

French and German hydrography in a changing world

An analysis calling for intensifying French-German cooperation

An essay by **FABIENNE VALLÉE AND GUNNAR TIETZE**

This journal is devoted to French-German cooperation in hydrography. The topic is worth an introduction. The paper starts from the origin and history of the French and German hydrographic services to consider their specificities and thus the bases of cooperation. In a second step it analyses the current opportunities for hydrography in general, considering the increasing demand for hydrographic data and the digitalisation of maritime activities. This context has led IHO and IALA to develop a new standard for data (S-100) and data exchange (MCP). Hydrography is basic. S-100 is a chance to seize. Implementing new standards requires multinational cooperation and pilot actions. Is the French-German hydrographic community ready to contribute their joint strengths?

history of science | hydrographic education | S-100 family | Maritime Connectivity Platform
 histoire des sciences | éducation hydrographique | famille S-100 | plateforme de connectivité maritime
 Wissenschaftsgeschichte | Hydrographieausbildung | S-100-Familie | Maritime Connectivity Platform

Cette édition du journal *Hydrographische Nachrichten* est consacré à la coopération franco-allemands apporte une vision de l'hydrographie. Le sujet mérite une introduction. L'article part de l'origine et de l'histoire des services hydrographiques français et allemands pour comprendre leurs spécificités et donc les bases d'une coopération. Dans un deuxième temps, il analyse les opportunités actuelles pour l'hydrographie en général, considérant la demande croissante de données hydrographiques et la numérisation des activités maritimes. Ce contexte a conduit l'OHI et l'AIMS à développer une nouvelle norme pour les données (S-100) et l'échange de données (MCP). L'hydrographie en est la base. La norme S-100 est une chance à saisir. La mise en œuvre d'un nouveau standard nécessite une coopération multinationale et des actions pilotes. La communauté hydrographique franco-allemande est-elle prête à apporter ses forces ?

Diese HN-Ausgabe ist der deutsch-französischen Zusammenarbeit in der Hydrographie gewidmet. Das Thema ist eine Einführung wert. Ausgehend von Entstehung und Geschichte der französischen und deutschen Hydrographischen Dienste werden deren Besonderheiten betrachtet, um damit die Grundlagen einer Zusammenarbeit besser zu verstehen. In einem zweiten Schritt werden die aktuellen Möglichkeiten für die Hydrographie im Allgemeinen analysiert, wobei der Beitrag die steigende Nachfrage nach hydrographischen Daten und die Digitalisierung maritimer Aktivitäten betrachtet. In diesem Kontext haben IHO und IALA veranlasst, einen neuen Standard für Daten (S-100) und Datenaustausch (MCP) zu entwickeln. Hydrographie ist grundlegend. Der S-100-Standard ist eine Chance, die es zu ergreifen gilt. Die Umsetzung neuer Standards erfordert multinationale Zusammenarbeit und Pilotprojekte. Ist die deutsch-französische hydrographische Community bereit, ihre Stärken gemeinsam einzubringen?

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1 Introduction

This edition of *Hydrographische Nachrichten* is special. Being written by German and French contributors somewhere it calls for further bilateral collaboration. The hydrographic community is small. We know each other at least on a national level. However, it is more like an exception between French and German hydrographers. Nevertheless, any cooperation requires a common topic, will-

ing partners, financial resources and coordination teams. We hope that this *HN* edition might provide some ideas, as hydrography is entering a new era.

With the fast digitalisation process, of all marine sectors, hydrography finds itself in the middle of the stage. It is a chance to seize. The challenge to be met speaking of new data formats only (Chapter 3) requires intense, international cooperation. The French-German couple could be at least a

strong player in this process. To better understand the potential of such collaboration let's go back in time a little bit.

2 Historical insights into French and German hydrography

Let's start from the beginning of hydrography in the two countries in modern times to better understand the current particularities. Of course hydrography is as old as men set out sailing. In Europe, while neglecting the Arab world, Asia and Polynesia, hydrography was a by-product of basically merchant shipping like the Hanseatic. This changed with modern times.

2.1 France

In 2020, the Shom (Service hydrographique et océanographique de la marine; English: hydrographic and oceanographic service of the navy) celebrated the 300 years of French hydrography, that is to say the history of the Shom itself (1720 to 2020, 300 years of French hydrography; <https://youtu.be/n0-BxWZev6Q>).

With the powerful rise of the French kingdom after the Thirty Years' War and increasing rivalry with the United Kingdom, the military importance of nautical charts and thus hydrography was recognised. Thus, in 1720, more than 300 years ago, a national authority directly affiliated to the navy was created.

Its task was to create and maintain a central archive of all nautical charts. This involved collecting all knowledge from geography and bathymetry and making it available as official nautical charts and accompanying nautical books, first and foremost to the navy but also to civil maritime shipping.

Based on this heritage Shom's missions have largely evolved since its very beginning, but it remains a regalian institution that federates developments in the field of knowledge and modelling of the oceans. Shom either supports public policies on maritime and coastal areas but also naval operations with its expertise in the hydro-oceanographic and meteorological domains.

In 2007, the Shom became a public administrative establishment (EPA). It remains part of the navy, while performing many civilian tasks including research.

In addition to its regalian character, Shom has a strong historical involvement in all international issues concerning hydrography in the broad sense. Shom is one of the fathers to establish the International Hydrographic Bureau (IHB) in 1921. In 1970, IHB became the International Hydrographic Organization (IHO).

Training and education of hydrographers was also centralised, not at Shom but at a Grand Ecole: ENSTA Bretagne (École Nationale Supérieure de

Techniques Avancées). Since 2010, ENSTA has been hosting students from École Polytechnique and the French Navy following courses in hydrography or maritime engineering fields. The ENSTA Bretagne hydrography courses have become one of the most important in Europe and are most renowned in the world.

Finally a word on the AFHy (Association Francophone d'Hydrographie): Initially made up of public actors only, the association opened itself to all French-speaking stakeholders in hydrography. The AFHy has the vocation to develop the relations, or indeed the cooperation between the academic, private and public sectors, an initiative highly appreciated in the francophone hydrography landscape (note the important commitment of the Quebecers).

2.2 Germany

In the days of the Hanseatic League, hydrography was a private matter for ship-owners. This did not change with its decline when, after the Thirty Years' War, Hamburg and Bremen clearly outstripped the Baltic ports from Lübeck to Danzig with the new overseas trades.

After the Congress of Vienna the interest in nautical charts and hydrography arose with the flourishing maritime trade. This gradually led, decades later thanks to the commitment of Hanseatic ship-owners of Bremen and Hamburg, to the establishment of the Seewarte (maritime observatory) in Hamburg for the benefit of merchant shipping. With the establishment of a German navy from the middle of the 19th century, the military aspect came to the fore, especially from the founding of the German Empire in 1871. The Seewarte, which became the DHI (German Hydrographic Institute) after the end of the war in 1945, was now established as a civil authority placed under the Ministry of Transport. The reunification brought the merger with the corresponding service of the German Democratic Republic and the renaming to BSH (Bundesamt für Seeschifffahrt und Hydrographie).

Hydrographic training and education was and is somewhat neglected in Germany. The traditional nautical colleges in Elsfleth and elsewhere essentially serve training of seafarers. Hydrography is occasionally offered as a special course by university institutes close to the subject (oceanography, geophysics, cartography). Genuine hydrographic training has only been established since a few decades in Hamburg, today at the HafenCity University (HCU). But even there it is affiliated or subordinate to geodesy and land surveying and was repeatedly on the verge of being completely dissolved.

DHyG (Deutsche Hydrographische Gesellschaft, since 1984, near 200 members) is the professional

association of German-speaking hydrographers. Whether they work in teaching, for government agencies and authorities, in industry or as service providers, the DHyG unites their professional interests. Finally, hydrographers worldwide have joined forces through the International Federation of Hydrographic Societies (IFHS).

2.3 Commonalities

Furthermore, there are many similarities. On both sides of the Rhine there are supreme authorities that take care of the maintenance and navigability of inland waterways and inland waters in general. These are partly set up nation-wide, partly separated according to catchment areas, Elbe, Loire, Rhône, etc. These authorities are responsible for safety of shipping, buoyage and beaconing, sounding surveys, etc. and at the same time for the environmental protection of waters and banks. In Germany, these are primarily the WSV (Wasserstraßen- und Schifffahrtsverwaltung des Bundes, Generaldirektion in Bonn), the BAW (Bundesanstalt für Wasserbau, Karlsruhe) and the BfG (Bundesanstalt für Gewässerkunde, Koblenz) as well as the Havariekommando in Cuxhaven.

In France, these tasks are carried out by CEREMA (Centre d'études et d'expertise sur les risques, l'environnement, la mobilité et l'aménagement) which is based in Compiègne and has numerous branches throughout the country and in the overseas departments. In addition, there are supreme authorities such as the CNR (Compagnie Nationale du Rhône, Lyon), which are responsible for research, environmental protection, water protection and hydraulic engineering. Furthermore, there are three so-called »Prefecture Maritime« in France, each responsible for the Channel coast (Cherbourg), the coast of the Bay of Biscay (Brest) and the Mediterranean coast (Toulon). They are responsible for safety and order as well as environmental protection, fisheries supervision, accident and disaster response, etc. in all the coastal waters under French jurisdiction (12-mile zone to EEZ).

Both countries have a technologically well-positioned industry, many innovative start-ups and small to medium-sized service providers. The situation of the private sector is comparatively better in France. With its overseas territories and correspondingly large EEZ, France offers a significant home market in the Francophone world. Industry finds more favourable framework conditions with the large offshore companies Elf, Total, Saipem, iXblue and others, accompanied by the high significance of the navy.

The enormous technological progress of the last decades has given hydrography a tremendous boost in both countries. The development has been similar and will therefore not be discussed further. However, in our opinion, digitalisation

leads to a special challenge with great economic potential. Hydrography is big data, the data itself is very dynamic. So, digitisation can be of great benefit. To exploit this treasure in a global context requires cooperation on a larger scale than before.

3 Is a new era for hydrography rising?

Digitisation is permeating all maritime activities. It is all about data, data exchange chains and data processing. Hydrography as foundation of knowledge and exploitation of rivers and oceans, is living its own revolution, obliged to anticipate the needs of all communities it serves. What will hydrography be tomorrow?

Navigation became more and will become much more than just plotting sailed routes on paper charts. Route optimisation, visualisation of metocean data, currents, sea state, etc. shall be integrated on the now electronic chart. A battle has been waged in the background over standards. Who would win between OGC (Open Geospatial Consortium) standards used for geographic information systems (GIS) and S-57? With S-57, the representation of hydrographic data was fixed in a static ENC. With OGC open architecture, all data can be exchanged and used by any actor in the data production/operations chain. For example, bathymetric data are publicly available from EMODNET (European Marine Observation and Data Network) – however, these charts cannot be used for navigation.

All this »new« data, and it is Big Data, is usually visualised in thematic maps via GIS tools. However, to make them available for mariners requires an integration into their workhorse platform ECDIS.

IHO and IALA and IMO have developed new standards (S-100 family) and a new data exchange model (MCP, Maritime Connectivity Platform), a service to assure the transfer of good »quasi approved« data to unlock the exchange of data within and outside the maritime community, on land or at sea. The electronic navigational chart is »alive«, able to incorporate potentially real-time data (e.g. currents, water level/under-keel clearance, etc.) or even forecast. This navigation surrounding context can be shared with VTS stations on land. Thus, the vessels can be remote controlled or even autonomous in future.

What will be the next generation of navigational charts and ENC display terminals (ECDIS, VTS, PPU), designed for humans? Who will certify the quality of the ENCs and hydrographic data potentially calculated in real time? With real-time data or forecast (same data structure with just a future time stamp but requiring reliable ocean models and simulation) there is no way to officially validate the map after some months of processing as in the past. Probably the hydrographic services as

state agencies will redefine their role and procedures.

The hydrographic community is also exploring remotely operated and even autonomous survey vessels to produce more data and to allow its exploitation more rapidly, at lower cost but with enhanced quality. What will be the next generation of data production/processing/exploitation chains?

Hydrography is thus undergoing a challenging but exciting revolution. The S-100 model coupled with the MCP is a powerful data (flow) structure. Still, it leaves many questions open. But let's also see the open door for French-German cooperation. The initiative will move away from Europe if we do not strengthen up cooperation. This goes in line with numerous opportunities for private enterprise to offer data and data-based services to the mariners and the maritime world.

Thus ECDIS may become a safe platform for manifold applications like the smartphone. However, if necessary regulations and harmonisation enforced by IMO, IHO and IALA do not evolve fast enough, there is a threat that an unofficial parallel world on tablets with a zoo of heterogeneous proprietary solutions would pop up.

4 French and German assets for cooperation

As common sense, implementing these new models requires transnational cooperation. Digitalisation is a fact. International security and interoperability remain *the* criteria.

Trans-national physical test beds are necessary to validate the technical implementation of IHO/IALA models. Countries like Korea, Norway, Denmark or Singapore are pioneers. They are providing the hot spots for the implementation of S-100/MCP and propelling their industry to the forefront

of development. The Korean KHOA S-100 test bed is one main example. Together with the ship handling simulator S-100 test system, it has already supported a pilot implementation of S-100 data models, a prototype shore-based ECDIS, supporting also the co-development of the MCP (Maritime Connectivity Platform) with European e-Navigation Project teams.

Considering only hydrography, it is worth mentioning the work achieved by the Canadian Hydrographic Service with PRIMAR and Norway on the production of hydrographical data using the St Laurent and the lakes as test bed. They have implemented and tested the data and chart production chain and demonstrated the capabilities of S-100 model for safety of navigation.

With their respective organisation and specificities, the French and German hydrographic communities are well positioned to take an active part in the development. However, this requires pulling financial resources and competencies when the determining factor is time. The market expects solutions now (e.g. remotely controlled navigation). Technologies progress at a faster speed than the theoretical standards themselves with the risk to open doors to »standards of fact«. Well known in standardisation processes such product can catch important market shares by creating solutions.

Could a stronger French-German cooperation be a way to favour the involvement of the two communities in this work and contribute to the international effort to speed up the implementation of S-100?

5 Conclusions

The conclusion is yours. We hope having excited the interest of the lectors with this essay. Ideas are welcome. //