15th MEETING OF THE IHO INTER-REGIONAL COORDINATING COMMITTEE

IHO-IRCC15

Tokyo, Japan, 12-14 June 2022

Report of the Marine Spatial Data Infrastructures Working Group

Submitted by:	Chair, MSDIWG
Related Documents:	MSDIWG Terms of Reference v2.0
	C-17 Spatial Data Infrastructures: "The Marine Dimension" - Guidance for Hydrographic Offices, Edition 2.0.0, January 2017
	C-17 Spatial Data Infrastructures: "The Marine Dimension" - Guidance for Hydrographic Offices, Edition 3.0.0
	UN-GGIM IGIF-Hydro Part 2
Related Projects:	OGC-IHO Federated Marine Spatial Data Infrastructures Projects

Chair:	Caitlin Johnson, USA from Apr 2023 Pearlyn Pang, Singapore from Sep 2022 Jens Peter Hartmann, Denmark from 2013
Vice-Chair:	Temporarily vacant Caitlin Johnson, USA from Sep 2022 Pearlyn Pang, Singapore from Mar 2021
Secretary:	Assistant Director, Leonel Manteigais, IHO Secretariat
Member States:	Argentina, Australia, Brazil, Canada, Cuba, Denmark, Estonia, Finland, France, Germany, India, Indonesia, Italy, Iran, Japan, Lebanon, Malaysia, Nigeria, Netherlands, New Zealand,

	Norway, Philippines, Portugal, Republic of Korea, Romania, Slovenia, Spain, Singapore, Thailand, Ukraine, UK, USA
Expert Contributors:	Buji Bui Inc, Massachusetts Institute of Technology, ESRI, GEBCO Seabed 2030, Geosciences Australia, H2i, IIC Technologies Inc, ICPC/EGS Group, INEGI Mexico, Linker Technologies, OceanWise, OGC, PAIGH-Honduras, SevenCs, Teledyne CARIS, YottaOcean Inc.
see **Annex A** for full details	

1. Meetings Held During Reporting Period

The fourteenth meeting of the Marine Spatial Data Infrastructures Working Group of the International Hydrographic Organization (MSDIWG) took place in-person from 30 January to 3 February 2023 in Genoa, Italy. The MSDIWG14 meeting was held back-to-back with the OGC Marine Domain Working Group and United Nations Committee of Experts on Global Geospatial Information Management (UN-GGIM) Working Group on Marine Geospatial Information (WG-MGI).

Indonesia offered to host the MSDIWG15 in 2024 and Portugal offered to host the MSDIWG16 in 2025.

Meeting Genova - 30/01-03/02/2023

The objectives of the MSDIWG14 meeting were to:

- Exchange knowledge through national, regional hydrographic commission and expert contributors' presentations.
- Discuss IHO strategy from a MSDI perspective
- Ready the draft of IHO C-17 version 3.0
- Exchange knowledge on MSDI use-cases, in particular, Marine Science data and Crowdsourced Bathymetry
- Outline the Future MSDI and geospatial ecosystem considering a IHO MSDI Vision for 2030 through discussions on S-100 and MSDI, and Digital Twins
- Update on Principles: Cooperation with WENDWG, FAIR principles with OGC, Application of ISO Principles in MSDI
- Brainstorm 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
- Update on OGC-IHO Federated Marine Spatial Data Infrastructure Projects

The MSDIWG14 was actively participated by 40 MSDIWG members as well as observers from the UN-GGIM Working Group on Marine Geospatial Information. The meeting received 12

national MSDI reports, 5 regional hydrographic commission MSDI reports, and numerous presentations from expert contributors.

2. Work Program

The existing MSDIWG Work Programme 2021 - 2024 approved by IRCC14 was discussed and reviewed at the MSDIWG14 meeting. In order to deliver on this Work Programme, the existing eight MSDI Tasks were retained, status of some work items was updated and new work items inserted. The latest Work Programme 2021 - 2024 can be found in **Annex B** of this report.

In relation to the List of Actions, the existing actions were evaluated in order to clarify their status and to establish the way forward. At the end of the meeting, new actions were added to the list. The latest list of action items can be found in **Annex C** of this report.

MSDIWG Terms of Reference
The amendment of MSDIWG Terms of Reference (ToR) was raised at the MSDIWG11 (2020) meeting in Rostock, Germany, and with the ongoing revision of C-17, the MSDIWG14 agreed that it was appropriate to revise the MSDIWG (ToR) to include clause 3.16 'Maintain and Update IHO publication C-17 – Spatial Data Infrastructures "The Marine Dimension", Guidance for Hydrographic Offices', in addition to editorials. Please refer to Annex D for complete draft MSDIWG ToR version 2.0 submitted for IRCC15 endorsement.

Connected MSDIWG

The MSDIWG has had fruitful exchange of knowledge with expert contributors from industry, academia, regional hydrographic commissions and non-governmental organizations (NGOs) for many years. Since 2019, the MSDIWG enhanced connections with experts from the Open Committee of Experts on Global Geospatial Information Management (UN-GGIM) Working Group on Marine Geospatial Information and have since shared a vibrant ecosystem for collaboration and innovation. The MSDIWG recognized the benefits of keeping connected to the bigger picture and keeping abreast on what the industry and other stakeholders have to offer by gathering together. Hence, agreed to continue facilitating the joint meeting arrangement for the next MSDIWG meeting with the OGC Marine Domain Working Group and the UN-GGIM Working Group on Marine Geospatial Information. This approach will be coordinated in consultation with the meeting hosts.

MSDI Use-Cases

The MSDIWG also followed up on findings from last year's International Seminar on Effective and Integrated Marine Geospatial Information Management held in conjunction with the MSDIWG13 meeting, hosted by Singapore, where it was highlighted that MSDIs have an important role in providing and sharing the marine data required to drive marine knowledge for agendas such as the 2030 Agenda for Sustainable Development and the UN Decade of Ocean Science. This is in line with the IHO Strategic Plan 2021 – 2026 which highlights the increasing need for marine data for diversified customers and a transforming hydrographic ecosystem. In addition to supporting safe and efficient navigation of ships, hydrography underpins many other aspects associated with

the sea including marine science. With data as our common language, the MSDIWG agreed to investigate how to support the connection between hydrography and oceanography through discussions on the challenges and existing solutions to integrate and make interoperable hydrographic and marine science data. The discussions were facilitated by presentations from Phillippa Bricher from Australia on Global Ocean Observing System (GOOS) and Singapore's Roadmap for Implementing Marine Science Data Standards. A new work item (B.4) was added to MSDIWG to identify marine science and/or oceanographic data themes that could require integration with hydrographic data.

The MSDIWG14 noted that there are practical use-cases for crowdsourced bathymetry (CSB) data and to make these data available via MSDI would enable a wider range of users' access and applications. This was facilitated by a presentation from a CSBWG representative on the publication B-12, the status of the provision of CSB data from ships, and potential use-cases of CSB. The MSDIWG and UN-GGIM Working Group on Marine Geospatial Information agreed to continue working together to identify common use-cases for bathymetry data residing in IHO DCDB and GEBCO Seabed 2030.

3. Progress on IRCC Action Items

A total of 30 actions arising from MSDIWG10 (2019) to MSDIWG13 (2022) meetings were addressed at the MSDIWG14 meeting, in addition to 7 relevant IRCC14 decisions/actions and 3 C6 decisions/actions. The IRCC14 and C6 actions addressed during the reporting period are summarized in **Table 1** below and elaborated in this section:

- IHO Strategic Plan 2021 - 2026: Targets 2.1 and 2.3
- IHO C-17 v3.0
- Application of ISO 9001 Principles to MSDI
- S-100 from MSDI perspective
- Digital Twins from MSDI perspective
- FAIR principles

Table 1: Summary of IRCC14 and C-6 Action Items addressed by MSDIWG during reporting period

Relevant Actions Items to MSDIWG from IRCC14 and C6	MSDIWG14 Agenda Item
Action IRCC14/5: MSDIWG to provide recommendations to IRCC 15 on how IHO MS can use the FAIR principles and establish a HO MSDI FAIR principles check list.	Agenda item 10 Guidance on applying FAIR principles
Action IRCC14/6: MSDIWG to provide recommendations to IRCC 15 on how MSDI and HOs can be part of Digital Twins in the future.	Agenda item 12 Discussion on the Future MSDI
Action IRCC14/7: MSDIWG to revise the IHO publication C-17.	Agenda item 15 C-17 Version 3.0 Drafting
Decision IRCC14/28: Take note of the S-100 initiatives from a	Agenda item 8 S-100 from

MSDI perspective.	MSDI Perspective
Action IRCC14/8: MSDIWG to investigate in liaison with the IHO Secretariat, having in consideration the possibilities, challenges and resources required, the establishment of a basic MSDI portal solution building on the already existing INToGIS solution and other available data.	Agenda item 4.2 Review the result and feedback from C-6, IRCC14, HSSC14
Action IRCC14/9: MSDIWG to investigate in liaison with the IHO Secretariat the different possibilities, challenges and resources need for step 2 of the MSDI Portal (an IHO marine data hub network) in order to have the information needed to take a decision about implementing step 2 and to present the recommendations at IRCC 15.	
Decision IRCC14/29: The MSDI draft questionnaire to be forwarded to the IHO Secretariat inviting, if deemed appropriate, to send it out to the IHO MS.	
Decision and Action C6/71: The Council invited the IRCC to identify a theme on which ISO 9001 Principles should be applied and to propose it to Council for endorsement (deadline: IRCC15/C-7). The Council noted a 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 (deadline: IRCC-15).	Agenda item 11 Spatial Data Quality and Integrity
Decision C6/51: The Council noted the progress made by IRCC in the development of the methodologies and metrics for SPIs allocated to IRCC and endorsed the proposals (definitions, metrics, action plan…) as reported in IHO CL 23/2022.	Agenda item 4.2 Review the result and feedback from C-6, IRCC14, HSSC14
Action C6/53: The Council agreed on the recommendation from the Secretary-General to refocus the function and the layout of a future MSDI portal. (deadline: C-7)	

IHO Strategic Plan 2021 - 2026 - Targets 2.1 and 2.3

At the IHO Assembly, the IHO Strategic Plan 2021-2026 was approved including three strategic goals. Each goal has targets and each target has a strategic performance indicator to measure the application of work programme items. The three targets of relevance to the MSDIWG are as follows:

   a. Target 2.1 (Build a portal to support and promote regional and international cooperation in marine spatial data infrastructures (MSDI)) of Goal 2

    b. Target 2.3 (Apply UN shared guiding principles for geospatial information management in order to ensure interoperability and extended use of hydrographic data in combination with other marine-related data) of Goal 2

    c. Target 3.1 (Collaborate with other bodies who deliver capacity building and training to improve effectiveness of capacity building activities and programmes) of Goal 3.

Two IRCC Workshops on SPIs were held in October 2021 and April 2022 and the results were shared at the MSDIWG14. The IRCC workshops concluded some recommendations for these SPIs, which includes keeping it simple and to use existing digital tools available at the IHO Secretariat as far as possible.

To measure the success of Target 2.1, it was approved at IRCC14 that an interim measure would be for the IHO secretariat to extract the number of accesses to the Map of National Geoportals annually and target to increase it over time. The MSDIWG members were encouraged to provide latest links to their respective MSDI portals. The IHO Secretariat also reported that in 2022 there were 461 visitors to the Map of National Geoportals. The MSDIWG14 meeting noted the interim measure and the longer-term solution agreed at C6 on the recommendation from the Secretary General to refocus Target 2.1 to global thematic layers of information genuine to the IHO scope such as those already provided in INToGIS.

The MSDIWG discussed the latest update on Target 2.1 and acknowledged the benefits of such a portal that would enhance data discoverability for the hydrographic community and our stakeholders. The discussions highlighted notable challenges such as the need to: (1) identify relevant and simple global thematic layers that will effectively contribute to the strategic goal 2 - increasing the use of hydrographic data for the benefit of society and (2) provide these data via existing platforms like INToGIS in the most efficient way without duplication of resources. The MSDIWG14 meeting noted the INToGIS functionalities and considering some of these global thematic layers could possibly be already available on other platforms and there is a need of two-way exchange between the hydrographic community and the wider marine or geospatial ecosystem, the Secretariat was invited to consider implementing an additional feature to the INToGIS, or relevant platform, which would allow external contributors to reach out to the IHO and contribute access to relevant thematic layers.

Considering the proposed revisions to Target 2.1 is subject to A-3 endorsement, the MSDIWG14 meeting agreed to wait for further direction from IRCC and revisit two relevant MSDIWG actions related to Target 2.1 after the outcome at A-3, namely building a data hub and the draft questionnaire.

The results of the Target 2.3 questionnaire issued via IHO Circular Letter on Member States' success in applying the UN shared guiding principles was presented at MSDIWG14. The MSDIWG 14 meeting noted 34 Members responded to the Circular and they are generally positive.

IHO C-17 v3.0 Update

Action IRCC14/7 - The MSDIWG was tasked to revise IHO C-17. The IHO C-17, Spatial Data Infrastructures: "The Marine Dimension's" main purpose has been to provide Guidance for Hydrographic Offices on establishing MSDIs. In recognition of the varying levels of MSDI maturity internationally, and to make relevant the IHO C-17 with the latest information and trends: IHO

Strategic Plan 2021 - 2026, IHO-OGC MSDI Concept Development Study, ongoing Federated MSDI pilot projects, reference materials from BoK, FAIR Principles, S-100 and the UN-GGIM documents including the Integrated Geospatial Information Management Framework for the water domain (IGIF-Hydro) Parts 1 and 2, the MSDIWG embarked on an update of the C-17 publication. A C-17 drafting team consisting of about 23 MSDI members, led by Italy (Nicola Marco Pizzeghello), Singapore (Pearlyn Pang) and USA (Caitlin Johnson) had regular biweekly meetings since August 2022 in addition to side discussions by editors and chapter team meetings led by chapter leads.

The updates were deemed significant enough to entail a version 3.0. There are two notable updates to the C-17 version 3.0:

a. It is set out to be a cookbook for HOs on not only establishing MSDIs but also advancing our MSDIs, addressing all levels of MSDI maturity and leaving no one behind. This gives newly established MSDIs a chance to keep abreast of future trends and to adopt the latest advances in technologies, standards and practices.

b. It underscores a "IGIF-aligned MSDI implementation", explaining the bridge between the MSDI 4 pillars to the UN-GGIM IGIF 9 strategic pathways and how HOs can apply these frameworks such that MSDIs can be integrated with the larger geospatial ecosystem. The marine domain is highly interconnected internally and with the terrestrial and atmospheric systems. In line with the IHO Strategic Goals 2021 - 2026, to address many of the environmental challenges, climate change and sustainable development, and increase safety and efficiency of port-to-port navigation, integrated marine spatial data is important.
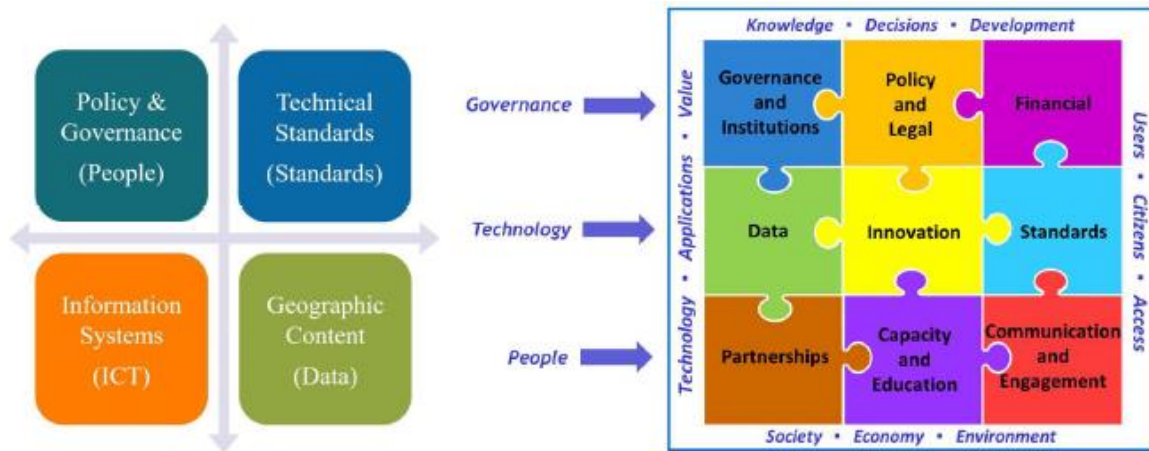

Figure 1: 4 Pillars of MSDI and the UN-GGIM IGIF 9 strategic pathways.

c. It is not intended to be prescriptive, but to highlight the recommended role of HOs for MSDIs and provide examples of good practices through case studies. A case study template was distributed and members were encouraged to submit case studies.

In promoting communication of MSDI, Germany (BSH) had also generously offered to produce and standardize infographics for the C-17. The draft C-17 version 3.0 was further refined at a

drafting breakout session at the MSDIWG14 involving all members present and post-meeting by the drafting team. To facilitate efficiency of minor updates to be incorporated, for instance new case studies, the MSDIWG requested the Secretariat to consider if an online interactive version of the C-17 is feasible in future. The update to C-17 was presented at the CBSC21 Intersessional Meeting. The C-17 version 3.0 in **Annex E** is submitted to IRCC15 for endorsement.

Application of ISO 9001 Principles to MSDI

Decision and Action C6/71 - The MSDIWG was tasked by IRCC to identify a theme where International Organization for Standardization (ISO) 9001 basic principles could be applied and be beneficial. Facilitated by presentations on data quality, the ISO 9001 Quality Management Systems and the 7 Quality Management Principles from Italy and Portugal, the MSDIWG14 discussed and agreed that the ISO publications and standards (ISO 9001:2015) can be used to certify and guide the quality of HOs MSDI development and implementation. The proposed application and benefits of the 7 QMPs from MSDI perspective are summarized in **Table 2** and detailed in **Annex F**. IRCC15's endorsement is sought for the application of 7 QMPs from MSDI perspective and its inclusion in the IHO C-17 version 3.0.

Table 2: Summary of ISO 9001 7 Quality Management Principles from MSDI Perspective

QUALITY MANAGEMENT PRINCIPLES (QMPs)	MSDI PERSPECTIVE
QMP 1 – Customer focus	All possible **users** are MSDI customers
QMP 2 – Leadership	MSDI needs a **strategic vision**, aligning policies, processes and data
QMP 3 – Engagement of people	Focusing people enables a **people centric** and not only data centric MSDI
QMP 4 – Process approach	MSDI data management **workflow** is composed of several individual trusted processes
QMP 5 – Improvement	MSDI is a long-term **change of view** and not an objective to achieve or a web portal
QMP 6 – Evidence-based decision making	MSDI **links** data and information to policy and governance
QMP 7 – Relationship management	Networking enables MSDI **shared knowledge**

Future of MSDI

    a. S-100 from MSDI Perspective

Decision IRCC14/28 - Facilitated by update from MSDIWG appointed S-100WG point-of-contact, Jonathan Pritchard, the MSDIWG14 meeting discussed the latest S-100 initiatives from a MSDI perspective. The MSDIWG14 produced a list of MSDI-relevant S-1xx product specifications as a starting point to engage responsible HSSC Working Groups and review the use of S-100 beyond navigation:

- Georegulation - S-121 (UNCLOS maritime Limits and Boundaries), S-122 (Marine Protected Areas)
- Water depth, level and movement - S-102 (Bathymetric Surface), S-104 (Water Level Information for Surface Navigation) and S-111 (Surface current)
- Certain feature classes within S-101 (e.g. Regulated Areas, Traffic Management, Restricted Area, Administrative Areas)
- Some parts of S-123 (Marine Radio Service) and S-127 (Marine Traffic Management)
- Metadata - S-128 (recording revision status and extents of available data)

Ongoing work by the S-102 Project Team on S-102 "for non-navigation" was raised as a potential priority product and something of which the MSDIWG could contribute expertise. For instance, by: (1) highlighting elements of S-100 that could be emphasized or broadened in order to enable MSDI use cases beyond navigational use; (2) identifying methods for dual production of datasets for both navigation and non-navigation use simultaneously. This includes framework level methodologies for extension, filtering and transformation of data. A new work item (E.5) for MSDIWG was added to support S-100 from MSDI perspective.

b. Digital Twins from MSDI Perspective

Action IRCC14/6 - MSDIWG was tasked to explore how MSDIs and HOs can be part of Maritime Digital Twins (DT) of the future. At MSDIWG13, the WG initiated discussions towards a common understanding of DT of the future. At MSDIWG14, the WG delved deeper and discussed the role of MSDIs for DTs of the future - as data producers, providers (enablers), and users (beneficiaries). MSDIs and HOs may not necessarily be creators of DT, but can be enablers of DT. A DT from the HO perspective could be characterized by:

- Dense, static and dynamic data spanning across the phenomena
- Combination of modeling and data analytics
- Inclusion of "Predictive" component(s) aiming to answer questions and estimate complex multi-variable behaviors, normally using some element of Machine Learning.
- Domain based, land, sea/oceans, buildings, ships, cities, healthcare, decarbonization

To prepare MSDIs to be "DT-ready" and provide "DT-ready" data, APIs and services, HOs can consider first the data required for the domain-based DT. S-100 and OGC API can provide a good baseline for many of the required datasets, for example, S-102, S-104 and S-111 Depth, Tidal/Water Level and currents) with good temporal support. Nevertheless, where HOs may not be data producers or owners of required (near) real-time data, collaboration and interfacing with data providers would be required, and this is where tapping on an established MSDI network, governance structure and system infrastructure would be beneficial. The MSDIWG14 meeting highlighted components to prepare MSDIs to support DTs of the future:

- Scalability of MSDI infrastructure
- Requirement to produce and/or provide data not currently within scope of national or regional MSDI
- Requirement to interface real-time sensors to existing MSDI
- Increased focus on data fidelity across the scope of the DT paired with interoperability

There are many benefits and demands from MSDI to support DTs, possibly from within the HO itself to enhance services and also from externally. As a potential platform to eventually assess the "readiness" of hydrographic data and MSDI to support DTs of the future, the MSDIWG14 encouraged members to join DITTO (https://ditto-oceandecade.org), an Ocean Decade Action, where best practices and common understanding of digital twins of various marine domains are discussed. The MSDIWG14 agreed to look further into how MSDI can be "DT-ready", our challenges and opportunities for innovation. A new work item (E.6) for MSDIWG was added to support MSDI to become DT-ready, and under the lead of the UN-GGIM Working Group on Marine Geospatial Information, some MSDIWG members (Netherlands, Singapore, USA, IIC Technologies and ESRI) volunteered to work on a draft project proposal to be jointly submitted to the IHO Innovation and Technology Laboratory.

MSDIs are evolving from a data infrastructure to a knowledge infrastructure and enabling and benefiting from DTs would be one of the many ways MSDIs would drive marine knowledge.

FAIR principles

Action IRCC14/5 - MSDIWG was tasked to provide guidance on FAIR (Findable, Accessible, Interoperable, Re-usable) data principles and a checklist. The MSDIWG14 noted various examples of existing applications of FAIR principles to data management practices and provision in MSDIs. OGC shared recent developments of FAIR+, otherwise known as FAIR-TLC, which includes three additional principles, also relevant in the marine domain: traceability, licensure, and connectedness. The MSDIWG14 noted its relevance, its inclusion in the draft C-17 v3.0, and agreed that the OGC should build on Norway's FAIR principles parameters to incorporate the FAIR+ principles into a FAIR(+) principles checklist to be submitted to IRCC when completed.

4. Problems Encountered

IRCC9/18 - RHC Chairs to encourage Member States in the region to nominate RHC MSDI Ambassadors to promote MSDI and to help Member States to prepare the national reports with respect to the status of MSDI. A majority of RHCs have now, or are in the progress of, establishing RHC MSDIWGs. At the IHO MSDIWG14 meeting, 5 RHCs gave regional presentations of the work and challenges of MSDI from a regional perspective. For more information, see https://iho.int/en/msdiwg14-2023. However, members expressed the challenge of limited resources, resulting in hindered progress of RHC MSDIs.

The important role of the appointed RHC MSDI ambassador was highlighted to address this challenge and was discussed to fundamentally entail updating RHCs and/or RHC MSDIWG on

the IHO MSDIWG latest discussions and actions, vice versa. To create a more proactive approach to support RHC MSDIs and enhance cooperation, a three-steps approach was agreed at MSDIWG14:

(1) Gather the number of active RHC MSDI WGs and their MSDI ambassadors
(2) Encourage all to update list of SDI and MSDIs
(3) Create a procedure for cooperation to enable our MSDI ambassadors. For instance, guidance on how to support two-way sharing between RHCs and IHO MSDIWG, for MSDI to remain a standing agenda item in RHC and MSDIWG, exchange of RHC MSDI use-cases using template provided under the MSDIWG BoK, template for status report, and sharing of resources and capacity building.

At a time when national and regional SDIs/MSDIs and geospatial programs are being developed worldwide, along with the upcoming suite of S-100 products for navigation and beyond, coordinated access and management of geographic information through the RHC remains important. Besides regional MSDI ambassadors, the establishment of regional MSDIWGs and the provision of annual RHC MSDI reports to the MSDIWG meetings would facilitate the gathering of member states approaches and to enable a coordinated approach to marine and maritime geographic information. Existing RHC MSDIWGs have demonstrated the benefits of such coordination, especially with the sharing of resources for MSDI establishment and capability development. RHC MSDIWGs can also now consider the latest trends discussed at the MSDIWG14 meeting in their respective region's context.

5.   Any Other Items of Note

MSDI Training Materials and Capacity Building

IRCC10/10 - The MSDIWG was tasked to develop basic MSDI training material in order to allow RHCs to deliver training with their own personnel. MSDI has been highlighted as an important component of the future development of HOs and since then, Denmark sponsored the production of MSDI Training Materials - MSDI Orientation (Presentation and Training Booklet) and MSDI Fundamentals (Presentation and Training Booklet) and made them available free-of-charge to all IHO Member States at the IHO web page under MSDIWG Body of Knowledge https://iho.int/en/body-of-knowledge, and as an interactive e-learning material downloadable via YouTube and accessible via the IHO e-learning center.

MSDIWG13 invited WG members to review the available e-learning training materials and the results were presented by Germany, Singapore and Portugal at MSDIWG14. With the upcoming update to IHO C-17 v3.0, MSDIWG14 noted the need to prepare for an update to MSDI training materials which presently focus on high-level MSDI 4 pillars, and that this feedback gathered 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 9 strategic pathways. The MSDIWG14 agreed on a two-step approach: (1) to consolidate key topics (e.g. communicate what IGIF means for HOs, outline MSDI maturity, guidance on how to build and/or maintain a MSDI team), and (2) to produce new training materials.

<u>WEND100 Principles from an IGIF Approach</u>

MSDIWG noted that the WEND100 matrix is a diagnostic tool or litmus test for RHCs to consider the IGIF 9 strategic pathways when making a S-100 product or MSDI. MSDIWG14 invited RHCs to try this matrix out on their MSDIs and share the results and experience at the next MSDI meeting or when ready.

6. Conclusions and Recommended Actions

In line with the IHO Strategic Goals 2 and 3 (2021 – 2026) in particular, and increasing attention on the Oceans in this UN Decade of Ocean Science and 2030 Agenda, expectations from MSDIs have been increasing and our growing membership is testament to that.

The MSDIWG has benefitted from exchange of knowledge from diverse members and connections. The MSDIWG14 meeting was the fourth time the three working groups – the MSDIWG, the UN-GGIM Working Group on Marine Geospatial Information and the OGC Marine Domain Working Group – have come together for our annual meetings. Collectively, with diverse participants from government, academia and industry, we address the "why" marine spatial data matters, "what" we have and what is required and "how" we can achieve them. The MSDIWG14 meeting also welcomed representatives from ISO, and holistic standards discussion befitting for the broad challenges MSDIs faced were possible with all three standards developing organizations present.

The MSDIWG recognizes the need to continuously share and review good practices to help newly establishing MSDIs jumpstart their developments and close the gap, leaving no one behind. At the same time, for MSDIs to remain relevant to the broader water domain and geospatial ecosystem, we must also think ahead and innovate together with our stakeholders on trends and future trends such as Digital Twins.

Action required of IRCC refer to report item 8.

7. Justification and Impacts

No additional items to report.

8. Action Required of IRCC

The IRCC is invited to:

a.   endorse MSDIWG Terms of Reference version 2.0

b.   endorse IHO C-17 version 3.0

c.   endorse application of ISO 9001 7 Quality Management Principles from MSDI Perspective and for inclusion into IHO C-17 version 3.0

d.   appoint RHC MSDI ambassadors and inform the MSDIWG with contact details

e.   note the report and give guidance on way forward

Marine Spatial Data Infrastructures Working Group (MSDIWG)
Membership List
(Updated 2 April 2023)

Member States	Name	E-mail
Argentina	Silvia Beatriz CHOMIK	fraymundo(*)hidro.gov.ar
Australia	Phillippa BRICHER	phillippa.bricher(*)defence.gov.au
Brazil	Ricardo FREIRE	ricardo.freire(*)marinha.mil.br
	Christopher FLORENTINO	christophersjc(*)yahoo.com.br
Canada	Chris HEMMINGWAY	chris.hemmingway(*)dfo-mpo.gc.ca
	Jean-François BEAUPRÉ	jean-francois.beaupre(*)canada.ca
Cuba	Ramón PADRÓN DÍAZ	hg(*)unicom.co.cu
Denmark	Christian THELLUFSEN	chthe(*)gst.dk
Estonia	Peeter INGERMA	peeter.ingerma(*)vta.ee
Finland	Juha TIIHONEN	juha.tiihonen(*)traficom.fi
France	Eric LE GUEN	eric.le.guen(*)shom.fr
Germany	Jens SCHRÖDER-FÜRSTENBERG	Jens.Schroeder-Fuerstenberg(*)bsh.de
India	PP CHAKRABORTY	ia-inho(*)navy.gov.in
Indonesia	TRISMADI	trismadi(*)gmail.com
	DYAN PRIMANA SOBARUDDIN	dyanmaxp(*)gmail.com
	Mohammad Qisthi AMARONA	qisthi.amarona(*)gmail.com
Italy	Nicola PIZZEGHELLO	nicolam.pizzeghello(*)marina.difesa.it
	Manuela MILLI	manuela_milli(*)marina.difesa.it
	Ilaria TANI	ilaria.tani(*)unimib.it
	Alessandra SAVINI	alessandra.savini(*)unimib.it
Iran	Ali KOUROSH NIYA	Alikouroshniya(*)gmail.com
Japan	Yoshiharu NAGAYA	ico(*)jodc.go.jp
Lebanon	Afif Ghaith	Ghaithafif(*)gmail.com
Malaysia	Kamaruddin Bin YUSOFF	kama(*)hydro.gov.my
Nigeria	Olumide Olajide FADAHUNSI	info(*)nnho.ng jide_fadahunsi(*)yahoo.com
Netherlands	Ellen VOS	em.vos(*)mindef.nl
New Zealand	Rachel GABARA	rgabara(*)linz.govt.nz
Norway	Gerhard HEGGEBO	gerhard.heggebo(*)kartverket.no
Philippines	Rosalino DELOS REYES	noly_reyes(*)yahoo.com
Portugal	Telmo Geraldes DIAS	geraldes.dias(*)hidrografico.pt
Republic of Korea	Jun-Shik LEE	ljs7979(*)korea.kr
	Namhoon KIM	kimnhoon(*)korea.kr
Romania	Andrei Răzvan LUCACI	andrei.lucaci(*)dhmfn.ro
	Lucian DUTU	lucian.dutu(*)dhmfn.ro
Slovenia	Vesna Dežman	Vesna.Dezman(*)gis.si
Spain	Alberto FERNÁNDEZ ROS	ihmesp(*)fn.mde.es
Singapore	Lawrence CHEW	lawrence_chew(*)mpa.gov.sg
Thailand	Rittidate KATETONG	hydrotech(*)navy.mi.th
Ukraine	Oleg MARCHENKO	chart_dpt(*)charts.gov.ua
UK	James CAREY	james.carey(*)ukho.gov.uk
USA	Sebastian CARISIO	sebastian.p.carisio(*)nga.mil ngamaritimemsdi(*)nga.mil
	Caitlin JOHNSON (**Chair**)	caitlin.s.johnson(*)nga.mil
Expert Contributors	**Name**	**E-mail**
Buji Bui Inc.	Neehar KARNIK	neehar.karnik(*)bujibui.com
Consultant	Roger LONGHORN	ral(*)alum.mit.edu

ESRI	Rafael PONCE	rponce(*)esri.com
	Lars BEHRENS	l.behrens(*)esri.de
GEBCO Seabed 2030	Jamie MCMICHAEL-PHILLIPS	director(*)seabed2030.org
Geosciences Australia	Jonah SULLIVAN	jonah.sullivan(*)ga.gov.au
H2i	Denis HAINS	dhains(*)h2i.ca
IIC Technologies Inc	Edward KUWALEK	edward.kuwalek(*)iictechnologies.com
	Jonathan PRITCHARD	jonathan.pritchard(*)iictechnologies.com
ICPC/EGS Group	Antonio BADAGOLA	abadagola(*)egssurvey.com.br
INEGI Mexico	Mario Angel JAHUEY AMARO	mario.jahuey(*)inegi.org.mx
Linker Technologies	Sasha DOSS	sdoss(*)lynkertech.com
OceanWise	Mike OSBORNE	mike.osborne(*)oceanwise.eu
	John PEPPER	john.pepper(*)oceanwise.eu
OGC	Trevor TAYLOR	ttaylor(*)opengeospatial.org
	Scott SIMMONS	Ssimmons(*)opengeospatial.org
PAIGH- Honduras	Yidda HANDAL	Yiddahandal(*)gmail.com
SevenCs	Friedhelm MOGGERT-KAEGELER	mo(*)sevencs.com
Teledyne CARIS	Peter SCHWARZBERG	peter.schwarzberg(*)teledyne.com
	Andy HOGGARTH	andy.hoggarth(*)teledyne.com
	Juan CARBALLINI	juan.carballini(*)teledyne.com
	Trish BURTON	trish.burton(*)teledyne.com
	Julien Barbeau	julien.barbeau(*)teledyne.com
YottaOcean Inc.	Gigab HA	gigab.ha(*)yottaocean.com
IHO Secretariat	**Name**	**E-mail**
Assistant Director	Leonel MANTEIGAS (**Secretary**)	leonel.manteigas(*)iho.int

Annex B

MSDIWG-9-10C

IHO Marine Spatial Data Infrastructures Working Group (MSDIWG)
DRAFT WORK PLAN 2021–2024

MSDI Tasks

A	Communication and dissemination
B	Operational - Data sharing and management
C	Policies and governances – RHC. (Ensure that MSDI is a standing agenda item for RHCs' meetings (IHO Res 2/1997, as amended, refers))
D	Standards (OGC and HSSC)
E	Innovation – Future perspectives (2021 - 2030)
F	Training and education
G	Maintain and extend the publication IHO MSDI C-17 (IHO Task 3.9.2.1 refers)
H	Conduct annual meetings of MSDIWG, arranged back to back with 1-day MSDI Open Forum (IHO Task 3.9.1 refers)

No	Work item	Priority H-high M-med L-low	Milestones	Start Date	End Date	Status P-planned O-ongoing C-completed	Responsible / contact person(s)	Related Pubs / Standard	Remarks
A.1	Implement MSDI and MSP Maturity Assessments (national and regional) to enable consistent reporting from MS through RHC to IRCC.	H	1. Evaluate available template's 2. Decide on template. 3. Promote template to use.	2021	2022	P	USA (NGA)		
A.2	IHO Strategy Goal 2.1. Build a portal to support and promote regional and international cooperation in marine spatial data infrastructures (MSDI).		1. Investigate the different possibilities 2. Gather information and evaluate IHO MS user needs 3. Prepare a proposal for IRCC approval 4. Build a portal	2021	2024	P			
A.3	Develop and provide guidelines on MSDI implementation.	M	1. Guidelines in place based on outputs from tasks B1-3: C2	2017	2022	O	?		

A.4	Develop MS or RHC relevant Case Studies. Ref: C2	M	1. Arctic Region 2. Baltic Region 3. Brazil 4. East Asia Region	2017 2017 2018 2018	2022	P	USA Denmark Brazil Korea		Status? 1. Completed. Template available on MSDIWG BoK.
B.1	Create an implementation "roadmap" template for MSDI (at national and/or regional level)	H	1. Gather information 2. Compile information 3. Publish template for implementation	Mar 17	Dec 18	O	IIC Esri USA, (NGA)		USA (NGA) Comment: Ref. IGIF Implementation Guide
B.2	Identify core data for input to MSDI to support multiple applications [Ref: B1]	M	1. Marine Cadastre 2. Emergency Response 3. Coastal Zone Management	Mar 17	2023	O			
B.3	Identify wider user requirements for bathymetry data	H	1. Develop primary use case for Arctic Bathymetry SDI 2. Update concept development study ($) 3. Propose test-bed 4. Build test-bed ($)	2017	2022	O	OGC USA (NGA)		MSDI-CDS Complete 2019
B.4 New			1. Identify marine science and/or oceanographic data themes that could require integration with hydrographic data						
C. 1	Alignment with UN-GGIM IGIF and IHO MSDI C-17	H	1. Compare the two foundation concepts 2. Define the HO perspective 3. Propose changes to C-17	2021	2022	O	C-17 Drafting Team		
C. 2 New	Cooperation with RHC MSDIWG		1. Identify and list RHC MSDIWG MS and Chairs. and MSDI Ambassadors 2. Create procedures for cooperation	2021	2024	P	ARMSDIWG, SWPHC MSDIWG,		
C.3	Develop a governance model for MSDI	M	1. Deliver best practice governance models to BoK (Ref: B3)	2017	2022	O	Denmark USA (NGA)		USA (NGA) Comment: Ref. IGIF

17

										Implementation Guide, Strategic Pathway 1
C.4	Data Sharing and Publishing Licence	M	1. Provide updated licensing models and templates as 'best practice' to MSDI BoK	2018	2024	O	NZ, USA, OceanWise, Indonesia, Malaysia Esri			
C.5 New	Outline Data Principles MSDI to consider		1. Recommend application of ISO9001 principles from MSDI perspective. 2. Produce FAIR principles checklist. 3. Note WEND100 principles and matrix for MSDI	2022	2024	O	Italy, Norway, OGC Marine DWG WENDWG			
D.1	Identify relevant standards to support MSDI implementation and operation.	H	4. Provide annual reports to IRCC and HSSC 5. DGGS (Ref: B3)	Jun 17	2022	O	OGC Marine DWG			
D.2 New	Assess the suitability and shortcomings of standards in supporting data interoperability.	M	1. Identify standards relevant to bathymetry (Ref: B3) 2. Marine Cadastre 3. Oceanography 4. Opportunities with HSSC/S-100 during decade of implementation. (To identify the best opportunities to use S-100 in MSDI as well as interoperability with OGC API Standards.)	2018	2024	O	OGC Marine DWG (inc: Portugal)			
D.3 new	Cooperate with the OGC MSDI Pilot		1. Participate in and Promote the OGC Pilot Project 2. Assess output from the OGC Pilot 3. Evaluate relevance and implications from a HO perspective	2021	2023	O				

			4. Take appropriate actions as necessary						
E.1	Identify and report on the future trends affecting MSDI e.g. autonomous platforms, standards, big data, cloud, internet of things and artificial intelligence.	M	1. Information gathering (Horizon Scanning) 2. Publish White Paper (inc: PPP)	2018	2024	O	Esri OceanWise USA Portugal Caris		
E.2	Establish an IHO MSDI Vision for 2030.	L	1. Prepare draft Position Paper ("think piece") to include technologies, methodologies, sustainability 2. Align with other Visions 3. Align with IHO Strategic Roadmap for S-100	2018	2022	O	OceanWise UK US (NGA)		
E. 3. New	Identify challenges, options and solutions in relation to data security and integrity from a HO MSDI perspective		1. Information gathering (Horizon Scanning) 2. Reporting to IHO MSDIWG 3. Evaluate input to C-17 and IHO bodies/WG 4. Investigate possibilities with Blockchain based system for assuring data integrity. 5. Take appropriate actions as necessary	2021	2023	P			
E. 4. New	Corporation with IHO-Singapore Innovation and Technology Laboratory		1. Identify the different IHO MS user needs with relation to future trends affecting MSDI (E.1) 2. Discuss how IHO MS can participate in the work of IHO innovation lab 3. Report back to IHO MS	2021	2024	O	UNGGIM WG MGI, OGC Marine DWG, Singapore, Netherlands		
E.5 New	Identify and assess elements of S-100 which could be emphasised or broadened to enable MSDI use-cases	L	1. Review the use of S-100 products beyond navigation.(through	2023	2026	P			

			2. Identify which elements of S-100 could be emphasized or broadened in order to enable MSDI use cases beyond navigational use. 3. Contact regional MSDI Working group via the Regional Commissions to assess possible S-1xx Product Specifications candidates extension themes (beyond navigational use). 4. Provide recommendations to relevant subordinate bodies of HSSC and IRCC. ● ●						
E.6 New	Support MSDI to become Digital-Twin ready	M	1. Contact and advice the regional MSDI Working group via the Regional Commissions to identify potential Digital Twin requirements. 2. Create questionnaire to HOs on DT data, service and/or infrastructure requirements. 3. Assess the provided DT requirements, prioritise them and report to Regional Commissions for further action.	2023	2026	P			
F.1	Develop and maintain training syllabi	M	4. Review and update in line with relevant developments, methods and content	2018	2022	C	Denmark IIC		
F.2	Support development and delivery of e-learning platforms	L	1. Coordinate activities with East Asia (KHOA)	2018	2023	O̶	Esri		

			2. Compile list of existing e-learning modules relevant to MSDI			C	OceanWise KHOA		
F.3	Develop a MSDI communications plan for MSDI BoK	M	1. Identify the need, audience and focus 2. Report findings 3. Deliver Plan	2018	2020	P	IHO NZ(LINZ) Netherlands US (NOAA)		
F.4 New	Update MSDI Training Materials	M	1. Review existing MSDI training materials 2. Identify users of the MSDI training materials 3. Identify content to be included in update of MSDI training materials.	2023	2026	O			
G.1	Maintain IHO publication C-17 to reflect developments in ICT, Content, Standards and Governance of MSDI	H	4. Manage content 5. Create a Wiki 6. Request IRCC remove document from IHO Res: 2/2007 7. On-line dynamic content	2017	2020	O	OceanWise Esri USA Denmark Germany Portugal		V2.0 now approved by IRCC
G. 2	Update C-17 in accordance with BX (UN-GGIM/IGIF)		1. Create a C-17 drafting team 2. Identify the need for changes 3. Evaluate the structure of C-17 with IHO MSDIWG members. 4. To send out a questionnaire to IHO MS and RHC's. 5. Update C-17.	2021	2023	O	C-17 Drafting Team		
H.1	Conduct 2019 -21 meetings of MSDIWG, arranged back to back with MSDI Open Forum, OGC Marine DWG and UN-GGIM MGI WG meeting	H	1. Date and venue defined 2. Logistics in place 3. Open Forum program defined 4. Develop content for DWG workshops	2017	2024	C	MSDIWG Management Group (Chair/Vice Chair, Sec, IHB)		2021 – Singapore 2022 -? 2023 - ? 2024 -?

21

LIST OF ACTIONS FROM THE MSDIWG14 MEETING 2023

Action N.	Action Items (agenda item)	Responsible	Deadline	Status
04/2017	Action 4/2017: Submit an updated paper to HSSC11 outlining further development and implementation of DGGS.	OGC Marine DWG	2023	OGC Marine DWG investigating delivery of this.
04/2018	Action 4/2018: MSDI case studies: provide 500- word (maximum) examples for MSDI BoK.	Malaysia, Indonesia, RoK, USA	March 2020	Closed
19/2018	Action 19/2018: Include "economic impacts" of MSDI with respect to hydrography in the MSDI BoK. MSDIWG Members to send relevant reports and case studies for BoK.	All, IHO Secretariat	December 2019	Members invited to send relevant reports and case studies to the IHO Secretariat Ongoing
04/2019	To investigate the development of a "Guide on Standards for the Common People" to be made available in the BOK (6)	OGC Marine DWG	April 2019	Closed – refer to UN-GGIM standards Guide ed 3
05/2019	To add the OGC "Guide on Standards for the Common People" in the BOK from Action MSDIWG10/04 (6)	IHO Secretariat	May 2019	Closed – refer to UN-GGIM standards Guide ed 3
06/2019	To share MSDI use cases as they are developed by the EAHC/MSDIWG and report the status to the MSDIWG (7)	EAHC MSDIWG	MSDIWG11	Investigate. Members welcomed to share MSDI use-cases
10/2019	To investigate how to make the e-learning developed by Denmark in the EAHC TRDC e-learning platform hosted by ROK (10)	ROK, Denmark September	2019	Done
14/2019	To develop an outreach strategy considering the target audience and the means to do it and report back to MSDIWG (11.1.1)	MSDIWG Chair/Vice-Chair	MSDIWG14	Awaiting. MSDIWG can reference the CSBWG outreach materials. We should try to investigate and see how we can

				investigate outreach activities.
19/2019	To submit a paper to HSSC on data integrity for MSDI with a precise description of the problem to be solved (11.2)	OGC Marine DWG	HSSC12	Closed
23/2019	To prepare a paper to submit the template on maturity assessment produced under Agenda MSDIWG10/22 to IRCC (11.3.1)	MSDIWG Chair	IRCC11	Closed
24/2019	To investigate the possibilities for the development of an online living C-17 publication (12.1)	MSDIWG Chair, Vice Chair and IHO Secretariat	MSDIWG14	Ongoing
25/2019	To investigate the incorporation of the living C-17 to the IHO website infrastructure (12.1)	IHO Secretariat	MSDIWG14	Ongoing
26/2019	To consider the draft C-17 produced under Actions MSDIWG10/25 and to submit to IRCC12 (12.1)	MSDIWG11	MSDIWG12	Closed
01/2020	To draft a CL on MSDIWG11 outcomes (CDS, questionnaire, video)	IHO Secretariat	MSDIWG12	Closed
03/2020	To update the BoK with the list of marine themes.	IHO Secretariat	MSDIWG14	Ongoing
9/2020	To send questions from MSDI Maturity Assessment Survey out to MSDIWG MS for comment.	VC/MSDIWG	MSDIWG12.	Closed
10/2020	Investigate distribution options for MSDI Maturity Assessment Survey.	C & VC/MSDIWG	MSDIWG12.	Done
11/2020	Possibly turn MSDI Maturity Assessment Survey in to IHO Online Form.	VC/MSDIWG, IHO Secretariat	MSDIWG12.	Closed
12/2020	Release MSDI Maturity Assessment to IHO and share with UN-GGIM WG-MGI.	C & VC/MSDIWG, IHO Secretariat	MSDIWG12	Done
13/2020	Update to C-17 to be included in MSDIWG work plan and investigate a new format (e.g. Wiki). Include IGIF in update of C-17 (crosswalk)	C/MSDIWG, CoChair UN-GGIM WG-MGI	MSDIWG14	Awaiting
14/2020	Establish a drafting group for C-17.	C/MSDIWG	MSDIWG14.	Awaiting

16/2020	Investigate possibilities for funding for enhancements to training material.	C/MSDIWG	MSDIWG12	Closed
17/2020	Create Spanish version and French versions for enhancements to training material.	IHO Secretariat	MSDIWG13	Closed All materials transferred to IHO e-learning center team
19/2020	To work on the landing page (i.e. home page) for training material.	MEX, IHO Secretariat	MSDIWG12.	Closed
20/2020	How to investigate the possibility of train the trainee for MSDI training material.	C/MSDIWG IHO Secretariat	MSDIWG12	Closed
21/2020	Submit the MSDI use cases to the UN-GGIM/WGMGI.	IHO Secretariat	MSDIWG12	Done
22/2020	Developing the MSDI use cases in a future revision of the IHO publication C-17	C-17 Drafting Group	MSDIWG14	Awaiting
23/2020	Template framework for MSDI use cases in MSDI BOK	NZL, VC/MSDIWG, IHO Secretariat	MSDIWG13	Done
28/2020	Create use cases for MSDI-supportable UN SDGs identified by MSDIWG breakout group.	CAN, GBR, BRA	MSDIWG13	
29/2020	Visualize/describe governance model in C-17, training material and body of knowledge.	C & VC/MSDIWG, IHO Secretariat	MSDIWG14	Awaiting
30/2020	Update MSDIWG ToR with C-17 maintenance	C/MSDIWG & IHO Secretariat	MSDIWG13	Done To submit to IRCC15
31/2020	IHO Strategic Plan 2.1: Build a portal to support and promote regional and international cooperation in marine spatial infrastructures (MSDI).	C & VC/MSDIWG, IHO Secretariat	MSDIWG12	Ongoing
32/2020	IHO Strategic Plan 2.3: Apply UN shared guiding principles for geospatial information management in order to ensure interoperability and extended use of hydrographic data in combination with other marine-related data.	C & VC/MSDIWG, IHO Secretariat	MSDIWG12	Done Following WEND 100-Matrix
33/2020	Value proposition statement prepared for MSDI MS who have not yet engaged in the process (1 page)	OceanWise, OGC	MSDIWG13	Closed

1/2021	To investigate if status of national MSDI implementation in the national reports, could use the NZ matrix as a new starting point?	C/MSDIWG, NZL	MSDIWG13	Closed
2/2021	To circulate the Arctic SDI Governances documents to the MSDIWG MS	C/MSDIWG & C/ARMSDIWG	MAR 2021	Done https://arctic-sdi.org/documents/strategic-documents/ and Body of knowledge.
3/2021	C/MSDIWG should include Arctic SDI Governance document in MSDIWG report to IRCC			Done
4/2021	To give a presentation of the FAIR principles at the next MSDIWG meeting	C/MSDIWG	MSDIWG12 (in person OCT)	Closed
5/2021	IHO Secretariat to circulate Draft Work Plan 2021 – 2024 to MS	IHO Secretariat	MAR 2021	Done
6/2021	MSDIWG MS to comment and indicate their participation in the Draft Work plan	MSDIWG MS	APR 2021	Done
7/2021	IHO Secretariat to circulate Draft updated Action list to MS	IHO Secretariat	MAR 2021	Done
8/2021	MSDIWG MS to comment and indicate their participation in the Draft updated Action list	MSDIWG MS	APR 2021	Done
9/2021	Circulate IGIF-H (when available) to MSDIWG MS for comment.	C/UN-GGIM WG-MGI &C/MSDIWG	Pending	Closed
1/2021	Make proposal/paper to IRCC linking MSDI and S100 implementation beyond Safety of Navigation. Circulate to MSDIWG MS for comment.	C/MSDIWG, IIC	IRCC13	Closed
12/2021	Send out draft UN-GGIM Standards Guide Ed. 3	SGP	MAY 2021	Done
13/2021	MSDIWG MS invited to comment on draft UNGGIM Standards Guide Ed. 3	MSDIWG MS	MAY 2021	Done

14/2021	Review MSDIWG action list for ideas to participate in the joint IHO-Singapore Innovation and Technology Lab. -e.g. development of automatic data harvesting prototype for marine spatial data (ref. Arctic SDI project)	C/MSDIWG, SGP	JUN 2021	Done
15/2021	Investigate how MSDIWG can provide information to IHO e-Learning Project team	C/MSDIWG,	IIC JUN 2021	Done
16/2021	Investigate funding to update IHO e-Learning resources	C/MSDIWG	JUN 2021	Done
1/2022	Nominate contact points from Data Quality WG, NIPWG and S100WG to report back to MSDIWG on relevant MSDI matters	S100WG – OGC MarineDWG/IIC Technologies	MSDIWG14	Awaiting
2/2022	Compile list of relevant S-1xx products point of contacts		MSDIWG14	The contact point to S-1XX (Jonathan Pritchard) Done MSDIWG14
3/2022	MSDIWG to identify the S-1xx products that could be relevant for MSDI users		MSDIWG14	Done MSDIWG14
4/2022	SWPHC MSDI WG to update terms of reference on making data in line with the UN SDG goals and UN Shared Principles	SWPHC Chair/UK and MSDIWG	MSDIWG14	SWPHC MSDI should set the pace
5/2022	MSDIWG and UNGGIM WG MGI to work together to identify common use-cases for bathymetry data residing in DCDB and Seabed 2030	MSDIWG and UN-GGI WG MGI	MSDIWG15	Done MSDWIG14
6/2022	MSDIWG to identify use-cases of crowdsource bathymetry	MSDIWG	MSDIWG14	Done MSDWIG14
7/2022	MSDIWG to test the MSDI Training Materials on the IHO e-learning portal (https://elearning.iho.int)	MSDIWG	MSDIWG14	Done
8/2022	OGC to provide guideline or Recipe Book and showcase(s) for Hydrographic Offices to implement OGC APIs	OGC Marine DWG	MSDIWG14	Necessary to liaise with OGC or they will forget (Chair)

9/2022	OGC API - Feature Link to be made available to Body of Knowledge	OGC Marine DWG	MSDIWG14	Necessary to liaise with OGC or they will forget (Secretary) TT
10/2022	OGC to provide presentation on OGC APIs for MSDIs at MSDIWG14	OGC Marine DWG	MSDIWG14	Done
11/2022	OGC to share links to latest OGC APIs for dissemination to MSDIWG	OGC Marine DWG, IHO Secretariat	MSDIWG14	Necessary to liaise with OGC or they will forget (Secretary)TT(09/2022)
12/2022	OGC to provide draft guidance on how to follow the FAIR principles from HO perspective	OGC Marine DWG	MSDIWG14	Necessary to liaise with OGC or they will forget (Chair) It is necessary to report to IRCC15 (IRCC14/Action 5)
13/2022	MSDIWG to follow-up on IRCC14's outcomes of the IRCC Workshop and suggest how MSDI could contribute to SPI 2.3.1	MSDIWG Vice-Chair	MSDIWG14	Done
14/2022	MSDIWG to explore practical approach or best practices on principles for MSDIs	MSDIWG Vice-Chair	MSDIWG14	Template in the BoK, revisit it (Chair and Vice-Chair) – include in C-17
15/2022	MSDIWG to include proposed FAIR principles checklist to be included in report.	OGC Marine DWG; Norway	MSDIWG14	Necessary to liaise with OGC or they will forget (Chair)
16/2022	MSDIWG to establish a C-17 Drafting Team	MSDIWG Vice-Chair USA (NGA) Italy	August. 2022	Done
17/2022	C-17 Drafting Team to provide a first version at MSDIWG14	MSDIWG Vice-Chair USA Italy	MSDIWG14	Done
18/2022	MSDIWG to investigate the role of MSDI in Maritime Digital Twin, how to proceed and the possibility to establish a pilot project together with the IHO-Singapore Innovation and Technology Laboratory with Singapore as a pilot study area. Status Report to be provided at MSDIWG14.	MSDIWG Chair and Vice-Chair Netherlands IHO-Singapore Innovation Technology Laboratory OGC Marine DWG	MSDIWG14	Awaiting The DT is created necessary to meet, invite more members, establish a plan and liaise with IHO Lab.

19/2022	MSDIWG to provide feedback on WENDWG's WEND Product Matrix from MSDI perspective when deemed appropriate.	WENDWG Chair, IHO Secretariat	MSDIWG14	Done
20/2022	UKHO to provide relevant S100 guideline from MSDI perspective that could be made available on BoK.	UKHO, MSDIWG Chair and Vice-Chair	MSDIWG14	Closed
21/2022	OGC FMSDI S-122 Engineering Report to be made available to the MSDIWG when made public	MSDIWG Chair OGC	August 2022	Awaiting Dependent on the availability of the Report (Chair)
22/2022	An expert group to explore MSDIWG's task related to Target 2.1 Build a portal to support and promote regional and international cooperation in marine spatial data infrastructures (MSDI). Step 1: Make data that is already available into INToGIS and Step 2: establish a hub	MSDIWG Chair and Vice-Chair, ESRI	MSDIWG14	On hold Meeting within the IHO Secretariat in September? (Secretary)
23/2022	Recommendation for Step 2: establish a hub, to be submitted at MSDIWG14	ESRI	MSDIWG15	On hold – A-3 Have input from ESRI. (Vice-Chair)
24/2022	An online workshop to be convened to further discuss Step 2: establish a hub for Target 2.1 Build a portal to support and promote regional and international cooperation in marine spatial data infrastructures (MSDI).	MSDIWG Chair and Vice-Chair, ESRI	MSDIWG15	On hold – A-3 First is necessary to have the information from ESRI about the concept, requirements for implementation and evaluation cost/benefit
25/2022	Hosting the MSDIWG14 and coordination with the UN-GGIM Working Group on Marine Geospatial Information and OGC Marine DWG on back-to-back meetings.	IHO Secretariat MSDIWG Chair and Vice-Chair Italy	MSDIWG14	Done
26/2022	Hosting the MSDIWG15 and coordination with the UN-GGIM Working Group on Marine Geospatial Information and OGC Marine DWG on back-to-back meetings.	IHO Secretariat MSDIWG Chair and Vice-Chair Indonesia	MSDIWG15	Secretary will liaise with Indonesia to define the venue at MSDIWG15.

01/2023	Submit the amended Terms of Reference to IRCC15.	MSDIWG Chair	IRCC15	
02/2023	WG to consider and discuss "MSDI Vision for the Future"	MSDIWG	MSDIWG15	
03/2023	WG to continue to consider "What does S-100 mean for MSDI? What role can MSDI play in S-100?"	MSDIWG Chair and Vice-Chair, S-100 PoC	MSDIWG15	Reach out to S-102 project team as part of reviewing the uses of S-100 beyond navigation
04/2023	WG to investigate with the IHO Secretariat the possibility to incorporate a function on INToGIS for other communities to contact and contribute with marine-related spatial data	IHO Secretariat	MSDIWG15	
05/2023	Members invited to send or update the links to national SDI/ MSDI portals to the MSDIWG Secretary	MSDIWG	MSDIWG15	
06/2023	Provide Policy and Legal case study for C-17	Italy	June 2023	
07/2023	Provide link to authoritative data paper and ensure alignment in C-17	C-17 Drafting Team		UN-GGIM Policy and Legal Framework WG paper
08/2023	Provide presentation about Marine Base Map land/sea data continuity solutions	RoK	MSDIWG15	
09/2023	Share FAIR Principles Guide when it becomes available	Norway		
06/2022 10/2023	Share Data Value Proposition leaflet with MSDWIG	SWPHC MSDIWG		
11/2023	Create a list of RHC MSDI WGs and MSDI ambassadors	IHO Secretariat	MSDIWG15	
12/2023	Develop "Best-Practices" or "Rules of Procedure" document for engaging regional MSDI Working Groups and detail operational successes; possibly reference IHO MSDIWG Case Study Template on MSDIWG BoK	MSDI Ambassadors -Australia, USA (NGA), Italy, Portugal, Denmark		
13/2023	Develop status (active/ non-active) survey for regional MSDI Working Groups to get a sense of the level of activity in each	MSDI Ambassadors -Australia, USA (NGA), Italy, Portugal, Denmark		

14/2023	Assist S-100 Coordinators in RHCs in completing MSDI section of S-100 WEND100 IGIF Matrix	MSDI Ambassadors/ S-100 Contact Point		
15/2023	Contact regional MSDIWG via RHCs to assess possible S-1xx product themes for use cases beyond navigational use		MSDIWG16	
16/2023	Repurpose Norway FAIR Principles Guide when delivered for MSDIWG use	OGC		
17/2023	OGC - FAIR+ presentation to be presented at MSDIWG15	OGC	MSDIWG15	
18/2023	Submit 7 QMPs Table with coordination with C/IRCC	MSDIWG Chair		Rephrase QMP4 ISO 9001 Principles application to MSDI Decision and Action C6/71
19/2023	Identify potential Digital Twin requirements in the respective Regional Hydrographic Commissions	Regional MSDIWGs	3 months before MSDIWG15	
20/2023	Create questionnaire to HOs on Digital Twin data, service and/or infrastructure requirements			
21/2023	Report to IRCC15 on how MSDI and HOs can be part of Digital Twins in the future		IRCC15	Action IRCC14/6
22/2023	Provide national marine science data standards to BoK when ready	Singapore		
23/2023	Invite MS to provide case studies and comments to C-17 3.0 Draft	MSDIWG	March 2023	
24/2023	WG to inform CBSC Intercessional about C-17 3.0 draft and submit to IRCC15	C/ VC MSDIWG	March/ April 2023	

MARINE SPATIAL DATA INFRASTRUCTURES WORKING GROUP (MSDIWG)
Terms of Reference and Rules of Procedure

References:
a) HSSC1 Meeting, Singapore, October 2009
b) HSSC5 Meeting, Shanghai, China, November 2013
c) HSSC6 Meeting, Valparaiso, Chile, November 2014
d) IRCC7 Meeting, Mexico City, Mexico, June 2015
e) IRCC11 Meeting, Genoa, Italy, June 2019

TERMS OF REFERENCE

1. Objective: **s**upport the activities of the IHO related to Spatial Data Infrastructures (SDI) and/or Marine Spatial Data Infrastructures (MSDI) and/or Marine Spatial Planning (MSP), as far as marine data is involved.

2. Authority: this Working Group (WG) is a subsidiary body of the Inter-Regional Coordination Committee (IRCC). Its work is subject to IRCC approval.

3. The WG should:

3.1 Monitor national, regional and international SDI activities and trends, and present information on those activities to IRCC members by correspondence and at the annual meeting.

3.2 Promote the use of IHO standards and Member State (MS) marine data in SDI activities.

3.3 Liaise, as appropriate, with other relevant bodies to increase the visibility of marine spatial data.

3.4 Identify actions, procedures and resolutions that the IHO might take to contribute to the development of SDI and/or MSDI in support of MS.

3.5 Determine any actions that the IHO and individual MS might take to forge links with other bodies (e.g. OGC, ISO TC211, IOC) to ensure MS are best placed to meet the developing challenges associated with data management and governance.

3.6 Identify and recommend possible solutions to any significant technical issues related to interoperability between maritime and land-based inputs to SDI, and in particular:
    a) Datum issues.
    b) S-100 interoperability with SDI.
    c) S-100 interoperability with oceanographic, marine biological, geological and geophysical data structures.

3.7 Identify any IHO capacity building requirements related to MSDI.

3.8 Develop a syllabus for MSDI familiarization.

3.9 Follow the developments of MSP implementation worldwide.

3.10 Establish a list of relevant MS National MSDI and MSP data contact points and contact persons.

3.11 Establish a list of additional relevant institutions, contact persons/data experts.

3.12 Study the most relevant MSP issues in a cross-border / trans-boundary context in relation to data and information seen from a MS perspective.

3.13 Compile minimum requirements for Hydrographic data for MSP and the recommendations of distribution/sharing of this data.

3.14 Provide an overview of (national / regional) MSP best practices.

3.15 Establish MSP on the IHO website under Body of Knowledge.

3.16 Maintain IHO publication C-17 – Spatial Data Infrastructures "The Marine Dimension", Guidance for Hydrographic Offices.

Table 2: Summary of ISO 9001 7 Quality Management Principles from MSDI Perspective

QUALITY MANAGEMENT PRINCIPLES (QMPs)	MSDI PERSPECTIVE
QMP 1 – Customer focus	All possible **users** are MSDI customers
QMP 2 – Leadership	MSDI needs a **strategic vision**, aligning policies, processes and data
QMP 3 – Engagement of people	Focusing people enables a **people centric** and not only data centric MSDI
QMP 4 – Process approach	MSDI data management **workflow** is composed of several individual trusted processes
QMP 5 – Improvement	MSDI is a long-term **change of view** and not an objective to achieve or a web portal
QMP 6 – Evidence-based decision making	MSDI **links** data and information to policy and governance
QMP 7 – Relationship management	Networking enables MSDI **shared knowledge**

Elaborated as follows:

- **QMP 1 – Customer focus:** The primary focus of quality management is to meet customer requirements and to strive to exceed customer expectations.
  MSDI perspective: All possible users are MSDI customers.
  Benefits: Increasing use of data, wider community of users, enhanced reputation.
  Actions: Plot direct and indirect users; understand users' current and future needs, satisfaction and expectations; manage relations with users.
- **QMP 2 – Leadership:** Leaders at all levels establish unity of purpose and direction and create conditions in which people are engaged in achieving the organization's quality objectives.
  MSDI perspective: MSDI needs a strategic vision, aligning policies, processes and data.
  Benefits: Better communication of MSDI levels; data-centric and not only data-driven HO; fit for purpose.
  Actions: Encourage an organisation-wide commitment to quality and trust founded on MSDI; provide people with the required resources, training, and authority to act with accountability to release authoritative MSDI services; guide the future of the HO through an MSDI perspective.
- **QMP 3 – Engagement of people:** Competent, empowered and engaged people at all levels throughout the organization are essential to enhance its capability to create and deliver value.
  MSDI perspective: focusing people enables a people centric and not only data centric MSDI.
  Benefits: motivation; initiatives and creativity to change; shared MSDI vision.

Actions: empower people to develop MSDI skills; open discussion and sharing of knowledge and experience around MSDI topics; focus on the importance of individual contribution.

- **QMP 4 – Process approach:** Consistent and predictable results are achieved more effectively and efficiently when activities are understood and managed as interrelated processes that function as a coherent system.
  MSDI perspective: MSDI data management workflow is composed of several individual trusted processes.
  Benefits: focusing key processes; predictable outcome; optimized performance.
  Actions: manage risks of data quality management in the full MSDI spectrum; define necessary data and metadata for each data package; analyze interrelations among different processes.
- **QMP 5 – Improvement:** Successful organizations have an ongoing focus on improvement.
  MSDI perspective: MSDI is a long-term change of view and not an objective to achieve or a web portal.
  Benefits: focus on route causes investigation; being more reactive and proactive; drive for innovation.
  Actions: establish measurable MSDI key performance indicators (KPI); structured education; use improvement to update data services.
- **QMP 6 – Evidence-based decision making:** Decisions based on the analysis and evaluation of data and information are more likely to produce desired results.
  MSDI perspective: MSDI links data and information to policy and governance.
  Benefits: improved decision making; data driven decisions; easier change of past decisions;
  Actions: establish measurable MSDI KPI; curate a lessons learned repository, make data available for all decision-makers; make data and information more reliable and quality flagged.
- **QMP 7 – Relationship management:** For sustained success, an organization manages its relationships with interested parties, such as suppliers.
  MSDI perspective: networking enables MSDI shared knowledge.
  Benefits: common understanding of goals; focus more valuable data; long term stability.
  Actions: determine relevant MSDI players; prioritize relationships; create relationships sharing data.