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Status Report of the Arctic Regional Marine Spatial Data Infrastructures Working Group (ARMSDIWG)

Submitted by:	Chair ARMSDIWG, United States of America
Executive Summary:	This report contains the current status of the ARMSDIWG in its sixth full year of existence. ARMSDIWG awaits approval of key foundational documents, after an expired Work Plan and reassessment of resource capacity, in order to resume operations and understand the way forward as directed by ARHC. Relevant information on related projects and groups is provided in this report.
Related Documents:	*User Survey Report: Better access to geographic data for Arctic marine and ocean areas*
Related Groups/Projects:	Arctic Spatial Data Infrastructure (Arctic SDI) http://arctic-sdi.org/ *Federated Marine SDI* https://www.ogc.org/projects/initiatives/fmsdi

ARMSDIWG Workshops

No meetings to report since ARHC11. ARMSDIWG is still awaiting approval of new Terms of Reference and Work Plan presented to ARHC11.

Commitment from ARHC to be the Marine Component in an Arctic SDI

As mentioned in the ARMSDIWG report to ARHC11, ARMSDIWG's current resources along with their organizational breadth and structure are very limited in capacity and cannot equally mirror that of the Arctic SDI organization nor support operational tasks that may be desired by ARHC, such as the Arctic Voyage Planning Guide (AVPG). ARMSDIWG's previous Terms of Reference (ToR) was not initiated with an operational component, so the last few years of ARMSDIWG interpreting AVPG criteria/requested data, inventorying available datasets, attempting to align data standards and formats between contributing agencies, and deciding on the hosting of a common technology platform offered by some members has been a lengthy process without achieving a prototype stage at the very least. If achieved, the AVPG prototype would have been potential foundation/catalyst to meet other requirements by user groups in the Arctic, such as the Norwegian-led *User Survey Report*, which would respond directly to the needs of the Arctic Council working groups, to include PAME, with whom ARHC has a Memorandum of Understanding (MoU), the main purpose of which is "to enhance coordination on strategies to improve hydrographic data in the Arctic."

If ARHC wants to improve hydrographic data in the Arctic, rather than focus on specific projects, and limiting to their curated views of data, a true federated approach is ideal, where ARHC's Hydrographic Offices (HOs) assess their own data holdings against a list of requirements for *Findable*, *Accessible*, *Interoperable*, and *Reusable* (FAIR Data Principles) data services and provide these services using their own technology resources as modern HOs. Much work has already been done in IHO, OGC, Arctic Council, and ARMSDIWG to understand what data is needed by the broader user base in the Arctic. ARMSDIWG could be the aggregator of these requirements for ARHC HO's to then operationalize and truly become the Marine component to an SDI for the Arctic (ref. *MSDI Aggregated Data Web Service Checklist for the ARHC* as a starting point to account for data available from each HO).

The truth remains that an Arctic user still does not currently have a central or common way to find authoritative Arctic marine spatial data from ARHC's HOs, nor do they have a total set (i.e. gaps in coverage) of usable web services available to them for the majority of themes they've asked for in various studies and surveys.

ARMSDIWG has no authority over the HOs that participate within the working groups; true authority exists at the individual national level of the data producer/provider, which governs the data's "FAIR-ness". It is up to the

data producer/provider to act on the requests of users within the authority that they have been granted by their respective governments to make their data available. ARMSDIWG, at its current capacity, can simply help organize these requests and monitor progress from a collective Arctic HO perspective.

If ARMSDIWG is meant to provide technology, and resources to operationalize data from the collective of Arctic HOs, then significant technology, time and personnel resources must be allocated, and HOs must take additional responsibilities for components of the required technology (e.g., storage, hosting, content curation, software development/configuration).

It appears that without a stronger level of commitment from the HOs within ARHC, ARMSDIWG will not be able to facilitate the participating HOs, as a collective, providing the Marine component to an SDI in the Arctic Region.

With this report, ARMSDIWG has provided again, their updated ToR and aligned Work Plan given their current capacity and resources for ARHC consideration. If approved, the Work Plan has been designed to internally assign volunteer leads from ARMSDIWG to each of the Work Plan Tasks for efficient tracking and execution of overall Tasks.

However, if ARHC wishes to truly be the facilitator of the Marine component to an Arctic SDI, it recommended that a commitment on the level of a Memorandum of Understanding (MoU) should be considered. Additionally, ARHC MS would need to be assigned responsibility for leading aspects of the Arctic MSDI in a similar model to the National Mapping Agencies of the Arctic SDI organization, where national leads are responsible for specific functions/activities: Strategy, Communication and Value Creation, Operational Policies, Technical, Cloud & Cascading Service, Geoportal, Data.

At this point in time, there still exists a window of opportunity for the HOs of ARHC to be the authorities on the Marine component to an Arctic SDI, as they should, given their authority as HOs within their respective nations. However, without both the existing coordination (i.e. ARMSDIWG) coupled with the potential ownership stake in ensuring requested hydrographic data is provided to Arctic users by the HO, the users will continue to rely on other data and data providers as they already have begun to do.

Federated MSDI-Pilot

The Federated Marine Spatial Data Infrastructure (FMSDI) Pilot is an OGC Innovation Program initiative with the objective to enhance Marine Spatial Data Infrastructures (MSDIs), to better understand MSDI maturity and demonstrate the power of FAIR (Findable, Accessible, Interoperable, Reusable) data in the context of the marine environment.

This pilot directly responds to the recommendations from the OGC-IHO MSDI Concept Development Study (CDS) and is evidenced by the success of the OGC-IHO collaboration in the OGC-IHO Maritime Limits and Boundaries Pilot to initiate a full-scale Pilot to demonstrate a multi-country, federated MSDI under land/sea interface use-cases. This pilot further builds on OGC Arctic Spatial Data Infrastructure Pilot results.

Phase one of the FMSDI Pilot was the Marine Data Availability and Accessibility Study (MDAAS). The second, already completed phase, was to further advance the interoperability and usage of Marine Protected Area (MPA) data by implementing the IHO standard S-122 and several OGC API standards. The results of these two phases are demonstrated in the "Towards a Federated Marine SDI: IHO and OGC Standards Applied to Maine Protected Area Data" Engineering Report.

The third phase, supported by United States (NGA), started in JUL 2022, focuses on land/sea use cases and extends the use cases developed in the second phase to add the Arctic region as a new location to the demonstration scenarios. Phase 3 will advance the implementation of open data standards, architecture, and prototypes for use with the creation, management, integration, dissemination, and onward use of marine and terrestrial data services for the Arctic. This phase includes an overarching, sea-based health and safety scenario incorporating the land/sea interface in the Arctic. The scenario will demonstrate the technology and data used with OGC, IHO, and other community standards in response to a grounding event and the

evacuation of a cruise ship or research vessel in the Arctic. Incorporating the Arctic Voyage Planning Guide (AVPG) will also be an important part of the Phase 3 use case

Currently, all sub-scenarios are still being reviewed to include all stakeholders, use of interoperable technologies (e.g., OGCAPIFeatures/Coverages/Styles, OGCCatalog, OGCSensorThings API (IoT), OGCWMX (WMS, WMTS)), data and platform, use of the AVPG themes, and architecture wiring diagram & storyboarding. In particular, OGC DGGS API implementation is being explored to leverage the Arctic use case data integration using an equal area Discrete Global Grid System. Additionally, the drafting of the Engineering Report for this phase has been initiated.

In lieu of an expired Work Plan and awaiting approval of the new Work Plan and future direction, all ARMSDIWG participating HOs have been invited by OGC to participate as observers in Phase 3 of the FMSDI Pilot with the intention of exploring the AVPG in a use case in the Arctic among other activities. While the use case will be focused off the United States coast and use primarily United States and international data, the hope is that the study can be shaped by ARHC HO participation, and include considerations and re-applications beyond the United States.

Phase 3 is planned to conclude in DEC 2022 with full results of the Pilot becoming available around that time.

Figure 1: Open Geospatial Consortium (OGC) FMSDI Pilot Timeline (source: https://www.ogc.org/projects/initiatives/fmsdi)

Cooperation with Arctic SDI

At the time of this report, the Arctic SDI is pausing all official meetings until further notice.

Invited Actions of ARHC

The ARHC members are invited to:

- Take note of the report.
- Consider mechanisms (such as an MoU) for stronger commitment to the HOs of ARHC to become the authoritative facilitators of the Marine component to an Arctic SDI.
- Review, discuss, and/or approve the updated ARMSDIWG ToR (provided under separate cover).
- Review, discuss, and/or approve the ARMSDIWG Work Plan 2021-2026 (provided under separate cover).
- Take action as seen appropriate.