CHS Workforce of the Future Report

May 2023

Report compiled by Dr. Sonja Bhatia, Dr. Geneviève Béchard, and Elizabeth Bonner

Acknowledgements

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Overview of the May 2023 CHS Workforce of the Future Regional Engagement Sessions

The global digital transformation underway in hydrography requires hydrographic offices to adapt to meet new international standards and changing user needs. In that vein, the Canadian Hydrographic Service (CHS) initiated the CHS *Workforce of the Future*[6] project. Directors in each region held regional engagement sessions in which they asked members of their workforce to consider the evolving role of CHS in the data value chain and the skillsets the organization's workforce would need as digitalization progressed. Held in May 2023, the sessions were guided by themes that emerged from an International Hydrographer of the Future Workshop hosted by CHS the previous year (Foroutan *et al.* 2022 a and b). The perspectives that were heard from the CHS engagements sessions are shared in this report. Analysis from this exercise will inform the CHS Human Resources and Training Plans to be developed in 2024.

Structure of Engagement Sessions

CHS hosted *CHS Workforce of the Future CHS Workforce of the Future* regional engagement sessions in each of its five regions: Pacific, Ontario Prairie and Arctic, Ottawa, Quebec, and Atlantic. Participants were invited to provide responses to questions from the following themes:

I. The Future Role of Hydrography;
II. The Changing Technological Context; and
III. People, Skills, and Organizational Culture

The two hour in-person meetings were made up of a brief regional introduction, followed by three breakout groups of not less than five and not more than 12 people. Questions posed included (Annex A):

How do you envision the future of hydrography? How do you envision it at CHS?
How do you see user needs evolving?
What skillsets do you see CHS looking for in future recruitment campaigns?

[6] The engagement *CHS Workforce of the Future* instead of *Hydrographer of the Future* encourage participation from all employees at CHS, not just those identifying as traditional hydrographers.

Outcome of the Engagement Session

The engagement sessions were well attended and garnered some insightful and future-looking discussions, with common themes emerging around data and project management, research and innovation, artificial intelligence and technologies of the future.

Still, as one might expect in an organization with many regional offices--and in a country as geographically, culturally, and linguistically diverse as Canada--at times, divergent opinions emerged during the regional conversations. This diversity is an organizational strength that allowed for a fruitful exchange of ideas.

Table 1 highlights common themes and key insights, while still capturing the diversity of perspectives that were shared by staff.

Table 1. Summary of what was heard in the May 2023 CHS engagement sessions held in the five CHS Regions (Pacific, National Capital, Ontario, Prairie and Arctic, Quebec, and Atlantic Regions)

Evolving Role of Hydrography	***Cultural Evolution***	***Changing Operational Requirements***	***Technological Advances & Needs***	***Client and Stakeholder Needs***
-Future is uncertain and change is inevitable -Non-navigational uses (supported by IHO) -S-100 standards -Interoperable, automated data delivery -Client-driven; may need to evolve to ocean mapping -Explore pros and cons of moving CHS out of Science and into Canadian Coast Guard -Widespread data dissemination; accessible data; real-time data delivery -Longer ships; less room for error -Hydrographic offices place in the value chain: receive and validate data, then distribute to end-user	-Flexibility in long-term planning to adapt to new advances -Openness to innovation -Improved transparent, two-way communication underpins success of digital transformation -Divergent views of CHS as both a leader and lagging behind -Don't lose sight of core mandate and bread and butter work of hydrography; balance innovation and core activities -Organizational change is fast-paced -Probationary period of PDAP may limit employees' willingness to provide feedback to management -Mindset of continuous updates	-More financial resources and evolving HR needs -Increased need for data management and validation -Project management mindset -In-house scripts and automated processes -Arctic hydrography focus due to climate change -Increased data collection, but bottleneck is in processing and cartography; more emphasis on cartography -More centralization/intra-regional collaboration to avoid redundancy -May need more contracting for technology we don't have in-house -Human judgement in conjunction with machine learning – will need to decide balance and trusted information -Simplified licensing system and business model -R&D teams can develop recipe-style approaches to be adopted by rest of organization -Defining authoritative datasets from sources external to CHS; need to manage and communicate uncertainty -Processes to avoid systematic error, especially as we automate -Consider ping-to-chart style teams	-Improved database structure; databases that talk to each other and are interrelated, system integration, and access to IT infrastructure -Improved metadata and version control (CHSDir) -Software evolving rapidly -Automation and AI – bring efficiencies, but also more work during transition -Will continue to need CARIS Software -Need to improve use and understanding of satellite imagery -More autonomous and uncrewed Surface Vessels – accuracy may need to improve; opportunity for continuous surveying -Data self-service -LIDAR -New communication tools: tide gauges, satellite, and data distribution methods; need improved connectivity in the Arctic -SharePoint and other sharing software -Use of the cloud – data storage is expensive -Digital twin -CSB with effective application of CATZOC to fill gaps in data-limited areas (e.g. Arctic)	- S-100 facilitates innovation and partnership. Example is Coastguard development of an S-201 (Aids to Navigation) service; so does MSDI -Stronger connections to stakeholders via networking and outreach (e.g. industry, academia, First Nations) -Increasing non-navigational users; need to understand who they are -Non-SOLAS vessels (e.g. sailors, fishers) -More partnerships (intra governmental and outside) – critical to implementing true enterprise solutions -International community and IHO, coordination with US -As user base expands, consult with end-user prior to data collection; e.g. LIDAR could have partnered to achieve broader data collection to support OGD -Facilitate more contact with users so that working level have better understanding of needs and so that working level can understand the importance of our work and take pride in it -Time on ship; understand how our mariners use our products -Ensure all employees aware of the work of regional/national industry groups to foster awareness of these groups' activities

<table>
<tr><th>Workforce Composition and Disciplines</th><th colspan="2">Future Competencies</th><th>Training</th><th>Recruitment</th><th>Retention</th></tr>
<tr><td rowspan="6">-More diverse workforce needed
-Dedicated technical specialists (keep a list for consultation)
-Partnerships between hydrographers and computational experts
-Dedicated R&D teams that can stay connected to changes in private sector
-Hydrographers
-Oceanography, GIS, geodesy, data science, engineering, acoustic theory backgrounds, and in-house IT to support development of new products and tools
-Electronic and tidal technicians (currently regional differences)
-Data managers and validators
-Increasing need for specialization – multidisciplinary becoming obsolete; see more roles for specialized hydrographers</td><td>Technical Competencies</td><td>Functional/Interpersonal Competencies</td><td rowspan="6">-Instructors need to be up-to-date in rapidly changing technological context
-Training modules that provide the theoretical (the why, not just the how) context with expanded availability to all staff as needed (evergreen)
-Time and financial support
-Knowledge transfer/ mentorship
-More exposure to fieldwork
-PDAP limits employees to being task oriented; not innovative, future thinkers
-Data management
-Contract/project management
-PDAP is viewed by many as obsolete and others as an integral part of CHS’ future
-In-person training desired
-Survey hardware training
-S-100 training</td><td rowspan="6">-Promote hydrography as a discipline; More innovation in recruitment for diversity (promote CHS outside of usual places)/increase awareness down to elementary and high school levels
-Recruit for computation skills and train in-house where interest or background allow
-Oceanography background for modeling and dynamic products
-PC-level leaders; difficulty staffing PC roles
-Recruit more technical and scientific support
-Recruit data managers
-Project managers
-While still a valued skillset, don’t limit to just Cat A/Cat B
-Hire more students</td><td rowspan="6">-Career path for technical roles (e.g. ENSUR 2, PC, EG06, other)
-Shorten PDAP program or probationary period
-Mental health and work-life balance
-Improved connection with colleagues
-Communicate the importance of the work we do
-Listen to employees’ needs
-Hybrid and flexible work
-Competitive pay
-Employee recognition
-Match skills and interest to position
-Foster an inclusive and diverse workplace</td></tr>
<tr><td colspan="2">Working Level</td></tr>
<tr><td>-Coding
-AI and machine learning
-Technically inclined/ interest in technology/ technical knowledge
-Tinkering/building/ expertise in instrumentation
-Scientific/engineering/ research and development
-Theoretical knowledge
-Hydrographic knowledge</td><td>- Communications skills
- Ability to network and build partnerships with other government departments and the private sector
- Lifelong learner
- Agile, nimble, open-minded
- Creative/innovative and able to identify and fill organizational needs identify a need
-Critical thinking</td></tr>
<tr><td colspan="2">Leadership</td></tr>
<tr><td>-Technical expertise</td><td>-Empathetic leadership
-Transparent Communicator
-Mobilize People
-Foster innovation
-Change manager
-Partnership builder</td></tr>
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Conclusion

Hydrography is a dynamic discipline with an exciting future. Innovation in S-100 products and services requires a diverse workforce, efficient data management, and centralized digital components. Project management, communication, and proactive planning are essential for success. A strong understanding of user needs and a willingness to adapt will ensure continued credibility. Increased demand for hydrographic products and services will contribute to a need for resource prioritization during a time of fiscal restraint. A concrete plan for adapting to change is essential for hydrographic offices to keep pace with rapid advancements in technology and so CHS is in the process of developing Human Resources and Training plans with medium-to-long-term outlooks.

References

Foroutan, M., Bhatia, S., Béchard, G. (2022a). CHS Hydrographer of the Future Workshop Report, April 2022.

Foroutan, M., Bhatia, S., Béchard, G. (2022b). THE HYDROGRAPHER OF THE FUTURE — Reflections on an International Virtual Workshop. International Hydrographic Review (28), 172-180 (2022). https://doi.org/10.58440/ihr-28-n12

Annex A
CHS Workforce of the Future Engagement Sessions Suggested Questions

Session 1 Theme: The Future of Hydrography

- *How do you envision the future of hydrography? How do you envision it at CHS?*
- *What do you think the composition of our user-base will be 5 years from now? 10 years from now?*
- *How do you see user needs evolving?*
- *How do you see CHS' role evolving?*
- *How can we foster innovation at CHS?*
- *How does this impact you and your role? What supports/training/information do you need?*

Session 2 Theme: Changing Technological Context

- *How do you envision the future of hydrography? How do you envision it at CHS?*
- *We have been digitalizing for some time, but we are moving towards a digital twin and where everything is online 'the internet of things', and real-time data delivery. How do you see these changes impacting CHS?*
- *Strengths/Limitations of these new technologies and capabilities (USV, AI, supercomputers, modeling)?*
- *How should we at CHS define authoritative data? What role do you see for crowd sourced bathymetry?*
- *As we move to S-100 services, how do we define what is authoritative? And what is the role for CHS?*
- *At what point in the data chain should CHS hand off our data? What level of control should we maintain over CHS data?*
- *How do all of these changes impact you? Your work? What supports/training/information do you need to adapt to these changes?*
- *What partnerships do we need to innovate?*

Session 3 Theme: People Skills and Organizational Culture

- *How do you envision the future of hydrography? How do you envision it at CHS? How does this impact you? Your role?*
- *Do you see competencies needed at CHS evolving over time?*

- *Do you feel you will be supported as required competencies evolve? What supports do you need as competencies evolve?*
- *How can we support career progression for our staff?*
- *What skillsets do you see CHS looking for in future recruitment campaigns? What role do you see for students?*
- *How can CHS attract and retain employees with the skillsets we need in an increasingly global marketplace?*