RESEARCH ON THE AIRWAYS DIVISION, BUREAU OF LIGHTHOUSES

Compiled by Mary Louise Clifford

Tom Beard email, 4/1/2007: . . . the first airway system in the United States was Coast Guard. . . . CG beacons began about 1920 (about the time of the first air-to-ground radios—developed by the Navy and CG shortly after for their war on liquor smuggling) as an unofficial offering to aircraft flying the east coast and reporting to lighthouses as they passed. Lighthouses then had the only governmental interconnected communication system (that I am aware of) allowing for this service. Also, lighthouses were readily identifiable landmarks from the air.

> "The United States military entered the aviation arena during World War I, an episode in history that was instrumental in demonstrating the versatility of the newly invented airplane. During the war, a variety of tasks for military aircraft were tried, one being a venture with the U.S. Post Office. In May 1918, the first air mail route was established between New York and Washington, D.C., with other short routes in the eastern states following. The Army turned the operation over to the Post Office in 1918, transferring all equipment and personnel. As Air Mail routes slowly expanded, work was started on the transcontinental route. This ambitious plan called for a 2,612-mile route from New York to San Francisco, complete with the 17 primary landing fields having an Air Mail Radio Station (AMRS). The transcontinental route was opened on August 20, 1920. All 17 AMRS were operational by the end of 1921. The AMRS specialist made local weather observations, obtained other weather information by radio, and often made their own forecasts. They also assisted in loading and unloading mail, servicing the airplane, and maintaining their own equipment, often building their own radios."John, Schamel, *Flight Service History 1920-1998, <www.atctraining.faa.gov>*

> "Pilots used railroad or early road maps since flying was a fair weather daytime activity. Mail planes of the day normally came equipped with a compass, a bank-and-turn indicator, and an altimeter. Pilots were often skeptical of their instruments and would only fly along a well-known route. And there was a problem. Mail could only fly in the daylight. Many skeptics looked at Air Mail as an expensive frill, since it offered no clear-

cut savings in time. Mail could cross the country by rail in three days. The short daylight hops aircraft could give to the mail weren't cost-effective." *Ibid.*

MEMO re Secretary [of Commerce]'s letter of June 9, 1919, regarding light to assist air men: [RG26 E50, File #3017]:

A vertical beam, as suggested in the Secretary's letter, may be projected from a lighthouse by deflecting rays of the regular light by means of a reflector placed outside the usual lighthouse lantern, or housed in a bay projecting from the side of the lantern.

Since few lights are required to illuminate the entire horizon, it would be practicable in most cases to secure the proposed beam without impairing the usefulness of the light as an aid to marine navigation.

It is suggested, however, that a vertical beam may prove of very limited service to the air man, as it would be visible from points even moderately distant horizontally only when illuminating favorably placed clouds, or when atmospheric conditions make its path visible, while in a clear atmosphere it would be visible only from a point vertically above.

In view of widely varying altitudes at which men fly, it would seem that they need an all-round light, visible from any point above its horizon.

Standards types of illuminating apparatus for marine lighthouses are designed to illuminate the horizon equally, in whole or in part, or to sweep the horizon with flashes. Fixed light apparatus of this type has been adapted to guide air men (see Pintsch catalog) by turning it on it side (vertical axis horizontal) and, to meet the requirement of an all-round light, then revolving in about a new vertical axis (in the focal plane) producing flashes sweeping the horizon. The characteristic of this light, however, is not constant; the duration of the flash increases as the light is approached until it appears as fixed light from points nearly vertically above, and flashes again appearing, diminishing with increasing distance as the observer passes on. It is believed that the high speeds of flying make a constant characteristic even more important to the air man than to the mariner, and that therefore standard illuminating apparatus is not well adapted to the requirements, excepting where its use may be limited to mark a straightaway lane, as in the case of the mariners range lights.
It is suggested that inquiry be addressed to Trinity House for detailed information of the construction of illuminating apparatus, etc., and characteristics of lights established for the guidance of air men.

Letter from the Acting Commissioner of the Lighthouse Bureau to the Secretary of the British Lighthouse Service, Trinity House, London, July 21, 1919:

> The Bureau is informed that at a luncheon given in London June 5, by Maj. Gen. Seely, Under Secretary for Air Service of Britain, in honor of Lt. Commdr. A.C.Read, and other American participating in the trans-Atlantic Flight, it was announced that the British lighthouses soon will be fitted to throw vertical beams to assist air men.
>
> If you can properly and conveniently do so, this Service would be pleased to be advised as to the steps that are bring taken in this matter, and as to the nature of the apparatus. *Ibid.*

Letter from Secretary Smith, Trinity House, London, to the Acting Commissioner, Bureau of Lighthouses, 6th August 1919:

> In reply to your letter dated 21st July 1919, I am directed to acquaint you that the question of projecting vertical beams of light from Light Houses to assist Aerial Navigation is at present under consideration and as soon as they are in a position to do so the Elder Brethren will be happy to furnish your Board with information on the subject. *Ibid.*

Letter from the Acting Commissioner of Lighthouses to the Director of Air Service, War Department, June 29, 1920:

> I beg to state that the Lighthouse Service has made no experiments with a view to utilizing vertical beams of light in navigation. It may be stated that The Sperry Gyroscope Co., Manhattan Bridge Plaza, Brooklyn, N.Y., is interested in this matter, and was to have carried out a series of tests at one of the light stations of this Service, which, however, have not been commenced, so far as this Service is advised. Chance Brothers & Co., Ltd., Smethwick, Birmingham, England, have advised this office that they are prepared to manufacture apparatus and lanterns capable of showing vertical beams of light and it is suggested that, if desired, you communicate with these firms for further information in the matter. *Ibid.*

Letter from O Westover, the Director of Air Service, War Department, to the Commissioner of Lighthouses, Department of Commerce, March 5, 1920:

> Patrol of the Altantic Coast between Langley Field, Hampton, Virginia, and Mitchell Field, Mineola, L.I., N.Y., is being regularly carried out by the Air Service. The patrol airplane leaves Langley Field on Mondays and Thursdays, at 10:00 A.M., and returns from Mitchell Field to Langley Field of Tuesdays and Fridays, leaving the fields at 10:00 A.M.

each week. The patrol from Mitchell field to Langley Field leaves Mitchell Field on Wednesdays and returns from Langley Field to Mitchell Field on Thursday, leaving the fields at 10:00 A.M.

It is desired to establish radio, or visual liaison between the patrol planes and the lighthouse stations along the route of the patrol airplanes. The patrol airplanes are equipped with radio sending and receiving sets. The sending set has a range of wavelength of two hundred meters to five hundred fifty meters, but with added antenna inductances, it is possible to operate up to six hundred meters.

It is also desired that the lighthouse stations along the route of the patrol be instructed to watch for the patrol airplanes with a view to sending assistance or notifying the nearest aviation station in the event of a forced landing.

A letter has been written to the Commandant, United States Coast Guard, in reference to the cooperation of that service with the Air Service on the airplane patrol project. *Ibid.*

Letter from the Commissioner, Bureau of Lighthouses, to the Director of Air Service, War Department, March 11, 1920:

I beg to state that the Lighthouse Service will be pleased to cooperate in this matter, and will direct the Superintendents of the 3rd, 4th, and 5th Lighthouse Districts, whose addresses are Tompkinsville, N.Y., Philadelphia, Pa., and Baltimore Md., respectively, to instruct the keepers of the light stations and masters of light vessels in the patrol zone to be on the lookout for these patrol planes and to render all assistance possible, when required. It is suggested that you furnish the Bureau, if practicable, an approximate time table, in quadruplicate, showing when the planes will reach each light station, in order that the keepers of lighthouses may be on the lookout for the same, if it does not interfere with their duties.

An experimental lighting apparatus is about to be placed at Navesink Light Station for throwing vertical beams to aid navigation. Radio fog-signal stations will be established at Sea Girt Light Station, on Ambrose Channel light vessel, and on Fire Island light vessel in the near future for the use of aerial or marine craft equipped with radio-direction finders.

The Cape Charles, Winter-Quarter Shoal, Five-Fathom Bank, Overfalls, Fenwick Island Shoal, Tail of the Horseshoe, Northeast End, and Scotland light vessels, which are all in the proposed patrol sone, are quipped with radio, maintained and operated by the Navy Department,,

and, therefore, it is respectfully suggested that, should you so desire, you confer with the Navy Department in the matter of the cooperation of these stations. *Ibid.*

MEMO to light keepers from King, Superintendent of Lighthouse, 5th District, March 12, 1920. Subject: coast Patrol Airplanes

The Director of Air Service, War Department, has requested cooperation of the Lighthouse Service in establishing communication, either radio or visual, between patrol airplanes en route between Langley Field, Hampton, Va., and Mitchel Field, Mineola, Long Island, N.Y., with the Lighthouse stations along the route of this aerial patrol.

The patrol airplane leaves Mitchel Field en route to Langley Field on Tuesday, Wednesdays and Fridays at 10 a.m. Patrol airplane leaves Langley Field en route to Mitchel Field on Mondays and Thursdays at 10 a.m.

You are instructed to be on the lookout for these patrol planes and to render all assistance possible when required. An approximate time table has been requested to be furnished showing when the plane may be expected to reach each light station in order that keepers may be on the lookout if it does not interfere with their regular duties. *Ibid.*

MEMO from Wm. F. Pearson, Director of air Service, War Department, to the Commissioner of Lighthouses, April 28, 1920:

Reference is made to letter from the Commissioner of Lighthouses, Department of Commerce, dated March 11, 1920, concerning Radio Liaison for Coast Patrol Airplanes, in which paragraph 2 contained a suggestion that the Air Service furnish the Bureau of Lighthouses with an approximate time table in quadruplicate, showing when the Coast Patrol airplanes would be in the vicinity of all light stations and lighthouses. Enclosed are four copies of the approximate time table as requested, and it is planned to have the Communication officer of Langley Field visit the superintendents of the third, fourth and fifth lighthouse districts and complete all details for the proposed Radio liaison. The Communication Officer has also been instructed to confer with the Navy stations and arrange all details.

Upon the compleion of the first few endeavors to maintain wireless communications between lighthouse station, lighthouses, the Navy and the coast defense patrol airplanes, a copy of the reports will be forwarded for information. *Ibid.*

TIME TABLE OF COAST DEFENSE AIRPLANES
between Langley and Mitchel Fields

Mondays and Thursdays

Langley Field . . . . . 10.00 A.M.
Cape Charles City 10:15
Chincoteague Inlet 10:45
Cape Henlopen 11:20
Cape May 11:30
Atlantic City 11:55
Barnegat Inlet . . . . . .12:20 noon
Sandy Hook 12:45
Rockaway Beach 12:50
Mitchel Field. . . . . 1:00 p.m.

Tuesday and Fridays

Mitchel Field . . . . . .1:00 p.m.
Rockaway Beach 1:10
Sandy Hook 1:15
Barnegat Inlet 1:40
Atlantic City 2:05
Cape May 2:30
Cape Henlopen 2:40
Chincoteague Inlet 3:15
Cape Charles City 3:45
Langley Field . . . . . 4:00 *Ibid.*

Letter from the Director of Air Service, War Department, to the Secretary of Commerce, May 8, 1920:

> The Direct or Air service desires to call your attention to the First Annual Army Air Tournament to be held at Bolling Field, Anacostia, D.C., on Friday, May 14th, and Saturday, May 15th, 1920. All the officers and employees of your office are cordially invited to attend this event.
>
> The Air Tournament will be a combination of a ground exhibit and an aerial exhibition of the activities of the Air service, and will include air races over a closed course, aerial gunnery, observation and acrobatics, and an exhibition of the latest type of planes and equipment in use by the Army

Air Service.

It is believed that this occasion will afford an excellent opportunity for the officers and employees of your office, and for the pbulic at large, to acquaint themselves with the progress of aeronautics.

Announcements will be made regularly in the daily newspapers regarding the program and detailed events, but should any further information be desired, you are requested to call upon the Publicity Officer for this occasion, Branch 1171, War Department telephone.

The Air Service will endeavor to make this occasion one of sufficient interest and educational value to amply reward those who visit Bolling field on the days specified above, and it is therefore hooped that the personnel of your office may be urged to attend. *Ibid.*

MEMO [from the Commissioner ?] to the Secretary of Commerce, April 1, 1921:

Referring to the subject of cooperation and standardization respecting aerial activities of the various branches of the government, on which, according to the press, a conference was held yesterday between yourself and the head of other Departments:

I beg to invite attention to the question of navigational aids for air traffic. This is a subject which has already received some attention and which is certain to be of increased importance in the future. Quite recently this office has had informal inquiries from the Navy on the subject, and during the late war supplied to the military services data as to lighthouses to be used to facilitate air navigation. Several manufacturers are making equipment to furnish lighted beacons for the aid of airplanes.

The present appropriations for the Lighthouse Service are based on estimates for providing a system of aids to navigation only on the navigable waters of the United States, and are too restricted to meet all the reasonable demands of the present for this purpose. It might well be possible, however, for the Lighthouse Service to render effective cooperation in connection with any system of lighted beacons for aid navigation, particularly along the coasts, the Great Lakes and the interior rivers which are lighted, which may be found desirable in time of peace or war.

This is submitted with a view to making the resources of this Service available in any investigation of the subject considered advisable.

Ibid.

MEMO from H.D. King, Superintendent of Lighthouse, 5th District, to the Commissioner, April 16, 1921:

> The Lighthouse Service in this district does, in fact, find that its mail service to Eastern North Carolina points, especially along the banks where remote from rail connections, is uncertain and irregular at times, and susceptible to improvement. This seems particularly the case on that section of the banks between Roanoke Island and Ocracoke. Service to Roanoke Island is reasonably dependable and regular, as is also service between Beaufort or Moorhead City and Ocracoke, but material delays and uncertainties are experienced in the transmission of mail as well as light package freight to the intermediate territory. It appears that communication between Cape Hatteras and Ocracoke is by small light draft motor boats skirting the banks closely, and that there is a large proportion of weather during which this class of boat in unable to maintain regular service. Furthermore, the amount and character of the traffic is apparently not such as to warrant the expense of maintaining larger craft that could proceed under all weather conditions. There are also, in all probability, intermediate post offices which would be inaccessible to larger and deeper vessels.
>
> It would appear that an air mail route would render highly efficient service, the only question being whether the number of people to be served and the amount of mail to be carried is sufficient to warrant the no doubt considerable expense, especially in view of the fact that there is now available a coastal telephone system for use in all cases of emergency.
>
> *Ibid.*

"Paul Henderson, who became the Second Assistant Postmaster General in 1922, agreed that Air Mail was an expensive fad. He recognized, like others before him, that Air Mail would become profitable only when it became a round-the-clock operation.

"Fortunately, Paul had proof that it could be done. In February 1921, a grand experiment had been conducted. Two flights would fly the Transcontinental, one in each direction and the flights would continue into the night. Despite a raging blizzard across the Great Plains and the Midwest, one flight was able to make it with its load of mail from San Francisco to New York. The determination of one pilot, Jack Knight, who flew three segments of the route, made it succeed. Jack was able to find his way across the snow-swept plains by following the bonfires lit by supportive citizens and postal employees.

"Using six aircraft and six pilots, the air mail relay took slightly more than

24 hours to cover the distance from San Francisco to New York. Proof of substantial timesaving was made."

Schamel, *The Development of Night Navigation in the U.S.*, <www.atctraining.faa.gov>

Clipping dated November 26, 1921, source unknown:

BIG LIGHTHOUSE TO GUIDE FLIERS

What is perhaps the most powerful lighthouse ever constructed has just been completed in the works of Barbier Bernard & Turenne, in the Rue Curial, Paris. It is intended for a new aerial station at Dijon, and its construction has taken more than two years.

The new lighthouse has been tested for durability and power, and the whole fabric which is made of steel girders supported on concrete piles, will now be pulled down for transport to Mont Africa, nine miles from Dijon, where it will be set up permanently. It is intended as a guiding light for the great airways to the east and south of Europe, and was ordered by the Service de Navigation Civile des Messageries Aeriennes at an estimated cost of 800,000 francs.

The light consists of eight arc lamps, four on a lower deck and four on an upper. The whole of the inside structure revolves on massive bearings, and the lights themselves are controlled by a single operator sitting in the bottom of the house. The carbons in the arc lamps have to be replaced every two hours, but this does not involve any interference with the general working of the instrument, for each particular lamp is lowered in turn to the basement by means of an electric elevator and a mechanic replaces the carbon pole without the least difficulty.

It will be possible to see the flash at a distance of nearly 200 miles.

Ibid.

MEMO from Thurman H. Bain, Chief, Engineering Division, Air Service, to the Bureau of Lighthouses, May 20, 1922. Subject: Aerial Lighthouse

> The Engineering Division, Air Service, is developing aerial beacons suitable for use in making connection with night flying, both for military purposes and for schedule flights on airways, and altho the problems to be solved in the development of aerial beacons are different in many respects from those of the marine beacon, any information which, in your opinion, will assist the Air Service in the development of aerial lighthouses, will be greatly appreciated. *Ibid.*

Letter from the Commissioner of Lighthouses to Chief, Engineering Division, Air Service, May 25, 1922:

Referring to your letter of Mary 20 . . ..

The Bureau takes pleasure in advising you that Chance Brothers and Company, Limited, Smethwick, Birmingham, England, have made a specialty of this class of lighthouses and apparatus and you might want to communicate with them requesting their catalogues. They have been manufacturing lighthouses and their apparatus for many years and are experts in their line.

It is also probable that the following firms who are in the same line of business can be of service to you in furnishing advice and apparatus:

Barbier Benard et Turenne, Paris, France
G. Denesdin, Paris, France
Henry Lepaute, Paris, France
Sautter, Marlé and Company, Paris, France
H. Luchaire, Paris, France
Societé Internationale D'Eclairage, Paris, France

It is suggested that you consult also the back numbers of the London "Engineering" for the past four years. See article on page 141 for the July 30, 1920, issue.

In this country you may communicate with the American Gas Accumulator Company, Elizabeth, N.J.

White this service has not been called upon to establish aids to aerial navigation, it would seem that any usual type of lighthouse apparatus employed to show a light if held or revolved horizontally would answer your purpose. The United States Lighthouse Service employs two types of lenticular apparatus known as (1) fixed lenses which show a steady light and (2) revolving lenses which show flashes of light of any desired characteristic. Both these apparatus stand with their longer axes vertical and cast their light horizontally toward the horizon, but they could with little trouble be modified to operate with their longer axes horizontal, in which case they would cast their light from one horizon to the other by way of the zenith. It occurs however to the Bureau that aids arranged in this manner, particularly for the use of aviators, if located in the neighborhood of the sea coast might interfere with vessels at sea and should therefore be placed at such height and their rays of light shielded sp as to prevent this. Or, if obliged to locate them in cities, they should be placed high enough and free of all interference from small buildings that would obscure their light; in the open country low towers will probably be all that will be needed in the way of elevation.

> The Bureau will be pleased to advise you further regarding any particular question which may arise in connection with your work, and it may be desirable to confer in any event in case of the establishment of your lights on the seacoasts which might interfere with marine navigation.
>
> *Ibid.*

Letter from S.S. Bradley, General Manager of the Aeronautical Chamber of Commerce to George R. Putnam, Commissioner, Bureau of Lighthouses, August 2, 1923:

> The Aeronautical Chamber of Commerce transmits to you with its compliments a copy of the Aircraft Yearbook for 1923.
>
> The development of commercial aviation has had the sympathetic consideration of the Administration. As an important element in national security it is receiving the careful attention of the War and Navy Departments. It is a generally recognized fact, however, that national defense in the air can not be fully realized without the development of commercial aviation.
>
> The Aeronautical Chamber of Commerce is endeavoring to instruct the public and to stimulate the use of aircraft as a useful servant in commerce and industry. The suggestion has been made that your department could greatly assist in accelerating popular acceptance by utilizing aircraft for such services as may be required.
>
> At your convenience the undersigned would appreciate the privilege of an interview. *Ibid.*

MEMO from the Commissioner of Lighthouses to Keepers of Lighthouses, Commanding Officers of Lighthouse Vessels and Other Employees of the Lighthouse Service, August 4, 1923:

> The bearer of this communication, Brigadier General William Mitchell, Assistant Chief of the Air Service, U.S. Army, who is making a tour by airplane along the New England coast, may call upon you for assistance in effecting communications, transportation for shot distances, putting up for overnight, or in other minor ways. You are requested to show Gen. Mitchell every courtesy and render such assistance as practicable without interfering with the work of the Service. *Ibid.*

Letter from the Commission of Lighthouses to Brigadier General William Mitchell, Assistant Chief of the Air Service, War Department, August 7, 1923:

> I take pleasure in sending you with this the formal letter [above].

> The Lighthouse Service has been very much interested in possibilities of making its lighting system of the greatest use in aerial navigation, and I take this opportunity of inviting any suggestions from you in this connection. It is possible that as a result of this trip you may have some suggestions as to how the coast lights could be made of greater utility for aerial navigation. I have just attended the Lighthouse conference in London and find that interest is being taken in this subject by the lighthouse authorities of various countries, but thus far n special plan has been evolved. The two small lighthouses in the vicinity of New York Harbor which we are now remodeling, we are planning to have the bare light visible from above as well as showing through the lens in a horizontal place in the usual way. *Ibid.*

Letter from J.S. Conway, Acting Commissioner of Lighthouses to Mr. A.P. Hagar, Safety Car Heating & Lighting Co., New York, October 2, 1923:

> In response to your inquiry of September 29, 1923, as to the names and addresses of the technical men in charge of design and operation of the land beacons used by the Post Office Department, I am informed that this matter comes under the jurisdiction of the Division of Air Mail Service, Post Office Department, and that inquiries by you addressed to the General Superintendent, Air Mail Service, Post Office Department, attention of Mr. J.V. Magee, will receive consideration . *Ibid.*

"Paul Henderson, the Second Assistant Postmaster General, saw what was needed. 'An airway exists on the ground, not in the air.' A 1923 experiment conducted by the Army Air Corps in Ohio showed that pilots could navigate at night using rotating light beacons. With this example, Henderson was able to press his requests for the development of a similar system for the Air Mail routes. Congress in 1923 approved funding for the lighting of the Transcontinental Air Mail Route. Work started immediately on the Cheyenne to Chicago segment. Being in the middle of the nation, flights starting at daybreak on the coasts would be able to fly either end of the lighted segment before dusk.

"What resulted was the first ground based civilian navigation system in the world. Beacons were positioned every ten miles along the airway. At the top of a 51-foot tower was a I million candlepower rotating beacon. Pilots could see the clear flash of light from a distance of 40 miles. Also at the top of the tower were two color-coded 100,000 candlepower course lights. These pointed up and down the airways. There were colored green, signifying an adjacent airfield, and red, signifying no airfield. The course lights also flashed a Morse Code letter. The

letter corresponded to the number of the beacon within a 100-mile segment of airway . . .

"The beacons were also built to aid daytime navigation. Each tower was built on an arrow-shaped concrete slab that was painted yellow. The arrow pointed to the next higher numbered beacon. An equipment/generator shed next to the tower had the beacon number and other information painted on the roof.

"Regular scheduled night service on the Transcontinental Air Mail Route started on July 1, 1924. Now operating around the clock, Air Mail was able to cross the nation in 34 hours westbound and 29 hours eastbound. *Schamel*

Letter from J.S. Conway, Acting Commissioner of Lighthouses to Mr. Luther K. Bell, Aeronautical Chamber of Commerce, New York, February 8, 1924:

> The Bureau acknowledges receipt of your letter of February 2, 1924, requesting information in regard to aircraft, and has to advise that there are no aircraft activities in use in the Lighthouse Service at the present time.
>
> *Ibid.*

Letter from C.F. Egge, General Superintendent, Post Office Department, to Mr. T.W. Noblitt, Flat Creek, Tennessee, February 23, 1924:

> Your letter of the 18th instant, addressed to the Department of Lighthouses, has been forwarded to this office for attention and reply.
>
> Our light flying course extends from Chicago, Illinois, to Cheyenne, Wyoming. At Chicago, Iowa City, Omaha, North Platte and Cheyenne, we have terminal fields where regular landings and take-offs are made. These fields are equipped with a high-intensity arc searchlight which revolved three times a minute and has a range of approximately one hundred miles in clear weather. This is used as the terminal field beacon. The terminal field is also floodlighted and lights are placed around the boundaries in order to determine the limits of the field for the aviator. Buildings are floodlighted from the outside in order to give the pilot a daytime perspective.
>
> The emergency fields which have been established every twenty-five miles along the course are equipped with an 18-inch incandescent searchlight. A 320volt 900-watt motion picture lamp is used in these beacons. Like the terminal field beacons, they revolved but instead of revolving three times per minute, they are revolved six. At each corner of the emergency field an acetylene boundary marker is place. These boundary markers are similar to traffic beacons that are used at street intersections.

> In addition to the above types of illumination, we also use an acetylene flashing beacon of low candle power. These beacons are placed every three miles along the course and make the airway. They are especially helpful in bad weather. *Ibid.*

Letter from Mason M. Patrick, Chief of Air Service, War Department, to George R. Putnam Commissioner, Lighthouse Bureau, July 28, 1924:

> It has occurred to me that your Bureau in the course of its work would come into rather close contact with the Canadian Bureau of Light Houses. This organization may be in a position to give our Army Air Service Round-the-World Flight much needed assistant during the passage of that Expedition along the Coasts of Labrador, New Foundland and Nova Scotia. Present progress would indicate that the flight will be passing throughout that portion of the route during the middle of August.
>
> If the good offices of the Canadian Bureau of Light Houses can be solicited on behalf of the United States Army Air Service Round-the-World Flight, it will be great appreciated. *Ibid.*

Letter from A. Johnson, Deputy Minister, Canada Department of Marine and Fisheries, Ottawa, to Commissioner of Lighthouses, Washington, 2nd August 1924:

> I beg to acknowledge receipt of your letter of the 31st ult. . . . enclosing copy of [above] . . .. In reply I beg to say that I have very great pleasure in issuing instructions accordingly . . ..
>
> As this Department does not maintain any lights on the east and south coasts of Newfoundland except at Cape Bauld, Cape Race, Cape Freels, and Cape Ray, I am forwarding a copy . . . to the Deputy Minister of Marine, St. Johns, Nfld., for his consideration. *Ibid.*

Letter from Mr. Wm. Liningstone, President, Lake Carriers Association, to Superintendent of 11th District, December 26, 1924:

> A rather unusual matter has developed in the progress of the mail service which affects our lake navigation.
>
> Several of our masters have complained that at Huron, Ohio, they have been confused and in danger of running ashore by reason of a high-powered revolving electric light established 2 ½ miles west thereof, as a guide for the aerial mail service.
>
> We understand that these lights have been established about every 25 miles from New York to San Francisco.

If this is the case, and the air route lies along the south shore of Lake Erie for the latter's entire length, it would see, to be that these lights should have a special characteristic which will not confuse them with the harbor lights, and that they should be bulletined by the Lighthouse Department and shown on Lake Survey charts.

Will you not kindly give this your careful consideration so that we can get the matter in satisfactory shape before the opening of navigation, 1925, and oblige.

I am also taking the matter up with the Lake Survey and the Postmaster General. *Ibid.*

MEMO from Superintendent, 10th District, Lighthouse Service, December 30, 1924. Subject: Letter from Mr. Wm. Livingstone, President, Lake Carriers' Association relative to air mail lights.

Forwarded to the Commissioner. It is suggested that the Post Office Department be requested to furnish this Service with a map showing the location of all lights established for guidance of air mail flyers which are located adjacent to the lake shores where they would be visible to navigators. Also data showing characteristics, heights, etc. Upon receipt of this information further consideration will be given. *Ibid.*

Letter from Herbert Hoover, Secretary of Commerce to the Postmaster General, March 3, 1925:

It has come to my attention that masters of vessels navigating the Great Lakes have experienced some confusion, along the south shore of Lake Erie, between lights established for the guidance of air mail flyers and the lights established for lake navigation by the Lighthouse Service of this Department.

I am taking the liberty of inclosing for your information a copy of Department Circular No. 213, Rules and Regulations governing Private Aids to Navigation, which apply to aids maintained by other branches of the U.S. Government as well as by private individuals or corporations.

It is clearly in the public interest that confusion between lights for aerial navigation and those for water navigation be avoided, and the suggestion is made that wherever the former are located as so as to visible to water navigators, they be marked by a distinguishing characteristic.

I should be pleased to receive an expression of your views on this subject, and to be furnished a map, if available, showing the location of all lights established for guidance of air mail pilots adjacent to the shores of

the Great Lakes where they would be visible to navigators. Data showing the characteristics of the several lights, their heights, and other pertinent information would also be appreciated. *Ibid.*

Department of Commerce Circular No. 213, April 12, 1924:

Section 3 of the act of Congress approved June 30, 1906, authorizing aids to navigation in the Lighthouse Service, provides that after January 1, 1907, it shall be unlawful for any person, company, corporation, or municipality not under the control of the Commissioner of Lighthouses to establish, erect, or maintain in the navigable waters of the United States any light as an aid to navigation or any other aid to navigation similar to any of those maintained by the United States under the control and direction of the Commissioner of Lighthouses without first obtaining permission so to do from the Commissioner . . .. *Ibid.*

Letter from Harry S. New, Postmaster General to the Secretary of Commerce, March 7, 1925:

I have your letter of March 3 [above] . . .. Most certainly this Department does not want to in any way interfere with or endanger this lake navigation.

I am having prepared a map showing the exact location of the several lights which are located along the south shore of Lake Erie on the Air Mail route. This map I will send you at the earliest possible moment. Included on it will be data to indicate the character of the several types of lights which are used there. *Ibid.*

MEMO from the Superintendent, 10th District, Buffalo, to the Commissioner of Lighthouses, April 9, 1925. Subject: Lights Maintained by Post Office Department for use of air mail flyers:

This matter has been investigated through the visit of a representative to the light maintained in the vicinity of Huron. This light is located about two and one half miles west of Huron and two and one half miles south of Lake Erie. This light is the nearest of any of these lights to the lake, and the only one which has been complained of as being confusing to navigators. The next nearest light to the lake is situated a few miles wet of Cleveland and approximately five miles south of the lake shore. The keeper at Cleveland states that he has not seen this light from his station.

The illuminating apparatus consists of a 24" headlight so mounted that it can be rotated six revolutions per minute bu means of a small electric motor. Current is generated bu a Delco outfit. The duration of flash is about 1.5 seconds. The light is used only when a plane s passing that vicinity.

In regard to the light near Huron, the most effective way to avoid confusion would be to tilt the reflector so that the lowest ray of the beam would form an angle of about 15° with the horizontal. This would prevent the direct rays of the light from being seen on the lake, and the beam or reflection if seen would not be mistaken for a lighthouse at such an elevation. This office is not sufficiently familiar with the requirements to judge whether this change would invalidate the light for the use of aviators, but since they pick up the light at a considerable distance above the tower, it would not seem that the suggested change would be a material detriment to such use.

It is recommended that this suggestion be referred to the Post Office Department for consideration.

The map and correspondence is returned herewith as requested.

Ibid.

Letter from J. Wallace Drake, Acting Secretary of Commerce to the Postmaster General, May 21, 1925:

With reference to letter of April 20, 1925, from the Post Office Department and to previous correspondence in regard to confusion experienced by navigators on Lake Erie due to the Air Mail Beacon Light located near Huron, Ohio, I desire to inform you that this matter has been further investigated by this Department and the views of the Lake Carriers' Association, which made the original complaint, have been further canvassed, and it is now believed it will not be necessary for the Post Office Department either to move the beacon back inland or to screen it from lake visibility, unless the Post Office Department for its own purposes desires to make this change. It is felt that if the light is properly designated on the charts, it will be understood by navigators without difficulty. *Ibid.*

Letter from Superintendent, 19th District, Honolulu, to the Commissioner, May 28, 1925:

It is desired to bring to the attention of the Bureau the situation

here regarding aerial navigation and it potential effect on this Service, with the suggestion that consideration be given to the adoption of a policy for meeting future development.

Today's news carries assurance that the dirigible Los Angeles will make the trip to Hawaii in August or September of this year. Such a flight during the summer had been tentatively considered. This is possibly due, or at least partly due, to the activities of the local chapter of the Aeronautical Association, organized shortly after General Mitchell's visit here in 1923, which is determined on the development of commercial aviation in Hawaii as particularly adapted to the conditions here. The U.S. Navy is now planning a non-stop flight with heavier than air machines from the Pacific Coast to Hawaii, for which special planes have already been built. It has been publicly announced that the Post Office Department will favorable consider the establishment of inter-island air mail service at the first opportunity; and the Superintendent has been personally informed by Mr. A.W. Van Valkenburg, the leading and most active member of the local Association, that a trip he made last year to Washington, Detroit, and other centers of air craft industry, convinces him that aerial development of these islands will come sooner than anyone now suspects. Mr. Van Valkenburg was chiefly instrumental in the preparation of a field, the procurement and erection of a mooring mast to make possible the flight of the Los Angeles, as well as for legislation by the Territorial legislature, just adjourned, providing for airdromes on the various islands. Editorials favorable to and urging such development appear every few days in the local papers.

Aside from the development above outlined, the almost daily inter-island flights of army and navy air craft have continued for the last two years; and Major Brant, Army Air Service, who was sent here from Washington to direct aircraft during the recent maneuvers, and who called on the Superintendent a few days ago prior to his return to Washington, recently led a squadron of Army land planes from Oahu to Kauai and back over ninety miles of open sea.

There are two things which seem to the Superintendent deserving of serious consideration by this Service, in this connection:

First, the establishment of lighthouse radio signals at light stations in Hawaii, strategically situated, for the aid of aircraft equipped with radio compasses. For trans-Pacific flights such as those made by the Los Angeles and naval planes, a radio station at Makapuu Point, as already

contemplated in the general scheme heretofore outlined by the Bureau would be of inestimable value. Once begun, local authorities in such matters freely predict,, these flights will be repeated, resulting eventually (some claim at an early date) in regular service. For the assistance of inter-island flights as now made by the military services as well as one or two individual commercial fliers, and as contemplated by the Postal Service, similar radio station at Nawiliwili, Kauai, and Kauhola, Hawaii Island, would be of great value, due to the ever present hazard of cloud banks obscuring islands from air pilots, often make approaches and landing unsafe. Such a station on the island of Maui, preferably at Kahului, would also be highly desirable, but this Service now has no keeper station on that island.

Second, lights and day marks for use of air pilots on inter-island flights. These aids would be of considerable value to military aviation, and at the inauguration of air mail service would probably be essential. General Mitchell discussed with the Superintendent the practicability and value of distinctive ground markings at light stations, for day marks; and the elaborate development of lights for air mail night flying on the mainland would indicate the value attached to such aids by the Postal Service. It is suggested that co-operation with the Post Office Department might be possible to the extent of securing its assistance in providing for such aids here.

This Office has not provided in its estimates for 1926, for any improvements herein suggested, and so detailed recommendations are made at this time, pending an expression of opinion on these matters by the Bureau. In the event that it is desired that plans be made for radio signal installations, drawings, etc. of necessary equipment would be needed, none of which has been supplied to this Office. *Ibid.*

Clipping from Washington Star, July 21, 1925:

J. Walter Drake, Assistant /secretary of Commerce, and Prof. J.W. Roe of New York University have been named on a committee to undertake a survey of the status of civilian aviation throughout the world to be made jointly by the Commerce Department and the American Engineering Council. Mr. Drake is to be chairman of the committee, Secretary Hoover announced, while Prof. Roe will be director of the survey.

Field assistants include Lieut. J. Parker VanZandt of the United

States Army Air Service, and Prof. Alexander Klemin of the aeronautical engineering section on New York University. Members of the committee are: Dr. W.F. Durand of the American Society of Mechanical Engineering; Prof. E.P. Warner, Massachusetts Institute of Technology; Luther K. Bell, traffic manager of the Air Mal Service, and C.T. Ludington, Philadelphia.

The intention of the committee is to assemble facts on all commercial aviation systems now in operation at home and abroad, with analyses of their economic returns. This will be followed up in the United States by a study of existing conditions and traffic possibilities for new aviation projects, with some consideration to legislation and to governmental experience.

"If commercial aviation is to be developed in this country," the announcement of the Commerce Department said, "it will probably be largely through private financial support rather than direct governmental aid, as in Europe. This support must come from investors and banks, who will not and cannot be interested in this field until the facts relating to the commercial possibilities and risks are available."

Clipping from The New York Times, *September ??, 1925:*

SENATOR BINGHAM CALLS FOR A NEW AIR POLICY
Believes That Loss of Shenandoah and Large Naval Seaplane Emphasizes the Need for Adoption by Congress of a Carefully Considered Aviation Program By Hiram Bingham

The failure of the Shenandoah to outride the terrific "line storm" encountered on her passage over Ohio, and the failure of the big flying boats built at the Naval Aircraft Factory in Philadelphia to complete their flight to the Hawaiian Islands have brought vividly to the attention of the American people the fact that American aviation is not so successful today as we want to see it. It is too early to comment fully and definitively on the recent disasters to naval aviation. It appears to be quite evident, however, that we did not have adequate meteorological services authorized to send out frequent reports along the prepared lines of flight. It is possible that the Shenandoah might be safe and sound today had she received warning of the terrible storm that lay ahead of her.

Furthermore, it is obvious that the Hawaiian flight was attempted on a day when normal Trade Wind weather was not reported for the latter part of the journey. It seems that it should have been possible with ships stretched across the Pacific, all sending in weather reports by radio, to

have picked a day with favorable wind and weather for the entire distance. The northeast Trades are the prevailing winds for nine months of the year in that part of the Pacific. Such winds could have been counted on to have greatly assisted the aviators. Nevertheless, they appear to have started on a day when westerly winds were reported from the vicinity of the Hawaiian Islands.

It is very hard for those of us who believe firmly in the future of aviation to witness these disasters even complacently, though we know that in such a new art as air navigation much still has to be learned. Such things only emphasize the need for adoption by Congress of a carefully considered aviation program for the United States.

American's Record in the Air

American built the first airplanes capable of sustained flight. Americans were the first to learn how to fly machines heavier than air. American hold more important world records than do the citizens of any other nation. The first plane that cross the Atlantic belonged to the United States Navy. The first planes to circumnavigate the globe ????????????? by the United States Post Office. American pilots are second to none. American airplane designers are equally at the head of their profession. The ability of American to organize difficult aviation experiments has been recognized repeatedly as of superior quality. Nevertheless, aviation has not advanced in this country so rapidly as we had hoped.

Travelers to Europe find that it is possible to fly in comfort and at regular intervals between the principal cities. Insurance rates for passengers and freight when carried by airplane are far lower in Germany than in the United States. Insurance rates on valuables carried from Paris to London by air are very much less than by the usual methods of transportation. All the leading European countries have been willing to promote commercial aviation. We have done practically nothing.

Where Europe Leads

It is no secret that in England and France commercial aviation is safer than in the United States. It is no secret that France and England are spending more money on aviation than we are. Last year England provided about $1,700,000 to aid commercial aviation. This included the upkeep of commercial air ports, the surveying of new airways, the purchase of land for improvement of airports, construction of buildings thereon, and a direct subsidy to the great Imperial Airways Corporation to enable it to carry on regular service between London and various cities on the continent.

Various committees, official and unofficial, have been appointed to examine into the reasons for the present unsatisfactory state of affairs. It is not my purpose to anticipate their reports. It is enough to say that insurance companies do not yet feel warranted to giving as low rates for freight and passengers when transported by air in the United States than they do in Europe. Evidently American commercial aviation has not made as satisfactory progress as it could have made.

Air Corps Like Marine Corps ??????

need, what are some of the steps that might profitably be adopted as an aviation program for the United States?

An Air Bureau Needed

The first thing to do is to establish a Bureau of Air Navigation in the Department of Commerce. Proposals for such a bureau have twice been made in bills introduced by Senator Wadsworth of New York, and have twice passed the Senate and failed to pass the House. The need for such a bureau is imperative. Every other world power has had a similar agency for years. We have a bureau that gives efficient aid to ocean navigation, but none that gives aid to air navigation.

It should be the duty of this bureau to establish an aircraft inspection service to examine aviators and furnish certificates of their ability as pilots and of their physical fitness to fly. No one is now permitted to act as a captain or pilot of an ocean vessel unless he has a valid certificate from the Federal Government. It is extraordinary that similar provisions have not long ago been applied to the master of aircraft. This proposed aircraft inspection service of the Department of Commerce should also be required to certify the aviation mechanics on whose ability depend ???????

It should also examine the air worthiness of aircraft and issue certificates of registration and periodic examination. It is utterly ridiculous that the United States Government, while not allowing any person to take passengers across Long Island Sound in a steamboat unless the captain, mate, engineers, boilers, hull, lifeboats and life preservers have all been passed as satisfactory to Federal Inspectors, nevertheless permits any one to take passengers across the Sound in any type of aircraft without any examination or certificate whatsoever. No wonder our insurance companies decline to believe that the present risks of commercial aviation are such as to warrant as low rates as are granted to ocean navigation.

A few States like Connecticut have laws requiring the examination

of pilots and aircraft, but in most states there is nothing to prevent a rash and foolhardy youngster who has had less than two hours flying experience in flying from passing himself off as a competent commercial pilot, or even as a "flying instructor," and persuading credulous passengers and students to take a chance with him in the air. No wonder there are more aviation accidents in America than in France or England, where Government regulation is as adequate for air navigation as for ocean navigation.

Controlling "Gypsy" Flyers

It is natural that proposals for this form of regulation have met with strenuous opposition from "gypsy pilots" and their friends. The same kind of opposition came from venturesome sea captains in the early days of the merchant marine. No one likes to go to the trouble and expense of being examined and securing certificates of ability. Strange as it may seem, there have been ship owners who were perfectly willing to send unseaworthy craft on ocean voyages! The new bureau of Civil Air Navigation should be careful not to establish burdensome rules and regulations which will hinder the growth of the new science. At the same time ??????????????

The Department of Commerce should be directed to stimulate commercial aviation by laying out and maintaining navigable air routes that will be of service to Government agencies desiring to employ aircraft. The Department should be directed to determine costs and other operating factors that will be of value to prospective air transport companies. It should also assist in educating the public of the desirability of utilizing air mail and air express. The air mail is today the safest and most regular of the forms of mail transportation.

The Army Air Service, under the able direction of Major Gen. Mason M. Patrick, has devoted much attention to the study of the possibilities of commercial aviation. ?????????????????????? The remarkable success of the Army Air Service in laying out and conducting its model airways, over which army planes have flown about one million miles without any fatal accidents, is an instance of what can be accomplished and what should be continued.

Beacons for Aircraft

The Department of Commerce must also be authorized to supply aids to air navigation similar to those it supplies to ocean navigation. The Bureau of Lighthouses, which has so efficiently provided lights and

beacons for our seaports, should now be authorized to provide lights and beacons for all Federal, State and municipal airports. The present Bureau of Lighthouses , divided as it is into nineteen lighthouse districts, with a smoothly working organization and abundant experience in the maintenance of lighthouses, needs only proper ????????????? and appropriations to enable it to assume charge and control of the construction, maintenance, repair, illumination, inspection and superintendence of aviation lighthouse depots, lights and signal stations, lighthouses, fog signals, beacons and daymarks, and generally of all things appertaining to the adequate lighting and marking of air ports and air ways.

The Secretary of Commerce should be authorized to discontinue from time to time such lights as may for any cause become useless or unnecessary, and also to re-establish any light which have been discontinued whenever he believes that such re-establishment to be required by public convenience or the necessities of air commerce. The experience of the present Commissioner of Lighthouses in work of this character and the nature of his present equipment both I material and personnel will be of immense advantage in the development of this program.

The Secretary of Commerce should also be authorized to establish and maintain radio stations at all Federal, State and municipal air ports as fast as appropriations for this purpose are available. The use of radio bearings in the navigation of seagoing vessels has made rapid progress in the last four years. The directional use of radio in air navigation is now being developed by the Army Air Service at McCook Field, and we may expect that in the near future the necessary equipment will be available for aiding aircraft threatened with disaster due to fog or low visibility. In the air, as in the water, the greatest responsibility rests on the pilot in time of fog, and he is often in need of all possible aid.

The radio compass so recently developed for ocean navigation should also provide the air pilot with a practical means of taking bearings in fog, comparable in accuracy with bearings of visible objects and available at greater distances. The radio signal may be used as a leading mark to steer directly or to pass at a safe distance. Any number of vessels may obtain bearings simultaneously. The radio compass may also be used for avoiding collisions in fog.

The transmitting stations, being automatic, may be operated by

employees of lighthouses without the necessity of additional personnel. Unquestionably, the Department of Commerce should be authorized and directed to develop the use of radio in safeguarding air navigation as rapidly as possible. Since the Lighthouse Service of the Department of Commerce was the first to install practical radio fog signals, it is the natural bureau to which we should look for similar aid to air navigation.

Air Charts Wanted

The Department of Commerce should also be directed to have the Coast and Geodetic Survey provide as adequate charts for air navigation as it now provides for ocean navigation. No one would think of attempting to take an ocean vessel into unfamiliar waters without a good chart, one which indicates obstructions to navigation as well as safe channels and the whereabouts of beacons and lighthouses. Nevertheless, aid pilots are expected to navigate aircraft in most cases without adequate charts. No one begrudges the expense to which the United states Government has been put in the preparation of its coastwise charts, and no one should begrudge to the airman the expense necessary in providing him with similar aids to navigation.

One of the most serious obstacles to the progress of commercial aviation has been our national tendency to think along lines of railroad and motor transport. It has even been suggested that commercial aviation be placed under the same branch of Government as that which controls our railroads. As a matter of fact, the problems of the commercial use of the navigable air are so similar to those of the commercial use of our navigable waters that it appears to be quite evident that the Department of Commerce, which furnishes most of the aids to ocean navigation is the one best qualified to furnish similar aids to air navigation.

Help from Weather Bureau

The Department of Agriculture should be authorized to extend the functions of the Weather Bureau so as to give our air pilots adequate and frequent information regarding meteorological conditions likely to be encountered along our navigable air routes. As present the Weather Bureau has charge of the issuing and displaying of storm and flood warnings, the gauging and reporting of river stages, the maintenance and operation of the United States Weather Bureau telegraph and telephone lines, the collection and transmission of marine intelligence for the benefit of commerce and navigation. To these it seems reasonable to add the adequate collection and frequent transmission of wind and weather conditions for the benefit of air

navigation.

Its telegraph and telephone lines should be extended to air ports so that there may be immediate notice given of such air conditions as will benefit or render unsafe flights between two air ports. Radio and visual signals should be provided along the air ways in order to give warning of dangerous conditions likely to be encountered ahead. It has long been recognized as a most necessary and proper function of the Federal Government to display storm warnings and weather forecasts in all important seaports. The same thing should be done for air ports. Until it was done for sea ports, lives were unnecessarily lost in wrecks at sea. Until it is done for air ports lives will be unnecessarily lost in airplane crashes, and the progress of commercial aviation will be retarded.

Tasks for the Government

The Postoffice Department should be encouraged to make liberal contracts with properly accredited organizations for the transportation of mail and parcel post on terms designed to build up and stimulate private enterprise in air lines. This is a very important and proper form of Government aid. Whether the Government should develop aircraft equipment and methods specifically for commercial use as distinguished from military use is a moot point. Personally, I should be inclined to leave such development to private initiative.

How far the United States Government should proceed in the establishment of necessary and desirable ground facilities, such as landing fields, hangers, shops and service field equipment which go to make up an adequate airport, is another moot point. The question of expense is a very serious one, since there are such an enormous number of places in the United States that would like to have the Federal Government furnish them with adequate air ports. I am inclined to favor the cooperation of the Federal Government, as suggested above, by the adequate provision of aids to navigation in the establishment of lighthouses, radio and weather bureau service only as and when the States or municipalities establish adequate air ports.

At the same time, the army and the navy must have their own air ports, and these in time of peace should be available for commercial use upon the payment of reasonable charges and under proper regulations. It is possible that near the great centers of population Federal air ports should be provided, which could be of material assistance in the national defense in times of emergency.

Airport at Governors Island

I believe that it would be wise for the War Department to make Governors Island into a first-class air port and permit commercial and mail planes to use it as a port of call. There is hardly room enough on Governor Island for proper terminal facilities to be provided, but the opening of that area as a port of call would be of enormous benefit to the progress of aviation in the most thickly settled part of the United States. Few things have ????? than the loss time consumed in reaching any air port from the center of New York's financial district.

Suitable provision should be made for leasing to private parties space for hangers and shops in the immediate vicinity of army and navy landing fields. While nothing should be permitted which would seriously interfere with their proper use by our military and naval authorities, at the same time, in view of the very substantial aid which we would expect from commercial aviation in time of war, it would be good policy on the part of the United States Government to encourage the commercial use of all landing fields now Federally owned and controlled.

Would Set Air Service Free

So far as our military aviation program is concerned, I am strongly opposed to taking away from the Secretary of War and the Secretary of the Navy such an important and indispensable aid as aviation. Unlike many of my friends in the Air Service, I do not believe that wars can be won without infantry or battleships. On the other hand, I am strongly of the opinion that in the army and in the navy the Air Service should form separate corps, as has been suggested by General Patrick. The popularity and success of the Marine Corps as an adjunct of the navy under the direct control of the Secretary of the Navy shows how practical such a proposal is.

It is absolutely necessary that those officers who look forward to aerial fighting and to training our air forces must not only be permitted but also encouraged to specialize in aviation and give their entire time to the problems of military and naval aviation. The navigation of the air is such a new and unstandardized art that for the present it is foolish to expect progress by any system of details to the Air Service. It is not fair to expect the commander of a battleship to take charge of troops operating on shore. It is not fair to expect the Colonel of a regiment of marines to take command of a battleship. No more is it fair to expect the commander of a battleship to take command of an aviation school or of the tactical

operations of air forces. “Landlubbers” should not command battleships; “sea-lubbers” should not command airships.

Where Aviation Belongs

The Army Air Service should have its separate promotion list and a separate budget, but it should be completely under the control of the Secretary of War. Similarly, then Naval Air Service should have a separate promotion list and a separate budget and be as independent as the Marine Corps, at the same being absolutely under the direction of the Secretary of the Navy. In the same way commercial aviation should be able to grow in accordance with individual initiative and personal enterprise, and at the same time be under the control of the Secretary of Commerce.

When we can secure proper inspection of pilots and aircraft, adequate airports, well charted airways and the necessary aids to navigation, then commercial aviation in the United States will come into its own. While I do not believe in direct subsidies, I am strongly of the opinion that money spent in granting the same type of aids to air navigation that we have for years granted to ocean navigation will ultimately be of great value to the United States.

Clipping from a Baltimore newspaper, September 25, 1925:

NEW OPPOSED UNIFICATION OF AIR SERVICES
Joins War And Navy Protests In Testimony Before Board
INQUIRY RECEIVES FACTS ON AIR MAIL
Secretary Hoover Discusses Commerical Aviation, Recess to Monday

The President’s aircraft board completed today the first phase of its inquiry into aviation by hearing from Postmaster-General New and Secretary Hoover. It then recessed until Monday.

Adding to the mass of information already supplies by the War and Navy Departments, the two Cabinet members avoided the controversial issues involved and discussed only commercial aviation and development of Air Mail Services.

Mitchell Due Tuesday

The recess was taken to enable the board members to attend to private affairs and also to reexamine the testimony already introduced. Upon reconvening the board will hear from air pilots, among them Col. William Mitchell, former assistant chief of the Army Air Service and whose attacks on the Government’s military aviation policies largely were responsible for inception of the inquiry. He is expected to appear on

Tuesday.

Commercial aviation was presented today as an industry on approved merit, and the story of its progress, told jointly by Mr. New and Mr. Hoover, was in contrast to previous testimony disclosing idfferences of opinion s among army and navy heads.

Air Mail Separate Service

Mr. New prefaced his testimony with the statement that postal air mail had no connection with the military air dispute, but when questioned as to his views on unification of the air services he joined Acting Secretary of War Davis and Secretary Wilbur in opposing the proposal.

Secretary Hoover was not questioned at all bu the board and confined his statement to commercial air activities. He advocated creation of a bureau of civil aeronautics, however, and he said that he believed a sept-supporting air service for commercial transportation is now a possibility within the United states, for which the federal Government should immediately provide.

He urged also an expansion of the Air Mail Service, which Mr. New previously had asserted has demonstrated commercial aviation is "an entirely feasible thing."

Federal Aid Needed

Mr. Hoover recommended a Federal agency be created to give aviation approximately the same aid now given governmentally to navigation and urged that municipalities cooperate by providing local air ports.

"I believe that by this minimum extension of governmental activities," he said, "we can secure commercial aviation in the United States without subsidy. It seems to me certain that we cannot have successful development of commercial aviation until some Government service provides for it."

He said he believed aviation would necessarily grow route by route and that the bureau he proposed would at the outset "need perhaps $400,000 a year and that the subsequent expansion would depend upon the growth of the industry."

Describes Other Help

Describing how the Federal Government lights and marks channels for water navigation, issues constantly advice to navigators, provides for safety inspection of water craft and licenses navigation, Mr. Hoover said that the coast of providing a parallel service to aviation "would not be an

extravagant sum."

"Much of the work, he continued, "of such a service can be undertaken by the extension of existing bureaus of the Department of Commerce, which have already technical personnel and established organizations."

The Secretary reviewed the problems confronting development of commercial aviation in Europe and he said he believed "the establishment of regular air service in the United States is much nearer self-supporting practicability than in Europe."

Three Recommendations

He presented these recommendations:

First—The establishment of an aviation bureau.

Second—We should contract out the carriage of mail.

Third—The establishment of airports at important municipalities.

"I believe," he added, "that with this minimum extension of governmental activity we can secure commercial aviation in the United States without a subsidy."

Is An Arm Of Defense

Mr. Hoover touched upon the close relation between commercial aviation and the national defense, saying:

"I need not emphasize the importance of commercial aviation as an arm of defense. While it is not probable that the actual commercial plane will be much used in actual battle, yet the building up of the manufacturing industry behind such aviation is of the most vital importance, and we must develop the airways across our own country so that they may be used for the purpose of defense.

"The cost of successfully establishing commercial aviation under the proposals I have made should, in fact, result in actual saving to the Government. Its establishment will relieve the Government of the indirect expenditure necessary to maintain a reserve of manufacturing equipment for defense purposes; it would secure a large reserve of personnel and it would ultimately relieve the Government of the present loss in support of the Postal Air Service."

Letter from W.S. Crosley, Navy Hydrographer to the Commissioner of Lighthouses, 6 October 1925:

Numerous criticisms have been received recently from naval aviators concerning their difficulty in identifying many of the lighthouses

in inland waters, commonly known as "bug lights."

Frequently during thick weather naval aviators have sighted these lights but have been unable to identify them by the surrounding country due to low visibility. RG26 E1 (NC-63) Box 161

Letter from J.S. Conway, Acting Commissioner of Lighthouses to the Hydrographer, Navy Department, October 9, 1925:

With reference to your letter of October 6, 1925, . . . in regard to difficulty in identifying small lighthouses in inland waters.

The Bureau would be pleased if you would furnish the names of localities where in your opinion proposed marking of such lighthouses is desirable. *Ibid.*

Letter from W.S. Crosley, Navy Hydrographer to the Commissioner of Lighthouses, 14 October 1925:

With reference to your letter of October 9, requesting the names of localities where similar bug lighthouses should be marked in order that they may be distinguished from the air, the following list of localities is furnished:

East Coast

<u>Most</u> important

Narragansett Bay
Husdon River
Delaware Bay and River
Chesapeake Bay
Potomac River
Rappahannock River
York River
James River
Albemarle Sound
Currituck Sound
Roanoke Sound
Croatan Sound
Pamlico Sound
Pamlico River
Neuse River

Less important

Penobscot Bay
Kennebec River
Core Sound
Bogue Sound
Cape Fear River
Savannah River
St. John's River
Lake Okeechobee
Florida Reefs Nos. 1908-1931 Incl.
1968-1971 Incl.
San Carlos Bay
Pine Island Sound
Tampa Bay
Santa Rosa Sound
Pensacola Bay
Mobile Bay
Mississippi Sound
Lake Pontchartrain
Mississippi River Passes
Mississippi River
Galveston Bay
San Jacinto River

West Coast

San Diego Bay
San Francisco Bay
Sacramento River
Columbia River
Juan de Fuca Strait
Admiralty Inlet
Puget Sound *Ibid.*

Letter from H.B. Bowerman, Acting Commissioner of Lights, to Superintendents of Lighthouses, 1st, 3rd, 4th, 5th, 6th,7th, 8th, 17th and 28th Districts, October 21, 1925:

There are enclosed copied of letters dated October 4 and 14th, 1925, from the Hydrographic Office, Navy Department, in regard to the identification by naval aviators of many of the Lighthouses in inland waters. The letter of October 14 gives some of the localities where the Navy Department seems to consider it desirable that the lights be specially distinguished.

You are requested to submit report and recommendation on this project so far as it relates to the localities listed which are in your district.

RG26 E1 (NC-63) Box 161

Letter from W.J. Durand, Secretary, President's Aircraft Board to the Commissioner of Lighthouses, October 21, 1925:

Transcript of testimony as recently given before the President's Aircraft Board is herewith placed in your hands for correction.

You are requested to make no unnecessary changes in your testimony, and it is not permissable to make definite additions to the record as it now stands. Should you desire to make any such addition, it may be submitted as a supplementary document for consideration by the Board, but not as part of the public record.

It is desired that you simply make the necessary typographical or other corrections, and involving the least possible change in the record as it now stands. *Ibid.*

Letter from H.D. King, Superintendent 5th District, to the Commissioner of Lighthouses, October 23, 1925:

Subject: Identification of Light Houses for air craft:

In view of the increasing use of air craft and the possible further expansion of aerial navigation, it is believed that the suggestion of the Hydrographer of the Navy Department is deserving of favorable consideration. All lighthouses with metal roofs have these roofs painted annually, and the additional trouble and expense of suitable roof markings will be small in proportion to the possible usefulness of such marks.

Owing to the large number of lighthouses in the 5th District which would be involved in this work, it is suggested that it would be desirable for an officer of the Navy Department familiar with the needs of air craft in this direction, be designated to confer personally with representative of this Office, with a view to agreeing on a practicable and effective system of marks, and also for selecting those particular lighthouses on which such markings are desired. There would appear to be no advantage in such marks on certain of the lights, but this and certain other questions could only be satisfactorily decided by officers having experience with the needs of air craft. *Ibid.*

Letter from Robert Warrack, Superintendent, 17th District, to the Commissioner of Lighthouses, October 27, 1925:

Complying with Bureau letter of October 21, 1925, regarding distinguishing marks on lighthouse structures on the inland waters in this district to assist Naval Aviators in identifying the various stations, the following is submitted:

It is believed that suitable numbers or symbols, about 10 feet in diameter, could be painted on the roofs of the dwellings or other buildings at the following stations:

Columbia River: Desdemona Sands
Tongue Point Lighthouse Depot
Warrior Rock
Willamette River

Juan de Fuca Strait: Slip Point
Ediz Hook
New Dungeness
Smith Island

Admiralty Inlet: Point Wilson
Marrowstone Point

Puget Sound: Point No Point
West Point
Alki Point
Robinson Point
Browns Point
Mukilteo Point

The Superintendent is not familiar with the Navy's system of marking or numbering, and recommends that the Navy be requested to state what markings are desired, also the approximate size of the figures. This service would then be in a position to place the marks on the most conspicuous surface suitable for the size of the emblem desired. *Ibid.*

Letter from J.T. Yates, Superintendent, Staten Island, to Commissioner of Lighthouses, November 3, 1925:

This office is in doubt as to what lights are referred to as "bug lights". If small lights such as acetylene lights are the ones referred to, it would be difficult to mark them so that markings would be readily discernible from aeroplanes on account of the size of the structure. About all that could be done would be to put a number on the side of th tank houses.

It if is the larger stations, numbers could be painted on the roofs, or

stations otherwise marked for identification, but in localities such as the Hudson River and Narragansett Bay, it does not appear that such stations would be necessary or beneficial, for the formation of land, islands, hills, and the many towns and bridges would appear to furnish much more desirable and numerous landmarks than any possible markings on light stations, and as all lights in these tow sections are of different type, they are self-identifying without additional markings.

This office is of the opinion that th action proposed would not be of sufficient benefit to warrant its cost, and consequently the marking of stations as proposed is not recommended. RG26 E1 (NC-63) Boxes 161

Letter from B.D. Dorry, Superintendent, 4th District, to the Commissioner of Lighthouses, 3 November 1925:

Subject: Designating lightstations for aviators

Referring to Bureau letter of October 21, 1925, on the above subject, it will be possible to identify all stations with dwellings by marking the roofs of the dwellings according to some prearranged and comprehensive plan which will avoid all duplications. Minor lights on towers and having no buildings can only be identified by prepared signs placed horizontally on such reservations as have sufficient area to accommodate them, as now done at Coast Guard Stations. Where sites are leased, and of small area, I doubt the practicality of successfully identifying them.

I suggest that steps be taken to learn the names of the lights that are necessary to the plan. Recommendation can then be made as to the most desirable method for marking, dependent upon the kind and character of buildings on the site, area of site, etc. Specially, information should be furnished as to the minimum size of marks permissible, and total area to be involved in their display. This information would depend upon the system employed and the size and number of characters to be used in any given marking, all of which should be predetermined. *Ibid.*

Letter from H.W. Rhodes [?], Superintendent, 18th District, to the Commissioner of Lighthouses, November 7, 1925:

In reply to Bureau letter of October 21st, relative to the marking of lights in inland waters in order that they may be identifies by naval aviators, the Bureau is advised as follows:

It is not entirely clear as to whether it is desired to consider marking beacon lights where the present type of structure is not such as

will permit painting a numeral or other sign without more or less extensive work in the way of building up the structure, and the following report is submitted on the assumption that the Bureau would only desire to consider marking lights where there are buildings with sufficient roof area to carry the desired marks.

San Diego Bay: Both the Navy and Army aviation fields at San Diego are located at North Island, practically in the center of the harbor, and as this harbor is so compact and marked throughout by characteristic structures, it is not believed that aviators operating there would require identification marks on any of the light structures in the bay. However, if desired, numerals could be painted on the roof of the dwelling at the Ballast Point Light Station and also on the roof of the Quarantine Station at La Playa (subject to the approval of the Public Health Service).

San Francisco Bay: Southampton Shoal Light Station, East Brother Light Station, Carquinez Strait Light Station and Roe Island Light Station could all be marked at little expense with identifying letters or numerals. Lights in the southern part of San Francisco Bay and in the upper part of Suisun Bay are either lens lanterns or post lanterns on beacon structures or single pile beacons, and it would not be feasible to mark these lights without going to considerable expense in building up the structures.

Sacramento River: The lights maintained by this Service in the Sacramento River, with one exception, are post lights, and it would be impracticable to provide identification marks on the dolphin or single piles carrying such lights without expensive construction work.

It appears probable that this Service or some other Government Bureau will be required in the future to establish and maintain lights and other beacons along the coasts and possibly in the interior of the country as aids to aviators. It is believed that the Lighthouse Service is probably better equipped to handle such a service than any other Bureau, but if such work is to be undertaken, it should be with the distinct understanding that it is an added duty and responsibility, and that adequate provision must be made in the way of appropriations to meet the cost of the work.

This district will be glad at this time to install such markings as may be deemed necessary to aid aviators in fixing their positions at night or in thick or heavy weather, but as present appropriations are insufficient to meet the requirements for new aids to navigation throughout the district, it is considered undesirable to undertake such work unless additional appropriations are provided. *Ibid.*

Department of Commerce Summary of Supts' reports—marking lighthouses for aviation purposes:

1st District: (a) Suggests number could be painted on roof of dwelling
(b) Asks for list of stations desired to be marked and distance such marks may be expected to be seen, etc.

3rd District: In doubt as to what is meant by "bug lights" but comments
(a) Small acetylene lights difficult to mark to be readily discernible; suggests all could be done would be to put numbers on side of tank houses. Large stations numbers could be painted on roof, etc.; localities such as Hudson River, Narragansett Bay, would not require marking; formation of land, hills, islands, etc., towers and bridges would furnish more desirable marking than stations.
(b) Proposed action as to marking stations not recommended.

4th District: (a) Suggests it is possible to mark roofs of stations, etc. Minor lights would require prepared signs, similar to Coast Gd. Stations, etc.
(b) Asks name of lights, etc. in order to make recommendation to most desirable methods for marking, dependent upon kind & character of bldgs on site, area, etc.

5th District: (a) Suggests that all lighthouses having metal roofs could be suitably marked, and thinks would be well worth trouble and expense in proportion to usefulness, etc.
(b) Asks that Navy Dept be requested to have its officers familiar with air craft confer with rep of 5th District before undertaking this work, etc.

6th District: (a) Localities listed in 6th Dist, Cape Fear and Savannah Rivers do not have "bug lights" or any type of light with roof on which number could be placed.
(b) No recommendation made.

7th District (a) Two lights, Sanibal Island and Egmont Key, can be identified without special marking. Minor aids specified are only few hundred yards apart and would not be necessary to mark all.
(b) Suggests mark structures with letters, about 24 single identity markers; figures would require two markers on each structure over 9. That letters be block, 45 inches high, with numbers 9 inches wide, made of galv. iron supports; submits B/P - letters to be skeleton structure, painted white, etc.

8th District (a) Impracticable to place numbers or letter on single pile structure;

localities mentioned in this district have this type of structure. Recommends that when practicable aids to nav. which it is desirable to mark to distinguish from air be given appropriate numbers, when funds are available.

(b) Desires to know proper size for markings, numbers or letters from Navy Dept., etc.

17th District (a) It is believed suitable numbers or symbols about 10 ft in diameter could be painted on roofs of dwellings or other buildings.

(b) Requests that Navy be asked as to system of numbering, size of figures, etc.

18th District See letter above. *Ibid.*

"The Air Commerce Act of May 20, 1926, is the cornerstone of the federal government's regulation of civil aviation. This landmark legislation was passed at the urging of the aviation industry, whose leaders believed the airplane could not reach its full commercial potential without federal action to improve and maintain safety standards. The Act charged the Secretary of Commerce with fostering air commerce, issuing and enforcing air traffic rules, licensing pilots, certifying aircraft, establishing airways, and operating and maintaining aids to air navigation. A new aeronautics branch of the Department of Commerce assumed primary responsibility for aviation oversight.

"In fulfilling its civil aviation responsibilities, the Department of Commerce initially concentrated on such functions as safety rulemaking and the certification of pilots and aircraft. It took over the building and operation of the nation's system of lighted airways, a task that had been begun by the Post Office Department. The Department of Commerce improved aeronautical radio communications and introduced radio beacons as an effective aid to air navigation." Wikipedia article

"The passage of the Air Commerce Act on May 20, 1926, brought a variety of aviation-related tasks under the control of the Department of Commerce. The Transcontinental Airway System was transferred from the Post Office to the Bureau of Lighthouses. A new organization within the Bureau—the Airways Division—took over in June of 1927. By this time there were 45 radio operators working as the renamed Airway Radio Stations.

"Early specialists were primarily former maritime radio operators. They were all experienced in building, maintaining, and operating radios for long periods with little of no assistance. These radios used point-to-point telegraphy using Morse Code—known as CW (Continuous Wave)—to communicate with

other ground stations. CW was used for air ground communication until voice radios were developed. CW was not phased out of the air traffic system until 1948. Weather and aeronautical information was passed along the routes from one station to the next. The standard Morse Code gave wy to shorthand methods as radio traffic increased. John Schamel/web

Lighthouse Service Bulletin, Volume III, No. 29, May, 1926, p. 135:

> The Lighthouse Service of the Department of Commerce has been giving attention to the utilization of existing aids to navigation, for the benefit of aerial navigation. Recently, as the result of conferences with the Hydrographic Office of the Navy Department, arrangements have been made to try out experimentally a plan for painting the roofs of lighthouses with characteristic marks, along certain defined airways in Chesapeake Bay and tributaries in the fifth lighthouse district. A number of designated lighthouses are now being marked for this purpose on the airway between Norfolk and Washington. They are as follows: Upper Cedar Point, Mathias Point Shoal, Lower Cedar Point, Cobb Point Bar, Blackistone Island, Ragged Point, Piney Point, Point Lookout, Smith Point, Great Wicomico River, Windmill Point, Stingray Point, Wolf Trap, New Point Comfort, York Spit, Back River, Cape Henry, Thimble Shoals, and Newport New Middle Ground.
>
> They are number serially, beginning at the north, each lighthouse in addition to the number bearing the letter "WN," indicating Washington-Norfolk. In all cases where there is roof space available for the painting of numbers sufficiently large to be legible, the serial number, together with the letter indicating the airway, is painted in large white block letters, thus: W1N, W2N, W3N, etc. In addition to the designating figures and letters a large white arrow pointing true north is painted on the roof.
>
> In case of lighthouses of certain types of construction, there is not sufficient roof space available for clearly designating the structure by letters and figures. In such cases a wide ring of characteristic color is painted on the roof, or on the awning of any gallery that may exist. This ring has the eastern half of one color and the western half of contrasting color, the dividing line between the two halves of the ring indicating true north. In certain cases where surrounding features are so prominent or well known that there is not possibility of confusion, or where they type of lighthouse makes it impractical , such marking is omitted. This special painting of the lighthouse roofs is expected to be of considerable value to seaplanes, especially in localities where there are many lighthouses of

similar construction and close together, which makes it difficult to identify them on account of the high speed of planes. This plan is, of course, of value only for daylight flying, and may be extended later if service tests prove satisfactory.

The 1926 Annual Report of the Bureau of Lighthouses stated that

> The Department of Commerce was charged with fostering air commerce by the act of May 20, 1926. In accordance with the provision of this act for utilizing existing agencies so far as practicable, the Lighthouse Service was at the end of the fiscal year cooperating in the matter of marking and lighting airways. Earlier in the year, it had, at the suggestion of the Navy Department, cooperated in a project, which has been carried out, for painting the roofs of lighthouses with characteristic marks along certain defined airways over Chesapeake Bay.
>
> Several surplus lighthouse lenses have been transferred to the Air Service of the War Department for aviation purposes.

Lighthouse Service Bulletin, Vol. III, No. 36, December, 1926:

> The Lighthouse Service is cooperating with other bureaus of the Department of Commerce in connection with marking and lighting airways. One development in this connection of interest was the painting of the roofs of the lighthouses over Chesapeake Bay with characteristic marks.

LSB, Vol. III, No. 37, January 1927:

> The air commerce act of 1926 provides for the encouragement and use of aircraft in commerce, under the Secretary of Commerce. The work has been placed under the immediate supervision of the Assistant Secretary of Commerce for Aeronautics, William P. MacCracken, jr., and four divisions have been established: Registration, research, airways, and

information.

In accord with the intent of Congress that existing facilities of the department should be used so far as practicable in carrying out the provisions of the air commerce act, the airways division has been set up as aa part of the Lighthouse Service, and F.C. Hingsburg, on October 1, 1926, was appointed chief engineer, airways division. Mr. Hingsburg was previously superintendent of lighthouses on general duty, and has been connected with the Lighthouse Service since 1911.

Under the general supervision of the Assistant Secretary of Commerce for Aeronautics, the airways division will examine the airways, select emergency landing fields and beacon sites, erect structures, install the navigational aids, and thereafter maintain them. These activities are being carried out through some expansion of the Lighthouse Service, with additions as needed to its personnel, and under its district organization.

The airways to be established during the fiscal year 1927 are primarily those required by the air transport companies engaged in carrying mail under contract with the Post Office Department. These and other companies are developing express and passenger traffic. The principal advantage of air transportation is the saving of time. In order to make the saving of time more effective night flying is essential, and the air navigation facilities being established on airways primarily provide the necessary lighting for night flying for carrying out the mail schedules established by the Post Office Department.

There are 9,475 miles of airways now in operation or proposed for the near future, of which 2,041 miles of the transcontinental airway are already lighted. Over 1,100 miles of additional lighted airways will be established during the calendar year 1926. Along the airways between airports revolving searchlight beacons are established approximately 10 miles apart, and emergency landing fields are 40 to 50 acres in extent, having suitable runways of not less than 1,500 feet in length for the landing of aircraft. The fields are lighted by boundary lights spaced approximately 300 feet apart, showing the outline of the field from the air. A cable is carried around the field furnishing electric current to the 15-watt lamps in the boundary standards. Red lights are mounted on all obstructions and green lights are used to show the best approach to the field. An internally lighted wind cone mounted on the airway beacon structure shows to direction and velocity of the wind. The airway beacon consists of a 24-inch revolving searchlight with 1,000-watt lamp, showing

candlepower of approximately 2,000,000, with a flash every 10 seconds. The searchlight beacons are mounted on 50-foot skeleton windmill type towers and are automatic in operation by the use of a sun relay where commercial power is not available. Otherwise, farm lighting sets are used for generating electric current. The daymark consists of a concrete arrow 56 feet long pointing the direction along the airway. Each airway route carries a number which is painted conspicuously on one side of the gable roof of power-house buildings. Each beacon is numbered consecutively, and the designated number is likewise painted to show from the air for the identification of the structure. Part-time caretakers are employed locally to operate the engine generating sets and for the maintenance of emergency fields.

LSB, Vol. III, No. 41, May 1927:

Visitors at the all-American aircraft show at Bolling field, May 2 to 5, during the meeting week of the Inter American Aeronautic Commission, will have an opportunity to visualize the part played by the Department of Commerce in civil aeronautics under the air commerce act.

The regulations division, of the office of the Assistant Secretary of Commerce for Aeronautics, will have a corps of inspectors on the field to explain aircraft identification, licensing, and the general regulation of air commerce. One or more of the department's planes, used by inspectors in traveling about the country, will be in actual operation.

The information division is showing a model ideal airport as a goal for those cities anxious that their airports shall rate the highest possible under the Department of Commerce schedule.

The airways divisions of the Bureau of Lighthouses will exhibit a model of one of its intermediate landing fields equipped with beacon, boundary lights, obstruction lights, etc., together with a monster airway map showing the location of every beacon and lighted field on the airway system.

These exhibits will be of profound interest to the mayors and chambers of commerce all over the country who have been asked by the show committee to send representatives.

The Coast and Geodetic Survey, of the Department of Commerce, will exhibit the first airway strip map to be published by the department, and samples of maps and mosaics to show the convenience and economy of aerial photography in both new mapping and correction of old maps.

> The Bureau of Standards will show a working model of a radiobeacon with the visual indicator for use in keeping aircraft along the airway. Another exhibit of interest to engine designers is the model of the Bureau of Standards altitude chamber, used for testing engines, both aircraft and automobile, under pressure and temperature conditions corresponding to any specified altitude up to 45,000 feet. Superchargers are tested under flight conditions in this chamber. Various equipment for testing aircraft instruments will also be shown.
>
> It is expected that complete radiobeacon equipment will be demonstrated in flight and in an all-metal three-engine airplane using the department's transmitting beacon at College Park along the New York-Atlanta airway.

In that same month, May 1927, Charles Lindbergh flew solo across the Atlantic. Thereafter he flew route surveys for budding American airline companies and attended exhibitions in which he often starred.

"On July 1, 1927, the U.S. Post Office ended its Air Mail operation. The Transcontinental Air Mail Route, and other air mail routes, were turned over to the fledgling Airways Division in the Commerce Department"s Bureau of Lighthouses. The Airways Division continued with the development of lighted airways. An improved version of the beacon was fielded in 1931."

Schamel, *The Development of Night Navigation in the U.S. <www.atctraining.faa.gov>*

1927 *Annual Report of the Commissioner of Lighthouses,* fiscal year ending June 30:

> The number of airway aids in commission was 755, including 616 aids maintained by the Post Office Department up to June 30 and transferred to this department July 1, 1927.

LSB, Vol. III, No. 43, July 1927:

> Commissioner of Lighthouses, touring Europe discusses the need for international uniformity in aids to navigation, including those for airways.

Letter from F.C. Hingsburg, Chief Engineer, Airways Division, to General Electric Company, September 1, 1927:

> This will acknowledge your letter of August 19, 1927.
>
> You are advised that the Department of Commerce does not install lighting equipment at airports. Under the present policy of the Department,

portions of certain airways where night flying is carried on, are lighted and maintained by the Government, the line of standard beacons now being used for this purpose ending at points approximately ten miles from the terminal airports of the airway routes. In certain instances the Department has on request assigned representatives to confer with city authorities or local business men in connected with projected airports. These representatives advise as to the location of landing fields with relation to prevailing winds, clearness of approach, nature of the ground, and accessibility. No particular equipment is recommended by the Department and no engineering advice is furnished.

The actual construction of airway routes between cities is done by contract, the work being advertised and let to the lowest bidder in accordance with Government regulations. RG 26 E 50 File #3017

Airways Division SPECIFICATION FOR AIRWAY FLOOD LIGHTS, May 11, 1927:

GENERAL DESCRIPTION - Each floodlight unit shall consist of a drum type housing mounted on a rigid pedestal, this drum to be fitted with a 14" or 16" commercial precision parabolic glass mirror, mogul screw socket, a spread light lens, and suitable provision for mounting a color screen.

DRUM - The drum shall preferably be of cast aluminum non-corroding alloy, not less than 3/16" thick, or as an alternative, galvanized Armco iron of rigid construction will be considered. The drum shall be supported on a trunion mounting with a glange for fastening to a wooden deck, and shall be of sufficient strength and ruggedness to provide adequate support for outside mounting. The steel support shall be galvanized throughout. Provision shall be made to elevate the light, and hold the light firmly in position by a lever clamp. The lights will be subject to high winds and the design of the support shall be adequate to insure rigidity in the adjusted position. The design of the drum shall be adequate to carry off the heat. If ventilation is utilized to dissipate heat, the unit shall be rendered insect-proof by installation of suitable fine mesh bronze wire screen. Access to the floodlight unit shall be provided with a hinged door, front and rear, held in place with suitable swivel wing nuts, or the approved equivalent. The entire unit shall be ruggedly constructed, absolutely weather-proof, insect-proof, and designed to give adequate and long service exposed to the weather. A water-proof, rubber-bushed hole shall be provided in the bottom of the drum for the admission of electrical conductors. Diagonal peep sight holes shall be drilled in the drum for focusing the lamp, and the holes shall be threaded and provided with 6/32 brass,

knurled head screws to close the holes against insects. An adjustable mounting of brass or galvanized steel with a porcelain mogul screw societ shall be installed for the reception of a G-40, 500-watt floodlight lamp. The adjustment shall be adequate to provide for the substitution of a 1000-watt floodlight lamp, should greater intensity be found necessary. Each drum shall be fitted with 15 ft. of extra flexible No. 12 duplex, "Okocord," "Super-service," or approved equal.
MIRROR - Each floodlight unit shall be equipped with a 14" or 16" commercial, precision, parabolic optical glass reflector, properly annealed, and guaranteed not to crack from heat. The optical glass used shall be high transmission, tough and uniform, and of quality that will not crack when subject to repeated heating and cooling. The reflector shall consist of a heavy, homogeneous coating of metallic silver, backed for protection in accordance with the Navy Department Specifications 17M3c.

The glass reflector shall be mounted in such a manner that there will be no breakage from shipment or rough handling while in transit.
FRONT LENS - The front lens shall be convex, heat resisting, spread light lens of approximately 40° horizontal spread. The front lens shall be made of clear high transmission glass free from imperfections, and suitable annealed, so as to insure freedom from cracks when operating under service conditions in rain or snow.
COLOR SCREEN - Each unit shall be furnished with a suitable red orange color screen of not less than 40% light transmission, made of heat resisting high transmission glass free from imperfections, suitable annealed to insure freedom from cracking. The color screens shall be installed so as to be easily removable.

Each bidder must furnish drawings and complete specifications of the equipment quoted on. Rights are reserved to accept equipment on manufacturer's specifications should it be deemed advantageous to the Government. The floodlight units will be inspected at the plant of the manufacturer before acceptance.

The units shall be adequately packed for freight shipment on Government Bill of Lading, and the prices quoted are to be F.O.B. manufacturer's plant.

RG 26 E 50 File #3017

Airways Division SPECIFICATION FOR 51 FT., 62 FT., AND 75 FT., FOUR POST BEACON TOWERS, September 27, 1927:

Requirement - It is required that there be fabricated and delivered f.o.b. bidder's factory or warehouse, 51 ft., 62 ft., and 75 ft. galvanized steel skeleton towers in accordance with these specifications and attached drawings Nos. 502 (9-23-27) 503 (9-23-27) and 501 (6-16-27).

Corner Posts - The splices for the top 30 ft. shall be made with at least a 6" lap with three bolts in each leg of the angle (6 bolts).The splices on the remainder of the tower shall be made with at least an 8" lap and four bolts on each leg of the angle (8 bolts). The corner posts shall be securely fastened at the top with gusset plates as shown on drawings Nos. 501 and 502.

Girts - Girt "A" shall be placed with the back of the angle up and girt "B" with the back down in order to provide for attaching switch cabinet. Legs shall be punched fo that girt "B" may be attached to any face of the tower.

Braces - All braces shall be flattened and punched for bolting to each other at intersections and also shall be flattened and punched for bolting to intermediate girts at crossing points. All braces shall be cut, flattened, and punched for bolting to corner posts with one bolt at each connection so as to form a rigid symetrical structure from top to bottom. Braces shall be so arranged as to prevent so far as possible a pocketing of water.

Anchor Posts and Plates - Anchor plates shall be provided with two 1" diameter holes for use where it becomes necessary to anchor the tower legs to rock. All metal to be placed below ground level shall be given one coat of black asphalt paint.

Galvanizing - All steel parts, including bolts and nuts, shall be galvanized after fabricating, and shall meet the provisions specified by the National Electric Light Association, for galvanizing.

Bolts - All bolts shall be of the diameter shown on the drawings and shall be of the proper length to permit of peening after the nut has been tightened to prevent loosening. An excess of at least 10 per cent of bolts shall be supplied in order to provide for loss and replacements.

Ladder - The ladder rails shall extend below the ground level in order to fasten into the concrete foundation. The ladder rungs shall be of an oval pipe type and spaced 15" c/c. The ladder shall be assembled and shipped in convenient lengths for handling.

Platform - A platform 6 ft. square shall be provided 2 ft. below the top of the tower with galvanized 2" angle supports, railing and braces as shown. The platform shall be of 1 ½" x 6" Louisiana Gulf red cypress No. 1, common S 4 S,, not less than 1 1/4 finished thickness, planks laid with ½" space between adjacent planks and shall be bolted to the angle iron frame with 1/4" galvanized bolts. The platform shall be provided with a trap door about 18" by 22" furnished with extra heavy galvanized 5" T hinges and galvanized 4 ½" safety hasps. Both hinges and hasps shall be provided with brass pins. All woodwork shall be given one coat of chrome yellow paint equal in color to No. 4 specifications 3-1, Q.M..C., U.S.A.

Wind Cone Bracket - A galvanized wind cone bracket as shown on the blueprint No. 501 shall be furnished with each tower. Horizontal brace arms shall be connected to the tower by a hinge joint. The upper end of the suspension iron shall be detachable from the tower. The 1" pipe flange shall be furnished. (The wind cone will not be furnished under this contract.)

75 Ft. Extension - The 51 ft. towers shall provide for an extension to 75 ft. by adding two lower panels, anchors and anchor posts, as show on drawing No. 503. Where the extension for 75 ft. tower is required the anchors and anchor posts shown on Drawing No. 502 will be omitted. Bidders will quote a unit price for furnishing the complete material required to extend the tower to 75 ft. and the Government reserves the right to order not less than five nor more than fifteen such extensions at the unit price quoted.

62 Ft. Extension - The 51 ft. towers shall provide for an extension to 62 ft. by adding the upper or 11 ft. panel together with girt "B", anchor posts, and anchors shown on Drawing No. 503. Where the extension for 62 ft. tower is required the anchors and anchor posts shown on Drawing No. 502 will be omitted. Bidders will quote a unit price for furnishing the complete material required to extend the tower to 62 ft. and the Government reserves the right to order not exceeding five 62 ft. such extensions at the unit price quoted.

Inspection and Payments - Inspection will be made by a representative of the Bureau of Lighthouses. Towers will be inspected at the contractors works and the contractor, if so directed, shall assemble and erect one tower at his works for inspection. A progress report of 75 per cent based on the unit prices quoted will be paid upon completion, inspection and acceptance of each lot of twenty-five towers. Final payment will be made upon receipt in the Office of the Bureau of Lighthouses of Government bills of lading duly receipted by common carrier, showing complete shipment.

Shipping - Towers will shipped on Government bills of lading which will be furnished from time to time together with shipping instruction. Platform shall be assembled and the trap doors secured by wooden cleats nailed to the under sides of the platform; ladders shall be assembled and shipped in convenient lengths for handling; anchor plates shall also be assembled but otherwise the towers shall be shipped disassembled. All bundles shall be made up in such a manner as to assure the number of pieces in each bundle. As a rule only one tower will be shipped to one destination. All members shall be appropriately numbered or otherwise marked for convenience of erection and twenty-five copies of erection diagram furnished. RG 26, E 50, Box #3017

Letter from Wm. P. MacCracken, Acting Secretary of Commerce, to General

Herbert M. Lord, Director, Bureau of the Budget, *September 12, 1927:*

> To provide the necessary aircraft required for survey of civil airways, arrangements were made to transfer five planes from the Post Office Department to the Airways Division. One of these planes has been ferried to the Naval Aircraft Factory at Philadelphia for an estimate of the cost of making the minor changes to make these planes suitable for the work. It was found that these planes require a general overhauling and reconditioning and will cost approximately $4,000 each to place them in serviceable condition for survey work
>
> The airplanes sold by the Post Office Department to air mail contractors average $5,996 per plane. It is believed that the sale value of planes transferred from the Post Office Department would be about $5,000 each. Considering these facts, it appears advantageous to purchase new planes for survey work as they will have the more recent improvements including Wright Whirlwind Engine, and maneuverability which will enable landing and take-off in small fields with greater safety. The cost of the new airplanes approximate $10,000 each.
>
> It is therefor requested that the purchase of five airplanes from the appropriation Air Navigation Facilities be granted, there being sufficient funds for the purpose, and that the air mail planes be turned back to the Chief Coordinator for disposal. *Ibid.*

Letter from H.C. Ritchie, General Electric Company, to F.C. Hingsburg, Airways Division, September 28, 1927:

> I have just received copy of supplemental specifications for ground markers dated September 20th which calls for a 3-foot circle of crushed stone, white washed, around the boundary markers on intermediate fields.
>
> I have been suggesting a similar method of marking boundary light locations on airports, but have been suggesting an eight-foot circle.
>
> I find that Selfridge Field in Detroit installed the white circle around boundary lights and I am informed by the Sgt. Electrician on the field that they can be picked up at an elevation of 10,000 feet.
>
> I would like to issue a new sheet for our Airport Lighting Bulletin suggesting this method of daylight marking and boundary lights and would like your opinion as to whether an eight-foot circle would be better for airport marking.
>
> I had hoped that by this time the lighting of Schenectady Airport would be far enough along that we could try out several sizes of circles

and view them from different elevations.

I also obtained at Selfridge a formula issued by the Army Air Corps for suitable whitewash to use on this crushed stone. Considerable cement was used with the lime to assure permanence.

Perhaps you could dig up this specification from the Army engineers. Please let us know if you think it advisable for us to issue this information in our bulletin. *Ibid.*

LSB, Vol III, No. 48, December 1927, Summary of Annual Report, 1927:

An airways division has been set up as a part of the Lighthouse Service, the work of this division covering the examination of airways and intermediate landing fields and the erection and maintenance of aids to air navigation. This is one of several divisions in the Department of Commerce under the air commerce act; it functions under the supervision of the Assistant Secretary of Commerce for Aeronautics. An official of the Lighthouse Service was appointed chief engineer of the airways division on October 1, 1926, and the work has been actively in progress. As it will be covered more completely elsewhere in the department's report, only brief references to it are indicated here. The plan followed has been to expand the present facilities and organization of the Lighthouse Service to carry on this work. The geographical organization is such that it has been necessary to establish only one new office, at Salt Lake City, Utah, the balance of the work being conducted through the existing district and bureau offices and organization.

There were 1,386 miles of airways lighted during the year, on which 139 aids to air navigation were established and placed in operation by the Department of Commerce, and work on 694 miles of additional airways was under contract. The transcontinental airway, with 616 aids, previously maintained by the Post Office Department, was transferred to the jurisdiction of this department on July 1, 1927.

LSB, Vol. III, No. 51, March 1928:

A conference of airways extension superintendents and airways engineers of the airways division, Lighthouse Service, convened Monday, February 6, 1928, at the office of the airways division, Washington, for the purpose of discussing the problems which have arisen in connection with survey and lighting of airways since this work was started in the fall of 1926. All phases of airways work were brought up and discussed in detail,

with the result that the procedure of surveying airway routes has been slightly modified in ways which are expected to expedite the work somewhat and at the same time improve its quality.

The Assistant Secretary of Commerce for Aeronautics, William P. MacCracken, jr., addressed the opening meeting, explaining the importance of airways work in the program of the aeronautical activities of the Department of Commerce. On February 7 the Commissioner of Lighthouses addressed the meeting, touching on the traditions of the Lighthouse Service and the relation of airways lighting to the aids to marine navigation established and maintained by the service.

At the session on February 10 the program of the airways division for the remainder of the fiscal year 1928 was presented by Mr. Hingsburg, chief engineer of the division.

The conference closed on February 11, with a visit to the Bureau of Standards, where the working of the various portions of the radio division was explained and illustrated, followed by a visit to College Park Fields, where the actual installation of the equipment at the ground station and on board the airplane was shown.

Besides the resulting improvement of methods, the conference was of distinct benefit in the exchange of information and experience and making all the members of this division better acquainted with the problems to be met.

Memo from F.C. Hingsburg, Chief Engineer, Airways Division, April 12, 1928, entitled Acetylene Airways Route Beacons:

A hearing was held by the Assistant Secretary of Commerce for Aeronautics on April 10, 1926, in connection with bids covering acetylene routing beacons, Proposal No. 19310, which were opened on March 30, 1926. It was decided that all bids be rejected owing to imperfect specifications and the possibility of obtaining superior equipment based on manufacturer's design. It was arranged that tests of acetylene lighting equipment meeting the general requirements for airways lighting, be submitted to the Department for test at the General Lighthouse Depot, Staten Island, N.Y. A committee consisting of Superintendent of Lighthouses J.T. Yates, and Chief Engineer of the Airways Division, F.C. Hingsburg, was appointed by the Assistant Secretary to test out the equipment and report to the Assistant Secretary the results of the tests and the suitability of the apparatus submitted for airways lighting. Upon this

report, revised specifications and detailed drawings would be prepared covering the apparatus serving the best interests of the Government.

RG26 E 1(NC-63) Box 161

Letter from J.C. Conway, Acting Commissioner of Lighthouses, to Superintendent of Lighthouses, Staten Island, April 12, 1928:

The attached general requirements for Airways acetylene route beacons, is sent you for your comments and criticisms, before being sent to the American Gas Accumulator Co. And Interflash Signal Corporation for their views, in connection with the reissue of proposal for furnishing this equipment. Please expedite your report. *Ibid.*

J.T. Yates' reply:

The following comments are offered in connection with this matter. This office considers that it would be desirable to submit such lanterns as they may now have, that are acceptable for the purpose to this Depot for tests, and that the tests made be such as will clear up the points given in the following comments, and determine as far as possible the best type of light, etc. they require.

The requirements are not considered sufficiently specific, to permit manufacturers making proper bids. Also there is a large chance for variation account [*sic*] the individual judgment necessary to determine what might be required, as for instance, paragraph 2 states that the maximum brightness shall be shown to a pilot flying at 1000 ft. elevation along the course. This would not appear to have any meaning unless the height of tower, land, and distance of pilot from the light was known.

The vertical distance divergence desired should be stated in degrees, and it should also state what percent of diminution of candlepower will be allowable within the angel of divergence.

The requirements that lights should be seen 1 ½ miles and 3 1/3 miles is very indefinite as same would depend greatly on atmospheric conditions. Under favorable conditions the light of an ordinary land lantern could be seen for either of the distances, while under the most adverse conditions there is no light known that can be seen at either of the distances. Also consider that the type of light (single or duplex units) desired should be determined and stated.

A luminous period of 12 ½ % will naturally require a very short light period or a very long dark period, either of which is objectionable, and it is a question if light with less candlepower and longer luminous period might not be preferable. *Ibid.*

Memo dated April 12, 1928, author unknown:

> The acetylene beacon shall be the most effective apparatus designed by manufacturers for approximately 3 1/3 mile spacing of lights along airways. This apparatus will be installed generally on 20-foot towers furnished by the Government, but where required, 30, 50, 75, and 80-foot towers will be used. The maximum brightness shall be shown to the pilot flying at 1000 feet elevation along the course. The horizontal divergence of the range light shall be sufficient to permit the airplane to drift 1/2 mile either side of the axis of the course without losing its effectiveness.
>
> The vertical divergence shall be sufficient to see the light from the adjacent beacon to cover flying at lower elevations and also when flying at 1000 feet elevation the pilot shall see the light with the same brightness to a point above the light as he approaches from the adjacent beacon.
>
> The beacon shall show an azimuth or off-course light visible on al bearings of an effective range of 1 ½ miles under atmospheric conditions permitting the airway range light to be seen 3 1/3 miles, equivalent to the spacing of the lights. The azimuth light shall be visible to within 15° of the zenith, showing the same effective brightness to the pilot as he approaches at 1000 ft. elevation.
>
> The beacon light shall be of manufacturer's design and may be single or duplex units combing the principles of range lights by use of optical lenses or mirrors showing along the airway course and dioptric lenses for the azimuth and zenith lights. The acetylene lights may use single or cluster burners of proper sizes arranged to give maximum results The light shall have a distinctive characteristic of 12 ½ % luminous period. The light will be tested using burner sizes aggregating 3 cu. ft.
>
> The lanterns shall be all bronze castings, ruggedly constructed for long life and shall have a proper ventilating system rendering the apparatus storm-proof. The apparatus shall be insect-proof. The flasher shall be of marine type, K 130 or equal, with piping, valves, and connections interchangeable with Lighthouse Service apparatus. The design of the range light shall provide for change of elevation and course within reasonable limits. *Ibid.*

Memo from J.T. Yates, Superintendent, Staten Island, April 23, 1928:

> On April 16th the Interflash Signal Corporation left at this Depot a 200 mm range lantern, which they requested be tested for weather

proofness when operating without the syphon. Stated this test was desired in connection with lanterns to be furnished the 7th District.

On April 18th the lantern was connected up on the south dock at this Depot and a stream of water from a 1/4-inch pipe was played on the top of the lantern from a height so that it struck top of lantern in a manner similar to a very heavy rain. At this same time a jet of air from a 1/4-inch pipe with 100 pounds pressure was played against the side of the lantern from a distance of 4 feet. During this test light was not affected, but when lantern was opened it contained a small amount of water that came in around the door; the door appears to hit on the shoulder before it touches the taper.

The water was then shut off and a jet of air from a 1/4-inch nozzle, 100 pounds pressure, was blown against all parts of the lantern at a distance of 2 feet and did not affect the light, but extinguished pilot when blown against the bottom of the lantern from a distance of 2 feet, the air entering through the ventilating and drain hole in the bottom of the lantern.

The same jet of air was then directed against the lantern holding nozzle directly into all of the vent openings. Plume was not affected and it did not even cause flame to flicker, but when directed against the opening in the bottom, light became extinguished immediately. *Ibid.*

Memo from the Superintendent, Staten Island, to the Commissioner, May 7, 1928:

Enclosed are blueprints in duplicate showing tests that have been made on 24" Gas Airway Beacons submitted by the Interflash Signal Corporation. From these tests it will be seen that it is impossible to get the desired divergence with this type of light.

It will be noted from Curve D, that this was about the maximum amount that the flame could be shifted out of focus in order to obtain divergence and that same had very little effect in that respect. Curve E will also illuminate the face that the light was thrown out of focus more than was practicable with no material effect as to the matter of divergence. The only result of throwing the light out of focus with this type of mirror, is that of decreasing the peak candlepower.

It would appear that this eliminates this type of beacon., for it is impossible to get the required amount of divergence with this style of apparatus.

Acting Commissioner replied "with suggestion that your office write the Interflash

Signal Corporation, furnishing them a copy of this report, together with a copy of the joint agreement as to requirements, with request that they make changes or submit apparatus that meets the required divergence, etc. *Ibid.*

Letter from Chief Engineer, Airways Division, to American Gas Accumulator Company, Elizabeth, NJ, May 8, 1928:

> The inclosed memorandum from Airways Extension Superintendent C.I. Stanton covers the necessity of 152 acetylene range lanterns for installation on airways on which contracts will be awarded before June 30, 1928. According to the construction, contracts which will be advertised for the installation of lighting facilities, the equipment should be available for installation during the month of August.
>
> On account of the action taken by acetylene equipment manufacturers in connection with bids covering airways requirements, the Airways Division is not justified in making any purchase of acetylene equipment until the proposed tests have been conducted. The delays incurred in connection with these tests have brought about a critical condition. Lighting equipment to meet the advertised program of the Department must necessarily be purchased from available funds before June 30, 1928. If acetylene equipment continues to remain unavailable, because of the situation brought about by acetylene equipment manufacturers, it will be necessary to use substitute automatic apparatus to complete the lighting program on schedule time. *Ibid.*

Letter from D.M. Merrill, American Gas Accumulator Company, to J.T. Yates, 3rd District, May 21, 1928:

> We are forwarding to you, by messenger, the experimental 18" bull's-eye lens-special conical reflector system for test. This piece of apparatus is accompanied by two burner heads; one permitting the location of two 1 ft. burners on the axis of the lens, and the other placing the burners side by side in the focal plane, with the axis of the lens passing through the center of the joint flame produced.
>
> We have hesitated about sending this piece of apparatus for test because of the inferior quality of the reflector. Our own tests of it have demonstrated the reflector to be so inaccurate as to render it almost valueless in this connection. Mr. Hingsburg feels it is advisable that the test be made irrespective of this condition.
>
> If this type reflector had been put into production, we would have manufactured it by the electric-deposition method, using precision metal

moulds. The time involved in making up such a mould is such that we considered the delay that would have been caused by employing this method for the test to have been such as to defeat the desires of the Bureau. Consequently, we decided to make up the reflector by the speediest known means; namely, by spinning on wooden chucks. We even discarded the possibility of making steel chucks because of the delay involved. If the reflector had been spun on a steel chuck, instead of a wooden one, the resultant accuracy of the reflector would have been very considerably closer to perfection.

Is it the same old story of "haste makes waste." We feel, however, that the Doublet-lens arrangement under consideration holds promise, and we are, consequently, willing to have this system we are submitting for test at least temporarily side-tracked. In effect, the Doublet-lens system accomplishes the same end we were striving at with the lens-reflector system.

We know your own manufacturing experience will testify to the statements we have made above. In case the Doublet-lens combination proves satisfactory for the purpose, we will all forget about this other system. In case it does not so prove out, we will agree to spend the time and money to make a more perfect reflector, so that that system can be given a fair trial. *Ibid.*

Letter from Hingsburg, Chief Engineer, Airways Division, to Superintendent, Staten Island, June 6, 1928:

Referring to the drawings left at your office by the Chief Engineer of the Airways Division, covering the acetylene airways route beacon: This drawing was made after considerable study, taking into consideration thoughts expressed by you on occasion of the last visit of the Chief Engineer to your office.

Drawings were made of a cylindrical shell 20" in diameter supporting the 18" lens at each opening and fastening the doublet in a crab fastened to the side of the cylinder. This arrangement was impracticable as it did not permit the installation of a K130 flasher.

Preliminary sketches were also made of a shell with a rectangular base 12" x 18" in plan, with a door in the side for adjusting the burner, the flasher being set to one side in the base in accordance with our conversation. The door cut in the side deprived the housing of the necessary strength and it was clumsy and very weak. Small models were

made of the various shapes applicable to the shell of the lantern and the one giving greatest promise was left in your office.

The drawing of the lantern embodies all of the features which we rediscussed, covering a thermosiphon ventilator of manufacturer's design and air currents in the lantern sweeping the glass so as to prevent the deposit of soot. Adjustability of the burner was provided by mounting the flasher in grooved rails for horizontal adjustment and elevating the burner post for vertical adjustment.

Careful consideration has been given to the use of five per cent silico aluminum for both top and bottom lanterns. The characteristics of silico aluminum as compared with bronze is set forth on the attached data sheet. It will be noted that the five per cent sililco aluminum is seventy-five per cent as strong of bronze and has twenty-nine percent of the weight of bronze. The dimensions shown on the sketches cover the recommendations for silico aluminum and are twenty-five percent in excess of thicknesses considered necessary should bronze be considered. The total weight of the lantern will be approximately fifty per cent of the weight of a bronze lantern. The five per cent silico aluminum is anticorosive and is painted on the outside is considered suitable for the purpose intended. *Ibid*

Memorandum regarding Acetylene Airway Route Beacons, J.T. Yates, June 9, 1928:

Clips on ring for holding 18" lens in place, unsuitable if clips are intended, and unsuitable and expensive if ring is intended. Consider flat machined ring preferable.

Flasher bolts. It will be difficult to get the 4 flasher bolts in position to set flasher down over them.

Double hinge. Think this would be better on side and less liable to cause breakage of doublet.

Depression on side shell. Do not consider that this will be worth the cost.

Should be a boss at least 1" thick cast on side of shell if sunvalve is to be used.

Should be boss on bottom of lantern for gas connection to take F-10 connection outside and F-40 inside, or a hole can be left on cut in shell and this connection made with flange and held in place by 4 screws: latter better as it permits renewal of boss in event of its being damaged, cross threaded, etc.

Latch bolt. Only one shown for holding lens ring in place. Doubtful is this joint, which is vertical, can be kept storm proof, with only 1 latch bolt. Should be 3, located 120 degrees.

On cover gasket, the point of contact of metal to rubber too wide: reduce metal at edge to permit better compression of rubber.

Shell should have rib to reinforce at ends and to hold it in shape while and after machining.

Joint at bottom considerable expense. Think this could be cast with body.

Air space vents as shown to be closed and located in bottom of air space to let small amount of warm air up through in space in order to reduce difference in temperature on tube and prevent condensation.

Draft tube to extend down as low as possible and not obstruct light, so as to remove greatest possible amount of gasses, etc.

Baffles over intake ventilation considered unnecessary and detrimental. *Ibid.*

Memo from Yates to Commissioner, June 12, 1928:

Enclosed for the information of the Bureau are prints in duplicate upon which is shown the candlepower derived from lens in doublet when the bottom is shifted approximately 3 and 6 degrees. It will be noticed that the entire bottom does not shift for the same distance, but as part of the bottom with the average candlepower does shift approximately the amount desired, it is thought that this arrangement will be entirely satisfactory, and it is also probably that better results will be obtained with the 10-inch doublet than with the 6 5/8-inch now being tested. Additional test will be made on this lens and information forwarded to the Bureau as fast as completed. *Ibid.*

Letter from Acting Commissioner Bowerman to Superintendent, Staten Island, June 13, 1926:

Referring to your letter of June 9, 1928, inclosing memorandum regarding acetylene airways route beacon:

The suggestions will be incorporated in the drawings covering the new unit, with the possible exception of Item No. 4, covering the depression on side of shell. It is considered necessary to provide a baffle on the sides of the lantern to prevent air currents from reaching the base of the lantern without passing between the doublet and 18" lens. If the depression on the side of the shell is not provided for, this baffle must

necessarily be quite large and it may be necessary to rib it to provide proper support. It is considered that the casting is complicated to a greater extent in this way than by providing the depression. The drawings are being retraced and blueprints will be forwarded for further criticism as soon as completed.

The candlepower curves of the doublet lens arrangement have been received and noted with interest. It appears that the maximum deflection of light using the 6 5/8" doublet is 6°. It is believed, however, that this deflection will be increased with a 10" doublet, and based on this assumption, no provision is being made for filler pieces for changing the position of the lens, it being considered that the entire deflection can be made by altering the position of the burner in the focal plane. Your views and suggestions relative to this point will be appreciated. *Ibid.*

Letter from Acting Commissioner Bowerman to Superintendent, Staten Island, June 20, 1928:

Referring to telephone conversations today relative to elevating the beam of the acetylene airways route beacon 2° by inclining the optical lens and doublet with respect to the focal point rather than lowering the acetylene flame in the focus to produce the same results, you are advised that the drawings are being revised accordingly.

It is suggested that this arrangement be tested and photometric measurements taken showing the result of inclining the optical and doublet lenses in order that a comparison can be made with the curves already submitted. *Ibid*

Letter from the Airways Division to the Commissioner, June 22, 1928:

There are enclosed blueprints in duplicate upon which are indicated further tests that have been made of the airway route beacon lenses. It will be noted on this print that the loss of candlepower from shifting the beam vertically is not as much as was shown on prints previously furnished, there having been an error on the previous prints. This correction may have some bearing on the desirability of elevating the lens, although if the majority of the beams are to be thrown above the horizontal, this office would still consider the shifting of the lenses desirable.

Acting Commissioner Bowerman's reply:

Returned to Superintendent, Staten Island, New York, advising that the Bureau believes the lenses should be elevated 2° above the horizontal and

any adjustment to the light beam can be made by shifting the burners up or down as desired. *Ibid*

1928 Annual Report of the Commissioner of Lighthouses for the fiscal year ending June 30:

The number of airway aids to navigation in commission at the close of the fiscal year was 1,275, covering 5,877 miles of airways.

Letter from F.C. Hingsburg to the Superintendent, Staten Island, July 12, 1928:

Mr. Rhodes of the American Gas Accumulator Company telephoned the Bureau today in connection with the order for 100 Airways route beacons, which will be placed by the Department.

Mr. Rhodes suggested that I might be well for the Lighthouse Service to arrange a conference for the purpose of definitely fixing the sizes and measurements of the respective parts of the lantern in order that complete interchangeability may be secured in this connection. The ventilating system stipulated is of manufacture design and the dimensions have not definitely been fixed in the drawings of the Airways Division. It was Mr. Rhodes' thought that the Government could reserve the right to fix these dimensions on the lot of beacons being purchased by the Third District so as to provide for interchangeability.

It is requested that this matter be given consideration and if considered desirable, representatives of the American Gas Accumulator Company and the Interflash Signal Corporation be brought together so as to settle the sizes and dimensions for the assurance of complete interchangeability of all parts. *Ibid*

Three drawings for the acetylene Airways Route Beacons, dated June 21, 1928.

Memorandum to Mr. J.B. Rhodes from V.L. Oestnaes, July 12, 1928:

Referring to specifications for Acetylene airways Route Beacons dated June 12, 1928, we have reviewed these specifications, as well as the drawing, with the following comments:

Paragraph 3:

We are under the impression that the steel manifold should contain a shut-off valve and be provided with a filter, similar to our standard lantern valve.

It is our suggestion that the glass lenses be mounted with cork spacers about 1/16" thick to prevent direct contact between the glass and

the metal.

The drawing shows the dowel pins for guiding the inside door, which we feel are unnecessary, provided the hinge pins are reamed properly.

The drawing shows four swing bolts for the outer door, whereas the specifications call for two only. If four swings bolts are wanted, it will, of course, be necessary to provide loose fitting hinge pins.

Drawing calls for 1/4" square rubber gaskets, whereas specifications read 3/16". It is our intention to follow the drawing as we believe this will make a better job.

It is our intention to provide the door for the inner doublet with two hinge pins in order to eliminate the cumbersome cut-out in the cast baffles of the inside of the lantern. All hinge pins with, of course, be reamed in line.

It is also our intention to secure the hinge pins with set screws in turned grooves on the pins in favor of the through pins shown on the drawing.

Paragraph 7:

It would be desirable if the Department would specify the horizontal distance between the burners desired.

Paragraph 9:

Specifications call for an eight-hole manifold with gauge connection, gauge cock and plugs. No gauge is specified nor the manner in which the gauge is to be attached to the manifold. We presume that the standard pressure gauge valve will be required but would like to have confirmation thereof. Reference is made to drawing #505 but no copy has been received of this drawing.

Paragraph 10:

The drawing does not show a drain plug at the bottom of the lantern, such as is used in all standard maritime lanterns, and we feel that the inclusion of this feature is highly desirable.

Paragraph 11:

Reference is made to the fact that ventilation and performance of the lantern will be tested at the General Lighthouse Depot, Staten Island, New York, and approval of the lantern submitted shall be secured before the contractor completes the remaining units under the contract. It is requested:

That an outline be provided of the test to which the lantern

and ventilating system will be subjected in order that preliminary tests may be conducted before submitting the finished unit.

It is assumed that the General Lighthouse Depot's standard practice, which requires that they be notified seven days in advance of the test, will be followed.

It is assumed that any time consumed while the lantern is at the General Lighthouse Depot shall not be charged against the contractor in computing liquidated damages, if any.

Paragraph 12:

Before proceeding with the construction of the first unit under contract, it is our opinion that the contractor should submit detailed drawings of the device it is proposed to supply and that these drawings be approved by the Department before production is begun.

Paragraph 13: Chang method of moving flasher. *Ibid*

Letter from J.T. Yates to the Commissioner, July 14, 1928:

Mr. Rhodes called on the phone regarding this [letter of July 12 from Airways Divisions] on July 12 and was advised by this office that it had no authority to enter into any such conference and that it did not consider such conference necessary or desirable, for the specifications and drawings clearly indicated what was desired, leaving the responsibility for details within the limits of the specifications, also the ventilation to the manufacturer, and that any such conference would lead to confusion: also that it did not consider it advisable to standardize on any one manufacturer's details at this time.

It any details are to be approved, the American Gas Accumulator Company should submit prints of same for approval, and any questions regarding specifications or drawings to be submitted by letter.

It is recommended that Bureau's instructions of July 12th regarding conference be cancelled, and that the American As Accumulator Company be advised to handle this matter as outlined above. *Ibid*

Letter from John B. Rhodes, American Gas Accumulator Company, to F.C. Hingsburg, Chief Engineer, Airways Division, July 16, 1928:

You will recall our telephone conversation of July 12, and our letter to Mr. Yates of the same date, a copy of which is forwarded to you.

We stated at the time that we desired that an opportunity be afforded us to review with a representative from your office the details of the design for the bottom section of the Aviation Routing Beacon which

we hope to have the opportunity to manufacture for you. Our purpose in asking for such a conference was a dual one.

First. We wish to assure ourselves that our interpretation of your specifications is correct, and also that an opportunity might be afforded for consideration of one or two changes which we would consider in the light of improvement.

Second. We understand that it is the desire of your department insofar as possible to purchase only standard units, and that to accomplish this purpose you take the first production unit you receive and establish this unit as standard for the order to which it applies and to future orders. In this particular case we have learned that a second order will be placed before you receive the sample unit on the order which we hope to receive. With the thought that you could still effect the standardization which you desire, we offered to open to competitors any conference we might have concerning the details of our proposed beacon. By so doing any matters on which our company or a competitive company might not agree could be threshed out and a uniform practice arrived at. This would scarcely be possible, however, if our work had proceeded to a point beyond which changes would be costly, because they would necessitate redoing work already accomplished.

Mr. Yates has acknowledged our letter of the 12th, and we have talked with him by telephone on two different occasions since that date, and he has declined to agree to the conference we have requested, for two reasons:

First. He states that inasmuch as the proposed contract will come from Washington, he lacks jurisdiction unless, and until, he receives special instructions to that effect from your office.

Second. He states that it is the desire of the department to purchase to manufacturer's design within your specifications, rather than to a set standard. He also advanced the argument that to set a standard around our design might work to our advantage in future biddings. We take issue with this point on the ground that we have offered to modify our design to accommodate competitor's practices within reason, and, more than that, we assume that if we produce a design that is acceptable on one order, it will be acceptable also on other orders placed in the immediate future. Therefore, any advantage that we might have by reason of owning patterns, drawings, etc. would be ours in any case.

Mr. Yates has suggested that if we wish advice and approval

concerning details of design, we should communicate this point in writing. This we are most happy to do, and we propose to do so later. We believe, however, that a conference at which the pros and cons of any points we might raise in a letter could be threshed out is still highly desirable. We should, therefore, appreciate your advice as to our proper procedure in this matter. We are entirely prepared to write you in detail of the matters on which we desire to see you, to call upon you at your office in Washington, or to handle this matter in any way that you see fit. *Ibid*

Memo from J.T. Yates regarding the Visit of Mr. Rhodes of A.G.A., July 20, 1928:

On July 20 Mr. Rhodes and Mr. Oestnaes called and stated they had called to discuss acetylene airways beacon, the bids for which are to open July 24. Were advised that the discussion must be considered unofficial as it was the practice of this office to handle such matters by letter only. He stated that he had a list of things he wanted to talk over, and would then take up by letter. As he had a typewritten list of questions I asked him for a copy as a memo of the conversation, and had to request it several times before I got it, same as attached. The various numbered items were taken up and considered, and he was advised as follows:

No. 1. This office did not favor the filter in valve as it was not as efficient or as easily cleaned and attended as the standard filter used in the lens, same as shown on sketch #231.

No. 2. Cork spacers are provided for on drawing.

No. 3. Dowel pins necessary and to be used.

No. 4. Four bolts as shown on drawing to be used. They also were advised that the hinge pin should be a fit in lugs on lantern body; the lugs on door being elongated in one direction only, not large round holes.

No. 5. The 1/4-inch gasket shown in drawing to be used. Specifications in error in this respect.

No. 6. In this change Mr. Rhodes said it would be difficult to have th slot in the baffle made in casting to allow for the bolt, also the slot would make an air leak in the ventilation that would be detrimental. Advised him that I could not agree with him in either point, but could see no objection to the use of the two hinge pins, if they considered it more economical, and if desired, we would take it up with the Bureau when they submitted officially, but if used they would have to tap the lugs of the frame screw bolts in so there would be no movement of bolt in this part of the hinge,

and put cotter pins through the top end of bottom bolt, which would be located with head down.

[No number 7]

No. 8. It will be necessary that this distance, also the angle at which the burners are to be set, be determined and furnished the contractor to permit them to make up the burner stands. This can be taken from the burner which was used for tests at this Depot. The burners were set at a distance of 13/16" on centers, and the angle of the burners themselves was 22 degrees from the axle of the beam.

No. 9. The American Gas Accumulator Company is in error in stating no pressure gauge called for for same is called for by 3rd line of Paragraph No. 9 as is all other necessary valves and connections. This office prefers the omission of the gauge valve and the drilling of an additional hole in the upper side of the manifold and mounting gauge direct without valve for the reason that many gauges are injured and destroyed by turning pressure on them too quickly, and as there is no capacity in the gauge line it is difficult to turn pressure on them otherwise. This office had no print of Drawing No. 505 to furnish bidders but has requested same from Bureau. Paragraph 9 of specifications calls for 3/16" tubing. This is an error; should be 8 m.m.

No. 10. No use of drain plug in bottom of lantern can be seen for these lights, but it would not be detrimental in any way.

No. 11. Advised that lantern would first be tested by playing water down on the lantern from a hose held some 20 or 30 feet above the lantern so that the water would strike the lantern in form of drops resembling heavy rain. At the same time a jet of air from a 3/8" nozzle 100 pressure, would be directed against the lantern from a distance of about 5 feet, to test the weather proofness of lantern. It would then be subjected to the jet of air as above held at all distances from 6 feet to directly into all ventilation openings. If in this test the pilot was extinguished or flame caused to flicker, the lantern would be rejected; also that it would be kept in operation for a time in a temperature of about 130°F to see that ventilation was adequate for hot climate. As for the time lantern was under test being charged against contractor, they were advised that it would be for such test was provided for in specifications and contract.

No. 12. In connection with the approval of drawings, he was advised this office would examine any drawings they cared to submit and would have them approved or disapproved, but all approvals would be subject to the

terms of specifications, and would be for general design only; there would be no checking of dimensions of their details, except only as far as weight and strength of parts were concerned.

No. 13. Mr. Rhodes then brought up the question of arranging for the side adjustment of flasher and burner, stating that it would be pretty close work to arrange piping, etc., to permit this movement, and that they would prefer to secure the flasher, and arrange the spider that holds the burner post, so that the burners could be moved at will on this spider, the spider (on foot) to have an oblong slot in which the burner post will slide and be secured at such position as desired by a lock nut. They are to submit sketches. In looking into this further that contention that the arranging for the moving of the flasher will be somewhat difficult, is found to be correct, and it would be a somewhat more simple and economical arrangement to have the burner point slide in the spider on stand, and would simplify the interior piping. This arrangement would make the burner stand and supports for this flasher different from the regular standard, but this has to be the case in any event, for the necessity of making a burner posts to permit burners being set at required angles takes up such amount of height that the regular burner stand on either make of flasher cannot be used. In connection with the swivel burner posts, the necessity of same has been pointed out to both the A.G.A. and Interflash. The burners have a taper thread and same is in no fixed relation to the angle of the burner, so that if regular double burner stand was used, when burners were screwed in as tight as they have to be, they would stand at any and all angles. To overcome this it is necessary to have a separate burner post for each burner with a swivel or union connection for mounting it to the stand. The A.G.A. proposed to use the construction they use in their cluster burner stands which is complicated, expensive, and difficult to install new burners on. I proposed they make burner stands using the F 40 A connection on the burner; then turned to desired angle, and F 40 A connection set up. *Ibid.*

Letter from F.C. Hingsburg, Chief Engineer, to American Gas Accumulator Company, July 20, 1928:

Referring to your letter dated July 16, 1928, pertaining to the details of the bottom section of the airways route beacon:

It is believed that the full sized drawings together with the dimensions given will enable competitors to manufacture a suitable

lantern. The specifications and drawings clearly indicate what is desired, leaving the responsibility for details within the limits of specifications, also the ventilation to the manufacturer.

Any minor changes or improvements should be submitted for approval, and any questions regarding specifications or drawings should be submitted by letter. It is not believed that a conference of manufacturers, pertaining to a contract on which the award has been made, would be proper. *Ibid*

Letter from John B. Rhodes, A.G.A. Company, to J.T. Yates, Superintendent, Staten Island, July 21, 1928:

We refer to our conversation of Friday, on the subject of your Proposal No. 27614, calling for 100 Acetylene Airways Route Beacons, and, more particularly, to Specification No. 1371, which accompanied that inquiry.

We should appreciate your advice and opinion on the matters itemized below, not only in connection with your own inquiry, but, if such a course is feasible, in connection with an inquiry from the Department of Commerce, at Washington, upon which bids were received some time ago, and upon which this company was the low bidder.

We itemize our queries as follows:

1. The specification mentioned that the lanterns will be supplies with a filter, but does not state the location or type. In conformity with your ideas on the subject, we propose to install a filter in the high-pressure line within the lantern between the intake manifold and the regulator.
2. Your drawing shows four swing bolts for the outer door, whereas the specifications calls for only two. It is proposed to follow the drawing, as we believe that this will make a better job.
3. Your drawing calls for 1/4" rubber gaskets, whereas the specification reads 3/16". Here again we propose to follow the drawing, rather than the specification.
4. It is our intention to provide the door for the inner doublet with two hinge pins, in order to eliminate the cumbersome cut-out in the cast flange on the inside of the lantern. These two hinge pins will be threaded into one section of the hinge and additional security will be provided through the medium of a cotter pin.
5. It would be desirable if the Department would specify the horizontal distance between the burners desired.
6. Specification and drawing require that the horizontal adjustment of the

focus be accomplished by moving the entire flasher regulator set. We attach two sketches to indicate the difficulty of making this adjustment as required, and we suggest that in lieu thereof the adjustment be made entirely on the burner stand. We attach a flue print showing the type of burner stand that would be used, and, in addition, a sketch showing the entire assembly of the burner stand and the burners. If this meets with your approval, we should like your authority to proceed to manufacture as shown.

7. The specification calls for an eight-hole manifold with "gauge cock" and plugs. No gauge is specified, nor is the manner in which the gauge is to be attached to the manifold indicated. We assume that the eight-hole manifold would indicate that six tanks will be used, each of which, of course, requires an inlet to the manifold, that the seventh hole is for the outlet and the eight hole is for the pressure-gauge valve referred to in the specification as the "gauge cock". We believe that a better arrangement would be to use a seven-hole manifold, with the gauge hole in the top thereof, and the gauge attached directly thereto. This would obviate the need for a pressure-gauge valve. We suggest that, if awarded your contract, we should be happy to supply you with a standard 3" gauge, similar to that manufactured for your service by the Ashcroft Co. And graduated either in atmosphere or in pounds instead of the pressure-gauge valve.

8. In paragraph 9 of your specification reference was made to drawing No. 505 from which we can obtain the proper sizes and dimensions of the piping. No copy of this drawing has been received, and we would appreciate one at your convenience.

9. It is presumed that no objection will be made if we supply a drain plug at the bottom of the lantern similar to that used in all of our standard marine lanterns.

10. In paragraph 9 of your specification reference is made to the fact that the tubing shall be 3/16" in diameter, etc. We presume that the specification should read that piping shall be 8 m/m copper-covered steel tubing, except inside of the lantern, where 5/32" copper-covered steel tubing shall be used. In this connection, we should appreciate a copy of your sketch No. 256-A, showing the Type F-40-A connection. *Ibid.*

Letter from Superintendent Yates to the American Gas Accumulator Company, July 31, 1928:

The matters brought up in your letter of July 21, 1928, were discussed with Mr. Hingsburg on his recent visit at this Depot and were agreed on. As he was leaving for the west and would not again be in Washington for some weeks, he stated that he would send Washington a memorandum and that they would advise us in connection with this matter, but as such advice has not been received, the conclusions reached during the discussion are herewith given for your information and guidance in connection with the contract you are now fulfilling for Acetylene Airways Route Beacons.

1. Filter is to be installed in the internal piping of the lantern and is to be of F-500 type.
2. The four swing bolts as shown on drawing to be used.
3. The 1/4" rubber shown on the drawing for the door to be used.
4. The use of two hinge bolts is to be permitted with the understanding that they are to be threaded into the lugs of the door frame, the lower one is tio have a cotter pin as discussed between yourself and the writer recently, detailed sketch of this hinge arrangement to be submitted for approval.
5. The horizontal distance between the burners is to be 13/16" on centers and the angle of the burners themselves will be 22° from the axis of the beam. The angle of the burner may necessarily have to be changed slightly to allow for imperfect burners when they are actually installed and tested.
6. The change in the design of moving the burners in place of the flasher will be permitted along the lines as shown on sketches forwarded with your letter of July 21st, with the understanding that the burners are to have union connections at the lower end to permit proper adjustment. The specified movement of the burners from side to side will be retained and also that there will be an up and down movement of at least one inch either up or down. The track on which the burner stand shifts from side to side is to be graduated in inches with marks at 1/16" spacing.
7. In lieu of the 8-hole manifold and gauge cock you will be permitted to use the 7-hole manifold with the hole drilled in the side for the gauge connection, to omit the gauge cock and furnish a 3-inch nickel-plated cast-bronze gauge with screw face and steel spring dial to be graduated in atmospheres. Your attention is invited to the fact that the pressure gauge is called for in the third line of paragraph #9 of the specifications.
8. In connection with the piping, valves, fittings, etc. required for the installations, it will be somewhat difficult to arrange this piping for the installations owing to the different sizes and types of tanks that will be

used at various places and on account of same it has been decided to have the contractor furnish the necessary pipe and fittings and some to be made up on the job when installations are made and there is enclosed a list of the pipe, valves and fittings, etc. that will be required for such installation. There is enclosed for your information a copy of Drawing #505 referred to in the specifications.

9. There is no objection to the use of drain plug in the bottom of the lantern providing you desire to install same.

10. All piping outside of the lantern will be the 8 mm. tubing. All high pressure piping inside the lantern to be the 5/32 copper-covered steel tubing with the F-40A connections. There is enclosed in accordance with your request blueprints in duplicate of Sketch #256-A. *Ibid.*

Airways Division, Bureau of Lighthouses, Department of Commerce, August 2, 1928 – SPECIFICATIONS FOR 300 M/M ACETYLENE AIRWAYS LANTERN: [Drawing 509 attached]

1. GENERAL DESCRIPTION: The lantern shall consist of a 300 M/M half fresnel lens and conical top lens section, mounted in a lantern housing, fitted with an acetylene regulator and flasher, one foot burner and dual pilot and ventilating system as shown on drawing number 509, and as specified hereinafter. It is intended that the lantern shall be mounted on the double-ended range lantern , shown on Airways Division Drawing Nos. 509-A, B and C, the combination forming the standard acetylene airways route beacon. The lantern shall be a self-contained unit designed for exposure to the weather and shall be absolutely wind-proof, storm-tight and insect-proof. Provision shall be made for the future attachment of a sun valve by providing the necessary bosses for the attachment of a sun valve cock manifold. The characteristics shall be flashing, 40 flashes per minute with a luminous period of 1/8. Complete piping, fittings, manifold, gauges, valves, etc. shall be furnished for installation on 20 foot tower and to connect up with three commercial 300 cc. ft. cylinders.

2. LENSES: The lenses shall be approximately 300 M/M in diameter, lower lens being 360° fresnel, cut at the upper part of the central drum. The upper section shall be 3 5/8" high, 4 3/8" internal diameter at the top with inside prisms as shown, and shall be fitted to the lower lens section by means of a brass “Z” ring. The optical glass shall be clear, hard, high transmission, pressed and polished lenses of proper optical design. The

maximum candlepower from the lower section using a one-foot acetylene burner at 4" pressure shall be not less than 180 B. c.p. with a distribution of light from 0° to +8°. The light distribution of the upper section shall be from +4° to +30°.The lenses shall be similar and equal to the Corning lenses held as the standard of comparison.

3. LANTERN: The base castings shall be 5% silico-aluminum, properly proportioned to conform to the dimensions shown on the drawings. Bosses for holding down bolts shall be drilled and tapped to fit the route beacon saddle on which the lantern will be mounted. A boss shall be provided on one side for a steel manifold containing the P-10 and P-40A fitting for the acetylene gas connections and a multiple disk abut off valve and fitter shall be provided, the manifold and fittings being identical with the manifold installed in the lower range shown on Drawing No. 509-A. On the opposite side a boss shall be provided for the future attachment of a manifold containing the standard sun valve cock and standard connections, and the boss shall be drilled and tapped to suit the standard spacing of holding down bolts. A 1/4" aluminum cover plate shall be installed to cover the opening, and shall be fastened with screws place to accommodate the sun valve fitting should one be installed at a future date. The bottom castings shall be provided with lugs as shown for the hinges and latch bolt nut as shown, the castings being machined so as to provide a bevelled joint making a weather- and airtight joint. The latch shall be designed for installation of a padlock as shown. The bottom casting shall be ribbed as shown and lugs shall be provided for the tie rods and support of inner glass globe. The tie rods shall be six in number of flat cold rolled brass 1/8" x 5/8" and installed as shown. The top casting supporting the ventilator shall be of bronze. A pyrex inner globe as shown shall be attached to a spun brass base and secured in plaster of paris. The inner globe and lens shall be supported on three lugs with a suitable locking arrangement so that the glass will be held in place when the lantern is opened.

Aluminum castings shall conform to Ordnance Department U.S.A. specification 57-72 Grade No. 1 for 5% silico aluminum. Bronze castings shall conform with Ordnance Department U.S.A. Specifications No. 57-70B, grade No. 5. All corresponding parts shall be machined and finished and shall be properly fitted and assembled. Workmanship must be good. All brass and copper parts, including screws and bolts, coming in contact with aluminum shall be aluminum sprayed, cadmium plated or treated in

an approved manner to prevent electrolytic action; all steel parts shall be cadmium plated.
4. PATENTS. If any article, device or arrangement used is subject to a patent right, the cost of royalty for its use is to be paid by the contractor. All parts must be guaranteed for a period of one year against defective and inferior parts and workmanship. The proper performance and reliability of apparatus shall be guaranteed for one year.
5. PAINTING. The metal parts of the lantern shall be neatly painted with a hear resisting primer coat and enamel of approved brand, color to be similar to yellow No. 4 U.S. Army Color Chart supplement to specification No. 3-1.
6. GENERAL: The successful bidder will be required to fabricate one complete beacon in advance of quantity production, this sample to be inspected by the Chief Engineer of the Airways Division or an authorized representative, and final approval given by him prior to further manufacture of the beacons.
7. SHIPPING: The lanterns shall be carefully and adequately boxed and packed for shipment on Government bills of lading. Payment will be made for each lot of lanterns or individual units upon shipment. Each lots of lanterns will be inspected by the Government before shipment. *Ibid.*

Memorandum from Superintendent Yates, Staten Island, September 6, 1928:

1. A representative of the A.G.A. Company brought to this Depot an acetylene airway route beacon lantern, to represent the lot ordered by the Bureau, for test as to ventilation. The lantern was the same one as submitted for test on August 31, except that the ventilator had been modified.
2. The lantern was connected up with gas supply on the south bulkhead dock and lighted. Compressed air was directed to all parts of the lantern at various distances up to one or two inches from door joint and ventilator with out showing any effect whatever on the burning flame. Water was showered over the lantern with a garden hose, and compressed air directed against the lantern; the compressed air directed against all parts of the lantern and ventilator at varying distances up to one or two inches. Upon completion of this test, the lantern was opened and it was found that there was approximately 8 or 10 drops of water in the bottom of the pot, and two or three drops hanging on the inside of the shell at the ventilator opening. This water evidently entered where a brass ring forming the lower section

of the ventilator was attached to the top of the lantern shell and set in plaster of Paris and putty, this brass ring taking the place of a ring or boss that will be cast integral with the lantern shells on the lanterns that are to be furnished by the contractor. No water whatever entered the lantern through the ventilator itself. As the leakage of water referred to above was evidently due to the temporary mounting of the ventilator on top of the lantern, the lanterns to be furnished with the ring cast on top should prove water-tight, and similar tests should be made on one of the lanterns to be furnished when completed.

3. With the exception of the leakage of water referred to above, where the ventilator was temporarily attached to the lantern, the test of the ventilator and lantern with air and water was satisfactory.

September 12, 1928: Copy forwarded to A.G.A. with copy of memorandum of Sept. 12. At the proper time a completed lantern such as is to be furnished under your contract be submitted to this office for test and inspection as a whole, as the lantern submitted for test on August 31 was not a completed lantern such as will be furnished under your contract. Ibid.

Test of A.G.A. Acetylene Airway Route Beacon Lantern, September 10, 1928:

1. The lantern submitted by the A.G.A. Company for test as to ventilation was placed inside of tankhouse at this Depot on the morning of September 7, a steam hose having been placed in the tankhouse, to ascertain whether the lantern would function properly under heated conditions. When the lantern was placed in the tankhouse, and before the steam was turned on, it was flashing 35 flashes per minute, the temperature being 69°F. The number of flashes per minute were check at the intervals as shown below:

September 7, 1928		
Time	Temp.	Flashes
11.00 a.m.	118° F.	39
12:30 p.m.	120° F.	39
1:30 p.m.	121 “	39
3:00 p.m.	124 “	39
4:15 p.m.	126 “	39
September 8, 1928:		
8:00 a.m.	132° F.	39

2. The steam was shut off on Saturday, September 8, and on Monday morning September 10, the light was found to be still flashing 39 flashes per minute. *Ibid.*

Memorandum regarding Test of Acetylene Airway Route Beacon submitted by American Gas Accumulator Company, J.T. Yates, October 10, 1928:

1. The airway route beacon submitted by this company was placed on the dock, connected with the gas tanks and placed in operation and was then tested as follows.
2. A jet of air from the 1/4" nozzle at 100 pounds air pressure was directed at the lantern from a distance of 4 feet and was played over the various parts of the lantern without affecting the flame in any manner.
3. The same jet was then played over the lantern at a distance of 2 feet without affecting the flame or burner in any way.
4. The same jet was then directed against the lantern close to and played over the lantern in all its parts, including being held directly against the different parts of the ventilator screens and same did not have any effect on the flame or pilot.
5. The lantern was then tested with the water and air test. A jet of water from the 1/4" pipe was allowed to fall down over the door of the lantern from sufficient distances so that the water struck lantern in a broken stream somewhat resembling a heavy rain. While the water was being played on the lantern a jet of air from the 1/4" nozzle at 100 pounds pressure was played against the lantern in all its parts and at various distances, to as far as possible represent the effect that would be encountered in a heavy rain and strong wind. Throughout this test the lantern was not affected and no water entered same, except around the holding down bolts of the saddle, all of which bolts showed leaks. These bolts were not fitted with aluminum washers as called for on the drawings nor were they imbedded in suitable putty.
6. After this test the lantern was then placed in a room with super-heated temperatures for burning test. *Ibid.*

Letter from Acting Commissioner Conway to Superintendent, Staten Island, October 11, 1928:

1. Reference is made to Bureau letter of October 9 and your indorsement of October 10 relative to arrangements with the American Gas Accumulator Company for shipment of 25 complete assemblies of acetylene tubing and necessary fittings to Lovelock and Batle Mountain, Nevada.
2. The Bureau has a contract No. Cc 407, order No. 29-1039 dated July 20,

1928, Requisition 609, Proposal 19811, for 100 complete acetylene route beacons. This contract provides for complete piping necessary to make installation on a 20-ft. tower. The drawing inclosed with letter of October 9 was made for the purpose of showing the details of the piping in question. A copy of Proposal 19811, specifications of June 21, 1928, and drawings Nos. 509A, 509B and 509C are inclosed for your information.
3. The tanks are being furnished by the Airways Engineer at Salt Lake City and, although the Bureau has requested information as to type, that data is not yet at hand. It is hoped that, with the above information, you will be able to arrange with the American Gas Accumulator Company to expedite shipping of the tubing. *Ibid.*

Memo from J.T. Yates to the Commissioner, October 12, 1928.
Subject: Test of Acetylene Airway Route Beacon submitted by American Accumulator Gas Company:

Enclosed for the information of the Bureau is copy of memorandum of October 12, 1928, regarding this lantern. [*October 12 Memo follows*]

The following comments are offered in connection with the various paragraphs of the memorandum:

1. Large ventilating hood not objectionable, except possibly in appearance. Recommend no change.
2. The interior flexible piping to be re-arranged to permit the shifting of burner full 2" without piping interfering with side of lantern.
3. A round rubber gasket as called for in specifications to be furnished and slot in door frame to accommodate same.
4. A.G.A. state that all flashers are drilled as referred to in this paragraph.
5. The use of proper gasket will practically overcome this difficulty. If not, A.G.A. will change the elongation.
6. More care to be exercised in fitting the doors to the baffles. No space greater than 1/32 should be permitted.
7. A.G.A. state they will install the centering pins.
8. A.G.A. state that they will relocate filter.
9. A.G.A. state present baffle was temporarily made in a hurry and that on all other lanterns this will be called for in the specifications.
10. Dimensions given in this paragraph are in error as lantern was measured over the top in place of at the center, at which point it is 13" long as called for.
11. The reason for this increased length was due almost entirely to the

excessive putty which held the lamp away from its sitting.
12. The same condition found here as referred to in paragraph 11.
13. A.G.A. state they will reduce the depth of this box.
14. A.G.A. state they will install aluminum washers.
15. A.G.A. desire to increase the height of the saddle to overcome this difficulty. This office would recommend that as the most practical method.
16. A.G.A. they will make all filters used on these lanterns of rustless steel.
17. The construction of the saddle is such that it has a connecting yoke about 2" above the top of the lantern, which should recompense for the omission of the strap at the top of the lantern. No change considered necessary at this time.
18. A.G.A. state that sun valve cock was installed on this lantern only on account of its being for exhibition purposes.

It is requested that this office be advised by telegraph if the suggestions by this office meet the Bureau's approval so that the A.G.A. Company can be advised without delay. *Ibid.*

Memorandum regarding Test of Acetylene Airway Route Beacon Submitted by American Gas Accumulator Company. J.T. Yates, October 12, 1928:

In this connection attention is invited to memorandum of October 10, 1928, regarding this subject.

The lantern was removed from the superheated temperature after burning at a temperature of between 120° and 130° for a period of 36 hours, during which the lantern or flame was not affected in any manner. Also, the number of flashes per minute during this test did not vary as it did on a previous test of a lantern submitted by the A.G.A. Company.

After the lantern was removed from the temperature room it was examined and movements checked with the following results:
1. The ventilator hood is 8 1/4" diameter over screen and 6 1/4" high. This hood is much larger than is shown on the drawing, which was 5 3/4" diameter and 41/2" high. The hood is much larger than necessary and gives lantern somewhat of an unsightly appearance. This large hood makes necessary large saddle to top lantern, the same being 10 ½" diameter by 12 ½" high.
2. The interior flexible piping to burner not installed according to specifications or agreement. So arranged that burner can be moved only 1 1/4" off center without piping coming into contact with the side of the

lantern.
3. The rubber gasket in the door is not of the type or size called for in specifications or equal to same. This is objectionable as it will require stocking a special size and type of rubber for new inner gaskets in the A.G.A. lantern.
4. The arrangement for burner movement is heavy and somewhat clumsy. This type requires an exact relation between the bolt holes and the flasher top and reducing valve and the holding down bolts of the flasher and reducing valve. If this relation is not maintained on all flashers that may be used with this device, they could not be used in this lantern.
5. The elongation of hinge bolt holes in lens door not properly placed. The door goes up metal to metal before the clamps are screwed up. When clamps are released, the clearance is on the wrong side, which allows no compression on the gasket.
6. The lens door is not properly fitted up to the baffles on the lantern. There is a space from 1/16 to 1/8 inch between the door and all baffles.
7. No centering pins in the hinge ring of the 10" doublet as called for. This ring can be moved up and down 1/6" unclamped.
8. The filter is located over the adjusting screws in such position that access to the adjusting screws is difficult.
9. The baffle across the end of uptake is 11- or 12-gauge metal in place of #14 called for. This heavier metal is objectionable as it will exert a heavy pressure on the door frames from the expansion. This metal should not be thicker than #14 specified and it would be desirable to have the edges of this baffle turned up at an angle when in contact with the door frame to take care of the expansion.
10. The lantern is 12 5/8" long overall in place of 13" called for in drawing.
11. The 10" doublet sitting is 2 7/32" from focal center in place of 2" called for in drawing.
12. The sitting of the 18" lens is 6 11/32" in place of 6 1/8" called for on drawing.
13. The sun valve cock sets on a boss, the recess inside of which is so deep that it will be impossible to set up the connections of the interior piping of the sunvalve. This boss should be reduced in depth by at least 3/4".
14. No aluminum washer under head of saddle bolts as called for.
15. The holding down bolts for the top lantern cannot be installed or removed without removing saddle for the heads of bolts come in contact

with ventilator top.
16. The filter is not made of restless steel and shows considerable rust after only one day's operation of lantern.
17. The saddle has no yoke across the top of lantern connecting the feet as shown on drawing, but rests on feet 2 1/4 by 1 3/8" only.
18. Lantern has sun valve cock in place instead of aluminum cover plate as called for. *Ibid*

Letter from J.T. Yates to American Gas Accumulator Company, October 13, 1928:

In accordance with your agreement during [our] conversation, you are hereby directed to furnish 26 outfits of piping, valves, fittings, etc. in accordance with drawing #527, blue print enclosed, in lieu of 26 outfits as shown on letter from this office of July 31, 1928, and in accordance with our agreement you will have these outfits delivered to this Depot where same will be packed by this office and shipped.

In connection with the fittings for the tank end of piping, you will hold action on them in abeyance until the last thing, in order to ascertain if information cannot be obtained in regard to type of tanks used and type fittings to be installed. If such information is not received by the time you are complete on the other parts of the piping, you will install the F-10-A connection as shown an sketch #256B, blue print herewith. *Ibid.*

Letter from Superintendent Yates to Commissioner, October 15, 1928. Subject: Airways beacon contract No. Cc407, Order No. 29-1039:

The Bureau's attention is invited to paragraph 8 of letter to the American Gas Accumulator Company of July 31, 1928, a copy of which was forwarded to the Bureau with letter of July 31, 1928, wherein it will be seen that the American Gas Accumulator Company and Inteflash Signal Corporation were to furnish certain amounts of piping and fittings in lieu of the made-up connections called for in the contract.

On receipt of Bureau letter of October 11, the matter was again taken up with the American Gas Accumulator Company who stated that they were willing to furnish the 26 sets of connections referred to, and there is enclosed for the information of the Bureau, copy of letter dated October 13, 1928, to the American Gas Accumulator Company.

On October 13, 1928, this office was advised by the American Gas Accumulator Company that it was their practice to furnish all tank connections with the Commercial acetylene type fitting, and that if any

other companies bid on gas they would be required to furnish a connecting fitting so that the Commercial acetylene fittings could be connected to their tanks, and stated this had been the practice on outfits that had been sent out heretofore. They were advised by this office that it did not consider such procedure satisfactory or entirely fair to all of the gas companies concerned, and in consequence of which they were directed to withhold action in installing the fitting on tank end of the piping until the last thing to see if information as to the type of tanks used could not be obtained so that the proper fitting could be installed,, which information has been received, and the American Gas Accumulator Company has been notified on this date to install the fittings for the Prest-O-lite company cylinders. *Ibid.*

Memor from J.T. Yates regarding Test of Acetylene Airway Route Beacon Submitted by American Gas Accumulator Company, October 25, 1928:

On October 24 the American Gas Accumulator Company bought to this Depot a lantern that had been changed to overcome the omissions and objections referred to in memorandum of October 12, 1928.

In examining this lantern it was found that all of the omissions, etc., referred to in that memorandum had been corrected, and that the following changes would be necessary to make this lantern acceptable and in compliance with the specifications:

1. The trombone coil interferes with the wing nuts of the inner doublet door frame, also do not permit the full 1" lowering of the burner. This coil to be changed by the omission of the horizontal trombone part of the coil and by arranging so that the 1" movement up and down be obtained. The manner in which this was to be done was explained to the American Gas Accumulator Company's representative.
2. Fill in the air space between the horizontal baffle and the door frame. A false brass plate had been tapped to the baffle plates same extending over the edge of the baffle and against the door frame. This place was satisfactory except that there was an undue amount of clearance between the plate and the door frame of the inner doublet. Plates to be more carefully fitted at this point.
3. The inner ventilator hood was low so that it cut off a small amount of the light from the upper prisms of the doublet. This ventilator to be cut away in the center about ½" on a radius and about 3" across arc.
4. Aluminum washers not provided under the heads of the holding down

bolts of the upper lantern saddle; also, feet of this saddle not imbedded in red lead which is to be corrected on future lanterns. *Ibid.*

Letter from Superintendent Yates to the American Gas Accumulator Company, October 27, 1928. Subject: Ventilator, Airway Route Beacon.

When the lantern was examined at this Depot this matter was checked roughly but quite carefully and there appeared to be every evidence that the ventilator would cut off the light from the top prisms as stated, however, it is not desired to have any change to the ventilator unless such interference does exist, which can best be determined by the light when it is in operation. It is suggested that you try one of the lights to ascertain if this condition does exist and be guided by your findings in the matter of shortening the ventilator.

It may be stated that the lantern from your company now under test at this Depot, shows a small dark sector at the top of the lens, which this Office attributes to the length of the ventilator. *Ibid.*

Letter from Chief Engineer to American Gas Accumulator Company, October 30, 1928:

It is urgently requested that 26 acetylene range lights be shipped for the Pleasant Valley Cutoff and 5 additional range lights be shipped for the section of airway between Blue Canyon and Verdi. Unless these units reach their destination and are installed before November 15, 1928, the close of the season, it is hardly feasible to install them until next July when the season opens. All preparations have been made for turning on the lights on the western end of the Transcontinental, in order to save a business day by flying to western and eastern divisions at night and the central division by day. In is earnestly requested that every effort by made to have these units shipped by express in order that they may be installed before the close of the season. *Ibid.*

Memorandum from J.T. Yates, November 3, 1928:

On November 2, 1928, it was noted that a slight amount of soot had collected on the upper part of the 10-inch doublet lens in the acetylene airways route beacon submitted by the A.G.A. Company for test; also at one place it appeared as if the flame was being distorted so that the tails of smoke from same were being impinged directly on the upper part of the lens. As this particular spot appeared to be caused by burners operating at

excessive presure, Mr. Merrill, of the A.G.A., was called on the phone and advised of the condition and requested to use extreme care in adjusting the burner pressure for all of the lanterns that were shipped our for service.

Ibid.

Letter from Mechanician F.C. Younger to Superintendent 3rd District, November 16, 1928.
Subject: Airways Beacons - Bureau contract Cc-407, order No. 29-1029:

On November 19 proceeded from Bound Brook, NJ, to Elizabeth, NJ, and inspected two airway beacons at the plant of the A.G.A. Company, made by them on account of Bureau contract.

These lanterns were found to be in accordance with plans and specifications.

Flashers were operated and burners tested and found to be correct.

The above two lanterns were not painted, as they are to be used temporarily for exhibit, and information as to what paint to use on them was not obtainable.

Lanterns accepted: No. 536, Flasher 12309, Gov. 20283
No. 537, Flasher 12203, Gov. 20322 *Ibid.*

Memo from J.T. Yates to Commissioner and A.G.A. Company, November 23, 1928. Subject: Inspection of 24" [sic] Acetylene Airway Route Beacons at A.G.A. Company's plant, Elizabeth, NJ, on account of contract with Bureau of Lighthouses for 100 of these lanterns:

Arrived at A.G.A.'s plant at 10:45 a.m. to inspect 5 lanterns which they had advised by telephone were ready for inspection. On arrival there was advised by them that they had 15 lanterns ready and asked if inspection could be given to the 15 and advised that it could. The following lanterns were inspected:

No. 538, Flasher No. 12258, Governor No. 20262
534 12340 20339 Etc.

The lanterns were examined throughout and found to be in accordance with the specifications and acceptable. All lights were place in operation and characteristics checked. On lantern #534 the inner doublet was found spattered with paint, which was cleaned off. On lantern #544 one of the dowels on the doublet door frame was loose. This was to be replaced with a new dowel. These lanterns were accepted and A.G.A. will take steps to ship them as directed by the Bureau. *Ibid.*

Memorandum regarding test of 24" Airway Route Beacon Submitted by Interflash Signal Corporation, November 24, 1928:

November 24: Interflash Signal Corporation brought down a new lantern for test. They have modified the screen , but have not put on the insulation pipe we suggested to take place of temporary asbestos insulation which was tried out. In places they have enlarged secondary uptake flue to increase circulation. Doubt if this change will be beneficial.

November 26: The light in new lantern submitted by Interflash on November 24th, went fixed light at 6 p.m., November 24th. Light continued this (dim) until Monday a.m. When examined, both burners found burning, small flame and badly carboned up. Cleaned off carbon and while same being done flasher commenced to operate O.K. On this a.m. Monday weather clear and cold throughout the night. All lanterns were examined, small amount of moisture on the inside of outer lens on all lanterns, but both Interflash lanterns showed more moisture than the A.G.A. lantern.

November 27: This a.m. weather clear, cold, strong N.W. wind. There was considerable condensation on the inner side 18" lens. At same time there was none in A.G.A. lantern.

At 9 a.m. this date the flasher on this lantern started showing fixed light.

November 28: On November 27, 1928, Mr. Karlsen of Interflash Signal Corp. brought down a new uptake flue and installed in last lantern they submitted for test. This flue was evidently designed to increase circulation, as it was arranged to permit greater flow of air through the secondary uptake flue. On examining same advised Mr. Karlsen that I was of the opinion that this flue would increase condensation, as the secondary flue would distribute more heat to the incoming air.

On the morning of November 28th examined lantern, weather cloudy, cool, damp air. Found the inside of outer lens covered with condensation; at same time the lens of A.G.A. lantern was dry. The exterior of secondary outlet flue was so hot one could hardly bear hand on side, as was likewise the top cap of ventilator.

The other lantern that was previously submitted for test by Interflash was removed from Machine Shop where changes had been made in ventilation and placed in operation for further test.

November 29: On morning of November 29, 1928, examined the three lanterns. Weather cloudy, temperature mild, slightly damp air. The A.G.A.

lantern and Interflash lantern that have been re-midelled [sic] by 3rd District were perfectly dry inside of lantern and on inside of outer lens. The other lantern of Interflash, which is latest lantern submitted by them and one in which they installed new intake flue on November 27th, was covered with condensation on inner sides of 18" lenses,

November 30: On morning of November 30, 1928, examined all lanterns. The weather was warm, with slight drizzling rain.

The A.G.A. lantern and Interflash lantern on which changes were made in 3rd District were dry, except for a very slight deposit of condensation on inner side outer (18") lens. The other Interflash lantern, the last submitted and changed by them, was likewise dry, except on inner side of outer lens, but there was a great deal more condensation than in the other two lanterns, and the outside of secondary flue intake on this lantern was so hot the hand could hardly be borne on same, which [sic] on the other two lanterns this flue was cool.

The Inteflash lantern changed in 3rd District was returned to shop to have main on inner uptake flue altered by removing the necking at the top to increase this part of flue to its full size and also have the small ball baffle over the top of this flue removed to further increase the draft through this inner flue.

The Interflash altered at 3rd District was taken into shop this a.m. Top of inner uptake flue reamed out to full diameter of pipe, and bell deflector removed from over this flue. Lantern again placed in operation at 11:15 a.m.

Examined lantern at 1:30 p.m. during heavy fine rain. Found inner side of the outer lenses of this and the A.G.A. lantern covered with very thin coat of condensation, both about equal, no drops or moisture running. Examined the other Interflash lantern and found the condensation much heavier, water standing in drops or running down over prisms.

It was also noted that there was a great difference in the temperature of the top of ventilator, the top of the 3rd District corrected lantern being cool and other Interflash lantern hot.

December 1, 1928: At 9:30 a.m. examined all lanterns. Weather fair, after a steady rain of 24 hours' duration. Found all lanterns, 2 Interflash and 1 A.G.A., had some condensation on the inside of the lantern drums, the last lantern of Interflash the most.

On A.G.A. and last lantern of Interflash the condensation on inner side of outer lens had been sufficient to run down and fill up small space

formed in bottom of lens frame and to run through ventilator into bottom of lantern. On Interflash lantern changed in 3rd District shop this had not occurred. There was no water in this space, but lenses of the other two lanterns had dried up more since rain stopped, probably due to the inlet air being warmer. The warm inlet air which causes the condensation would likewise assist in drying it up when weather is such that none is forming.
December 3, 1928: On December 1st a representative of Interflash came and cut away casting to increase air inlet space and installed new baffle to insulate top of inner uptake flue. At that time all lenses were wet from previous rain.

On morning of December 2nd examined all lanterns. Found water laying on bottom prisms of A.G.A. and first Interflash lantern, but the Interflash lantern that they changed on Saturday had dried up completely. On this lantern the outside uptake flue and top of lantern were much cooler than heretofore.

On December 3rd a.m. weather fine rain, examined all lanterns; found all dry; also examined them at 1 p.m. and found them the same.

Examined them at 3 p.m. and found that the first Interflash lantern had just a trace of condensation on the inner side of outer lens. The A.G.A. and lantern last modified by Inteflash were dry.
December 4, 1928: Examined all lanterns. Found slight moisture in all lanterns, very slight in A.G.A. and last lantern re-modelled by Inteflash, more in first lantern. At 11:30 a.m. examined all lanterns; found that A.G.A. and last Interflash had dried up, first Interflash had not.

There was no moisture on the inside of metal parts of lanterns, same only on inside of outer lens.

On this date applied air test to last Interflash lantern submitted, by directing air at 100 lb. pressure from 3/8" nozzle against the ventilator of lantern from various distance [sic] from 5 feet being held directly against the inlet and outlet ventilating openings. The flames or pilots were not affected by same, and lantern is considered waterproof.
December 5, 1928: On a.m. this date examined all lanterns, weather moderate S.E. wind, fine rain; rain had been falling for about 2 hours, damp all night.

Both A.G.A. and last Interflash lantern showed very slight condensation on inner side outer lens, not enough to wet finger tip when rubbed over the lens. The other (older) Interflash lantern showed considerable moisture.

December 6, 1928: At 8 a.m. examined all lanterns, weather cool and clear, No dampness or condensation in A.G.A. or last Interflash lantern, small amount on inner side outer lens on first Interflash lantern. The last re-modelled lantern of Interflash appears to be equal to A.G.A. in matter of condensation and somewhat superior in matter of soot deposit and is in acceptable condition. Many alterations on this lantern of temporary construction. Interflash to incorporate the change in lantern in a permanent manner and submit for final test.

December 10, 1928: December 9th a.m. examined all lanterns; weather clear and cold after 18 hours N.E. snowstorm. Found slight amount frost on inner side outer lens of the A.G.A. and last Interflash lanterns. The old Interflash was heavily coated. Frost on any of the lanterns did no appear to diminish the light to any noticeable degree.

On a.m. December 10th examined all lanterns; weather clear and cold (26 degrees). Frost had disappeared and all lanterns dried up, except the old Interflash, which was still heavily coated with condensation, but no frost.

December 11, 1928: On this date Interflash brought in new airway route beacon for test, and removed the two previously under test.

The new lantern has all the changes made in a permanent manner that were made on other lanterns under test in a temporary manner. Lantern set up on test shed for test.

December 12, 1928: This a.m. examined new lantern submitted by Interflash Signal Corporation. Weather cool 30°, slight dampness in air.

Found inner side outer doublet very wet, condensation running from same. At same time A.G.A. lantern found only slightly damp, not enough to see, could determine only with fingers. Called Mr. Karksen of Interflash regarding same.

December 13, 1928: On morning of December 12th Mr. Karlsen of Interflash Signal Corporation came down and cut 3/8" off top of inner draft tube to afford better outflow of air; also at same time a piece of asbestos was installed on top in cover plate to separate entirely the inlet and outlet air changers.

On morning of December 13th examined and found slightest trace of condensation on inner face outer lens. There was the same on A.G.A. lantern and slightly more than on the Interflash. The weather was mild and foggy, which had existed about 3 hours previous to the examination.

December 14, 1928: At 8 a.m. examined both Interflash and A.G.A.

beacons. Weather mild with cold mist and fog; found the slightest trace of condensation on both lanterns, both about alike, not enough to wet finger when rubbed over glass, but enough to show finger marks.
December 17, 1928: At 8 a.m. examined lanterns. Weather slight fog and dampness mild. Found slightest trace of condensation on inner side outer lens both lanterns, about same in both Interflash and A.G.A.

At 3 p.m. examined both lanterns: had been fine rain since 10 a.m. Found condensation had increased in both. There was a considerable amount more in the A.G.A. than in the Interflash.
December 18, 1928: At 8 a.m. examined both Interflash and A.G.A. beacons. Weather clear, after an all-night strong wind and rain. Found both lanterns practically dry. A.G.A. lantern had slight moisture laying on lower prisms of outer lens that had not dried up at the time. Interflash lantern dry.
December 19, 1928: Weather cool (temperature 31°) and clear. Examined both Interflash and A.G.A. lanterns and found them both dry. *Ibid.*

Memorandum from J.T. Yates, November 27, 1928:

Mr. Lee of the Airways Division of the Bureau, on the phone regarding shipment of 15 lanterns from the A.G.A. Company, stating they had letter from A.G.A. quoting additional price of $3.00 each for adapters. Asked if we could furnish the adapters and was advised that we were making them, but had none ready for delivery at this time. He also stated they wanted the F-10-A connections installed on the piping and adapters furnished. He was advised that the A.G.A. contract did not require the furnishing of the adapters, and that if they were desire they would have to pay the A.G.A. Company additional for them. He stated that the gas tanks to be used with these outfits would be Prest-O-Lite tanks, under which conditions I advised that they install F-10-B connections to fit the Prest-O-Lite tanks on the piping and that they procure adapters later when they are required. He requested that we advise the A.G.A. Company as to the use of the F-10-B . He also spoke about a letter from the A.G.A. in regard to additional piping which he did not understand. I advised him that recently while at the A.G.A. Company's plant I was shown a memorandum that was sent to the A.G.A. by the Bureau requesting to fill out and give the additional price they would require for furnishing piping for towers higher than the 20-foot towers for which piping was covered by the contract; that A.G.A. had furnished these prices and Bureau had in turn acknowledged

same and so doing stated that the acknowledgment was not an order for furnishing the piping. The Bureau then later sent to A.G.A. a list of the various stations where additional piping would be required, but did not cover same with an order. They requested that we advise the A.G.A. to ship the 15 lanterns by express to the places for which they already had shipping instructions to furnish and install piping called for in the list and to fit the piping with the F-10-B connections and that they would send an order covering the additional length of piping furnished on account of the higher towers. *Ibid.*

Letter from J.T. Yates to the A.G.A. Company, November 28, 1928:

In confirmation of the above reference to telephone conversation you are advised that the Bureau has by telephone directed this office to instruct you to ship the 15 lanterns referred to in your letter to the Bureau as being ready for shipment by express and to install F-10-B pipe connections on the piping and to omit furnishing the adapters. You are also to furnish additional piping required for the additional height of towers and the Bureau will later send you an order covering the furnishing of additional lengths of piping. *Ibid.*

Memorandum Regarding Test of Airway Route Beacons from J.T. Yates, November 29, 1928:

On morning of November 29, 1928, examined the three lanterns. Weather cloudy, temperature mild, slightly damp air. The A.G.A. lantern and Interflash lantern that have been remodelled by Third District were perfectly dry inside of lantern and on inside of outer lens. The other lantern of Interflash, which is latest lantern submitted by them, and one in which they insalled new uptake flue on Movember 17th, was covered with condensation on inner sides of 18" lenses. *Ibid.*

Memorandum Regarding Test of Interflash Airway Route Beacon from J.T. Yates, November 30, 1928:

On morning of November 30, 1928, examined all lanterns. The weather was warm with slight drizzling rain.

The A.G.A. lantern and Interflash lantern On which changes were made in 3rd District were dry, except for a very slight deposit of condensation on inner side outer (18") lens. The other Interflash lantern, the last submitted and changed by them, was likewise dry, except on inner

side of outer lens, but there was a great deal more condensation then in the other two lanterns, and the outside of secondary uptake flue on this lantern was so hot the hand could hardly be borne on same, while on the other two lanterns this flue was cool.

The Interflash lantern changed in the 3rd District was returned to shop to have main on inner uptake flue altered by removing the necking at the top to increase this part of flue to its full size and also have the small ball baffle over the top of this flue removed to further increase the draft through this inner flue. *Ibid.*

Memorandum Regarding Test of Interflash Airway Route Beacon by J.T. Yates, November 30, 1928:

The Interflash lantern altered by 3rd District was taken into shop this a.m. Top of inner uptake flue reamed out to full diameter of pipe, and bell deflector removed from over this flue. Lantern again placed in operation at 11:15 a.m. *Ibid.*

Memorandum regarding test of Interflash Airway Route Beacon bu J.T. Yates:

On Dec. 1st representative of Interflash came to cut away casting to increase air inlet space and install new baffle to insulate top of inner uptake flue. At that time all lenses were wet from previous rain.

On morning of Dec. 2nd examined all lanterns. Found water laying on bottom prisms of A.G.A. and first Interflash lantern, but the Interflash lantern that they changed on Saturday had dried up completely. On this lantern the outside uptake flue and top of lantern were much cooler than heretofore. *Ibid.*

Memo from H.B. Bowerman, Acting Commissioner of Lighthouses, to Superintendent of Lighthouses, Staten Island, December 4, 1928:

In acknowledging your letter of November 28, with copy of your letter to the American Gas Accumulator Company of the same date and memorandum of telephone conversation with the Bureau of November 27, you are advised that the Bureau has requested the AmericanGas Accumulator Company in letters of November 10 and 15 to include the necessary piping for the various heights of tower on the following Government bills of lading:

B/L	Acct. T. Beacon	Tower height	Destination
C-109022	2	51"	Truckee, California

C-109022	2	75'	Truckee, California
C-109022	1	20'	Truckee, California
C-110099	1	51'	Truckee, California
C-109021	6	20'	Lovelock, Nevada
C-109088	12	20'	Lovelock, Nevada
C-109023	14	20'	Battle Mountain, Nevada
C-110097	1	20'	Battle Mountain, Nevada
C-109024	2	75'	Elko, Nevada
C-109024	11	20'	Elko, Nevada
C-109025	20	20'	Wendover, Utah
C-109025	4	51'	Wendover, Utah
C-109026	4	20'	Salt Lake City, Utah
C-110063	1	51'	Carson, Iowa

> You will note from the above that they have been requested to supply extra piping with route beacon for four 75' and eight 51' towers. The necessary piping for 20' tower installations is included in the contract.
>
> It is requested that you advise the American Gas Accumulator Company to include the cost of extra piping in their voucher for payment at unit prices for extra tubing shown in equalization order dated November 8, 1928. *Ibid.*

Memorandum regarding test of Interflash Airway Route Beacon from J.T. Yates, December 4, 1928:

> Examined all lanterns. Found slight moisture in all lanterns, very slight in A.G.A. and last lantern remodelled by Interflash, more in first lantern. At 11:30 a.m. examined all lanterns. Found that A.G.A. and last Interflash lantern had dried up, first Interflash lantern had not. There was no moisture on the inside of metals parts of lanterns, same only on inside outer lens. *Ibid.*

Test of Interflash AirwayRoute Beacon by J. T. Yates, December 5, 1928:

> On a.m. this date examined all lanterns. Weather moderate, S.E. wind, find rain, rain had been falling for about two hours, damp all night. Both A.G.A. and last Interflash lantern showed very slight condensation on inner side of outer lens. Not enough to wet fingertip when rubbed over them, but enough to show marks of finger when rubbed over lens. The other (older) Interflash lantern showed considerable more. *Ibid.*

Memorandum regarding test of Interflash Airway Route Beacon by J.T. Yates, December 6th, 1928:

At 8 a.m. examined all lanterns. Weather cool and clear,

No dampness or condensation in A.G.A. or last Interflash lanterns, small amount on inner side outer lens of first Interflash lantern.

The last remodelled lantern of Interflash appears to be equal to A.G.A. in matter of condensation and somewhat superior in matter of soot deposit and is in acceptable condition. Many alterations on the lantern of termporary construction. Interflash to incorporate the change in lantern in a permanent manner and submit to final test. *Ibid.*

Memo from J.T. Yates to Commissioner of Lighthouses, December 10, 1928. Subject: Defective acetylene piping

This matter was taken up with the American Gas Accumulator Company, who stated that they would do anything within reason to make this matter satisfactory, but stated that in their opinion the piping and fittings when sent from their plant were as good as they could be made, in which this office concurs, for all of the piping was examined and appeared to be of good quality, and this office feels that to require the American Gas Accumulator Company to replace this piping without defective piping being returned to this depot so that it be examined by the American Gas Accumulator Company would be an injustice to them.

There are certain instances in the copper covered piping where brittle copper is encountered so that the cracks in the copper will occur regardless of how carefully the bending is done, but such defects are not of a frequent occurrence. It may be stated that the manner in which this piping is being installed by having the connections brazed in place before the pipe is bent has been found to be a very unsatisfactory one in this district, for it is very difficult matter to make any bends near the ends of the pipes without either cracking the copper cover which has been heating in brazing or starting the brazing. For this reason this matter was taken up with the Chief Engineer of the Airways Division and it was decided that this pipe should be furnished and fittings installed and brazing done in the field after pipe was bent, in consequence of which a supplemental agreement was entered into with the American Gas Accumulator Co. On their first contract for airway route beacons to furnish pipe and fittings in place of pipe made up with the fittings on the end, for it was felt certain

that if the fittings were installed on the pipe and attempts made to bend same, the trouble which has now been encountered would be encountered. A considerable amount of care is necessary in the bending of copper covered steel tubing in order to bend same without cracking the copper cover. A bend of 2" radius is about the smallest that can safely be made and even with same it sometimes happens that the copper cover is cracked. It may be stated that it is the practice in this district where small cracks are found in the copper cover to smooth same off and cover with solder in order to protect the steel piping from the weather, which has been found a very unsatisfactory method of repair. It is requested that all piping which has been found defective and that it is desired to be replaced, be returned to this depot for examination by the American Gas Accumulator Company. *Ibid.*

Handwritten note of phone message, 122/10/28:

AGA Co. (Mr. Iglar) phones will have 25 airway lanterns ready for inspec. at 2 p.m. tomorrow. I asked if some wouldn't be ready earlier in day so we could finish inspec. tomorrow. Said would find out & call me.

Mr. Iglar phones can start inspec. of lanterns 10 a.m. tomorrow. *Ibid.*

Memo from J.T. Yates, December 11, 1928.
Subject: Airway Beacons – Bureau contract Co-407, Order 29-1039:

On this date proceeded to Elizabeth, NJ, and inspected 25 airway beacons at the plants of the American Gas Accumulator Co., made by them on account of Bureau contract.

Flashers were operated and burners tested, and after minor adjustments were made, were found to be in accordance with plans and specifications.

These lanterns were found to be in accordance with the plans and specifications and therefore stand accepted.

Accepted:

Lantern	Flasher	Governor
No. 545	12330	20346
570	etc.	etc.
557		
Etc.		

T. Javoroski, Jr., Mechanician

Fwo:FM Office of Superintendent of Lighthouses, Staten Island, NY, 3rd

District, December 12, 1928 *Ibid.*

Special Requisition, DEPARTMENT OF COMMERCE, LIGHTHOUSE SERVICE December 11, 1928, by F.C. Hingsburg, Acting Commissioner of Lighthouses Superintendent of Lighthouses, Staten Island, NY

It is requested that the articles specified below be shipped from Staten Island, NY.

Quantity	Purpose and description of articles or services	Estimated cost
	Acetylene lantern, 300 m.m. (Acetylene blinkers)	
	Ship to Assistant Secretary of Commerce for Aeronautics, % Harrison-Wright Company as follows:	
1	Dry Lake, Nevada - for installation on 20' tower	300.00
1	Moapa, Nevada - "	300.00
2	Nada, Utah - 1 for 20' tower & 1 for 51' tower	600.00
1	Bloom, Utah - for installation on 20' tower	
2	Ship to Assistant Secretary of Commerce for Aeronautics % Muhleman and Kayhoe, Inc., Birmingham, Ala. for 51' towers	600.00
	The above acetylene lanterns covered by your Order No. 28426 and request for purchase made by Bureau on Form 98. Airways Requisition No. 3, dated August 7, 1928. Reference is made to 3rd District Sk. 410.	
	Acetylene Route Beacons	
	Ship to Assistant Secretary of Commerce for Aero. %Harrison-Wright Co. as follows:	
2	Dry Lake, Nev. - for installation on 20' towers	771.00
2	Moapa, Nev. - "	771.00
1	Little Field, Ariz. - "	385.00
2	Bloomington, Utah - "	771.00
2	Leeds, Utah - "	771.00
2	Pinture, Utah - "	771.00
6	Cedar City, Utah - "	2313.00
6	Nada, Nev. - "	2313.00
6	Milford, Utah - "	2313.00
3	Black Rock, Utah - "	1156.00

10	Acetylene route beacons, ship to		
	Bloom, Utah - for installation on 20' tower		3855.00
4	Toplift, Utah -	"	1542.00
3	Tooele, Utah -	"	1156.00

Acetylene route beacons covered by your order No. 28026, and request for purchase made on Form 98 Airways Requisition #1, dated July 6, 1928 (Bureau #206)

Piping should be furnished in accordance with Airways Division Drawing 528 for 20 ft. and with 3rd District Sketch No. 410 for 51 foot towers. All should be fitted with F-10a connection, adapter for F-10A (3rd District Sk. 256B) and aluminum washers F-13A

CC-Worthington
-Airways
-Finance
-Files
-Harrison-Wright Co.

Airways req. #4

Payment to be made from funds alloted: APPROPRIATION
The above amount has been charged against the allotment of Air Navigation Facilities 19929 *Ibid.*

Memo from F.W. Ockenfels, Asst. Superintendent, General Depot, Staten Island, to Commissioner, December 20, 1928.
Subject: adapters for connections for 300 mm. Airway Lanterns, Order 28426:

It is noted that F-10a connections and adapter for F-10A, Sketch #256B, are called for. It also states that they are to be same as installations made by the American Gas Accumulor Company. As all outfits sent ouit by the American Gas Accumulator Company for the 100 airway route beacons had the F-10B connections, the reference to their connections have this office in doubt as to what is desired.

In Connection with this matter, attention is invited to the fact that the gas outlet on the Commercial and Air Reduction Company cylinders are horizontal, while on the Prest-O-Lite Company cylinders it is vertical, and if the straight adapter as shown on Sketch #256B is used it will mean a

re-bending of the pipe each time a different type tank is used, which will soon destroy the piping. This can be overcome by the use of the side outlet adapter, F-10A to F-10B, as shown on Sketch #256D, print attached, and this office would recommend the use of this adapter in place of the straight one shown on Sketch #256B. As the piping for the airway route beacons sent out by the American Gas Accumulator Company has the F-10B connections, they will require an adapter F-10B to F10A same as straight one of Sketch #256B, except it will be made with a side outlet. This district will have same designed on sketch the same as others if Bureau considers the use of the side outlet adapters desirable. *Ibid.*

Memorandum from J.T. Yates regarding test of Interflash Aurway Rioute Beacon, December 21, 1928:

At 8:30 a.m. weather cool, clear, temperature 28°, examined both A.G.A. and Interflash lanterns; found them both dry. Removed the asbestos wicking that had been installed to plug connection between inlet and outlet air chambers in hood.

December 22, 1928:

At 8:30 a.m. examined both Interflash and A.G.A. beacons, weather cool (26°), clear slight dampness in air.

There was a great amount of condensation on inside of outer lenses on Interflash lantern. It had formed so that it had run down over the prisms and had frozen on same so that entire inside of lens was covered with ice. At same time there was only a very slight film of condensation on the A.G.A. lantern, not enough so that it could be seen from the outside of the lantern.

The above tends to show that the cause of condensation on this lantern is due to the mixing of warm air and cool air in the outer hood, which during the test had been prevented by the space connecting the two passages being closed by a strand of asbestos wicking, which was installed temporarily for test purposes.

Inteflash Signal Corporation advised by ‘phone of above results.

December 23, 1928:

Examined Interflash lantern, weather cool (30°), clear, slight moisture.

Found the inner side of outer lens of Interflash lantern very wet. Water had run down over prisms and formed a pool in bottom of lens frame; also metal part of lantern wet inside. At same time A.G.A. lantern

showed only slight deposit of condensation on inner side of outer lens.

December 24, 1928:

On morning of December 24th examined both lanterns - weather cool, 32°, damp, heavy frost. Found inner side outer lens of Interflash lantern very wet. Water had run off prisms filled the space in lens frame and run over and into bottom of lantern forming a considerable pool; also the inside of metal parts of lantern were wet with condensation. At same time A.G.A. lantern showed a slight film condensation on inner side of outer lens. *Ibid.*

Memorandum regarding test of Inteflash Airway Route Beacon, from J.T. Yates, January 1, 1929:

On January 1st examined Interflash lantern during light misty rain that had endured for 12 hours previous; found the inner side of outer lens both Interflash and A.G.A. beacons covered with condensation, both about the same, not enough to run on either.

January 2, 1929:

On morning of January 2nd examined both latners, weather cool and clearing after fog for 18 hours up to 10 p.m. January 1st. Found condensation on both lanterns, but same was drying up and had run down on to bottom part of prisms. The Interflash showed slightly more moisture than the A.G.A.; also on the Interflash found condensation on inner side of metal part of lantern, but on lower side of door flange only. In investigation to determine cause of condensation at this one point only, found that the door had not been closed tight and there had been an air leak around this point due to the fact that the door frame hits on the taper before coming in contact with the rubber gasket, and it is necessary to set clamps up very hard to stop the air leak around the door, which is liable to break the lenses; also this lantern has a 3/16" rubber gasket to in of 1/4" called for in specifications. Inteflash Company's attention was called to this defect previously.

January 3, 1929:

Examined both A.G.A. and Interflash lanterns, weather cool, 26° and clear; found just slight trace of moisture on inner side outer lens of A.G.A., Interflash had more, which had formed to a coating of frost. Lantern not as good as A.G.A. and not acceptable. Note that there is a considerable space between inside baffle plate and outer hood.

January 6, 1929:

On morning of January 6th examined both A.G.A. and Interflash lanterns after a heavy beating rain of 26 hours duration and still raining slightly at the time of examination.

Found inner side of outer lens of both lanterns coated with condensation, so that it had just started to run. The A.G.A. had slightly more than the Interflash as water had run on 7 lower prisms on A.G.A., and only on 3 on the Interflash.

January 7, 1929:

Examined both; the Interflash was entirely dry, water still laying on prisms of the A.F.A.

January 8, 1929:

Examined both lanterns, weather cool, 20°, clear. Interflash perfectly dry; small amount moisture on lower prisms of A.G.A.

Ibid.

Memorandum regarding tests of 300 mm. Airway Beacon submitted by American Gas Accumulator Company on Order No. 28426, January 8, 1929:

On January 7, 1929, Mr. Rhodes and Mr. Merrill of the American Gas Accumulator Company called at this office and left a sample 300 mm. Airway lantern for inspection and test.

On January 8th an inspection of the lantern was made and following found:

The spaces of screws in slots for holding chimney support are irregular and it is difficult to remove shade and support without removing screws so that there is a danger of breaking the shade in its removal or replacement.

Part of the tie rods in this lantern are straight and some are bolted. They were made in this manner so that the most suitable type could be selected for use on the remaining lanterns. The tie rods for the remaining lanterns are to be bent at the ends and on a straight line between attachment bolts, the bars to be twisted so that the edge of the bar will be on the focal line.

The filter is not located so as too interfere with the attachment of the sunvalve piping and connections. It is to be located on the opposite side from the sunvalve boss and piping arranged to suit.

The two brass knobs on boring of chimney support appear to be unnecessary and should be omitted as there is ample room to grasp the side of the shade holder when removing or replacing

same.

The top casting is made of what appears to be cast iron in place of cast bronze as called for in the specifications.

The ventilation of this lantern appears to be unnecessarily restricted. The are of the inlet air holes through the outer hoods is much less than the area of the uptake flue, which will necessarily restrict the amount o air that is drawn through the lantern and result in poor ventilation and an unnecessary amount of condensation; also the outlet air passages appear to be to extensively baffled as the current of air is baffled at four different places, which will also restrict ventilation. As soon as weather will permit, this lantern will be given an air and water test and as soon as same is completed it will be placed under a burning test to prove the system of ventilation. *Ibid.*

Memorandum regarding test of 300 mm. Airway Lantern on account of contract with American Gas Accumulator Company, from J.T. Yates, January 10, 1929:

On January 10th the lantern was set up on the dock and connected and placed in operation.

A stream of water from a 1/4" nozzle was placed down on the top of lantern from a height so that the water hit the lantern in drops. At the same time a jet of air from a 1/4" nozzle at 100 pounds pressure was played against the lantern to resemble as far as practicable conditions that would be encountered during a heavy driving rain. After the lantern was opened, no water was found inside of lantern except a small amount that had come in around the cover of the sunvalve opening cover plate. This plate should be provided with a gasket.

A jet of air from the 1/4" nozzle was then directed against all parts of the lantern at a distance of about 5 feet and flame and pilot were not affected by same.

A jet of air from the 1/4" nozzle at 100 pounds pressure was then held directly against the screen in way of the inlet and outlet air passages and flame or pilot not affected by same.

The lantern was found satisfactory as far as these tests were concerned, with the exception that a gasket is needed under the sunvalve cock opening cover plate.

The lantern will next be tested by placing in a room under heated temperatures and will then be given a burning test to determine its

qualities in regard to condensation, etc. *Ibid.*

Letter from J.T. Yates to American Gas Accumulator Company, January 11, 1929:

The airway route beacon that has been at this depot for some months undergoing a burning test is now ready to return to your works for the installation of a new supporting frame for top lantern door, gaskets, baffle shields, etc., so as to place same in an acceptable condition. *Ibid.*

Letter from J.T. Yates to the Commissioner of Lighthouses, January 11, 1929:

The following prices were received from the American Gas Accumulator Company for furnishing the additional pipe fittings and installing the connections on piping for the above referred to lanterns [airway lanterns on Order #28426]:

For 20' tower - $11.00
For 51' tower - $29.00
For 75' tower - $41.00

These prices are considered reasonable and will be accepted.

This office has just ascertained that on previous shipments of piping the American Gas Accumulator Company have coiled same up into coils of two feet diameter, which puts a permanent set into the pipe and cover and results in excessive breaking of the covering, especially in cases where bends are attempted to the reverse of that in which the pipe was rolled. They have been directed to ship all pipe straight in the future.

Ibid.

Letter from F.C. Yawger, Mechanician, to Superintendent, 3rd District, January 23, 1929:

On January 23, proceeded to Elizabeth, NJ, and inspected 10 airway beacons at the plant of the American Gas Accumulator Co., made by them on account of Bureau contract. These lanterns were found to be in accordance with plans and specifications. Flashers were operated and burners tested and were found to be as per specification.

Lantern serial numbers with numbers of flashers and governor contained are as follows:

Lantern	Flasher	Governor
585	12396	20385
588	etc.	etc.
Etc.		

It is recommended that the aforenamed lanterns be accepted.

Ibid.

Letter from J.T. Yates to Interflash Signal Corporation, February 13, 1929: Subject: Liquidated Damages, Order #28026, dated Sept. 18, 1928, 100 Airway Route Acetylene Lanterns, Contract #03a-911, dated August 22, 1928. Purchase Voucher attached:

The aforementioned order was not completed within the time specified in the contract, and liquidated damages are involved. In view of the fact that this office has no authority to decide on liquidated damages, check in the amount of $36,858.43 has been forwarded to you under separate cover.

Statement in detail is as follows:

Due to be delivered	Inspected and accepted	Value	Delay in days	Liquidated damages
1928	1929			
Nov. 19	Jan. 18 (1)	$ 385.50	60	$ 15.42
	Jan. 24 (6)	2,313.00	64	101.77
	Feb. 9 (18)	6,939.00	82	379.33
Nov. 29	Feb. 9 (25)	9,637.50	72	462.60
Dec. 9	Feb. 9 (25)	9,637.50	62	398.33
Dec. 19	Feb. 9 (25)	9,637.50	52	324.10
		32,550.00		1,591.57

This method of settlement is adopted in order that you might receive as much as possible of the money due you without further delay. If you so desire, you may submit claim for the aforementioned deduction of liquidated damages, voucher for which purpose is attached. *Ibid.*

Memorandum regarding test of 300 MM. Airway Lantern submitted for test by the American Gas Accumulator on account of Order #28426 on contract proposal #27902, February 25-26, 1929:

Lantern was connected up and tested for wind and weather proofness.

A stream of water from a ½" pipe was allowed to fall over the lantern from a height so that the water hit the lantern in drops inn the form of rain. At same time a jet of air from 1/4" nozzle at 100 lbs. Pressure was directed against the lantern from a distance of 4 feet, during which no water entered any part of the lantern.

A jet of air from a 1/4" nozzle at 100 lbs. pressure was directed

against the lantern at a distance of 4 feet, and it was noted that it caused the flame to tail up slightly. The nozzle was then moved up to within 2 feet of the lantern and when played against the top part of the ventilator caused the flame to distort, flatten down and smoke. It was not affected so much when jet was directed against the lower part of the ventilator in vicinity of air intake openings. After test was completed, lantern was removed by American Gas Accumulator Company for alterations.

On February 26, 1929, the American Gas Accumulator Company brought the lantern back for further test after having made some alterations to ventilation. On the occasion lantern was tested with air only. When jet of air from 1/4" nozzle, 100 lbs. pressure, was directed against the lantern at a distance of 2 feet it caused a decided flicker of the flame, not as much as during test on the 25th, but sufficient to cause excessive smoke and poor flame. *Ibid.*

LSB, Vol. III, No. 61, January 1929:

Important progress was made during the fiscal year in extending and improving airway lighting, including improvement of lighting equipment and apparatus. About 2,450 miles of airways were lighted during the year and 520 aids to air navigation established. At the end of the fiscal year a total of 5,877 miles of airways were lighted with 1,275 lights in operation.

Memorandum from J.T. Yates regarding test of 300 MM. Acetylene Airway Lantern submitted by American Gas Accumulator Company on account of Order #28426 on contract #27902, March ?, 1929:

On March 1st lantern was returned for test after attention to ventilators. It was tested with air in usual manner, and when nozzle was held two feet from lantern there was a decided flicker to flame, and it was very bad when held close to lantern.

On March 5th the lantern was returned again and tested with air and was found to be windproof under all tests. The American Gas Accumulator Company requested further tests with some of the baffles removed. When they took lantern apart it was noted that ventilation had been very much restricted on the inlet so much so that I doubt if it would function without excessive condensation. A.G.A. evidently did not desire to have it go on test for condensation in that condition. With baffles in question removed, lantern was not satisfactory, but was better than during

test of March 1st. Lantern was removed byA.G.A. Company for further alterations. RG26 E 1(NC-63) Boxes 161

Memorandum from J.T. Yates regarding test of 300 mm Airway Beacon submitted by A.G.A. Co. under account Contract C3a-961, proposal No. 27902, March 7th, 1929:

The A.G.A. Co. made alterations to inlet ventilator and returned lantern for test. It was tested in the usual way with compressed air, and was found to be entirely windproof. Aid from a 1/4" nozzle was held directly against the screen of both inlet and outlet ventilators and flame was not affected by same. Lantern was removed by the A.G.A. Co. To make the alterations in a more permanent manner after which it is to be returned for condensation test. *Ibid.*

Memorandum from J.T. Yates regarding test of 300 MM. Airway lantern submitted for test by the American Gas Accumulator Company on Order #28426 on contract proposal #27902:

Lantern was subjected to air test to ascertain windproofness. Air from 1/4" nozzle at 100 lbs. Pressure was directed against lantern from a distance of 4 feet to within 2 inches of all parts of the ventilator, and flame of lantern was not affected in any way, so that lantern can be considered thoroughly wind-proof.

The lantern was then setup on top of test shed for condensation test. If lantern is found satisfactory in condensation test, it will be approved with the understanding that the lower edge of inlet baffle is to be flanged down outside the boss of casting in place of being secured to top of same with screws and shellac joint as at present, and that a larger mesh perforated metal be used for but screen; also subject to changes, etc. as stated in memorandum of January 6, 1929. *Ibid.*

Memorandum from J.T. Yates regarding test of 300 MM. Airway Lantern Submitted for Test by American Gas Accumulator Company on Order #28426 on Contract Proposal #27902, March 18, 1929:

On March 14th lantern was returned to depot at 4:30 p.m. by American Gas Accumulator Company and was again placed in operation on test shed.

At 8 a.m. on March 15th examined lantern, weather foggy and hazy, comparatively dry, temperature 46°: found lantern dry throughout; flame

of light flickered, appeared high and light of long duration. Same found to be due to a broken burner, which was replaced by representative of American Gas Accumulator Company.

At 8:20 a.m. March 16th, weather heavy, damp, fog, which had existed for 18 hours previously, temperature 52°, examined lantern and found it to be practically dry, no condensation could be seen. Upon rubbing fingers over inside of fresnel lens found a slight coating of steam about the same as would be obtained from blowing breath on glass, but no perceptible dampness could be detected in same by fingers. It is considered that if lantern is found equally as good during rain that it will be satisfactory for all purposes.

March 17th, weather cool high wind, clear, lantern dry.

March 18th, weather cool, clear, temperature 41°, lantern dry. On this date tested lantern for wind-proofness. On playing air fro, 1/4" nozzle 100 lbs. pressure, against ventilator, it affected the flame to the degree that it would not ignite regularly, and caused it to flicker badly. A.G.A. were advised by phone of the trouble with lantern. *Ibid.*

Memorandum from J.T. Yates regarding Lens and Cap for 300 MM. Acetylene Airway Beacon, March 29, 1929:

On March 28, 1929, Mr. Hingsburg and Dr. Gage were at this office, and the matter of possible changes in the glassware for this lantern was discussed and likewise an examination was made of the lends and cap now used on this lantern.

Some re-arrangement to improve the light beams from this lantern was considered desirable, but just what was not determined, the matter having been left until further experience had been had with this lantern as it is at present, the matters considered being the increasing of the opening at the top of the cap to assist in the ventilating system, also of having the light from the cap concentrated in a beam of smaller angle. During observations of the lantern the following was noted:

At an angle of 6° light came from the lower prisms of fresnel and lower prisms of cap; no light came from the belt of the fresnel.

At an angle of 10° a small amount of light came from the lower prisms of the fresnel, none from the center, and a small amount from the middle section of the cap. The light from the cap was of slightly higher intensity than from the lower prisms of the

fresnel.

At 15° no light from fresnel; light came from top prisms of cap only; there was a very small amount from the lower prisms of the cap.

At an angle of 20° no light from the fresnel; light from upper and lower prisms of the cap only with a very small amount of stray light from the center prisms of the cap. *Ibid.*

Letter from F.C. Hingsburg, acting Commissioner of Lighthouses to the Superintendent of Lighthouses, Staten Island, May 3, 1929:

It is found that there are needed in the Sale Lake District for top lantern installation on acetylene routing beacons 119 off the 300 m/m lanterns in addition to the fourteen ordered shipped to that District. No doubt there are a few more of these lanterns required for other districts in addition to those already ordered shipped.

It will apparently be necessary to place an order for another lot of those lanterns, and the Bureau desires to know whether or not the lantern made from the existing specification is considered satisfactory, and if not, what changes should be made in order to secure the best lighting results. Advice as to the degree of completion of the existing order and probably dates of shipment of the lanterns for which you have received shipping instructions is requested.. *Ibid.*

LSB, Vol. III, No. 67, July 1929:

The airways division of the Lighthouse Service is now using a Fairchild cabin monoplane, the N.S.-7, which is equipped for carrying four passengers in addition to the pilot, for inspecting air navigation facilities. The airplane is powered by a wasp 400-horsepower air-cooled motor and is being equipped with the latest type radio and navigation equipment in order to properly certify the adequacy of the aids to air navigation, and landings are made at intermediate landing fields for the purpose of inspection.

A recent 10-day inspection trip was made in the airplane N.S.-7 by Superintendent of Lighthouses F.C. Hingsburg, chief engineer of the airways division, and was piloted by W.T. Miller, principal airways extension superintendent. Starting from Washington, DC, the flight was made to Pittsburgh, Columbus, Dayton, St. Louis, Kansas City, Moline, Newton, Iowa City, La Crosse, Milwaukee, Chicago, Cleveland, New

York, and back to Washington.

The new proposed air route from Washington to Pittsburgh was flight checked and the feasibility of the route determined. The Army airway between Uniontown and Dayton was flown, and the new air terminal of the Pennsylvania Railroad at Columbus, Ohio, where connections are made to the Transcontinental Air Transport, was inspected. Beacon lights and intermediate landing fields on the lighted section of airway between Dayton and Columbus were also inspected from the air.

Six new radio communication stations now under construction by the airways division at St. Louis, Kansas City, Iowa City, La Crosse, Chicago, and Bryan for broadcasting hourly weather conditions were inspected. These stations are equipped with 2,000-watt radiotelephone transmitters.

The intermediate landing fields and lighting facilities on the Kansas City - St. Louis Airway were inspected, also a section of the Kansas City - Chicago Airway. The twelfth lighthouse district office at Milwaukee, Wis., was visited, and Airways Engineer I.D. Marshall was a passenger over the Transcontinental Airway between Chicago and Cleveland, the beacon lights and intermediate fields on the route being inspected from the air. The new radiobeacon at Goshen was flight checked, adjusted to mark the airway course, and placed in operation.

The airway radiobeacon making the route over the Allegheny Mountains between Cleveland and New York were flown over and checked, the airplane landing at the fields at which these beacons are located and the stations inspected and adjusted. Voice broadcasts of weather information were received each hour while in flight, and the landing conditions at the terminal and principal landing fields were received by radio each hour very clearly and distinctly.

LSB, Vol. III, No. 68, August 1929:

Further illustration has been made by the airplane for inspecting air routes. An interesting inspection trip took place on June 17, 1929, the inspecting officials including besides Mr. Hingsburg, chief engineer of the airways division, H.L. Beck, superintendent of the sixth lighthouse district. The inspection covered the section of the Atlanta - New York Airway from Richmond to Atlanta and was made between 10 a.m. and 6 p.m., inclusive of four stops en route.

This is the first inspection of airway routes by airplane which has been participated in by the superintendent of a lighthouse district, and it was found by Superintendent Beck that the information gained in this way would be of material assistance in the administration of the airways under the jurisdiction of his district.

The experience of direct observation of the conditions of air navigation was found of great value in giving as appreciation, not otherwise obtainable, of the extent to which air navigation differs in exactitude from marine navigation by "dead reckoning"; of how inconspicuous the airways beacons and intermediate landing fields are from the air in the daytime; and how necessary to safety in foggy weather are the directional radiobeacons.

Memo to the Commissioner of Lighthouses, November 19, 1929.
Subject: Requests for inspection of acetylene beacons manufactured by the American Gas Accumulator Company on Bureau contract Cc 487 Order 29-1039:

In compliance with request contained in the Bureau's letter referred to above [November 18 file 2017-A/4], there is shown below a list of the requests for inspection received by this office from the American Gas Accumulator Company by telephone, of the beacons furnished on the above contract:

11/3/28 - 14 beacons reported ready for inspection on 11/3/28
14 inspected and accepted 11/5/28
11/9/28 - 12 beacons reported ready for inspection on 11/12/28
12 inspected and accepted 11/12/28
11/16/28 - Arrangements made by this office with A.G.A. to have
2 beacons ready for inspection 11/20/28
2 inspected and accepted on November 19th but this office has no record of the request for inspection.
11/22/28 - 5 beacons reported ready at that time for inspection
Inspector sent 11/22 but no beacons ready
11/23/28 - 5 beacons reported ready for inspection at that time
15 inspected and accepted 11/23/28
12/10/28 - 25 beacons reported ready for inspection on 12/11/28
26 inspected and accepted 12/11/28
1/3/29 - 20 beacons reported ready for inspection on 1/4/29
22 inspected and accepted on 1/4/29

1/22/29 - 10 beacons reported ready for inspection on ½3/29
- 10 inspected and accepted on 1/23/29

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LSB Vol. IV, No. 2, February 1930: Endnote to article entitled "Development of Radio Apparatus at the Detroit Lighthouse Depot:

> "The above outlines briefly the work of the eleventh district pertaining to the development of radio aids to marine navigation. The rapid increase in air commerce in the past two years has necessitated a similar, though technically more difficult development program in connection with the application of radio to the civil airways. This program will be described at a later date."

LSB, Vol. IV, No. 6, June 1930, p. 24:

> The Lighthouse Service recently used established commercial transport passenger-carrying planes for inspection duty to good advantage. A saving in time of several days was effected by the general inspection officer of marine aids to navigation on his return journey from San Francisco to Washington. A plane was taken at Oakland, Calif., on April 12, the 365-mile trip to Las Angeles being completed in three hours. At 5 a.m. on April 15 a transport plane was boarded at Los Angeles for Kansas City, this part of the journey taking 12 hours, about one-third the time required by train travel.

LSB, Vol. IV, No. 7, July 1930, p. 27

> Report from commander and chief pilot of airship *Southern Cross,* Charles Kingsford-Smith: "We carried no radio compass. This valuable instrument is, in its present stage, too heavy for a trans-Atlantic plane which must carry so much fuel; but we made use of the direction-finding radio compass all the way across, for the ships all carry them. By means of the radio compass the operators and navigators aboard a vessel can obtain the bearing of another vessel, be it plane or steamer that is transmitting. . . . "

LSB, Vol. IV, No. 12, December 1930, p. 48:

> Continued progress was made in extending airways facilities. Lighting installation was completed on about 3,300 additional miles of airways, making a total of approximately 13,500 miles of lighted airways in operation, together with an extensive system of intermediate landing fields, and radio stations and range beacons.

LSB, Vol. IV, No. 15, March 1931, p. 62:

A successful landing in a thick blanket of fog, was recently made bu Charles Peeples, N.A.T. pilot, at Fort Worth, Tex. Enveloped by fog which he first encountered at the Red River, Peeples picked up the signals of the new airways radiobeacon, and approached Fort Worth. When these signals indicated that he was directly over th landing field, he banked his plane and made a successful landing. In describing the landing, the pilot said that nothing could be seen until he was nearly on the ground.

LSB, Vol. IV, No. 18, June 1931, p. 73:

A new type of revolving beacon, having two 36-inch lenses, is now available for marine work, having been developed in the airways division. Among the advantages which this beacon offers over previous types is that of two lenses. This amounts to a doubling of the light period, and makes it possible to double the number of flashes without speeding up the beacon.

Another important feature of the new beacon is the inner lens doublet which considerably shortens the focus and permits the mounting of two lenses with a single light source in a housing not excessively large. The inner doublet also facilitates changes in the color of the light, as either or both of the doublets may be of colored glass. [Specs follow]

Ibid, p. 75-76:

F.C. Hingsburg,, chief engineer, airways division, returned to Washington on June 25, having concluded a 5,400-mile aerial survey which included the proposed northern airway which would connect St. Paul, Minn., and Seattle, Wash. Leaving Washington on June 5, the journey was made by way of Bellefonte, Pa., Chicago, and Salt Lake City to San Francisco. Contacts were made with airways district personnel at both Salt Lake City and San Francisco, and later at Portland, Oreg.

From Seattle the route lay over the States of Idaho, Montana, North and South Dakota, and Wisconsin. This flight is a preliminary step to a detailed survey which Congress has authorized as a means of determining the feasibility of establishing a northern air route which would form a more direct connection between north Pacific cities and cities in the Great Lakes region.

On his inspection Mr. Hingsburg was accompanied by Lawrence C. Elliott, airways extension superintendent, who is to be in change of the northern airway survey.

"Aircraft radio in 1931 was still primitive. Few ground stations, and few aircraft, had radiotelephony. A flying operator had to send and receive in Morse code and transcribe the results while changing tuning coils in the set and adjusting a long trailing antenna to suit the frequency in use.; altogether a four-handed job, and one a pilot alone would have found overwhelming." [Tom Ferrell review of *Anne Morrow Lindbergh* in February 4, 2007 *New York Time Book Review*.]

LSB, Vol. IV, No. 4, December 1931, p. 95:

> Airways facilities were further extended during the year. Lighting installation was completed on about 2,283 additional miles of airways. The additional radio facilities established included 13 standard airway radio communication stations, 43 aural type and 2 visual type radio-range beacons, a number of radio-marker beacons, and telephone typewriter circuits aggregating over 3,000 miles.

LSB, Vol. IV, No. 34,October 1932, p. 136,:

> H.J. Walls, radio engineer, attached to the airways division, Lighthouse Service, was appointed a technical adviser representing the Department of Commerce at the International Radio Conference now being held in Madrid. The last conference was held in Washington in 1927; at this conference the present frequency band for radiobeacons was adopted.

LSB, Vol. IV, No. 36, December 1932, p. 139:

> During coastal flights an airship carries on navigation by lighthouses and similar aids exactly as does a surface vessel. On the recent return of the airship *Akron* from the Puget Sound region, the commanding officer reported the voyage as particularly interesting because of the high speed that was made after rounding Tartoosh. During practically the whole night, several lights were in sight at one time, and it required continuous thumbing of the light list to keep up the identification of lights.
>
> "By 1933 the Federal Airway System operated by the Airways Division comprised 18,000 miles of lighted airways containing 1,550 rotating beacons and 236 intermediate landing fields. Air Mail pilots routinely navigated the skies during the night, following the "signposts" of the rotating beacons." Schamel, T*he Develoopment of Night Navigation in the U.S., <www.atctraining.faa.gov>*
>
> "Standardized air-ground voice radios became available in the early 1930s

as more aircraft became radio equipped. Teletype was introduced to the ARS in 1928. One Circuit was available for all traffic, which included message traffic for other government agencies. A second circuit was added later, allowing weather information to be separate from flight information and administrative messages.

"The station keeper's duties remained pretty much the same. Service wasn't limited to just mail planes, though. Any pilot stopping at or calling the ARS could get weather information or make a position report. Search and Rescue duties were added to look for overdue aircraft. Specialists still did their own technical maintenance on radios and teletypes, and often maintained the airport's lighting aids.

"Pilots of the era came to rely on the dedication and professionalism of the station keepers, the pilot's only contact with the air traffic system. This reliance would continue, even with the addition of airport control towers in the 1930s. Tower controllers were specialized in that airport environment. The ARS controllers still provided the majority of services to pilots nationwide."

Schamel, *Flight Service History 1920 - 1998,* <www.atctraining.faa.gov>

LSB, Vol. IV, No. 43, July 1933, p. 155:

> In connection with a reorganization of the Aeronautics Branch in the Department of Commerce, the Airways Division was transferred from the Lighthouse Service on July 1, 1933. In a letter dated June 5, announcing this change, the Secretary of Commerce stated:
> May I take the opportunity to extend to the Bureau of Lighthouses my sincere thanks and congratulations for the splendid service they have rendered in the promotion of these all-important functions, aids to air navigation. This has been a signal service, and it is my wish that this testimonial be made a part of the record of the Bureau of Lighthouses, and all those who have made personal contributions, consider this also as addressed to them personally.

LSB, Vol. IV, No. 48, December 1933, p. 166: In Organization of the Lighthouse Service, Frederick C. Hingsburg, formerly Chief, Airways Division, is named Chief, Signal Division.

"The aeronautics Branch was renamed the Bureau of Air Commerce in 1934 to reflect its enhanced status within the Department. As commercial flying increased, the Bureau encouraged a group of airlines to establish the first three centers for providing air traffic control (ATC) along the airways. In 1936 the Bureau itself took over the centers and began to expand the ATC system. The

pioneer air traffic controllers used maps, blackboards, and mental calculations to ensure the safe separation of aircraft traveling along designated routes between cities.

"In 1938, the Civil Aeronautics Act transferred the federal civil aviation responsibilities from the Commerce Department to a new independent agency, the Civil Aeronautics Authority. The legislation also expanded government's role by giving them the authority and the power to regulate airline fares and to determine the routes that air carriers would serve." Wikipedia article

"By 1937, the air carrier industry had expanded so rapidly that the functional responsibilities for aviation activity within the Department of Commerce had become fragmented. For example, airways beacons had become the responsibility of the Department [Bureau] of Lighthouses while aviation maps had become the responsibility of the Coast and Geodetic Survey organization. This fragmentation and the lack of formal procedures for establishing aviation regulations resulted in numerous Presidential Executive Orders pertaining to air carrier issues. In an attempt to deal with this problem, the Bureau of Air Commerce published a biweekly magazine entitled, "Air Commerce Bulletin," to disseminate information about aviation operations and regulations.

"The inadequacy of the air Commerce Bulletins led to the passage of the Federal Register Act in 1937. The Federal Register Act made it mandatory that all federal regulations be codified into a Code of Federal Regulations.

"In 1938, as a result of a need to modify the Air Commerce Act and a disastrous air safety record in the preceding years, the Civil Aeronautics Act was enacted. The Bureau of Air Commerce was replaced by the newly formed Civil Aeronautics Authority (CAA). The CAA was given the additional authority to isse air carrier route certificates and to regulate airline fares." Chapter 2. The Federal Aviation Adminstration and Flight Standards: History and Organization Source ???

"The continued growth of aviation led to the Civil Aeronauutics Act in June 1938, creating the Civil Aeronautics Authority (CAA). The CAA took over many of the functions of the Department of Commerce and the ARS became the Airway Communication Station (ACS). Skill technicians were assigned for maintenance of the electronic equipment in the system. The basis of the Airway Facilities System was formed in the years before World War II." Schamel, *Flight Service History*, <www.atctraining.faa.gov>