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THE CENTENARY OF THE BRAZILIAN HYDROGRAPHIC SERVICE

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ABSTRACT

The "Repartição Hidrográfica" of the Ministry of Marine of Brazil was founded on 2nd February 1876 with the principal task of systematically surveying the coasts of Brazil. In 1976 Brazil celebrates the Centenary of the Repartição, which is now actually called the Directorate of Hydrography and Navigation.

This article will show how the Coast has been surveyed over these 100 years. It will call to mind the names of those who worked for the creation of a specialised hydrographic service in the Brazilian Navy and those whose dedication has made of the Naval Hydrographic Service one of the best cartographic organisations in the country.

EARLY PIONEERS

At the time of the Independence of Brazil (1822), our coastline had been partially surveyed by the Portuguese colonisers, and a French hydrographic group under Commandant ROUSSIN had surveyed one section in 1819-20. Thus Brazil received a legacy of nautical charting from abroad. After Independence, further French missions continued the work, led notably by BARRAL, TARDY de MONTRAVEL and MOUCHEZ. Considering the lack of facilities, these teams produced excellent hydrographic work, but we shall not consider them further, preferring to concentrate on Brazilian cartography.

The first charts resulting from surveys made by Brazilian officers date from 1830. Among these early works are those of Capitão-Tenente Joachim Raimundo de LAMARE, in particular his charts of the Lagoa dos Patos (1844) and the Baia de Guanabara, from a survey of 1847. Another notable survey was the 400 mile long stretch of north-east coast between the Rio Mossoró and the Rio São Francisco executed by Primeiro-Tenente Manoel Antonio Vital de OLIVEIRA (figure 1) from 1857 to 1859. The five charts and the "Pilot" resulting from this survey show a remarkable

FIG. 1. — Capitão-de-Fragata Manoel Antonio VITAL de OLIVEIRA (1829-1867).

representation of the coastline, considering the limited facilities available for the work. Another well-known chart drawn by Vital de OLIVEIRA is the Carta Reduzida das Rocas (Brazilian North-East Coast) of August 1858 (figure 2).

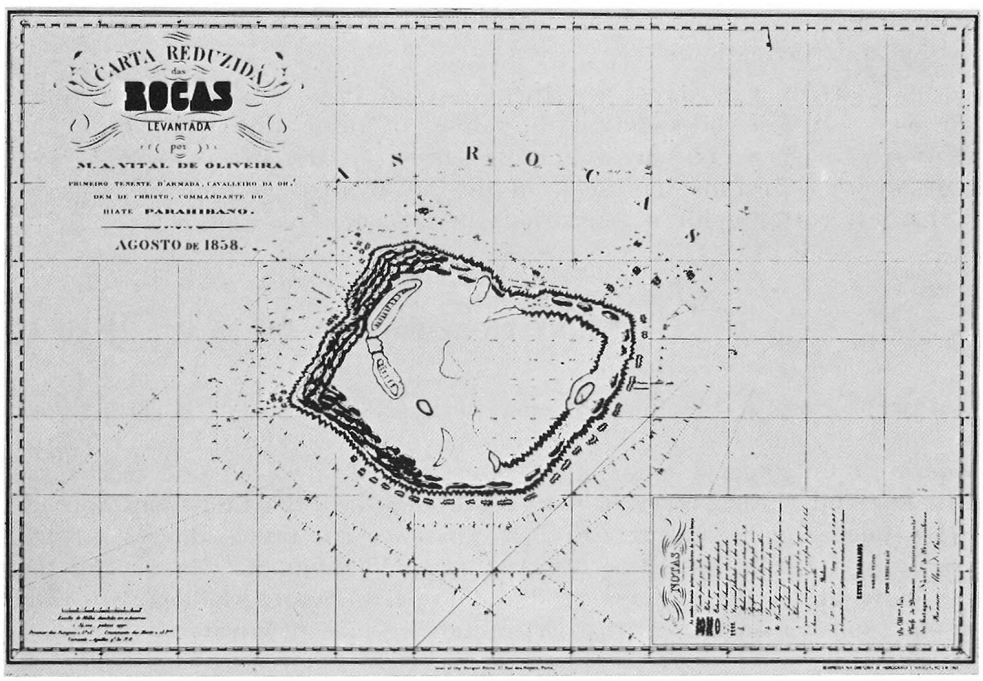

FIG. 2. — The "Carta Reduzida das Rocas".

In 1862 the Minister of the Navy, Joachim Raimundo de LAMARE, decided to commission a full General Chart of the Coast of Brazil, and in the following May he laid down the outline plan for a permanent Hydrographic Service and designated Capitão-Tenente Vital de OLIVEIRA, commanding the steamer *Ipiranga,* to carry out the necessary preliminary studies. At the same time he appointed Primeiro-Tenente Antonio Luiz von HOONHOLTZ

to carry out a hydrographic survey of Santa Catarina in the south of the country.

The work for the General Chart of the Coast was started in the south, but was interrupted by the war between Brazil and Paraguay; Vital de OLIVEIRA was himself killed in action in February 1867. Subsequently he received the title of "Father-Hydrographer of the Brazilian Navy", a just homage to one who devoted most of his life to the charting of national waters and who can really be considered the ancestor of all Brazilian hydrographers.

FIG. 3. — Capitão-de-Fragata Antonio Luiz von HOONHOLTZ.

By Decree of 2 February 1876 the Imperial Government created the Hydrographic Department of the Ministry of the Navy. A few days earlier the Department of Lights had similarly been formed; it later merged with the former. The new "Repartição Hidrográfica" was placed under Capitão-de-Fragata Von HOONHOLTZ, later to become Baron de TEFFÉ, who headed the service until 1890. Von HOONHOLTZ quickly formulated plans for the complete survey of the coasts, but was never able to carry out these large works for lack of resources. However, in spite of the difficulties, and with only one ship — the steamer *Lamêgo* — the new Department pushed through various surveys of coastal ports. Most of the charts of this phase were drawn by Capitão-Tenente Francisco Calheiros da GRAÇA.

The Hydrographic Department was merged in 1891 with the Department of Lights and the Central Meteorological Department (dating from 1888), the new organisation being styled the Repartição da Carta Maritima.

In 1907, under Admiral Arthur Silveira da MOTTA, Baron de Jaceguai, the service started to publish the series of coastal charts of Brazil based on existing individual charts and printed in the Naval Printing Press. These cannot be considered as real examples of Brazilian cartography, since they were taken from English and French charts. Still, this was the first coastal series published in Brazil; it became known as the "Jaceguai collection" in homage to its creator, a notable hydrographer who had gained renown for his surveys on the River Paraguay during the war with that country.

The Service was re-named in 1908 "Superintendência da Navegação", with wider responsibilities, and in 1914 it moved to the Ilha Fiscal. The building there dates from 1888, and was formerly a Customs Post.

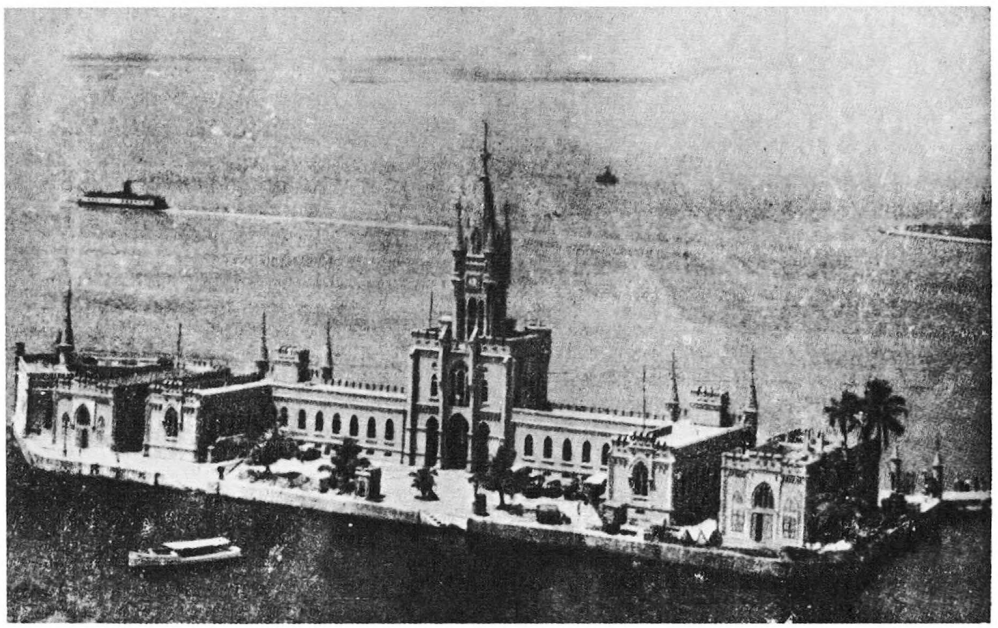

FIG. 4. — Ilha Fiscal, Rio de Janeiro, headquarters of the "Diretoria de Hidrografia e Navegação".

DIRECTORATE OF NAVIGATION

During the First World War, few new charts were produced owing to the total mobilisation of the Navy's resources to safeguard freedom of navigation in the South Atlantic, where Brazil was necessarily drawn into the conflict owing to Germany's submarine campaign. This long gap in work made the resumption of hydrographic surveying in 1922 difficult and expensive, but in this year Capitão-Tenente Antônio Alves CÂMARA surveyed the Baía de Guanabara. Soon after, the name of the Department was once again changed, to "Diretoria de Navegação", and this change marked the consolidation and development of hydrography in Brazil,

inspiring the use of new techniques and the acquisition of modern instruments and, above all, infecting the young officers with enthusiasm under the new regime. The charts of this period show great accuracy and, generally, much detail, and they are still safe to use now.

An important survey from this epoch is that of the Baía de Ilha Grande (Rio de Janeiro Province), by Capitão-de-Fragata Manuel José NOGUEIRA da GAMA in 1929. This work used for the first time the Invar wire for triangulation, the 60° prismatic astrolabe for observing vertical coordinates and the optical micrometer theodolite for measuring angles; and the expression "modern cartography" is considered to cover charts published subsequent to this survey, previous cartography being considered as obsolete. The first chart resulting from this survey was Chart 1604 "Porto de Angra dos Reis", dated 1933.

This was also the period of the establishment (26 June 1931) of specialised courses in hydrography and navigation for officers, the result of which is that we now posses a first class team of hydrographic specialists. In this phase was begun also the regular and continuous publication of charts based on thorough and periodic surveys. We must recall here the names of the Director and Vice-Director responsible : Vice-Almirante Heráclito da GRAÇA ARANHA, Director-General of Navigation, and Capitão-de-Mar-e-Guerra Manoel José NOGUEIRA da GAMA.

The years following saw technical and administrative advances in the Directorate of Navigation, such as the adoption of aerial photography for hydrographic surveys, the introduction of the echo sounder, the systematic publication of Sailing Directions (*Roteiro da Costa do Brasil*), Light List (*Lista de Faróis*) and List of Radio-Signals (*Lista de Sinais-Radio*) and the regular distribution of Notices to Mariners (*Avisos aos Navegantes*). The first chart produced entirely by the Directorate on its own presses in the Ilha Fiscal was in June 1939 : Chart 1703 "Porto de Cananéia".

THE SURVEY SHIP « RIO BRANCO »

To meet growing requirements, the Diretoria de Hidrografia e Navegação took delivery on 25 January 1934 of the former Canadian Coast Guard ship *Rio Branco*, built in Britain in 1914. Among the extensive conversions for hydrography was the installation of the first modern echo-sounder acquired by the Directorate — a dual-scale Atlas. (hitherto, soundings had been made by leadline). The first soundings by echo in Brazilian hydrography were made in October 1935 in the Canal de São Sebastião.

From 1942, the Second World War put a stop for five years to the steady flow of hydrographic activities, particularly surveys in the south and the hydrographic courses; and the survey vessels were armed and reclassified as corvettes for convoy escort duties. *Rio Branco* was attached to the North-East Command. After the War, the Department was again renamed (1946) : "Diretoria de Hidrografia e Navegação", a title which it retains to this day. Departments were also created for Navigation, Lighthouses and Buoys, Works and Maintenance and, later, Geophysics.

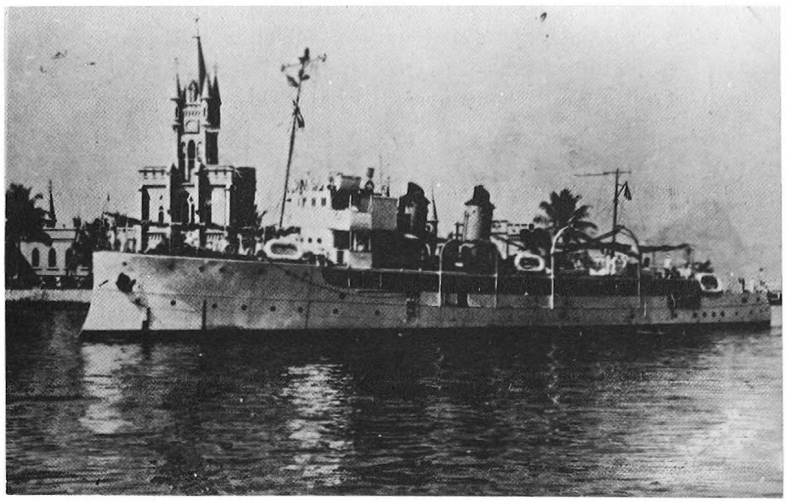

FIG. 5. — The survey ship *Rio Branco*.

The discovery of large manganese deposits in the Amapá region in 1952 called for a navigation route through the northern arm of the Rio Amazonas, which had never been surveyed. For the prompt exploitation of the mines an early survey of this very inhospitable equatorial region was necessary, and the *Rio Branco* was detached for this dangerous work, sailing from Rio de Janeiro on 29 July 1952. The Amazon survey lasted almost a year and brought much credit to the Diretoria. In a 1954 survey, even longer, of this region the *Rio Branco* utilised a Raydist for positioning, other methods being here impracticable. These will long remain the most difficult and arduous survey campaigns of Brazilian hydrography.

On 31 December 1956 the *Rio Branco* was paid off after 22 years of service in Brazil, ranging from the mouth of the Rio Amazonas in the North to the Rio Grande in the south of the country. She can be regarded as the true school of our modern hydrographers, who acquired onboard the *Rio Branco* the necessary experience for the advancement of the Brazilian Hydrographic Service to its present level of prestige.

THE NEW SURVEY SHIPS

As the needs of hydrography grew, the Brazilian Navy ordered 2 new survey ships of 1875 tonnes from Ishikawa-Jima of Tokyo, the *Sirius* and *Canopus,* which arrived in Brazil in 1958. At the time these new ships were probably the most modern in the world. During the delivery voyage of NHi *Canopus* past the port of Salvador (Bahia Province) a helicopter was used for the first time in Brazilian hydrography for a triangulation in the Baía de Todos os Santos.

The ships *Taurus, Argus* and *Orion* (343 tonnes), built at the Naval Arsenal at Rio de Janeiro, were commissioned into service in 1959. They

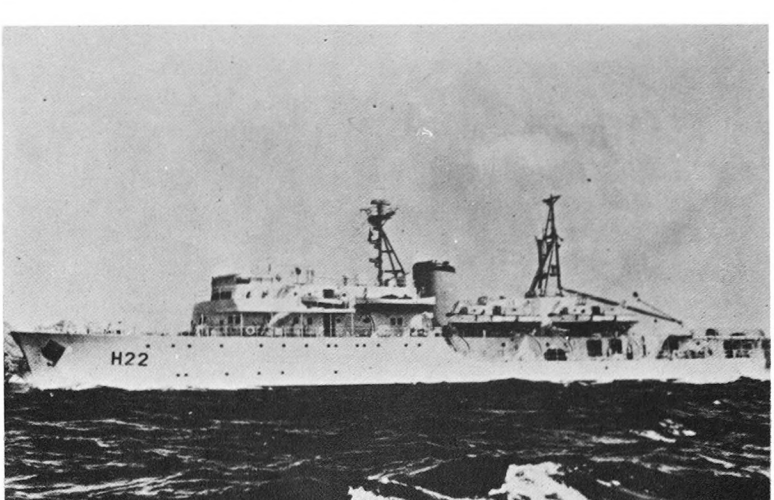

FIG. 6. — The survey ship *Canopus*.

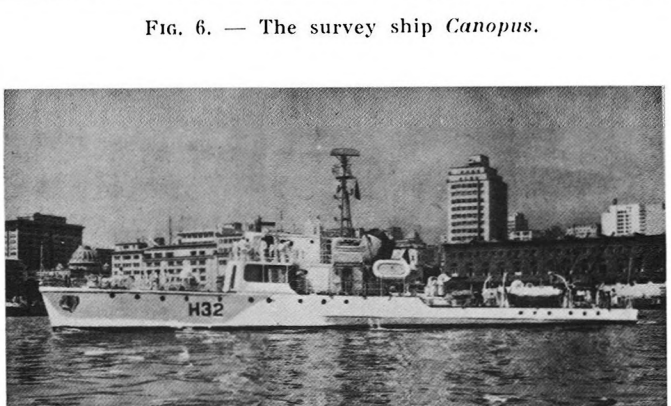

FIG. 7. — The survey ship *Órion*.

are shallow-draft ships, designed to work further inshore than the *Sirius* and *Canopus*, but restricted to areas close to base or where support from the larger vessels is possible. With the delivery of these five ships, a golden age of hydrography in Brazil commenced, which continues to this day.

The first task of the *Sirius*, supported by the *Órion*, was the survey of the Rio Pará in order to permit safe access to the Amazon port of Belém. This survey, which lasted until late 1960, was the first where Tellurometer was used, for trilateration on the Ilha de Marajó.

NHi *Canopus* was first detached to the South coast, where in a long and intensive campaign lasting three years a vast amount of ground was covered, from the Chuí stream in the extreme south of the country to the mouth of the Rio Doce in the Province of Espírito Santo. Following this,

the *Canopus* surveyed the Archipélago de Abrolhos, one of the most dangerous regions on the coast. These islands had previously been surveyed in 1861 by the French officer MOUCHEZ, and the survey had long been considered one of the best works of this eminent hydrographer.

To permit the access of large ships to the inland port of Manaus, the Directorate started in 1967 the survey of the Rio Amazonas from Macapá upwards, and the NHi *Argus* was allocated to this task.

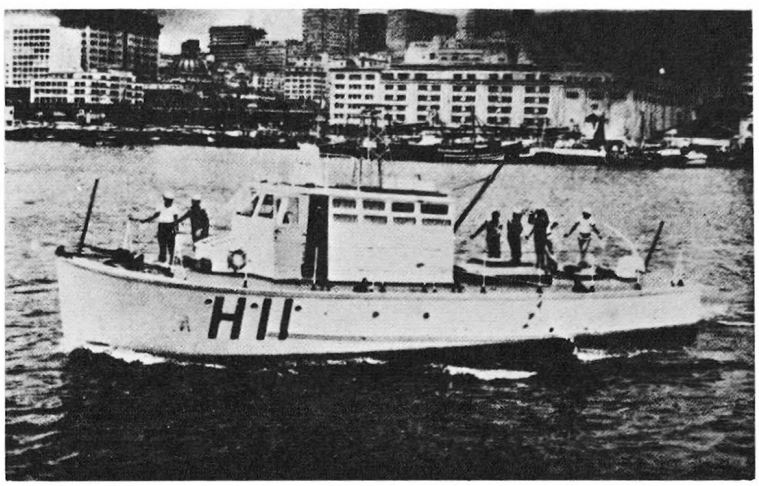

FIG. 8. — The survey launch *Rio Branco*.

In late 1968 the hydrographic launches (AvHi) *Paraibano* and *Rio Branco* joined the survey fleet, first of 6 new wooden hulled, shallow draft vessels of 16 metres, built in Brazil and designed for river and inshore work. The other vessels, *Itacurussá, Nogueira da Gama, Camocim* and *Caravelas,* were all commissioned by 1972.

From 1969, it was decided to speed up survey work on the North Coast, and the *Sirius* and *Canopus* were sent to work on the coasts of the Province of Maranhão, including a precise relocation of the Manuel Luís reefs. Previous charting of this danger had depended on the 1820 survey by Admiral ROUSSIN, the famous French hydrographer. At the same time, a more thorough survey of the North-East coast was carried out, between Cabo Calcanhar and the Rio São Francisco. This work replaced previous charting by Vital de OLIVEIRA (1859) and MOUCHEZ (1865).

The Amazon survey between Macapá and Manaus, the first major river survey by the Diretoria, was concluded in 1970, and permitted passage from the Atlantic to Manaus, 890 miles upriver. Two years later *Canopus* completed most of the North coast survey using for the first time a Geoceiver satellite receiver for locating the soundings. The last chart from this work — No. 100 "Do Cabo Orange à Ilha de Maracá" was published on 25 August 1973, completing the series of coastal charts at 1/300 000. These 22 charts covering the whole coast of Brazil are based on the most modern hydrographic surveying techniques.

PRESENT SITUATION

As far as coast surveys are concerned, the Diretoria is finishing work on the North Coast, which should be complete end 1975 or early 1976. In the next few years, until 1978, the East Coast between Rio São Francisco and the Arquipélago Do Abrolhos will be surveyed; this will be the final stage of the coastal survey which has been striven for by Brazilian hydrographers for so long.

Port surveys are satisfactory, almost all Brazilian ports having been recently mapped. As for charting of the rivers, which are very important to Brazil, work is in progress. As already stated, the Amazonas (Macapá to Manaus), the Pará and its connections with the Amazonas, and part of the Paraná and Uruguai have been surveyed. From Manaus to Iquitos (Peru) there are pilot charts from surveys by Brazilian Navy ships which navigate this stretch of the Amazonas regularly. At present surveys are in progress on the Trombetas (tributary of the Amazonas) and the Paraguaia between Corumbá and Asuncion, capital of Paraguay. Turning to lakes, Lagoa dos Patos was surveyed in 1966 and Lagoa Mirim is in progress.

Since 1967 the Diretoria has published Fishing Charts and Sonar Charts. In the GEBCO programme, Brazil has already published 29 bathymetric sheets at 1/1 000 000 covering a large area of the South Atlantic. Brazil joins 17 other nations in the preparation of the General Bathymetric Chart of the Oceans, following the programme adopted by the International Hydrographic Organization.

Also under the auspices of the IHO, of which Brazil is a founder Member State, the Diretoria has already published three of the six International Charts of the South Atlantic planned in the series. The others will appear by 1978.

Oceanography

With the creation of a Division of Oceanography in the Diretoria 11 years ago, the Brazilian Navy rationalised oceanographic activities. Up to 1957, various ships were used for these tasks, but then the Sail Training Ship *Almirante Saldanha* was re-allocated for oceanography, and she undertook many missions in the International Geophysical Year 1957-58. Since being completely remodelled for oceanographic research 1962-64, NOc *Almirante Saldanha* has worked every year off the Brazilian coasts. In 1966 she used for the first time a proton magnetometer for measuring the Earth's total magnetic field, and in 1969 she was involved in operation "GEOMAR I", studying marine geology and geophysics off the North and North-East coasts.

Since 1968 the Diretoria de Hidrografia e Navegação has been Brazil's designated oceanographic authority at the Intergovernmental Oceanographic Commission, sponsored by UNESCO. In 1971 an oceanographic data centre was established by the Diretoria — the Banco Nacional de Dados Oceanográficos.

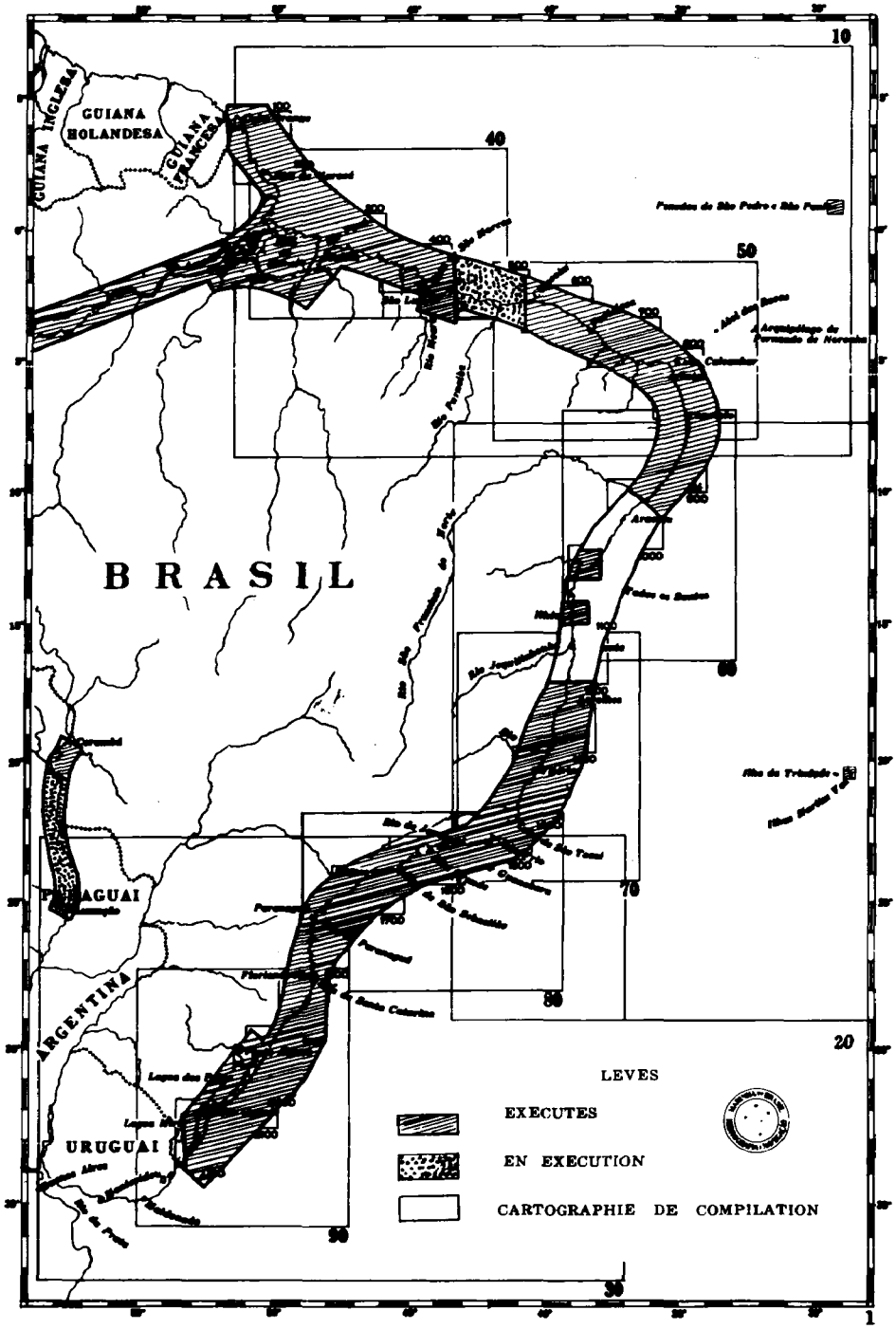

FIG. 9. — Current state of surveying in Brazil showing.
(a) surveys completed; (b) surveys in hand; (c) chart compilation.

As oceanographic activities increased in scope a second specialised ship became necessary, and the NOc *Almirante Câmara*, acquired from the United States, was commissioned on 1 July 1974. Now a third oceanographic research ship is being built in a Brazilian yard, specially for marine geology and geophysics. She will be named *Álvaro Alberto* in homage to the great Brazilian naval scientist who founded the National Research Council.

Training

Since 1954, officers from Chile, Colombia, Ecuador, Guatemala, Mexico, Paraguay, Peru, Uruguay and Venezuela have followed the specialist courses in Hydrography and Navigation at the Diretoria. So far, over 59 foreign officers have followed these courses, which also take students from Brazilian institutes.

Meteorology

The Diretoria is responsible for issuing regional weather forecasts, and the Serviço de Previsão do Atlântico Sul (SPAS) is installed also on the Ilha Fiscal. There are 37 weather reporting stations ashore and 62 in ships. In 1972 the SPAS began direct reception of satellite weather photographs.

Buoyage

The "Almirante Moraes Rêgo" Centro de Sinalização Nautica e Reparos was created in 1965 to replace the old Serviço de Faróis e Balizamento. The Centre is responsible for lighthouse services, buoyage and beacons on the coasts, ports, rivers and lakes, and for the maintenance of ships and craft of the Diretoria. There are five regional offices covering the whole country, and five buoy-tenders. The construction of three modern buoy-tenders is planned.

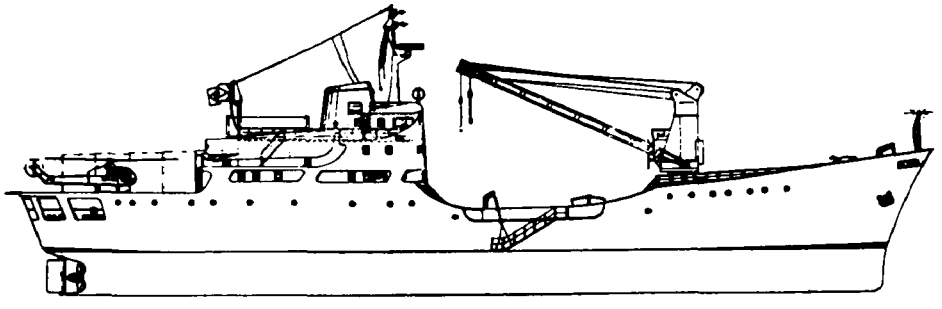

FIG. 10. — The new buoy and lighthouse tender *Graça Aranha*.

For a long time, the Diretoria has needed a vessel specially designed for the construction and maintenance of lights, and thus was launched, in May 1974, the NF *Graça Aranha*. This name was chosen to honour the

illustrious Vice-Almirante Heráclito da GRAÇA ARANHA, Director-General from 1932 to 1935, who inspired so much of the development of Brazilian hydrography. It is fitting that this first lighthouse tender built specially for the Service should honour one of the many Brazilian hydrographers, past as well as present, who have striven so hard to embellish the renown of the nautical charts of Brazil.

(Translated from the Portuguese).

"WHAT TO DO WHEN YOU DAMAGE YOUR THEODOLITE"

"If the novice should have the misfortune to break any material portion of his theodolite, so as to render it ABSOLUTELY USELESS the following plan will be found useful: Do not imagine that such a case is improbable, on the contrary, the most careful surveyor, especially if he is a heavy man, is apt to break through the lid of his theodolite box in using it for a seat. In this case, serious injury nearly always ensues. Or again, with the beginner especially, in his zeal to be in time for dinner, the young surveyor may happen to force down the lid of the box whilst the instrument is not in its proper place. Such accidents are unavoidable, but as they are usually attended with unpleasant consequences, the following rule may be found of use:

"Having satisfied yourself that the instrument is thoroughly disabled, no further harm can be done to it; and much benefit may accrue to yourself by carefully selecting the most reckless of the boat's crew to carry the theodolite down the hill to the boat. Then the rest is easy; anyone who has a taste for surveying can imagine what happens. Offer a reward of a glass of grog to the first man down in the boat, and it naturally follows that the seaman encumbered with the theodolite can scarcely fail to fall over a stone or two, or better still, into some pit or crevice or hole in the rocks. The man is scarcely likely to be injured, but the fall will sufficiently account for the damage done to the instrument, which damage it will indeed most probably increase. There is, to be sure, some risk of discovery; yet we must run some risks in the naval profession, and it is at least better to do so than to incur the certainly of having to pay ten pounds or more for the repair of the damaged theodolite."

From *The Bogus Surveyor, or a Short History of a Peculiar People*, Written and published anonymously by a young British Surveying Officer in 1887 under the pen-name of "Whitewash".