



IHO

International Hydrographic Organization



# 21<sup>st</sup> MACHC

# Conference Minutes

Hosted Virtually by the United States of America  
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## Opening Remarks

### **Kathryn Ries, Chair of the Meso American - Caribbean Sea Hydrographic Commission (MACHC)**

Kathryn Ries, Meso American - Caribbean Sea Hydrographic Commission (MACHC) Chair, opened the 21<sup>st</sup> Conference of the MACHC on November 30, 2020, and welcomed the many members of the MACHC within the region and from other parts of the world. Ms. Ries referenced the background of her video screen, an aerial view of the city of New Orleans, Louisiana, where the United States hosts had fully expected to receive everyone in person. The plan was to introduce all participants to one of the largest ports in the country, and to one of its most beautiful and famous cities known for its distinctive culture, music, and food.

Ms. Ries noted that the pandemic changed everything, and that this will be the first time ever that the Commission meets virtually, adding that she looks forward to future opportunities when all can meet again in person. Ms. Ries referenced the Agenda, noting that it was designed to be as substantive and engaging as possible given the virtual environment. Before introducing the opening speakers, a [welcome video](#) was played that highlighted the core work of the MACHC and which can be found on the International Hydrographic Organization (IHO) MACHC website.

Ms. Ries humorously recalled a comment made by a MACHC colleague at one of the first meetings of the Commission she attended. He remarked that it was “easier to understand God, than hydrography in the United States”, because hydrography is not the sole responsibility of one agency, which can be confusing. The three principal agencies are: the National Oceanic and Atmospheric Administration (responsible for surveying and charting U.S. coastal waters); the U.S. Navy (responsible for surveying in international waters); and the National Geospatial Intelligence Agency (responsible for charting international waters). Noting that the three agencies complement each other and work well together, she then introduced their senior level representatives and invited them to make their opening remarks.

### **Rear Admiral Tim Gallaudet, Assistant Secretary of Commerce for Oceans and Atmosphere and Deputy Administrator of the National Oceanic and Atmospheric Administration (NOAA)**

Rear Admiral Tim Gallaudet, Assistant Secretary of Commerce for Oceans and Atmosphere and Deputy Administrator of the National Oceanic and Atmospheric Administration (NOAA), thanked the MACHC Chair. Admiral Gallaudet recognized many good friends and colleagues from the IHO, including recently elected IHO Director Admiral Luigi Sinapi, Admiral John Okon of the United States Navy, and Vice Admiral Robert Sharp of the National Geospatial-Intelligence Agency. Admiral Gallaudet emphasized the large role the MACHC plays in advancing the goals of the IHO and in supporting the United Nations’ Decade for Ocean Science, as well as the very important goals of Seabed 2030. The Admiral further elaborated on the importance of partnerships between the government, non-governmental organizations, and industry to advance the work of this Commission. Finally, Admiral Gallaudet indicated that even if it is just virtually, it is great to be involved, and he thanked everyone, wishing all a very productive conference.

### **Rear Admiral John Okon, Commander of the United States Naval Meteorology and Oceanography Command (CNMOC)**

Admiral John Okon, Commander of the United States Naval Meteorology and Oceanography Command (CNMOC) welcomed all the participants, noting that unfortunately COVID-19 had kept everyone from meeting in person. Admiral Okon thanked the MACHC Chair for her leadership and her team for their support organizing this meeting virtually so that the pandemic would not obstruct this important regional conversation.

Admiral Okon mentioned that many key issues are facing us globally as well as regionally. Longstanding alliances and partnerships forged through the IHO Assembly and Regional Hydrographic Commission (RHC) meetings are absolutely critical to building a shared understanding and promoting regional safety, national security, the blue economy, and capacity building. The Admiral added that he looked forward to a very robust four-day conversation and thanked the MACHC Chair in advance for her facilitation.

### **Vice Admiral Robert Sharp, Director of the National Geospatial-Intelligence Agency (NGA)**

Vice Admiral Robert Sharp thanked the MACHC Chair for making this virtual meeting a priority and all those who were involved in putting it together. Due to the pandemic, all the participants have had to adapt to virtual meetings, and the Admiral thanked everyone for their attendance and adjustment. Vice Admiral Sharp further noted that it seemed like “old home week” because many of the participants have known each other for many years, and he offered his congratulations to Admiral Sinapi for his leadership at IHO and his election as IHO Director.

Vice Admiral Sharp emphasized the importance of participation and that the value to come from this conference would be the dialogue and personal connections made. Although a little more difficult virtually, the Vice Admiral challenged all participants to meet someone new, to exchange contact information, and to follow up with one another after the conference to continue to build relationships.

### **Admiral Luigi Sinapi, Director of the International Hydrographic Organization (IHO)**

Admiral Luigi Sinapi expressed greetings from the International Hydrographic Organization (IHO) on behalf of its Secretary-General and the Directing Committee. Admiral Sinapi added particular thanks to the MACHC Chair of this large hydrographic Commission for her proactiveness in stimulating and organizing new initiatives in the fields of hydrography, oceanography, and cartography for the benefit of the MACHC Full Members, Associate Members, and Observers, as well as the many potential new members. He thanked the other three Admirals for testifying as to the importance of this Commission for the Mesoamerican and Caribbean region.

Admiral Sinapi mentioned the new IHO strategic goal related to participation in international activities on the sustained use of the oceans. It confirms that the IHO is now also clearly committed to reconciling the use and the preservation of the marine environment. The United Nations Decade of Ocean Science for Sustainable Development (UN Ocean Decade) and Seabed 2030 serve as effective and recognized contributors to the major ocean related challenges. The Admiral commended the MACHC for all the work that aligns so well with these goals, and highlighted that the MACHC is the first Regional Hydrographic Commission to develop a regional Seabed2030 program to be submitted for endorsement as a UN Ocean Decade action.

Admiral Sinapi noted that hydrographic data is traditionally primarily used for the safety of navigation, although it can actually be used by a wide variety of stakeholders. The Admiral praised the work of the MACHC for its efforts to make key navigation data sets accessible for non-navigational uses, for supporting cooperation between its Members States, neighboring Commissions, and other regional organizations to leverage resources and expand capacity building activities, and for developing a disaster response framework to position the Commission to effectively communicate and provide assistance. The Admiral concluded by thanking the MACHC for what it is doing for the benefit of the region and expressed wishes for an intensive and fruitful meeting.

## Formal Open

Kathryn Ries, MACHC Chair, thanked all the opening speakers for their inspirational and affirmative remarks. Ms. Ries also recognized Vice Admiral Edgar Barbosa of Brazil, who had taken up the position as Vice MACHC Chair after MACHC20, and who was participating in the MACHC Conference for the first time. Ms. Ries then declared the MACHC21 Conference officially open.

## 1.0 Meso American - Caribbean Sea Hydrographic Commission (MACHC) Administration and Organizational Issues

### 1.2 Approval of Agenda

Kathryn Ries, Meso American - Caribbean Sea Hydrographic Commission (MACHC) Chair, moved to begin with Agenda Item 1.2, Approval of the Agenda. Ms. Ries explained that the Agenda has been primarily organized around the core work of the MACHC, produced by its MACHC International Charting Coordination Working Group (MICC); the MACHC Marine Spatial Data Infrastructure Working Group (MMSDIWG); the Capacity Building Committee (CBC); the most recent initiative for The Nippon Foundation-GEBCO Seabed 2030 Project; and disaster response.

Ms. Ries further explained that nine meetings had been held in advance of the MACHC21 Conference to ensure plenary time is spent discussing substantive results and recommendations. These meetings included four Seabed 2030 webinars; pre-conference meetings of the MICC, MMSDIWG, and CBC; and a workshop sponsored by three industry partners, TCarta, EOMAP, and Esri to share satellite-derived bathymetry (SDB) technologies and experiences. These meetings were open to all MACHC members, as well regional organizations, industry, and other representatives who are important partners in these efforts. The results of all these meetings can be found on [MACHC Initiatives](#) website as indicated below:

- September 11, 2020: [Seabed 2030 Webinar #1](#)
- September 25, 2020: [Seabed 2030 Webinar #2](#)
- October 09, 2020: [Seabed 2030 Webinar #3](#)
- October 14, 2020: [MACHC Integrated Charting Coordination Working Group](#)
- October 23, 2020: [Seabed 2030 Webinar #4](#)
- October 28, 2020: [MACHC Marine Spatial Data Infrastructure Working Group](#)
- November 03, 2020: [Capacity Building Committee/SDB Technology and Experience](#)
- November 04, 2020: [Capacity Building Committee Meeting](#)

Ms. Ries displayed and reviewed the four-day agenda, noting that the disaster response agenda item had a special focus on operating during a pandemic. This was one request for something slightly different for the agenda this year, for obvious reasons. Ms. Ries opened the floor for comments on the Agenda as presented. There were none and the Agenda was approved.

21.1.2	Decision: Approved the MACHC21 Plenary Agenda.
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### 1.3 List of Documents

Ms. Ries, MACHC Chair, then moved to Agenda Item 1.3, the List of Documents, which is available on the International Hydrographic Organization (IHO) website, along with the List of Participants. Ms. Ries noted that there are some presentations that are still missing, and encouraged participants to please submit those as soon as possible to ensure a smooth flow of this virtual conference.

21.1.3	Decision: Approved the MACHC21 list of documents and participants.
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### 1.4 Matters Arising from Minutes of MACHC20 Meeting

Ms. Ries, MACHC Chair, then moved to Agenda Item 1.4, Matters Arising from Minutes of the MACHC20 meeting. She noted that there were two opportunities provided earlier this year for comments on the minutes. The deadline was extended to take into account disruptions from the pandemic. The comments received were integrated into the report, and as indicated in Circular Letter 11, only left the approval of the minutes at this meeting. There were no objections and the minutes from the MACHC20 meeting were approved.

21.1.4	Decision: Approved the minutes of the MACHC20 meeting.
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### 1.5. MACHC 20 Action List Review

Ms. Ries, MACHC Chair, introduced the next Agenda Item 1.5, the MACHC20 Action List review. She displayed a summary indicating a total of 37 MACHC20 actions. Twenty-one of them were completed (shaded in green) and six are continuous actions (shaded in gray). She noted that only two of the continuous actions are truly new. The other four were refinements on previous existing actions, which were consolidated. The continuous actions were included only to show how they were resolved. For example, the continuous action on MSI (20.2.3) is one that has been in place since the MACHC17 (17.2.1.1) meeting and has been updated as the action has evolved. At the MACHC20, a [matrix showing the status of MSI contributions](#) is now available as a tool to assist implementation of this action, found on the MACHC Initiative website.

This left only nine open actions to address, many of which will be addressed by the relevant committee or working group chairs. Ms. Ries also proposed to remove or delete any action remaining unresolved for more than three MACHC Conferences, of which there are only a few. While the Action List presented included actions from the 12<sup>th</sup> Meeting of the IHO Inter-Regional Coordination Committee (IRCC12), she explained that they would be reviewed in the upcoming IRCC Report agenda item.

Ms. Ries made specific comments on action 20.5.2, a hydrography and cartography course that COCATRAM proposed to organize with the support of the MACHC in 2021. Due to the pandemic, it is expected to be held in 2022 and will be included as part of the next IMO biennium plan. The next action, action 20.6.4.2, is one that was proposed for removal from the action list due to its incorporation into the Seabed 2030 Strategy and Work Plan. There were a number of additional actions which will fall under Seabed 2030.

Action 20.7.1.2 is to consider amendments for the MACHC disaster response framework based on the anticipated approval and amendment of the IHO Resolution 1/2005 on disaster response. This was originally going to be taken up at 2<sup>nd</sup> Session of the IHO Assembly (A-2). Since the Assembly was virtual and abbreviated, this was reviewed by Circular Letter instead. Many components are already incorporated in the disaster response framework of the MACHC. Thus, Ms. Ries determined that existing action 20.7.1.2 from the last MACHC already proposes to review the amendment, compare it with the MACHC disaster response framework, and offer any changes by correspondence. Actions 20.8.1.1, 20.8.1.2, and 20.8.4 are

related to the work of the MMSDIWG and will be addressed by the chair of that group in his report to plenary.

Action 20.10.1.C1 regarding plans for a Latin American Hydrography Conference in 2021 has been deleted. This is still very much in the initial stages and there is not enough information about it, but it may be reintroduced in the future.

There were a few other previous open actions from the MACHC19 meeting. One related to capacity building and the efforts to develop an individual recognition scheme for Latin American hydrographers which is in process, with a report available in advance of the next MACHC conference. The next action was related to encouraging completion of the International Bathymetric Chart of the Caribbean Sea and the Gulf of Mexico (IBCCA). Since this action list was posted, the very good news arrived that the project is expected to be completed before the end of 2020. A progress update was provided on Thursday morning under the agenda item 6. Survey and Risk.

Action 19.9 regarding development of a regional electronic navigational chart scheme has a proposal as part of the MICC report. The open action 15.5.1.2 about Haiti becoming a member of the IHO has been on the list for the past three years. While the MACHC certainly hopes Haiti will become a member as soon as possible, in the absence of an update, this action will be deleted from the list. Another action 15.6.3.4, which has been on the books ever since the MACHC15 conference is to invite the Caribbean Disaster Emergency Management Agency (CDEMA) to attend our meetings. Fortunately, schedules have finally aligned, and the Director of that agency would be making a presentation under the Disaster Response agenda item.

Ms. Ries noted that especially during this time of pandemic when normal operations have been so challenging and difficult, the MACHC can feel proud that its Members were able to make as much progress as they had during the year, both with these actions and in the meetings of its committee and working groups. With that, the floor was opened for comments.

Vice Admiral Barbosa of Brazil thanked Ms. Ries and referred to the action IRCC 12/2 regarding the report on the Future of the Paper Chart noted at the IHO Hydrographic Services and Standards Committee (HSSC) 12. The HSSC and the IHO Assembly endorsed the recommendations provided by the IHO Nautical Cartography Working Group. In this regard, the IHO Council has decided to monitor the implementation by the HSSC. The HSSC will report to the IHO Council annually on these recommendations. Therefore, Vice Admiral Barbosa suggested other wording for the action IRCC 12/2 for members to take note of the report and, in particular, its recommendations. Another point referring to action IRCC 12/4, Vice Admiral Barbosa suggested updating Annex 1 of the MACHC Statutes with the changes in the amended IHO Resolution 2/1997, thereby fulfilling IRCC 12/4.

Ms. Ries responded by thanking Vice Admiral Barbosa and Brazil, noting that the IRCC actions he referred to will be discussed during the IRCC report under agenda item 2. She suggested taking up those questions then, because actions such as reviewing the report on the Future of the Paper Chart is an example of a new action from this meeting. This was accepted by Vice Admiral Barbosa on behalf of Brazil.

Ms. Ries then recognized Captain Marc van der Donck of the Netherlands. Captain Van der Donck built on the intervention of Vice Admiral Barbosa of Brazil, asking about the relation between the new amended IHO Resolution 2/1997, and whether Ms. Ries, MACHC Chair aimed to revisit the Statutes more extensively, rather than only looking at the annexes. Ms. Ries agreed to look at the Statutes more extensively, and again clarified that the plenary was only currently reviewing the actions from last year, and would then move to new actions in the context of agenda item 2.0. There were no further comments and thus the review of actions from MACHC20 was approved and ended.

21.1.5

Decision: Approved the “updated” version of the MACHC20 action list as presented.

## **2.0 Meso American-Caribbean Sea Hydrographic Commission (MACHC) Developments, International Hydrographic Organization (IHO) Bodies, Policy Aspects**

Kathryn Ries, Meso American-Caribbean Sea Hydrographic Commission (MACHC) Chair, moved on to Agenda Item 2.0, addressing policy issues and reports from the International Hydrographic Organization (IHO) bodies that have implications for the MACHC, and welcomed IHO Director, Admiral Luigi Sinapi, to present his report from the IHO Secretariat.

### **2.1 IHO Secretariat Report (Admiral Luigi Sinapi, Director of the IHO)**

Admiral Luigi Sinapi, IHO Director, thanked Ms. Ries, MACHC Chair, for the opportunity to brief the MACHC on the outcomes of the virtual 2<sup>nd</sup> Session of the IHO Assembly (A-2) and the 4<sup>th</sup> Meeting of the IHO Council (C-4). Admiral Sinapi summarized the recent virtual Assembly, having almost 250 participants from 71 IHO Member States. Member States approved the new IHO strategic plan. The inclusion of Goal 3 relates to participation in international initiatives on the sustainable use of the oceans, and confirms that the IHO is clearly committed to helping to reconcile the use and the preservation of the marine environment, in line with the global initiatives, such as the United Nations Decade of Ocean Science for Sustainable Development (UN Ocean Decade) and Seabed2030. The 2020 General Bathymetric Chart of the Oceans (GEBCO) ocean mapping grid release showed 19% global coverage and is comprised primarily of existing data and some new data. The target coverage for year four is 25% (6% growth), which is very ambitious in the wake of challenges associated with COVID-19 shutdowns.

There was strong emphasis on the importance of marine geospatial data. Traditionally, hydrographic data is used primarily for the safety of navigation, but the IHO recognizes its value for many other uses by a wide variety of stakeholders, such as to monitor changes and effectively protect the Oceans. The Assembly also approved the S-100 Implementation Strategy. The C-4 (which has five MACHC members) was tasked to implement the Roadmap of the S-100 Implementation Decade and support the transition from paper-based products and S-57 Electronic Navigational Charts (ENCs) to the S-100 suite of standards.

The World-Wide Electronic Navigational Chart Database Working Group (WENDWG) of the IHO Inter-Regional Coordination Committee (IRCC) is developing a new set of WEND-like principles for production and dissemination of S-101 ENCs and of S-100 based products. The WENDWG established a drafting group to re-write the WEND principles to include the full suite of navigation services. The IRCC12 agreed to expand on existing principles and assist their unified application with an implementation guide.

Regarding capacity building, Admiral Sinapi noted that 91% of the budgeted work was completed in 2020, although the pandemic had a significant impact. He expects that the 2021 IHO Capacity Building Sub-Committee (CBSC) Work Plan will require an extensive review and a prioritization of the submissions. The new e-Learning Center and Women in Hydrography Capacity Building Projects will be explained in further detail in the CBC agenda item.

Admiral Sinapi noted that the MACHC is the second largest Commission of the IHO, with many non-IHO Member States that are involved in MACHC activities, which he encourages to become new IHO Members.

Ms. Ries, MACHC Chair, thanked Admiral Sinapi and opened the floor for comments or questions.

Mr. Kemron Beache of St. Vincent and the Grenadines asked about the purpose of the new WEND-like (WEND-100) principles. Admiral Sinapi responded that the new S-100 standards and related product specifications are not only to be used for safety of navigation and cartography itself, but for a variety of new products and services. The S-100 standard has been drafted to facilitate and create an overarching structure for the new S-100 products, specifically beginning with S-101 ENC's, which will replace the traditional S-57 format, hence the need for these new WEND-like principles.

Ms. Ries indicated that the MACHC had noted his report, and observed that a number of recommendations proposed in the report would have a great deal of overlap with the upcoming reports, including those from the IRCC. Ms. Ries asked that all these recommendations be reviewed after the other presentations conclude.

21.2.1.1	Decision: Noted the IHO Secretariat Report and to consider all recommendations and take any actions, as appropriate.
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Ms. Ries then moved on to the IRCC Report, where she represented the MACHC at the virtual 12<sup>th</sup> Meeting of the IHO IRCC.

### 2.1.1 IRCC Update (Kathryn Ries, Chair of the MACHC)

Kathryn Ries, MACHC Chair, noted that many IRCC agenda highlights were already covered by Admiral Sinapi and would not be repeated. Ms. Ries indicated that only a summary of all the Regional Hydrographic Commissions' (RHC) reports had been provided, due to the virtual nature of the meeting. A high-level summary of common themes, challenges, and issues was provided by Admiral Sinapi (including impacts of the pandemic on all of the commissions, and challenges of moving to virtual meeting formats). However, the value of increased collaboration and regional partnerships, particularly as it relates to Seabed 2030 and other initiatives was noted under capacity building, as well as the new e-Learning Center proposed by the Republic of Korea and the new initiative for Empowering Women in Hydrography.

The IHO Marine Spatial Data Infrastructures Working Group (MSDIWG) and the Global Geospatial Information Management Working Group (GGIM) spoke about their accomplishments and efforts to better align and integrate its work, focusing on the development and management of geospatial information and particularly making sure that marine data gets as much visibility and equal importance as land-based data. On Seabed 2030, there was a great deal of emphasis on ocean mapping activities, including crowdsourced bathymetry, which resulted in some of the recommendations for the RHC.

Ms. Ries proposed to proceed to address the specific actions that the IRCC assigned to the RHCs. In summary, out of the 13 total recommendations for RHCs, five of them are related to Seabed 2030 and crowdsourced bathymetry that are already in progress via the MACHC Seabed 2030 Strategy that will be presented later in the agenda, and one is related to MSDI that will be addressed by the MACHC Marine Spatial Data Infrastructure Working Group (MMSDIWG). There are three that are related to other

aspects of Seabed 2030 that either were completed or are part of continuous MACHC actions. There are only four potential new MACHC actions.

Regarding IRCC Action 12/4 on IHO Resolution 2/1997, Ms. Ries observed that it may merit additional study to determine whether the MACHC needs to change anything in its Statutes or whether it is enough to just update the existing annex, as suggested by Vice Admiral Barbosa of Brazil.

Captain Van der Donk of the Netherlands agreed that the MACHC should take some time to study its Statutes to ensure that they are fully aligned with the scope of IHO Resolution 2/1997 as amended, and possibly include more emphasis on capacity building and some other minor issues we should probably be looking at. Ms. Ries, MACHC Chair, asked if Brazil and the Netherlands would work with her after the meeting to further analyze and then propose any changes to MACHC Members by circular letter. Brazil and the Netherlands agreed to this approach.

21.2.1.1.4	Action: MACHC to implement the IHO Resolution 2/1997 as amended by A-2. Partly implemented - Brazil and the Netherlands to work with MACHC Chair to examine further action.
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The next IRCC action requested that RHCs invite Member States who have experience in developing and providing e-learning contents to share their resources and experiences to the e-Learning Project Team. This is in relation to the new proposal from the Republic of Korea to set up an e-Learning Center. Lucy Fieldhouse, IHO Capacity Building Sub-Committee (CBSC) Coordinator, is a member of that team and would speak to this in her report. The new MACHC action follows:

21.2.1.1.5	Action: Invite the Member States who have experience in developing and providing e-Learning contents to share their resources and experiences to the IHO CBSC e-Learning Project Team.
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Ms. Ries continued with the next IRCC action requesting RHCs to promote the discussion of any item with relevance to Spatial Data Infrastructures (SDI), Marine Spatial Data Infrastructures (MSDI), and Marine Spatial Planning (MSP) and to take appropriate actions. The MACHC is already doing this through its MMSDIWG. The next action is to consider Crowdsourced Bathymetry (CSB) and Seabed 2030 initiatives be permanently added as an agenda item at future RHC meetings. These topics were already on the agenda for this meeting and can easily be continued. There are three more actions related to Seabed 2030 and CSB asking Member States to release datasets to the IHO. They are already in progress either via the proposed MACHC/Intergovernmental Oceanographic Commission Sub-Commission for the Caribbean and Adjacent Regions (IOCARIBE) Seabed2030 Strategy and Work Plan.

The action about modifying the current Seabed 2030 Coordinator title to a joint RHC coordinator for CSB and Seabed 2030 would be discussed as part of the Seabed 2030 Agenda Item. The MACHC Seabed 2030 Coordinator, Cecilia Guzman of Mexico, is already serving in this dual role, and the Seabed 2030 proposals that she would present includes CSB as an integral component of the Strategy and Work Plans.

Ms. Ries continued with the next action (IRCC 12/17), which encourages Member States to promote the need to map the seabed. Once again, this is being addressed as part of the MACHC Seabed 2030 Strategy. The next action (IRCC 12/19) is already a continuous MACHC action (20.6.4.1), and the last action (IRCC 12/20) requests the RHCs to participate at the regional level in those actions of the UN Ocean Decade matching with IHO's new strategic targets. The MACHC is already doing this with the proposed Seabed2030 Strategy which, if approved, will be proposed as a candidate for endorsement as a

regional program for the UN Ocean Decade. At this point, Ms. Ries asked if there were any comments or concerns with categorizing the actions as described. Hearing none, the MACHC noted the IRCC Report.

21.2.1.1.1	Decision: Noted the IRCC Report and to follow-up on RHC related actions.
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The Chair moved to Agenda Item 2.1.1 HSSC Report presented by Captain Rodrigo Obino of Brazil.

### 2.1.2 IHO Hydrographic Services and Standards Committee (HSSC) Update (Captain Rodrigo Obino, Brazilian Hydrographic Office)

The 12<sup>th</sup> Meeting of the IHO Hydrographic Services and Standards Committee (HSSC12) was held in virtual format in October 2020. Brazil, France, the Netherlands, United Kingdom, and United States attended HSSC 12. In 2021, the HSSC 13 meeting is planned to take place in Bali, Indonesia, at the end of May over five days depending on the world's health situation. There is a possibility that the meeting will be in a hybrid format, or that it will be postponed to November 2021.

The Committee had seen some developments of the product specifications over the past year. There has been an adoption of the second edition of S-101, the first edition of S-111 Surface Currents, and first edition of S-127 Marine Traffic Management. Still under development are product specifications for S-104 Water Level Information, S-124 Navigational Warnings, and S-128 Catalogs of Nautical Products. The product specifications go beyond the work of Hydrographic Offices. Flexibility is provided in S-100 based products, such as the use of portable devices for product visualization and the availability of real-time data. It was also indicated that HSSC will elaborate a confidence document with stakeholders that formalizes the guiding principles of dual fuel concept. However, the release of edition five of the standard S-100 will be delayed until 2022. Some product specifications in an initial priority list will be aligned to S-100 Edition 5.0.0 by 2023: S-101, S-102, S-104, S-111, S-122, S-123, S-124 and S-129.

HSSC 12 endorsed the recommendations of the final report on the Future of the Paper Chart. This report was appreciated by the Assembly which endorsed the HSSC recommendations on the Future of the Paper Chart and also tasked the HSSC to implement these recommendations. The sixth edition of S-44 was adopted in September of 2020. The main changes from the previous edition include the introduction of the new, more stringent exclusive order. The use of exclusive order should be limited to areas with exceptional conditions and specific requirements. It is based on the combination of the survey pattern and the theoretical area of detection of the survey instrumentation, expressed in percentage. The special order now explicitly requires full bathymetric coverage of 100% of the feature search. The project team that was responsible for reviewing the previous edition and drawing and drafting the sixth edition of S-44 was disbanded, and it was determined that the IHO Hydrographic Surveys Working Group (HSWG) will have the responsibility of maintaining S-44.

An IHO Resolution and some IHO publications that HSSC has been involved in were released or updated as follows:

- New IHO Resolution 01/2019 – Digital Tide and Tidal Current Tables.
- IHO Publication C-51 Edition 6.0.0 – Manual on Technical Aspects of the United Nations Convention on the Law of the Sea – 1982.
- IHO Publication S-97 Edition 1.1.0 – Guidelines for Creating S-100 Product Specification.
- New IHO Publication S-67 Edition 1.0.0 – Mariners' Guide to Accuracy of Depth Information in Electronic Navigational Charts (ENC).
- IHO Publication S-49 Edition 2.1.0 – Mariners Routing Guides.

21.2.1.2	Decision: Noted the HSSC Report.
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Ms. Ries, MACHC Chair, observed that the IRCC 12 asked RHCs to help disseminate and raise awareness of S-67 and for Member States to review the paper on the Future of the Paper Chart and provide feedback on it, which are two new actions for the MACHC. Below is a table that consolidates all the related IHO, IRCC, HSSC and continuing MACHC actions:

Number	Reference	Action
21.2.1.1	IHO/11.1 MACHC/20.9.6	MACHC members are invited to check the quality of the information available in INTOGIS II for Region B and report any discrepancies.
21.2.1.2	IHO/11.3	MACHC is invited to follow the finalization of the WEND100 principles, which will be presented at the next IRCC13 in June 2021, through the active participation at the WENDWG works.
21.2.1.4	IHO/23.1	MACHC Members and Associate Members are invited to officialise and/or review their positions on the conduct of CSB in their waters of jurisdiction (cfr. IHO CCLL 11/2019 and 20/2020) and to identify further potential sources of bathymetric measurements and survey data providers to facilitate the further completion of the DCDB data holdings.
21.2.1.5	IHO/32 IRCC12/3 IRCC11/18 MACHC/17.2.1.4	Countries in the MACHC Region are strongly encouraged to review their entry in the IHO Yearbook and C-55 and to provide the IHO Secretariat with the appropriate updates or to report no change (CL 20/2019 refers).
21.2.1.6	IHO/39	MACHC Members are invited to submit papers for publication in the IHR.
21.2.1.1.1	IRCC 12/1	Share the publication <a href="#">S-67 Mariners' Guide to Accuracy of Depth Information in Electronic Navigational Charts (ENC)</a> to the Marine Institutions and Schools.
21.2.1.1.2	IRCC 12/2 IHO/11.2	Member States to review the <a href="#">Future of Paper Charts</a> report and provide feedback on it through the MACHC Chair to the Nautical Cartography Working Group (NCWG).
21.2.1.1.6	IRCC 12/11	Promote the discussion of any item with relevance to SDI/MSDI/MSP and to take appropriate actions.
21.2.1.1.7	IRCC 12/12	Add CSB and Seabed 2030 initiatives as permanent Agenda items at future MACHC meetings.
21.2.1.1.8	IRCC 12/13	Encourage Member States to support the CSB initiative with positive actions, such as requiring all research vessels to collect bathymetric data for late uploading, when on passage or when it does not interfere with other research activities.
21.2.1.1.9	IHO/27 IRCC 12/14	Modify the current title of "RHC Seabed 2030 Coordinator" to a joint "RHC CSB/Seabed 2030 Coordinator" and provide the identification of the Coordinators.

Number	Reference	Action
21.2.1.1.10	IHO/27 IRCC 12/16 MACHC/ 20.6.4.1, 17.6.5	Encourage MS to release datasets or subsets into the public domain via the IHO DCDB.
21.2.1.1.11	IRCC 12/17 IHO/27	Encourage Member States to promote the vital need to map the entire seabed.
21.2.1.1.12	IRCC 12/19 MACHC/ 20.6.4.1 IHO/27	Encourage all Member States to make existing seabed mapping data available for use by Seabed 2030 in the GEBCO Grid.
21.2.1.1.13	IHO/23.2 IRCC 12/20 MACHC/ 17.2.2.4	RHC to participate at Regional level in those actions of the UN Ocean Decade matching with IHO's new strategic targets (IRCC12-08C).

Ms. Ries next invited Mr. Chris Janus, Chair of Sub-Committee on the World-Wide Navigational Warning Service (WWNWS-SC) to present an update.

## 2.2 Maritime Safety Information/World-Wide Navigational Warning Service (WWNWS) Report (Chris Janus, International Maritime Organization (IMO)/International Hydrographic Organization (IHO) WWNWS-SC Chair)

Chris Janus of the United States National Geospatial-Intelligence Agency and Chair of the International Maritime Organization (IMO)/International Hydrographic Organization (IHO) Sub-Committee on the World-Wide Navigational Warning Service (WWNWS-SC), thanked the MACHC Chair and expressed appreciation for the opportunity to provide the WWNWS-SC presentation. Mr. Janus also expressed gratitude to the previous Chair of the WWNWS-SC, Mr. Peter Doherty who recently retired. Mr. Janus recognized some of Mr. Doherty's accomplishments and contributions specifically to the MACHC. The WWNWS' capacity building started with Mr. Doherty when he took the time to develop the three-day MSI course and instructed the very first course in Jamaica in 2007. The WWNWS has provided 23 courses for over 360 participants from 124 countries, and it all started here in the MACHC. Mr. Janus sincerely thanked Mr. Doherty for his dedication to the WWNWS, to the MACHC, to the Mariner, and for his friendship. He spoke for all the MACHC as he wished Mr. Doherty "fair winds and following seas as he charts his next course".

The IMO/IHO WWNWS is an internationally coordinated service for the promulgation of navigational warnings, which is a message containing urgent information that needs to broadcast to ships. This year was particularly busy with an unprecedented number of hurricanes, and the WWNWS issued numerous navigational warnings informing mariners regarding port closures due to these dangerous storms, allowing them to adjust their course to navigate more safely to a different area, or to remain out of harm's way. There are a number of NAVTEX stations, and two of the newest are in Colombia. Mr. Janus thanked Colombia for all their outstanding work to establish these two new stations to enhance the capacity the coastal warning service within the MACHC.

Mr. Janus noted the Iridium logo on his slide and indicated that it is the newest or the second recognized mobile satellite service provider within the GMDSS. Moving forward, many of the navigation areas and

the meteorological areas will begin to implement this new service. An initial operating capability or trial phase are under way and going through the various checklists to achieve a full operational capability. NAVAREA IV and NAVAREA XXII began broadcasting in an initial operating capability via Iridium earlier this month.

Mr. Janus further highlighted the MSI Capacity Building Training conducted just after the MACHC20 meeting in the Dominican Republic in December 2019. There were 18 participants from 13 countries. Eleven countries have provided MSI since completing the course, which is an unprecedented increase considering all the courses taught throughout the years.

At the MACHC20 meeting the [first MSI status matrix](#) was introduced and is hosted on the MACHC Initiative website. The previous measure of effectiveness was based on how much MSI a country provided. However, depending on how much MSI is actually available for a particular country, this may lead to an inaccurate conclusion. Thus, to improve the way countries collaborate and record or track how successful they are, Mr. Janus decided to amend that measure to track regular contact as an additional indicator as to how effective this effort is within the MACHC. He encouraged all countries to visit the [MSI section](#) of the MACHC Initiatives website where they can review the regional MSI status matrix and also find a list for points of contact that need to be regularly updated.

Ms. Ries thanked Mr. Janus and moved that the plenary note the report.

21.2.2.1	Decision: Noted the WWNWS Report.
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Ms. Ries then mentioned that the MACHC does have two continuous actions for the National Coordinators to update their information and for all countries to review annually their status on the MACHC initiative website, as follows:

Number	Reference	Action
21.2.2.1	MACHC 20.3, 17.2.1.1	Member States to review the MACHC Initiatives website to verify your respective MSI status. ( <a href="https://www.iho-machc.org/msi.html">https://www.iho-machc.org/msi.html</a> )
21.2.2.2	MACHC/20.3, 17.2.1.1 IRCC11/8	Member States to review and verify the MSI National Coordinator point of contact for your respective country and report any changes to <a href="mailto:navsafety@nga.mil">navsafety@nga.mil</a> by February 1, 2021.

Ms. Ries also thanked Mr. Janus for the tribute to Peter Doherty. Mr. Doherty did so much for the region and left a tremendous legacy that will be honored as the Commission continues the important work he initiated. The MACHC wishes Mr. Doherty the very best in this next phase of his life. Just before taking a break, the Ms. Ries explained the procedure for the group photo, asking that all participants take a headshot or a selfie from their phone and send it to the designated contact along with their first name, last name, and country. A composite would be put together that became the [final MACHC group photo](#) found on the IHO MACHC website.

After the break, the Ms. Ries welcomed everyone back to the afternoon session. Before beginning with Agenda Item 9.0, she recognized Dr. Leendert Dorst of the Netherlands. Dr. Dorst referred to the color-coded MSI matrix mentioned in the WWNWS presentation and noted that while Curaçao indeed is green, the other five regional islands within the purview of the Netherlands are coded white. Dr. Dorst reported some good news, indicating that the green status now applies to all six islands. A trained

representative of the Royal Netherlands Navy is responsible for this function for the six Caribbean islands. He requested that all six islands can be color-coded green.

Mr. Janus of the United States expressed appreciation for the update from the Netherlands and agreed that those changes will be made to reflect the appropriate status in the Netherlands and the associated islands.

## 9.0 Nautical Charts and Publications

Kathryn Ries, Meso American-Caribbean Sea Hydrographic Commission (MACHC) Chair moved on to the report of the MACHC International Charting Coordination Working Group (MICC) report by the Working Group Chair, Bernice Mahabier of Suriname.

### 9.1A MACHC International Charting Coordination Working Group (MICC) Report, (Bernice Mahabier, MICC Chair)

Bernice Mahabier of Suriname thanked everyone for their support of the MICC and for their contributions. Ms. Mahabier covered the membership and the work procedure, noting quarterly conference calls, the annual meeting, and sub working groups. The results of the sub working group on development of a regional electronic navigational chart (ENC) scheme would be presented by its Subgroup Chair, Captain Leonardo Tun of Mexico.

Ms. Mahabier noted the adjustment of the MACHC boundary to include the Amazon River. She also covered the progress of available ENCs, which stands at 964 and International (INT) Chart progress. The ship port analysis for the MACHC regional ENC scheme now shows that out of 191 ports, only 17 are not adequately covered.

Regarding the S-100 series testbeds, Ms. Mahabier notes that the Netherlands has done an S-102 bathymetric surface testbed, the USA has done one for S-111 surface currents, and France has done one for S-122 marine protected areas. Finally, Ms. Mahabier presented the MICC Work Plan for 2021.

Ms. Ries, MACHC Chair, thanked the Ms. Mahabier for her presentation and asked for any questions except those regarding the new ENC scheme, a topic that would be addressed in the next presentation.

Mr. John Nyberg of the United States thanked Ms. Mahabier for an excellent report, noting that the MICC is making notable and wonderful progress on the ENC scheme in the region. Mr. Nyberg further inquired if there were any plans to focus a little more on what the future of the paper chart might look like for the region. Given that the United States has indicated that they would not make any new paper charts moving forward, it might be very good to hear from the region about what an adequate paper chart suite might be, and to continue the focus on advancing the ENC suite.

Ms. Mahabier replied that the MACHC will have to develop a collective view and make a collective decision about the future of the paper chart in the region, as it is indicated by the International Hydrographic Organization (IHO) Inter-Regional Coordination Committee (IRCC), and by the MACHC Chair to be one of the topics of discussion.

Captain Rodrigo Obino of Brazil commented that Brazil was pleased with the work done by the IHO Nautical Cartography Working Group (NCWG) in the report on the Future of the Paper Chart. Further, Captain Obino recognized the need to develop a unified symbology for both raster and vector products and the need to develop ways to enable Hydrographic Offices to produce paper charts directly from S-101. However, Captain Obino expressed that there is no need for a simplified chart or a backup chart

for international maritime navigation, adding that the standard nautical paper chart will remain necessary for some time.

Ms. Ries mentioned that the MACHC has a new action from the IRCC to review the Future of the Paper Chart report, and to look at its implications both nationally, as well as regionally. This may be something that the MICC could undertake because most of the MICC members represent the primary charting authorities.

Ms. Mahabier responded that the MICC can take a look at this issue, but further noted that the IMO officially recognizes the nautical paper chart as an official nautical chart. Thus, the MACHC will have to take that into consideration as well, and perhaps seek feedback on this from the IHO and the International Maritime Organization (IMO).

Ms. Ries responded that while there was unfortunately no IMO representative at the conference, that the feedback could certainly be pursued within the context of the MICC. Ms. Ries added that paper charts are going to be around for a good while, it does behoove the MACHC to begin looking toward the future and try to formulate what might make sense for the region. She suggested that starting with a review within the MICC of the results of the report on the Future of the Paper Chart would be a reasonable first step, and Ms. Mahabier agreed.

Captain Marc van der Donck of the Netherlands added that the NCWG has put forward the recommendations which were endorsed by the IHO Hydrographic Services and Standards Committee (HSSC) and by the IHO Assembly. There will not be a specific new standard for simplified paper charts to derive from S-100 or any other ENC in the future, but it does not stop Member States from looking at how paper charts can be simplified for the future. Also, the initiative to look at how to produce paper charts from ENCs is also a recommendation that came from HSSC and the IHO Assembly. There is plenty of work on the Future of the Paper Chart in process through the endorsed recommendations.

Ms. Ries, MACHC Chair, summarized the discussion, noting that the plenary concluded that the MICC will take a look at this as part of its work plan over the next year, starting with a review of the Report of the Future of the Paper Chart, and begin a related discussion about how the MACHC region might approach this topic.

Ms. Ries then moved to the next presentation on an approach to a regional ENC scheme (MACHC20 Action 19.9), by Captain Leonardo Tun of Mexico.

### **9.1B Proposal for Regional ENC Scheme (Captain Leonardo Tun, Director of Hydrography at the Mexican Secretary of the Navy)**

Captain Leonardo Tun, Director of Hydrography at the Mexican Secretary of the Navy, greeted the Conference and thanked everyone for the opportunity to make this presentation. Captain Tun first thanked Colombia for proactively working with the adjustments for the proposal from the last meeting, as well as all the other countries who have contributed to this effort. The presentation included a background of the MICC, actions that the sub working group has taken, their results, and some requests to MACHC Members.

Captain Tun referenced the MACHC19 meeting in 2018 where Colombia presented a research project as an alternative to improve the ENC scheme of the region. Then at the MACHC20 meeting in 2019, Colombia presented a proposal for a regional ENC scheme to unify cell sizes based on current coverage of INT charts. At the same meeting, the creation of a sub working group on a regional MACHC scheme

was approved by the Members. The objective of the MICC sub working group has been to redesign and create a harmonized, gridded ENC scheme to effectively meet the challenge of the S-101 standard. In addition, the increase in the use of electronic nautical cartography has led some countries and the IHO to rethink the forms of production and design of their cartographic schemes, having electronic nautical cartography as a primary product, as it is reflected in the final report “The Future of the Paper Nautical Chart”.

Over this year, the ENC scheme proposed by Colombia was adjusted according to the comments made during the MACHC20 meeting. The MICC collaborated in the analysis of ENC coverage for the region in Usage Band 3. A survey was prepared and sent to the MACHC Members together with the adjusted proposal, requesting feedback and acceptability of adopting a regional ENC scheme in the short, medium, or long term. There were some concerns on the gridding scheme, and potential issues in boundary areas. There was also not agreement regarding the Usage Band that needs to be in the regional scheme and the compilation scale. There was also a feasibility concern with the current proposal. In the end there was not consensus for the current proposal. There was, however, an option supported for a step-by-step approach, starting with the smaller scale Usage Bands (Usage Band 1 has two producers in the region, the United States and United Kingdom, and Usage Band 2 has eight producers, and Usage Band 3 have nine producers).

Finally, Captain Tun, on behalf of this sub working group, requested of the MACHC to approve the report, endorse the advances of the sub working group, endorse the approach of a gridding proposal to be further refined by the MICC sub working group, and endorse a step-by-step proposal starting with Usage Band 1.

Ms. Ries opened the floor for comments and recognized Mr. John Nyberg of the United States. Mr. Nyberg thanked Captain Tun for the presentation and further indicated that it seems like a lot of good work had been done, and that this path forward is worth pursuing. He added that the United States is certainly interested in participating and looks forward to working with the group to make that happen.

Dagoberto David of Colombia noted that as Admiral Sinapi had said before, there are three strategic objectives to be able to develop and improve the current schemes, and thanked the MACHC for supporting it. Mr. David said all have some ENC cells that work, but that there is a need to improve those cells. The ideal situation would be to start over with Usage Band 1, then with the Usage Band 2, and then Usage Band 3. He expressed his appreciation to the countries that already responded to the survey and those who support the effort.

Chris Thorne of the United Kingdom also thanked Captain Tun for a good presentation. Mr. Thorne went on to say that the United Kingdom Hydrographic Office (UKHO) will be prepared to work with the MICC sub working group and the United States specifically for the Usage Band 1 scale to move this forward for the benefit of all.

Captain Marc van der Donck of the Netherlands noted the recognition of the good work done by the sub working group. Captain Van der Donck agreed on the incremental approach and emphasized the need to balance the pros and cons of scheming and having a unified way of making ENCs. He further observed that in balancing the pros and cons, they see value in a unified scheme for use Usage Band 1 and Usage Band 2. However, the Usage Band 3 scale has a level of flexibility that outweighs the advantages of having unified Usage Bands.

Ms. Ries thanked Members for their comments and asked Captain Tun to confirm that the proposal is only to start with the scale Usage Band 1, while in parallel the sub working group continues to address all of the outstanding issues and concerns raised. That way, by the next MACHC conference, there would be some lessons learned from beginning with the scale Usage Band 1 charts, and then determine from there whether it is desirable or feasible to expand to any other scale bands.

Captain Tun, Chair of the sub working group, confirmed that this summary was correct. The focus of the group is to start working on Usage Band 1 and in parallel start analyzing Usage Band 2 and the other related issues and how to resolve them.

Vice Admiral Edgar Barbosa of Brazil commended Mexico and Colombia for consolidating the survey results and the MICC sub working group for the report. Vice Admiral Barbosa noted that Brazil sent its response to the survey on November 17<sup>th</sup>, 2020 and would like to apologize for not having sent it earlier. He further explained that Brazil is of the opinion that any proposed ENC scheme for the region should take into account the capabilities of coastal States and of primary charting authorities.

Vice Admiral Barbosa also expressed that Brazil thinks that any ENC scheme proposal should minimize its impact on Hydrographic Offices. The regular grid scheme will likely create demands for new hydrographic surveys. Another concern regarding a regular grid scheme is the increase in land coverage within each ENC cell. In a regional ENC scheme, Hydrographic Offices should try to minimize gaps and overlaps by proposing minimal change to the current coverage. Brazil sees no need to change the boundaries limits of its ENCs. Moreover, any change in the boundaries of the Brazilian ENCs would interfere with the South West Atlantic Hydrographic Commission (SWAtHC) scheme. Brazil does not agree with a regular grid scheme for the whole region, but would support a regional ENC scheme for the smallest scales, starting with Usage Band 1 (Overview).

Diógenes López of Cuba supported the statements of Brazil, particularly the concern that a gridded scheme would include greater land coverage and some cells would not have much information regarding the sea. Cuba supports the idea of staying with the current scheme.

Ms. Ries, MACHC Chair, summarized the discussion noting that based on all of the interventions there is agreement to endorse the incremental step-by-step proposal of starting now with the Usage Band 1 cells (United States and United Kingdom), and that the sub working group will continue to work and take into account all of the concerns that have been expressed by the interventions so far. With that, Ms. Ries suggested approval of the report of this sub working group and the proposed next steps; the MICC's requests of the MACHC to:

- Note the MICC Report.
- Approve the MICC 2021 Work Plan -with particular focus on submission of INT Chart submission to IHO Web Catalogue (<http://chart.iho.int:8080/iho/main.do>) and maintenance of ENC schemes using INTOGIS II.
- Endorse the proposed approach for a standardized regional ENC Scheme (to be presented by MICC Subgroup Chair, Mexico).

The incremental approach for the regional ENC scheme was agreed. The MACHC then agreed to note the MICC Report and approved the MICC 2021 Work Plan, which will be adjusted slightly to include the review of the report on the Future of the Paper Chart, and to begin discussions about a potential future

way forward the region. As there were no further comments from the floor, the Ms. Ries congratulated both Ms. Mahabier and Captain Tun on the significant progress made.

21.9.1.1	Decision: Noted the MICC WG Report.
21.9.1.2	Decision: Approved the MICC 2021 Work Plan, as adjusted to include review of the “The Future of the Paper Chart” report and to begin a discussion on the potential way forward for the region considering the recommendations endorsed by the IHO Assembly.
21.9.2.1	Decision: Noted the MICC Regional ENC sub working group report and endorsed its advances.
21.9.2.2	Decision: Endorsed the approach of a gridding proposal, taking into account coastal States positions, to be further refined by the MICC Regional ENC sub working group.
21.9.2.3	Decision: Endorsed the proposed incremental approach for a standardized regional ENC scheme, starting with Usage Band 1 cells.

Ms. Ries, MACHC Chair, then moved on to introduce some complimentary presentations presented by other partners. The first presentation was on conversion from S-57 to S-101 presented by Morgane Gaumet of France.

### **9.3 S-57 to S-101 Conversion (Morgane Gaumet, French Naval Hydrographic and Oceanographic Service (SHOM))**

Morgane Gaumet of the French Naval Hydrographic and Oceanographic Service (SHOM) stated that SHOM goals for 2024 are to convert the approximately 850 ENC portfolios from S-57 to S-101. Further plans are to produce data directly in S-101, stored in Hydrographic Production Database (HPD) database, and to let PRIMAR convert ENC cells to S-57 during the “dual fuel” period. Currently cartographic and hydrographic data are stored in an S-57 database and all cartographic products are derived from this database. The main issues were to determine the conversion rules for objects and attributes that do not have a direct equivalent in both norms; prepare a roadmap detailing the transition process; establish procedures for databases and/or ENC conversions; set up a production line of S-101 ENC; adapt the production process for paper charts to produce the charts from the S-101 database; and establish organization during and after the dual fuel period. An experimentation team worked on the subject of S-101 and on adjustments of the production process.

The team used five benchmark converters including: CARIS; Esri; dKart; SevenCs; and GEOMOD. This resulted in S-101 products visualized with the converters and in the Naval Information Warfare Center (NIWC) S-100 viewer. Positive results were that objects or attributes with a direct equivalent in S-101 are in most cases correctly converted. Also, some converters allow rules to be customized (rules in an .xml file), while other converters also allow back conversion from S-101 to S-57. On the other hand, some converted cells cannot be opened by the S-100 viewer, maybe due to topological or S-101 encoding issues. Other converters do not keep the Feature Object Identifier (FOID) when converting objects, making the comparison between different versions of the same cell difficult. Uses of the text placement feature attributes helps to reduce clutter.

Ms. Ries thanked Ms. Gaumet for the presentation of very interesting work and progress on an area that is important as we move forward from S-57 to S-101. Ms. Ries then turned to the presentation by an industry partner, Juan Carballini of Teledyne CARIS.

#### 9.4 S-101/S-57 Chart Production Solutions (Juan Carballini, Teledyne-CARIS)

Juan Carballini of Teledyne CARIS indicated that CARIS maintains active participation in the S-100 working group to further the development of the standards and products. Portrayal for S-100, validation checks for S-101 ENCs, and reviewing each draft of the S-101 ENC specification are examples of a few areas where CARIS has contributed. The company is also participating in the 6<sup>th</sup> S-100 Testbed Strategy Meeting in Busan, South Korea, taking place September 18-20, 2021. As many of the world's hydrographic authorities use CARIS for all or some of their hydrographic survey and nautical charting workflows, it is important for CARIS to provide geospatial solutions that support S-100 as the hydrographic community transitions to the standard and related products. Further, CARIS encourages various stakeholders to be involved in the development and testing of different S-100 specifications.

Additionally, Mr. Carballini indicated that the S-101 ENC Product Specification (PS) specifies the content, structure, data encoding, and metadata required for compiling S-101 ENC data. The specification also includes the portrayal requirements for use within an Electronic Chart Display and Information System (ECDIS). Mr. Carballini shared images of bathymetry prepped and de-conflicted into a single surface and some tools for geospatial solutions.

Ms. Ries, MACHC Chair, thanked Mr. Carballini and opened the floor for few minutes if anyone has any questions for either he or Ms. Gaumet.

Marvin Sandoval of Costa Rica's National Geographic Institute asked Mr. Carballini if the training is only in English and the answer is no; CARIS provides training in Spanish as well and has several instructors who can deliver the training in Spanish.

Ms. Ries noted no further comments from the floor and thanked both presenters for their very interesting presentations and asked everyone to remember Vice Admiral Sharp's challenge to the conference participants to reach out to somebody new, even if only virtually, to talk about issues that have come out of the discussion today and establish new working relationships. Ms. Ries thanked everyone again for their attention and wished everyone a good afternoon or evening depending where they are on in the world.

## 5.0 Regional Capacity Building and Leveraging Capacity Building Partnerships

### 5.1 Capacity Building Committee (CBC) Report (Lucy Fieldhouse, Meso American-Caribbean Sea Hydrographic Commission (MACHC) CBC Chair)

Kathryn Ries, Meso American-Caribbean Sea Hydrographic Commission (MACHC) Chair, introduced the MACHC Capacity Building Coordinator, Lucy Fieldhouse, to make a presentation and lead this agenda item.

Ms. Fieldhouse of the United Kingdom and Capacity Building Committee (CBC) Chair thanked everyone for coming back to day two of the conference and noted that she would start with the MACHC20 actions relating to capacity building and provide an overview of the 18<sup>th</sup> Meeting of the International Hydrographic Organization (IHO) Capacity Building Sub-Committee (CBSC18). The MACHC20 actions relating to capacity building are all completed. The first action, 20.3.b.1, was the results from the breakout groups from the Santo Domingo meeting and the related requests for high level technical visits from Members within the MACHC. These were incorporated in the 2021-2023 Capacity Building Plan and have received funding for the next year. The second action, 20.3.b.2, related to the IHO CB Procedure 11, used to assess the status of IHO Member States within the IHO capacity building (CB) phases was implemented. The assessment was uploaded to the MACHC website and will be there for continuous revision.

Action 20.5.1.1 related to the Draft 2021-2023 Capacity Building Plan to include offerings from neighboring Regional Hydrographic Commissions (RHCs) and wider CB providers was done and was included in the new CB Plan. Action, 20.5.2, refers to the Central American Commission of Maritime Transportation (COCATRAM) 2020 Hydrography and Cartography Course. Unfortunately, due to the pandemic, this course was postponed, but hopes are to hold it in 2022 as part of the next International Maritime Organization (IMO) Biennium Plan. Ms. Fieldhouse continued to provide a brief overview of the key points from CBSC 18, noting the new CBSC chair, Evert Flier of Norway, and the new CBSC vice chair, Luiz Claudio Fonseca of Brazil. One of the key proposals that the MACHC Chair addressed during the first day of the MACHC21 conference was the South Korean proposal 3.3 to the IHO Assembly that refers to the establishment of the IHO e-Learning Center, which is very much in its infancy. A CBSC e-Learning project review team has been established and it will look at the structure of the Center, how it will be implemented, and develop rules and guidelines for the running of the Center itself. Ms. Fieldhouse indicated that she is on that team and will provide updates.

In order to support the development of hydrographic services, the IHO Secretariat requested that coastal States share any documentation relating to the establishment and operation of National Hydrographic Commissions (NHCs). This information will be collated to assist other coastal States to develop such NHCs and support the development of hydrographic capacity. On the International Hydrographic Review (IHR), some MACHC Members have already contributed to this important publication, but all Members are encouraged to consider submitting papers or notes that champion the work that colleagues and organizations are doing within the region. The importance of keeping C-55 current was also highlighted, as this is utilized in the IMO audit. Finally, Ms. Fieldhouse mentioned the IHO CB Fund for 2021, which increased from 2020, and has enabled a significant number of activities to be funded.

Many regions have been impacted by the pandemic in terms of delivering capacity building activities. However, the IHO-funded Maritime Safety Information (MSI) Training in 2019 kindly hosted by the Dominican Republic just after the MACHC20 Conference. As already mentioned, the success from this course saw an impressive increase of 50% on MSI information. The other activity for the MACHC region in 2020 was the Tide and Water Levels Workshop for Spanish speakers. Although a very practical course, it had to be postponed due to the pandemic. The intent is for it to take place in 2021. Funding from all the co-sponsoring partners – IHO, Intergovernmental Oceanographic Commission (IOC), and COCATRAM – was carried over for this purpose, and Costa Rica is committed to hosting the course in their country.

The IHO funded CB activities that the MACHC region has benefited from is the CAT B Marine Cartography and Data Assessment course funded by the Nippon Foundation and run by the United Kingdom. This was scheduled to be delivered in September 2020, but due to the pandemic, it has been delayed until 2021. Ms. Fieldhouse further alerted all IHO Member States of an opportunity noted in IHO Circular Letter 34/2020 for the CAT A Hydrography Course. It outlines the criteria for the candidates and the application process.

On November 3, 2020, a webinar on Satellite-Derived Bathymetry (SDB), supported by EOMAP, Esri and TCarta was conducted, exploring the technology and possible applications of SDB. There was also a very interesting presentation from Venezuela about their lessons learned and their experiences using SDB within their waters. Several upcoming SDB opportunities are supported by the European Space Agency (ESA). One is the Earth Observation (EO) Clinic or EO Science for Society Program which aims to demonstrate the use of new SDB and EO products for coastal and shallow water mapping and provide capacity building on methods, software, and concepts to integrate EO data with onsite survey information. The other is the EO Resilient Society that allows interested countries to experience the technology and data/software services for developmental purposes. More information can be found on the [EO Clinic website](#). A third opportunity is a one-hour webinar, scheduled for the December 8, 2020, which will be held by TCarta and Esri and will include more in-depth use cases and applications. The final opportunity is the 3<sup>rd</sup> International Conference on SDB, also known as [SDB day 2021](#), which will occur on January 27, 2021.

There are four scheduled activities funded for 2021, including a High-Level Technical Visit to the Dominican Republic, a High-Level Technical Visit to Jamaica, a Technical Visit to Honduras, and a funded two-day Seminar on Raising Awareness of Hydrography.

Ms. Gerardine Delanoye of the International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA), provided an update on how IALA can assist countries with safety of navigation challenges. A list of countries scheduled for visits of sponsored technical missions or reviews was provided. Plans are to conduct these missions together with the IHO and the primary charting authorities. An overview of [available training](#) is on the IALA website. IALA also looked at how to assist countries during these challenging times by organizing remote events to conduct risk assessment virtually with the country and their stakeholders. Further, IALA is developing an Aid to Navigation (AtoN) procurement course to instruct interested countries in all aspects of developing a proposal. IALA also organizes national micro seminars which generate progress reports as well as a series of technical webinars that will soon be available.

Ms. Fieldhouse, CBC Chair, continued, stating that the CBC had met on November 4, 2020, where the following items were raised for developing a draft proposal for funding MACHC capacity building activities in 2022, which the plenary would be requested to endorse. Based on the national reports, there was one request for a High-Level Technical Visit from Belize. The second item raised was an MSI workshop that Colombia and the IHO Sub-Committee on the World-Wide Navigational Warning Service (WWNWS-SC) are

working together to develop. The third is a Hydrographic Governance Awareness Seminar. The fourth proposal is for a Bathymetric Data Processing Course, which would include neighboring RHCs.

These requests were put forth for approval or additional feedback by the MACHC. These will then be submitted in April to the IHO CBSC, and then at the June CBSC19 meeting where the entire work plan will be finalized. Actions requested of the MACHC Plenary is to note the report, and to approve the work plan and submissions for CBSC19.

## **5.2 Caribbean Regional Track of the Inter-American Development Bank (IADB) Pilot Program for Climate Resilience Overview (Gerard Alleng, IADB Climate Change Senior Specialist)**

Gerard Alleng, Inter-American Development Bank (IADB) Climate Change Senior Specialist, thanked the MACHC for the opportunity to speak about this program on climate change which has been ongoing within the region for the last five years. IADB offices are located in all of their member countries within Latin American and the Caribbean region, which is important because that is where the programs originate. Discussions with governments and clients begin with interactions whereby they support country led programs and country focused programs, as well as regional programs, which is the focus of Mr. Alleng's presentation.

The Pilot Program for Climate Resilience (PPCR) was funded through common investment funds, which proceeds along two tracks: country-led projects, and region-wide projects. These programs are to provide financing for investment in scaling up adaptation measures within specific areas and specific countries for the Caribbean.

The regional track started in 2015 with a focus on priorities. The process goes through a strategic program for climate resilience. The IADB develops a document with all countries essentially developing a similar document through a series of consultations or interactions, and many workshops. The goal is to identify priorities for action with regard to climate change adaptation. The specific objective is to improve regional processes regarding data acquisition, storage, analysis, access, and dissemination of information, and also to be able to pilot and scale up some adaptation initiatives. The PPCR Caribbean Regional Track has four components:

- Geospatial data management and management of adaptation planning, sea level rise, and storm surge impact analysis.
- Consolidating and expanding the regional climate network and global platform linkages.
- Downscaling and expanding climate projection models and high-resolution maps.
- Applied adaptation initiatives – health, marine, water, and agriculture.

One of the more significant issues was a need for information related to climate change projections at a scale that was useful for small island countries. At the time, countries were moving from a resolution of 25 kilometers and now they are down to one kilometer. In terms of grids and looking at the projections on the changes within countries, the logic is that countries will have to be able to implement applied adaptation initiatives in four areas: health, marine, environmental waters, and agriculture. By focusing on these components, the member countries would feed information into designing these IADB adaptation initiatives. There was emphasis in discussions with countries about the need for improving their bathymetric data, which included discussion on the use of Light Detection and Ranging (LIDAR) system. The consensus was that this was something these countries needed. There was also discussion that some countries already had some LIDAR data, but what they really wanted was not to have another survey, but to build the capacity within their countries to analyze and assess the information that would be provided over time. In the case of Jamaica and Haiti, they did not have LIDAR data at the time, and they wanted

some coverage. With the resources available, the IADB indicated that there would be studies on Jamaica and Haiti and then, as a group, a program for building capacity together with analysis and processing of the data to create a geospatial output.

Ms. Fieldhouse thanked Mr. Alleng, adding that the presentation was very insightful and that it is interesting to hear about the use of geospatial data and that data management, which is very important. An invitation was extended to Mr. Alleng and the IADB to attend the next MACHC conference, when hopefully the training will have commenced, to share more of the lessons learned and the next steps.

With that, the Chair moved to the next Agenda Item, 5.3 on Empowering Women in Hydrography and introduced Admiral Smith from the United States to take the floor.

### **5.3 Empowering Women in Hydrography (Rear Admiral Shepard Smith, Director of the United States National Oceanic and Atmospheric Administration Office of Coast Survey (NOAA OCS))**

Rear Admiral Shepard Smith, Director of the US NOAA Office of Coast Survey (NOAA OCS), thanked the previous speakers for showing the breadth that fields of hydrography touches and indicated that this is of significant interest to NOAA and its many sister organizations within the United States. Admiral Smith further indicated that he is excited to see it being taken on by the MACHC as well. He explained that it was his pleasure to speak on behalf of an IHO initiative on Empowering Women in Hydrography, and acknowledged that it is really the initiative of Dr. Geneviève Béchar, Canada Hydrographer. It is about leadership and passion, both within Canadian Hydrographic Service (CHS) and the new chair of the IHO Council, who has really taken on this project. Looking at any picture of a typical IHO meeting and particularly of leadership meetings, one can see that there is a big gender imbalance in leadership, and in hydrography globally. The IHO is not the first to realize this, and there are initiatives throughout other fields as well at the United Nations. The CHS has engaged in an effort to encourage organizations to take concrete actions, remove barriers for women, and increase the representation of women at higher echelons as subject matter experts and in policy-making processes, and to increase the awareness and the benefit of having gender diverse teams at all levels. Admiral Smith noted that there is a significant proportion of women leaders in the MACHC right now, including current MACHC Chair Ms. Ries, as well as others chairing committees and sub committees, demonstrating that the MACHC region is doing a good job. Admiral Smith added that in the Arctic Regional Hydrographic Commission, three out of five permanent members of currently led by women.

Under the United Nations Decade of Ocean Science for Sustainable Development (UN Ocean Decade), Canada has put forward €68,000 per year for the next three years into a fund that will be available through the IHO network to support the development of women hydrographers. Other IHO Member States are encouraged to contribute, not only financially but also in the form of in-kind contributions.

The United States has begun to develop its contributing work plan and envisions internships and exchanges between Hydrographic Offices to provide developmental opportunities for women hydrographers and to support greater women participation in IHO and other professional events. At the United States-Canadian Hydrographic Conferences, a “Women in Hydrography Session” has been held for the last few years, and each time the group picture shows more women.

Within the IHO organizational framework, the 12<sup>th</sup> Meeting of the Inter-Regional Coordination Committee (IRCC) (IRCC12) approved “Empowering Women in Hydrography” for the Capacity Building Work Plan for 2021. The 2<sup>nd</sup> Session of the IHO Assembly (A-2) approved the proposal and a workshop is now planned for May 2021. Admiral Smith also added that the United States/NOAA is offering space on

NOAA hydrographic vessels starting in 2022 and that this in-kind contribution is reflected in the MACHC CB Plan for 2021-23. He encouraged other MACHC Members to contribute as well. It is hoped that this program can accelerate the gender balance within hydrography globally and provide more exposure, interest, and contribution of women to IHO bodies.

Ms. Fieldhouse, CBC Chair, thanked Admiral Smith, noting that this is a fantastic initiative. She continued by observing a slow increase in the number of female applicants for training courses, suggesting that change is happening.

Ms. Ries, MACHC Chair, thanked Ms. Fieldhouse and Admiral Smith, indicating that there was time to take a few questions before proceeding to Agenda Item 5.4. Ms. Ries recognized Captain Helber Carvalho of Brazil.

Captain Carvalho highlighted the good cooperation with MACHC in all activities and indicated that he is a member of the project team for the establishment of the IHO e-Learning Center, hosted by South Korea, and is available for any clarification on the work being carried out by this project team. Any participation and all contributions are welcome.

Ms. Ries thanked Captain Carvalho for making the point about the partnerships because one distinctive part of this next CB Plan for the next three years (2021-2023) includes other partnerships where the MACHC is collaborating to provide training and making a much greater impact across a wider number of stakeholders including those beyond MACHC Members. She also commended Ms. Fieldhouse and the work that she has done with the CBC to support collaboration with neighboring Regional Hydrographic Commissions. Ms. Ries then recognized Marvin Sandoval of Costa Rica.

Mr. Sandoval stated that Costa Rica's National Monitoring Tsunami System Office in the National University of Costa Rica is planning to host a Tides and Water Levels Workshop for Spanish speakers in 2021 for the MACHC region and the Intergovernmental Coordination Group for the Tsunami and Other Coastal Hazards Warning System for the Caribbean and Adjacent Regions Early Warning System (ICG/CARIBE-EWS).

Ms. Ries responded that this is a good reminder that the Introduction to Tides and Water Levels Training for Spanish speakers, which was to occur this year, will hopefully take place in person during the coming year, and that Costa Rica is hosting. This is co-sponsored by other regional partners such as the CARIBE-EWS, the neighboring Regional Hydrographic Commissions (SWAtHC and SEPRHC), and COCATRAM. It is a very good example of multiple partnerships that are co-sponsoring training to provide the widest benefit for all participants. Ms. Ries then recognized Vice Admiral Edgar Barbosa of Brazil.

Vice Admiral Barbosa thanked Admiral Smith of the United States for his presentation on Empowering Women in Hydrography and also congratulated him for contributing to the project and to the region. Brazil strongly supports this project and in the past 30 years has shown a considerable increase of the number of women in the Brazilian Hydrographic Office, in the areas of cartography, marine geology, geophysics, oceanography, and meteorology. In the Division of Cartography there are 20 officers trained in cartography, 10 of whom are women. Women are a slight majority in some other technical areas.

Ms. Ries thanked Vice Admiral Barbosa for the comments on their progress and then recognized Mr. John Nyberg of the United States.

Mr. Nyberg raised a question for Gerard Alleng of the IADB on the Climate Resilience Program, asking whether there was an international body at a global level where best practices are shared with regard to climate resilience, particularly regarding coastal data. Additionally, Mr. Nyberg thanked Mr. Alleng for

the presentation on what seems like a fantastic project. Mr. Alleng responded that the climate investment funds started back in 2008 in a number of countries and it was always the intention to extract the lessons learned from all these programs and to share best practices with regard to all the various initiatives. Webinars have been held on culture, even gender, and in climate change adaptation, and will continue.

Ms. Ries then recognized Rear Admiral Rhett Hatcher of the United Kingdom. Admiral Hatcher thanked Admiral Smith for his presentation on Empowering Women in Hydrography and added that the United Kingdom Hydrographic Office (UKHO) also strongly supports this proposal. The Women's Network at the UKHO is healthy, strong, and improving. Admiral Hatcher and others have talked to Canada and offered to support this effort with online workshops and group/individual mentoring help when appropriate.

Ms. Ries thanked Admiral Hatcher, and then recognized Derrick Peyton of IIC Technologies Inc. who asked Admiral Smith whether the opportunities for women to work on NOAA vessels will also be available to university students. Admiral Smith of the United States responded that there would not be any restriction, adding that the idea with this particular program is that the placements should be in the context of international hydrography and supported by the IHO capacity building effort. However, NOAA also has visiting scientists at all levels on its ships all the time, and if there is a particular candidate, NOAA can consider those requests as well.

Ms. Ries, MACHC Chair, noted another question from the chat room on whether this opportunity to spend time on NOAA vessels applies to women outside the United States. Admiral Smith responded that this is the express intent because NOAA has other programs in place for providing development opportunities for women from the United States onboard NOAA vessels. This opportunity is specifically for foreign nationals.

Ms. Ries applauded a comment from the Cuban delegate, Mr. Diogenes Almeida, who thanked Admiral Smith for his presentation and added that Cuba strongly supports this project and that the percentage of women that are studying hydrography in universities, preparing themselves for a career on hydrography, has risen considerably.

Ms. Ries then asked to go back to the last page of Ms. Fieldhouse's presentation which showed CBC requests of the MACHC. Ms. Ries summarized the session, including interventions from the plenary, and concluded that there was support to note the report and approve the CB 2021-23 Work Plan, including the proposed CB submissions for the 19<sup>th</sup> Meeting of the IHO CBSC. Receiving no further comment comments, the requests were approved.

21.5.1	Decision: Noted the CB Report.
21.5.2	Decision: Approved the CB 2021-2023 Workplan and CB submissions for CBSC19.

Ms. Fieldhouse, CBC Chair, thanked all the participants and proceeded to introduce the complementary presentations from industry partners, starting with Agenda Item 5.4a by IIC Technologies on On-line Offerings for IHO Publication S-8B and IHO S-5B.

#### 5.4A Online Offerings for IHO Publication S-8B and IHO S-5B (Alejandro Gerones, IIC Technologies, Inc.)

Alejandro Gerones of IIC Technologies Inc. greeted the participants, noting that this presentation is available in both English and Spanish. Mr. Gerones focused on the developments that IIC Technologies has in place for the creation of learning capacities in the S-5 and S-8 categories for hydrographers and cartographers. IIC Technologies is based in India but has offices throughout the world, with a focus on the development of skills on the full range of hydrographic operations from hydrographic surveys to the creation of marine spatial data infrastructures (MSDI), including going through all the other operations in hydrography and cartography. In 2012, IIC Technologies was recognized for S-8, and in 2014 they labelled their program as portable, with the idea of making it deployable to anywhere in the world and similarly with S-5 for hydrographers. They switched the name to global delivery just to make it a more understandable, meaning that they can put it anywhere in the world.

The challenge is to provide a stimulating and effective learning framework for all those who participate. There is a strong need to blend the relevant theory with practice, and then to have an ongoing program despite increasing costs of travel and now travel restrictions due to the pandemic.

For the global delivery, there are two approaches. Globally, the training can be deployed anywhere at any of the IIC Technology location, or at a client selected location. In the first approach, the classroom instructor leads practical sessions at selected locations, deliverable for the entire duration or divided into annual blocks up to three years.

The second approach, which is more advanced and more in tune with the world today is a focus on delivering the theory online or distance learning, followed by practical training at selected locations. For instance, for a program that lasts for 22 weeks, 10 or 12 weeks can be completed at home or at the office doing the theory and some of the practical practice. This can be followed by a shorter period of time at a selected location to complete a program, thereby relieving the stress of being away from home and from family for three months. The second option is only 16 weeks, leaving you with a month or a month and a half more time to spend at the office or at home with one's family. Some of the characteristics of each of the aspects is a strong component of theory and practices, combined with self-guided studies, self-preparation, and the final project that can be the creation of a chart or the conducting of a short survey on the water and processing of the data.

For any effective educational program, there will be a learning curve. There is a strong component on the teacher's side for the progress assessment of the student to ensure skills development meet this complexity of the curricular task. Assessments are conducted through quizzes from the lecture, simple practical exercises written next to them, and other methods that any educational program has to assess the progress of the students to the final completion of the program with a comprehensive cartographic project for the S-8 or the conduction of a survey for S-5.

At this point, Mr. Gerones showed some samples of IIC activities and a screenshot of the platform used. Right now, IIC Technologies is working with 20 students from the United States National Geospatial-Intelligence Agency (NGA) on S-8. IIC Technologies has 22 students for S-5 from Canada's CHS and the Department of National Defense (DND) on S-8. These can be delivered in many languages. Right now, IIC Technologies is also providing French services for the Canadian Hydrographic Service (CHS) and has previously done independent modules in Spanish. Although most of the materials online are in English, the goal is to have all available in Spanish by the end of 2021.

Ms. Ries, MACHC Chair, thanked Mr. Gerones, adding that if the MACHC does not already have information on IIC Technologies' trainings, that they should be added to the MACHC Initiative website list of capacity building opportunities for easy member access. Ms. Fieldhouse, CBC Chair, thanked Mr. Gerones for a very interesting presentation, adding that it's great to see the developments that IIC Technologies is undertaking to make the course so accessible. It also supports the empowering women initiative by enabling more people to attend the course by shortening the required time away from home. Ms. Fieldhouse then moved on to introduce Agenda Item 5.4B by Julio Leal of Axys Technologies.

### **5.4B Hydrolevel Buoy System for Accurate Tide/Water-Level Measurements Anywhere in the Ocean (Julio Leal, Axys Technologies)**

Julio Leal of Axys Technologies thanked the MACHC Chair and CBC Chair. Mr. Leal started by mentioning that the challenge for the hydrographer is to reduce the depths to the chart datum. Traditionally, this is done using a baseline and tide gauges to ensure safety of navigation for commercial and military vessels. However, in areas where access is denied such as areas of conflict or where the land topography does not allow entry, there is no infrastructure to install it gauges, which becomes a challenge.

In these places, the hydrographer relies on a combination of techniques such as tidal constituent databases and dynamic modeling to produce estimates of chart datums and apply corrections. This modeling is based on the best available data and estimates, but will not always produce the desired results and may end with errors which could be up to 40 to 60% of the total depth. There is also the problem with land permissions as placing tide gauges may require permissions from national and local authorities, institutions, companies, landowners, or others, making for costly operations.

A few years ago, Axys Technologies was approached by the United States Naval Oceanographic Office (NAVOCEANO) with a requirement to measure water levels to determine the chart datum. Engineers got together and came up with a solution called the Hydrolevel Buoy System. It is a buoy that follows the waves and will keep the water level measurement very precisely. The buoy is equipped with dual frequency Global Navigation Satellite System (GNSS) receiver, a tilt sensor which is the same one that is used for the measuring the waves, and a data processor which is the Axys WM500, a core technology in all our Axys Technologies' buoys.

The data is processed to provide the elevation of the water level in a generic ellipsoidal reference frame. Taking the buoy apart, there is a solar panel assembly consisting of 10 solar panels at 6.9 watts each with four 100-amp batteries, a sensor module, and telemetry. It is a very rugged buoy and can withstand impacts, shocks, and extreme temperatures. No special tools are required and the buoy can be maintained by trained staff. It generates a real-time, accurate, three-dimensional position using a global differential GNSS solution.

The GNSS solution methods utilizes the real-time kinematic (RTK) method, which is what the hydrographer uses to place the GNSS receiver on a known benchmark to get the correction data. Post-process kinematic, which is basically the same thing without the radio link, is also utilized. The accuracy of all these methods is about 5-10 centimeters. The information from the ellipsoid satellite is needed for the local chart datum. To determine that, the difference is measured between the two by placing a GNSS receiver over a benchmark, getting the position and elevation, and determine the corrections.

Mr. Leal noted that the benefits of this system are that it increases flexibility and operational range, enables positions to be measured on the absolute three dimensions, and eliminates the guessing of water level estimates. When deployed for less than 30 days, it may be used to refine tertiary gauge requirements for hydrographic survey projects and it can measure water levels anywhere in the world without the need for permissions or the costly deployment of personnel to land based infrastructure. Mr. Leal mentioned that while the Tides and Water Levels Workshop for Spanish speakers planned for 2021 is focused on traditional tide gauge systems, he would be happy to explore whether a presentation such as this might be appropriate as part of that workshop to provide a view into the future of where these technologies are heading.

Both Ms. Fieldhouse and Ms. Ries thanked Mr. Leal for the very interesting presentation, as well as referencing the potential collaboration for the Tides and Water Levels Workshop.

## **8.0 Marine Spatial Data Infrastructure (MSDI)**

### **8.1 MACHC Marine Spatial Data Infrastructure Working Group (MMSDIWG) Report (Jim Rogers, MMSDIWG Chair)**

Jim Rogers of the United States and MACHC Marine Spatial Data Infrastructure Working Group (MMSDIWG) Chair, and Amy Northern of the United Kingdom and MMSDIWG Vice Chair, presented the MMSDIWG Report.

Ms. Northern, thanked the MACHC Chair and reviewed the key 2020 accomplishments of the MMSDIWG. The group was fortunate to be able to conduct three virtual meetings, despite the challenges of the global pandemic, and enjoyed numerous presentations from stakeholders. At the MACHC20 the previous year, the group organized an MSDI Workshop as part of the pre-conference Seminar on Hydrographic Governance to highlight the importance of considering MSDI as integral to developing traditional hydrographic capacity. The MMSDIWG also disseminated its inventory survey of key geospatial data layers.

A subsequent Additional Layers Survey, based on feedback from the working group, was created and the MMSDIWG Work Plan was updated. Ms. Northern mentioned the [MMSDIWG website](#), including ongoing opportunities, and the working documents. She also covered some key accomplishments including support for the Greater Caribbean Region Maritime Accident Risk Project with Dawn Seepersad, and Risk Assessment and Mitigation Measures with Amrika Maharaj, both of Trinidad and Tobago. Ms. Northern referenced interaction with some other the regional stakeholders, such as the Red Golfo Marine Protected Area Project, the Caribbean Marine Atlas (CMA), the Caribbean GeoPortal, as well as the United Nations Global Geospatial Information Management (UN-GGIM) initiative.

The MMSDIWG Chair, Mr. Rogers continued the presentation going over actions from the MACHC20 meeting. The first was on the need for an Additional Layers Survey in response to desired data layers for some of the MSDI users within the within the region. The next action was to re-invite Members to respond that had not already filled out the original survey. The next one was to explore how to become involved in the Caribbean Geospatial Development Initiative (CARIGEO) which is on the agenda for the afternoon. Another was to encourage Members who do not have their own MSDI to consider making their marine spatial data available to the CMA so as to not have to recreate it individually. The final action to determine protocols needed to ensure that bathymetric data is accessible and in what formats to support MapAction disaster response mapping requirements.

Mr. Rogers reviewed the Draft MMSDIWG 2021 Work Plan and encouraged Members to complete the surveys (both the original and the Additional Layer Survey) if they have not already done so. On the original inventory, there were 16 responses from Members and on the newest survey for the additional layers, only three responses have been received. Further, Members were encouraged to make their MSDI data available in geographic information system (GIS) formats that can be used to support the analysis necessary in the various MSDI use cases and to consider some minimal regular update cycle to their MSDI data to ensure the data does not become outdated. And finally, Mr. Rogers encouraged Members to coordinate the provision of data to regional MSDI efforts like the CMA to improve discoverability and sharing of MSDI for non-navigation users.

Mr. Rogers added that some of the things the MMSDIWG 2021 Work Plan aims to do is to start reaching out to some of the other Regional Hydrographic Commissions (RHCs) to see what they are doing to get a better idea from a best practices and knowledge standpoint. The MMSDIWG efforts are part of a larger MSDI or SDI between global SDI, regional initiatives, and national MSDIs. In conclusion, he requested the MACHC to note this report and approve the MMSDIWG 2021 Work Plan.

As in the previous session, it was decided to go on to the other supporting presentations and, then once those were concluded, the floor would be open for questions.

## **8.2 Risk Assessments and Mitigation Measures of Maritime Navigation in the Caribbean Sea (Amrika Maharaj, University of West Indies)**

Amrika Maharaj thanked the MACHC Chair and began to present her research focused on solutions to reducing the risk of maritime navigation by developing a strategy that considers the likelihood of a vessel accident in relation to the vessel traffic flow and the navigational information that is available. Ms. Maharaj explained that shipping is a crucial characteristic for the proper operation of a country's transport infrastructure and extensively influences the development and the growth of the country's economy. To develop a strategy of the likelihood of an incident requires an assessment of shipping accidents globally to identify key contributing factors relating to ships and the environment to produce statistical evaluation for use in risk assessment; application of mitigation measures such as improved charting and traffic management to reassess risk; and a strategy for assessment of the impact of risk reduction measures through the provision of tools and models that will support port development.

The study revealed that most incidents are due to collisions, followed closely by groundings. Geographical Weighted Regression (GWR) was used to explore spatial variations in the relationship between the locations of maritime accidents with the factors that presents a risk to maritime navigation. The findings of GWR produces a surface of parameter estimates, spatial changes in the magnitude of the parameter estimates across the surface indicate the locally changing influence of a variable on the dependent variable, and local models using GWR were demonstrated to be suitable for the study. Thus, findings of marine risk show the need for additional spatial data, but spatial variability of marine accidents are confirmed. In summary, the Caribbean Sea is a special area and there is need for risk management and an urgent need to monitor and manage risks to maritime navigation to ensure improved security of the maritime environment.

Ms. Ries, MACHC Chair, thanked Ms. Maharaj, adding that this is a good example of why the MACHC needs to make its data available to support use cases like this. At this point, Ms. Ries introduced the next speaker, Valrie Grant.

### 8.3 CARIGEO Portal (Valrie Grant, Vice-Chair United Nations Global Geospatial Information Management (UN-GGIM) Americas)

Ms. Grant, Vice-Chair United Nations Global Geospatial Information Management (UN-GGIM) Americas, provided an overview of the Caribbean Geospatial Development Initiative and how it feeds into the maritime data and the MSDI. This initiative is to bridge the digital divide as it relates to geospatial data in the Caribbean, recognizing that many of the countries are at different stages in their growth and development. Thus it is necessary to be able to have access to the spatial data. This initiative is basically an alignment of various frameworks, an initiative that started out of the UN-GGIM group in the Americas.

The objectives of the initiative are to implement strategies in collaborating with different partners and agencies, national governments, and institutions to build capacity and develop the fundamental data set that is needed in each country, including marine data. It should also provide for short-term support in the interim to develop regional and nationwide coverage of fundamental datasets to meet national and regional quality standards and specifications and promote the formulation and implementation of sustainable mechanisms for both the discovering, accessing, maintaining, and using these fundamental datasets. Ms. Grant also provided information on the organizational framework for collaboration that empowers stakeholders to use the fundamental datasets to address the challenges in their areas of interest. The focus of the initiative is to assess the current state in the Caribbean as well as the matter of related governance, policies, and standards. Collaboration and partnerships, and the data sets and tools are needed, as well as capacity development and communication so that individuals can build awareness and also have the right message.

Ms. Grant next covered the guiding principles that are critical for those who believe in collaboration to innovate. They include collaboration and coordination and an adherence to geospatial standards and ownership and accountability. Others include transparency, respect, and confidence, as well as standards of service, and adherence to law. Ms. Grant covered the situational analysis including data needs and how to impact change and the work executed. She further outlined some areas of possible collaboration with MACHC such as workshops to understand gaps, needs, and opportunities; awareness raising; capacity building; making marine data accessible through the CARIGEO Portal; and standards.

Mr. Rogers, MMSDIWG Chair, thanked Ms. Grant for a great presentation, noting that the MMSDIWG can definitely see a lot of value in partnering with CARIGEO and that the group looks forward to continued engagement. With that, John Pepper from the industry partner OceanWise was introduced.

### 8.4 Approaching Mission Critical: The Future of Marine Data (John Pepper, OceanWise)

John Pepper of OceanWise presented an exhaustive presentation on MSDI planning, implementation, and maintenance, noting that OceanWise has been involved with MSDI matters for a decade now and has been at the forefront of producing the first training program presented to the North Indian Ocean Hydrographic Commission back in 2010. Mr. Pepper explained the work of OceanWise and its best practices, with an emphasis on education. He covered their operating framework for data management, stressed the need for technical standards, and elaborated on the web service applications. Mr. Pepper further explored where the biggest challenges lie ahead, and covered the “SDI Roadmap” and development timeline. He closed by highlighting related IHO programs and projects, including the MMSDIWG’s developing MSDI Work Plans and initiatives at regional levels; the MSDI Concept Development Study; and the UN-GGIM Working Group on Marine Geospatial Information.

Mr. Rogers, MMSDIWG Chair, thanked Mr. Pepper for his presentation and opened the floor for comments.

Dr. Leendert Dorst of the Netherlands had a question for the CARIGEO Portal initiative, noting that over the past years, the Netherlands has been working with the CMA and are also developing a portal where the Netherlands, as well as some other countries, have registered data. The question was then whether the CARIGEO Portal was aware of these efforts, and if so, whether they had been in contact CMA so that MACHC Hydrographic Offices don't need to continue with registering their data at different portals. Ms. Grant, UNGGIM Americas, CariGEO, responded, indicating that in fact that some of her steering committee colleagues have been in touch with that group and as mentioned, one of the quick wins for the short-term goals is to have a meeting in order to avoid inadvertent duplication of effort and find ways to collaborate in a complementary way.

Rafael Ponce of Esri thanked all presenters and shared a few comments and questions for Mr. Rogers, the MMSDIWG Chair, regarding the MSDI Inventory Survey. Mr. Ponce suggested that in addition to the layers that are being asked of countries to provide, it is also important to know what type of services customers might need. For instance, is that layer in the raster format or in a vector format? Mr. Ponce's other comment was with respect to connecting other activities around the world and in other RHCs, such as the Geospace Sea Project in Singapore, which is creating a center of excellence where MSDI is a central piece. Mr. Rogers responded that the request to consider services as part of MSDI is noted. He added that the MMSDIWG is already pulling together information to see what is available from an MSDI services perspective from other sources. Some of that information could be made available on the MMSDIWG page on the MACHC website.

Kemron Beache of St. Vincent and the Grenadines posed a question for Ms. Maharaj, asking what factors have been identified for St. Vincent and the Grenadines that make some of its maritime areas high risk. Mr. Beache also asked for a copy of Ms. Maharaj's report. Ms. Maharaj responded that the presentation is available on the website. The factors that do contribute to the likelihood of a maritime incident increasing in St. Vincent and the Grenadines is ease of entry, the traffic density, and the number of navigational hazards in the area.

Ms. Ries asked a question about CATZOC, inquiring if it is the metadata versus the underlying data, and if that is one of the additional layers required to support this study. Ms. Maharaj responded affirmatively that what is needed is the metadata for the quality and age of the chart (i.e. CATZOC), not necessarily all the details behind the data. Captain Marc van der Donck of the Netherlands added that CATZOC is a very useful layer. The CATZOC itself can be quite coarse. It is a polygon which covers a wider area, and in those areas might be various objects which have better, quantifiable parameters to them, whereas CATZOC would give a broader course on vertical and horizontal certainty of all the objects in the area. Thus, CATZOC would be the first step, but the next step would be to pick out the individual objects in the area. If there is more data available associated with those objects, these should be given as well. Mr. Rogers responded that this is understood, and that while CATZOC is not a perfect measure of what is going on in an area, it is nevertheless a starting point.

Ms. Ries, MACHC Chair, proposed a close the session by returning to the MMSDIWG requests of the MACHC.

Mr. Rogers, MMSDIWG Chair, concluded by saying that the MMSDIWG had several successful quarterly meetings this year with good active participation by both users and partners within the region. He thanked everybody for their participation. He added that obviously these use cases can very well illustrate the broader need for this data and the purposes of moving forward with MSDI. With that, Mr.

Rogers asked that MACHC consider the requests to note the Working Group Report and the proposed MMSDIWG Work Plan for 2021.

After asking for any final comments on these requests and hearing none, the MACHC Chair noted the conclusion that they are approved and closed out the session.

21.8.1.1	Decision: Noted the MMSDIWG Report.
21.8.1.2	Decision: Approved the MMSDIWG 2021 Work Plan.

Ms. Ries, MACHC Chair, thanked everyone for a set of very excellent presentations and a lot of good work that is moving forward. Further, Ms. Ries expressed hope that all Members will participate in executing the MMSDIWG Work Plan.

### 3.0 National Reports, Breakout Groups, and Common Themes/Issues

#### 3.1B National Reports and Breakout Groups

Kathryn Ries, Meso-American Caribbean Sea Hydrographic Commission (MACHC) Chair, then reviewed the instructions for the National Report Breakout Groups taking place the following day. There would be three breakout groups engaging in separate, parallel virtual rooms. Groups A and B would have simultaneous translation services provided, while Group C would be English only. Group A would be Chaired by Bernice Mahabier of Suriname, Group B by Captain Leonardo Tun of Mexico, and Group C by Lucy Fieldhouse of the United Kingdom. Countries giving National Report presentations were distributed approximately evenly across the three groups as seen below. Additional national delegation Members and other Observers were free to move between groups listening to any presentation as they chose.

Group A (English and Spanish)	Group B (English and Spanish)	Group C (English only)
Suriname (Chair)	Mexico (Chair)	United Kingdom (Chair)
Cuba	Barbados (A)	Antigua and Barbuda (A)
Grenada (A)	Colombia	Belize (A)
Guyana	Costa Rica (A)	Brazil
Honduras (A)	Dominican Republic	France
Mexico	El Salvador (A)	Haiti (A)
Netherlands	Guatemala	Jamaica
Nicaragua (A)	Panama (A)	St. Kitts and Nevis (A)
Santa Lucia (A)	Trinidad and Tobago	St. Vincent and Grenadines (A)
United Kingdom	United States	Suriname
Venezuela		

Each Chair facilitated their breakout group, moving through the National Report presentations in a timely and efficient manner, leading subsequent question and answer periods for each report. The National Reports were to provide information on the year’s top achievements, challenges and/or obstructions, and plans that affect the region.

After hearing each National Report, the Chairs then facilitated discussions on overall points of synergy or potential collaboration (for example areas where the MACHC might collaborate or work more closely based on the information from all the National Reports), and implications and messages for MACHC plenary (for example, major messages that the breakout group should share with the rest of the plenary). The result of these discussions were then merged and shared by Ms. Ries, the MACHC Chair the next morning.

### 3.1B Summary of Breakout Group Common Themes/Issues

As a result of sharing all National Reports and discussing points of synergy as breakout groups, Ms. Ries, MACHC Chair, presented a consolidation of all overall major messages:

- Overall, there had been a surprising and commendable amount of progress and success over the past year, despite problems and setbacks from COVID19.
- The MACHC should also continue to emphasize and prioritize capacity building and training while taking into account different levels of national hydrographic maturity, need, and opportunity, including need for:
  - High level technical visits.
  - MSI training, including establishment of physical infrastructure and technical aspects.
  - Hydrographic governance.
  - CAT A and CAT B courses.
  - Electronic Navigational Charts (ENC) validation.
  - Satellite-derived bathymetry (SDB) processing.
  - S-100 training including S-57 conversion to S-100.
  - Tides courses.
- Greater sharing of National Spatial Data Infrastructures (NSDI)/Marine Spatial Data Infrastructure (MSDI) training, services, and data analysis will support multiple regional uses.
- It is important to continue to leverage regional partnerships to advance common priorities such as those with Central American Commission of Maritime Transportation (COCATRAM), Intergovernmental Oceanographic Commission Sub-Commission for the Caribbean and Adjacent Regions (IOCARIBE), Intergovernmental Coordination Group for the Tsunami and Other Coastal Hazards Warning System for the Caribbean and Adjacent Regions Early Warning System (ICG/CARIBE-EWS), Caribbean Environment Program (CEP), and the Project for Strengthening Hydrographic Capacities in Mesoamerica and the Caribbean Sea (FOCAHIMECA), Seabed2030, capacity building, International Bathymetric Chart of the Caribbean Sea and the Gulf of Mexico (IBCCA), etc.
- It is important to increase/expand Crowdsourced Bathymetry (CSB) data collection in the region.

Potential opportunities for MACHC Members and other partners to collaborate more closely include:

- Countries continuing to re-scheme their ENCs and working to align them with the new regional ENC scheme.
- Countries providing Maritime Safety Information (MSI) national contacts to continue to provide MSI and collaborate together.
- Sharing best practices related to survey planning and specifications.
- The 5C's Project and the Caribbean Community Climate Change Center, focused on LIDAR surveys and providing equipment to a number of countries.
- Providing opportunities on hydrographic survey vessels and opportunities for hydrographic survey analysis and nautical cartography processing, such as that being offered Brazil.

Lastly, highlights that breakout groups wanted to share with the broader plenary included:

- Phase one of the International Bathymetric Chart of the Caribbean Sea and the Gulf of Mexico (IBCCA) project is on track to be completed by the end of 2020.
- Colombia has made great strides in developing training available in Spanish to the region and the advances of the IBCCA project.
- The United States is developing a Global Maritime Traffic Density Service (GMTDS) to support hydrographic risk assessments at regional and global scales. This will be very important to the region for assessing further hydrographic survey needs.
- The Netherlands made available web services for geographic names and administrative units for its territories for everyone via their website.
- Venezuela produced two new ENC's to be available very soon.
- The Montserrat Hydrographic Surveys Coordinating Committee has been established.

## 6.0 Survey and Risk

### 6.1 Meso American-Caribbean Sea Hydrographic Commission (MACHC)/Intergovernmental Oceanographic Commission Sub-Commission for the Caribbean and Adjacent Regions (IOCARIBE) Seabed 2030 Planning Results and Recommendations (Cecilia Guzman, MACHC Seabed 2030 Coordinator)

Kathryn Ries, Meso American-Caribbean Sea Hydrographic Commission (MACHC) Chair, introduced the MACHC Seabed 2030 Coordinator, Cecilia Guzman of Mexico, to present the joint MACHC-Intergovernmental Oceanographic Commission Sub-Commission for the Caribbean and Adjacent Regions (IOCARIBE) Seabed 2030 planning results and recommendations. The MACHC and IOCARIBE, a sister ocean science regional organization, initiated this collaborative effort at the IOCARIBE-XV Session held in Oranjestad, Aruba in May 2019, where in response to the proposal from the MACHC Chair, IOCARIBE members produced recommendation SC-IOCARIBE-XV.7 to:

*Enhance cooperation with the MACHC and other regional partners in joint priority areas such as:*

*(i) Share and use a gap analysis tool to increase and monitor existing and future regional data contributions to Seabed 2030 in partnership with the Seabed 2030 Regional Data Center for the Atlantic and the International Bathymetric Chart of the Caribbean Sea and the Gulf of Mexico (IBCCA).*

Ms. Guzman thanked all for the opportunity to serve as the regional Seabed 2030 Coordinator, and also thanked those who responded to emails and for the active participation during the four-part Seabed 2030 webinar series that had been held in the fall of 2020 to educate members and stakeholders about Seabed 2030 and ways they can contribute. The webinar series was organized by Ms. Guzman, along with the MACHC Chair, Ms. Ries; the Director of the IHO Data Center for Digital Bathymetry, Ms. Jennifer Jencks; Head of the Seabed 2030 Project Atlantic/Indian Oceans Regional Data Assembly and Coordination Center, Dr. Vicki Ferrini; and the Secretary of IOCARIBE, Dr. Cesar Toro.

IOCARIBE and the MACHC sent out joint Circular Letters announcing the webinar series and requesting designation of national points of contact for Seabed2030 were from each country and other interested regional stakeholders. They were held using the Interactio video conference platform that provided simultaneous translation in English and Spanish to ensure full understanding of the content. The four two-hour webinars were held on the following dates:

- September 11, 2020: Current Mapping Status/ International Hydrographic Organization (IHO) Data Centre for Digital Bathymetry (DCDB) and Seabed 2030 Project Regional Data Assembly and Coordination Centers (RDACC)
- September 25, 2020: How to Build the Map: Sharing Data and Attribution
- October 09, 2020: Increasing Data Coverage: Crowdsourced Bathymetry (CSB) and Related Tools
- October 23, 2020: Review, Wrap up, and Next Steps

All of the presentations were videotaped and are found here on the [Seabed2030 section](#) of MACHC Initiative website and are available as resources for the participants, other Regional Hydrographic Commissions (RHCs) and stakeholders. Based on the discussion results of the previous webinars, during the fourth webinar, the MACHC Seabed2030 Coordinator introduced a draft joint MACHC-IOCARIBE Strategy and Annual Work Plan to capitalize on the enthusiasm and guide the work going forward.

Ms. Guzman and the IOCARIBE Secretary also introduced a proposal to have the final Strategy and Work Plan be submitted as a regional program for endorsement as a United Nations Decade of Ocean Science for Sustainable Development (UN Ocean Decade) activity, upon approval by the MACHC and IOCARIBE membership. This proposal and the documents were received positively during the webinar, and participants were invited to review them further and provide feedback afterward. Comments received were integrated and the final draft documents were circulated in advance of the MACHC21 conference to be discussed in this plenary.

Ms. Guzman explained the current status of ocean mapping in the region and how one can contribute data and how to make it available. She also spoke about CSB and the opportunities to receive regional support to increase it. She proceeded to show the Seabed2030 section of the MACHC Initiatives website and the webapp, which highlights gaps, existing public and non-public data, and planned surveys to help prioritize future efforts to fill them. Ms. Guzman encouraged all to familiarize themselves with the app and to contact her to provide additional information to it.

Ms. Guzman then reviewed the major elements of the draft MACHC-IOCARIBE Seabed 2030 Strategy (vision, mission and goals) and the proposed Work Plan for 2021. The MACHC-IOCARIBE [Strategy](#) and [Work Plan](#) can be found in English and Spanish on the [Seabed2030 section](#) of the MACHC Initiative website. Ms. Guzman went on to highlight the UN Ocean Decade, and how this Strategy and Work Plan can contribute to it by helping build a regional digital ocean map, which is foundational to achieving many of the desired outcomes, including a/an:



One of the Ocean Decade Challenges is also to:

*Develop a comprehensive digital representation of the ocean through multi-stakeholder collaboration that provides free and open access to explore, discover and visualize past, current and future ocean conditions.*

This initiative aligns perfectly with this challenge. The first call for the UN Ocean Decade actions is January 15, 2021 to be considered for endorsement as official contributions. This initiative meets the criteria for a UN Ocean Decade Program in that it is regional in scale, fulfils one or more of the objectives, and is a long-term, interdisciplinary and multinational effort. Since IOCARIBE is a body of the United Nations system through the IOC, it can submit this initiative directly on behalf of itself and the MACHC, if approved here. Ms. Guzman asked the MACHC to:

- Note this report.
- Approve the MACHC- IOCARIBE Seabed 2030 Strategy.
- Approve the Seabed2030 2021 Workplan
- Approve the IOCARIBE submission of the Seabed 2030 Strategy by January 15, 2021 to be considered for endorsement as a UN Ocean Decade program.

Dr. Cesar Toro, IOCARIBE Secretary and co-sponsoring partner of this proposed Strategy, congratulated all the Members of the MACHC on the work accomplished despite the major constraints that all have been facing. He noted the presentation made by Ms. Guzman and encouraged all the Members of the MACHC to endorse the Strategy as well as the Work Plan. This is part of the UN Ocean Decade and a great opportunity for all to achieve this major objective that the region has been working toward. Dr. Toro further indicated that this is the moment to work together and highlighted the importance of the partnership. By working together, this will be an achievement of not only the national institutions, but also private industry partners in communications, maritime transportation, and more, as well as a great opportunity to raise the capacity of Members to develop and access information that is provided by this initiative. He encouraged all to fulfill the action requested by the Seabed2030 Coordinator, Ms. Guzman, and indicated that he will be very happy to keep all informed about the process.

Ms. Ries thanked Dr. Toro for affirming that IOCARIBE is a co-sponsor with MACHC on the strategy. Since IOCARIBE is part of the IOC, which is part of the United Nations' United Nations Educational, Scientific and Cultural Organization (UNESCO), they can submit this strategy on the MACHC's behalf directly for consideration as a UN Ocean Decade Program. Ms. Ries further indicated that if the Strategy and the Work Plan are approved at this meeting, the IOCARIBE Secretary would send these documents to the IOCARIBE Member States for their approval, which is expected to be achieved by the end of this month. The documents would then be submitted by IOCARIBE on the MACHC's behalf by the January 15, 2021 deadline.

Captain Rodrigo Obino of Brazil thanked and congratulated the MACHC Seabed2030 Coordinator for her presentation and the comments from Dr. Toro. Captain Obino then suggested some minor edits to the Strategy to clarify that the International Bathymetric Chart for the Caribbean (IBCCA) is a component of General Bathymetric Chart of the Oceans (GEBCO), although GEBCO may have benefited from the contributions of IBCCA. Additionally, IOC does in fact sponsor IBCCA, but the IHO does not co-sponsor IBCCA. Captain Obino further suggested removing the beginning of the second sentence, and adding that the IHO benefitted from contributions of IBCCA through the IHO Center for Digital Bathymetry, and then a new sentence about the IHO-IOC Joint Bathymetric Center Chart of the Oceans GEBCO Project.

Captain Obino's second comment is on the page showing "what is one hundred percent mapped". He added that this is already in the Seabed2030 product strategy and therefore does not need to be mentioned again since there is not a precise metric to prove that this is possible. His third comment was on the last sentence of the description of goal one regarding: "the possible existence of such data, even if it cannot be shared, knowing that it exists will help better identify gaps in coverage and plan new surveys." Captain Obino indicated that Brazil considers this not to be true, and suggested it be removed. Instead, the suggestion was made to add the expression "accessing most bathymetric data available in the region." The MACHC Chair thanked Brazil, noting that the intervention included a number of specific comments and asked Brazil to provide those in writing so they could be incorporated.

Admiral Luigi Sinapi, IHO Director, congratulated and commended the great progress made by the region and by all the Members with this initiative. He noted his participation in the fourth webinar when the draft strategy of MACHC and IOC/IOCARIBE for the Seabed2030 Project was presented. Admiral Sinapi also emphasized the importance of submitting the strategy to be recognized as a UN Ocean Decade action by the January 15, 2020 deadline, and that this Regional Hydrographic Commission would be the first one to demonstrate this leadership role of an RHC. He further encouraged the MACHC to respond positively to the proposal from the CSB Working Group Chair to amend the title of Regional Seabed2030 Coordinator to include CSB. Admiral Sinapi added that the IHO sees this as another big piece of the picture that can contribute to the engagement of this and other RHCs and

Members in the global initiatives for mapping the oceans and ocean sustainability. He commended the MACHC for its proactive stance.

Rear Admiral Shepard Smith of the United States echoed the comments made, adding that this is such an impressive initiative, starting only about a year ago at the MACHC20 meeting in the Dominican Republic. Admiral Smith highlighted that the strategy includes some concrete actions and is well-organized. Further, what is most impressive about this whole effort is the deep engagement and partnership, not only across the nations of the MACHC, but also with other intergovernmental organizations, with IOCARIBE, and alignment with the program of the UN Ocean Decade. Admiral Smith reiterated that this is really impressive work, and congratulated Ms. Guzman for her fabulous leadership of this initiative. In addition, the Admiral indicated that this is one of the things everyone has been trying to do globally for the last few years, which is to raise the profile of the RHCs in the Seabed 2030 project, and in the UN Ocean Decade. This is being attempted in a number of regions, but this is by far the most organized and the most engaged of all the RHCs.

Rear Admiral Rhett Hatcher of the United Kingdom also congratulated and thanked Ms. Guzman for an excellent brief on this agenda item and added that the United Kingdom is strongly in support of the aims and goals of Seabed2030 and in particular, the MACHC Strategy, and supports the Work Plan, noting its coherence with the UN Ocean Decade. Admiral Hatcher also added that the United Kingdom Hydrographic Office (UKHO) is actively investigating how to do this nationally.

Vice Admiral Edgar Barbosa of Brazil thanked Ms. Guzman for presenting the draft Strategy for Seabed2030 and the draft Work Plan for 2021. Admiral Barbosa also congratulated the MACHC Chair for joining efforts with IHO DCDB and Seabed2030 project, which will create an awareness and promote greater collaboration in region. The Admiral further added that Brazil is of the opinion that the MACHC has a very good strategy with well-defined and functional goals and objectives. He also noted that MACHC/IOCARIBE Seabed 2030 Work Plan for 2021 has clear and palpable actions for MACHC Members.

Ms. Ries, MACHC Chair, thanked the Admirals and noted that there were no more comments from the floor, although there were many positive comments in the chatroom. Ms. Ries then moved to approve all of the actions requested of the MACHC plenary, taking into account Brazil's specific comments on edits. Ms. Ries further indicated that the proposed changes will be addressed and adjusted before providing the final documents to IOCARIBE for circulation to its Members for approval. The following decisions were taken:

21.6.1	Decision: The MACHC noted the MACHC/IOCARIBE Seabed 2030 Report.
21.6.1.A	Decision: The MACHC approved the MACHC/IOCARIBE Seabed 2030 Strategy.
21.6.1.B	Decision: The MACHC approved the 2021 Seabed 2030 Work Plan.
21.6.1.C	Decision: The MACHC approved the IOCARIBE submission of the Strategy by January 15, 2020, to be considered for endorsement as a UN Ocean Decade Program.
21.6.1.D	Decision: The MACHC approved the expansion of the title of Seabed 2030 Coordinator to "RHC CSB/Seabed 2030 Coordinator" (IRCC action 12/14).
21.6.1.E	Decision: Approved CSB and Seabed 2030 initiatives be permanently added to the Agenda of future MACHC meetings.

## 6.2 IBCCA (Dagoberto David, General Maritime Direction of Colombia)

Dagoberto David of the General Maritime Direction of Colombia indicated that the IBCCA work started in 1986 and is 34 years old now, and has been a tremendous project and a great idea. There was also a time period when it was not worked on, but with joint effort from a lot of committed people, the project has moved forward.

This project started by being sponsored by the IOC, and in 2006, there was an idea to create charts of all of the Caribbean Ocean and Gulf of Mexico with the National Institute of Statistics and Geography Institute (INEGI) of Mexico as the responsible editor for all work. Mr. David noted that the area of coverage was divided onto 16 different charts of eight degrees by nine degrees, and listed all the countries who participated.

Mr. David elaborated on the technical process and the need for quality control, which was done through a series of video conferences where different participants were asked to report on the improvements. Sheets 1-12 of IBCCA were completed from the information received from Costa Rica as part of this analysis, review, and validation process carried out in 2020 year. With the information from Costa Rica, the INEGI work concluded at the beginning of November 2020. Most of the work, which was done in each of the participating countries, was all sent to Mexico who then ensured that everything was in accordance with the specifications. The important part was to settle on the boundaries of each chart. There was some work regarding the name positioning, which is an artistic matter. Right now, as noted at the beginning, all of the charts have been completed.

At this time, there is a mosaic with 16 PDF files with metadata available. They will be accessible via a portal and available to the entire community around mid-December 2020. The second phase of the project is to amplify the coverage for part of the Mexican Pacific so that Mexico has its bathymetric charts on both coasts. With better technology, better knowledge, and better data, the second phase should last between four and five years, and can contribute data to Seabed2030.

In conclusion Mr. David stated that this presentation was going to be done by the INEGI, but because of internal matters were unable to do so. Further, he emphasized that INEGI did the hard work and thanked INEGI and the Secretaría de Marina (SEMAR) in Mexico because they delivered the charts on time.

Ms. Ries, MACHC Chair, thanked all involved with this tremendous accomplishment, noting that this has been long time in the making, and that it is really great to see it coming to completion and to hear about the efforts for a second phase.

At this time, the Dr. Leendert Dorst of the Netherlands was recognized. Dr. Dorst stated that this is a really wonderful result and that he looks forward to seeing this online. Dr. Dorst also pointed out that the Netherlands volunteered to create sheet 1-10 but then struggled to follow up because of insufficient resources. He added that the team in Colombia has done the vast majority of the work. Once again, Dr. Dorst on behalf of the Netherlands thanked everyone for helping out to create this sheet.

Marvin Sandoval of Costa Rica thanked Mr. David, Colombia, and his team, as well as INEGI and CMR colleagues for finishing this project. Mr. Sandoval added that it has been 34 years for this project and is a very important and strategic result for the region. He also took this opportunity to acknowledge the work of the Hydrographic Institute of Costa Rica and Donya Marta Aguilar for their support finishing this project.

IOCARIBE Secretary Dr. Cesar Toro also thanked Mr. David for the presentation, as well as all the Members, and in particular the institutions who have been leading this effort during all these decades. Dr. Toro also stressed the cooperation between the MACHC and the IHO for the very long endeavor on the production of this bathymetric chart which is a testimony of this cooperation. He further noted that this is a good and interesting basis for the joint work that will be submitted next year to the UN Ocean Decade Programs. He ended by congratulating and thanking all Members.

Ms. Ries, MACHC Chair, thanked all commentators, adding that there are all kinds of congratulatory messages in the chat. She applauded Colombia's leadership in this project and for getting it to the finish line. This long anticipated and very welcome project completion is duly noted.

21.6.2	Decision: Noted completion of IBCCA Project phase 1 and plans for phase 2.
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With that, the Ms. Ries recognized the next speaker, Dawn Seepersad of the University of the West Indies for her presentation on Economic Assessment of Risk in Maritime Navigation across the Greater Caribbean Region.

### 6.3 Economic Assessment of Risk in Maritime Navigation across the Greater Caribbean Region (Dawn Seepersad, University of the West Indies)

Dawn Seepersad, University of the West Indies, informed the group that this presentation is based on a strategy developed to conduct an economic assessment of the risks in maritime navigation across the Greater Caribbean Region (GCR). Maritime navigation is important to the economies because it facilitates economic expansion. However, maritime navigation places the environment, the economy, and culture of the region at risk of unwanted events if it is left unmanaged. This study therefore involves an economic assessment of the risks and maritime navigation across the GCR. Due to the global reliance on maritime trade, the frequency and size of vessels transiting the GCR and accidents involving large vessels which can have devastating effects on the region have been increasing. The results of this study would therefore contribute to the monitoring and management of maritime navigation across the region.

Ms. Seepersad went over the objectives which include a risk assessment strategy an economic model to estimate losses associated with maritime accidents. This economic model is useful because decision makers tend to take action to implement risk control options when potential losses are expressed with a dollar volume. The risk assessment methods developed by International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA) whose interest is in maritime safety through adequate safety of navigation and Land Information New Zealand (LINZ) whose interest is in maritime safety through charting were used to examine the Gulf of Paria. This area generates significant revenue for Trinidad and Tobago from its seven seaports. The LINZ strategy uses both satellite and terrestrial Automatic Identification System (AIS) data to identify vessel position and characteristics along with the location of factors, which are likely to cause a maritime accident.

The data sets are weighted based on their relative level of risk in maritime navigation. The weights are then combined to produce a heat map. The weights were acquired for the Gulf of Paria using questionnaires and interviews with experts. The result show that there is risk in maritime navigation across the Gulf of Paria and control options should be considered to reduce risk. IALA has developed a computer program IALA Waterway Risk Assessment Program (IWRAP), which uses statistical data relating to vessels, navigational methods, and waterway conditions to produce results relating specifically to the probability of collisions and groundings in a waterway each year.

By applying the LINZ and IALA strategies to the Gulf of Paria, a strategy for the economic assessment of risks in maritime navigation is well suited to developing States, particularly within the GCR. This strategy assesses the main criteria. The first criteria is vessel traffic, the next is the location of hazards which can contribute to collisions or groundings and then consequences. Results of this strategy can provide detailed information about the circumstances of collisions or groundings and the estimated impact value on marine and coastal areas.

The benefits of applying the strategy to States within the GCR is that the strategy uses satellite AIS data because many States do not have terrestrial AIS data and the risk value reflects both the probabilities and consequences of collisions or groundings in terms of economic losses per year. Ms. Seepersad concluded by noting that the economic assessment of risks in maritime navigation provides a risk assessment strategy which is suitable for the operating environment in developing States. It uses satellite AIS data, simulating the most likely ship traffic, as well as other possible scenarios and calculates the risk value per square kilometer, which can be used to determine risk control options.

Dr. Cesar Toro, Secretary for IOCARIBE, thanked Ms. Seepersad for another great presentation and asked if there is an intent to expand the geographic scope to other parts of the GCR outside of Trinidad and Tobago waters. Ms. Seepersad responded that the intent is to extend this research to five territories which have been identified as being areas that represent the major operating environments within the GCR.

Gerardine Delanoye, IALA, thanked Ms. Seepersad for the great presentation and, noting a question from the Netherlands in the chatroom, indicated that Ms. Seepersad works as a consultant for IALA now, adding that in relation to other target countries there may be other possibilities where she can be involved and continue her work in areas where IALA has an interest. Ms. Delanoye asked for interested States to contact her or the Dean of the Academy Mr. Omar Frits Eriksson, who together with Ms. Seepersad will explore opportunities.

Ms. Ries, thanked Ms. Delanoye, then relayed a question from the chatroom on how this methodology and strategy might be used for insurance purposes. Ms. Seepersad responded that for insurance purposes, the strategy can highlight hotspots within the study area, and once a ship has been identified as regularly entering a hotspot, possibly using the AIS system, their insurance rate might be adjusted.

Jim Rogers of the United States thanked Ms. Seepersad for a great presentation. Mr. Rogers further indicated that from an economic risk perspective, this highlights Marine Spatial Data Infrastructure (MSDI) and the need to share data for such purposes. It is definitely a great use case for why MACHC needs to make MSDI data available in the region. Mr. Rogers also added that this took a lot of work behind the scenes to build the data initially because it was not easily available, such as bathymetry or CATZOC, which was ultimately provided by individual MACHC Members. He thanked Ms. Seepersad for all her efforts to help highlight MSDI and the need for work within the region.

Ms. Ries inquired as to whether Ms. Seepersad is getting the kind of support that she needs from the MACHC through the MACHC Marine Spatial Data Infrastructure Working Group (MMSDIWG) for the data layers that are needed to support the Project. Ms. Seepersad responded that she has used the data available on the [MMSDIWG website](#) in her thesis, and whenever contacting Members of the MACHC, she is met with a lot of support and thanked everyone for that.

Kemron Beache of St. Vincent and the Grenadines then asked whether modeling of accidents in “hot spot” areas was possible. Ms. Seepersad responded that within the Caribbean there are not a lot of accidents being reported. She noted a recent accident within the Gulf of Paria which did correspond with a red or hotspot area from the LINZ risk assessment, as well as an area identified as being at risk for the IALA risk assessment, and from the analysis, the results have actually been in alignment with the results from both LINZ and IALA strategies. Given the little historical accident information available, it has actually aligned quite well.

21.6.3	Decision: Noted progress of the research project on the Economic Assessment of Risks in Maritime Navigation across the GCR.
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Ms. Ries brought this session to a close, noting that there had been an industry presentation scheduled. Unfortunately, that presenter was unexpectedly unable to attend.

## 7.0 Meso American - Caribbean Sea Hydrographic Commission (MACHC) Disaster Response

Kathryn Ries, Meso American - Caribbean Sea Hydrographic Commission (MACHC) Chair, welcomed everyone back from the break. She indicated that this coming section on disaster response should be very interesting, noting that we just ended the hurricane season with a record breaking 30 plus hurricanes. The emphasis on the impact to operations from the pandemic was a topic identified as high interest by MACHC Members when responding to a survey about desired agenda items for this conference. Further, these types of response efforts, whether to hurricanes, oil spills, or any other kinds of natural or human induced hazards, have been made even more difficult by the pandemic. With that, Ms. Ries introduced the director of the Caribbean Disaster Emergency Management Agency (CDEMA), Elizabeth Riley.

### 7.1 Caribbean Disaster Emergency Management Agency (CDEMA) (Elizabeth Riley, Executive Director of CDEMA)

Elizabeth Riley, Executive Director of the Caribbean Disaster Emergency Management Agency (CDEMA), thanked the MACHC Chair, expressing appreciation for the opportunity to speak to the MACHC on the CDEMA. Ms. Riley touched on the background of CDEMA, the hazards and the types of impacts experienced in the region, the strategic direction which is embodied in a comprehensive disaster management strategy, and also the resilience framework which has been adopted at the regional level. She also discussed the regional response mechanism as it leads into some potential areas for interfacing with the Regional Hydrographic Commission (RHC) going forward.

CDEMA is a branch of the Caribbean Community (CARICOM), with responsibilities for all things disaster management, specifically within their mandate. There are five main areas that CDEMA has been asked to address, they are to: 1) mobilize and coordinate disaster relief; 2) mitigate consequences of disasters; 3) provide comprehensive information on disasters; 4) encourage disaster loss reduction and cooperative arrangements and mechanisms; and 5) establish enhancement and maintenance of adequate emergency disaster response capabilities among the Participating States. CDEMA is also charged to encourage disaster loss reduction, cooperative arrangements, and mechanisms, including through partnerships such as with this RHC. CDEMA also has a responsibility to support their States to make sure that they establish and maintain the adequate disaster response capabilities at the national level. There are 19 participating States and one of the critical things that is really a feature of the region is diversity in terms of the types of hazards, but also diversity in terms of the level of capabilities within each of the States as well.

The beauty of the CDEMA system is the recognition of the limited capabilities at the national level that are brought together to better support all of the countries within the system. In addition to what is known about the hazards that are impacting the hydrogeological site, there are a number of small Island States within the system. Of course, there is evidence of climate change according to climate scientists, with immediate concern for the region.

In addition, Ms. Riley stated that the region has been experiencing an increase intensity of cyclonic activity. The year 2017 was a very critical watershed year for the region because of the multiple category 5 hurricanes, with direct impact on the region. In recognition of the vulnerability of the region and the diversity of the hazards, CDEMA embarked on a strategic approach to addressing these hazards. Key outcome areas were identified on strengthening institutions and knowledge management which is very much linked to the ongoing conversation on how we can build a better evidence base for decision-making around issues of risk. Integration is another key outcome, as well as community resilience.

On the response side, as a part of the remit to coordinate relief and response to impacted States, CDEMA established the regional response mechanism which in essence is an arrangement which is held together through a series of agreements, plans, protocols, and standard operating procedures between a diversity of actors at the national level with our participating States and also with the international community development partners, technical specialist agencies of CARICOM, the United Nations, and other partners.

CDEMA also has a system supported by a range of response teams which are drawn from the national level within participating States. CDEMA supports its States in a diversity of areas, such as relief management, operational support, damage assessments, search and rescue, and more, which can be leveraged to support any of the States and coordinated through the Regional Coordination Center in Barbados. The region is geographically zoned under States to allow for a shorter response time and each of those sub regions is coordinated by a sub-regional focal point. CDEMA has four sub-regions led by Jamaica, Antigua and Barbuda, Barbados, and Trinidad and Tobago, which cover specific territories. Essentially, countries make the requests for support where required, which is usually when they are either fully overwhelmed, or if there is an impact requiring specialized assistance.

Now for COVID-19, CDEMA utilized the existing regional response mechanism and the Regional Coordination Centers, and it is supporting cells. To support the regional efforts to respond to COVID-19, CDEMA established a new specialized cell, which allows tapping directly into and communicating directly with its health sector partners. This governance arrangement has been ongoing since about February of 2020 and still continues. In addressing the situation with COVID-19, CDEMA made a number of modifications to the usual arrangements for addressing hazards. Extensive modification of plans to take into consideration COVID-19 protocols were made. Also, specialized training and adjustments to arrangements for deployment teams had to be conducted, given the dynamic nature of COVID-19 and the fact that the agency draws on personnel from across the region. CDEMA has been supported by the University of the West Indies for statistics on what is happening with COVID-19, with daily updates on the situation in each country.

Another big feature was related to the fact that small Island States experienced some challenges because of the disruption in the global supply chain for essential medical devices and supplies. CDEMA supported the community in the establishment of a logistics mechanism that allowed bringing into the region, either through donation or bulk procurement, items to a centralized hub which was facilitated on the marine side by the Barbados Port and on the air side, by the Grant Adams International Airport.

Ms. Riley referred to the information clearinghouse function, which is an area where CDEMA and MACHC could potentially collaborate. There is the Caribbean Risk Information System (CRIS) which is available on the [CDEMA website](#). It comprises a virtual library, which is essentially a big repository of all things, disaster management information related to countries, and also documentation and standards developed by the coordinating unit. There are also specific databases that are identified, and something called the GeoCRIS, which is the geospatial side of the information that has been assembled, which supports decision-making processes in country. CDEMA is also integrating the real-time emergency event management arrangement which has restricted access but allows communication with our countries in real time as events are unfolding. All three areas of the CRIS architecture are already in place, the GeoCRIS, the virtual library, and the databases are up and operational, but the real time emergency event management is still in the development process.

Ms. Riley further noted that there are some overlaps with 12 CDEMA States being either Full Members or Associate Members of the MACHC. There are also some common partnerships, and this is important because a lot of the work is done through partnerships and collaborative arrangements. MapAction, of course, is a critical partner for CDEMA. So there already some natural associations and entry points for further engagement.

In conclusion, there are promising areas to look into to keep the conversation going. Based on the report from the MACHC20 conference under the disaster response section, MACHC and CDEMA could talk about how to utilize the GeoCRIS as a possible repository to allow easy access to publicly available hydrographic information in support of decision-making in the aftermath of events. Access to the ports in the aftermath of events is absolutely critical for being able to provide relief and getting timely information on alternate landing sites for critical regional logistics and arrangement.

Another area which could be explored is coordination, as both the MACHC and CDEMA work with a lot of similar actors. Together the two organizations can create spaces where partners can bring and leverage their expertise, and facilitate connections due to our regional mandates and geographical reach. A big part of the work at CDEMA is about bringing like-minded entities together, entities that have common goals and common results in mind.

The MACHC Chair thanked Ms. Riley for the very interesting presentation, adding that there are certainly several opportunities that look very promising for the two organizations to pursue.

Captain Marc van der Donck of the Netherlands noted that there are a number of common Members, but there are also other States in the Caribbean area and inquired if CDEMA has a formalized relationship with them as well the local rescue centers. Ms. Riley responded that they do because CDEMA recognizes that hazards do not discriminate according to language or any other parameters. CDEMA has done a lot of reaching out to non-CDEMA participating States, specifically with respect to the Dutch territories. There is a Memorandum of Understanding with the Netherlands for cooperation with respect to the Dutch territories and CDEMA is currently in negotiation with the government of France on a memorandum of understanding with the French territories. CDEMA has a lot of informal relationships already with the French territories, as well as with CARICOM Cuba, which provides for collaboration on disaster management. There is also the Caribbean Forum (CARIFORUM) arrangement that allows CDEMA to reach out to the Dominican Republic. CDEMA also has a Multi-National Caribbean Coordination Cell (MNCCC) which allows collaboration directly with the military forces of the Dutch, the French, British, Canadian and the United States militaries.

Ms. Ries, MACHC Chair, interjected, regretting having to close the session because of the quality of the conversation. However, Ms. Ries proposed to initiate closer coordination between the organizations and suggested as a place to start, establishing communications between CDEMA and the Commission to further explore going deeper into some of the areas discussed for potential cooperation. This was accepted and follow-up conversations are anticipated in 2021.

21.7.1.1	Action: MACHC Chair to follow up with CDEMA Director to explore collaboration opportunities for disaster response.
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With that, Ms. Ries moved to the next topic on Oil Spill Response in Brazilian Waters.

### 7.2 Oil Spill Response in Brazilian Waters; Lessons Learned (Vice Admiral Edgar Barbosa, Brazilian Director of Hydrography and Navigation (DHN))

Vice Admiral Edgar Barbosa, Brazilian Director of Hydrography and Navigation (DHN), began by indicating that in case of an oil spill in Brazil, it is mandatory for the hydrographic service to be involved, noting that this will provide the technical, not the operational, response. In this case, there were a lot of organizations that supported the investigation. The technical investigation consisted mainly of resources and information, including the Brazilian Navy, the Federal Police Environment Ministry, academic institutions, and some technical institutions to help with the mathematical modeling. The Vice Admiral covered the three spills along the coast, affecting 3,600 km of coastline, 130 cities, and 11 states. He added that 5,340 tons of oil residues lead to an unprecedented incident in length and duration.

In this case, the DHN's Director was the head investigator, adding that there is also still an on-going criminal investigation. It was important for the marine environment to discover what happened, and it demanded a multidisciplinary analysis, specifically the chemistry analysis, the mathematical modeling, and maritime traffic analysis and the dispersion of oil. Admiral Barbosa continued discussing the weathering process of the oil at sea, such as spreading evaporation, oxidation, emulsification, biodegradation, biodegrade, biodegradation, and dispersion sedimentation, as well as the oil geochemistry (light oil versus heavy oil). As soon as the heavy oil goes to the sea, there is an emulsification, especially in the beginning, resulting in an increase in volume up to 200%, and then with time, this goes back to 100%. It will dissipate after one year, but still about 25% of the oil remains in the water.

Admiral Barbosa then covered the modeling mathematics, which included reverse mathematical modeling. After much analysis and research, it was concluded that this accident was caused by a ship transiting the area. Studying the subject, they realized that it is common that some ships do not make use of Automatic Identification System (AIS), making it difficult to analyze the maritime traffic.

To conclude, there are some lessons learned about this investigation. Letters had to be sent to some marine authorities, which needed a quick response and that did not always happen. It was also realized that there are a lot of blanks in international laws that need to be considered and dealt with at the International Maritime Organization (IMO) to try to change some laws in order to avoid future large spills. However, during this investigation, they increased our capacity to analyze oil in our laboratory of the Brazilian Navy. They also increased the capacity to use the mathematical modeling, which is needed to predict where the oil going.

Ms. Ries, MACHC Chair, thanked Admiral Barbosa for a very interesting presentation on this case study. With that, Ms. Ries introduced "lightning talks" on how different countries in the region have responded to hurricanes, particularly during this pandemic. First introduced was Julia Powell of the United States National Oceanic and Atmospheric Administration (NOAA) who presented the Disaster Response in a Pandemic.

### 7.3A Emergency Survey Response to the 2020 Hurricane Season (Julia Powell, United States National Oceanic and Atmospheric Administration (NOAA))

Julia Powell, United States National Oceanic and Atmospheric Administration (NOAA), thanked the Chair and elaborated on her role within NOAA's Office of Coast Survey (OCS), specifically the Navigation Services Division (NSD). This Division includes a series of navigation response teams consisting of three-person teams that conduct hydrographic surveys on small, trailer-ready, 30-foot vessels to update NOAA's suite of charts. These teams are strategically located around the country and remain on call to respond to emergencies in order to restore resumption of shipping after storms and to protect life and property from dangers to navigation.

This year NSD responded to four storms, the first being hurricane Laura, impacting Galveston and Lake Charles. Then came Hurricane Sally, which hit Pensacola, Florida, then Hurricane Delta, which unfortunately hit Lake Charles Louisiana again, followed by Hurricane Zeta, which affected the Gulf Coast of Mississippi. For storm preparation in normal times, daily in-person meetings would be conducted at headquarters to plan a potential response based on storm information, and the Navigation Managers would actually embed within the United States Coast Guard (USCG) to help with local coordination. However, this response was completely different, and all of the meetings, including the regional-based Navigation Managers were held virtually, eliminating local embedding with traditional Emergency Interagency Response Centers. In some cases it was difficult to reach all participants to discuss any assessment and anticipation of a response.

Of course, the goal is to get on scene and get on the water and survey as quickly as possible. During the pandemic, recreational vehicle (RV) rentals were deployed due to the scarcity of available lodging. The United States Federal Emergency Management Agency (FEMA) was already using hotel lodging as part of their evacuation strategy, resulting in low supply of hotel rooms. Immediately after the storm hits, the Navigation Managers talk to their local and regional representatives and determine where the actual need for an emergency hydrographic survey might be.

For example, there were requests from Houston-Galveston, Port Arthur, for the Calcasieu Ship Channel. The Navigation Managers determine the assets in region, and their priority. The NSD vessels have very limited capabilities outside the break water. Thus, if needed, they start coordinating with their sister division, the Hydrographic Surveys Division (HSD), for assets to survey the deeper parts of the channel.

The HSD was able to successfully survey the Lake Charles entrance channel after Hurricane Laura, which gave them a baseline of data for when Hurricane Delta hit the same region. Fortunately, the HSD had one of its own assets, the Thomas Jefferson in the region, and was able to go back and survey the entrance channel, locating additional sunken barges that were then removed by the United States Army Corps of Engineers (USACE) to allow ship traffic to resume.

Having to plan everything virtually is very difficult. To manage how to do this type of operation during a pandemic, certain protocols were put in place. Personnel had to wear personal protective equipment (PPE) while on the vessel and all had to socially distance themselves, as far as practical. The vessels are small, normally holding only three people, and there were times they had to limit this to two people on the boat.

For maximum safety and processing purposes, three people are needed on the boat. For the first storm, Laura, they did not bring in outside data processors. By the time Hurricane Delta came, they had learned to create a "bubble" safety team that could process data located about two hours away in their own hotel rooms. A data runner would deliver data from the actual survey location to the hotel rooms for overnight processing.

The challenges and lessons learned from trying to operate emergency response during a pandemic within NOAA, include limiting travel to only essential personnel for primary mission essential functions like emergency response. They created special emergency yearlong travel authorizations which minimized the typical travel administrative bureaucracy and allowed the teams to be deployed immediately when needed. Although NOAA required the use of PPE and the practice of social distancing, they were sending the survey teams into regions that may or may not be using the same practices, which is a risk. They also put in place a COVID-19 testing contract and provided all of the team's access to testing and lodging before they returned home.

The MACHC Chair thanked Ms. Powell and then introduced Lieutenant Commander Natalia Otálora of the General Maritime Direction of Colombia to talk about their response to Hurricanes Eta and Iota.

### **7.3b Response to Hurricane Eta and Iota (Lieutenant Commander Nathalia Otálora, Colombia)**

Lieutenant Commander Nathalia Otálora, Colombia, thanked the MACHC Chair for the opportunity to share how Colombia responded to the emergencies of Hurricanes Eta and Iota. LCDR Otálora shared images of the 48-hour period which transformed a tropical wave to a depression and transforming into a hurricane resulting in very severe conditions. She shared some of the images on how it affected structures, tourist sites, piers, and homes. In preparation, the hydrographic team prepared to conduct bathymetric surveys of canals and ports. However, Iota arrived in less than the expected time, with a lot more power, and a lot more energy.

These atmospheric disturbances only took around 24 hours to transform from a tropical storm to a huge depression and storm, causing a lot of infrastructure damage in Providence. The waves were between five and six meters high. The storm was tracked using all available data and navigation signals. In St Andrés, Iota raised highways, and swept the ocean far into the city, taking with it, all of the foundations. People thought that it was a tsunami.

The President of Colombia was able to communicate with the mayor of Providence Island and was informed that the damage was at 98%. Fortunately, only two lives were lost. The Providence Port was completely destroyed. The hydrographic assets were completely destroyed and some sank. The hydrographic service immediately moved forward, assessing all of the different navigation teams to deploy the hydrographic team. The team was made up of four people who were fully committed to perform surveys, and completed a total of eight surveys in critical areas. A multipurpose ship was deployed to provide humanitarian help, as well as technical personnel for marine preservation in order to re-establish a channel in order to have a safe access to the port.

Because the port was inaccessible, it was necessary to do hydrographic surveys, which they did in some areas. All of the work that took place, both in Providence Island and Santa Catalina, was to generate plans and charts and verify navigable areas, anchoring, and other areas of interest. They were able to support the re-establishment and rehabilitation of Andrés Island and Providence Island, which really highlights the importance of hydrography in emergency response.

This was a great opportunity for rehabilitation for both San Andrés and Providence. Today Providence high school is back open, and the city is open for tourism. LCDR Otálora invited the MACHC participants to visit San Andrés Island. She further noted the commitment of Colombia and its national hydrographic service to the Mesoamerican and Caribbean region.

Ms. Ries, MACHC Chair, thanked LCDR Otálora and Colombia very much for the presentation, noting that these are examples of how difficult it is to respond to emergencies like this that are so devastating. But under these unprecedented circumstances, having to do these operations in a pandemic is a major challenge. With that, Ms. Ries moved to Agenda Item 10.0, Closing Activities.

## 10.0 Closing Activities (Kathryn Ries, Meso American-Caribbean Sea Hydrographic Commission (MACHC) Chair)

### 10.1 Confirmation of the MACHC Chair and Election of the Vice Chair

Kathryn Ries, Meso American-Caribbean Sea Hydrographic Commission (MACHC) Chair, introduced Agenda Item 10.1, the confirmation of the new MACHC Chair and the election of the Vice Chair. Ms. Ries added that according to the Statutes at the conclusion of the conference, Full Members will offer suggestions regarding the election of a new Chair and Vice Chair. In order to assure this continuity, the Statutes suggest that the Vice Chair be elevated to the position of Chair for the next two-year period, which in this case is Brazil. Thus, in accordance with the MACHC statutes, the Chair proposed the elevation of Brazil as the natural next step and asked if there are any objections. There were no objections, and it was confirmed that Brazil will serve as the new Chair of the commission.

21.10.1.1	Decision: Confirmed Brazil as the incoming MACHC Chair.
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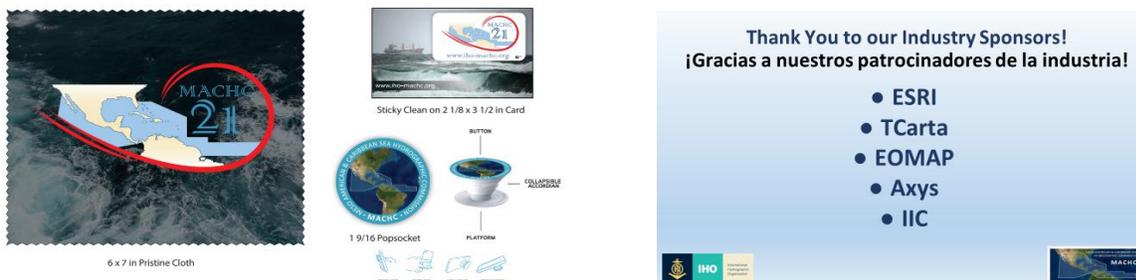
Nominations for the next Vice Chair had been requested via MACHC CL-10 and only one nomination was received, from the United Kingdom. Ms. Ries added that she has not been contacted about any other potential nominations. Thus, the request to the floor was for any objections to the United Kingdom becoming the new Vice Chair of the commission. There were none, and therefore the decision for the United Kingdom as the new Vice Chair was affirmed.

21.10.1.2	Decision: Approved the United Kingdom as the new MACHC Vice Chair.
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The Chair declared that we have a new MACHC Chair, Brazil and a new Vice Chair, the UK and congratulated both. They will assume their positions officially on March 1, 2021.

### 10.2 Any Other Business

Ms. Ries, MACHC Chair indicated that no one requested any topics under this agenda item. However, she mentioned that some conference mementos would be sent to all participants as a reminder of this event. Since everyone has some sort of “screen” (cell phone, tablet, computer, etc.), each participant will receive a “pop socket” and screen cleaning items with the conference logo on them. They are small, practical, and easy to mail. She thanked the industry partners who paid for their production, specifically Esri, TCarta, EOMAP, Axys Technologies, and IIC Technologies.



Ms. Ries, MACHC Chair, again thanked the three industry partners who co-hosted the great Satellite-Derived Bathymetry Workshop as one of the pre-conference capacity building events: Esri, TCarta and EOMAP. She also acknowledged all the other industry partners who contributed their valuable expertise and information to the conference and related MACHC activities.

### 10.3 Review List of Actions and Decisions

Ms. Ries, MACHC Chair, moved to Agenda Item 10.3, to review the conference actions and decisions. The List of Decisions was presented one by one.

After concluding with the List of Decisions, the Chair recognized International Hydrographic Organization (IHO) Director, Admiral Luigi Sinapi. Admiral Sinapi provided a clarification regarding the decision on the expansion of the title of the Seabed2030 Coordinator which was added.

The MACHC Chair next moved to the List of Actions, going through them one by one. Ms. Ries added that often recommendations that come from the IHO Secretariat and the Inter-Regional Coordination Committee (IRCC) are overlapping. Sometimes they are duplicative of already continuous MACHC actions. These recommendations were examined and consolidated where there were overlaps or duplication. The draft lists of Decisions and Actions were approved by the plenary. The participants were given until December 16, 2020 after the meeting to do a final review and provide any additional comments.

21.10.1.3	Decision: Approved the draft List of Decisions and Actions.
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Ms. Ries then moved on to the topic of the next meeting, and recognized Rear Admiral Shepard Smith of the United States to speak.

### 10.4 Next Meeting

Rear Admiral Shepard Smith of the United States indicated that he is the outgoing Director of the National Oceanic and Atmospheric Administration (NOAA) Office of Coast Survey (OCS), noting how disappointed he was that the United States was not able to host this year in New Orleans as planned. He said that the United States had a really great hosting plan set up, and that New Orleans is one of the iconic American cities that would work very well as a host site for the MACHC. He introduced the incoming Director, Captain Rick Brennan, who currently serves as the Chief of the Hydrographic Surveys Division. He indicated that Captain Brennan has been a career long hydrographer, and that he counts Captain Brennan as a trusted colleague and one of his closest personal and professional confidants, and a dear friend. He said it is a great joy to be able to hand over the keys to one of one of the great hydrographic offices of the world to someone that he trusts and respects so much. With that, Admiral Smith asked Captain Brennan to take the floor.

Captain Rick Brennan thanked Admiral Smith, and indicated that he could not be more excited to assume the role of Director, adding that he is committed to continuing Admiral Smith's leadership and support for the MACHC. He continued, adding that this is a strong regional collaboration model for the world. As Admiral Smith said, the United States very much wanted to be able to host this meeting in person, but unable to do so due to the unprecedented pandemic. However, the United States does hope that circumstances will allow them to do this next year as previously planned. As a MACHC Member who has not hosted an in-person MACHC conference for some time, the United States is prepared to try again, and would be honored to host the 22<sup>nd</sup> Conference of the MACHC in 2021.

The preliminary dates proposed are November 29 to December 3, 2021. These dates do not appear to conflict with any other scheduled IHO meetings. The venue will be in one of two potential major port and cultural areas in the United States, either Miami, Florida, or New Orleans, Louisiana. As soon as the United States has made a final determination, they will communicate the location. Captain Brennan asked the participants to please accept his personal assurance that this venue will be highly suitable for the needs of the MACHC and all related amenities that will make the meeting both productive and enjoyable.

He concluded by saying he hopes that the MACHC will agree to this offer to host the 22<sup>nd</sup> Conference of the MACHC in 2021.

The MACHC Chair thanked Captain Brennan and indicated that there has been a lot of enthusiastic response to the United States' offer to host, and it is considered approved.

21.10.1.4	Decision: Approved the location of MACHC 22 in the United States to be held in early December 2021.
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### 10.5 Closing Comments

Vice Admiral Edgar Barbosa of Brazil expressed gratitude to the Commission for the trust placed on Brazil to coordinate the MACHC work starting in March 2021. Brazil joined MACHC in 2005, and since then has given much attention to this Commission. Brazil feels very honored to participate in this Commission. The Admiral also congratulated the United Kingdom for being elected Vice Chair. The Brazilian Hydrographic Office has enjoyed a great relationship with United Kingdom Hydrographic Office (UKHO) for a long time and will continue the work that has been done promoting the activities and the cooperation of hydrography and cartography Maritime Safety Information (MSI), Marine Spatial Data Infrastructure (MSDI), and projects between the MACHC Members and coastal States and partners in the region. Obviously, the success of MACHC has always been the cooperation among its Members, recognizing the diversity in the region to conduct the agreed work.

Vice Admiral Barbosa also noted that it is very important to thank the active participation of industry, academia, regional organizations, and the research institutions in all MACHC conferences and workshops – their contribution is immeasurable and very important for the Commission. Vice Admiral Barbosa also expressed gratitude to IHO Director Admiral Luigi Sinapi and IHO Assistant Director, Leonel Manteigas, for their presence this week. He also stated he wanted to take some time to express a few words of appreciation for the work that Ms. Kathryn Ries, the MACHC Chair, has been doing for the Commission. During her Chairwomanship, she brought the Vice Chair into the decision-making process, and for this they are very grateful for the trust placed in Brazil.

Ms. Ries was always extremely attentive and maintained a relationship of trust. She was dedicated to the Commission, organizing two excellent conferences. She worked intensely coordinating members' response to actions resulting from the two previous conferences, and he was sure she will continue to be active in the next three months. Ms. Ries reactivated the MACHC Initiatives webpage of the MACHC, and NOAA should be thanked for this support. She managed to bring together a cohesive and attentive team, which helped support the work of the Commission so much over the past two years. For this conference in particular, a special thanks is given to Erich Frey, Percy Pacheco, and David Bidwell.

Ms. Ries led a smooth transition from the Working Group of the Marine Economic Infrastructure Program to the MACHC Marine Spatial Data Infrastructure Working Group (MMSDIWG). Capacity building received a great deal of attention from her, and technical visits to our members were carried out, and others are planned for the next year (hopefully). The MACHC International Charting Coordination Working Group (MICC) has continued to increase its production in our region, an increase of five and a half percent in the number of Electronic Navigational Chart (ENC) cells available from 914 in 2018, to 964 in 2020. Vice Admiral Barbosa emphasized that Ms. Ries promoted the regional project of Intergovernmental Oceanographic Commission (IOC)/International Bathymetric Chart of the Caribbean Sea and the Gulf of Mexico (IBCCA) and contributed to this project. The conclusion is the mapping of the entire affected region this year. Ms. Ries established a good relationship with partners

to foster the collection of bathymetric data in the MACHC region, which improves the relationship with the IHO Data Centre for Digital Bathymetry (DCDB), and the Seabed2030 project.

The MACHC now has a very good Strategy to contribute to Seabed 2030 project for the next decade. Ms. Ries led MACHC to enter the United Nations Decade of Ocean Science for Sustainable Development (UN Ocean Decade). There are so many other achievements of hers that would take many hours to enumerate them. Vice Admiral Barbosa concluded by saying “Ms. Kathryn Ries, MACHC Chair, we have to thank you so much for your contributions. You have been working for the Commission for a long time, and we will be always very happy to continue to count on your experience” and requested applause.

Ms. Ries thanked the Vice Admiral very much, adding that these words are very kind and much appreciated. She indicated that the work of a Chair is only as good as the collaboration and support that the Chair receives. She expressed great appreciation for the tremendous work from all Members of this Commission, and for the very productive and collegial working relationship with Brazil, thanking them very much.

The MACHC Chair then recognized IHO Director, Admiral Luigi Sinapi. Admiral Sinapi made closing remarks on behalf of IHO, and commended and congratulated the proactiveness and the great job done by this region under Ms. Ries’ leadership as the MACHC Chair, and the team. He added that with a Vice Chair and the leadership team of the MACHC working groups, the IHO is thankful for a great job. Additionally, he complimented the MACHC for being the first Commission to respond so positively to all the international initiatives such as the UN Ocean Decade and Seabed2030. He also welcomed Brazil as the new Chair, and the United Kingdom as Vice Chair, and emphasized that he looks forward to meeting in person next year. Admiral Sinapi extended his thanks to the United States for reiterating their availability to host the next meeting.

Nathanael Knapp of the United Kingdom, commended Ms. Ries, the MACHC Chair, for a couple of things: first, running an excellent conference, but also an amazing experience. Even more importantly, he recognized Ms. Ries for an outstanding stint at the helm of the Commission, saying that it has been very fortunate to have had such a knowledgeable, experienced, and consistent leader during what have been most testing times. The United Kingdom is extremely grateful for the MACHC Chair’s leadership. Mr. Knapp also recognized Brazil for their exceptional support in the Vice Chair role. Mr. Knapp also congratulated Admiral Barbosa on assuming the mantle of MACHC Chair and recognizing how big the shoes are that need to be filled. The United Kingdom is honored to undertake the role of Vice Chair in the next term, and looks forward to making new progress along with friends and colleagues in the MACHC region with all the exciting and important programs of work that have been discussed over the last four days.

Ms. Ries, MACHC Chair, then made some final remarks. In her final comments, Ms. Ries stated that she had initially thought about summarizing the accomplishments of the Commission over the past few years, but they are already self-evident, not only in the presentations that that have heard over these past few days, but also in the very kind words of Vice Admiral Barbosa. However, what is really admirable about the MACHC is not just what gets accomplished, which of course is vital and important, but *how* it is done. The biggest word in the “word cloud” generated at last year’s meeting about the value of the Commission, shown in the opening video, is “collaboration.”

The MACHC Members really collaborate well among each other and collaborate well with our regional partners. The Commission has made great progress in forging new partnerships, and not just to exchange information – we are actively working together to achieve common goals. This is very important and impressive because it expands the resources that are available. These resources are being leveraged effectively in order to reach common goals and to benefit a much broader base of users. This

is reflected in the MACHC Capacity Building Plan, as well as many of other initiatives, including the most recent one on the Seabed 2030 Strategy. It has also been very satisfying to see the leadership evolution of the Commission.

This Commission is a model in many ways for other Regional Hydrographic Commissions (RHCs), through current initiatives and related activities, and it has also been very satisfying to see the leadership role of women increase. Ms. Ries observed that never before in the many years that she has participated in the MACHC have there been so many women in the top leadership positions; Lucy Fieldhouse, Capacity Building Coordinator; Bernice Mahabier, MICC Chair; and Cecilia Cortina Guzman, the Crowdsourced Bathymetry (CSB)/Seabed2030 Coordinator. This is not at all to discount the leadership of Jim Rogers, which is highly valued. However, he has a very capable Vice Chair, Amy Northern, who is coming up quickly from behind!

Ms. Ries went on to recognize her highly competent team who found out very quickly that organizing a virtual conference is no easier than an in-person one. The team worked tirelessly for months to organize every detail, technically, logistically, and substantively. The MACHC Chair requested that these team members' video be turned on so that the conference participants could see briefly the people behind the scenes, without whom, this conference would simply not have been possible: Percy Pacheco, David Bidwell, Alexis Maxwell, Erich Frey, and Heidi Allen.

Ms. Ries also thanked the indispensable interpreters from Interactio, without whom we would not have been able to have such a smooth and successful meeting. She also thanked Brazil, for the close and extensive collaboration. It has been an invaluable partnership, and they have worked together so closely and so well for a long time. Ms. Ries affirmed that the Commission will be in very good hands with Brazil as the new Chair and will, no doubt, be well supported by the United Kingdom in their new role as Vice Chair. She concluded by stating that it has just been a profound professional privilege and a personal pleasure to have served as the Chair of this Commission for the past two years. She thanked everyone for this opportunity and looks forward to continuing to do great things together--and seeing everyone in person, in the United States, next year!

And with that, Ms. Ries declared the conference adjourned.