INTERNATIONAL COOPERATION IN MARITIME MATTERS

by

REAR ADMIRAL A. P. NIBLACK, U. S. Navy (Retired)

President of the Directing Committee.

The World War interfered seriously with the international co-operation of the various countries of the world in scientific research, but, on the other hand, there were developed, during this period, many scientific instruments of great value so that it might be said that applied scientific research was actually intensified by the World War. Many of the results are being gradually utilised to the advantage of international commerce and navigation, and many of the international organisations are resuming their periodic Conferences which were interfered with by the War. It will be noted that one of the great bye-products of the War, the League of Nations, is proving itself particularly active and fruitful in simplifying international communication in all of its various ramifications, through its Committee on Communications and Transit.

The loss of the "Titanic" in 1912 led to the "International Conference on Safety of Life at Sea" in London, in 1913-14, but, owing to the War, the Convention then drawn up was adopted subsequently by only five countries. This may be regarded as a fortunate circumstance, since the experiences of the war, and the progress in methods of communication through improved inventions, have already made the London Convention somewhat out of date. There is a general concensus of opinion that another International Conference, similar in scope, should be called to modernise the Convention of 1914, with a view to its proposed general adoption by Maritime States.

The Government of the United States of America has called a Radio Conference of all the governments of the world to meet in Washington early in October of this year, and has invited a subsidiary Conference of the Maritime States of the world to sit at the same time to consider a revision of the International Signal Code Book, as well as the international Codes of Signals themselves. The latest edition of the International Signal Code Book is based upon that of 1889 and does not include all the subsequent agreements made at the International Marine Conference in Washington at the end of the same year. Meanwhile the radio, the submarine, aviation, meteorology, fuel-oil, motor-ships, and a host of entirely new subjects remain unprovided for in the International Signal Code Book and meanwhile, also, the various meetings of the Radio Conferences have adopted numerous international signals which are not in the Visual Code Book. It is anticipated that the two Conferences in Washington will unify the signals used by radio, and by visual and sound signalling, and will, as well, unify the various international codes of signals used between ships, between ships and shore, and by aviators.

There has been no International Conference more fruitful in its benefits to mariners than the International Marine Conference in Washington in 1889. It is hoped therefore that the Radio and International Signal Code Book Conferences at Washington will achieve equally important results and be the forerunners of other conferences to bring about international agreements in the conflicting and multifarious aids to navigation in order to evolve gradually a uniform system (*i. e.* a sign language), to take the place of the local and non-uniform vagaries which even endanger rather than aid navigation. It is probable that in 1928, too, the League of Nations will call a Conference on Uniformity in Buoyage, Buoy Lighting and Port Signals. What is more urgently needed is the revision and modernisation of the " Regulations for Preventing Collisions at Sea " — otherwise known as " The Rules of the Road ", which were adopted by the Washington Conference in 1889.

As pointed out in the *Hydrographic Review*, Volume III, N° 2, for July 1926, 350 international organisations were in existence before the Covenant of the League of Nations was adopted. Of this total not more than 5 or 6 have any direct relation to maritime matters ; and of the 18 Committees or sub-organisations of the League of Nations, that of Communications and Transit has only 16 States Members represented in it and is practically the only one which has to do with maritime matters, and that only incidentally. Besides these, we have the International Hydrographic Bureau, which deals almost exclusively with the provision of maritime information which navigators must have in order to conduct their ships in safety on all the seas of the world.

In the last *Hydrographic Review*, Volume IV, N° 1, the writer clearly pointed out, in an article on : " Ocean Currents in Relation to Oceanography, Marine Biology, Meteorology and Hydrography", the interdependance of these four branches, and it is hoped that future oceanographic expeditions will not fail to embrace the requirements of all four subjects jointly.

Fortunately, nothing could be more admirable in all these respects than the German Atlantic Expedition, which sailed from Wilhelmshaven on April 16, 1925, in the " Meteor ", and returned in July, 1927, having accomplished two years of ideal oceanographic work. The "Meteor" is a schooner rigged, turbine driven ship of 1300 metric tons displacement, 75 metres long, 10 metres beam and 4 metres draft. She has two sets of turbines and carries 450 tons of coal. The crew, including the scientific staff, numbers 136 men. There is installed on deck a laboratory, a drafting-room, a dark room for photography and a work room for instrument repair. In the laboratory are sections for chemistry, biology, geology and meteorology. The drafting-room for hydrography contains a scientific library as well as the instruments used in meteorology, for distribution about the ship at various points of observation, for the air and for the surface of the sea. In the forecastle on the upper deck is installed the windlass for deep-sea anchorage, with tension dynamometer and automatic brakes for handling the wire hawser used in anchoring. This wire hawser is 7,500 meters long, is loosely wound and its upper circumference is 50 m/m and its lower circumference, at the anchor, is 36 m/m, weighing in all 5.7 tons. Anchoring and heaving in are done with a specially strong winch.

Various books on the preliminary preparations of the Expedition and its general results have already been published, but it will take some years to analyse, study and summarize all the results. H. R. MILL characterizes it as the greatest oceanographic work since the Challenger Expedition, and Walfried ECKMAN as " an intensive physical examination " of the South Atlantic Ocean " such as no other ocean has heretofore undergone ". The published charts give twelve profiles, with 269 observation stations, and the following statistics of the determinations made by the Expedition may be of interest :

Salinity and temperature	7,738
Hydrogen concentration	6,147
Oxygen composition	5,723
Free carbonic acid	233
Alkalinity	303
Phosphor contents	3,305
Wire soundings with bottom specimens	306
Echo soundings, over	54,000
Measurements of currents at anchor during	292 hours
Measurements of densities free from interference	269 days
Plankton experiments by centrifugal pump	986
Sediment observations	239
Plankton catches with the Nansen locking net	351
Plankton catches with the middle Apstein net	58
Plankton catches with deck-washing pump	213
Total pilot balloon ascensions	641
Among these, ascensions over 5,000 m.	268
" " 10,000 m.	151
" " 15,000 m. (max. 20,700).	46
Kite flights, max. height, 4,360 m.	167

Many new and improved types of instruments were used, and it is to be hoped that at least the more important will be shown at the Exhibition of Oceanographical Instruments at the Conference on the " Exploration of the Sea ", at Copenhagen in May, 1928. The detailed results of the German Atlantic Expedition " Meteor " will be awaited with keen interest.

The detailed results of the " Pourquoi Pas ? " Expedition of Dr. CHARCOT will be awaited with equal interest, together with descriptions of the instruments used in its oceanographic research.

A very good illustration also of international co-operation is that of the " Ice Patrol Service of the North Atlantic Ocean ", which has been maintained for 14 years by contributions from various governments, in accordance with the aforesaid " Convention for the Safety of Life at Sea ", drawn up in London in 1914. This Service is provided by the U. S. Government, through its

U. S. Coastguard Service which, for instance, in 1926, maintained two coast-guard cutters, the " Tampa " and the " Modoc ", with the " Mojave " as a stand-by in case of the necessary withdrawal of either of the other two vessels. The object of the Patrol is to locate by scouting and radio information the icebergs and icefields close to and menacing the North Atlantic Steamship lane routes. To do this, it is necessary to determine the southerly, easterly and westerly limits of the ice and to keep in touch with it as it moves southwards. Radio broadcast are sent out twice daily giving the whereabouts of the ice and particularly when it is in the immediate vicinity of these steamship routes. In the course of the annual experiences of this Ice Patrol, it has been found necessary to institute an exhaustive investigation into the meteorology and oceanography of the ice regions in order to obtain a greater knowledge regarding the behaviour of drifting ice. Fortunately, through the invention of the Electric Salinity Tester by the U. S. Bureau of Standards, and first used in the season of 1924, it has been practicable for the Patrol vessels to construct, each season, and several times during the season, ocean current maps of the critical area where the Labrador Current and the Gulf Stream meet, producing the greatest menace to shipping from floating ice. After many seasons of experiment, that of 1926 saw the introduction of the BJERKNES method, through the assignment of Lieut.-Commander Edward H. SMITH of the U. S. Coastguard as Oceanographer, he having been sent to the Geophysical Institute at Bergen, Norway, in 1924-5, where he had a year's study with Professor HELLAND-HANSEN.

Lieut.-Commander SMITH says that this method of " Dynamic Oceanography provides an easy and efficient means for mapping currents over extensive ocean surfaces, which guarantees its wide employment in future hydrographical surveys ".

The equipment of each ship consists of duplicate sets of oceanographic gear and instruments for observing temperature and salinity at each station at seven different depths, *viz.* 25, 50, 125, 250, 450, 750, 1,200 metres and also of :

1 Electric Hoist designed for rapid reeling.
6,000 feet of 1/4" wire running rope.
2 Metre Wheels.
12 Greene-Bigelow Water Bottles with messengers.
24 Negretti & Zambra deep-sea thermometers.
6 Cases citrate bottles with rubber gaskets.
1 Electric Salinity Tester.

Lieutenant-Commander SMITH says that :

" A station team of six men is detailed from each watch, and as the " work at every station is identical, the men soon become real experts. With " a well-trained team it is possible to complete all of the observations down " to 1,200 metres within the space of an hour, including the time necessary to " stop the ship for the sounding and also to get under way. It is important " that no more time than absolutely necessary be borrowed from the primary " duty of the Patrol — ice scouting ".

" The critical area upon which the Ice Patrol's attention becomes focussed " is about 40,000 square miles off the Tail of the Grand Banks. This locality " is sometimes called the gateway to the Atlantic because it is by this point " that nearly all of the Arctic ice passes on its journey to temperate latitudes. " The currents over this area also are subjected to devious paths, and a berg " may be carried slowly to the westward in one part of the current, while " other ice farther off-shore is perhaps swept across the bows of approaching " passenger ships. A practical and comprehensive current map of this 40,000 " square mile rectangle requires a basis of 20 to 25 well distributed stations " spaced 20 to 30 miles apart. A vessel capable of maintaining a speed of " ten knots is able to perform the observational work, including running time " between stations, in about four days. Three times during the ice season of " 1926 the Patrol ship on duty off Newfoundland conducted such a survey " and, on one occasion, the work was extended over an area of 100,000 square " miles in the short time of four days. This is the first time in the history " of oceanography that deep-sea observations have been treated immediately " on board ship and the final results employed for a practical economic pur- " pose. It demonstrates, moreover, what can be accomplished in charting the " circulation in other little-known regions. "

It has been found that the wind is a most important factor which governs the southward drift of polar ice and the study of atmospheric pressure differences between various points in the Arctic and North Atlantic region, from December to March each year, furnishes the best data for predicting the amount of ice which will trouble the ocean lanes. This is subject to great annual variations, for instance, in 1912, the year in which the " Titanic " was lost, there were approximately 1,200 bergs counted south of Newfoundland, while, in 1924, there were only 11 and, in 1926, 345.

In the year 1926 about 450 steamships of many different nationalities acknowledged the receipt of the ice predictions and thanked the Ice Patrol. About 465 deep-sea soundings were taken by means of the sonic depth-finders, particularly to the southward of the Grand Banks in the deeper portion of the Atlantic basin. These were corrected for the velocity of sound in water at different temperatures, salinity and pressure, the range of soundings being from 24 fathoms to 2,850 fathoms.

Lieut.-Commander SMITH further states :

" As was done on previous patrols a meteorological map was constructed " twice daily on board ship, the data being obtained from the general synoptic " reports broadcasted by the United States Weather Bureau from Arlington at " 10 a. m. and 10 p. m. In addition to this the patrol ship was furnished " with a daily forecast especially prepared by the Weather Bureau. All this " information was broadcasted by phone to approaching steamers immediately " following the ice broadcasts. The report on fog conditions was one of the " most important features of this service from the standpoint of the steamship " captain. The element of fog in the Grand Banks region, it is obvious, " greatly increases the ever-present danger of collision with ice.

" Twice daily, at 8 a. m. and 8 p. m., a weather report was dispatched to " the United States Weather Bureau, Washington, D. C., and at the end of " each cruise a more detailed report was forwarded by mail to Washington " weather officials. "

The patrol vessels were able to make important meteorological observations and they found, for instance, in the 1926 ice season, that the cyclone and anti-cyclone movements alternated across the Grand Bank region from West to East and that, with the progress of the season, the gradients become gentler, the winds weaker, and the vortices travel more slowly. The BJERKNES method is particularly applicable to forecasting cyclonic movements and determining their structure, there being two types which may be classified as " *a* " and " *b* ". The cyclones of the " *a* " type have a definite warm sector, separated from the cold part by definite surfaces, and these become intensifying storm centers moving in the direction of the air current in the warm sector and very nearly at the same as that of the air in that sector. The speed ot the cyclone is found by multiplying the number of isobars by the sine of the latitude.

The "*b*" class of cyclones have no distinct discontinuity surfaces of warm and cold such as the class " *a* ", and the cyclones are formed by two air masses of different densities coming within proximity or each other, the thermal characcer of the two types being the usually accepted index.

The Ice Patrol, with the assistance of the British Meteorological Office, and, more recently, the U. S. Weather Bureau, has begun an investigation into the effect of the weather upon the distribution of ice-bergs, as pressure data are now received by radio from meteorological stations in Greenland. The service of the Ice Patrol in obtaining meteorological data of great value, opens up a new field of international co-operation.

The research work of the British ships " Discovery " and " Scoresby " (1926-7), in whale marking and taking plankton collections off the coast of Africa and in the vicinity of South Georgia, deserves notice as of international importance.

It is in a similar way that the Steamship " Jacques Cartier " of the Compagnie Générale Transatlantique is co-operating in meteorological research by demonstrating the possibilities of international weather forecasting for the benefit of shipping on the North Atlantic Ocean, in every trip which it makes across. The French Government places on board scientific meteorologists who, with the daily data broadcasted by the British Meteorological Office, the U. S. Weather Bureau, and contributed by merchant ships which are at sea in the vicinity, combined with the observations which are made on board the ship itself, broadcast daily weather predictions, giving most satisfactory weather forecasts. The activities of this ship clearly demonstrate the possibility of giving vessels crossing the North Atlantic an excellent weather-forecasting service. There is probably some good reason why seamen are not entitled to this service through international co-operation because, somehow, they do not get it. For instance, during the transatlantic flights in May, 1927, LINDBERG, CHAMBERLIN and BYRD had continuously the benefit of weather prediction for their flights and it is a much simpler problem to give the same forecasts for shipping. It is possibly all due to a question of lack of funds — or failure to receive funds when requested. The meteorological offices have the same benefit of daily reports from shipping which the Hydrographic Offices have. With the increasing knowledge on the part of ship captains of the elements of meteorology, much can be done by the exchange between ship captains, by radio, of meteorological data, in enabling them to make their own predictions with a considerable degree of accuracy.

As has been previously stated, it was pointed out in the *Hydrographic Review*, Volume IV. N° 1, in an article entitled : " Ocean Currents in Relation to Oceanography, Marine Biology, Meteorology and Hydrography " that all four branches are equally interested in acquiring fuller data on the subject of ocean currents. Hydrography wishes to know in how far ocean currents may affect navigation. Marine Biology wishes to known the effect of ocean currents on marine life. Meteorology wishes to know in how far ocean currents cause changes in the weather. Oceanography desires to know the causes that contribute to producing ocean currents. No doubt it would, for instance, be profitable to study the ocean currents on the Grand Bank as affecting the fishing industry. We have seen that the Ice Patrol has contributed much to the study of ocean currents and meteorology in a limited area through the principles set forth by BJERKNES and his school of oceanography. In the study of ocean currents, the U. S. Coast & Geodetic Survey publishes a series of pamphlets embodying systematic current observations made on board light-vessels, in co-operation with the U. S. Lighthouse Service. This work might well be supplemented by more Hydrographic Offices. A study of the mean latitude of centers of barometric depressions across the North American continent and the North Atlantic Ocean might reveal a close relationship to ice conditions in the polar basins, since low ocean temperatures are due to ice and higher temperatures are due to the heat of the sun. Professor BJERKNES has shown that the causes of ocean currents and of atmospheric movements are founded upon the same principles, and the study of one may well show co-relationship with the other.

One of the great problems of meteorology is to find a method of determining, a month or a season ahead, what the weather conditions are likely to be in any given region, through the study of solar variations and of ocean currents. This implies a wider knowledge of not only the fluctuations in the strength but in the direction of ocean currents, as well as the nature of the currents set up by a moderate or a strong wind, lasting for a day or two. These fluctuations in currents are quite important in hydrography but particularly in marine zoology because of their effect upon fish, sea mammals and microscopic plants, which inhabit both coastal and ocean areas of the sea, causing variations in valuable fisheries through the deflection of the microscopic food supply on which they subsist, as such microscopic plants flourish only in the upper layers, to which sufficient light penetrates. In other words, the fertility of the sea is largely dependent upon ocean currents keeping the ocean in slow but constant circulation. The evaporation of the surface of the ocean into the air, and the flowing of the currents into other regions causes the water to rise from the ocean deeps, which is rich in nutrient salts. The temporary drifts of the upper layers of water, caused by the wind blowing for several hours a day, rarely exceeds a knot per hour, even with the strongest winds. Along the coast these temporary currents get mixed up with the tidal streams, causing variations which create errors in navigation. These problems distinctly affect hydrography.

The Exhibition of Instruments for the Study of Oceanography, which was to have taken place at Prague in September of this year, in connection with the meeting of the Geophysic and Geodetic Union, has been postponed until May, 1918, when it will be held in connection with the Conference on the Exploration of the Sea, which thus more closely corresponds with the vital interests of Oceanography.