

**14<sup>th</sup> MEETING OF THE IHO MARINE SPATIAL DATA INFRASTRUCTURES  
WORKING GROUP (IHO-MSDIWG14)  
Genoa, Italy, 30 January – 3 February 2023**

**(Including joint sessions with the UN-GGIM Working Group on Marine Geospatial  
Information and the OGC Marine DWG)**

**DRAFT REPORT**

**1. Joint Opening session, Welcome and Introduction of participants and practical information**

*Docs: MSDIWG14-01A List of Documents (Chair)  
MSDIWG14-01B List of Participants (Chair)*

The 14th Meeting of the IHO Marine Spatial Data Infrastructures Working Group (MSDIWG) took place from 30 January – 3 February 2023 Grand Hotel Savoia in Genoa, Italy, organized by the Italian Hydrographic Institute (IIM). The MSDIWG14 meeting was arranged as a joint meeting together with the Marine Domain Working Group (Marine DWG) of the Open Geospatial Consortium (OGC) and the UN-GGIM Working Group on Marine Geospatial Information (WG-MGI).

CDR Tocci invited the speakers for their welcome statement.

Admiral Massimiliano Nannini (Director of IIM) welcomed the participants and mentioned that the IIM will celebrate soon their 150th anniversary since the IIM was funded in 1887. He enhanced the relevance of hydrographic data for the benefit of humanity and the importance of the oceans. It was expressed the importance of the meeting and the expectations about the respective outcomes.

Mr. Marco Bucci (Mayor of Genova) welcomed the participants and expressed the hope that all will enjoy the stay in the city. He enhanced the relevance of maritime information and its importance in the history of the city as well and the sensibility of the sea and the need to know it to better protect it. He enhanced the contribution that MSDI and this meeting can provide expressing to have high expectations about the outcomes of this meeting to the protection of the sea and the humanity.

Ms. Elisabetta Trovatore (Deputy Director of the Department for Environmental and Civil Protection of Liguria Region) mentioned the pleasure to bring the compliments from her director. She expressed the concerns with the climate changes and to better face the challenges and to be better prepared, it is necessary to have data from the land and sea. She also expressed the importance to communicate the activities of the Civil Protection Department and their priorities related with data.

IHO Director Luigi Sinapi thanked the hosts and enhanced the challenges that the MSDIWG will face in this meeting, such as the S-100 data model and the respective products with the support of OGC, the review of C-17 and the MSDI Portal that the next Assembly will discuss.

Ms. Pearlyn Pang (Chair of MSDIWG and Co-Chair of UN-GGIM WG-MGI), Dr. John Nyberg (Co-Chair of UN-GGIM WG-MGI) and Mr. Rafael Ponce (Co-Chair of OGC Marine DWG) thanked the welcome from the former speakers and the organizers to have offered to host this joint meeting and expressed the importance to have an IHO MSDIWG, UN-GGIM WG-MGI and OGC Marine

DWG back-to-back meetings. This is a very important meeting and the rich agenda items create a lot of expectations in progressing together.

The Italian Hydrographic Institute provided some administrative information.

## **2. Approval of the MSDIWG14 Agenda**

*Docs: MSDIWG14-02 Agenda and Timetable (Chair)*

The agenda was presented by the Chair with an explanation about what is expected in each item. The Chair mentioned the need to adjust the agenda. The agenda was approved by the participants.

## **3. Terms of Reference for the MSDIWG**

*Doc: MSDIWG14-03 MSDIWG Terms of Reference - Draft amendments (Chair)*

The Chair proposed to include the insertion of the responsibilities related with the C-17 in the MSDIWG Terms of Reference. Germany proposed to remove the term “update” from the Terms of Reference.

It was approved to insert point 3.16 Maintain IHO publication C-17 – Spatial Data Infrastructures “The Marine Dimension”, Guidance for Hydrographic Offices.

## **4. Objectives and structure of the meeting**

The Chair went through the objectives for the meeting and invited the participants to consider them, specifically in light of an IHO MSDI Vision for 2030

The objectives mentioned included the discussion of the IHO strategy from an MSDI perspective and the ISO Principles. Discuss the draft IHO C-17 version 3.0, exchange knowledge on MSDI use-cases and outline the Future MSDI and geospatial ecosystem (S-100 for MSDI and Digital Twins). Update on the Principles, brainstorm on potential project(s) at the IHO-Singapore Innovation and Technology Laboratory, contribute to UN SDGs and UN Decade of Ocean Science through cooperation with the UN-GGIM Working Group on Marine Geospatial Information and have an update on the OGC-IHO Federated Marine Spatial Data Infrastructure Projects

### **4.1. Review of action items from MSDIWG13**

*Doc: MSDIWG13-04a Minutes of MSDIWG13 (Chair)*

*MSDIWG13-04b Action items from MSDIWG13 (Chair)*

The Chair went through the active actions from MSDIWG13 and asked for comments to update the respective situation. The list was updated with the respective status and the MSDIWG14 Actions is available on the meeting’s webpage document *MSDIWG13-04b Action items from MSDIWG13*.

### **4.2. Review the result and feedback from C-6, IRCC14 and HSSC14**

*Doc: MSDIWG14-04.2 Review the result and feedback from C-6, IRCC14 and HSSC14 (Chair)*

The Chair went through the document MSDIWG13-05 with the actions from C-6, IRCC14 and HSSC14 relevant to the MSDIWG.

About the Council 6/71, on the task given by the IRCC to the MSDIWG “to identify a theme in their portfolio of activities, where ISO 9001 basic principles could be applied and be beneficial” will be discussed in agenda item 14. About the Portal, she presented the current situation and the objective related with target 2.1 enhancing the main principles recommended by IRCC and that should be feasible and really contribute to the benefit of the society.

Director Sinapi resumed the situation about the portal enhancing the proposal that will be presented to the 3<sup>rd</sup> session of the assembly and that so far only received positive comments from the MS.

Ellen Vos informed that Netherlands has some information included in EMODNET and Inspire and that this data may be in some portals but not in an IHO portal. Director Sinapi mentioned that the intention is not to duplicate efforts but to have all information integrated. The work of the members should be collecting all the available information.

Singapore asked if in the Portal there will be the Marine Protected Areas (MPA) approved by the IMO, Director Sinapi clarified that it should integrate the globally recognized MPA.

The Chair informed that the IHO Secretariat will do the implementation.

Germany mentioned that we are confusing two things: the S-100 for the mariners and a portal where all can contribute, the HUB, the 2<sup>nd</sup> option. He suggested that this investigation can be a task for the IHO Lab and then the Secretariat can host the portal. The Chair expressed that we need to discuss how this can be solved.

UK expressed concerns about how the portal will contribute to the benefit of the society. Director Sinapi clarified that this will be discussed at A-3 but the portal project is open to additional suggestions that can be presented at the A-3. Parry Oei asked what value such a portal will have since the information is already available. Germany clarified that the portal will be focused on the marine side with centralized information. Director Sinapi informed that the Secretariat proposed a way to approach using information that are dispersed. Parry mentioned that maybe it should contain the information available on S-131, some charts have information available but sometimes the information is not coherent, MPA Singapore is asking the mariners what they should do to provide an important contribution. Germany clarified that the objective is not to duplicate the information but to connect it through a portal. Rafael Ponce expressed that the concept of the portal is unidirectional and suggested a HUB that brings a bidirectional approach, and the collaboration is controlled. Yong Baek clarified that the main objective of INTtoGIS is to contribute to organize the cartographic production allowing to consult the available information and metadata. John Nyberg emphasized the importance of data discoverability and the value in aggregating the data that contribute to simplify the process for the users to find it. UN-GGIM already has a HUB with several tools available on-line. Chee Hai Teo mentioned the system approach through a distributed arrangement that they call federated information, the system is called data HUB, as long as the information is available the information is used, the main point is to have the contributes and to find the framework to facilitate the organizations of the countries to have a governance to share the data.

The Chair summarized the discussion highlighting that one of the merits of such a Portal will be the concentration of the data making it easy to find and that MSDIWG will liaise with the IHO

Secretariat to evaluate the way to implement it. Two notable challenges would be: (1) to identify relevant global thematic layers to achieve the strategic goal 2 - increasing the use of hydrographic data for the benefit of society and (2) the provision of these data via existing platforms like INTToGIS in the most efficient way without duplication of resources. Chair noted that some of these global thematic layers could possibly be already available on other platforms and there is a need of two-way or bidirectional exchange between the hydrographic community and the wider marine or geospatial ecosystem, hence invited the IHO Secretariat to consider the MSDIWG's suggestion of implementing an additional feature of the INTToGIS, or relevant platform, which would allow external contributors to reach out to the IHO and contribute relevant links or data. Chair noted that subject to the outcome of A-3, possible next steps could be for the MSDIWG together with the IHO Secretariat, (1) identify priority products or layers based on what is available and accessible, (2) identify its users (e.g. SDG alliance) to ensure the portal is beneficial and effectively contributes and value-adds to IHO goal 2, (3) outline functions required of INTToGIS.

#### **4.3 Short review of work programme**

*Docs: MSDIWG14-04.3*

The meeting reviewed the MSDIWG Work Plan 2021 – 2024 changing the status of some of the work items in accordance with the document *MSDIWG14-04.3* available on the MSDIWG14 webpage.

#### **5. National presentation from members on status of SDI and MSP**

Before the reports started, the Chair asked the members to update the list of SDI/MSDI portals sending the information to the Secretary.

*Docs: MSDIWG14-05A National Report - Italy  
MSDIWG14-05B National Report - Japan  
MSDIWG14-05C National Report - Spain  
MSDIWG14-05D National Report - Croatia  
MSDIWG14-05E National Report - Singapore  
MSDIWG14-05F National Report - Portugal  
MSDIWG14-05G National Report – Australia  
MSDIWG14-05H National Report - Lebanon  
MSDIWG14-05I National Report – Iran  
MSDIWG14-05J National Report - ROK  
MSDIWG14-05K National Report - UK  
MSDIWG14-05L National Report - Norway*

##### **National Report – Italy**

Nicola Pizzeghello presented the Report describing the main characteristics of the National Hydrographic Standard. For the incoming information the key point is partnership like the one they have with the Coastal Guard but is necessary to provide guidance on how to provide the information. IIM has a portal to share authoritative data. The Project UP portal is used to deliver for instance ENC data such as for MPA. The information is used for the Italy Marine Spatial Planning and IIM controls it.

### **National Report – Japan**

Kosei Takahashi from the Japan Coast Guard presented the history of the Geospatial information that started with a system called Marine Cadastre, after 2019 changed to a system based on web-GIS. The system has more than 250 layers. He presented the data flow mentioning that the main difficulty is to go to other organizations to find the data sets and have an adequate harmonization. The number of accesses increased in last years and some examples of data available in the system are the water global surface temperatures, the weather information and navigational warning. The system is also used for disaster prevention information and sea ice concentration. It uses an API data linkage that connects the contributors to the system and some directly with a part of the portal that is connected with the external users.

Trevor Taylor asked if for the API they had looked for the existent OGC API's and that on Thursday there will be a presentation on the OGC API's.

### **National Report – Spain**

The presentation that provides information on the IdelHM Portal and the New Web Services including the InfoMAR is available on the website but was not presented because no Delegate from Spain attended the meeting.

### **National Report – Croatia**

Ena Sarajlic presented the National SDI available in the respective website and the current contributions with 11 datasets and 19 services. They also work with INSPIRE and have some applications, like the GeoAdriatic and the Croatian Marine Data Geoportal that provides the Navigational Warnings and register the hydrographic surveys executed. The Cro nav system supports access by mobile systems. She showed the analytics and the future developments.

### **National Report – Singapore**

Lawrence Chew presented the GeoSpace-Sea Strategic direction to the government agencies, research, education, industry and the general public. He also described the respective continued maturation, the proposal for implementation of the Digital Twin in Singapore and the future plans.

### **National Report – Portugal**

Telmo Dias mentioned the responsibilities of the IHPT (Portuguese HO). The vision for MSDI includes the Digital Twin of the Ocean, the mission (increase the use of hydrographic data for the benefit of society) is aligned with the FAIR principles. He explained the respective main components and architecture.

The future development is organized considering an alignment with the IHO strategic development goals.

Director Sinapi thanked and enhanced the clear link with the IHO Strategic Plan that was adopted in developing the portal.

The Chair asked what the changes and challenges regarding the Digital Twins would be. The IHPT is trying to engage with some groups to learn how to implement the Digital Twins.

## **National Report – Australia**

Pip Bricher described the products and Services provided by the Australian Hydrographic Office MSDI and the approach related with the data but there are additional phases and thinking about the data management pathways. The **AusSeabed** marine data portal contain data not only from the HO but also from several other agencies.

One of the focuses now is the S-100 transformation and the respective products. They are also concerned with the governance principles and funding some Ocean Science for the public good. John Lowell asked how as a PCA how they integrate with the other nations. Paul mentioned that they have this integration within the region.

The Chair asked what the challenges are in integrating Oceanographic information with the hydrographic, the AHO puts a lot of resources in this integration.

## **National Report - Lebanon**

Cdr Ghait informed the meeting that Lebanon don't have a National SDI but only stand alone files. He mentioned the supported areas of activities such as the safety of navigation, the oil and gas exploration, the cartographic production, the GNSS reference stations, the hydrographic surveying and the Maritime establishment. He mentioned the sources of information and the problems they face actually.

Nicola informed that in 2014 Italy started a strong cooperation with Lebanon; in 2020 Lebanon joined the IHO and now they are presenting at this meeting which is an important progress.

## **National Report – ROK**

Myeonghun Jeong from Chosun University, Republic of Korea, presented the status of the National MSDI informing that the objective is to transform the Supply Chain Management and the information is based in the S-100 Model.

The general architecture was also described with the Database designed for Consistency, traceability and scalability. KHOA as a pilot project for marine base map and the lessons learned related with the integration of land and sea data were summarized. A Marine information streaming service was implemented.

Chair asked what solutions were found to fill the gaps between land and sea, the representative explained that integrating it was a problem so they are thinking of using other systems.

## **National Report – UK**

James Carey explained the drivers to change such as the S-100, the decline in the use of the paper and the increasingly sophisticated use of marine data. He summarized the main points of the Digital Twins of the Ocean Summit 2022 such as the importance of data sharing interoperability (Q-FAIR), the Hydrographic Data is going to be a key foundation, currently very oceanographic in focus and participation. In terms of services they reorganized the Governance having the best practice in its wider context with a reorganization of the operations having a Strategic Data Service. In terms of current activity they are working in a data strategy, definition of data stewardship, data improvement to support S-1xx, standards development, data quality plan, embedding data governance, continued support to business as usual and OGC FMDSI projects.

Nicola asked how they manage the resources that a Digital Twins requires, they are working on the process to identify how slow data change and fast change data which is not an easy process. Director Luigi Sinapi mentioned that is very pleased to see the progress on the Digital Twins that is now as the motto for 2023 “Hydrography underpinning the Digital Twins of the Ocean”.

### **National Report - Norway**

Njål Tengs-Hagir from the Norwegian Mapping Authority explained how they are organized in terms of National SDI with more than 600 organizations representing the public sector that is focused on the user needs and on the socio-economic value. The national geospatial strategy towards 2025 with an action plan with 55 main activities was described. The main topics include marine activities, cultural heritage, base maps, crisis management and planning among others. It was explained how the geoportal makes the data available and the importance in improving the availability and usability making the services more FAIR. They are working on MSP in a cross sectoral cooperation and in a Marine Spatial Management tool based on the need for more coherent and uniform geospatial information. Some of the finalized products were mentioned, they have now about 60 products and are focused on the MPA's.

Chair asked about the FAIR principles indicator, the motivation and logic behind it. Norway shared that it was intended to put pressure on the data owners to ensure data quality Presently, the metadata that was collected by hand is done automatically and is reported to the ministries. Norway agreed to share the FAIR principles logic and checklist for OGC to refine as a joint submission at the next meeting.

### **National Report – Iran**

Ali Niya presented what they have related with MSDIWG starting to provide the context of Iran with more than 5,000km of coastline and where different organizations play a role in the marine spatial data, the 3 main organizations include Ports and Maritime Organization-PMO. Some sectoral platforms related with MSDI were referred as well as the respective opportunities and challenges. He also mentioned the characteristics that the Iran MSDI should have.

Chair mentioned that they are not alone and some other countries are also in the beginning with the MSDI, the meeting will discuss the new C-17 that is an important publication to provide guidance.

In the end of the presentations Teo asked what are the relations between the national MSDI and the National SDI's. Finland mentioned that they are making steps towards integration but this is a process that requires time. Trevor mentioned that is not important if the data is federated, connected and not duplicated as far as the FAIR principles are applied. The Chair resumed that the integration technically is possible and the IHO C-17 draft v3.0 provides guidance for this alignment.

## **6. RHC presentation from RHC MSDIWG**

*Docs: MSDIWG 14-06 Introduction*  
*MSDIWG 14-06A Report - Baltic Sea and North Sea Hydrographic Commissions*  
*MSDIWG 14-06B Report - Mediterranean and Black Seas Hydrographic Commission*  
*MSDIWG 14-06C Report – South-West Pacific Hydrographic Commission*  
*MSDIWG 14-06D Report - Arctic Regional Hydrographic Commission*  
*MSDIWG 14-06E Report - Eastern Atlantic Hydrographic Commission*

### **Regional Report - Baltic Sea and North Sea Hydrographic Commissions**

Christian Thellufsen informed that not much has happened since MSDI WG13. The Work program has several ambitious points but no one was signed up for the work tasks. They decided to start to work in a different way creating a sub-group, maybe will change the ToR and aim to have simpler and more concrete goals. He questioned what the focus of the MSDI WG's are? and resumed on some of the difficulties such as the changes in members, the too ambitious program, etc. He proposed to be realistic on the level of ambition, be concrete in the goals and often evaluate the group.

Netherlands mentioned that also what are we measuring is important and that we are here sharing experiences and opinions.

### **Regional Report - Mediterranean and Black Seas Hydrographic Commission**

Nicola Pizzeghello is the MSDI ambassador. On the last Hydrographic Commission meeting was delivered a presentation on MSDI mainly focused on IGIF as a framework which made the hydrographers aware on the importance. He updated the points of contact and the Chair. They had some training at regional level a workshop about MSDI in Türkiye and that the e-learning portal and the MSDI course was also mentioned. He stated the difference between a regional MSDI WG coordinator and an ambassador being the ambassador an intermediate level.

Chair mentioned that is important to have at least an ambassador.

### **Regional Report - South-West Pacific Hydrographic Commission**

Paul Sliogeris presented the SWPHC MSDI WG established in 2021. He explained the objective and resumed the activities through the last year with an increase in the participation. They had 5 working group meetings and 2 workshops. The Work plan was reviewed, established a MS Teams space to develop actions and capture shared resources. They invited UN-GGIM to present IGIF-I to the WG, presented at the Pacific Geospatial Conference 2022, Fiji and created a Data Value Propositions leaflet. In 2023 they intend to progress on the actions from SWPHC Work Plan.

### **Regional Report - Arctic Hydrographic Commission**

Caitlin Johnson mentioned the virtual meeting with the approval of the ToR and the Work Plan. All ARMSDI WG participants were invited by OGC to participate as observers in Phase 3 of the FMSDI Pilot with the intention of exploring the AVPG in an Arctic use case among other activities. They initiated the Federated Marine SDI-Pilot Phase 3. The Arctic SDI is pausing all official meetings until further notice.

John Lowell enhanced that in this region the countries are very cooperative like in the Antarctic.

### **Regional Report - Eastern Atlantic Hydrographic Commission**

LCDR Telmo Dias informed that the regional MSDI WG was established in 2021 and actually there are 8 members (France, Ghana, Morocco, Nigeria, Portugal (chair), Spain, UK and Gambia) and they are developing the respective TOR, the list of actions and some proposals. He enhanced some actions of the current list of actions that include, among others: review the procedures for



the transmission of survey data and identify sources of bathymetry and encourage data owners to contribute with datasets or subsets to IHO DCDB and GEBCO. He concluded with the current challenges and opportunities.

## **7. Presentation from stakeholders and expert contributors**

No presentations were made here but can be referred to under the OGC Marine Domain Working Group and UN-GGIM Working Group on Marine Geospatial Information meetings held in conjunction with the MSDIWG14.

## **8. S-100 from MSDI Perspective**

Jonathan Pritchard (JP) informed the meeting that S-100 edition 5.0.0 was published and became a live standard. It has more flexibility with revisions of metadata sections. In the MSDI aspects of S-100 edition 5.0.0 he enhanced the operationalization, the interoperability, the data protection/authentication mechanisms and the revisions on the metadata sections.

The SDI from an HO point of view was presented with some characteristics associated with the data coming in and out of S-100 being the interoperability a concern due to different formats, common reference frames and the interoperable models being necessary to consider conversion. One important aspect is to know how to prioritize the work since many do not need the “cutting edge”, the diversity of adoption increases as we move forward and the S -100 community needs to address the basics of implementation.

Rafael Ponce (RP) mentioned that so far, the MSDIWG have been involved in S-100 domain but in the last meetings started to talk about oceanography and other areas, but there is not enough products on this area and suggested to invite people from this communities to attend the MSDIWG meetings. JP agreed since the interoperability will be much better if we work also with that communities and we will get things out of those boundaries. RP suggested that the MSDIWG acts as an HUB for the marine community in a broader concept. JP stated that there will be advantages and disadvantages on that that would need to be evaluated.

Ellen Vos about the AMLs asked if the MSDIWG should try to look at this product specifications and see what they have. The Chair suggested that MSP may be also one of the products to be considered.

Parry Oei expressed the concern about the extending findability and accessibility to other communities and asked what is the contribute this WG can made in that area.

Yong Baek in relation with the INTToGIS explained that the objective is to have the metadata of the products but we are working on the next version of INTToGIS that can support the FAIR principles since will provide information about the producers of the products.

The chair mentioned the future portal that will have information from INTToGIS and should include the information about the producers to facilitate the Findability. John Nyberg enhanced the importance of MSP Navigation and also that the available data can contribute to MSP. Paul Sliogeris asked if it will be possible to convert S-XXX data to the data formats of the

Oceanographic and other communities instead of asking them to use the S-XXX data in an unhelpful format. Trevor Taylor mentioned that OGC is doing some work on that and the possibility to attract other communities in terms of data transformation. Peter Parslow from ISO mentioned a project about data transformation. Parry O. expressed the importance of use cases that allow us to understand how to do the data transformations, to help the States that do not have the resources. James Carey informed that this topic will be further debated in the OGC meeting.

Chair summarized that is necessary to review the existing product specifications and if there is the need for a new product specification. She reminded the WG of existing platforms such as the IHO Lab which we could tap on to explore these topics and maybe consider to developing some guidance with and to other communities. She suggested to come back at the next meetings with some ideas. Teo mentioned that maybe we should ask why the standards are formed, normally are developed for ourselves, but can be for other communities.

The MSDIWG14 discussed and produced a list of List of S-1xx products relevant for MSDI, and agreed to engage S-102 PT as a starting point considering their plans to produce a S-102 product specification for non-navigation.

## **9. WEND-100 from an IGIF Approach**

John Nyberg presented on the WEND-100 Principles mentioning that the current version is initially intended for S-101. The principles have been followed by an implementation guide and aimed the S-1XX products more important to IHO, but other products can align with them.

It encourages data availability, distribution through compatible and coordinated networks, standardization, authority of service, and data protection. It also addresses the avoidance of service duplication, coordinated data management, quality management, and assistance and training. In this version Capacity Building is explicitly noted.

It was discussed the SPI 1.3.1 that has a goal of 50% (2026). The WEND -100 Matrix that includes an MSDI column was built around the IGIF pathways and was send to the RHC's. It was recognized that would not be easy to fill the matrix, nevertheless, RHCs were encouraged to try the matrix and report back at next meeting their experience, potentially utilizing the MSDI regional ambassadors for assistance.

## **10. Guidance on applying FAIR Principles**

Trevor Taylor mentioned that OGC is working on FAIR+ that include some more elements and Johnathan Pritchard will present something on the OGC meeting.

Nicola P. mentioned that in the new version of C-17 there is some basic information on FAIR+.

Chair noted the additional three principles to be included under FAIR+ and requested that the FAIR+ principles be included in the eventual FAIR (+) principles checklist OGC is working on, and that it could be built upon Norway's existing FAIR principles matrix or parameters.

## **11. Spatial Data Quality and Integrity**

Nicola Pizzeghello from Italy presented the data 7 Quality Management Principles starting with the ISO 9000 for the quality of products and services and the connection with the expectation of

the customers. He presented the fundamental concepts of the quality is the degree to which an inherent characteristic of an object fulfils the requirements. The quality can be applied to all pathways of the IGIF. The 7 Quality Management Principles available in the ISO website that is a part of ISO 9001 were presented and a question is if the principles are applied in the future version of C-17.

Telmo Dias from Portugal presented on the data quality starting with the traditional purpose of the bathymetric data that is the safety of navigation. To increase the use of the hydrographic data, the data quality is essential since it allows the users to compare and select the data that suits the purpose. The quality is a question of degree on how the data comply with the requirements, it is a relative concept. He mentioned also the ISO standards related with the Geospatial data quality. The data quality elements are the completeness, logical consistency, positional accuracy, temporal accuracy, thematic accuracy and usability. He also mentioned the Descriptors and the Metaquality as well as the Data quality evaluation process flow. The data quality shall be reported as metadata.

Chair thanked Portugal and Italy for putting this topic in the agenda that is very important for the data in special in the MSDI that have a broader range of contributors from different areas.

Ellen Vos from Netherlands mentioned that the DQWG is also working on the data quality for the S-100 products. Chair mentioned that is very relevant, on the last meeting MSDI WG asked for a DQWG point of contact and reinforced the request. The Chair also called the attention for the table related with the 7 QMPs and asked contributors to propose to IRCC to use as the application of the ISO 9000 principles.

Section 1.5 on C-17 the ISO 9000 7 QMPs application to MSDI the table was updated to be submitted to IRCC.

## **12. Discussion on the Future MSDI**

### ***Digital Twins from MSDI Perspective***

Johnathan P. explained the difference between Digital Twins and Static Datasets related with their changes overtime. Digital Twin is a dynamic, virtual representation of a physical system, device, or process that is constantly updated in real-time with data from sensors, devices, and other sources. This enables the digital twin to accurately reflect the current state of the physical system and to simulate how it will behave in the future, taking into account changes such as wear and tear or changes in operating conditions. Digital Twins is a combination of modeling and data analytics. Some examples of related projects and pilots were mentioned but still quite limited to a part of the globe. Three Components for Digital Twin: Duplication (static and dynamic); Simulation and Analysis; and, Feedback to the Real World. The Digital Twins require High density data some Hydrographic Offices (HO) may not provide real time data and is necessary to have it from other agencies. For an HO the predictive capabilities may help like the erosion etc.

Rafael P. mentioned that normally the HO's are data creators that provide relevant data enabling the Digital Twins of the Ocean. Chair asked if there are other roles that the MSDI WG should be concerned. Johnathan P. mentioned that a Digital Twins possibly will provide some information that maybe affected the navigation such as the integration of the cartographic model with tides and in the future should be necessary to discuss on the governance. Jens S.-F. suggested that

in a future meeting we should sit together and discuss which Digital Twins are on the interest of the MSDIWG.

The Chair invited the participants to envision and discuss the elements of the future MSDI.

Some questions were putted to the meeting to facilitate the discussion, such as:

- What are Digital Twins?
- What are the stakeholders demands from MSDI?
- What are the benefits of supporting DTs?
- How can MSDI be “DT-ready” and provide “DT- ready” data/APIs/services?
- MSDI role in: S-100 and Digital Twins
- Other emerging trends
- Towards IHO MSDI Vision for 2030

Rafael P. mentioned the importance of the HUB Concept to collaborate with other communities and the possibility to provide some examples.

Portugal on the 2 February by email informed that:

Digital Twins:

- We see MSDI role in Digital Twins as data providers (enablers), but also as users (beneficiaries). The benefits can come from Digital Twins outcomes, for instance, the conjunction with bathymetry, tide, and surface currents, could help predict bathymetric changes, and to decide where to survey next. It can also help us understand the value of our data, in conjunction with other marine data, from other domains (geology, oceanography, chemistry). The benefits can also derive from a close connectivity to the users (more stakeholders will use our data, which will increase its value and the HO role).
- From another perspective, we encourage all members to join DITTO (<https://ditto-oceandecade.org>). DITTO is an Ocean Decade Action (<https://oceandecade.org/actions/digital-twins-of-the-ocean-ditto/>) and becoming a partner is very simple (<https://ditto-oceandecade.org/ditto-partners>). The objective of DITTO is to exchange best practices, common understanding, regarding digital twins models and frameworks. It covers all the marine domains (seafloor, water column and sea surface), so its a great opportunity to engage with other marine data producers and enablers (oceanography, academia, etc.). It's also a way to assess if hydrographic data and S-100 format is “ready” and “usable” for the broader community.

Future for MSDI:

- The main role will be to evolve from a data infrastructure to a knowledge infrastructure. This aligns with the comment from Esri and Netherlands. We have some developments in this area, for instance we are creating a specific Python module/function, so that programmers/developers can interact with our data directly (without a specific knowledge about hydrographic or marine data), and we are also developing a Jupiter Hub that will function as a repository for users to share specific case studies of marine data use regarding problem solving, analytics and machine learning implementation.

- Regarding the main trends, we identify augmented reality and location-based services. This is a way of getting more users to know and use marine data. In this area, we are digitalizing the sailing directions (pilots) to be incorporated in an augmented reality application that will provide marine static information (pilots), integrated with real-time or forecast information (tide, waves, winds), based on the location of the user and through an augmented reality interface on the smartphone.

### **13. OGC APIs for MSDIs**

The OGC APIs for MSDi will be discussed at the OGC Meeting. Johnathan P. explained that the APIs provide a robust means for data transport and access by end users and enumerated some of the respective advantages. S-100 offers web-friendly GML encoding but stops short of formalized API structures for S-100 (General Feature Model GFM) data. There are additional challenges for API implementations such as: Metadata approach and methodologies; S-100 specific structures, e.g. topology, gridded data, multiple vertical datums, quality, portrayal (if required); highly interconnected datasets with a rich relationship structure; and, different “aggregation” mechanisms. He enhanced that there is a need for better guidance and HOWTO level of advice for implementing authorities. In the way forward was mentioned that Methods for aggregating API endpoints together and the transformation structures to allow APIs to automatically deliver transformed data to calling processes remain to be developed. There is as a first draft of S-100 GFM data expressed in a JSON encoding. This needs to be expanded to metadata and collections and better harmonized to OGC API features, also to gridded and coverage data. Intelligent Querying and selective access need to be considered. Transformation of content and methods for aggregation, together with common OGC API Records metadata would enhance this greatly and OGC would like to contribute to such efforts in the future.

### **14. Establishment of project teams if deemed necessary**

No project teams were established.

### **15. C-17 Version 3.0 Drafting Session**

MSDIWG Vice Chair Caitlin J. introduced the background with the decision at MSDIWG11 (2020) to review and update the C-17 version 2, in order to incorporate the IHO Strategic Plan, IHO-OGC MSDI CDS, BoK, FAIR Principles, S-100 and the IGIF Structure. At MSDIWG13 (2022) was formed a drafting team led by Singapore, Italy, U.S.

She resumed the update timeline with the draft circulating for review in January 2023 and with the intention, at this meeting, to have a breakout session for members to review and comment on the sections. After the MSDIWG14 it is planned to have: a consolidation of group comments and email circulation for further comment; MSDIWG to provide comments via Google Doc link (to be shared); Case Study Submission; do an infographic standardization – special thanks to Germany (BSH); and, have a final email circulation. Then the chapters were introduced by:

Chapter 1 (Introduction and Background) - Telmo Dias;

Chapter 2 (Role of the Hydrographic Office and MSDI) - Jens Schroder-Furstenberg

Chapter 3 (MSDI Maturity) - Julien Barbeau

Chapters 4.1 (Governance) and 4.3 (People) - Chris Hemmingway

Chapter 4.2 (Technology) - Rafael Ponce

Chapter 5 (Emerging Trends in MSDI) - Caitlin Johnson

Then the meeting was divided in groups to discuss the updates of each Chapter and on Friday did the wrap up of all contributes.

## **16. Marine Science and Ocean Observation Data Governance**

The Chair introduced the topic.

### **16.1 Data Sharing in Ocean Observation Community**

Pip Bricher presented the Global Ocean Observing System (GOOS) that sets a broad framework across a range of scientific disciplines, and the regional alliances that are tasked with turning that overall approach into actual observations and systems. She mentioned the GOOS data portal that is a mix of data and “only” metadata layers. They collaborate with EMODnet and it is easy to pick up a point and download the data. FAIR describes attributes of a dataset. For the hydrographic community, FAIR needs a bit of thought, especially for HOs that are embedded in a defence organisation. She introduced the TRUST Principles where we can be certified with some guidance on how to go through the process. Also, the CARE principles for indigenous data governance were mentioned. One of the weaknesses of the international data aggregation efforts is in transparency about what each portal holds. The Schema.org Cluster helps to improve search and discovery.

### **16.2 Singapore’s Roadmap for Implementing Marine Science Data Standards**

Singapore started the categorization of the Marine science datasets in different levels through standardization. The 3 phases approach with the categorization, the Interdisciplinary Integration of International Standards and the Implementation of Marine Science Data Standards as the authoritative Source was described. The several advantages of standardization were summarized as well as the outcomes of the implementation.

John Nyberg mentioned that it is very good, we have it for hydrographic data like in the DCBD but maybe should be also developed for other areas such as oceanography etc. Pip B. provided some examples. Chair mentioned that it would be good to have the roadmap in the BoK.

## **17. Use-cases of crowdsourced bathymetry**

Afif Ghaith from Lebanon presented an update on the crowdsourced bathymetry (CSB). The CSBWG updated publication B-12. To date, just 32 coastal States have replied positively to the provision of CSB data from ships within waters subject to their jurisdiction into the public domain. He mentioned that the process to have the authorization it is normally complex and not dependent on the HO. It expressed the value of the CSB data and mentioned the case of the Canadian HO that use CSB to update the Nautical Charts in the northern passages. Some examples of trusted

nodes were also mentioned and provided some Potential use-cases of crowdsourced bathymetry with a MSDI perspective and How would the MSDIWG envision using CSB. How would the MSDIWG envision collaboration with the CSBWG.

Saudi Arabia asked how the data and the quality is controlled, Lebanon responded that it is by their HO.

Chair highlighted the examples on how MSDI can use CSB data that should be considered as a case for members to consider the provision of CSB data via their MSDIs.

## **18. Discussion on MSDI Training Materials and Capacity building**

MSDIWG13 invited WG members to review the available e-learning training materials.

Germany introduced document MSDIWG14-18.1 a paper on the revision of the e-learning center materials in December 2022.

Singapore participated by reviewing the e-learning training materials available and provided the respective comments.

Portugal suggested to produce or make available more practical material/guides, in order to enhance MSDI development in the member states that are less developed and suggested to build a wiki (shared live repository), instead of using a static BoK. Portugal offered to investigate a suitable platform to host this repository.

With the upcoming update to IHO C-17 v3.0, Chair highlighted the need to prepare for an update to MSDI training materials which presently focus on high-level MSDI 4 pillars, and that this feedback could be relevant for the updates. For instance, by including technical data and systems management training, and incorporating the alignment of the MSDI 4 pillars with the UN-GGIM IGIF nine strategic pathways. Chair outlined two steps towards an update of the MSDI training materials. The first, to consolidate what we would like to see in the update, and the second, its production could be from one or more of the Member States.

## **19. Updating the MSDIWG work plan and action list**

The meeting went through the MSDIWG Work Plan and the Chair focused on the most recent items.

The meeting then went through the list of actions with the new actions from the MSDIWG14 and drafted the document MSDIWG14-19.2.

## **20. Drafting of the MSDIWG14 Report to IRCC15**

The Chair resumed the topics discussed during this week and mentioned that will prepare the MSDIWG Report to IRCC15

## **21. Election of MSDIWG Chair and Vice-Chair**

The Secretary resumed the process informing that no candidatures were received and asked the participants if anyone opposes to the formal election of the Chair and Vice-Chair. Since there was

no opposition, Ms. Pearlyn PANG (Singapore) was elected as Chair and Ms. Caitlin JOHNSON (USA) as Vice-Chair by unanimity.

## **22. Any other business**

Chair invited participants to consider other topics arising from the meeting.

## **23. Evaluation of Meetings, Next MSDIWG15 Meeting and host for MSDIWG16 (2025)**

In relation to future meetings, it was decided that the next MSDIWG meeting will be also a joint meeting with UN-GGIM Working Group on Marine Geospatial Information and the OGC Marine DWG.

The MSDIWG Chair announced that Indonesia offered to host the MSDIWG15 in 2024 and Portugal offered to host the MSDIWG16 in 2025. The dates and venues of the next meetings were then announced to the meeting:

- MSDIWG15 (2024) - Indonesia (4-8 March TBC)
- MSDIWG16 (2025) - Lisbon, Portugal (TBC)

## **Joint Closing Session**

John Nyberg thanked Admiral Nanini, his Team and the government of Genoa and enhanced the results and important outcomes of the meetings.

Admiral Nannini mentioned that was a big commitment, thanked the staff and enhanced the importance to host the meetings of the IHO Working Groups and support them in progressing their work and hoped that all participants enjoyed the time in Italy.

John Nyberg and Pearlyn Pang thanked all participants and the host for the meeting.