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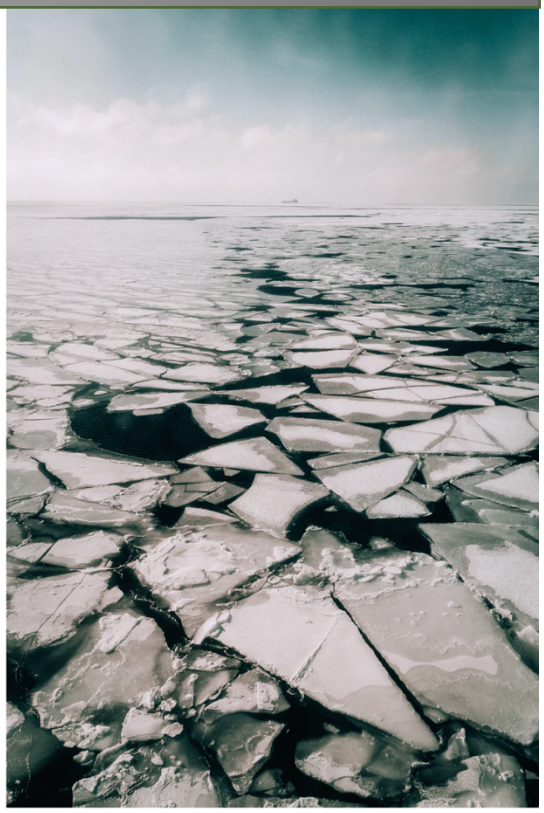
ARCSAR
Arctic and North Atlantic Security and Emergency Preparedness Network

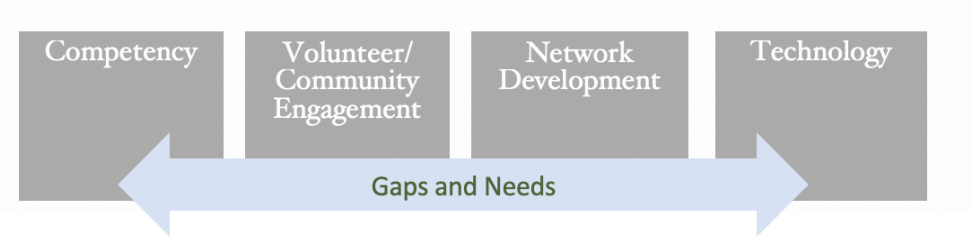
ARCSAR Policy Paper #4: July 2020

Needs for Technology and Innovation in the Arctic and North Atlantic



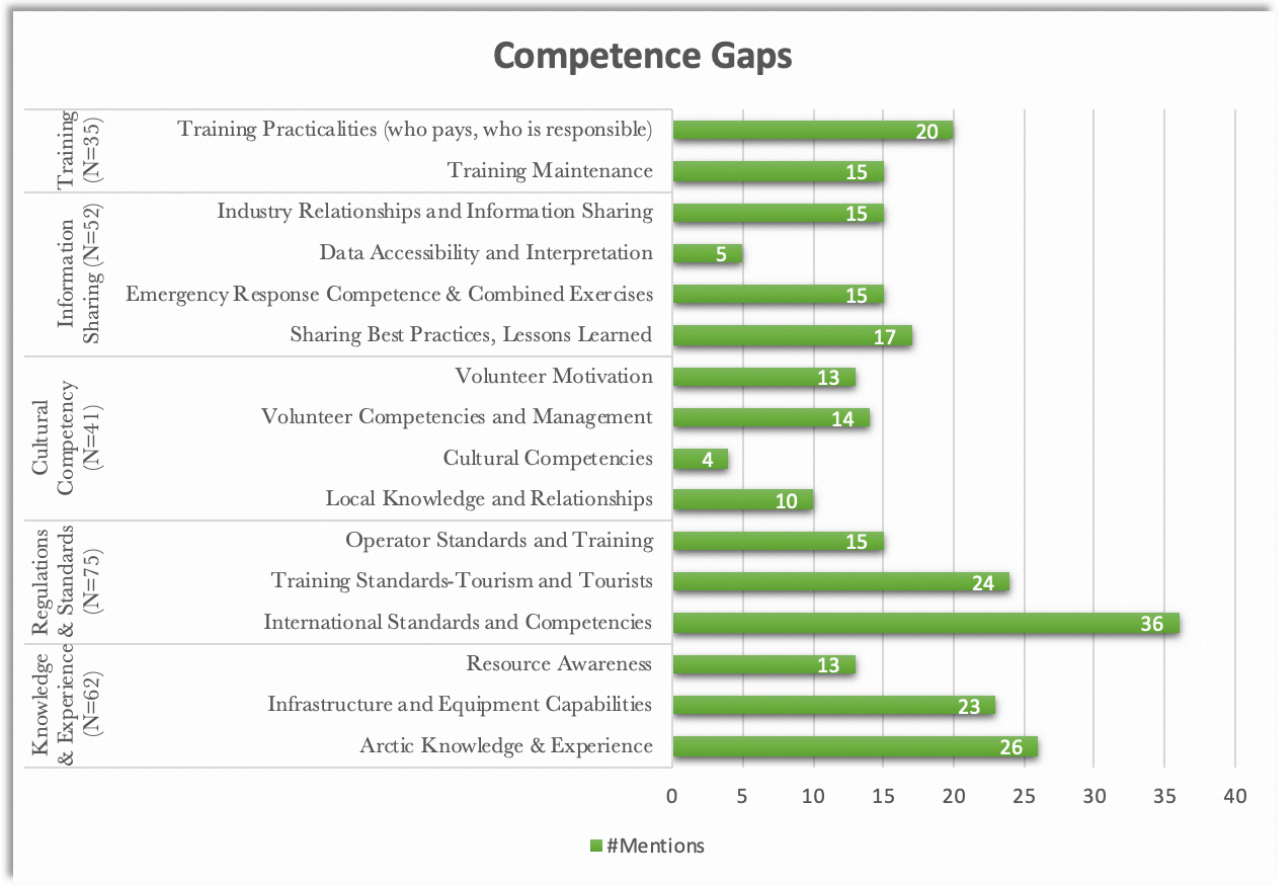
The Arctic and North Atlantic Security and Emergency Preparedness Network (ARCSAR) commenced project operations in 2018 with the express purpose of supporting practitioners involved in security and emergency response in the ANA region. By bringing together first responders, researchers, industry, and those involved in governance and policymaking, ARCSAR's mission is to establish international best practices and innovation platforms for security and emergency response institutions in the Arctic and North Atlantic. This project, which is funded through the EU Framework Programme for Research and Innovation Horizon2020, is working to develop solutions to security and safety threats which stem from increased commercial activity in the region, including increased traffic through the Northern passages, cruise traffic, and offshore oil and gas activity.

In October 2019, ARCSAR network members met for a *Workshop on Innovative Emergency Response Solutions, Training and Knowledge Sharing* in Reykjavik, Iceland. Participants represented a wide variety of Arctic North Atlantic stakeholders including industry, rescue responders, university and educational institutions, local communities and volunteer organizations. A roundtable discussion format was utilized to assess gaps in four thematic areas including technology, volunteer and community engagement, competence and network development.[1] Table discussions were recorded, and later transcribed and analyzed, to assess common themes and issues, which emerged both between and within each area/question.[2] Overall, there was sufficient overlap in responses to indicate a high level of agreement regarding the current set of needs in the ANA region.[3]



Competence Gaps

Participants were asked to consider the gaps and challenges of competence development in the ANA region. Perhaps unsurprisingly, the most common response concerned training for the various stakeholders in the region. However, the strongest preferences emerged for the development of international standards, which participants felt were needed in order to provide clarity and establish greater proficiencies for operators in the area. This was supported by the next most common response, which involved the additional knowledge and awareness required to operate safely in the Arctic, especially in light of limitations in infrastructure and equipment which characterizes the region. Especially important was the development of training standards for the tourism industry, and standards for new operators in the area, which was also a consistent topic of discussion. However, participants also discussed the difficulties stemming from the more practical aspects of training implementation, including how to motivate others to participate in training, and determining who holds responsibility for training.



** (Unit of measurement is number of times issue was mentioned. This should not be confused for number of people mentioning a particular issue.)*

Training

Notable comments that capture some of the themes concerning training include:

- *"We lack the transfer of experience and knowledge from the old tourist guides, expedition leaders and so on to the new ones. Because there are too many new ones coming in, so they don't have this geo- site specific knowledge that is needed, Arctic knowledge.*
- *"I'd say competence development is taking somebody from zero to trained effective strength, but also allowing for the continued training that is required to maintain that competence."*
- *"Because as it is in Norway now, there is no rules in the tourism, there is no question about qualification for guides, for the companies, of course we have the Norwegian law who tell about the cars, the boats, which license. But for a guide company, there is no special rules about the guide qualification.[…]So that would be really nice to have something told from the government that this is the level you should have before you start sending tourists out in the nature."*
- *"The problem for my company is we have guides from this winter from more than 10 different countries and it's 10 different educations. Most of our guides that have been guiding in either Alaska, Iceland, or Finland before, because it's a type of people who search for cold area. So it would be nice to have a same type of education for people who do diving in Arctic. Then if I employ a guide who has been on Iceland before, then I know that this person has an education fitted for Northern part of Norway as well."*

However not all responses highlighted problems in the area. For example, when discussing the importance of training, the practice in Svalbard could serve as a standard or best practice in the region:

- *"I have a comment about what we do in Longyearbyen and Svalbard. Continuously, we train the locals, being all the students in the university in Svalbard, and also all the Red Cross members. Every year we go through a complete set of how to bring down helicopters and how to contact us and how to do an alarm if you need it, et cetera. It's an expanded, what we call in the aviation industry, crew resource management. But this, we included with the community resource management. So, we tried to bring all the resources that are out there into the system of a rescue that's available in Svalbard. So that's actually going out there and reaching out to go to the university and on the big screen, and they get all the students in there and tell them about the services and everything and how they're supposed to deal with us if they need us. And also to have a demonstration outside the university on the field. The same for all the guides. Every guide that comes to Svalbard we try to do this with. Some of them are of course coming with cruise ships and we don't meet them before they get there, but all the local guides we try to do this with. So, depending on what kind of organization you come from, but we offer it to everybody into the kindergarten. And we promote it to the city several times a year, through the governor of Svalbard."*

With regard to more specific competencies needed for those operating in the area, participants included awareness of specialized equipment, limitations of current

technology and the importance of experience in navigating hazardous Arctic conditions. Additional knowledge pertaining to how to best include local communities in the rescue response, and coordination across Arctic states was also deemed essential.

- *"There's not enough [training], you go and get your certificate, sail up to the Arctic without actually having been there before, and that's when you start learning."*
- *"One of the challenge is we are getting the vessels up but not with crews but they're not familiar with the weather systems, with the cold and they do not have the local experience and knowledge. And actually, we are lacking the competence when we had these vessels operating in our waters."*
- *"You have the trained volunteers and people that like to be out in nature, climbing …we want them into the rescue service, because they know the area."*
- *"[With regard to competencies needed to work together] You've got language, […].but then there's the operating procedures. Professional style, […] equipment because you can have equipment that's not compatible. Metric versus standard.[…] And even SOP you're talking at different ICS, like incident command structures, right?*

Information Sharing

Increased coordination between Arctic states could also lead to easier and more efficient information sharing in order to establish best practices and share lessons learned. Other needed improvements in this area included making data shareable and more accessible to a variety of stakeholders. Finally, participants also advocated for the creation of a database or platform where rescue personnel could find local resources and assets in times of an emergency.

Cultural Competencies

The last category which emerged from responses to this question was a need for increased cultural competence in the region. These desired competencies ranged from appreciating and accommodating differences in language and culture between Arctic states, to increasing respect for local and traditional knowledge, and exercising care when interacting with local populations. One participant in particular captured the inherent difficulty in establishing a set of best practices that could work for all Arctic states.

- *"I think an interesting question with regards to best practice and making people competent to operate in this area is you're looking for a best practice, but you're looking at states across the Arctic that have very different traditions, languages, cultures, etc. How do you handle this heterogeneity within what you want to make as best practice? Because I suspect that best practice for Alaska is going to look different than best practices for the North of Norway, and it's going to look different to best practice in Finland. So, if you're going to define one set of best practices, how? And if you're not, what you're going to have as the principles that allow you to develop different and interacting best practices?"*

However, participants also mentioned other types of culture as well, in the form of operational culture and differences in working philosophy between operators and industry. As an example, when discussing information sharing, one industry representative noted that in her domain, specialized knowledge and best practices are seen as proprietary, and therefore less likely to be shared; unlike practitioner and operator best practices that once established, can and should be widely disseminated in the region.

Participants in another group noted the importance of coordination between industry and end users of products and new technology. Discussing the *Viking Sky* incident, one operator considered how technology could actually impair safe ship operations.

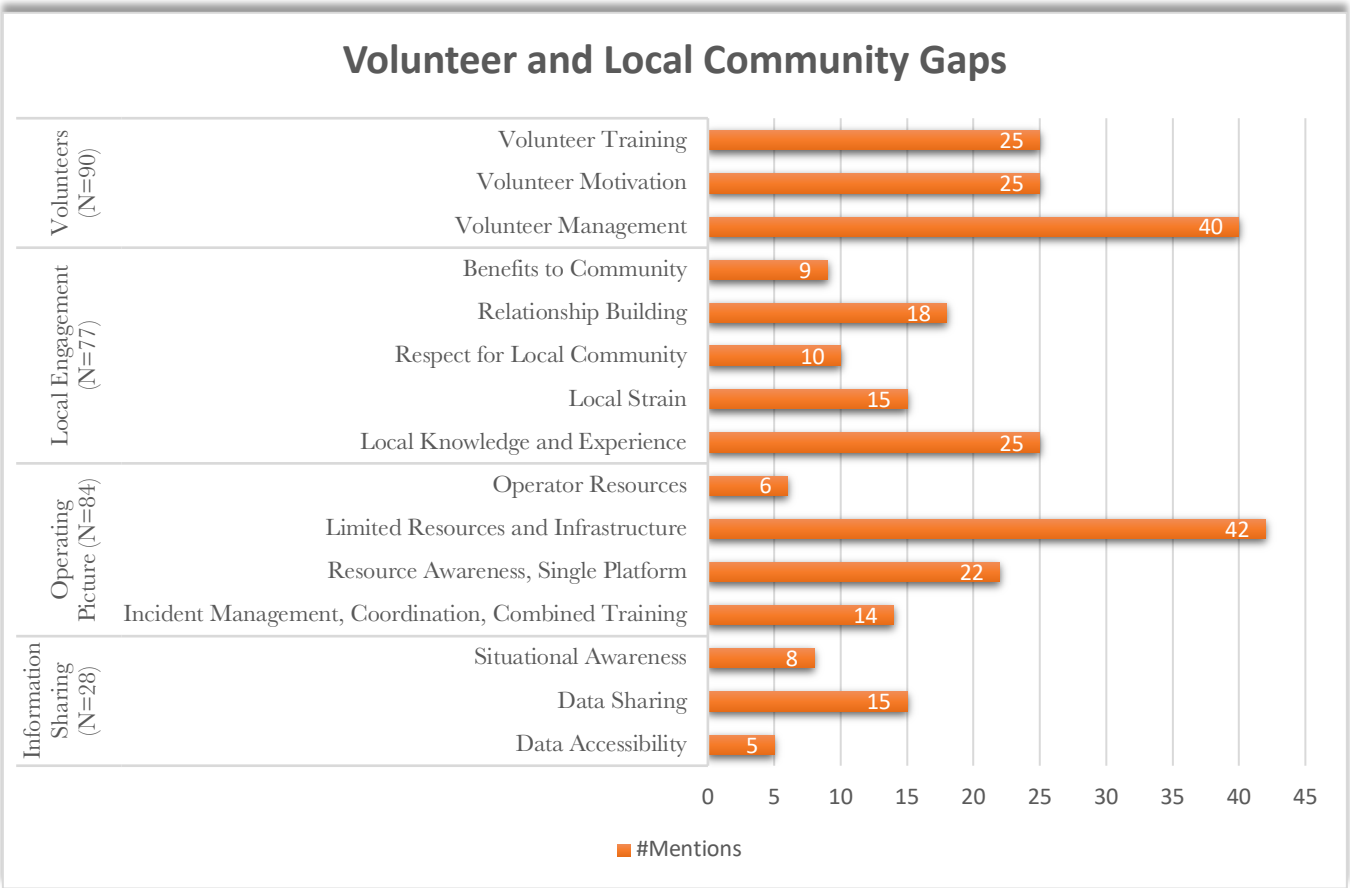
- *"We have been sailing these routes for years and as long as we can trust the ship, [there] should not be any problem. But I think the regulators need to go in and stand against commercial pressure in a higher degree, like with the Boeing 737 Max, you know, where they said, 'Let's get it out there, get it out there,' and there's some serious design flaw with it. The same with this system that there's no override button. […] The problem was that somebody had put into the computer that the computer could overrule the people on board. This was completely different for what they was[sic]trained for, for what they was using normally because then they always have a overrule button. We have to make sure that the modern technology that we accept on board is actually working together with the safety thinking. Meaning that somebody should have an opportunity of overruling it."*

Incidents like these also point to the importance of training maintenance and ensuring that operators and emergency responders are familiar with, and have some say over, new technologies that are being developed. In these ways, our participants clearly felt that industry had an important role to play as partners in shaping safety and security response protocols in the ANA region.

Finally, the importance of working together in face to face exercises was stressed. One proposed innovation was to conduct workshops immediately after actual incidents occur, providing members with the opportunity to work through incident responses and lessons learned. Participants felt that this would add additional value to the current practice of conducting workshops on fictional incidents. Putting lessons learned at the center of the discussion, with both those involved in the incident, but also other relevant stakeholders as well, would allow responders the opportunity learn from the event, but also improve coordination by providing insight into how each system approaches potential problems.

Volunteer and Community Development

An additional prompt asked of workshop participants was, "What is the best solution that you bring to the table to assist a voluntary organization or a local community in search and rescue." Responses to this prompt generally fell into four categories, centering on volunteers, the importance of local engagement, the importance of local communities in operations, and information sharing.



Again, unsurprisingly, the most common response centered around the importance of local communities to safety and security response operations, especially in light of limitations in infrastructure and resources. As has been said in many other venues, ANA safety and security is impossible without help from local communities. The largest problems reported here involved difficulties in knowing what resources exist or were available in these communities, making management of incidents from afar much more difficult.

Volunteer Management

The vast distances which are characterized in the ANA region mean that volunteers and local communities become the likely first responders when an incident occurs. But as crucial and beneficial as volunteers and communities are to emergency response in the Arctic, so too is the importance of proper engagement and management, to ensure that volunteers are capable of responding and do not become part of the problem. For our participants, setting expectations and parameters was considered paramount, to avoid problems that may arise from spontaneous or untrained volunteers responding to an incident.

- *"They have their own boats, but we have our own within the coastguard with about 4,000 volunteers and we find the standard varies hugely depending on how well they're managed locally, so if clear parameters aren't set, they'll continually overstep their role and then they get into kind of dangerous behaviors, dangerous actions. They'll accept responsibility that they shouldn't, that isn't theirs."*
- *"When you're working with volunteers, you need to manage expectations from the very beginning and set parameters from the very beginning, otherwise, it can be absolute chaos and you can actually, end up with a worse situation than you started with."*

However, a number of participants also noted the importance of striking the proper balance when it comes to volunteer management. Over management of volunteers may cause them to quit, whereas undermanagement may lead to a greater potential for incident escalation or volunteers becoming part of the problem.

- *"If you try and regulate them too much and over manage them, they just leave. Because it stops being fun. They are volunteers after all."*

Yet other participants were quick to note that volunteers and local communities do not always need to be managed, as they often have more knowledge and awareness than professionals.

- *"I'm not sure if it's a benefit or a challenge, but three years ago, we started to make common training and workshops with our professional rescue, and many of our volunteer rescue. We bring them together in trainings, and bring them together in workshops, and meetings. The funniest thing is that the professionals, it's a bad word, but I say the professionals learn more from the volunteers, than the volunteers from professionals."*
- *"But I was thinking about this, if you look at this Viking sky accident. You have a local community that just started to do something, and 'I can make some foods,' and started to make foods [sic]. And someone else will say, I can do that, and they started to do that, and it worked. But there were no plan for it, it just start working. And that's an important thing to remember, that if something big happened there is a local community that they would start working anyway."*

Situational Awareness

Volunteers and local community members are also deemed essential in their contribution to situational awareness, thereby increasing the efficiency of the emergency response function. By providing information as to the exact nature of the incident, responders can know better what resources are needed and respond accordingly.

- *"For oil spill response, a local villager can take their phone down to the shore and almost FaceTime back to our rescue coordination center in Alaska. It's better than just saying, 'Oh, we've got watermelon or cantaloupe-sized stones with thick oily tar on it.' Now you can actually see. So do I send a boom, do I send steam cleaners? […] The people making the decisions can actually see what kind of equipment that may need to be deployed in order to minimize the impact to the environment."*

Technology could also be useful for the development of incident management solutions. While some states report utilizing technology to assist with incident management (e.g., Arctic ERMA, Common Resource Register), others reported a desire to have greater access to these types of technology, or to have greater integration of these technologies into existing equipment.

- *"Yeah, we have a webpage which we call SAR-I and so every challenge that we put into this webpage and then we have an app so we can run through what the rescuers doing, what IceSAR is doing, what Coast Guard is doing."*
- *"So, in the United States we use the Incident Command System and that has helped us with self-deployers, and it helps from span of control, so coordination as well."*
- *"I would have liked to see that on your radio you could have a window, you could scroll down like a webpage with all information, so you don't have to repeat it to each and every one. They could just scroll down. What's going on, who's doing what."*
- *"Need a database where you can see the capacities that different countries have, need an overview of what is available if there is an incident."*

On the other hand, technological solutions to incident management and situational awareness require adequate resources to communicate with emergency responders, and a number of respondents noted the lack of consistent communications coverage and bandwidth in the ANA region, indicating that these solutions are not as reliable as they might otherwise be.

Establishing Relationships

Finally, the importance of local engagement was a consistent theme in responses to this question, with implications and suggestions for a number of stakeholders, including volunteers, government officials, policy makers and tourism operators. Establishing cultural competencies that respect local traditions was also seen as important.

- *"I was just thinking about what I've heard in this and other places recently, about not overwhelming communities, establishing systems for talking to communities. If a cruise ship for example, is going to go and visit this is actually from the Canadian and American Arctic, is going to visit a town, and these people maybe think it's a bit weird, everybody looking in their windows, and these channels of communication seem to be something that everybody's telling me is really important."*
- *"I think it should be taken into account in policy making that the regional-level decision makers will let the population know that you need to provide help in an emergency case. According to the Samaritan law, that you need to help if someone is in need of help, so that it would not feel like a burden or surprise for the local population."*
- *"I think that it can be a problem, especially if it's coming tourist companies from abroad, but also for local companies if we just do our operation without adapting to the local traditions and so on, then it's hard to explain to local people to join a rescue operation because we bring in tourists, use the nature."*

Our participants also emphasized the importance of building effective relationships with local communities before incidents occur. This can include strategies to reduce the strain that is placed on these communities by increased tourism, and concern for the emotional distress experienced by volunteer responders.

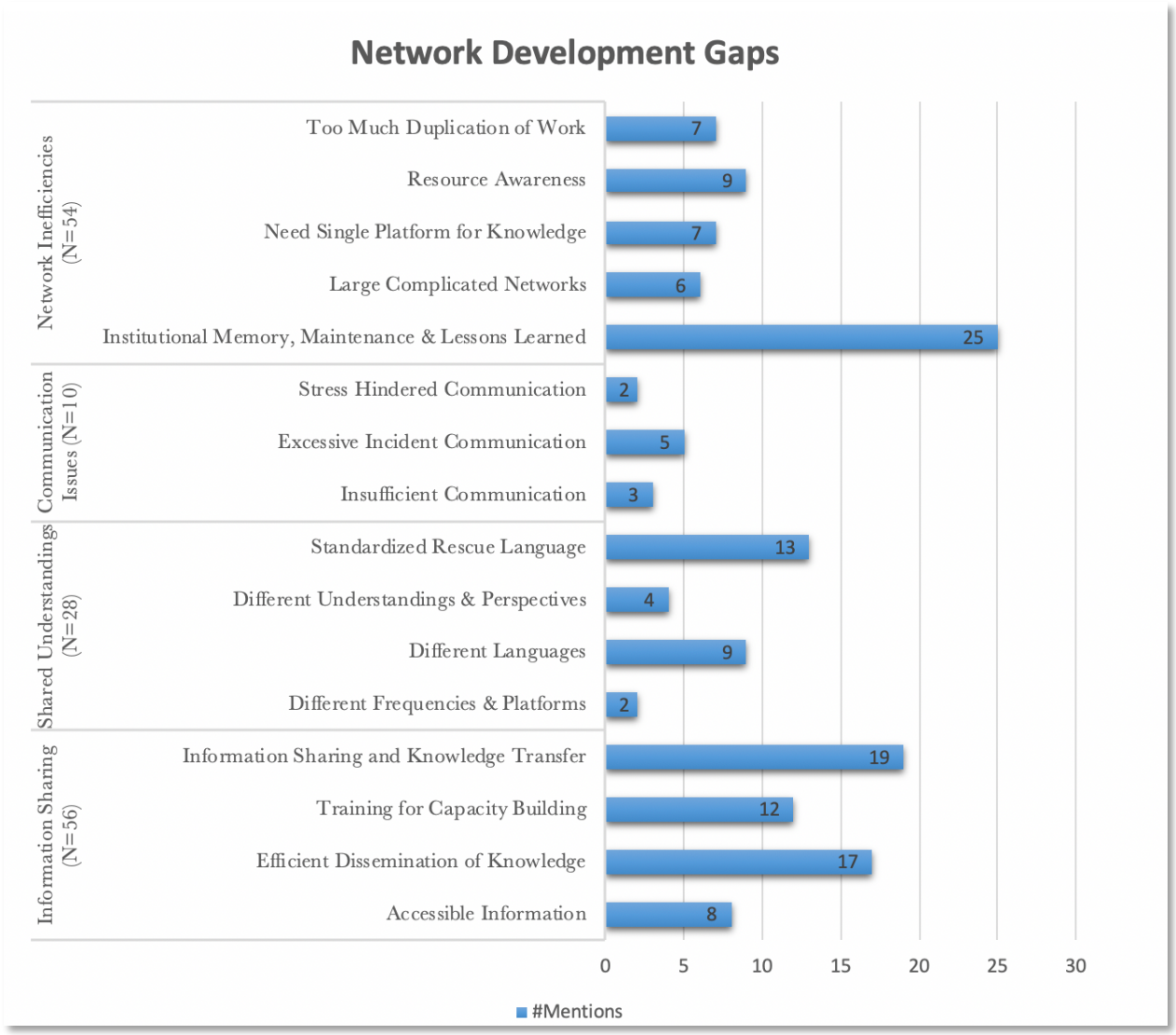
- *"I live the area where we have a tourist attraction in Norway called Trolltunga and it's increased in a few years from, nobody was going there until 120, 130 thousand people. […] But what we have experienced is that the volunteers are actually worn out. So, at one point they refused to assist because people have been on their fifth rescue operation in two days and we don't have much technical stuff in these areas, so they have been walking on their feet. So, they were just totally in fatigue."*
- *"[We have to worry about] Post traumatic stress, that's on volunteer responders."*

Innovations and best practices that were mentioned in this area largely had to do with combined training activities and exercises between locals and first responders. Participants also stressed the importance of identifying how training could benefit local communities, and increase resources and opportunities available to them, which in turn also facilitates relationship building.

- *"Yeah, I see something baseline to all of these actions that can be to improve the engagement with local communities, otherwise you won't see any volunteers doing anything. […] So, if they don't know what we are doing there or what a tour operator is doing there on or all the benefits that they will have from that, they will never engage. And you won't get any volunteer to rescue or help to anybody else."*
- *"I also want to acknowledge that the local community, in this kind of training, a wider perspective, because you give them training in first aid. That gives a bigger help for the society, even if it's not SAR. Thing is might be in another accident [sic]. It's more person in the community who knew how to rescue."*
- *"Building local empowerment."*

Network Development and Cooperation

Participants were asked about how to best develop the safety and security network in the ANA region. Responses to this question fell into four thematic areas: network inefficiencies, difficulties with communication, a need for increased understanding and shared perspectives, and information sharing.



The most prominent concerns centered around information sharing, which included both recommendations for joint exercises and training to build capacity, but also called for a more efficient manner of exchanging knowledge and information. Participants were

consistent in their belief regarding the need for a single information sharing platform that could be used to more effectively disseminate knowledge among the different Arctic stakeholders. They also highlighted the importance of ensuring that the data was easily accessible, searchable and user friendly, in order to discourage overloading all individuals with all of the information.

- *"They need more people or a system, an easy system. And I think the ARCSAR innovation Arena could be a, sorry, not only the Innovation Arena, but also the website could be a place where we could try to meet some of these needs and challenges we have."*
- *"I think just little things to make that a searchable and user friendly to find… Just user friendly so you can use it, have a search function."*
- *"I have a lot of information that might be useful to a lot of people in this room or I have contacts within my research corporation. And my challenge is actually how do I get the latest information I have to the right people, either on a short term or in the kind of not on an emergency basis, but on a best practice training basis, without occupying too much of their time, without inviting them to irrelevant meetings five times a year."*

In fact, the idea of efficiency came up often in responses to this question, with some participants noting the high degree of overlap in meetings and events. Participants felt that without an efficient mechanism for sharing information, there was too much duplication of work happening, with stakeholders being unaware of what had been done before and reinventing the wheel over and over. For this reason, some participants identified a problem with project legacy, emphasizing the need for a sustainable information sharing network that existed beyond the lifetime of any particular initiative.

- *"So many forums ongoing in the Arctic, lots of duplication. Need a platform to share what they are talking about, having a good platform to share information would reduce traveling and all the meetings."*
- *"Every effort needs to be made to integrate or work upon what already exists because there are so many groups doing the same thing."*
- *"Need to get the right people involved without occupying too much of their time or reinventing the wheel."*
- *"No place to learn what has been done before, no institutional memory, no lessons learned from trainings or field exercises so keep repeating same things over and over."*
- *"Need a repository of lessons learned, that is categorized, a place to keep SOPs and best practices, [that] has to be accessible."*
- *"Network development and maintenance from personnel turnover, because as soon as somebody leaves you have to reestablish the network with a new person."*

In addition to information sharing was the importance of developing shared perspectives and understandings between Arctic North Atlantic stakeholders, despite differences in language, approaches and perspectives. As a solution, some participants encouraged the wider adoption of a standardized rescue language as a means of overcoming these problems. For example, some participants pointed to IAMSAR as a universal rescue

language which could be more widely utilized. On the other hand, they also noted that the fact that you had to buy the manuals presenting a barrier to more widespread adoption.

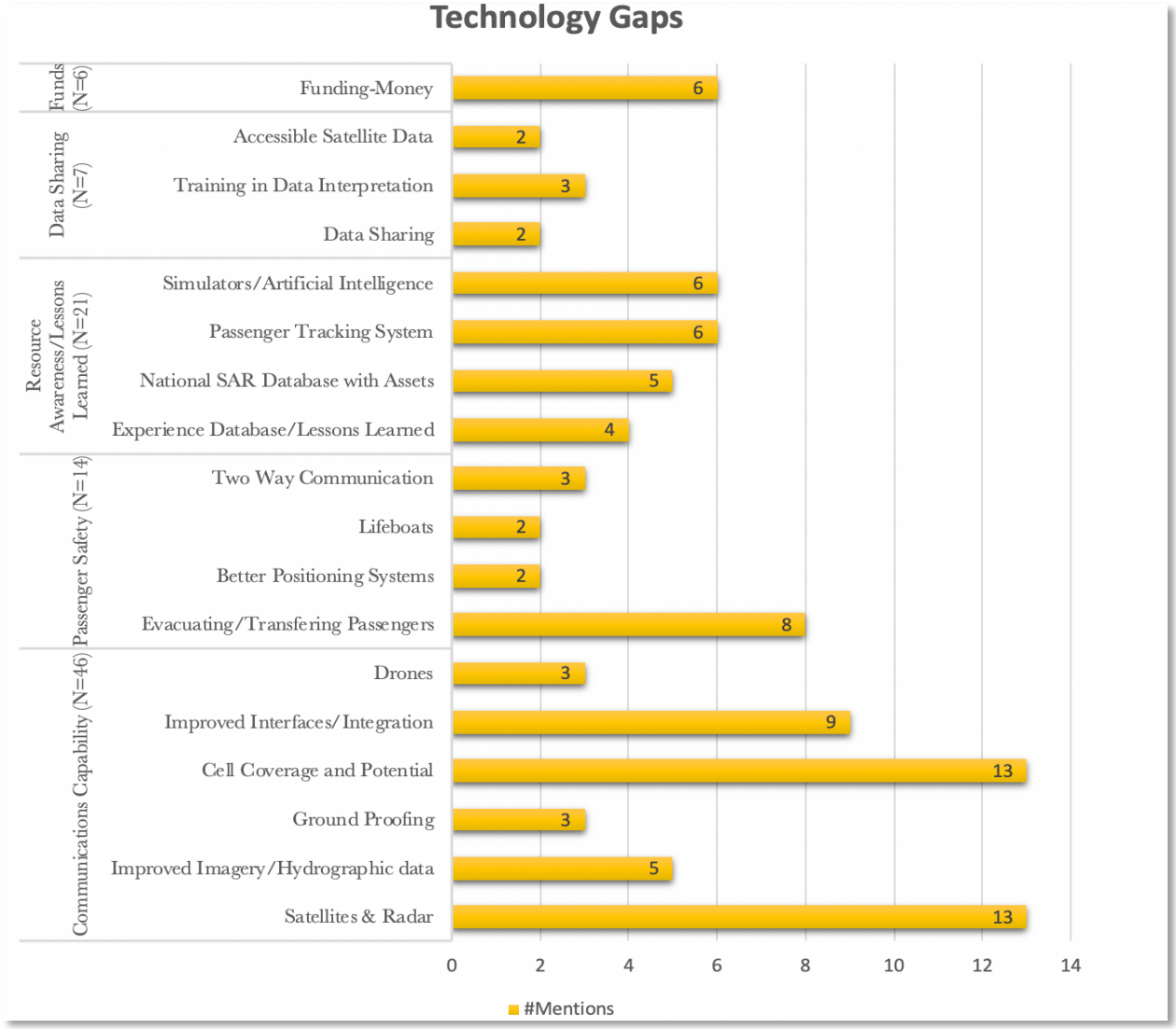
- *"Shared training on IAMSAR manuals to develop and standardize rescue language."*
- *"Standards could help to establish best practices that could be easier to integrate if something bigger happens."*
- *"Could talk across countries with a universal rescue language."*
- *"Use same technology for imaging, different languages and symbols across different groups."*
- *"IAMSAR manuals would provide same terminology all across world but you have to buy the manuals, [they] should make them free to standardize, and train everyone on same language."*

Finally, participants noted that there were additional issues in communication beyond language issues in the ANA region. More specifically they pointed to difficulties in communication when under stress, and a lack of understanding as to proper communications protocols, citing examples of either talking too much or too little during incidents in the region.

Technology Gaps

Finally, the last topic of discussion at the workshop centered around technology, both in terms of what technologies individuals had, and also what technologies were needed to increase safety and security in the ANA region. In terms of technology, there was a large degree of overlap, both in terms of what participants had, and in the shared limitations of those technologies (including limited broadband, spotty coverage, etc.).

Looking forward, discussions centered on existing technologies that could be adopted or expanded for use in the ANA region. These included location apps like what3words, InReach, Rescueme and the 113 app, which are used to track individuals in their respective regions. But these were only of limited utility, as participants were quick to note, because cell phones become "useless" at higher degrees North.



Some technological solutions in development in educational institutions, as reported by researchers from NORD University, include simulation technologies which would incorporate data recorded from vessels to be used for incident simulations and training. Additionally, researchers at LAUREA are working on an exercise evaluation tool, EVAT, which can be used to inform best practices.

- *"At LAUREA, we have very simple tool. It's an evaluation tool. We evaluate exercises. Then we find where the challenges are, best practices, lessons learned. I think that really will help to improve our performance. The tool is electronic tool. It's very simple, but it's very practical and very supportive. The technological tool doesn't always need to be fancy and big. It can be a small solution and really beneficial. It is an app as well [that can be used] offline and online. It is called, EVAT evaluation tool."*

Other participants pointed to the promise of machine learning and artificial intelligence, which could be applied to accident modelling, utilizing existing data that is already being collected on vessels.

- *"So, this is information coming from many sources and using machine learning to … And artificial intelligence to look into the systems and how they are working and plan, or make predictions about the likelihood of incidents. You have deviations, if you have something that goes wrong there, the simulators will just give you an early warning and can suggest solutions."*

Other technology that was mentioned as being in the development stages at present, includes:

- *"a Sar-I webpage to put every challenge into and an app that runs though what the rescuers are doing, what ICESAR is doing, what Coast Guard is doing."*
- *"METNO in particular, we've got sea ice and iceberg hazards, we have this ice watch program which is trying to bring more in situ observations into the automated satellite classification forecast middle data sets."*

On the other hand, there were concerns noted that even with advanced technology in production or in use, an effective means of interfacing with all relevant stakeholders is still needed before new technologies could realize their full potential.

- *"So that is made available for each different organization, but we … The JRCC [inaudible 00:29:39] doesn't have capacity to use this data in a good way."*
- *"Radio tools, radio key commands to give exact position of a vessel or on land, like what3words but more technological, and is integrated with main rescue systems (integrated decision support) is needed."*
- *"Integrated information that works from one agency to the next."*
- *"Level of integration between the ice chart data and the bridge of a ship, integrating ice charts with navigation charts [is still lacking]."*

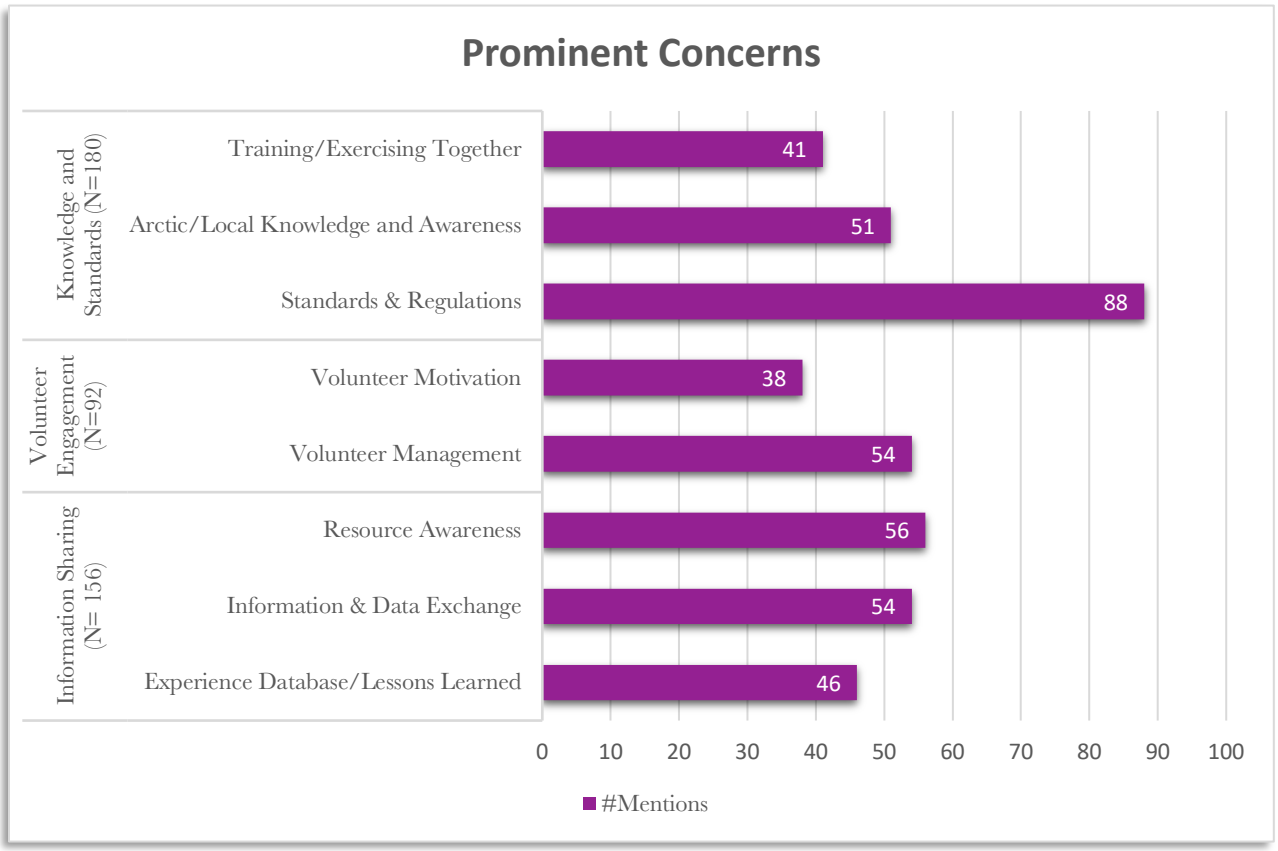
Discussions then turned towards innovation and participants were asked, "if money were no concern, what technology would you need to make your jobs easier?" Prominent in responses to this question were expanded broadband and cell coverage, and expanded use of satellites and radar capabilities. Participants were also concerned with the current state of technology for the evacuation and movement of passengers should an incident occur.

- *"We can't mass rescue between ships, need a system like a pod to winch over to another ship that could hold four or six people to winch over, or from ship to ice. Also need life rafts and lifeboats that work if it's too rough. If I could wish for something, it would be a hoisting emergency pod that winched between ships."*
- *"Transferring people and tracking people."*
- *"Winches to take any lifeboat or life raft and lift it up from the sea to coastguard vessels."*

Participants also mentioned some of the concerns here that have been previously discussed in other areas, including the desire for an accessible lessons learned database, and a database of resources and assets available in the region. The need for additional funds and support was also a popular response to this question.

Most Prominent Concerns

In fact, it is interesting to note that there were a number of issues and concerns that consistently emerged throughout the discussions of all four thematic areas. The most prominent of these concerns generally involved an appreciation for the knowledge and experience needed to safely operate in the ANA region. It is perhaps unsurprising then that participants favored greater standardization of training, and increased international regulations, which they felt would go a long way to improve safety and security. Additionally, participants felt that joint exercises and training opportunities would be beneficial to facilitate cooperation and coordination among Arctic states, and between the various Arctic stakeholders (including greater coordination between operators and industry representatives). It is important to note, however that they also believed additional structure was needed so as to minimize duplication of efforts and redundancy in these cooperative efforts.



**Note: Prominent concerns were calculated by summing the number of mentions across all four thematic areas.*

Along those lines, participants also felt that additional structures were needed in order to facilitate information sharing among the various ANA stakeholders. Participants were largely in agreement in their responses to all four discussion questions that a platform was needed where various entities could share best practices and lessons learned. They envisioned a platform that was accessible and user friendly, so that information could be

disseminated as efficiently as possible, and could be targeted in such a way to avoid overwhelming individuals with irrelvant information. This platform was important both as a means to enhance cooperation and coordination of the response function, but also to improve institutional memory, thereby preventing the duplication of efforts with each new initiative in the region.

Another type of information sharing platform that participants regularly mentioned in their list of needs and gaps was a database containing all available resources and assets in the region, including related points of contact. Like the information sharing platform, this database should be widely accessible, easily searchable and regularly updated. Again, however, there were concerns raised as to responsibility and legacy for the database, both in the need to keep the list updated, all-inclusive, and survivable beyond the life of any particular project.

Finally, concerns that were likely to overlap particular discussion questions involved a need for increased cultural competence and sensitivity for local communities and their role in Arctic safety and security. Participants noted the importance of good relationship building with local communities, and ensuring that communities are prepared, and respected in terms of the roles they may be called upon to play. This was seen as essential in light of the limitations in resources that characterize much of the ANA region.

Policy Implications

Taken as a whole, results from this Knowledge and Innovation Exchange Workshop point to a few interventions that should be considered priorities for future work in the ANA region. The following recommendations would all greatly impact safety and security, but vary in terms of ease and readiness of implementation.

1. Facilitate Greater Knowledge Exchange

Creation of a single, comprehensive SAR database should take priority in future innovative efforts for the region. Through this platform, lessons learned can be shared and best practices can emerge, knowledge could be advanced, and network activities will be memorialized, all of which should help to avoid undue duplication of efforts. While endorsement as to the importance of the database from high level authorities like the Arctic Council and the Arctic Coast Guard Forum will be fundamental to its creation, development is only the first step. Maintenance and survivability of the database will also require buy in from the on the ground personnel who will be tasked with populating it. Additionally, ensuring that the information is accessible, user friendly and useful will ensure the widest possible reach.

Consideration of how tools like LAUREA's EVAT mobile app, and other SAR exercise tracking tools can interface with the database should also be explored, since practical considerations pertaining to responsibility to record, and determining who will pay to host and maintain the database, also need to be established. Given that the ARCSAR network is currently working alongside the EPPR to formulate a lessons learned arena, we are well situated to begin to explore the creation of this much needed resource.

Similarly, the creation of an accessible resource database should also be prioritized, since knowing the location and availability of various assets in the ANA region would substantially enhance situational awareness and response capabilities. Unfortunately, the creation and maintenance of such a database falls victim to some of the same issues and concerns as the lessons learned database. Similarly, it may also take government level mandates to ensure the creation and maintenance of the platform, but once again however, the benefits outweigh the practical costs of creation. The ARCSAR network, which brings together first responders, researchers, industry, and those involved in governance and policy making, may be in a uniquely beneficial position to facilitate the creation of this database as well.

2. Industry Collaboration and Inclusion

The desire for increased coordination and cooperation with industry emerged consistently throughout the workshop. Not only did participants call for greater information sharing

and collaboration between industry and operators, but industry representatives also mentioned the resources that were available due to their presence in the region. For example, a representative of the oil and gas industry discussed available resources on platforms that could be utilized in the event of a nearby emergency, including helicopters and medical supplies. Similar discussions surrounded available resources that tour operators possess that could also be utilized in times of need (e.g., snowshoes, snowmobiles, gear and kit). Currently there appear to be few, if any mechanisms in place to leverage operator equipment and local technology in times of need, or to engage tour operators specifically as emergency responders.

Additionally, participants reported a disconnect between producers of technology being used in the Arctic and the end users or first responders who might be utilizing that tech. This suggests that industry representatives could be doing more in terms of outreach to the community. It is especially concerning if ship operators are not involved in crafting the technology that is being developed on ships, and this lack of input may result in more dangerous situations should an incident occur. Equally concerning was the report of rescue operators who were unaware of technology that would assist with emergency response: *"[There is a] gap in understanding what tech people have, we were unaware that beacons were being made that had two way communications. We were not aware that inReach had two way communications, [so we need a] greater understanding of what tech exists."*

Concerns about proprietary tech aside, these discussions indicate that industry representatives should make every effort to update rescue authorities regarding the parameters of the tech they are developing and selling to users in the region. ARCSAR's network, through its inclusion of both responders and industry representatives, is also well situated to facilitate this type commuication, and should look for opportunties to increase this type of collaboration in their events.

3. Relationship Building with Local Communities

ARCSAR is also well situated to facilitate relationship building between rescue responders, and the local communities who may be called upon to assist in rescue operations. This is currently one of the many challenges that is currently posted on the ARCSAR Innovation Arena, and network members continue to work towards crafting solutions and interventions to facilitate cooperation and coordination with local communities. Although every opportunity to conduct joint exercises and training opportunities as a means of building capacity should continue, other less obvious solutions should also be considered. One example could be examining the feasibility of holding workshops in more varied locations. The benefits of doing so would alleviate multiple concerns, including opportunities for greater participation and relationship building with smaller communities, but also varying workshop participants so that the same individuals

are not attending all meetings. It would also provide vital insight as to how others in the region operate before an incident occurs.

4. Universal Rescue Language

Finally, because standardization of training and the adoption of a universal rescue language was such a prominent concern for our particpants, facilitating the adoption and wider accessibility of the IMO's International Aeronautical and Maritime Search and Rescue (IAMSAR) Manual should be prioritized. SOLAS chapter V Safety of Navigation requires ships to carry an up-to-date copy of Volume III of the IAMSAR manual, but our participants reported that widespread knowledge of the rescue language conveyed in the manual was lacking, which they attributed to the cost of the manual. The fact that there already exists a universal rescue language that could be used to bridge differences between the different stakeholders in the ANA region, but is not being widely used presents as an obvious problem that should be addressed. Having important safety information behind a paywall is a problem that is not unique to the issue of a standardized rescue language (for example incident data in the region is also only accessible through a paid service), but every effort should be made to either make this information freely available, or develop an alternative universal rescue language. The fact that communication and coordination concerns are consistently noted as problematic in after action exercise reports also supports the recommendation. Having this information freely available would help bridge differences in language and as such, should be prioritized as an intervention that would have a large impact on safety and security in the ANA region.

Implementation Issues

As mentioned earlier, ARCSAR is currently working towards creating a lessons learned database that, once operational, will advance experiential awareness in the ANA region. The primary concern is legacy and ensuring that the database continues in funding and maintenance for many years in the future. Mechanisms also need to be put in place to ensure full engagement with the database and regular updating by all relevant parties. Ensuring that smaller municipalities, for example, register incidents that happen in their areas is going to be difficult without additional supports. It seems more likely that at present only the larger planned exercises would be ready for inclusion leaving the more mundane (and potentially more likely) incidents unrecorded. Developing a standard format for incident registration will also be important, to ensure that all relevant information is included, and that entries are comparable, so as to faciltate the development of best practices.

While our workshop participants discussed some previous attempts to develop a resource awareness database, apparently those efforts never became fully operational. Again, as noted earlier, a fully functional database or platform for sharing resources will fall victim to some of the same issues in terms of responsibility for creation and maintenance, and

incentivizing full participation. Turnover in terms of employees and resources also creates a problem which will need to be addressed before this platform is fully functional, a fact consistently noted by our workshop participants.

In terms of ease of implementation, cost is the largest impediment to the last two recommendations (although it is a component of the first two recommendations as well). As was commonly discussed in the workshop, travel in the ANA region is expensive, and therefore likely the first thing to be cut from lean operating budgets. Varying workshop locations so as to attempt to draw in more and varied participants is associated with additional costs as well, so finding ways to expand budgets to accommodate relationship building may be easier said than done in the region.

Finally, implementing a universal rescue language will require one of two options, either subsidizing the cost of the IAMSAR manual for some stakeholders, so as to ensure more widespread adoption, or developing a new rescue language. Seemingly the first option would be easier, but ensuring that the costs associated are borne by those who will most benefit from it will be important (e.g., an additional surcharge added to polar certificates, for example). Since operators are already required to carry a copy of the manual onboard vessels, it may be simplest to add required SAR language competencies to the training standards required by the Polar Code. More difficult will be the dissemination of training from rescue responders down to local communities. Coordinating with volunteer organizations like the Red Cross to examine ways to incorporate rescue language training will also be prudent.

ENDNOTES:

[1] *In this discussion format, moderators for each thematic area rotated among fixed tables, facilitating discussions and including as many different participants as possible.*

[2] *Table discussions were recorded, transcribed and analyzed using NVivo software, to examine common themes and responses within each area/question. The number of times an issue was mentioned in the discussion was counted, serving as a proxy for the amount of attention paid to a particular issue.*

[3] *It should be noted that that there was often a degree of overlap such that one response could be categorized in more than one way. Therefore, classifications which emerge from these discussions should be interpreted broadly, and in a manner that appreciates the interconnectedness of the issues involved.*