14th MEETING OF THE IHO INTER-REGIONAL COORDINATING COMMITTEE
IHO-IRCC14

Denpasar - Bali, Indonesia, 6-8 June 2022

Report of the MSDI Working Group

Submitted by:	Chair, MSDIWG
Related Documents:	C-17. Spatial Data Infrastructures: "The Marine Dimension" - Guidance for Hydrographic Offices, Edition 2.0.0, January 2017. Development of Spatial Data Infrastructures for Marine Data Management, OGC-IHO MSDI Concept Development Study (MSDI-CDS). UN-GGIM. Integrated Geospatial Information Framework. A strategic guide to develop and strengthen national geospatial information management. UN-GGIM. Future trends in geospatial information management: the five to ten year vision. Second edition.
Related Projects:	MSDI Concept Development Study (MSDI-CDS) http://www.opengeospatial.org/projects/initiatives/msdi-cds-2018

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	see Annex A for full details

1. Meetings Held During Reporting Period

The thirteenth meeting of the Marine Spatial Data Infrastructure Working Group of the International Hydrographic Organization took place on the 9th and 13th May 2022 in Singapore. The meeting was arranged by MPA Singapore as a hybrid meeting.

The MSDIWG 13 meeting was arranged as a joint meeting together with the Marine Domain Working Group (MDWG) of the Open Geospatial Consortium (OGC) and the UN-GGIM Working Group on Marine Geospatial Information (WG-MGI).

The main focus areas from the MSDIWG13 meeting were:

- Updates to C-17
- IHO strategy from a MSDI perspective including SPI and the ISO principles
- Cooperation with relevant IHO WGs, S-100 and the implementation plan from a MSDI perspective
- S-100 Development and Showcase from a MSDI and MSP perspective
- Expectations and cooperation with the WENDWG from a MSDI perspective
- FAIR principles
- Exchange of knowledge/presentations from national MS and expert contributors
- UN Decade of Ocean Science for Sustainable Development
- Future cooperation with Singapore-IHO Innovation and Technology Laboratory

- IHO Crowdsourced Bathymetry, DCDB and GEBCO Seabed 2030
- IGIF-MSDI Maturity
- Maritime Digital Twins
- Future geospatial information ecosystem, what's next? 3, 5, 7 years vision?

See https://iho.int/en/msdiwg for work plan and actions.

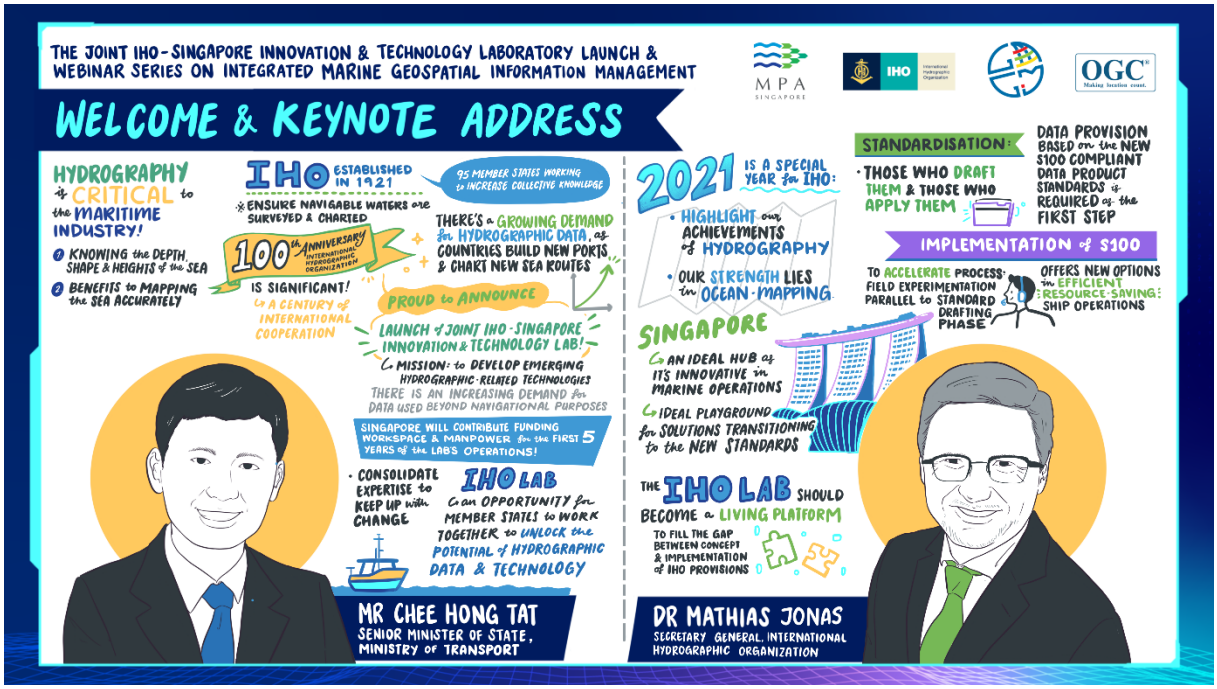
From 10 - 12 May The International Seminar on United Nations Global Geospatial Information Management, with the theme "Effective and Integrated Marine Geospatial Information" took place. The seminar was arranged and hosted by Maritime and Port Authority of Singapore. The intention of the seminar was to provide a forum for deliberating key considerations for integrated marine geospatial information within a data ecosystem for effective policies, decisions, programmes and projects to achieve national development priorities and the 2030 Agenda for Sustainable Development.

The International Seminar sought to share and exchange knowledge, information and experience, and facilitate peer-to-peer engagement and learning. Through cooperative dialogue it considered guidance, recommendations, standards and approaches relevant to the availability and accessibility of marine geospatial information for a multiplicity of purposes for the deepest and broadest benefits of society, environment and economy. The International Seminar included three days of sessions and presentations addressing identified sub-themes. For more information https://ggim.un.org/UNGGIM-wg8/

See Annex B for the seminar program.

The MSDIWG13 meeting was originally planned to take place in the end of October 2021. Due to Covid 19 it was decided to postpone the MSDIWG 13 meeting and instead to arrange a joint Webinar Series on Integrated Marine Geospatial Information Management 26 – 29 October 2021. The Webinar Series on Integrated Marine Geospatial Information Management was a Joint seminar between UN-GGIMWG MGI, the OGC MDWG, IHO MSDIWG and MPA Singapore/Joint IHO-Singapore Innovation and Technology Laboratory.

The general objective of the webinar was to discover the utility and impact of good marine geospatial information, and showcase some of the applications and opportunities it can offer from inland and coast to deep-sea, and from local to international scales.



See Annex C for more information.

2. Work Program

The existing Work Programme approved by IRCC 13 was discussed and evaluated at the MSDIWG meeting based on recent achieved results with a focus on MSDI from an international, regional and national perspective. It was agreed not to propose any adjustments to the existing work program 2021-2024. In order to deliver on this Work Programme, eight MSDI Tasks have been established. The work programme can be found in Annex G 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 have been added to the list. The list of action items can be found in Annex F of this report.

It was agreed that the IHO/MSDIWG should continue to facilitate joint meetings which would allow non MSDIWG stakeholders (e.g., Regional Hydrographic Commission (RHC) Members, government, academia, industry, funding agencies and NGOs) to attend in order to identify what the MSDIWG and the commercial partners can offer. This approach will be coordinated in consultation with the meeting hosts.

The IRCC and its subordinate bodies were tasked by A-1 to identify and recommend on whatever actions may be required to incorporate the Statement of Shared Guiding Principles for Geospatial Information Management in the work programmes (see A-1 Decision N° 22). The key interest for the IHO is enabling Member States to ensure MSDI provides a framework for the provision of hydrographic information beyond the field of surface navigation. The MSDIWG is using the UN-GGIM Shared Guiding Principles for Geospatial Information Management as a framework (IGIF and IGIF-Hydro) and these principles are incorporated in the existing work program for the MSDIWG. The Shared Guiding Principles for Geospatial Information Management are available at the MSDIWG web page at:
www.iho.int/msdiwg → Body of Knowledge

3. Progress on IRCC Action Items

MSDI Ambassadors.

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 vital element of this work would be to collect and collate responses from Member States on MSDI prior to each RHC meeting. A majority of RHCs have now, or are in the progress of, establishing RHC MSDIWGs. At the IHO MSDIWG13 meeting, several RHCs gave regional presentations of the work and challenges from a regional perspective. For more information, see https://iho.int/en/msdiwg13-2022

It is important that RHCs consider MSDI as a standing RHC agenda item and that National Reports should incorporate the status of MSDI, plans for involvement in MSDI and challenges facing the HO.

In order to create a common MSDI framework and an update on national status with relation to SDI and MSDI implementation, it is recommended that National Reports include topics in relation to key successes and challenges using each of the four pillars from the IHO publication C-17. (ref. C-17, 2.1. Policy and Governance, Technical standards, Information systems and Geographic content).

Education and Learning.

IRCC10/10 (MSDIWG to develop basic MSDI training material in order to allow RHCs to deliver trainings with their own personnel). MSDI has been highlighted as an important component of the future development of hydrographic offices. It was concluded that there is either no, or very little, basic teaching material available for MSDI training that is free of charge for IHO Member States. IRCC therefore decided to task the IHO MSDIWG to establish basic MSDI training material, in order for IHO Member States and the RHCs to conduct basic MSDI education/training. The MSDI training material is

now free available on IHO webpage under MSDIWG Body of Knowledge https://iho.int/en/body-of-knowledge.

A MSDI e-learning program has also been developed to enable people access to MSDI teaching externally and even receive the teaching online. The MSDI teaching material is available on the IHO's website for free. The e-learning interactive material can be downloaded or used on YouTube.

Members of MSDIWG are now participating in the established IHO e-learning PT. The MSDI training material is now integrated into the work of the IHO e-learning PT and the MSDI e-learning material will be available for IHO MS.

Strategic Performance Indicators
At the IHO Assembly, the IHO Strategic Plan 2021-26 was approved including, three Strategic Performance Indicators (SPI) related with the MSDIWG. Target 2.1 has special relevance for the MSDIWG (Build a portal to support and promote regional and international cooperation in marine spatial data infrastructures (MSDI)) and 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 and 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. With relation to Target 2.1 the MSDIWG has included it in the MSDIWG Work plan in order to deliver on this Target.

At the MSDIWG13 meeting, the members discussed the proposed way forward and agreed on a proposal to IRCC 14 and a draft questionnaire that can be send out to the IHO MS.

4. Problems Encountered

There remains a high priority need for communication and outreach with relation to MSDI.

5. Any Other Items of Note

FAIR principles.
The FAIR Data Principles (Findable, Accessible, Interoperable, Re-usable) are used widely in the geospatial community, promoting and supporting knowledge discovery and innovation as well as data and knowledge integration, and sharing and reuse of data.

The FAIR principles do not strictly define how to achieve a state of "FAIRness". Rather they describe a continuum of features, attributes, and behaviors that will move a digital resource closer to that goal. The principles help data and metadata to be ‘machine readable’, supporting new discoveries through the harvest and analysis of multiple datasets.

The benefits of using the FAIR principles include:

- Gain maximum potential from data assets
- Stay aligned with international standards and approaches
- Attract new partnerships with researchers, business, policy and broader communities
- Increase the visibility and citations of research Improving the reproducibility and reliability of research
- Evaluate the status and maturity of national and regional MSDIs

In order to have a Hydrographic Offices approach to the FAIR Data Principles the MSDIWG has now included the FAIR principles in the MSDIWG work and intends to provide recommendations to IRCC 15 on how IHO MS can use the FAIR principles in their work with their national and regional MSDI and a HO MSDI FAIR principles check list the OGC MDW is included in this work.

Digital Twins.
The concept of Digital Twins is now widely used and in the marine community, the concept of Digital Twin of the Ocean or Digital Twin of the Sea are now under development.

"A digital twin is a virtual representation of an object or system that spans its lifecycle, is updated from real-time data, and uses simulation, machine learning and reasoning to help decision-making."

Digital Twins provide a framework for creating a digital truth about the physical environment. Through simulations that show the cause and effect of an event happening, Digital Twins help policymakers and decision-makers make informed decisions to prevent incidents from occurring or mitigate the event's impacts. A digital twin should be seen as a digital replica of a living or non-living physical entity. By combining the physical and the virtual world, data is provided enabling the virtual entity to exist at the same time with the physical entity.

As seen from a MSDIWG perspective a MSDI could be an important component in a Digital Twin of the Ocean or Digital Twin of the Sea allowing users to simulate and learn from it and apply these learnings to the actual assets or objects.

The MSDI will be able to provide the datasets in order to create a highly complex virtual model that is the exact counterpart (or twin) of a physical thing. The 'thing' could e.g. be a harbour, sailing route marine protected area. Connected sensors on the physical asset collect data that can be mapped onto the virtual model. Anyone looking at the marine digital twin can now see crucial information about how the physical thing is doing out there in the real world. A marine digital twin will be a vital tool to help operators understand not only how products and initiatives are performing, but how they will perform in the future. Analysis of the data from the connected sensors, combined with other sources of marine information, will allow e.g. agencies to make predictions.

In order to have a Hydrographic Office approach to the Maritime Digital Twins the MSDIWG has now included the Maritime Digital Twins in the MSDIWG work and intends to provide recommendations to IRCC 15 on how MSDI and HOs can be part of Digital Twins in the future.

Initiatives to support data users in finding, accessing and reusing data
In New Zealand, Maritime Geospatial Information (MGI) is collected by various public and private organisations. The NZMGI-WG aims to increase the findability and accessibility of MGI.

Land Information New Zealand (LINZ) initiated a data portal study. The NZ MGI Data Portal study was undertaken to:

1. support data users in finding, accessing and reusing NZ MGI
2. encourage data custodians to share the MGI they hold.

The study captured the overarching purpose of the portal, as well as details on functionality, data types, data providers, responsibilities, discovery and access mechanisms, licensing and standards. One of the result of the study was to provide a data portal matrix. The matrix focus on the overall items as listed below:

- Purpose of the portal
- Types of marine geospatial data supported by the portal
- Data is supplied by
- External data is uploaded by
- External data is managed by
- Third party data supplier is responsible for
- Accessibility
- Data exploration
- Data reuse

- Standards
- User experience
- Analytics for data owner

The NZ MGI data portal matrix is attached in Annex D. All information is also available on NZ website: https://www.linz.govt.nz/sea/marine-geospatial-information/finding-and-accessing-mgi

Establishing a portal matrix study is a good and practical national initiative to support data users in finding, accessing and reusing marine data and it will encourage data custodians to share the marine geospatial data they hold. It is therefore recommended that IHO MS should study the initiative and especially the portal matrix in order to investigate if they could benefit by establishing a similar facility/matrix.

6. Conclusions and Recommended Actions

The work in the MSDIWG is progressing well. The Work Programme creates the framework for the WG, and helps to manage the challenges.

The main challenges for the MSDIWG are to raise awareness of the importance of MSDI, and to provide training and education to support MSDI development at the Member State and RHC levels. These challenges are being addressed by the training material, the planned upgrade of C-17 and the establishment of MSDI Ambassadors at RHCs.

Taking the development of UN-GGIM, Integrated Geospatial Information Framework (IGIF) and IGIF-H (i.e. The Operational Framework on Integrated Marine Geospatial Information) in consideration, it is important that there is better alignment and integration with IGIF and IGIF-H as this will ensure a uniform approach to data management between land and sea. There are numerous common elements within IGIF/IGIF-H and MSDIWG and simple connections could be made which would bring the definitions section up to date. As a consequence, the MSDIWG has now initiated a process for updating/modifying the IHO publication C-17 in response to the two IGIF initiatives and the MSDIWG has established a drafting PT. The focus of a new version of C-17 will be on how Hydrographic Offices can act in response to IGIF and IGIF Hydro and the broader global perspective and will focus on some of the working issues, like data consistency, data quality, multiple-use best practices, business models, the FAIR principles, maritime digital twins etc. leaving IGIF and IGIF-H to define broader use cases.

MSDI Ambassadors.

At a time when SDIs are being developed worldwide, regional and at local levels, the approach to coordinated access and management of geographic information has become a standard and the need for regional MSDI coordination through the RHC has been more important than ever.

In order to promote an increased awareness of maritime spatial data infrastructure in different regions it is therefore proposed that RHCs should establish regional MSDI WG and nominate regional MSDI ambassadors to the MSDIWG as well as providing yearly regional reports to the MSDIWG meetings.

It is recommended the regional MSDIWG should be the forum for MSDI coordination of maritime information. Regional MSDIWG should study the individual participating countries' approaches to coordinated access to maritime information in order to identify areas where maritime SDI implementation is underway and where problems can be foreseen. The regional MSDIWG could also provide recommendations on how to proceed with the MSDI implementation and, if deemed necessary, an action plan with specified time schedules for MSDI activities.

RHCs will be able to achieve joint training and a general increase in the awareness of maritime SDI. It is also recommended that the National Reports should include topics in relation to the key successes and challenges according to the four MSDI pillars.

Education and Learning.
MSDI training material is now available on the IHO homepage for free and will be also on the IHO E-learning center. IHO MS are encouraged to use the MSDI training material and report to the MSDIWG if they have any comments or questions to the content of the MSDI training material.
https://iho.int/en/body-of-knowledge
https://elearning.iho.int/_HTML/closed_course_list.php

Strategic Performance Indicators
At the MSDIWG 13 meeting there was a long discussion about how to proceed with the IHO MSDI portal and what to recommend to IRCC14. The MSDIWG members agreed to recommend to IRCC14 that the IHO MSDI portal should serve as a focal point for access to datasets with a global theme. The implementation of a portal should be divided in 2 steps.

Step 1. Establishing a basis portal solution building on the already existing INToGIS solution and already available data. This can be global metadata on hydrographic product services and assisting global datasets relevant for the conduct of hydrographic activities in support of the three Strategic Goals. The technical solution should be to set up a portal of portals. The content should be maintained either by the IHO Secretariat and/or IHO subordinate bodies, collaborating entities like RENCS which provide datasets with a global theme or composed out of the respective contributions by Member States. The following examples illustrate this concept approach. INToGIS (maintained by the IHO Secretariat) providing the following functionality:

- S-122 MPA
- IHO Membership (IHO secretariat)
- INT Chart coverage (RHC)
- ENC coverage (RENC)
- Global CATZOC dataset (RENC)
- Global AIS dataset (US)
- C-55 content (IHO secretariat)
- Global MSI Navarea layout t.b.d. (IHO secretariat)
- S-100 showcases / best practices (MS)
- SCUFN Gazetteer
- DCDB Map Viewer
- Global Bathymetry (GEBCO Grid)

This suggestion will require a minimum of resources and can relatively easily be implemented by the IHO Secretariat.

Step 2. To establish an IHO marine data hub network following the same principles as e.g. the established UN-GGIM SDG data hub network. The idea with the Marine hub will be to have a user driven approach where the IHO MS will be able to update the hub with relevant information and data. In order to take a decision about implementing step 2 there is a need to evaluate on how to proceed with step 2 and to investigate the different possibilities and challenges and resources needed. The MSDIWG suggest that the MSDIWG should be tasked to investigate the different possibilities, challenges and resources need for step 2 in order to have the information needed to take a decision about implementing step 2 and to present the recommendations at IRCC 15 in 2023.

Draft questionnaire
A draft questionnaire has been developed by the MSDIWG. The purpose of the questionnaire is to identify the relevant information and datasets with a global theme to be hosted under the future basic IHO portal.

The expected uptake of S-100 products should make the portal solution attractive as the authoritative source to inform about the ongoing test phase and later the status of global production of such datasets. Therefore, the questionnaire is designed to get an initial impression of the ongoing activities and use cases and for the planned regular provision of such services. There is a split between those S-xxx

products which have been assigned to the two different IHO priorities and others which do not belong to the S-1xx domain, such as S-2xx and S-4xx.
The draft questionnaire is attached as Annex E.

The use of a questionnaire will be in accordance with the ISO 9001 Quality management principles. 1. Customer-focus. Customer-focus is a crucial principle of quality management. Customer-focused companies are committed to meeting their customers' needs and providing them with high levels of customer service.

The MSDIWG suggest that the draft questionnaire should be forwarded to the IHO Secretariat and if deemed appropriate, to send it out to the IHO MS.

7. Justification and Impacts

There is a need to update the publication C-17 in order to align it with UN-GGIM, Integrated Geospatial Information Framework (IGIF) and with IGIF-H. A closer alignment and presentation on how IGIF/ IGIF-H can/will work in a marine/maritime environment would help to set the scene better for IHO MS.

The goal of the joint OGC/ IHO Pilots is to show the value of interoperability and to demonstrate the benefits of standards through pilot(s) and demonstrations. This is done by piloting a recommended SDI architecture to support a Marine SDI and developing demonstrations. The pilots will allow MSDIWG members to access the results from the MSDI-CDS and assist members who are interested in supporting a MSDI follow-on Pilot initiative.

Two activities in relation to S-100 from a MSDI perspective are envisaged, one to oversee and influence how S-100 is able to express data relevant to MSDI applications, for instance richer coordinate reference systems, modelling of complex relationships and encodings configured for marine geospatial data. The other activity is to define MSDI models of features within one or more MSDI-specific product specifications. The goals, therefore, are twofold:

1. Ensure end users can reuse data better by optimizing the S-100 framework for broader MSDI use cases
2. Provide the opportunity for data producers to address entire classes of use case with S-100 based product specifications.

Ensuring MSDI is considered in existing product specifications could also benefit many MSDI stakeholders. S-102, S-104, S-111, for instance all have great potential for broader use and a closer working relationship with the S-100 working groups defining their content could help shape these important product specifications. Recent developments within the S-102 community have highlighted the importance of ensuring that scientific and non-navigational use cases are provided for and other product specifications will likely follow suit.

S-100 is certainly capable of being leveraged in this way and it is not hard to see the possibilities for defining MSDI product specifications for specific use cases proactively. The IHO geospatial registry is a unique asset, defining all major marine geospatial features within a number of domains. Product specifications then bind together networks of features, attributes and relationships and key use cases in MSDI could drive definitions of product specifications in the MSDI domain. Consideration should be given to whether MSDI requires its own domain or not and this should be discussed with the S-100 community.

If S-100 is better addressed by the MSDI community then IHO C-17 could include specific guidance in respect of S-100, specifically:

1. Using C-17 as a "Meta-Standard", guiding implementers showing how S-100 data can be defined, re-used and made interoperable with external data frameworks.

2. Detailing specific use cases addressed by future MSDI product specifications within the S-100 framework
3. Defining better the relationships between the IGIF/IGIF-W and MSDI communities.

IGIF and IGIF-H is concerned with the institutional arrangements within any SDI. MSDI and IGIF are complementary activities. MSDI and C-17 approaches cross-thematic data reuse from the perspective of participating hydrographic offices whereas the UN-GGIM's IGIF starts out from a cross-thematic standpoint and is relevant to hydrographic offices as well as the other elements of a national SDI infrastructure. The emergence of the IGIF-H offers specific advice to marine geospatial agencies for implementation of the IGIF. Implementation and a focus on hydrographic offices using S-100 as the broad framework could reside within C-17.

A summary of suggested initiatives, with relation to S-100 from a MSDI perspective is:

1. Investigate, in discussion with the S-100WG and IHO Registry Manager whether a proposal for an MSDI domain in the registry is required
2. Assess the potential for MSDI-specific products using S-100 addressing key use cases.
3. Prepare, through stakeholder input, proposals for revision of C-17 in respect of S-100 implementation.

8. Action Required of IRCC

The IRCC is invited to:

a. note the report
b. appoint RHC MSDI ambassadors and inform the MSDIWG with contact details
c. take note of the proposed initiative's and give guidance on way ahead
d. discuss any item with relevance to SDI/MSDI/MSP and to take appropriate actions

Annex A

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(Updated 19 May 2022)

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Annex C

The Webinar Series on Integrated Marine Geospatial Information Management

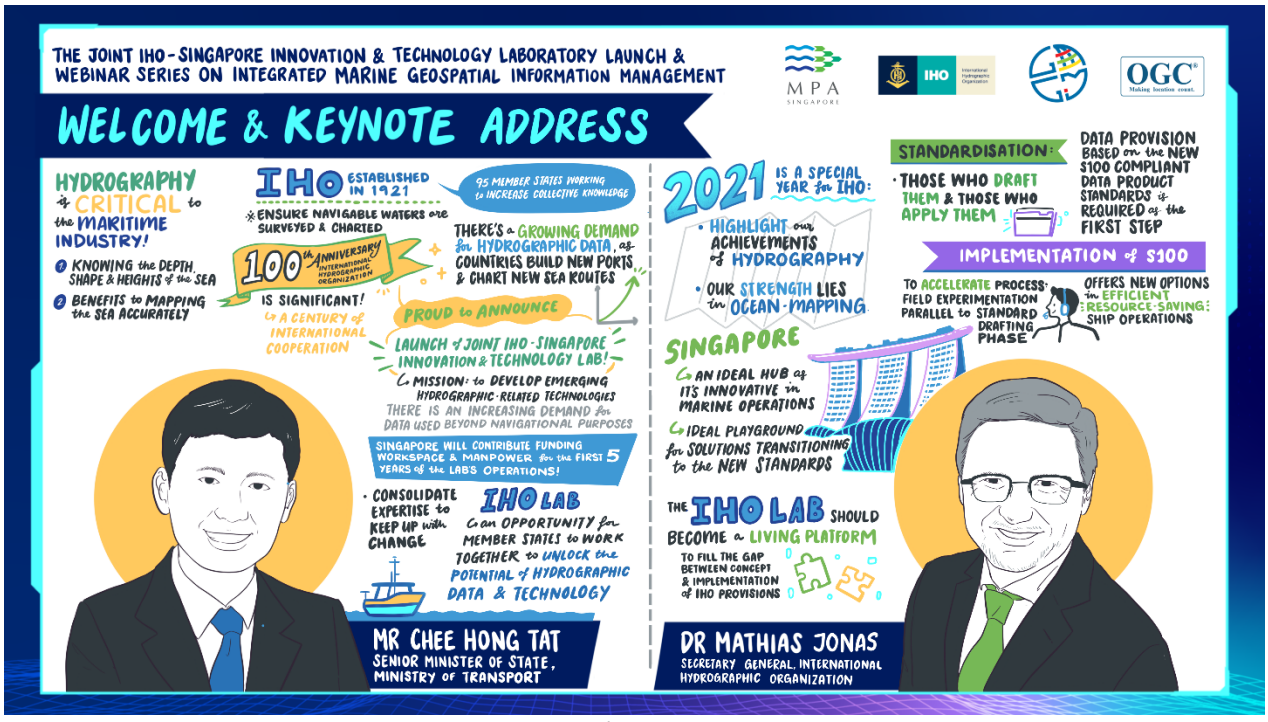
Webinar Series on Integrated Marine Geospatial Information Management

26 – 29 October 2021

General objective of the webinar: To discover the utility and impact of good marine geospatial information, the applications, and opportunities it can offer; from inland to coast to deep-sea, from local to international scales.

26 Oct 10:00 UTC – 11:45 UTC (105 mins)	**27 Oct** 10:00 UTC – 11:15UTC (75 mins)	**28 Oct** 10:00 UTC – 11:15UTC (75 mins)	**29 Oct** 10:00 UTC – 11:15UTC (75 mins)
10:00 hrs. (UTC) 3:00 a.m. (Los Angeles); 5:00 a.m. (Mexico City); 6:00 a.m. (New York); 12:00 noon (Copenhagen); 6:00 p.m. (Singapore); 9:00 p.m. (Canberra); 11:00 p.m. (Nuku'alofa)			
Joint IHO-Singapore Innovation and Technology Laboratory Launch • Opening Ceremony (30mins) **Break 10 mins** Focus/Theme: **Technology and Innovation for Integrated Marine Geospatial Information Management** • 3 Presentations (12 - 15 mins per presentation)	Focus/Theme: **An Operational Framework for Integrated Marine Geospatial Information Management** • Brief opening statement/setting the scene • 5 Presentations (12-15 mins per presentation) • Open discussions (15 mins)	Focus/Theme: **Integrated Marine Geospatial Information Management Practices** • Brief opening statement/setting the scene • 4 Presentations (12 - 15 mins per presentation) • Open discussions (15 mins)	Focus/Theme: **Standards for Findable Accessible Interoperable and Reusable Marine Geospatial Information; the Future of Marine Geospatial Information** • Brief opening statement/setting the scene • 4 Presentations (12 - 15 mins per presentation) • Open discussions (15 mins) **Closing Address** (10 mins)

Welcome notes.



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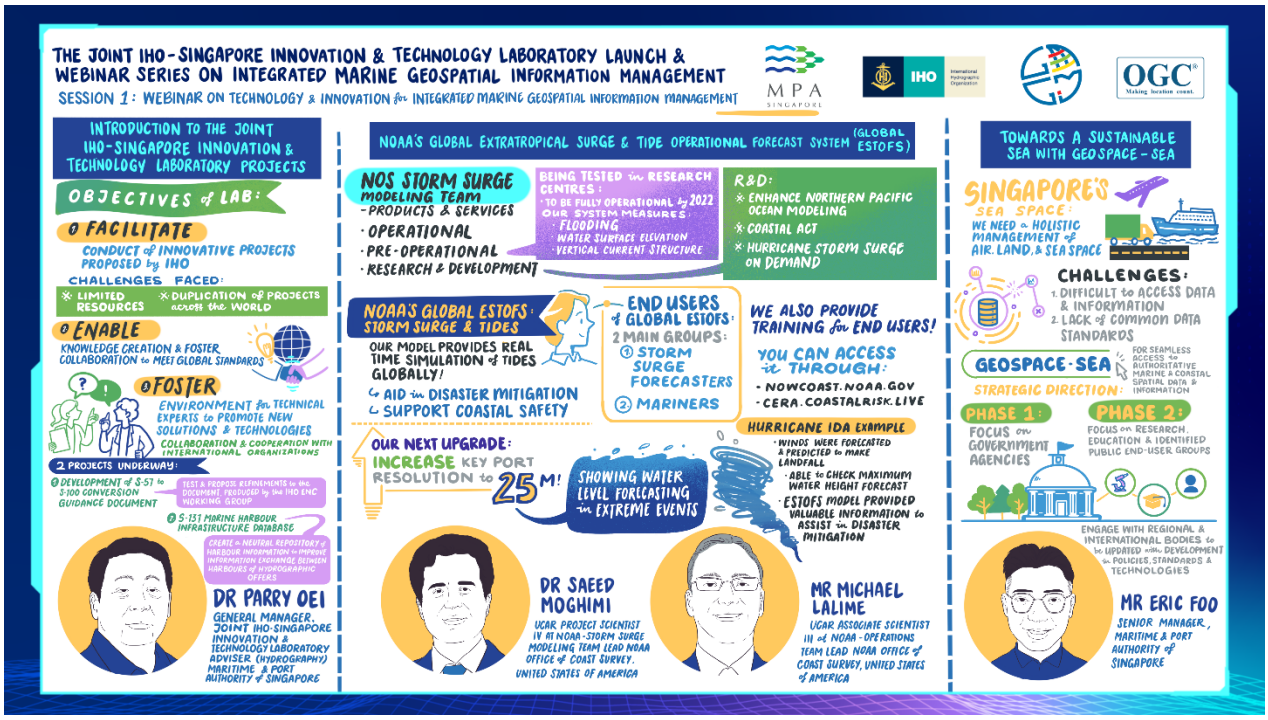
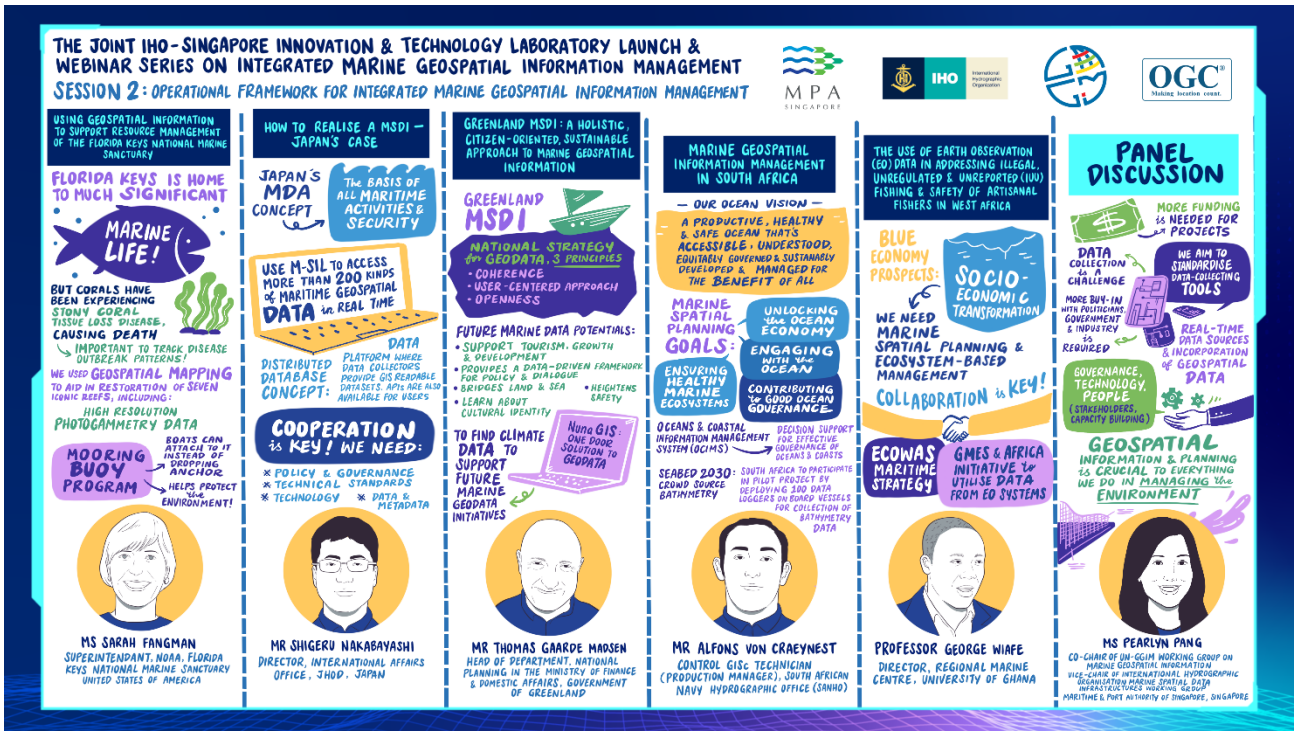
Session 1.



Session 2.



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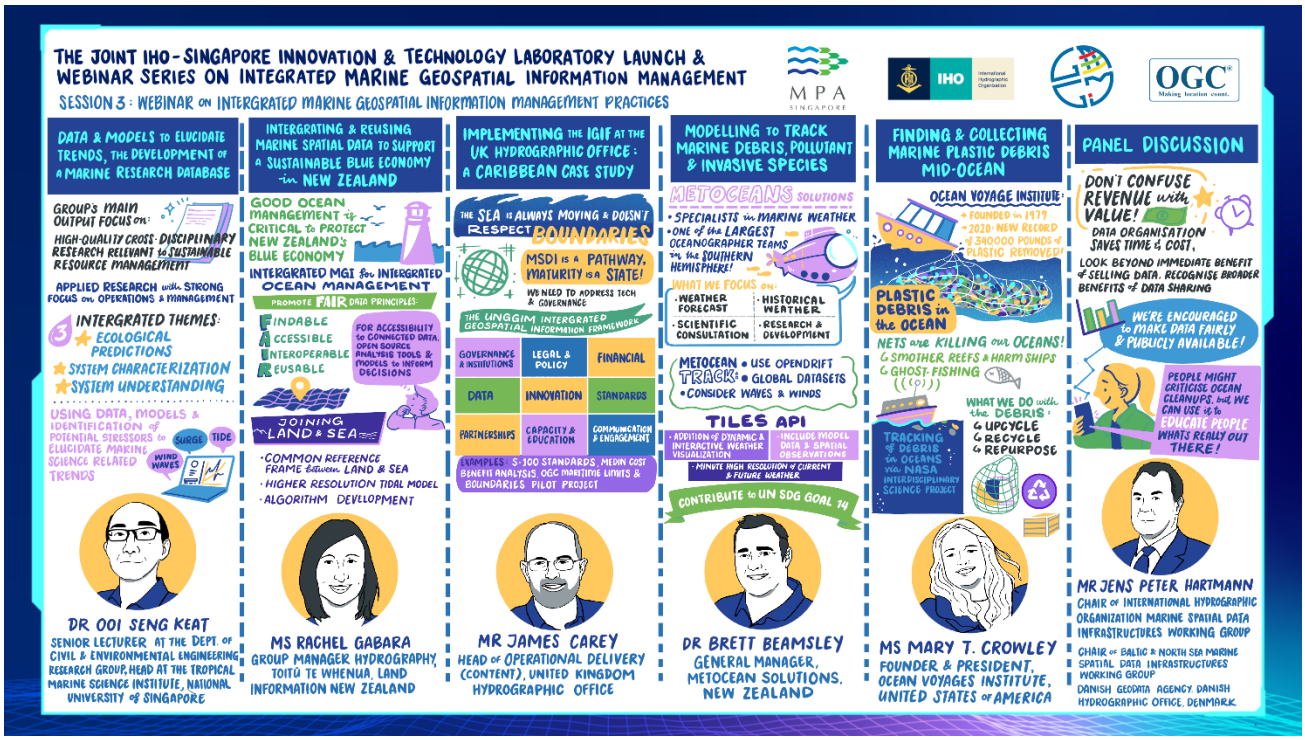
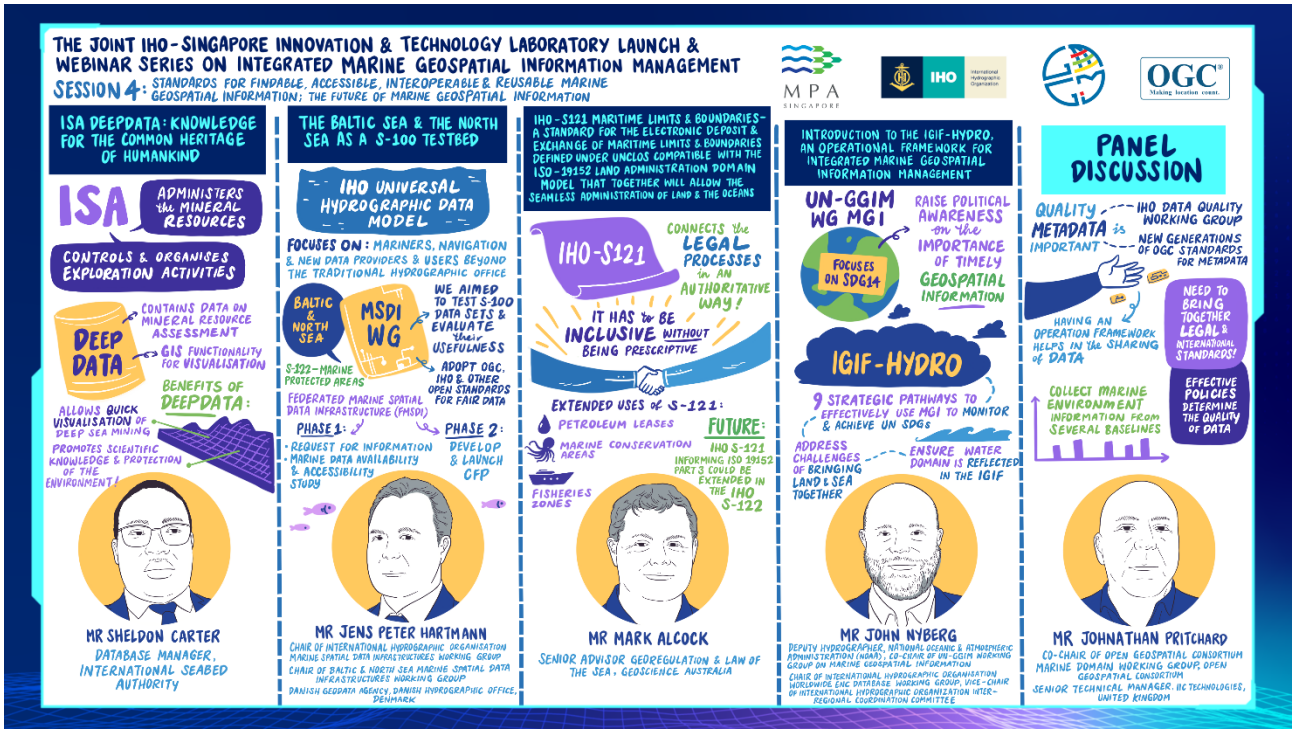

THE JOINT IHO-SINGAPORE INNOVATION & TECHNOLOGY LABORATORY LAUNCH & WEBINAR SERIES ON INTEGRATED MARINE GEOSPATIAL INFORMATION MANAGEMENT
SESSION 3: WEBINAR ON INTERGRATED MARINE GEOSPATIAL INFORMATION MANAGEMENT PRACTICES
MPA SINGAPORE
IHO
OGC
DATA & MODELS TO ELUCIDATE TRENDS, THE DEVELOPMENT OF A MARINE RESEARCH DATABASE
GROUP'S MAIN OUTPUT FOCUS ON:
HIGH-QUALITY CROSS-DISCIPLINARY RESEARCH RELEVANT TO SUSTAINABLE RESOURCE MANAGEMENT
APPLIED RESEARCH WITH STRONG FOCUS ON OPERATIONS & MANAGEMENT
3 INTERGRATED THEMES:
ECOLOGICAL PREDICTIONS
SYSTEM CHARACTERIZATION
SYSTEM UNDERSTANDING
USING DATA, MODELS & IDENTIFICATION OF POTENTIAL STRESSORS TO ELUCIDATE MARINE SCIENCE RELATED TRENDS
SURGE
TIDE
WIND WAVES
DR OOI SENG KEAT
SENIOR LECTURER AT THE DEPT OF CIVIL & ENVIRONMENTAL ENGINEERING RESEARCH GROUP, HEAD AT THE TROPICAL MARINE SCIENCE INSTITUTE, NATIONAL UNIVERSITY OF SINGAPORE
INTERGRATING & REUSING MARINE SPATIAL DATA TO SUPPORT A SUSTAINABLE BLUE ECONOMY IN NEW ZEALAND
GOOD OCEAN MANAGEMENT IS CRITICAL TO PROTECT NEW ZEALAND'S BLUE ECONOMY
INTERGRATED MGI FOR INTERGRATED OCEAN MANAGEMENT
PROMOTE FAIR DATA PRINCIPLES:
FINDABLE
ACCESSIBLE
INTEROPERABLE
REUSABLE
FOR ACCESSIBILITY TO CONNECTED DATA, OPEN SOURCE ANALYSIS TOOLS & MODELS TO INFORM DECISIONS
JOINING LAND & SEA
· COMMON REFERENCE FRAME BETWEEN LAND & SEA
· HIGHER RESOLUTION TIDAL MODEL
· ALGORITHM DEVELOPMENT
MS RACHEL GABARA
GROUP MANAGER HYDROGRAPHY, TOITŪ TE WHENUA, LAND INFORMATION NEW ZEALAND
IMPLEMENTING THE IGIF AT THE UK HYDROGRAPHIC OFFICE: A CARIBBEAN CASE STUDY
THE SEA IS ALWAYS MOVING & DOESN'T RESPECT BOUNDARIES
MSDI IS A PATHWAY, MATURITY IS A STATE!
NO NEED TO ADDRESS TECH & GOVERNANCE
THE UNGGIM INTERGRATED GEOSPATIAL INFORMATION FRAMEWORK
GOVERNANCE & INSTITUTIONS
LEGAL & POLICY
FINANCIAL
DATA
INNOVATION
STANDARDS
PARTNERSHIPS
CAPACITY & EDUCATION
COMMUNICATION & ENGAGEMENT
EXAMPLES: S-100 STANDARDS, MEDIN COST BENEFIT ANALYSIS, OGC MARITIME LIMITS & BOUNDARIES PILOT PROJECT
MR JAMES CAREY
HEAD OF OPERATIONAL DELIVERY (CONTENT), UNITED KINGDOM HYDROGRAPHIC OFFICE
MODELLING TO TRACK MARINE DEBRIS, POLLUTANT & INVASIVE SPECIES
METOCEANS SOLUTIONS
· SPECIALISTS IN MARINE WEATHER
· ONE OF THE LARGEST OCEANOGRAPHER TEAMS IN THE SOUTHERN HEMISPHERE!
WHAT WE FOCUS ON:
· WEATHER FORECAST
· HISTORICAL WEATHER
· SCIENTIFIC CONSULTATION
· RESEARCH & DEVELOPMENT
METOCEAN TRACK: • USE OPENDRIFT • GLOBAL DATASETS • CONSIDER WAVES & WINDS
TILES API
· ADDITION OF DYNAMIC & INTERACTIVE WEATHER VISUALIZATION
· INCLUDE MODEL DATA & SPATIAL OBSERVATIONS
· MINUTE HIGH RESOLUTION OF CURRENT & FUTURE WEATHER
CONTRIBUTE TO UN SDG GOAL 14
DR BRETT BEAMSLEY
GENERAL MANAGER, METOCEAN SOLUTIONS, NEW ZEALAND
FINDING & COLLECTING MARINE PLASTIC DEBRIS MID-OCEAN
OCEAN VOYAGE INSTITUTE
· FOUNDED IN 1979
· 2020: NEW RECORD OF 340000 POUNDS OF PLASTIC REMOVED!
PLASTIC DEBRIS in the OCEAN
NETS are KILLING our OCEANS!
& SMOTHER REEFS & HARM SHIPS & GHOST-FISHING
TRACKING of DEBRIS in OCEANS via NASA INTERDISCIPLINARY SCIENCE PROJECT
WHAT WE DO with the DEBRIS:
& UPCYCLE & RECYCLE & REPURPOSE
MS MARY T. CROWLEY
FOUNDER & PRESIDENT, OCEAN VOYAGES INSTITUTE, UNITED STATES OF AMERICA
PANEL DISCUSSION
DON'T CONFUSE REVENUE with VALUE!
DATA ORGANISATION SAVES TIME & COST,
LOOK BEYOND IMMEDIATE BENEFIT & SELLING DATA. RECOGNISE BROADER BENEFITS of DATA SHARING
WE'RE ENCOURAGED to MAKE DATA FAIRLY & PUBLICLY AVAILABLE!
PEOPLE MIGHT CRITICISE OCEAN CLEANUPS, but WE CAN USE it to EDUCATE PEOPLE WHAT'S REALLY OUT THERE!
MR JENS PETER HARTMANN
CHAIR OF INTERNATIONAL HYDROGRAPHIC ORGANIZATION MARINE SPATIAL DATA INFRASTRUCTURES WORKING GROUP
CHAIR OF BALTIC & NORTH SEA MARINE SPATIAL DATA INFRASTRUCTURES WORKING GROUP
DANISH GEODATA AGENCY, DANISH HYDROGRAPHIC OFFICE, DENMARK

Session 4.


THE JOINT IHO-SINGAPORE INNOVATION & TECHNOLOGY LABORATORY LAUNCH & WEBINAR SERIES ON INTEGRATED MARINE GEOSPATIAL INFORMATION MANAGEMENT
SESSION 4: STANDARDS FOR FINDABLE, ACCESSIBLE, INTEROPERABLE & REUSABLE MARINE GEOSPATIAL INFORMATION; THE FUTURE OF MARINE GEOSPATIAL INFORMATION
MPA SINGAPORE
IHO
OGC
ISA DEEPDATA: KNOWLEDGE FOR THE COMMON HERITAGE OF HUMANKIND
ISA
ADMINISTERS the MINERAL RESOURCES
CONTROLS & ORGANISES EXPLORATION ACTIVITIES
DEEP DATA
CONTAINS DATA ON MINERAL RESOURCE ASSESSMENT
GIS FUNCTIONALITY FOR VISUALISATION
BENEFITS OF DEEPDATA:
ALLOWS QUICK VISUALISATION OF DEEP SEA MINING
PROMOTES SCIENTIFIC KNOWLEDGE & PROTECTION OF THE ENVIRONMENT
MR SHELDON CARTER
DATABASE MANAGER, INTERNATIONAL SEABED AUTHORITY
THE BALTIC SEA & THE NORTH SEA AS A S-100 TESTBED
IHO UNIVERSAL HYDROGRAPHIC DATA MODEL
FOCUSES ON: MARINERS, NAVIGATION & NEW DATA PROVIDERS & USERS BEYOND THE TRADITIONAL HYDROGRAPHIC OFFICE
BALTIC & NORTH SEA
MSDI WG
WE AIMED TO TEST S-100 DATA SETS & EVALUATE their USEFULNESS
ADOPT OGC, IHO & OTHER OPEN STANDARDS FOR FAIR DATA
S-122-MARINE PROTECTED AREAS
FEDERATED MARINE SPATIAL DATA INFRASTRUCTURE (FMSDI)
PHASE 1:
· REQUEST FOR INFORMATION
· MARINE DATA AVAILABILITY & ACCESSIBILITY STUDY
PHASE 2:
DEVELOP & LAUNCH CFP
MR JENS PETER HARTMANN
CHAIR OF INTERNATIONAL HYDROGRAPHIC ORGANISATION MARINE SPATIAL DATA INFRASTRUCTURES WORKING GROUP
CHAIR OF BALTIC & NORTH SEA MARINE SPATIAL DATA INFRASTRUCTURES WORKING GROUP
DANISH GEODATA AGENCY, DANISH HYDROGRAPHIC OFFICE, DENMARK
IHO-S121 MARITIME LIMITS & BOUNDARIES-A STANDARD FOR THE ELECTRONIC DEPOSIT & EXCHANGE OF MARITIME LIMITS & BOUNDARIES DEFINED UNDER UNCLOS COMPATIBLE WITH THE ISO-19152 LAND ADMINISTRATION DOMAIN MODEL THAT TOGETHER WILL ALLOW THE SEAMLESS ADMINISTRATION OF LAND & THE OCEANS
IHO-S121
CONNECTS the LEGAL PROCESSES in an AUTHORITATIVE WAY!
IT HAS to BE INCLUSIVE WITHOUT BEING PRESCRIPTIVE
EXTENDED USES OF S-121:
PETROLEUM LEASES
MARINE CONSERVATION AREAS
FISHERIES ZONES
FUTURE:
IHO S-121 INFORMING ISO 19152 PART 3 COULD BE EXTENDED IN THE IHO S-122
MR MARK ALCOCK
SENIOR ADVISOR GEOREGULATION & LAW OF THE SEA, GEOSCIENCE AUSTRALIA
INTRODUCTION TO THE IGIF-HYDRO, AN OPERATIONAL FRAMEWORK FOR INTEGRATED MARINE GEOSPATIAL INFORMATION MANAGEMENT
UN-GGIM WG MGI
FOCUSES ON SDG14
RAISE POLITICAL AWARENESS on the IMPORTANCE OF TIMELY GEOSPATIAL INFORMATION
IGIF-HYDRO
9 STRATEGIC PATHWAYS TO EFFECTIVELY USE MGI TO MONITOR & ACHIEVE UN SDGs
ADDRESS CHALLENGES OF BRINGING LAND & SEA TOGETHER
ENSURE WATER DOMAIN IS REFLECTED IN THE IGIF
MR JOHN NYBERG
DEPUTY HYDROGRAPHER, NATIONAL OCEANIC & ATMOSPHERIC ADMINISTRATION (NOAA); CO-CHAIR OF UN-GGIM WORKING GROUP ON MARINE GEOSPATIAL INFORMATION
CHAIR OF INTERNATIONAL HYDROGRAPHIC ORGANISATION WORLDWIDE, EINC DATABASE WORKING GROUP, VICE-CHAIR OF INTERNATIONAL HYDROGRAPHIC ORGANIZATION INTER-REGIONAL COORDINATION COMMITTEE
PANEL DISCUSSION
QUALITY METADATA is IMPORTANT
IHO DATA QUALITY WORKING GROUP
NEW GENERATIONS OF OGC STANDARDS FOR METADATA
HAVING AN OPERATION FRAMEWORK HELPS IN the SHARING of DATA
NEED TO BRING TOGETHER LEGAL & INTERNATIONAL STANDARDS!
COLLECT MARINE ENVIRONMENT INFORMATION FROM SEVERAL BASELINES
EFFECTIVE POLICIES DETERMINE THE QUALITY OF DATA
MR JOHNATHAN PRITCHARD
CO-CHAIR OF OPEN GEOSPATIAL CONSORTIUM MARINE DOMAIN WORKING GROUP, OPEN GEOSPATIAL CONSORTIUM
SENIOR TECHNICAL MANAGER, IIC TECHNOLOGIES, UNITED KINGDOM

Annex D.

The NZ MGI data portal matrix

		Te Kete Korero a Te Takutai Moana	AuSEABED	Petlab	LAWA	IRA Moana	NZ Petroleum Basin Explorer	LDS	IHO	NZOON
Purpose of the portal	Discoverability of data or metadata catalogue	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Visualisation of data and geospatial information	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Access to data	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Other	✓	✓							
Types of marine geospatial data supported by the portal	Species data (e.g. seabirds, fish, algae, invertebrate, marine mammals, etc)									✓
	Community data (e.g. species distribution, modelling datasets, species turnover, etc)				✓					✓
	Ecosystem data (e.g. marine habitat)									✓
	Depth/bathymetry (e.g. grids, soundings, contours, surfaces, models, etc)		✓				✓	✓	✓	✓
	Geophysical (e.g. seafloor characteristics, backscatter, sedimentology, slopes, curvature, rugosity, ground sampling, etc)		✓		✓			✓	✓	✓
	Water observations (e.g. temperature, turbidity, water column backscatter, salinity, sound velocity profiles, etc)									✓
	Sea level data (e.g. coastline, tidal data, etc)						✓	✓		
	Meteorological data (e.g. air temperature, air pressure, wind, etc)									
	Marine infrastructure (e.g. hazards, marine farms, coastal construction, aids to navigation, etc)						✓	✓		
	Human activities (e.g. pollution, plastics, chemicals, oil, gas, vessel tracks, commercial catch effort, recreational fishing intensity, etc)		✓				✓			
	Management areas (e.g. marine reserves, sanctuaries, fishing restrictions, Mataitai, Taiapure, fishing reporting grids, etc)		✓				✓	✓		
	Other	✓		✓		✓	✓			
Data is supplied by	Own organisation	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Other organisations / Third party	✓	✓	✓	✓	✓	✓	✓	✓	✓
External data is uploaded by	Portal owner / Own organisation	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Data supplier		✓	✓		✓	✓	✓		✓
External data is managed by	Portal owner / Own organisation	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Data supplier	✓	✓	✓	✓	✓	✓	✓	✓	
Third party data supplier is responsible for	Costs of their data being uploaded on the portal	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Costs of their data being maintained on the portal	✓	✓	✓	✓	✓	✓	✓	✓	
	Costs of their data being stored on the portal	✓	✓	✓	✓	✓	✓	✓	✓	
	Costs of their data being accessed/downloaded on the porta	✓	✓	✓	✓	✓	✓	✓	✓	
	Costs of the portal infrastructure being maintained and administered				✓					
	Other costs		✓			✓				
Accessibility	Direct download	✓	✓	✓	✓	✓	✓	✓	✓	✓
	API		✓	✓		✓	✓	✓	✓	
	Webservices (wmts, wms, wfs, etc)	✓	✓	✓		✓	✓	✓	✓	
	Physical media (USB drive, disc, etc.)							✓	✓	
	Other				✓					
Data exploration	Search	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Filter	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Subset	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Custom visualisation (e.g. turning layers on/off, zooming, changing basemap, etc)	✓	✓	✓	✓	✓	✓	✓	✓	✓
Data reuse	Data released under open licence (e.g. Creative Commons, etc)	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Licensing restrictions exist									
	Other licensing policy			?	✓					
	Free access/reuse the data	✓	✓	✓	✓	Varies	✓	✓	✓	✓
Standards	ISO 19115/19139	✓	✓	✓	✓	✓	✓	✓	✓	✓
	OGC Web Services	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Predefined / standardised vocabularies	✓	✓	✓		✓	✓	✓	✓	✓
	Proprietary standard									✓
	Custom standards		✓			✓	✓			
	other			✓						
User experience	No login required	✓	✓	✓	✓	✓	✓	✓	✓	
	Available user guide/help tab	✓	✓	✓	✓	✓	✓	✓	✓	✓
Analytics for data owner		✓	✓	✓	✓	✓	✓	✓	✓	✓

Annex E.

DRAFT MARINE SPATIAL DATA INFRASTRUCTURES (MSDI) QUESTIONNAIRE

Member State/Organization: _____

The intent of this questionnaire is to determine the level of expected uptake of S-100 products in order to create a first impression of the ongoing activities in uses cases and for the planned regular provision of such services.

Please share this questionnaire with all National Organizations that have relevant S-100 data and invite them to fill it and return to the IHO Secretariat (if it is required in Word format, please contact info@iho.int).

Question	Answer
General	
Please provide your name and e-mail	
Name of organization	
Purpose of the organization	Select: Hydrographic Office, Maritime Safety Authority, National Geospatial Data Agency, private company, other
Country	
S-100 national contact point. If yes, please provide contact details and e-mail address.	
Contact details	
e-mail address.	
S-100 test cases	
Products/product name	
Aim of the project	
Name of the project	
Project partners	
Effected S-100 products	
Link to data or website	
Other relevant themes that can be presented	
Can the data be presented to IHO GIS	
Other information	
Provide the contact point details and e-mail addresses	
Regular production (S-100 priority 1).	
S-101	
- planned for production?	
- planned coverage?	
- planned distribution	
- other information	
S-102	
- planned production	
- planned coverage	
- planned distribution	
- planned update cycle	

- other information	
S-104	
- planned production	
- planned coverage	
- planned distribution	
- planned update cycle	
- other information	
S-111	
- planned production	
- planned coverage	
- planned distribution	
- planned update cycle	
- other information	
S-124	
- planned production	
- planned coverage	
- planned distribution	
- planned update cycle	
- other information	
S-129	
- planned production	
- planned coverage	
- planned distribution	
- planned update cycle	
- other information	
Production (S-100 priority 2 and S-400).	
S-122	
- planned production	
- planned coverage	
- planned distribution	
- planned update cycle	
- other information	
S-123	
- planned production	
- planned coverage	
- planned distribution	
- planned update cycle	
- other information	
S-411	
- planned production	
- planned coverage	
- planned distribution	
- planned update cycle	
- other information	
S-412	
- planned production	
- planned coverage	
- planned distribution	
- planned update cycle	
- other information	

Annex F

Action list.

LIST OF ACTIONS FROM THE MSDIWG13 MEETING 2022

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	Related activity on IGIF-MSDI Maturity guide OGC is working on with UKHO. Sponsors and resources are still welcomed. Ongoing
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	Ongoing.
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 elearning 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	Awaiting/to discuss Later To coordinate with IHO e-learning on the possibility of

				these translations.
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	Awaiting
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	Ongoing
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	Awaiting Expected to be sent in MAR 2021
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	Awaiting
13/2021	MSDIWG MS invited to comment on draft UNGGIM Standards Guide Ed. 3	MSDIWG MS	MAY 2021	Awaiting Send feedback to MSDIWG ViceChair
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 appoint contact points from Data Quality WG, NIPWG and S100WG to report back to MSDIWG on relevant MSDI matters	S100WG – OGC MarineDWG/IIC Technologies	MSDIWG14	
2/2022	Compile list of relevant S-1xx products point of contacts		MSDIWG14	
3/2022	MSDIWG to identify the S-1xx products that could be relevant for MSDI users		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	
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	
6/2022	MSDIWG to identify use-cases of crowdsource bathymetry	MSDIWG	MSDIWG14	

7/2022	MSDIWG to test the MSDI Training Materials on the IHO e-learning portal (https://elearning.iho.int)	MSDIWG	MSDIWG14	
8/2022	OGC to provide guideline or Recipe Book and showcase(s) for Hydrographic Offices to implement OGC APIs	OGC Marine DWG	MSDIWG14	
9/2022	OGC API - Feature Link to be made available to Body of Knowledge	OGC Marine DWG	MSDIWG14	
10/2022	OGC to provide presentation on OGC APIs for MSDIs at MSDIWG14	OGC Marine DWG	MSDIWG14	
11/2022	OGC to share links to latest OGC APIs for dissemination to MSDIWG	OGC Marine DWG, IHO Secretariat	MSDIWG14	
12/2022	OGC to provide draft guidance on how to follow the FAIR principles from HO perspective	OGC Marine DWG	MSDIWG14	
13/2022	MSDIWG to follow-up on IRCC14's outcomes of the IRCC Workshop and suggest how MSDIWG could contribute to SPI 2.3.1	MSDIWG Vice-Chair	MSDIWG14	
14/2022	MSDIWG to explore practical approach or best practices on principles for MSDIs	MSDIWG Vice-Chair	MSDIWG14	
15/2022	MSDIWG to include proposed FAIR principles checklist to be included in report.	OGC Marine DWG	MSDIWG14	
16/2022	MSDIWG to establish a C-17 Drafting Team	MSDIWG Vice-Chair USA (NGA) Italy	August. 2022	
17/2022	C-17 Drafting Team to provide a first version at MSDIWG14	MSDIWG Vice-Chair USA Italy	MSDIWG14	
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. Input paper to be provided in MSDIWG14.	MSDIWG Chair and Vice-Chair Netherlands IHO-Singapore Innovation Technology Laboratory OGC Marine DWG	MSDIWG14	
19/2022	MSDIWG to provide feedback on WENDWG's WEND Product Matrix from MSDI perspective when deemed appropriate.	WENDWG Chair, IHO Secretariat	MSDIWG14	
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	
21/2022	OGC FMSDI S-122 Engineering Report to be made available to the MSDIWG when made public	MSDIWG Chair OGC	August 2022	
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	MSDIWG Chair and Vice-Chair, ESRI	MSDIWG14	

	1: Make data that is already available into INToGIS and Step 2: establish a hub			
23/2022	Recommendation for Step 2: establish a hub, to be submitted at MSDIWG14	ESRI	MSDIWG15	
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	
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	
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	

Annex G

MSDIWG 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. 4. Send out template to MS for national Maturity Assessments	2021	2023	P	USA (NGA) Chair		
A.2	IHO Strategy Goal 2.1. Build a portal to support and promote regional and international cooperation in marine spatial data infrastructures (MSDI).	H	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	IHO Sec. Chair Vice Chair NGA Norway		
A.3	Develop MS or RHC relevant Case Studies. Ref: C2 (Investigate if it is possible to engage the RHC MSDI ambassadors)	M	1. Baltic Region 2. Brazil 3. East Asia Region	2021	2023	P	Denmark Brazil Korea		

B.1	Create an implementation guide “roadmap” template for MSDI, at national and/or regional level. (IGIF Implementation Guide, Strategic Pathway 1 to be considered.)	H	1. Gather information 2. Compile information 3. Publish template for implementation	2021	2023	O	USA, (NGA) IIC ESRI		
B.2	Identify core data for input to MSDI to support multiple applications [Ref: B1] Ref. to IGIF and IGIF W. and OGC Concept development study.	M	1. Marine Cadastre 2. Emergency Response 3. Coastal Zone Management	Mar 17	2023	O	Chair/V. Chair		
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	P	Chair/V. Chair NGA Norway		
C.2	Cooperation with RHC MSDIWG	H	1. Identify and list RHC MSDIWG MS, Chairs RHC MSDIWG and MSDI RHC Ambassadors 2. Create procedures for cooperation	2021	2024	P	Chair IHO Sec.		
C.3	Develop a governance model for MSDI	M	1. Deliver best practice governance models to BoK (Ref: B1) 2. IGIF Implementation Guide, Strategic Pathway 1 to be considered.	2017	2023	O	Denmark USA (NGA)		
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		
D.1	Identify relevant standards to support MSDI implementation and operation. Ref: B1.	H	1. Provide annual reports to IRCC and HSSC	2021	2024	O	OGC Marine DWG		
D.2	Assess the suitability and shortcomings of standards in supporting data interoperability.	M	1. Identify standards relevant to bathymetry (Ref: D1) 2. Marine Cadastre 3. Oceanography	2018	2024	O	OGC Marine DWG Portugal Chair		

			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.)						
D.3	Cooperate with the OGC MSDI Pilot	M	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 4. Take (appropriate actions as necessary	2021	2023	O	Chair		
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	2023	O	Chair IHO Sec. OceanWise UK US (NGA)		
E.3	Identify challenges, options and solutions in relation to data security and integrity from a HO MSDI perspective	M	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.	2021	2023	P	Chair V. Chair IIC		

			5. Take appropriate actions as necessary						
E.4	Corporation with IHO-Singapore Innovation and Technology Laboratory	M	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	V. Chair IHO Sec.		
F.1	Develop and maintain training syllabi	M	1. Review and update in line with relevant developments, methods and content	2018	2022	O	Denmark IIC		
F.2	Support development and delivery of e-learning platforms	L	1. Coordinate activities with East Asia (KHOA) 2. Coordinate with E-learning PT. 3. Compile list of existing e-learning modules relevant to MSDI	2018	2023	O	Esri OceanWise KHOA Chair IHO Sec.		
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	2022	P	IHO Sec. NZ(LINZ) Netherlands US (NOAA)		
G.1	Maintain IHO publication C-17 to reflect developments in ICT, Content, Standards and Governance of MSDI. V2.0 now approved by IRCC	H	1. Manage content 2. Create a Wiki 3. Request IRCC remove document from IHO Res: 2/2007 4. On-line dynamic content	2017	2022	O	OceanWise ESRI USA/NGA Denmark Germany Portugal		
G.2	Update C-17 in accordance with BX (UN-GGIM/IGIF)	H	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	P	Chair NGA		

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. 2022 -Singapore 2023 - Italy 2024 - Indonesia	H	1. Date and venue defined 2. Logistics in place 3. Open Forum program defined 4. Develop content for DWG workshops	2017	2024	O	MSDIWG Management Group (Chair/Vice Chair, IHO Sec.)		