several particular

\[^{34}\] Ibid., 57.

\[^{35}\] U. S. Civil Aeronautics Authority, Bulletin, ibid.
species, one plane could serve several different companies. The Coast Guard often performed such services, saving days of fruitless beating up and down the coast. A Coast Guard patrol plane finally located sizable schools of mackerel off Cape Ann in 1929 and reported back by radio to end several days of frustrated inactivity for dozens of fishermen. Further up the coast, aircraft were used to search out the quarry for sealing fleets.

36 Ernest L. Jones, "Possibilities of the Aerial Fish Patrol," Aviation, XVII (July 7, 1924), 724-25.


CHAPTER IV

FLYING PHOTOGRAPHERS

Forward areas in World War I offered considerably less than favorable conditions for surveyors to construct the indispensable battle maps of the front lines. Use of the aerial camera made possible, for the time, adequate maps of the battle areas. Peacetime aerial surveys returned similarly valuable results, as in the survey of the Mississippi River Delta, which was so marshy that it was about as inaccessible as a battle front.¹ Postwar assessments of aerial photography concluded that existing shortcomings could be corrected and forecast successful application of aerial photography in mapping the thousands of miles in the United States that appeared as a terra nullis, while allowing cartographers to keep pace with change in the constant process of revising the existing maps.² Mapping done from a moving platform in mid-air, conjectured the American Architect, would at least "introduce a


a spirit of adventure and a lively interest into what is now a tedious and ungrateful operation."

The Coast and Geodetic Survey wrestled with the constant task of revising its charts to keep up to date on seashore cities and the ever-changing coastline of an entire continent. It seemed likely that many changes could be incorporated into the existing maps and charts through the application of aerial photography, and the first experiments were carried out in the Spring of 1919. Attempts to chart underwater features from the air were discouraging, but the photos of the expanding metropolitan area of Atlantic City, New Jersey, with its adjacent sand beaches and coastal marsh areas was judged to reveal "great possibilities." A more ambitious project was carried out in 1920; recording a 120 mile long stretch of coastline from Cape May to Sandy Hook in a single flight was acclaimed as "a very striking demonstration."

Aerial photography in original survey work seemed feasible, and a pilot project for such a program was carried out in the challenging conditions of the Mississippi River Delta. The Delta area, with its particular characteristics of soil, vegetation, and stretches of marsh-land, pushed the costs of ordinary surveying procedure to prohibitive levels, but the Coast and Geodetic Survey needed up-to-date charts on the changing river mouth and the Corps of Engineers required more

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4 Mattison, 244.
accurate surveys for its engineering projects along the river. A way had to be found, and the aerial camera seemed to be the solution. With the cooperation of the Naval Air Service, a satisfactory survey was carried out in the spring seasons of 1921 and 1922, a total of 513.6 square miles being mapped at a tolerable cost of $13,319.43.  

Aerial photography would never replace survey work on the ground, concluded W. T. Lee, a flier connected with the Geodetic Survey, but aviation did usher in a new and refreshing view of the world for the geographer and geologist that could not be matched by anything else. For the landscape gardener, the architect, the city planner--aerial views presented an unobstructed, comprehensive perspective that allowed a project to be properly visualized in relation to its actual surroundings.

An air view made the important subject the central figure of the picture, explained Lee, reducing the constriction and clutter of an earth-bound vista and giving a new completeness, meaning and drama to familiar scenes. Washington, D. C., portrayed in an aerial photo, put the Capitol in the center of broad, converging avenues; an anchoring structure set off by the supporting roles of the Senate Office Building and the Library of Congress. Now, this could all be very easily recognized with any good map, Lee admitted; maps were important and they were precise, but they were little more than a precise skeleton, lacking


the visual and aesthetic impression of an air photo with its tree-shaded roads, its woods and grassy clearings. In large scale engineering projects, he concluded, the air photo emerged as an "incomparable tool" in sizing up true relationships, possibilities, and progress underway.

The profusion of illustrations in Lee's book were appropriate to its suggestive title, *The Face of the Earth as Seen from the Air*. Aerial photos were new in the early twenties, and they must have had an undeniable fascination apart from their function as examples to support the text. Lee's book had variously stark shots and pleasing vistas of mountains, buildings, waterfronts, coastlines, islands, and peninsulas. Nevertheless, Lee's purpose was to illustrate the usefulness of aerial photography, and a picture of the intricate, capillary tendrils of a river drainage system was a practical example. Meaning to show that air photos disclose errors in many river charts where marshy terrain makes accurate surveying difficult, Lee conscientiously reminded the reader that airplanes present a new way to study the incompletely understood complex of mud flats along much of the East Coast.

Shifting the view from mud flats to mountain tops, Lee observed that in order to get a picture of a volcanic crater, it used to be necessary to find a low crater and a neighboring peak that was high enough to give the photograph some degree of perspective. With an airplane, a photographer could get a full view of any volcanic chasm.

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straight down its yawning throat. In fact, said Lee, air photos were so admirably suited as a tool of physical geography, that a "geologic renaissance" could be in the offing. A case in point was the experience of a professional American geologist in France during the war. In using military reconnaissance photos, he discovered that he could identify and define geologic formations with such accuracy that it was not only possible to fill in gaps in existing geologic maps, but correct their mistakes as well.\(^9\)

Lee also described the map-making experiments carried out at Schoolcraft, Michigan, a joint project of the United States Geological Survey and the Army Air Service. The Schoolcraft project yielded promising results, and the photographic records included a captivating portrait of the little community. Commenting on the picture, Lee remarked that it showed so many features that were characteristic of central and western United States; the square repetition of the section line roads tracing the dimensions set up years ago by the United States Land Office; the precise fragmentation into the smaller fields; the shady groves of trees from the seedlings brought by homesteaders. The scenario was heavily flavored with nostalgia. "The picture of the village itself might be taken as a prototype of the American village," Lee continued, "with its fairly regular layout of streets, its business center indicated by a few larger roofs along the widest street, its lawns, trees, and gardens, the bordering farm lands, and the scattered

\(^9\) Ibid., 57, 69.
extensions of the village into points in the direction of the main roads.¹⁰

The facing page had a regular Geological Survey map, a square of treeless white desert, tracked across by even double lines for roads; anonymous, insect-like black squares for houses. By comparison it was utterly devoid of vitality and life—even repulsive.

Aside from its scientific and aesthetic appeal, aerial photography had commercial promise, and imaginative young pilots found a growing market for their services. About 1920 Reed Chambers made an aerial catalog of California Senator Phalan’s ranch which pleased the Senator so much that Chambers spent about five months doing other ranches in the area and wound up with a profit of several thousand dollars. Chambers flew on to photograph San Jose for the city planning commission, and then took a similar job with San Francisco. Technical delays on the San Francisco operation ate up all his profits, so Chambers flew airmail for a time before going into the aviation insurance business.¹¹ Bryan Moore, who did general flying work in the Seattle area in the mid-twenties made somewhat regular charter flights with a local photographer who had found a market for aerial shots of real-estate developments, new office buildings, and apartment houses. The photographer paid $1.00 a minute or $50.00 an hour and you had to give him credit, said

¹⁰ Ibid., 54-56.

¹¹ Reed Chambers, OHC, IV.
Moore. In addition to the rates, he was flying in mountainous country and there was plenty of turbulence. Still, he kept coming back. Many people must have, for the aerial photo companies did a growing business that in 1925 amounted to an estimated $1,000,000 per year.  

Aerial photographs were generally of two types: the oblique, or perspective view which was a panoramic shot useful in advertising, general planning, and so on; and the vertical, or mosaic technique with matched photos to construct a scaled map. Both techniques demanded a sharp focus of detail and required special equipment. The bellows of ground cameras in use at the time were vulnerable to wind pressures, and they had to be re-designed with a metal cone. High altitude, high speed photography had the drawback of blurred images until Sherman Fairchild came up with a rapid, between-the-lens shutter. This development undoubtedly helped raise Fairchild Aerial Survey, Incorporated to a premier position in the business.

Fairchild Aerial Surveys grew from four men after the war to nearly 100 by 1924, operating in fifteen states from New York to Texas.


The company carried out as many as thirty-two contracts in New York alone, including one project for the Russell Sage Foundation as well as commercial jobs involving publicity photos for Goodyear and General Electric, and various surveys for power companies. Fairchild's most publicized work was the aerial map for New York City, done in 1923 and 1924. Taken at 16,000 feet, the photos used for the map show an amazing clarity of detail, capturing every tree, bush, and unrecorded path in the city. Fairchild's contract called for two maps of different scales, one for 400 square miles of the city limits, and a second map of an area of 625 square miles to include adjacent sectors of New York and New Jersey.

Nelson P. Lewis, a consulting city planning engineer with the Russell Sage Foundation, had already forecast the use of aircraft as a valuable tool in city planning. Writing early in 1922, before all of the techniques of aerial surveying had been refined, he agreed that accurate topographic details were essential in planning, but pointed out that such details involved much time and expense in the early stages of planning when a general concept of the plan was more important. The details could always be worked out later. Aerial photography could give this general concept, and at low cost.


16 Sherman M. Fairchild, "Aerial Mapping of New York City," American City, XXX (January, 1924), 74-75.
Lewis admitted that it was possible to observe first hand the peculiarities of any locale by riding and walking through it, tracing the valleys and ridges, judging the location of wooded acres to parks and existing buildings. Nevertheless, the observer still ended up with an indistinct picture of important relationships. How much better it would be if the planner could see the entire region from a height of one or two miles, a vantage point that would put details into proper relationship with each other, and then record the whole scene on a photograph to have constantly at hand for referral. With the possibility of obtaining accurate information for general planning without maintaining survey crews for weeks and months of tedious work, "it is quite evident," Lewis concluded, "that a great advance has been made in a direction which will be of inestimable value to those planning for the future development, not only of cities, but of suburban and rural districts."  

Lewis's endorsement of aerial photography carried the weight and the prestige of the Russell Sage Foundation, and was quoted to substantiate the use of aircraft in municipal planning that soon followed. Panoramic views of cities were useful in luring new industries, proved highly useful in long range planning, and were admitted as evidence in

Utilities corporations like the Rochester Telephone Corporation used air maps to determine rate and direction of city growth in order to estimate the location and number of telephones to be used in the next three to five years as well as to locate sites for offices and other construction in a multi-million dollar expansion program to extend over one and a half decades.  

In an age of rapid urban development, aerial surveying provided a new means for tax reassessments for the benefit (and sometimes embarrassment) of taxpayers and growing communities running short of revenue. 

Up to date tax maps were essential since equalization of tax rates was necessary to maintain confidence of present and future city taxpayers. Unfortunately, the costs of mapping at a rate to keep up with cities spreading all over the countryside was prohibitive, at least until the advent of aerial photography. The use of aircraft in tax equalization was inaugurated by Edward A. McCarthy, an expert in municipal appraising, whose Municipal Service Company had experience in using aerial maps as well as older survey methods. The first city to be reappraised with the

18 C. G. Krueger, "Application of Aerial Surveying to Watersupply Problems," American City, XXX (May, 1924), 493-94; Sherman M. Fairchild, "Aerial Photography," Annals, 49-55. See also other comments by the city engineer of Syracuse, New York, Nelson F. Pitts, jr., "What Aerial Mapping Has Done for Syracuse," American City, XXXVII (September, 1927), 354-56; and remarks by the engineer and secretary of the City Planning Commission of Allentown, Pennsylvania, Arthur A. Cassell, "Making and Using Airmaps for City and Regional Planning," American City, XLI (December, 1929), 119-21. A lively controversy over aerial mapping in the Engineering News-Record, LXXXVII (November 17, 1921), 828; ibid., LXXXVIII (May 1, 1922), 786-87, included U. S., Canadian, and Australian comment which reaffirmed the usefulness of aircraft although it was agreed they would not entirely displace other methods.

use of air maps was Middletown, Connecticut, whose forty-two square miles were mapped in sixty days at a cost of $1,000. By way of comparison, McCarthy's own home town, New Britain, had only thirteen square miles, but the old survey methods used there had cost $48,000 and it took four years to complete the job.

Once the mapping of Middletown was over, fourteen months were required to analyze the results, which turned up some surprising and discomfiting facts. For example, forty-nine out of 248 stores on Middletown's main street were not on the assessment lists, and it was found that a total of 1,896 pieces of property were altogether missing on the rolls. With the cooperation of Fairchild Aerial Surveys, McCarthy's company finished contracts with four other Connecticut towns; in each case, the assessment lists swelled and the tax rate dropped. In East Haven, the cut was from twenty-eight and one-half mills to fifteen. In spite of the decline in tax rates, all of the cities derived surplus funds from their larger assessment lists with the result that they were able to build schools and roads which the taxpayers had blocked before. 20

In the spring of 1925, the Survey Graphic devoted an entire issue to regional planning. As a means of portraying the concepts underlying this particular issue, the editors included reproductions of etchings by Ralph Pearson, one of which is a panoramic view of a

community as it appeared from the sky. "Perhaps an eagle flying into the sun has this simplified vision of earth," remarked the editors. "It is seldom that the layman or even the artist can look at his world, free and detached, and arrive at an understanding of the fundamental elements of design contained in it." 21

The comment suggested the value of aerial photography in providing comprehensive views that gave a distinctive visual impact to the text of the articles in the magazine. Lewis Mumford's article, "Regions - to Live In," immediately followed Pearson's illustrations; Mumford's article itself was illustrated with a full page photograph (by Fairchild Aerial Surveys) captioned, "A Region in the Making." This particular photo was a striking example of the use of aerial photography to portray the elements of the region. It was a broad and distant vista of a wooded mountain range emerging from the haze of a dim horizon, a wide valley marked by cultivated clearings, a network of roads, a small community, the rail-road tracks hard by the factory on the waterfront. 22

It was not a fictitious relationship that was portrayed; it was not an artist's view, second-hand. This is a factual record, a first-hand, eye-witness report, and its visual significance for the reader was unmistakable. Another illustration was an aerial shot of Chicago, chosen to portray Clarence E. Stein's "Dinosaur Cities," the antediluvian

21 Survey Graphic, LIV (May 1, 1925), 147.
22 Ibid., 150.
urban complexes that had already played out their historic roles. The photo showed the unwieldy immensity of a huge metropolis ribbed with interminable avenues, sprawling its way out into the horizon. It was a striking picture of a design for human living that was out of date.

As "an aeroplane observer with a quite celestial eyesight" Stuart Chase found a colorful allegory to dramatize the disheartening picture of industrial America that he saw—belabored consumers crammed into a few cities at inefficiently located railheads which forced the wasteful process of crosshauling raw materials and finished products. Mumford's view of the "aeroplane" was less allegorical. Mumford saw aircraft as an aspect of the dispersal of city concentration, "The Fourth Migration," stimulated by technological developments in transportation, communication, and electric power. Aviation, with its relatively low traffic volume of the mid-twenties, had initially developed along main lines favoring urban concentration, although an increase in volume would stimulate an aerial network with a dispersal effect. This seemed likely, said Mumford, since aircraft were less bound to linear movement than even an automobile.

Aerial photography was an obvious aid in regional planning of public power and related programs. The major part of the October 15,

23 Ibid., 134.

24 Stewart Chase, "Coals to Newcastle," Survey Graphic, LI (May 1, 1925), 143-144.

1920, issue of the Journal of Electricity was devoted to the uses of aircraft in hydro-electric projects. The magazine's frontispiece was a graphic concept of the river basin area of the entire Southwest, as an example of how hydro-electric projects would stimulate industrial and commercial possibilities of the area. An explanatory note entitled, "The Airplane; a Necessary Tool in the Development of the West" stated that the material used as a basis for the regional map was collected by airplanes.26

R. C. Starr, a construction engineer of the San Joaquin Light and Power Corporation, explained the role of aviation in the King's River project, a ten-year construction program for eleven plants with a combined capacity for 500,000 horse-power. For a project of this type, an engineer needed highly accurate figures on the precipitation in a particular locale, the nature of the drainage area, and the volume of run-off in order to compute the stream flow and the potential of the hydroelectric plant. It was possible to make an estimate for a proposed project, using the available records of stream flow in similar regions. Variations occurred, however, and accurate records had to be compiled before realistic estimates could be made for a given area. Aerial survey was the only method in which mountain-summit area drainage reservoirs could be economically and accurately estimated. Ground survey crews working along the trails might miss small springs and streams beyond a ridge; planes could continue work during seasons when deep

26 Journal of Electricity, XLV (October 15, 1920), 352.
snow would bring operations to a complete standstill; surveying parties were spared the hazardous and time-consuming negotiation of dangerous cliffs and trekking over snow fields. After using aerial photography, Starr commented that "The results obtained ... have proven beyond doubt the value of these (aerial) surveys for preliminary studies of large hydroelectric projects."  

Major H. H. Arnold, commander of the Air Service, Ninth Corps Area, furnished the pilot and the camera for the King's River job. Arnold pointed out the value of the airplane in this case, which took six flying hours to cover a territory that otherwise would have required numerous survey parties and several months. One Air Service engineer projected a hypothetical hydroelectric construction job in a remote area, and estimated that the use of air freight to carry 15,000 tons of men and supplies to the construction site rather than build a road would save about $500,000 over a two-year period.

While this proposal remained to be tested, other companies made significant use of aerial surveying in power projects. When it was surveying the right of way for two new high-tension lines of twenty-five and thirty miles in length, the Pennsylvania Water and Power Company used

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aerial photography to plot the location of their high-tension towers, eliminating much work by preliminary surveying parties. When boundary questions developed, the air photos not only eliminated thumbing through often inaccurate property records, actual photographs produced on the spot smoothed the negotiations in right-of-way conferences. Another power survey in North Carolina was completed rapidly, including the production of accurate topographic maps constructed with the aid of a stereoscopic system to bring out the different ground contours recorded in special photographs.

Apart from aerial photography, one of the earliest uses of aviation was in mining operations. New mines were often located in remote areas far from existing transportation, and airplanes offered the only fast way to travel. Many mining towns had a brief life that did not justify the construction of expensive roads and railroad tracks. Planes required a small investment and could be used to survey, establish mines, service the operation and fly out the raw product. The 1920's witnessed a number of such projects, and planes were found to be valuable in a variety of ways. One plane was used to service an entire circuit of California mines with light supplies and mail in 1920, and proved useful in averting costly shutdowns. In remote districts of Nevada and Idaho, air transport was used to carry 117,000 pounds of steel pipe to isolated

32 Ogburn, Social Effects, 537-38.
mines in the mountains. The Bureau of Mines used airplanes to speed oxygen and medical supplies to the Argonaut mine accident in California, and a special Bureau engineer was flown to the scene of a mine explosion in Wyoming.

Service and emergency work was only part of the story of aviation's role in mining, however. Mainly because of aerial photography, mining became the largest user of airplanes for industrial purposes. "Development of new mining areas has been advanced by decades," said the Engineering and Mining Journal, "as the airplane has been pressed into the service of prospecting, surveying, and mapping." One example was the use of aerial photography to map the growing lead and zinc district in northeast Oklahoma.

The biggest application of aerial surveying was probably in the petroleum industry. The first companies to launch such programs began in 1927, and by 1929, nearly every major company doing work in the West and Southwest was using aircraft to make survey maps. Air photos were used to pinpoint promising features, eliminating the considerable amount of time normally consumed by casting around on the ground. If it seemed worthwhile, geologists learned to follow clues of vegetation and differentiation of soil types in order to trace an exposed rock ledge


35 Engineering and Mining Journal, GXXXVI, 537, 554.
that continued underground. In one case where surface indications were hard to define, geologists used aerial photos to locate the contact point of two promising formations. The photos revealed a definite connection that could be seen under a grainfield with a three foot high stand. When called for, accurate topographic features could be constructed by using the stereoscope technique. Companies also discovered the advantages of making a quiet survey of a promising area from the air, without arousing the instincts of speculators.  

Around the end of the decade, aerial photography was used to make the accurate survey required to lay down a 600 mile long oil pipeline,  

and Fairchild Aerial Surveys had begun projects for petroleum surveys out of its Dallas headquarters that totaled 30,000 square miles by 1933 and extended into Mexico.  

The rugged, remote regions of Alaska that were surveyed and mapped for the first time in 1926 and 1929 provided one of the most imaginative and dramatic tests of the usefulness of aerial photography. The Department of the Interior asked the Navy to do some aerial mapping in order to fill in the knowledge of the mineral and other natural resources.


37 George Svehla, "A Survey of Civil Aviation in the Southwest," Aero Digest, XVII (September, 1930), 54.

resources of Alaska, and the project eventually included the cooperation of various government bureaus; the Bureau of Fisheries and the Lighthouse Service needed various types of information; the Forest Service wanted timber estimates; the division of roads in the Department of Agriculture was interested, and so on.

The man most responsible for the 1926 project was R. H. Sargent, a veteran of eighteen years with the Geodetic Survey in Alaska, who went along as the expedition's technical adviser. The Navy supplied the three Loening amphibians, as well as the supporting vessels—a 250 ton freight lighter converted into a machine shop, photographic laboratory, offices, and quarters for the expedition's seven officers and forty men, and the U. S. S. Gannet, a mine sweeper with five officers and sixty men, to tow the lighter.

The survey, lasting from May to August, 1926, had an ambitious goal of 40,000 square miles, but with only fifteen days of flying weather, the crews had to settle for 10,000 square miles. This was a remarkable record. The area of operations spanned nearly 1,000 miles from Ketchikan to Anchorage, over impenetrable forests, mountain fastnesses, and vast glaciers, where a crash or even a forced landing left virtually no chance for escape or rescue. It was a demanding test for cameras, planes, and pilots. As if these hazards were not enough, the grumbling crews found it necessary to set up a night watch at one point because their planes were being endangered by errant ice floes.

Photographers on the expedition produced striking portraits of a magnificent wilderness in the process of recording the potential of its
natural resources. The discovery of important watersheds for power sites coupled with accurate timber estimates prompted negotiations for new pulp mills in Ketchikan. With an estimated capacity for pulp production equalling one third of the daily requirements in the United States, this was to be an important source of newsprint so indispensable for a civilised society. The expedition returned with a set of previously nonexistent daily weather reports for the area, and presented the chart makers with new problems of revision. One bay on Prince of Wales Island had been misplaced eight miles from its true position. 39

Speaking for the Department of the Interior, R. H. Sargent said in 1929 that it would take still more years before the full results of the 1926 expedition could be evaluated, and added that it was impossible to estimate its value in dollars and cents. At any rate, it was felt worthwhile to send another expedition in 1929, with four planes this time, to map an additional 13,000 square miles. 40

The work in Alaska represented some of the most valuable assets of aerial photography: the ability to penetrate formidable geographical barriers; comprehensiveness; speed; and an added bonus of aesthetic charm.


CHAPTER V

BUSINESS BY AIR

Benny Howard, a leading designer in the twenties, produced his first plane as the result of prohibition. "The thing that built aviation to start with," he recalled, "that really held its pants up for, oh, quite a few years, was the bootlegging." Barnstormers helped keep up interest in aviation, but the bootleggers were the only ones who put money in it. Benny soon found that his handiwork was not judged by its safe handling characteristics, or even its speed. The crucial test was how many cases of illicit beverage his creation could safely haul out of a secluded flying strip and into the air. Aviators at least found a source of employment, even if they did get shot at occasionally, and there was always work for a pilot with a little hustle and a flexible conscience. Clarence Jones remembered that he would fly a job for the bootleggers one day, and hire out to the Revenue agents on the next.¹ Air borne bootlegging perhaps contributed a colorful chapter to the development of American aviation, but aircraft were already being groomed for more mundane uses within the purview of the law.

Writing in the New Republic just after the end of the war, Frank E. Hill remarked on the phenomenon of aviation as a reflection of the

"modern world's fever for dispatch." The most striking thing, he said, was that aviation had arrived without the general public actually realizing it. When Otto Praeger, the assistant Postmaster General, discussed the very real promise of commercial aeronautics before a group of aviation manufacturers assembled in banquet, his speech "gave an official cast to an idea which six months ago was not considered seriously by anyone but geniuses and enthusiasts." The serious queries already received by aircraft manufacturers suggested great promise in the future. "A knock has come at our door," said Hill; "we are surprised with a myth become reality." Future projections displayed intelligent foresight. Emphasizing the factor of speed as an important asset in air transportation, Donald Douglas predicted an important passenger travel in the future, along with airmail and certain classes of express like fruits, film, and repair parts with low weight and bulk, but high value. In 1921, V. E. Clark, chief engineer of the Dayton-Wright Company, stated emphatically that "any thinking man knows that it will be impossible to prevent aircraft from taking a serious part in the activities of the commercial world." His main ideas reflected those of Douglas, although he made further observations. For example, planes could be used in transporting detailed tables and drawings used for planning business operations, not only increasing the effectiveness of a project, but also creating savings in time and money not possible by

2 Frank E. Hill, "Enter Aerial Commerce," New Republic, XVIII (February 1, 1919), 21-23.

telephone or telegraph. Clark also predicted significant advantages for using aircraft to carry high salaried executives, which would save considerable amounts of valuable time and proportionately increase their personal effectiveness and working capacity.  

Another observer, writing in 1923, saw new imaginative concepts of business organization being fostered by aviation. The ability to fly over long stretches of the country in rapid time was certain to enlarge a man’s vision and business instinct. As men from the rims of the continent and its broad inner reaches found it possible to conquer formidable distances and confer face to face, broader and bolder enterprises would result. Even though it was not sanguine about the prospects of a large passenger traffic, the New Republic declared in 1925 that the tempo of modern civilization made it axiomatic that aircraft would become a "useful instrument of commerce." Commercial aviation—scheduled commercial air transport—really began in 1925 when the government contracted for airmail service with commercial airlines. These original airmail routes formed the basis for the passenger and cargo net of airlines to come. The five original airmail contractors were Colonial Air Lines, Robertson Aircraft Corporation, National Air Transport, Varney Speed Lines, and Western Air Express. By 1930, Colonial and Robertson had been incorporated into the American Airlines system; National Air Transport and Varney had become part of United Air Lines; Western Air Express was part of Transcontinental and Western Air, 

Incorporated (now Trans World Airlines). Other companies like Braniff Airways, Delta Air Lines, Eastern Air Lines, and Northwest Airlines made their appearance in the same period.  

Representative Clyde Kelly, father of the Airmail Act of 1925 (the "Kelly Act"), urged more consideration of airmail in part because of its usefulness to banking. The process of clearing checks between the east and west coasts normally took five days. If handling of float could be speeded up by an airmail with coast-to-coast service of thirty hours, Kelly estimated a float release of one hundred fifty million dollars per day. The Federal Reserve Bank of New York demurred at this figure, but agreed that the sums could run into tens of millions. In any case, the airmail service as of 1924 was skimming off float at the rate of $5,000 to $20,000 dollars per day.  

There was probably more business interest in general aviation than generally realized, as testified by Harold Bixby, the St. Louis banker who later helped underwrite Charles A. Lindbergh. "I met a lot of men who were interested in those early phases of aviation," he recalled, "--remember that this was in 1923." Bixby himself used the services of Bill Robertson's air line, the Robertson Aircraft Corporation, to speed up the handling of float between St. Louis and New York—virtually subsidizing him in fact, until Robertson could get on his feet.  

Colonel Paul Henderson, Assistant


6 "How the New Airmail Increases Our Cash," Literary Digest, LXXXII (July 5, 1924), 52-55.

7 Harold Bixby, OHC, I.
Postmaster General reported to the Illinois Bankers Association in Chicago that airmail could effect savings on interest rates on float up to $809,589.00 annually on transactions between the New York Federal Reserve bank and other branches.

More and more banks were making effective use of airmail by 1927. The Journal of Commerce outlined the practice in use by twenty-one leading banks in New York to speed up business with Cleveland and Chicago. The system was an effort to limit periods of idle funds because of the Federal Reserve System deferred availability schedule. Picking out their largest checks on Cleveland and Chicago, the New York banks put them in an airmail envelope, along with a telegram. On delivery at Chicago and Cleveland, the telegram was sent back to the Reserve Bank in New York, where the items were credited to the New York banks and the funds deemed to be immediately available. In the first eight months of 1927, over $52,000,000 was handled in this way between just these three cities, with interest savings of over $5,000. The Kansas City Clearing House, using airmail, saved interest averaging $6,375 to $7,500 monthly by the Fall of 1927, and two years later, one bank reported savings of $33,000 in one year alone.

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8 New York Times, July 11, 1924.


Airmail helped speed up business transactions in a multitude of ways. Businesses paid the higher airmail rates willingly in order to gain the advantages of a faster tempo in correspondence, which in turn yielded economies in stepping up the rate of handling goods, the application of capital, and utilisation of executive time. Oil shippers, from California to the Gulf Coast, saved days in time and thousands of dollars annually by using airmail to forward bills-of-lading. In other cases, airmail proved fast enough to shave expenses in business usually handled by telegraph and wire services. Advertising agencies sent copy all over the country by air rather than use the more costly telegraph. Citrus growers on the west coast dispatched their cargo manifests by air, instead of wiring them East. The post office at Medford, Oregon processed a disproportionate increase in airmail every summer, originating from apple growers who wanted a fast handling of selling orders, bills-of-lading, railway car tracers, re-supply orders, and so on. The airmail continued to serve the increasing needs and faster pace of business activities of the 1920's. By the end of the decade, millions of dollars each day were consigned to Wall Street in the form of checks, drafts, and interest-bearing securities, all stowed away in bulging airmail sacks. In 1929, airmail and air express delivered $7,000,000,000 to New York City alone.13

12 Ibid.

The airmail was appreciated enough that intense political pressures were brought to bear in order to secure service for areas beyond the reach of existing routes in Georgia, Michigan, and South Dakota. "Use of the airmail is now such an integral part of the business machinery," commented one observer, "that if anything should arise to injure or destroy it, the hurt would be felt immediately by the commerce of the nation."15

Another aspect of commercial aviation, cargo by air, had a prophetic, if unsuccessful, inauguration in the winter of 1919, when the American Railway Express Agency loaded 1,100 pounds of freight in a converted Handley-Page bomber bound for Chicago. Frozen radiators delayed the start from Washington, and the plane was finally forced down on the way, making an ignominious landing on a race track in Ohio. Undaunted by this initial failure, the company closely followed the progress of aviation in the ensuing years, and made new plans in 1927 for the commercial airlines to fly express.16 National Air Transport and Colonial Air Transport offered service to the East, while Boeing Air Transport and Western Air Express covered the West. Depending on the length of the haul, rates varied from twenty-five to fifty cents based on each quarter pound or fifty cubic inches. Shortly after

11 Paul T. David, Economics of Air Mail Transportation (Washington, D. C., 1934), 185-82.

15 Richard Rea Bennett, Aviation; Its Commercial and Financial Aspects (New York, 1929), 4. The volume of air mail rose from 810,855 pounds in 1926 to 7,772,014 pounds in 1929 (U. S. Bureau of Air Commerce, Aeronautics Bulletin, No. 1 April 1, 1934), 4).

midnight on September 1, 1927, National Air Transport started the first run from Chicago to New York with a conglomerate cargo of news reels, machinery parts, advertising copy, trade journals, candy, and Paris Carters. 17

Air express quickly proved itself a useful tool of business in emergencies or unusual situations. Production lines were kept from having to shut down when air express delivered magneto parts to Detroit and auto lamps to St. Louis. A printing plant on a twenty-four schedule lost only hours rather than days when a replacement part was shipped by air from Connecticut to Illinois. There was the case of a manufacturer who produced one of his specialty items near its normal markets, shipping out small orders to more distant points, even though he had other plants in those territories. One day, he received a substantial rush order from a distant territory close to one of his plants. Filling the order at the regular plant to send out as usual would involve excessive freight charges and a time-consuming rail haul. The manufacturer solved both of these problems by flying the necessary tools to the distant plant, which then filled the production order on schedule.

Paul Henderson, a vice-president of National Air Transport, cited these cases to underscore the usefulness of aviation in paring inventories of small-bulk, expensive parts and materials. Occasional air cargo shipments could affect substantial economies by reducing the size and carrying charges on inventory, and retail stores throughout the

17 National Air Transport, Bulletin Board (August 19, 1927), 1-2; ibid., (September 1, 1927), 1-4.
country soon made everyday use of air delivery to re-stock supplies
of light weight items. Even if a business could not use air shipments on a regular basis, it could still operate at closer tolerance without extreme danger. "Not one item out of a thousand may have to be shipped by air," pointed out one business magazine, "but the fact that any one of the thousand can be shipped by air, if it is necessary, on a few hours' notice, makes it safe to lower the reserve a little all along the line." 19

Imaginative plans to transport various commodities by air soon followed. Western Air Express equipped itself with "refrigerator" planes to fly shrimp from Mexico, where they were ten cents per pound, to Los Angeles where the price was sixty cents. 20 When Pan American began South American operations in 1929, the line experimented with air-borne shipments of hatching eggs to Guatemala. A solid success, the trial run eventually developed into a service delivering thousands of live baby chicks all over South America. 21

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In spite of the increasing use and interest in air express, the combined air express revenues of United Air Lines predecessors, including National Air Transport, show that air cargoes did not develop an important source of revenue for the air lines themselves. Air express accounted for 1.74% of revenues in 1928, passengers for 4.26% and mail for the remaining 94%. Although revenue doubled to around eight million dollars in 1929, air express dropped to less than one per cent of the total revenues. 22 Henderson voiced complaints in 1930, stating that emergencies constituted most of the volume of air express, and there were not enough emergencies to make the volume of air express important. The only routine consignments, he said, were unset precious stones, because shippers apparently felt there was less exposure to theft in mid-air. Henderson felt that the biggest block to a higher volume was the price. At one dollar a pound by air, it was too much cheaper to ship one hundred pounds by rail, for example, which cost only four dollars and fifty cents. 23

Air express may not have brought hoped for revenues to airlines, but its increasing volume does bespeak its usefulness and importance to commerce. The volume stood at 45,859 pounds in 1927, rose to 257,443 pounds in 1929 (including foreign freight) and climbed to over 1,000,000 pounds by 1931. Henderson's criticism of discouragingly high rates, at 22 Mayer, Meyer, Austrian and Platt, Corporate and Legal History of United Air Lines, 1925-45 (Chicago, 1953), 309.

least in early years, seems justified when the above figures are compared with the volume of independently carried freight. Over one and a half million pounds already in 1926, it averaged around the two million mark until it began to decline in 1931. 24

Categories are hard to define and statistics are conflicting for these early years; it appears that the examples cited above do not cover many of the early, pioneering efforts in air freight. Credit for the most plausible beginning of air cargo should go to L. S. Plautt and Company, which used a plane for delivering merchandise from its stores in Newark and Asbury Park, New Jersey early in July of 1919. 25 Another pioneer in independent air freight about 1920 was the Thompson Airplane Company, whose service in the Detroit, Lansing, and Saginaw area included the delivery of auto parts. 26 The most impressive record was compiled by Henry Ford’s private airline which ran mainly from Detroit to Chicago, Cleveland, and Buffalo. The line carried 1,000,000 pounds of freight when it started in 1925, over 2,000,000 in 1927, and 14,000,000 pounds from 1928 to 1932. 27 From a commercial standpoint, the Kohler


Aviation Corporation is perhaps more significant. The company operated three Loening amphibians in a daily shuttle of 125 miles over Lake Michigan from Milwaukee to Grand Rapids, carrying both passengers and freight. Kohler opened operations in the Fall of 1929, but early the following year, established its freight charges at the same level as regular railway express, and offered deferred service as well. By April of 1930, its growing passenger list averaged 300 per month, and the volume of monthly freight, 13,000 pounds of it, threatened to outclass the combined air routes of the Railway Express Agency, which encompassed some 12,000 miles. 28

Aviation gave businesses a new way to demonstrate products, increase sales, and operate more efficiently. After developing some new receiving sets, the Crosley Radio Corporation was anxious to introduce them to the market as quickly as possible. Perhaps with an eye to future aviation business, the company seized on the occasion of a National Air Tour organized in 1927, bought a plane to fly the circuit, and put two samples of the new receivers on board. By alerting their distributors and dealers in advance of the tour schedule, Crosley was able to introduce the sets in twenty-four cities in sixteen days, with direct sales amounting to around $200,000.29 Perhaps the most unique concept of using aircraft as a link between product and consumer was the program


29 "Management Short Cuts," Magazine of Business, LII (September, 1927), 339.
introduced by Royal Typewriter. With a Ford tri-motor dubbed the "Royal Air Truck" the company proposed more effective delivery service to its 500 branches and agencies within two to twenty hours of a call. The method of delivery was by parachute drop. A more direct contact was effected by the United Cigar Stores Company of America, whose boldly emblazoned "First Flying United Cigar Store" would dramatically advertise its presence with a couple of swoops over a prospective city before the pilot, the colorful Roscoe Turner, brought the plane to earth to dispense its wares. The procedure used by one oil company had a more practical and lasting significance, however; in using its planes to fly nitroglycerin from a central storage point to field operations, eliminating stockpiling and an idle inventory at dozens of areas around the fields, this company anticipated one of the basic advantages of air cargo.

When larger passenger aircraft like the Fokker and Ford tri-motors were introduced in the latter half of the twenties, businessmen themselves began to fly. In 1928 an early passenger described a business trip with four associates through four southern states as being calm, uneventful, and fruitful. Business flying in those early years was

30 "Business Has Wings," Magazine of Business, LII (October, 1927), 414-15; Roscoe Turner, OH&G, V.

31 "Aviation Is about to Become of Age," American Mercury, CVIII (September, 1929), 51.

not always calm and uneventful. It was necessary to shout to be heard in a Ford, and on cold winter days, the cabin temperature hovered around fifty degrees. Nor would a business man flying coast-to-coast include five days fogged in at Omaha as part of a "fruitful" commercial journey. Nevertheless, a traveler who had endured all these tribulations still commended the airways. One should check the safety reputation of an airline, he cautioned, but if it stands up, "by all means fly. You will save a lot of time and come down safely," he added reassuringly.

An engaging chronicle of several air trips can be found in Records of an Airplane Passenger in 1928 and 1929, by a Mr. Frederick Arthur Poole. Poole was impressed enough by his journeys to record them in this elegant little volume which he had privately printed in twenty-five copies. Its photos are protected with textured opaque facings, and the thirty one gilt-topped pages have deckled edges. The text is a spare, hour-and-minute record of Poole's business flights in executive and commercial aircraft; a series of impressions on the spur of the moment that evokes a picture of personal, homely little aerial journeys that ended when planes began to fly across the continent at five or six miles up, and the only vista the soon monotonous top side of a cloud layer.

Mr. Poole skimmed terra firma at 1,000 feet and ninety miles per hour, a combination that allowed him to have fun watching as the plane

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33 Myron M. Stearns, "All Aboard by Air: Transcontinental Passenger Service," World's Work, LVIII (April, 1929), 34-41. Stearns said that the fare for the regular twenty-one hour flight from Chicago to San Francisco was $200.00.
caught the attention of cattle, sheep, horses, pigs and chickens before they cowed and scattered. The pilots followed the Mississippi at a height of fifty feet, leisurely climbing to miss the bridges, and then letting down again to good-naturedly buzz traffic in the channel. After a commercial flight turned back because of fog, fares were refunded, and then the steward dispensed sandwiches and ginger ale all around.  

An advertisement by the National City Company, bankers in New York, appearing in the Review of Reviews in 1929, indicates that business flying had attained a reasonable degree of prestige and acceptance. The illustration depicts a man with a briefcase, purposefully striding towards a waiting plane. The accompanying copy notes that people live at a fast tempo, reflected by this busy executive using a swift airliner to attend an important meeting.  

The number of airline passengers, domestic and foreign climbed from 5,782 in 1926 to 173,105 in 1929. By 1933, the figure was 568,940, including more than 75,000 foreign passengers. In 1933, airlines flew nearly 200,000,000 passenger miles.  

Although commercial aviation

34 Frederick Arthur Poole, Jr., Records of an Airline Passenger in 1928 and 1929 (Chicago, 1929), passim.

35 Review of Reviews, LXXIX (March, 1929), 105.

was not really competitive with bus and rail transportation until after
1945, the airlines' clientele was an influential one. High level
businessmen comprised the bulk of airline fares, and the social effects
of their mobility was probably greater than the statistics suggest.
Businesses were encouraging their top men to patronize the airlines. A
1929 survey showed that most passengers were traveling for business, and
that some eighty leading corporations allowed employees and executives
on company business to put air fares on expense accounts. Neith-
was flying based entirely on a local appeal. In the spring of 1930,
one airline kept a record of the name and address of every passenger it
carried for one month and found that its clientele of 2,500 was drawn
from forty-two states and 407 different cities. In spite of a wide geo-
graphic basis, however, about 48% of the airline's business originated
in seven large cities.

Given the existing lack of airline coverage over all of the United
States, many time conscious executives discovered the expediency of
having a company owned, or even a personal executive aircraft. The
Magazine of Business discussed business flying in a matter-of-fact,
dollars-and-cents series of articles; evidence of the growing esteem
and public acknowledgment of the value of aviation in a fast-paced modern
world. Late in the summer of 1927 the magazine's publisher, A. W. Shaw
Company, hired the services of a professional pilot and bought a six-

37 *Aircraft Yearbook* (1930), 28-29.

38 *Paul Peter Willis, Your Future in the Air* (New York, 1940), 33.
place Stinson to be used by R. L. Putman, a company vice-president based in Chicago. Mr. Putman did considerable travelling in conducting the affairs of the Shaw chain of publications, which included The Magazine of Business, Factory, and The Industrial Distributor and Salesman. "The officers of the company" it was explained, "have balanced the cost against the potentialities of multiplying the effectiveness of a major executive."^{39}

For the benefit of prospective air-borne executives, The Magazine of Business recorded a detailed summary and log of Mr. Putman's activities in succeeding articles over the next twelve months. In spite of some mishaps, generally inadequate ground service, and a scarcity of convenient airfields, marked air routes, and so on, the Stinson still proved to be a valuable business tool. "With the airplane," Putman said, "we have accomplished many things that simply could not have been accomplished by any other means of transportation."^{40} Given the rudimentary character of flying aids and services available at the time, Putman and his Stinson logged a remarkable 144,327 miles for the year, mostly in the East and Midwest, but including excursions as far south as Florida, north to Minnesota, and west over the prairies to Wyoming and Colorado. Perhaps even more remarkable is the report that hundreds of acquaintances were made with other flying businessmen, including the ubiquitous oil executive as well as a steel man from Pittsburgh, an


^{40} Ibid., (December, 1927), 754.
Ohio manufacturer visiting his several plants, a baker with a chain of outlets, an advertising representative, and others. 41

The experience made Mr. Putman a warm advocate of aviation and its advantages in various phases of marketing. His remarks to a session of the American Management Association in 1927, duly reported in the Management Review, constitute a prescient analysis of aviation's possibilities. Inventory costs would be reduced, said Putman, because it would no longer be necessary to stock such large quantities of spare parts. An air shipment would suffice to maintain production in the event some hiatus developed, and a new shipment dispatched in the meantime. With lower inventories, he continued, the working capital is increased. This could lower money rates, but most likely would stimulate the financing of new projects.

Business at airplane speed would increase the area of business possibilities for sales, build volume, promote mass production, and lower unit cost in turn. The sales and service organizations would also be affected, since the speed and flexibility of the airplane would tend to reduce the number of such facilities needed for business operations. Putman observed that his own field of business, publishing, would be changed by aircraft. Papers and magazines, by air delivery, could achieve a larger area of circulation while their news was still of value. Specialized magazines in particular might benefit from faster and wider distribution. Then there was the saving of time and increased effective-

ness of executives who could make geographically scattered business appointments and return to close out the business day in the home office. 42

In the wake of all this discussion, manufacturers of aircraft soon began to beam an appeal to the potential market for executive aircraft. "The American Eagle, America's Foremost Business Airplane" soon made its entry into the advertisement columns of The Magazine of Business, and the Fairchild Company also called attention to the virtues of its aircraft in the role of executive transports. 43 The new executive fleet was replete with executive amenities, at least in the larger planes. The interior of John Hay Whitney's Sikorsky amphibian was fitted with a lounge on one side of the cabin, and comfortable chairs on the other, all upholstered in a boldly patterned fabric. J. C. Graves, vice-president of the Richfield Oil Company posed in his company's tri-motor which was equipped with dictaphone, and a business-like table appointed with a vase of flowers, as well as a buffet and berths for overnight hops. 44


43 Magazine of Business, LII (November, 1927), 615; ibid., LIV (July, 1928), 93.

These air-borne executive suites served definite business functions, nonetheless. The "Stanolind," a Ford tri-motor owned by the Standard Oil Company of Indiana, compressed the thirteen hour trip from Chicago to the Sugar Creek, Missouri facility into three hours and fifty minutes, carrying eight time-pressed, high salaried executives. The National Lead Battery Company reorganized on a plan that called for de-centralized manufacture and distribution designed to give faster service at lower transportation costs from plant to consumer. Faced with the problem of management of production centers scattered from New York to Seattle and St. Paul to Dallas, the company bought a two place plane to enable its top executives to keep in touch. Using a plane able to carry four or five of a company's top men on trips from Chicago to Casper, Wyoming allowed one firm to save $16,000 per year over the cost of the plane, even with an initial outlay of $22,000 and an overhead of $2,000 per month for the purchase, equipment and maintenance of its aircraft. "Even at present costs" remarked Factory and Industrial Management, "the company-owned plane is almost indispensible where fast emergency transport may at times be a matter of life and death, as in carrying relief equipment in remote mine disasters. The plane is an economy also where it can be used more or less continuously in shortening the travel time and enlarging the range of action of executives."


47 Factory and Industrial Management, LXXV, 1191.
An incomplete roster of industries which flew their own planes in 1929 run into the dozens. The list began with A-C Spark Plug and continued through a Wood Brothers Corporation in Kansas City. It included farmers, petroleum companies, breweries, supply firms of all types, construction engineers, mining firms, and familiar trade names as Jell-O, P. Lorillard, and Walgreen Drug Stores. Such a catalog gives some idea of the imaginative resourcefulness displayed by all types of businessmen in adapting the airplane as a useful tool of business. Aircraft did useful work beyond the borders of the United States as well; the refrigerated shrimp express in Mexico is one example, but American enterprise had the capacity to venture even further afield. Mr. Ernest B. Filsinger, a former president of the Export Manager's Club of New York set one precedent as the first commercial passenger to fly from Johannesburg, South Africa to Berlin; another record was his five week aerial coverage of a buying territory in South Africa which normally would have required five months. As export manager of the Royal Baking Powder Company, his trip must surely have ranked as a tour-de-force in export marketing expertise for 1929.  

By 1929 more and more businessmen were coming to recognize the effects of aviation, from the multiplication of an executive's capacity to the advantages of airmail and air freight. Aviation affected business vision as well, fulfilling the prophecy of ten years earlier. Paul

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Henderson, exploring the expansion of passenger routes in the northwest, concluded it was not yet feasible, although he was intrigued by the observation of an outstanding businessman from the area. The man hoped the passenger lines would be a reality soon, because they would increase the existing benefits of passenger routes from the East to Los Angeles. Henderson pressed for details. How did the passenger terminal in Los Angeles influence economic activity as far up the coast as Oregon and Washington?

Faster transportation brought men and their money to the West, came the reply. Some of those men took time to travel up the coast. "There they see opportunities for investing capital where it will yield an economic return and deliver an economic service," explained Henderson's friend. "Such men are already helping to build up our northwestern states." And so rapid air travel helped speed up the process of filling out the "economic hollows" of the continent.50

The aspect of more rapid travel increased the exposure of businessmen to new personalities and new ideas. Air travel widened the visionary promise of existing capacity and future potential of business opportunities across the country. Business and business concepts moved at a faster, air-age tempo.51

50 Henderson, Magazine of Business, LV, 139.

51 Ibid., 140; Warren Jefferson Davis, Air Conquest (Los Angeles, 1930), 202 ff.
CHAPTER VI

AVIATION TECHNOLOGY

The creation of the National Advisory Committee for Aeronautics in 1915 heralded the arrival of aviation technology. Dr. Charles D. Walcott, Secretary of the Smithsonian Institution, had suggested such an organization some years earlier, and urged the United States government to pass legislation authorizing an advisory group to engage in research and other programs to promote aviation. His idea did not receive favorable attention at first, although in 1913 the Advisory Committee of the Langley Laboratory was created under the auspices of the Smithsonian Institution. The Smithsonian designated the Committee's members, which included government personnel nominated by the Secretaries of War, Navy, Commerce, and Agriculture. With the outbreak of war in Europe, additional federal support was discouraged since there was some feeling that a government advisory committee for aeronautics had warlike connotations which would compromise the neutral role of the United States. It soon became apparent, however, that a more official body was needed to effect the best cooperation and coordinate the research activities of civil and military aviation. Moreover, there was

a legal problem because Congress had never authorized the participation of the various government officials who were involved in the work of the Langley Committee. The Naval Appropriation Act of March 3, 1915, made official provision for the establishment of a National Advisory Committee for Aeronautics which was to coordinate the activities of the respective military and civil departments of the government. Its research reports and facilities were to be accessible as well to any private firm in the United States if such private firms provided adequate compensation.

Specifically, NACA was charged with the duty to "supervise and direct the scientific study of the problems of flight, with a view to their practical solution, and to determine the problems which should be experimentally attacked, and to discuss their solution and their application to practical questions." The dozen members appointed by the President represented the Treasury, War and Navy departments, as well as the Weather Bureau, Bureau of Standards, and the Smithsonian, and included delegates from Stanford, Northwestern, Johns Hopkins, and Columbia Universities—an indication of the Committee's range of inquiry and suggestive of the probable effects of its research in "application to practical questions." The initial appropriation totalled $25,000 for a period of five years. One of the first projects under the aegis of NACA was research in propellers carried out at Stanford in 1916 under the direction of Dr. William F. Durand and Dr. Jerome C. Hunsaker.

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2 Scientific American, CXIV, 140.
of MIT. Hunsaker was also a leading figure in wind tunnel research, which he had observed at England's National Physical Laboratory during a visit in 1914. 3

Fourteen years after its birth in 1915, the tremendous growth and complexity of aeronautics required an expansion in NACA's personnel and finances. In 1929 the Committee's membership was increased from twelve to fifteen with the addition of Harry F. Guggenheim of the Guggenheim Fund; William P. MacCracken, jr., of the Department of Commerce; and the respected Edward P. Warner, editor of Aviation magazine. The importance and scope of NACA's activities are reflected in its statistics. Totaling $615,770 in 1929, the appropriation for 1930 was $1,508,000, including an allocation for the construction of a full-scale wind tunnel and other added facilities. In 1929, NACA distributed a total of over 100,000 technical notes, memorandums, and circulars throughout the United States and maintained a technical representative for Europe at the American Embassy in Paris to keep informed on the latest foreign developments. 4 In retrospect, the NACA has been one of the most important foundations of American aviation. 5

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4 NACA, Annual Report (1929), 4-11.

The growth of aviation technology can not only be traced in the development of the NACA, but also in the growth of cadres of professional aeronautical engineers. Although the Armour Institute of Technology in Chicago reportedly offered aeronautical courses as early as 1910, the best known of these pioneer courses was initiated by Jerome C. Hunsaker, who became interested in the field of fluid dynamics through his studies in naval architecture at M. I. T. in 1909. From the study of hydrodynamics in his naval courses, Hunsaker passed on to an interest in aerodynamics as well. Fortunately, M. I. T.'s president, Richard C. MacLaurin, was an interested student of aviation as a new scientific art and a promising form of technological progress, and he formulated plans for a pioneering course in aeronautics around 1912. Hunsaker himself translated a book on aeronautics by Alexandre Eiffel, the well known French engineer. It was published by Houghton Mifflin, and used in the first course in aeronautics at M. I. T. in 1913--taught by Hunsaker. During the First World War, the general course in aeronautics became a regular class in the strict discipline of aeronautical engineering. In 1925 it was taught by Edward P. Warner, who was to become another outstanding figure in aviation.

6 "Aeronautic Education in Colleges and Universities," Airway Age, I (March, 1929), 265-69.

7 Jerome C. Hunsaker, OHC, I; Another of the earliest texts was written by one of Hunsaker's colleagues at MIT - Edwin Bidwell Wilson, Aeronautics; a Class Text (New York, 1920).

8 "The MIT Aeronautical Course," Aviation, XIX (July 13, 1925), 42-43.
Another pioneering course was begun by Felix W. Pawlowski, a professor in mechanical engineering at the University of Michigan, who began to develop courses in aeronautical engineering about 1913. The course was shifted to the Department of Naval Architecture and Marine Engineering in 1915 (an interesting move in light of Hunsaker's experience and indicative of the close relationship of aerodynamics and hydrodynamics), and the course was operated at a third-year college level. Pawlowski's first bachelor of science in aeronautical engineering received his diploma in 1917, and post graduate work was offered a few years later. The University of Detroit announced the formation of an Aeronautics Department in 1920 under the direction of Lieutenant Thomas F. Dunn. Coursework was offered beginning with the fall term of 1921, with the first bachelor of aeronautical engineering awarded in 1925.\footnote{Altman, \textit{Michigan History Magazine}, XXII, 218-19; \textit{Airway Age}, X, 268-69.}

In 1921, New York University offered similar course work in the new field of aeronautics.\footnote{Bernardo, 194.}

The Daniel Guggenheim Fund for the Promotion of Aeronautics was a tremendous stimulus to aeronautical engineering just as it was to the dozens of other aeronautical subjects with which it became involved. Even before the Fund was officially established, an important grant of half a million dollars was made to New York University in 1925, establishing the Guggenheim School of Aeronautics within the College of Engineer-
ing. After the Guggenheim Fund was formally announced in 1926, this grant was followed by other awards to a number of schools, always for the purpose of furthering the study of aeronautical sciences at the university level. Stanford was the recipient of $300,000 for study and experimentation in technical problems; $300,000 was earmarked for permanent study and experimentation at the California Institute of Technology; M. I. T. also received $225,000 for the construction of permanent facilities; the University of Michigan received $78,000 for the completion of aeronautical laboratories and expansion of the University's curriculum in the field of the aeronautical sciences.

Alexander Klemin, a professor in aeronautics at New York University when the Guggenheim School was established, emphasized the need for professionals in aeronautical engineering to maintain progress in the discipline and to help schools encompass the growing body of scientific knowledge on the subject by keeping up to date on the latest researches. Klemin cautioned that aeronautical engineering should always be taught with a firm background in the general engineering curriculum, never as an entirely separate course of study. In some universities of the West, Klemin noted, aeronautical engineering was undertaken only at the postgraduate level. The general rule was to include it in the undergraduate curriculum.

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curriculum before intensified research in a graduate school, as was the practice at M. I. T. Aeronautics courses were customarily given as the fourth year in naval architecture at Michigan or in the fourth year of a general course of engineering at Klemin's own school, N. Y. U. By 1929, a survey by an aviation magazine reported a total of 1,400 aeronautical engineering students enrolled in fourteen schools across the United States. The University of Detroit led in enrollment, with 341 students, followed by the University of Michigan, 150; M. I. T., 161; N. Y. U., 120; and the Armour Institute, 118. Smaller enrollments were reported at the University of California, Berkeley, 83; University of Minnesota, 75; and the University of Washington, 60. Other schools included Purdue, University of Kansas, Stanford, University of Nebraska, and the California Institute of Technology.

The Guggenheim Fund also sponsored a drive to promote increased instruction in aeronautics subjects in elementary and secondary schools. Accordingly, the Fund announced the establishment of a Committee on Elementary and Secondary Aeronautical Education at the start of 1928. "Because it is possible that the children of today will, upon maturity, be living in an age when transportation by air will be a common feature of life," the Fund explained in its press release, "it is particularly

14 Airway Age, X, 265-69.
important that the principles and methods of aviation should be familiar to their minds." The press release went on to call attention to the fact that elementary and secondary instruction in the principles of aeronautics was necessary to foster the understanding and familiarity of air transportation inherent in the "air-minded" generations of the future.15 Speaking for the Fund's Education Committee in an address to the National Education Association, William F. Durand, a member of the engineering faculty at Stanford and a member of the original twelve man National advisory Committee for Aeronautics, stressed the need for vocational training in aviation in secondary schools. Durand warned that aeronautical studies and vocational training would promote more interest in other areas of learning and would necessitate more attention to strengthening the school curriculum in these areas. In his opinion, aeronautics was probably the most important and diversified subject in the modern curriculum, encompassing mathematics, physics, chemistry and mechanics, not to mention numerous aspects of engineering, meteorology, navigation, psychology, and physiology. Aeronautical terminology was yet another problem. Durand reminded the audience that the NACA had recently defined 565 words in current usage relating to specifically aeronautical affairs which were not yet in current dictionaries. At least 200 to 300 of these words should be a part of the vocabulary of the "average man" said Durand, in order to comprehend the present growth of aviation reported in the daily newspapers.16

15 News release dated January 26, 1928 to be issued January 27, 1928, in Guggenheim Papers, Box 1.

Various existing sciences were inevitably affected by the development of a constantly maturing discipline of aeronautical engineering. As early as 1919, the Scientific American Supplement was calling attention to the effect of aeronautics on various aspects of physics, especially aspects of aeronautics involving the "dynamics of and through media"—the study of motion through a medium of resistance. More explicitly, Alexander Klemin spoke of the effect of aeronautics on hydrodynamics, which he described as the "flow phenomena of a perfect fluid." For many years, explained Klemin, there had been little progress in the field of hydrodynamics, but as a result of the new requirements of aerodynamics, mathematicians had been forced to re-study the "problems of flow of viscous fluid." Germany's Dr. Prandtl of Gottingen, he pointed out, had made much recent progress in theoretical analysis pertaining to the forces acting on moving aerodynamic bodies such as airship hulls and airfoils. Such foreign researches were of importance in the United States, because they were chronicled in the various scientific journals of the time and made available in this country. Prandtl's studies, for example, were set down at the request of the NACA, translated by its staff, and circulated in one of its technical reports, "Applications of Modern Hydrodynamics to Aeronautics."


Aviation technology had a bearing on automotive engineering in the 1920's, an aspect which was the subject of a special symposium, "Probable Effect of Aeronautic Experience on Automobile Practice," conducted in 1919 at the annual meeting of the Society of Automotive Engineers and subsequently published in its Journal. The comments of the participants concerned war-time experience in aircraft manufacturing that could be applied to automotive engineering in the post-war decade. Howard C. Marmon, in a discussion of automobile and airplane engines, emphasized that although no radical design changes were in the offing, the experience of manufacturing high-performance aircraft engines had yielded a "multitude of engineering minutiae" which could be applied to automobile production techniques in order to give better service and improvement in engine performance. Marmon said that one of the most significant developments in aircraft engines that would be a contribution to automotive performance was the use of the steel cylinder. It would be especially effective in heavy duty engines because of its rapid cooling qualities and its resistance to the loosening and fracturing effects of constant vibration.

Henry M. Crane, vice-president and chief engineer of the Wright-Martin Aircraft Corporation, stressed the particular requirements of aircraft engine development in lighter and higher quality bearings as well as the higher performance characteristics of magnetos and spark


plugs that would be feasible to adapt in automobile engine manufacture. Crane also noted that the use of composite aviation fuels had interesting promise for automobiles. Engine performance would be affected by the use of these composite fuels which raised the ignition temperature and consequently resulted in higher compression ratios.\textsuperscript{22} The final comment was made by O. E. Hunt, an engineer of the Packard Motor Car Company. After an especially strong assertion that no revolution in automobile design would result from the experience with aircraft, he agreed that improvement in some details such as oil control and carburetion could be copied from aircraft engines along with increased use of overhead valves and camshafts. The most important contribution of airplane production, said Hunt, was the evolution of a new approach to the problems of design and manufacturing. Engineers were conditioned to think more in terms of lightness, had an increased respect for "good metallurgical practice," and discovered new concepts of high quality workmanship. "In setting up new ideals of design and workmanship," Hunt concluded, the experience of aircraft production had given an "inspiration of far greater value than any design details could possibly yield."\textsuperscript{23}

Crane's remarks during the symposium are of more than passing interest, since he moved from Wright-Martin to become the technical

\begin{footnotes}
\item[22] Henry M. Crane, "Possible Effect of Aircraft Engine Development on Automobile Practice," \textit{ibid.}, 240-42.
\end{footnotes}
assistant to the president of the General Motors Corporation. It was while he held this position that he continued to affirm the influence of aviation on engine design and construction techniques, and once more made reference to high-test fuels in the form of anti-knock gasoline.

Developments in the area of high-test fuels were progressing rapidly in mid-twenties, as exemplified in the work of an American named Midgely. Midgely's researches involving the use of tetra-ethyl lead was striking enough to merit the approving notice of the well-known British scientific authority, Harry E. Wimperis. The American petroleum industry found it increasingly necessary to meet the production requirements of high-test gasolines, not only for the increasing numbers of automobiles, but to satisfy the needs of a growing aviation industry for special grades of aircraft engine fuel as well as an increasing demand for special types of lubricants. At the close of the decade, Skelly Oil Company was spending $2,000,000 for a new facility to produce aviation gasoline, and other companies who were serving the special requirements of the aviation business included well known firms like Texaco, Cities Service, Phillips, and Shell.


Even if the automobile industry was not radically influenced by the growth of aviation technology, the concept of aeronautics had favorable connotations of design and performance that showed up in advertising campaigns. In one instance, the publicity department of the Ford Motor Company was able to combine two of its fine products in one photograph which displayed an impressively sized Lincoln against the backdrop of an airfield stocked with Ford tri-motors. The aero-dynamic connotation was no doubt contrived to complement the "speed and strength . . . inherent in the graceful lines of the new Lincoln body," described in the advertisement's caption. By accident or design, a full page color advertisement was inserted on the facing page by the Franklin Automobile Company, which proclaimed that its mechanical vehicles could boast a quality of performance just like the "craft of the air."

"Smoothly, swiftly, powerfully they slip through space. And the Franklin too," the company added. Not only that, but italicized emphasis was given to the fact that the Franklin also had "airplane feel"27—an indication at least that Packard's O. E. Hunt had been partly right ten years earlier when he told the Society of Automotive Engineers that aeronautical engineering would stimulate new concepts in design and workmanship.

Pilots themselves came under increased technical scrutiny. It was essential to learn more about the effect of flight on the human body as pilots performed more functions in the sky and began to spend long hours

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27 *Country Life*, LVI (October, 1929), 92, 93.
in the air under all sorts of arduous physical conditions. There were many unanswered questions about the ability of human beings to handle a machine as powerful and as complex as an airplane in an unknown and hostile medium. Flying an aircraft put more than a normal demand on all normal human functions and required strict and unceasing attention. "The man who drives an automobile may make a mistake twice," the layman was warned, "but for the pilot his first error in judgement is only too often his last." The airman was subject to the psychological and physiological effects of high altitude compounded by the added factors of high speed, severe vibrations, and deafening noise, all of which exposed his senses to an unaccustomed strain. In order to be better informed in the selection of pilots and to maintain a constantly high level of fitness for aviators, it was considered imperative to develop some standards of aviation medicine suitable to the requirements of human beings confronted with a new set of environmental factors that was bewildering and full of dangers.

Again, it was the emergency of war that spurred the beginnings of research in the field of aviation medicine. In 1917, the Army Medical Research Board was organized with a special research laboratory for aviation medicine located at Hazelhurst Field, Long Island, New York. Research was continued when the war ended, and a program was inaugurated


to train a number of doctors to go on permanent duty as flight surgeons with active units of the Army Air Service. One of the most vexing problems of early aviation was the inability of pilots to do blind flying, or instrument flying, in smoke, fog, or clouds when it was not possible to see the ground clearly. When they were unable to orient themselves in relation to the earth below, pilots found that they were prone to a total loss of the sense of their flight attitude—a complete confusion of lateral and horizontal position. Through original research in aviation medicine, however, Major David A. Meyers formulated the physiological principles which helped furnish the basis for the techniques of blind flying which evolved in 1926.

The technical progress in aircraft and an increase in aircraft performance forced continual revision of the old precepts of flight medicine, created new problems, and prompted new discoveries. The passage of the Air Commerce Act in 1926 meant added pressure of the federal government to establish the most rigorous requirements for the selection of pilots engaged in air transport as well as encouraging further studies to insure passenger comfort and safety. With the passage of the Air Commerce Act, authorities finally awoke to the realization that "flight in aircraft could and should be accomplished without exposing both passengers and pilots to the deafening roar of high powered motors, paralyzing cold, the stupefying effects of the rarefied air at high altitudes, the deadly fumes of carbon monoxide, and the blistering
effects of winds of hurricane velocity." In 1929, the organization of the Aero Medical Association of the United States, in addition to the founding of the Journal of Aviation Medicine, marked the elevation of aviation medicine to the rank of a recognized branch of science. A spokesman of the Mayo Clinic, looking back over the previous two decades of aviation medicine prior to 1941, remarked how the term "flight surgeon" had become an accepted term of military nomenclature, and commented with satisfaction on the hundreds of physicians with specialization in flight medicine. It was significant too, he said, that so many leading medical schools included or were expanding their curriculum to offer instruction in aviation medicine, in addition to a number of well known universities who were sponsoring path-breaking research in the field.

Research on the condition of man in the air was paralleled by an increasing interest in the air itself. The intensive study of meteorology was an outgrowth of wartime requirements, although many significant

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31 Ogburn, Social Effects, 374. In 1936 the Bureau of Commerce listed 700 doctors who were specially trained to check the qualifications of pilots who flew passengers and mail over scheduled routes; by the end of the thirties, many airlines had their own medical and research divisions. The military services and the Civil Aeronautics Authority were conducting various studies, as well as the Mayo Clinic, Harvard, and Columbia. See: "Flying Superman and Superwomen," Literary Digest, CXIII (November 14, 1936), 22; Donald E. Keyhoe, "Living in a Spotlight," American Mercury, CXVIII (July, 1937), 27.
advances in technique were due to the stimulus of aeronautics in the postwar decade. Increased knowledge of the upper atmosphere grew out of the progress of aviation. For example, the "great circle" routes to the Orient that took aircraft over the Arctic helped focus attention on polar regions which in turn led to better understanding of weather theory.\(^\text{32}\) Willis R. Gregg, chief of the aeronautical division of the Weather Bureau, praised the ability of aircraft to gather accurate weather data for early morning radio broadcasts in the mid-twenties.

The Weather Bureau had followed the practice of releasing balloons with instruments attached to collect data on conditions in the upper atmosphere. The balloons did not always yield satisfactory results. Their uncontrolled ascent and flight path limited their value in gathering precise weather data at significant altitudes over important geographic regions; calms and storms limited their capacity for routine data collection on a regular frequency; prolonged balloon flights were acceptable for research purposes but had little utility for daily weather broadcasts early in the morning. An airplane, taking off at eight o'clock in the morning, could fly a comprehensive weather mission in rapid time to gather the relevant factors at the best altitude, including the air pressure, temperature, humidity, visibility; define the extent and altitude of the cloud layer, and check any unusual conditions in the process. All of this information would be analyzed and prepared in time for the first weather broadcast at nine o'clock in the morning--

\(^{32}\) Ogburn, *Social Effects*, 670.
exactly one hour after the plane was rolled out of the hangar. 33

This procedure recalled an earlier condition when pioneer balloonists had enhanced man's knowledge of the upper atmosphere. Balloonists and aircraft pilots after them served meteorology for a time until the techniques they pioneered were incorporated into newer and more sophisticated instrumentation of various weather devices which replaced them. The situation then reversed itself, and the meteorologist evolved into the position of advising the pilot. Nevertheless, aeronautics had a fundamental effect on the advances in meteorology and the science of weather prediction; it was the increasing activity of aviation that necessitated more accuracy in forecasting as well as a greater knowledge of the vagaries of weather. When the Air Commerce Act of 1926 went into effect, the services of the Weather Bureau were put into a new schedule of operations around the clock in order to supply the passenger lines with indispensable weather information. Prior to 1926, up-to-the-minute weather reports had been issued for special events such as air races and long distance flights; never before had accurate momentary forecasts been immediately at hand for regular air line operations. 35 In addition to aviation, up to date forecasting was

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important to farmers, ranchers, construction engineers, resort owners, fishermen—dozens of people whose work was affected one way or another by cloudless skies or stormy ones, and who were grateful for the Weather Bureau's daily warning or promise of better days to come.

Fog, rain, sleet and snow; the requirements of scheduled flight services fostered a closer attention to the study of surface weather conditions in general. Revised standards to estimate visibility and cloud frequency were developed. For the first time, information of this type, including wind characteristics as well, was systematically collected for the plains states and the Pacific coast where such data was sketchy or had never been available in a comprehensive report. The nature of general weather trends and development over the entire continental United States came into sharper focus as the Weather Bureau encouraged stations across the country to send in standardized reports to be summarized in a meaningful compilation. 36 "Aid to American aviation," concluded a historian of the weather bureau, "has involved more innovation, technological development, and opportunities for expansion of Weather Bureau facilities than any other field of weather service." 37

Meteorology in the twenties cannot be discussed without mentioning the Daniel Guggenheim Fund for the Promotion of Aeronautics. Concerned about the lack of an organized weather service, a shortcoming


37 Whitnah, 167. See also, ICAC, *Papers*, 525-53.
that had been a severe handicap to Lindbergh, Harry Guggenheim engaged the Fund in various projects including a scholarly text on meteorology for aviators, operation of a Model Weather Service in California, a grant to the University of Michigan in support of an expedition to Greenland for research and studies in forecasting storms, and plans for developing a program of course work for professional training in aeronautical meteorology. Although the Department of Geophysics in the St. Louis University's Institute of Technology had offered instruction in meteorology as early as 1925, course work on a professional level was first inaugurated at M. I. T. in the autumn of 1928 under the auspices of the Guggenheim Fund.

The first courses were taught by Carl-Gustaf Arvid Rossby, a transplanted Swedish expert and a veteran of Guggenheim's Model Weather Service, whose first lecture was delivered on the top floor of the Guggenheim Aeronautical Laboratory, a benefit of the Fund's earlier concern with aeronautical engineering. The three year program was carried out on the graduate level until 1940, when it became a separate department of meteorology. Early in the thirties, M. I. T. carried out the first serious research in collecting and utilizing upper air data through the development of the radiosonde, a device to measure humidity, 

38 Guggenheim, The Seven Skies, 80-82; Lomask, Seed Money, 108-112.

temperature and air pressure at high altitudes that grew out of Rossby's experience with the Model Weather Service. This fundamental contribution to meteorology was followed by the formulation, in cooperation with the Department of Agriculture, of the five day weather forecast, which was to have a substantial value for agriculture, industry, and the general public.

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CHAPTER VII
GROWTH, ADMINISTRATION, REGULATION

In 1929 Victor Selden Clark declared that the manufacture of aircraft occupied a position of "minor importance" in the hierarchy of American enterprise. He acknowledged that the value of aircraft manufactures had doubled from $7,000,000 to $14,000,000 between 1925 and 1927. Such growth had promise for the future, Clark said, but in his opinion, the main value of aircraft manufacture to the engineering industry was in terms of innovations in engineering technique.¹

Judging the industry by its peak of wartime achievement compared to its postwar record in 1929, the prospects of aircraft manufacturing did not seem overly rewarding. From April, 1917, to November, 1918, American producers had delivered 13,984 planes valued at $113,721,043, with the capacity to turn out 21,000 aircraft per year at the time of the Armistice.² The war's end shut off the lucrative military contracts, and just 780 planes were built in 1919, all but eight of them for the military. Until the middle of the decade, the military services continued to claim most of the production. The effects of the

² Welman Austin Shrader, Fifty Years of Flight (Cleveland, 1953), 20.
Kelly Act of 1926, which turned over mail routes to private contractors, is seen in a comparison of production figures in 1925, when 445 of 789 planes were manufactured for the armed services, and 1926, when they claimed only 478 out of 1,166. In 1929, after the Air Commerce Act and Lindbergh, 779 military types were produced in contrast to 5,414 civilian aircraft; a total value of $70,334,107 for all aircraft, parts, and equipment. In spite of the depression, the book value of the three main sectors of the transportation industry indicates a steady increase by aviation. The following figures emphasize the dominant position of the automotive industry, but show that the aircraft industry experienced a significantly higher rate of growth, even in the thirties.


5 U. S. Department of Commerce, Historical Statistics, b11. The air transport industry also proved more resilient than rail passenger business during the depression years, especially in contraction periods. See Thor Hultgren, American Transportation in Prosperity and Depression (New York, 1948), 135, 361.
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<th>1919</th>
<th>1929</th>
<th>1937</th>
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<tr>
<td>Total Book Value in Dollars</td>
<td>2,326,000</td>
<td>3,261,000</td>
<td>3,294,000</td>
</tr>
<tr>
<td>Motor vehicles</td>
<td>1,816,000</td>
<td>2,575,000</td>
<td>2,504,000</td>
</tr>
<tr>
<td>Locomotive and Railroad equipment</td>
<td>491,000</td>
<td>578,000</td>
<td>610,000</td>
</tr>
<tr>
<td>Airplanes</td>
<td>18,000</td>
<td>111,000</td>
<td>180,000</td>
</tr>
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This indication of the strength of the aviation business encouraged enthusiastic reports by the aviation press, business journals, and investment houses. An aircraft show at Detroit in 1928 excited the reporter of the *Magazine of Business*. The exhibition catalogued 100 exhibits in all, evidence of the expanding foundations of the aviation industry and a yardstick promising a sound potential for growth. There was a definite feeling of modernity, novelty, and challenge. "A new industry," patterned the writer. "Striking new vehicular forms. A new nomenclature. New firms." Yet, the new aviation industry was strongly rooted in a sound structure of modern technology, resting on a foundation of firm, although comparatively modern enterprises such as B. F. Goodrich, Standard Oil, AC Spark Plug, Westinghouse, and so on. These contemporary giants exhibited at the aircraft show too, and their presence lent an atmosphere of stability and practicality to the vehicles of the future.  

6 "America's First Aircraft Show," *Magazine of Business*, LIII (June, 1928), 74.
production to date all added a "sense of solidarity" to the new airplane business. The enterprise of aeronautics was further buttressed by a growing myriad of manufacturers, sub-contractors, suppliers of parts and accessories. Pynchon and Company, members of the New York Stock Exchange, published an eighty page review of The Aviation Industry in 1928; a surprisingly extensive catalog of the dozens of firms in one way or another involved in aeronautical manufactures.8

Pynchon's book, however, was less an admiring tribute to a new technological phenomenon than a gambit designed to engage the interest of potential investors in aeronautical securities, a topic which Mr. Pynchon further detailed in later discussions of the subject.9 The House of Pynchon was not the only institution to try to catch the eye of the prospective star gazers in aerial securities. Another member of the Stock Exchange, Pask and Walbridge, chronicled The Development of Aviation in the United States in a sixteen page pamphlet that included a scholarly little outline of the history of American aviation, a resume of the expansion of mail and passenger lines, and other statistical progressions which were intended to underscore the potential in-


vestment value of the industry. A more specific title issued by Pask and Walbridge surveyed The Development and Outlook of the Fairchild Aviation Corporation and Its Subsidiaries. After another sixteen pages of optimistic, yet conscientiously objective analysis enlivened by several attractive photographs, Pask and Walbridge inevitably concluded that the Fairchild Aviation Corporation was a sound investment that "possesses merit as a speculation." Those who sought up to date information on promising aeronautical securities could avail themselves of the services of the Aero Analyst; a Financial and Technical Review published from time to time in New York. Founded in the spring of 1929, the high flying Aero Analyst had a short-lived existence, wiped out by the nose dive of the stock market crash.

Before the crash of the market, the Commercial National Bank and Trust Company of New York reported that $500,000,000 had been "made available" to aeronautical development from 1927 to 1929. The company's own investment information listings had more than doubled from 230 to 600 entries as of July, 1929, which required the firm to issue a new 156 page Financial Handbook of the American Aviation Industry. The


bank was only reporting the trend, however, for the real investment
deluge was yet to come. Beginning in March, 1928, and running through
December, 1929, $1,000,000,000 of aviation securities were traded in the
New York Stock Exchange. By 1932, the value had sunk to $50,000,000--
an investment loss that returned only five cents for every dollar.\textsuperscript{14}

The big market in aviation stocks reflected the general bullish-
ness in securities, although it was certainly abetted by the over con-
fidence radiated by the brokerage houses as well as the public press.
Leading magazine publishing companies like Crowell and Curtis both
carried dozens of articles all predicting a sound evolution of aviation
in the future, and published their own respective studies of the air-
plane business. Admittedly, there was something of an ulterior motive
involved in these reports. \textit{Colliers}, the leading organ of the Crowell
organization, put forth an evaluation of \textit{The Aviation Industry and Its
Market}, which not only tabulated the usual statistics of production,
flyin g fields, and so on, but also outlined the role played by Crowell
publications in influencing the buying public.\textsuperscript{15} The same idea was
implicit in \textit{The Aviation Industry}, a more extensive compendium origin-
ating from the Curtis Publishing Company. The Curtis volume includes
an interesting item about advertising revenues which once more indicates
the relatively small size of the aviation business as compared to the
automobile industry. Manufacturers in the aircraft sector spent sli ghtly
over $1,000,000 with Curtis, while the automobile companies subscribed to

\textsuperscript{14} Freudenthal, 88.

\textsuperscript{15} Colliers, \textit{The National Weekly, The Aviation Industry and Its
Market} (New York, 1930).
$6,500,000 worth of advertising. 16

Nevertheless, the significance of these two leading publications expending so much attention on aeronautics should not be overlooked. It is also necessary to give both of them credit for publishing a number of constructive and informative articles on the problems as well as the progress of aviation. Not all of their stories were the glamourized, stereotyped sagas of dashing airmen and dangerous aircraft.

The Saturday Evening Post, in particular performed a valuable service in printing articles by Howard Mingos, a leading aviation authority and editor of the Aircraft Yearbook, and Charles A. Lindbergh. Other able, commonsense pieces on aviation were contributed by Ralph D. Weyerbacker and the Post's associate editor, Wesley W. Stout. 17 While these essays may have whetted the appetites of some individuals with a craving for choice morsels among aerial stocks, they also imparted a sound fund of knowledge to the general public. After the hysteria of fortune hunting had blown over, the basic information of these articles helped create the foundations of an intelligent and realistic approach to aviation. 18


18 For a concise listing of the above and other articles in the Saturday Evening Post, see pages 135-39 in The Aviation Industry.
The aviation industry developed into a factor of industrial location that created different types of jobs in traditional centers of manufacturing and brought new opportunities to other areas that were particularly suited to the special requirements of aircraft production. Some companies, like Boeing in Washington, were content to stay where they were. Many manufacturers preferred to remain in the East, close to transportation centers and points of distribution. The East also provided the skilled aptitudes of machinists for engine manufacture as well as furnishing a pool of workers and shops for the specialized production of sensitive instruments and aircraft fittings. The western prairies, characterized by areas of level plains and clear weather attracted some of the pioneer designers and manufacturers who liked the promising flying and testing conditions there. Famous names like Stearman, Beech, and Cessna have been associated with Wichita since the early part of the twenties. Promise of extended periods of flying weather, plus the topographical conditions and growing labor supply attracted more manufacturers to the state of California, whose salubrious climate had special advantages. The facilities for aircraft production necessitated large buildings with plenty of space to accommodate the growing wing-span and fuselage length of modern planes. Such buildings for aircraft construction and assembly required less heating expense in California, and were subject to less depreciation resulting from the attrition of the weather.

19 William Glenn Cunningham, The Aircraft Industry: a Study in Industrial Location, (Los Angeles, 1951), chapters I and II.
Atlanta, Georgia, tried to sell itself as a center for the aviation industry on the basis of its existing position as a hub of air routes through the South, also boasting of its production advantages for aircraft manufacturers. An unwholesome prejudice was in evidence, however, when the city proclaimed in its propaganda that it could offer the well-known skills of "Anglo-Saxon workers."\(^{20}\) Promotion on the west coast had a more justifiable bias. It was argued that the prevalence of favorable weather on the southern Pacific coast permitted longer hours of flying time, which was not only valuable in performance evaluation of aircraft—it meant that manufacturers could derive more utility from their investment in fields, equipment, and so on that was useless in eastern winter weather. Coastal winds were even less variable than those on the plains, so that there was a smaller element of danger in take-off and landing. Numerous flat, brushless areas along the Pacific coast allowed a safer margin in emergency landings, the argument ran on, and this feature also made it easy to lay out an airfield in the most practical location to a city. In addition to all this, it was necessary to keep in mind that South Americans were being tremendously impressed by the achievements of American aviation; the Pacific coast location was a favorable locale for situating airfields in support of South American air routes.\(^{21}\) In 1929 the Los Angeles Chamber of

\(^{20}\) Magazine of Business, LIV (October, 1928), 403.

\(^{21}\) J. F. Richardson, "First in the Air; Preview of the Pacific Coast's Aviation Future," Sunset, LIX (December, 1927), 12-13.
Commerce sponsored a full page advertisement in *World's Work* which pointed out that the west coast, especially Los Angeles County, had indeed arrived as a center of aeronautics and supported its claim by citing statistics. The United States Department of Commerce was quoted to the effect that thirty-two per cent of all flying activity in the United States originated in Southern California. The Chamber added that not fewer than twelve major aircraft and engine manufacturers were operating in the same area.

New York nevertheless remained the industry leader. Noting the rapid growth of the aviation industry, the Bureau of Labor Statistics was prompted to undertake a rather complete survey in 1929 to ascertain the size and importance of this segment of enterprise. Aside from manufacturing, the Bureau reported, there would be direct and indirect influences on employment through factory and airfield construction; openings for pilots, mechanics, and ground crews; and side effects on component industries such as metals, rubber, and petroleum. The Bureau sent and received a questionnaire from 101 known aircraft and engine companies in twenty-nine states, compiling a set of figures for production including all of 1928, with employment figures from January to May, 1929. As for aircraft, the production total in 1928 was 4,886, with 1,020 produced in New York, 858 in Kansas, and 821 in Ohio. A total of 22,082 workers were listed on the payrolls, led again by New York with 4,396, California with 1,605, and Michigan, Washington,

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*World's Work*, LVIII (June, 1929), 5.
Kansas, New Jersey and Ohio all reporting over 1,000. These results led the Bureau to make an optimistic, if judicious forecast. Keeping in mind that aviation was a relatively new industry, the Bureau said, the outlook was encouraging that aviation would have an effect of "material importance" on the job market. 23

The Bureau's inclusion of airport construction, although it promised jobs for workers, not only highlighted growing problems for cities in selecting and maintaining airport sites, it posed serious questions for many city administrations as to whether or not it was feasible to invest in airport construction. Aviation was growing, to be sure. Was it growing rapidly enough to warrant airport construction? On the other hand, if a progressive city did not spend the necessary sums for an airfield, might it not run the risk of becoming a second-rate commercial center, losing its position to a more foresighted neighboring metropolis? Most cities accepted the challenge. In 1926 there were ninety-two intermediate landing fields lighted by the Department of Commerce, increasing to a total of 385 such fields just five years later. From 1927 to 1931, the number of municipal fields jumped from 240 to

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636, and the total number of all fields in operation increased from 1,036 to 2,093 in the same period. 24

Clearly, cities were very rapidly faced with complex problems in the design, construction, and operation of airports. Answers to these difficulties came from diverse sources. To those who were interested, the Westinghouse Lamp Company supplied a forty page pamphlet devoted to the single subject of Airport and Airway Lighting, a valuable analysis on the location and types of equipment as well as the various systems of lighting to insure the highest degree of safety and efficiency. 25 Civil engineers plagued with unknown dimensions about laying and building landing strips could consult a volume put out by the Ford Motor Company entitled The New Era of Transportation. Written in all seriousness, this overall handbook on the subject of aeronautics included several passages of unintended humor. In the chapter reviewing some "General Information About the Landing Field," the author imparted the colorful axiom that a terminal field is one "where the planes stay at night," a phrase that conjures up a sort of technological barnyard where aircraft, like other denizens of the air, may go to roost until the dawn. The best surface for the landing field, after all, was alfalfa or heavy grass. Other solemn specifications included tested principles of engineering


evaluation. "The surface of the landing field," advised the text, "should be hard enough to support the plane during all seasons and so smooth that a motor car can be driven at fifty miles an hour over any part of it without throwing the passengers out of the seat."  

A more professional discussion was given by a consulting engineer, Ernest Payton Goodrich, in the National Municipal Review. Goodrich's article is a significant analysis of the problems of airfield planning to allow for the requirements of the safe operation of aircraft in relation to the landing field's size, location, design and so on. He already recognized the difficulties in situating fields so as to allow the necessary margins of operational safety, yet retaining convenient and quick access to the heart of a city. Airfields on Long Island and in New Jersey were already so far from Manhattan that it took as much time to get downtown as it did to fly from Boston.  

A professor of political science from the University of California, Austin F. McDonald, nevertheless reaffirmed the necessity of cities to maintain modern airports, not only to attract new businesses, but also to keep firms in residence from moving away. McDonald's timely article was written as a

26 Ford Motor Company, Stout Metal Airplane Division, The New Era of Transportation (Detroit, Michigan, 1927), 11.

Simon N. Patten Fellow of the American Academy of Political and Social Science, which had granted him funds for this special research project and printed his findings in its Annals in recognition of the scope of the airport problem and the importance of airfields to modern cities. In spite of the irritating complexities of airport management, McDonald found that the public accepted municipal ownership, and that the chief fields were municipal rather than privately owned.28

The increasingly specialized requirements of operating flying fields are reflected in Civil Airports and Airways, with each chapter written by an expert on various aspects such as runway surfacing, lighting, shop management, and administration. The book itself was edited by a professional consulting aeronautical engineer, Archibald Black.29 As a part of its City Planning Studies, Harvard University published a special monograph on Airports, Their Location, Administration, and Legal Basis,30 and another example of the growing technical literature in this field was a book by Donald Duke, Airports and Airways; Cost, Operation and Maintenance.31 Airports were not always a profitable


29 Archibald Black, Civil Airports and Airways (New York, 1929).

30 Henry V. Hubbard, et al., Airports; Their Location, Administration and Legal Basis (Cambridge, Massachusetts, 1930).

item for a municipality. Encouraged by the Lindbergh boom and spurred by a civic desire to keep up with other cities, Columbus, Ohio passed an $850,000 bond issue in the fall of 1927 for the construction of an airfield to be known as Port Columbus. Port Columbus seemed a likely success because it was one of the terminal points of the combined air and rail service between New York and Los Angeles offered by Transcontinental Air Transport and the Pennsylvania Railroad. Opened in July, 1929, the forty-eight hour trip was not able to offer a considerable time advantage over crack trains, and faltering revenues cracked further under the strain of the depression.\(^{32}\) Although it made no profits, the losses of Port Columbus at least compared favorably with those of other airfields; the field earned fifty-six per cent of its expenses in 1929, and as much as sixty-two to eighty-six per cent in succeeding years. Some American airports, however, not only made their expenses, but even earned a modest return. Cities fortunate enough to have such profitable fields included Newark, Cincinnati, Cleveland, Kansas City, Lincoln, and Salt Lake City.\(^{33}\)

City managers and engineers were not the only persons presented with unique problems brought about by the growth of aviation; insurance agencies had to develop new procedures for underwriting the brand new risks of flying—"a veritable insurance adventure hardly inferior to

\(^{32}\) R. H. Simpson, "Columbus Prepares for Transcontinental Air Lines," American City, XL (April, 1929), 150; Smith, Airways, 144-46.

to that of aviation itself." An Englishman wrote the first aeronautical policy in 1912, and the postwar interest in aviation in the United States caught the interest of several groups. Unfortunately, inexperience resulted in some extremely dangerous ventures that ended in considerable losses, with the result that most companies refrained from issuing any comprehensive policies until the Air Commerce Act in 1926 enforced more stability in aviation. In the meantime, there were other attempts to create reasonable standards. Soon after the war, a group of insurance companies formed the National Aircraft Underwriters' Association, and enlisted the cooperation of the Underwriters Laboratories to open a new department to certify aircraft. Higher quality of new aircraft construction caused UL requirements to be eased around 1923, permitting some planes to be accepted for insurance without the UL certificate. A few companies also paid for the services of qualified aviation engineers to act as underwriters in order to build up expert sections to deal with aviation insurance including fire, theft, and storm as well as public and passenger liability.

Rates were originally high enough to lend credence to the assertion of an insurance magazine that excessive insurance costs were a decisive deterrent to air travel. In 1920 one large company put a limit of


36 "Is Aviation Blocked by Insurance Timidity?" Literary Digest, LXXXVI (September 5, 1925), 62.
$2,000 on the amount of air travel insurance it offered for a duration of one year—and charged $90.00 for each $1,000 of insurance. Three years later, restricted coverage was available to passengers or pilots who engaged in limited flying at a cost of $25.00 per year for $1,000.\(^{37}\) By 1929, insurance for schedule flights could be obtained for $0.75 to $1.50 per $1,000 of insurance, and Pan American included a $500 accident insurance policy in the fare. Some companies offered a special year-long policy for flying travelers at rates of $15.00 per $1,000; Mutual Life covered its regular policy holders with an added premium for occasional fliers; Bankers of Iowa charged no extra premium if a policy holder flew only from time to time; Equitable had no restrictions at all for airline passengers.\(^{38}\)

Some observers blamed weaknesses in insurance coverage on the lack of regulation of aeronautics. The truth was, one critic acidly commented, "any inexperienced pilot with any second-hand plane, who can induce a passenger to go into the air with him is free to do so, a condition unthinkable at sea."\(^{39}\) Actually, American courts of law


\(^{38}\) Alexander Klemin, "American Passenger Air Transport," Scientific American, CXLI (October, 1929), 361; G. L. Lloyd, "Aviation Insurance in America," ICAC, Papers, 93. See also, Joint Committee, Civil Aviation, 160-75; Black, Transport Aviation, 303 ff; Ray A. Dunn, Aviation and Life Insurance (New York, 1930). Dunn's study was written for the Guggenheim Fund.

had begun ruling on aeronautical matters nearly a century earlier, when a balloonist made an unplanned landing in a garden patch. The unfortunate aeronaut was immediately made partner to a suit for damages he had wrought in landing his craft and extricating the wreckage. The gardener won. As early as 1911, Governor Baldwin of Connecticut proposed federal control of aviation in a message to the American Bar Association. Although he failed, soon afterwards Connecticut became the first state to pass aeronautical legislation, followed by Massachusetts. After November, 1918, various legislative proposals circulated in Congress, though none were ever reported out of committees. In 1920 the Conference of Commissions on Uniform State Laws and the American Bar Association cooperated in approving a uniform state law policy and released a joint statement enforcing a program of federal legislation two years later. Federal action, however, failed to follow.

In the face of this inability to achieve any encouraging results, other influential forces were beginning to advocate the idea of federal control of aeronautics. Secretary of Commerce Herbert Hoover convened an air law conference in the summer of 1921. Even though the conference had no immediate results, Hoover's influential position and the identification of the Commerce Department with the idea of legislation was an important development. The highly respected Edward P. Warner emphasized that he did not favor subsidies for aeronautics, although it

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41 Albert E. Blomquist, Outline of Air Transport Practice (New York, 1941), 5.
was imperative to pass legislation for the regulation of aircraft and set up a Bureau of Aeronautics to help pave the way for successful development of American aviation. Air mail, he continued, should be carried by private firms under contract to the government, which should also lay out and maintain a system of regular airways. In addition, said Warner, the government ought to ratify the International Air Law Convention, written at Paris in 1919, "to put us in line with the rest of the world."  

A joint report of the American Engineering Council and the Department of Commerce in 1925 re-affirmed the necessity of American participation in the International Air Law Convention, pointing out that most of the major countries of the world were already members, and further recommended the formation of a Bureau of Civil Aeronautics in the Department of Commerce. In the wake of the controversy over aircraft and national defense centered around Brigadier General Mitchell, the report of the President's Aircraft Board included recommendations which resulted in the passage of the Air Commerce Act in May, 1926, creating an Aeronautics Branch, Department of Commerce, with an Assistant Secretary for Aeronautics, William P. MacCracken.

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43 Joint Committee, Civil Aviation, 99-121.

44 Laurence F. Schmeckebier, The Aeronautics Branch, Department of Commerce; Its History, Activities, and Organization (Washington, Brookings Institution, 1930), 7-9. See also MacCracken, Annals, 118-23; Davis, ibid., 141-50; Smith, Airways, 96-100.
By the end of the decade, the body of laws and regulations of the air was complemented by the creation of the Air Law Institute of Chicago under the auspices of Northwestern University. The plan for such an institute apparently originated with Professor John W. Wigmore, Dean of the Law School at Northwestern. Wigmore was motivated by the desire to make Chicago a more air-minded city, and an occasion presented itself on the impending return of Northwestern's Professor Frederick D. Fagg, who had been an exchange professor at the Air Law Institute of Koenigsberg, the only one of its kind in Europe. Wigmore solicited the aid of a friend, Reed Landis, to encourage Jerry Land of the Guggenheim Fund to support the proposed Institute. Both Land and Harry Guggenheim indicated their interest, and the Air Law Institute was incorporated in August, 1929, with one-third of the initial cost of $35,000 subscribed by the Guggenheim Fund. As stated in the announcement of its opening, the purpose of the Institute was to furnish information on air law in the U. S. and abroad, to build up a library of air law, to publish a journal, the Air Law Review, and to engage in other appropriate activities.

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45 News item from Chicago Daily Tribune, June 12, 1929; letter of John W. Wigmore to Jerry Land, June 28, 1929, in Guggenheim Papers, Box 4.

46 Letter of Reed Landis to Jerry Land, July 1, 1929; letter of Jerry Land to Reed Landis, July 9, 1929, ibid.

47 Letter of Harry F. Guggenheim to John W. Wigmore, July 23, 1929; item from Northwestern University Bulletin, no. 11 (November 11, 1929), ibid.
CHAPTER VIII
DIMENSIONS OF FLIGHT

Critics speculated that the "freedom and exhilaration" induced by travel in the sky would influence art. "Aircraft may carry forward the deep-lying constructive forces that are the essence of real art purpose," intoned one writer. "The aircraft in itself is a stimulating, inspiring thing."¹ Still another critic pondered the effect of aviation on poetry, lamenting that poets seemed to maintain a "respectful distance" in dealing with the machine age—a relatively new phenomenon, after all, with implications for mankind that were sometimes murky. Fortunately, as Babette Deutsch noted, recent work indicated that poets were coming to grips with the problem, proving that it was possible to write unpedestrian poetry about machines. Miss Deutsch cited the poem, "Clouds," by Frank Ernest Hill as a happy example.²

CLOUDS

Earth dies to haze below, the cables sing
The motor drones like some gigantic fly,
A monstrous mound of vapor bathes my wing
And backward with the wind goes sweeping by;
Above the voids white crags go sharp and dim,
Oaks wave, the discs of rootless islands swim,
And arches climb and crumble in the sun
Over gray dinosaur and mastodon.

Earth, dim and fluid, seals the ragged spaces
Where misty islands meet and part below;
Cities that mask eternal hungering faces,
Black wood and water mingle in its flow.
Down, down ten mountain heights beneath this floor
Of marble-smooth and marble-solid air,
The shout and pride of color are no more
Than moon-faint mottlings. Distance does not spare.
They are the clouds now. Icy-lipped I ride
A window-floor immeasurably wide,
Firmer than rooted stone. And through its glass
I watch their formless, sunken shadows pass.

Readers who were not inclined to poetry could avail themselves
of a growing tide of books on aviation. Before 1925, one reviewer noted,
a general survey of aeronautical literature would have been an easy job.
By 1929 a complete survey meant a Herculean task to wade through a
flood of histories, war stories, text books, and just plain propaganda.
Most of the books, the reviewer added, were pretty trivial. 3 On the
other hand, the outlook for book publishers was extremely bright.
Approving notice was made of a statement by Roy Howard, chief of the
Scripps-Howard chain, that stories on aviation, flyers, and flying
commanded more reader attention than any other item his papers printed.
Although the trends indicated that the reading audience was evincing
a higher degree of selectivity, a vast market in aviation literature
still loomed ahead. George Palmer Putnam forecast a decline in the
popularity of individual accounts of long distance records such as
Lindbergh's We, and Chamberlin's Record Flights. The new emphasis was
on adult and juvenile fiction in addition to an increasing demand for

3 Daniel Sayre, "After We the Deluge," Bookman, LXVIII
(January, 1929), 584-87.
textbooks and technical studies. Apparently to a man, every garage mechanic in America decided to catch up in the new field of aeronautics; the Ronald Press reported an unheralded demand for technical books on the subject. Without doubt, asserted a writer in Publisher's Weekly, the hottest subject in America was aviation, and bookstores who failed to take action were missing a "phenomenal opportunity."\(^4\)

For those who could afford it, sport aviation became a growing movement. Flying caught the fancy of the smart set, "taking its place in country life along with other outdoor diversions."\(^5\) As early as 1923, Detroit boasted plans for a thirty-one story Aviation Town and Country Club. In glowing prose, the Club's official magazine described its special aeronautical facilities; the very latest conception, belonging to tomorrow as well as today. The new diversion developed its special brand of literature like the Sportsman Pilot, a magazine of generous format and slick, high-quality pages full of the latest airy gossip. One section featured graceful photographic portraits of leading lady aeronauts to be—"Fair Devotees of Flight." To merit such an accolade, it was not necessary to have a flying license; just to be a candidate.


\(^5\) Lee McCann, "Travel via the Skyway," Country Life, LVI (October, 1929), 98.

\(^6\) Aviation Town and Country Club Magazine, I (December, 1923); ibid., II, (January, 1924), 7.
was enough. In 1929 Aviation Country Clubs were formally organized with a National Board of Governors and a National Committee on Admissions. The Clubs were originally intended to promote aviation in general, but for the most part magazines like the Sportsman Pilot were devoted to matrimonial affairs of the aerial elite and style notes on how the well accoutered aviatrix should appear at the airdrome. The Club did sponsor a national tour by Ruth Nichols, a well known flyer, to publicize the idea of Aviation Country Clubs as a means of promoting aviation. Miss Nichols recalled later that all during the tour, she appeared only in casual hats and dresses to dispel the public's notion that flying was dangerous.

The ability to make a comfortable flight in an enclosed-cabin plane, allowing passengers to travel without irksome flying suits and goggles as Miss Nichols did, suggests the progress of aviation in ten years. In 1919, the noted designer Grover C. Loening had exhorted his colleagues to be "brutally frank" and admit that it was not altogether a pleasure to fly. Loening reminded his associates that there was "a disappointing absence . . . of the sense of buoyant exhilaration which almost everyone looks for on his first trip. Airplanes are very material,"

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7 Sportsman Pilot, I (March, 1929), 11.


9 Ruth Nichols, OHG, III.
he emphasized, "their vibrations are very evident, their grip on the
air almost ferocious, and frequently oil, exhaust, and the cold rush
of air add to a feeling of utter subordination to a mechanical power."
Goggles, helmets, and flying suits were of small help. "The general
nature of flying," he admitted with reluctant candor, "even as a pas­
enger, uses up nervous energy." Nevertheless, Loening added that there
was enjoyment in flying that included the pleasures of magnificent
views from a vantage point high in the air.10

For all of its discomforts, the airplane provided a new per­
spective of the world that was stimulating and exciting. In 1924
Lieutenants A. W. Stevens and John A. MacReady made a photographic tour
of the United States, recording an aerial panorama of America that was
unique for the generation of the twenties. The fliers themselves,
though they failed to record it on film, wrote of the memorable sight
of New York City at night—an awesome stretch of winking lights that
suggested a metropolis burned to the ground, leaving a sea of glowing
embers. The multi-lighted skyscrapers took the form of towering, white­
hot cinders suspended in the dark night sky. In a remarkable series of
portraits, the two fliers presented an entirely new face of America. A
canyon in Death Valley became an abstraction, with an optical trick of
approaching and receding cliff-lines. Sand dunes assumed the graceful,
elegant folds of heavy brocade. From the air, the tailings left from

10 Grover C. Loening, "Making the Airplane a Utility," Society
of Automotive Engineers Journal, IV (June, 1919), 1489.
a gold dredge working in a river took the peculiar pattern of squeezed toothpaste. Farm fields strewn across the landscape suggested a cubist canvas of heroic proportions. The craggy shoulder of a mountain curved upwards to a lofty summit that lost itself in yet another world—a world of the sky's infinite horizon, ethereal clouds and soaring spires in an endless space.

Airline passengers enjoyed plane travel because of the thrill that came from having performed one of man's persistent dreams—flying. They also appreciated the new perspective of the earth afforded by a flying-trip, recalling their impressions with enthusiasm and verve. A flight across the United States was a dramatic reminder of the geographical diversity and variety of America. Travellers who terminated their journey in California were rewarded with a special sight—a sea of color to greet them as they cruised among the clouds above the mountain tops: "Miles upon miles of flowering orchards, filling the valleys and sloping up green hill-sides in a surge of pink and white blossoms . . . here and there foot-hills lying crumpled between drifts of deep-piled velvets and velours, carelessly spattered with petals. Deep greens and light greens, emerald and sea greens, with the rich brown of the earth showing through fields of waving young grain . . . .

We high riders reigned alone in this unreal realm, this sky kingdom, with a hidden world there at our feet."^{12}

^{11} "America from the Air," National Geographic Magazine, XLVI (July, 1924), 84-92.

The dramatic experience of flight made its imprint on the imaginations of professional flyers as well as laymen. An Army Service pilot, recording his sensations during a survey of airmail routes, was particularly impressed by one segment of the trip over an arid district in the West. "The course lay above a country that God had seemingly forgotten," he wrote. "Ugly waterless gullies wandered lost in the cracked and cauterized earth, and the whole bleak, lifeless landscape simmered in the fires of an unconsoling sun. The last outpost of civilization seemed to have receded beyond recall while we hung like a suspended speck, an ineffectual wavering thunder, at the heart of an oppressive mystery."13 He also recalled the sense of disengagement and introspection that took hold of him at certain times in night flights. He seemed to float, like a lost soul, through a dark, uncharted sky marked only by phantom-like suspended clouds and clusters of wandering stars. Experiences like that, he remarked, with a haunting fusion of reality and illusion, had colored his "'sentiment of existence'" in a way that was difficult to define.14 Charles Lindbergh also commented on this sense of solitude and the paradox of this emotion recurring while borne aloft by a creature of the machine age. "I may be flying a complicated airplane, rushing through space, but this cabin is surrounded by simplicity and thoughts set free of time . . . Here, in the Spirit of St. Louis, I live in a different frame of time and space . . . How detached the


14 Ibid., 57-58.
intimate things around me seem from the great world down below. How strange is this combination of proximity and separation. That ground—seconds away—thousands of miles away. This air, stirring mildly around me. That air, rushing by with the speed of a tornado, an inch beyond. These minute details in my cockpit. The grandeur of the world outside. The nearness of death. The longness of life."  

Aside from the drama of flight, more attention was given to the social consequences of rapid airline routes linking all areas of the country. The Independent gave editorial support to an enlarged air transportation system and pointed out that air transport would have the same effect as other rapid transportation in bringing together the respective benefits of rural ease and urban commerce and culture. Following his conquest of the Atlantic, Lindbergh's air tour of the United States once more caused the Independent to predict an even closer feeling of community between the east and west coasts. Eventually, said the Independent, aviation in the form of airmail and passenger transportation would do more than the train, telegraph, and radio to reduce sectionalism in the United States. Aircraft was one of several modes of transportation in the twenties that was binding America more tightly together. Even though its statistical size did not compare to the

15 Lindbergh, Spirit of St. Louis, 227-28.
railroad industry or the revolution wrought by the automobile, its subtle
effects were being felt and recognized. Analyzing the concepts of
"spatial distance" in the journal, Sociology and Social Research, Roderick
McKenzie evaluated the social influences of travel in terms of time and
cost. Although he was mainly concerned with water and rail transport-
ation, McKenzie took time to comment on the potential effects of aero-
nautics. The most important impact on time and distance factors, he
pointed out, had been made by the automobile and the airplane, which had
respectively created new scales for local travel and long distance
travel. As the automobile had helped to erase urban-rural boundary lines
and give rise to metropolitan areas, the airplane promised to have a
somewhat similar effect on a larger scale.18 The newspaper columnist,
Heywood Broun, criticised this trend. Fulminating at the invasion of
privacy by airborne loudspeakers and other aeronautical improvisations,
Broun saw no advantage in further shrinkage of the United States which
would promote even more standardisation and conformity. As to the
enjoyment of flying, there was no beauty in a blurred countryside, he
added truculently.19

Will Durant scorned the critics who wanted to turn back the clock.
That meant a return to the age of cobwebs, bugs, snakes, dirt and chores,
he said, and we need have no more of it. Durant recited a litany of

18 Roderick McKenzie, "Spatial Distance," Sociology and Social
Research, XIII (July-August, 1929), 520, 522.

19 Heywood Broun, "It Seems to Heywood Broun, Nation, CXXXIX
(September 4, 1929), 2hl.
praise for the machines and tools that liberated man: microscopes, radios, tractors, and telescopes. The airplane he regarded as another mark of progress for a better world. Nor was romance lost in the saga of machines. From the dream of Icarus, to the detailed sketches of da Vinci, to the persevering Wrights and the astounding realization of an ageless quest—one could not ask for a more romantic story of achievement. "We move over the land and the air with the freedom of timeless gods . . . ," wrote Durant. "Mere speed is useless: it is as a symbol of persistent human will that the airplane has its highest meaning for us; long chained, like Prometheus, to the earth, we have freed ourselves at last, and now we can look the skylark in the face . . . ."20

The swift, high-flying airplane epitomized the promise of a technological age. As he drove to the airfield to watch the preparations for the 1927 transatlantic flights, Gilbert Seldes followed the highway through a gritty, bleak industrial area, followed in turn by the "tasteless monotony" of colonies of workers' homes. It left him depressed until suddenly he reached the flying field. An airplane, confided Seldes, never failed to take hold of his imagination; his spirits lifted at the sight of a sky alive with aircraft. Each time one rose into the air he always wished he were a part of it. It possessed fragility and grace—and dazzling speed to whisk it over the horizon. A dwindling speck, it turned; a polished surface of the wing reflected a waning ray

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20 Will Durant, "Is Progress a Delusion?" Harper's Weekly, CLIII (November, 1926), 748.
of daylight like a window flaming in the setting sun. An aircraft was an anomaly of the prosaic things of equations, wood, fabric, engine, and gasoline which produced the wonder and thrill of throwing off the bonds of earth. Even when reduced to the dollars-and-cents process of making a living, their nobility rose above the inanity and grossness of commercialism. "There is no ugliness, no monotony, no grasping," explained Seldes. "They represent one of the ideals toward which commercialism and industry and mechanical progress can move; they are a triumph of applied science and a triumph of the human spirit at the same time. Watching them, you can forget mean streets and mean bickerings. Here is something better than machinery and better than man."

Denying the charge that the machine age was eroding the historical skills of the workman, Stuart Chase reminded critics that, even though a certain number of trades were made obsolete, the advance of technology spawned new jobs as it proceeded. Moreover, Chase continued, the personal skills of the workman continued to find a place in the modern age. The aviation technology of the twenties, for example, put a high premium on the craftsman's intimate technique. Building an airplane required the homely vocations of cabinet makers, tinsmiths, coppersmiths, and even seamstresses. The careful work they lavished on each "ship" imparted to it an individuality compounded of skilled craftsmanship, knowledge, and love. In a supreme compliment to these workmen of the

21 Gilbert Seldes, "Transatlantic," New Republic, LI (June 1, 1927), 47.
machine age, Chase commented reflectively, "Somehow they put me in mind of the builders of Chartres." Then he admitted with regret, "It is sad to think of mass production hanging, like a sword of Damocles, above their heads." Even though the skills of the airplane workmen were doomed to give way to the spreading regimen of assembly-line technique, Chase hastened to reassure the pessimists that it was not wise to become too maudlin. In spite of the massive standardization of volume production, modern technology had the promise of producing a sound airplane that was practically proceed and fool proof to boot. Moreover, "a standardized airplane need send no hostages to liveliness." The medium of the sky in which an aircraft functioned demanded the precision of a micrometer and the glossy finish of a buffing tool. It was just possible that these machines could turn out a more appropriate and graceful ship than craftsmen ever could. Individualism? It lived on in an age of power and the machine. The qualities of individualism had not been obliterated, they were recognized now in relation to the machine age. Charles Lindbergh, tending a machine over 3,000 miles of open sea, was so closely bound to his plane that he spoke to audiences not of himself alone, but of "we." He felt a sense of kinship with his plane, said Chase, and people loved him the more for it. Nobody called Lindbergh a "robot." 24

22 Stuart Chase, Men and Machines (New York, 1929), 178.

23 Ibid., 102.

24 Ibid., 144.
The machine was accepted as a child of the new age of technology, the result of the mating of two sciences, theoretical and applied, with engineers acting as godfathers. Lindbergh's flight was interpreted as an aspect of the promise of the machine age, although it had elements of traditional concepts of the American heritage of individualism. Lindbergh epitomized the daring pioneer, striking out alone, an underdog challenging and conquering the hostile elements of nature and escaping the limitations of society. He was the self sufficient individual that had settled the United States, cast in the mold of the independent, moral Yankee character. Lindbergh's flight symbolized individual achievement within the framework of the age of technology. There were new frontiers to conquer in the contemporary world; the challenges of that world were met by man adapting himself to the technological discipline of the machine. Lindbergh's conquest of the Atlantic was a metaphor for the mastery of the complexities of the twentieth century.


26 John Erskine, "Flight," Century, CXIV (September, 1927), 514-15. This aspect of Lindbergh's flight is also discussed by Kenneth S. Davis in The Hero: Charles A. Lindbergh and the American Dream (New York, 1959), 243-44.
CHAPTER IX

INTERNATIONAL SKYWAYS

"We have been speeded up during the last decade by the steamship and the railroad," observed the editor of Aerial Age in 1919, "and the speed that we will realize by the aeroplane air route will bring that comingling of nations we are all striving for, and when we secure it we will have eliminated the greatest barrier to civilization--warfare--and will have closely approached a condition of modern Utopia on this earth." In fact, he added, we will probably have to develop a universal language.¹

As the world entered the postwar decade, partisans of aviation regarded the airplane as a definite factor in promoting international contacts leading to international peace and understanding. Many flying veterans of World War I such as Gill Robb Wilson and Eddie Rickenbacker left the service with a whole-hearted belief that the airplane would become a vehicle to eliminate geographical boundaries and bind mankind together.² "There will . . . be no east or west," wrote an observer, "and with the new aerial age will come a new internationalism founded on speedy intercommunication and good will toward all mankind."³

¹ G. Douglas Wardrop, "War Aviation in Retrospect; Commercial Aviation in Prospect," Journal of the Engineers Club, XXXVI (April, 1919), 147-49.

² Gill Robb Wilson, OHC, I; Eddie Rickenbacker, ibid.

Even though the first airplane flights over the Atlantic were made in 1919, most Americans heard little about the impact of aviation on international relations until the U. S. Air Service completed its globe circling tour in 1924. Lowell Thomas compared the flight to the voyage of Magellan, opening new avenues of commerce and ushering in a new era of civilization binding all nations closer together. In an address to the Franklin Institute in Philadelphia while the flight was in progress, Major General Mason M. Patrick, Chief of the Air Service, remarked that it had more than military significance. Aviation, he said, could also be a great boon to international communications, allowing men from the remote corners of the earth to come together and know each other better. Understanding was the result of knowledge, continued Patrick. Airplanes, the most destructive military weapon ever made by man, could well become important vehicles to promote peace throughout the world. Patrick reaffirmed these sentiments at the conclusion of the flight and continued to emphasize this role of the Air Service and its aircraft in succeeding articles and a book.

4 The Navy Seaplane, NC-1, flew from New York City to Plymouth, England, via Newfoundland, the Azores, and Portugal, May 16-27, 1919; the British Vickers bomber flew nonstop from Newfoundland to Ireland, June 14-15, 1919.

5 Lowell Jackson Thomas, The First World Flight (Boston, 1925), 3.


7 Mason M. Patrick, "The World from Above," Aero Digest, VI (January, 1925), 14-16, 47; Mason M. Patrick, The United States in the Air (Garden City, 1928), 126-27 passim.
The airplane became a symbol of a new human spirit of internationalism. This was the aspect of Lindbergh's flight that impressed Harry Guggenheim most of all. "No appeal of science to man's reason could have accomplished in a period of years what Charles Lindbergh's appeal to heart and imagination accomplished between the dawn of May 20th, and the night of May 21st," he wrote. "The world was impressed with the significance of the airplane not only as a lessener of the distances between the habitations of men, but between the minds of men as well."

Writing for the Review of Reviews, J. J. Jusserand, the French ambassador to the United States from 1902 to 1925, remarked on the wild acclaim and unabashed joy with which the clannish Parisians welcomed Lindbergh as one of their own. On this occasion, Jusserand recalled some thoughts expressed in an essay by the famous chemist Marcelin Berthelot just before his death in 1907. Of all the inventions destined to make great changes in the world, Berthelot had written, surely one of the most significant was the airplane. In the mastery of the air, there would be no more frontiers to separate nations. Just so, said Jusserand; Lindbergh and the Spirit of St. Louis had inaugurated a new state of human relations.

Myron T. Herrick, the American Ambassador who received Lindbergh in Paris, commented particularly on the feeling of international goodwill generated by Lindbergh's flight over the Atlantic

8 Guggenheim, Seven Skies, 68-69.


10 Herrick described these feelings in the "Foreword" he wrote for Lindbergh's We, pages 5-12, especially page 10.
a feeling so strong that it affected negotiations between the United States and France which led to the conclusion of the Kellogg-Briand Pact of 1928.\textsuperscript{11}

The flight of the \textit{Spirit of St. Louis} colored American relations with other European countries as well as France. Lindbergh's rapid tour of European capitals and his exposure through the European press corrected the image of "Uncle Shylock" that was not compatible with this appealing, forthright, competent young man. Successive trans-Atlantic flights improved the situation. Clarence Chamberlin and Charles Levine, landing their Columbia propitiously near Martin Luther's home at Eisleben helped heal the scars of war between the United States and Germany.\textsuperscript{12} David Lawrence, a foreign correspondent for Consolidated Press, reported that the Germans were highly complimented by the route chosen by Chamberlin and Levine; German public reaction was surpassing the French reception of Lindbergh. The Berlin \textit{Allgemeine Zeitung} approvingly acknowledged the feeling of good will apparent in the wake of the Chamberlin-Levine flight, and the \textit{Tageblatt} conjectured that, as space was so easily negotiated, it was presumable to expect more and more national barriers to go down. "The ethereal bridge traversed by the


Columbia thus is certain to become a span of peace between nations," said the editors. 13

E. W. Burgess, a professor of sociology at the University of Chicago, has noted that the first pre-meditated project to promote international friendship through aviation was Lindbergh's South American tour in 1928. 14 Dwight Morrow, the American ambassador to Mexico, had been searching for some action to improve Mexican-American relations which had been recently brought to a low ebb by the possibility of American intervention. Morrow had been impressed with the electric effect of Lindbergh's Atlantic flight on Franco-American relations. When Lindbergh returned to this country, Morrow spoke to him about a similar flight to Mexico. 15 Lindbergh was indeed interested. He already had an urge to fly through South America for the enjoyment of it, and he was intrigued by the prospects of pioneering a route for future air lines through the area. His plane and its engine were still in fine shape after his transcontinental American tour. When Morrow's influence finally resulted in an invitation from Mexican President Calles, Lindbergh accepted at once. 16 On his arrival, December 11, 1927, Mexico welcomed Lindbergh

13 Cited in "America and Germany Reunited by Air," Literary Digest, XCVIII (June 18, 1927), 5-7.


like a national hero. In a remarkable gesture of esteem originally reserved for native Mexicans of extra-ordinary attainments—and never foreigners—the Mexican Chamber of Deputies convened in "solemn session" to receive the American visitor. Charles W. Hackett, professor of Latin-American history at the University of Texas and an experienced observer of Mexican-American affairs, characterized Lindbergh's visit as "the capital event in the development of Ambassador Morrow's new diplomacy." Lindbergh proceeded to embark on aerial odyssey through Central and South America, making one triumphal entry after another in thirteen capitals. Climaxing a two month tour, he arrived in Havanna, Cuba, February 8, 1928, to appear before a session of the Pan American Congress. Dispatches from correspondents of the New York Times all along the route testified to the emotional response to his trip which helped create a tremendous feeling of good-will towards America and aroused a new interest for South America in the United States.

17 Charles W. Hackett, "Success of Lindbergh's Good Will Mission to Mexico," Current History, XXVII (February, 1928), 727-29. Morrow had adopted a very fruitful attitude of friendship, respect and trust towards the Calles government. Another of his moves was to invite Will Rogers, who was still in Mexico City at Lindbergh's arrival.


19 "Southward Air Trade Outlooks," Outlook, CXLVIII (January 18, 1928), 98-99; "We Discover Central America," Review of Reviews, LXXVII (February, 1928), 111-13. The same issue carried a number of cartoons from sources across the United States that supported Lindbergh's South American flight on pages 134-35.
Returning from the Pan American Conference, Charles Evans Hughes warned an audience at Princeton that U. S. relations with Latin America were facing increasing difficulties because of increased contact of European and South American statesmen in the League and World Court. Although Hughes qualified his remarks as being "nonpolitical," he nevertheless proceeded to suggest the future value of aviation in redressing this balance of relations. He pointed out that air lines from the U. S. to South America were more practical since there were no interminable stretches of open-ocean flying that made transatlantic routes so hazardous. Modern developments meant that old barriers were falling to "create a new feeling of intimacy among the American states." Aviation, Hughes continued, should cause Americans to look for a more "realistic conception of our relations to the American states and our duties and privileges." Other observers also called attention to the role of aeronautics in promoting amicable relations with South America and added that it could serve our national interest at the same time.

From the first, South America seemed a likely field for the use of aviation because of the propaganda value of aeronautics in spreading proof of technical ability and prestige in general. This was especially true of European governments. As aviation developed, however, airlines were looked upon as extremely valuable weapons of commercial competi-


ation, and Americans took alarm at European airline development in South America. Senator Ransdell of Louisiana began agitating for airmail routes to South America as early as 1925. He was interested in the business value to his own state, but his correspondence with other individuals indicated an awareness of the commercial possibilities in various quarters. The Bureau of Foreign and Domestic Commerce of the Department of Commerce noted the increased speed of business correspondence as a valuable asset in foreign trade, and a St. Louis businessman spelled out the definite advantages of airmail to facilitate handling of small cargo shipments. Publicity generated by various long distance flights and Lindbergh's South American tour focused even more attention on the business prospects of aviation. An extensive correspondence by air was not required to maintain established trade lines of sugar and coffee, but it was necessary to open new markets and speed up business transactions concerning other types of goods. The time advantage of airmail would give the United States a tremendous advantage over European competitors.

Herbert Hoover was an important figure in the development of commercial relations and subsequent aerial links to South America. During


his term as Secretary of Commerce, disbursements for the promotion of foreign commerce in South America increased from $30,000 to $338,000. Hoover's endorsement of airline routes to South America was emphasized during his South American tour as President-elect. Hoover assumed the Presidency at a peak of investment activity in South America. Billions in loans were being made to South American governments and American investment bankers liked the idea of improved communications to an area where the United States was competing with the Germans, British, and French. Among the backers of the New York, Rio, and Buenos Airline (NYRBA), were two men deeply involved in South American trade, James Rand of Remington Rand, and Lewis Pierson, of the Irving Trust Company. The chief agent of aerial commerce to South America, however, was intended to be Pan American Airways, since six of the first seven South American airmail contracts were awarded to it in 1928 and 1929. The seventh went to Pan American-Grace Airways, whose stock was evenly divided between Pan Am and the W. R. Grace and Company steamship line.


27 Matthew Josephson, Empire of the Air; Juan Trippe and the Struggle for World Airways (New York, 1944), 43-45, 71.

28 Burden, 24-25.
When Pan Am began operations on October 27, 1927, from Key West to Havana, company officials acknowledged the encouragement given them by Hoover as Secretary of Commerce. The original route was only 110 miles, but with good management, as well as a virtual monopoly on foreign airmail contracts, the company's route mileage soared. On January 1, 1929, Pan Am covered 261 miles, grew to 5,275 miles by March, and expanded to 11,075 by August with 4,500 more miles to be added soon. In the first six months of 1929, Pan Am flew 1,000,000 miles, carried 7,000 passengers, and delivered 250,000 pounds of mail with an efficiency average of 99.85%--the highest of any American carrier. Pan Am was not just an air mail route. In an area of primitive land transportation and intermittent sea transport, the ability of the air line to save days and even weeks of travel made it a vital element in a new era of commerce. The trip from Miami to Santiago, Cuba was reduced by thirty-three and a half hours. Panama could be reached in two days instead of twelve. Mail to Chile was delivered in nine days as compared to twenty; the three and a half week ordeal by boat and burro to Tugucigalpa, Honduras, could be made in a day and half by air. Two years after commencement of operations, Pan Am had advanced from a 110 mile shuttle service to become an international carrier delivering passengers, mail, newspapers, and government correspondence to twelve countries over a


30 Earl Reeves, Aviation's Place in Tomorrow's Business (New York, 1930), 118-20.
route that tied together two continents. During the depression, Pan Am’s business continued to rise. Its gross revenues climbed 150% from 1930 to 1934, permitting Pan Am to retire its debts and still show an annual profit of $1,000,000. In 1930 only 3% of the correspondence to Latin America (excluding Mexico and Cuba) went by airmail, but by 1939 the figure had risen to 16.5%.

International airline routes between the United States and other countries brought into sharper focus the unresolved problems of international regulation raised at the Paris Peace Conference in 1919. Pleas for American cooperation in international aviation were heard throughout the decade. In spite of the advice of influential men and organizations, the United States refused to sign the International Air Convention of 1919. The spectacular Lindbergh and Chamberlain-Levine flights in 1927 raised new questions about the international control of aviation


32 Josephson, 78.


34 George H. Houston, "Aeronautics, International Aspects, National Control, Commercial Development, etc.," Society of Automotive Engineers Journal, VI (May, 1920), 293.

35 See above, Chapter VII, 1114-15.
and new aerial conquests in 1928 increased the recognition of aviation as a factor in international relations. Lindbergh's South American tour, the Arctic flights of Wilkins, Zeppelin passenger trips over the Atlantic, the transatlantic flight of the German monoplane Bremen, the world flights of Australia's Kingsford-Smith and the Frenchmen, Coste and Le Brix—all underscored the necessity to reach agreement on the world wide scope of aeronautics.  

The United States had already made a start along these lines in signing the Pan American Convention on Civil Aviation at Havana on February 15, 1923, seven days after Lindbergh landed in the city at the end of his thirteen nation circuit of South America. The Pan American Convention included agreements on the sovereignty of air space, registration, inspection, and related matters. 37 America evidenced a growing awareness of international aviation when Congress passed a joint resolution authorizing President Coolidge to issue invitations to foreign governments to convene in Washington for the purpose of exchanging views on various aspects of aviation in honor of the twenty-fifth anniversary of the Wright brothers' flight. The International Civil Aeronautics Conference in Washington, December 12-14, 1928, was attended by official delegations from thirty-nine countries as well as a large number of representatives from government agencies, societies,  


37 The text of the Convention can be found in Colegrove, 173-82. Limited navigation agreements were signed with Canada in 1929, as well as airmail agreements with Austria, Germany, and Belgium. Ibid., 234, 226.
trade organizations, and business. The conference was an auspicious gathering, a milestone in international aviation, and it had a great propaganda value. A total of ninety papers, many of much merit, on a wide variety of subjects created a fund of valuable literature. Unfortunately, nothing concrete in the way of international regulation resulted from the meeting. Problems of regulation of military flights, crew standards, emergency rescue and signal procedure and the field of American-European flights remained unsolved. The United States did not enter into any meaningful international control of aeronautics until 1947 when President Truman signed the agreement creating the International Civil Aeronautics Organization.

Reassessments of aviation at the close of the twenties included a realization of the problems of national security posed by aviation, as well as its promise as a vehicle of peace. After the successful bombing tests in 1921 which sank the German cruiser Frankfort and the battleship Ostfriedland, Billy Mitchell continually argued his theories on aerial warfare in magazines and books. "The former isolation of the United States is a thing of the past," he warned in Winged Defense. The protection of the Atlantic and Pacific had vanished with the advent of aircraft possessing speed and range to make the entire country vulnerable to planes. They did not have to pierce any coastal barriers or fight any preliminary skirmishes to force their way into a strategic pass; the whole continent, with its industries and population, lay

38 ICAC, Proceedings, 1.
Mitchell's warnings, unheeded by many, seemed more credible after the flurry of long distance flights in 1927 and 1928.

After Lindbergh's transatlantic crossing, the New Republic commented on the fact of so many leading authorities agreeing that future wars were to be won by controlling the air and agreed that aeronautics should be supported for reasons of national defense. Stuart Chase adopted a somewhat paradoxical and fatalistic point of view concerning the role of the airplane and the hope for a peaceful world. Men and Machines included a chapter on "The Two-Hour War," which was an account of the existing capability of an aerial armada to liquidate whole nations by means of chemical bombs dropped from planes. Planes offered a virtually fool-proof delivery system, Chase said, because enough of them were bound to be able to penetrate anti-aircraft and other defensive systems to create a wasteland. Cost was not a prohibitive factor either, since airplanes were comparatively cheap. It was possible to build a fleet large enough to do the job without breaking the national budget. In one last burst of malign optimism, Chase saw a ray of hope in the event that two opposing nations or coalitions should liquidate each other in a future war. As the surviving non-combatants viewed the fait accompli, "the neutral world will be in a sufficient state of shock to see that this sort of thing must stop. Forever. The surviving West," reasoned Chase, "together with the East, will then ban the machine


(airplane) from war—which means, of course, the banishment of war.

. . . . Or so the conclusion hangs, neatly balanced between the hope and the belief, within my mind.\footnote{11}

Heywood Broun also expressed regret that the primary importance of the airplane remained its use as a weapon of destruction in war.

"At the moment the score stands against the new invention," Broun said. "There is blood upon the fuselage." Yet some positive aspects of aviation offered encouragement for the future. "It would be silly to deny that the airplane may serve to enrich life and living," Broun continued. "It can wipe out boundaries and mountain chains for warlike purposes, but this same conquest of the wide spaces could serve to emphasize a feeling of international solidarity. The vision of a united world is no longer fantastic . . . . In another century there will remain no such thing as an isolated people." The problem was that political theory lagged behind technological progress. America's "cornfed statesmen" were behind the times when they invoked Washington's farewell address to justify a position of isolation. Broun suggested calling a holiday in technological progress until the politicians were able to catch up.\footnote{12}

Broun's opinion about the positive effects of aviation was probably shared by most people at the end of the twenties. As Harry Guggenheim expressed it, the geographical barriers of rivers, seas, mountains, and deserts separating the peoples of the world had been eliminated by

\footnote{11}{Chase, Men and Machines, 307-17.}

\footnote{12}{Heywood Broun, Nation, CXXIX, 241.}
aircraft, giving mankind a new freedom that erased the misunderstandings and prejudices undermining human relations.43

In 1930 the Aero Educational Research Organization named Warren Jefferson Davis's *Air Conquest* the best contribution to aviation literature in the preceding year. The editorial board wrote that it had been impressed by the way Davis had presented aviation against "a background of idealistic purpose—the opening up of a new international horizon through the breaking down of national barriers."44 One of the key themes of Davis' book was his reflections on the nature of European airlines—especially German ones. Recognizing the extent and international coverage of German air routes, he scoffed at the idea that they would ever be used for aggressive purposes. Building them up, said Davis, had taken too much sacrifice and energy. Germany would never countenance the possibility of seeing them destroyed by war.45 At any rate, the role of aircraft in blurring national boundaries and nationalities was creating international good will that would last forever. An air trip over the European continent mingled people of all nationalities; looking down from the speeding plane, everyone could very clearly see the close relationships of countries and the interlocking diversity of European resources, transportation, and industry. Aviation made an

43 Guggenheim, *Seven Skies*, 11-12.


45 Ibid., 223.
anachronism of boundaries and prejudices. Furthermore, he added, when he had commented on this fact to his fellow passengers, they all agreed with him. Davis asserted that the years 1928-1929 had been the pivotal stage when the concept of aviation had changed from one of war to one of peace, and expressed the opinion that commercial airlines to the Orient would serve to reduce the tensions between America and Japan.

For writers concerned with aviation, the constant theme was the effect of speed in transportation and communication. One of the chapters of Hornell Hart's Technique of Social Progress (1931), was entitled "Indexes of Technical Mastery." To show what he meant, Hart included a chart to portray the rate of increase of communications and the effect on civilization from 1900 to 1929. Hart added a figure-curve showing miles flown on air routes to dramatize the downward curve of railroad passengers caused by auto and plane travel. An important aspect was his analysis of the progressive shrinkage of the world caused by transportation—from Magellan's 1,090 days to circumnavigate the globe in 1522, to the German Graf Zeppelin's twenty-one in 1929, to Wiley Post and Harold Garry's nine days by airplane in 1931 (actually eight days, fifteen hours, and fifty-one minutes). These achievements in transportation promised a tremendous rate of increase in communication. "Communication is the very life blood of culture itself," Hart declared.

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\[\text{Ibid., 93-95.}\]

\[\text{Ibid., 222, 230.}\]
"If technological progress has stimulated communication, it has facilitated that collective functioning through which the life of the individual expands into world-wide sweep." In effect, the late twenties and early thirties marked the transition of civilization into the air age world.

The universal sky destroyed the traditional geography of time-distances influenced by land and sea barriers and required a new type of air age map. Two-dimensional maps had inherent limitations as to true shape, size, direction, and distance. Some of these aspects were necessarily distorted in order to obtain the advantages of others, for each map had its special advantages when designed for a particular need. The Mercator map was highly useful for a mariner in charting one or a series of straight line courses. For an ocean basin geography, the Mercator map was an admirable navigational aid, but it was not suited to the navigational capability of aircraft whose straight line courses were not limited to the availability of a navigable body of water. One of the most suitable maps for the air age was the azimuthal (directional) equidistant map, in which parallels appeared as equally spaced circles along the meridians, as in the familiar polar projection. On such a map, all air routes from one city to another are straight lines with their true directions preserved. To travel from Los Angeles to Moscow, a plane would not fly east, as one would suppose from a Mercator map, but north over the Arctic. This fact dramatized a new element of geo-

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graphical relationships brought about by the air age. People who were accustomed to thinking in geographical conceptions based on a Mercator map considered Los Angeles to be closer to Rio de Janeiro than to Moscow. Air age geography put the Russian capitol closer to Los Angeles and forced a reconsideration of the importance of Alaska and the Arctic. In 1925 the geographical implications of aircraft were recognized and treated by A. P. Berejkoff, a radio engineer for General Electric, in an article appearing in *Aviation* magazine. Berejkoff called his map the "equidistant zenithal projection," resembling the standard azimuthal equidistant map in theory and appearance. Air transport lanes of the future, he pointed out, would follow a "great circle route"—a point worth noting because such a route usually came close to the Arctic.

As early as 1912, the Arctic's commercial significance for the air age occurred to Vihljalmur Stefansson. He first publicly expressed this idea six years later during a talk to visiting European businessmen in New York City. Stefansson's concept was explicitly set down in the National Geographic in 1922. "The map of the Northern Hemisphere shows that the Arctic Ocean is a huge Mediterranean," he explained. "It lies between the continents somewhat as the Mediterranean lies between Europe and Africa. In the past it has been an impassable Mediterranean. In the near future it will not only become passable, but will become a

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51 Vihljalmur Stefansson, *The Northward Course of Empire* (New York, 1924), 111.
favorite air route between the continents." 52 Stefansson stressed the fact that trans-Arctic aviation and great circle routes would be a significant link between large cities of the modern age which were more and more concentrated north of the Tropic of Cancer. 53 The importance of the Polar Mediterranean described by Stefansson came to have a political, as well as commercial, significance. Thirty-five years later the geographer Hans Weigert commented, "we are still struggling to grasp the changes which Polar aviation has caused in the locational relationships of the powers of the East and West, by turning the Arctic Mediterranean and its frozen lands into a pivot area and strategic center." 54

By 1929, it was necessary to consider the entire globe from a new standpoint of air age geography. All inhabited parts of the earth were affected by the "shrinking world" brought about by faster ocean travel, the development of the railroad and the automobile, and accelerated by the airplane. The airplane especially altered the significance of old routes of communication and prompted the need to consider the relationship of continents in the new light of the air age.


Advocates of aviation who were shocked at the harsh demonstration of aviation's potential in World War I were gratified by the practical application of aircraft to a multitude of peacetime uses. Although aircraft did not entirely displace older methods of performing various tasks, many jobs were completed with greater dispatch and increased efficiency on a larger scale, as in agricultural dusting and aerial surveys for hydroelectric projects. Aviation provided a more comprehensive framework for the approach to projects in regional planning and promoted a wider view of business programs.

Aircraft affected the pace as well as the scope of life. The speed of airmail and a rising volume of air cargo were new factors influencing the tempo and organization of commercial activity, continuing a trend toward decentralization. In comparison with railroad passenger travel, Recent Social Trends noted that air passenger statistics in 1930 were "inconsiderable," although the study pointed out that "the rapidity of growth in air travel is significant for what it may forecast." Moreover, the factors of cost and safety, which had been hindrances to air travel in the past, were definitely improving.¹ Even

¹ President's Research Committee on Social Trends, Recent Social Trends in the United States (New York, 1933), I, 183-84. Railroads covered 26,875,512,000 passenger miles in 1930. Airlines, on the other hand, did not even reach the mark of 200,000,000 passenger miles until 1933. Ibid., 169; U. S. Bureau of Air Commerce, Aeronautics Bulletin, No. 1 (April 1, 1934), 4.
though the passenger statistics for scheduled airlines were modest, the patrons of the airlines were often key executive personnel; this aspect of commercial aviation undoubtedly had a greater significance than suggested by the figures. Private business flying also had an important bearing on the conduct of business although definitive statistics in this area are virtually non-existent for the twenties.

The development of the aviation industry created new jobs and new challenges of administration and regulation. Aviation influenced such diverse fields as medicine, meteorology, and mechanics. Thoughtful observers like Stuart Chase considered aircraft as an encouraging example of the new technology—workmanlike, efficient, and graceful. Flight—a delight in itself—broadened the dimensions of man's experience and imagination. Heywood Broun echoed the hopes of many when he spoke of the role of aviation in promoting a new spirit of international good will.

From 1919 to 1929, American aviation progressed through the pioneering era, establishing the pattern of aviation's impact on industrial utility, commerce, communication, travel, geography, and international relations. The first decade after World War I was the prelude to the air age. In 1929 aviation was poised at the threshold of a new epoch.
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