



20th MACHC Conference Minutes December 02-06, 2019



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Formal Opening

The formal opening of the 20th Conference of the Meso American and the Caribbean Sea Hydrographic Commission (MACHC) took place on Wednesday, December 4, 2019. A Seminar on Hydrographic Governance took place just prior to the MACHC on Monday, December 2, and included an introductory training on Marine Spatial Data Infrastructure on Tuesday morning December 3. The MACHC Integrated Charting Committee and the Marine Spatial Data Working Groups held pre-plenary meetings on Tuesday afternoon.

Vice Admiral Emilio Recio Segura, Commander General of the Dominican Republic Navy warmly welcomed all the attendees (132 attendees from 23 countries, 9 regional organizations, 11 companies), emphasizing the importance of hydrography to regional safety, security and the economy. His remarks were followed by those from Rear Admiral Mustafa Iptes, Director of the International Hydrographic Organization who thanked the hosts for their generous hospitality and noted the strength of the Commission and its contributions to the global hydrographic community. The MACHC Chair Ms. Kathryn Ries also recognized the outstanding organization by the hosts and emphasized the goals of the MACHC: 1) to ensure safety of navigation through seamless chart coverage of the region; 2) to increase capacity of all the members to provide the highest quality navigation products and services; and 3) to make the Commission's valuable, authoritative data available for multiple non-navigation purposes. She noted the opportunity for the MACHC to take a lead role in providing regional contributions to the Seabed 2030 Initiative, and simultaneously to the United Nations Decade of Ocean Science for Sustainable Development.



1.1 Introductions (Katie Ries, MACHC Chair)

After a brief recess for the group photo, the Plenary convened. The Chair invited all the participants to introduce themselves.

1.1A Welcome of Guyana as a new IHO Member



Guyana has long been an Associate Member of the MACHC. Upon having recently joined the IHO, Guyana became eligible to become a Full Member of the MACHC upon signing the MACHC Statutes. Mr. Rene Duesbury of the Guyana Lands and Surveys Commission did so, and Guyana was enthusiastically welcomed by all the participants. All coastal states of South America are now IHO members.

1.2 Approval of Agenda and Timetable

The Chair invited any comments or adjustments to the [agenda](#). The US and Guatemala asked that they be able to report on a Technical Visit to Guatemala as part of the Capacity Building Session (Agenda Item 5). This was noted and included, and the agenda was approved.

20.1.2	Decision: MACHC approved the agenda with minor adjustments including the addition of a Guatemala Technical Visit presentation to agenda item 5.
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1.3 List of Documents and Administrative Arrangements

The List of Documents and the List of Participants were available from the [MACHC website](#). No changes or additions were noted.

20.1.3	Decision: The MACHC approved the list of documents and participants.
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1.4 Matters Arising from the Minutes of the MACHC19 Meeting

The final draft version of the [MACHC19 Minutes](#) was sent out for comment on February 24, 2019. Comments received were incorporated, and no further comments were noted by the plenary. Hence, the MACHC19 Minutes were approved.

20.1.4	Decision: The MACHC approved the minutes of the MACHC 19 meeting with no additional changes.
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The Chair then led participants in a brainstorming “word cloud” exercise to create a shared vision of the commission’s collective vision for the future of MACHC. Participants submitted responses via cell phones and laptops using a live polling system. Each time the same word was entered into the system, it grew larger in relation to the others. “Collaboration” was by far the most commonly cited word used to describe the vision of the future for MACHC with 13 submissions out of a total of 56. Other words which received more than two submissions each were “cooperation” (4) and “capacity building” (3). It is evident from the results the importance of close collaboration across nations further development of strong working relationships will continue to paramount to MACHC into the future on a host of current and emerging issues.



(Word Cloud) What ONE word best describes your vision for the future of MACHC?



Total Results: 56

1.5. MACHC 19 Action List Review

At the 19th MACHC in Cartagena, Colombia, Action 19.1.5 requested the Chair to:

“Review all the recent IHO, IRCC and HSSC actions in the context of the current MACHC action list and determine how to consolidate, streamline, and take action on them.”

As part of this review, the Chair found a number of duplicative or similar actions, as well as actions mixed with decisions, or activities that belong in MACHC Working Group work plans. Repetitive actions were consolidated, decisions were distinguished from actions, completed actions were removed and relevant actions were captured as “open” or “continuous” or referred to MACHC Committees or WGs. An updated list with explanatory notes on proposed changes was sent out to the MACHC via Circular Letter 10, with a request for comments in order to distribute a “clean” version in advance of MACHC20.

The Chair presented this “clean” list to the plenary, with a proposal to only review “open” actions and use this approach going forward, which was approved by the plenary. Updates were captured for the open actions during the discussion for incorporation in the MACHC19 Action list.

20.1.5	Decision: The MACHC approved the “clean” version of the MACHC19 action list as presented in plenary as the basis for moving forward.
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2. MACHC Developments, IHO Bodies, Policy Aspects

2.1 IHO Secretariat Report (Mustafa Iptes, IHO Director)

The IHO Director presented a broad overview of IHO corporate activities which include working to increase the IHO membership, among others. He encouraged MACHC Associate Members to apply for membership. The MACHC is also encouraged to engage with coastal states in the region that are not yet Associate Members.

Preparations are underway for the Second Session of IHO Assembly, April 21-24 in Monaco, which will review the new 3-year IHO work program and budget (2021-23) as well as proposals from Member States, the Council and the Secretariat. The IHO is working on outreach related to World Hydrography Day 2020 - with a theme of “Hydrography - Enabling Autonomous Technologies”.

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The IHO website has undergone a comprehensive redesign and both it and the new GIS services will be available January 1, 2020. The IHO is also working on several special events related to the IHO Centenary Celebrations.

The Director went on to describe different IHO programmatic areas and made related MACHC recommendations. The US commented that all of these recommendations need to be addressed. The Chair responded that they are already being addressed within the existing MACHC Action list or by the related Agenda item as follows:

Program Area	IHO Recommendations to MACHC	MACHC Action
INT Chart and ENC Production Coordination - Region B	MACHC to consider providing regional CATZOC practices to the DQWG.	Part of MICC Workplan and Agenda Item 9.
Maritime Safety Information Services	Recommendation. Engage with National Coordinators to ensure they fulfill the responsibilities detailed under item 3.6 of the IHO Publication S-53 "Joint IMO/IHO/WMO Manual on Maritime Safety Information".	Agenda Item 2.3
Capacity Building Program: IHO CB budget unable to keep pace with the demand	MACHC members are invited to identify opportunities in national or regional funding agencies to incorporate hydrographic development in the broader projects supporting developing countries.	Agenda Items 5 (focus on leveraging partnerships for CB: COCATRAM; IALA, IADB, SEPRHC and SWaTHC; Caribe EWS)
Crowdsourced Bathymetry	Encourage Members, Associate Members and Observers to: make data freely available for inclusion in the DCDB and the widest possible use....; reply to Annex B of IHO CL 11/2019 and consider IHO CL 47/2019; etc.	Agenda Item 4a CSB
GEBCO support through Seabed 2030 Project	Continue inviting Seabed 2030 project representatives to MACHC meetings to discuss options for deepened cooperation and support, etc.	Agenda Items 6.3 and 6.4 (Head, Atlantic/Indian Oceans Regional Data Center in attendance)
Updating IHO GIS and Databases--country and regional information	Countries in the MACHC Region are invited 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).	In MACHC Continuous Action List
International Hydrographic Review	RHCs to confirm representative for International Hydrographic Review.	Agenda Item 2.1.1 and 10.1--article ideas from MACHC captured via live polling during meeting

2.1.1 IRCC Update (Katie Ries, MACHC Chair)

The IRCC11 was held in Genoa, Italy, in 2019, and the IRCC12 will be held in Gdansk, Poland, on 8-10 June 2020. The Chair represented MACHC and other MACHC Member States included representatives from Colombia, France, Netherlands and the United Kingdom. The MACHC Report to IRCC11 was distributed via MACHC CL 5/2019.

The Chair highlighted the following accomplishments in the MACHC Report to IRCC11:

- MACHC initiated collaboration with the Seabed 2030 Regional Data Center for the Atlantic and Indian Oceans to develop a regional “gap analysis”.
- The International Bathymetric Chart of the Caribbean (IBCCA) was reinvigorated.
- A MACHC Marine Spatial Data Infrastructure Working Group (MMSDIWG) was established.
- MACHC increased collaboration with regional partners for: Capacity Building (four training activities funded, with new regional co-sponsors: COCATRAM; Caribe EWS; SEPRHC; SWAtHC) and MSDI (RDACC, IHO DCDB, Caribbean Marine Atlas).
- The increase in ENC coverage (914 available; 12 large scale ENC coverage cruise ship ports).
- Initiation of a Disaster Response Strategy for MACHC.

There were several IRCC11 actions assigned to RHCs. The Chair indicated that 4 out of 5 actions related to MSI are already in the MACHC continuous action list and one is to be addressed during MACHC20 as Agenda Item 2.3. Similarly, 7 out of 10 hydrographic survey actions are already in the MACHC continuous action list. Three more related to crowd sourced bathymetry/Seabed 2030 are to be addressed during MACHC20 (for example establishing a Seabed 2030 Regional Coordinator, Agenda Item 6.4). Fourteen charting actions will be dealt appropriately in the MICC work plan. While the MACHC has confirmed its representative to the IHR (Chris Thorne), the Chair noted the importance of providing him with article ideas during the conference via the live polling mechanism, so that he had good candidates to consider for the forthcoming IHR deadline of January.

The Chair noted that the MACHC already acted on another IRCC recommendation to engage with MapAction (Agenda Item 8.4), a humanitarian mapping non-governmental organization that works through skilled GIS volunteers in the immediate aftermath of a disaster. Its skill and experience are recognized as crucial in helping the UN and other charities and agencies to target and coordinate the delivery of humanitarian aid. The MACHC is the first RHC to try out the new IHO-developed training materials for MSDI (funded by Denmark), during a half day “Introduction to MSDI” training that was part of the pre-plenary Hydrography Governance Seminar. Lastly, the Chair reiterated the IHO Director’s statement that IHO Capacity Building resources are not equal to the demand, making it imperative that the MACHC strategically partner with others in the region (and with neighboring RHCs) with common CB goals.

20.2.1.1	Action: Member states provide suggestions for articles for the region for the IHR (starting via the live polling at MACHC20)
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2.1.2 HSSC Update (Ricardo Freire, Brazilian Naval Hydrographic Office)

Brazil informed that the HSSC11 was held in Cape Town, South Africa, in 2019, and that HSSC12 will be held in Bristol, UK, in May 2020. The following MACHC Member States had representatives attending HSSC11: Brazil, Colombia, France, Mexico, Netherlands, United Kingdom and United States of America.

HSSC11 was characterized by two main levels of discussion:

- Operational/strategic level, examining the new draft IHO Resolution 2/2007 as amended, the revised Strategic Plan 2021-2026, the S-100 Implementation Strategy, and the future of paper nautical charts.
- Technical level, working on the progress in the development of the S-1xx Product Specifications framework, their operationalization in accordance with the S-100 concept, the Demonstration showcase of S-100 based products, the interoperability between S-101 ENC and S-1xx.

Brazil provided an update on the situation of the Editions of the S-1xx Product Specifications under IHO's remit, most of them Edition 1.0.0, except one Edition 2.0.0 and a few others under development. S-102 Edition 2.0.0 was issued recently. In respect to S-101 ENC Product Specification, Edition 1.0.0 was issued in 2018, there will be a revision issued in 2020 and it is expected to have issued Edition 2.0.0, the operational edition, by 2022. The final draft of edition 6.9.9. of S-44 will be completed by the end of next year.

Components	Edition 1.0.0 (2018)	Edition 1.X.X(2019)	Edition 2.0.0 (2022)
Main Documentation	✓	✓	✓
Feature Catalogue	✓	✓	✓
Portrayal Catalogue	Partial	✓	✓
Validation	Partial	✓	✓
Data Classification and Encoding Guide	✓	✓	✓
Encoding Format	✓	✓	✓
Encryption		✓	✓
Alerts and Indications		✓	✓
Full Test Data Sets for Type approval		Partial	✓
Notes	Portrayal will be limited to S-52 rules translated to LUA (SRL=1)	Edition 1.X.X refines all the additional rules (SRL=2-3)	Operational Edition (SRL=4)

Other important subjects discussed at HSSC11 were:

- The Future of Paper Nautical Chart – in the recent years there has been an increase in the sales of ENC along with a corresponding decrease in the sales of nautical paper charts. Therefore, a few countries are thinking of moving to a paperless solution. So, it was decided to investigate more about this issue by making a survey within IHO Member States. The outcomes of the survey on this issue conducted by NCWG will be reported at HSSC12 (see more detail in Agenda Item 9.4).
- HSPT is finalizing the drafting process of Edition 6.0.0 of S-44, expected to be released in 2020.
- Initial guidance on the definition and harmonization of Maritime Services in the context of e-navigation is under development.

2.2 Council Report (RDML Shep Smith, Council Chair; Admiral Palmer Fonseca, Council Vice Chair)

The third meeting of the IHO Council was held from October 15-17, 2019 Monaco, with 38 Member States in attendance (including observers). The MACHC was represented by Brazil and the Netherlands. Culminating 24 months of work, the Council endorsed a new IHO Strategic Plan for consideration at the IHO Assembly-2. The concise, easily readable plan has three major goals:

1. Evolving the hydrographic support for safety and efficiency of maritime navigation, undergoing profound transformation.
2. Increasing the use of hydrographic data for the benefit of society.
3. Participating actively in international initiatives related to the knowledge and the sustainable use of the Ocean.

Another major accomplishment was development of the S-100 Implementation Strategy and Roadmap that lays out the transition from S57 ENCs to S101 and other new standards. The Roadmap is a living document, updated annually, to lay out the timeline and responsibilities for the transition to and development of these new services. Maintained collaboratively with the Council Chair, the IRCC and HSSC Chairs, and IHO Secretary-General it includes necessary engagement (for example with IMO), production and capacity building actions.

New services and products need to be developed that use these standards. When ENCs were first being produced, the IHO developed a set of principles about how to coordinate those services around the world (e.g. to avoid duplicating services), called the WEND Principles. A broader set of principles for new World Electronic Navigation Services (WENS) is required to apply to these new services. The WENS working group, part of the IHO WEND, is developing these.

The Council also considered the possible redefinition of the term "Hydrographic Interest". Currently this is defined as "tonnage" and is used to choose 1/3 of the Council seats. IHO General Regulations Article 16 (c) calls for "...The definition of what constitutes an interest in hydrographic matters shall be reconsidered at the latest at the second Assembly meeting." The Council commended Uruguay, Argentina and Brazil on their thorough and thoughtful development of an alternative definition based on "demand" (level of maritime trade) and "offer" (capacity to provide responsive hydrographic services). Their co-sponsored proposal will be considered at Assembly-2.

Other issues to be highlighted at Assembly 2 will be the S-100 Showcase and Seabed 2030, updated versions of the IHO Resolutions on RHC governance (IHO Res2/1997), and disaster response (2/2007, 1/2005), among others. The Chair noted the importance of designating new MACHC representatives to the Council and consider potential candidates for the new Council Chair, as his term is over.

The IHO Council Chair reflected that, despite early skepticism about the value of this new body, it has proved its value. It is essentially the executive business arm of the organization that considers all the major programs holistically to address major strategic as well as tactical issues. It took a lot of effort to make a clear distinction about its role, vs the Assembly or IHO Committees, and it was deliberately kept small to allow greater trust and dialogue. The IHO Director agreed with this perspective and noted that the Council's excellent intersessional work will facilitate the Assembly's consideration of these important topics and related budget matters.

2.2.1 Overview of election process for MACHC representatives to the IHO Council (Katie Ries, MACHC Chair)

In order to choose the next two MACHC representatives to the IHO Council, the MACHC Chair reviewed the election process, according to the Annex 3 of MACHC Statutes. Eligible Member States were to indicate their desire to be candidates privately to the Chair by the end of the first day of the meeting. If more than two eligible candidates were interested, an election would be held by ballot at the end of the second day and results announced on day three.

Brazil said that it supports this process, as this was the same one adopted during MACHC17, in Dec 2016. Brazil also proposed a slight amendment to the voting procedure described in Paragraph 7 of Annex 3 of MACHC Statutes to make it less restrictive. The sentence in questions currently says:

The voting procedure will *"...take place in the three months prior to the Assembly, preferably at a Conference of the MACHC otherwise by correspondence if no MACHC Conference is scheduled."*

The Netherlands suggested simply removing the phrase "in the three months" from Paragraph 7. Brazil agreed with what the Netherlands proposed, and suggested a further amendment as follows:

"The voting procedure will take place prior to the Assembly, once the distribution for regionally-based seats on the IHO Council is announced, preferably at a MACHC Conference."

The amendments proposed by the Netherlands and Brazil were approved.

20.2.2.1	Decision: The MACHC approved amendment of the MACHC Statutes, Paragraph 7, Annex 3 – Voting Procedure language to "The voting procedure will take place prior to the Assembly, once the distribution for regionally-based seats on the IHO Council is announced, preferably at a MACHC Conference."
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2.3 Maritime Safety Information/WWNWS Report (Peter Doherty, IMO/IHO World-Wide Navigational Warning Service Chair)

The Chair of the IMO/IHO World-Wide Navigational Warning Service (WWNWS) Steering Committee (SC) gave an overview of the history of this critical internationally coordinated service designed to promulgate hazards to navigation by satellite affecting the safety of life at sea. He discussed the composition of the WWNWS Steering Committee which helps support IHO Member States to develop their capacity to provide maritime safety information (MSI), and the vital role of National Coordinators, charged with collating and issuing coastal warnings within their national area of responsibility and reporting them to their NAVAREA Coordinator. He stressed the importance of working within national administrations to ensure that their data is made available to the relevant NAVAREAs– this will help prevent accidents. The MACHC Region falls within the NAVAREAs IV and XII. An IHO-funded 3-day comprehensive MSI Training course is taking place immediately after this MACHC meeting from 9-11 December in Santo Domingo.

The Chair went on to demonstrate the status of regional MSI, through [a matrix](#) developed on the new MACHC Initiative website. It shows a color-coded representation that describes the level of MSI support that National Coordinators provide to NAVAREA IV and NAVAREA XII. This matrix will be used to identify and prioritize the need for future MSI training and support within the MACHC.

France asked for clarification about how the metrics were established for MSI Status matrix. The WWNWS-SC Chair explained that the countries shaded in green means that the National Coordinators provide MSI on a regular basis, while the countries shaded in yellow did complete the IHO MSI Capacity Building Course and are providing a moderate amount of MSI. The countries shaded in red have completed an MSI training course but are not providing MSI. The white shading means that this country has not attended an MSI training course and is not providing MSI. These metrics are maintained by the Chair (drawn from their database), not by the individual countries and are based on the participation in MSI training courses and subsequent MSI contributions. This is a “snapshot” in time that will be continually updated.

Therefore, any errors or changes in status should be reported directly to the Chair as soon as possible. Other important documents found on the site include a list of National Coordinators and members should ensure that information is up to date, along with defined responsibilities and the template for MSI submissions.

Alberto Costa Neves (IHO) praised the Chair and the US (NOAA and NGA) for building the MACHC MSI webpage. It addresses the five IRCC actions related to this topic. He reiterated the importance for the countries not shaded in green to get in touch with Mr. Peter Doherty, Mr. Christopher Janus and/or himself in order to receive support to update their status.

20.2.3	Action: Countries not shaded in green in MSI matrix should get in touch with NAVAREA IV and XII Coordinator (Mr. Peter Doherty and Mr. Christopher Janus) and/or IHO Secretariat (Assistant Director Alberto Costa Neves) to request an update as appropriate. (<i>Current MACHC continuous action 17.2.1.1 updated accordingly</i>). Also ensure that National Points of contact are accurate.
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2.4 Hydrography in Latin America: Trends and Perspectives (Carlos Tejada, HYPACK)

Carlos Tejada of HYPACK presented trends and perspectives of hydrography in Latin America is a very active market for hydrographic services with demand driven from container ship and cruise ship growth, new ports and routes, riverine waterway traffic, and new hydroelectric power plants.

The role of the hydrographer is also changing as a result of advances in technologies and software. These advances include easy onboard and multi sensor configurations, HYPACK data and information consolidation, faster AI driven outputs, advanced lidar and multibeam capabilities, multispectral bathymetry processing, cross brand integrations, HYPACK lidar payload, and autonomous vehicles.

These new tools and technologies are critical to meeting the region’s growing hydrography demands, but they also necessitate greater access to formal education, certification processes, and adherence to national specs.

2.5 A Hydrosatial Information System, the Next Frontier for Hydrographic Offices (Rafael Ponce, ESRI)

Rafael Ponce of ESRI presented a vision of a hydrosatial information system for the next frontier of Hydrographic Offices. Our world, like a human body, has a nervous system – an intelligent and responsive platform that can understand and analyze what is happening around it, and acting to reach objectives. We want to move from being hydro spatial organizations, to a hydro spatial nervous system that makes information open and available to everyone so that they are empowered to plan and act towards better outcomes.

By sharing and collaborating at all levels, delivering powerful capabilities (from GIS, traditional mapping, data visualization, real-time data collection, online analysis, and integrated trends and dashboards), geo-enabled systems and workflows, and integrated science and AI/machine learning this vision can be realized.

S-100 is the baseline and will open the door for this reality. In this new landscape charts, data, and information will be automatically produced from web browsers and edited to particular user needs – including other uses beyond safe navigation.

3. National Reports

3.A Instructions and Guidelines for National Report Breakout Groups (Katie Ries, MACHC Chair)

All members and associate members were asked to present a national report outlining their top achievements during the year, top challenges or obstructions, and top plans that will affect the region. Each nation was also asked to answer the following two questions to support the development of the 2021-2023 MACHC Capacity Building Plan:

- What is your greatest capacity building priority to recommend for IHO CB funding consideration (Phase 1)?
 - High-level visit (political awareness)
 - Technical visit (assessment of national capabilities and awareness)
 - Maritime Safety Information training
 - Hydrographic Awareness Seminar (pre-MACHC meeting)
- What is your greatest capacity building priority (Phase 2 or Phase 3) for which to seek other partnership/funding opportunities outside of IHO CB?

Members broke out into two smaller groups (one primarily English speaking, the other primarily Spanish speaking) to share these presentations, discuss and engage on their contents, and vote to prioritize their collective top five capacity building recommendations. Detailed instructions of this process may be found [here](#), and all national reports [here](#) between 3.1 and 3.28.

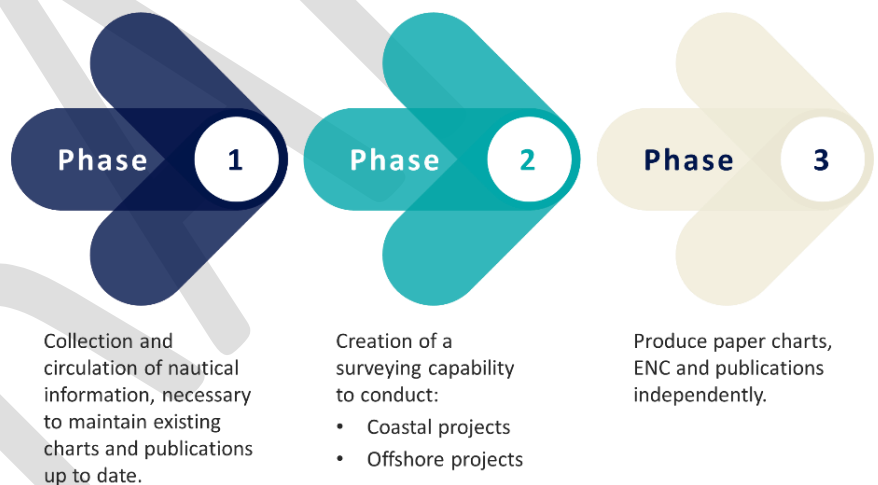
3.B MACHC Capacity Building Plan overview (Ms. Lucy Fieldhouse, Capacity Building Coordinator)

The CB Coordinator reviewed the current MACHC CB Plan (2018-2020) and the IHO Phases of Capability Building.

A Phase 1 Technical Visit to Guatemala was conducted in March 2019, and a Skills 1 assessment course was funded. As agreed at MACHC19, there were [four submissions](#) to the IHO Capacity Building Subcommittee for 2020: Raising Hydrographic Awareness (Phase 1-funded); MBES processing (Phase 2); MSI training (Phase 1-funded); Tides & Water Levels for Spanish speakers (Phase 2-funded).

The IHO capacity building funds are not sufficient to meet the demand, and therefore it is important for the MACHC to work strategically with other regional partners to leverage resources for training of common interest that has broader impact. It is highly unlikely that activities outside of Phase 1 will be funded in the future. The reason the Tides and Water Levels course was funded was due largely to the fact that it had broad co-sponsorship (CARIBE-EWS; COCATRAM; SEPHC and SWAtHC) and related resourcing.

The breakout groups need to keep this in mind as they develop their priorities to be considered in the new MACHC CB plan for 2021-23. Member States also need to be aware that the results from the breakout groups will not automatically be approved and funded. The breakout groups are an interactive way to generate some good ideas for the plan, but they are only one input to be considered.

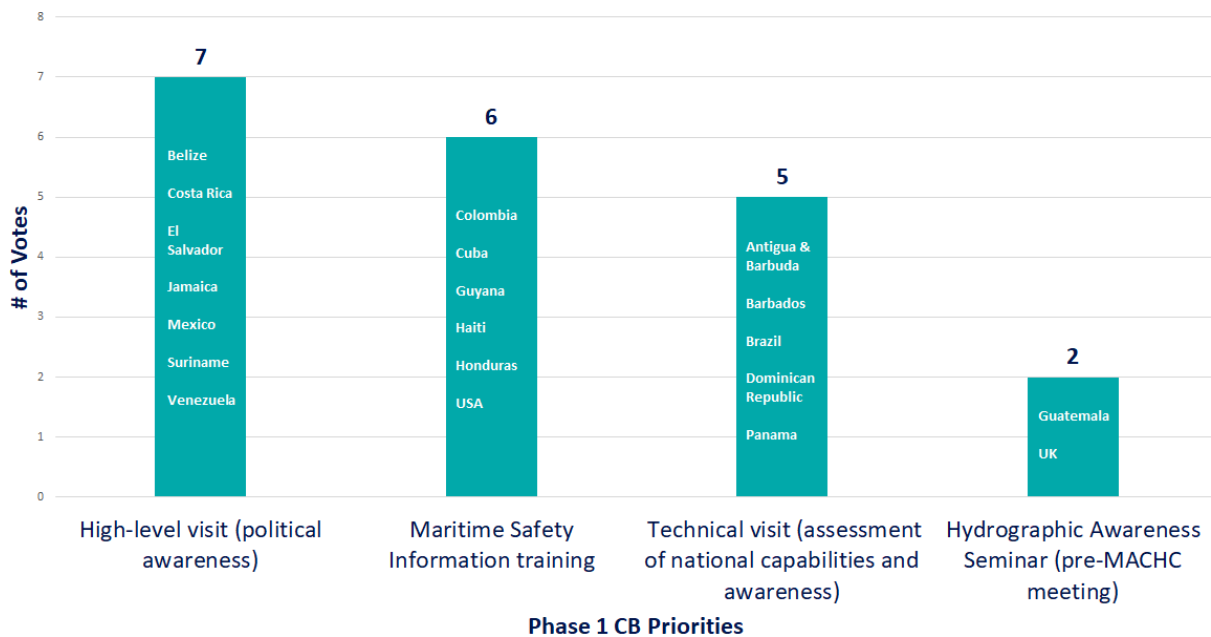


3.C Breakout Group Results (Antonio Williams, Jamaica Surveys and Mapping Division; Dagoberto David, Colombia Maritime Administration Department)

Each breakout group Chair presented the results of their respective group to the combined plenary for comment and discussion.

The combined result from both breakout groups to the first question “*what is the greatest capacity building priority to recommend for IHO funding consideration (phase 1)?*” indicate that collectively there are three close candidates: high-level visits for political awareness, maritime safety information training, and technical visits to assess national capabilities and raise awareness. The Capacity Building Coordinator, Ms. Lucy Fieldhouse, will further assess these results in the context of the broader Capacity Building Plan under development and will communicate with country representatives for further information as needed.

What is your greatest capacity building priority to recommend for IHO CB funding consideration (Phase 1)?



In response to the second question, “*what are the greatest capacity building priorities (Phase 2 or Phase 3) for which to seek other partnership/funding opportunities outside of IHO CB*”, the English speaking breakout group comprised of representatives from Antigua and Barbuda (A), Barbados (A), Belize (A), France, Guyana, Haiti (A), Jamaica (Chair), Netherlands, Suriname, USA (rapporteur), United Kingdom & Montserrat presented the following as their top 5 priorities:

1. Create a regional center of expertise for the Caribbean (cartography, hydrography, and all other aspects related to producing navigation charts).
2. Manage data collection for the production of paper charts, ENC, and publications.
3. 2021 Tide and Water Levels course for English speakers.
4. MSDI training as a “Phase 1.5” effort (without a basic MSDI, data collection and product generation does not work).
5. Category B nautical cartographers training.

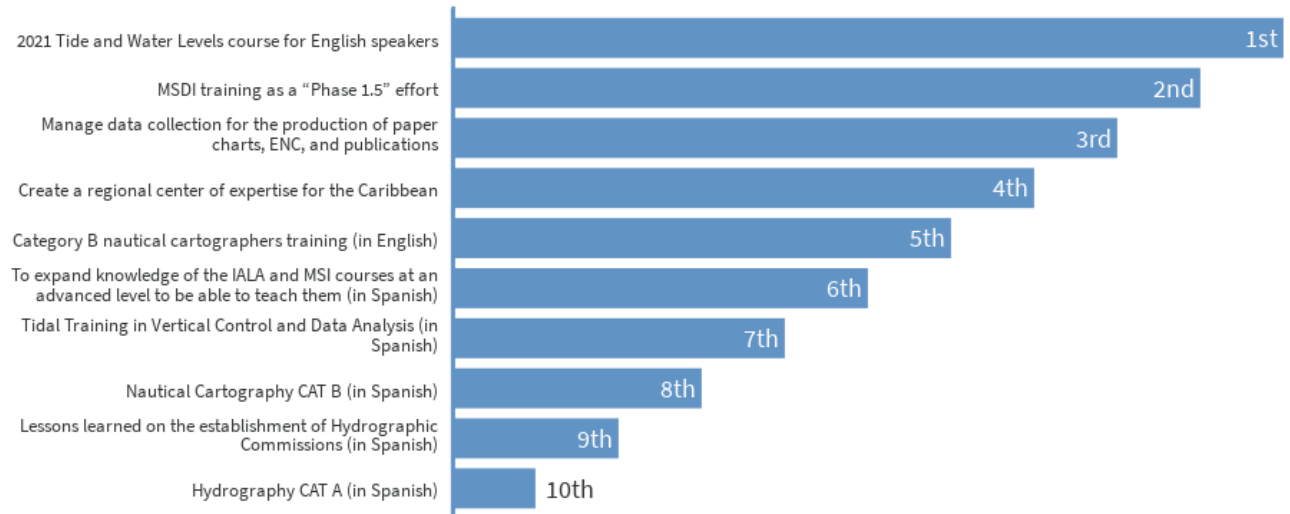
The Spanish speaking breakout group comprised of Brazil (rapporteur), Colombia (Chair), Costa Rica (A), Cuba, República Dominicana, El Salvador (A), Guatemala, Honduras (A), México, Panamá (A), Venezuela presented the following as their top 5 priorities:

1. Nautical Cartography CAT B in Spanish.
2. CAT A Hydrography in Spanish.
3. Tide Vertical Control and Data Analysis Training in Spanish.
4. Lessons learned in establishing National Hydrographic Commissions in Spanish.
5. Expand the expertise in the region to enable advanced IALA and MSI courses taught in Spanish.

After asking questions of clarification and engaging in a brief plenary discussion of the results, all ten priority recommendations were viewed together and further prioritized from “most important” to “least important”. This prioritization was done via the live polling system, and each national representative was allowed only one submission.



Rank in priority order from MOST important to LEAST important the following recommendations to the question: What is your greatest capacity building priority (Phase 2 or Phase 3) for which to seek other partnership/funding opportunities outside of IHO CB?



Total Results: 23

In the discussion of the breakout group results in plenary, it was emphasized that these priority CB activity lists are but one input to the development of the new MACHC CB plan for 2021-23. They must be looked at in the context of where the requesting countries are in the IHO Capacity Building Phases of Development, to ensure they are ready for the requested technical visit and or training. The IHO Assistant Director recommended that the CB Coordinator use IHO Procedure 11 to assess MS status and produce a matrix similar to the one done for MSI status. The CB Coordinator also asked that individual Member States interested in technical visits to confirm that interest directly with her. Another request was made to translate Procedure 11 into Spanish which Guatemala graciously offered to do.

20.3.B.1	Action: Member States requesting “high level/technical visits” from the breakout group results should confirm their interest directly to the CB Coordinator (Lucy.Fieldhouse@ukho.gov.uk). These will be evaluated for potential inclusion in the 2021-2023 MACHC Capacity Building Plan.
20.3.B.2	Action: Use the IHO CB procedure 11 to assess the status of Member States within IHO CB phases to better evaluate the requests for phases 1, 2 & 3 training opportunities resulting from the breakout group process.
20.3.B.3	Action: Translate Procedure 11 into Spanish (Guatemala) (completed)

3.1 Industry Activities to Support Countries in the Region

3.1.1 Innovations for Today's Hydrographic Office (Diego Muñoz, QPS)

QPS presented the three components of its innovative workflows for today's hydrographic offices: Qinsy for survey planning and acquisition, Qimera for data processing and cleaning, and Fledermaus for 4D geospatial analysis and visualization. These components provide data filters, direct monitoring for near real-time processing, tools to correct for refraction, dynamically solve for problems such as wobble, easily divide projects, link to your S-57 workflows, and provide water-column and backscatter processing.

3.1.2 Raising hydrographic awareness using USV (David Vincentelli, iXBlue)

iXBlue provides photonic solutions, navigation systems, acoustic systems, motion systems, composite and specialized ships, and sea operations. The USV DriX has varied integrated sensor suites available, is deployable via a LARS cradle system for launch and recovery (davit or crane), contains collision avoidance software utilizing active and passive sensors, and has full autonomous capabilities up to 10 days at 4 kts or 5 days at 8 kts. The system was utilized during 2019 in the MACHC region in collaboration with Mexico and NOAA, and is becoming a trend internationally.

3.1.3 Transparency in Shallow Water SDB: Levels of Quality Assurance Mechanisms and New SDB Software Capabilities (Thomas Heege, EOMAP Germany)

Satellite derived bathymetry (SDB) can be hugely cost effective and provide significant coverage/speed advantages. Recently SDB was used by EOMAP in the Tonga mapping of LINZ including over 400,000 sq. km and 6,500 sq. km in 2m resolution, as well as extreme 9cm resolution nearshore mapping in the OECS region.

Effective SDB includes accurate corrections of environmental parameters/impacts and traceable uncertainty estimates to quantify data, automation and qualified staff, and the balancing of an automated and manual QA/QC process. SDB is increasingly supporting IHO CB activities by making cost-effective data and initial SDB training is available (many online). Training and certification for hydrographers is a major focus 2019-20, including MACHC, via the EOMAP "eoLytics" facility and other various training delivery modes.

3.1.4 S-101 Production with Teledyne CARIS Software (Juan Carballini, Teledyne CARIS)

Caris has a long heritage in the development of S-100 and S-101/102, and the software allows for full support of S-101 ENC production (Caris Composer). S-101 implementation will affect hydrographic offices, producers, distributors, ECDIS manufacturers and end users alike, and familiarization with the S-101 feature library will be essential.

Some current S-57 features are not supported in the S-101 feature library, but about 80% of S-57 data can be translated and encoded/migrated into S-101 standard. Caris HPD (currently upgrading from version 3.2 to 4.0) can also migrate to S-100 standards. Conversion tools can be customized to individual needs, with automated and interactive processes available (exporting S-101 data back to S-57 is fully automated).

Training opportunities include free S-100 workshops and dedicated on-site training for clients, with 2020 training plans including Panama, Netherlands and Singapore.

3.1.5 IIC Technologies: Data Streaming Solution and IHO S- 5/S-8 B Certification (Derrick Peyton, IIC Academy)

The IIC Academy Cat B S5 hydrographic and S8 cartographic training program is onsite but migrating to distance-learning to address challenges of course duration and geographic dispersal of students. Training solutions are designed to be modular, flexible, distance-learning, blended learning and delivered over time (the course is 20 weeks but can take up to 3 years to deliver/complete). On-site courses have been delivered internationally in a number of IHO member states and are available globally.

The main steps include theory (11 weeks), practical (5 weeks), self-guided (concurrent) and a final project (4 weeks) in accordance with S5 – combination of distance learning and essential residential content. Academic integrity and auditing are essential for accreditation/IBSC recognition.

4. Reports from Observing States and Organizations

4.1 International Association of Marine Aids to Navigation and Lighthouse Authorities (Ms. Gerardine Delanoye, Capacity Building and Resources Manager)

The Capacity Building and Resources Manager (Ms. Gerardine Delanoye) provided an update on IALA and the Worldwide Academy, which is its primary training and capacity building arm. IALA brings together representatives of the aids to navigation services of about 80 countries for technical coordination, information sharing, and coordination of improvements to aids to navigation throughout the world. Capacity building activities are, where appropriate, coordinated with the International Maritime Organization (IMO) and the International Hydrographic Organization (IHO) as part of the United Nations “Delivering as One” initiative.

IALA encourages its members to work together in a common effort to harmonize aids to navigation worldwide and to ensure that the movements of vessels are safe. IALA has a Risk Management Toolbox to help countries to conduct maritime risk assessments to inform where and how to provide Aids to Navigation (AtoN) and Vessel Traffic Systems (VTS.)

She outlined IALA integrated standards framework with their associated recommendations, guidelines and model courses for countries to use to plan how to provide these services and to demonstrate their compliance with international SOLAS Chapter V regulations. The Worldwide Academy helps countries through training, technical needs assessment missions and reviews, and standard compliance. Membership in IALA allows access to and resources for participation in these activities.

She also spoke about the progress toward changing IALA’s status to that of an Intergovernmental Organization (IGO), which resulted in a Diplomatic Conference being convened in Malaysia from 25-28, 2020 to consider and adopt a Convention on the International Organization for Marine Aids to Navigation. A World-Wide Academy seminar on Safety of Navigation will be held the day before the Conference on 24 February 2020.

4.2 IOC Sub-Commission for the Caribbean and Adjacent Regions (Dr. Cesar Toro, Secretary of the IOC of UNESCO Sub Commission for the Caribbean and Adjacent Regions)

The Secretary noted the coastal and ocean hazards facing the region such as tsunamis, storm surges, large amounts of Sargassum seaweed choking the waters and washing up on beaches, hurricanes such as Maria, and frequent unreported oil spills. Monitoring and forecasting such hazards and related management strategies requires hydrographic data.

IOCARIBE and the MACHC share a common interest in increasing data collection for these purposes and to contribute to Seabed 2030 and the UN Decade of Ocean Science for Sustainable Development (2021-2030). Therefore, the IOCARIBE-XV meeting in Aruba, May 2019 recommended the enhancement of the cooperation with the MACHC in the following priority areas:

- 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).
- Identify respective capacity building training offerings and consider co-sponsoring those of common interest to avoid duplication of effort, leverage resources and maximize impact.
- Explore sharing, delivery and management of marine spatial data holdings through pilot projects with partners such as the IODE and the Caribbean Marine Atlas.

The MACHC Chair (who attended the IOCARIBE-XV) and the IOCARIBE Secretary noted with satisfaction that collaboration in these three areas is well underway and should continue to expand. Now that the MACHC Seabed 2030 gap analysis tool has been developed it will be linked to the IOCARIBE website with the intent to focus attention on filling gaps with existing data, and with future mapping efforts. The Caribe Early Warning System is already a co-sponsor of the MACHC Tides and Water levels training (2020). MACHC members such as The Netherlands are already contributing key marine spatial data sets to the Caribbean Marine Atlas, and the CMA is a member of the MMSDIWG. The IBCCA group has been revitalized and plans to complete the project in early 2020.

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20.4.2	Decision: The MACHC endorsed the recommendation of SC-IOCARIBE-XV.7 on collaboration between IOCARIBE and the MACHC to enhance cooperation and joint priorities such as 1) encouraging respective member contributions to Seabed 2030; 2) identify respective capacity building training offerings (exchange links of training websites) and consider cosponsoring those of common interests; and 3) explore sharing, delivery, and management of marine spatial data holdings.
20.4.2	Action: Establish links between the IOCARIBE and MACHC websites for easy access and visibility of available training courses of mutual interest, to advance the use of the Seabed 2030 tool, and continue current engagement between the CMA and MMSDIWG, the CARIBE-EWS, and the joint IBBCA.

4.3 International Maritime Organization (Mr. Colin Young, Regional Maritime Advisor)

The Voluntary IMO Member State Audit Scheme (VIMSAS) was established to support countries to fulfill the full range of their IMO regulatory responsibilities including those required by SOLAS Chapter V. Section 9 for navigation. It supports participating countries by conducting an objective assessment of their compliance, identifies targeted capacity-building where it will have the greatest effect and help develop national supportive legislation. These activities are carried out under the “Implementation of IMO Instruments Sub-Committee” of the IMO Maritime Safety Committee. The states of MACHC MS vis a vis their individual audits were reflected in the slides.

A High-Level Symposium on International Maritime Development in the Caribbean Region for Ministers responsible for maritime transport was hosted by Jamaica in February 2019. Following presentations delivered by a number of international and regional organizations and subsequent discussion on the matters delivered, the Ministers and other participants developed the Jamaica HLS Resolution 2019.

The Ministers invited the IMO to increase delivery of regional maritime training and asked Caribbean States to urge their policy makers to put a high priority on it. They were also invited to request the IMO to assist in the establishment of a national framework for hydrographic services in order to meet the mandatory obligations of SOLAS Chapter V - Regulation 9 and research the feasibility of the establishment of a regional hydrographic office.

IHO Director Mustafa Iptes and Assistant Director Alberto Costa Neves said that IHO Secretariat supports the initiative even though it would not be part of the IHO structure, since IHO is based on accession of Member States. He added that Coastal States must work among themselves to advance these initiatives. The IHO Secretariat can help with this process, as it participates in these meetings and will attend the

First Caribbean Regional Knowledge Partnership Workshop (KPW) on maritime technical cooperation activities, 20 to 24 January 2020 in Kingston, Jamaica. He invited MACHC MS to ensure their IMO representatives raise the importance of hydrographic training at this meeting.

20.4.3	Action: MACHC attendees to ask their IMO reps to raise awareness of Hydrographic issues at the potential donor organization meeting taking place in Jamaica, 20-24 January, with IALA, IHO participation.
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4.4 Training Offerings for the MACHC Region (Daniel González-Aller, Spain)

Spain is very interested in supporting Hydrographic Capacity Building in the MACHC and outlined a broad range of training offerings provided in Spanish through their Naval Hydrographic Academy. 122 foreign students have been trained there since 1969. This includes basic and advanced hydrographic training both in Spain and those which can be done within the MACHC region. The courses in Spain are CAT A and B; hydrographic surveying; management of hydrographic equipment and processing of hydrographic data and some include scholarship opportunities. Other training modules could be organized in the region, ranging from MSI, basic hydrographic surveying, MBES data processing and tides and water levels. Spain is pleased to work with the CB Coordinator to identify collaboration opportunities for the new MACHC CB Plan (2021-23).

5. Regional Capacity Building: Leveraging CB Partnerships

5.1 CBC Report (Ms. Lucy Fieldhouse, MACHC Capacity Building Coordinator)

As per her introductory remarks in Agenda Item 3.b, the MACHC CB Coordinator noted that the title of this part of the agenda is purposely called: “Leveraging CB Partnerships.” At the IHO Capacity Building Subcommittee (CBSC17) in June 2019, it became apparent that the IHO Capacity Building fund has been reduced due to a lack of surplus funds from previous years. Funding has fallen from 200,000 euros in 2018 to 86,000 euros in 2020. These reduced resources will affect the amount available for MACHC capacity building efforts going forward, so there is a need to be strategic in our partnerships with other regional organizations and stakeholders who have common capacity building needs.

A Phase 1 Technical Visit to Guatemala was conducted in March 2019, and a Skills 1 assessment course was funded. As agreed at MACHC19, there were [four submissions](#) to the IHO Capacity Building Subcommittee for 2020:

- Raising Hydrographic Awareness (Phase 1-funded and held just before the MACHC20 meeting).
- MBES processing (Phase 2--not funded).
- MSI training (Phase 1-funded and held post the MACHC20 meeting).
- Tides & Water Levels for Spanish speakers (Phase 2-funded, planning underway to hold the course in Costa Rica for 2020).

It is highly unlikely that activities outside of Phase 1 will be funded in the future. The reason the Tides and Water Levels course was funded was due largely to the fact that it had broad co-sponsorship (CARIBE-EWS; COCATRAM; SEPHC and SWAtHC) and additional funding.

The next CBSC18 will be in Gdansk, Poland June 2020. Final priorities will be checked against other regions. Strong proposals with external partners and funding will be key to success. She outlined the timeframe for submitting new MACHC proposals for 2021-23:

February 28	Final requests for CB activities to CB Coordinator
April 1	Produce MACHC 2021 submission for CBSC 18 Meeting (first year of MACHC CB 2021-23 plan)
May 1	Draft MACHC 2021-23 Plan available for MACHC review
June 3-5	Finalize 2021 CB Priorities at CBSC 18 meeting

A participant commented that if a country is not a full IHO member they will not be funded for phase two or three capacity building. Director Iptes and AD Costa Neves highlighted the benefits of membership, both encouraging associate members to become full members. Nonmembers can sometimes attend IHO courses if they pay for their own participation costs. The CB Coordinator will take into account training opportunities of common interest identified by industry, regional organizations, neighboring RHCs and observer countries as the new MACHC CB Plan is developed.

20.5.1.1	Action: Produce draft of 2021-2023 MACHC Capacity Building Plan; review training priorities and offerings from SEPRHC and SWAtHC, COCATRAM, IALA, Spain, industry etc. to identify potential areas of common interest/opportunity for the new CB Plan.
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5.2 Update of COCATRAM on its Regional Projects/Training Priorities (Secretary General Otto Noack, COCATRAM)

The Central American Commission of Maritime Transport (COCATRAM) presented a report on their capacity building activities in the region. COCATRAM is a specialized agency that is part of the Central American Integration System (SICA), based in Managua, Nicaragua. One of its many functions is to help the region improve the efficiency of its maritime and port development services in Central America, and therefore it has capacity building objectives compatible with those of the MACHC. COCATRAM is pleased to be a co-sponsor of the MACHC Tides and Water Level Training being planned for 2020 in Costa Rica and looks forward to future collaboration opportunities.

COCATRAM is administering \$800,000 USD of IMO funds to support its member state capacity building, including two sub regional training courses in 2020--one on Navigation Aids in Costa Rica and one on Hydrography and Cartography in the Dominican Republic. COCATRAM invited MACHC involvement in the planning and participation in the latter course. The Chair commented that co-sponsored activities such as these should be reflected in the new MACHC Capacity Building Plan for 2021-23.

20.5.2	Action: COCATRAM 2020 Hydrography and Cartography Course content and logistics to be planned and participants from the region identified.
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5.3 IHO/IALA Capacity Building Initiatives: Building Maritime and Marine Capacity in the Caribbean for Climate Resilience and Sustainable Development (Alberto Costa Neves, IHO Assistant Director)

The IHO Director Alberto Costa Neves gave an overview of how the IHO is working with other intergovernmental and nongovernmental organizations (such as IHO, IMO, IOC, WMO, IAEA, IALA, FIG, IMPA) to determine how to better provide training and services of common interest in a unified way (“Deliver as One”). He emphasized that joint technical/needs assessment visits involving the IHO, IMO and IALA can occur, but that interested countries have to make such a request to their IMO representatives. It is the same for joint training, which can happen when requested by multiple countries. MACHC Member States need to be proactive in order to have additional IMO funding made available for these purposes. Other regions have done this successfully, such as Africa. After countries contact their IMO Country Representative, that person will then approach the IMO Technical Cooperation Division and request a joint “needs assessment visit” by the IMO, IHO and IALA.

IHO is working with other agencies to seek joint funding from external donor organizations. He provided a glimpse of a presentation that will be given to donor agencies that highlights the critical need to build maritime and marine capacity in the Caribbean for climate resilience and sustainable development. Given the increase in disasters linked to extreme weather events and climate change, the significant maritime trade and sensitive marine resources in the region, a proposal is being developed to produce a regional risk analysis, assess capacity and infrastructure and build greater resilience to respond to the identified risks. Ideally this will attract donor organization funding for related capacity building initiatives.

20.5.3	Action: Member States to liaise with their IMO representatives to request joint technical visits with IALA and IHO (funded by the IMO) as part of the IMO MS Audit Scheme (VIMSAS).
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5.4 Caribbean Regional Track of the IADB Pilot Program for Climate Resilience Overview (Ainsley Henry, University of the West Indies Mona Campus)

Since the Climate Investment Fund was established in 2008, 14 donor countries have contributed over \$8 billion in support of scaling up mitigation and adaptation action in developing and middle-income countries. These resources are held in trust by the World Bank and disbursed as grants, highly concessional loans, and risk mitigation instruments to recipient countries through multilateral development banks (MDBs).

Participation in the Climate Investment Funds (CIF) strengthens the InterAmerican Development Bank (IDB)'s ability to help Latin America and the Caribbean adapt to potential climate change threats and mitigate greenhouse gas emissions. As one of six CIF implementing agencies, the IDB pipeline adds up to US\$686 million in CIF grants and concessional loans. These resources finance investment programs and knowledge and capacity building activities in areas such as renewable energy development, sustainable forest management, energy efficiency, sustainable transport, and national and regional adaptation planning.

The Strategic Climate Fund element includes a Pilot Program for Climate Resilience (PPCR). Under the global program, 47 projects have been approved with PPCR financing of US \$799 million and co-financing of US\$1048 million with a goal to integrate climate resilience with core development planning.

This includes a Regional Program for the Caribbean of US\$60 – 75 million for the region with grants and concessional loans available for investment in scaling up adaptation measures. Activities are currently proceeding along two tracks:

- Country-based investments in highly vulnerable countries: Haiti, Jamaica, Dominica, St. Lucia, St. Vincent and the Grenadines, and Grenada.
- Region-wide activities involving regional organizations (e.g. UWI, CDEMA, CIMH, CARPHA, CFRM, CARDI and CCCCC)

The objective is: To help improve regional processes of climate relevant data acquisition, storage, analysis, access, transfer and dissemination, and to pilot and scale up innovative climate resilient initiatives. This is being done through a grant (US\$10.39 million) executed by Mona Office for Research and Innovation – UWI.

There are four components to the regional work being done under this program. The one most relevant for the MACHC is the first: Improving geospatial data and management for adaptation planning, sea level rise and storm surge impact analysis. Under this component coastal mapping is being done in several island nations, including Jamaica and Haiti, which are described in more detailed in Agenda Item 6.5.

In answer to the question of how countries engage in the processes that lead to these projects, the presenter said that an assessment was done across the world, and those that came to the top were then selected as pilot projects, of which 6 are in the Caribbean.

5.5 Neighboring RHC CB Priorities: SEPRHC and SWAtHC (Captain Germán Escobar Olaya, Director of the Center for Oceanographic and Hydrographic Research of the Caribbean; Ricardo Freire, Brazilian Naval Hydrographic Office)

The SEPRHC and SWAtHC CB Coordinators presented an overview of their respective Commissions, its activities from the previous year, and new priorities for the coming year.

Captain Germán Escobar Olaya, Dirección General Marítima Centro de Investigaciones Oceanográficas e Hidrográficas del Caribe, provided a presentation on SEPRHC. Membership is comprised of Chile, Colombia, Ecuador, and Peru - with Panama serving as an observer. Upcoming priorities for the year include providing support to:

- S-100
- MSI
- Law of the sea
- MSDI Implementation
- Tsunami inundations hydrographic actions
- Antarctic Charts
- ENC Productions and QA
- Bathymetry with RTK
- Operation and interpretation of data collected with sub-Bottom profiler
- Operation and interpretation of data collected with Magnetometer
- Operation and interpretation of data collected with Piston Core and Heat Flow

The group will also be providing training in 2020 for hydrography Cat A and B, and aids to navigation. SEPRHC continues to actively cooperate with SWAtHC, MACHC, other intergovernmental organizations such as IOC, IALA, and IMO, as well as industry and other stakeholders to advance capacity building, promote maritime and navigation safety, and more.

Ricardo Freire, Directorate of Hydrography and Navigation of the Brazilian Navy, provided a presentation on SWAtHC. The following capacity building priorities were identified:

- Multibeam bathymetry
- Bathymetry with RTK
- Side Scan Sonar - image processing and interpretation - objects identification and quality of seafloor
- Digital Photogrammetry with satellite images
- Management of digital data from different surveys
- Tide gauge stations - Tide
- New technologies
- Operation and interpretation of data collected with marine magnetometer
- Operation and interpretation of data collected with sub-bottom profiler
- Marine Spatial Data Infrastructure
- ENC Production and QA

The group will also be providing a technical visit to Bolivia, a seminar to raise awareness of hydrography, and potentially MSI, seabed classification, and ENC production and QA workshops as well depending on funding. SWAtCH is also promoting and expanding IBSC recognized hydrography programs in coming years.

5.6 Technical Visit to Guatemala (Jim Rogers, USA National Geospatial-Intelligence Agency; Edwyn Raxon, Guatemala Ministry of National Defense)

Jim Rogers, USA, provided a readout from the recent technical visit to Guatemala. By all accounts the visit was a success and a valuable experience for all involved. Key achievements included:

- The Guatemala Navy (DIGEMAR) is a regular contributor of MSI information in support of their National Coordinator obligations.
- Guatemala has a functioning hydrographic commission (CIIHO) that regularly meets to coordinate hydrographic issues across the government. The CIIHO is backed by regulated authority.
- The Guatemala Navy (DIGEMAR) and the Port Authority perform regular hydrographic surveys in the Guatemalan Ports.
- Puerto Quetzal is surveyed every 3 months
- The CIIHO has coordinated several joint survey projects on the Lakes of Guatemala.
- Guatemala is actively working in the IHO CB Phase 1 & 2 areas.

A number of recommendations were also made which are actively being followed up on by all parties involved:

- Guatemala and the US Primary Charting Authority (PCA) should work cooperatively to establish a new agreement with defined roles and clear lines of communication.
- Establish a mechanism for regularly sharing Guatemala Navy (DIGEMAR) hydrographic surveys with the PCA to update the charts.
- The Guatemala Navy (DIGEMAR) should work toward building an MSDI as a first step to a Phase 3 Cartographic capability.
- The Guatemala Navy (DIGEMAR) should take initial GIS training to support a Guatemala MSDI capability.
- Build a more complete Tide capability in Guatemala waters. Establish additional Tide Gauges on the Pacific Coast.
- Expand hydrographic survey capability to support offshore surveys.

The success of the technical visit should serve as an example for others, and any nation interested in pursuing such a visit should contact Jim Rogers or a Guatemala representative for additional detail.

20.5.6

Action: Members interested in technical visits should note recommendations from the Technical Visit to Guatemala and speak with the US and Guatemala.

7. MACHC Disaster Response

7.1 MACHC Response to Disasters – IHO resolution 1/2005 (Katie Ries, MACHC Chair)

The Chair introduced this agenda item by recalling the IHO Resolution 1/2005 as amended that encourages RHCs to have disaster response as a standing agenda item at their meetings. The 2018 Seminar on Hydrographic Governance prior to the MACHC19 included a workshop on dealing with maritime disasters.

It produced a draft Disaster Response Plan Framework that has now been largely implemented on the new bilingual (English/Spanish) MACHC Initiative Website found here. It provides a centralized place for critical information needed by both countries impacted by an event and those who want to support the response. It includes preparation (national, regional and industry senior and working level emergency points of contact); response (national and industry assets potentially available after an event; template for damage assessment) and communication.

For example, during Hurricane Dorian, the website served as a centralized place where Member States involved in the response could find summary information about each other’s response activities, view available geospatial data sets and easily find contact information. The principal responding Member States (NL and UK) to Hurricane Dorian found it a very useful tool. During the discussion it was noted how important it is to continue with these advance preparations (to “prepare for war while in peace”) so that the MACHC is as well positioned as possible to respond effectively to the next event. The IHO and the Chair urged all Members States and partners who have yet to provide the emergency contact information and to fill out the other templates to do so as soon as possible. The IHO also noted that the upcoming Assembly-2 will be considering the proposed amendments to IHO Resolution 1/2005 and encouraged the MACHC to review the final approved version in the context of the Commission’s disaster response activities.

20.7.1.1	Action: Provide/update senior and working level POCs on the MACHC website for disaster response and complete country/industry/regional disaster response capability and resource templates (create a new continuous action).
20.7.1.2	Action: Consider the amendments of the MACHC disaster response framework based on the anticipated approval and amendment of the IHO resolution 1/2005 on disaster response at IHO Assembly-2.

7.2 Response to Hurricane Dorian impacts in The Bahamas (Chris Thorne, United Kingdom Hydrographic Office)

The UKHO has a Humanitarian Aid and Disaster Relief (HADR) team that is called together in the event of an emergency like Dorian. In this particular instance, the UK was fortunate that there were UK platforms in the region which enabled them to provide a high level of immediate support in the wake of Hurricane Dorian, which is not always the case. The UK RFA Mounts Bay was the first vessel to provide aid and assistance to the Bahamas, which included 300 ration packs, 100 tons of water, 900 emergency shelters and 1000 hygiene kits. The HMS Protector followed up with 23 tons of aid and there were humanitarian experts from onsite to assist in coordinating relief efforts. The UKHO provided imagery and mapping support to RFA Mounts Bay and HMS Protector, and 3 digital charts to MapAction to support their on-the-ground relief efforts. The UKHO anticipates data contributions from The Netherlands who also was involved in the response to update their charts. The UK provided details to the MACHC Chair to enable greater awareness and coordination between member states and continues to review their internal procedures for dealing with Requests for Information (RFI) to ensure a timely response. They noted that while they contacted our colleagues in the Bahamas, they never received a direct request from them for support. This is understandable given the overwhelming and devastating impact of the hurricane, and it was noted in the discussion that efforts should continue to reach out and include them at future MACHC meetings.

20.7.2	Action: Continue to reach out to the Bahamas to engage them in the MACHC.
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7.3 Response to Hurricane Dorian Impacts in The Bahamas (Lieutenant Karel Buizer and Leendert Dorst, Kingdom of the Netherlands)

The Netherlands was also fortunate in that they also had assets in the region for a planned large emergency assistance exercise named Caribbean Coast of Dutch Defense that were diverted to assist the hurricane-hit Bahamas, after getting a request for assistance from the Caribbean Disaster Emergency Management Agency (CDEMA). Dutch Navy ships HMS Johan de Witt and HMS Snellius (the latter a hydrographic vessel) delivered humanitarian goods and conducted surveys in critical harbor entry points for relief supplies such as Marsh Harbor (Great Abaco Island). They observed that the diplomatic clearances were quick (done over the 2-day transit to arrive in the Bahamas), that communications outside Royal Netherlands Navy were difficult, due to limited satellite bandwidth and that the best communications method was WhatsApp. They started with no data but received aerial photos and reconnaissance reports from the UK Ministry of Defense, which was crucial for the quick start-up on hydrographic operations. They found the CDEMA website situation reports quite useful, as well as reports from MapAction (although only available in PDF) and the big data files supplied by US NGA useful but very difficult to download over limited satellite bandwidth. They expressed appreciation for the reports from other MS and industry and how the quick availability of a myriad of data and information on the MACHC website and in online portals proved to be invaluable. They concluded with the recommendation for Disaster Relief portals to be very light on data sizes; have an “expert use” section with GIS-downloads; and have updated post-event data. The Netherlands then presented a CD with all their survey data to the UKHO (primary charting authority for the Bahamas) to use for chart updates, which was gratefully accepted.

7.4 Tsunami and Other Coastal Hazards Warning System for the Caribbean and Adjacent Regions (Silvia Chacon-Barrantes, Director of ICG/Caribe EWS)

The ICG/Caribe EWS Director provided updates on this important regional program, noting that over the past 500 years more than 110 tsunamis have impacted over 4,000 people in the region. The Caribe EWS WGs and Technical Teams are working on Tsunami Monitoring, Tsunami Hazard Assessment, and related Preparedness, Outreach and Resilience Activities. Twenty-eight nations participate in the EWS, which overlap with MACHC membership. They have developed an implementation plan adopted for 2018-2023 that will be used to track ICG goals with key indicators aligned with the Sendai Framework. This is expected to be a dynamic document that will be adjusted as needed. She is pleased with the current collaboration with the MACHC, as the EWG is a co-sponsor of the Tides and Water Levels training workshop that will be held in Costa Rica in 2020 and looks forward to more in the future.

She spoke about the importance of high-resolution hydrographic data to support improved coastal inundation models and Tsunami Evacuation maps. She encouraged the MACHC members to ensure that the inundation modelers have the most recent data. The Chair noted that the MACHC already has a continuous action in our action list for this purpose. The Netherlands responded that perhaps we are all not collectively doing enough to be sure the modelers in our countries are using the *best available* hydrographic data.

20.7.4

Action: Engage [Tsunami Warning National Contacts](#) and determine if inundation modelers are using the *best available bathymetric data* (update existing continuous action 19.4.1.a with this language).

7.5 Modern Hydrographic Surveys as a Disaster Mitigation Tool (Don Ventura, FUGRO)

The FUGRO representative presented a compelling case for the advantages a country can realize from investing in modern, holistic surveys to baseline what a country has in terms of coastal geomorphology and habitat for both resilience and disaster assessment, mitigation and recovery. It can fuel better disaster management strategy implementation by establishing a more consistently-acquired and accurate geo-dataset, that serves as baseline to monitor future changes. This includes mapping the geophysical and geological constituents of the coast, as well as the aqua flora and fauna, coastal vegetation and native animal species requiring protection.

These data can be used to create different products for different stakeholders, such as improving flood inundation models, or helping prioritize areas in a national survey program. The resulting information also provides solid evidence for international aid agencies to help release timely funding and support for response and restoration activities. He noted that the InterAmerican Development Bank provides high levels of funding for projects to mitigate the coastal impacts of climate change in the Caribbean which require baseline mapping work integral to their success.

7.6 Real-time data input to a Common Operating Picture for Disaster Response (Mike Osborne, OceanWise)

The OceanWise representative joined the conference via Skype and spoke about the importance of having real-time data easily accessible in a centralized place in order to have an integrated data management system for use during disaster response or many other purposes. However, data comes from many sources, in varying formats, in different standards which make it challenging to establish that common operating picture. The presenter noted the importance of having agreements on what data is needed and how it will be shared.

He highlighted the OceanWise architecture and Ports group network which can deliver real-time environmental data anywhere to anyone for 23 ports. They also offer marine data analysis services to assist with project and operational decision making and risk mitigation. He gave examples of how countries in the region are using some of these products, such as the monitoring system supporting vessel movements at a terminal in Santo Domingo that supporting vessel safety and climatology in the Marigot fishing harbor that survived Hurricane Maria and recorded data throughout the storm.

Doing this work in the context of International Standards such as ISO, and particularly those related to data quality are key to ensuring that it is “fit for purpose”. Establishing data management and governance is equally important to ensure that the system will operate well and deliver the desired results.

7.7 Sonar Tools and Autonomous Platforms for Disaster Response Survey (Vicente Carrasco, Kongsberg)

Kongsberg has a long and unique history spanning over two centuries. The company is organized into three areas: digital (maritime simulation and industrial digitalization), maritime (seaborn transportation, robotics and sensors, and offshore oil and gas), and defense and aerospace (defense, space, and surveillance).

The company leverages these skills and areas of expertise in survey and hydro acoustics, monitoring, positioning and communications, mapping, and maritime robotics. These capabilities are integrated, highly accurate, highly efficient and cost effective, and secure. Kongsberg surveying capabilities and technologies are force multipliers - equipped with broad sensor coverage, the ability to transfer data over longer ranges, and able to be run fully autonomous both under water and on the surface if desired. The company’s experience and cutting-edge technology make it fully capable of meeting hydrographic and maritime needs.

6. Survey and Risk

6.1 Economic Assessment of Risks in Maritime Navigation across the Greater Caribbean Region (Ms. Dawn Seepersad, University of the West Indies)

The presenter provided an update on her Economic Assessment of Risks in Maritime Navigation across the Greater Caribbean Region (GCR) project endorsed by the MACHC in 2017. Maritime navigation is important to the GCR because it facilitates economic expansion. However, the environment, economy and culture of the region are at risk of unwanted accidents which can have short or long-term consequences. This study therefore involves an economic assessment of risk in maritime navigation across the GCR.

The results will contribute to the monitoring and management of maritime navigation by supporting the: i. Prioritization of resources, ii. Reduction of risk, iii. Improved security of the marine environment, and iv. Expansion of international trade opportunities. The study includes formulation of a risk assessment strategy and generates an economic model to estimate losses associated with maritime accidents. The main features of the strategy being developed include a statistical analysis of vessel position Information along shipping routes and space-time simulation of various scenarios of vessel transits with ship domains which calculate the likelihood of collision and groundings in a particular area.

The strategy can provide: Detailed information about the circumstances of collision and grounding candidates and the value of marine and coastal areas where collision candidates are identified, as well as a risk value per sq. km, which is well suited to make decisions about risk control options. It is currently being applied in the Gulf of Paria and ideally will be expanded to the broader region in the future. The presenter noted with appreciation the provision of key data layers from nautical charts in support of the study (Bathymetry, Coastline, Maritime boundaries) and requested others to be considered by the MMSDI WG, such as T-AIS data and valuation reports for sensitive areas.

20.6.1

Consider request for additional data layers to further support the “Economic Assessment of Risks in Maritime Navigation across the Greater Caribbean Region” project in MMSDIWG workplan.

6.2 Global Statistical Analysis of Marine Incidents (Ms. Amrika Maharah, University of the West Indies)

This study takes a global look at the causes of Maritime accidents due to a variety of factors, including meteorological conditions, human error, malfunctioning aids to navigation, inadequate charts, among others. It also looked at the number of incidents per vessel type, number of casualties and incidents, distribution and cause of accidents per year, as well as the time of day that they occur.

The result of the analysis concluded that the cause of a majority of these incidents were due to collision. The major type of vessels that were involved in all accidents were cargo vessels, followed by fishing and tanker vessels. The correlation between the causation factor and the location suggested that most incidents occur in the South China Sea, Bay of Biscay and the Black Sea and that most accidents occurred during the early morning rather than in the evening. The presenter observed that proactive consideration of these potential high-risk areas should be taken to avoid the risk of shipping accidents in the future in these highly sensitive and bio-diverse areas.

6.3 GEBCO/IBCCA (Dagoberto David, Colombia DIMAR)

The International Bathymetric Chart of the Caribbean Sea and the Gulf of Mexico (IBCCA) is a regional cartographic project sponsored by the Intergovernmental Oceanographic Commission (IOC) of the United Nations Educational, Scientific and Cultural Organization (UNESCO), and the International Hydrographic Organization (IHO). The objective is to create a bathymetric map for the Caribbean Sea, Gulf of Mexico and adjacent regions. The National Institute of Statistics and Geography (INEGI) of Mexico took the responsibility coordinating the project in its editorial phase, converting to digital media, editing, printing and the distribution of this new cartography. The Editorial Committee includes Colombia, Costa Rica, Cuba, United States of America, Mexico and Venezuela who have held meetings of the Editorial Committee every two years and in each of the countries.

The effort was re-energized, and four virtual work meetings were held during 2019 to establish an action plan for completing the first edition of this bathymetric chart for the region. The Board would like to meet face-to-face at INEGI – Mexico in order to accelerate the technical review and subsequent approval of the final products with a goal to complete the project by first quarter of 2020. However, it needs the financial resources to do so (US \$30,000).

It was noted that the data to produce this first edition of the map is from prior to 1990 (extracted from the DCDB) and that a second phase of the project would include a higher resolution range, drawing on bathymetric data collected between 2010 and 2018. IBCCA proposes to continue with the second phase of the project, which would be aligned with the SEABED 2030 initiative and MACHC-related programs. This will only occur through the commitment of Member States if no external financing can be found. IBCCA encourages participation of Member States and promotes the sharing of available information. The presenter thanked the IBCCA Secretariat of Mexico for the management of the videoconference meetings, and Jennifer Jenks of US NOAA for updating the website and the President of MACHC for supporting the continuation of the project. During the discussion, the importance of Member States providing their existing and future data to the IHO DCDB was re-emphasized to support this project, as well as others.

6.4.A GEBCO/Seabed 2030 and MACHC Contributions (Dr. Vicki Ferrini, Head of Atlantic/Indian Oceans Regional Data Center)

The Nippon Foundation - GEBCO Seabed 2030 Project is a collaborative project to inspire the complete mapping of the world's ocean by 2030 and to compile all bathymetric data into the freely-available GEBCO Ocean Map. To achieve its goals, Seabed 2030 has established several Regional Data Assembly and Coordination Centers (RDACCs) responsible for coordinating with stakeholders and existing data compilation efforts, providing information about data gaps, and assembling regional data products that are integrated into GEBCO global products.

The IHO Data Center for Digital Bathymetry (DCDB) is the recognized IHO repository for all ocean bathymetric data. The DCDB works closely with the Seabed 2030 Project to provide long-term preservation, discovery and access of source bathymetry data. The Director of the IHO Data Centre for Digital Bathymetry affirmed this partnership in her [letter to MACHC Members of November 2019](#), where she summarized the existing multibeam and single beam data holdings in the DCDB for the MACHC region. She also encouraged the Members to respond positively to the IHO CL 11/2019 Annex B: Acceptance of Crowdsourced Bathymetry Activities in National Waters of Jurisdiction (see next Section 6.4.b) and looks forward to working with the MACHC and providing any needed assistance.

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Although the spatial extent of the MACHC region overlaps with multiple Seabed 2030 Regions, the regional extent is most closely aligned with the area coordinated by the Seabed 2030 Regional Center for the Atlantic and Indian Oceans. As Head of this RDAC, she has worked closely with the MACHC Chair to develop a section of the new MACHC Initiative Website focused on [regional contributions to Seabed 2030](#).

A Gap Analysis was conducted to help identify gaps in coverage based on the publicly available data at the IHO DCDB. The interactive map on the site highlights gaps in data coverage from the perspective of this international archive, based on the coverage of both multibeam and single beam data found there.

There are many more existing data sources that have not yet been contributed and Member States are urged to ensure that they are submitted to the DCDB. Even if bathymetry data cannot be shared, sharing polygons that show the extent of existing data can be important in helping to plan new surveys.

Providing information about planned surveys is an important part of mapping the gaps. There is a layer in the MACHC Seabed 2030 web application for Member States to add polygons showing future surveys in the region. The MACHC Chair noted that the US has already entered their planned surveys for the Gulf of Mexico, and one planned starting on May 24, 2020 for an ocean exploration cruise that will involve 24-hour-per-day systematic mapping operations focused on the deep-water areas south of Puerto Rico. This cruise is anticipated to map approximately 28,000 square kilometers of seafloor.

The release of the GEBCO 2019 world ocean map marks a significant improvement over previous products and more than doubles global coverage of bathymetry data to 15%. In the coming year, the Seabed 2030 Project will be working to compute a percentage to complete for RHC areas. This information will be added to map interfaces to document progress.

She invited Member States to: Contribute data and geospatial information about data coverage to IHO DCDB, coordinate upcoming data acquisition through the MACHC and explore the MACHC-Seabed 2030 [Web App](#).

During the discussion, the IHO praised the efforts of the MACHC for being so proactive on this topic and hopes that other RHCs will follow suit. A question was raised by the IOCARIBE Secretary about how to ensure that private sector companies are contributing their data as well. The response was that many of these companies are working as contractors for MACHC Member States who need to ensure that the data collected on their behalf in this manner is submitted to the IHO DCDB. The MACHC Chair noted that there is already an existing continuous action to do this, but that it will be updated to reflect this important point. She also noted that the tool should be shared beyond the MACHC to partners such as IOCARIBE to raise awareness with their members and other stakeholders across the region.

20.6.4.1	Action: Provide existing bathymetric data to the IHO DCDB (bathydata@iho.int) as indicated in MACHC continuous action 17.6.5, <i>including that collected by private sector companies under their authorization</i> (MS) (update existing continuous action with the italicized addition).
20.6.4.2	Action: MS provide future survey plan polygons to add as a layer in the MACHC Seabed 2030 gap analysis tool to Percy.Pacheco@noaa.gov (MS) to encourage survey collaboration and avoid duplication of effort.
20.6.4.3	Action: A link to the Seabed 2030 Regional Gap Analysis tool will be shared with IOCARIBE, so that it, in coordination with the MACHC can raise awareness and encourage the increase in contributions to the IHO DCDB and Seabed 2030 from their respective member states.

6.4.B Crowdsourced Bathymetry (John Lowell, USA National Geospatial-Intelligence Agency)

CSB data is the collection of depth measurements from vessels, using standard navigation instruments, while engaged in routine maritime operations. While CSB data may not meet accuracy requirements for charting areas of critical under-keel clearance, it holds the potential for a myriad of other uses. CSB is valuable data with scientific, commercial and research value, that can be acquired at no cost to the public sector and can help fill gaps where data is scarce.

The IHO produced a document in 2019, [B-12 IHO Guidance on Crowdsourced Bathymetry](#), and is available online. The IHO called for Member State Approval of this Guidance in its CIRCULAR LETTER 11/2019 25 January 2019. Member States were also separately requested to indicate whether they support CSB activity within their waters of national jurisdiction, including any caveats they wish to apply, by returning the Template Form provided in Annex B.

Thirteen Member States have responded positively and filled out the Template, including three from the MACHC region (the US, Brazil and The Netherlands). The IHO encourages all coastal states (not only IHO Members) to respond to the Circular Letter and fill out the template. They are encouraged to ask questions of those who have already filled it out, or the IHO representatives to the MACHC. The IHO acknowledged that they do not have an established mechanism for handling responses from non-IHO member coastal states but that they would develop one.

Many MACHC Member States were not familiar with the CSB Initiative and asked for the DCDB to provide instructions (in English and Spanish) on the bathymetric data submission process, and to translate CSB presentations (like this one) into Spanish, including key definitions.

A very related action (number 12) from the IRCC 11 meeting asked all “RHC Chairs to consider the [tasks listed as duties](#) for the Regional Seabed Coordinator/Mechanism (doc. IRCC11-0713) and to include Seabed 2030 in RHC work plans and reports to IRCC.” Given all the activities summarized in 6.4.a and in this section, the advantages of having a designated Regional Seabed2030 Coordinator for the MACHC are obvious. When the Chair asked if there were any Member States interested in taking on this role, Mexico proposed Ms. Cecilia Zuleima Cortina Guzman, the Bathymetric Database Manager of the Mexican Navy Hydrography Directorate to take on this role. Mexico’s proposal was enthusiastically accepted, and the decision made to designate her as such.

20.6.4.B	Decision: Approved Mexico's offer to provide the MACHC regional Seabed 2030 Ambassador/Coordinator.
20.6.4.B.1	Action: Provide link on MACHC Initiative website to IHO CL11/2019 for MACHC IHO MS to review and provide their response on CSB national policies.
20.6.4.B.2	Action: Non-IHO MS to review and provide their comments to IHO CL11/2019 to the MACHC Seabed 2030 Coordinator for collation and submission to IHO.
20.6.4.B.3	Action: IHO to determine how to handle responses from non-IHO coastal states.
20.6.4.B.4	Action: DCDB to provide instructions (in English and Spanish) on the bathymetric data submission process.
20.6.4.B.5	Action: Translate technical CSB presentations and information into Spanish including key definitions.

6.5 Lidar Surveys in Jamaica and Haiti to Support Climate Resilience in the Caribbean (Ainsley Henry, University of the West Indies)

As indicated under Agenda Item 5.5, the Pilot Program for Climate Resilience (PPCR) in the Caribbean consists of six participating countries each with individual National Projects (Dominica, Grenada, Haiti, Jamaica, Saint Lucia and Saint Vincent and the Grenadines) and a regional track of activities, co-implemented through regional organizations.

The Climate Investment Fund through the Inter-American Development Bank (IDB) has provided \$10.39 million USD in grant funding to implement over 5 years the Investment plan for the Caribbean Regional Track of the Pilot Program for Climate Resilience (PPCR). The University of the West Indies Mona signed a Technical Cooperation (TC) to implement the regional track through a Program Management Unit set up under the Mona Office for Research and Innovation.

Component 1 focuses on: Improving Geospatial Data Management and Management for Adaptation Planning, Sea Level Rise and Storm Surge Impact Analysis. Its objective is to improve accessibility to high quality current Bathymetric and near shore topographic data that will:

- Support Climate Change analysis related to sea-level rise, storm surge and flooding.
- Inform on-going and future coastal land-use and adaptation planning at the regional and national levels.
- Make data available for use by multiple stakeholder groups in each country and build capacity of geospatial professionals in pilot countries to use LIDAR technology and products.

Bathymetric LIDAR is still being collected in vulnerable coastal areas of interest in Jamaica and Haiti and will be made widely available for multiple purposes. This activity is clearly of interest to the MACHC and presents a potential collaboration opportunity for increasing data collection and capacity building. However, there needs to be a better understanding of the criteria used for country participation and how to best engage with the IADB. The MACHC Chair volunteered to follow up with the IADB Project Director based in Washington, DC who was unable to attend the meeting.

20.6.5	Action: Seek and share information on the process by which the Inter-American Development Bank determines the criteria for funding projects.
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6.6 Satellite-Based Hydrographic Surveying of Remote Small Island and Developing States (Kyle Goodrich and Carol Fisher, T-Carta Marine and T-Carta Caribe)

Satellite-derived bathymetry can provide a good alternative to more traditional survey methods in shallow water. In contrast to other survey methods, it requires no mobilization of persons or equipment, provides rapid access to bathymetric data and saves costs. Satellite-Derived Bathymetry can make operations in shallow water more effective and reduces project risks, if users are aware of varying techniques and quality control.

In December 2018 TCarta was awarded a contract by the UKHO to survey the waters of Kiribati, a remote island nation in the Pacific. TCarta worked in close partnership with Maxar (DigitalGlobe) to successfully task imagery, overcome challenging environmental conditions, and implementation of remote data validation techniques, culminating in on-time delivery of the largest SDB contract ever awarded by an international Hydrographic Office. Both LiDAR and MBES options would have required mobilization of equipment and personnel to one of the most remote locations on the globe and incur very high cost and risk. In August 2019, data was handed over to Kiribati government as part of Commonwealth Marine Economy Program to enable coastal monitoring and defense efforts as well as in development plans for safe navigation. A cost analysis contrasting SDB and traditional hydrographic surveys at Pedro Bank at San Pedro Bank, Jamaica highlighted the advantages of SDB.

6.7 Enhancing the Accuracy of Current Profiles from Surface Buoy-Mounted Systems (Julio Leal, AXYS)

AXYS Technologies Inc. (AXYS) is an ISO 9001-2015 registered company with over 40 years’ experience in the design, manufacture and deployment of remote environmental monitoring systems worldwide to support a variety of needs. The presentation covered a variety of sensors used to monitor complex dynamics motions of waves and currents. It highlighted a collaborative partnership that was formed in 2014 to explore the advantages of buoy-mounted Acoustic Doppler Current Profilers (ADCP). Two studies identified two primary technological limitations which led to improvements that were then field tested in 2018-19. This led to a new integrated design to incorporate this technology that increases the accuracy of current profiles from these buoy mounted systems.

8.1 MMSDI WG Report (Jim Rogers, MMSDI WG Chair; Tom Scott-Clarke, MMSDI WG Vice Chair)

The MMSDIWG was co-chaired by the US and UK. There was a run through of the MSDI page on the new MACHC Initiative website developed by NOAA. The UK led in developing ToRs and guidance framework and the commencement of an inventory was acknowledged. The MACHC chair asked all countries present to contribute to the survey and assist in compilation of additional layers. Suriname suggested there should be an annual update of the shoreline. They pushed for a diversity of approaches on MSDI development, but the UK noted that multiple sources might confuse users and that there is merit in standardizing approaches in the region. The UK shared Data Principles, including the need to safeguard access.

Accomplishments since MACHC19 were presented, including:

- Initiated an inventory of national MSDI data holdings.
- Established a [website portal](#) to establish an inventory and make key data sets (bathymetry, shoreline and maritime boundaries) more accessible for non-navigation uses, such as a regional risk assessment for maritime accidents, management of marine protected areas and disaster response.
- Contributed some of these datasets to the Caribbean Marine Atlas, an existing regional geospatial data and information platform and encouraged other countries in the region to make their open geospatial information available there and avoid having to build a duplicative individual MSDI.
- Increased national bathymetric data contributions to the IHO DCDB and to the Seabed2030 Regional Data Assembly and Coordination Center for the Atlantic and Indian Oceans.
- Established linkages with the UN-GGIM Working Group on Marine Geospatial Information effort.

All of these activities will continue to be expanded upon as part of the workplan. It was also noted by Rafael Ponce (ESRI) that the MMSDIWG should consider getting more involved with the Caribbean Geospatial Development Initiative (CGDI), and the Nature Conservancy’s [Caribbean Challenge Initiative](#). Ponce offered to make formal introductions for the working group.

20.8.1	Decision: The MACHC approved the MMSDI WG Report and Work Plan .
20.8.1.1	Action: All MS invited to fill out the MMSDI WG Survey on the MACHC Initiative Website.
20.8.1.2	Action: MMSDI WG to explore how to become involved in the Caribbean Geospatial Development Initiative as part of next year's work plan. Put the documents on the MMSDI WG site for all to review.
20.8.1.3	Action: MS and all coastal states are encouraged to make their other open marine spatial data available on the Caribbean Marine Atlas to take advantage of the excellent existing infrastructure and not have to recreate it individually.

8.2 UN-GGIM/WGMGI Update (John Nyberg, USA NOAA)

John Nyberg (co-Chair of UN-GGIM/WGMGI) presented an update regarding the WGs progress on its work plan. Highlights included an update on the group's communications plan, capacity development tracking, and the promotion of standards-based data. Mr. Nyberg detailed the WGs work on a use case exercise that intends to promote the importance of data sharing and availability, particularly for disaster response and to help monitor progress on the UN Strategic Development Goals.

He requested that MACHC members complete and return the use case questionnaire by the end of March 2020. He also encouraged members of the MACHC, who are not members of the group, to consider joining.

20.8.2.1	Action: MS consider joining the UN-GGIM-WGMGI (ask John.Nyberg@noaa.gov for more information) as per existing continuous action 19.8.1.
20.8.2.2	Action: Complete the UN-GGIM-WGMGI Use Case Survey on the MACHC MMSDIWG page and ask USA (John.Nyberg@noaa.gov) for assistance as needed.

8.3 Caribbean Marine Atlas (Ms. Carolina Sanchez, CMA)

The Caribbean Marine Atlas (CMA) is a digital technological platform online which function as repository of geospatial and documental information to support decision making in Integrated Coastal Zone Management (ICZM) as well as monitoring and evaluation of Caribbean Large Marine Ecosystem (CLME). The presentation included the coordination structure, tools, and information technology needed to support this platform for the benefit of the region.

Last year CMA was able to increase the supply of information across a spectrum of topics for the region. This included updates to the landing page to make visible the supporting role in the regional Strategic Action Program (SAP), M&E, and State of the Marine Environment and associated Economies (SOMEE) reporting efforts. Currently, it provides relevant background upfront, as well as a shortcut to access information that specifically relates to certain aspects of the CLME and SAP (and thus the SOMEE report, whose structure is based on the SAP), hyperlinks to various pages on the CLME and HUB, and acknowledgements and regional ocean governance contacts. At the same time, the [CLME and HUB](#) also links back to the CMA2 GeoNode. The webpage now hosts 1,092 layers, 142 maps, and a catalogue of 111 documents and 93 information sources, marking a substantial increase in available information from 2017.

8.4 MapAction: Navigation Datasets for Disaster Response (Sudesh Botha, MapAction Caribbean)

MapAction is focused on two distinct areas: increasing the knowledge and capacity of their own volunteers and increasing the knowledge and capacity of their humanitarian partners. Their well-rehearsed deployment model means volunteer mapping professionals are often at the scene within 24-48 hours of a disaster striking and run a range of preparedness projects that complement their rapid deployment capability. Since 2003 MapAction has been deployed to more than 80 humanitarian emergencies ranging from earthquakes to conflict-related crises.

MapAction's professionals and tools identify affected areas and where the affected people are. MapAction then tracks where other relief agencies and teams are working, and what aid and resources they are provided to ensure optimal deployment. Another critical component is their ability to identify where access routes are as a result of the disaster, and how to get relief supplies into landing zones and across difficult terrain to help affected population areas.

The UKHO played an important role in providing charts and large-scale bathymetric data to MapAction for their response to Hurricane Dorian. It was used to assist responders and aid agencies in determining the best and most efficient routes to deliver aid to areas that needed it most. Charts were used to as a critical tool to determine alternate landing options and where smaller boats could be used safely to deliver aid to distribution centers, especially where meals were supplied.

He noted that data requests and protocols for access need to be formalized with partners like the IHO/MACHC and appreciated that the MMSDI WG has initiated the inventory of where bathymetric datasets can be found. How to access

them and in what formats is a dialogue that needs to continue between the MMSDI WG and MapAction to better prepare for future disaster response events in the region.

8.4	Action: MMSDI WG to determine protocols needed to ensure that bathymetric data is accessible and in what formats to support MapAction disaster response mapping requirements.
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8.5 Need for a Marine Spatial Data Infrastructure Across the Meso America and Caribbean Sea

This presentation did not occur as the presenter was unable to attend. She incorporated the main points of this presentation into the one she gave at 6.1.

9. Nautical Charts and Publications

9.1 MICC Report, 9.2 Examples of Other RHC Schemes, and 9.3 Proposed ENC Scheme for the MACHC (Bernice Mahabier, MICC Chair)

The MICC Chair presented the MICC Report, which included accomplishments since the previous MACHC meeting and elements of the Workplan for the coming year. Major activities include:

- MACHC ENC Online established and available from MACHC Initiative Website
- MACHC ENC Boundary limits now include parts of the Amazon River within the MACHC area, which should now be reflected on IHO and other sites depicting RHC boundaries.
- Increasing Availability of ENCs in Region: 933 in 2019
- Increasing Availability of INT Charts in the region: 51 produced, 33 schemed in 2019
- Ports Analysis evaluation to identify gaps: 2018/2019: anchorage areas were added to list making a total of 92; currently only 32 not covered
- Development of a MACHC Regional ENC scheme through a MICC sub-working group established in 2019 to develop guidance for a way forward, taking into account a proposal from Colombia (Agenda Item 9.3) and the experience of neighboring RHCs, (SWAtHC and SEPHC--Agenda Item 9.2).
- S 100 Series Test Beds. National Testbeds are in progress for S-102 (Bathymetry), S-111 (surface currents), S-122 (marine protected areas)

20.9.1	<p>Decision: The MACHC approved the MICC WG Report, Workplan and its recommendations for Member States:</p> <ul style="list-style-type: none"> • To submit proposals for new INT Charts, or amendments (for example, to limits, scale of portrayal) to existing INT Charts, in the Region • Request new INT Chart numbers for new charts that are planned • Report the status of production of international charts (INT Charts and ENCs) • Endorse the progress on ENC production throughout the region • Encourage MACHC ENC Online and INT participation • Encourage to provide CATZOC information to RENC • Work towards approval Of the standardized regional ENC scheme • Encourage S-series test beds and production of S-122 Marine protected areas and S-123 Marine Radio services • Encourage Product Specification development participation
20.9.1	Action: Dominican Republic to provide additional input/assistance related to cruise ships to the MICC WG.

9.4 Future of the Paper Chart: Results of IHO Survey (Alberto Costa Neves, IHO Assistant Director)

Fifty-two Member States Survey responded to the IHO Survey on the future of nautical paper charts and the potential impacts of a paperless (chart) world. It covered a range of questions related to plans for developing simplified paper chart as backup for electronic systems; current use of or movement toward a single database to generate both paper and ENC; paper chart distribution methods; comparison of ENC and Paper chart sales; types of nautical charts being produced; plans to re-scheme paper/raster charts, among others. The team that is analyzing the results and finalizing the report will submit it to the HSSC12 meeting in May 2020. Potential recommendations that could influence the focus of the HSSC Nautical Cartography Working Group include:

1. Implementing a standard S-4 symbology in an S-100 Portrayal Catalogue for raster paper/charts.
2. Freezing S-4 so that future NCWG efforts can focus exclusively on enhancing the portrayal of S-57 and S-101 ENCs and other S-100 based products.
3. Enhance ECDIS Portrayal of ENC for both S-57 and S-101 and help facilitate ways to make the current and future display of ENCs as acceptable to mariners as the presentation on paper charts.
4. Raster from ENC - Develop a standard means of generating raster nautical charts from ENC data.
5. Backup Chart Specification - Develop a specification for – or general guidelines for – a simplified paper/raster chart that would be suitable as a back-up for ECDIS and ECS.
6. Chart on Demand / Custom Chart – Coordinate efforts of various HOs that are developing online "Chart on Demand" or bespoke "Custom Chart" capabilities
7. INT Chart Production and Coordination – What, if any, recommendations - does NCWG want to make regarding the future of production or INT charts and coordination efforts related to INT charts or ENC within ICCWGs? Does it make sense to freeze INT Charts Schemes for instance. If yes, what is the impact on S-11?
8. Minimum Paper Chart Standard - Develop a new “minimum” standard for Paper Chart Production derived from Chart Content Databases (also used for ENC Production)

9.5 High Definition ENCs for Precision Navigation (Rafael Ponce, ESRI)

Precision navigation, in marine transportation terms, is the ability of a vessel to safely and efficiently navigate and operate in close proximity to the seafloor, narrow channels, or other hazards. For large vessels entering a port— when space is tight and time is critical—mariners anticipate ocean and weather conditions by using observations, forecasts, and underlying foundational data in addition to high definition electronic navigational charts (ENCs).

A High Definition ENC product includes bathymetry depicted with depth area intervals of 1 meter or closer within the depth range of relevance, focused on a physically constrained waterway. The additional bathymetric information is incorporated in the base ENC dataset. The product may also include more detailed port infrastructure. Under the current IMO ECDIS Performance Standards, this product is suitable to be displayed and operated on any type-approved ECDIS and then can be used to fulfill the IMO’s chart carriage requirements. Hydrographic surveys to be used in the compilation of HD bathymetric areas will, in the majority of cases, need to meet IHO S-44 Special Order survey requirements. The presenter went on to demonstrate the ESRI Maritime ArcGIS tools and workflows that are available for creating HD ENCs depth contours.

9.6 WEND WG Report (John Nyberg, WEND WG Chair)

The WENDWG Chair presented the WEND update. His presentation highlighted the updated WEND TORs which support the S100 implementation strategy and the continued improvement of IHO ENC coverage and overlap management. The presentation introduced improvements to the IHO ENC Catalog and INTOGIS II. Mr. Nyberg introduced the WEND transition to WENS, a major focus of the working group moving into 2020. WENS will address the S100 services in addition to ENCs. He requested the MACHC to note the report and its recommendations for Member States.

20.9.6	Decision: Noted the WEND WG Report
20.9.6	Actions: Member States requested to: <ul style="list-style-type: none"> • Support process outlined in WEND overlap Resolution 1/2018 – continue good work at keeping overlaps to a minimum - and for that, submit ENC Schemes to the approval of RHC S-11 Part A, Section 200 (as part of MICC Plan) • Consider making CATZOC values available in INTOGIS II additional layers for Management Mode only, before April 7-9 2020 WEND meeting (by March 29) • Support the development of the WENS Principles, by reviewing updated version after April WEND meeting (by May 29)

10. Closing Activities (Katie Ries, MACHC Chair)

10.1.A Election Results for MACHC Representatives to IHO Council

As per Agenda Item 2.2.1, The MACHC Chair provided eligible Member States the opportunity to indicate their desire to be candidates for the two available IHO Council seats by the end of the first day of the meeting. Only Brazil and the Netherlands indicated their interest and therefore an election was not necessary as the two seats were naturally filled.

20.10.1	Decision: Affirmed that Brazil and The Netherlands will continue to represent the MACHC on the IHO Council. The Chair will formally communicate this decision to the IHO Secretary General.
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10.1.B Report to A-2

The deadline for submitting the MACHC report to A-2 was extended to December 15, and the Chair agreed to send an initial draft for MACHC review immediately following the conference. The Chair also asked members to provide input to help determine which two issues should be emphasized during the region’s five-minute presentation to the Assembly 2. Input was provided via the live polling system and the most frequently cited topics were capacity building, disaster response, close collaboration and participation, and ENCs. All results may be found in the appendix on page 36.

10.1.C Chair invites participants to present any other business

International Hydrographic Review Publication

Throughout the conference participants were able to submit responses to the question “*What MACHC article topics would you like to see in the next International Hydrographic Review publication?*” This input will then be considered by Chris Thorne (UK/MACHC Representative for IHR) for future article submissions. The most frequently mentioned suggestions related to regional initiatives, MSDI, surveying, capacity building, and S-100. All results may be found in the appendix on page 37.

Latin American Hydrographic Conference 2021

Rafael Ponce (ESRI) sought the future endorsement and support of MACHC member states participation in the Latin American Hydrographic Conference in 2021 (likely September). This will be part of THSOA Latin American Chapter activities, and Member States are invited to participate and contribute papers and presentations as a way for MACHC to

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be represented. Two potential venues include Cartagena or Barranquilla, Colombia. More information will be made available as details are confirmed.

20.10.1.C.1	Action: Respond to the invitation to participate in a Latin American hydrography conference in 2021 and consider lending assistance by MACHC21.
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Member State Engagement for Capacity Building with the IMO

The IHO reminded MACHC Member States of the importance of reaching out to their IMO Representatives to request Phase 2 and 3 hydrographic-related training in both English and Spanish for the region, such as two-week Hydrographic Governance and Basic ENC and Chart Production courses. French speaking MS are encouraged to engage with France and their IMO representative to find out about training opportunities in French or in another French-speaking region.

20.10.1.C.2	Action: English-speaking MS interested in a 2-week Hydrographic Office management training course should approach their IMO reps to request a similar IMO training in 2021 (or in the next IMO biennium plan for 2022-23) at the Senior Maritime Administrators' Workshop (March 5-6, 2020). Similarly, Spanish-speaking MS should request a similar course for Spanish speakers from their IMO representatives, to be coordinated with the IHO, IMO, IALA, and COCATRAM in 2021.
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MACHC Conference Venue in 2020

Rear Admiral Shep Smith, Director of the U.S. Office of Coast Survey, announced that as a MACHC Member State who has not hosted a MACHC Conference for some time now, the United States is prepared and would be honored to host the 21st Meeting of MACHC in 2020.

The specific dates proposed are Nov 30 - Dec 4, 2020, that 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, FL or New Orleans, LA. As soon as final determinations have been made about location they will be communicated. It will be a venue suitable for the needs of the MACHC and all the related amenities that will make the meeting both productive and enjoyable.

The proposal was accepted by the MACHC members.

20.10.1.C	Decision: MACHC21 will be hosted in the United States from November 30-December 4 2020.
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MACHC Initiative Website

Lastly several changes to the website were recommended. It was agreed that a running list of acronyms on the MACHC website should be made available in both English and Spanish. Costa Rica offered to provide translation and work with Percy Pacheco (U.S. NOAA) to complete this action. It was also agreed that a more user-friendly events calendar would be added to aid in tracking and planning for upcoming opportunities.

20.10.1.C.3	Action: Develop and post a list of acronyms on the MACHC website (in both English and Spanish).
20.10.1.C.4	Action: Enhance the events calendar on the MACHC website to aid in tracking and participating in the many events and opportunities available. (Add to existing Google calendar).

10.2 Review Actions and Decisions

All actions and agreements from MACHC 20 were reviewed, adjusted, and agreed upon by the plenary. The full list of actions and decisions may be found here [\[insert link\]](#).

10.3 Lessons learned identified

Feedback on the conference was offered via live polling questions at the close of the session, as well as via an online survey provided post-meeting. The combined results are found below.

Overall the conference was very well received, with the majority of responses indicating participants were highly satisfied (56.67%) or satisfied (40.00%), and only one participant reporting they were neutral on the event.

A majority of responses indicate that the conference was the right length (61.90%), while most who would advocate for change believed it was a half-day too short (28.57%) rather than a half-day too long (9.52%).

A majority of responses also indicated the new breakout group process used for the national report outs and capacity building recommendations was well received and should be replicated in the future (63.64%), and most of the others indicated that they liked the process but would make some changes next time particularly to allow more time for presentations, interaction, and discussion (31.82%). Only one person did not like the new format.

Suggestions and feedback were also provided by participants to inform what issues should be raised to for the region at the IHO Assembly-2, thematic gaps in the conference to be addressed next year, article topics to cover in future International Hydrographic Review publications, and any other comments and suggestions. The MACHC Chair will adjudicate and act upon these recommendations, and the details and specific results may be found in the live polling results that follow.

Finally, the IHO Director made some closing remarks, congratulating the Chair for her excellent preparation and superb management of the Conference. He especially thanked the Dominican Republic for their outstanding arrangements and the logistics associated with the venue and meeting every need of the participants. He particularly acknowledged the diligent efforts and attentiveness of the Director del Servicio Hidrografico, Armada de la Republica Dominicana (SHARD), Captain Juan Pablo Sandoval, Sub-Director del Servicio Hidrografico Lieutenant Commander Primitivo Lopez, Group Coordinator Lic. Ana Vanessa Ricardo Acosta and other SHARD staff who contributed significantly to ensuring the comprehensive preparations and smooth running of these meetings. In addition to the meticulous organization, the social events provided in Santo Domingo by both SHARD and industry partners were thoroughly enjoyed and much appreciated.

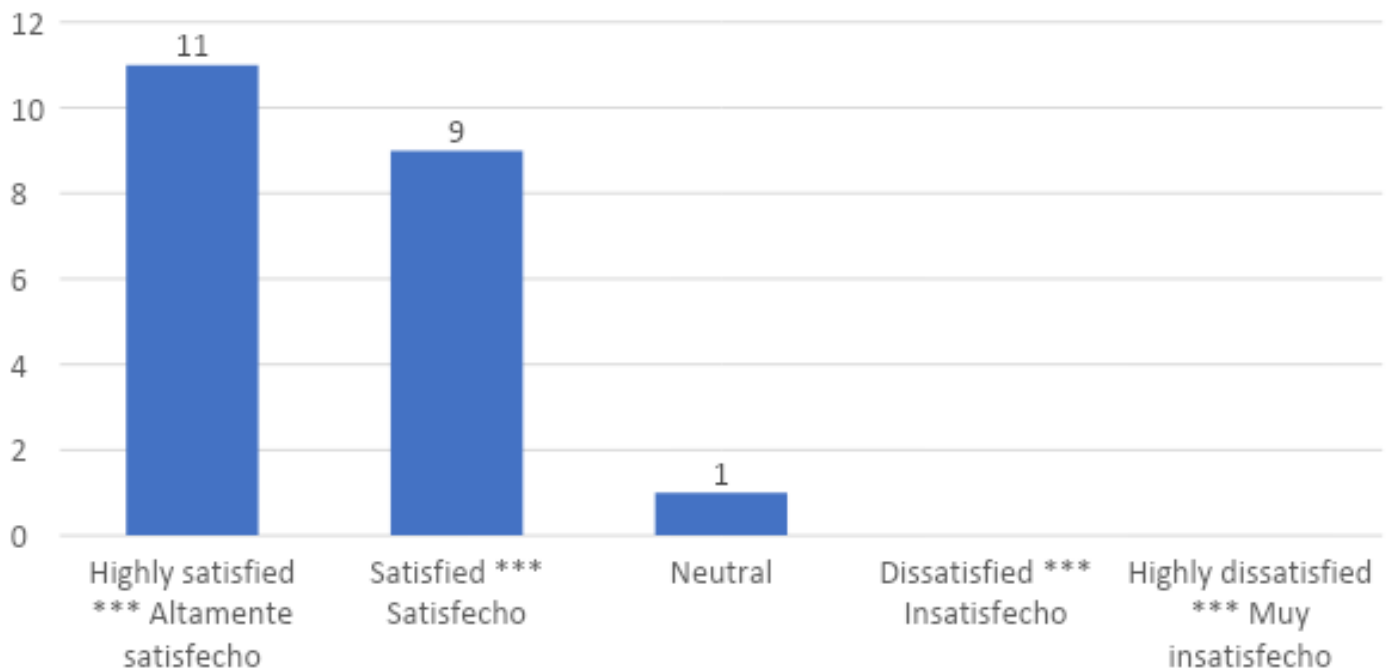
The Chair echoed these accolades and further recognized all the other critical elements to the success of this conference, including the hard work of the interpreters, the MACHC WG and Committee Chairs, the Chairs of the breakout groups, the rapporteurs and the members of the MACHC Chair Group who planned extensively for months, as well as the active participation by all the attendees. She noted that the majority of the current MACHC leadership (Chair, CB Coordinator, MICC Chair and Seabed 2030 Liaison) is female, which is unprecedented for the Commission and great progress towards ultimate gender balance. She ended by saying that she very much looks forward to seeing everyone at the next meeting in the United States, and with that, brought the meeting to a close.

Appendix Overview

The following appendix contains all live polling taken during the conference, as well as the results of an electronic survey post-meeting to obtain additional feedback for lessons learned. This data will be reviewed by the MACHC Chair and taken into consideration in the planning of MACH21.

Overall Conference Satisfaction

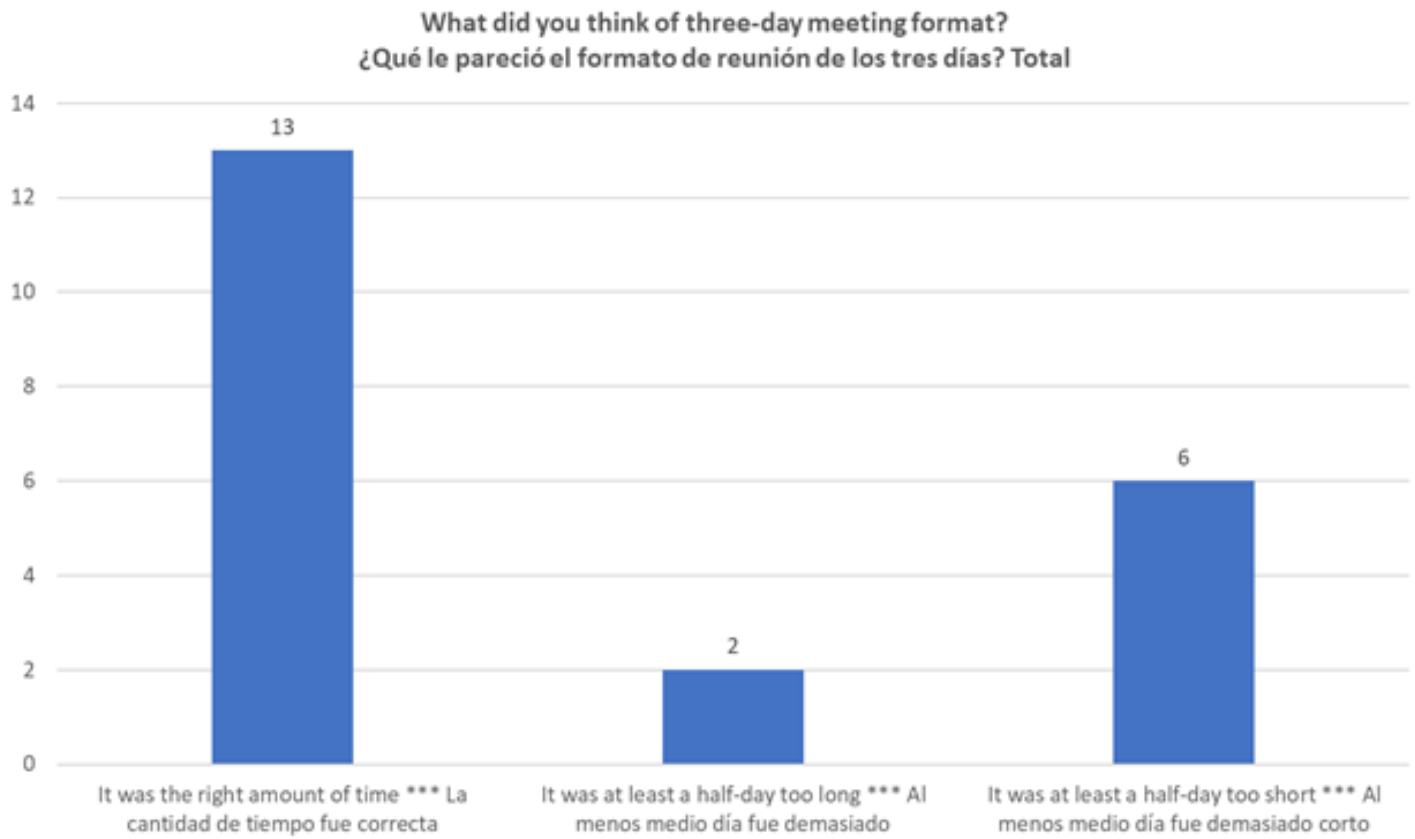
How satisfied are you overall with this MACHC conference? ¿Qué tan satisfecho está en general con esta conferencia de la MACHC?
Total



Additional Comments

- There is always room for improvement.
- The presentations of MS, WG and Subcommittees would be 15 minutes of time.
- It is always a fantastic meeting.
- There should be more time available to discuss about MICC, MMSDIWG and CBC outcomes and less time for other issues. There have been too many thematic areas being considered on the Agenda that could be discussed during the Seminar.

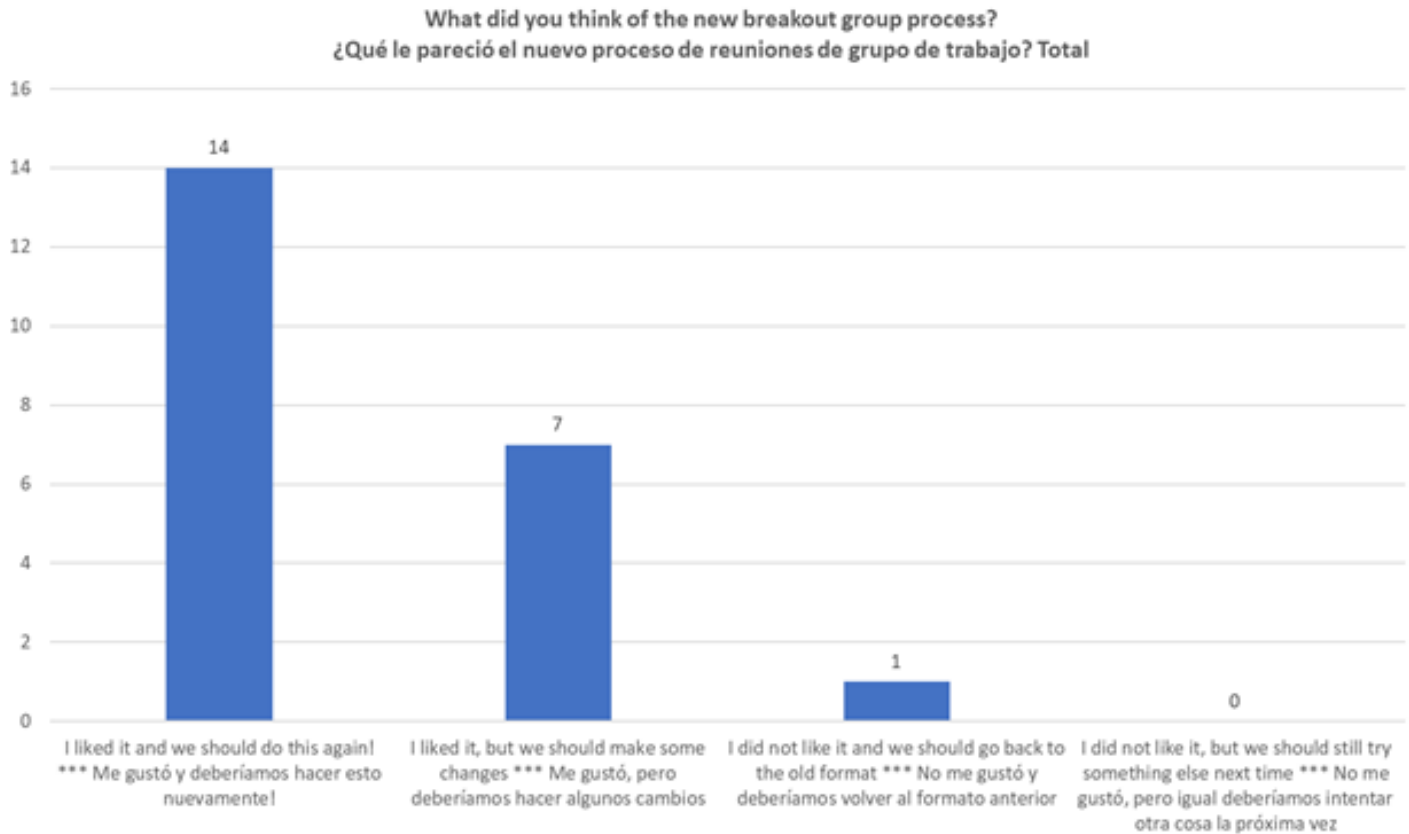
Three-Day Meeting Format



Additional Comments

- Improved participation time for Hydrographic Services.
- I think we rushed the conference a bit. In my view, a more meaningful meeting would require more time for discussions and decision making that country reports (and sometimes the IHO rep talking about the importance of Hydrography to hydrographers is irrelevant). Inviting other stakeholders and listen to their needs is also something important and missing. The industry makes a big effort to attend and be there for one week, giving them 15 minutes to talk (and sometimes rushing them) is not the best way to encourage their participation in the future. Besides, the industry provides the latest technological advancements to the community. Getting five days would give the majority enough time to discuss, learn and digest information.
- The fact that we didn't cover all topics suggests it was too short
- The presentation of the industry must be in technical hydrographic topics... not advertisement of products and no more 10 minutes.
- I think 4 days (like in the past, with even 5 days) would be more fruitful.
- At least a few days the day was extensive which interfered with the rest of the times.
- Too many presentations from organizations and industry.
- Preferably, each day starting at 9 a.m. and ending until 5 p.m.
- The content of the agenda is quite demanding, can facilitate advance agreements between working groups or advance presentations on the plenary.
- The time was adequate but there are too many days loaded so the meetings become tired.

New Breakout Group Process



Additional Comments

- There are always logistical challenges to get two (or even three) different rooms for people so have specific discussions, but this is fundamental to have successful breakout sessions. Establishing specific desired outcomes I think would also make participants focus on what matters and not to diverge (too much) from the central topics.
- I think the reporting period should be larger to allow more interactions.
- The new meeting process allowed to deepen discussions and analyzes of important issues of common interest.
- There should be more time available for the breakout group process. The breakout groups should stick to what was planned and other thoughts can follow what was planned. The outcomes from it should be discussed and defined by the plenary before moving to the next session.
- It was my first plenary. Prioritizing the slides was productive to shorten time, even so, when making the summary and asking for an opinion it implied to the plenary that the expected result was not obtained, since it was opened to opinions without being completed in the document.
- The presentation of the results of the working groups should no longer take time in discussions as it is assumed that everything has already been said.

MACHC Issues for IHO Assembly-2

What Two Issues Should the MACHC Chair Highlight About Our Commission at IHO Assembly-2?

Capacity Building

- The potential impact on the region if there is reduced funding available for CBC activity.
- Support to CB MACHC.
- Need for more Capacity Building resources in the region.
- Advancement of capacity building.
- Strengthen the capacity building committee to provide more training.
- Search stakeholders for MACHC Cooperation in CB.
- National Report Breakout Group process oriented to MACHC Capacity Building Plan.
- The importance of capacity building and lack of funds for it.

Disaster Response

- Disaster response issues.
- Disaster Response Framework Plan.
- Importance of hydrography in disaster response and the need for greater assistance to the MACHC smaller developing states especially in the area of gathering basic hydrography information.
- Disaster response and developments on S100.
- Disaster response.
- Disaster response.
- ENC's and Disaster Response.
- ENC's and Disaster Response.

Collaboration and Participation

- There is unity of the commission and the community's growing synergy.
- Importance of participation in larger projects where hydrography is inserted.
- Open cooperation to associate members (observers) in the growth of capacity building, either by carrying out lifting projects on their coasts to update their letters or include them in agreements or training to achieve their own abilities.
- Collaboration.

ENCs

- Lack of major ports ENC coverage issues.
- More efforts to re-scheme ENC.
- Regional ENC scheming challenges with the shift to S-101 (three bands, overlaps etc.).
- Regional feelings regarding the future of the paper chart.

IHO Presence

- The desire for an IHO presence within the region.
- In our region political will is still an issue and special dedication must be placed in assisting local maritime authorities to convey the importance of hydrographic surveys in its benefits to each country and as a region.
- Need for IHO attendance at the annual senior maritime administrators meeting in the Caribbean.

Training

- The importance of the Technical Visits and the Hydrographic Governance Seminars in the past years to raise awareness for non-IHO member coastal states.
- Expand the number of short trainings that can be given to countries that begin to carry out hydrographic work.
- Training in Hydrography and Cartography.

MSDI

- The importance of MSDI to small states development and its importance in meeting the UN development goals.
- MSDI developments in the region.

S-10X

- Challenge to meet the demands of the S-10x era.

Environment

- Efforts so that we can help care for the environment.

MICC

- Advance of the working groups, MICC.

Charting Committee

- The success of the charting committee.

Website

- The creation of the MACHC Initiative website in complement to the IHO MACHC website.

International Hydrographic Review Publications

What MACHC Article Topics Would You Like to See in the Next International Hydrographic Review Publication?

Regional Initiatives

- SDB as regional initiative.
- Probabilities that we can have a UNIQUE HYDROGRAPHIC WINDOW regionally. At least in Central America we need to grow much more. With this window we can communicate, support and grow regionally much faster.
- Success stories in the MACHC.
- Managing risks in the region.

MSDI

- A comparative study of postmodern nautical charting compilation techniques with marine spatial data infrastructure derived nautical products in Bristol, UK.
- Drawing MSDI together.
- UKHO vision for MSDI.
- I would like to see an article dealing with: what are the benefits, and how could marine spatial data infrastructure (MSDI) be implemented at the national level (country)?

Surveying

- Survey Harmony: Bache, Parry, and Dalrymple's impact on 20th Century American Broadway Musicals (Thorne, UKHO).
- LIDAR bathymetric surveys.
- Hydrographic mapping.
- Hydrographic surveying and GIS.

Capacity Building

- Capacity Building.
- CME: A new model for Capacity Building.
- Maybe a Capacity Building article? It could be something about the Technical Visit Process in the MACHC Region and how it helps Member States grow their capability.

S-100

- Roadmap for provision of S-100 services (Jonas).
- Expected impacts in the next 10 years to Hydrographic Offices' production effort regarding new S-100 products.
- Expected S-100 impacts on HO's production efforts.

ENCs

- Paper vs ENCs.
- ENC Online as a poor man's MSDI (ESRI).

Crowd Sourcing

- A comparative study of postmodern sounding selection techniques with crowd sourced derived surveys in Road Town, BVI through the utilization of an optimized implementation of Franceschini's sorting method (Chris Thorne, UKHO).

Cruise Ships

- Identification of the key parameters required for determining the long-term sustainability of established cruise ship destinations - John Nyberg / USA, NOAA.

Thematic Gaps

During This Conference Were There Any Thematic Areas Missing from the Agenda That Should Be Included Next Year?

- I think MSDI is the future of the IHO in general, many people think of an MSDI as a portal, which is just the interface, there are many things MS don't really know, including the benefits of sharing information.
- S-100.
- Emphasis on Cartography.
- S-100 and its potential beyond nautical charting and on the bridge information. This is linked to the MSDI topic too. How to transition from an S-57 to an S-100 system will be a hot topic soon.
- More presentation about CSB.
- Formalize cooperation agreements according to international schemes in order to improve the cartographic updating capacity of the most disadvantaged countries.
- Bathymetric data, different sources, raster surface vs. vector points, which one is more useful?
- Hydrography influence in harbor authority.

Additional Comments

Do You Have Any Other Thoughts or Comments That You Would Like to Share?

- In order to have a successful five days conference, each day should not be more than 8 hours; extended periods of time start reducing people's attention, mainly by half of the week.
- It was a well-run MACHC with exceptional hospitality from the hosts.
- MACHC 21 must be in Miami or Puerto Rico.
- All presenters should stick to the time available and planned on the Agenda. More guidance on this should be given before the presentations and right before someone starts its presentation. Warning should be given one minute to the end and at the end.
- The division of groups in the presentation of their reports was useful for the reduction of time yet limits the perception of feeding the full of neighboring realities.
- It should be left at least one afternoon in the middle of the meeting or at the end of the meeting so that participants can learn a little about the attractions of the host city.
- There were unnecessary presentations that could be converted into reports. These presentations eventually took the time that could be dedicated to MICC, MMSDIWG and CBC. Probably, these presentations could be made during the Seminar.
- At the end of each session, the outcomes from it should be discussed and defined by the plenary.
- More time for questions and discussions with fewer presentations. Presentations given in WGs should not be repeated in plenary only a one slide summary should be allowed.