THE COAST GUARD AT WAR

WEATHER PATROL

VII

This edition is designed for service distribution and recipients are requested to forward corrections, criticisms, and comments to Commandant, Coast Guard Headquarters, Washington, D. C., Attention Historical Section, Public Information Division.

duty springs directly from the manner of performing the duty. The present Ocean Station vessels remain as near as possible to a fixed position, observe no radio silence, can engage in SAR mission as desired since there is no requirement for continual evasive action to be taken to confound submarines.

To sum up, the war-time weather patrol was pretty much just that, he got the weather observations and kept himself moving around in a 100 mile radius taking great efforts to enhance defensive strength. The peace-time patrol sits on Station and provides a myriad of services besides the weather reporting, (aids to navigation, communication, search and rescue).

D. O. REED

FOREWORD

The differences in War-time Weather Patrol and Peace-time Weather Patrol can be pointed up best by a comparison between the respective instructions as issued to the vessels performing the duty.

Instructions for (War-time) Weather Patrol Vessels as promulgated by CTF 24 in his Operation Plan 1-43 are quoted in part below:

(1) Patrols will be maintained, as practicable within one hundred miles of the following positions:

Station No. 1 - Lat. 39° - 00'N, Long. 50° - 00'W
Station No. 2 - Lat. 54° - 00'N, Long. 44° - 30'W

(2) In proceeding to and from station make such speed as necessary to carry out schedule laid down by District Coast Guard Officer, First Naval District.

(3) While on station cruise at as high a speed as is practicable consistent with weather conditions and fuel requirements.

(4) While en route to and from, and while on station patrol general course being steered or zig-zag as radically as possible consistent with other requirements. Take all other practicable measures to enhance defensive strength. Attack enemy submarines and take such offensive action as may be practicable against surface vessels and aircraft.

(5) Report to Commander Task Force Twenty Four your arrival on and departure from station, and any temporary absence from an area whose center is the assigned stations and whose radius is one hundred miles, and reasons therefor. Include Commander Task Force Twenty Four as an action or information addressee on all operational messages transmitted after leaving base until return thereto.

(6) Make reports of enemy information to the Commander in Chief, United States Fleet, for action, Commander Task Force Twenty Four and Commandant, United States Coast Guard, for information.

(7) Carry out such rescue operations as may be practicable consistent with other obligations.

(8) Make weather observations and reports thereof as directed by the District Coast Guard Officer, First Naval District (at present these are contained in DCGO First Naval District Confidential Letter Op-610-601 of September 22, 1942.)

Vessels performing present (peace-time) weather patrol are governed by various instructions, excerpts from which are quoted below:

"Ocean Station vessels shall insofar as is practicable, when on station maintain position within the centre ten mile square, except when diverted, engaged in rescue operations, or when it is necessary to maneuver for greater safety of the ship and comfort of personnel ---"

Ocean Station vessels shall
"Transmit beacon signals for passing aircraft
Furnish radar fixes to aircraft on request
Furnish direction finder bearings on request
Be prepared at all times to give courses and distances to nearest airfield or seadrome.
Furnish weather information to enroute aircraft on request"

"Shall proceed to the assistance of a forced-landed aircraft or a vessel in distress within the limits of the ocean station the area of which is covered by the position indicating radiobeacon grid ---"

The differences in the conduct of the patrols is seen to exist in both the scope and manner of performing the duty. As to scope of the duty, the only thing in common with the two patrols is the program of weather observations, the peace-time patrol provides aids to navigation functions such as radiobeacon service, radar fixes, direction finder bearings, and giving other miscellaneous services, also the vessels will currently take an active part in distress communication in their area and provide SAR services more complete than the war-time vessels would attempt. This expanded scope of the

TABLE OF CONTENTS

PART I

WARTIME OCEAN WEATHER PATROL 1

Establishment of Ocean Weather Patrol 1
Surface Craft 1
Air Observation 1
Inadequacy of Merchant Ship Observation 1
Trans-Atlantic Air Traffic During the War 1
Meteorological Forecasting Essential to Successful Trans-Atlantic Flights 1
Atlantic Weather Patrol 3
Coast Guard Weather Ship in Last Atlantic Sub Saga 3

PART II

POSTWAR WEATHER PATROL 7

Pacific Weather Patrol 9
Special Equipment of Weather Patrol Vessels 9
Only Two Atlantic and Two Pacific Weather Stations in May 1947 11
Admiral Smith Stresses Importance of Ocean Weather Reporting 11
Coast Guard Cutter Stood By Downed Trans-Atlantic Airliner 25
A First Hand Experience 27

APPENDIX A 29
APPENDIX B 29
APPENDIX C 31
APPENDIX D 33
APPENDIX E 34

PART I
WARTIME
OCEAN WEATHER PATROL

ESTABLISHMENT OF OCEAN WEATHER PATROL

It was on January 25, 1940, that the Coast Guard in cooperation with the Weather Observation Service, was authorized by the President to use its newly modernized cutters, now capable of extended cruises, to establish, at the request of the Weather Bureau, an Atlantic Weather Observation Service. Five Coast Guard cutters took turns patrolling two weather stations, which were areas about 10 miles square, between Bermuda and the Azores, usually for 21 day periods. On February 10, 1940, the Coast Guard cutters BIBB and DUANE assumed Weather Stations 1 and 2 located at 35° 38' N, 52° 21' W and 32° 44' N, 41° 13' W, respectively. Their daily weather reports were designed primarily for the protection of the rapidly increasing trans-Atlantic air commerce. There were few trans-Atlantic scheduled flights prior to World War II. The Pan American Airways was operating clippers between New York and Lisbon via the Azores. In the winter the route was shifted southward. Other companies were preparing to enter the trans-Atlantic passenger business when, on the outbreak of war, practically all civilian aviation was displaced by the high priority of military aircraft and military operations. When, during 1940, Great Britian was suffering great shipping losses and the transportation by sea of planes became critical, risks were boldly taken to fly American bombers directly from Newfoundland to England. A third ocean weather station was made thereby necessary, located about 500 miles northeast of Newfoundland. The five cutters were now required to maintain three weather stations. When, in the summer of 1942, the operational control of this group was transferred from the Coast Guard to the Navy's U. S. Atlantic Fleet, the ships and personnel continued to be Coast Guard.[1] By July 1942, the first fighter planes were being flown across the Atlantic by way of a chain of U. S. Army airdromes bridging the ocean from Labrador to Greenland to Iceland. This new northern route required two more Coast Guard manned plane guard and weather stations, one midway between Labrador and Greenland in Davis Strait and the other in Denmark Strait between southern Greenland and Iceland. These were known as plane guard stations "A" and "B". Just prior to the invasion of Normandy in June 1944, three additional ocean weather stations, requested by the U. S. Army, were located in blank areas far out in the mid-Atlantic, and the British Navy established one ship weather station about 50 miles west of the British Isles. On October 21, 1944, eight more weather stations including two plane guard stations were established. By May 1945, therefore, a total of 16 stations had been established north of 15° latitude to give adequate weather observation and air sea rescue facilities to personnel traveling to the United States. Six more were between the equator and 15° N in the Atlantic.[2] Eleven of these stations were operated by a task force of 26 frigates[3] based regularly at Naval Operating Base, Argentia, Newfoundland, and rotating on a schedule which permitted visiting Bermuda, Greenland, Iceland and Boston.

1. The number and location of ocean weather stations, originally determined by the Weather Bureau in consultation with the commercial airlines, were during the war determined by the cognizant committees under the Joint Chiefs of Staff, primarily the Meteorological Committee of which the Weather Bureau, but not the Coast Guard was a member. With the establishment of the Air Coordinating Committee, that body recommended and approved the number and location of the stations.
2. See Appendix A for location of all weather stations.
3. See "C.G. at War - Transports & Escorts -Vol. I & II" for ship's histories of these patrol frigates.

SURFACE CRAFT

Six patrol craft and six sub-chasers were distributed at Bermuda, Azores, Newfoundland, and Iceland to cover the intermediate zones of air sea rescue as the planes approached terminal points. These vessels reported, by radio to shore, the surface weather conditions every three hours, significant weather changes as often as once every hour, and later made upper air observations four times daily.[1] They alternated 25 days at sea and 15 days in port.

AIR OBSERVATION

Meteorological observation for safe air navigation were also collected by airplanes flying from several strategic air fields in the North Atlantic area. These planes, equipped with weather instruments, made daily routine flights when weather permitted out over the ocean for distances of 500 miles or more, taking observations at altitudes varying from near the surface to 10,000 feet or higher. During 1945 such flights were being made from Bermuda, Nova Scotia, Newfoundland, Iceland, England, and the Azores. Weather planes often proceeded along the entire ocean route from one airdrome to another, generally in advance of large flights of transient aircraft. During the war this task was carried out by the U. S. Army from this side of the Atlantic and by the Royal Air Force for the eastern Atlantic.

INADEQUACY OF MERCHANT SHIP OBSERVATION

It has been proposed at times by those not familiar with the situation, that all necessary weather reports from the North Atlantic could be furnished by steamships plying the regular sea lanes. Unfortunately such scheduled routes leave large ocean areas seldom traversed. Furthermore, the daily number of weather observations essential to the safety of aircraft have become so technical and require such a high degree of accuracy, that it is impracticable for them to be taken by merchant ships.

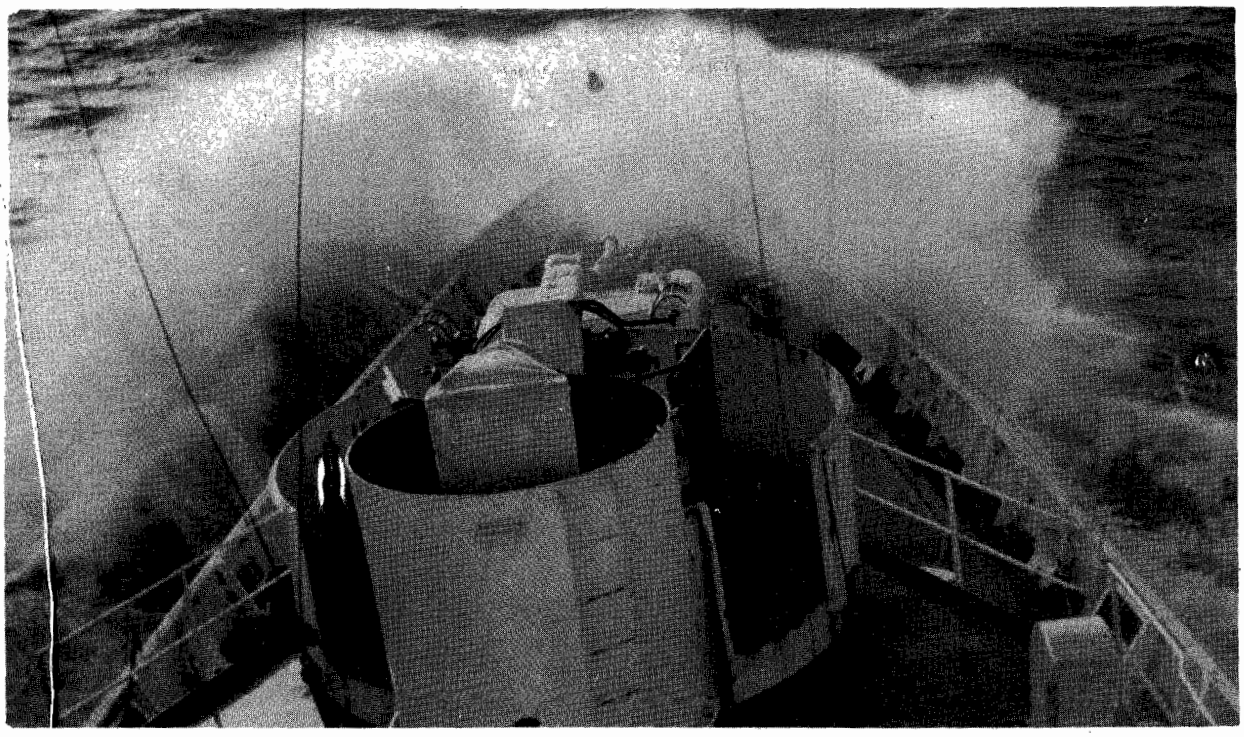
TRANS-ATLANTIC AIR TRAFFIC DURING THE WAR

Some idea of the justifiable size of the safety services in the post war era may be obtained from the volume of the trans-Atlantic air traffic during the war. During 1944, there were 8,641 tactical aircraft ferried eastbound and 100 westbound. Transport planes totaled 5,070 eastbound and 5,059 westbound. Other flights, including weather reconnaissance observations, and a shuttle service between Labrador, Greenland, and Iceland, and the United Kingdom totaled approximately 2,000 for the year. The total number of flights across the North Atlantic waters was therefore over 20,000, or an average of 54 flights per day. In addition there were some 50 flights per month by the Naval Air Transport between Newfoundland, the Azores, and Europe. Also about 100 trans-Atlantic flights per month were made by planes operated by commercial companies under wartime charter, including Pan-American and British Overseas Airways, Inc.

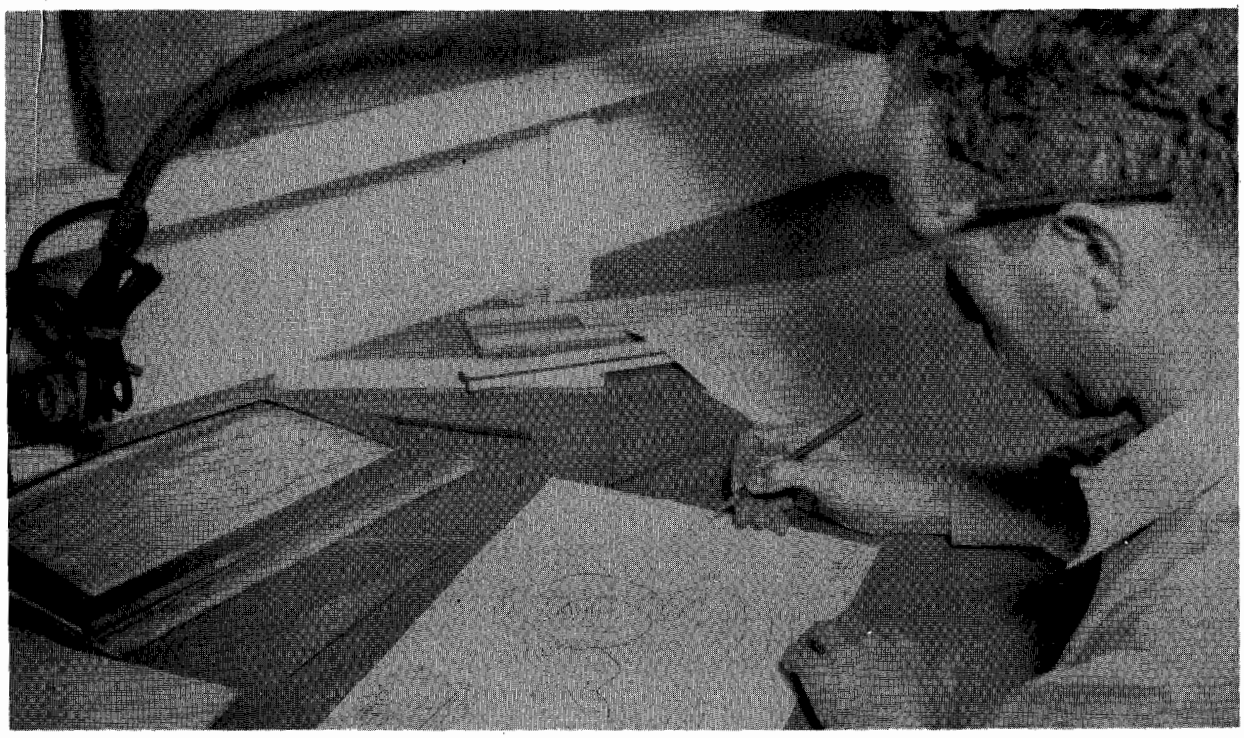
METEOROLOGICAL FORECASTING ESSENTIAL TO SUCCESSFUL TRANS-ATLANTIC FLIGHTS

The 20,000 successful North Atlantic flights in 1944 depended primarily on accurate meteorological forecasting. Planes move or stop on the signal of the airdrome weather officer.. While higher and faster flights will cause sterminess in the lower levels to assume less

1. The first U. S. upper air observations were made on the Ice Patrol vessels in 1949, being made and worked by Coast Guard personnel alone.



BLUE-GREEN WATER AND A SHOWER OF WHITE SALT SPRAY
BREAKS OVER THE BOW OF A COAST GUARD CUTTER
ON ITS WAY TO TAKE ITS STATION IN THE NORTH ATLANTIC OCEAN
FOR WEATHER PATROL



ABOARD A COAST GUARD WEATHER SHIP
THE WEATHER OBSERVER DRAWS UP A WEATHER MAP

and less importance, forcasting winds aloft, and selecting the most favorable flight levels, will continue to be vital. For safe flying over the United States, hundreds of observation stations are reporting weather hourly or oftener throughout the twenty four hours.'

ATLANTIC WEATHER PATROL

With the onset of World War II in Europe in 1939, surface weather reports which had normally been made by trans-Atlantic shipping were discontinued because of the radio silence imposed on belligerent shipping and because of the passage of the Neutrality Act, with the consequent laying up of United States ships in the European trade. The result was that practically no weather reports at all were being received from the North Atlantic Ocean area. At the same time American flag trans-oceanic flying was increasing and this activity required complete and accurate weather information. There was thus a manifest need for strategically placing ships which could provide the necessary meteorological data.

Therefore, in January, 1940, at the request of the Secretary of Agriculture (for the U. S. Weather Bureau) the President ordered Coast Guard cutters performing neutrality patrol off the Grand Banks withdrawn from the patrol and directed the Coast Guard to establish ocean weather stations with them. Two such stations were established early in 1940 between Bermuda and the Azores, with the Coast Guard providing the ships and communications facilities and the Weather Bureau the meteorological personnel and equipment. These 2 stations were continued until early in 1943 when 2 additional stations were established in the Davis and Denmark Straits off Greenland as an aid to the Army planes flying over the Northern route (Newfoundland, Labrador, Greenland and Iceland to Britain). The total number of stations was increased to 8 in 1944 because of further demands for more complete meteorological data to facilitate the expanding air operations, both trans-oceanic and over Europe. Three of these stations also performed duties as plane guard stations. In March, 1944, operational control of the entire weather patrol was turned over to the Navy because of military considerations. After VE-Day the biggest movement of aircraft in history began as personnel and planes were redeployed across the North and South Atlantic en route to the Pacific theater. To assist in this operation plans were laid for increasing the number of weather stations in the North and South Atlantic to a total of 22. However, of these only 20 were actually placed in operation. Two of the stations were operated by the British and 13 by the United States. For a period of approximately 3 months 2 of the U. S. Stations were actually manned by Brazilian vessels working out of Recife, Brazil. ~~At this time also all station vessels~~ assumed duties as plane guard vessels; that is they gave radio beacon and air-ground-air communications services and were prepared to assist in the event of ditching by aircraft.[1]

1. For a list of the Atlantic Weather Stations as ~~of May 5, 1945, see Appendix A.~~

COAST GUARD WEATHER SHIP IN LAST ATLANTIC SUB SAGA

A routine weather patrol in the mid-North Atlantic by a U. S. Coast Guard vessel during the first days of peace in Europe, turned into one of the last war dramas of that turbulent water route between America and Great Britain. Events cast the ship in two other Coast Guard roles — as warship and mercy ship, with a sad ending to her mercy role.

Commander by Lieutenant Commander Edward M. Osborne of East Hampton, Long Island, New York, the patrol frigate, USS FORSYTH, helped to take the Nazi super-submarine U-234 into custody on May 15, 500 miles off the coast of Newfoundland.

Later the same day the FORSYTH's doctor, Ralph B. Samson, 1635 East Columbus Street, Columbus, Ohio, was called upon to perform a major operation in mid-ocean on an American sailor who had been critically wounded aboard the German U-boat in the accidental discharge of a pistol.

And as a final ingredient to these events, Dr. Samson was assisted in the operation by the German U-boat doctor, who volunteered to try to help save the life of the American sailor.

The German sub, the prize U-boat taken by American water forces, was carrying high ranking officers of the German air force, battle plans, and aerial maps of strategic targets in the United States. She was reported on her way to Japan, and was carrying two Japanese, both of whom committed suicide prior to her surrender.

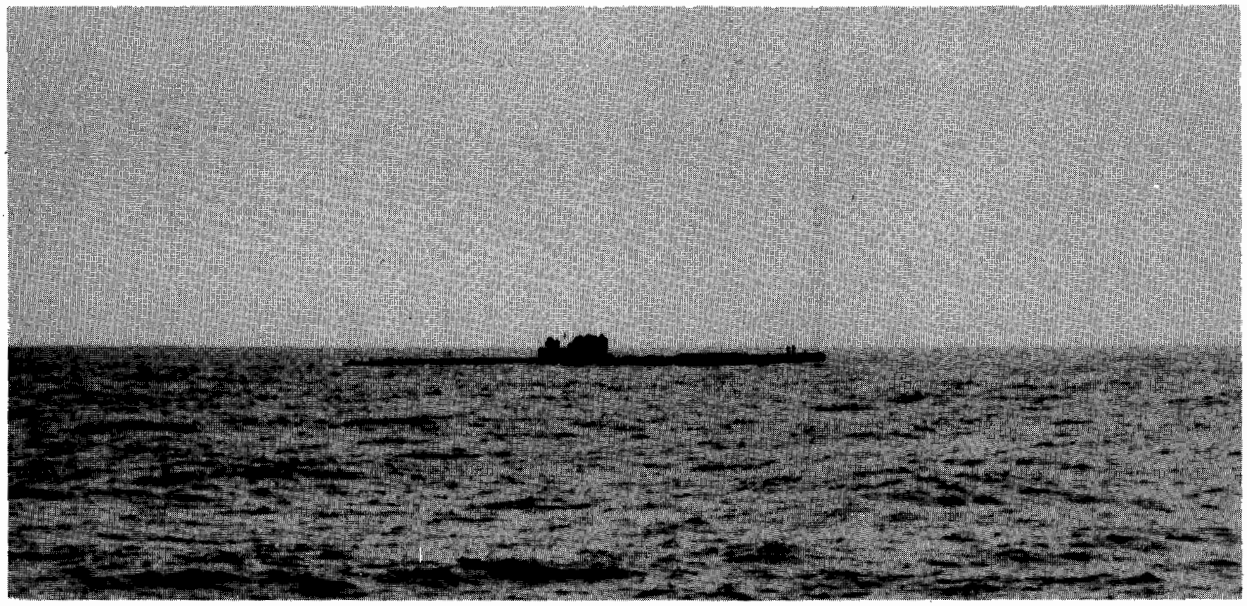
For 20 days, with whales and gulls her only diversion, the FORSYTH had beaten back and forth on her "station" in mid-ocean, sending in her periodic weather reports. She was operating at "war cruising" as part of the Weather and Rescue Patrol of the US Atlantic fleet. This duty, her complement had been told at her commissioning a few months earlier, would be of benefit to all mankind.

On May 12 the FORSYTH received a radio report that a German submarine was in her area and wanted to surrender. In haze and fog, the FORSYTH searched the mid-North Atlantic for the sub for three days. In the meantime, two Canadian warships had raced to the scene in the hope of taking the prize.

Early on the morning of May 15 the FORSYTH "came up" on the 1600-ton sub. She had been spotted shortly before by the USS SUTTON, Navy destroyer escort, which was standing by. Under orders to bring the U-boat into port, the SUTTON took most of the German officers and crew off the U-boat and put an armed guard aboard. With the SUTTON and FORSYTH escorting, the sub was headed for the United States.

A few hours later the FORSYTH was notified that one of the SUTTON's guards aboard the U-boat had been accidentally shot and was in a critical condition, necessitating an operation. The German doctor, Frans Walter, said he was unable to perform the operation aboard the sub because of limited facilities and because it was a two-doctor job. He volunteered to assist if the operation could be done aboard the FORSYTH.

Weather favored the task for Dr. Samson, who



THE NAZI SUPER-SUB U-234, 303 FEET LONG, 1600 TONS, "LYING TO" AT SURRENDER IN MID-ATLANTIC
UNDER THE GUNS OF THE USS SUTTON, NAVY DESTROYER ESCORT AND THE USS FORSYTH, NAVY
AIR-SEA RESCUE AND WEATHER PATROL FRIGATE MANNED BY U. S. COAST GUARD PERSONNEL
THE AVERAGE GERMAN SUB IS ABOUT 200 FEET IN LENGTH AND FROM 500 TO 600 TONS
THE U-234 HAS BEEN THE "PRIZE" SUB TAKEN BY U. S. WATER FORCES

THE OPERATION ON KONEMANN IS PERFORMED IN THE FORSYTH'S SMALL "SICK BAY"
LEFT TO RIGHT: JOHN R. MARSH, PHARMACIST'S MATE FIRST CLASS, RD 2,
JAMESVILLE, N. Y.: DR. SAMSON, WHO PERFORMED THE OPERATION: AND
THE GERMAN DOCTOR FRANZ WALTER, WHO ASSISTED

went aboard the sub to examine the sailor and bring him to the FORSYTH. Transferred in a stretcher from the sub by Dr. Samson in the FORSYTH's 26-foot motor whaleboat across a mile of water, the wounded man reached the FORSYTH's "sick bay" without mishap. He was Monroe Epting Konemann, Radioman third class, USNR, of Washington, D. C.

It was found the bullet had entered the small of the back, travelled upward and punctured Konemann's rectum and large intestines. A large amount of hemorrhage had occurred, requiring a "lalarotomy"— locating of the bleeding point and repair of the punctures in the intestines. In completing the operation a "colostomy" was performed — the intestine brought out through the side so it would function without disturbing the injured portion.

The operation lasted three and one-half hours and was performed while the three vessels were underway.

In port at Argentia, Newfoundland, two days later, Konemann was transferred to the Navy dispensary, where a week later, on May 25, he died of internal hemorrhages.

Konemann was shot when a German Mauser pistol accidentally went off in the hands of another American sailor. He and other guards were collecting the pistols and other small arms aboard the U-234 when the accident occurred.

Lt. Comdr. Osborne, 39-year-old captain of the FORSYTH, is a veteran of this war in the North Atlantic. Prior to receiving command of the FORSYTH, he served aboard the US Coast Guard Cutter INGHAM. He entered the service in March 1942. He is a graduate of the East Hampton High School and of LaFayette College, Easton, Pa. Married to the former Ethel Diffene, they have one child a girl, age 7.

As a civilian before the war, Lt. Comdr. Osborne was active in sailing and racing small boats in the Long Island waters. He was in the insurance and real estate business at East Hampton.

Dr. Samson, a senior assistant surgeon of the Public Health Service, wears the uniform of a lieutenant. (The US Public Health Service provides medical service and medical officers to the Coast Guard in peace and war.) He entered the Public Health Service in March 1941, following a 10 months' surgical residency at Steubenville, Ohio. He took his pre-medical and medical schooling at Ohio State University. His first assignment in the service was at the Marine Hospital at Pittsburg, Pa., where he served as assistant in surgery until transferred in December 1944 to the FORSYTH. He is married and has two children, a boy, age 5, and a girl, age 2.

The enlisted men who assisted in the operation on Konemann were John R. Marsh, Pharmacist's Mate first class, RD 2, Jamesville, N. Y., and Charles E. Dube, Pharmacist's Mate third class, 523 Haverhill St., Lawrence, Mass.

Two blood transfusions were given Konemann after the operation, one by Dube and the other by George Burke, Yeoman first class, 18 Hartshorn Street, Reading, Mass.

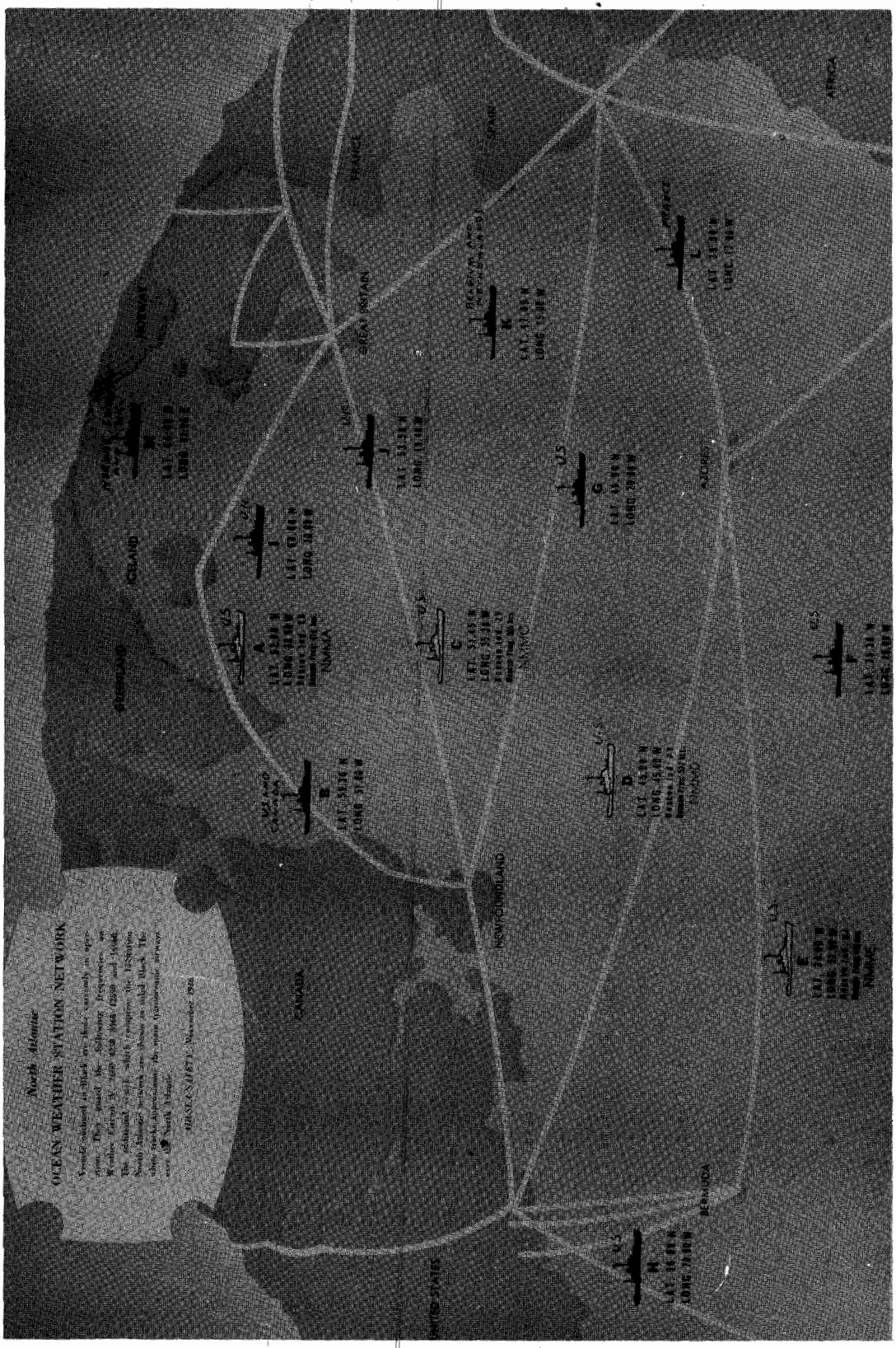
Despite the seriousness of the events, and true to the tradition of American servicemen, the episode in the North Atlantic had its comedy aspect.

With the three vessels "hove to" in mid-ocean, ~~and the sub lying a mile off, Dr. Samson made the trip~~ to the sub in the FORSYTH's small boat to examine the patient and bring him aboard the FORSYTH. As he went to board the sub, the doctor's timing was bad. He jumped as a swell carried the small boat down and out from the U-boat. He did a "belly-whopper" on the curved hull of the sub and clutched frantically at the smooth plates.

German and American sailors grabbed him and pulled — but did not get him aboard with the first heave.

The doctor yelled, "For ____ sake, pull!"

They did.


North Atlantic
OCEAN WEATHER STATION NETWORK
GREENLAND
ICELAND
NORWAY
FRANCE
SPAIN
GREAT BRITAIN
AZORES
AFRICA
CANADA
NEWFOUNDLAND
UNITED STATES
BERMUDA
NMMA
NMMC
NMME

PART II
POST WAR WEATHER PATROL

On March 15, 1946, the Navy turned operational control of the Atlantic Weather Patrol back to the Coast Guard, although it continued to keep directional control of the program. Because of personnel limitations that the Coast Guard was experiencing, the number of U. S. manned stations was decreased at this time to 6. The British also were suffering from the same limitations and progressively from January until May they withdrew their vessels until on 1 May, 1946, the United States was the only Government maintaining any Atlantic Station vessels. In May, 1946, as the affects of demobilization were fully felt by the Coast Guard, all but one station were temporarily abandoned. At this time the Commandant stated that with the personnel and money allocated to the Coast Guard for fiscal year 1947 the Coast Guard would be able to operate only 4 Atlantic stations. Early in August the Coast Guard was able to reestablish 1 station, making a total of 2 that were being operated, and on September 22nd another station was reestablished. On July 1st, 1946, the Coast Guard received directional control of the entire program.

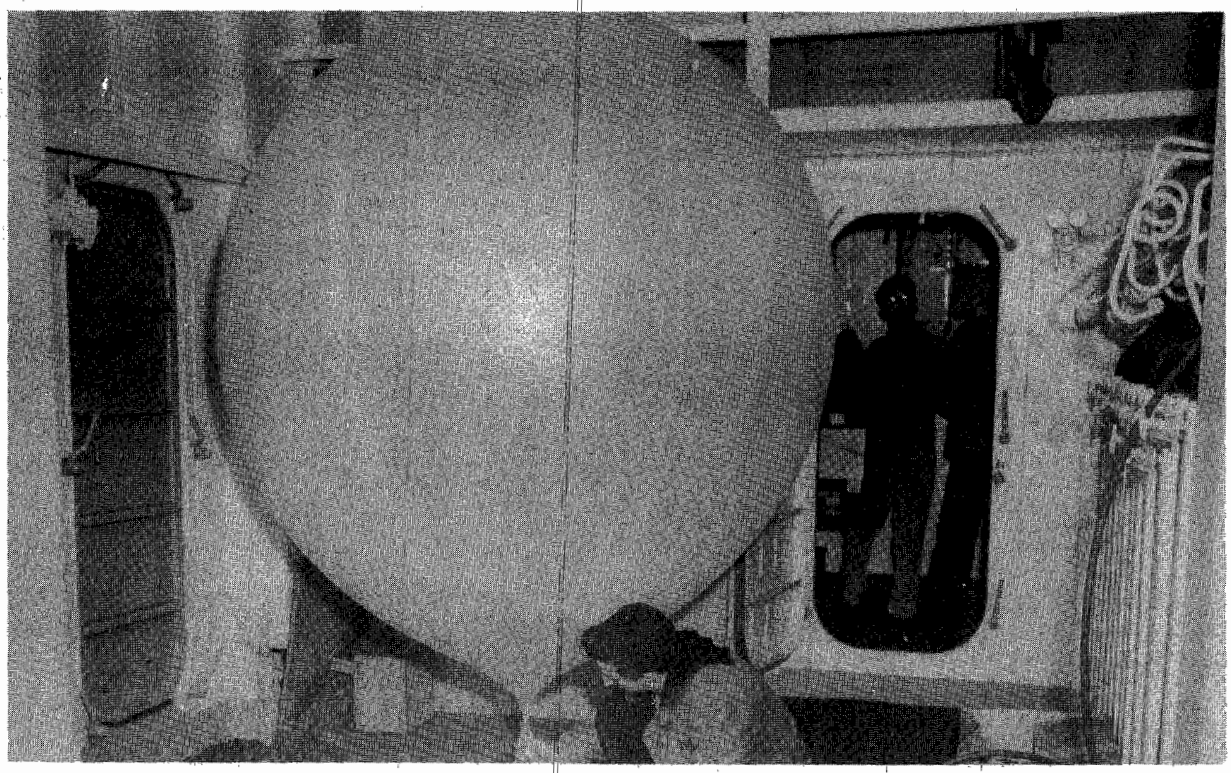
The need for the services supplied by the patrol vessels had not lessened since the war because as the military flying had decreased, commercial operations had increased tremendously in number and were continuing to expand. The first steps to establish the weather patrol on a permanent peacetime basis were taken at the North Atlantic Route Conference of the Provisional International Civil Aviation Organization in Dublin in March, 1946. This conference recommended that a minimum of 13 stations be established in the North Atlantic. These stations were to be in the following locations:

53-50 N	18-40 W
56-30 N	51-00 W
52-45 N	35-30 W
62-00 N	33-00 W
45-00 N	45-00 W
34-00 N	52-00 W
35-30 N	40-00 W
47-00 N	18-00 W
36-00 N	70-00 W
39-00 N	17-00 W
60-00 W	20-00 W
67-00 N	00-00 W
46-00 N	29-00 W

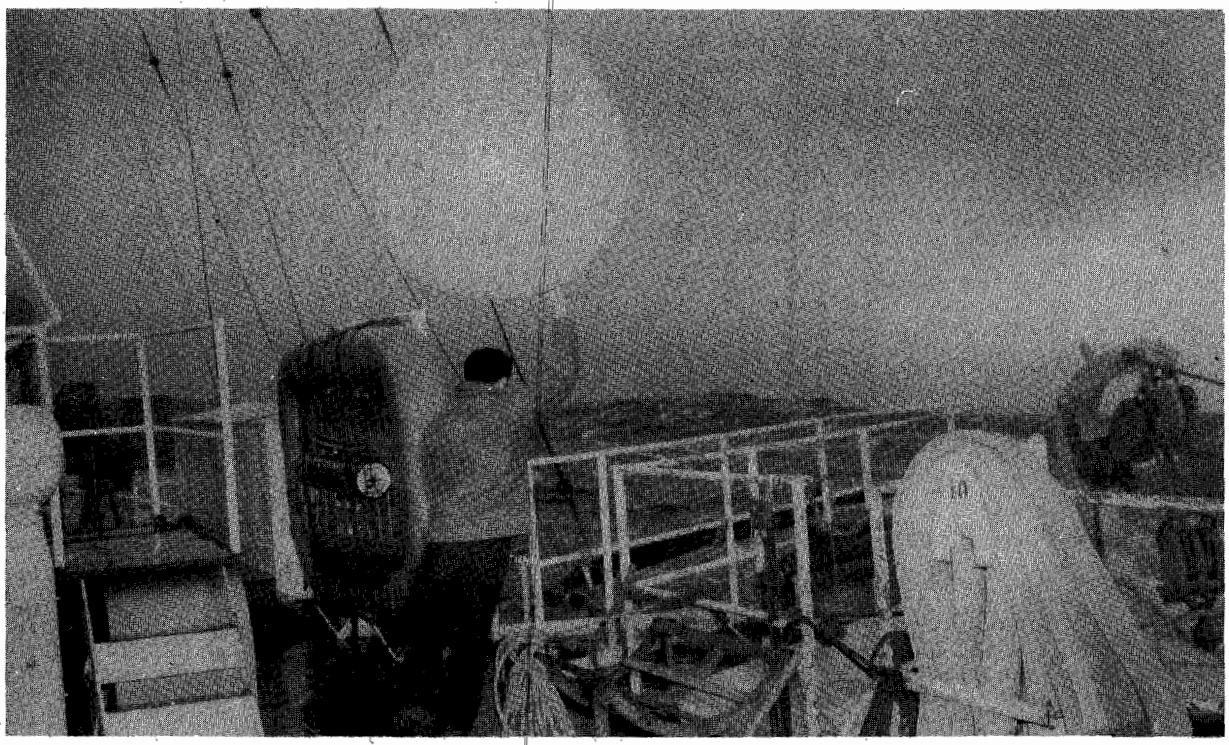
The Council of PICAO in Montreal approved these recommendations in the latter part of May, 1946, and preliminary steps were taken to implement this recommendation. It became apparent that except for the U. S. the member nations of PICAO would not be able to contribute to the financing of the patrol at least for another year. The PICAO council then requested all member nations that were able to do so to establish 1 or more weather patrol stations. To implement this action the United States was requested to meet with Belgium, Canada, Denmark, France, Iceland, Ireland, The Netherlands, Norway, Portugal, Spain, Sweden, and the United Kingdom and investigate the situation thoroughly. This meeting commenced on 16 September, 1946, with the United States delegation of representatives from the Commerce (Weather Bureau and CAA), Treasury (Coast Guard), War, Navy and State Departments, and the Bureau of the Budget. Certain tentative agreements were arrived at subject to ratification by the Governments of the nations concerned. Subject to such ratification, it seemed likely that the agreements arrived at therein would be the basis for a permanent agreement when such was arrived at. The United States portion of this program consisted of 7 stations to be manned wholly by the U. S. and 1 station manned jointly with Canada.

In December, 1945, one of the U. S. South Atlantic Stations was abandoned and in early March, 1946, the other South Atlantic Station was abandoned.

Weather stations operated May 26, 1947, by the Coast Guard were: Station "Able" 62°N, 33°W and Station "Charlie" 52°-45'N, 35°-30'W in the Atlantic Ocean; Station "Fox" 30°N, 140°W and Station "Able" 49°N, 148°W in the Pacific Ocean.



INFLATING A 500 GRAM BALLOON WITH HELIUM
IN SHIP'S BALLOON SHELTER PRIOR TO WEATHER OBSERVATION



ABOUT TO RELEASE 100 GRAM BALLOON
TO WHICH COPPER WIRE IS ATTACHED FOR TRACKING BY THE SHIP'S RADAR.
100 GRAM BALLOON DOES NOT CARRY RADIOSONDE

It had been determined both by PICAO and by the Air Coordinating Committee (a committee consisting of all Governmental departments interested in U. S. aviation) that the weather reporting was the most important of the duties actually performed by a weather patrol ship on station and it was for this weather reporting that the ships were operated. The following observations are taken: surface observations, RAOBS*, PIBALS*, and RAWINS*. The results are transmitted by radio to shore direct by Coast Guard communications circuits and they are delivered to the Weather Bureau which affects national and international distribution of the reports.

The remaining two functions that the patrol vessels perform are search and rescue, and communications, including air navigational aids. These are performed as desirable services inasmuch as the ships are on the spot and can give them.

An interesting aspect of the weather patrol vessels is the estimate made by a British economist for PICAO in the Spring of 1946, that the cost to operate the 13 weather patrol stations will be approximately 13 million dollars per year but that the meteorological data provided by these stations would save airline operating companies about 26 million dollars annually.

PACIFIC WEATHER PATROL

In 1943 COMINCH directed CINCPAC to establish two weather reporting stations. These were established north of the Hawaiian Islands and in the Gulf of Alaska. Later that year three plane guard stations were established on a direct line between San Francisco and Hawaii. At a later date these plane guard stations began reporting weather. From this time on as the Navy moved westward there were established additional weather reporting stations and plane guard stations. The weather reporting stations were off routes normally flown by aircraft while plane guard stations were on such routes. In general the plane guard vessels made the same weather reports as did the weather reporting vessels themselves. On January 1, 1946, there were a total of 24 weather and plane guard stations. Initially the stations were manned by YP's and PCE's, but, towards the latter part of the war Coast Guard manned PF's operated many of these stations.[1] Throughout the entire war, however, the Navy had complete directional and operational control of the program, except for the station 923 (48 N - 136 W) which was manned by the Canadians.

In February, 1946, the program was reduced to a total of 16 stations, 6 plane guard and 10 weather stations. Of these 2 plane guard stations and 4 weather stations, including the Canadian station, were East of the Hawaiian Islands. Shortly thereafter, the Canadians found themselves unable to man their station and in effect the station was discontinued. On April 15th the Coast Guard assumed operational control of the weather and plane guard stations east of the Hawaiian Islands with the Navy retaining directional control. Because of personnel limitations the number of stations to be manned was reduced at this time to 2 plane guard and 1 weather station. As demobilization neared completion, it became apparent that the Coast Guard could not keep this number in operation and the Commandant in June obtained approval of the Navy to reduce the number of stations to 1 weather station, and 1 plane guard station between Hawaii and San Francisco. On July 1st, 1946, the Coast Guard assumed directional control and indicated that these two stations were all that it could man during that fiscal year 1946-47. The stations were being operated by Commander, Western Area using six 255-ft. cutters, 3 operating out of San Francisco and 3 out of Seattle.

The Navy was continuing the operation of 6 weather and 4 plane guard stations west of the Hawaiian Islands, although because of difficulties incident to demobilization some of the stations were abandoned from time to time.

The PICAO route conference for the Pacific had not yet been held. It was anticipated, however, that when this conference was held it would recommend a minimum of 20 stations for the North Pacific Ocean. Five of these probably would be east of the Hawaiian Islands, and therefore, presumably would be operated by the Coast Guard.

In general the remarks pertaining to the duties of Atlantic Weather Patrol vessels apply also to the Pacific Weather Patrol.

SPECIAL EQUIPMENT OF WEATHER PATROL VESSELS

These ships are equipped with dual anemometers -- one on each yardarm for the purpose of measuring surface wind velocity. They have air search radar for taking RAWINS. (The air search radar tracks free balloons, with metal reflectors attached, after a theodolite has tracked the balloons for the first 2,000 feet.) PIBALS are taken similarly.

On deck is a shelter for the balloons used in radiosondes. There is radiosonde receiving equipment installed. There is a shelter for the Weather Bureau equipment and instruments. Special thermometers are used to record the surface sea temperature.

On each weather station vessel there is a midships gangway (platform from one side of the ship to the other), from which the observations are made.

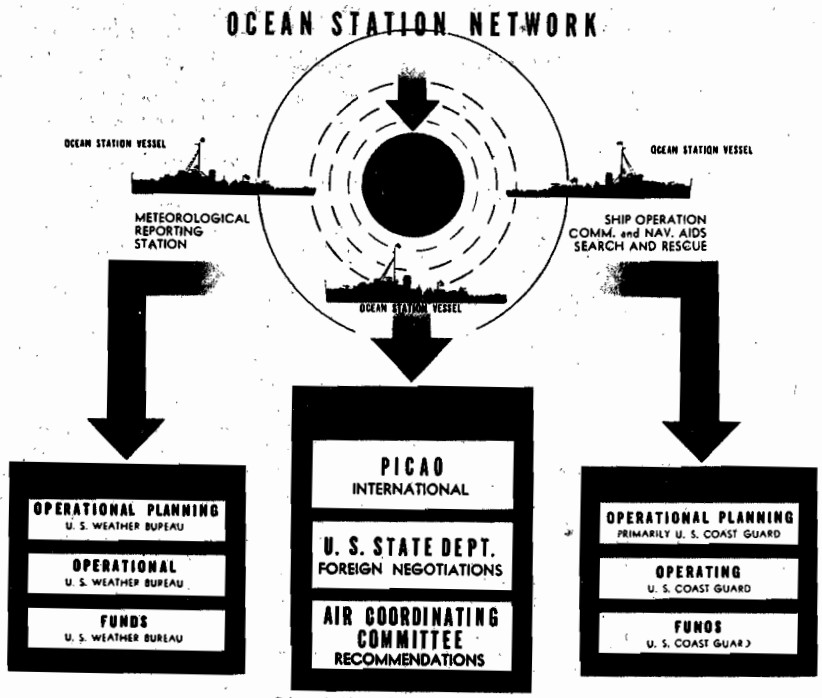
Weather station vessels are equipped to give radiobeacon service to passing aircraft, and they communicate with planes in flight on aircraft frequencies.

* RAOBS (Radiosondes) are measurements of upper air temperature, pressure and humidity at various computed altitudes. They are obtained by sending aloft by means of a small free balloon a midget radio transmitter which sends this data to the surface observer automatically.

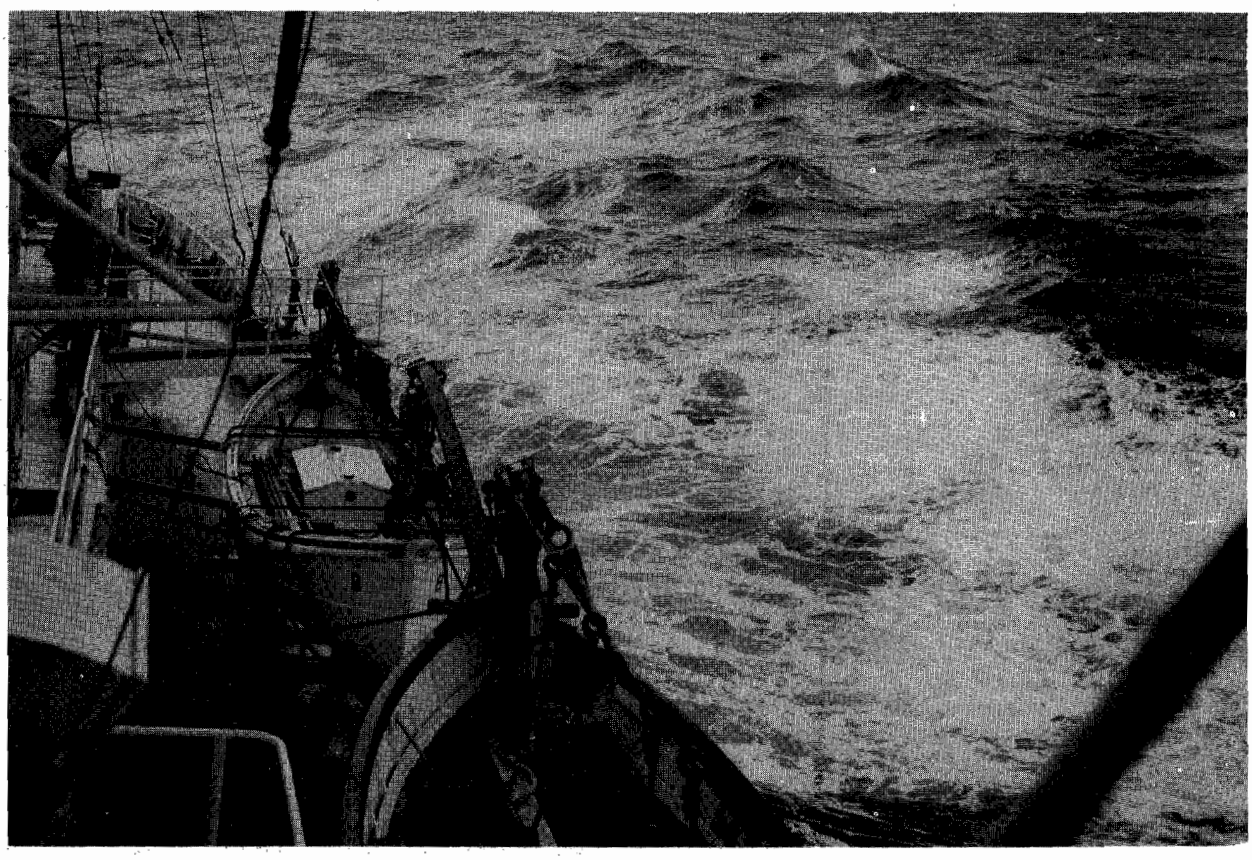
*PIBALS are measurements of the direction and intensity of winds aloft obtained by tracking the movement of a small free balloon which has an assumed ascensional rate. The tracking is done visually with a special type of transit known as a theodolite.

*RAWINS[1] are measurements of the direction and intensity of winds aloft obtained by tracking a small free balloon which has a radar reflector attached to it. The tracking on ships is done by a standard radar. In the case of CG Weather Patrol ships the radar is an SC-4 or other air-search radar in the 175-225 mc band. A standard balloon with an assumed ascensional rate may be used (like PIBALS), but greater accuracy results by combining the RAWIN with the RAOB; computed heights from the RAOB are then used. This latter method is now being used on CG ships. When specially designed equipment is used, this method is called RASON.

1. See Appendix E.



Schematic Chart of Ocean Weather Stations



SEEMINGLY RESENTFUL OF MEN AND SHIPS
THE SEA SEEMS TO CONSTANTLY ROLL AND TOSS
IN AN EFFORT TO RID ITSELF OF THEM

ONLY TWO ATLANTIC AND TWO PACIFIC WEATHER STATIONS IN MAY 1947

Over the North Atlantic, an area two or three times that of the United States, the Coast Guard was maintaining only one weather station by June 30, 1946. Two decommissioned stations in the Atlantic were reestablished in August and September, 1946, and on October 15, 1946, a fourth station was being prepared for opening by the Coast Guard. Due to lack of Coast Guard personnel, however, only two stations were being maintained in the Atlantic, together with two in the Pacific in May 1947.[1]

ADMIRAL SMITH STRESSES IMPORTANCE OF OCEAN WEATHER REPORTING

Rear Admiral Ed. H. Smith, USCG, in an article (October 1946) on "Safety of Shipping and Air Transport, North Atlantic Region" says:

"Weather over the ocean, is of concern both to planes and ships. Despite progress in ship design, weather at sea is still the greatest single cause of marine casualties, and delays in turn-around-schedules, due to storms at sea, eat into operating profits. Although hundreds of observation stations report hourly changes over the United States, on the North Atlantic (an area two or three times greater) there are no stations regularly established. It has often been proposed by those not familiar with the situation that all weather reports be furnished by shipping. Unfortunately, however, the traffic follows certain routes prescribed either by track agreement, safety or economy, leaving large areas seldom traversed. Furthermore, the technical character of observations and the degree of accuracy required for modern meteorological forecasting (especially upper air analysis necessary for aircraft) is simply not practicable by passing ships.

"Weather is particularly important to overseas transport. The 20 thousand successful flights across the Atlantic in 1944 depended upon accurate weather forecasting. Planes move or stop on the signal of the airdrome officer. While higher and faster flights will cause storminess in the lower levels to assume less and less importance, forecasting winds aloft and selecting the most favorable flight levels will continue to be vital.

"The Meteorological Committee of the Dublin North Atlantic Route Service Conference last March emphasized the necessity of safe ocean flying, by recommending the establishment of weather stations at designated fixed positions on the North Atlantic. The present plan is patterned on the organization developed and tested during the war; the organization which advanced the progress of air navigation of the North Atlantic from a risky pioneering project to a practical, daily reality. As military traffic is now being displaced by commercial, the present service has been requested continued by PICAO until it's member States can ratify the Convention.

"Last month (September 17, 1946) at London, PICAO struck hard for a North Atlantic Weather Service. Representatives of Belgium, Canada, France, Ireland, the Netherlands, Norway, Sweden, the United States signed a joint agreement to establish an adequate North Atlantic Weather Service under international sponsorship to begin not later than 1 July, 1947. The agreement specified a minimum of 13 stations maintained continuously by vessels thoroughly equipped with modern meteorological instruments, electronic navigational gear, and trained technical personnel. The United States, operating approximately 65 percent of the trans-Atlantic aircraft, will provide 7½ of the 13 floating stations, the remaining half station being Canada's obligation. This system of apportioning the cost of service among nations to provide greater safety of life at sea has precedent in the 33-year old International Ice Patrol. In the present instance, however, the member nations, with little exception, will participate with their own station vessels. Great Britain, for example, is to man two of the ocean stations near the British Isles. Great Britain, Norway and Sweden are to share a station in the Northeastern Atlantic, as also are Belgium and the Netherlands further south.

"Although the weather ships and personnel will come from ten or more nations differing in language and thought, the data which they will furnish is in standard international code equally familiar to all. The observations will include surface and upper air temperatures, pressures, and humidities, also the velocity, and direction of winds from the sea surface to 10 or 15 miles aloft. These reports will be transmitted by radio to shore every three hours daily (oftener during passing storms) whence they will receive world-wide dissemination.

"The floating stations will remain as near a published fixed point as possible, transmitting radio beacon signals by which planes can shape their course across the Atlantic, similar to flying air-way beacons over land. Surface shipping equipped with direction finders can also home on the weather stations as navigational check points, and receive other miscellaneous services that do not interfere with the primary duty of weather reporting. Routine oceanographic observations will be collected not only as they influence weather but to learn more about ocean currents of practical value to surface craft.

"The cost of the above service is estimated to be one million dollars per station per year. The estimate of the volume of trans-Atlantic air traffic expressed in dollar value of property investment, and number of lives risked, will largely and ultimately dictate the amount of funds subscribed by member nations. There is a great discrepancy in present day estimates of trans-Atlantic air revenues, ranging from 30 million to 150 million. It is also claimed by a British economist that the ocean weather service will save airline companies approximately twice its cost. The annual cost of International Ice Patrol is approximately 150 thousand dollars.

"We should not lose sight of the important fact that the need for accurate meteorological forecasting over the ocean (where that medium constitutes by far the greater part of the flight) is not based solely on a question of safety. While head winds increase the length of sea voyage, they are of vital and serious concern to air craft. Accurate information on the velocity and direction of winds at several levels along established routes is absolutely essential to proper loading and fueling prior to an overseas flight. It is from this economic point of view also that some claim the cost of the proposed ocean weather service will easily pay for itself."

The following is quoted from "Air Sea Safety" of November 1946, pages 26 to 38 inclusive:

"Getting weather from the oceans is a job which has never been adequately supported by the governments of the world, nor has the public at large fully recognized its value or its effect on our economy.

1. See Appendix B

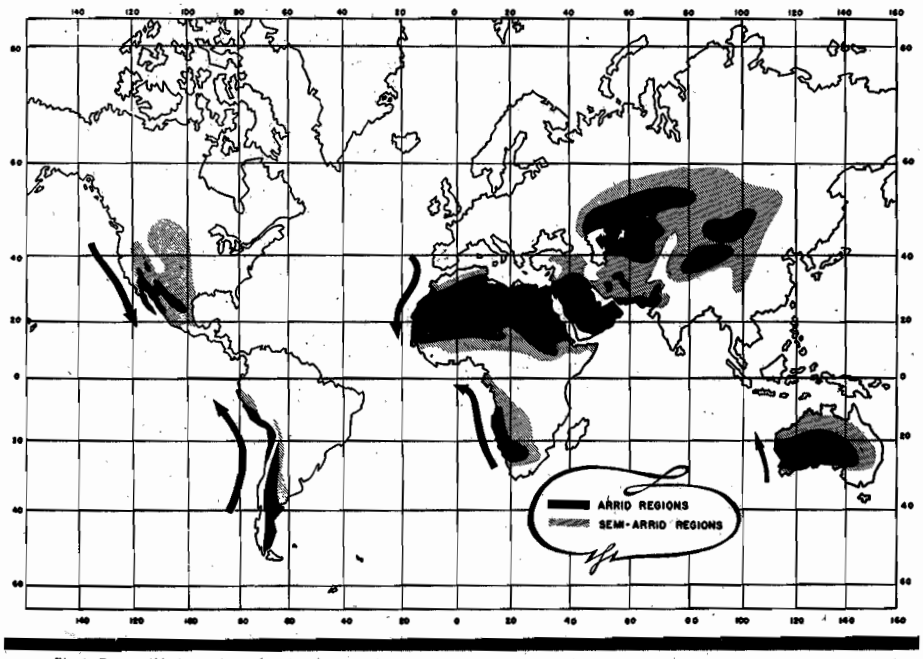
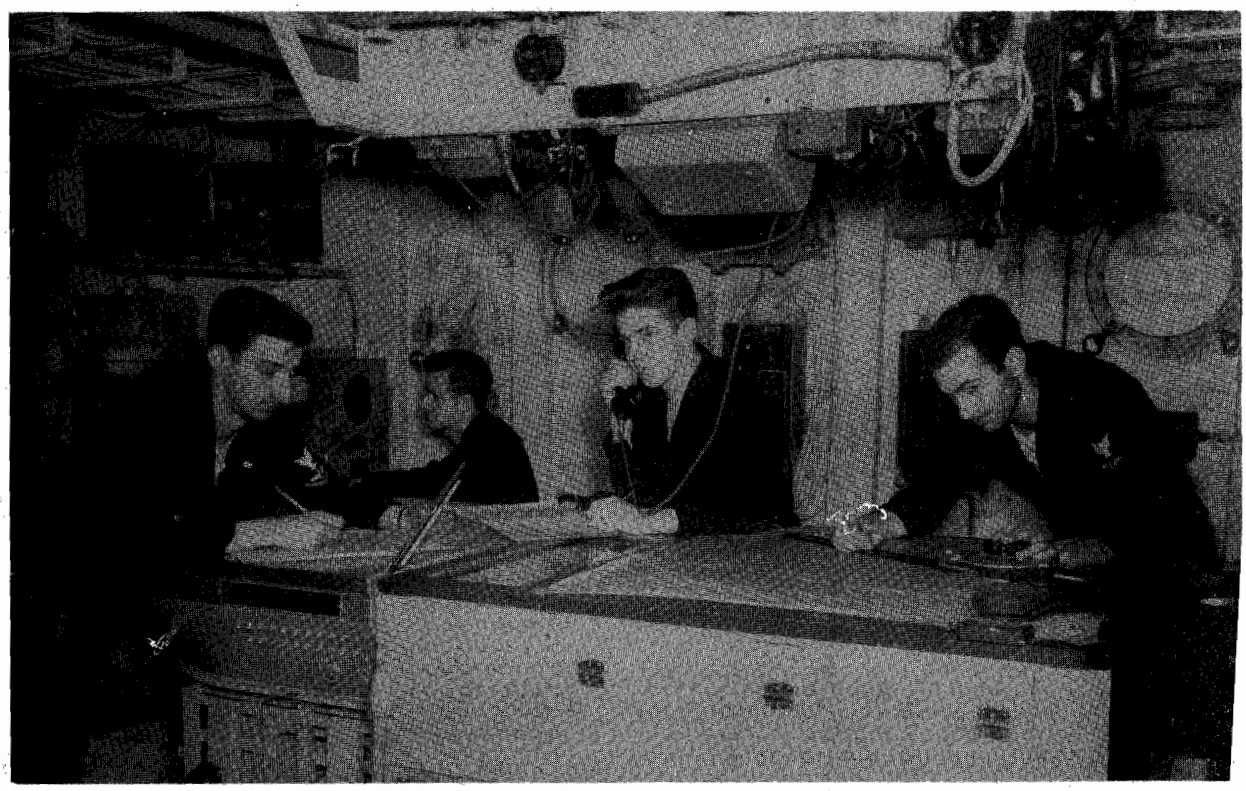


Fig. 1. Deserts (black areas), semi-arid regions (shaded areas), and cold ocean currents (arrows). All deserts lie in or near the sub-tropical pressure belts with cold ocean currents in the nearest ocean area to the westward.



OCEAN WEATHER OBSERVATIONS WEATHER STATION "CHARLIE" CGC DUANE

"Most of us - if we thought about it at all, agreed that it was an excellent idea - even urged that GEORGE do something about it right away. Yes, LET GEORGE DO IT . . . we really should have these weather stations, - and let the maritime people carry the cost - or the aviation people - or the search and rescue group!

"But it was not quite that easy, - however willing GEORGE might be. The value of such observation and weather reporting is not confined to any one country, or to any one group in it. The value is as substantial to Russia, Germany and Italy, for example, as it is to the United States and the seaboard countries of Western Europe. Accurate forecasts are of vital importance to aviation, shipping, fishing fleets, agriculture, road and rail transport, and industry. They demand a frequent and regular supply of observations from a network of stations covering the Atlantic.

"The oceans are the great stabilizers of temperature in the earth's atmosphere. In the north, for instance, our northern continent and polar regions receive little or no heat from the sun. The air in that region constantly gives off its heat by radiation and, if it were not for the oceans, the temperature would drop to depths never before experienced. Cold waves and blizzards pour down upon us from Canada, but the circulation and warmth of the oceans are a compensating influence.

"Undoubtedly a slight change in temperature makes a big difference in weather over the continent, yet without accurate forecasts of these changes in ocean temperature, we can only speculate on its effect - sometimes with costly result.

"An example of just how costly the lack of accurate forecast can be, is to be found in the far western part of the United States, - in that area which supplies the bulk of the raisin and dried fruit crop. The products of this summer-dry climate are worth many millions of dollars, and the industry is geared to normal alternations of winter rain and summer drought. The fruit is dried in the sun and if an unexpected rainfall occurs in the autumn before the fruit is dried, or can be protected, it will be ruined.

"The causes of rain are found in the condition of the Pacific Ocean. It is the relative temperatures of the Pacific that control rainfall on the U. S. Pacific Coast. The Weather Bureau issues rain warnings so that protective measures can be carried out in time and, in October 1945, it issued a good forecast, as rain forecasts go, which called for a light rain. The growers took a chance and left much of the fruit crop unprotected. A moderate rain came - just a little too much - and the damage was 12 million dollars!

"Figure 1 shows the deserts and semi-arid regions of the world along with certain cold ocean currents. On the continents east of these cold currents, there are deserts and surrounding the deserts are regions where irrigation is required for agriculture. We have very little reliable information about the temperatures of these ocean currents.

"Taking the HUMBOLDT CURRENT or CURRENT OF PERU, for example, we find a dry and barren desert along the coast, as shown by the black strip in Figure 1. Once in a long period of years, this cold ocean current weakens and warmer water comes down from the direction the Equator. Heavy rains fall on the desert, transforming it into a garden while, in contrast, fish and wild life perish in the sea and in the air over the warm water because of the high temperatures. There is a complete change in climate - floods occur where formerly barren desert prevailed.

"While no such situation takes place in the United States, a series of terrible droughts occurred in the '30's. In the southwestern area of the country the desert seemed to be expanding. Dust clouds filled the sky and hundreds of thousands of persons were forced to abandon their homes in the Great Plains region. In just one year of that drought, 1934, the estimated damage to agriculture was 5 billion dollars. Less than a decade later, parts of the same region were ravaged by floods.

"During the drought, wind erosion took millions of acres of land out of production permanently. It is estimated that agricultural land has been reduced to 450 million acres and at the present rate, without proper control, it will be reduced to 150 million acres. Then we would find ourselves on the borderline between scarcity and famine when another great dip in the rainfall curve takes place.

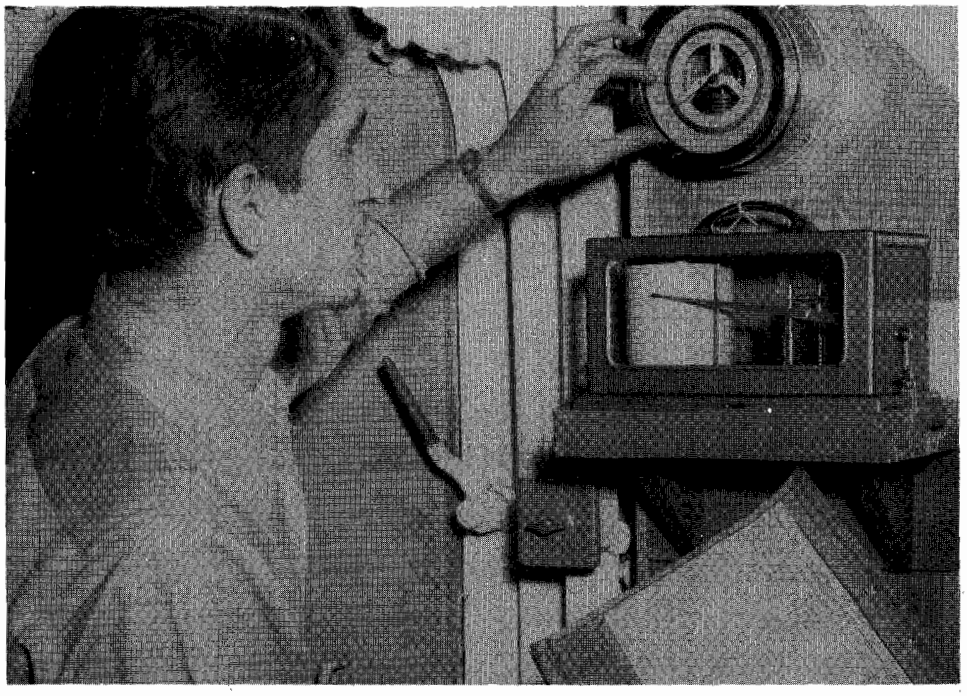
"Weather reporting ships, of course, will not prevent expansion of the deserts, dust storms and the like, but an advance knowledge of the conditions which cause them will make it possible for us to make adequate preparation. Then national planning could provide for a storage of our surplus for the lean years, and we could have a flexible work and relief program and flood-control measures which would take care of the extremes in the rainfall cycle and support a constructive program to conserve our natural resources. When these situations are permitted to come upon us without warning, as they will continue to do so long as we fail to improve and report our knowledge of the oceans, they become tragedies of prime importance.

"As far as other countries of the world are concerned the temperature and rainfall problem is even more critical than in the United States, and with advance knowledge of broad scale climatic changes, the same factors of preparation, conservation and relief could be applied internationally.

"An interesting commentary on the value of ocean weather stations to airline operating companies, is to be found in the estimate recently prepared by a British economist for PICAO, in which it was pointed out that while it will cost approximately 13 million dollars a year to operate thirteen weather stations in the North Atlantic, the meteorological information which they would provide these companies would save them approximately 26 million dollars a year. These figures were computed on the basis that the information provided by the weather vessels would permit each transoceanic flight to carry three more passengers. Estimating the oneway fare at $375, and with a minimum of 200 round trips per week, the total savings would approximate 26 million dollars.

"That certain countries were prepared to establish meteorological ships in the North Atlantic even before the era of frequent transatlantic flight, is evidence that their worth was recognized by some. France, for instance, established a ship on station for this purpose in the North Atlantic in 1939, and proposals for stationing a British ship in the area was under consideration when war broke out.

"With war's advent, the surface weather reports normally made by ships engaged in Atlantic crossings was discontinued because of the American Neutrality Act, and because of the radio silence imposed on belligerent shipping. Yet the need was urgent, because transoceanic flying was on the increase, and it became apparent that some method would have to be



THOUGH NOT AS PICTURESQUE AS THE MERCURIAL BAROMETER OF OLD
THIS MODERN ANEROID BEING READ BY A WEATHERMAN ON A COAST GUARD WEATHER SHIP
IS FAR MORE ACCURATE

TWIRLING PSYCHROMETER TO OBTAIN SURFACE AIR TEMPERATURE AND HUMIDITY

devised for providing the required meteorological data.

"There were hurried, grave-faced conferences of aviation, weather, air safety, and shipping groups. Desperate efforts were made to obtain every possible weather report from merchant ships, but it was clear to everyone that this source would soon cease altogether. The only alternative seemed to be to send ships out to get the required information. The United States was neutral, but there was no guarantee that combatant submarines would respect that neutrality . . . we might lose desperately needed ships. Other factors contributed to making the job much harder to execute than to plan, yet its importance was heavily underscored by the decision to go ahead.

"The operation began in the midwinter of 1940, - one of the most wicious ever recorded in the area of the North Atlantic where the Gulf Stream, the North Atlantic Drift and the prevailing lows in the area . . . combine to create one of the stormiest scenes in the world.

"For as much as 30 days at a time, in one continuous watch, the Coast Guard cutters assigned to the task clung to fixed positions while one great storm after another whipped the ocean to new furies in passing over the small vessels. Even for the hardened Coast Guardsmen, this was the toughest kind of duty. These ships and crews stayed there and took it. - their reports kept on coming, making it possible to chart the weather for the bombers and fighters flying to the British Isles - way station on the Devastation Route to Germany.

"These stations - two in number - were located between Bermuda and the Azores. They were established at the request of the Secretary of Agriculture, - the President ordering Coast Guard cutters to terminate their neutrality patrol off the Grand Banks for weather station duty. These two stations comprised the entire system until early in 1943 when, to provide meteorological aid for the Army's northern air route over Newfoundland, Labrador, Greenland, and Iceland to Britain, two more stations were established in the Davis and Denmark Straits off Greenland.

"Rapid expansion of air operations increased the need for more complete meteorological data and resulted in the addition of four more stations in 1944. Three of the total of eight stations also functioned as plane guard stations . . . and in March of the same year, military consideration prompted turning operational control of the entire weather patrol system to the Navy.

"The end of the war in Europe witnessed the most gigantic movement of aircraft in history as planes and personnel were deployed across the North and South Atlantic en route to the Pacific. To provide the required weather reporting service in support of this massive operation, the number of stations was increased to twenty, thirteen of them operated by the United States - seven by the British. For about three months, two of the United States-listed stations were actually manned by Brazilian vessels operating out of Recife, Brazil. At this time, too, the weather ships took on the added duties of plane guard vessels, - rendering radio beacon and air-ground-air communications service to aircraft, and standing ready to assist in ditching incidents.

"In December 1945, one of the United States-manned stations in the South Atlantic was discontinued, and in March, 1946, one more in the same area was abandoned. In the latter month, the U. S. Navy returned o operational control of the United States stations to the Coast Guard although continuing its directional supervision.[1]

"Shortly thereafter, principally because of personnel limitations imposed on the Coast Guard, the number of United States-manned stations was reduced to six. The British were also experiencing the same restrictions so that progressively from January to May 1946, all British ships were withdrawn. Thus, the United States became the only government maintaining ocean weather station ships in the North Atlantic. In May, as the demobilization program imposed even more rigid restrictions on personnel, all but one of the stations were abandoned and the Coast Guard went on record as saying that, at best, 1947 budget and personnel allocations would permit the manning and operating of but four stations. Two of the decommissioned stations were reestablished in August and September and on October 15, as this article was being prepared, it was anticipated all stations would shortly be in operation again.

"While this discussion concerns itself primarily with the North Atlantic ocean weather station network, it might be well, at this point, to review the picture in the Pacific.

"In 1943, the Commander-in-Chief, Pacific, was directed to establish two weather stations, which were located north of the Hawaiian Islands and in the Gulf of Alaska. A short time later, three plane guard stations were set up on a direct line between San Francisco and Hawaii. These plane guard stations shortly thereafter began reporting weather.

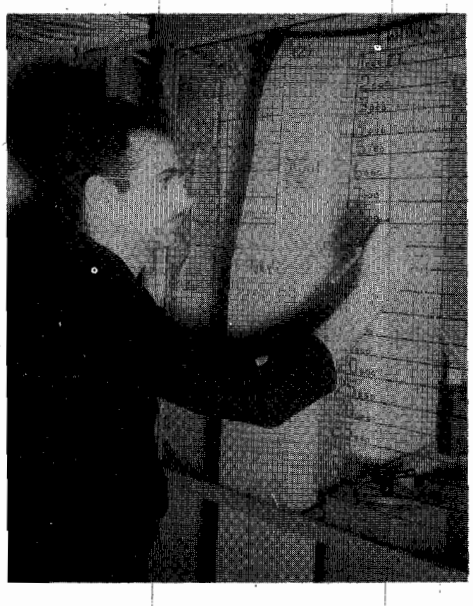
"From then on, as the Navy moved westward, additional weather and plane guard stations were established. Generally those ships which were designated as plane guard stations were located directly on the regular aircraft routes, which the weather ships were not.

"The Pacific network was progressively expanded until - about January 1, 1946 - a total of twenty-four weather and plane guard stations were in operation. Initially, the stations were manned by YP's and PCE's, but during the latter part of the war, many of these types were replaced by Coast Guard-manned PF's. All through the war - except for one Canadian-manned station - the U. S. Navy exercised full directional and operational control over the Pacific network.

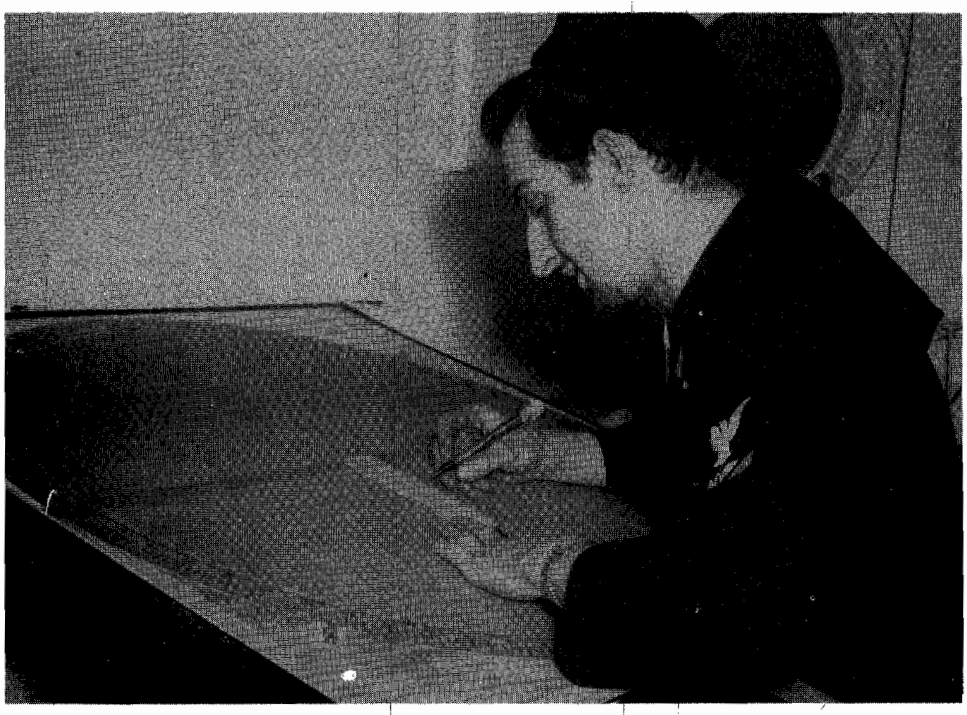
"Late in February, the Pacific network began to feel the impact of the same obstacles which were forcing a reduction in the North Atlantic operation, with the result that eight stations were discontinued, - of which two were weather stations and six were plane guard stations. Six of these, including the Canadian stations, were located east of Hawaii. Shortly thereafter, the Canadians were forced to discontinue their station, and on April 15th, the Coast Guard took over operational control of all stations in this area. The number of stations was gradually reduced until, with demobilization nearly complete, the number was reduced to one weather and one plane guard station between Hawaii and San Francisco. On July 1st, the Coast Guard took over directional control of these two stations, which were manned by 255-foot cutters, - three operating out of Seattle, three out of San Francisco.

"West of the Hawaiian Islands, the Navy continues to operate six weather and four plane guard stations, although here, too, difficulties incident to demobilization of personnel have forced their temporary discontinuance from time to time.

1. On July 1st, 1946, complete directional and operational control of the U. S.-manned North Atlantic ocean weather station system was vested in the United States Coast Guard.



ENTERING WIND DIRECTION AND VELOCITIES ON BOARD
WHERE IT IS READILY AVAILABLE
FOR PLANES REQUESTING LATEST DATE



USING AEROLOGICAL PLOTTING BOARD FOR COMPUTING UPPER AIR WIND

"Lest the impression be given that the Navy or Coast Guard failed to properly evaluate the need for these stations, or assigned ships and personnel to duties of lesser importance, it should be pointed out that the manning and operation of a weather reporting and plane guard network is a more complex problem than is generally realized. Its demands are exacting and its ship and personnel requirements are relatively large.

"In the four-station network presently operated by the Coast Guard, three ships are required to man each station, and each ship is relieved regularly every twenty-one days.

"Each vessel carries a crew of approximately 125 of officers and men, which includes its medical staff, plus four U. S. Weather Bureau Observers and meteorologists. All members of the crew are also specially trained in rescue work and are subject to frequent drills designed to maintain a high degree of operational efficiency.

"All vessels carry a complete array of scientific meteorological equipment, comparable in scope to that found at a first-class airport. They also carry air and surface search radar and the Navy YR Beacon which enables them to render radio beacon service . . . and a complete list of rescue equipment such as life rafts, line-throwing guns, suspension litters, rescue baskets, breeches buoy and many others. In short, each vessel is completely equipped to perform its mission in a most scientific manner.

"Life aboard these vessels is a busy one for crew and specialized personnel alike. Weather Bureau meteorologists, for example, make regular surface observations every three hours, winds aloft observations four times daily, and radio soundings of the upper air twice daily. These observations are then transmitted to the Coast Guard's Washington Radio Station (NMH) which promptly relays them to the U. S. Weather Bureau for national and international distribution.

"The collective call sign for any or all of the ocean weather ships is NMMZ. Normally, the ships remain on station within an area of ten miles square, the center of which is the geographic position assigned to the station.

"All weather ships guard the 500 kc, 4220 kc, 8280 kc, and 116.1 mc frequencies continually. 8280 and 500 kc are the distress frequencies normally used by merchant vessels when calling the weather ship. 4220 kc and 116.1 mc are aircraft-to-ship voice frequencies which are not used by merchant vessels except in extreme emergencies, when 8280 or 500 cannot be used.

"Continual 24-hour radio beacon service is provided at 05, 20, 35, and 50 minutes past each hour. Each signal is of three-minute duration except at 0405 and 1605 when no transmission is made. The radio signal is a continuous carrier wave with identifying letters super-imposed continually, using a modulated signal at 1020 cycles. The identifying signal consists of four letters, the first two of which are the beacon identification for the station, - the other two letters are obtained from the grid, which is used as follows:

"The center of the grid is the geographical position assigned to the station. If the ship is on station - that is, within the 10-mile square of the center - the last two letters of the identifying signal are OS, the latitude and longitude designators respectively.

"If the ship is off station, but the grid, the latitude and longitude designators of the square in which the ship is located are transmitted as the last two call letters, - the latitude designator always being given first.

"The center of each grid aquare should be considered the location of the weather ship for all computations, thus providing for a maximum error of 7½ miles, and an average probable error of 2½ miles.

"The emission of the radio beacon has a high degree of vertical polarization which makes it an excellent direction finder signal. Generally, surface vessels can obtain bearings at distances exceeding 200 miles. In the event of any mishap which might render the radio beacon equipment inoperative, the same service would be provided by the weather ship's communication transmitter. This transmitter gives an interrupted tone-modulated signal in lieu of the continuous carrier wave, and the identifying signal is followed by a 20-second dash in order to provide service for automatic direction finders.

"If a station ship is off the grid completely - as when on a distress mission - no beacon service is provided unless requested for homing purposes, - in which case the weather ship's international radio call is used as the identifying signal.

* * * * * * * * * *

"As previously noted, the job of integrating and supporting a comprehensive ocean station network is international in scope. Long range planning is necessary and with the curtailment of military operations, the problem became acute. The need for leadership and action was imperative, and PICAO, in September 1946, took steps to bring together the nations concerned for the purpose of arriving at an agreement to crystallize such a network.

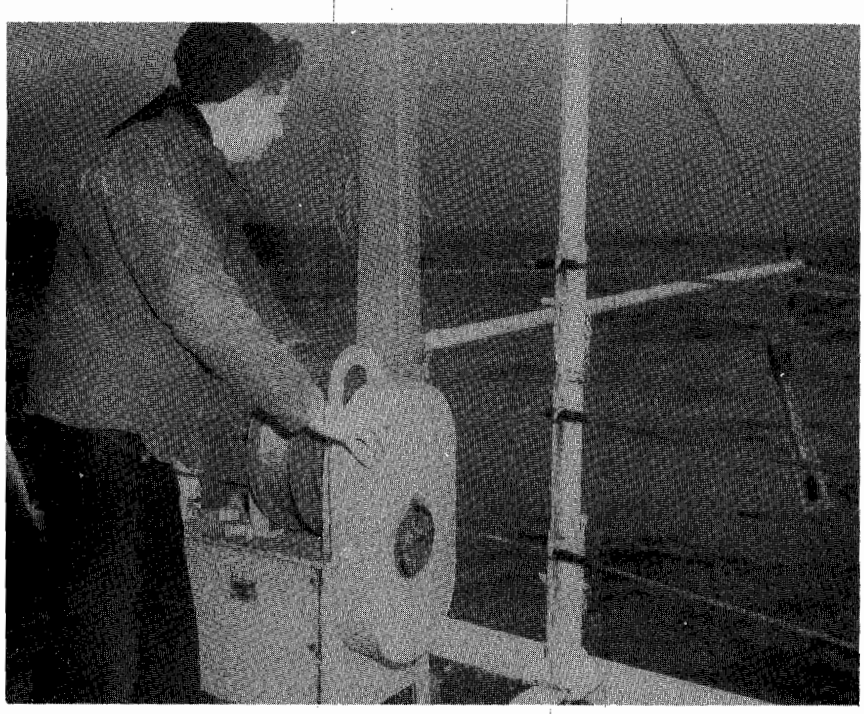
"Representatives of thirteen nations - Belgium, Canada, Denmark, France, Iceland, Ireland, Netherlands, Norway, Portugal, Spain, Sweden, United Kingdom, and United States, - met in London on 17 September in a conference opened by Dr. Edward Warner, President of the Interim Council of PICAO, acting as temporary chairman.

"Sir Edward Nelson, head of the United Kingdom delegation, was elected chairman of the conference; Mr. A. C. McKim, head of the Canadian delegation, vice chairman; and Dr. J. Dubsky, member of the PICAO Secretariat, secretary general. Financial, technical and drafting committees were set up also, and PICAO's legal counsel, Mr. J. A. Fruin, assisted at meeting of the financial and drafting committees as adviser.

"The conference concurred in the recommendation of PICAO at the Regional Air Navigation Meeting in Dublin, that thirteen ocean weather stations, located as set forth in the International Agreement which follows, are required for safe, regular, economic air traffic across the North Atlantic. This action implemented earlier recommendations of the International Meteorological Organization concerning the establishment of stationary meteorological ships.

"The conference established an International Agreement on North Atlantic Ocean Weather Stations with the following Annexes:

CIVILIAN WEATHER OBSERVERS PREPARING "RADIOSONDE"
(INSTRUMENT WHICH MEASURES AIR TEMPERATURE, PRESSURE AND HUMIDITY
AND TRANSMITS THIS INFORMATION TO RECEIVER ABOARD SHIP).



READY TO LOWER BATHYTHERMOGRAPH
WHICH RECORDS SEA WATER TEMPERATURE TO A DEPTH OF 450 FEET

Annex I, containing technical items concerning:-
(a) location of stations
(b) services to be performed
Annex II, containing general terms of separate agreement between Canada and the United States of America;
Annex III, containing general terms of separate agreement between Norway, Sweden and the United Kingdom;
Annex IV, containing general terms of separate agreement between Belgium and the Netherlands;
Belgium, Canada, France, Iceland, the Netherlands, Norway, Sweden, the United Kingdom and the United States agreed, subject to ratification of the governments concerned, to participate in the financing and operation of the 13-station network, with the division of operating responsibility set forth as follows:

Stations A-C-D-E-F-G-H to be operated by the United States.

Station B to be operated by Canada and the United States jointly.

Stations I-J to be operated by the United Kingdom.

Station K to be operated by Belgium and the Netherlands jointly.

Station L to be operated by France

Station M to be operated by Norway, Sweden and the United Kingdom jointly.

"The delegates of the signatory governments further agreed to endeavor to secure from their respective nations the early acceptance of the agreement. While it is intended to have all thirteen stations in complete operation by July 1st, 1947, the governments concerned have been urged to commence the operation of the program at the earliest possible date, before the coming into force of the agreement.

"The text of the Agreement and Final Act is included with this article as is a map illustrating the location of the thirteen vessels comprising the network, together with radio call designations and other information which, it is believed, will serve as a useful guide to all those engaged in transoceanic air and marine navigation.

"FINAL ACT AND INTERNATIONAL AGREEMENT ON NORTH ATLANTIC OCEAN WEATHER OBSERVATION STATIONS

The Governments of BELGIUM, CANADA, FRANCE, IRELAND, the NETHERLANDS, NORWAY, SWEDEN, the UNITED KINGDOM and the UNITED STATES OF AMERICA, being Member States of the Provisional International Civil Aviation Organization (hereinafter called "the Organization") and being desirous of providing the North Atlantic region with adequate air navigation facilities for safe, regular and economic air services in accordance with the general aims and objectives of the Organization, HAVE AGREED as follows:

Article 1

(1) Ocean weather stations shall be operated and maintained at appropriate locations in the North Atlantic region as hereinafter provided, beginning not later than 1st July, 1947.

(2) Each signatory Government shall use its best endeavors to commence the operation of the ocean weather stations as soon as possible before that date.

Article 2

(1) The locations of the ocean weather stations shall be initially as specified in ANNEX I hereof. The location of any ocean weather station may be changed by the Council of the Organization, with the consent of the Government or Governments responsible for that station.

(2) The services to be performed by the ocean weather stations shall be as specified in ANNEX I hereof and shall be carried out by Governments and groups of Governments as herein provided. The Organization shall co-ordinate the general programme of the operation of the stations. It shall keep the International Meteorological Organization advised of any action taken by it in connection with each co-ordination and shall invite the international Meteorological Organization to send representatives to participate in any meetings called for the purpose of accomplishing such co-ordination.

(3) The terms of ANNEX I may be amended by the Council of the Organization, with the consent of any Government whose financial or operating obligations would be directly affected thereby; and the Council may provide for any such amendment to come into effect for the several stations progressively, as its terms are accepted by the Governments responsible for each station in turn.

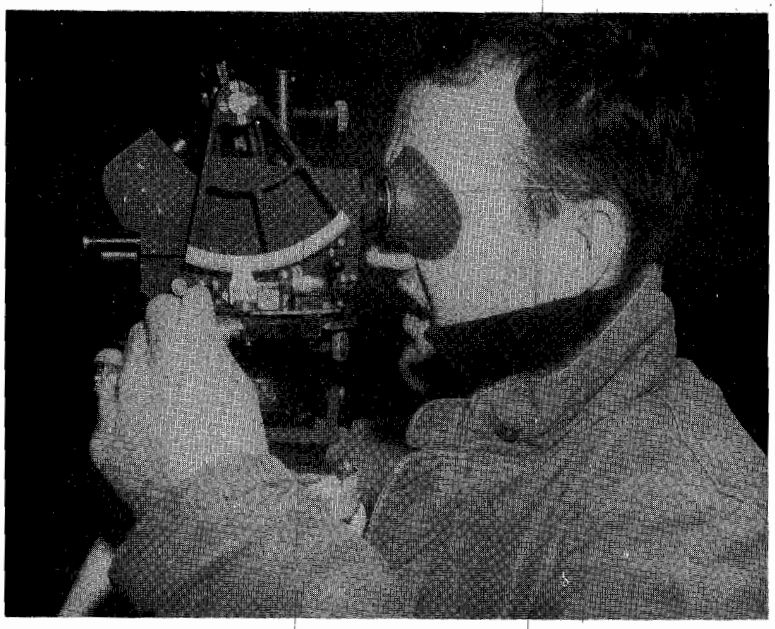
(4) The applicable standards, recommended practices, procedures and specifications of services approved by the Council of the Organization shall be observed in the operation of the ocean weather stations. The manner of making meteorological observations and of collecting reports and transmitting them to main meteorological offices or forecasting centres shall be in accordance with the appropriate procedures and specifications promulgated by the International Meteorological Organization.

(5) The signatory Governments shall supply such information to the Council of the Organization upon its request as may be necessary for the fulfilment of the purposes of this Agreement.

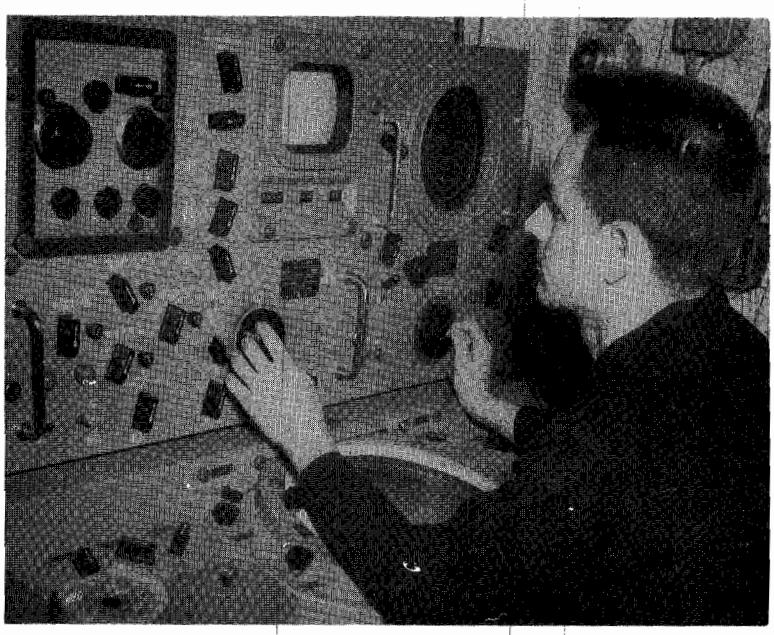
Article 3

(1) The ocean weather stations referred to in ANNEX I by letters shall be financed and operated by the signatory Governments as follows:

STATIONS	GOVERNMENTS
A C D E F G H	United States of America
B	Canada and United States of America jointly
I J	United Kingdom
K	Belgium and the Netherlands jointly
L	France
M	Norway, Sweden and United Kingdom jointly



BALLOON IS TRACKED WITH THEODOLITE
UNTIL ITS DISTANCE FROM THE SHIP
IS GREAT ENOUGH SO THAT IT CAN BE PICKED UP BY SHIP'S RADAR



AFTER RADAR HAS CONTACT WITH THE BALLOON
THEODOLITE TRACKING IS NO LONGER NECESSARY

(2) The signatory Governments jointly responsible for the financing and operation of an ocean weather station shall allocate the costs and operating responsibilities among themselves in such proportions as they may determine from time to time, which proportions are understood to be initially as stated in ANNEXES II, III and IV. Each of these Annexes shall be subject to amendment by agreement of the Governments immediately affected by them, notice of any such amendment to be given to the Secretary-General of the Organization by the Governments concerned, acting jointly or separately.

(3) Ireland shall make a general monetary contribution at the rate of £ 5,000 per annum.

Article 4

(1) General monetary contributions may be made by Governments towards the financing of the ocean weather stations provided under this Agreement.

(2) Any such general monetary contribution may be received by the Council of the Organization and shall be applied in accordance with priorities to be determined by it from time to time.

(3) The Council of the Organization is requested to examine the question of approaching Governments other than those which are signatories to this Agreement with a view to inviting them to consider making general monetary contributions. Any Government making such a contribution shall become a party to this Agreement, and this Article and the list of parties to this Agreement shall be deemed to be amended accordingly.

Article 5

(1) If any difference between two or more signatory Governments relating to the interpretation or application of this Agreement and its Annexes cannot be settled by direct negotiation, such differences shall, on the application of any Government party to the difference, be referred to the Council of the Organization for its recommendation.

Article 6

(1) This Agreement shall come into force upon acceptance by all the signatory Governments.

(2) Each signatory Government shall inform the Secretary-General of the Organization at the earliest possible date whether signature on its behalf constitutes an acceptance of this Agreement.

(3) The Secretary-General of the Organization is requested to inform all signatory Governments of each acceptance of this Agreement and of the date on which this Agreement comes into force.

Article 7

(1) Subject to the provisions of paragraph (2) of this Article, the present Agreement shall remain in force until 30th June, 1950. The Council of the Organization is requested to convene a Conference of the signatory and other interested Governments not later than 1st April, 1949 for the purpose of considering revision and renewal of this Agreement.

(2) In the event that the operation of any of the ocean weather stations provided by this Agreement is abandoned or terminated, otherwise than with the consent of all signatory Governments, and that the Council shall not, within 90 days thereafter, be able to make arrangements for the resumption of such operation, this Agreement shall terminate at the expiration of such 90 days. The Secretary-General is requested to notify all signatory Governments of the date of any such termination of the Agreement.

Article 8

(1) Reference to the Organization herein shall be deemed, after the coming into force of the Convention drawn up at Chicago on 7th December, 1944, to be referrence to the International Civil Aviation Organization created by such Convention.

Whereunto the undersigned representatives of their Governments have affixed their signatures ad referendum:
endum:

For the Government of BELGIUM (s)
For the Government of CANADA (s)
For the Government of FRANCE (s)
For the Government of IRELAND (s)
For the Government of the NETHERLANDS (s)
For the Government of NORWAY (s)
For the Government of SWEDEN (s)
For the Government of the UNITED KINGDOM OF GREAT BRITAIN (s) and NORTHERN IRELAND (s)
For the Government of the UNITED STATES OF AMERICA
ICA (s)

DONE in London the 25th day of September, 1946 in the English, French and Spanish languages, all of which texts shall be authentic and shall be deposited in the archives of the Organization. Certified copies of the texts shall be transmitted by the Secretary-General of the Organization to all signatory Governments.

ANNEX I

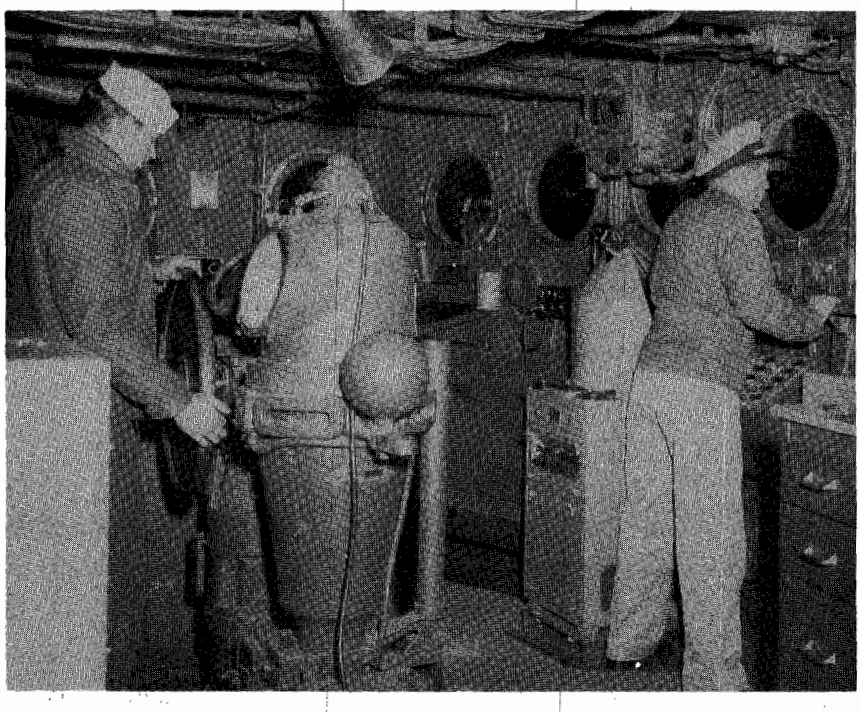
Location of Ocean Weather Stations and Services To Be Performed

1. Location of Ocean Weather Stations

The 13 ocean weather stations which form the subject of this Agreement shall be established and maintained at the following positions:

Station A:	62.00	N	- Mid Atlantic
	33.00	W	
Station B:	56.30	N	- Western North Atlantic
	51.00	W	
Station C:	51.45	N	- Mid-Atlantic
	35.30	W	
Station D:	45.00	N	- Western North Atlantic
	45.00	W	
Station E:	34.00	N	- Western North Atlantic
	52.00	W	
Station F:	35.30	N	- Western North Atlantic
	40.00	W	
Station G:	46.00	N	- Eastern North Atlantic
	29.00	W	
Station H:	36.00	N	- Western North Atlantic
	70.00		
Station I:	60.00	N	- Eastern North Atlantic
	20.00	W	
Station J:	53.50	N	- Eastern North Atlantic
	18.40	W	
Station K:	47.00	N	- Eastern North Atlantic
	15.00	W	
Station L:	39.00	N	- Eastern North Atlantic
	17.00	W	
Station M:	66.00	N	- Eastern North Atlantic
	02.00	W	

A GOOD MAJORITY OF THE MANY DAYS SPENT AT SEA BY A COAST GUARD WEATHER SHIP
IN THE NORTH ATLANTIC OCEAN ARE STORMY ONES



THROUGH THE LONG DAYS AT SEA ON WEATHER PATROL
THE HELMSMAN MUST KEEP THE COAST GUARD WEATHER SHIP STEADY ON HER COURSE
AND THE WATCH OFFICER MUST KEEP ALERT FOR SIGNS OR CALLS OF DISTRESS
FROM SHIPS OR PLANES IN HIS AREA

2. Service to Be Performed by Ocean Weather Stations

2.1 Meteorological Services

2.1.1. Meteorological observations shall be made on ocean weather stations in accordance with the following routine;

2.1.1.1. Surface observations, eight times daily, the observations to include all elements contained in the International Code for ships' observations;

2.1.1.2. Special observations of meteorological phenomena and of important changes which may occur between the regular observations, such information to be reported in the International Code for warnings of sudden changes in weather conditions, or in plain language if necessary;

2.1.1.3. Upper air wind observations[1] not less than four times daily, such observations to be made normally by radar methods. In the event of failure of the radar equipment, however, the observations shall be made by pilot balloon;

2.1.1.4. Upper air pressure, temperature and humidity observations,[2] not less than twice daily;

2.1.2. Reports of the observations referred to in paragraph 2.1.1. shall be transmitted to the appropriate shore stations in accordance with prescribed schedules;

2.1.3. Reports of observations from other ocean weather stations shall be received and re-transmitted in accordance with prescribed schedules.

2.2. Search and Rescue Services

2.2.1. The ocean weather station vessels shall form part of the general search and rescue organization and shall participate in any search and rescue operation in accordance with PICAO procedures and with those of the Convention for the Safety of Life at Sea, 1929. To this end they shall remain as close as practicable to their assigned positions unless it becomes necessary for them to leave their stations for search and rescue operations.

2.2.2. The ocean weather stations shall carry, as far as practicable, such search and rescue equipment as is necessary for effecting a sea rescue;

2.2.3. The crews at the ocean weather stations shall be expertly trained from the point of view of effecting a sea rescue.

2.2.4. The communication equipment on the ocean weather stations shall be sufficient to guard safety, distress or emergency calls from mobile units, air or surface, for communication with surface vessels or aircraft for distress, emergency and safety purposes, for transmission on regional search and rescue frequency when search and rescue operations are in progress and for beacon operation in accordance with a prescribed operating schedule and on an assigned frequency;

2.3. Navigational Aids to Aircraft

2.3.1. The ocean weather stations shall provide, when circumstances so require, navigational aid to aircraft, including the transmission of relevant meteorological information;

2.4. Incidental Services

2.4.1. In addition to the services specified in paragraph 2.1., 2.2. and 2.3., the ocean weather stations shall perform such incidental services as may be required, on the understanding that the performance of such services does not involve any appreciable addition to the obligatory personnel and equipment carried. These incidental services include:

2.4.1.1. Reports of observations from merchant ships received and re-transmitted in accordance with prescribed schedules;

2.4.1.2. Such supplementary air traffic control facilities as may be prescribed;

2.5. Other Services to be Performed in Connection with the Operation of Ocean Stations.

2.5.1. The States operating the ocean weather stations shall provide to other participating States copies of all regular surface and upper air meteorological observations made on their stations;

2.5.2. Statistical meteorological records and summaries of the observations shall be maintained in standard form and copies exchanged between participating States.

2.5.3. The participating States shall use their best endeavours to facilitate the inclusion, in the observational programme of the ocean weather stations, of such oceanographical and other scientific observations as may be found desirable.

1. There are two methods used to measure the direction and intensity of winds aloft:
   (a) PIBALS . . . visual tracking of the movement of a small free balloon having an assumed ascensional rate, using a special type of transit known as a theodolite.
   (b) RAWINS (Rawinsondes) , . . tracking a small free balloon to which a radar reflector is attached. Aboard ships, a standard radar is used (Coast Guard station ships use the SC-4 or other air-search radar in the 175-225 mc band). While a standard balloon with an assumed ascensional rate may be used, greater accuracy is obtainable by combining the RAWIN with RAOB, then using the computed heights from the RAOB, (Ed.)

2. Called RAOBS (Radiosondes) . . . and obtained by attaching a midget radio transmitter to a small free balloon and sending it aloft, - the required data then being automatically transmitted to the surface observer.

ANNEX II

Arrangement Between the Governments of the United States and Canada for the Financing and Operating of Ocean Weather Station B

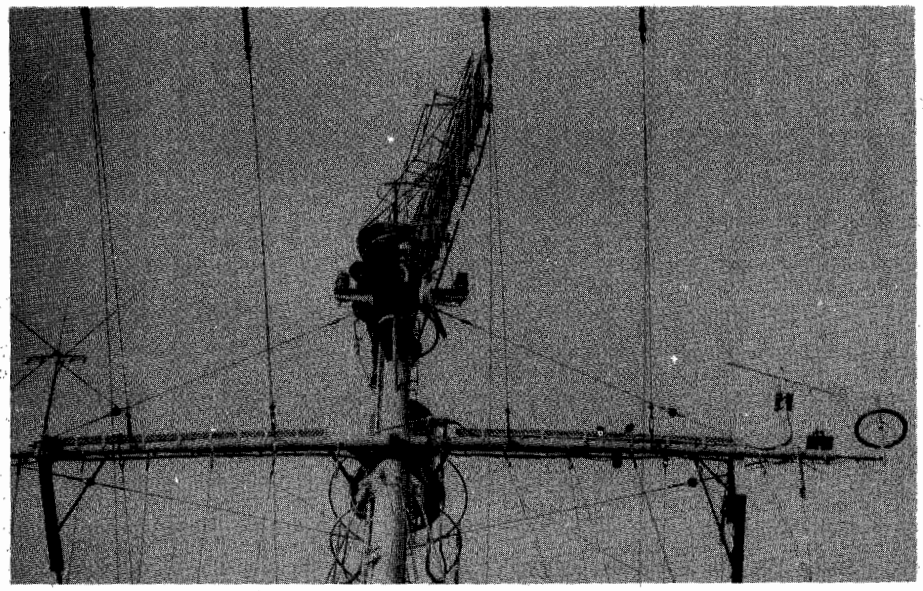
The United States of America to provide and operate the station. Canada to have the option to provide and to operate to the extent of fifty per cent of the station or otherwise to contribute in a manner mutually acceptable to both Governments.

ANNEX III

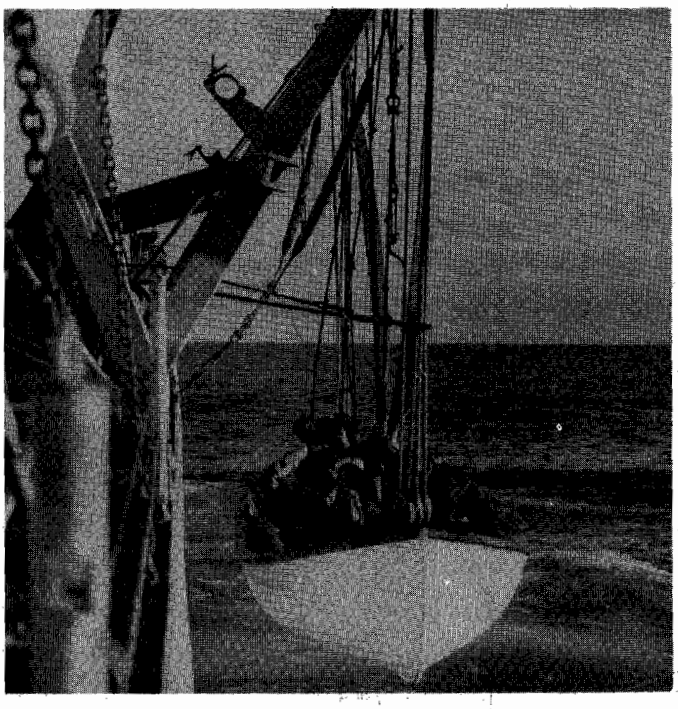
Arrangement Between the Governments of Sweden, the United Kingdom and Norway for the Financing and Operation of Ocean Weather Station M

Norway to operate the station.
Sweden to contribute to cost of operation 43%
United Kingdom to contribute to cost of operation 35%
Norway to contribute to cost of operation 22%
Sweden to be entitled to discharge part of its obligations by providing 50% of the meteorological personnel.

The United Kingdom and Sweden shall, by agreement with Norway, be entitled to discharge in whole or in part their liabilities in kind, instead of in cash.



THIS MAZE OF RADIO ANTENNA WIRES, RADAR SCREEN, AND GUY WIRES
MADE IT POSSIBLE FOR THE WEATHER SHIP BIBB TO GUIDE
THE SEAPLANE BERMUDA SKY QUEEN IN TO A SAFE LANDING NEAR THE WEATHER SHIP
SO THAT THE CREW COULD SAFELY RESCUE ALL PASSENGERS AND CREWMEN FROM THE DOWNED PLANE



SPEED BEING IMPERATIVE IN ALL RESCUE OPERATIONS,
PUTTING A LIFEBOAT OVER THE SIDE QUICKLY
CAN MEAN THE DIFFERENCE BETWEEN LIFE AND DEATH

ANNEX IV

Arrangement Between the Governments of Belgium and the Netherlands for the Financing and Operation of Ocean Weather Station K

The Governments of Belgium and the Netherlands to provide and operate half a station each."

* * * * * * * *

'COAST GUARD CUTTER STOOD BY DOWNED TRANS-ATLANTIC AIRLINER

An American International Airways Flying Boat, the SKY QUEEN, bound from Shannon, Ireland to Gander, Newfoundland with 62 passengers and 8 crew members with its fuel supply exhausted from fighting strong headwinds made a successful forced landing at 0659 (local) October 14, 1947, three miles from the Coast Guard weather ship GEORGE M. BIBB (under the command of Captain Paul B. Cronk, USCG). Weather Station "Charlie" where the BIBB was patrolling is located at 52° 45' N, 35° 30' W just about in the middle of the North Atlantic Ocean, 809 miles from Argentia, Newfoundland. After landing, the Flying Boat taxied to the Coast Guard Weather Ship BIBB.

Earlier indications that the aircraft was running into danger were contained in a dispatch from British Overseas Aircraft Command saying that Flying Boat NC 18612 was 100 miles from weather station "Charlie" at 0930Z with its fuel expected to run out 5 minutes short of its estimated time of arrival at the Coast Guard weather ship BIBB.

Another dispatch requested that all shipping be alerted in the area around weather station "Charlie" as the heavy seas would make landing difficult for the heavily ladened flying boat. She made a perfect landing on the sea beside the BIBB shortly after 7 A. M. on the 14th with waves running as high as 30 feet.

The moderating weather which had been forecasted would have reduced the hazard of rescue but by 3 o'clock in the afternoon, the weather had shown no signs of moderating and the plane was beginning to leak. Transfer of personnel was, therefore, begun despite the high seas that were still running. Three merchant seamen aboard the SKY QUEEN volunteered to make the first trip in a small rubber raft and they were picked up successfully by the cutter. A larger raft completed three more trips safely bringing survivors to the BIBB. On the fourth trip, with 16 persons aboard, the raft broke adrift. A motor surfboat was sent to the raft's aid and both were swamped. As the surfboat began to break up, the BIBB moved in with seamen over the side on landing nets. By miracles of courage and effort all those on surfboat and in the water were rescued. By this time darkness had fallen and operations were suspended with 22 persons still on the plane. Early next morning, October 15, 1947, the BIBB radioed "all passengers and crew safely aboard" and four days later she steamed proudly into Boston Harbor, a broom lashed to her masthead signifying a "clean sweep" in the rescue operation.

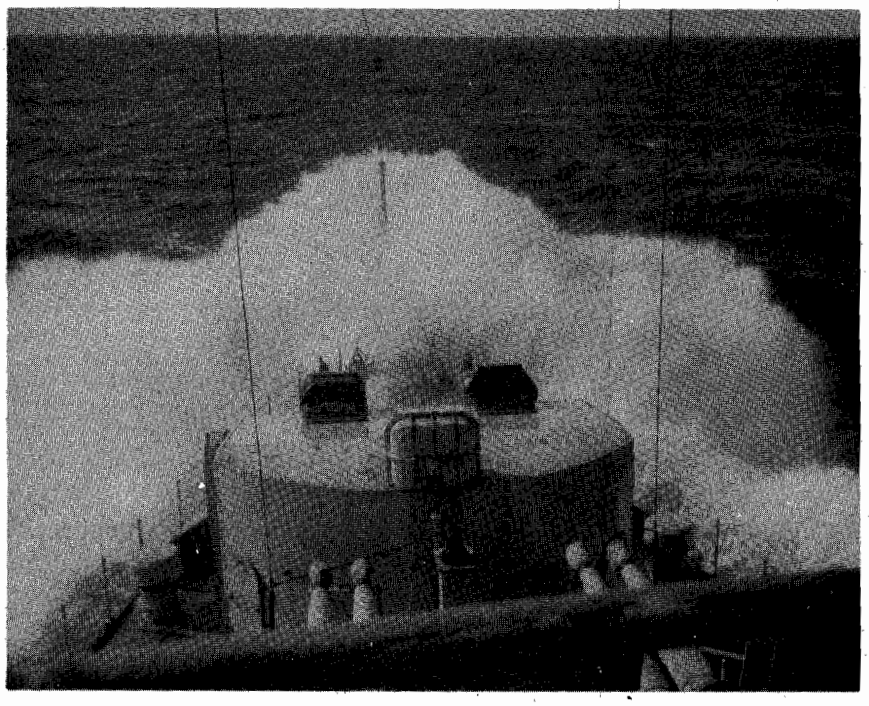
Coast Guard cutters assigned to this ocean weather station program usually remain at sea for a period of approximately one month — included in this figure is ten to twelve days' travel time, depending, of course, on the location of the Station. In the course of future operations, it is the Coast Guard's intention to rotate all major cutters on weather station duty — basing them in Boston, New York and Norfolk.

Life aboard these Coast Guard weather ships patrolling their stormy squares in the Atlantic is not only lonely but also trying, both physically and mentally. However, the realization that theirs is among the most difficult of all assignments, as well as of vital necessity to ocean flying, has developed an "esprit de corps" among these men that is seldom matched. Rarely in the North Atlantic do stretches of good weather appear — for the most part the days are overcast and stormy, with high seas running. The acute pitching and rolling of the cutter occasionally makes sleeping difficult — the sleeper being tossed about in his bunk, awakening between catnaps stiff and sore. The food is excellent — steaks, chickens, French fried potatoes, ice cream, etc., are regular items on the crew's menu — plus a never ending stream of coffee from coffee pots that never cease to percolate. Recreation while on station is rather limited, consisting chiefly of movies (where elements are favorable), short wave broadcasts, daily news bulletins, general reading, and 101 different types of card games. As the day draws near on which the weather ship is to be relieved, officers and enlisted men have but one thought in common, and that is to be HOME again. During a portion of the time that the cutter is in port, certain members of the crew depart on annual leave; the remaining members effect necessary repairs to the cutter, take aboard commissary stores, as well as supplies for the other departments, preparatory to the ship's next patrol.

As mentioned previously, it is the responsibility of Weather Bureau Personnel, usually four or five in number, assigned to ocean weather station duty, assisted by Coast Guardsmen, to obtain and transmit twice daily reports through Coast Guard Radio Washington (NMH) to the Weather Bureau for distribution by them through the same channels as other weather information — this weather information is also sent via short wave to Europe. Part of their work entails surface observations every three hours, radio sonde observations (this observation is for the purpose of recording the temperature, humidity and pressure of the upper regions at various altitudes by means of radio sonde transmitters suspended from giant balloons) taken daily at 1000 and 2100 GCT. The aviation interests engaged in ocean traffic make wide use of the information so received, basing their flights largely on these weather reports. Ultimately, when all thirteen ocean weather stations are completely manned, the pay load of commercial airliners should show a marked increase over that formerly carried. No longer will it be necessary for airliners to carry great amounts of extra fuel because of unknown weather conditions along many parts of their route.

The Coast Guard weather ships serve as a radio beacon for the high-flying airliners which it seldom sees, due to not only the altitude of the planes, but also the overcast weather that is so common in the North Atlantic. As the transatlantic plane approaches the sector patrolled by the weather ship, it is picked up on the radar ("S.C.") screen of the weather ship at a range of fifty miles or under. From this point on a constant plot is kept on the plane as to its course and speed until it disappears from view. The airliners' flying pressure pattern flights usually pass within fifty miles north or south of the weather ships. As they pass radio

"ALL WORK AND NO PLAY MAKES COAST GUARDSMEN DULL BOYS."
SO THEY LIVEN UP THEIR LONG STAY AT SEA ON WEATHER PATROL
WITH A LITTLE BIT OF HOMEMADE ENTERTAINMENT



EN ROUTE TO HER WEATHER PATROL STATION FAR AT SEA
A COAST GUARD WEATHER SHIP IS SHOWN HERE STICKING HER NOSE INTO THE SEA

communication is established — and if they request it — they are given radar fix as to their actual course and speed as plotted aboard the Coast Guard cutter. It is the Service's hope that in the future, with all thirteen weather stations fully manned and equipped with new and improved type of radar, it will be possible to run a constant plot on all transatlantic planes during the entire time they are over water.

Surface vessels, too, benefit from the various services offered by the ocean station vessel, as they can make use of the up-to-the minute weather information, as well as using the radio beacons to check on their position and speed. This advanced weather knowledge makes it possible for ships to get favorable winds by minor course changes, save enormously on fuel expended, as well as being able — because of time saved — to make more crossings per year. When fully manned, this proposed network of thirteen ocean station vessels will provide the best distress listening watch across the Atlantic on the 500 kc ever offered to merchant ships that might be in distress or badly in need of help.

Of the European nations that are committed to this ocean station program, England was to have two short hull corvette ships on station by about September 1, 1947. The French expected to have their station manned the Fall of 1947. Their weather ships were to be frigates furnished and equipped for this type of duty by the United States. The Netherland and Belgium Governments, manning one station between them, had also acquired American frigates and special equipment to fulfill their obligation and were just about ready to go into operation by the middle of October 1947.

Congressional authority to establish ocean weather stations was sought in S.2212 which passed the House June 8, 1948, after previously passing the Senate. It went to Conference June 12, 1948, and became Public Law No. 738 on June 22, 1948.

A FIRST HAND EXPERIENCE

James F. Cizek, Aerographer's Mate, Second Class, USCG, describes his assignment on weather patrol as follows:

Ships assigned to ocean weather patrol perform three fold duties: (1) They act as floating weather reporting stations periodically recording and transmitting vital weather data observed on the open seas; (2) They give signals to airliners as they cross the ocean; (3) In distress at sea, they assist in rescue of survivors (an excellent illustration of this is the BIBB's recent outstanding rescue mission).

Weather Stations are located at strategic positions so as to give the weather data needed by land stations. Such stations are located between Iceland and Greenland (Able); Greenland and Labrador (Baker); and half way between Newfoundland and Ireland (Charlie). These ships stay out a period of three weeks at a time at the end of which another ship relieves them. Including travelling time between stations, a ship is usually out at sea about a month and a half.

My first Weather Patrol was made on the Coast Guard Cutter MENDOTA which was launched, by the way, in the city of Baltimore. The ship is 255 feet in length and other ships of this class are also used on Weather Patrol. I reported aboard the MENDOTA at Boston from which port most Weather Patrol ships operate. The weather crew consisted of four civilian Weather Bureau men and three Coast Guard Aerographer Mates such as me. Our job was to assist the civilian Weather observers in their work. After preparing for many days to make sure that all weather equipment was aboard and in good working order, the ship was ready to sail. When that day arrived all hands had a look of adventure and excitement about them and also a feeling inside that for over a month they would be fighting the forces that nature might throw at them.

A few hours after we left Boston there was no more land to be seen and our work began immediately. Every three hours we sent surface weather observations to Washington by way of ship's radio. These observa- consisted of the present weather, sky condition, atmospheric pressure, temperature and dew point, wind and the state of the sea. Later on, after we were 200 miles from the nearest land Weather Station, we inflated 6-foot rubber ballons with helium gas and to these balloons we attached a radiosonde instrument which transmitted to us on a high frequency radio receiver, the pressure, temperature and humidity of the upper stratum to an altitude of 15 miles. Simultaneous to this balloon release we sent another smaller balloon, the course of which was followed with a theodolite to determine the direction and velocity of the winds aloft. Such observations were made every seven days a week.

By now we were over the Grand Banks of Newfoundland,-water, sky and an occasional whale or black fish were all there was to be seen. In the early spring, eyes were cast on the horizon for a glimpse of ice bergs. From this time on we took Bathythermograph readings. This was done by lowering a rocket shaped instrument into the sea to a depth of 500 feet, to record the temperature of the sea. These were taken every five miles and when the weather got rough, which was most of the time, it really made conditions hazardous. For instance, on my last patrol, a wave swept over the deck and carried off the winch that was used to lower the "BT" rig. It's weight of 500 pounds was not enough to keep it from being hurled into King Neptune's domain. After several days we arrived on station. Excitement passed among the crew as the ship to be relieved came into sight. Acter maneuvering, a breeches buoy was passed and the ship's mail and motion picture film was exchanged. The departure of the relieved ship was witnessed by our crew with sadness in their eyes. We lost her over the southern horizon, homeward bound.

At this phase of the patrol our work changed. Instead of following the small balloons with a theodolite we attached a tin foil target to the large balloon and sent two smaller balloons with similar targets aloft. These we tracked with ship's radar. This system is better than the theodolite method previously mentioned because when cloudy sky prevails, our observation was not possible. This type of work continued during three weeks of unpleasant cruising on station. Now and then aircraft asked us for weather conditions and we were on hand to give it to them.

Once on station time seems never to pass. Everyone has his own calendar on which he crossed off each day. At night movies were shown for all hands not on watch. Sometimes cookies, pop corn, or other refreshments were passed out to boost morale among the men. All kinds of food are appreciated because chow is not what we are used to. This is due to lack of space to keep stores.

Meanwhile Mother Nature threw all her might

at us relentlessly, night and day. The ship pitched and rolled at crazy angles. Wind, spray and rain beat down on us. Sometimes it was hard to distinguish the difference between the rain and the spray. Sleep sometimes became almost impossible and thinking back, one often sat on the deck to eat meals.

Three weeks of this slips by faster than one thinks. Working, eating and sleeping helps to pass the time and by now our relief ship is just over the horizon. The day we get relieved is a joyous one. All hands are out on the deck early to greet the relief ship. That doesn't mean that our work is over. We still have a long way to go. Again we take Bathythermograph soundings over the same waters that we travelled weeks before. There are meteorological forms to be checked and still the weather observations must be taken.

Before we know it, however, time has caught up to us and we are sailing into Boston harbor. So ends a Weather Patrol.

oOo

APPENDIX A

WEATHER STATIONS

STATIONS	LOCATION	OPERATED BY
1	56°31'N-51°00'W	CTF24
2	60°30'N-33°00'W	"
3	55°30'N-44°00'W	"
4	51°00'N-42°00'W	"
5	52°30'N-30°00'W	"
6	44°30'N-46°00'W	"
7	41°30'N-37°00'W	"
8	34°00'N-52°00'W	"
9	35°30'N-40°00'W	"
10	36°00'N-70°00'W	"
11	29°30'N-71°30'W	"
12	05°00'N-26°00'W	COMSOLANT (With Brazilian vessels)
13	00°00'N-30°00'W	COMSOLANT (With Brazilian vessels)
14	06°30'S-28°30'W	COMSOLANT (With Brazilian vessels)
15	07°30'S-21°30'W	COMSOLANT (With Brazilian vessels)
16	60°40'N-13°40'W	CINCWA (Under admiralty)
17	53°50'N-18°38'W	"
18	45°00'N-16°30'W	"
19	41°30'N-18°30'W	"
20	35°20'N-16°10'W	FOGMA
21	09°40'N-21°45'W	FOCWAF (COMSOLANT until British take over)
22	00°00'N-12°11'W	Not required at present 182352B

oOo

APPENDIX B

May 12, 1947

STATEMENT ON DEVELOPMENT OF WEATHER STATIONS

1. The ocean weather station program began in 1940 at the direction of the President pursuant to a request of the Secretary of Agriculture (Weather Bureau), as a joint Weather Bureau-Coast Guard operation; the Coast Guard providing the ships and communication facilities, including the shore radio station (Coast Guard Radio Washington, MMH), and the Weather Bureau providing the observational personnel and the special instruments and equipment required. This arrangement has continued throughout the period in question and is in operation now. The number and location of ocean weather stations was originally determined by the Weather Bureau in consultation with the United States commercial airlines, whose needs were being served. During the war, the number and locations were determined by the cognizant committees under the Joint Chiefs of Staff, primarily the Meteorological Committee of which the Weather Bureau is a member, not the Coast Guard. With the establishment of the Air Coordinating Committee, that body has recommended and approved the number and location of the stations and finally the interested North Atlantic States agreed at London in September, 1946, that a minimum of 13 ocean weather stations were required at positions set forth in that agreement. The Joint Chiefs of Staff and the Air Coordinating Committee have approved the 13 stations minimum and the positions.

2. On February 10, 1940, the Coast Guard cutters BIBB and DUANE assumed positions, marking two ocean weather stations on the great circle course between Bermuda and the Azores, located as follows:

Station No. 1 - 35°38'N 53°21'W
2 - 37°44'N 41°13'W

These stations were continuously occupied in various positions in the western North Atlantic through 1943. During the summer of 1942, two plane guard, or flight security, vessels were established; one between Labrador and Greenland and one between Greenland and Iceland.

These stations, Plane Guard Stations "A" and "B" respectively, manned by Coast Guard vessels, were operated under the Commander, Greenland Patrol, a Navy Task Group of the Atlantic Fleet, to protect the military aircraft flying route to Great Britain. These were later incorporated into the Atlantic ocean weather station net. Thus, during 1940 and 1941 the Coast Guard operated two ocean weather stations and during 1942 and 1943 two ocean weather stations and two plane guard stations. This involved a varying number of different vessels but probably averaged about 2.5 vessels per station.

3. COMINCH (COmmander in Chief, U. S. Fleet) letter of February 20, 1944, Serial 00569 FF1/A 4-3, to CINCLANT (Commander in Chief, Atlantic Fleet) and Commandant, Coast Guard directed that two additional ocean weather stations be established. These were occupied about March 10, 1944, the four stations being located as follows, the plane guard stations (2) remaining as before:

Station No. 1 - 34°N 55°W
2 - 37°N 40°W
3 - 43°N 38°W
4 - 54°N 44°30'W

By the provisions of COMINCH/CNO (Commander in Chief, U. S. Fleet and Chief of Naval Operations) letter to CINCLANT/COMDT (CG) dated March 15, 1944, Serial 00860 FF1/A-1, effective April 1, 1944, operational control of ocean weather stations, and vessels attached thereto, passed from the Coast Guard to CINCLANT. The actual operations were delegated to CTF-24 (Commander Task Force 24) in Argentia, with administrative and technical control vested in COMDESLANT (Commander Destroyers Atlantic Fleet). This shift of control was for reasons of military security and exercise of command in the Atlantic Ocean. COMINCH/CNO dispatch 161455 of May 1944 directed that two additional weather stations be established immediately at 58°N 37°W and 50°N 34°W. These were occupied on May 20 and 25 respectively and were temporarily designated plane guard station "C" and weather station 5 in that order. Information was received on May 22 that the British were to occupy two weather stations in 55°N 30°W and 45°N 18°W. By dispatch 101824 June, 1944, CTF-24 requested that plane guard stations "A", "B", and "C" be redesignated stations 6, 7, and 8 respectively. About this time, in order to adequately man all stations, several naval vessels of the Atlantic Fleet were used temporarily to fill in until the commissioning of the frigates (PF's) for this duty. By speed letter dated October 21, 1944, Serial 00773 to CTF-24, CINCLANT directed the establishment of eight ocean weather stations, including two plane guard or flight security stations; these latter, however, were to make full weather reports, surface and upper air, in the same manner as weather stations. The eight stations were located as follows:

Station No. 1	34°N	55°W
2	32°N	40°W
3	43°N	38°W
4	54°N	44°30'W
5	50°N	34°W
6	58°N	52°W (plane guard)
7	63°N	31°30'W (plane guard)
8	58°N	37°W

4. The number of stations manned and their locations remained as of October 21, 1944, until VE-Day in the spring of 1945. In order to safeguard the tremendous increase in air traffic involved in the redeployment of allied air forces, the Combined Chiefs of Staff directed an immediate increase in the number of ocean weather stations. By July 1, 1945, 22 stations were being maintained in the Atlantic as follows:[1]

Western North Atlantic by United States	11
Eastern North Atlantic by United Kingdom	5
South Atlantic between Recife and Dakar,	
(a) by Brazil under CONSOLANT (Commander South Atlantic Fleet)	4
(b) by United Kingdom	2
TOTAL	22

On November 1, 1945, United States stations 1, 5, 9, 11 and Brazilian stations 14 and 15 were discontinued. At this same time, however, stations 12 and 13 were manned by Coast Guard under COMSOLANT, so that as of November 1, 1945, the Coast Guard was manning nine stations, two in the South Atlantic and seven in the North Atlantic. Demobilization caused further reductions in British manned stations, so that on January 1, 1946, the United States was manning nine stations and the United Kingdom five stations, a total of 14.

5. During January, 1946, the British abandoned four more stations and on January 1, 1946, station 12 was relocated in the North Atlantic to fill the gaps left by the discontinued stations. Station 13 was discontinued on March 1, 1946, ending all South Atlantic operations. Therefore, on March 1, 1946, the Coast Guard was operating eight North Atlantic weather stations and the British one. At a conference with CNO on March 1, 1946, the following, in brief was agreed and accomplished:

(a) Reduce Atlantic stations to six by March 15, 1946.

(b) Return operational control to the Coast Guard as of the same dated March 15, 1946

Stations 10 and 12 were disestablished between March 1 and 15, and on May 1 the United Kingdom abandoned their last weather station, station 19. From that date until the present the Coast Guard has been the only agency operating Atlantic weather stations. Due to demobilization, the following table shows the stations occupied by the Coast Guard in the Atlantic for the remainder of 1946:

March 15 to May 1	6
May 1 to May 20	1
May 20 to June 10	3
June 10 to August 5	1
August 5, to September 22	2
September 22 to December 15	3
December 15 to May 1, 1947	2

7. The ocean weather stations in the Pacific have a shorter history and can be summed up in one paragraph. In general, the Pacific stations were manned by Navy vessels of various types until the frigates, manned by the Coast Guard, began to operate in the Pacific Area, about May and June, 1944, when some of these vessels took up that duty. COMINCH established a Pacific weather patrol in 1943 with the establishment of two stations in the north-eastern Pacific. This was shortly increased to four, and three plane guard stations were established on the flight line from San Francisco to Pearl Harbor. During the ensuing years, the number of ocean weather and plane guard stations all over the Pacific was increased by military necessity to 20. It was not until April 15, 1946, that the Coast Guard entered the picture as an operating agency in the Pacific. On that date, operational control of the then existing five stations east of Hawaii passed to the Coast Guard to be operated cooperatively with the Weather Bureau as in the Atlantic. In May, 1946, these five stations were reduced to three, and later just prior to June 30, 1946, the stations operated by the Coast Guard were reduced to two in the Pacific. This is the situation at present.

8. An interesting tabulation of all ocean weather and plane guard stations, Atlantic and Pacific, as of January 22, 1946, is as follows:

Total Ocean Weather Stations.....34
- Atlantic 12
  - British..... 3
  - United States (CG) 9
- Pacific 22
  - Canada 1
  - United States (Navy)..21

Total vessels manned by CG for ocean station duty 44
- Atlantic 23
- Pacific 21

U. S. Weather Bureau personnel involved....55 (Atlantic only)

1. For locations see Appendix A.

9. In summation, the following table shows the number of ocean weather stations operated by the Coast Guard each year, as nearly as can be figured considering the many changes, and broken down into Atlantic and Pacific:

	Weighted Average	
1940 and 1941		
Atlantic	2	
Pacific	0	2
1942 and 1943		
Atlantic	4	
Pacific	0	4
1944		
Atlantic	7	
Pacific	0	7
1945		
Atlantic	10	
Pacific	0	10
1946		
Atlantic	4	
Pacific	1	5
1947		
Atlantic (to May 1)	2	
Pacific (to May 1)	2	4

oOo

APPENDIX C

The following is part of a memorandum, dated June 2, 1945, from the Commander, Task Force 24, (Rear Admiral Ed. H. Smith, USCG) to the Commandant:

METEOROLOGICAL SERVICE

Prior to World War II there were few transatlantic scheduled flights. The principal American Company (Pan American Airways) was operating clippers between New York and Lisbon via the Azores. In the winter the route was shifted southward. Other companies were preparing to enter the transatlantic passenger business when, on the outbreak of war, practically all civilian aviation was displaced by the high priority of military aircraft and military operations.

Contemporary with the inauguration of scheduled air traffic across the North Atlantic, request was made for the establishment of two ocean weather reporting stations, equidistant, and located more or less along the air route between New York and the Azores Islands. The U. S. Coast Guard was directed to maintain the continuous operation of these two stations, and furnished five cutters for the service. The U. S. Weather Bureau supplied the necessary meteorological personnel and equipment. The observations included weather data from the surface, radiosonde, and pilot balloon observations of winds aloft.

Sometime during 1940, when Great Britain was suffering great shipping losses, and the transportation by sea of planes became critical, risks were boldly taken to fly American bombers directly from Newfoundland to England. This required a third ocean weather station about five hundred miles northeast of Newfoundland. The five U. S. cutters were now required to maintain the total of three stations. In the summer of 1942 the operational control of this group (Atlantic Weather Patrol) was transferred from the U. S. Coast Guard to the U. S. Atlantic Fleet. The ships and personnel continued to be Coast Guard.

The ever mounting sinkings from U-boats and the grave military situation in Europe required serious consideration of flying the small, short range fighter planes as quickly as possible to England. A chain of U. S. Army airdromes was constructed across the North Atlantic bridge from Labrador to Greenland, and over this route the first fighter planes were flown in July, 1942. This new northern route required two more plane guard and weather stations, one midway of Davis Strait and the other in Denmark Strait between southern Greenland and Iceland.

Just prior to the invasion of Normandy, three additional ocean weather stations requested by the U. S. Army, were located in blank areas far out in the mid-Atlantic. The British Navy at this time established one ship weather station about five hundred miles west of the British Isles. In May, 1945, in order to give adequate air sea rescue facilities to personnel traveling to the United States by air, the positions of the ship stations were aligned with reference to the principal ocean air routes and a total of 18 stations were established north of 15° north latitude. Eleven of these stations are operated by Task Force TWENTY-FOUR by a total of 26 frigates. A total of six patrol craft and six sub-chasers are distributed at Bermuda, Azores, Newfoundland and Iceland to cover the intermediate zones of air sea rescue as the planes approach terminal points.

The twenty-six frigates base regularly at the Naval Operating Base, Argentia, Newfoundland, and rotate on a schedule which permits visiting Bermuda, Greenland, Iceland and Boston. Argentia, the most centrally located base for these vessels, has an excellent harbor accessible the year around. Its facilities include emergency dry docking, a large machine shop for voyage repairs, a fuel depot, supply storehouse, recreation for the personnel and an air field which is connected with the U. S. by the Naval Air Transport Service. Argentia is the headquarters of this same task force which also operates the Ice Patrol service off Newfoundland during the ice season.

The North Atlantic Weather and Rescue Patrol vessels report by radio to shore, the surface weather conditions every three hours; significant weather changes as often as once per hour, and upper air observations four times daily. In order to provide navigational check points for aircraft along the route, the vessels are required to remain as near the station center as possible. They alternate 25 days at sea and 15 days in port exclusive of 30 days per year yard availability and training. The more detailed instructions under which the weather ships operate is contained in Commander Task Force TWENTY-FOUR Plan, copies of which are in the files of Commandant Coast Guard.

In addition to the surface ship weather stations, meteorological observations for safe air navigation are also collected by airplanes flying from several strategic airfields in the North Atlantic area. The planes are equipped with weather instruments and make daily routine flights (weather permitting) out over the ocean for distances of five hundred miles or more, taking observations at altitudes from near the surface to ten thousand feet or higher. Such routine flights are now made from Bermuda, Nova Scotia, Newfoundland, Iceland, England and the Azores. Weather planes also often proceed along the entire ocean route, from one airdrome to another, often in advance of large flights of transient aircraft. During the present war this important task has been carried out by the U. S. Army, for this side of the Atlantic, and by the Royal Air Forces for the eastern Atlantic. In postwar times, however, with the transfer of activity from military to commercial interests, this service should be combined with that of the weather ships at sea.

Due to the war, transatlantic air operations have increased at such a tremendous rate that the normal safeguards have been far outdistanced. More and more attention, however, is now being given to greater safety of life in the air out over the ocean. Plans and recommendations by military commands at present conducting transatlantic operations are devoting more and more study to an adequate and efficient weather organization.

The present operations plan based on high military priority, according to responsible air force commanders, is expected to continue with little abatement for the next one or two years. Subsequently, however, the question of costs will be critically examined and expenditures subject to curtailment to the overall investment. Certain restrictions are now being lifted with regard to civilian travel. The Air Transport Command is providing more space for civilian passengers engaged in important business transactions and requiring rapid transportation. A transition from military to commercial operations after the war is expected, therefore, to flow from one to the other without perceptible interruption.

It has been proposed at times by those not familiar with the situation, that all necessary weather reports from the North Atlantic be furnished by steamships plying on regular schedules. Unfortunately the ship traffic follows certain prescribed routes or lanes which are based on safety and the shortest possible passage, leaving large ocean areas seldom traversed. Furthermore, the daily number of weather observations essential to the safety of aircraft have become so technical and require such a high degree of accuracy, that it is impracticable for them to be taken by merchant ships. Hourly weather reports from North Atlantic Weather and Rescue Patrol stations are now being planned. The U. S. Weather Bureau has requested special additional radiosonde observations from certain North Atlantic Weather and Rescue Patrol stations prior to, and during the passage of hurricanes along the eastern seaboard of the United States. This additional weather information will increase still further the accuracy of transatlantic forecasting.

After the war European nations will derive corresponding value that comes from more detailed and accurate weather information applied to the management of commercial and agricultural enterprises.

In order to get some idea of the justifiable size of the safety services in post-war times, the following figures have been obtained from the North Atlantic Division of the Air Transport Command, under whose operational control practically all the North Atlantic air traffic is included. During 1944, there were 8,641 tactical aircraft ferried eastbound and 100 westbound, over the air routes. Transport airplanes totaled 5,070 eastbound, and 5,059 westbound. Additional flights, including weather reconnaissance observations, and a shuttle service between Labrador, Greenland and Iceland and the United Kingdom, totaled approximately 2,000 for the year. The total number of flights across the North Atlantic waters therefore was over 20,000, or an average of close to 54 flights per day.

No exact figures are at hand regarding the volume of Naval Air Transport traffic but it is understood to consist of approximately 50 flights per month between Newfoundland, the Azores and Europe.

Throughout the war, as previously stated, there have been a certain number of planes operated by commercial companies under wartime charter. In the North Atlantic area these include Pan-American and the British Overseas Airways, Inc. It is estimated that total flights averaged 100 per month in 1944 until ice conditions at Botwood, Newfoundland, suspended operations over the northern route. It is expected that traffic will be resumed as soon as ice permits in the spring of 1945.

It is doubtful that commercial operations, immediately following the war, will attain the volume that prevailed in 1944. Pan-American Airways, in urging one single overseas company of all U. S. Airlines interested in trans-oceanic trade, claims that the foreign business totals no more than 18 per cent of domestic travel, which in round numbers come to about $30,000,000 annually. A large majority of the American airlines, however, which are bidding for a share of the foreign travel, do not agree with this view and confidently expect business to soar after the war. Great Britain and some other foreign countries are looking forward with great expectations to heavy trans-atlantic air travel. Some estimated figures on operating revenue from transatlantic passengers, mail and express run as high as $150,000,000.

The 20,000 successful North Atlantic flights in 1944 depended primarily on accurate meteorological forecasting. Planes move or stop on the signal of the airdrome weather officer. While higher and faster flights will cause storminess in the lower levels to assume less and less importance, forecasting winds aloft, and selecting the most favorable flight levels, will continue to be vital. For safe flying over the United States, hundreds of observation stations are reporting weather hourly or oftener throughout the twenty-four hours. Over the North Atlantic, an area two or three times that of the United States, only sixteen stations exist today.

In order to carry out an adequate weather service in post-war times it is believed that a total of twelve stations is desirable, supplemented by flight lines of weather reconnaissance planes.

The proposed positions of the weather stations are open to minor adjustment, but their general distribution and the number is considered basic. Three stations (4, 5 and 11), have been located along what is regarded as the main, post-war, transatlantic air route. Changes in routes, however, will doubtless follow developments in aircraft design and operation. As previously stated, the total investment, and the number of lives risked, will largely dictate the size of funds appropriated for safety services. Expenses, as in any other economic enterprise, will eventually have to be adjusted to overall revenues. If it should be determined that the total of twelve stations recommended above does not receive final approval, elimination of stations in the following order is recommended: Stations 7, 10, and 2.

Nine of the stations located in the Western Atlantic Area should be maintained by ships centrally basing, as they are at present. Three of the stations located in the eastern part of the North Atlantic should be based on the British Isles. To satisfactorily man these stations 30 weather vessels will be required. A conservative estimate of the total cost of operation of the ships, exclusive of depreciation, is $10,000,000 per year. A breakdown of the estimated cost per ship under peacetime operating conditions is as follows:

Personnel Salaries and Wages	$157,240
Maintenance and Operation	167,576
Administrative Expenses (3.42% of above)	11,108
Total annual expenses per vessel, excluding depreciation	$335,924

For the 30 vessels, this would amount to approximately $10,000,000 annually. Assuming that the same ratio of depreciation to other costs holds as has been found for ice patrol vessels in peacetime operations, that is 16.2 per cent of the total, the total annual cost per vessel would be of the order of $400,000.

It is recommended that a Board composed of U. S. Government and transportation officials and scientists meet annually, or oftener as necessary, to review the operations of the North Atlantic Weather and Rescue Patrol in the Western Atlantic Area, and make recommendations as to its work and progress.

oOo

APPENDIX D

UNITED STATES COAST GUARD
Washington 25, D. C.

Address Reply To
THE COMMANDANT (C)
Refer to File: CG-618

8 February, 1946

MEMORANDUM TO ALL CHIEFS OF OFFICES

Subj: Policy, weather ship operation and weather stations

Ref: (a) Executive Order No. 9666, 28 December, 1945

1. Executive Order No. 9666 contains an exception to the effect that the Coast Guard shall continue to maintain and operate mid-ocean weather stations under the directional control of the Navy. The period during which this duty shall continue will be determined by agreement between the Secretary of the Treasury and the Secretary of the Navy.

2. It will be noted that the exception does not obligate the Coast Guard to assume any greater responsibilities in connection with weather station manning and weather ship operation than it had at the time the Executive Order became effective. If greater obligations or different obligations are to be assumed changes will be accomplished as a result of mutual agreement between the two Secretaries.

3. The Coast Guard's post-war program with respect to weather stations provides for the manning by the Coast Guard with Coast Guard vessels and personnel of a total of nine to ten weather stations located in the Atlantic and Pacific. It is proposed that the ships required will be provided by transfer to the Coast Guard of 18 naval vessels supplemented by 9 or 10 regular Coast Guard vessels. The manning and operation of the 18 naval vessels to be transferred to the Coast Guard is contingent upon Congress authorizing funds and personnel. The Coast Guard has made no provision for manning weather stations in excess of the nine distributed in the Atlantic and Pacific.

4. In view of the conditions stated above, the policy of the Commandant is therefore as follows:

(a) The Coast Guard will not assume any commitments increasing in any way its present obligations to the Navy as expressed in Executive Order No. 9666.

(b) The Coast Guard will not make changes in its present obligations to the Navy which will adversely affect or increase its post-war plans of maintaining a total of nine weather stations.

(c) The Coast Guard will not accept from the Navy ships, planes, or other equipment which would create an excess of what is required in the post-war plans and asked for in the Budget for 1947.

(d) An effort will be made to scale down as circumstances permit present obligations so that when July 1, 1946, arrives, ships, equipment, personnel, etc., used in manning nine weather stations will be within the limit provided for in the Budget for 1947.

(e) The Coast Guard is attempting to obtain on loan from the Navy 18 AVP type vessels to be used as weather ships and to replace 18 PFs now performing such duty.

(f) The Coast Guard will not acquire any PFs and will cease manning them as soon as agreement is obtained from the Navy. It will be noted, however, that 18 PFs are necessary for weather ships until the 18 AVPs are obtained but for such period only.

5. Ships will not be accepted from the Navy as Coast Guard property which are not required in our continuing program even though it is permissible at a later date to declare them surplus property. It must be realized that considerable expense and also personnel are required to care for ships declared surplus and placed out of commission awaiting final disposal.

6. It is important that the above policy be strictly adhered to in making all decisions and commitments with respect to weather ships and ocean weather stations.

J. F. FARLEY

oOo

APPENDIX E

AIR SEA RESCUE BULLETIN - APRIL 1946

WEATHER BUREAU RAWINSONDE PROGRAM

By B. C. Haynes, Chief of Observations Section, U. S. Weather Bureau. BS, MS, California Institute of Technology. Formerly: (1) Head of Technical Training Section of the Weather Bureau; (2) Air Safety Specialist in Meteorology, Safety Bureau, Civil Aeronautics Board; (3) In charge Aviation Meteorology Dept., Boeing School of Aeronautics. At present: (1) Member - Sub-committee on Deicing Problems, National Advisory Committe for Aeronautics; (2) Member - Advisory Council of the Air Safety Division of the National Aeronautics Association; (3) Member - Institute of Aeronautical Sciences; (4) Author "Meteorology for Pilots," Civil Aeronautics Bulletin No. 25.

One of the most notable contributions to aerial navigation and upper-air meteorology during the war was the development of radio direction-finding units which could be used in conjunction with balloon-borne radiosonde[1] transmitters to obtain winds at high levels during all weather conditions. The direction-finding equipment was developed by the Army Signal Corps and the Farnsworth Television and Radio Corporation, and is now being made available to the Weather Bureau for use in its upper-air program. The principal components of the new equipment are the radio receiver indicator with azimuth and elevation radar-type oscilloscope and antenna, designated as SCR-658 type. The Weather Bureau has been operating 76 radiosonde stations in the United States and its possessions, and on ships in the Atlantic Ocean, where upper-air observations of temperature, pressure, and humidity are made by use of a balloon-borne radio-meteorograph called a radiosonde. This instrument transmits pressure, temperature, and humidity signals on a frequency of 72.2 megacycles to a radio receiver on the ground. The signal is automatically recorded, and values of the upper-air elements are obtained. At extreme altitude the balloon bursts and the radiosonde descends to the surface of the earth on a small parachute.

The new program involves a radiosonde operating on a frequency of 403 megacycles. This wavelength is suitable for direction-finding. The antenna of the SCR-658 may be rotated through the vertical and horizontal angles so that maximum signal strength will be indicated by the oscilloscopes when the antenna array is pointed directly at the ascending radiosonde. Elevation and azimuth angles may then be read on indicators at one-minute intervals. Direct computation of the altitude of the radiosonde may be made by pressure-temperature relationships, using the values transmitted by the radiosonde during its flight.

In actual practice, three observers working as a team are required to make the observation, compute the values, and code the message for transmission by teletype and radio at the scheduled times. One observer acts as the SCR-658 operator and is in general charge of the assembly of the balloon, parachute, and radiosonde train, and the actual operation of the direction-finding equipment. A radiosonde

1. Radiosonde. - A combination radio meteorograph and transmitter which measures pressure, temperature and humidity.

observer operates the radiosonde ground equipment and computes the pressure, temperature, altitude, and humidity data as they are received on the recorder. A third observer acts as the winds-aloft computer, and he must work in close cooperation with the operator of the direction-finding set and the radiosonde observer. Azimuth and elevation angles are telephoned to him each minute by the operator of the SCR-658 set, and altitudes are computed and given to him by the radiosonde observer as the flight progresses. Using these data he computes the position of the balloon with respect to the station at each minute-interval, and then obtains the wind direction and speed through the various levels of the flight.

The Weather Bureau's wind-aloft program has in the past been based almost entirely on the visual observation of pilot balloons by means of a theodolite. The network of pilot balloon stations now consists of 165 stations which make four observations daily. The use of rawinsonde[2] methods will make observations possible within and above cloud decks that would otherwise restrict observations by the visual method. The present program calls for the establishment during 1946 of rawinsonde equipment at 43 stations in the United States, Alaska, and the Caribbean. Twice-daily observations will be made beginning at 10 a.m. and 10 p.m. E.S.T., respectively. Following is a complete list of stations at which the rawinsonde equipment is to be installed this year according to present plans announced by the Weather Bureau:

Buffalo, N. Y.; Caribou, Maine; Nantucket, Mass.; Pittsburgh, Pa.; Washington, D. C.; Greensboro and Hatteras, N. C.; Miami, Fla.; Nashville, Tenn.; San Juan, Puerto Rico; Bismarck, N. Dak.; Huntington, W. Va.; International Falls and St. Paul, Minn.; Sault Ste, Marie, Mich.; Albuquerque, N. M.; Big Spring, Brownsville, Fort Worth, and San Antonia, Texas; Burwood, La.; Little Rock, Ark.; Grand Junction, Colo.; Rapid City, S. Dak.; Columbia, Mo.; Lander, Wyo.; Las Vegas and Reno, Nevada; Oakland and Santa Maria, Calif.; Boise, Idaho; Glasgow and Great Falls, Mont.; Medford, Ore.; Spokane and Tatoosh Island, Wash.; Alaska, Barrow, Bethel, Fairbanks, Gambell, Kotzebue, McGrath, and St. Paul Island.

oOo

2. Rawinsonde. - Same as Radiosonde except that it also embodies a surface radio direction finder which permits the measurements of wind direction and velocity.