

DEPARTMENT OF NAVIGATION AND HYDROGRAPHY OF THE ARGENTINE REPUBLIC

*Transmitted by the Rear-Admiral, Director General of Navigation
and Hydrography*

I. — BRIEF HISTORICAL ACCOUNT

The earliest evidence of an official organization with hydrographic objectives appears in 1876. On January 31 of that year, an Order of President Avellaneda established the « Commandancia General de Marina », among whose duties was « supervision of all work connected with bridges, piers, canals, soundings, and coastal and river charts, carried out for military purposes » Later documents show that the « Comandancia » had authority over a Hydrographic Department.

On January 1, 1879, following an Order likewise signed by President Avellaneda and countersigned by General Julio A. Roca, then Minister of War and the Navy, the Hydrographic Department was actually organized through the establishment of the « Oficina Central de Hidrografia » (Central Hydrographic Office), with Colonel of the Navy Don Clodomiro Urtubey as its first director. The staff of this organization, which may be regarded as being the first Argentine Hydrographic Office, consisted in addition of an assistant director, cartographer, draughtsman and secretary.

The earliest operations directed towards a thorough investigation of our coasts and waters were carried out under the control of this small organization, which was responsible for all matters affecting safety of navigation.

The first hydrographic surveying expedition was carried out by the gun-boat « Constitución », under the command of Sargento Mayor Don Martin Rivadavia, later first Minister of the Navy. This led to the publication in 1883 of the chart of Bahía de San Blás, which is the earliest chart of purely Argentine origin.

The establishment of a General Staff of the Navy by order of December 3, 1890, provided for inclusion in the Personnel Division of the « Escuelas y Oficinas de Hidrografia » (Hydrographic Schools and Offices). Then on October 8, 1895, at the request of the General Staff, the Executive Authority decided to do away with the Central Hydrographic Office for reorganization purposes. Changes were completed by February 3, 1896, and an order was issued appointing members of the staff.

The Ministry of the Navy was organized by Act 3727 of October 11, 1898, and in the Organizational Order of October 29 of the same year, the « Hydrography, Lights and Beacons Division » is mentioned as coming under the General Secretariat of the Navy. It was put in charge of all ques-

tions relating to national hydrography, lights and maritime signals, and the Naval Observatory.

Hydrographic operations on a large scale were begun at this period, including surveys of Beagle Channel, from Cabo San Pío to Bahía Lapataia in 1899, Río de la Plata in 1904, and Ría de Bahía Blanca in 1905.

Since then, under various designations but with its specific functions unchanged, the Department of Navigation and Hydrography has steadily extended the range of its activities and increased the size of its undertakings to their present stage of development.

II — ORGANIZATION

The Department of Navigation and Hydrography consists of the following Divisions and Sections:

1. Logistics Service;
2. Navigation Division;
3. Hydrography Division;
4. Maritime Meteorology Division;
5. Buoyage Division;
6. Observatory Division;
7. Workshops Division;
8. Division of Accounts;
9. Secretariat.

The Logistics Service, which includes the Personnel Division, is in charge of all organizational aspects of the Department.

The Navigation Division is in charge of all matters relating to navigation in general, the composing and editing of all books of use in navigation, Notices to Mariners, chart supervision, national and international exchanges, the distribution of publications, the supplying of naval vessels with navigational instruments, etc.

The Hydrography Division is in charge of all hydrographic surveying, tidal and oceanographic investigations, the construction and printing of charts and tide tables, and printing of the Nautical Almanac.

The Maritime Meteorology Division has jurisdiction over all investigations, observations and installations connected with this branch of meteorological science.

The Buoyage Division is responsible for the installation, maintenance and supervision of all Argentine maritime buoyage.

The Observatory Division is in charge of the Naval Observatory. Its duties consist in the computation and maintenance of time, time-broadcasts to vessels, and it is the country's official time-keeper. It also prepares the Nautical Almanac.

The Workshops Division is in charge of the construction of beaconing equipment, the investigation and repair of lighting equipment, instrument repair, etc.

The Division of Accounts heads the Sales Section and Finance Section, which deals with all money transactions of the Department.

The Secretariat of the Department performs such duties as its name implies, and deals with all matters relating to the transmission of correspondence.

Floating equipment at present consists of two hydrographic and oceanographic vessels: the *Bahía Blanca* and *Madryn*; two registered vessels, the sea-going hydrographic tugs *Chiriguano* and *Sanavirón*; and two weather-ships: the *Heroína* and *Sarandí*.

III. — HYDROGRAPHIC SURVEYS

The hydrographic surveying of coastal areas has been carried out according to a priority schedule drawn up with due regard to the economic and navigational importance of each area involved.

As matters now stand, practically all of the coast has been surveyed. The degree of accuracy obtained having been governed by the extent of requirements and by the instruments of each period, the necessity has arisen for a complete revision of the work done so far in order that it may be standardized and connected together. To this end, a study is being made of triangulations, baseline measurements and astronomical observations in order that a rational approach may be made to the problem, as it is intended that all surveys shall comply with the requirements established for the second international order.

Main triangulation angles are at present measured according to the Schreiber method, with a weight of 12, and angles corresponding to base expansion polygons by the same method, with a weight of 24.

Base measuring is done with 50-metre invar tape according to the method advocated by the U.S. Coast and Geodetic Survey. Bamberg or Wild T.4 universal theodolites are used in making astronomical observations, and lately, use was resumed of an S.O.M. precision prismatic astrolabe. Regulation methods are: Sterneck and Gauss for latitudes; the Stechert method and transit observations for longitudes, and elongations of stars and observations of Sigma in Octans in the case of azimuths.

The probable error in fixes obtained so far is in all cases less than 2" for latitude and longitude and under 5" for azimuth; most of the errors are respectively within 1" and 2", which is the margin of error allowed by regulation since 1935.

The hydrographic operations programme involves the completion of coastal surveys, the connecting up of previous survey work into a consistent whole, and the bringing up to date or re-surveying of areas in which changes have taken place.

Included in this programme is the carrying out of new surveys in the case of areas originally covered by documents that were destroyed in a fire at the Intendencia de Marina 35 years ago, such as the Río de la Plata region; and the periodical surveying of extremely variable shallow areas.

IV. — PHOTOGRAMMETRIC WORK

Aerial photography has been used in connection with our chart production since 1925, when the first survey of this type was made in the Cabo Dos Bahías area (Golfo San Jorge).

Until 1948, plotting from photographs was done by graphical methods for topographical purposes only. The Photogrammetry Section was created at the end of that year, and is at present being extensively developed. Full use is now being made of photographs, and surveys are made according to modern technical methods.

The photogrammetric programme includes the aerial surveying of the entire coastline by means of vertical or fan-shaped photographs, as occasion demands, and the trimetrogon method will be applied in Antarctica to the fullest possible extent.

V. — TIDAL OPERATIONS

Tidal investigations may be stated as having begun during the opening years of the present century, as the very first surveys undertaken by the Navy made it clear that a thorough and methodical study of tides along our shores was imperative.

The first Tide Table, giving predictions for six ports, was issued by the Hydrographic Office in 1920. The increasing needs of navigation made it necessary to include a greater number of principal and secondary ports every year, with the result that the publication is now one of the most important of its kind.

The tidal programme at present being developed includes research into the following problems:

1. Observation and prediction of the tide with the greatest possible degree of accuracy;
2. Determination of datum plane of soundings along entire coast;
3. Determination of mean sea levels and basic plane of reference of the land;
4. Determination of contour of sea-coast;
5. Determination of tidal and current flow;
6. Determination of meteorological action on the sea surface, tides and currents;
7. Observation and study of « seiches »;
8. Observation and prediction of swell and surf;
9. Study of amphidromic points, tidal oscillation zones, tidal propagation, Saros cycle of the tide, coastal stability and variations in the sea-floor.

Provision has been made in this regard for the establishing of a series of tidal stations, including six high-precision « base » stations and 24 secondary stations.

Base stations will be set up at: Mar del Plata, Punta Delgada, Madryn, Comodoro Rivadavia, San Julian y Río Grande ; secondary stations at: Buenos Aires, Río Santiago, San Clemente, Quequén, Arroyo Pareja, Puerto Belgrano, San Blás, San Antonio, Golfo San José, Puerto Pirámide, Santa Elena, Isla Leones, Cabo Blanco, Puerto Deseado, Santa Cruz, Río Gallegos, Cabo Vírgenes, Bahía Thetis, Ushuaía, Islas Orcadas, Archipiélago Melchior, Isla Decepción, and two others in Antarctica at locations to be determined at an appropriate time.

VI — OCEANOGRAPHIC OPERATIONS

With due regard to the practical and scientific importance of oceanographic research and its influence on navigation and maritime industries, the Argentine Hydrographic Department has made every effort since its inception to develop research of this nature.

Original operations were carried out on a restricted scale, which in view of the rudimentary technique of the period, prevented valuable results from being obtained. For this reason, the oceanographic laboratory of the Department was set up in 1926, and put in charge of analyses, statistics, the drafting of detailed instructions to vessels and the co-ordination of various activities.

The area in which organized operations were first carried out according to a pre-arranged plan was the Province of Buenos Aires and the north coast of Tierra del Fuego; but the examination of data previously supplied by our naval vessels and hydrographic expeditions enabled the collection of a great deal of valuable information that could be used in compiling lithological charts, and charts showing surface salinity and mean surface isotherms.

Included in the oceanographic programme is a complete investigation of our waters. In order to make the most of any opportunity that arises and to increase as much as possible knowledge regarding the sea, special oceanographic duties have been systematically assigned to all detached hydrographic parties during the past few years.

VII — CARTOGRAPHIC OPERATIONS

Since the Department's inception and as a logical consequence of its specific duties, an office responsible for the production of chart originals has always existed.

The earliest chart published by the Navy was of Bahía de San Blás, issued in 1883. Since then, in accordance with the rate of hydrographic surveying, there has been a progressive increase, as shown in the following table, to such an extent that the entire coast-line has been covered and all navigation requirements have been fulfilled.

CHARTS PUBLISHED

| Period | New Charts | New Editions | Total Charts published |
|-------------|------------|--------------|------------------------|
| 1883 - 1899 | 2 | — | 2 |
| 1900 - 1909 | 11 | — | 11 |
| 1910 - 1909 | 22 | 15 | 37 |
| 1920 - 1929 | 41 | 35 | 76 |
| 1930 - 1939 | 35 | 34 | 69 |
| 1940 - 1950 | 38 | 34 | 72 |

Until 1925 the printing of charts was done by private concerns. In that year the first printing-press was acquired and in 1926 the first chart was printed in our own shops. It was Chart No. 47, covering Bahía Laura.

Future cartographic activities involve plans for a progressive increase in the number of charts, the establishment of sub-divisions that are considered necessary, and the bringing up to date of charts covering areas newly surveyed.

VIII. — BEACONAGE OPERATIONS

There has been an evolution in Argentine maritime beaconage that parallels general developments during the past century in the technique of lighting systems and equipment.

Historical documents show that a permanent service in aids to navigation began in 1849, when Punta Indio Lightship was set up and became the first point of contact of ships approaching ports of Río del Plata from overseas.

During a period of thirty-five years, the growing traffic made an increase in lightship service imperative wherever, for reasons of security or for directional purposes, permanent marking became necessary. Lightships were therefore posted at Banco Chico in 1857, Rada Lightship went into operation in 1865, Punta Piedras in 1874, and La Manuelita in 1881.

This first group was followed, while lighthouses were being built on land, by the commissioning of Bahía Blanca Lightship in 1899, Recalada in 1903, and finally El Intermedio in 1904.

Over twenty years elapsed before the last lightship was put into commission in 1925, that of the Prácticos-Recalada, which was used for regular inspection and to carry pilots in Río de la Plata. With this lone exception, all lightships were withdrawn as signals on land were developed or the reasons for their commissioning disappeared. La Manuelita Lightship was withdrawn in 1881, Punta Piedras Lightship in 1903, Rada Lightship in 1910, Punta Indio in 1915 (after 66 years' service) El Intermedio in 1917, Banco Chico in 1920, and Recalada Lightship in 1925. Bahía Blanca Lightship was withdrawn in 1931 after it had suffered damage, and since the mouth of the river has now been buoyed, its services are no longer necessary. It has therefore been withdrawn definitely and replaced by a red buoy numbered « 1-bis ».

The historical development of shore-based maritime beaconage is more consistent and regular than that of lightships, as its origin dates back to the close of the last century, when technical knowledge of construction and the use of appropriate materials made a rational approach to the study of works of a permanent nature possible.

Maritime signalling from the shore dates back to 1884, when the first two lighthouses, Martín García and San Juan de Salvamento, were completed and commissioned. The former was in continuous operation for 54 years, and was replaced in 1938 by a semaphore system. San Juan de Salvamento remained in operation for 18 years, and was replaced in 1902 by Año Nuevo Lighthouse on the island designated by that name.

From 1884 to 1914 beaconage developed at a slow but uniform rate, and if progress was no swifter, it was because of the unavailability of automatically operated equipment. Structures of the highest quality were therefore required, as well as large staffs for the uninterrupted maintenance of the equipment, supplied with petroleum vapour and incandescent mantles. During this period lighthouses were set up at Río Negro (1887), Punta Mogotes (1891), San Antonio (1892), Punta Medanos (1893), Año Nuevo (1902), Isla Pingüino (1903), Cabo Vírgenes (1904), Punta Delgada (1905), Recalada Lighthouse at Bahía Blanca (1905-1906), Comodoro Rivadavia (1910), Villarino (1911), and Segunda Barranca (1914).

Martín García and San Juan de Salvamento Lighthouses were withdrawn from this initial series, as mentioned previously, as well as Comodoro Rivadavia Lighthouse (1918), and Villarino (1924).

1915 marks the beginning of a new era in lighting service. European technique had perfected and applied the use of acetylene gas dissolved in acetone, and flashing equipment was devised that enabled the installation of fully automatic light beacons, with sun-valves to turn them off in the daytime. Our country immediately adopted the Swedish Aga system, which provided a solution for both principal and secondary lighting problems along our extensive coast-line. The first organized beaconage programme was also begun in 1915, to be completed in 1944, when plans were immediately made for its extension in order to meet the main requirements of present-day navigation and those bound to arise in the near future.

A new plan was drawn up in 1948 covering not only increases in beaconage but improvements in signalling equipment. This programme is at present being carried out.

Maritime beaconage at the present time consists of:

| | |
|--|-----|
| Permanently attended lighthouses | 14 |
| Automatic lighthouses | 52 |
| Lighted beacons | 109 |
| Unlighted beacons | 140 |
| Light buoys | 40 |
| Unlighted buoys | 28 |
| Lightship | 1 |
| Fog-signal stations | 2 |
| Acetylene gas works | 1 |

IX. — NAVAL OBSERVATORY OPERATIONS

The Naval Observatory was created in 1881, and its first Director was a former French Naval officer, Don Francisco Beuf.

In 1888 its duties consisted in the transmission of time-signals to ships moored in the roads or harbour by means of a cylinder, later replaced by a light, which supplied a signal daily at 2100 hours.

When the radio station was set up at Dársena Norte, the service included daily transmission of a radio-signal at 2200 hours.

In order that accuracy of time determination might be increased, the original transit instrument was replaced in 1921 by a Bamberg instrument, which is still in use.

In 1923 the Naval Observatory was directed by Executive Order to supply the time daily to the National Postal and Telegraph Service and to check the time shown by the clock-tower on the Plaza Británica, which supplies the official time to the city of Buenos Aires. To this latter service was afterwards added an automatic telephone time-service.

In 1926 the Observatory was equipped with a set of sidereal clocks and an automatic time-signal transmitter, and in 1927 light-signals were replaced by radio time-signal transmission.

A new automatic time-signal transmitter went into operation in 1931 (Modified ONOGO System), which sent out this latter type of signal every day at 1000 and 2200. An impersonal micrometer was also mounted on the Bamberg telescope, and two wings were added to the Observatory, one containing a clock and chronometer workshop.

A talking clock connected with the Buenos Aires telephone system went into operation in 1937, and since then the official time has been distributed as follows:

1. RADIO BROADCASTING STATIONS: a) By a clock striking chimes every hour on the hour;
b) By three musical notes sounded on the half-hour.
2. TELEGRAPH: By telegraphing a time-signal every day at 1100 to the head-office of the Postal and Telegraph Service, re-transmitted to all branch offices.
3. TELEPHONE: With the talking clock connected to the telephone system.
4. RADIO: By radio signals broadcast to vessels in accordance with the international signal system every day at 1000 and 2200. These signals can be received to within 0.05-second accuracy, but their range is limited.

In 1938 a frequency control was added to the basic time-keeping equipment, and during this same period radio time-signal receiving and recording equipment was installed.

In 1939 acquisition was made of a new talking clock, and during the following year of an electric chronograph equipped with a drum and two stylus attachments for recording meridian transit observations of stars.

The addition of new services made it increasingly evident that the Observatory building lacked sufficient space. By 1944 plans had already been made for the construction of a new building, and the following operational programme was drawn up:

1. Improvement of time determination through use of new equipment (transit instrument);
2. Improvement of time determination through use of photographic methods, in order to eliminate the personal factor in observations;
3. Transmission of time signals, in addition to those already being sent out, by the American system of uneven pulsing obtained through the master frequency control;
4. Transmission of standard frequency signals on various wave lengths;
5. Acquisition of sufficiently powerful transmitting equipment to cover the entire territory of the Republic;
6. Acquisition of another more up-to-date master frequency control;
7. Acquisition or construction of equipment for the reception of signals sent out by other countries, for recording purposes;
8. Exchange of signals and observations with various observatories to determine longitudes, errors in delays of transmission, etc.;
9. Co-operation among all radio-broadcasting stations in the capital in broadcasting official time;
10. Transmission by State Radio, linked with all stations in the country, of a special time-signal at 2030 hours;
11. Extension of chronometry service to include all official organizations within the country;
12. Acquisition of necessary instruments to complete chronometer workshop.

In 1945, transmission of radio time-signals was begun at 0200, 1300 and 2100, consisting of a special signal supplying a beat every second for five minutes, followed by the ONOGO international signal.

In 1946 an electronic comparator to within a thousandth of a second, designed and built by the Naval Observatory, went into operation. It considerably reduces comparison differences of clocks and is an efficient contribution to more accurate instantaneous readings of both signals transmitted by other observatories and those of the Observatory itself. Plans have also been made for the purchase of a photographic Zenithal Telescope, built in Great Britain.

In 1947, the computation and compiling of the Nautical Almanac was added to the normal activities of the Naval Observatory.

Towards the middle of 1947, the management of the Observatory took over the new building while it was in the hands of the builders in order to begin work on radio installations and instrument positions. Clocks, talking clocks and amplifying equipment were transferred by degrees, with no interruption occurring in time-service.

The transfer was completed by mid-October, 1947, and on October 15, at 2100 GMT, transmission of the radio time-signal took place for the first time in the new building, located on Avenida Tristan Achaval Rodriguez (Avenida Costanera Sud) on the corner of Alferéz Pareja.

The national flag was displayed for the first time at the new building on December 17, 1947, upon the occasion of the sixty-sixth anniversary of the Naval Observatory. Since then, all time-service activities have taken place in the building.

X. — MARITIME METEOROLOGY SERVICE

The duties of the Maritime Meteorology Service consist in supplying meteorological information and assistance to maritime navigation, and in the study and investigation of maritime meteorology problems.

Its system of stations consists of the following:

| <i>Station Number</i> | <i>Name</i> | <i>Category</i> |
|-----------------------|------------------------------|-----------------|
| 87580 | Martín García | 1.C.S.A. |
| 589 | Pontón Intersección | 2.C.S. |
| 598 | Pontón Prácticos Recalada | 2.C.S. |
| 596 | Punta Indio | 1.C.S.A.A. |
| — | Puerto Mar del Plata | 2.C.S. |
| 753 | Faro Recalada a Bahía Blanca | 1.C.S. |
| 748 | Comandante Espora | 1.C.S.A.A. |
| — | Flota de Mar | 1.C.S.A. |
| 743 | Faro El Rincón | 1.C.S. |
| 798 | Faro Segunda Barranca | 1.C.S. |
| 839 | Faro Punta Delgada | 1.C.S. |
| — | Faro Isla Leones | 1.C.S. |
| 898 | Faro Cabo Blanco | 1.C.S. |
| 928 | Faro Cabo Vírgenes | 1.C.S. |
| 938 | Ushuaia | 1.C.S.A.A. |
| 970 | Melchior (Antarctica) | 1.C.S.A. |
| 975 | Decepción (Antarctica) | 1.C.S.A. |

They are connected by radio, telegraph, telephone and teletype with the Navy and National Meteorological Service base stations. Plans exist for the establishment of 21 other stations.

Meteorological assistance to navigation is transmitted from the Buenos Aires base station and by the base stations in the six coastal divisions, as well as by the Navy meteorological base stations, which supply similar information to units of the Fleet.

Except as regards the latter, assistance to navigation is also provided by the National Meteorological Service, as the Maritime Meteorology Service is still in the process of being organized. It is hoped, however, that in the near future it can begin operations that are fully consistent with its obligations.

To provide for the Meteorological Service, the Navy trains, and avails itself of the services of, a specialized group of officers, petty officers and civilian personnel. Equipment and instruments are at its disposal, as well as two weather ships fitted out with modern appliances.

There is also a plan to issue publications supplying information on technical subjects related to maritime meteorology.

Buenos Aires, April 12, 1951.