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# An analysis of the economic factors governing route structure in the air transportation industry

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BOSTON UNIVERSITY

GRADUATE SCHOOL

Thesis

AN ANALYSIS OF THE ECONOMIC FACTORS

GOVERNING ROUTE STRUCTURE

IN THE AIR TRANSPORTATION INDUSTRY

by

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(B.A., Louisiana State University, 1945)

submitted in partial fulfilment of the

requirements for the degree of

Master of Arts

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## INTRODUCTION

This work is designed to give a simple, brief, but reasonably comprehensive picture of each of the economic factors underlying the location of routes in the air transport industry. It proceeds on the premise that there are certain basic factors -- economic and otherwise -- which have been and will continue for a while, although in varying degree, to be influential in the air transport pattern.

The selection of factors is the result of careful examination of local, regional, and international air service networks.

As each segment of the air transport pattern is generally attributable to not one but several elements together contributing toward the selection of that route, the task of this thesis is to isolate each factor and to present it clearly by itself.

In attempting this, I have selected examples of routes the locations of which are due largely, if not entirely, to the influence of the factor being considered.

The material has been divided into four major sections, each treating a different class of economic factors. The first deals with the physical cause of aviation routes, namely, surface configuration.

The next part considers the demand factors. Types of air service demanded -- mail, passenger, and freight -- the basic factors creating demand for these services, and the factors facilitating the creation of this demand are discussed. The demand-creating factors are industry, military and political considerations, and raw materials. Those conditions -- economic,



political, and otherwise -- which facilitate the creation of demand for air transport are stage of economic development, other transportation facilities, availability of capital, state and national capitals, and raw materials.

A psychological analysis of the air route determination constitutes the third section. Here the influence of established travel lines on air route network and the consequent concentration of air routes is discussed.

Finally, operational factors governing the structure of aviation routes comprise section four: distance, size and type of equipment, amount of traffic available, frequency needed, and cost.

With the exception of military lines, maps and cited statistics of routes pertain only to scheduled airline operations already in existence. Unscheduled chartered flights have been ignored because of the absence of statistics concerning them and because of their minor importance in international traffic. Nevertheless, it is evident that largely the same economic factors govern the organization of their routes.

The traditional approach to the subject of aviation routes has been an inductive approach based upon the empirical analysis of the air transport industry.

Writers have drawn conclusions as to what constitute the factors governing route structure by observing the experience of this industry in the allocation of routes. Reasons advanced by the different national governments for the certification of certain route operations deemed necessary for the public or national welfare have been the bases of these conclusions.

An attempt has been made in this paper to determine additional factors influencing air route location.

Considerations of surface configuration, other transportation facilities,





the availability of capital, the size and economic development of nations, and established route patterns, although not so evidently determining elements in the air route pattern as some of the demand-creating factors frequently pointed out in the hearings of the United States Civil Aeronautics Board, are, nevertheless, factors which have understandably affected the existence and location of air routes.



PART I

PHYSICAL FACTORS



## 1. SURFACE CONFIGURATION

It is generally understood that air transportation overcomes natural obstacles to communication among nations. This is true in an ever-increasing degree as more nations and world areas begin to capitalize upon the inherent flexibility of modern air transportation.

Air-age apostles see the world on a globe completely lacking in conventional land markings. Only cities, as potential harbors for air transport, are shown on the sphere.

Surface configuration is rapidly ceasing to be the hazard it was to the planes and flyers of the immediate past. The technological improvements in flying and airway equipment are increasing the range and safety of flying to the point where previously unsurmountable surface obstacles are becoming of less and less importance.

Concerning this factor of surface configuration, one writer has said: "Notice how little the routes through the air-ocean are influenced by the factors that determine the paths of surface transportation. Mountains are no problem; the Alps, which cost Hannibal a year of his Roman campaign and decimated his forces are crossed by air almost hourly even today. Natural harbors are not essential to even the flying boat type of aircraft; only a single strip of protected water is needed, and that, as our patrol boats in the South Pacific have learned, can be built by a handful of men in a matter of days.

Even the existence of tropical or arctic weather is no barrier to an airplane operating four or five miles off the earth's surface where the



temperature always hovers below zero....The fairly narrow tropical hurricane belts and certain polar areas"<sup>(1)</sup>...are the only barriers to air transport.

The crossing of the "hump", the Himalaya Mountains, in India and Tibet by our air forces during the second World War was a tremendous stride in reducing the value of physical barriers as such. In Spain, the Pyrenees have not remained an obstacle to direct air connection between that country and the rest of Europe. The high Rocky Mountains along the west coast of North America are being flown over regularly and frequently by the three transcontinental airlines of the United States — United, Transcontinental and Western Air, and American — as well as by Western Airlines and several other domestic lines. Although accidents over mountain ranges by commercial and military transports are not rare phenomena, they nevertheless have not been of frequent occurrence. Poor visibility has been a large causal factor here.

Even the rugged Andean mountain chain in western South America is ceasing to tie air network to the coastline. The first air route crossing of the Andes was inaugurated by American and British lines between Santiago, Chile and Mendoza, Argentina where the mountain range is relatively narrow. Now there are lines crossing the ranges, fully or in part, from several different places along the west coast. (See Map I.) Especially complete networks of commercial air lines are found in mountainous regions of Colombia where much of the population is situated in nearly isolated deep valleys.

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(1) Cleveland, Reginald M. and Neville, Leslie E., The Coming Air Age, McGraw Book Company, Inc., 1944, pp. 43-44.





RELATION BETWEEN SURFACE CONFIGURATION AND AIR TRANSPORT ROUTES

COMMERCIAL AIR ROUTES ACROSS AND ALONGSIDE HIGH RUGGED MOUNTAINS OF WESTERN SO. AMERICA  
DECEMBER, 1942

MAP I



SOURCE:  
THE STRUGGLE FOR AIRWAYS  
IN LATIN AMERICA  
WILLIAM A. M. BURDEN - COUNCIL ON FOREIGN RELATIONS - NEW YORK,  
1943 - MAPS II & XI, PAGES 3 & 245.

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On the other hand, it cannot be denied that these ranges have had a restraining effect in the past on the development of air routes in this region and have influenced the pattern of air as well as surface transportation. Within the continent of South America ground and air communications have hugged the coast while much of the interior has remained relatively "untouched" by highways or airways.

This patterning after surface transportation has technical as well as economic explanations; early planes were severely restricted in range, traffic volume was small, and airport and airway facilities were hard to establish and maintain off the established surface lanes of travel. (1) In addition, the relatively small population and undeveloped country of much of the interior of South America have not been factors to create demand for air service in that region.

Large expanses of water no longer influence the direction and extent of our international air routes. In May, 1939, Pan American Airways inaugurated transatlantic scheduled services from New York to Europe. Its transpacific service extends from San Francisco to Hongkong. The feasibility of a shorter commercial air route to the Orient was proved recently by the first non-stop flight from Honolulu to Manila. A member of the Pacific Air Command piloted a superfortress on the 5,525 mile trip. (2)

The frozen Arctic Ocean is impassable to land and sea forces. Aircraft, however, can fly over it. The proximity to it of the great powers indicates the importance of air routes over this enclosed sea.

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(1) Van Zandt, John Parker, The Geography of World Air Transport, Vol. I, The Brookings Institute, Washington, D.C., 1944, pg. 38.

(2) Boston News Bureau, April 2, 1946, pg. 3.

1. *[Faint, illegible text]*

2. *[Faint, illegible text]*

3. *[Faint, illegible text]*

4. *[Faint, illegible text]*

5. *[Faint, illegible text]*

6. *[Faint, illegible text]*

7. *[Faint, illegible text]*

8. *[Faint, illegible text]*

9. *[Faint, illegible text]*

10. *[Faint, illegible text]*

These long over-water hops have been a recent development, and long non-stop flights in particular. The carriage of sufficient fuel for non-stop flying over great distances was a problem which had to be met before such services could be inaugurated. Thus, until recently, over-sea air routes were determined largely by the location of islands or land areas scattered along the way which could serve as airports or refueling stations.

For this reason, aircraft in scheduled service have not normally flown "great circle" courses, which we hear mentioned so frequently, but instead have flown from airport to airport along established airways. Intermediate islands with the airports that have been so essential for economic operation are far off some "great circle" routes of prime importance.

Planes with fuel capacities large enough for non-stop flights are yet expensive not only to construct, but also to operate. Higher fares are in order, since the pay-load capacity is necessarily reduced. Nevertheless, there are several fairly long non-stop routes over water, either in existence now, or proposed, including Newfoundland to Spain; Natal, Brazil to Dakar, Africa; Boston to Dublin; New York to London; and Adak, Aleutian Islands to Tokyo, Japan.

On the other hand, short over-water hops -- flights between two cities close to the water or flights between two nearby land areas as such -- have never had a restraining hand on over-water air route structure. The Key West to Havana, Buenos Aires to Montevideo, and Vancouver to Victoria hops as well as the several flights across the English Channel between British Isles and the European continent are as natural routes

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as those over inland lakes, rivers, and bays.

It is very evident that the configuration of the world's surfaces was, in the past, an important factor in the patterning of our national and international air services. Many of our present-day routes were placed where they are in order to avoid the barriers of jungles, swamps, mountains and relatively long non-stop distances over water. The configuration of the world's surfaces is no longer an important consideration in the formation of the world air network, and, in some parts of the world where technological improvements in aviation are being put into use, it may be given little or no consideration.





PART II

DEMAND FACTORS



## 1. TYPE OF SERVICE DEMANDED

The existence of a demand for air service, whether motivated by social, economic, or military considerations, is obviously indispensable to the inauguration of aviation routes. The demand factor may be analysed best by classifying it first as to types of service demanded and then as to the nature of the factors creating the demand. This first classification will be discussed in this chapter; the latter is reserved for Chapter 2.

Three types of service are demanded of and offered by the air transportation industry: mail, passenger, and freight. The carriage of mail was the initial job of the airlines. Thenceforth, air transport has developed principally as a passenger service.

The early pattern of airline routes and service were influenced largely by the flow of mail between great population centers. In fact, serious air transportation was begun in the United States as a result of "the spontaneous attraction of the airline and the Post Offices for one another."<sup>(1)</sup>

In 1919 the Post Office began its first operation of air mail service between New York and Washington, D.C., and in 1926, succeeded in inaugurating a transcontinental night and day air mail service from New York to San Francisco, "one of the Post Office Department's greatest contributions to commercial air transportation."<sup>(2)</sup>

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(1) Frederick, John H., Commercial Air Transportation, Richard D. Irwin, Inc., Chicago, 1945, pg. 6.

(2) Ibid., pg. 8.



The time consumed in getting the mail to the Long Island landing field and to the Washington Post Office in the operation of the New York to Washington route gave this mail service little value as such. Thus, a demand<sup>(1)</sup> motivated by economic considerations was not yet existent at that time.

Today the incentive for air mail operation is largely economic but also political and military. Governments in authorizing air service deliberate upon its effects upon the postal service as well as upon commerce and political matters. In the United States, the Civil Aeronautics Act of 1938 directs the Authority to regulate the air transportation industry in such manner as to assure the sound development of an air network to meet postal needs. The inauguration of international air service in particular necessitates consideration of the postal, commercial, and diplomatic relations between home governments, and far regions to which routes are to extend.

The airplane has proved to be a competitor of both telecommunications and shipping in the transmission of communications, but there should be a tendency toward the elimination of this latter competitor in this field in the event that the program of long-haul air postal service for all first class mail at three cents an ounce is adopted.<sup>(2)</sup> The Post Office estimates that the volume of mail carried by air under this program will be ten times<sup>(3)</sup> that of today.

In spite of the prospects of a large volume increase in air-borne mail, air mail routes probably will continue to follow passenger routes, as most of them do at the present time. Mail service is certain to grow, but main-

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(1) Kennedy, Thomas Hart, An Introduction to the Economics of Air Transportation, The Macmillan Co., New York, 1924, pg. 34.

(2) New York Times, March 15, 1946, pg. 1.

(3) Boston News Bureau, March 18, 1946, pg. 10.



ly on the existing long-haul routes. There are many airlines over which mail alone is carried, but generally their existence has been due to their potential passenger traffic.

Although the volume of air mail and air cargo can be considered no more than moderate, the increase in the number of passengers carried in the United States is impressive. Passenger traffic for American lines has increased from 50,000 air travelers in 1928 to 1,536,000 in 1938. That the development in the air transport industry is mainly a passenger development can be readily seen by the increase in the percentage of total airline revenue attributable to the passenger miles flown. The percentage of total revenue derived from passenger traffic in the operation of the domestic carriers of the United States grew from 55.4 per cent in 1935 to 67.0 per cent in 1940. In the operation of foreign carriers in the United States, the percentages in these same years were 13.6 per cent and 37.6 per cent respectively.

One American author has observed the following concerning the character of air transport traffic: "Commercial travel constitutes the bulk of air passenger traffic and will continue to do so for some years....The service provided by the network of domestic airlines has done much to reshape merchandising and methods of management with the result that each month sees a marked annual increase in passenger traffic."

The importance of passenger traffic to the industry is shown by the preference given passengers in the loading of aircraft. This preference can be exemplified by the scheduling of air service to meet passenger

(1) Daggett, Stuart, Principles of Inland Transportation, 3rd ed., Harper and Brothers, 1941, pg. 112.

(2) Ibid.

(3) Blomquist, Albert E, Outline of Air Transport Practice, Pitman Publishing





(1)  
demand by the inherent designing of most aircraft to accommodate the maximum number of passengers, and by the consideration given to potential passenger traffic in the inauguration of new air routes.

Most of the air routes and services in operation today run where they do because they connect population centers and depend upon passenger traffic. This situation evolved from one in which passenger travel by air did not meet readily with public acceptance because of the absence of safety in flying. In 1919, the French line from Toulouse, France to Morocco, Africa carried only three passengers in the two hundred and forty-one trips made that year.

(2)  
As a means of freight service, air transport has not been, nor is it likely to be in the immediate future, of major importance. This is in sharp contrast to the past and future importance of aerial conveyance of mail and passenger traffic. One writer has surmised that "all the express carried by all of the scheduled air transport lines in the United States in 1938 could have been loaded into a single railroad train."

(3)  
Three principal reasons lie behind this relative importance of air transport to freight service. The cost of conveying cargo by air on a trans-ocean journey has been estimated to be nine hundred times the cost of conveyance by ship. The preference in loading given to passenger and mail traffic, the resulting uncertainty as to the time of departure, and

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Corporation, New York, 1941, pg. 243.

(1) It has been a policy of the United States Post Office Department to cooperate with all airlines in attempting to adjust mail schedules to fit the trend in passenger service.

(2) Kennedey, T.H., An Introduction to the Economics of Air Transportation, The Macmillan Co., New York, 1924, pg. 89: quoted from an article in the Christian Science Monitor, by Edward P. Warner.

(3) Daggett, Stuart, Principles of Inland Transportation, 3rd ed., Harper and Brothers, 1941, pg.111.

(4) Brig. Gen. Sir Osborne Mance, International Air Transport, Oxford Uni-



and the low carrying capacity of aircraft also operate in favor of surface transportation.

In contrast to the future importance of air transportation to the carriage of freight, air freight will probably be of notable importance to the air transport industry in the not far-off future. The demand for air transportation of high value goods of light weight and limited bulk, such as diamonds, jewelry, and watch movements, and emergency, strategic, and perishable goods is great in spite of many adverse factors which must be faced. This is particularly true for emergency goods such as penicillin, and for perishable freight as fruits, vegetables, flowers, and sea-food. Entirely new markets may be created for such produce which at present cannot be transported at all by surface modes of travel. Orchids and other exotic flowers from South America are predicted to give stiff competition to domestic florists when air cargo routes to North America and Europe from South America are developed. Certain tropical fruits may be found in market sections of northern cities. Newspapers and newsreels are other examples of perishable goods which may create a new demand for air freight service.

Although air routes carrying only freight are rather common now, many of them were developed only after consideration of their future passenger traffic. Nevertheless, in the routes that carry perishable goods, extreme flexibility of the service pattern is a growing possibility. Shipment over these routes may have to be in accordance with the location of supply and demand. If this becomes the case, unscheduled and contract service may be more efficient than scheduled airline service. Both scheduled and unsched-

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versity Press, New York, 1944, pp. 49-50; estimate made by Leslie Luncinan, Director-General of the British Overseas Airways.



uled operators are attempting to develop air freight business through the establishment of standards and uniform procedures for their respective  
(1)  
types of operation.

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(1) Boston News Bureau, March 13, 1946, pg.1.



## 2. FACTORS CREATING DEMAND — BASIC FACTORS

Demand for airline service to various points is created by several basic traffic sources, and is facilitated by the absence or inadequacy of other transportation facilities as well as by such factors as stage of economic development and availability of capital. The basic factors creating the demand will be treated now; the other factors will be discussed in the next two chapters.

The principal traffic sources creating demand are industry, military and political requirements, and raw materials.

As a basic factor underlying air route structure, population, per se, is of no importance. Certain economic and political factors must be present also. Overpopulation is found in those nations whose economic wealth cannot support adequately the population: India, Japan, China, Italy, and Java.<sup>(1)</sup> In these areas population has not been a stimulus to the growth of air transportation. It has been industry throughout the world which has attracted population, raised standards of living, and created demand for air service.

It is not a coincidence that the major inter-continental air route terminals in the world are in areas of dense population, namely, western Europe and the east coast of the United States. Those regions largely constitute the core of heavy industry throughout the world. (See Maps II and III.) Great Britain and the United States have the highest standards

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(1) England, with the exclusion of Wales, is the most densely populated country in the world, with 705 people per square mile, yet it is not classified as overpopulated. India, on the other hand, with the population density of 202, is in this class. Raisz, Erwin, Atlas of Global Geography,





RELATION BETWEEN PRINCIPAL INTER-CONTINENTAL AIR ROUTES  
AND AREAS OF DENSE POPULATION  
MAJOR TRUNK ROUTES OF INTERNATIONAL AIR TRANSPORT  
AUGUST 1939

MAP II



POPULATION PER  
SQUARE MILE

- 0-2
- ▨ 2-60
- 60-250

SOURCES: ATLAS OF GLOBAL GEOGRAPHY  
ERWIN RAISZ, GLOBAL PRESS  
CORPORATION, NEW YORK, 1944, p. 48;  
AND INTERNATIONAL AIR TRANSPORT AND NATIONAL  
POLICY, OLIVER J. LISSITZYN, - COUNCIL ON  
FOREIGN RELATIONS, INC., NEW YORK, 1942, MAP I, p. 4.



CORE REGIONS OF HEAVY INDUSTRY IN THE WORLD

MAP III



SOURCE:  
ATLAS OF GLOBAL GEOGRAPHY,  
ERWIN KAISZ, GLOBAL PRESS CORPORATION, NEW YORK, 1944, pp. 52-58



of living in the world measured by the average annual per capita income of each nation. Western Europe follows not far behind. It thus can be seen that industrialization of these nations has allowed adequate support of their dense populations -- a fact not to be disregarded in its bearing upon air route location. Air transport routes, in normal conditions, are concentrated in and between industrialized areas.

Another important trans-oceanic and inter-continental route lies between eastern China and the west coast of the United States, two densely populated regions. The latter terminus possesses considerable heavy industry. China, on the other hand, has only negligible industry. There are military and other political explanations behind the selection of this terminus.

India's dense population has been no incentive to the economic operation of air transport service there, due to the lack of industrialization and the resulting low standard of living. Many of the present-day routes touching this country are either British lines tying together the British Empire or services motivated by other political or military reasons.

The old shipping axiom that routes must connect population centers is a half truth, for although it does apply in the United States in almost every case, it cannot have such general application in the rest of the world and particularly is a misstatement where surface transportation is dissimilar from that within the United States.

Domestic route authorizations in the United States for a specific number of daily flights between cities of certain populations are granted



(1)  
 by the Civil Aeronautics Board. All cities over a quarter of a million population have direct air service. The only city today of over 100,000 population and more than twenty-five miles from a certified airline stop which is not itself an airline stop is Trenton, New Jersey. There are only six such cities in the 50,000-100,000 population bracket. (2)

In recent applications from commercial airlines seeking to extend their lines to Rhode Island, the main arguments for such extension are the large population of Providence and the concentration of several important industries in that section. Providence is "the second largest city in New England" (3) and a leader in the silverware industry.

According to Reginald M. Cleveland and Leslie E. Neville, on pages 46 to 48 of The Coming Air Age, industry will be a less important factor in determining air route location in the future.

"The most widely traveled route will probably be that with the shortest inter-continental hop, namely a route starting from the north-central part" of the United States and ending in Russia or China. "...Now with all spots on the globe accessible to all other spots, our population centers will not remain static...." but will be "...reallocated with relation to the pattern of primary air routes, just as their proximity to sea and land route terminals dictated their location in earlier days. The new urban centers which enter the air age as main route terminals will inevitably be-

(1) Cleveland, R.M. and Neville, L.E., McGraw-Hill Book Co., Inc., 1944, pp. 91-92.

(2) Patterson, W.A., President of United Airlines, "Prospective Expansion of Airline Routes and Services in the United States ", April 24, 1945, at the third session of the Chicago Forum on Aviation, pp.2-3.

(3) Christian Science Monitor, February 1, 1946.





come manufacturing centers as well"... and will attract a large part of the population.

The writers could have reference only to inter-continental routes, for it is extremely improbable that domestic routes will be reallocated for the purpose of shortening hops and that industrial centers will follow. It is true, however, that the new termini of future international routes will gain much in business and prestige. Whether or not they will become manufacturing centers of great importance cannot be certain.

Military considerations, national prestige, empire linking, and propaganda are important basic factors creating demand for air routes. Although a few lines of present military value such as the route across the South Pacific will lose much of their current importance as peace returns, economic rather than strategic factors then will control. Many air bases grown up under the stress of military necessity will be of doubtful peacetime commercial value. Nevertheless, some of these routes will be serviced by commercial air transport operation after the military operation ceases.

Brazil has been getting ready to take over fourteen air bases on the northern and eastern coasts of Brazil developed by the United States Armed Forces for movement of troops between that country and Europe, Africa, and Asia. The connection of these bases with other United States airfields (1) in the Caribbean "is the key to the development of Brazil's Civil Aviation." The United States is interested in negotiating landing rights there for civil aviation. Pan American Airways has already filed application with the Civil Aeronautics Board for peacetime service to Africa. (2)

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(1) Washington Post, Oct. 14, 1945.

(2) Lissitzn, Oliver J., International Air Transport and National Policy, Council on Foreign Relations, New York, 1942, pg. 318.



Referring to the great air service built up by the Air Transport Command -- approximately 200,000 miles of route (see Map IV) -- one writer speaks of "the legacy of incalculable value which global warfare will leave to world air transport....Investments in Goose Bay, Laborador; along the Alcan Highway to Alaska and beyond; and many other airways aids along important routes of the future can contribute immeasurably to the rapid development of world Air Transport."<sup>(1)</sup>

An air commerce pact negotiated by the United States and Great Britain February 11, 1946, opened British military air bases to civil use, "contingent upon making satisfactory agreements with Newfoundland and Canada regarding civil use of Gander, Harman, and Argentine airbases in Newfoundland and Goose Bay airbase in Laborador."<sup>(2)</sup> It is evident that the Army Air Force is also giving great care to bases built up during the war in Iceland, Greenland, and the Aleutians. General A.A. Arnold has urged that the United States retain bases in the Pacific and the Aleutian Islands to keep us near to the economic centers of other nations. He emphasized particularly the wisdom of retaining a base in Iceland.<sup>(3)</sup>

The civilian air force is said to be to our military air force what our merchant marine is to our navy. Nations have expressly recognized the interdependence of military and commercial air facilities by correlating these facilities.

It is assumed both in the Atlantic Charter and the Joint Four-Nation

(1) Van Zandt, J.P., The Geography of World Air Transport, Vol. I, The Brookings Institute, Washington, D.C., 1944, pp. 39-41.

(2) Boston Herald, February 12, 1946.

(3) Washington Post, December 7, 1945.



MAP IV

IMPORTANCE OF MILITARISM IN WORLD AIR TRANSPORT NETWORK

AIR TRANSPORT COMMAND ROUTES OF THE UNITED STATES ARMY AIR FORCE  
THROUGHOUT THE WORLD JANUARY, 1944

(SOUTH PACIFIC ROUTES NOT SHOWN)



SOURCE:

THE GEOGRAPHY OF WORLD AIR TRANSPORT

J. PARKER VAN ZANDT VOL. I  
THE BROOKING INSTITUTE, WASHINGTON, D.C. - 1944 - p 41



Declaration of Moscow (1943) that air power will be maintained by each of the Big Four -- United States, Great Britain, Soviet Russia, and China -- in the post-war era as a measure of national and international defense. In view of this, no state can afford to separate commercial from military aviation.

The policy of the United States as set out in the Civil Aeronautics Act of 1938 is one which closely relates military and commercial air transportation. The Civil Aeronautics Board was expressly authorized to encourage development and regulation of service in the air transportation system adequate to "the needs" of national defense. The Civil Aeronautics Board has announced a list of international air routes which it deems "would be desirable for post-war operation by our own air carriers." <sup>(1)</sup> The proposed routes would represent approximately a one hundred per cent increase in mileage over that of the then certified services.

Generally speaking, air routes to be militarily useful must be "going concerns" established by civil airlines. To establish air forces ready for emergencies at all strategic places would be economically prohibitive. Yet, a system or organization of air routes covering a nation and connecting her territories and colonies makes available to air forces, when necessary, facilities for military operation. Toward this end, Britain's and the United States' civil aviation policies have been directed.

National and political interests such as empire linking, national prestige, diplomatic intercourse, and propaganda have been potent forces in the development of the world air transportation system.

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(1) Pogue, L. Welch, Chairman of Civil Aeronautics Board, "International Air Routes", radio interview, Washington, D.C., June 26, 1944, pg. 3.





A well known expert on national air policy states, "The geographical direction of the air transport efforts of every major power is dictated by broad considerations of national interest rather than by the profitability of air services....Air transport has become an instrument of national politics and its importance as such is growing." <sup>(1)</sup> The United States is a notable exception. Although national interests are given due consideration in the authorization of new routes by all nations, economic reasons have been the principal motivating force behind the inauguration of air services by the United States and, generally speaking, by Britain, also.

The British, French, Dutch, Italian, Belgian, Japanese, and Portuguese governments have all concentrated much of their air development efforts on inter-empire air communications. Great Britain, in particular, has a well-developed air network connecting her scattered empire possessions. (See Map V.) Air France, who has in past years devoted attention to air links with French African colonies, has recently been authorized to operate between Martinique and Haiti and between Indo-China and the Aleutians. <sup>(2)</sup> The United States has a very complete network of air routes leading to her outlying territorial possessions.

The prestige of nations is greatly enhanced by possession of well-developed air transportation networks, particularly in international traffic and is damaged to an equal extent by inadequately developed systems.

Economic and military importance is claimed to be a counterpart of the prestige thus obtained. Advantages in diplomatic intercourse and in the speedy dissemination of propaganda, both spoken and written, are obvious

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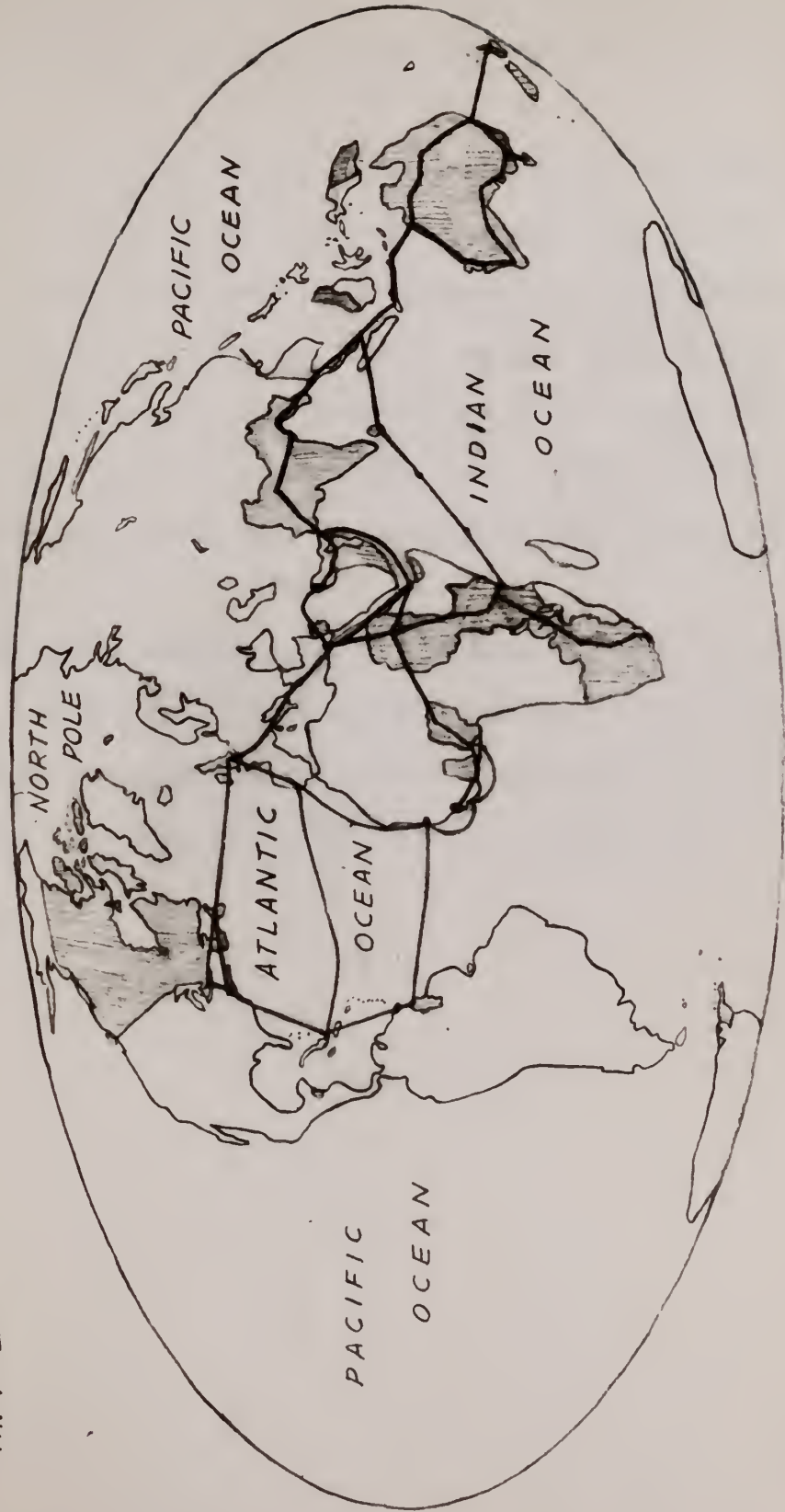
(1) Lissitzn, Oliver J., International Air Transportation and National Policy, Council on Foreign Relations, New York, 1942, pg. 421.

(2) Christian Science Monitor, June 17, 1946, pg.6.



PRINCIPAL BRITISH AIR ROUTES  
CONNECTING PARTS OF BRITISH EMPIRE \*

MAP V



\* INCLUDING DOMINIONS

SOURCE: ATLAS OF GLOBAL GEOGRAPHY,

ERWIN RAISZ, GLOBAL PRESS

CORPORATION, NEW YORK, 1943

p. 39; "MAIN INTERNATIONAL AIR

ROUTES OF PRINCIPAL NATIONS,"

OFFICE OF AIR TRANSPORT INFORMATION, UNITED

STATES DEPARTMENT OF COMMERCE, 1943. (MAPS)



effects on certain selected air routes; French, Italian, German, United States, and Latin American routes have been influenced by this latter consideration.

Raw materials, too, play a role in the generation of air traffic, although, generally speaking, their bulk and comparatively low value makes ocean and rail carriage necessary. A few strategic and costly raw materials of light weight and limited bulk, such as radium, diamonds, and other materials which in the main are inaccessible are better conveyed by air transport. Many such goods in northern Canada and Alaska, formerly untouched or reached only by dog sled are finding their way into markets via air. (See Map VI.)

Air freighting has prospered also in Australia, Siberia, and parts of South America. In New Guinea, air transport made possible the development of rich gold fields. Peru is another country in which air service has been of enormous value in opening up resources in the mining regions.



AN EXAMPLE OF IMPORTANT RAW MATERIALS NOT EASILY ACCESSIBLE BY SURFACE TRANSPORTATION

MAP VI



SOURCE : ATLAS OF GLOBAL GEOGRAPHY,  
ERWIN RAISZ, GLOBAL PRESS CORPORATION, NEW YORK, 1944, p. 52





### 3. FACTORS FACILITATING CREATION OF DEMAND

Certain conditions, not themselves factors creating demand for air service, may be considered factors facilitating the creation of this demand. These are stage of economic development, other transportation facilities, and ~~availability~~ of capital. Capital cities and resort areas, as such, are not sufficiently important sources of air travel to warrant treatment as basic demand-creating factors. Demand for air service in many capitals is motivated in great part by other than the interests of the governmental agencies located within these cities. Many resort areas in the world are unserved by air transport and in some of those which are served by scheduled airlines, other interests are present to attract air traffic. For these reasons capitals and resorts are treated as factors facilitating the creation of demand for air travel.

Use of air transportation in relatively backward and undeveloped areas of the world is essential in quickening the pace of economic development. Nevertheless, this use is normally retarded by the very backward character of the economic development of these regions. Hence it is seen that air routes which exist here at all either are of special military or political significance to some nation or else have great potentialities of becoming very profitable lines in the future. They are usually subsidized by home or foreign governments.

The economic development of nations varies in its divers stages from time to time as well as from place to place. (See Map XI) Transportation has invariably changed with it, adapting itself to the demands of the area



and of the time.

Nations developed economically at a much slower pace back in the days when animal and boat were the chief means of communication and transportation. As technological discoveries were made, transportation facilities improved greatly. Ocean-borne vessels could travel further than previous means of conveyance and made for a wider and quicker exchange of ideas and methods. A fringe development as seen in South America, Australia, and Africa results from the past use of essentially one mode of travel, namely, the ship.

Later, the automobile and train made possible a more intensive and earlier development of world areas than could have existed with the transportation facilities of the past. It is worthy of note that the westward movement in the United States was quickened by the introduction of the locomotive.

The advent of the commercial use of the plane in 1920 has been of special significance to Australia, Africa, China, Latin America, and Northern Canada in spite of the fact that these regions remain relatively undeveloped. It is noteworthy that these five large areas are being developed in an era when several forms of transportation are available, and thus probably will attain an advanced stage of economic development in a shorter period of years than that required for the development of older nations such as England.

Latin America is experiencing a quickening in the tempo of economic development as a result of her air facilities. In many of these republics air transportation is of special significance in the development of mines.

Canadian airlines, although offering mainly unscheduled services,



reach far into the north of that continent, where they are of immense economic importance, in the arctic regions, and at at least one point, Aklavik, a line approaches the North Ocean. Much of the air service in Canada is brought into the middle north and particularly into the mining regions. Alaska has seen a similar development in the air transport industry with many unscheduled flights reaching areas containing important resources.

Thus it can be seen that the lack of economic development present in these five world areas has had a notable influence on the type of routes existent there as well as upon the incentives which must exist for any air operation at all. Air routes in northern Canada are typically pioneer or "bush" operations. The Trans-Canadian Airline network opening in southern Canada above the United States border, in fact, results from a consolidation of several small bush operations of the past. Air service in remote areas in South America, in the Andes and Amazon Basin regions, may also be classified as bush or hinterland operations.

The absence of surface transportation in some areas of the world has facilitated a demand for air service within these areas. In areas, such as the United States, in which there is a well-developed surface transportation system, a greater integration and intensification of the system will be brought about by the airplane. The demand for air service, in this case, is a demand for routes and services to supplement those already supplied by other transportation facilities, and is aided by the inadequacy of these existing facilities.

Large areas of the earth are remote from any railroads, highway, or



navigable river and are accessible only by small roads, beasts of burden, or human carriers. In great part due to the airplane, inaccessible areas are likely to become world markets in the future.

Asia -- with the exception of India and Japan -- Africa, Australia, northern Canada, and South America are sorely lacking in adequate surface transportation. (See Map VII.) Inadequate transportation in South America, especially in tropical regions, has hindered the development of resources. The transportation facilities in the coastal area where most of the population is concentrated is far from satisfactory, consisting only of broken segments of railroad line, and small roads, with the exception of the Pan-American Highway which circumscribes approximately two-thirds of the continent. (See Map VIII.) It probably will be another two and one-half years before this highway is finished and motoring from San Francisco to Buenos Aires and Rio de Janeiro will become a reality. It is possible that coastwise road and railroad improvements in South America may decrease air traffic -- both potential and existent. (1)

In the interior of South America transportation has been even less adequate than in the coastal areas, the usual means of conveyance in the jungles and mountains being pack animals. Slow maritime service completes the picture of relative inaccessibility. In the light of these conditions, and due to the increasing development of this region, air transportation is placed in a very favorable position.

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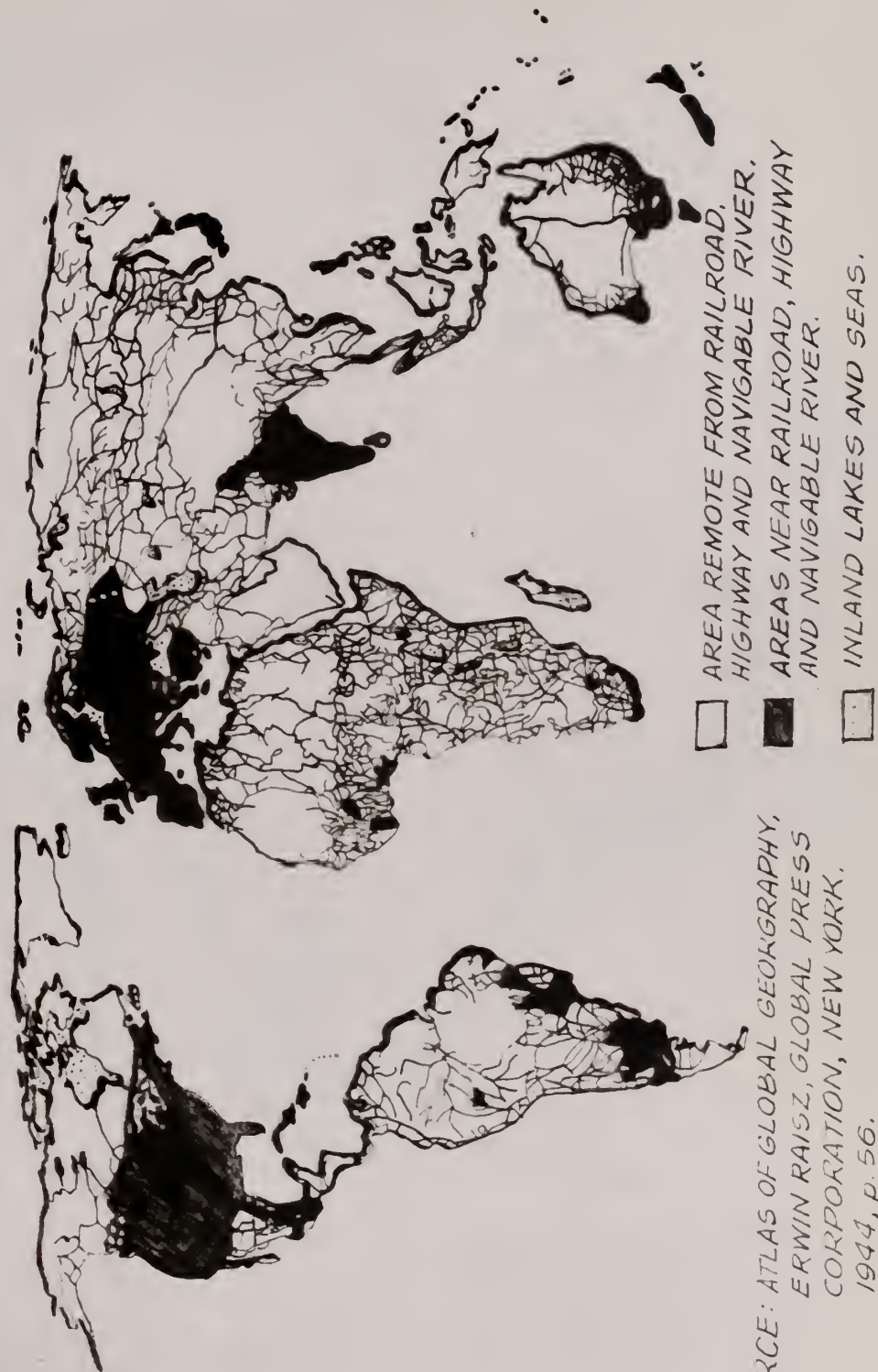
(1) Local air traffic in Peru as alleged to have declined as a result of recent highway construction and improvement. Lissitzn, O.J., International Air Transport and National Policy, Council on Foreign Relations, New York, 1942, pg. 330; ex lib. Aeronautical World News, Vol. II, (N.S.), pg. 432, April 30, 1940.





LACK OF LAND SURFACE TRANSPORTATION IN  
LARGE AREAS OF THE WORLD

MAP VII

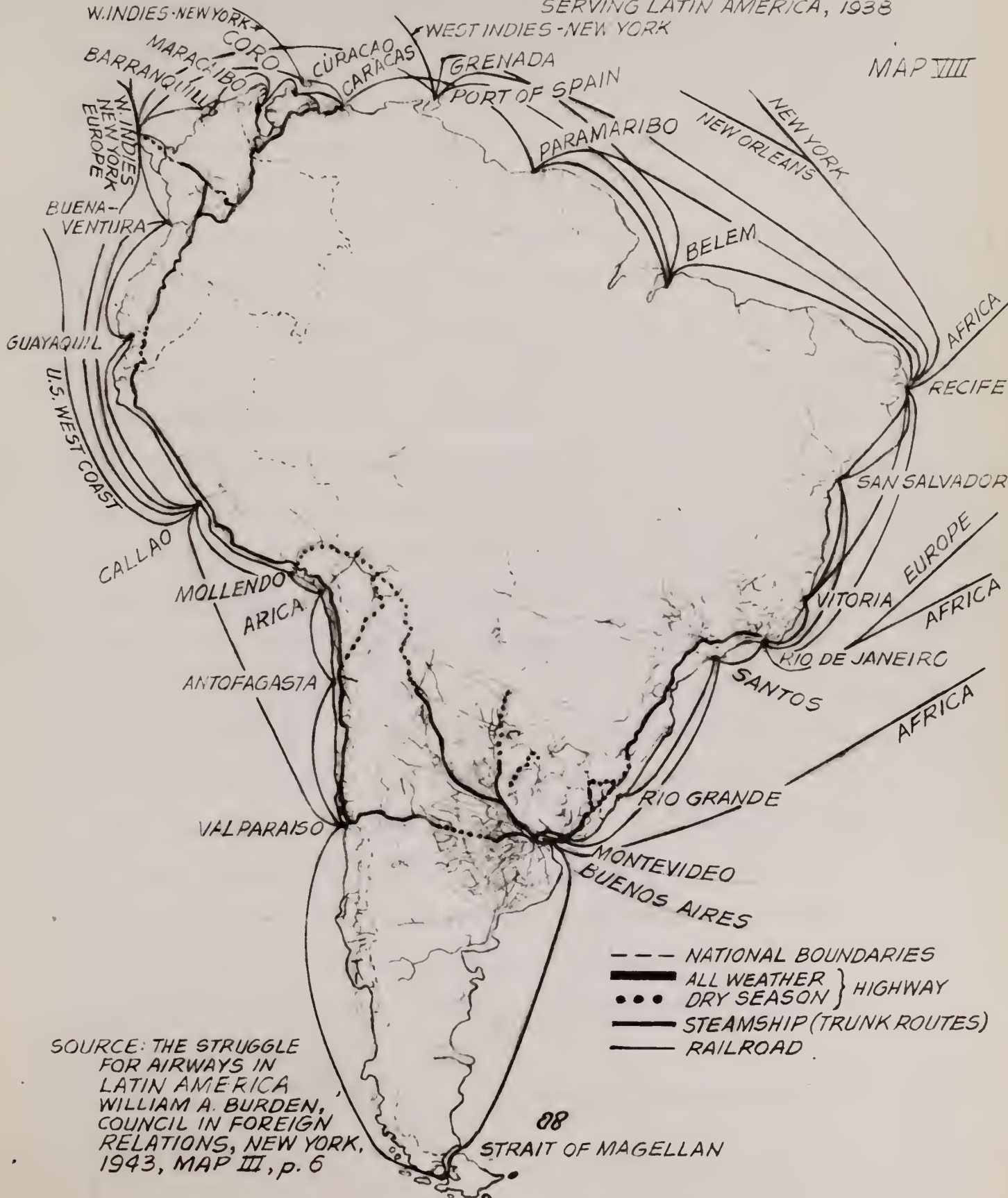


SOURCE: ATLAS OF GLOBAL GEOGRAPHY,  
ERWIN RAISZ, GLOBAL PRESS  
CORPORATION, NEW YORK,  
1944, p. 56.



PRINCIPAL HIGHWAY, RAILROAD AND STEAMSHIP ROUTES  
SERVING LATIN AMERICA, 1938

MAP VIII



- NATIONAL BOUNDARIES
- ALL WEATHER } HIGHWAY
- ... DRY SEASON }
- STEAMSHIP (TRUNK ROUTES)
- RAILROAD

SOURCE: THE STRUGGLE  
FOR AIRWAYS IN  
LATIN AMERICA  
WILLIAM A. BURDEN,  
COUNCIL IN FOREIGN  
RELATIONS, NEW YORK,  
1943, MAP III, p. 6

08  
STRAIT OF MAGELLAN



In Colombia, Bolivia, Mexico, and Central America, the tropical climate and mountainous terrain have caused difficulties in surface transportation. The importance of air transportation has been enhanced in Albania where railroads and highways are absent. Similar conditions exist in the polar regions of Canada and U.S.S.R. Parts of western Canada are accessible only by canoe in the summer and by dog team in the winter or by aircraft. The latter mode of transportation is much cheaper and more effective. The Morobe gold fields in Africa are reached from the coast in twenty-five minutes by air, whereas it takes a week to reach them by native track. (1)

There are yet many economically promising routes which have not been opened. No direct air tie has existed between the United States and Japan, although the volume of past transportation and communication has warranted such. Batavia and Manila are not connected in spite of the long-lived interest in establishing such air service. (2) The route from New York or Washington, D.C., to Buenos Aires and Rio de Janeiro appears to warrant more direct service than via Miami and the Caribbean Islands. In addition very important routes to the Orient across the polar area from the North American continent have yet to be given their proper emphasis.

Even in areas where surface transportation is well developed, such as in the United States, air transport may play a large part. Not only is this so because of difficulties of terrain and large expanses of water, but also as a result of the inadequate use of the existing transportation facilities. Air service in this country is a necessary supplement to existing surface transportation.

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(1) Lissitzn, O.J., International Air Transport and National Policy, Council on Foreign Relations, New York, 1942, pg. 50.

(2) Ibid., pg. 397.



Map IX

RELATION OF INACCESSIBILITY  
TO AIR TRANSPORTATION NETWORK  
AIR TRANSPORTATION ROUTES IN SOUTH AMERICA  
JANUARY 1941



SOURCE: THE STRUGGLE FOR AIRWAYS  
IN LATIN AMERICA, WILLIAM  
A.M. BURDEN, COUNCIL ON  
FOREIGN RELATIONS, NEW  
YORK, 1943, MAP VII, p. 70

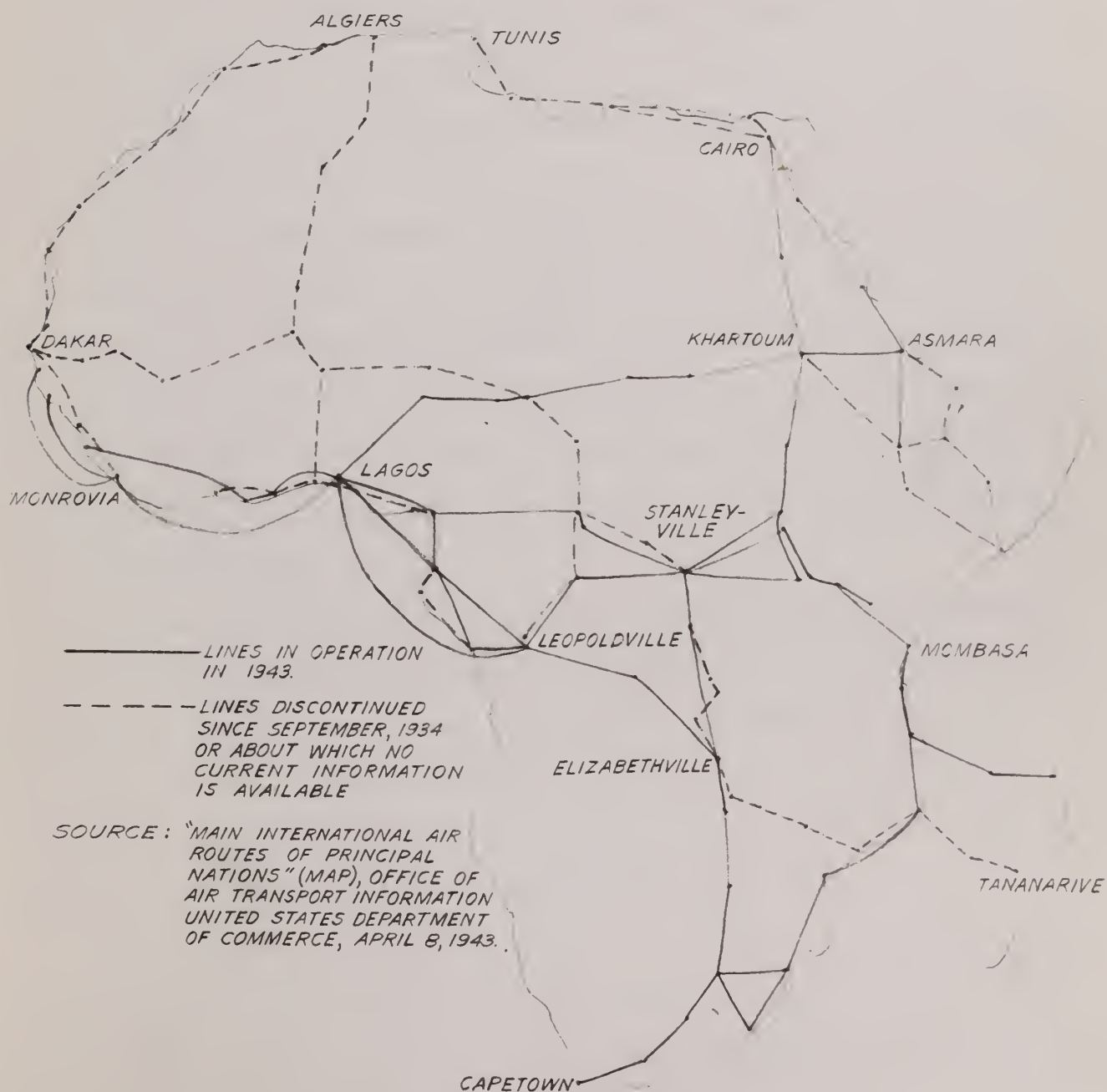




RELATION OF INACCESSIBILITY TO THE  
AIR TRANSPORTATION NETWORK

MAP X

MAIN INTERNATIONAL AIR ROUTES IN AFRICA  
APRIL, 1943





Air transportation has been largely a passenger development in the United States. It is a new transportation industry which not only has diverted some traffic from older forms of transportation but also has created new traffic. This diversion of traffic from one mode of transportation to another as well as creating new traffic itself, appears to be a legacy which each new form of travel has inherited from the preceding one. The traffic that the air transport industry has diverted from surface vessels is in great part passenger traffic.

This fact is understandable in light of the actuality that as the tempo of economic and political life is stepped up with the passage of time, the older water-borne transportation becomes too slow for personal diplomatic and economic intercourse and has to give way in part to rail, and that in turn to air. This traffic diverted to the airlines in the long run will probably be small in proportion to that created by new businesses which now are coming into being.

A recent campaign against the inadequacy of railroad passenger service on the transcontinental trips brought out the fact that transcontinental passengers traveling from eastern to western United States had to get off one train and board another at Chicago, St. Louis, or New Orleans, while freight cars went right through. The slogan, "A Hog Can Cross the Country without Changing Trains -- But You Can't", was adopted.<sup>(1)</sup>

That no-change, cross-country service is offered by the transcontinental airlines is a fact in favor of the air transport industry. This unfavorable feature of train service is only one indication of the inadequate employment of surface transportation for passenger use. Of course, during

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(1) Newsweek, March 18, 1946, pg.77.



the war emergency, civilian use of both rail and air transport as well as of automobile- and ocean-borne transportation was restricted, and this restriction made all transportation in this period inadequate.

The fact that for many years air route structure in the United States was patterned after that of the railroad indicates the inadequacy of existing rail facilities. (1) Only recently is there a trend away from this.

In regard to the extent of competition existent between the airplane and types of land transportation, automobile transportation is a competitor on short trips only, and rail on lines somewhat longer.

Attempts to coordinate sea and air as well as railway and air operation indicate an endeavor to reduce or eliminate competition among the various transport industries through the allocation of air routes and services by international transportation pools. Such allocation would have a profound effect upon the selection of routes and an unfavorable effect upon operation of the economic factors normally influencing route location.

Capital necessary for the operation of a new route can come from either private or public sources. The relation between availability of capital and route structure is evidenced by the different effects of public and private financing upon the nature of air routes. The greater the proportion of public support in airline operation, the greater the tendency for route structure to be influenced by national considerations. A coroll-

(1) The coincidence of air and rail routes does not necessarily show that the facilities of the latter industry are inadequately serving the area concerned. Differences in the type of service demanded of the two industries, in the length of their respective routes and the frequency of their stops as well as the foreseen creation of a new traffic demand by the air route may be responsible for the existence of air service alongside that of rail. Despite differences in service offered by these two agencies it can be said that inadequacies in rail service have been instrumental in creating a demand for air travel.



lary of this is that as the importance of subsidy to airline operation diminishes, commercial and other economic considerations grow in importance in determining the pattern and nature of air routes.

Capital for routes will be forthcoming if the demand for these services is of sufficient intensity. It is axiomatic that private capital will flow where profits exist. If a route is not economically justifiable but the national demand for it is strong, government funds will be advanced for its support.

In spite of these facts, difficulties in raising capital in the air transport industry exist. It is said by one writer that financing difficulties "result from governments requiring the industry to develop along non-profitable lines in order to serve" <sup>(1)</sup> prestige or other non-commercial ends. The important exception to this uneconomic basis for air routes is found in the air transport pattern in the United States. One of the most important considerations of the United States Government in granting subsidy to air routes had been the probability that those routes would become self-supporting.

Difficulties in financing have been evidenced notably in the German, Dutch, British, French, Italian, and Japanese air transportation business in which unprofitable lines were state-supported for military and political reasons. The Amsterdam to Batavia air route of which the Netherlands required a large investment and gave no promise of immediate profits had to be state-supported. <sup>(2)</sup>

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(1) Lissitzn, O.J., International Air Transport and National Policy, Council on Foreign Relations, New York, 1942, pg. 131.

(2) Ibid., pg. 134.





A special Air France subsidy was provided for the Dakar-Natal trans-Atlantic service, including provision for the equipment used on this route. State-aid of this sort exists for several other long-distance and inter-continental services. (1)

In the United States, the Civil Aeronautics Board considers the financial and technical positions of the applicants for a new route -- that is, its fitness and ability to operate the service. On the other hand, it believes that if a route has sufficient public interest to be authorized, it has sufficient public interest to be given direct public aid when and if such aid is needed. This aid is in the form of air mail payments sufficient for the coverage of operating deficits.

Other things being equal, the financing of routes in the United States presents somewhat less of a problem to the air transport industry than it has presented to the railroad industry. In air transportation there is a more rapid rate of capital turn over; a relatively small investment per dollar of revenues is needed.

There are two principal reasons for this. Airways throughout the world do not require the large capital necessary for the construction of railroad tracks. The amount of capital to be supplied by United States airlines for route operation does not represent the total capital required for the operation of that route; the United States Government constructs and finances all airways and air terminals needed for services authorized for United States air transport operation.

The rights of way in the railroad industry, on the other hand, are not public rights of way used by all companies within the industry and

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(1) Ibid., pg. 177.



hence do not warrant government financing. The fixed capital which a railroad company must supply in the operation of a new route includes capital for the rights of way and terminals as well as for the vehicles to operate the rights of way.

Generally the capital cities of states, provinces, and "departments", as well as of nations are a factor creating demand for air service. While the political nature of business in capital cities is usually deemed to be an important source of air traffic, actually it is only in national capitals and in some state capitals of the United States that air service can be considered important. In addition, the demand for air travel in many of these capitals is motivated in great part by commercial and other interests. It is for these reasons that state and national capitals are treated as demand facilitating factors.

The relative importance of national capitals as air transport centers necessarily varies with the economic and political development of nations. It is undoubtedly true that some state capitals are greater air traffic centers than some national capitals. (See Maps XII and XIV.) In large capital cities it is difficult to determine the amount of air traffic, potential or existent, which is occasioned by the seat of the national or local government and the amount resulting from the pressure of industry, jobbing enterprises, and other sources of traffic within those cities.

Map XII shows that all of the important world capitals lie on major international air routes. European capitals, with only three exceptions, are inter-connected by a network of international trunk routes. Whereas the capitals of some of the smaller empire possessions in Africa are not



of sufficient international significance to warrant connection by trunk line service, many of them are accessible by air by smaller empire-linking routes.

Bogota, Colombia, the only national capital in Latin America not on a major international air route, has eight different national or international routes leading into it. (1) The relative importance of Wellington, New Zealand among national capitals and the more strategic location of Auckland, New Zealand places the latter city on the sole trunk route leading into this dominion. (2)

Trans-Atlantic service from Washington, D.C. to Paris, Rome, and Athens and service from Washington to Lisbon, Madrid, and Rome has recently been inaugurated by the Trans-World Airlines. (3) Extension of American Airlines System's transcontinental service to include another foreign capital, Oslo, Norway, effective April 5, 1946, was in addition to its service to Reyjavik, Iceland, Stockholm, Copenhagen, and London. (4) The Amsterdam, Berlin, Warsaw, Helsinki, and Moscow services are not yet in operation. Eire is negotiating with Sweden for direct airline service between Stockholm and Dublin.

National capitals, and to a lesser extent state capitals, have had and still have an influence on the domestic air transport pattern. There are twelve different domestic routes leading directly into Washington, D.C.

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(1) As of Dec. 1942; Burden, W.A.M., The Struggle for Airways in Latin America, Council on Foreign Relations, New York, 1943, pg. 213.

(2) Most of the capitals of the Chinese republics lack air service due to economic and political reasons. With the exception of Chungking which is served these republic capitals stand very low in importance in international affairs.

(3) Boston Herald, Jan. 30, 1946; Boston News Bureau, Apr. 1, 1946, pg. 8; Christian Science Monitor, Apr. 20, 1946, pg. 5.

(4) Boston News Bureau, March 30, 1946, pg. 3.



RELATION OF ECONOMIC DEVELOPMENT TO AIR ROUTE NETWORK  
LAND USE THROUGHOUT THE WORLD

MAP XI



SOURCE: ATLAS OF GLOBAL GEOGRAPHY  
ERWIN RAJEZ, GLOBAL PRESS  
CORPORATION, NEW YORK,  
1944, pp 50-51

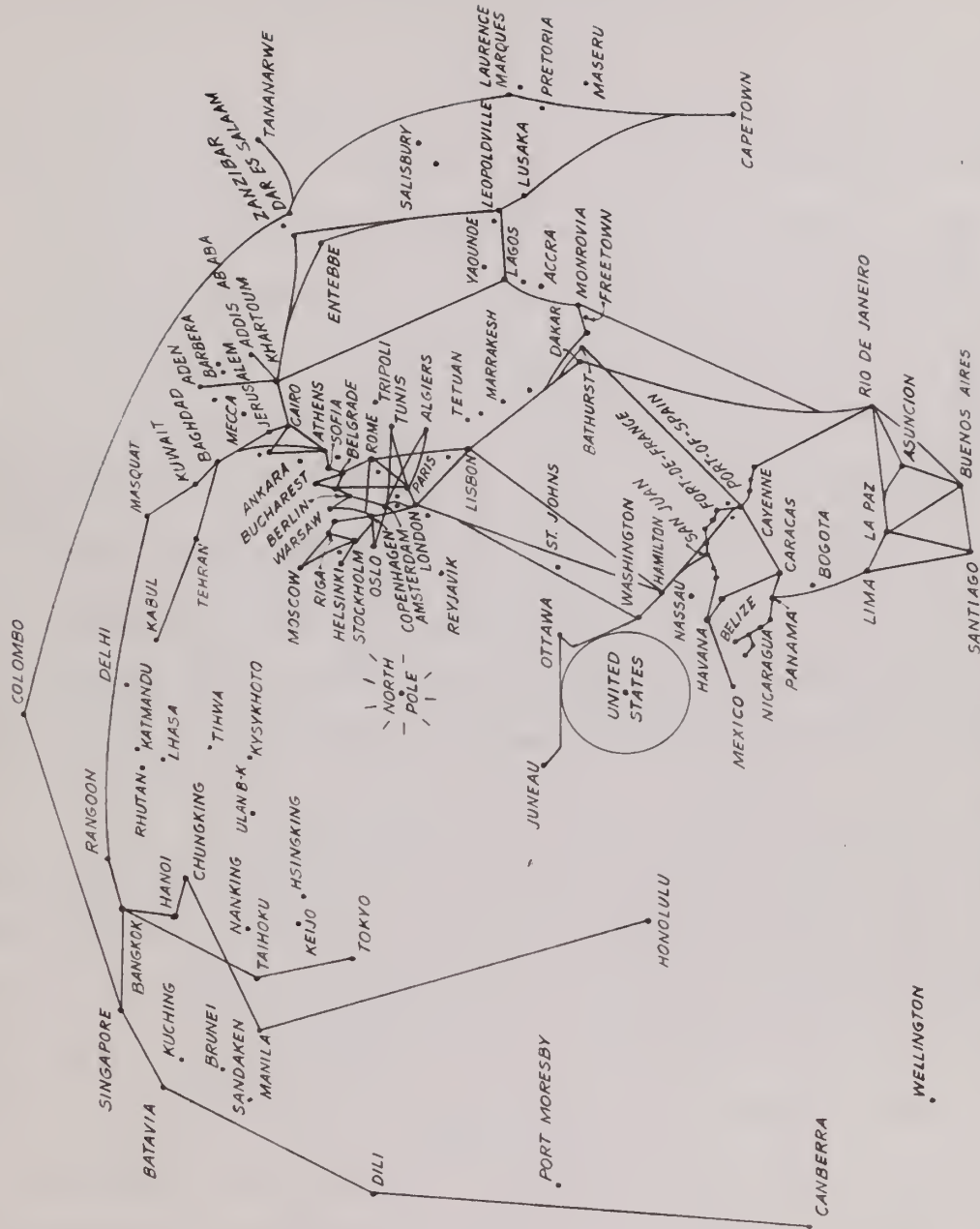




# EXTENT TO WHICH NATIONAL CAPITALS ARE CONNECTED BY TRUNK AIR ROUTES

INTERNATIONAL AIR ROUTES CONNECTING NATIONAL CAPITALS - 1943

MAP XII



\* NATIONAL CAPITALS ARE "CAPITALS OF COUNTRIES AS GIVEN IN HAMMOND'S REVISED ATLAS, INCLUDING ALL CAPITALS OF AREAS WITHIN INTERNATIONAL BOUNDARY LINES AND EXCLUDING CAPITALS OF PROVINCES, STATES AND "DEPARTMENTS." THIS MAP IS AN OBLIQUE AZIMUTHAL EQUIDISTANT PROJECTION

SOURCE - "ATLAS OF GLOBAL GEOGRAPHY," ERWIN RAUSZ, GLOBAL PRESS CORPORATION, NEW YORK, 1944; PAGE 45; AND "MAPS INTERNATIONAL AIR ROUTES OF PRINCIPAL NATIONS," OFFICE OF AIR TRANSPORT INFORMATION, U.S. DEPARTMENT OF COMMERCE, APRIL 8, 1943 (MAFS)



(See Map XIII) Two state capitals, Atlanta, Georgia, and Charleston, West Virginia, each have seven routes leading directly into them from other state capitals. Five other state capitals have six such routes. (See Map XIV.)

That some state capitals in the United States have no air service at all tends to prove that the interests of the centrally located governments and agencies are not alone an important source of air traffic. Providence, Rhode Island, the second largest city in New England, is the only large city in the United States which is served by only one airline. Pending before the Civil Aeronautics Board are applications from three commercial airlines which seek to extend service to this city. <sup>(1)</sup> Although the fact that Providence is a state capital is cited by these airlines as a justification of such service, the briefs filed by a number of Rhode Island industries which would greatly gain from air routes serving Providence set forth the basic demand factors governing inauguration of these routes.

Pleasure and health resorts of the type of Miami Beach, Florida and Phoenix, Arizona are additional factors facilitating demand for air traffic, attracting the wealthy vacationers and the ailing, both of whom demand speed and comfort. Tourist spots do not create demand for such travel; instead "they usually attract motorists who do not intend to spend all their vacation in these places". <sup>(2)</sup> Yellowstone Park, Grand Canyon, and Carlsbad Caverns, in the United States, are of this type. Some of the well-known health resorts in the United States are served by scheduled air trans-

(1) Christian Science Monitor, Feb. 1; Feb.27, pg. 6; Mar.1. 1946.

(2) Frederick, John H., Commercial Air Transportation, Richard D. Irwin, Inc., Chicago, 1945, pg. 173.



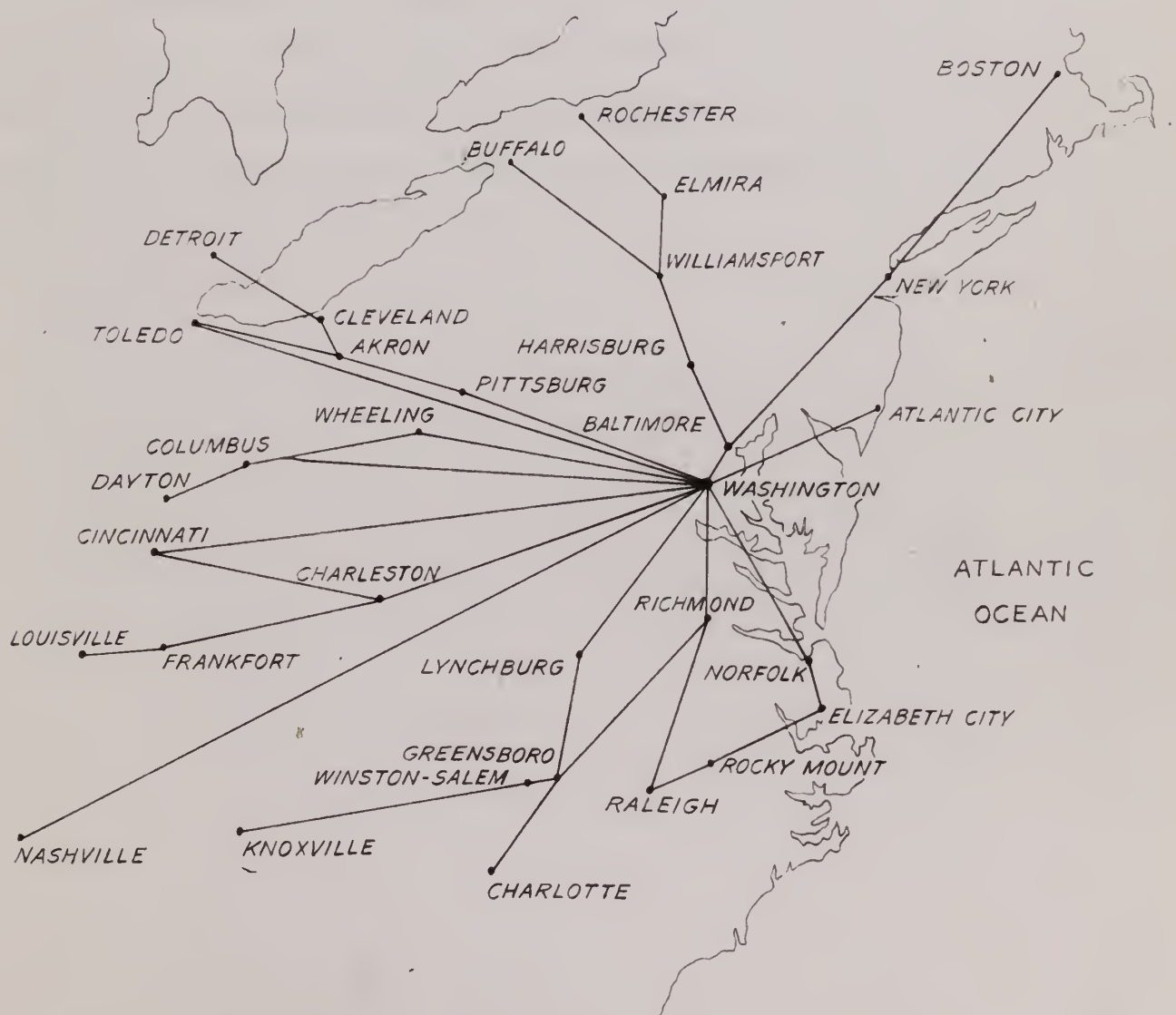
IMPORTANCE OF A CAPITAL IN THE DOMESTIC AIR NETWORK

NETWORK OF COMMERCIAL AIR ROUTES

MAP XIII

LEADING INTO WASHINGTON, D.C.

JUNE, 1946.



SOURCE: COMPILED BY O. L. BROWN  
FROM AIR LINE SCHEDULES.



port carriers. Albuquerque, New Mexico and Phoenix, Arizona have as many as seven direct routes entering in; Miami and Tampa, Florida, popular pleasure resorts, have respectively five and six such direct routes. (See Map XV.)

On the other hand, there are a great number of important resort areas which are accessible only by surface transportation or by chartered non-scheduled flight. Although a few of these, Catalina Island, California, and points on Cape Cod, Massachusetts, just recently have been given scheduled (1) service, a great many such areas still remain off the principal routes of surface as well as air transportation.

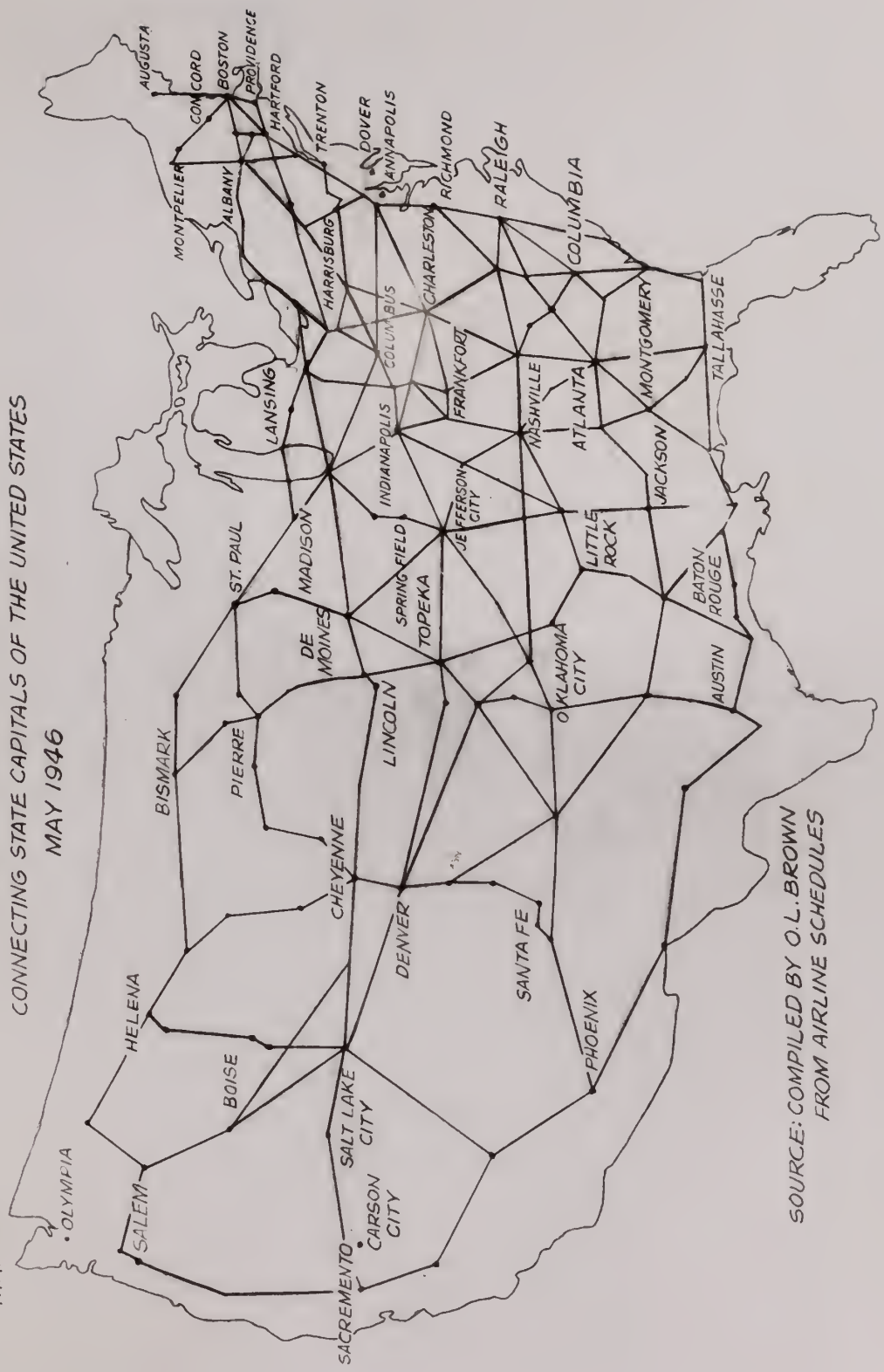
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(1) Boston News Bureau, June 6, 1946, pg. 4; Boston Traveler, June 18, 1946; pg. 20; Boston Globe, May 10, 1946, pg. 18.





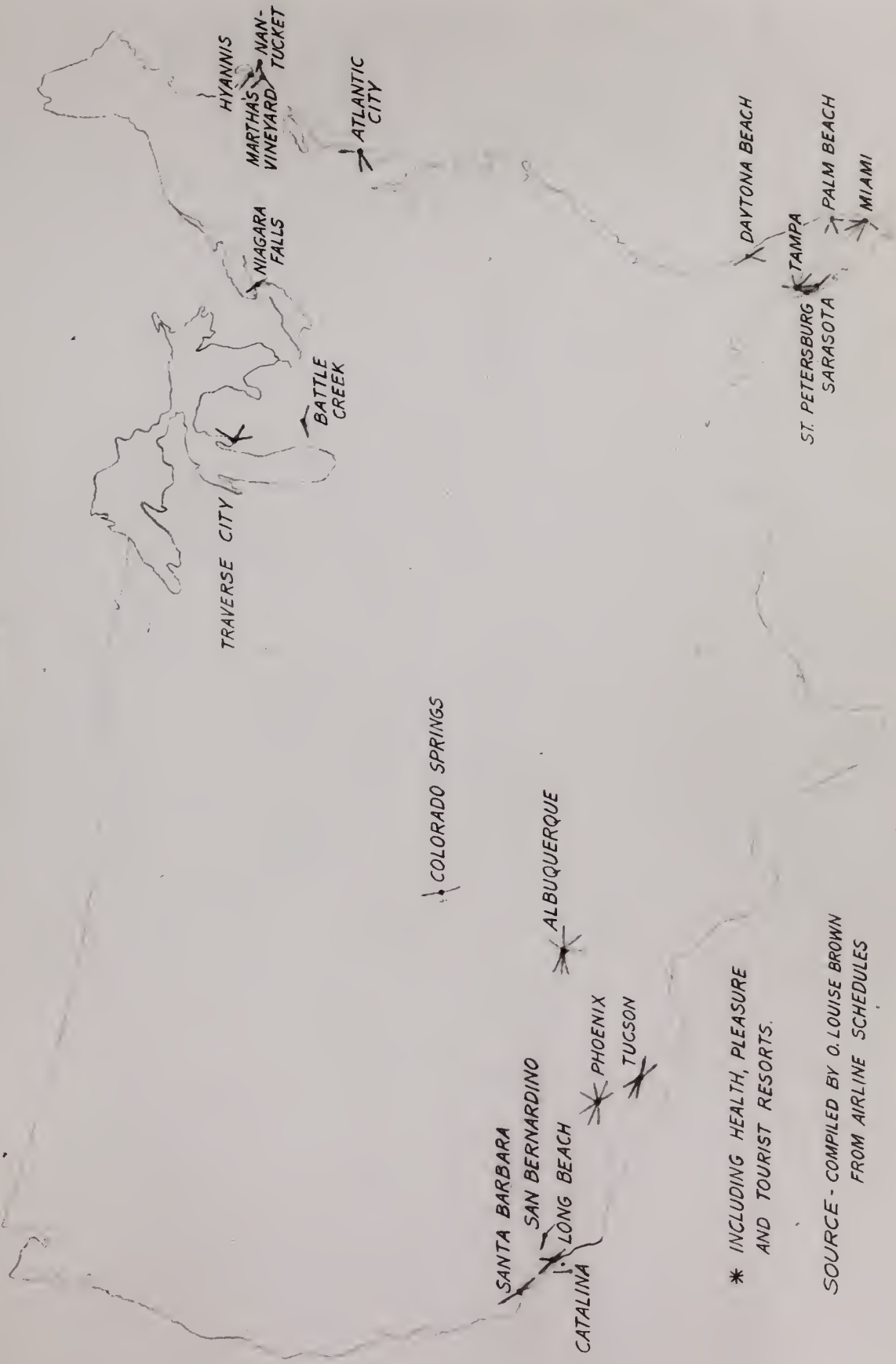
MAP XIV  
 AVAILABILITY OF AIR SERVICES BETWEEN CAPITALS  
 DOMESTIC AIRLINE ROUTES  
 CONNECTING STATE CAPITALS OF THE UNITED STATES  
 MAY 1946



SOURCE: COMPILED BY O.L. BROWN  
 FROM AIRLINE SCHEDULES



MAP XV  
 IMPORTANCE OF RESORT AREAS IN AIR TRANSPORT NETWORK  
 DOMESTIC AIR ROUTES FEEDING INTO RESORT AREAS  
 IN UNITED STATES \*  
 1946



\* INCLUDING HEALTH, PLEASURE  
 AND TOURIST RESORTS.

SOURCE - COMPILED BY O. LOUISE BROWN  
 FROM AIRLINE SCHEDULES



PART III

PSYCHOLOGICAL FACTORS



## 1. ESTABLISHED TRAVEL ROUTES

A psychological factor having an economic bearing upon the determination of air service is the patterning of air service after existent travel routes. For many years air transportation routes ran directly over or alongside railroad routes.

A study of the Civil Aeronautics Authority says this concerning transportation patterns: "Not only is a large part of our population concentrated in a relatively small number of clusters, but the clusters are stretched out along fairly straight paths. These paths or lines are, in fact, major travel routes for all forms of transportation. Thus, the vast bulk of the urban population and the airline stops needed to serve it lie along the airways — along the major air routes." <sup>(1)</sup> The discovery responsible for this conclusion was that, of 850 points which were considered "affording complete domestic coverage", 500 of them were within twenty miles of the center of an existing airway.

It is true that a great number of the domestic air routes of the United States have been established alongside already existing transportation lines for the purpose of serving the same population and industrial centers. A psychological barrier to the change of route pattern for years prevented the extension of air service along potentially profitable routes not served by surface transportation.

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(1) Patterson, W.H., President of United Air Lines, "Prospective Expansion of Airline Routes and Services in the United States", April 24, 1945, address made at the third session of the Chicago Forum on Aviation.





Only in recent years have airlines in this country established routes not coinciding with other transportation routes. These lines generally have been established in order to serve points of high traffic potentiality and to create a new demand for air service.

Pennsylvania-Central Airlines was the first United States airline to break its air service pattern away from the railroad routes. The territory served by the Pennsylvania-Central Airlines from Washington to the Great Lakes is densely populated and highly industrialized, and the potential traffic is great. "The company's lines cutting diagonally across the routes of the major companies...afford a considerable amount of interline business. Little competition is encountered from other companies."<sup>(1)</sup>

The very characteristic of concentration present in the air transport route structure seems to contradict the diverse quality of the industry itself -- an inherent quality of flexibility the advantages of which are yet to be fully realized. Although the airplane can fly everywhere, air routes have tended to be concentrated in certain regions of the world.

Concerning the flexibility of this industry, one writer has said: "The only barriers that can turn aside air transport are the fairly narrow tropical hurricane belts and certain polar areas where the winds reach cyclonic velocities."<sup>(2)</sup>

The concentration of routes in parts of northeastern United States is a rational economic development of the industry since this region has a very great demand for air service. Already the busiest in the world, the

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(1)Frederick, John H., Commercial Air Transportation, Richard D. Irwin, Inc, Chicago, 1945, pg.104.

(2)Cleveland, R.M., and Neville, L.E., The Coming Air Age, McGraw-Hill Book co., Inc., 1944, pg. 43-44.



airway between New York and Boston has become increasingly active with the recent addition by several airlines of a daily schedule in each direction. American Airlines is now operating fifty daily schedules between these two cities; Eastern Airlines is operating sixteen; and Northeastern, twenty-three. The flexibility of the airplane as opposed to the rigidity of the railroad has not been evidenced fully yet.

All air service between New York and Boston has been, until recently, via Hartford, Connecticut. Applications are now on file with the Civil Aeronautics Board for routes from New England to New York by way of Concord, New Hampshire, and Hyannis, New Bedford, Lawrence, and Worcester, Massachusetts. Other recent airline applications have been for routes which will by-pass New York on north-south flights for the purpose of easing traffic congestion in this vicinity. Transcontinental and Western Air, in its application for new service, claims service to points in New England "would make it unnecessary for traffic between the points to proceed through New York, as it does today."<sup>(1)</sup>

Undoubtedly some of the new long-distance and intercontinental routes which will evolve as world economic and political conditions approach normality will approximate great circle courses and aid in the growing trend toward decentralization of population, industry, and travel routes. Suburban growth will be an important decentralizing factor in air route network. Urban communities of the future have been described as areas on the map rather than small dots. Suburban areas many miles in depth, circumscribing cities, may have many aspects of the towns of the medieval era.

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(1) Boston Traveler, March 1, 1946, pg. 12.



PART IV

OPERATIONAL FACTORS



## I. DISTANCE

Operational factors governing air route structure are those factors which influence the extent and location of routes by virtue of the feasibility of actual operation of such services.

Most writers in the United States who have treated air transport operation consider the prime economic characteristic of operation in this industry to be rate of speed. No doubt this is true of domestic operation within the United States, but it is not sound reasoning to conclude that this is characteristic of the industry as a whole throughout the world.

This not uncommon belief is based upon observation of the air transportation industry in one country, the United States, one of six nations in the world in which domestic air transportation is justified by speed alone. Distance, a necessary prerequisite to the operation of the speed advantage in domestic air travel, is found in only six nations.

The United States, Canada, Russia, China, Australia, and Brazil are the sole large single-nationality areas which can be traveled long distances by air without the crossing of international borders. (See Map XVI) The U.S.S.R. has approximately sixteen per cent of the distribution of total  
(1)  
land in the world.

As a result of the Watres Act of 1930, in the United States three East-to-West transcontinental airlines were organized in an effort to unify the  
(2)  
air transportation industry. Since then, Northwest Airlines, operating

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(1) Van Zandt, J.P., The Geography of World Air Transport, Vol. I, The Brookings Institute, Washington, D.C., 1944, pg. 11.

(2) Frederick, J.H., Commercial Air Transportation, Richard D. Irwin, Inc., Chicago, 1945, pg. 12.



The first part of the document discusses the importance of maintaining accurate records of all transactions. It emphasizes that every entry should be supported by a valid receipt or invoice. This ensures transparency and allows for easy verification of the data.

Furthermore, it is noted that the records should be kept in a secure and accessible format. Regular backups are recommended to prevent data loss in the event of a system failure or disaster. The document also mentions the need for periodic audits to ensure the integrity and accuracy of the information stored.

In addition, the text highlights the role of technology in streamlining record-keeping processes. Modern accounting software can automate many tasks, reducing the risk of human error and saving valuable time. However, it is stressed that users must be properly trained to utilize these tools effectively.

Overall, the document serves as a comprehensive guide for anyone responsible for financial record-keeping. It provides clear instructions and best practices to ensure that all records are accurate, complete, and secure.

EDGE LAND AREAS UNDER ONE NATIONAL JURISDICTION

MAP XVI



ARCTIC  
OCEAN

U.S.S.R.

CHINA

AUSTRALIA

UNITED  
STATES

CANADA

BRAZIL

A. C.



across the extreme north of the nation, claims recognition as the fourth transcontinental line. These routes are justified due to the width of the United States and the importance of bringing together the nation. The East-West route of Trans-Canada Air Lines is a parallel case.

The medium-length hauls so important to the commercial airlines in the United States cannot be so to the British domestic air system within England's small area.

Distance is instrumental in determining the nature of routes as well as the extent of them. The need for "feeder", regional, and "continental national binder" routes depends, in large degree, upon the extent and area of land within international boundary lines.

Generally the lengths of the hops within an air route determine the directness of that route between its terminals. The greater the number of stops and the shorter the hops within the route, the more apt is the service to diverge from its general direction and thus to lose in directness.

The distance between stops is largely influenced by the existence or non-existence of airport and airway facilities along the route, and the communities of interest between the terminals as well as among terminals and all points along the way.

[The text on this page is extremely faint and illegible. It appears to be a multi-paragraph document, possibly a letter or a report, with several lines of text visible but not readable.]

## 2. FACTORS OF EQUIPMENT, TRAFFIC, FREQUENCY AND COST

The nature of aviation routes may be affected in part by the type and size of equipment available for use at the time a new service is being inaugurated. In 1928 the Boeing single-motor biplane, capable of carrying 16,000 pounds pay-load and accommodating two passengers, could not service long international runs, but limited aviation routes operated to relatively short domestic runs. The Pan American Clipper ships now used on the trans-oceanic flights transport forty passengers over a distance of 4,000 miles. These are constructed to carry the fuel and pay-load necessary for safe and profitable over-ocean flight and are equipped with the navigation and other aids essential to such flying.

Technological improvements in aircraft and aircraft equipment have made high-altitude flying over routes in mountainous terrain a common phenomenon. The restricted altitudinal ranges of planes in the not-too-distant past limited route operations to those over considerably level terrain.

The size and type of aircraft may influence or be influenced by the length of take-off and landing runs, and also make impossible an otherwise feasible route by virtue of the length of runways.

The load capacity of airplanes can influence route patterning. Small fuel capacities of these vehicles are seen to have restricted air operation of the past to relatively short non-stop flights. The pay-load capacity of a plane must be great enough to allow due profits to be forthcoming from an economically justifiable route.

1870

Received of the Treasurer of the State of New York  
the sum of \$1000.00  
for the year 1870

Witness my hand and seal of office  
this 1st day of January 1870

John W. Foster  
Governor

It is obvious that the economic operation of an air service presupposes and necessitates a reasonable amount of potential traffic. This traffic is ascertained by the number of long-distance telephone calls made and the telegrams and first class mail sent from and to points served by the route. Bank clearings also indicate a community of interest between cities. Completely efficient use of equipment is dependent upon traffic demands and such use varies with the size of equipment and the traffic volume.

Reasonably frequent service on established routes is necessary for their profitable operation. The size and number of aircraft available for use are factors determining the possibility of frequent operation. As reconversion of the aircraft industry to production of planes for commercial uses advances, more frequent flight schedules have been evidenced.

The final factor influencing the actual operation of air services is that of cost. In the United States the airplanes necessary to service a route are an expense which must be met by the airline company or companies. The airports and airway facilities which must be established for the new service are financed by government funds. The government, in considering the authorization of a new route regards the cost in airmail payments and that of airway and airport facilities in relation to the expected public benefits of the service.



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## FINDINGS AND CONCLUSIONS

The causes of air route development are several. Many customarily considered the only are, in reality, just a few of the factors. The air route structure of the world cannot be tied down categorically to two or three factors, nor does this structure within one nation or region evolve from only a few causes.

By taking several examples of air transport development, a wide range of factors affecting the route network is evidenced. It is true that some are seen more readily than others; nevertheless, these latter cannot be disregarded.

It is also true that the importance of all causes of route development vary proportionally with the period of time and the region under consideration.

In the United States in particular, members of the air transport industry and others concerned with the operating and regulating aspects of the industry have tacitly assumed certain factors as the sole factors influencing the extent, nature, and location of our air service. They base their reasoning for the justification of air transport on a few important factors, some of which are without doubt of fundamental importance. These are specifically industry, population, raw materials, and military and political considerations. Although population, per se, is not a source of air travel, domestic air service authorizations in the United States between cities of certain population are granted by the United States Civil Aeronautics Board on the basis of these populations.

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[Extremely faint, illegible body text, likely bleed-through from the reverse side of the page]

Considerations of surface configuration, the availability of capital, the size and economic development of nations, and established route patterns, although not so evidently determining elements in the air route network as some of the demand-creating factors frequently cited in hearings of the Civil Aeronautics Board, are, nevertheless, factors which inevitably have affected the existence, location, extent and nature of air routes.

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## ABSTRACT

There are certain basic economic factors which have been, and will continue to be for some while, though in varying degree, influential in the air transport pattern. Although several elements working together contribute to the selection of certain routes, it is desirable to isolate each of these factors for a clear analysis.

The economic factors may be classified as physical, treating surface configuration; demand, including type of service demanded, factors creating the demand, and factors facilitating the creation of this demand; psychological, dealing with the influence of established travel routes and the consequent concentration of air route network; and lastly, operational, treating those factors which influence the extent and location of routes by virtue of the feasibility of actual operation of such services, namely distance, equipment, traffic, frequency of service, and cost.

The configuration of the world's surfaces is no longer an important consideration in the formation of the world air network, and in some parts of the earth where technological improvements in aviation are being put into use, it may be given little or no consideration. Nevertheless, many of our air routes have their present locations because of the presence of jungles, swamps, mountains, and relatively long non-stop distances over water, which created a real hazard to the flyers of the immediate past. Long non-stop flights are a recent development which resulted from the construction of a plane with large enough fuel capacity for such operation.

Of the three types of service demanded of the airlines---mail, passenger,



and freight--mail service was the initial job of the air transportation industry. The pattern of early airline routes and services was influenced largely by the flow of mail between great population centers. As passenger service came into demand, it followed the already existent mail routes.

The absence of safety devices in the early history of air transportation made for a slow acceptance of passenger service; today, however, nearly all of the airlines cater to passenger traffic. The limited cargo space of the airplane has resulted in a high cost of conveyance and thereby kept air freight service from gaining very great importance. Nevertheless, high-value goods of light weight and emergency and perishable goods have created a demand for air freight service which is growing rapidly and may contribute toward establishing a flexible freight service pattern.

Several traffic sources may be considered basic demand factors governing air service, namely, industry, military and political considerations, and raw materials. It is no mere coincidence that the major intercontinental air routes have terminals in areas of heavy industry. Industry is the most important of the basic factors creating demand for air service.

Military and political needs for strategic air routes also have a profound influence upon the pattern of air service. The former needs can be evidenced in the extensive and well-developed network of the Air Transport Command routes of the United States Army Air Force, a network which extends to points all over the world. The demand for the carriage of strategic and costly raw materials by air, although of less importance to the air transportation industry than the demand created by the two aforementioned factors, nevertheless, is significant.





The stage of economic development of nations, the condition of surface transportation facilities, the availability of capital, capital cities, and resort areas are not factors of sufficient importance to be treated as basic demand-creating factors; they are more correctly factors facilitating the creation of demand for air routes.

The economic development of backward nations has been stepped up as a result of air facilities reaching or extending within these nations. Air service here has been typically unscheduled bush operation.

Non-existence of other transportation facilities, inadequate use of existing means of travel are both contributing factors in the determination of air route patterns. Air transport can be the initial means of communication in an area or can act as either a substitute for or a supplement to other transportation facilities. The exclusive, substitutional, or supplementary character of the air service influences the nature of the route.

The relation between availability of capital and route structure is evidenced by the different effects of public and private financing upon the nature of air routes. The greater the proportion of public support in airline operation, the greater the tendency for route structure to be influenced by national considerations.

While the political nature of business in capital cities is deemed to be an important source of air traffic, actually it is only in national capitals and in some state capitals of the United States that air service can be considered important. In addition, the facts that some state capitals of the United States have no air service at all and that commercial and other interests are responsible for a great part of the demand for air travel in and out of capital cities necessitates consideration of capitals



as a factor only facilitating this demand. Resort areas are a similar demand facilitating factor.

The psychological factor of patterning air transport routes after existing surface transportation routes is a barrier to the change of route pattern. In recent years air networks have managed to break away from those of other means of travel.

Operational factors governing air route structure are those factors which influence the extent and location of routes by virtue of the feasibility of actual operation of such services. The first operational factor, distance or size of nations, is a necessary prerequisite to the operation in the domestic network of the speed advantage of air transportation. There are only six nations in the world large enough for domestic air operation to be justified by speed alone.

The pattern of aviation routes may be affected in part by the type and size of equipment available for use at the time a new service is being inaugurated. Technological improvements in aircraft and in aircraft equipment have made high-altitude flying over routes in mountainous terrain and long-distance flying without stops common phenomena.

For completely efficient use of equipment, traffic must be considerable. Lack of or decline in traffic volume do not make for profitable operation. Reasonably frequent service is also necessary for profitable operation. The size and number of aircraft available for use, as well as traffic volume, are the important factors determining the possibility of frequent operation.

Cost factors in the operation of routes by United States air carriers includes the cost of equipment and performance of service to be borne by



the airlines themselves and the expense of establishing airports and airway facilities borne by the United States Government. In considering the authorization of a new route, the Government regards the cost in air mail payments and that of airway and airport facilities in relation to the expected public benefits of the service.



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