# The Science of an Ocean Voyage

*Hydrography*

Prepared with the cooperation of the Hydrographic Office, U. S. Navy.

To the science teacher or student, bound for Europe with the idea of visiting places of scientific interest, the ocean voyage might seem rather uneventful, and merely a necessary evil to be endured before the real part of the trip commences. But astronomy, physics, zoology and even chemistry have their part in an ocean trip.

Of unfailing interest on the boat is the daily posting of the ship's position, from which the passengers can see where the boat is, and the path it took in getting there. In the early summer months this route, if one sails from New York, is usually due east to a point at 40° 30′ north latitude and 47° west longitude, the place that navigators call the "corner of the North Atlantic." Out to this point the path is what is called a rhumb line, that is, it is a straight line on a map on the Mercator projection. From the "corner," the ship appears, on the map, to sail in a curve to the northwards. Actually, however, the path is that of a great circle, which is the shortest distance between two points on the surface of a sphere.

We all remember Lindbergh's path to Paris, which was along a great circle, and crossed Nova Scotia, though on the ordinary map it appears most circuitous. If he had flown high enough, over New York, and if his eyes had been good enough, he would have seen Paris in the distance, and then, if he had headed straight for Paris, he would have flown over the path that he actually took.

It might seem that a ship should follow as closely as possible this same path, just skirting Nova Scotia. This would be the shortest route across the Atlantic, but it would take the ship over the Grand Banks, which is an area of shoals. The water here is under a hundred fathoms, or 600 feet, deep, and fogs and ice are frequent. Hence the path actually used is taken. The route passes south of the southern tip, called the "Tail," of the Grand Banks. Incidentally, hydrographers have selected a hundred fathoms as the depth at which "coastal" waters cease and "ocean" waters commence.

The ocean currents are also a source of interest, especially that most famous of all currents, the

*"SHOOTING THE SUN" in mid-Atlantic to determine a ship's position*

Gulf Stream. At about 150 miles out from New York the influence of the stream is felt. Sometimes there is even a rather well defined line of demarcation between the green cold water, at a temperature of perhaps 60 degrees F. and the warm waters, of a deep blue color, and perhaps 80 degrees F. From then on the ship continues in the Gulf Stream the rest of the way across.

Meteorologically, the early summer months are the most uneventful of the year. Gales are at a minimum, and though they may, and do, occur, they lack the intensity of those encountered later. Another thing to notice are the favorable winds that usually accompany the voyage over. This is the result of the Atlantic high, a high pressure that is centered at approximately the Azores. Around a high pressure area in the northern hemisphere the winds move in a clockwise direction. That is, north of the high, east is their prevailing direction, while to the south it is to the west, and it is to the north of the high that the ship travels.

It is possible that the summer tourist may see an iceberg, but it is rather unlikely, because south of the Grand Banks ice is not very common in the summer time. However, if one should sail from Montreal or Quebec, and emerge to the Atlantic at Belle Isle, he should be able to see all the ice he wants.

If ever one felt a debt of gratitude to the astronomer, the ocean traveller should experience it. Navigation itself is essentially an astronomical problem. Also, all the methods depend upon correct time of the ship's chronometer, which can be set from radio time signals. Here also, the astronomer plays his part, for the time is determined at observatories on land.

Every clear day, about noon, the passengers will see one of the ship's officers on the bridge with the sextant, getting the altitude of the sun above the horizon. From this can be determined the ship's latitude. Or again, the officer may be noticed taking sextant observations at dawn or twilight, when a few of the brighter stars and the horizon are both visible. By taking the positions of three heavenly objects practically simultaneously, a precise "fix" can be obtained. Details of this method will be found in any good astronomical text-book.

Though social diversions are apt to occupy a large part of the passenger's time in the evening, and keep him in the salon, he should not forget to watch the stars at least occasionally. Being far away from the lights of a great city, mid-ocean is really a pretty good place to observe the constellations, even though the large amount of moisture in the air prevents the observer seeing stars as faint as he could see from a California mountain, for example.

After turning the "corner of the Atlantic" the ship goes northward rather rapidly, and this is shown in the sky. It is especially evident if the passenger watches the Pole Star on successive nights of the voyage, and notices how it seems to climb higher and higher as he approaches England, which is about ten degrees of latitude farther north than New York. This means that the Pole Star will appear ten degrees higher in the sky from England; while Antares, the brilliant red star in the southern summer evening sky, will appear ten degrees lower. In the course of a few nights, especially on a fast steamer, this change will be very noticeable.

Also with its astronomical aspects is the change in time as the ship travels eastward. When it is noon in New York it is five o'clock in the evening in England, and this means that a total of five hours must be dropped in the voyage over. The time used by the passengers usually changes at midnight, the clocks always being pushed ahead on the eastward voyage. The ship's (*Turn to next page*)

# Europe's Weather Stations

*Meteorology*

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LONDON: Meteorological Office, headquarters of the meteorological service for the British Isles. The administrative offices are at Adastral House, Kingsway. Several other branches, including the library, are in South Kensington. The historic Kew Observatory is a branch of the Meteorological Office. Modern methods of meteorological work in behalf of aviation are illustrated on a large scale at Croydon, the principal British airport.

PARIS: Office National Météorologique, headquarters of the French meteorological service. An important observatory is maintained at Parc Saint-Maur. Paris has also a municipal meteorological service with headquarters at Montsouris.

BRUSSELS: Observatoire Royal, at UCCLE, headquarters of the meteorological service of Belgium; also the chief astronomical observatory of the country.

BERLIN: Preussisches Meteorologisches Institut.

LINDENBERG (Kreis Beeskow, Prussia): Aeronautische Observatorium. Famous center of upper-air research and headquarters of the aeronautical weather service of Germany.

HAMBURG: Deutsche Seewarte. Important center of marine meteorology.

VIENNA: Zentralanstalt für Meteorologie und Geodynamik. Headquarters of the meteorological service of Austria.

ROME: Reale Ufficio Centrale de Meteorologia e Geodinamica. Headquarters of the meteorological service of Italy.

TORTOSA, SPAIN: Observatorio del Ebro. Large Jesuit institution devoted especially to the study of relations between solar and terrestrial phenomena.

DAVOS, SWITZERLAND: Physikalisch-Meteorologisches Observatorium. Founded by Dr. C. Dorno. Unique institution devoted especially to the study of the physiological effects of solar radiation, atmospheric electricity, etc.

Central offices of national meteorological services are found in all of the European countries; usually, but not always, at the capital cities.

A general account of meteorological organizations and their work is given in Charles Fitzhugh Talman's "Our Weather" (New York, 1925).

*Science News-Letter, April 7, 1928*

# Voyage—*Continued*

officers, however, change their time more frequently.

There are plently of things of scientific interest on the ship itself, such as the various instruments by which the ship is kept constantly under control, and which may be seen if the traveller has enough "pull" to get an introduction to the captain or the officer in charge. Most ships nowadays are equipped with radio finders, with which they can get a bearing from any radio transmitting station, either ashore or afloat.

Many modern ships are equipped with the automatic pilot, by which the human helmsman, who in olden days kept at the wheel, is replaced by a mechanism that keeps the ship in the proper course. Of course, this can only be used in the open sea, where there is no danger of collision with another vessel. "Fathometers," a form of the sonic depth finder, trace on a moving strip of paper a constant record of the depth of the water beneath the ship. Engine revolution counters show the speed of the ship through the water, and are checked near land by the log. It is either thrown over the stern, the common practice on American ships, or else, as on some French vessels, from a boom projecting out over the side from the bridge. Incidentally, if you want to call the sides of the ship right and left, instead of starboard and port, you have a perfect right to do so, for the common appellations have been adopted as official by the U. S. Navy.

A question that often comes up at sea is that of the distance that one can see. From a small boat, such as a life boat, one's horizon would be about 2.5 miles away. However, from a height of 45 feet, that of the promenade deck of a large liner, the horizon would be eight miles away. Another ship equally large could be seen easily when 15 miles distant.

This explains why ships going the other way are rarely encountered, except near port. The west-bound steamer lane, in mid-ocean, is about 60 miles north of the east-bound lane, and though the ships can pass close enough to be in easy touch by radio, they are not likely to be close enough to be visible to each other, unless one is far off the path.

Birds are most likely to be seen near land, though some may follow the ship all the way across. This is particularly true of the storm petrel, known to the sailors as "Mother Carey's chickens" and to the ornithologist as *Thalassidroma pelagica.* This is a fully descriptive name, for it means "wandering sea-walker." To see these dainty creatures skimming along over the tops of the waves, one realizes how closely it fits. Seagulls also are common.

The waves, by the way, are apt to be a good deal higher than the passenger in the deck chair is apt to realize. From the height of the deck they do not look so large. Actually, even in fine weather, they may be as high as 15 feet from trough to crest. In stormy weather they may easily reach a height of 30 to 45 feet, and be anywhere from 300 to 600 feet long. The highest recorded wave was met by the Majestic in December, 1922, its height being 80 feet!

The last evidence of land that the voyager is likely to see will be the Nantucket light ship, or possibly even Ambrose light. Then, as he approaches England, if his destination is Plymouth, Southampton, Cherbourg or Havre, the first evidence of Europe visible will be the Bishop Rock light, on the Scilly Islands, off the southwestern tip of England, which is visible for a distance of 18 miles. It is 148 feet high, and, at night, flashes in groups of two. About 180 miles before reaching this place, the ship reaches the European continental shelf, where the depth of the water is less than 100 fathoms, and where fish abound. From then on, fishing vessels are likely to be seen.

The first lighthouse visible on England proper, if bound for a Channel port, is the Lizard Head light, in Cornwall. If the boat is going to Southampton the famous Eddystone light is also seen. Then, just before sailing up the Solent to Southampton, the Needles light comes into view, and the voyage is practically over.

*Science News-Letter, April 7, 1928*

Marble used in the Lincoln Memorial at Washington came from the state of Colorado.

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A medieval decree forbade the wearing of squirrel fur by persons not of royal blood.

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The Japanese beetle in migrating can fly continuously for as much as seven miles.

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Oranges can stand a lower temperature than lemons.