100 YEARS OF ACHIEVEMENT AT THE HYDROGRAPHIC INSTITUTE OF THE CHILEAN NAVY

by Captain Raul HERRERA
Director of the Hydrographic Institute

The beginning of Chilean hydrographic activity dates back to the first years of our country as an independent nation. This was early in 1834 when the hydrographic and scientific work of Captain Robert FITZROY of the British Navy was yet fresh in our minds. Commanding the frigate *Beagle,* he had operated in the little known southern part of Chilean waters with the authorization of our Government.

The desire of the Chilean Government to acquire a better knowledge of the many vast and unexplored regions of its national territory with their immense natural riches led to Commander Roberto SIMPSON being despatched in December 1834 in the brigantine *Aquiles* to carry out a full survey of the coast and estuary of the Rio Bueno. This was the starting point of much valuable and indispensable work in exploring Chile's vast coastline as well as in investigations over an immense area of the ocean bordering its coast.

Hostilities during the conflict with the Peru-Bolivia Confederation meant that hydrographic surveying had to be suspended for four years. However the task was taken up again in 1841 with the survey of the Isla Mocha carried out by Lieutenant Commander Domingo SALAMANCA, and surveying work has gone on continuously right up to the present day. Among surveying achievements at this time were the port plan for Puerto Constitución surveyed in 1844 by Lieutenant Commander Leoncio SENORET, charts of the Rio Maullin, the Canal Chacao, the Taitao and Tres Montes Peninsulas (by Lieutenant Francisco HUDSON in 1856), the chart of the Rio Bio-Bio and its tributaries (by Lieutenant Manuel THOMPSON in 1863), and surveys of the Aysen area and the Guaitecas and Chonos Archipelagos (1870-1873) carried out by Commander Enrique SIMPSON in the corvette *Chacabuco.* All these surveys, and many more which it would take too long to enumerate, were executed in the course of the forty years following the first hydrographic survey of the Rio Bueno.

FRANCISCO VIDAL GORMAZ

Right from the beginning of his long career, one of Chile's greatest hydrographers, Captain Francisco Vidal GORMAZ, was to devote his talents as a scientist and his capacity for hard work to the task of exploring and surveying Chile's coastline.

FIG. 1. — Captain Francisco Vidal GORMAZ, first Director of the Hydrographic Department (1874-1891).

His earliest hydrographic experience was in 1856 as a Midshipman under the orders of Lieutenant Francisco HUDSON, a member of the scientific commission charged with finding a navigable passage between the Chonos Archipelago and the Golfo de Penas. His brilliant work during this two-year survey won him the opportunity to participate in the exploration of the upper reaches of the Rio Maullin. During this campaign he was entrusted with the hydrographic survey of the river basin in this area. In 1863 he explored and surveyed an area between the Seno de Reloncavi and the Rio Yelcho; in 1870, by this time a Lieutenant Commander in command of the corvette *Covadonga*, he surveyed the Canal Chacao. In

1872 he went on to survey the Calbuco Archipelago and the Rio Maullin. In over thirty years of scientific activity he had a total of 51 survey campaigns to his credit, among them those of Iquique and Antofagasta in the north of the country; in the centre in the provinces of Coquimbo, Valparaiso, Colchagua and Curico, and in the south from Arauco to the Chonos Archipelago.

During the southern region campaigns not only did Vidal GORMAZ undertake coastal surveys, but also explorations of rivers, lakes and bays in the region, drawing up detailed navigational and geographic descriptions, and revealing these hitherto unexplored regions by means of his excellent nautical charts of the many ports, creeks and anchorages.

Captain Vidal GORMAZ did not confine his scientific activities to work within Chile; he served as his country's delegate to the International Conference held in Washington in 1884 for discussions on the Prime Meridian. He also travelled in Europe and the U.S.A. in order to make a study of Hydrographic Offices, as well as completing many important and successful missions where his many talents and his extensive knowledge proved invaluable.

Vidal GORMAZ was a distinguished mariner, gifted hydrographer, notable geographer and prolific writer. For his achievements — which are witness to his scientific knowledge, his enterprise, experience and perseverance — he is rightly considered the "father" of hydrography in Chile.

FOUNDATION OF THE HYDROGRAPHIC INSTITUTE

At the same time as directing numberless important hydrographic surveys Captain Vidal GORMAZ never ceased to advocate the creation of a technical and scientific organization which, as in other more advanced nations, would assume the role of centralizing and directing all aspects of hydrography for the Navy.

Finally his cherished hope was realized when, on 1 May 1874, the President of the Republic, Don Federico ERRAZURIZ, and the Minister for the Navy, Don Anibal PINTO, signed a decree instituting a Hydrographic Department based at the Ministry of the Navy in Santiago. In later years the organization was to become the Hydrographic Institute of the Chilean Navy; however, this was merely a change of denomination, for the basic structure of the first organization remained unchanged.

In recognition of his talents and achievements Captain Vidal GORMAZ was appointed Director of this important organization and during his 17 years of office was to devote to it his store of scientific knowledge and his vast experience. The surveys were meticulously prepared, and precise instructions issued specifying both the methods and instruments to be used and the degree of accuracy to which the work was to be done.

In the very year of its foundation the Hydrographic Department started publication of "Noticias a la Navegación" which drew attention to all that

was new in hydrography in the Pacific and on the west coast of South America.

In December 1874 the Hydrographic Department published its first nautical chart — a plan of the Rio Maullin and its tributaries — which was printed by the Santiago firm of graphic designers Cadot and Brandt.

In January 1875 the first volume of the "Anuario Hidrográfico" was published in which the work of the Department was recounted.

At the time of the Pacific war of 1879 the country had unfortunately no Geographic Institute, and thus the Hydrographic Department was called upon to widen its field of activities to embrace geographical work and to publish land maps of northern Chile and of enemy territory which were of inestimable value to our armed forces.

Towards the middle of 1899 the Hydrographic Department was transferred to Valparaiso, occupying premises beside the Muelle Prat — a landing place where formerly the crews of all vessels anchored in the Bay had to disembark. This building was partly destroyed in the earthquake of 16 August 1906, with great material damage and the loss of some of its archives, instruments and equipment. The Department found a temporary home in the Naval Dockyard buildings whilst awaiting definitive headquarters.

In 1909 the Hydrographic Department moved into its present premises in Valparaiso, and in 1927 the name of the organization was changed to "Departamento de Navegación e Hidrográfico", to become in the year 1968 the "Instituto Hidrográfico de la Armada de Chile". Throughout these changes the structure of the organization has not been affected, and it has continued along the lines first laid down, expanding when called upon to do so to include other disciplines.

ACTIVITIES UP TO 1899

The era stretching from the creative impetus imparted by Vidal GORMAZ right up to 1899 — the last year of the Department's activities in Santiago — can rightly be termed the Golden Age of Hydrography in Chile. During this period, too, its important achievements were to become known further afield, gaining world wide appreciation among other maritime nations. As testimonies to these achievements we have the many charts and plans published and the prizes awarded to Chile at international exhibitions for the original work and research published in the "Anuario Hidrográfico" and other publications. Santiago de Chile (1875), Venice (1881), Liverpool (1886), Barcelona (1888), Seville (1929-30) were some of the cities to recognise in this way the efforts of a nation in its important programme of development.

A long and rewarding period of hydrographic activity was started in 1875 by Luis POMAR in the transport *Ancud* with a survey of the coast from 26 miles north of Valparaiso to 55 miles south and later a definitive

survey of Valparaiso by triangulation incorporating a large number of prominent points in the town. In January 1885 with the gunboat *Pilcomayo* he surveyed the coastal region between Antofagasta and the Rio Loa, starting with the astronomical determination of the geographic coordinates of Antofagasta and the triangulation of 180 miles of coastline.

After much fruitful reconnaissance work the hydrographic survey of the whole of the Rio Palena was successfully completed in 1884 by Ramon Serrano MONTANER with the tender *Toro*. Later — in 1888 — he was to do much reconnaissance and surveying in regions hitherto little explored, the Seno Ultima Esperanza, Seno Skyring, Canal Fitz-Roy and Seno Otway. In 1891 he incorporated the fruits of his survey work into his publication "Derrotero del Estrecho de Magallanes, de la Tierra del Fuego y los Canales de la Patagonia".

In September 1888 Lieutenant Commander Policarpo TORO in the transport *Angamos* officially took possession of the Isla de Pascua (Easter Island) in the name of the Chilean Government and proceeded to survey the island.

It would take too long to enumerate the many hydrographic surveys achieved during this period; suffice it to say that it was thanks to untold sacrifices and a spirit of self-denial that by means of these hydrographic surveys civilization could finally be extended to such inhospitable and unexploited areas as the islands of Juan Fernandez (Robinson Crusoe), Sala y Gomez, San Felix and San Ambrosio lying off our coasts.

FROM 1900 TO THE PRESENT DAY

This was a period starting with the transfer of the Hydrographic Department to Valparaiso, the first decade being marked by the regular participation in surveying work of such historic warships as the ironclad *Cochrane,* the cruisers *Pinto, Errazuriz* and *Zentano* who alternated with the gunboat *Magallanes* and the corvette *Pilcomayo* in this work. Throughout the period 1900-1905 Captain Baldomero PACHECO was ceaselessly surveying, working in both the central coastline area and in the channels and passages of the Tierra del Fuego, as well as the inhospitable Reina Adelaida archipelago. His greatest achievement was, however, the survey during 1904-05 of the Bahia San Quintin and of the southern part of the Istmo de Ofqui and adjacent areas.

In 1901 Commander Francisco NEF carried out with the *Magallanes* a survey of the Seno Baker and surrounding channels, thus opening up an important navigational route in this region.

In 1902 the Seno Skyring and the Canal Gajardo in the Magellan area were surveyed by Captain Roberto MALDONADO in *Magallanes.* Later, between 1907 and 1912, he was to survey much of the Chiloé region, the Guaitecas, the Rio Imperial, the Rio Tolten, besides channels in Patagonia and Tierra del Fuego. This was one of the longest ever survey campaigns,

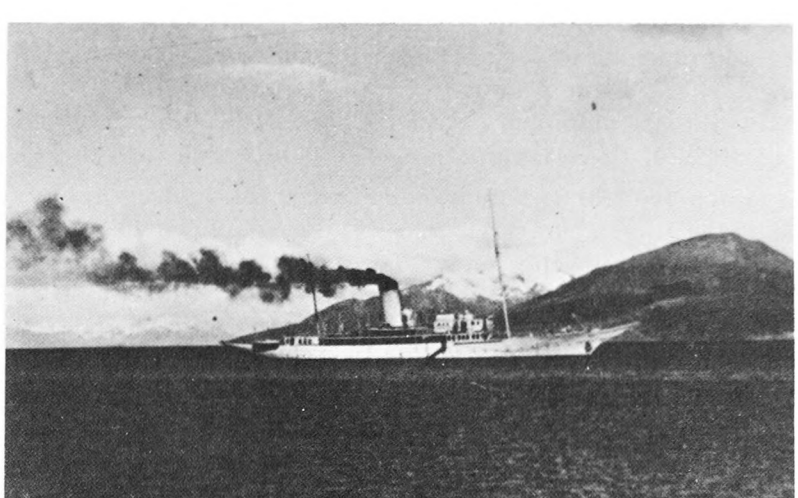

FIG. 2. — The hydrographic vessel *Vidal Gormaz* (702 tons) which saw service between 1940 and 1953.

his last survey in 1911-12 being of an area stretching from the Golfo de Penas and the Guayaneco Archipelago to the Golfo Trinidad.

In 1910 Commander Ismael HUERTA carried out a first order triangulation of Chiloé, one of the most important of such surveys in Chile. Here the mean baseline was of 3 096 m and the network of triangulation stations extended from Puerto Montt southward taking in the Seno Reloncavi and the gulfs of Ancud and Corcovado, one of the principal triangulation points to the west being the Isla Guafo. An area 147 miles long by 100 miles wide was thus covered.

During the first part of the century the method adopted for chart reproduction was copper engraving; compass roses, the coastline, meridians and parallels, soundings and other charting details were engraved by trained personnel using appropriate material.

In 1911 the Hydrographic Department was entrusted with the official Time Service which up to then had functioned in the Naval School, and a room was set aside for housing the clocks and for the maintenance of ships' chronometers.

In 1915 specialist courses for officers in navigation and hydrography were instituted in order to improve working methods and raise efficiency in the use of instruments.

In 1917 Commander José T. Merino SAAVEDRA in the corvette *Baquedano* surveyed the Seno Holloway, Puerto Slight and Puerto Barroso in the Golfo de Penas area on the southern side of the Taitao Peninsula.

Then in the year 1941 permanent tidal observations were commenced, starting with the installation in the port of Valparaiso of a standard automatic tide gauge as part of a programme to instal such gauges in all important Chilean ports. The help given by the Inter-American Geodetic Survey (based in the Panama Canal Zone) greatly assisted in the achievement of this project.

As part of the International Geophysical Year programme in 1957 a study was made of the volumetric variation of the sea and of the recording of long period ocean waves.

Working in cooperation with universities and other official bodies the Hydrographic Institute, using the corvette *Chipana*, inaugurated in 1960 a new programme of systematic investigations the first of which was the oceanographic campaign MARCHILE I covering a vast stretch of sea between Coquimbo and Chiloé. These and other research cruises all along the Chilean coast, particularly in the south, were carried out during this period; today the work still continues at a steady pace, using new material and the latest improvements in equipment and employing aircraft and larger vessels.

PRESENT DAY ROLE AND PRODUCTS

Today the role of the Hydrographic Institute of the Navy includes the provision of the necessary material, information, and technical assistance to assure navigational safety not only in rivers, lakes, interior and territorial waters, but also on the high seas off the Chilean coast. These activities involve hydrography, hydrographic surveying both offshore and in rivers and lakes, nautical cartography, publication of navigational charts for national waters, oceanography, planning and coordination of all national oceanographic activities, tides and tidal surges, marine geography, navigation, astronomy, official time signals, air photogrammetry, lights and buoyage.

The Hydrographic Institute is the official representative of the State of Chile to the following international organizations : the International Hydrographic Organization, the Intergovernmental Oceanographic Commis-

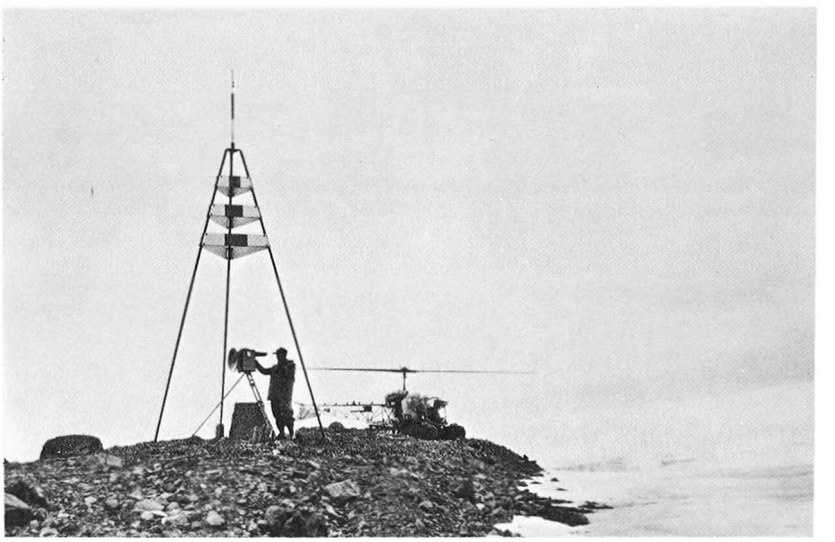

FIG. 3. — A Tellurometer survey in the Chilean Antarctic.

sion, the Scientific Committee on Oceanic Research, the International Association of Physical Sciences of the Ocean, the International Tsunami Warning system for the Pacific, the "Bureau International de l'Heure", and the International Association of Lighthouse Authorities.

The Institute is a member of various organizations, both national and panamerican, concerned with the study of the oceans and their natural resources as well as with cartography. The National Oceanographic Committee, with the Director of the Hydrographic Institute as its Chairman, has its seat at the Institute.

The hydrographic vessel *Piloto Pardo* (1 940 tons) is employed full-time on hydrographic work using such modern electronic measurement systems as Tellurometer, highly accurate deep echosounders, and among radio positioning aids the Sea-Fix system.

A Piper Navajo plane equipped with a wide angle Zeiss camera capable of taking pictures up to an altitude of 25 000 feet is available for photogrammetric work, which greatly facilitates the task of the hydrographer. The photogrammetric plotting is later effected in the Photogrammetric Department of the Hydrographic Institute with special Zeiss and Wild equipment.

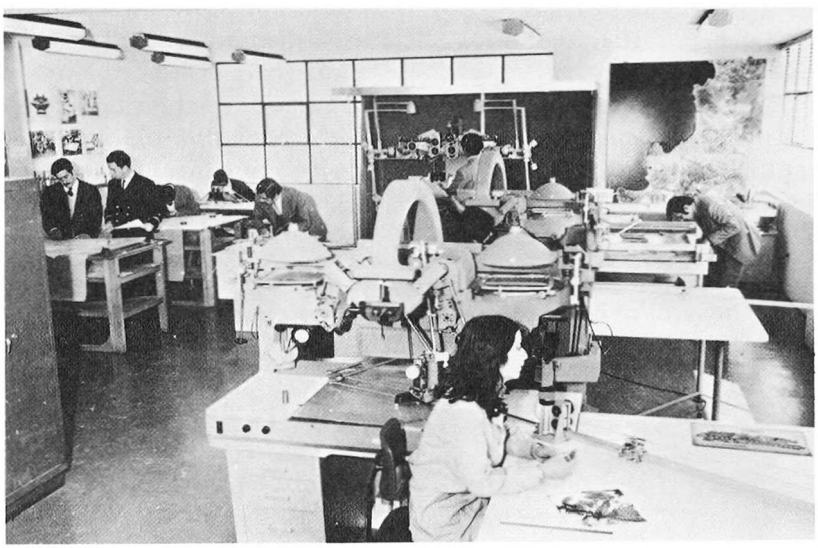

FIG. 4. — A view of the Aerogrammetric Department at the Hydrographic Institute showing the plotting and aerotriangulation equipment.

New cartographic reproduction methods have been adopted, and scribing is now done on plastic material instead of drawing on zinc plates. A modern Roland-Ultra offset machine for 1.25 × 1.25 m printing is installed.

The Hydrographic Institute issues and updates:

209 charts of Chilean coasts of various kinds and scales;

Sailing Directions for Chilean coasts (including Chile's Antarctic territory) — 6 volumes;

List of Lights for Chilean coasts;

Radio Aids to Navigation for Chilean coasts;
Notices to Mariners (fortnightly);
Table of Distances between Ports;
Tide Tables for Chilean coasts;
Glossary for Tides and Currents;

in addition to a score of publications of a scientific and technical character, among them :

Oceanographic Atlas of Chile;
Hydrographic Atlas of Chile;
Instructions to Navigators in Coastal Waters;
Manual of Hydrography (2 volumes);
Manual of Navigation;
Manual of Marine Cinematics;
Hydrographic Annals;
The Storm Surge of 1960.

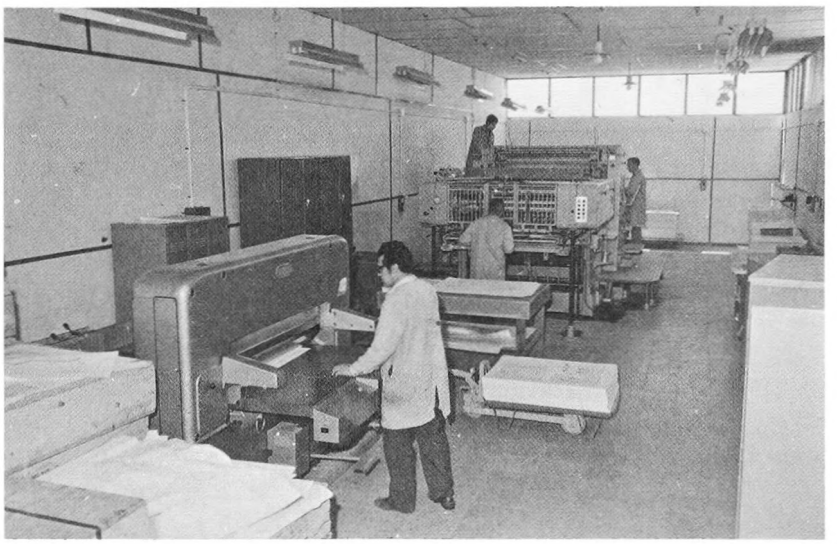

FIG. 5. — The offset chart printing press at the Hydrographic Institute.

The Institute is now modernizing its methods for measuring and recording tides, and the old float tide gauges are being replaced by pressure gauges.

Since 1960 nine systematic oceanographic expeditions have been carried out, mainly with the oceanographic vessel *Yelcho* (1 732 tons), the last of these, as late as 1973, being of an area between Valparaiso and the Juan Fernandez Archipelago, an area particularly rich in natural resources.

In view of the pressing necessity to improve navigational safety by modernizing maritime buoyage and visual aids, in most of our lighthouses the old acetylene system is to be replaced and a systematic programme of electrification is being carried out. A better service is thus offered since the luminous intensity is greater and consequently the range longer.

Thanks to an agreement with NASA, Chile now receives a series of data on ocean conditions gathered by artificial satellite. The development

of this technique is bound to lead to much progress in our knowledge of the marine environment around our coasts.

Since Caesium Atomic Clocks are highly accurate the one in the Time Signal Department will be invaluable not only in maritime and air navigation, civil life, and geodetic astronomy but also as the frequency standard for measurement equipment both in the laboratory and in the field. It also provides checks on the accuracy of radio station time signals.

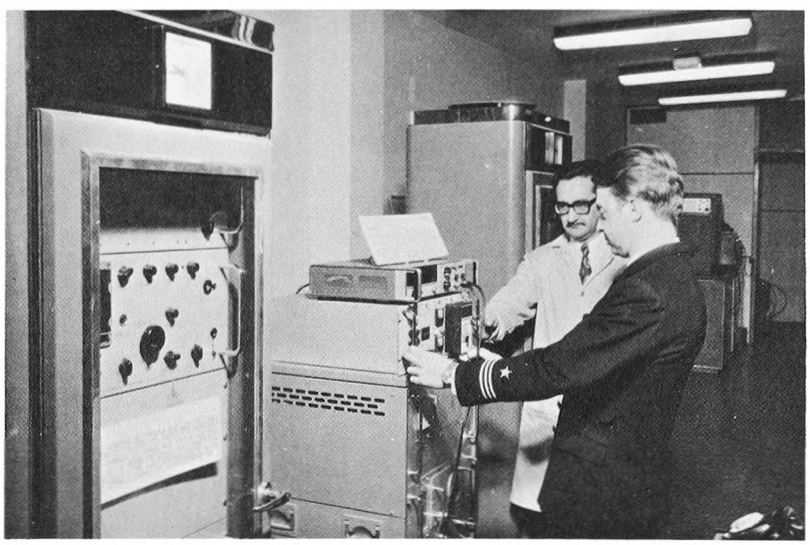

FIG. 6. — The Time Signal room for navigational purposes and checking of official time in Chile. Note the caesium Master Clock and two crystal clocks.

Since 1968 the organization has included a National Oceanographic Data Centre which is soon to have its own computer. This will be invaluable for oceanographic data processing as well as for mechanizing calculating work, particularly in the field of geodesy and photogrammetry.

THE CENTENARY CELEBRATIONS

1 May 1974 was the date on which the Hydrographic Institute of the Chilean Navy celebrated its first centenary.

The ceremony took place in front of the Institute and was presided over by Admiral José T. MERINO, member of the Council of Government and Commander-in-Chief of the Navy. At his side were Vice Admiral Luis EBERHARD, Governor of the Province and Commander-in-Chief of the First Naval Region, Rear Admiral Ernesto JOBET, Under Secretary of State for the Navy, and many other important civil and military officials.

Also invited were Rear Admiral Guillermo VILLA, Director of Navigation and Hydrography of the Peruvian Navy and Captain Alfredo ASTIZ, the Hydrographer of Argentina.

A moving note was provided by the presence of direct descendants of the President of the Republic and the Navy Minister who in May 1874 had signed the decree creating the Hydrographic Department, and of Señora Fresia VIDAL, niece of its first Director, Captain Vidal GORMAZ.

After hoisting the Chilean flag to the strains of the national anthem, Captain Raul HERRERA, Director of the Hydrographic Institute, delivered an address tracing the history of the organization and its role in the development of navigational safety and marine research.

"A century has gone by" said Captain HERRERA "since that historic day when the President of the Republic and his Minister for the Navy signed the decree to create the Hydrographic Department, a cause for which Captain Vidal GORMAZ had so earnestly fought and which he was to direct so ably. Thus it was that the first Hydrographic Service in Latin America — as well as the first cartographic institute in Chile — came into being. This was to give a vigorous impulse to the already intense Chilean activity in the field of hydrographic surveys, which led to a deeper hydrographic knowledge of the many hitherto unexplored regions".

Speaking of the Institute itself, the Director declared : "The creation of our Institute led to much technical and scientific progress in hydrographic operations. Its aim has ever been a better knowledge of the long coast of Chile as well as of the great Ocean which with its incessant hammering in the course of time finishes by altering the shape of the coastline".

Finally, having mentioned the various activities of the Hydrographic Institute and the important publications it issues, Captain HERRERA called to mind some of the most eminent of the country's hydrographers, men to whom the nation owes the safe and rapid maritime routes of today.

At the end of his address the Director offered Admiral José T. MERINO the first copy of the new Hydrographic Atlas of Chile specially published to mark the Institute's centenary.

Admiral MERINO then spoke, declaring in the course of his speech that "a brief retrospective glance into the past might lead one to the erroneous conclusion that with the inexorable passage of time a century is accomplished — or even two or three centuries — merely by allowing the time to pass".

"However" continued Admiral MERINO "it is evident that at the time it celebrates its first centenary the Hydrographic Institute is an organization within the naval family of which all can be justly proud. Numberless were the difficulties its hydrographers had to overcome before it could arrive at its present effective role; it has earned the gratitude of the world, witness of a century of accomplishment".

Admiral MERINO ended "In thanking the Director of the Institute for the gift of this Hydrographic Atlas — which may be said to be a concretization of 100 years of effort and progress — I would like to express to him and to all his staff the confidence of the Government, whose mouthpiece I am, that this march of progress will continue and be crowned with the success that only your own effort and sacrifice will make possible".

Later the new offset printing press was inaugurated by Admiral MERINO

who signed the first copy of the chart specially printed for the occasion as a reminder of the centenary celebrations.

The visitors then toured an exhibition which included reproductions of charts and displays tracing the various activities of the Hydrographic Institute during a century of existence.

FIG. 7. — The Centenary celebrations — admiring the cake are : the Director of the Hydrographic Institute and Señora HERRERA, the Governor of the Province of Valparaiso and Señora EBERHARD, and Rear Admiral Guillermo VILLA, Director of the Hydrographic Office of Peru.

A reception at the Naval Club in Valparaiso ended this first day of celebrations, the traditional birthday cake with its 100 candles being the centrepiece of this brilliant gathering.

The following day at sunset the celebrations were brought to a close with the official opening at Punta Angeles, Valparaiso, of a powerful electrically operated xenon light with a luminous intensity of nine million candelas in the presence of many eminent personalities of the Province.

(Translated from Spanish)