

## **HYDROGRAPHIC REQUIREMENTS FOR PLANNING AND DEVELOPMENT IN AFRICAN COASTAL AND INLAND WATERS**

by the International Hydrographic Bureau, Monaco  
presented by Rear Admiral A. CIVETTA (\*)  
at the Conference of E.C.A. Ministers of Planning and Development  
Tripoli, Libyan Arab Jamahiriya — 2-12 May 1990

---

### **Abstract**

Hydrography involves collecting data about the depth of water, the position of submerged dangers to navigation and the movement of water in the world's continental shelves and oceans, and publishing such data in the form of nautical charts. Such charts are essential for the safety of passengers and cargoes, for the exploration and exploitation of marine resources and the protection of marine environment. The latest charts available off the coasts and in the inland navigable waters of Africa are very often based on data collected up to 150 years ago. There are only five hydrographic ships and 13 hydrographic launches to survey 10,250,000 km<sup>2</sup> of African countries' Exclusive Economic Zones; only seven African maritime countries have any capability to produce their own nautical charts. In order to start to improve this highly undesirable restraint on the African economy, it is suggested that each African maritime country should form a national Hydrographic Committee and seek expert advice on creating a national hydrographic capability. It is also suggested that three Regional Hydrographic Centres should be established, attached to existing Regional Centres in East, West and North Africa, to provide on-going advice within the Region and to undertake the maintenance of the highly specialized hydrographic surveying equipment needed and the training of nautical cartography. The International Hydrographic Organization is willing to provide advice on the development of these facilities.

(\*) Director, International Hydrographic Bureau, 7, avenue President J.-F. Kennedy, MC 98011 Monaco.

## BACKGROUND

The national economies of coastal States, as well as of those non-coastal States with significant inland maritime areas (such as navigable lakes and rivers) have always been highly dependent upon marine commerce. By international conventions, all vessels are required to carry a set of nautical charts and publications adequate for their intended voyages. Coastal States have the responsibility to ensure that reliable data is available to enable the nautical charts and publications of their Exclusive Economics Zones (EEZs) to be maintained in order to reduce the risks to shipping from uncharted dangers with consequential loss of lives and cargoes and pollution of their marine environment. Non-coastal States have the same responsibilities for their inland maritime areas.

For many years, the size of merchant shipping did not change significantly and shipping routes remained much the same, so that charts based on old surveys were usually adequate to prevent ships from grounding. Within the last 30 years, there have been many new requirements for more accurate and detailed data; much larger ships have been introduced, using new sea-routes and new, or greatly enlarged, ports. Economic pressures have forced ship owners to accept much less underkeel clearances whilst modern technology has revealed the presence of many significant underwater hazards not detected by older surveys.

The Third UN Law of the Sea Convention confers upon coastal States the rights to the living and non-renewable marine resources in the waters and on the seabed within a 200-nautical mile wide EEZ and requires coastal States to show baselines and agreed maritime boundaries on nautical charts. It is well known that many such newly acquired EEZs are much larger than the land area of the coastal State. With the right to benefit from marine resources within EEZs go the responsibilities to ensure that adequate modern hydrographic data is available for marine environmental conservation and the management of their marine resources, including improved fishing industries, extraction of oil, gas and other mineral deposits and improved facilities for tourism and recreational sailing activities.

*In the African region, perhaps more than in any other region in the world, the responsibility for surveying and mapping or charting both the land and sea areas of the different countries was, for many years, accepted by countries from outside the region. In the case of land surveys and mapping, this responsibility was usually shared with the African country so that, when each achieved independence, there was a nucleus of expertise available to continue the work of updating their land maps. Recent technology, such as aerial photography and remote sensing, has enabled topographic land maps to be more easily produced and most African countries now have available their own series of land maps, at varying scale, which although not perfect, are based on data obtained within the last 25 to 40 years. This is certainly not the case with nautical charts of African waters. Only seven African countries have a capability to produce their own nautical charts.*

Data collection at sea is a slow and expensive undertaking but, until about 30 years ago, the world's major hydrographic offices were able to devote some of their limited hydrographic resources to the surveying of those areas of the world of interest to their national shipping. Unfortunately, local personnel were seldom involved in such activities and, with independence, most developing countries found themselves not only with inadequately surveyed and charted coastal waters and with no hydrographic capabilities or resources but also with no awareness of the problem and with new requirements and responsibilities.

Both land and sea features must be precisely positioned. The positioning of the coastline itself is of vital importance, not only for navigation but, in the case of a low water line, as a baseline for measuring the various offshore jurisdictional areas. Even today, some coastlines, particularly those of islands, are charted thousands of metres from their correct position. Fortunately the introduction of various Satellite Positioning Systems is rectifying these problems. The measurement of tides is another integral part of hydrography and this includes the study of cyclic changes of mean sea-level in connection with the long terms consequences of the 'green-house' effect.

Hydrographic surveying does not fall obviously under the responsibility of any one common Government Ministry. Departments such as Trade, Communications, Planning and Development, Fisheries, Transport, Energy, Tourism, Defence, Foreign Affairs should all have a common interest. Whilst the Land Survey Department will have expertise in surveying and mapping, they will not usually be familiar with the quite different techniques involved in hydrographic surveying and nautical charting nor will they have access to ships and boats or hydrographic instrumentation. Defence and Fisheries Departments may have ships and boats but lack surveying expertise. Such departmental differences should not be allowed to impede the development of a national hydrographic capability provided expert advice is sought and followed up, on an individual national, as well as a regional, basis.

## THE WORLD HYDROGRAPHIC SCENE

Various studies have been undertaken by the International Hydrographic Organization (IHO) in collaboration with the Department of Technical Cooperation for Development of the U.N. Secretariat and presented at various U.N. Regional Cartographic Conferences. The latest was presented to the Fourth UN Regional Cartographic Conference for the Americas on 24 January 1989 as E/CONF.81/INF/9. This has since been reviewed by IHO Member States and it is planned to have this wide distribution, later in 1990, as IHO publication SP-55.

From Table 1, it will be seen that data was only available from 101 of the 225 maritime areas identified and that Africa compares very unfavourably with all other regions with the exception of Australasia/Oceania. Of the 24 African EEZ areas for which data was available (out of a total of 55 African areas) only 19% was considered to have been surveyed sufficiently well for the safe passage

of ships or the management of marine resources whilst 64% was regarded by the experts compiling the report as being 'unsurveyed'.

**Table 1 — World Hydrographic Survey Summary**

Region	Areas in Region	No. of Areas Studied	EEZ Areas studied 1000 km	Percentages of Areas studied		
				Adequately Surveyed	Needing Resurvey	Not at all Surveyed
Europe	29	24	11,909	40	26	34
Africa	55	24	10,237	19	17	64
Asia	41	16	21,306	30	34	36
Australasia/Oceania	36	10	28,548	17	11	72
Antarctica	7	—	—	—	—	—
South America	21	11	9,964	39	27	34
North/C.America	36	16	15,244	39	25	36
<b>Total</b>	<b>225</b>	<b>101</b>	<b>97,208</b>	<b>29</b>	<b>22</b>	<b>49</b>

Looking at the resources available to the world's 153 maritime nations, Table 2 shows that, despite having about 10% of the world's EEZ areas included in the survey, the 45 African maritime nations have only 5 hydrographic ships (2% of the 266 available worldwide) and 13 surveying launches (3% of the 379 available worldwide). To carry out surveys in these vessels the 45 African maritime nations have 61 hydrographic surveyors (4% of 1,682), 86 assistant hydrographic surveyors (4% of 1,919), 12 nautical cartographers (2% of 666) and 12 nautical draftsmen (1.4% of 874). The number of charts produced by the 45 African maritime nations is quite disproportionately low, with only 272 charts (1%) produced by seven countries, many of which are no longer capable of being brought up to date and are based on data over 100 years old.

**Table 2 — World Hydrographic Resources and Chart Production Summary**

Region	No. of Marit. Nations in Region	Numbers of							
		Ships	Boats	(H)Surv.	Ass.Surv.	Carto.	Drafts	Charts	Pubs.
Europe	24	65	98	382	527	232	432	8,240	1,447
Africa	45	5	13	61	86	12	12	272	32
Asia	35	124	106	659	650	183	207	6,129	747
Australia	15	7	11	55	118	8	48	481	14
Antarctica	—	—	—	—	—	—	—	—	—
South America	12	21	31	299	473	64	73	1,098	307
North/C.America	22	44	120	226	65	167	102	4,845	265
<b>Total</b>	<b>153</b>	<b>266</b>	<b>379</b>	<b>1,682</b>	<b>1,919</b>	<b>666</b>	<b>874</b>	<b>21,065</b>	<b>2,812</b>

## THE AFRICAN REGION

The general status of hydrographic surveying and charting in Africa was very well addressed in a paper 'Hydrographic Surveying and Charting — The needs and the means' presented by Miss C. WILLIAMS, U.S. Naval Oceanographic Office, to the Fourth UN Regional Cartographic Conference for Africa, Abidjan, 5-16 November 1979. Unfortunately, very little improvement has taken place during the last ten years.

Table 3, shows, for the countries for which data was available, the approximate areas of the Exclusive Economic Zones of the coastal States of Africa and of some of the major Inland Maritime Areas in the continent. Since the Table was compiled, information has been received of action being taken by Malawi to survey its portion of Lake Malawi/Nyasa and by Tanzania to form a National Hydrographic Committee. However the Table highlights how few resources, in the form of trained hydrographic surveying and nautical cartographic staff, are available in Africa.

Although charts are available to international and national shipping in the series of some developed hydrographic offices (notably France, Federal Republic of Germany, India, Japan, Portugal, Spain, UK, USA and USSR), these are, in most cases, based on very old data which is no longer adequate for safe navigation. On many charts there are still large unsurveyed areas.

It should be noted that the areas of Exclusive Economic Zones and individual areas of shared Inland Maritime Areas cannot be calculated accurately until the various maritime boundaries have been negotiated by all the States involved. Such negotiations, and hence the exploration for and management of possible marine resources, cannot be concluded until adequate modern hydrographic surveys and charting have been carried out to delineate the inshore and offshore limits of the EEZs claimed by each State.

## DEVELOPING A NATIONAL HYDROGRAPHIC CAPABILITY

The IHO, an intergovernmental consultative and technical organization, with its Headquarters, the International Hydrographic Bureau (IHB), based in Monaco since 1921, is the recognized international authority on hydrography, with the responsibility for providing guidance and advice on all hydrographic matters. In order to provide such advice, the IHO has allocated funds in each of the years 1989 to 1992 to enable visits to be made by experts in the fields of hydrographic surveying and nautical charting to any country — whether an IHO Member State or not — which requests such a visit and at no expense to the requesting developing country other than that of transport within the country during the visit.

Since several Government Departments should be interested and involved with the development of hydrographic capabilities, it is possible that approaches may be made by different Departments to different UN or other organisations for advice — IMO, IOC, FAO etc. In some cases, approaches may also be made to non-governmental or private sector companies. The IHO has formed a Technical Assistance Coordination Committee (TACC), with the International Federation of Surveyors (FIG), representing the private sector, to build up a data bank of Hydrographic Technical Assistance programmes; this TACC started its activities in mid-1989. It is hoped to expand this Committee to include other UN agencies. The IHB has recently begun to issue a regular series of reports on all projects and visits of which it has been informed.

It is highly desirable that each country should form a National Hydrographic Committee at an early stage in the development of a hydrographic service with a Chairman to act as the national Focal Point with the IHO and other organisations involved with maritime matters such as the Indian Ocean Marine Affairs Coordination, International Maritime Organization etc.

#### REGIONAL COORDINATION — EQUIPMENT AND TRAINING

Hydrographic surveying involves the use of relatively expensive vessels and specialized equipment and the training of only small numbers of specialist hydrographic surveyors and nautical cartographers. Since many developing African countries are remote from the manufacturers of modern hydrographic equipment and have quite modest requirements for such instrumentation, there are good reasons for establishing or developing Regional Centres with capabilities to service and maintain equipment such as echo-sounders, sidescan sonars, tide gauges and electronic positioning systems. Such centres could also arrange hydrographic surveying seminars and training in nautical cartography.

In view of the high initial and running costs of vessels suitable for hydrographic surveying, every attempt should be made to use existing craft or to charter a suitable vessel. There are available several private hydrographic surveying companies but expert advice will be needed to select those with the appropriate type of expertise and to monitor their work, should it be decided to place the hydrographic tasks to contract.

Since only small numbers of hydrographic surveyors and nautical cartographers will be required by most of the individual African States, it is recommended that advantage be taken of the various courses in hydrography which have been reviewed and accredited by the Joint IHO/FIG Advisory Board on Standards of Competence for Hydrographic Surveyors. Details of these Standards are given in IHO Publication MP-005 'Standards of Competence for Hydrographic Surveyors'. IHO Publication SP-47 'Training Courses in Hydrography and Nautical Cartography' lists the various courses available, in different languages throughout the world and gives details of any assistance available in the way of scholarships or other financial support, as well as of academic and other qualifications needed for each course. In addition, practical on-the-job training

under competent supervisors will be essential and the IHO could offer advice on obtaining such supervised practical training by a developed hydrographic service.

In order to provide easily accessible advice to African States seeking to take advantage of the economic potential of their large EEZ areas and to safeguard their marine environment, consideration needs to be given to the appointments of expert Regional Hydrographic Advisers in East, West and North Africa in order to reduce the cost of providing advice on an ad hoc basis to individual African countries; such advisors would be available to monitor progress (or lack of progress) with any national or regional hydrographic project.

### INLAND MARITIME AREAS

The requirement for modern surveys and charts of large inland maritime areas is one which has been largely overlooked in the past. However, the potential for disasters due to vessels foundering after hitting uncharted and unmarked obstruction on the beds of lakes or rivers is at least as great as in offshore waters and in approaches to ports. Since such inland maritime areas are usually shared by more than one State, consideration needs to be given to joint projects by the States concerned.

### CONCLUSIONS

As a first step towards providing the modern hydrographic data — essential base for the conservation and management of the marine environment and resources in the coastal and inland waters of the African continent, each African country should make provision for a National Hydrographic Committee and for the development of a suitable national hydrographic capability, seeking the necessary expert advice. Provision also needs to be made for the creation of up to three Regional Hydrographic Centres to provide expert advice, to maintain specialists hydrographic equipment and to train nautical cartographers in each Region of Africa, with the possible help of a Regional Hydrographic Advisor.





Table 3 — Status of Hydrographic Surveying and Resources — AFRICA (cont.)

COUNTRY	Length of Coastline in kms (2)	Area of EEZ (3) Km <sup>2</sup> × 10 <sup>3</sup>	Number of Ports (2)		Percentage of EEZ which is			Numbers of						
			Major	Minor	Sufficiently Adequately	Needing Resurvey	Unsurveyed	Hydro Surv.	Asst. Surv.	Cartographers	Draftsmen	Charts		
													Surveyed Adequately	Needing Resurvey
Niger R.	See Lake Chad		2	—	—	—	—	—	5	0	0	0	—	0
Nigeria F.R. (1)	853	210.9	2	10	—	—	—	—	—	0	0	0	—	0
Sao Tome & Principe	209	128.3	2	1	—	—	—	—	—	0	0	0	—	0
Senegal R.	531	205.8	1	2	30	30	40	—	—	0	0	0	—	1
Seychelles R.	491	1 349.4	0	1	2	6	92	—	1	4	2	3	—	2
Sierra Leone R.	402	155.7	1	2	—	—	—	—	—	—	—	—	—	—
Somali D.R.	3 025	782.0	2	4	—	—	—	—	—	—	—	—	—	—
South Africa R.	2 881	1 553.4	5	6	30	50	20	—	8	12	2	2	—	153
Sudan D.R.	853	91.6	1	0	0	0	100	—	5	6	—	—	—	—
Tanzania U.R. (1)	1 424	223.3	3	5	0	0	100	—	1	4	—	—	—	0
Togo R.	56	2.1	1	1	—	—	—	—	—	—	—	—	—	—
Tunisia R.	1 143	85.3	4	8	10	60	30	—	—	—	—	—	—	—
Uganda R.	See Lake Victoria		4	—	—	—	—	—	—	—	—	—	—	—
W. Sahara	690	—	2	2	—	—	—	—	—	—	—	—	—	—
Zaire R.	37	1.	2	1	—	—	—	—	—	—	—	—	—	—
Zambia R.	See Lake Tanganyika		—	—	—	—	—	—	—	—	—	—	—	—
									61	86	12	12		272

INLAND MARITIME AREAS

Lake Chad (4)	(650)	(22.0)	—	—	—	—	—	—	—	—	—	—	—	—	—
Lake Nyasa (5)	—	28.5	—	—	0	0	100	—	0	0	0	0	—	0	
Lake Tanganyika (6)	—	33.0	—	—	0	0	100	—	0	0	0	0	—	0	
Lake Victoria (7)	27,000 sq m	69.0	—	—	0	0	100	—	0	0	0	0	—	0	

- Notes:
- (1) Excluding Inland Maritime Areas
  - (2) Taken from I.H. Review, July 1980 pp. 25-39 - Miss C.R. WILLIAMS, USNOO
  - (3) Taken from IHO/UN Report E/CONF.81/INF/9 of 24 Jan. 1989
  - (4) Waters shared by Cameroon, Chad, Niger, Nigeria
  - (5) Waters shared by Malawi, Mozambique, Tanzania
  - (6) Waters shared by Burundi, Tanzania, Zambia, Zaire
  - (7) Waters shared by Kenya, Uganda, Tanzania.