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PORTUGUESE HYDROGRAPHIC INSTITUTE: 60 YEARS OF OCEAN KNOWLEDGE PROJECTED INTO THE FUTURE

By Rear Admiral C. Ventura Soares,
Director-General of the Portuguese Hydrographic Institute
Email : ventura.soares@hidrografico.pt

The Portuguese Hydrographic Institute (IH) celebrated its 60th anniversary on September 22, 2020. The heritage it carries from the Portuguese hydrographic tradition, which dates back to the 15th century, the Age of the Discoveries, gives it special responsibility in the national panorama, in alignment with international dynamics currently underway with regard to ocean sciences. The United Nations' 2030 Agenda for Sustainable Development (2030 Agenda) and in particular its Sustainable Development Goal 14, "Conserve and sustainably use the oceans, seas and marine resources for sustainable development" (SDG 14), the United Nations Decade of Ocean Science for Sustainable Development 2021-2030 (Decade), and the Integrated Maritime Policy of the European Union, will shape the Portuguese governance structures of the Ocean for the next decade. Portugal is at a turning point, where it can be seen as an effective player in an international context, especially in the Atlantic. It is in this scenario that IH is found, a body of the Portuguese Navy and simultaneously a Marine Research Laboratory with a staff of 300, equally divided between military and civilians, whose present and future will be addressed here.

The present (2021)

IH is challenged to reconcile its military genesis with the functions of a research institution, supporting the government in pursuing public policies in ocean sciences. Its vision is "to be a reference research center in ocean sciences". The "IH" product is strategically associated with Quality, Innovation and Internationalization, contributing to maritime security and national defense in areas of Portuguese sovereignty, jurisdiction and responsibility, while also enhancing scientific knowledge, marine environment monitoring and Blue Economy development.

The national and international responsibilities of a hydrographic office, the insertion in the Navy to support military activities with geospatial, meteorological and oceanographic information (GEOMETOC) and its Research Laboratory activity in ocean sciences, with R&D responsibilities, are the three major pillars that underpin IH's technical-scientific activity, which is divided in the disciplines of Hydrography and Nautical Cartography, Navigation, Physical Oceanography, Marine Chemistry and Marine Geology. This activity is organized into three main themes: Ocean Mapping, Observation and Forecasting. These themes have as their domain of application the entire Atlantic Ocean framed by the Portuguese scientific strategic interests.

The Ocean Mapping theme, designed to map the seabed in morphological terms, and to geologically characterize the seabed and sub-seabed, has currently two programs underway: the SEAMAP 2030 Program, "Mapping the Portuguese Sea"

with the objective of carrying out total coverage of high resolution bathymetry of the seabed up to the limit of the Portuguese EEZ, or up to the outer limit of the extended continental shelf when and under the terms in which the Portuguese claim is recognized by the United Nations; and the SEDMAR Program, mapping the superficial marine sediments of the geological continental shelf and continental slope, is focused on the coast of the European continental part of Portugal and the archipelagos of the Azores and Madeira, up to 500 meters deep.

The Ocean Observation theme, which includes the observation of ocean dynamics, the physical and chemical characteristics of the water column, pollution by hydrocarbons and plastics / microplastics, acidification of the oceans, suspended particulate matter or underwater noise, has three major programs in execution: the main one is MONIZEE, an integrated observation system based on an operational monitoring network of the marine environment, with permanent and fixed sensors in coastal zones or in the areas where coastal processes predominate; the MONIATLANTICO Program, focused on large-scale, spatial and temporal observation of the Ocean, covering the Atlantic area of Portuguese interest; and lastly the MONIAQUA Program, focused on transitional waters.

The Ocean Forecasting theme, based on the operational capacity and knowledge of IH in the domain of ocean dynamics, is divided into two programs: the PREVOCEANO Program, which develops an oceanographic forecasting system, with a focus on supporting marine and coastal environment managers, scientific community, Blue Economy companies, mariners and civil society in general, with models for forecasting tides, sea waves, currents and coastal dynamics; the METOCMIL Program, which develops the operational meteorological and oceanographic forecasting system to support naval and maritime operations, under the direct responsibility of the IH operational center named CGEOMETOC. This operational center is boosting the setup of the NATO Maritime GEOMETOC Center of Excellence, MGEOMETOC, to be co-located in IH, which is expected to be fully operational in the first semester of 2021.

In addition to the three main technical-scientific themes presented, the transversal theme Ocean Data and the complementary theme Ocean Observation Technologies are also developed at IH. The transversal theme Ocean Data aims to manage IH's technical and scientific data, serving Portugal and the international community, and is based on the IDAMAR Program, supported by a spatial data infrastructure of the marine environment with a dedicated portal, HIDROGRÁFICO+. The complementary theme Ocean Observation Technologies is promoted through the IH SENSORTECH Program, with which IH aims the establishment of an anchor infrastructure for the development of marine observation technologies, through the creation of the Center for the Development of Ocean Observation Technologies.

All of the strategic themes mentioned above are aligned with the 2030 Agenda / SDG 14 / Decade initiatives. Issues such as climate change, the conservation of biodiversity in marine ecosystems, the mitigation of natural risks and the development of the Blue Economy will largely benefit from the data collected in the ocean through appropriate observation technologies.

Reference should also be made to other relevant projects (special projects), currently under development at IH: the adoption of the S-100 Universal Hydrographic Data Model in the production of the future S-101 Electronic Navigational Charts; the capacity building of the African Countries, that are part of the Community of the Portuguese Speaking Countries (CPLP), in hydrographic surveys, production of nautical charts and research in ocean sciences; the renewal of the hydro-oceanographic fleet of the Portuguese Navy, in order to provide the country with renewed capacity to occupy its maritime spaces through scientific knowledge.

The near future (2021-2030)

Some challenges and opportunities are carried forward into the future by these programs and projects in which IH is committed. In the field of Mapping, it is already clear that the traditional hydrographic survey obtains, in its execution, much more than the simple morphology of the sea bottom. A consequence of acquiring data in great variety and enormous quantity, whether originated from Mapping, Observation or even Forecasting, is the huge impact on the dimensioning of data infrastructures.

The technological challenge associated with the development of the S-100 Standard, with an impact not only in the production of the future S-101 Electronic Navigational Charts but also in the development of the concept of e-navigation, brings to IH a unique opportunity to consolidate itself as a modern hydrographic service, with technical and human resources able to implement new technologies that will ultimately serve the mariner of the future. In addition to electronic cartography, it is important to invest in the total digitalization of nautical publications into database management system's environment (georeferenced information), creating added value products for mariners, allowing, in an easily usable and configurable way, fast and improved access to the information currently contained in several nautical publications (Pilots, List of Lights or List of Radio Signals).

The extensive area of the Atlantic Ocean under Portuguese jurisdiction (almost two million square kilometers) presents an effective challenge in sustaining observation systems compatible with the resources available in Portugal and specifically at IH. The integration of the Institute's current observation systems in European and global observation networks, as well as in networks for specific purposes (for example tsunami early warning system in the North-eastern Atlantic – NEAMTWS or monitoring network to measure global sea levels - GLOSS) is an important step in recognizing the relevance of these systems in the Atlantic context. The new holistic approaches of the Atlantic basin, from the perspective of Observation, offers IH and Portugal a unique opportunity to strategically extend their intervention to the South Atlantic, namely in its eastern sector along the African coast. The fact that the set of CPLP Atlantic African countries is geographically within this sector, enhances this collaborative intervention, thus favoring capacity building.

The development of ocean observation technologies in IH can also induce the promotion of this segment in the Portuguese and international context. It would indeed be very stimulating to conceive that, after a generation, Portugal could become a country of excellence in the development of these technologies.

It is essential to operationalize the knowledge strategies of the ocean, which gains special prominence in countries like Portugal, whose future is certainly inseparable from the marine environment in its scientific, environmental, economic and political aspects. The Atlantic vocation of IH, therefore, involves operationalizing national strategies and strengthening international relations, seeking partnerships, especially within the Atlantic and CPLP countries, taking into account the existing common objectives. The year 2021 is the first year of the United Nations Decade of Ocean Science for Sustainable Development, the year of celebration of the 100th anniversary of the International Hydrographic Organization and it is ten-years distance to complete the Portuguese SEAMAP 2030 program aligned with the Nippon Foundation-GEBCO SEABED 2030 project. The Portuguese Hydrographic Institute, with 60 years recently completed, assumes to be a leveraging factor for ocean sciences in Portugal, in conjunction with the universities, industry and the citizens in general. This is clearly the will of the hydrographic community that serves at IH, so Portugal can surely benefit from this commitment. This decade will be crucial for the knowledge of the seas and oceans and determinant not only for the future of human societies but also for the planet. We must not waste it!