MTS 2020 Virtual Symposia
An Online Series for Marine Technology Professionals

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MTS’ 2020 Virtual Symposia
An Online Series for Marine Technology Professionals

- Back by Popular Demand - Applications of Bioluminescence in Marine Technology
  - Wednesday, May 27, 2020 – 12:00-1:00 pm (EST)
    - Edie Widder CEO, President, and Senior Scientist at the Ocean Research and Conservation Association (ORCA)

- Underwater Mateable Connector History: The Agony and Euphoria of Their Development
  - Wednesday, June 3, 2020 – 12:00-1:00 pm (EST)
    - James L. Cairns, Ph.D., Owner, Abyssal Systems; Executive Director, Cairns Foundation, Inc.; Founder, inventor, Ocean Design, Inc.
MTS’ 2020 Virtual Symposia
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- **Virtual Conference: Industry’s Role in Seabed 2030**
  - Thursday, June 11, 2020 (Time TBD)
  - **Captain Craig McLean** (Moderator), Assistant Administrator for NOAA’s Oceanic and Atmospheric Research (OAR) Office and Acting NOAA Chief Scientist
  - **Vladimir Ryabinin**, Executive Secretary of the Intergovernmental Oceanographic Commission (IOC) and Assistant Director General of UNESCO
  - **Jamie McMichael-Phillips**, Director, SeaBed 2030
  - **RDML Shepard Smith**, Director of NOAA’s Office of Coast Survey and US National Representative to the International Hydrographic Organization (IHO)
  - **Jyotika Virmani**, Executive Director of Schmidt Ocean Institute
  - **Mike Read**, President, Teledyne Marine
  - **Bjørn Jalving**, Senior Vice President Technology, Sensors & Robotics, Kongsberg Maritime
  - **David Millar**, Government Accounts Director, Americas, Fugro
  - **Rick Spinrad**, President, Marine Technology Society
Introducing The SeaBed 2030 Initiative

• Vladimir Ryabinin, Executive Secretary of the Intergovernmental Oceanographic Commission (IOC) and Assistant Director General of UNESCO

Setting the Stage for Nations to Join Forces in Mapping the Ocean

• Jamie McMichael-Phillips, Director, Seabed 2030

Private Sector NGOs and Philanthropic Foundations Joining Together to Tackle SeaBed 2030

• RDML Shepard Smith, Director, NOAA Coast Survey

Industry's Role in Rising to the SeaFloor 2030 Challenge
The Nippon Foundation-GEBCO Seabed 2030 Project

Setting the Stage for Nations to Join Forces in Mapping the Ocean

Dr. Vladimir Ryabinin
Executive Secretary,
Intergovernmental Oceanographic Commission of UNESCO
Assistant Director General, UNESCO
Parenthood

Intergovernmental Oceanographic Commission of UNESCO (IOC, 1960-)
International Hydrographic Organization (IHO, 1921-)
General Bathymetric Chart of the Oceans (IHO/IOC GEBCO, 1903-)

GEBCO - Nippon Foundation
Arctic Ocean

Southern Ocean

South Pacific Ocean

Southern Indian Ocean

Weddell Sea

MH370, 2014

Courtesy: Martin Jakobsson, GEBCO
The Ocean Frontiers!
No, Mars ...
Our prior view: GEBCO 2014

Courtesy: Martin Jakobsson, GEBCO
100% of the ocean floor mapped by 2030
The Nippon Foundation-GEBCO

Seabed 2030 Project

Jamie McMichael-Phillips – Project Director
GEBCO

‘The General Bathymetric Chart of the Ocean’

‘... a joint project of IHO & IOC, managed by the GEBCO Guiding Committee (GGC)’

‘...aiming to provide the most authoritative, publicly-available bathymetry data sets of the world’s oceans.’

‘... largely a voluntary community of international scientists and hydrographers collaborating with the support of their parent organizations.’
SEABED 2030

A collaborative project between The Nippon Foundation and GEBCO 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.
Seabed 2030 Management

Leadership

- The Nippon Foundation
- &
- GEBCO under the auspices of IHO and IOC

Seabed 2030 reports to GEBCO Guiding Committee
The Network of Centers

North Pacific – Arctic Ocean
Stockholm University & University of New Hampshire (SU & UNH)

Southern Ocean
Alfred-Wegener-Institut (AWI)

Atlantic-Indian Ocean
Lamont-Doherty Earth Observatory, Columbia University (CU)

South-West Pacific Ocean
National Institute of Water & Atmospheric Research (NIWA)
Land Information New Zealand (LINZ)
GNS Science (GNS)

Global Center
British Oceanographic Data Centre, National Oceanography Centre (NOC/BODC)
Seabed 2030 Phase 1 Existing Data

- Ingest all available existing data (Y)
- Catalogue embargoed existing data (Y)
- Develop new high-res GEBCO product
- Develop user tools for GEBCO products

GEBCO 2014
30-arc second Grid

$X + Y + Z = 100\%$

Data IN GEBCO
Data NOT in GEBCO
‘Map the Gaps’ = ocean NOT mapped
Seabed 2030 Phase 2: Mapping the Gaps

\[ X + Y + Z = 100\% \]

- **Ocean Frontier Mapping**
  - Use GEBCO Grid to inform location of future mapping
  - Advocate for greater mapping activity
  - Identify funding for mapping expeditions

- **Crowd Sourced Bathymetry**
  - Promoting CSB around the world
  - Gaining support of, and data from, contributors at all levels

- **Technology Innovation**
  - What can Seabed 2030 do to accelerate uptake of technology to accelerate rate of bathymetric mapping?
Why Now?

The need: Ocean under stress

Solutions: innovation

Big Data

Information Technology

The Cloud

IoT

Autonomy

Open Data

UN SDG-14
What we ask of you ......

• **Noting** that

• Some 70% of the Earth covered by the ocean, yet today we have mapped only ~ 15%

• Seabed shape is fundamental not only to safety of navigation but also to many ocean processes that:
  • Drive ocean current circulation, affecting climate & sea level rise predictions.
  • Allow forecasting of tsunami wave propagation & other dynamic phenomena (inc sediment transportation; wave action; & underwater hazards).
  • Allow better understanding of marine habitats, eco-systems and much more
  • Offer opportunities for new discoveries .......

• **Please** .................................
What we ask of you ..........

• Please join us in supporting Seabed 2030 by:

• Promoting the vital need to map the entire seabed

• Encouraging your own organisations and clients to make existing seabed mapping data available for use by Seabed 2030 in the GEBCO Grid
  • Non commercially sensitive/sanitised data if possible
  • Transit data between projects

• Helping us gather Crowd Sourced Bathymetry (CSB) for use by Seabed 2030 in the GEBCO Grid

• Supporting future seabed mapping projects where data can be used by Seabed 2030 in the GEBCO Grid

• Innovating technology that will accelerate seabed mapping
Thank you

Sponsors:

Regional and Global Center hosts:
Connect with Seabed 2030:

https://seabed2030.gebco.net/get_involved/
Industry Role in Seabed 2030

Rear Admiral Shepard M. Smith
National Oceanic and Atmospheric Administration
Mapping the Seafloor

**Multibeam and LIDAR surveys**
by trained hydrographers and other personnel from government, academia, and private sector

**Coastline**
Representing ~0-40 meters water depth, mapping in this area is ideal for aircraft using LIDAR technology and autonomous systems using multibeam sonar technology. Concerns about safe navigation require a high level of data accuracy.

**Shallow water**
Representing ~40-200 meters water depth, mapping this area is ideal for ships using multibeam sonar technology alongside autonomous systems as a force multiplier. Conditions are not usually suitable for aerial survey methods. Concerns about safe navigation require a high level of data accuracy.

**Deep water**
Representing water depths >200 meters, mapping this area is ideal for ships using multibeam sonar technology. Conditions are not suitable for aerial survey methods and navigation safety is not a primary concern in this area.

**Other sources**
- Unmanned aerial vehicles
- Satellite-derived bathymetry
- Sidescan sonar
- Single beam bathymetry
- Crowdsourced bathymetry

**Unmanned**
Difference in survey swath-width distance by depth.
Percent of U.S. Waters Still Unmapped in 2019

U.S. waters 54%

Total Area = 3,592,000 square nautical miles (snm)

57% - 2018
59% - 2017
<table>
<thead>
<tr>
<th>U.S. Waters by Region</th>
<th>Total Area</th>
<th>Total Unmapped Area</th>
<th>Percent of Unmapped Area</th>
<th>Total Shallow Water Area &lt;1000m</th>
<th>Total Unmapped Shallow Water Area &lt;1000m</th>
<th>Total Unmapped Deep Water Area &gt;1000m</th>
<th>Total LNM of Unmapped &lt;1000m</th>
<th>Total LNM of Unmapped &gt;1000m</th>
<th>Total LNM of Unmapped &gt;1000m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atlantic and Gulf of Mexico</td>
<td>472,186</td>
<td>227,600</td>
<td>11%</td>
<td>282,859</td>
<td>32,793</td>
<td>194,807</td>
<td>8,145,822</td>
<td>51,427</td>
<td>8,094,395</td>
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<tr>
<td>Great Lakes</td>
<td>45,639</td>
<td>43,101</td>
<td>2%</td>
<td>45,639</td>
<td>0</td>
<td>43,101</td>
<td>206,912</td>
<td>427</td>
<td>206,485</td>
</tr>
<tr>
<td>Caribbean</td>
<td>61,540</td>
<td>27,254</td>
<td>1%</td>
<td>5,241</td>
<td>26,414</td>
<td>840</td>
<td>19,655</td>
<td>4,676</td>
<td>14,979</td>
</tr>
<tr>
<td>Pacific (WA, OR, CA)</td>
<td>239,705</td>
<td>69,317</td>
<td>3%</td>
<td>39,632</td>
<td>57,926</td>
<td>11,391</td>
<td>264,589</td>
<td>15,076</td>
<td>249,513</td>
</tr>
<tr>
<td>Alaska</td>
<td>1,080,238</td>
<td>789,900</td>
<td>38%</td>
<td>471,850</td>
<td>407,149</td>
<td>382,751</td>
<td>9,092,706</td>
<td>111,538</td>
<td>8,981,168</td>
</tr>
<tr>
<td>Pacific Remote Islands &amp; Hawaii</td>
<td>1,691,726</td>
<td>894,585</td>
<td>44%</td>
<td>19,723</td>
<td>889,702</td>
<td>4,883</td>
<td>292,396</td>
<td>143,861</td>
<td>148,534</td>
</tr>
<tr>
<td></td>
<td>3,591,032</td>
<td>2,051,757</td>
<td>1</td>
<td>864,944</td>
<td>1,413,984</td>
<td>637,773</td>
<td>18,022,081</td>
<td>327,006</td>
<td>17,695,075</td>
</tr>
</tbody>
</table>

**Total Unmapped Area**

- Atlantic and Gulf of Mexico
- Great Lakes
- Caribbean
- Pacific (WA, OR, CA)
- Alaska
- Pacific Remote Islands & Hawaii

**Total LNM of Unmapped**

- Atlantic and Gulf of Mexico
- Great Lakes
- Caribbean
- Pacific (WA, OR, CA)
- Alaska
- Pacific Remote Islands & Hawaii
So...How can we get this done?

• Make use of as much existing data as possible.
• Coordinate standard protocols to ensure new data is suitable and available.
• Design mapping campaigns in the context of gap analysis.
• Use existing mapping capacity (government/military, commercial, academic, and philanthropic fleets).
• Use emerging technology to drive efficiencies.
• And, of course, find the money to pay for it. All money has strings.
Interagency Working Group on Ocean and Coastal Mapping
Working to develop Standard Ocean Mapping Protocol

For broadly applicable mapping:

• Guide data acquisitions and processing
• Encourage widest access to data
• Minimize duplication
• Get data into public archives
• Use national data standards and best practices (GDA 2018)
Affordable, global, low latency, high bandwidth communications

Applications:

- Remote monitoring of autonomous survey vessels
- Remote operation of survey equipment on vessels
- Quality control and data availability in near real time
- NTRIP, Ocean Models, swarm operations

Starlink—built for the land, but has equal capacity over the oceans.
Autonomous Vessels

- Increase Autonomy
- Mission aware
- Reliable and Resilient
- Reduce operator interaction
- Reduce cost
- Increase Range
Artificial Intelligence

We simply cannot scale our current practices without smarter planning, monitoring, and processing algorithms.
Bathymetric Lidar

- Less than 1% of the seafloor can be mapped with lidar.
- However, it is a critical tool for efficient mapping <40m where sonar work is much more difficult.
- Improvements in depth range, resolution, data processing, and seabed characterization are ongoing.
Satellite-derived Bathymetry

- Depth estimates from imagery
- Calibrated by relatively sparse ICE-SAT-2 altimetry
Pulling it all together: The National Bathymetric Source

- Disparate data types, accuracy, and resolution collected over decades
- Sourced from archives, updated daily, compiled at source resolution
- Outputs vary for charting, modeling, visualization, and GIS analysis
Questions?
Thank you for attending!

Please visit [www.mtsociety.org](http://www.mtsociety.org) for more information on upcoming webinars and PLEASE *pre-register!*

Interested in hosting a webinar and/or joining MTS?

Contact Monica Ostrander at [Mostrander@mtociety.org](mailto:Mostrander@mtociety.org)