CIVIL AERONAUTICS JOURNAL

ISSUED TWICE MONTHLY BY THE CIVIL AERONAUTICS AUTHORITY

VOL. 1 WASHINGTON, MAY 1, 1940 NO. 9

C. A. A.–N. Y. A. SEAPLANE BASE DEVELOPMENT PROGRAM[1]

Low Cost Seaplane Facilities Being Installed in 21 States—300 Small Bases Constructed or Being Planned—Joint Project Expected to Spur Growth of Water Flying

The Civil Aeronautics Authority in cooperation with the National Youth Administration early in 1939 inaugurated a Nation-wide seaplane base development program. The purpose of this program is to provide suitable and convenient docking facilities at a very low cost for the benefit of seaplane flyers and as an additional asset to those communities which adjoin water areas. There are many such communities, and the advantages derived from the "in town" or "doorstep" landing are obvious. Further, the program offers a useful and constructive workshop project for the National Youth Administration.

Private seaplane flying in the United States has steadily developed during recent years despite a lack of necessary facilities for servicing and handling and the lack of general understanding of its basic requirements. Water flying has an appeal which attracts people who would not otherwise fly. Commuting to business by water landing aircraft, as a single example, is now practiced by approximately 40 seaplane owners in the New York City area and the majority of these owners purchased their first plane for this particular purpose. Statistics show that the production of seaplanes increased 50 percent in 1939 over the preceding year, and the provision of more adequate facilities should add further impetus to the rapid growth and popularity of water operations.

The problem of the seaplane pilot is not in finding suitable places to land. In most cases his difficulties arise after landing when he seeks means of getting his craft and passengers safely ashore and of refueling. He must find suitable docking facilities specially designed so as to prevent possible damage to the wing structure resulting from his ship striking against high pilings or other obstructions such as are usually present at boat and ship docks. Every town or city which adjoins a water area of suitable size already possesses a potential landing area which could be made usable at little expense.

Because of their low cost, it is possible to install seaplane bases in many small communities which for economic or other reasons might not be able to construct or maintain airports. The establishment of bases in these communities should be helpful in stimulating all types of flying and expanding aviation in general.

The seaplane facilities which can be included in the program are floats (single or in combination of a number of units to make larger bases), moorings, wind cones and, in such instances as needed, dollies for use on existing ramps. The National Youth Administration constructs and installs these facilities of a standardized design in suitable and desirable locations throughout the country, providing it is supplied with the relatively small cost of the raw materials. The cost of materials for the standard 10- by 20-foot float developed by the Authority for the program, the largest single item necessary, is, for example, approximately $150 per unit, varying of course with local prices for lumber, paint, and hardware. As all labor costs are furnished by the Federal Government, it is in all cases necessary that a State, county, or municipality sponsor each project. The facilities when completed become the property of the sponsoring agency.

[1] A report by Capt. Robert S. Fogg, seaplane facility expert, Civil Aeronautics Authority.

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Published with the approval of the Director of the Bureau of the Budget by the

CIVIL AERONAUTICS AUTHORITY:

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Issued on the 1st and 15th of each month. Subscription $1 per year. Single copies 5 cents. Sold by the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C.

SEAPLANE BASES

(Continued from preceding page)

In general, the floats are made at N. Y. A. workshops but in some instances they are prefabricated at the workshop and assembled at the site selected. In some cases it is possible for the N. Y. A. to furnish trucking for the finished floats or the precut materials to the site, but where such trucking is not available arrangements are made between the sponsor and the N. Y. A. at the time of inception of the project. Actual construction work is closely supervised by expert N. Y. A. carpenters and engineers.

The floats are constructed so as to be supported in the water by 11 oil drums. There is a removable hatch in the deck of the float above each drum to facilitate replacement when necessary. It is recommended that all lumber, drums, and hardware be treated with two coats of black asphaltum paint. Automobile tires are placed on three sides of the float to act as bumpers. In order to achieve a standardized system of marking, the deck of the float is painted bright orange with a black triangle superimposed, the rest of the float is painted black, and the automobile-tire bumpers treated with aluminum paint. The combination of the three colors lends an extremely neat appearance to the float, and makes it readily discernible from the air.

Consulting and advisory services are available through the field representatives and a seaplane facilities expert of the Airport Section in the Authority's Technical Development Division. Comprehensive plans for simple seaplane landing floats suitable for use in refueling and the loading and unloading of passengers have been prepared by the Airport Section with the cooperation of the National Youth Administration, and these, as well as working drawings of several types of bases and the so-called "Boston Dolly" for use on existing ramps, are available upon request from the Airport Section and from all N. Y. A. State directors.

Obviously, it is impossible for the Civil Aeronautics Authority to furnish sufficient personnel to select all the desirable sites and contact individually all persons concerned. Interested communities should therefore communicate with their State or district N. Y. A. office and their State aviation officials.

The usefulness and efficiency of these seaplane floats are measurably increased if they are installed near existing facilities providing attendants, gasoline and oil service, telephones, and rest rooms, such as are offered by yacht and motorboat clubs.

Rivers, canals, lakes, and harbors are generally suitable for the installations where a clear area of at least 1½ miles in length with unobstructed approaches is available. The floats should be placed in as protected a position as possible in order that seaplanes can taxi to them after landing and be safe from high waves and winds. A minimum depth of 2 feet of water is required.

There are many recreation and summer resorts located at water areas where seaplane flying would not only be a welcome added attraction and convenience for the general public but in addition offer an added source of revenue for commercial aircraft operators with float equipment. It should be noted that the program does not require that the floats be placed on city owned or leased property.

The program is now well under way in 21 States and approximately 300 small seaplane bases are now completed or being planned. Work has begun on a chain of stations extending from Maine to Florida and along the Gulf coast to Brownsville, Tex., and is now extending inland. Completion of the program will make seaplane operations feasible from coast to coast and from border to border.

The list of progressive communities availing themselves of the opportunity of providing these facilities is growing rapidly. As the facilities are installed descriptive information pertaining to them is published in airport bulletins, Weekly Notices to Airmen, trade journals, and on aeronautical charts, thus enabling the cross-country seaplane flyer to intelligently chart his course and plan his trip in advance. The resulting publicity is in itself of considerable potential advertising value to the sponsoring community. Furthermore, the design of the floats is such that they may be used for motorboat landings when they are not being used for seaplane operations.

The installation of facilities of the type provided by the joint C. A. A.–N. Y. A. program is only the first step in a coordinated and comprehensive plan for bases of a more permanent nature which it is hoped may develop as water flying increases. The floats, being portable and of a standardized size and design, can be readily moved or combined with more units to provide larger bases when necessary. The facilities now being installed should form the nucleus for the future establishment of a completely adequate Nation-wide system of seaplane bases for the safe and and convenient operation of water flying aircraft.

Meteorological Conditions Associated With Aircraft Lightning Discharges and Atmospherics [1]

By E. J. Minser

Transcontinental and Western Air

ABSTRACT

From an analysis of a large number of actual cases, lightning discharges to aircraft in flight are determined to be between two oppositely charged regions in cumulo type cloud and to occur most frequently in the zone adjacent to the freezing isotherm, i. e., from 26° to 34° F. The origin of the electrical charge in cumulo type clouds is explained as resulting from the selective separation of positive and negative ions in the earth's electrical field by cloud and precipitation particles, and final concentration at the freezing isotherm through disruption of rain drops, the charge in the cloud being determined by the cause of disruption. Flight procedure through cumulo type clouds to avoid lightning discharges, is given.

INTRODUCTION

With the increase in number of large, all metal, transport planes flying regular schedules, there has been a consistent increase in the number of lightning discharges encountered by aircraft. In 1935, with the introduction of Douglas DC–2 equipment, the first definite discharges were reported, and since that time this phenomenon has been frequently observed, not only in the United States but in various other sections of the northern hemisphere.

The first lightning discharges were generally considered as freaks of nature, a "one in a million" event, and the possible hazard was overshadowed by the novelty of the phenomenon. When, however, the frequency of occurrence increased, a definite hazard was recognized, even though structural damage in each case was of a minor degree. Lacking any specific knowledge of this phenomenon, no means of prevention could be readily devised, except a general warning "to keep clear of thunderstorms."

This warning, wise as it appeared, did not decrease the number of discharges encountered, for an analysis of case histories soon revealed that the majority of discharges were not being encountered in thunderstorms but occurred in cumulus-type clouds that produced showers. As this type of cloud is common in all altitudes within the usual range of altitudes traversed by scheduled operations, the air transport industry was faced with a very grave problem.

[1] Presented at the joint meeting, Institute of the Aeronautical Sciences and Soaring Society of America, Elmira, N. Y., July 1, 1939. Reprinted from the December 1939, JOURNAL OF THE AERONAUTICAL SCIENCES through the courtesy of the author and the I. Ae. S.

During the winter of 1937–38 a detailed analysis of the meteorological conditions prevailing at the time discharges were encountered was begun. Until that time most of the research had been conducted by radio engineers, who worked on the premise that the discharges were the result of the airplane triggering a discharge between two cloud masses or, in the opinion of some, the result of a discharge between a cloud mass and the airplane. At the same time efforts were made to protect the radio equipment and other vulnerable parts of the plane and to devise means by which the electric charge could be drained off. Damaged parts of aircraft were shipped to the General Electric Co. which offered to make suitable measurements in an effort to determine the nature of the discharges with respect to time duration and current magnitude.

Up to the present time over 50 case histories of discharges reported in the United States have been analyzed in this study. In many of the early cases much valuable data were lacking and while pilots could recall certain of the conditions that existed, the information was far from being as complete as an investigation of this type demanded. However, about 25 accurate and complete case histories are available and it is upon these that this study is based.

Annual and Diurnal Distribution

Early in this study the annual distribution of discharges was plotted, primarily because the date of occurrence was one element that was available in every case. This curve revealed that two definite peaks occurred during the year with a maximum frequency in early spring, with a lesser peak in late fall. Since these peak periods are during the time of least thunderstorm frequency in the United States the early observed fact that discharges infrequently occurred in thunderstorms was borne out.

The diurnal frequency of occurrence revealed a definite peak between 4 p. m. and 8 p. m., which time period coincides with the period of maximum convection over the continent.

Altitude

The mean altitude at which discharges were encountered was 10,000 feet with a maximum of 18,000 feet and a minimum of 2,000 feet, with no one level predominant.

Turbulence

In all cases some degree of turbulence was reported. Light turbulence was usually present within the cloud, suddenly increasing to moderate or severe just prior to the discharge.

Precipitation

In every case precipitation was observed prior to and during the discharge. As well as could be determined by the pilots the precipitation was generally in the form of rain and/or wet snow, rarely dry snow.* When dry snow was observed the precipitation generally changed to wet snow and/or rain at the time of discharge. When snow alone was observed the discharge appeared to be vertical rather than horizontal.

Cloud Forms

It is difficult for a pilot to determine accurately, while on instruments, the type of cloud in which he is flying. Since no discharge was ever reported except when in a cloud, information necessary to establish the average cloud type could not be determined from the pilots' reports. Ground observers in the vicinity of the discharge generally reported cumulus type clouds as the predominant type, which is supported by the other meteorological data. The analysis of weather maps generally revealed modified polar air as being the prevailing air mass which likewise, because of its inherent instability, also supports this conclusion.

Electrical Phenomena

Electrical phenomena observed by the pilots are typed as aural and visual. This differentiation is necessary since static heard in the radio receivers increases with the intensity of corona discharge, which, of course, is invisible in daylight.

Static was in all cases severe. Ordinarily, it was weak until precipitation was encountered, at which time a definite increase in intensity was observed, becoming a steady roar at the time of discharge. With the discharge, the intensity decreased to a degree comparable to that present prior to encountering precipitation.

When the discharge occurred at night a corona discharge was reported in every case. The corona invariably followed a definite time sequence in all cases where observed and the degree of static varied directly as the intensity of the corona.

The corona discharge usually was observed to begin upon encountering precipitation and remain constant for a limited time, being generally restricted to extremities of the airplane having a small radius of curvature such as the nose, propeller tips, and wing tips. This static and/or corona would endure for a period of 15 to 30 seconds, and end abruptly with the lightning discharge which was usually observed as a vivid flash. Thunder, if heard at all, generally resembled a shotgun discharge.

Temperature

The average temperature existing at flight level is 28° F. In those cases where this element was reliably reported the extremes were one case each of −5°, 10°, and 40° F. The remaining temperatures fell within the limits of 25° to 34° F. Considering the wide variation of altitudes at which discharges were encountered the concentration of temperatures to a small spread near freezing is of interest, and it was this fact that motivated a more intense study to determine, if possible, the fundamental causes of lightning discharges.

In the geographical regions where the majority of the lightning discharges were encountered it was determined from aerological data that the mean elevation of the freezing isotherm was below surface during the winter months and above 3 kilometers during the summer. Thus, during the spring and fall the freezing isotherm would lie between 1 and 3 kilometers. Since the maximum frequency of discharges occurs during these two seasons, the importance of temperature as a factor in the generation of electrical charges in cumulus clouds was recognized.

*Wet snow observed in cumulus clouds under these conditions appeared to consist of a conglomerate of snowflakes and water. Because of their irregular form these particles cannot be classified as soft ice pellets, neither does the term sleet truly apply. The "splashing" of these particles on striking the windshield indicates that considerable liquid water is present, and hence the term "wet snow" is used.

Physical Results of Discharges

The damage to the structure of the plane and equipment has, in all cases, been of a minor nature and in no instance has it caused the failure of any essential part. Damage has been confined to punctures of the skin or forming frames, burned off trailing antennas, fusing of radio lead-in parts, torn fabric, and damaged tail cones. In every instance the damage was restricted to those parts of the structure having small radii of curvature, but in no one case was the damage of mechanical or of aerodynamic importance. The points of ingress and egress of the discharge have always been identified.

For an extended period of time the General Electric Co. and other organizations have recorded the intensity of lightning discharges to the earth and have fairly well established the maxima and minima of currents, time duration of discharges, and quantities of electricity involved. A comparison of holes burned in laboratory specimens by a controlled current of known magnitude and duration with the actual damaged aircraft structure indicates that in certain instances modern all-metal aircraft have withstood safely both high current short time and low current long time discharges as great as those known to have occurrred in the General Electric studies.

It is therefore believed that modern all-metal aircraft in flight is not endangered by lightning discharges and no hazard exists under such circumstances.

History of a Typical Discharge

The usual sequence of events culminating in a lightning discharge through an airplane is as follows:

Flight is being conducted at an altitude where the temperature is near freezing, on and off instruments in towering cumulus clouds from which occasional showers are observed. On entering an unusually large cloud, light to moderately wet snow or rain is encountered. If the cloud is entered on

(See LIGHTNING page 202)

PRIVATE FLYING

Crop-Dusting Airplane Precautions

Maintenance Bulletin Lists Fire-Prevention Precautions for Crop-Dusting Airplanes

The Authority has issued an airworthiness maintenance bulletin (No. 24) on the subject of crop-dusting airplanes. A questionnaire appears at the end of the bulletin, and readers should feel free to answer the questions therein and forward their replies to the Aircraft Airworthiness Section, Civil Aeronautics Authority, Washington, D. C.

The full text of the bulletin follows.

Airworthiness Maintenance Bulletin No. 24

ALL CROP-DUSTING AIRPLANES

Despite the usual precautions taken by operators of crop-dusting airplanes spreading sulphur, three cases of fire in the air, attributable to the use of this widely used insecticide, have come to the attention of the Authority during 1939.

As is generally known, sulphur dust has a very low ignition point and is highly combustible when atomized with air which is the case during dusting operations. Besides, due to its excellent dielectric properties it picks up electric charges readily which, under favorable atmospheric conditions of low relative humidity, can lead to combustion.

As a precautionary measure and in an effort to decrease the hazards from fire in the air during dusting operations, the Authority requests that in case you engage in dusting with sulphur the following precautions shall be taken:

1. Your airplane shall be completely electrically bonded. The installation of a small static rod (approximately 6 inches long) on each wing tip to serve as end terminal of the bonding appears to be helpful in dissipating electric charges into the air, provided the ends of the rods taper to a very sharp point. The installation of such rods is recommended at the same time the bonding is accomplished.

2. The gate at the bottom of the hopper shall be made of a nonferrous metal and also shall be bonded to the hopper.

3. All closed spaces in the fuselage, other than the hopper, shall be ventilated by allowing outside air to sweep these spaces in order to forestall any accumulation of dust.

4. No engine exhaust discharge under or along the bottom of the airplane shall be allowed. The most satisfactory location of the exhaust outlet appears to be on the top side of wings (top wing in case of biplanes). In placing the exhaust outlet overhead the necessity of extending it far enough up to prevent fire or sparks contacting the wing fabric should not be overlooked.

5. The entire tail group and the lower portion of the fuselage aft of the hopper shall be covered with *thin* aluminum alloy or that these fabric-covered areas shall be finished with acetate dope. In case metal covering is used, the balance of the airplane must be carefully considered for possible adverse effects due to a probable increase in weight.

If your airplane does not already incorporate the features listed above, the necessary alterations should be started immediately. Compliance with items Nos. 1, 3, and 4, will be a prerequisite to recertification of your airplane.

An appropriate entry should be made in the log book of your airplane for the benefit of field inspectors, recording the date of compliance with the mandatory items of this bulletin.

The requests contained herein are based on the service experience of the Authority and are made in an endeavor to assist you in preventing fires in the air while engaged in sulphur dusting operations.

Questionnaire Form on Fires in Air During Sulphur Dusting

This questionnaire has been prepared for the purpose of obtaining the opinion of the operators of crop dusters and other interested parties concerning the following specific questions:

1. Have you experienced sulphur fires in the air while dusting? (Yes, No)
   Describe briefly the circumstances.

   ---

2. What do you believe was the probable cause of the fire?

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3. Do you subscribe to the precautionary measures outlined in Airworthiness Maintenance Bulletin No. 24? (Yes, No)
   If answer is no, please describe why you do not agree and what you propose in its place.

   ---

4. Have you tried a long discharge pipe so that dust will not be carried back on to the tail surfaces? (Yes, No)
   If you have tried such an arrangement, please describe your experience and include a sketch.

From ..... (Name) ..... (Company)

C. A. R. REVISIONS

Airmen are reminded that the amendments to the Civil Air Regulations adopted by the Authority several months ago are effective as of May 1, 1940.

By virtue of these amendments, Part 20–*Pilot Certificates*, Part 24–*Mechanic Certificates*, and Part 52–*Repair Station Rating* are revised; Part 51–*Ground Instructor Rating* and Part 53–*Mechanic School Rating*, both new parts, are added; and former parts 23 and 25 are deleted.

Each part has been printed separately, and copies are now available. Those affected by the regulations may obtain copies of the applicable parts from the Correspondence Unit, Civil Aeronautics Authority, Washington, D. C. Others desiring copies may obtain them at 5 cents per part from the Superintendent of Documents, United States Government Printing Office, Washington, D. C.

Designation of Medical Examiners

During the month of March the following physicians were officially authorized to act as medical examiners for the Civil Aeronautics Authority in the cities named.

Georgia.—Dr. Walter B. Heller, Franklin Building, Toccoa.

Minnesota.—Dr. George J. Halladay, 712½ Laurel Street, Brainerd.

Missouri.—Dr. Harold J. Freiheit, 143 East Main Street, Fredericktown.

Ohio.—Dr. Charles R. Hoskins, 5 North Court Street, Athens.

Virginia.—Dr. Claude A. Nunnally, 1200 Prince Edward Street, Fredericksburg.

Alaska.—Dr. Thomas Morcom, Nome.

The following named physician is no longer conducting physical examinations for the Civil Aeronautics Authority.

Dr. Henry W. Aldridge, Manitowoc, Wis.

Letter of Approval

[*Number and date of assignment in parentheses*]

AIRCRAFT

Meyers, OTW, 2-place open land biplane, engine, Warner Scarab, Series 40 (2-550, August 22, 1939).

New Type Certificates

[Certificate numbers and dates of assignment in parentheses]

AIRCRAFT

Fairchild, M-62A, two-place open land monoplane. Engine, Ranger 6-440-C2 (724, April 3, 1940).

Piper, J5A, three-place closed land monoplane. Engine, Continental A-75-8 (725, April 13, 1940).

APPLIANCES

Aeronautical Sales and Service, skis, model AS-600-6, hickory runner. Approved static load per ski 660 lbs (133, April 10, 1940).

CORRECTIONS

The following corrections should be made to the listing of new type certificates (aircraft) carried on the April 15 issue of the JOURNAL.

Lockheed—add certificate number and date of assignment thus (723, March 30, 1940).

Engineering & Research model 415C engine is Continental A-65-8 instead of Continental A-65-1 as shown.

Aircraft Radio Equipment Approved for Scheduled Air Carrier Use

During the month of March the following units of aircraft radio equipment were approved by the Authority for scheduled air carrier use and issued type certificates.

Certificate No.	Manufacturer	Unit	Date
164	United Air Lines Transport Corporation.	ES-295G amplifier	Mar. 21
165	do	ES-295H radio control panel	Do.
166	do	ES-295H-4 pilot's jack box	Do.
251	Western Electric Co	30AA radio transmitter (part of 1B radio altimeter equipment).	Mar. 6
252	do	30AA radio receiver (part of 1B radio altimeter equipment).	Do.
254	do	10A power unit (part of 1B radio altimeter equipment)	Do.
255	do	K. S.-8387 meter (part of 1B radio altimeter equipment)	Do.
520	Eastern Air Lines	Type CES-222 antenna coupling unit	Mar. 12

AIRWAYS AND AIRPORTS

Technical Development Radio Report Issued

Technical Development Division Report No. 9, entitled "Preliminary Investigation of the Effects of Wave Polarization and Site Determination with the Portable Ultra-High-Frequency Visual Radio Range," has been issued by the Authority and is now available for distribution.

The report, which is by J. M. Lee and C. H. Jackson of the Authority's Radio Development Section, describes an investigation made to determine the effects of horizontal and vertical polarization on ultra-high-frequency radio range transmission, and to establish general site requirements for the installation of this equipment. Particular attention is devoted to the effects of polarization on the multiple course phenomenon. A description of the portable equipment used in the investigation is included, as are copies of actual recordings taken during tests with transmission both from an open field and immediately adjacent to sources of reflection. It is concluded that site requirements are much less severe with horizontal polarization than with vertically polarized transmission.

The report is well illustrated with photographs, diagrams, charts, and graphs. Copies may be obtained from the Publications and Statistics Division, Civil Aeronautics Authority, Washington, D. C.

Airport Projects Approved

In accordance with the provisions of section 303 of the Civil Aeronautics Act, the Administrator of the Authority has issued certificates of air navigation facility necessity authorizing the expenditure of Federal funds in the operation of the following projects:

Boulder City, Nev.—$13,000 for National Park Service, United States Department of Interior Civilian Conservation Corps project for grading installation of boundary and range lights, obstruction lights, beacon, code beacon, and a lighted wind cone at Boulder City Airport.

Fort Myers, Fla.—$95,174 for W. P. A. project for clearing and grubbing, grading, draining, and paving of three runways, and similar construction of a taxistrip and apron at Lee County Airport.

Gravelly Point, District of Columbia and Arlington County, Va.—$2,125,000 for P. W. A. project for further development of the landing area and other portions and facilities of the airport at Washington National Airport.

Houston, Tex.—$119,045 for P. W. A. project for construction of an administration building, hangar, parking areas, roadway, loading docks, and fences and walks; landscaping; electrical improvements and necessary equipment at municipal airport.

Lubbock, Tex.—$518 for N. Y. A. project for leveling apron to hangar, repairing fence around field, painting hangar and office building, and landscaping at municipal airport.

Raleigh, N. Car.—$11,062 for W. P. A. project for reconditioning and painting of hangar, and construction of an addition to the hangar to provide facilities for the Weather Bureau and Airway Communications, ticket offices for scheduled air carriers, waiting and rest rooms, storage and other facilities at municipal airport.

Aeronautical Charts

New Editions Issued

During March the following new editions of aeronautical charts were issued by the United States Coast and Geodetic Survey. Pilots are warned that previous editions of the same charts are canceled and now obsolete.

REGIONAL CHART

10-M.—March 1940. Size, 26 by 31 inches. Located in latitude 38°-44° north and longitude 69°-78° west, an area of some 198,000 square miles. Includes changes in air navigation facilities.

DIRECTION FINDING CHART

26-DF.—March 1940. Size, 29 by 32 inches. Located in latitude 25°-39° north and longitude 75°-91° west, covering an area of about 950,000 square miles. Civil airways added, together with an accumulation of changes since last edition.

SECTIONAL CHARTS

Cleveland.—March 1940. Size, 20 by 42 inches. Located in latitude 40°-42° north and longitude 78°-84° west, covering an area of about 51,000 square miles. New radio range at Patterson Field, realinement of Pittsburgh radio range, and accumulation of other changes.

Denver.—March 1940. Size, 20 by 43 inches. Located in latitude 38°-40° north and longitude 102°-108° west, an area of some 52,000 square miles. Gives radio range realinement at Pueblo, together with accumulation of other changes.

New York.—March 1940. Size, 20 by 42 inches. Located in latitude 40°-42° north and longitude 72°-78° west, embracing some 51,000 square miles. Shows new radio range at Philadelphia, radio ranges realined at Hackensack, Allentown, and Harrisburg, and revised civil airways.

Norfolk.—March 1940. Size, 23 by 37 inches. Located in latitude 34°-38° north, and longitude 75°-78° west, an area of 34,000 square miles. Includes addition of radio range at Langley Field, revised civil airways, and an accumulation of changes since the last edition.

Oklahoma City.—March 1940. Size, 20 by 46 inches. Located in latitude 34°-36° north and longitude 96°-102° west, covering an area of some 56,000 square miles. Radio ranges realined at Amarillo and Oklahoma City, and new radio range at Clarendon.

Rapid City.—March 1940. Size, 20 by 39 inches. Located in latitude 44°-46° north and longitude 102°-108° west, an area of about 47,000 square miles. New radio range at Sheridan.

San Antonio.—March 1940. Size, 20 by 43 inches. Located in latitude 28°-30° north and longitude 94°20′-99°40′ west, covering an area of about 52,000 square miles. Includes radio range added at Palacios and an accumulation of other changes.

Copies of aeronautical charts may be obtained from the Coast and Geodetic Survey, Washington, D. C., and from that Bureau's recognized dealers at major cities and airports. Regional and direction finding (DF) charts sell for 75 cents each, and sectional charts for 40 cents. On orders grossing $10 or more, including assortments, there is a 33⅓ percent discount allowed by the Coast and Geodetic Survey.

Recognized Dealers

The Coast and Geodetic Survey has announced the following changes in its list of recognized dealers authorized to sell charts.

New Dealers

Embry-Riddle Co., Miami Airport and Box 668, Miami, Fla. (This dealer supersedes Karl Voelter, Inc., municipal airport, Miami, Fla., on the Bureau's list.)

Southern Airways, Inc., Greenville Airport, Greenville, S. C.

Change of Address

The address of *C. S. Hammond & Co., Inc.*, a recognized dealer in aeronautical charts in New York City, has been changed from 30 Church Street to 1 East Forty-third Street.

LIGHTNING

(continued from page 199)

the forward side where up drafts are most prominent, precipitation is usually in the form of rain and moderate turbulence is experienced. If the rear of the cloud is entered, wet snow is the usual precipitation form.

Shortly after entering the region of precipitation, static increases in the radio and at night a corona discharge (St. Elmo's Fire) is visible on the wings, propeller tips, nose, and other extremities of the airplane's structure. As flight is continued through the cloud the intensity of the static increases to a steady roar, the corona becomes more vivid, with streamers extending forward into the cloud, and turbulence becomes more pronounced. These conditions continue for 10 to 20 seconds, then a flash of lightning occurs, ending abruptly the static and corona, after which turbulence steadily decreases.

This sequence of events is interpreted to indicate that the distribution of the electrical charge in a convective type cloud is roughly that shown in figure 1. In this diagram, the cloud is shown to

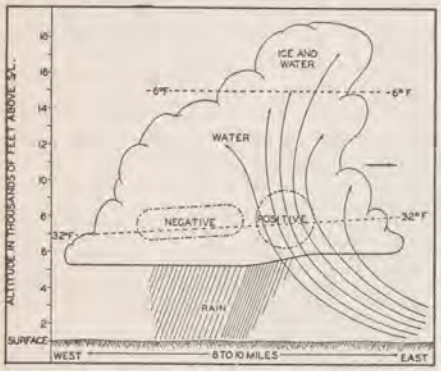


FIGURE 1.—Generalized diagram showing the distribution of electrical charge, hydrometers, and air currents in a shower cloud.

be moving eastward with the ascending currents entering the cloud base in the forward portion. In this part of the cloud a region of positive electricity is indicated.

In the rear of the cloud, where precipitation is in the form of wet snow, a region of negative electricity is indicated, with a neutral zone separating the opposite charges.

An airplane in flight through the regions of concentrated charge in the cloud would rapidly assume the charge of its environment and the charge would be gained faster than it would be dissipated except by brush discharge, which produces severe static and corona. On entering the neutral zone the airplane may, by virtue of its length as a conductor, initiate a discharge between the oppositely charged portions of the cloud.

ORIGIN OF THE ELECTRICAL CHARGE

The information obtained from the case histories used in this study is believed to contribute toward the solution of the origin of the electric charge in thunderstorms. In the past, cloud masses having a high electrical charge were considered to be limited to the cumulo-nimbus type. In this study the majority of lightning discharges were found to have occurred in cumulus clouds of the shower type. Discharges occurring in thunderstorms were limited to less than 10 percent of the cases, which is considerably less than would ordinarily be expected. This fact alone makes necessary a reconsideration of the prevailing theories of the origin of the electrical charges in thunderstorms.

That the electrical charge in thunderstorms originates in the cloud itself is generally accepted. The process whereby quantities of positive and negative electricity are produced and then separated so that two portions of the cloud are oppositely charged has been the subject of considerable theoretical and practical research, and the opposing theories proposed by C. T. R. Wilson [1] and G. C. Simpson [2] have been developed.

During this study an effort was made to explain the various observed conditions by these existing theories. While each of these theories was applicable in certain instances it now appears probable that a combination of the two, plus the introduction of Bergeron's ice crystal theory of precipitation [3] satisfactorily explains the origin and distribution of the electrical charge in thunderstorms.

In fine weather, the electrical field of the atmosphere is positive, and the earth carries a negative charge. In such a field negative ions are driven upward while positive ions move downward toward the earth. The mobility of these ions is about 1.5 centimeters per second in a field of gradient 1 volt per centimeter, but when captured by condensation or Aitken nuclei their mobility is only 0.005 to 0.0003 centimeter per second.

When, through condensation, cloud particles form in a stratum of the atmosphere, free ions are captured and the polarity of the droplet becomes opposite to the existing electrical field, that is, the lower surface of the drop will carry a positive charge with a negative charge upon its upper surface. As long as the cloud particles have no appreciable vertical movement the electrical field in the cloud remains positive with respect to the earth.

In a cloud of convective origin (cumulo type) the cloud particles are subject to extensive vertical displacements and the normal electrical field is disturbed. Cloud particles carried upward by ascending currents readily exceed the velocity of the upward moving negative ions. Since the upper surface of the drops are negatively charged, downward moving positive ions are attracted to the drop and captured, and the droplet in this manner becomes positively charged. Eventually, the upper portions of the cloud, at least that portion subject to strong vertical convection, also becomes positively charged.

Cloud particles that have formed at the condensation level (where the temperature is above freezing) and are carried by the ascending currents to a region of subfreezing temperature remain in liquid form, and do not freeze. Water vapor in the ascending air must continue to condense as the temperature is lowered through adiabatic cooling, and will increase the size of the cloud particles. At some critical temperature condensation becomes more improbable and sublimation of water vapor takes place on sublimation nuclei present. Thereafter, above that level, only ice crystals form, and the upper portion of cumulus type clouds becomes a mixture of ice and water particles.

The ice particles, being in the form of needles and plates, have a very slow rate of fall and the direction of fall is erratic. If the cloud remains supersaturated for some time the crystals will continue to grow and form flakes. Also, because of the lower vapor pressure over ice, sublimation at the expense of adjacent water particles will occur. However, because of their erratic direction of fall, crystals must readily collide with drops, and a conglomerate of ice and water will form.

In the rear portion of the cloud the strength of the ascending currents rapidly diminishes and the velocity of fall under gravity of the ice-water particles soon exceeds the sustaining force of the air stream. Since they are now exposed to more frequent collisions with the slower falling water particles, the size of these particles rapidly increases.

During the descent the polarity of the particle is positive with respect to the earth, that is, the lower surface is charged positively. Negative ions, moving upward in the electrical field, are therefore attracted and captured by the drop and carried downward, and through this filtering process the upper positive region is protected against neutralization by ascending negative ions.

The initial disruption of the droplet immediately after reaching the 32° F. isotherm appears to be the important phase in the origin of the electric charge. As an ice-water conglomerate, these particles have a high viscosity, and being irregular in form their rate of fall is retarded. Such particles would also intercept and capture free negative ions much more rapidly than would the smaller, slow moving water particles.

Upon melting, the form of the droplet becomes more nearly streamlined, its velocity of fall rapidly increases and, on attaining its terminal velocity, the particle disrupts. In 1927 Simpson [4] applied the experiments of Lenard to the breaking of drops by an air current and concluded that a separation of electrical charge is thus produced in a thunderstorm. Through this process the negative ions are liberated and the remaining positively charged liquid drops fall free. In this manner, a region of high negative charge is established below the freezing isotherm.

In the region of strong ascending air streams, the disruption of droplets likewise occurs. However, the water particles retaining the positive charge cannot fall free but are held suspended or carried aloft in the ascending currents unless the mass of accumulated water

(See REFERENCES *at end of article for footnotes)*

exceeds the sustaining force of the vertical air stream. The negative ions separated during this process are carried into the upper and rear portions of the cloud where they are captured by falling precipitation forms and concentrated below the freezing isotherm by the method previously described. In this manner two oppositely electrically charged regions are established in a horizontal plane in the thunderstorm.

In figure 2 the history of cloud particles, free ions, and precipitation forms in a typical cumulo-nimbus type cloud is shown. This diagram differs somewhat from that presented by Simpson [2] in that a third region of activity is designated along the front of the cloud. It is through the upward movement of cloud particles in this region that the positive charge at the top of the cloud is sustained.

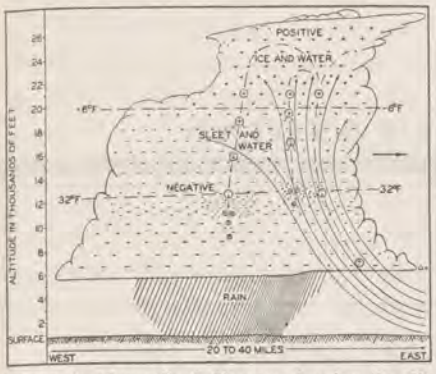


FIGURE 2.—Generalized diagram showing the distribution of meteorological elements and the mechanism of the separation of electrical charges in a typical thunderstorm.

A lightning charge within the cloud may occur between the negatively charged region below the 32° F. isotherm and (1) the positive region at the top of the cloud, (2) the positive region in the ascending air stream, (3) the earth, and between the positive region in the ascending current and earth.

In a large cumulus cloud that will produce showers, the electrical field may never attain the potential necessary to initiate a lightning discharge and the charges will gradually dissipate through leakage and neutralization. An airplane, however, moving between the two horizontally charged zones may, by virtue of its own length as a conductor, plus the short-circuiting effect of a trail of ionized gas particles (due to corona discharge from the plane) initiate a discharge. The airplane then becomes a conductor of the discharge. Data reviewed in this study verify this conclusion and account for all discharges reported.

It should be remembered that in an extensive thunderstorm the electrical generating mechanism is not limited to a single cell as illustrated in figure 2. Several such cells undoubtedly exist and the mechanism is duplicated in varying degrees of intensity within a single well-developed cumulo-nimbus cloud.

Flight Procedure

Since the initiation of a lightning discharge through an airplane in flight requires the passage of the plane between two oppositely charged portions of the cloud, discharges may be avoided by the following flight procedure:

(1) Avoid, if possible, instrument flight through large cumulo-type clouds, especially at the level where the temperature is between 25° and 35° F.

(2) If, when on instruments, it is apparent from the temeprature and degree of static and corona discharge that the airplane is in a highly charged zone, and a discharge is imminent reduce speed and descend.

(3) If a change in altitude is not possible and reduction of speed does not materially reduce corona or static, keep eyes focused on the instrument panel which should be brightly lighted at night. This will help to prevent temporary blindness if a discharge occurs near the cockpit.

Compliance with the above suggestions has in several instances enabled pilots to avoid lightning when all conditions indicated that a discharge was imminent. In no instance was a discharge encountered when this procedure was followed.

Rain and Snow Static

Rain and snow static is a term applied to those radio atmospherics frequently experienced when an airplane is flown through precipitation. The fact that this type of static does not occur in all types of precipitation nor at all temperatures, requires explanation.

In flight through a charged cloud or charged precipitation, an airplane quickly assumes the charge of its environment and continues to gain the charge faster than it can be dissipated through normal leakage. When the potential of the airplane is sufficient to produce a brush discharge or corona, the steady hissing in the radio receivers is heard.

Charged precipitation cannot be easily avoided, particularly by scheduled transports. Records indicate, however, that the most severe rain static occurs when rain is encountered at temperatures near freezing or below thunderstorms. Snow static is also most severe when it is encountered at temperatures near freezing and the intensity decreases directly with the temperature.

Rain and snow static can then be attributed to the same causes as lightning, that is, regions of high electrical charge, and can be avoided or minimized by recognizing and avoiding these regions.

Conclusion

No effort has been made in this paper to present quantitative electrical values of the processes described. Wilson using Macky's [5] figures obtains values that are in accord with direct thunderstorm measurements. Since the charge separation effected by the difference in rate of fall of precipitation forms and cloud particles approximates Wilson's theory, application to the process described in this paper appears practical.

Further investigation of the generation of electrical charges in thunderstorms and cumulus clouds is being continued as additional data are accumulated. Although the reports of pilots received since a summary of this paper was presented last winter substantiate the theory advanced herein, the number of reports is limited and it is possible that further information may require a revision of these views.

References

[1] Wilson, C. T. R., Journal of the Franklin Institute, vol. 208, p. 1, 1939.

[2] Simpson, G. C., Proc. Roy. Soc., Series A, No. 906, p. 309, 1939.

[3] Bergeron, T., *On the Physics of Cloud and Precipitation*, Mem., U. G. G. I., Lisbon, 1933.

[4] Simpson, G. C., Proc. Roy. Soc., Series A, No. 114, p. 376, 1927.

[5] Macky, Proc. Roy. Soc., Series A, No. 133, p. 565, 1931.

Authority To Hold Prehearing Conference on Air-Line Economic Cases

The Civil Aeronautics Authority announced on March 26 that it would thereafter require prehearing conferences before the opening of formal hearings on all economic cases relating to air lines. In order to arrange for these conferences, which are designed materially to speed the progress of such hearings, the Authority had to postpone temporarily all formal hearings on domestic air-line cases previously set to start on or after April 15. In establishing this policy for the use of the prehearing conference, the Authority is following an example set recently by the Supreme Court in specifying pretrial procedure for cases before all Federal courts.

In the past the Authority has found that in a number of cases the actual inauguration of hearings has had to be postponed due to the fact that one or more parties to the action were not prepared to begin hearings at the date set. Recent experiences with prehearing conferences have led the Authority to believe that such conferences would go far toward the elimination of such difficulties.

The Authority indicated the dates for prehearing conferences on the postponed cases would be assigned at an early date. No hearing date, however, will be assigned to a particular case until a prehearing conference has been held and the case appears to be adequately prepared by all parties.

CIVIL AERONAUTICS AUTHORITY

OFFICIAL ACTIONS

OPINIONS, ORDERS AND REGULATIONS

FOR THE PERIOD APRIL 1–15, 1940

NOTE ON THE ARRANGEMENT OF THESE PAGES

This part of the JOURNAL in each issue presents a current record of the official actions taken by the Civil Aeronautics Authority. Digests of all orders and regulations are carried in outer columns under the title "Abstracts." Persons having specific interest in any of these orders may obtain complete verbatim copies by writing to the Director of Statistics and Information, Civil Aeronautics Authority, Washington, D. C.

The large inner columns, set in different type, carry verbatim all opinions accompanying Authority actions. The type and format used will be utilized in the preparation of bound volumes of opinions of the Authority which will be issued at appropriate intervals. After the first volume is completed, the temporary page numbers now used will be replaced by the actual volume and page number which the text will carry in the bound volumes.

ABSTRACTS

ORDERS

Order No. 453: Solo pilot certificate of Harold Anderson suspended for 120 days.

The Authority on March 29 suspended for a period of 120 days solo pilot certificate No. 44586, held by Harold Anderson, Wolf Point, Mont., for piloting an aircraft carrying a person other than a certificated instructor and other violations of the Civil Air Regulations.

C. A. A. OPINIONS

C. A. A. Opinions—Vol. I Temporary Page No. CXLIII

DOCKET NO. 202

PAN AMERICAN AIRWAYS CO. (OF DELAWARE)—TRANS-ATLANTIC MAIL RATES

Petition for order fixing and determining the fair and reasonable rates of compensation for the transportation of mail by aircraft, the facilities used and useful therefor, and the services connected therewith, between the United States and Europe in trans-Atlantic service.

Decided April 3, 1940

Fair and reasonable rates of compensation for the transportation of mail by aircraft, the facilities used and useful therefor, and the services connected therewith, in so far as such rates relate to the payment of compensation for the transportation between the United States and Horta, the Azores, of mail destined for the Azores in excess of a load of 1,600 pounds per trip fixed and determined.

APPEARANCES:

Samuel E. Gates, for the Civil Aeronautics Authority.

SUPPLEMENTAL OPINION

BY THE AUTHORITY:

This proceeding was reopened on the Authority's own motion by order dated February 23, 1940, for the following limited purposes:

(1) To determine whether or not the rate of compensation being paid to the petitioner for the transportation of mail by aircraft, the facilities used and useful therefor, and the services connected therewith, insofar as such rate relates to the payment of compensation for the transportation between the United States and Horta, the Azores, of mails destined for the Azores in excess of a load of

sixteen hundred (1,600) pounds per trip, is fair and reasonable as required by the Civil Aeronautics Act of 1938, and particularly section 406 thereof; and

(2) In case such rate shall not be found to be fair and reasonable, to fix and determine the fair and reasonable rate or rates of compensation for the transportation between the United States and Horta, the Azores, of mails destined for the Azores in excess of such load of sixteen hundred (1,600) pounds per trip, as specified in said order.

On June 30, 1939, the Authority issued its order in docket No. 202, fixing and determining the fair and reasonable rate of compensation for the transportation by Pan American Airways Co., (of Delaware), herein referred to as "petitioner," of mail by aircraft between the United States and Europe, the facilities used and useful therefor, and the services connected therewith. The rates therein fixed and deter-

mined for the transportation of mail by aircraft were for a maximum mail load of sixteen hundred (1,600) pounds per trip, and the order contained the following provision with respect to payment for mails carried in excess of such maximum load:

> The foregoing rates are for a maximum mail load of sixteen hundred (1,600) pounds per trip and petitioner shall be paid $4 per pound per trip out-bound for any mails carried in excess of such load of sixteen hundred (1,600) pounds per trip, provided such trip shall have been completed at least as far as Foynes, Ireland, or Lisbon, Portugal.

Under date of November 16, 1939, the First Assistant Postmaster General of the United States addressed a letter to the Chairman of the Authority requesting an interpretation of the above-quoted provision, particularly with respect to the rate of compensation which should be paid petitioner for the transportation by aircraft between the United States and the Azores of mail destined for the Azores in those instances where the mail load between the United States and Europe exceeded sixteen hundred (1,600) pounds. Accordingly, the Authority, as above mentioned, by its order dated February 23, 1940, reopened the proceeding for the purposes stated.

On March 6, 1940, a public hearing was held before an examiner of the Authority, Francis W. Brown. No appearance was entered in behalf of petitioner, a stipulation, which was introduced into the record of said proceeding by counsel for the Authority, having previously been entered into by counsel for petitioner and counsel for the Authority. Said stipulation contained an agreed statement of facts. It also contained a proposed amendment of that portion of the "Order fixing and determining the fair and reasonable rates of compensation for the transportation of mail by aircraft over certain routes between the United States and Europe in trans-Atlantic service" entered in the above-entitled proceeding on June 30, 1939 (serial No. 80), above quoted, with respect to payment for the transportation of mail by aircraft between the United States and the Azores of mail destined for the Azores in excess of the maximum mail load of sixteen hundred (1,600) pounds, and a suggestion that the examiner recommend to the Authority an amendment of such provision, effective as of May 20, 1939, in the following language:

> The foregoing rates are for a maximum mail load of 1,600 pounds per trip out-bound, and petitioner shall receive additional compensation for any mails transported in excess of such load of 1,600 pounds, as follows: On trips proceeding as far as Lisbon, $4 per pound for out-bound mail transported from the

ABSTRACTS
Continued

Order No. 454. (Appeared in previous abstract.)

Order No. 455: Offers accepted in compromise of civil penalties for violations.

The Authority on April 2 accepted the following offers in compromise of civil penalties incurred for violations of the Civil Aeronautics Act and the Civil Air Regulations.

Ralph H. Barry, Saginaw, Mich.—For piloting an aircraft on a civil airway before said aircraft had been rerated as to airworthiness following an accident in which it was involved, and other violations—$50;

William F. Eckels, Alton, Ill.—For authorizing the flight of his registered aircraft on a civil airway when it was not certificated as airworthy—$25;

Arthur L. Howarth, Portland, Oreg.—For piloting an aircraft on a civil airway without being possessed of a valid pilot certificate—$50;

Warren C. Prosser, Denver, Colo.—For piloting an aircraft on a civil airway when said aircraft was not certificated as airworthy, and other violations—$25; and

Stewart W. Ralston, Minersville, Calif.—For piloting an aircraft on a civil airway carrying a person in excess of the number specified in the airworthiness certificate of said aircraft, and other violations—$100.

Order No. 456: Offers accepted in compromise of civil penalties for violations.

The Authority on April 2 accepted the following offers in compromise of civil penalties incurred for violations of the Civil Aeronautics Act and the Civil Air Regulations:

Duncan A. McIntyre, Tulsa, Okla.—For taking off from an airport at a time when there was risk of collision with other aircraft during such take-off—$100; and

Dr. R. W. Naudack, Monte Vista, Colo.—For piloting an aircraft on a civil airway without being possessed of a valid pilot certificate—$100.

Order No. 457: Solo pilot certificate of Richard G. Purcell, Jr., revoked.

The Authority on April 2 revoked solo pilot certificate No. 66666, held by Richard G. Purcell, Jr., Burbank, Calif., for piloting an aircraft on a civil airway over a congested area at an altitude not sufficient to permit at all times an emergency landing outside of such area in the event of complete power failure, and other violations of the Civil Air Regulations. (Previous orders Nos. 418 and 428.)

ABSTRACTS
Continued

Order No. 458: Student pilot certificate of Jack Robert Thornton revoked.

The Authority on April 2 revoked student pilot certificate No. 40080, held by Jack Robert Thornton, Paragould, Ark., for piloting an aircraft on a civil airway carrying a person other than a certificated instructor actually giving instruction, and other violations of the Civil Air Regulations.

Order No. 459: Student pilot certificate of Alfred R. Ellis revoked.

The Authority on April 2 revoked student pilot certificate No. 74763, held by Alfred R. Ellis, Iowa City, Iowa, for piloting an aircraft on a civil airway outside an area within a 25-mile radius of his point of take-off, and other violations of the Civil Air Regulations.

Order No. 460: Student pilot certificate of James Henry Layne revoked.

The Authority on April 2 revoked student pilot certificate No. 59350, held by James Henry Layne, Van Nuys, Calif., for piloting an aircraft on a civil airway carrying a person other than a certificated instructor actually giving instruction, and other violations of the Civil Air Regulations. (Previous orders Nos. 420 and 427.)

Order No. 461: Student pilot certificate of Paul E. Piche revoked.

The Authority on April 2 revoked Student pilot certificate No. 78210, held by Paul E. Piche, New London, Conn., for piloting aircraft on civil airways outside an area within a 25-mile radius of his point of take-off and other violations of the Civil Air Regulations.

Order No. 462: Parachute rigger certificate of Alva Wilson Spiva suspended for 90 days.

The Authority on April 2 suspended for a period of 90 days parachute rigger certificate No. 522, held by Alva Wilson Spiva, Wichita, Kans., for carelessness and inattention to his duty in his inspection and packing of a parachute.

Order No. 463: Penn-Central granted further hearing on Pittsburgh-Buffalo application.

The Authority on April 2 granted petition of Pennsylvania-Central Airlines Corporation for further hearing before decision by the Authority of the application of said company for an amendment to its certificate of public convenience and necessity covering the Pittsburgh-Buffalo route.

United States to Horta, the Azores, or Lisbon, Portugal, or points beyond; on trips proceeding as far as Foynes, Ireland, $4 per pound for mail transported from the United States to Foynes, Ireland, or points beyond: *Provided*, That petitioner shall not be entitled to any compensation in excess of such $4 per pound for the transportation of mail in excess of 1,600 pounds per trip to points beyond Lisbon, Portugal, or Foynes, Ireland, as the case may be.

The examiner announced at the conclusion of the hearing that no report would be issued and that he would recommend to the Authority the amendment of the order of the Authority dated June 30, 1939 (serial No. 80), in the language stipulated to by counsel as set forth above, such amendment to become effective May 20, 1939. The sole question involved, therefore, is with respect to petitioner's compensation for the transportation of mail from the United States destined to the Azores on trips where the total mail load carried is in excess of sixteen hundred (1,600) pounds. According to the stipulated facts, during the period from the commencement of service across the Atlantic, namely, May 20, 1939, to and including the month of January 1940, the total amount of such excess poundage was less than 250 pounds. The fact that the volume of mail between the United States and the Azores is nominal in no way alters the fact that petitioner is entitled to a fair and reasonable rate of compensation for the service rendered in transporting such mails.

Accordingly, the Authority, upon consideration of the record in this proceeding, as evidenced by the stipulation of counsel for petitioner and counsel for the Authority, and the recommendation of the examiner made at the conclusion of the hearing, finds that that portion of the "Order fixing and determining the fair and reasonable rates of compensation for the transportation of mail by aircraft over certain routes between the United States and Europe in trans-Atlantic service" entered in the above-entitled proceeding on June 30, 1939 (serial No. 80), which reads as follows:

> The foregoing rates are for a maximum mail load of sixteen hundred (1,600) pounds per trip and petitioner shall be paid $4 per pound per trip out-bound for any mails carried in excess of such load of sixteen hundred (1,600) pounds per trip, provided such trip shall have been completed at least as far as Foynes, Ireland, or Lisbon, Portugal.,

should be amended to read as follows:

> The foregoing rates are for a maximum mail load of 1,600 pounds per trip out-bound, and petitioner shall receive additional compensation for any mails transported in excess of such load of 1,600 pounds, as follows: On trips proceeding as far as Lisbon, Portugal, $4 per pound for out-bound mail transported from the United States to Horta, the Azores, or Lisbon, Portugal, or points beyond; on trips proceeding as far as Foynes, Ireland, $4 per pound for mail transported from the United States to Foynes, Ireland, or points beyond; *Provided*, That petitioner shall not be entitled to any compensation in excess of such $4 per pound for the transportation of mail in excess of 1,600 pounds per trip to points beyond Lisbon, Portugal, or Foynes, Ireland, as the case may be.

The Authority further finds that such amendment of the order of June 30, 1939, should be made effective as of the date of commencement of service over the route via the Azores, to wit, May 20, 1939.

An appropriate order will be entered.

Branch, Mason, Warner, Members of the Authority, concurred in the above opinion. Hinckley and Ryan, Members, did not take part in the decision.

SUPPLEMENTAL ORDER

The Civil Aeronautics Authority, acting on its own motion, pursuant to sections 205 (a) and 406 (b) of the Civil Aeronautics Act of 1938, having reopened the above-entitled proceeding by its order dated February 23, 1940 (serial No. 405), for the following limited purposes:

(1) To determine whether or not the rate of compensation being paid to the petitioner for the transportation of mail by aircraft, the facilities used and useful therefor, and the services connected therewith, insofar as such rate relates to the payment of compensation for the transportation between the United States and Horta, the Azores, of mail destined for the Azores in excess of a load of sixteen hundred (1,600) pounds per trip, is fair and reasonable as required by the Civil Aeronautics Act of 1938, and particularly section 406 thereof; and

(2) In case such rate shall not be found to be fair and reasonable, to fix and determine the fair and reasonable rate or rates of compensation for the transportation between the United States and Horta, the Azores, of mail destined for the Azores in excess of such load of sixteen hundred (1,600) pounds per trip, as specified in said order,

and a full hearing having been held thereon before an examiner of the Authority, and the Authority, upon consideration of the record in such proceeding and the recommendation of the examiner thereon, having issued its opinion containing its findings, conclusions, and decision, which is attached hereto and made a part hereof, and having found that its action in this matter is necessary pursuant to said opinion:

IT IS ORDERED, That that portion of the "Order fixing and determining the fair and reasonable rates of compensation for the transportation of mail by aircraft over certain routes between the United States and Europe in trans-Atlantic service" entered in the above-entitled proceeding on June 30, 1939 (serial No. 80) which reads as follows:

"The foregoing rates are for a maximum mail load of sixteen hundred (1,600) pounds per trip and petitioner shall be paid $4 per pound per trip out-bound for any mails carried in excess of such load of sixteen hundred (1,600) pounds per trip, provided such trip shall have been completed at least as far as Foynes, Ireland, or Lisbon, Portugal."

shall be amended to read as follows:

"The foregoing rates are for a maximum mail load of 1,600 pounds per trip out-bound, and petitioner shall receive additional compensation for any mails transported in excess of such load of 1,600 pounds, as follows: On trips proceeding as far as Lisbon, Portugal, $4 per pound for out-bound mail transported from the United States to Horta, the Azores, or Lisbon, Portugal, or points beyond; on trips proceeding as far as Foynes, Ireland, $4 per pound for mail transported from the United States to Foynes, Ireland, or points beyond; *Provided*, That petitioner shall not be entitled to any compensation in excess

of such $4 per pound for the transportation of mail in excess of 1,600 pounds per trip to points beyond Lisbon, Portugal, or Foynes, Ireland, as the case may be."

IT IS FURTHER ORDERED, That this amendment of the order of June 30, 1939 (serial No. 80), shall be made effective as of the date of the commencement of service over the route between the United States and Europe via the Azores, to wit, May 20, 1939.

ABSTRACTS

Continued

Order No. 464: City of St. Louis and Chamber denied intervention in convenience and necessity applications.

The Authority on April 3 denied motion of the city of St. Louis and the St. Louis Chamber of Commerce to intervene in the applications of Mid-Continent Airlines, Inc., Braniff Airways, Inc., and Northwest Airlines, Inc., for certificates of public convenience and necessity.

Order No. 465: Adopted supplemental order determining mail rates between United States and Azores by Pan American.

The Authority on April 3 adopted supplemental order (original order No. 80, June 30, 1939) determining fair and reasonable rates of compensation for the transportation of mail between the United States and Horta, the Azores by Pan American Airways Co. (Del.) (*For full text of opinion and order, see docket No. 202, p. 204.*)

Order No. 466: Student pilot certificate of Albert Hugh Johnston suspended for 30 days.

The Authority on April 5 suspended for a period of thirty days from March 31, student pilot certificate No. 84951, held by Albert Hugh Johnston, Atlanta, Ga., for piloting an aircraft on a civil airway carrying a person other than a certificated instructor actually giving instruction.

Order No. 467: Solo pilot certificate of Daniel A. Monan suspended for 30 days.

The Authority on April 5 suspended for a period of 30 days from March 31, solo pilot certificate No. 66064, held by Daniel A. Monan, LaGrange, Ga., for piloting an aircraft on a civil airway carrying a person other than a certificated instructor actually giving instruction.

Order No. 468: Offers accepted in compromise of civil penalties for violations.

The Authority on April 9 accepted the following offers in compromise of civil penalties incurred for violations of the Civil Aeronautics Act and the Civil Air Regulations:

Paul M. Bradley, Seattle, Wash.—For piloting an aircraft on a civil airway at an altitude of less than 500 feet, and other violations—$50;

Roy Donley, North Hollywood, Calif.—For piloting an aircraft on a civil airway at an altitude over a congested area

ABSTRACTS

Continued

insufficient to permit at all times an emergency landing outside of such area in the event of complete power failure—$25;

Lewis A. Jackson, Marion, Ind.—For piloting an aircraft on a civil airway in weather below the minimums prescribed for contact flight without being possessed of an instrument rating and when said aircraft was not equipped for instrument flight—$25;

Harold H. Reese, Des Moines, Iowa—For piloting an aircraft on a civil airway carrying a person other than a certificated instructor actually giving instruction, in violation of the terms of his solo pilot certificate—$25; and

Neal Umholtz, Oakland, Calif.—For piloting an aircraft on a civil airway after sundown although said aircraft was not equipped with proper navigation lights—$25.

Order No. 469: Offer accepted in compromise of civil penalties for violations.

The Authority on April 9 accepted the following offer in compromise of civil penalties incurred for violations of the Civil Aeronautics Act and the Civil Air Regulations:

Norman Cathcart, San Francisco, Calif.—For piloting an aircraft on a civil airway after sundown when the aircraft was not certificated as airworthy and was not equipped with navigation lights—$25.

Order No. 470: Interlocking relationships approved.

The Authority on April 9 approved interlocking relationships of A. M. Archibald, Franklin Gledhill, James H. Johnston, and Andre A. Preister, and Pan American Airways, Inc., and subsidiaries.

Order No. 471: Interlocking relationships approved.

The Authority on April 9 approved interlocking relationships of Lyman Delano and Pan American Airways, Inc., and subsidiaries, and certain transport companies.

Order No. 472: Interlocking relationships approved.

The Authority on April 9 approved interlocking relationships of Paul M. Davis and Eastern Air Lines, Inc., and Tennessee Central Railway Co.

IT IS FURTHER ORDERED, That, except as herein specifically amended, said order of June 30, 1939 (serial No. 80), shall remain in full force and effect until further order of the Authority.

DOCKET NO. 328

MID-CONTINENT AIRLINES, INC.—CERTIFICATE OF PUBLIC CONVENIENCE AND NECESSITY

(Bismarck-Minot Operation)

In the Matter of the Application of Mid-Continent Airlines, Inc., for a certificate of public convenience and necessity under section 401 (e) (2) of the Civil Aeronautics Act of 1938.

Decided April 9, 1940

Applicant found entitled, under section 401 (e) (2) of the Civil Aeronautics Act of 1938, to an amendment of its certificate of public convenience and necessity so as to authorize it to engage in air transportation with respect to mail, persons, and property between Bismarck-Mandan, N. Dak., and the terminal point Minot, N. Dak.

APPEARANCES:

Terrell C. Drinkwater and *John S. Wynne*, for applicant.

George A. Keyser, for Civil Aeronautics Authority.

OPINION

BY THE AUTHORITY:

By application filed November 17, 1939, Mid-Continent Airlines, Inc., seeks authorization under section 401 (e) (2) and section 401 (h) of the Civil Aeronautics Act of 1938 to extend its present operations so that it may engage in scheduled air transportation of mail, persons and property between Bismarck, N. Dak., and Minot, N. Dak.

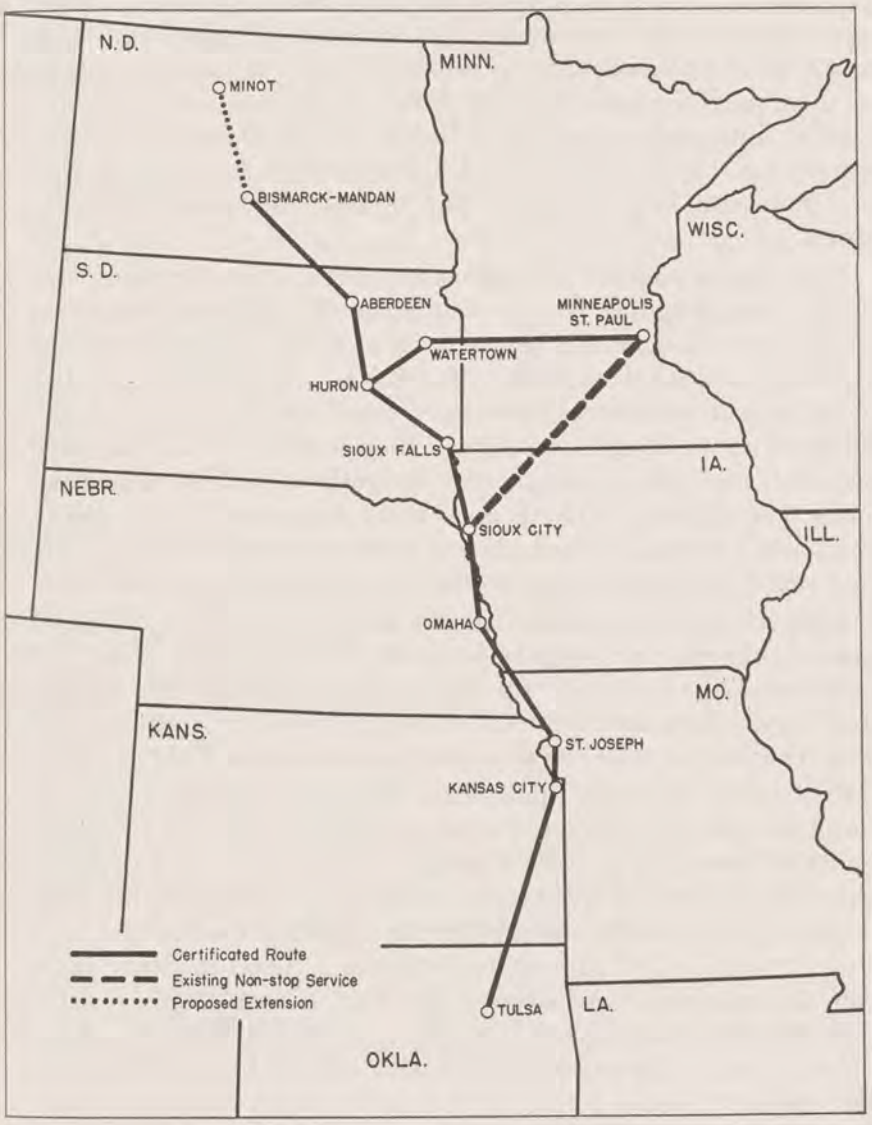
Due notice of the application was given to the public and the air carriers included in a list issued by the Authority. A public hearing was held on January 19,1940, before Examiner Thomas L. Wrenn of the Authority, and his report was duly filed and served, recommending the granting of the application. No exceptions or briefs were filed with respect to the report.

Section 401 (e) (2) of the act provides "the Authority shall, notwithstanding any other provision of this act, issue certificates authorizing the transportation of mail, and all other classes of traffic for which authorization is sought, between such points, namely, * * * (B) from Bismarck, N. Dak., to Minot, N. Dak. * * *" This section requires the Authority to issue a certificate of public convenience and necessity authorizing air transportation between the points named in the section and does not require a finding that the proposed air trans-

portation is required by the public convenience and necessity.[1] However, in order to carry out the policies set forth in section 2 of the act, we have previously held that in considering an application for the issuance of a certificate under section 401 (e) (2), it must determine that the issuance to a particular applicant will serve the public interest.[2]

Applicant now operates under a certificate of public convenience and necessity authorizing it to engage in air transportation with respect to persons, property and mail on route No. 26 between the terminal points Tulsa, Okla., St. Paul and Minneapolis, Minn., and Bismarck-Mandan, N. Dak., via certain intermediate points.[3] The evidence of record establishes that the service rendered by applicant between these points is well conducted. Applicant's present route and the extension for which authorization is sought to engage in air transportation are shown by the following map:

[1] Continental Air Lines, Inc.-Braniff Airways, Inc., docket No. 2-401(E)-2 and 150, decided April 28, 1939
[2] *Continental-Braniff* Case, *supra*.
[3] Mid-Continent Air Lines, Inc., docket No. 3-401(E)-1, decided March 7, 1939.



Applicant introduced evidence to show that it is fit, willing, and able to engage in air transportation between Bismarck and Minot. The distance between these points is 105 miles over a terrain of a generally rolling character providing many suitable sites for emergency landings. There are no unusual meteorological conditions prevailing in the area. The population of the territory to be served is com-

ABSTRACTS
Continued

Order No. 473: Interlocking relationships approved.

The Authority on April 9 approved interlocking relationships of T. B. Wilson and Transcontinental & Western Air, and certain motor transport companies.

Order No. 474: Temporary holding of existing interlocking relationships approved.

The Authority on April 9 approved temporary holding of existing interlocking relationships of Victor I. Hahn, Alexander C. Blanchard and William C. Blanchard, and White Pass Airways, and certain rail and navigation companies.

Order No. 475: Mid-Continent Bismarck-Minot extension approved.

The Authority on April 9 granted application of Mid-Continent Airlines to amend its certificate of public convenience and necessity for route No. 26 so as to authorize air transportation with respect to persons, property, and mail between Bismarck, N. Dak., and Minot, N. Dak.

(For full text of opinion and order, see docket No. 328, p. 208.)

Order No. 476: Solo pilot certificate of Ralph C. Mangum suspended.

The Authority on April 9 suspended for a period of 60 days, and thereafter until such time as he shall have demonstrated to the satisfaction of a designated representative of the Authority that he is thoroughly familiar with parts 01, 20, and 60 of the Civil Air Regulations, solo pilot certificate No. 72921, held by Ralph C. Mangum, Ely, Nev., for piloting an aircraft acrobatically over an airport without being equipped with a parachute, and other violations of the Civil Air Regulations.

Order No. 477: Russell O. Tilton ordered to show cause.

The Authority on April 12 directed Russell O. Tilton, Lakewood, N. J., to appear before an examiner of the Authority and show cause why his student pilot certificate No. S–99762 should not be revoked or suspended for starting the engine of an aircraft without a competent operator in said aircraft attending the controls, and without blocks placed in front of said aircraft, and other violations of the Civil Air Regulations.

ABSTRACTS
(Continued)

Order No. 478: Student pilot certificate of William F. Eckels revoked.

The Authority on April 12 revoked student pilot certificate No. 73397, held by William F. Eckels, Alton, Ill., for piloting an aircraft on a civil airway carrying a person other than a certificated instructor actually giving instruction, and other violations of the Civil Air Regulations.

Order No. 479: Boston-Maine petition for reconsideration of mail rate order granted.

The Authority on April 10 granted petition of Boston-Maine Airways, Inc., for oral argument and reconsideration of the order of the Authority fixing and determining the fair and reasonable rates of compensation for the transportation of mail by aircraft over route No. 27 (order No. 406).

paratively small. The 1930 population of the city of Minot was 16,099, while the 1930 population of Ward County, in which Minot is located, was 33,597 in an area of 2,054 square miles.

The vice president of applicant testified that survey flights were conducted over the route on April 20, 1938, and January 16, 1940.

These surveys disclosed that the airport at Minot requires extension and improved surfacing of the runways, and facilities for housing of aircraft and handling of passengers. The record shows that applicant intends to install certain facilities at Minot, including two-way radio communication equipment, consisting of a 100-watt transmitter and receiver, and that it would station a radio operator at Minot to serve also as station manager. On the basis of present costs, applicant's chief financial officer estimated that the cost of installation of these facilities would be $3,316. Applicant expects to receive weather information from the United States Weather Bureau and anticipates that the Bureau will establish weather reporting stations at Minot and Underwood, a city midway between Bismarck and Minot.

The vice president of applicant testified that applicant would operate the proposed route as an extension of that portion of its present route No. 26 having a terminal point at Bismarck, without requiring additional aircraft. An exhibit prepared by the Director of the Bureau of Federal Airways of the Civil Aeronautics Authority indicates that daylight schedules may now be operated between Bismarck and Minot without air navigation facilities in addition to those now existing. There is a radio range station at Bismarck which has a course directed toward Minot and which will be available for limited instrument operations between those points.

Applicant's vice president also testified that the applicant proposes to operate a schedule between Bismarck and Minot which would provide one round trip daily between those points during the hours of daylight shortly before the departure of a south-bound flight from Bismarck or after the arrival of a north-bound flight at Bismarck.

Exhibits prepared by applicant's chief financial officer were introduced to show the estimated expenses and revenues for a period of 1 month of operation between Bismarck and Minot. The witness estimated that a total of 5,940 miles would be operated monthly over the proposed route on the assumption that applicant would continue its present record of 93 percent performance. Total monthly revenues from the operation were estimated at $3,221, or 54.24 cents per mile, upon the basis of applicant's present mail rate on route No. 26 of 38 cents per mile. It was estimated with respect to passenger revenue that applicant would receive $915 monthly or 15.40 cents per mile on the basis of 35 percent occupancy of 10 passenger planes, at the present net passenger revenue of 4.4 cents per mile on route No. 26. The basis of this load factor estimate was not indicated, and in the light of experience it appears optimistic. Total monthly expenses of operating the extension were estimated at $3,155 or 53.12 cents per mile, giving an estimated net profit of $66 or 1.12 cents per mile. The evidence shows that the expenses for operation of 10 passenger

planes over applicant's present route for the year ending June 30, 1939, were 54.74 cents per mile and that applicant anticipates that the new section resulting from the extension of operations to Minot could be operated at 1.62 cents per mile less than the present route average as a result of apportioning indirect flying expenses over a mileage greater than that now operated. These estimated costs were calculated on the assumption that applicant would operate Lockheed Electras over its entire route, but no evidence was introduced to show the estimated cost of operation between Bismarck and Minot with smaller and less expensive equipment.[4]

In our decision approving the issuance of a "grandfather" certificate to applicant herein,[5] we found it to be a citizen of the United States within the meaning of section 1 (13) of the act. The chief financial officer of applicant testified that there have been no changes in the stock ownership or the managing officers and directors of the applicant affecting its citizenship since the hearing in that proceeding.

Applicant herein applied for a certificate under section 401 (e) (2) of the act and also applied under section 401 (h) of the act for an amendment of its present certificate to include the terminal point Minot, N. Dak., but did not introduce evidence establishing public convenience and necessity. Section 401 (h) provides that the Authority may alter, amend, modify, or suspend any certificate if the public convenience and necessity so require. As previously stated, we have held that no finding of public convenience and necessity is required for the issuance of a certificate under section 401 (e) (2) of the act.

The points which applicant presently serves on route No. 26 were authorized by the Authority under section 401 (e) (1) (B) of the act in accordance with former authorization of the Postmaster General. Since section 401 (e) (2), supplementary to section 401 (e) (1) (B), requires the issuance of a certificate with respect to certain points, notwithstanding any other provision of the act, we conclude that, under section 401 (e) (2), we may amend applicant's present certificate, issued under the "grandfather" clause, so as to authorize applicant to extend its present operations in air transportation, with respect to persons, property, and mail, from Bismarck, N. Dak., to the terminal point, Minot, N. Dak., named in section 401 (e) (2) of the act, notwithstanding the provisions of section 401 (h). It is therefore unnecessary to consider the application under section 401 (h) of the act for an amendment of applicant's present certificate.

[4] In its decision in Mid-Continent Airlines, Inc., mail rate proceeding, docket No. 3-406-(A)-1, fixing the rate of compensation to be paid applicant for the transportation of mail by aircraft, the Authority stated, on the basis of testimony given by applicant, that "Petitioner expects to purchase within the next year another Electra plane, * * * and a new type twin-engine Vega, * * *"

[5] Mid-Continent Airlines, Inc., docket No. 3-401(E)-1. Decided March 7, 1939.

On the basis of the above findings of fact, we find that applicant is a citizen of the United States within the meaning of section 1 (13) of the Civil Aeronautics Act, and that it is fit, willing, and able to engage in air transportation with respect to persons, property, and mail between the terminal points Bismarck, N. Dak., and Minot,

N. Dak., and to conform to the rules, regulations, and requirements of the Civil Aeronautics Authority and the provisions of the Civil Aeronautics Act.

An appropriate order will be entered, amending the certificate of convenience and necessity heretofore granted to Mid-Continent Airlines, Inc., for route No. 26, so as to authorize it to engage in scheduled air transportation in regard to persons, property, and mail between the terminal point Tulsa, Okla., the intermediate points Kansas City, Mo., St. Joseph, Mo., Omaha, Nebr., Sioux City, Iowa, Sioux Falls, S. Dak., Huron, S. Dak., and (*a*) Beyond Huron, S. Dak., the intermediate point Watertown, S. Dak., and the terminal point St. Paul and Minneapolis, Minn., and (*b*) beyond Huron, S. Dak., the intermediate points Aberdeen, S. Dak., Bismarck-Mandan, N. Dak., and the terminal point Minot, N. Dak.

Branch, Ryan, Mason, Warner, Members of the Authority, concurred in the above opinion. Hinckley, Chairman, did not take part in the decision.

ORDER

Mid-Continent Airlines, Inc., having filed application for a certificate of public convenience and necessity under section 401 (e) (2) of the Civil Aeronautics Act of 1938, authorizing it to engage in air transportation with respect to persons, property and mail between Bismarck, N. Dak., and Minot, N. Dak., and for amendment of its certificate of public convenience and necessity authorizing the air transportation of persons, property, and mail over route No. 26 so as to authorize similar air transportation between Bismarck, N. Dak., and Minot, N. Dak., under section 401 (h) of the Civil Aeronautics Act; a full hearing thereon having been held; the Authority, upon consideration of the record in said proceeding, having issued its opinion containing its findings of fact, conclusions, and decision, which is attached hereto and made a part hereof; and finding that its action in this matter is necessary pursuant to said opinion;

IT IS ORDERED, That the certificate of public convenience and necessity authorizing Mid-Continent Airlines, Inc., subject to the provisions of said certificate, to engage in air transportation with respect to persons, property, and mail, between the terminal point Tulsa, Okla., the intermediate points Kansas City, Mo., St. Joseph, Mo., Omaha, Nebr., Sioux City, Iowa, Sioux Falls, S. Dak., Huron, S. Dak., and (*a*) beyond Huron, S. Dak., the intermediate point Watertown, S. Dak., and the terminal point St. Paul and Minneapolis, Minn., and (*b*) beyond Huron, S. Dak., the intermediate point Aberdeen, S. Dak., and the terminal point Bismarck-Mandan, N. Dak., be, and the same hereby is, amended so as to authorize Mid-Continent Airlines, Inc., subject to the provisions of said certificate, to engage in air transportation with respect to persons, property, and mail between the terminal point Tulsa, Okla., the intermediate points Kansas City, Mo., St. Joseph, Mo., Omaha, Nebr., Sioux City, Iowa, Sioux Falls, S. Dak., Huron, S. Dak., and (*a*) beyond Huron, S. Dak., the intermediate point

Watertown, S. Dak., and the terminal point St. Paul and Minneapolis, Minn., and (*b*) beyond Huron, S. Dak., the intermediate points Aberdeen, S. Dak., Bismarck-Mandan, N. Dak., and the terminal point Minot, N. Dak.

IT IS FURTHER ORDERED, That the exercise of the privileges granted by said certificate shall be subject to the terms, conditions, and limitations prescribed by section 238.3 of the Economic Regulations of the Authority (formerly Regulation 401–F–1), all amendments thereto, and such other terms, conditions, and limitations as may from time to time be prescribed by the Authority.

IT IS FURTHER ORDERED, That said certificate, as amended, shall be issued in the form attached hereto and shall be signed on behalf of the Authority by the Chairman of the Authority and shall have affixed thereto the seal of the Authority, attested by the Secretary. Said certificate, as amended, shall be effective from the 9th day of April 1940.

U. S. GOVERNMENT PRINTING OFFICE: 1940