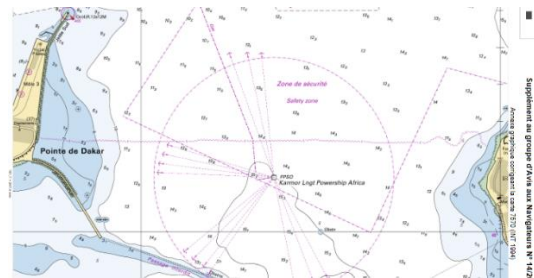




**IHO - Capacity Building  
Work Programme  
TECHNICAL VISIT  
TO SENEGAL  
REPORT  
11 - 15 April 2022**



**Our thanks to .../...**

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**MINISTRE DES PÊCHES  
ET DE L'ÉCONOMIE MARITIME**



AGENCE NATIONALE DES AFFAIRES  
MARITIMES (ANAM)



**SSMS : Service de sécurité maritime du Sénégal**  
Aides à la navigation et hydrographie



**HASSMAR : Haute autorité chargée de la coordination de la sécurité maritime, de la sûreté maritime et de la protection de l'environnement**



**Centre de Suivi Ecologique**



**Centre de Recherches Océanographiques  
de Dakar - Thiaroye**

Avec le concours de :



**Service hydrographique et océanographique de la  
marine (France)**



**Secrétariat de l'OHI (Monaco)**

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## ABSTRACT

The development of Senegal in hydrography and nautical cartography can be accelerated:

- firstly by supporting the activities and consolidating current means of the "subdivision" of Lighthouses and Beacons (Phares&Balises), a direction of the Autonomous Port of Dakar (PAD) ensuring on behalf of the State, the Maritime Safety Operational Service of Senegal (SSMS) in hydrography and aids to navigation. However, this service is not established as a National Hydrographic Service;
- by a more encompassing approach integrating in addition: physical oceanography, integrated management of coastal zones, nautical cartography, action of the State at sea;
- mobilizing new actors with very related interests who can only play win/win by cooperating together on shared projects with pooled resources and skills;
- provided that these new institutional (MPEM, HASSMAR, ANAM) and operational (PAD/SSMS, CRODT, CSE, MN) players can find themselves at least in a national coordination committee, which can be formed from a structure already existing, making it possible to efficiently share issues, projects, human and material resources and finally results;
- by becoming a member of the IHO (like IMO and IALA).

This report does not claim to be exhaustive, there are certainly potentialities which have not been inventoried and which should have been considered, it nevertheless offers some recommendations which are based on successful experiences elsewhere in Europe and Africa.

Concerning maritime navigation, with regard to ratified international conventions, in particular SOLAS (providing hydrographic services in order to establish and disseminate the information and nautical documentation necessary for the safety of navigation in its waters), Senegal's capacities are in terms of development:

- **acquired for phase 1:** collection and transmission of **maritime safety information** (MSI) to NAVAREA II, transmission of corrections to nautical publications, in particular nautical charts to Shom. It is nevertheless necessary to check (complementarity) and undoubtedly institutionalize the process which currently actively involves the PAD/SSMS (rather coastal) and the National Navy (deep-sea capabilities)
- **partially acquired for phase 2:** **hydro-oceanographic surveys** through data acquisition and archiving. The function should be extended to all Senegalese waters and not just the main areas of action of the PAD/SSMS;
- **not acquired for phase 3**, namely the **production of official nautical charts** (provided in co-edition by Shom).

This report includes a set of findings and proposals for action. To make it more accessible, it can be divided to be the subject of targeted actions. The National Coordination Committee to be set up will be able to distribute and plan the tasks between its various stakeholders.

## RECOMMENDATIONS AND ACTIONS TO BE FOLLOWED

The majority of the recommendations are to be followed within the National Coordination Committee and therefore to be included on the agenda of the first meetings.

Object	Comments - Recommendations
	<b>Phases 1,2,3 of development</b>
<b>Phase 1 development</b> <b>Maritime Safety</b> <b>Information (MSI)</b>	<ul style="list-style-type: none"> <li>• Clearly identify all the players in the maritime world who can provide nautical information and benefit from it (MN, PAD, secondary ports, new offshore players and the deep-water port of Ndayane, etc.)</li> <li>• In order to consolidate the current execution, in accordance with the international regulations (IMO-IHO) and the national texts, specify by an interministerial instruction the methods of the collection and the diffusion (urgent, rapid, deferred) of MSI</li> <li>• Ensure in particular that the provisions already in force (possibly partly informal) already provided by the MN and the PAD/SSMS are complementary and cover all the waters under Senegalese jurisdiction</li> <li>• The PAD and the secondary ports must be responsible for issuing local AVURNAVS</li> </ul>
<b>Phase 2 development</b> <b>Hydro-oceanographic</b> <b>surveys from data</b> <b>acquisition to archiving</b>	<ul style="list-style-type: none"> <li>• Identify all national needs in terms of surveys (PAD, secondary ports, MN, CRODT, CSE, coastal environment, etc.) and prioritize them</li> <li>• Identify all the possibilities of pooling material resources (ships/boats) (GPS, echo-sounders, tide gauges) and human resources (geomaticians, hydrographers, oceanographers, cartographers)</li> <li>• Specify, execute, qualify, reconstitute a large-scale national hydro-oceanographic survey in 2023. Consider doing so when the French hydrographic vessel <i>Laplace</i> and its two launches arrive in the first half of 2023 to optimize the acquisition of hydro-oceanographic measures with a view to satisfying, in addition to updating nautical charts, the related specific needs of the country. In this perspective, provide for cross-boarding on the ships and launches that will be concerned. The sharing of methods (e.g. hydrography in relation to the ellipsoid) can only be very beneficial in terms of developing hydro-oceanographic capacities. Then provide feedback to consolidate the sustainable conditions of a national organization</li> </ul>

	<ul style="list-style-type: none"> <li>• For the record: are needed floating means, scientific and IT equipment, logistical support infrastructure and of course sufficient quality and quantity of personnel (all professions combined: hydro-oceanographers, IT specialists, logisticians, managers)</li> <li>• Concerning the floating means (ships, boats) Senegal is not deprived of them with those of the National Navy, those of CRODT and of course the current dedicated means of the PAD/SSMS</li> <li>• Training of new expert agents in the acquisition of hydro-oceanographic data: that of IHO certified category B hydrographer is strongly recommended</li> </ul>
<p><b>Phase 3 development</b> <b>Cartographic production</b></p>	<ul style="list-style-type: none"> <li>• The co-production/edition of nautical charts with Shom (Coordinator of INTernational cartography for Region G and current primary chart authority) must continue within the framework of the Administrative Arrangement</li> <li>• It is nevertheless logical and necessary for Senegal to be able to gradually gain autonomy and already respond itself to specific cartographic needs such as sovereignty charts of State Action at Sea</li> <li>• It is therefore necessary to clearly identify the already existing capacities in terms of geomatics in order to pool them through joint projects</li> <li>• Constitute a national database in charge of collecting, qualifying, making available hydrographic and oceanographic data (depths, tides, type of bottom, topography of the coast, landmarks, beaconing, etc.). This database must be initialized with existing data (including historical data from Shom)</li> <li>• Designate one or more national referents by type of data</li> <li>• Produce a first chart support for maritime public policies: meet the needs of State Action at Sea (institutional limits, EEZ, continental shelf extension, fishing zones, marine protected areas, etc.)</li> <li>• Training of new expert agents in nautical cartography: that of marine cartographer certified IHO category B is strongly recommended</li> </ul>



<b>International relations: IHO, Regional/EAtHC, France</b>	
<b>Join the IHO</b>	<p><b>Be present at the international level</b></p> <ul style="list-style-type: none"> <li>• Join the international community as the country already is at IMO. Benefit from much more support from the IHO in terms of training. IHO Capacity Development actions are limited to Phase 1 for non-member countries.</li> <li>• <b>Ministry of Fisheries and Maritime Economy then Ministry of Foreign Affairs and Senegalese Abroad) →</b> apply the simplified membership procedure (see the IHO website). Transmission to the Minister of Foreign Relations of Monaco</li> </ul>
<b>Involvement in the Regional Hydrographic Commission (EAtHC)</b>	<p><b>Be present at the regional level</b></p> <ul style="list-style-type: none"> <li>• Participate to the next EAtHC (17th) plenary of 2022 which will take place in September in Cape Verde <a href="https://iho.int/en/eastern-atlantic-hydrographic-commission">https://iho.int/en/eastern-atlantic-hydrographic-commission</a></li> <li>• In particular participate in the seminar which will precede at the same place on maritime safety information (MSI), the co-production of nautical charts with a third country, risk analyzes (cartography/navigation) and the specification of hydrographic surveys Point of contact: henri.dolou@shom.fr</li> </ul>
<b>Administrative Arrangement (AA) with France</b>	<ul style="list-style-type: none"> <li>• This arrangement dates from 2009 and allows Senegal to be in compliance with SOLAS.</li> <li>• The work of the National Coordination Committee may lead to adjusting the obligations of the parties currently limited to Shom for France and to PAD/SSMS for Senegal. AA which could evolve to promote the progressive autonomy of Senegal</li> <li>• Beyond the topics of cooperation already indicated, it will be appropriate to address the subject of databases, the importance of which was mentioned during the Technical Visit.</li> </ul>
<b>Surveys - results:</b> Updating nautical charts	<ul style="list-style-type: none"> <li>• It is essential to provide Shom with all available data accompanied by quality files (metadata on the means used during the survey) and not only the PAD/SSMS surveys</li> <li>• Contact all operators who have survey data and send them to Shom with the metadata (archive these data in Senegal)</li> <li>• It should be noted that without the explicit authorization of the owners of the data, their use by Shom is restricted to updating nautical charts. They are neither disseminated nor used in other products without the express written consent of the owners.</li> </ul>

	<b>Senegal</b>
<b>Creation of one or more national databases</b>	It is essential that Senegal archives all the data mentioned above in a sustainable manner for free and shared valuations
<b>« CNC » HASSMAR</b>	<p>Develop a national framework: the National Coordination Committee (Aids to Navigation, Hydrography, Physical Oceanography, Marine Cartography) [Name and acronym to be defined]</p> <p>This committee can be formed from an already existing structure (the nautical commission has been mentioned), allowing the efficient sharing of issues, projects, human and material resources and finally results. Institutional (MPEM, HASSMAR, ANAM) and operational (PAD/SSMS, CRODT, CSE, MN) players will be particularly involved.</p> <p>HASSMAR, attached to the presidency, given its inter-ministerial competences, could promote its constitutive text or even go further by establishing the Lighthouses and Beacons service as also the National Hydrographic Service. The first meeting of the committee, to address concrete subjects, could be based on the suggestions for interdisciplinary inter-agency projects described in annex G.</p>
<b>Marine Nationale (Navy)</b>	<ul style="list-style-type: none"> <li>• The Senegalese Navy has nautical skills and sea intervention capabilities. It will be one of the first beneficiaries of the development of hydrography</li> <li>• Make available, according to rules to be defined, its nautical means of intervention at sea</li> <li>• Specify its needs in terms of nautical documentation and AEM</li> </ul>
<b>PAD/SSMS</b>	<p>Service in charge of Lighthouses and Beacons and hydrography</p> <ul style="list-style-type: none"> <li>• Have functional material means to comply with IHO specifications capable of updating official nautical charts. Have new tide gauges (permanent or occasional) on the territory</li> <li>• Get closer to physical oceanographers of CRODT</li> <li>• In terms of forward-looking management of skills and staff, have new agents follow the training of senior technician (Bachelor 3) in hydrography at Shom school (scientific/computer profile). More effective solution in the long term than following short courses</li> </ul>
<b>CRODT</b>	<ul style="list-style-type: none"> <li>• Reconnect with PAD/SSMS which will be re-equipped with hydro-oceanographic acquisition systems</li> <li>• New tidal observatories may be acquired to promote new studies of mean sea level in relation to climate change</li> <li>• Participate in the work of the National Coordination Committee by defending in particular the need for "marine geoscience" data</li> </ul>

	<ul style="list-style-type: none"> <li>Participate in the inventory of existing maritime data (including meteorology) (France, ORSTOM/Ird), promote their acquisition and sharing</li> </ul>
	<b>Formation</b>
<b>Basic training (CAT B) for senior technicians in hydrography or cartography</b>	<p>Training in hydrography (data acquisition) remains fundamental.</p> <p>However, it is now necessary to develop, in the country, its own capacities to produce products and services directly to users without necessarily going through a third country.</p> <p>It is therefore also necessary to train marine cartographers, considering the needs at sea and in inland waters.</p>

### MAIN CONTINUING ACTION

PAD/SSMS (based in Dakar) must above all maintain permanent relations with the NAVAREA II coordinator, who is also the primary chart authority for the waters of Senegal (France / Shom), so that MSI (Maritime Safety Information) are distributed on time to mariners (e.g. via SafetyNet in case of emergency) and that nautical documents (e.g. nautical charts) are updated at the appropriate frequency (e.g. nautical instructions, new chart editions).

#### Transmission of MSI

coord.navarea2@shom.fr or coord.navarea2@gmail.com (Emergency email address)

Tel : +33 2 56 31 24 24 24 (D7 - H24) Fax: +33 2 56 31 24 84

#### Non-urgent nautical information :

Hydrographic surveys, port plans: bri@shom.fr / copy: na-om@shom.fr and dmi-rex-d@shom.fr

#### Other nautical information:

na-om@shom.fr / copy: bri@shom.fr and dmi-rex-d@shom.fr

#### Postal address :

Département « Informations et Ouvrages Nautiques »  
 Service hydrographique et océanographique de la marine (Shom)  
 CS 92803 - 29228 BREST CEDEX 2  
 FRANCE

## INTRODUCTION

### 1 Preparation of the technical visit - Background

The visit was planned as part of the IHO Capacity Building Program for the year 2022

- *CBWP 2022: action A-12 - « High-level and Technical Visit to Senegal ».*

It was initiated in close collaboration with Mr Ibrahima CISSOKHO, Director of the subdivision of lighthouses and beacons of the Autonomous Port of Dakar (PAD) which provides the Maritime Security Service of Senegal (SSMS) in charge of aids to navigation and hydrography of the country. Commander Eric LEMONNIER, Liaison Officer to the Chief of Staff of the National Navy of Senegal, provided support for nautical cartography (acquisition, distribution, updating, etc.).

The terms of reference of the visit are recalled in Annex B.

### 2 Composition of the team

The visiting team consisted of:

<u>Name</u>	<u>Role</u>
Henri DOLOU	Project manager at Shom for African affairs (France on behalf of the IHO)

The lighthouses and beacons subdivision (M Ibrahima CISSOKHO and/or M Pathe Yéro THIOYE) participated in all the interviews.

## PART A - OVERALL ASSESSMENT OF THE SITUATION IN THE REGION

### 3 Effectiveness of the Technical Visit

The follow-up of actions resulting from drafted recommendations will make it possible to measure the real effectiveness of the visit in the long term. However:

- That it could have been prepared prior to the trip through exchanges and analyzes of existing reports and texts;
- That the issues of hydrography, oceanography and cartography have been addressed in terms of maritime navigation, environment, research and training and finally State action at sea;
- The following appointments were held (chronological order):
  1. M Ibrahima CISSOKHO, Director of Lighthouses and Beacons (Phares & Balises) of the Autonomous Port of Dakar (PAD) in charge of operations of the Senegal Maritime Security Service (SSMS) assisted by Mr Pathe Yéro THIOYE (In charge of study and monitoring of projects);
  2. M Ousmane NDIAYE, Director of Port Infrastructure at the Ministry of Fisheries and Maritime Economy (MPEM);
  3. M Papa Amadou SECK, Head of the P&B Navigation aids maintenance service;
  4. M Fara MENDY, Second Captain of "*Samba Laobé FALL*";
  5. Ms. Tiofane NDIAYE, Director of Maritime Security (DSM) at the National Agency for Maritime Affairs (ANAM);
  6. Captain (Navy) Mamadou NDIAYE, Deputy Chief of Staff of the National Navy (CEMN)
  7. the Secretary General, Captain Abdou SENE, of the High Authority responsible for the coordination of Maritime Safety, Maritime Security and Environmental Protection (HASSMAR);
  8. Mr. Limalé DEME, oceanographer at the Oceanographic Research Center of Dakar-Thiaroye (CRODT);
- For the record, the visit to the CSE (Ecological Monitoring Center) could not be organized as planned. This was compensated by exchanges by email and telephone during and immediately after the technical visit (Dr Ousmane BATHIERY - Geomatician Responsible for Training and Internships);
- That a restitution meeting (conclusions – recommendations) at the end of the visit was held at the PAD with the following stakeholders: HASSMAR for the AEM (State Action at Sea), the Senegalese Navy, the CRODT (oceanographic research) and finally the SSMS which, in addition to beaconing, is in charge of the country's hydrography;
- That the stakeholders able to collect nautical information have again been made aware of the SOLAS obligations ensured by Senegal in connection with France (NAVAREA II, cartographic coordinator, co-editor of the nautical documentation in force in the waters under jurisdiction of Senegal, capacity development coordinator).

Reusable communication media have been provided relating to:

- On issues and governance (institutional context);

- On hydro-oceanography (challenges and professions);
- On nautical cartography. From the acquisition of data at sea (hydrography, oceanography) and on the coast (topography) to the production of official nautical charts (navigation), paper and digital, their acquisitions and their updates;
- Finally on the main lessons learned immediately at the end of the Technical Visit.

The discussions were professional and constructive. Recommendations have been made. Some of them, shared during the summary meeting can be conducted in the short term such as (PRIMORDIAL):

- In accordance with international regulations (IMO-IHO) and national texts, specify by an interministerial instruction the methods of collection and dissemination (urgent, rapid, deferred) of nautical information (MSI: maritime safety information) for all waters under Senegalese sovereignty. It is essentially a question of validating and verifying the complementarity of quality actions already carried out by the National Navy and the SSMS (PAD) at a time when new activities are emerging at sea (Offshore) and new ports are being created;
- Develop from one or more existing structures a national coordination body for Hydrography, Physical Oceanography, Marine Cartography and Aids to Navigation that is multidisciplinary and inter-ministerial;
- Participate again in meetings, work and seminars of EAtHC (Eastern Atlantic Hydrographic Commission of the IHO);
- Join the IHO;
- Mobilize to master the processes of data acquisition (hydro-oceanographic), their qualification, storage, sharing, dissemination, etc.

It should be noted that the technical exchanges focused on the obligations of the SOLAS convention (chapter V) as well as on the expected economic benefits. As such, hydrographic investments can generate very substantial financial savings, in particular via:

- minimization of dredging operations;
- optimization of ship loading;
- welcome to ports of new ships with much higher capacities but with much more demanding drafts in terms of navigation constraints.

They also focused on the expected benefits in terms of the marine environment, particularly at the land-sea interface (coastal development – coastal protection).

#### 4 International and regional cooperation – Defense

a. [International and Regional Organizations]


OHI/IHO Status	Regional Hydrographic Commission	OMI/IMO	AIMS/IALA	OMAOC/MOWCA
Non Member	Associated Member CHAtO/EAtHC	Member	Member	Member

b. [Defense and security arrangements]

Subject not addressed during the visit.

## PARTIE B – SENEGAL – ASSESSMENT

### 5 Involvement in the Regional Hydrographic Commission (EAtHC)

Findings	Actions
<p>In recent years, Senegal's participation in EAtHC meetings has been irregular. The country was then represented by the PAD</p>	<ul style="list-style-type: none"> <li>• Participate in the next EAtHC (17th) plenary of 2022 which will take place in Cape Verde (September 28, 29 and 30) <a href="https://iho.int/fr/commission-hydrographique-de-l-atlantique-oriental">https://iho.int/fr/commission-hydrographique-de-l-atlantique-oriental</a></li> </ul>
	<ul style="list-style-type: none"> <li>• In particular participate in the seminar which will precede (26 and 27 September 2022) at the same place on maritime safety information (MSI), the co-production of nautical charts with a third country, risk analyzes (cartography/navigation) and specification of hydrographic surveys</li> <li>• Point de contact : <a href="mailto:henri.dolou@shom.fr">henri.dolou@shom.fr</a></li> </ul>

### 6 Preliminary liaison

The visit was mainly prepared through discussions with PAD and the collection of open information on the Internet.

The Shom was consulted as:

- NAVAREA II Coordinator (permanent role);
- EAtHC Capacity Development Coordinator (permanent role);
- International chart Portfolio Coordinator for Region G (permanent role);
- Producer of hydrographic surveys (occasionally);
- Co-producer of nautical charts and nautical publications (permanent role).

Shom provided copies (GeoTiff and paper on site) of the nautical charts listed in Appendix I

### 7 Technical Visit Contact Points - IHO Correspondents (P5-Yearbook) of EAtHC and Shom

The Technical Visit contact points are listed in Annex D. At this stage there is no need to modify (except an update of the names) the representation of Senegal at IHO and EAtHC.

Updated names for P5 (in list of non-member states):

- National hydrographer or equivalent: unchanged Mr. Ibrahima CISSOKHO
- Other point of contact: replace Mr. Abdoulaye DIA with Mr. Pathe Yéro THIOYE

Update for EAtHC: same

Joining IHO and appointing state and technical officials to the new national coordination committee (Hydrography, Physical Oceanography, Cartography, Aids to Navigation), which can be formed from an already existing structure, will be to possibly revise these representations.

- **IHO links:**
- Yearbook/P-5 : [https://iho.int/uploads/user/pubs/periodical/P5YEARBOOK\\_ANNUAIRE.pdf](https://iho.int/uploads/user/pubs/periodical/P5YEARBOOK_ANNUAIRE.pdf)
- EAtHC : <https://iho.int/en/basic-commission-documents-2>

## DESCRIPTION OF MARITIME ACTIVITIES

### 8 National Maritime Affairs - Stakeholders

The duration of the visit (5 working days) made it possible to meet important players in the maritime transport chain and hydro-oceanography.

#### General context, levels of development

The talks focused on the issues associated with hydrography: beyond safety of navigation (international commitments – SOLAS), economic performance through port capacities for receiving ships (including larger ones) and the optimization of their loading (through the depths shown on the nautical charts).

It was recalled that hydrography is an applied science dealing with the measurement and description of the physical elements of the seas and coastal areas. That its mastery necessarily intervenes in coastal protection (coastal development) thus underlining the transversal character of hydrography (physical oceanography is part of it) and consequently, at the governmental level, its interministerial ambition.

In terms of capabilities, according to the development phases of IHO, the following points of progress were noted:

Phase	Object	Level of development - Remarks
1	Collection and transmission of maritime safety information / nautical information (MSI) to NAVAREA II, transmission of corrections to nautical publications in particular nautical charts to the Shom	<b>Achieved.</b> <i>“The country fulfils its national obligations in a sustainable manner”<sup>1</sup></i> The actors (National Navy, PAD/SSMS) are well aware. They are in contact with Shom and regularly send information to it. It will be necessary to ensure that the collection and transmission of MSI covers the new offshore activities of Senegal and that MN-Navy / P&B complementarity of the PD is total. This should go through an inter-ministerial instruction where efficiency will have to count above all.
2	Hydrographic and oceanographic surveys through data acquisition	<b>Incomplete</b> <i>“The country is aware of its national obligations but does not have “national” means to do it”</i> Even if PAD is endowed with sufficient resources (through the repair of hydrographic equipment and their integration on board), these, although P&B have a range of action going well beyond Dakar, do not probably make it possible to meet all the hydro-

<sup>1</sup> Référence : <https://iho.int/uploads/user/Inter-Regional%20Coordination/CBSC/MISC/Templates%20Procedures/PDF/Procedure%2011.pdf>



		oceanographic needs of the waters under Senegalese sovereignty. The complementarity of P&B, CRODT, Marine Nationale (Navy) has not been explored in depth. It seems potentially very promising to now focus on phase 2 and thus provide a response to all "national" needs and not specifically those of the current P&Bs and the CRODT taken individually and each already having a ship of significant size.
3	Production of nautical charts and publications	<p><b>In the long term</b></p> <p><i>“The country fulfils its national obligations through a third party”</i></p> <p>An administrative arrangement currently organizes cooperation with France and in particular enables compliance with the SOLAS convention. It is nevertheless logical and necessary for Senegal to be able to gradually gain autonomy (the example of Morocco was presented) and already meet specific cartographic needs such as sovereignty charts of State Action at Sea.</p> <p>It is therefore necessary to clearly identify the already existing capacities in terms of geomatics in order to pool them through joint projects. This is one of the first actions to be carried out within the “National Coordination Committee”</p>

**Le Ministère de la Pêche et de l'Économie Maritime (MPEM)**



**MINISTÈRE DES PÊCHES  
ET DE L'ÉCONOMIE MARITIME**

MPEM is, among other things, responsible for the management and exploitation of the seabed.

In particular, it supervises ANAM and PAD.

He is responsible for the development of secondary ports.

The “Maritime Economy” program aims, among other things, to improve transport services and maritime training

Among the sectoral strategies reported are:


- Strengthening maritime safety and security and preventing maritime pollution;
- Massification of maritime employment;
- The establishment of a policy of good maritime governance.

Among the national directorates:

- the Department of Seabed Management and Exploitation (Direction de la Gestion et de l'Exploitation des Fonds Marins - DGEFM), whose mission is to develop and implement State policy on the management and sustainable exploitation of seabed resources, marine preservation of the seabed environment and development of oceanography;
- the National Agency for Maritime Affairs (Agence Nationale des Affaires Maritimes - ANAM) (see below),

The Ministry of Fisheries and Maritime Economy benefits from the support of the Oceanographic Research Center of Dakar – Thiaroye (Centre de Recherches Océanographiques de Dakar – Thiaroye - CRODT) which depends on the Senegalese Institute of Agricultural Research (Institut Sénégalais de Recherches Agricoles - ISRA) attached to the Ministry of Agriculture and Rural Equipment (Ministère de l’Agriculture et de l’Équipement Rural - MAER).

While ensuring the opening up of the natural regions of Sine-Saloum and Casamance, the modernization of the Merchant Navy also aims to improve river-sea transport services, through the establishment of appropriate maritime infrastructure and equipment in adequation with the mobility needs of people and goods necessary for the economic and social development of the regions concerned.

<b>Agence Nationale des Affaires Maritimes (ANAM)</b>	
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The National Agency for Maritime Affairs (ANAM) is under the supervision of the MPEM. It ensures compliance with the application of the maritime conventions of the International Maritime Organization (IMO). ANAM includes in particular the Maritime Safety Department, which was the subject of an interview during the technical visit.

<b>Haute autorité chargée de la sécurité maritime, de la sûreté maritime et de la protection de l’environnement marin (HASSMAR)</b>				
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It performs a general mission of coordinating State action at sea, in areas relating to maritime safety, maritime security, and the protection of the marine environment and river waters under Senegalese jurisdiction.

The 1974 International Convention for the Safety of Life at Sea (SOLAS), as amended, is considered the foundation document among international instruments relating to maritime safety and security.

**Coordinating bodies :**

- The National Crisis Management Coordination Committee (Comité national de coordination de gestion des crises - CNC), bringing together all the administrative structures with competences at sea;
- The Main Maritime Rescue Coordination Center (MRCC), on 24-hour operational watch, ensuring the coordination of emergency interventions at sea;
- Secondary rescue coordination centers (RSC)

<b>Port Autonome de Dakar - Service de Sécurité Maritime du Sénégal (PAD - SSMS)</b>		
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PAD/SSMS plays a major (but almost exclusive) role in terms of nautical information (NAVAREA II correspondent with the Senegalese Navy) and transmission of new bathymetric surveys to Shom. According to IHO Publication P-5 (list of non-Member States), the Chief of SSMS represents Senegal at meetings of this organization.

The missions of the PAD/SSMS are described in different chapters of this report.

The continuation of relations with the IHO in particular its Member States such as France, Morocco and Nigeria will offer important opportunities for capacity development both in the

continuous improvement of the processes of acquisition and processing of hydro-oceanographic data (quality approach) and in upgrading staff in terms of skills.

According to HASSMAR, the Lighthouses & Beacons service could evolve, in addition, into a real national hydrographic service.

### Marine Nationale (MN) - Navy



The sovereign missions (defense) of the Senegalese Navy are known. It is worth recalling here the importance it exercises in AEM (State action at sea) operational matters.

Moreover :

1. Navy participate in the collection (in the front row to observe) and the dissemination of nautical information;
2. Navy has ships that are all supports (maritime platforms) for carrying (at least occasionally) portable hydrographic and oceanographic data acquisition systems that could effectively supplement those of PAD and CRODT. The rapid development of phase 2 (data acquisition at sea, surveys) should also rely on these existing national resources;
3. Depending on its ambitions in terms of national hydrography (complementary to PAD), Navy could send one of its officers to follow a CAT B certified hydrography course. It has moreover already had hydrography training in Brazil recently.

### Centre de Recherches Océanographiques de Dakar-Thiaroye (CRODT)



Even if this center probably focuses its activities primarily on fisheries, it is nonetheless active in the field of physical oceanography, a theme extremely close to hydrography and even almost common for data acquisition at sea.

**Note:** the National Oceanographic Data and Information Center of Senegal (Centre National de Données et d'Informations Océanographiques du Sénégal - CNDO-SN), created during the launch of the project "Oceanographic Data and Information Exchange Network in Africa" ODINAFRICA is the national focal point for information oceanographic. The CNDO-SN aims to be a tool for decision support and services for research, education (reinforcement of expertise in the field of marine sciences) and the development and sustainable management of sea and coastal resources of Senegal.

The CNDO-SN relies very heavily on the Direction des Pêches Maritimes (DPM) and the **Centre de Recherches Océanographiques de Dakar-Thiaroye (CRODT)**, which respectively house the Information and Documentation Center and the Data Center of which they are integral parts

Note: this center was not met, but exchanges by email and telephone were able to provide important clarifications in terms of governance and coastal management.

CSE's mission is to contribute to the knowledge and sustainable management of natural resources and the environment, through the production and distribution of decision-making support products and services for the State, local communities, the private sector, civil society, research and development institutions, producer organizations and development partners.

CSE is involved in the WACA (West Africa Coastal Areas) project in the particular context of coastal resilience / maritime erosion (WACA ResIP: West African Coastal Management Program Senegal Resilience Investment Project).

CSE is therefore an organization experienced in the field of geospatial data acquisition (MOLOA: Mission d'Observation du Littoral Ouest Africain) and the management of projects.

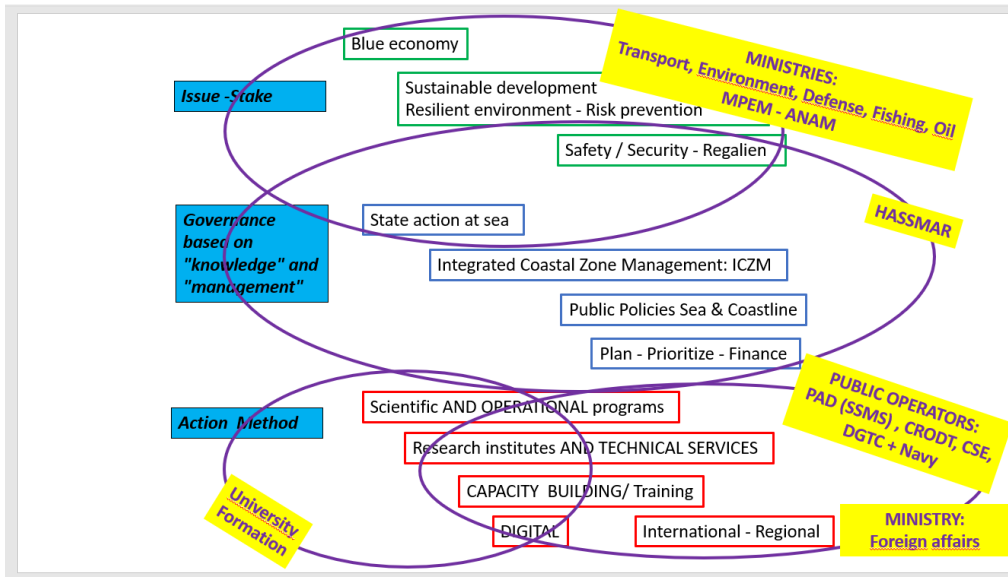
**Coordination (Aids to navigation, hydrography, physical oceanography, nautical cartography)**

**See chapter:**

COORDINATION AND CAPACITY DEVELOPMENT PROPOSAL

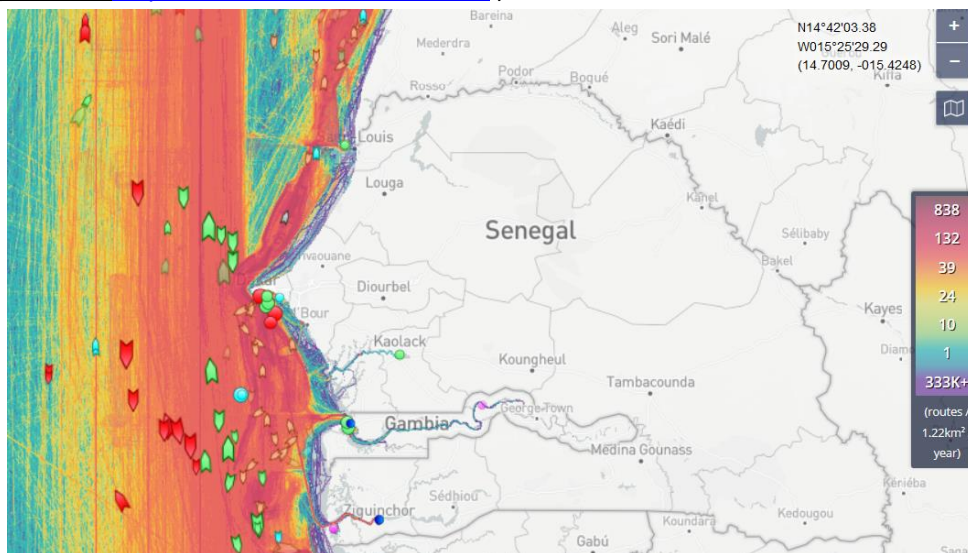
/ National Coordination/Consultation Committee (Hydrography, Physical Oceanography, Marine Cartography, Aids to Navigation)

- Its necessity is recognised: many common needs, shareable skills, resources to be pooled (through agreements, budgetary compensation if necessary);
- Its multidisciplinary (transport/navigation, coastal environment, safety/security, fishing, research and education in oceanography, etc.) and inter-ministerial nature was underlined;
- Concretely, it could be judicious to launch projects (including setting up resources) like those proposed in annex G;
- Note: such a committee does not, however, constitute an operational national body for research, development and hydro-oceano-cartographic production. Do such an operational organization that would require a heavy investment to study and set it up (status, governance, budget, material and human resources, etc.) is needed ? Rather than creating such a service ex-nihilo, it may be rather appropriate to already rely on existing structures, including that of the PAD/SSMS. The implementation of structures and operational means is part of the "Action/Method" level of the following figure. The subject is obviously to be debated between the actors concerned.

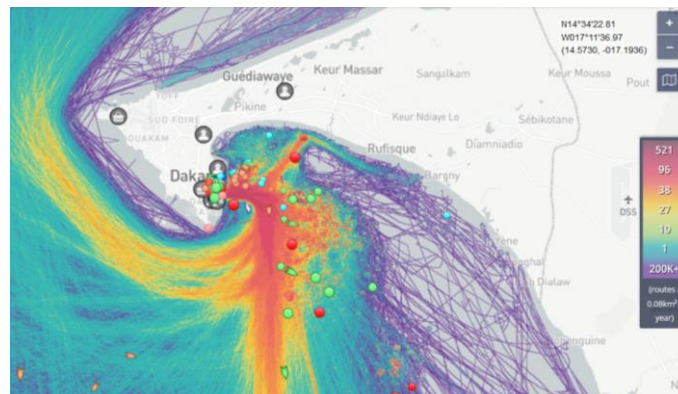


## 9 Maritime trade and traffic - Marine cartography / CATZOC

AIS data (source : <https://www.marinetraffic.com> )



General situation of maritime traffic off Senegal



Maritime traffic at the port of Dakar

## Official cartography of Senegal (see Annex I-1 and I-2)

France ensures de facto (pending greater autonomy from Senegal) the function of "Primary Chart Authority" through the production of nautical documentation made by the Shom on Senegalese waters, this cartographic responsibility being defined by an administrative arrangement between France and Senegal signed in 2009.

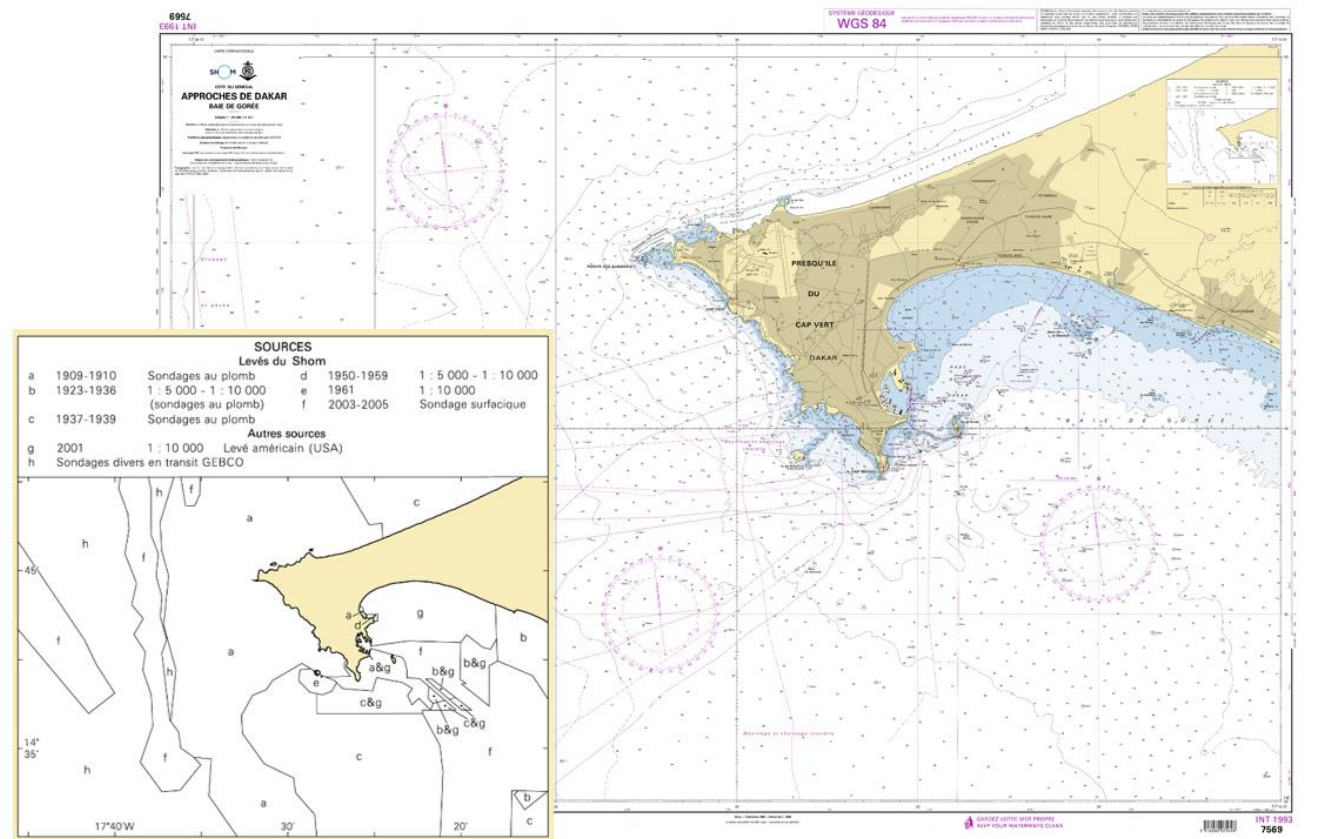
Senegalese waters are covered by a set consisting of paper charts, digital rasters in GeoTiff format and electronic navigational charts (ENC).

These products cover the most important known navigation needs.

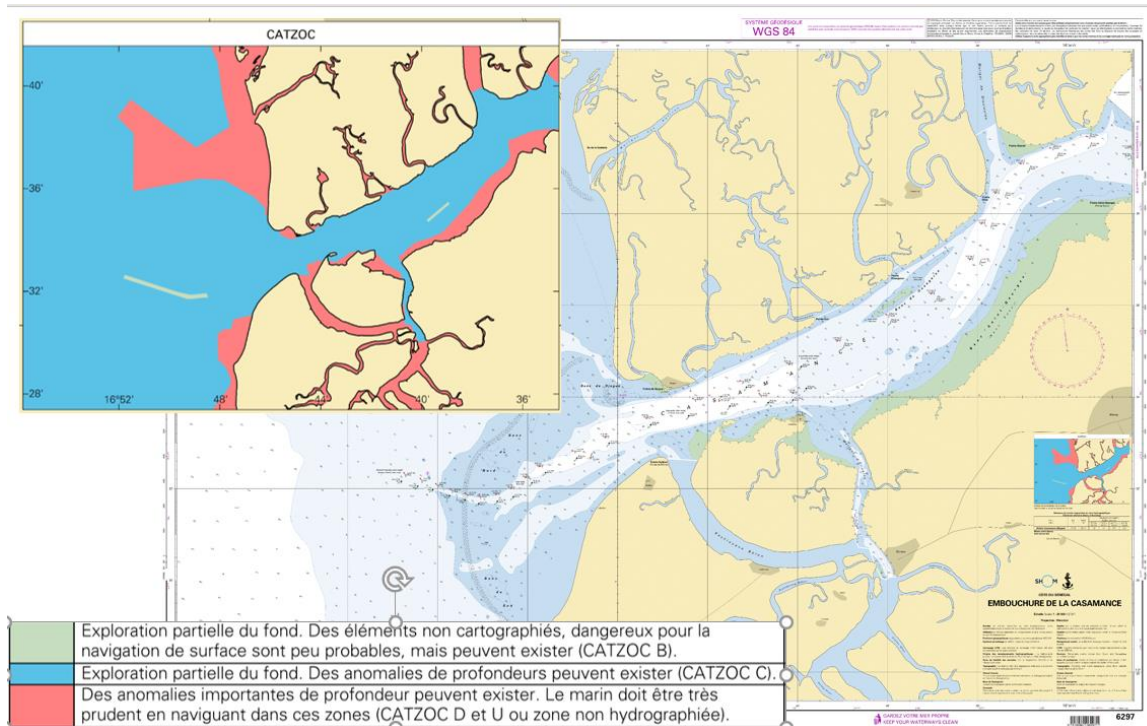
The fact remains that charts are often based, particularly in shallow waters, essentially on very old information (eg: years 1909 - 1910 with lead lines in the west of Dakar). The environment may have changed, the hydrographic techniques of the time no longer meet current requirements, which is already the case in terms of geolocation in WGS84.

If the immediate accesses to Dakar have been the subject of recent surface hydrographic surveys (2003-2005), the rest of the territory is very poorly surveyed or not surveyed even near Dakar.

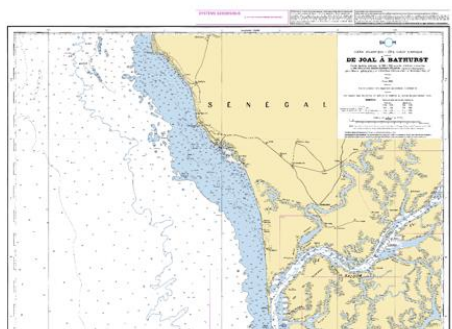
### Carte 7569 - Approches de Dakar :



### Carte 6297 - Embouchure de la Casamance :



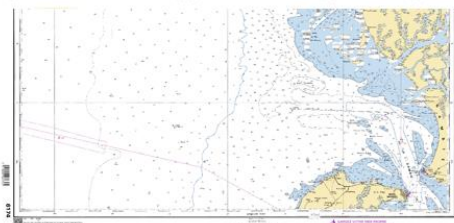
### Carte 6174 - De Joal à Bathurst



SYSTÈME GÉODÉSIQUE

Positions géographiques rapportées à un système géodésique local.

**Positionnement par satellites :** Les ajustements à apporter aux positions obtenues au moyen de systèmes de par satellites rapportées au système géodésique WGS 84 pour être en accord avec cette carte sont inconn



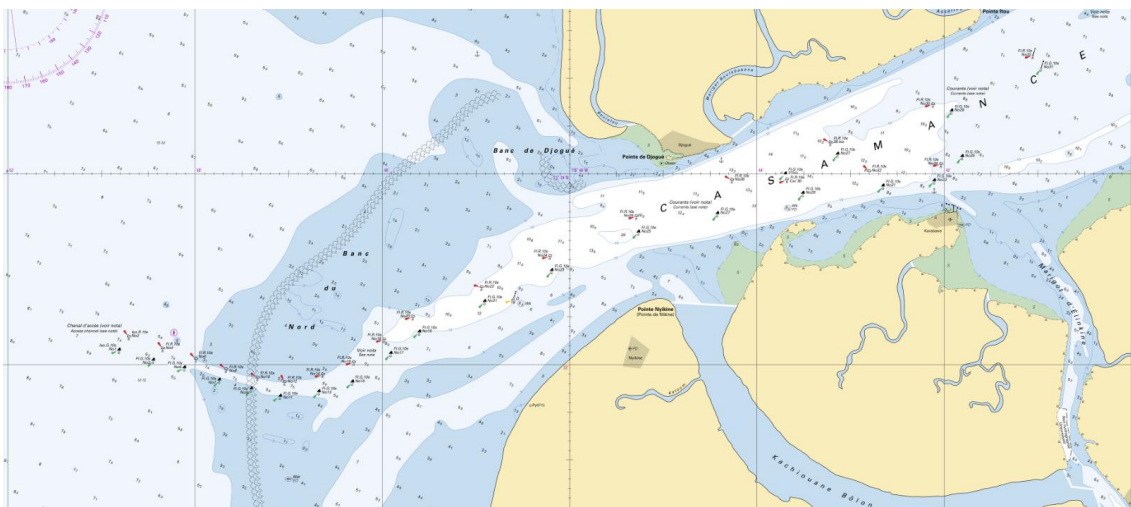
Source : <https://iho.int/uploads/user/pubs/cb/c-55/c55.pdf>

## Senegal (G)

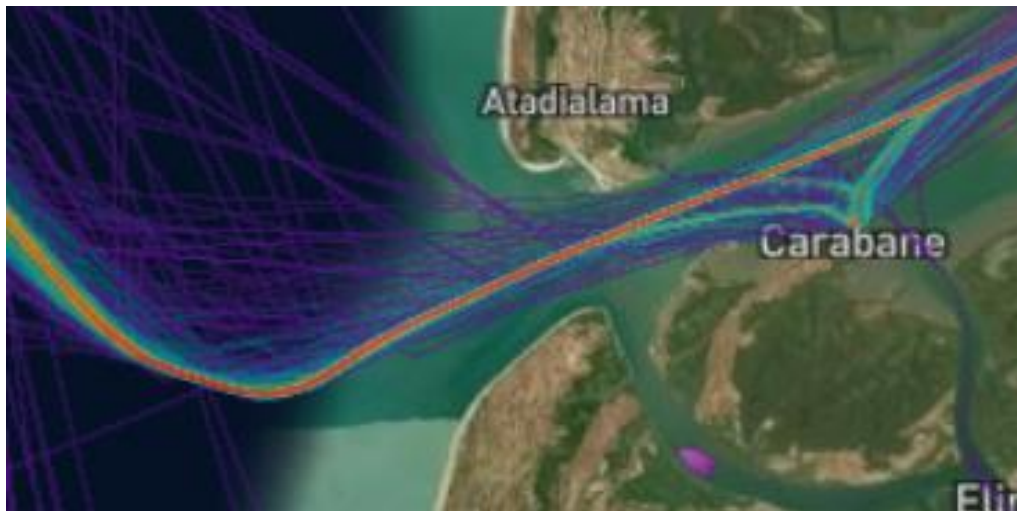
Nautical charting / Cartographie marine / Cartografía náutica		Offshore passage Navigation au large Pasaje offshore			Landfall and Coastal passage Atterissage et navigation côtière Recalada y Pasaje costero			Approaches and Ports Approches et ports Aproches y puertos		
<b>Coverage of charts published</b> Couverture des cartes publiées Cobertura de cartas publicadas		100	0	100	100	0	100	100	0	40
% Covered by INT or other paper charts meeting S-4 Couvert par des cartes papier INT ou autres conformes S-4 Cubiertas por cartas de papel INT o otras cumpliendo S-4										
% Covered by RNC meeting S-61 Couvert par des RNC conformes S-61 Cubiertas por RNC cumpliendo S-61										
% Covered by ENC meeting S-57 Couvert par des ENC conformes S-57 Cubiertas por ENC cumpliendo S-57										
Paper charts showing depth in meters Cartes papier avec les profondeurs en mètres Cartas de papel con profundidades en metros	100 %	Paper charts referenced to a satellite datum Cartes papier rapportées à un système géodésique satellitaire Cartas de papel referidas a un datum satelital			100 %	Data source Source des données Origen de los datos		France		
Notes	1. Data provided by France according to FR-SN bilateral agreement.									
Notes	2. Medium scale ENC coverage : partially covered by GB ENC's.									
Notas										

### Comments:

- This cartography must be enriched by all surveys carried out in waters under Senegalese sovereignty or jurisdiction. The hydrographic surveys received by the Shom (metadata included) so far only come mainly from the PAD. The official cartography is therefore not enriched by all the surveys carried out, such as possibly the exploration seismic surveys or the surveys of oceanographic laboratories. This is a subject to be submitted to the coordination committee.
- It should be noted that bathymetric surveys carried out in the context of oceanographic research should not be systematically discarded: even carried out with “general public” equipment, these data can only enrich the “white” areas of nautical charts.
- There are areas where hydrographic knowledge is insufficient or even non-existent. By correlating this knowledge with the current (including cabotage) and especially planned navigation zones, it will be possible to conduct a risk analysis and prioritize the hydrographic surveys to be carried out. This is again a subject to be submitted to the coordination committee (navigational aids included).







## 10 Responsibility for the safety of navigation

At the state and regulatory level, this responsibility seems to fall under the Ministry of Fisheries and Maritime Economy (MPEM) on which the National Agency for Maritime Affairs (ANAM) depends. This agency ensures in particular compliance with the application of the maritime conventions of the International Maritime Organization (IMO).

It should nevertheless be noted that HASSMAR is also designated “High Authority responsible for maritime safety”.

## 11 Responsibilities of the defense forces (Navy)

See the chapter “National Maritime Affairs – Actors”: Senegalese Navy. The AEM (State action at sea) exercise requires support in terms of hydrography and nautical cartography.

## 12 Coastal zone management and environmental protection

The subject was not specifically addressed (see CSE).

There are programs in West Africa such as WACA - MOLOA (West Africa Coastal Areas - Mission d'Observation du Littoral Ouest Africain) that have been launched and are now dealing with coastal environmental challenges in an operational manner.

These programs necessarily need marine geophysical data.



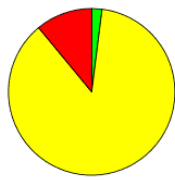
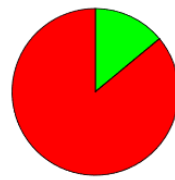

It should be noted that Shom, through a program financed by the FFEM (French Fund for the Global Environment) was able to digitize historical data from Senegal, such as bathymetric charts and bathymetric fair sheets useful for evolution studies, over time along the coastline (erosion rates).

## C-55 INDICATORS

### 13 Status of hydrographic surveys in the national maritime area

Source : <https://iho.int/uploads/user/pubs/cb/c-55/c55.pdf>

#### Senegal (G)

Hydrographic surveying / Levés hydrographiques / Levantamientos hidrográficos						
Survey coverage Couverture hydrographique Cobertura hidrográfica		Depth < 200m Profondeur < 200m Profundidad < 200m			Depth > 200m Profondeur > 200m Profundidad > 200m	
	Adequately surveyed Correctement hydrographié Adecuadamente levantado	2	87	11	14	86
	Re-survey required Nécessitant de nouveaux levés Requiere nuevo levantamiento					
	Never systematically surveyed Jamais hydrographié systématiquement Nunca levantado sistemáticamente					
Notes Notes Notas	1. Data provided by France according to FR-SN Technical Agreement signed on February 12th 2009. 2. Top priority is for modern surveys in the rivers and the estuaries of the Casamance and Saloum. The latter requires resurvey at annual intervals. 3. Survey requirements on the River Senegal are being assessed by l'Organisation pour la mise en valeur du fleuve Sénégal (OMVS).					

Note:

- these indicators are solely based on the data available to Shom: there may be surveys carried out by oceanographic research organizations or by private companies, in particular offshore (surveys/offshore) which are not known to Shom and therefore not exploited on the nautical charts and in the C-55 indicator;
- they clearly show the weakness (apart from port accesses) of hydrographic knowledge in depths less than or greater than 200 m.

### 14 Collection and circulation of nautical information

It is appropriate for the PAD and the Navy, the main observers at sea, to continue to provide information to the Shom in order to issue NAVAREA notices (rapid dissemination on Inmarsat) and to update nautical publications in due time, in particular by Notice to Mariners. The transmission should be based on a state organization (text of inter-ministerial scope ensuring PAD/Navy complementarity and integrating any new activity such as offshore) to be put in place.

The flow of information must relate to:

- nautical charts (eg: new depths, guaranteed dredging threshold, new quays, new navigational aids, wrecks removed, submarine cables, etc.);
- sailing directions;
- list of lights;
- tides (the harmonic constants used for the predictions to be made more reliable and precise using observations of water levels in Dakar and any other planned observatory).

### 15 Hydrographic survey capacity (SSMS/PAD)

#### General context :

The Maritime Security Service of Senegal (SSMS), which today merges with the Subdivision of Lighthouses and Beacons, is an establishment under the Ministry of Fisheries and Maritime Economy (MPEM) whose management is entrusted to the Director General of the National Company of the Autonomous Port of Dakar (PAD).

#### The missions of the SSMS/PAD:

This Subdivision has a Hydrographic and Cartographic Service created in 1992 to ensure in a satisfactory manner, that is to say in compliance with IHO standards, the following missions:

- Assistance to private companies in the setting up of maritime aids to navigation. Bathymetric surveys on behalf of these companies can be conducted on request;
- Hydrography of inland waterways (estuaries for Saint-Louis, Kaolack, Ziguinchor) within the framework of the control or establishment of channels;
- Hydrography of the PAD harbour and control of dredging operations (a contract binds the SSMS with the PAD for the accomplishment of these two tasks);
- Transmission of all nautical information necessary for the safety of navigation with a view to their publication, distribution and updating;
- Dissemination and transmission of notices to navigators to enable the updating of charts and nautical publications.

**Material resources :**

The SSMS has significant material resources listed in annex H.

In particular, it has the multi-purpose ship (hydrography – aids to navigation) *Samba Laobé FALL*



(Source : PAD)

**Human resources dedicated to hydrography:**

- an engineer responsible for coordinating the missions of the hydrographic team.
- a hydrographer technician.
- two hydrographic assistants.

Note: However, there are no trained hydrographers in schools specialized in hydrography, especially those whose programs are certified by the IHO. This is part of the needs identified by the SSMS in terms of capacity development. It was discussed (French-speaking solution) during the technical visit.

**International relationships**

The SSMS maintains relations with:

- IHO (EAtHC);
- Shom (under an Administrative Arrangement Senegal/France);
- IALA.

## 16 Independent nautical chart production capacity

There are no official capacities for the production of nautical charts, nor for their updating and distribution.

This is entrusted to France (Shom) under an administrative arrangement with Senegal signed in 2009.

## COORDINATION AND CAPACITY BUILDING PROPOSAL

### 17 National Coordination/Consultation Committee (Hydrography, Physical Oceanography, Marine Cartography, Aids to Navigation)

The current hydrographic activities of the SSMS will not be able to develop and respond, only within their current scope, to the broader needs of the country. This is not desirable neither for the SSMS nor for its potential partners who can only benefit from current and future pooled capacities.

At the heart of pooling:

- acquisition of hydro-oceanographic data at sea with dedicated vessels;
- their qualifications, archiving, shared dissemination;
- shared projects (navigation, marine environment) based on the constitution of a “marine geosciences” knowledge.

Senegal already has coordination structures in particular:

- those that the CSE already practices (coastal environment);
- that indicated by the SSMS and the ANAM: the Nautical Commission.

The Technical Visit does not conclude with the creation of an additional committee/commission. The CSE was also able to point out that many bodies already existed and that they should not be multiplied (coherence, efficiency).

But the coordination must be well organized (strong recommendation of IHO for all countries).

The multidisciplinary and inter-ministerial nature of the issues may justify HASSMAR taking up the subject which. It should integrate navigation safety issues and everything that is common with those of the marine and coastal environment.

CSE was able to point out other organizations concerned than those visited, such as the Department of the Environment and Classified Establishments (Direction de l'Environnement et des Établissements Classés - DEEC) of the Ministry of the Environment and Sustainable Development (ministère de l'environnement et du développement durable).

Whatever its name, this committee (inter-ministerial, inter-agency) will be an essential link in the operational organization of the Senegalese State (technical services, data management, production, etc.) to be set up (and therefore to be financed) for the execution of development programs in hydrography, oceanography and nautical cartography (river cartography to be integrated).

The organization and execution of training in Senegal and abroad is part of the development programs and therefore the subjects of the committee.

#### Propositions :

- First of all: gather around a table the potential actors of this future committee (which could be built on an existing structure) to first precisely define its mandate and its members. The IHO publication M2 makes recommendations : “The need for national hydrographic services”: [https://iho.int/uploads/user/pubs/misc/M-2\\_3.0.7\\_E\\_06142018.pdf](https://iho.int/uploads/user/pubs/misc/M-2_3.0.7_E_06142018.pdf);
- It is a question of launching a dynamic at the institutional levels (departments of the ministries) and technical (by specifying the corresponding actors: hydrographers,

oceanographers, aids to navigation, hydrodynamicists, surveyors, geomaticians, cartographers without forgetting the support functions in particular in computer science);

- The collection of needs (navigation, environment, etc.) in products (eg maps) and services (eg tide forecasts, extreme coastal events, etc.) will naturally lead to specifying the needs for the acquisition of hydrographic and oceanographic data. An essential step before prioritizing these acquisitions, and planning them by identifying the organizations (to be supported) or companies (to be contracted) that can carry them out;
- The collection of data is only economically conceivable if these are widely shared (one data - several applications – the SOLAS application through nautical documents being only one among others) and exploited. This raises the problem of archiving and disseminating data at the national level. Techniques and tools are better and better mastered with databases and communication and download portals. The fact remains that this requires IT structures and dedicated skills to be set up. This is a fundamental structural point to put on the agenda of the first meeting: setting up a Maritime Spatial Data Infrastructure (MSDI). Here too, it must be possible to rely on what already exists.

## **18 Phase 1 Hydrographic capacities: MSI and GMDSS**

Maritime Safety Information (MSI), as defined in International Maritime Organization Resolution A.705(17) and detailed in the joint IHO/IMO/WMO Handbook on MSI (IHO Special Publication S-53), consists of the collection and dissemination of navigational and weather warnings, search and rescue information and other urgent safety information, including nautical information relating to nautical documentation.

The dissemination of these MSI is based on the Global Maritime Distress and Safety System GMDSS: an international system that uses telecommunications means for search and rescue at sea (SAR) and the prevention of maritime accidents.

In addition, MSIs in their broadest sense include the updating of navigation charts and other nautical publications (list of lights, radio signals, sailing directions, etc.). The MSIs need an organization (procedures for collecting, transcribing and transmitting information, maintained equipment, trained personnel) with a national MSI coordinator in relation with the navigators, the cartographic authority (France /Shom) and NAVAREA II (France / Shom).

PAD/SSMS and the Navy disseminates information to the NAVAREA II coordinator (France / Shom).

However, this is not officially organized at the national level by the Senegalese state.

The conditions for processing MSIs (NAVAREA II) and non-urgent nautical information are specified at the beginning of the report in the chapter: MAIN COMMENTS, RECOMMENDATIONS.

## **19 Phase 2 Hydrographic capacities: conducting surveys**

The only existing hydrographic capabilities (multipurpose ship, equipped boats that can meet the requirements IHO's bathymetry standards) identified on site are those of the PAD/SSMS. As long as they are in good working order and calibrated, they are perfectly suited for harbour and coastal surveys.

Although these resources are used well beyond the scope of the PAD (apart from Dakar: Saint-Louis, Saloum and Casamance estuaries and rivers), they do not necessarily cover all national needs, whether navigation or marine environment.

**Proposal:** To be able to constitute, on shared projects (not necessarily permanently), the necessary capacities by relying on all the resources already available and therefore mutualizable to the PAD, the National Navy, the CRODT, etc.

It is also important here to identify all the possibilities of international cooperation:

- Those offered by France: Shom will be able to come to Senegal (on shared specifications), in the first half of 2023, to conduct hydrographic surveys in cooperation with *Laplace* hydrographic vessel. This mission could conveniently integrate “on the job” training actions by cross-boarding of hydro-oceanographers aboard *Laplace*, its launches and *Samba Laobe Fall*;
- Those that can be offered by countries of the sub-region whose hydro-oceanographic means have recently considerably increased (eg Morocco, Nigeria).

**20 Phase 3 Hydrographic capacities: production of nautical charts**

Senegal does not yet have the capacity to produce (and distribute worldwide) official national charts (SOLAS). France (via Shom) acts as the charting authority for the waters under the country's jurisdiction.

This is formalized in an Administrative Arrangement (February 12, 2009) between Senegal (at the time the Minister of Maritime Economy, Maritime Transport, Fisheries and Fish Farming) and France (Ministry of Defence, supervisory du Shom) to comply with the SOLAS convention.

**Proposition**

The co-edition of official nautical charts must continue with the current cartographic responsible (France/Shom) for maritime navigation (SOLAS) while offering Senegal the opportunity to gain autonomy.

Due to less significant regulatory constraints (standards, updating and distribution), cartographic documents (geomatics) for various applications such as coastal development, environmental monitoring or specific AEM charts, can obviously be produced by the Senegal. It is by relying on these already existing capacities that the autonomy mentioned above can also be built.

**21 Summary of the assessment of national hydrographic capacities - Table**

OHI IHO	CHAtO EAtHC	CNH « CNC » (1)	Phase 1 (2) Capacity	Phase 2 (3) Capacity	Phase 3 Capacity
NON Member	Associated Member	NO	YES	YES (3)	NO (4)

(1) National Hydrographic Committee (role of national coordination) (National Coordination Committee)

(2) Maritime Safety Information

(3) Hydro-oceanographic surveys through data acquisition and archiving. However, the function should be extended to all Senegalese waters and not just the main areas of action of the PA/SSMS;

(4) “SOLAS” charting. Co-publishing with France (Shom) under an administrative arrangement

## FORMATION

### 22 Basic training of hydrographic technicians (not only!)

#### Initial training of hydrographers

PAD/SSMS has skills, but the current executives have not had specific approved training in hydrography.

It will be necessary to have a pool of qualified senior hydrographic technicians in sufficient numbers. The recommended training is that offered by schools whose programs are approved by the FIG/IHO/ICA (International Federation of Surveyors, International Hydrographic Organization, International Cartographic Association) with Category B (CAT B).

The practical training which supplements the theoretical training of the schools will be, for harbour hydrographers, opportunely carried out in a port operating dredging and having a service in charge of hydrography.

The Shom' school (French-speaking) offers training approved in Category B: the Superior Certificate of Hydrographers, the program of which can be consulted (page 43) on:

[https://www.shom.fr/sites/default/files/2020-10/Offre\\_formation\\_2020-2021\\_Web.pdf](https://www.shom.fr/sites/default/files/2020-10/Offre_formation_2020-2021_Web.pdf)

Point of contact at Shom: Ronan Le Roy, head of the Shom training division and director of education: [drh-for-d@shom.fr](mailto:drh-for-d@shom.fr).

This license level 3 training is very demanding in terms of initial knowledge in mathematics and physics. It can be followed by young people who already have experience in geomatics, geodesy, physical oceanography or even maritime navigation.

This training will give enough versatility to future students to meet almost all the skills needed for data acquisition at sea and on the coast (rivers as well). The CAT B hydrographer will be able on his return to his country to train the "aid-hydrographers" that the country needs ("CAT C").

Note – PAD/SSMS: this need is well recognized by the PAD/SSMS which plans to train 2 agents successively. He will be put in touch with the Shom school.

Note - Senegalese Navy: depending on the role that the Navy wishes to take in national hydrography, the training of a category B executive may also be considered.

#### Initial training of "marine" cartographers

This is a fundamental subject because the country needs cartographic products and services to cover both the sea and its rivers.

It is moreover this "cartographic" desire that will generate the need for data and therefore for hydrographic surveys.

The progressive part that Senegal will take in the production of nautical charts (therefore in connection with the Shom), its own capacity to produce sovereignty charts for the AEM (including boundaries), can only benefit from a solid training in cartography dedicated to maritime navigation (fluvial included). Category B training (CAT B) is recommended.

The Shom school (French-speaking) offers such a CAT B training course: Marine cartography technician preparation course, the program of which can be consulted (page 48) again on [https://www.shom.fr/sites/default/files/2020-10/Offre\\_formation\\_2020-2021\\_Web.pdf](https://www.shom.fr/sites/default/files/2020-10/Offre_formation_2020-2021_Web.pdf).

It is however necessary to note that, unlike the Shom' Category B certified hydrographer training, this cartographer preparation training is not open every year but irregularly depending on the internal needs of the Shom.

Point of contact at Shom: Ronan Le Roy, head of the Shom training division and director of education: [drh-for-d@shom.fr](mailto:drh-for-d@shom.fr).

### **Also have "support" and "managerial" skills - Apply**

To consolidate its capacities, the SSMS will therefore be able to have young hydrographers trained in the most recent techniques. This could happen opportunely when the multipurpose ship *Samba Laobé Fall* will be refitted (hydrographic equipment included).

Trained personnel will therefore be able to quickly put their theoretical knowledge (school) into practice and qualify their practical qualification after two years: that is to say, move on to operations by conducting surveys exploited by marine cartographers and specialists in the marine environment. The following is quoted for the record because the SSMS is already an operational structure (including the "navigation" function) operating at sea, rivers and ports. It is thus recalled the importance:

- the "Support" function in specific equipment (GPS, echo sounders, tide gauges, etc.): maintenance in operational condition of equipment, IT (software, databases, webmaster, etc.).
- the "management" function which, beyond the PAD/SSMS, will be of great importance in coordinating (committee) in a global manner at the national level (inter-organisms) the development of hydrography and nautical cartography in the country:
  - exhaustiveness of the needs (to be planned) to be satisfied (navigation, coastal development, coastal protection, etc.). Definition of the corresponding products (charts in particular);
  - identification of all stakeholders (public and private) who have an interest in cooperating to derive benefits (they come together to pool capacities);
  - definition of the production systems to be implemented: hydro-oceanographic, cartographic and support functions (logistics);
  - definition of the means of intervention at sea (ships, boats, launches);
  - definition of onshore infrastructure;
  - definition of governance (supervision, contracts of objectives and means, therefore financing, agreements);
  - definition of human resources needs in sufficient quantity and quality for all structures and all qualification combined.



## 23 Continuous training in hydro-oceanography and related activities (navigation aids, port infrastructure development and coastal protection) - Management

### At the international level in hydrography

There are actually many opportunities and facilities to maintain knowledge in hydrography. It is still necessary to know them and be encouraged to follow them.

- IHO:
  - which offers training materials at: <https://iho.int/fr/publications-sur-le-renforcement-des-capacites>. In particular, there is a high-quality hydrography manual;
  - who organizes seminars. Those of the EAtHC are beginning to be known. The next will take place during the next EAtHC (17th) plenary of 2022 (September 2022) in face-to-face in Cape Verde: <https://iho.int/en/eastern-atlantic-hc>
- Shom (<https://www.shom.fr/>) which in addition to the statutory training of its school (CAT B) also offers opportunities for training in tide measurement (<https://www.sonel.org/>);
- AFHy: Association Francophone d'Hydrographie (<https://www.afhy.fr/>) where, in particular, hydro-cartographers of ports and rivers meet.

### Note :

- Also follow the e-learning opportunities that will develop;
- There is a need for regional training schools (West and Central Africa) in hydro-oceanography-cartography. It is necessary to get out of the current situation where there would be no other alternative than to enroll the agents to be trained in hydrographic schools outside the African continent. They may be French or English speaking. The contacts that IHO has been able to have so far on West and Central Africa have not really made it possible to identify the structures (schools, academies, etc.) immediately ready to host training courses for hydrographers and certified cartographers. The following have thus been identified as potentially suitable for training courses:
  - Two national hydrographic services - likely to offer complete training courses approved by the IHO/ACI/FIG (CAT B) - having recently considerably increased their hydro-oceanographic capacities, namely:
    - Nigeria: the NNHO (Nigerian Navy Hydrographic Office) which has a school in Port Harcourt (NNHS: Nigerian Navy Hydrographic School);
    - Morocco: DHOC (Hydrography, Oceanography and Cartography Division) of the Royal Navy;
  - Two maritime education centers more likely to offer more specialized training than approved, namely:
    - RMU (Regional Maritime University) in Accra (Ghana);
    - ARSTM (Regional Academy of Marine Sciences and Techniques) in Abidjan (Ivory Coast).

### **Miscellaneous at national level (Senegal)**

There are certainly national skills (public, private) that the technical visit could not identify, in particular:

- qualified surveyors (land);
- specialists in remote sensing (a means widely used in hydrography)
- professionals in GIS (Geographic Information Systems) (in support of the professions mentioned above);
- computer specialists skilled in databases and dissemination websites;
- engineers and technicians from engineering companies.

These are transversal skills essential to the development of hydro-oceanography-cartography. They constitute a base of skills to be pooled on which Senegal can count.

These skills will be particularly important within the national coordination committee. Participation in IHO meetings and more particularly in EAtHC meetings and seminars allows exchanges with counterparts from other coastal States of the Gulf of Guinea and West Africa

Editor



Henri DOLOU

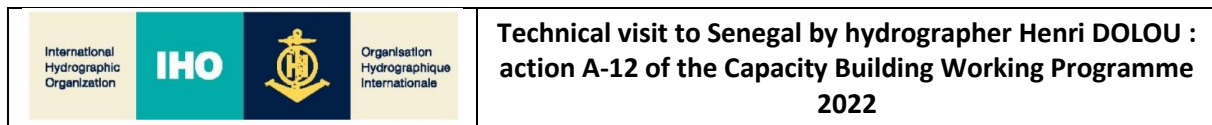
## ANNEX

### Annex A : Abbreviations

ANAM	Agence nationale des Affaires maritimes
ARSTM	Académie Régionale des Sciences et Techniques de la Mer <i>Regional Academy of Marine Sciences and Techniques</i>
CATZOC	<i>Category Zone of Confidence</i>
CBSC	<i>Capacity Building Sub-Committee (IHO)</i> Sous-comité de renforcement des capacités (OHI)
CBWP	<i>Capacity Building Work Programme (IHO)</i> Programme de travail de renforcement des capacités (OHI)
CHN	Comité Hydrographique National
CNDO-SN	Centre National de Données et d'Informations Océanographiques du Sénégal (ODINAFRICA)
CRODT	Centre de Recherches Océanographiques de Dakar-Thiaroye (de l'ISRA : Institut Sénégalais des Recherches Agricoles)
CSE	Centre de Suivi Écologique
DTGC	Direction des Travaux Géographiques et Cartographiques
EAtHC CHATO	<i>Eastern Atlantic Hydrographic Commission (IHO)</i> Commission Hydrographique de l'Atlantique orientale (OHI)
ECDIS	<i>Electronic Charts Display Information System</i>
ENC	<i>Electronic Navigational Chart (sea)</i> Carte électronique de navigation (mer)
GMDSS SMDSM	<i>Global Maritime Distress and Safety System</i> Système Mondial de Détresse et de Sécurité en Mer
HASSMAR	Haute Autorité chargée de la coordination de la Sécurité Maritime, de la sûreté Maritime et de la protection de l'environnement
IALA AISM	<i>International Association of Marine Aids to Navigation and Lighthouse Authorities</i> Association Internationale de Signalisation Maritime
IHO OHI	<i>International Hydrographic Organization</i> Organisation Hydrographique Internationale
IMO OMI	<i>International Maritime Organization</i> Organisation Maritime Internationale
IOC COI	<i>Intergovernmental Oceanographic Commission</i> Commission Océanographique Intergouvernementale
IODE	Programme International d'Échange de Données Océanographiques (COI)
IRD	Institut de Recherche pour le Développement
LPAOSF	Laboratoire Physique de l'Atmosphère et de l'Océanographie Siméon Fongang Ecole Supérieure Polytechnique de Dakar (ESP), établissement public de l'UCAD
MSI RSM	<i>Maritime Safety Information</i> Renseignement de Sécurité Maritime
MN	Marine Nationale
MOLOA	Mission d'Observation du Littoral Ouest Africain
MOWCA OMAO	<i>Maritime Organization of West and Central Africa</i> Organisation Maritime de l'Afrique de l'Ouest et Centrale
MPEM	Ministère des Pêches et de l'Économie Maritime
MRCC	<i>Maritime Rescue Coordination Centre</i>

<i>MSDI</i>	<i>Maritime Spatial Data Infrastructure</i> Infrastructures de données spatiales maritimes
<i>NC</i> <i>CM</i>	<i>Nautical Charts</i> Carte marine
<i>NHC</i> <i>CNH</i>	<i>National Hydrographic Committee</i> Comité National Hydrographique
<i>NtMs</i>	<i>Notice to Mariners</i> Avis aux navigateurs
<i>ODINAFRICA</i>	Réseau d'Échanges de Données et d'Informations Océanographiques en Afrique
<i>PAD</i>	Port Autonome de Dakar <i>Autonomous Port of Dakar</i>
<i>PCA</i>	<i>Primary Charting Authority</i> Autorité cartographique principale
<i>P&amp;B</i>	Phares et Balises
<i>RHC</i> <i>CHR</i>	<i>Regional Hydrographic Commission (EAtHC)</i> Commission Hydrographique Régionale (CHATO)
<i>SSMS</i>	Service de Sécurité Maritime du Sénégal
<i>Shom</i>	Service hydrographique et océanographique de la marine (France) <i>French Hydrographic and Oceanographic Service (French national hydrographic office)</i>
<i>SMAN</i>	Système mondial d'avertissement de navigation <i>Worldwide Navigational Warning Service (WWNWS)</i>
<i>SMDSM</i>	Système mondial de détresse et de sécurité en mer <i>Global Maritime Distress and Safety System (GMDSS)</i>
<i>SOLAS</i>	<i>[United Nations] Convention for the Safety of Life at Sea</i> Convention pour la sauvegarde de la vie humaine en mer
<i>WACA</i>	<i>West Africa Coastal Areas Management program</i> Programme de gestion du littoral ouest-africain
<i>WACA/FFEM</i>	<i>WACA/Fonds Français pour l'environnement Mondial</i> <i>WACA/French Facility for Global Environment</i>
<i>WACA/ResIP</i>	Projet national d'investissement pour la résilience des zones côtières en Afrique de l'Ouest de WACA <i>WACA National Coastal Resilience Investment Project in West Africa</i>

## Annex B : Terms of reference of the visit team of the Regional Hydrographic Commission



### Context

The IHO (International Hydrographic Organization) Capacity Building Program aims to coordinate the development of the capacities of Member and Associate States in the field of hydrography and nautical cartography in order to meet the objectives of IHO and the obligations related to Chapter V of the SOLAS Convention, the United Nations Convention on the Law of the Sea and other international instruments.

It was thus decided:

- to promote regional cooperation in capacity building in West and Central Africa (EAtHC: IHO Eastern Atlantic Hydrographic Commission);
- to identify the potential of national and regional training centers;
- to study the possibilities of organizing regional seminars.

On the proposal of France, which coordinates the IHO capacity building program for EAtHC, the IHO Capacity Building Sub-Committee proposes to conduct a technical visit to the country.

### Goals

The general objectives of the technical visits are as follows:

- discussions with the decision-making authorities of the country visited, emphasizing the importance of hydrography for coastal states and therefore the need to include associated hydrographic and nautical cartography activities in national plans;
- support the development of a national system for the collection and diffusion of maritime safety information (MSI) integrated within the Worldwide Navigational Warning Service (WWNWS);
- assessment of national capacities in terms of planning and carrying out the collection and use of hydrographic data in order to allow the production and updating of the nautical documentation essential for the safety of navigation and in support of others uses (infrastructure management, environmental protection, development of the blue economy, etc.);
- development of recommendations with the actors of the visited country in order to strengthen these capacities in a long-lasting and sustainable manner;
- preparation of IMO audits (IMSAS) and follow-up of recommendations in connection with hydrographic services;
- promote the emergence of development projects in the field of hydrography and nautical cartography in conjunction with IHO secretariat, IMO and funding agencies in order to obtain the sustainable establishment of capacities.

### Report

A report on the activities and recommendations of the team will be submitted to the president of the Regional Hydrographic Commission after the visits.

## Annex C: Reference texts

Note: this list (in French) is not exhaustive

### Textes de référence récents de la République du Sénégal

Objet	Référence officielle
<b>MPEM</b> Mise en valeur des fonds marins, des infrastructures portuaires et des transports maritimes Tutelle de la Marine marchande	Décret n° 2020-2212 relatif aux attributions du Ministre des Pêches et de l'Économie maritime
<b>HASSMAR</b> Organisation Coordination de l'Action de l'État en Mer	Arrêté n° 17.10.2006 * 006944 portant organisation de Haute Autorité chargée de la coordination de la Sécurité Maritime, de la sûreté Maritime et de la protection de l'environnement Rattachée à la Primature (Secrétariat Général du gouvernement) Tutelle technique assurée par le ministère des Forces armées Dispose d'un CNC : Comité National de Coordination
<b>ANAM</b>	Pour mémoire : Agence Nationale des Affaires Maritime Sous tutelle du MPEM
<b>PAD</b> SNPAD (Société Nationale) <b>SSMS</b>	Pour mémoire : Port Autonome de Dakar Sous tutelle du MPEM Service de Sécurité Maritime du Sénégal - Établissement relevant du MPEM - Confondu avec la subdivision des Phares et Balises. Gestion confiée au Directeur Général de la Société Nationale du Port Autonome de Dakar par convention

### Texte de référence de la France (Shom)

Objet	Référence officielle
Coopération entre le Sénégal et la France en matière d'hydrographie, d'océanographie et de cartographie marine	Arrangement administratif du 12 février 2009 entre le ministre de la défense de la République française et le ministre d'État, ministre de l'économie maritime, des transports maritimes, de la pêche et de la pisciculture de la République du Sénégal, relatif à la coopération en matière d'hydrographie et de cartographie marine

## Annex D : List of main contacts - Telephones - Mails

Prénom NOM	Fonction	Tél (+221)	Mail
<b>MPEM</b> <b>Ministère des Pêches</b> <b>et de</b> <b>l'Économie Maritime</b>			
M Ousmane NDIAYE	Directeur des infrastructures Portuaires	77 740 95 78	<a href="mailto:ousmane1234@yahoo.fr">ousmane1234@yahoo.fr</a>
<b>ANAM</b> <b>Agence Nationale des</b> <b>Affaires</b> <b>Maritimes (MPEM)</b>			
Mme Tiofane NDIAYE	Directrice de la sécurité maritime (DSM)		<a href="mailto:ndiayetiofane@yahoo.fr">ndiayetiofane@yahoo.fr</a>
<b>HASSMAR</b> <b>Haute Autorité chargée</b> <b>de la Sécurité</b> <b>et de la protection de</b> <b>de la coordination</b> <b>maritime, de la Sûreté</b> <b>l'environnement marin. MRCC</b> <b>maritime</b>			
Capitaine de Vaisseau Abdou SENE	Secrétaire Général	33 889 27 00 78 196 64 58	<a href="mailto:abdou.sene@hassmar.gouv.sn">abdou.sene@hassmar.gouv.sn</a>
Capitaine de Corvette Baba Diagne SENE	Chef du MRCC (Maritime Rescue Coordination Centre)	77 32 46 376	<a href="mailto:chef.mrcc@hassmar.gouv.sn">chef.mrcc@hassmar.gouv.sn</a>
<b>PAD</b> <b>Port Autonome de</b> <b>Dakar</b> <b>Maritime du Sénégal</b> <b>SSMS</b> <b>Service de</b> <b>Sécurité</b>			
M Ibrahima CISSOKHO	Directeur de la Subdivision des phares et balises	33 822 05 56 Port : 77 529 72 79	<a href="mailto:ibrahima.cissokho@portdakar.sn">ibrahima.cissokho@portdakar.sn</a>
M Pathe Yéro THIOYE	Chargé d'étude et du suivi des projets.	77 555 50 35	<a href="mailto:pthioye2@yahoo.fr">pthioye2@yahoo.fr</a> <a href="mailto:patheyero.thioye@portdakar.sn">patheyero.thioye@portdakar.sn</a>
M Fara MENDY	Second capitaine du baliseur « <i>Samba Laobé FALL</i> »		
M Papa Amadou SECK	Chef du service de Maintenance des aides à la Navigation		
<b>MN</b> <b>Marine Nationale</b>			
Capitaine de Vaisseau Mamadou NDIAYE	Chef d'État-Major - Adjoint	77 333 00 35 77 630 07 87	<a href="mailto:osacemmarine@armee.sn">osacemmarine@armee.sn</a> <a href="mailto:lamindiaye@gmail.com">lamindiaye@gmail.com</a>
Capitaine de Corvette A SEYE	Chef du bureau planification opérationnelle		
Capitaine de Corvette Ibrahima LY	Centre de coordination des opérations de la marine	77 616 67 63	<a href="mailto:Mocdakarcco2019@gmail.com">Mocdakarcco2019@gmail.com</a>
Capitaine de frégate Eric LEMONNIER	Officier de liaison près le chef d'Etat-major	Fixe : (00 221) 33 822 16 14 Portable : (00 221) 77 669 83 10	<a href="mailto:eric.lemonnier@diplomatie.gouv.fr">eric.lemonnier@diplomatie.gouv.fr</a> <a href="mailto:coopmarinedakar@live.fr">coopmarinedakar@live.fr</a>
<b>CRODT</b> <b>Centre de Recherches</b> <b>Océanographiques</b> <b>de Dakar Thiaroye</b>			
Dr. Saliou Faye	Océanographe Physicien Chercheur en Sciences de l'Océan et du Climat Responsable du CNDO- SN/ODINAFRICA/UNESCO/ OC	77 234 97 41	<a href="mailto:fayebayzal100@yahoo.fr">fayebayzal100@yahoo.fr</a> et <a href="mailto:saliou.faye@ucad.edu.sn">saliou.faye@ucad.edu.sn</a>

M Limalé DEME	Ingénieur d'étude en océanographie	77 616 67 63 76 021 45 70	<a href="mailto:limale.deme312@gmail.com">limale.deme312@gmail.com</a>
<b>CSE WACA</b>	<b>Centre de Suivi Écologique West Africa Coastal Areas</b>	<b>Département littoral</b>	
M Taibou BA	Directeur Technique		<a href="mailto:taibou@cse.sn">taibou@cse.sn</a>
Dr Ousmane BATHIERY	Géomaticien Responsable Formations et Stages	(Mob) 77 847 35 37 (338258066)	<a href="mailto:ousmane.bathier@cse.sn">ousmane.bathier@cse.sn</a>
Dr Moussa SALL	Département Evaluation environnementale et Gestion des risques Coordonnateur du Programme WACA MOLOA	Tel. : 33 825 80 66 / 33 825 80 67 Port : 77 658 49 26	<a href="mailto:sall@cse.sn">sall@cse.sn</a>
<b>Shom (OHI)</b>	<b>France</b>	<b>(+33)</b>	
M Henri DOLOU	Expert	(0) 6 86 15 14 82	<a href="mailto:henri.dolou@shom.fr">henri.dolou@shom.fr</a>
M Julien SMEECKAERT	Chef de la division des relations extérieures	(0) 2 56 31 97 81 / (0) 6 03 20 13 77	<a href="mailto:dmi-rex-d@shom.fr">dmi-rex-d@shom.fr</a> <a href="mailto:julien.smeekaert@shom.fr">julien.smeekaert@shom.fr</a>
M Pierre-Yves DUPUY	Directeur des missions institutionnelles et des relations internationales	(0) 2 56 31 24 04 (0) 6 38 78 59 55	<a href="mailto:pierre-yves.dupuy@shom.fr">pierre-yves.dupuy@shom.fr</a>
M Ronan LE ROY	Directeur de l'enseignement de l'école du Shom	(0) 2 56 31 24 09	<a href="mailto:ronan.le.roy@shom.fr">ronan.le.roy@shom.fr</a>
M Eric MAUGER	Expert nautique Bureau Afrique	(0) 2 56 31 24 39	<a href="mailto:eric.mauger@shom.fr">eric.mauger@shom.fr</a> <a href="mailto:na-om@shom.fr">na-om@shom.fr</a>
Mme Amandine LEFRANCOIS	NAVAREA II	(0) 2 56 31 26 09	<a href="mailto:amandine.lefrancois@shom.fr">amandine.lefrancois@shom.fr</a>



## Annex E : Agenda – Event

Object – Event	Observations
<b>J1 : Monday 11 April 2022</b>	
➤ PAD/P&B [Port autonome de Dakar / Phares et Balises] : SSMS [Service de Sécurité Maritime du Sénégal]	M Ibrahima CISSOKHO (Directeur) M Pathe Yéro THIOYE (Chargé d'étude et du suivi des projets)
➤ MPEC [Ministère des Pêches et de l'Économie Maritime] [Direction des infrastructures Portuaires]	M Ousmane NDIAYE (Directeur)
<b>J2 : Tuesday 12 April 2022</b>	
➤ PAD/P&B : service de maintenance des aides à la Navigation	M Papa Amadou SECK (Chef du service)
➤ PAD/P&B : baliseur « <i>Samba Laobé FALL</i> »	M Fara MENDY (Second capitaine)
➤ ANAM [Agence nationale des Affaires maritimes] [DSM : Direction de la sécurité maritime]	Mme Tiofane NDIAYE (Directrice)
<b>J3 : Wednesday 13 April 2022</b>	
➤ Marine Nationale [État-Major]	Capitaine de Vaisseau Mamadou NDIAYE (Chef d'État-Major de la Marine Adjoint)
➤ HASSMAR [Haute Autorité chargée de la coordination de la Sécurité Maritime, de la sûreté Maritime et de la protection de l'environnement]	Capitaine de Vaisseau Abdou SENE (Secrétaire Général)
<b>J4 : Thursday 14 April 2022</b>	
➤ CRODT [Centre de Recherches Océanographiques de Dakar-Thiaroye]	M Limalé DEME (Océanographe)
➤ Pour mémoire la visite du CSE [Centre de Suivi Écologique] n'a pu s'organiser comme envisagé. Cela a été compensé par de nombreux échanges par mails ou téléphoniques pendant et immédiatement après la visite technique	Dr Ousmane BATHIERY (Géomaticien Responsable Formations et Stages)
<b>J5 : Friday 15 April 2022</b>	
➤ Restitution (conclusions – recommandations) de la mission animée par le directeur des P&B en présence de représentants de l'HASSMAR, la Marine Nationale, le CRODT et du PAD/SSMS	M Ibrahima CISSOKHO (Directeur)

## Annex F : Photos



**Service de Sécurité Maritime du Sénégal (SSMS)  
(Phares et Balises du Port Autonome de Dakar) (P&B - PAD)**  
De gauche à droite : Pathe Yéro THIOYE (PAD/SSMS) – Henri DOLOU (OHI) - Ibrahima CISSOKHO  
(PAD/SSMS)



**Ministère des Pêches et de l'Économie Maritime (MPEM)  
Au centre M Ousmane NDIAYE Directeur des infrastructures Portuaires**



**À bord du baliseur polyvalent *SAMBA LAOBE FALL* (SSMS)**  
**À gauche M Papa Amadou SECK Chef du service de la maintenance des aides à la navigation**  
**À droite Second capitaine du *SAMBA LAOBE FALL* M Fara MENDY**



**Équipements de navigation et d'hydrographie à bord du *SAMBA LAOBE FALL* (SSMS)**



**Agence Nationale des Affaires Maritimes (ANAM)**  
**À droite Mme Tiofane NDIAYE Directrice de la sécurité maritime (DSM)**

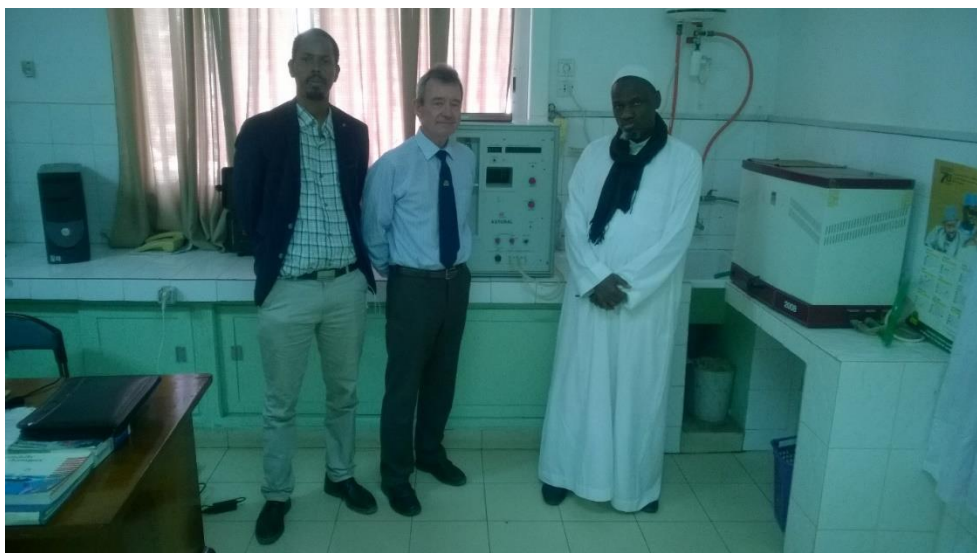


**Marine Nationale**

**De gauche à droite : Capitaine de Corvette SENE - Capitaine de Frégate LEMONNIER – H DOLOU – Capitaine de Vaisseau NDIAYE (Chef d’Etat-Major de la Marine Adjoint) – I CISSOKHO**



**Haute autorité chargée de la coordination de sécurité maritime, de la sûreté maritime et de la protection de l’environnement marin (HASSMAR)  
À gauche M le Secrétaire Général Abdou SENE**



À droite M DEME Ingénieur d'études en océanographie (CRODT)



Séance de restitution au PAD

De gauche à droite : Marine Nationale, SSMS/PAD (2), CRODT, HASSMAR/MRCC, OHI



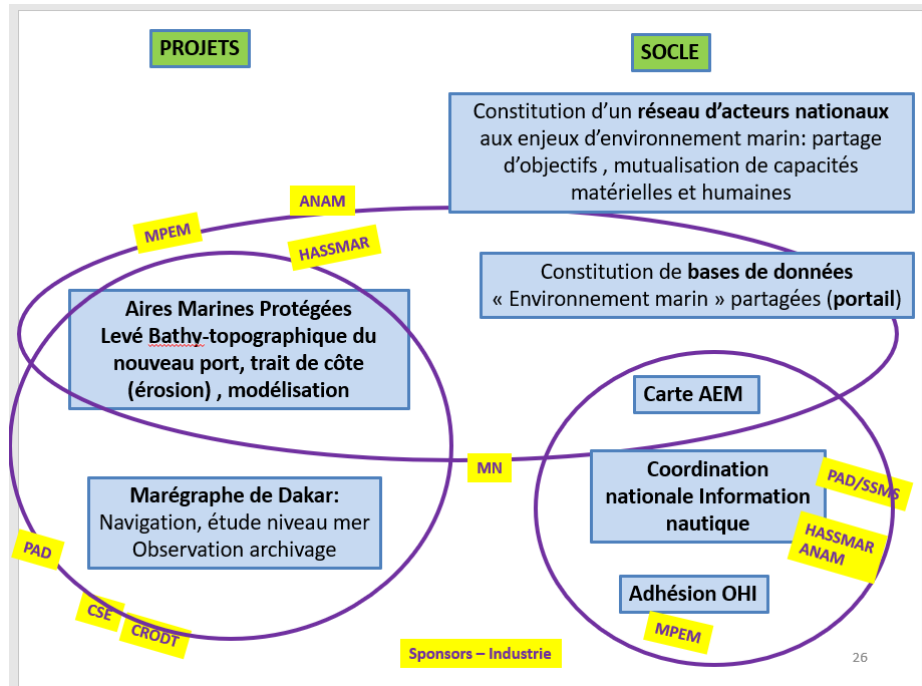
## Annex G : Possible interdisciplinary - interorganism projects

### Introduction

This appendix does not constitute a program of activity. It only offers suggestions of actions to be consolidated and then carried out by the stakeholders of the National Coordination Committee.

Actions could be carried out in an international framework (Sub-region, France, etc.).

Acquisitions of hydro-oceanographic data can be carried out systematically in order to constitute a knowledge base beforehand or in a targeted manner within the framework of close-end projects. In both cases, it is in the interest of the country to properly involve the interested stakeholders.



### Annex G-1 : Bathymetry: risk analysis in river navigation

The first step would be to make seafarers aware of the quality of the charts with regard to the routes followed. The superposition of followed routes (AIS on Marinetraffic) on the nautical charts (Shom) whose quality can be assessed with the exploitation of the sources, would allow a first analysis.

The following example relates to the Casamance River (Nautical chart N° 6138).

It would then be possible to specify and then carry out the hydrographic surveys necessary to update knowledge of the area (updating of the nautical chart) by involving not only seafarers but also fluvio-marine environment responsables.



<https://www.marinetraffic.com>: In red: intense navigation

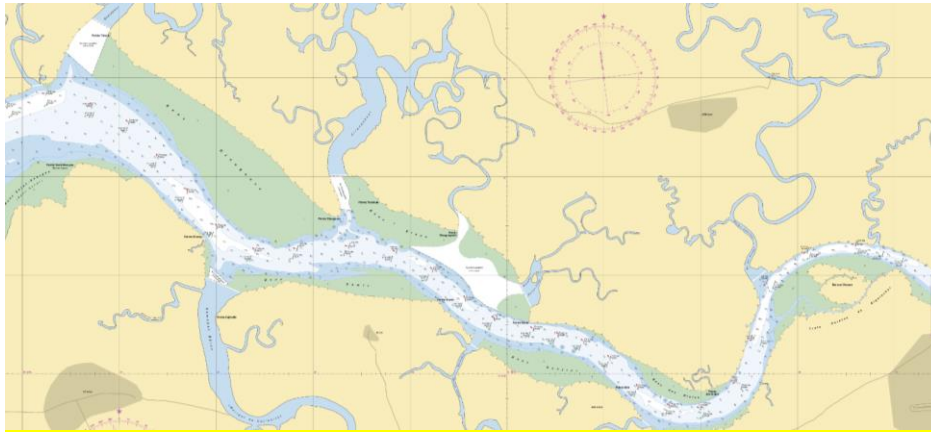


Chart 6138



	Exploration totale du fond (CATZOC A1 et A2)
	Exploration partielle du fond. Des éléments non cartographiés, dangereux pour la navigation de surface sont peu probables, mais peuvent exister (CATZOC B).
	Exploration partielle du fond. Des anomalies de profondeurs peuvent exister (CATZOC C).
	Des anomalies importantes de profondeur peuvent exister. Le marin doit être très prudent en naviguant dans ces zones (CATZOC D et U ou zone non hydrographiée).

Sources of chart 6138: In red: areas to be investigated when it is verified (Marine Traffic) that navigation is taking place there or is envisaged

## Annex G-2 : Bathymetry: risk analysis for coastal navigation and access to new ports

There are new needs for knowledge of seabeds linked to new ports (Ex: Ndayane) or new uses (vessels with larger capacities) which require a review of official nautical charts and their updating as soon as available bathymetric knowledge is considered insufficient (it may be very old and obsolete). It is proposed to prepare a hydrographic survey (or several) whose main objective would be to update the most sensitive charts in terms of navigation safety.

As these charts are co-produced with France, an initial shared risk analysis (France/Senegal) would make it possible to specify the bathymetry needs (including the tide).

The realization of this survey would be judiciously carried out in a large-scale operation associating French means Shom (The hydrographic survey ship *Laplace* could come in 2023) and Senegalese means (at least those of the PAD/SSMS).

The operation would be twofold:

- Acquiring hydro-oceanographic knowledge;
- Gain skills (development of human capacities) through cross-boarding (eg Senegalese on *Laplace* and its launches, French on *Samba Laobe Fall*). One of the points of exchange should relate to the methods of bathymetry/tide in relation to the ellipsoid and the essential precautions to be taken to bring back, in compliance with the requirements of the IHO standards, the soundings to hydrographic datum (level of lowest astronomical tides) of nautical charts.

In addition to Senegalese hydrographers, it is reasonable to think that oceanographers from the country (hydrological, tidal, bottom nature, coastal topography and sea current measurements will be acquired) will find it beneficial to join forces and contribute their expertise to such a project. Nothing would be more promising (CRODT and CSE concerned) to also ultimately define the long-term conditions for archiving data in databases with the establishment of dissemination portals.



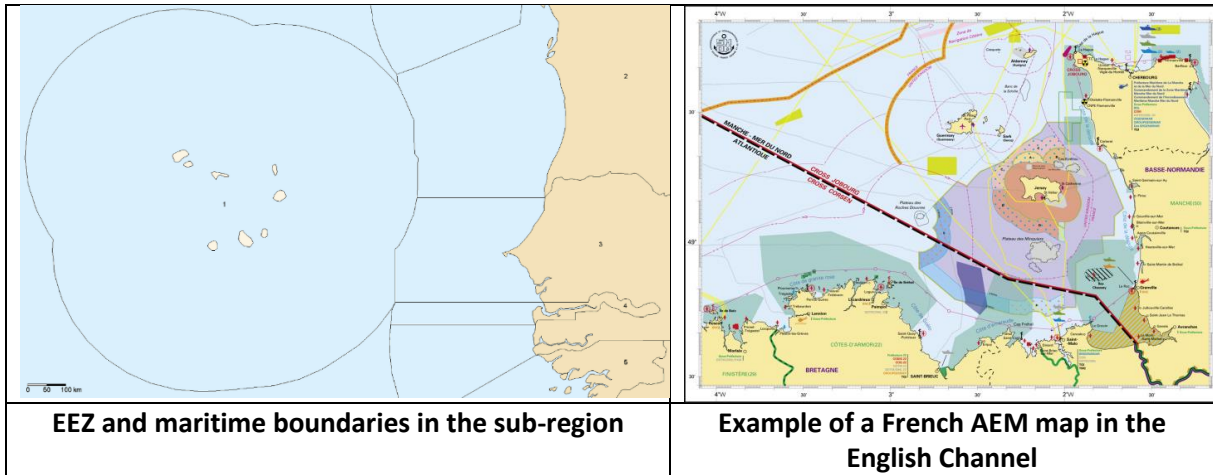
## Annex G-3 : National chart of State Action at Sea

To stay in the fields of cartography, the production of State Action at Sea charts (less restrictive in terms of production than the official "SOLAS" navigation chart) could be a project entirely led by Senegal. It would be a question of satisfying a current need (it is necessary to be able to locate on the charts the various existing maritime limits to carry out sovereign control activities) and to begin to acquire cartographic capacities with a view to gradually taking charge of the realization of official charts currently produced by France.

This cartography must be digital with georeferenced data (WGS84) usable by open source GIS (Geographic Information Systems) such as QGIS.

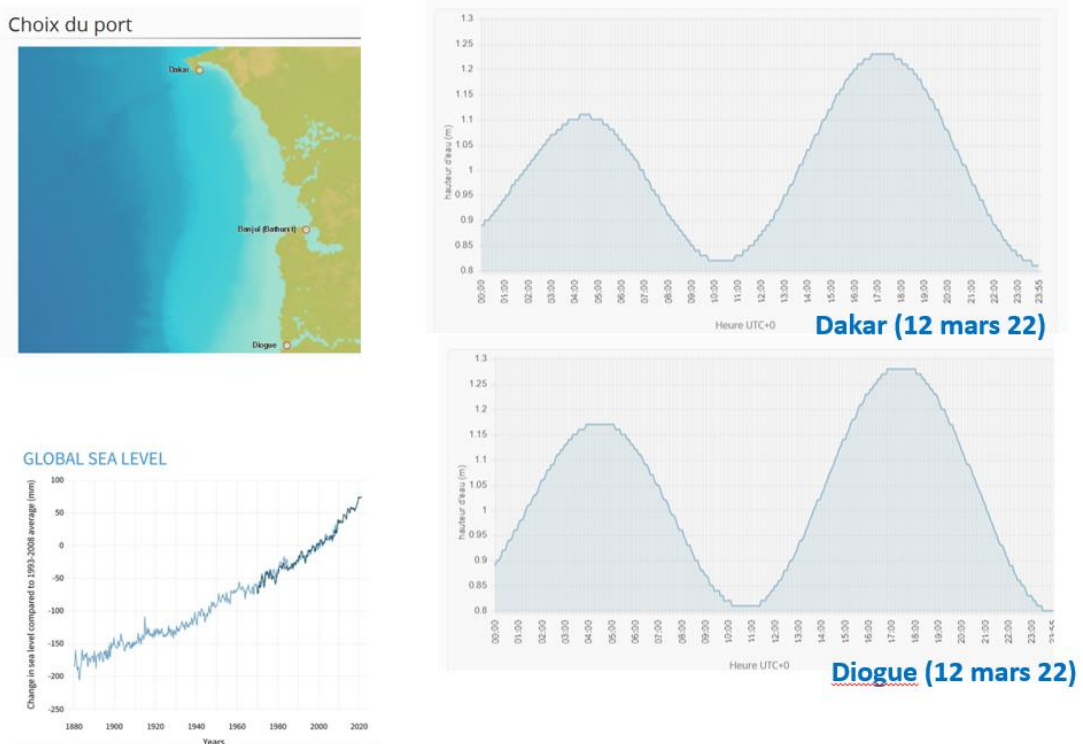
These charts can target specific areas such as sovereignty limits: EEZ, maritime boundaries, fishing areas, marine protected areas, etc.





## Annex G-4 : Tides

### Élévation du niveau de la mer, marée



This is a major topic:

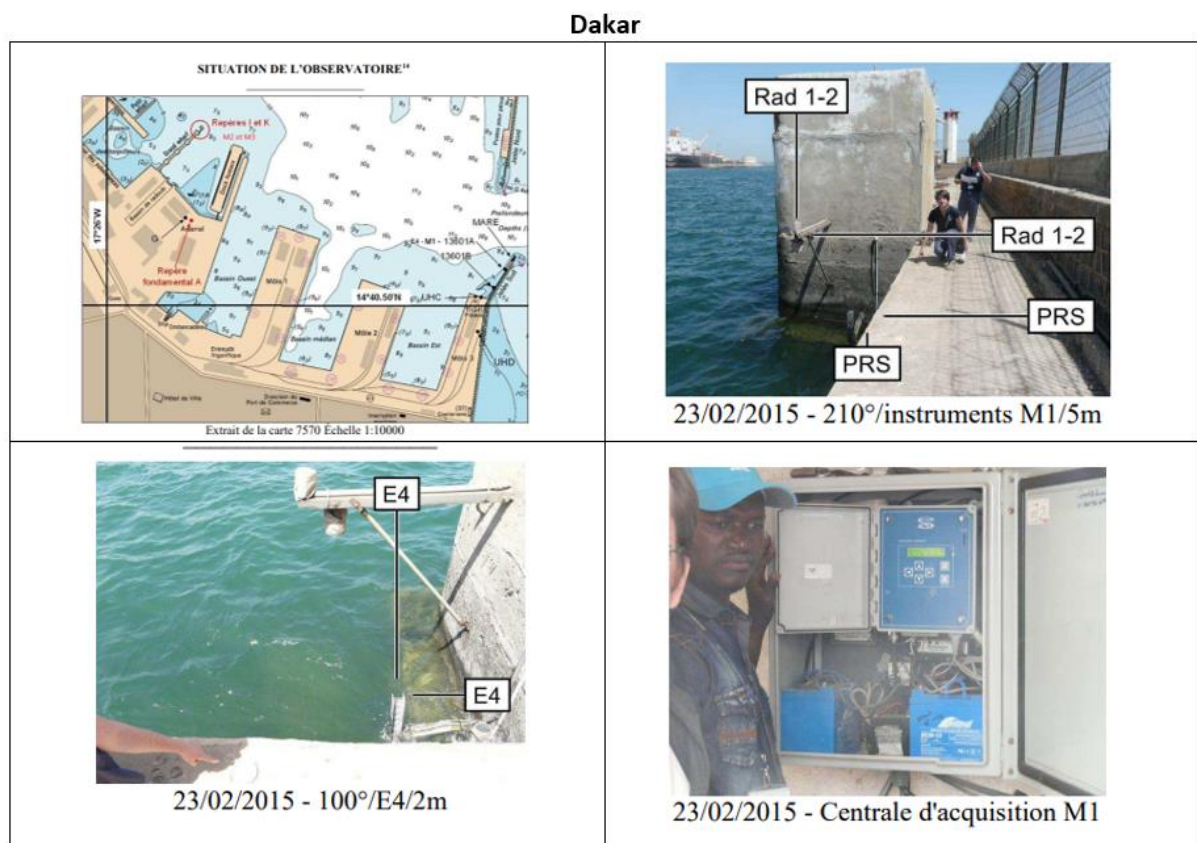
- because “IHO” standards applicable to hydrographic surveys in channels, recommended channels and port cannot be respected without observation of the tides;
- to financially optimize dredging;
- to prepare for future huge container ship the draft of which will approach the actual depths of the channel. Safety then also depends on the water levels observed in real time;
- for hydrodynamic studies (tidal currents) including those necessary for sediment transport or even marine pollution;
- for studies on climate change, in particular the rise of the mean sea level.

## Dakar

Concerning the current Dakar tide gauge, it is already a question of mastering the vertical references in relation to the ellipsoid and the general leveling (terrestrial - datum) of the country. The need for real-time tides can be studied for the benefit of maritime pilots (real-time for the watch and PPU Portable Pilot Unit).

The recovery and then the digital archiving (and dissemination) of all the measurements that have already been carried out in Dakar can be a task with great potential. If these are old paper records, their digitization should be considered. As a result, this is very structuring for the country, the constitution of the tide gauge database of Senegal on which will depend many studies relating not only to sea level rise but also all those relating to extreme meteo-oceanographic events (surges) that the country could suffer.

For the inventory, think not only to Shom, PAD but also of IOC (Intergovernmental Oceanographic Commission).



## Tide gauge in Dakar

### Other tidal gauges in Senegal

The acquisition of new tide gauges would cover needs (at least bathymetry) in the north and south of the country. If so, it would be advisable:

- clearly list the “functions/services” expected from users: hydrographers (accuracy), pilots (real time for PPU), oceanographers (databases);

- to associate from the design/beginning not only the users but also the services of Senegal concerned in particular the Direction of Geographical and Cartographic Works (DTGC: Direction des Travaux Géographiques et Cartographiques) which will be able to bring their expertise (including attachment of the hydrographic datum to the general leveling) in terms of leveling and of geodesy.

Note: tidal measurements in Banjul (Gambia) could be integrated into the project

### **Annex G-5 : Digital cartographies and visualization systems at sea**

Controlled navigation now involves electronic navigation charts: ENC (Electronic Navigational Chart) at sea.

Coupled with a GPS, they must be able to be displayed on systems such as ECDIS (Electronic Charts Display Information System).

Shom produces the ENCs.

It is possible that the maritime pilots of Senegal will one day need a specific digital cartography of very high definition. Their display system will be a PPU (Portable Pilot Unit).

These base charts on a very large scale (larger than those of the ENCs) will then have to be produced.

## **Annex H: Resources of the SSMS/PAD (Lighthouses and Beacons subdivision) in terms of hydrography and beaconing**

Source: Mr Pathé Yéro THIOYE in charge of studies and project monitoring

Subdivision of Lighthouses and Beacons / Hydrographic and Cartographic Service

### **The Subdivision has the following hydrographic equipment:**

- a multifunctional ship, equipped with a multibeam echo sounder system (EM3002) interfaced with new Hypack Hysweep software and a Zmax positioning system to correct the tide in real time during soundings;
- an ODOM dual-frequency single-beam echo sounder;
- a single-beam Hypack Max license for the hydrographic launch;
- a portable current meter;
- a hydrographic launch;
- an ADCP installed on board the multifunctional ship;
- positioning equipment: a Leica RTK transmitter and receiver positioning system;
- a bathycelerimeter;
- a digital tide gauge installed at PAD by ODIAFRICA;
- software for data acquisition and processing: HYPACK HYSWEEP/MAX;
- printers and plotters in AO, AI, A2 and A3 formats.

Additional need reported: a side scan sounder (SONAL), a magnetometer, a wave recorder, a light probe to complete the stock.

The acquisition of a second multi-purpose ship has been mentioned.

### **The Subdivision manages the aids to navigation equipment below:**

Approaching Dakar, navigators are guided by fixed landmarks (Mammelles, Cap Manuel and Almadies lighthouses) and a system of buoys delimiting an obstruction zone and two incoming and outgoing rails.

These buoys delimit:

- the obstacles to be circumvented [sand bank (Mbour), cemetery (Résolu), obstruction zone (between Gorée and Cap Manuel) and wrecks];
- The access channel to the port and to the SAR/ICS anchorage station for hydrocarbons.

The Lighthouses and Beacons maintain:

- 16 lighthouses and lights: 3 landing lights in Saint-Louis (Gothie Mathie, Guet Ndar and Gandiole), Kayar and Fass Boye, Almadies, Gorée, PAD pier lights (North and South), Diockoul, Yenne and Mbour , Joal, Djogué, Mamelles et Cap Manuel ;
- 171 ordinary buoys: Dakar (4 obstruction buoys), Kayar (2 fishing zone delimitation buoys) Mboro (1 buoy), Popenguine (4 buoys), Saloum (150 buoys);
- 229 lighted buoys: Dakar harbor (Tacoma, Douze, Une, Résolue and Mbao, 13 etc.), Mbour, landing (Saloum and Casamance), Lagoba, Casamance (103), Saint Louis (72), Wreck Sea Soul (4 ).

## Annex I : Charting

### Annex I-1 : Paper charts

Sources : Shom

#### Deux cartes couvrant l'ensemble des eaux sous souveraineté du Sénégal

N° FR	N° INT	Titre	1 : Échelle	Année publication ou édition
7388	1953	De Saint-Louis au fleuve Saloum	340 000	1997
7389	1954	Du fleuve Saloum à l'Ilhéu de Caio	342 000	1997

#### Dakar et abords de : Saloum, Gambie, Casamance

N° FR	N° INT	Titre	1 : Échelle	Année publication ou édition
6137	/	Cours de la Casamance – De l'embouchure à Ziguinchor	101 000	1961
6174	/	De Joal à Bathurst	100 000	1959
7569	1993	Approches de Dakar – Baie de Gorée	50 000	2008
7570*	1994	Rade et port de Dakar	10 000	2015

Saloum

	<table border="1"> <thead> <tr> <th>N° FR</th> <th>N° INT</th> <th>Titre</th> <th>1 : Échelle</th> <th>Année publication ou édition</th> </tr> </thead> <tbody> <tr> <td>5752</td> <td>/</td> <td>Rivière Saloum – De Foundiougne à Kaolack – Rivières Sine et Silif  Cartouche : Port de Kaolack</td> <td>50 000  10 000</td> <td>1967</td> </tr> <tr> <td>6147</td> <td>/</td> <td>Cours du Saloum – De l’embouchure à Foundiougne  Cartouche : Cours du Saloum  Cartouche : Cours du Saloum (suite)</td> <td>35 300  35 300  35 300</td> <td>1958</td> </tr> <tr> <td>6174</td> <td>/</td> <td>De Joal à Bathurst</td> <td>100 000</td> <td>1959</td> </tr> </tbody> </table>	N° FR	N° INT	Titre	1 : Échelle	Année publication ou édition	5752	/	Rivière Saloum – De Foundiougne à Kaolack – Rivières Sine et Silif  Cartouche : Port de Kaolack	50 000  10 000	1967	6147	/	Cours du Saloum – De l’embouchure à Foundiougne  Cartouche : Cours du Saloum  Cartouche : Cours du Saloum (suite)	35 300  35 300  35 300	1958	6174	/	De Joal à Bathurst	100 000	1959
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6174	/	De Joal à Bathurst	100 000	1959																	

### Casamance

	<table border="1"> <thead> <tr> <th>N° FR</th> <th>N° INT</th> <th>Titre</th> <th>1 : Échelle</th> <th>Année publication ou édition</th> </tr> </thead> <tbody> <tr> <td>6135</td> <td>/</td> <td>Cours de la Casamance – Du banc de Ouangaran à la pointe Samis</td> <td>35 000</td> <td>1956</td> </tr> <tr> <td>6136</td> <td>/</td> <td>Cours de la Casamance – De la Pointe Samis à Ziguinchor  Cartouche : Ziguinchor</td> <td>35 000  10 000</td> <td>1956</td> </tr> <tr> <td>6137</td> <td>/</td> <td>Cours de la Casamance – De l’embouchure à Ziguinchor</td> <td>101 000</td> <td>1961</td> </tr> <tr> <td>6297*</td> <td>/</td> <td>Embouchure de la Casamance</td> <td>35 000</td> <td>2020</td> </tr> </tbody> </table>	N° FR	N° INT	Titre	1 : Échelle	Année publication ou édition	6135	/	Cours de la Casamance – Du banc de Ouangaran à la pointe Samis	35 000	1956	6136	/	Cours de la Casamance – De la Pointe Samis à Ziguinchor  Cartouche : Ziguinchor	35 000  10 000	1956	6137	/	Cours de la Casamance – De l’embouchure à Ziguinchor	101 000	1961	6297*	/	Embouchure de la Casamance	35 000	2020
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6297*	/	Embouchure de la Casamance	35 000	2020																						

\* chart(s) bearing the coat of arms of the Republic of Senegal, in accordance with §3.1.1. of article 3 of the bilateral administrative arrangement.

In accordance with § 3.1.1. of article 3 of the administrative arrangement, on the occasion of any new edition, the cards will bear the logo of the Senegal Maritime Security Service (SSMS).

Planned publications:

Replacement of the 6135 and 6136 with a new 6138 in 2022 (done).

Redesign (with enlarged clipping) of map 6137 in 2023.

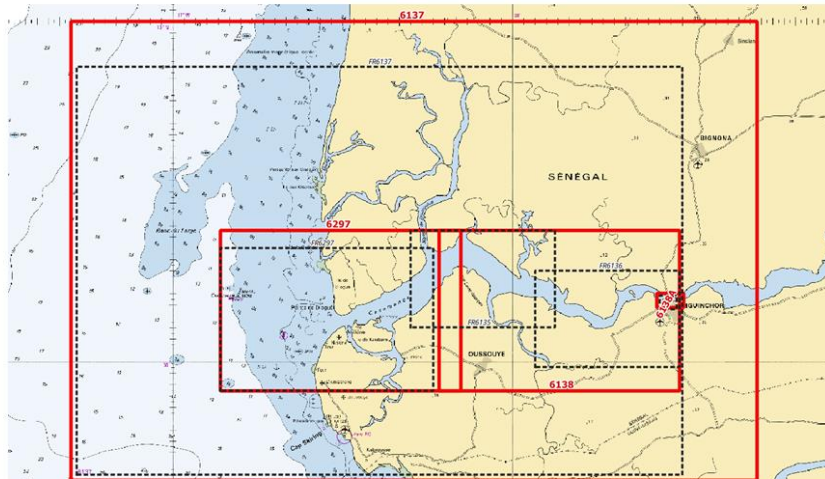


Figure 1 : Illustration du projet. En rouge, la proposition des nouvelles coupures. En noir, l'emprise actuelle des cartes du portefeuille. Arrière-plan : carte FR7389.

## Annex I-2 : Electronic chart

N°	Titre	1 : Échelle	Année publication ou édition	Nbre de corrections (ER)	Éditions prévues
<b>FR575700*</b>	Rade et Port de Dakar (Carte FR7570)	10 000	2015	13	-
<b>FR475690</b>	Approches de Dakar (Carte FR7569)	50 000	2015	13	-
<b>FR462970*</b>	Embouchure de la Casamance (Carte FR697)	35 000	2020	0	-
<b>FR373890</b>	Du fleuve Diombos à Ilhéu de Caio	342 000	2017	7	-
<b>FR373880</b>	De Saint Louis au fleuve Saloum (Carte FR7388)	340 000	2016	12	-
<b>FR271850</b>	De Cabo Roxo à Monrovia	1 000 000	2015	7	-
<b>FR166240</b>	Des îles Canaries à Freetown (Carte FR6624)	3 500 000	2016	10	-

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This mention will be carried later on the other ENCs in a future edition (excluding FR166240).

### Planned publications

Simultaneously with the redesign of the paper nautical chart portfolio presented above, the ENCs will be published.