Report of the Roundtable Discussion

"The Science of Ice: Global Research Cooperation - Priorities to inform future research collaboration activities in the Arctic"

organized by the **Icelandic Centre for Research (RANNIS)** and
the **International Arctic Science Committee (IASC)**
in conjunction with the **Arctic Circle** Conference
in Reykjavik (Iceland) on 12 October 2013

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Introduction

The Science of Ice: Global Research Cooperation was an interactive roundtable discussion organized by the Icelandic Centre for Research (RANNIS) and the International Arctic Science Committee (IASC). It took place on October 12th 2013 from 16:10-18:30 at the Harpa conference center during the inaugural meeting of the Arctic Circle in Reykjavik, Iceland. This summary captures highlights of the session using information presented visually and orally during the session and Internet resources where noted. While not a comprehensive report, this summary does illustrate the state of research cooperation in the Arctic as discussed in the session. The session organizers would like to thank the presenters and participants for their contributions to this dialogue.

The attending 32 participants (see participation list in Appendix A) included scientists, policy makers, business people and community members.

The discussion began with brief opening reflections highlighting research collaboration efforts and challenges in the Arctic from the following six speakers:

- Thorsteinn Gunnarsson, Head of Division, Rannis and IASC Council Member (Session Chair)
- Karin Lochte, Chair, Alfred Wegener Institute
- Jean-Claude Gascard, Senior Scientist, the French National Center for Scientific Research
- Li Yuansheng, Vice Director, Polar Research Institute of China
- Astrid Ogilvie, Fellow, Institute of Arctic and Alpine Research, University of Colorado at Boulder and the Stefansson Arctic Institute
- Olav Orheim, Member, Norwegian Scientific Academy for Polar Research

The session aimed to provide an informal platform for an open dialogue on important issues in Arctic research cooperation on a global level and for exploring the inclusion of local and traditional knowledge. Participation from academic, industry, and community members from at least 11 countries allowed for diverse perspectives on collaboration. The session also aimed to define priorities that can inform future research collaboration activities in the Arctic.

The Arctic is of local, regional, national, and global concern. Changes in the Arctic not only affect the governments and people of the Arctic but also the world as a whole. Therefore, how people cooperate between arenas (e.g., private and public, local and external) and sectors (e.g., academic, industry, and policy-making) and between the disciplines within these sectors calls for collaboration at various levels of society. The dialogue of the session revolved around the following topics: the value of cooperation, challenges to cooperation, examples of existing and potential cooperation, and priorities for cooperation.

Value of Cooperation

The value of cooperation in research outweighs its costs. Cooperating with others, however, generally adds complexity to conducting research in the Arctic. This is often due to additional layers of bureaucracy. Cooperation may also mean project members have less autonomy within a given project. This is, by definition, a part of the collaborative process. An increase in bureaucracy and a decrease in autonomy are, however, minimal costs considering the benefits associated with cooperation. Cooperation often facilitates shared expenses and reduces individual costs. It promotes shared resources (i.e., both human and infrastructure) that expand the depth and breadth of research possibilities. Collaboration can improve the dissemination of information through access to more outreach avenues. Collaboration can also improve the quality of science and reduce duplication through increased communication; reduce environmental impacts through shared research efforts and data; improve transparency in research through broader communication and sharing; and increase opportunities for scientists through shared costs and infrastructure.

Changes are taking place quickly in the Arctic and collaboration is a way to increase the pace of research to attempt to understand these changes in a timelier manner. Collaboration may

involve limited sacrifices but can result in more research opportunities, more data collection, and quicker dissemination of a greater volume of high quality information to the world.

Challenges to Cooperation

There are various challenges encountered when trying to cooperate globally on Arctic research. The Arctic system is complex and rapidly changing. The affects of the changes are widespread, reaching a global scale and touching all sectors of society from politics and economy to culture and daily living. The scale of need in Arctic research requires global cooperation at local, regional, national, and international levels.

Scale and Funding

Funding for research in the Arctic is a pervasive challenge. The scale of cooperation needed to acquire the depth of skills and equipment required to conduct research in the Arctic provides logistical and funding challenges. Diversified teams of scientists and community members are required to address the complex problems of the Arctic. Research projects often require a critical mass of human resources and expensive infrastructure. This increases funding needs. There is a need to have people in the Arctic to understand the Arctic—research is often field based thereby increasing transportation and infrastructure costs.

Icebreakers, complicated logistics, and oft needed air travel make the cost of transportation high in the Arctic. The Dronning Maud Land Air Network (DROMLAN), a non-profit, international co-operative project to reduce costs and increase flexibility and availability of transportation in the Antarctic (http://dromlan.org), is an example of reducing transportation costs but we need innovative thinking to advance research cooperation efforts in the Arctic.

National priorities are difficult to challenge. Progress in research requires finding ways to cooperate globally within national constraints. Understanding both environmental and cultural systems at the local, regional, national, and global levels provide further challenges. Culture affects what issues are important to whom in what locations at all these levels. The local, regional, national, and global communities place constraints on funding that affect research and the ability for collaboration.

Data

There are gaps in Arctic research data. The Arctic is one of the more understudied areas of the globe. There is a lack of current in situ data in many areas of Arctic research. The fast paced changes taking place also pose a need for both current data and consistent data collection over long time horizons. Only having data on pieces of the puzzle that constitute the Arctic

environment challenges scientists ability to have a holistic understanding and provide information for problem solving.

Data access and awareness are also challenges to overcome in Arctic research. There is a lack of knowledge about what data exists, especially across disciplines and between sectors, and how to access it. There is currently no collaborative repository for Arctic data that is comprehensive and openly accessible.

Cross-sector relationships

There is a disconnect between industry and academia. The two communities need to find a way to bridge gaps and facilitate cross-sector collaboration to better advance our understanding of the Arctic. The gaps may be a result of differing priorities and language as well as intellectual property right interests. The same can be said for gaps between policy, academia, and industry.

Cooperation—Examples and Ideas

Current & Past Projects

Various countries conduct and seek to expand cooperative research in the Arctic. China is expanding its polar research program and is interested in increasing the number of research expeditions in the Arctic to improve research opportunities and available data. They are currently in the process of building a new icebreaker designed for oceanic investigations and estimate it will be completed and sailing in approximately three years (i.e., 2016). Ny-Ålesund, Svalbard is a good example of various countries working together from bilateral and multinational research stations. The accessibility of Ny-Ålesund is one reason it facilitates cooperative efforts. More than ten countries conduct research from Ny-Ålesund where researchers work and live together in several research stations:

- Norwegian Polar Institute (NPI - Sverdrup station)
- Norwegian Institute for Air Research (NILU)
- Stockholm University
- Norwegian Mapping Authority (NMA)
- Alfred-Wegener-Institute & Institute Polaire Francais (AWIPEV)
- British Antarctic Survey (BAS - NERC)
- The National Research Council of Italy (CNR – Dirigibile Italia)
- Norwegian Space Centre/Andøya Rocket Range (SvalRak)
- National Institute for Polar Research (NIPR, Japanese)
- Korea Polar Research Institute (KOPRI)
- Chinese Arctic and Antarctic Administration (CAAA – Yellow River Station)
- The Arctic Centre of the University of Groningen, The Netherlands

- The Kings Bay Marine Lab
- National Centre for Antarctic and Ocean Research, India (NCAOR, Himadri)

(List provided by Olav Orheim, session presentation, Oct. 12, 2013)

The Troll Station in Antarctica "is a growing site for international research cooperation" (Olav Orheim, session presentation, Oct. 12, 2013) where collaborative efforts facilitate more affordable research in the Antarctic.

The Developing Arctic Modeling and Observing Capabilities for Long-term Environmental Studies (DAMOCLES) is a completed European ice-atmosphere-ocean monitoring and forecasting system that employed research cooperation to study the Arctic. The Arctic Climate Change, Economy and Society (ACCESS) is a current collaborative European project that started after DAMOCLES ended. For more information on these projects please see http://www.damocles-eu.org/index.shtml and http://www.access-eu.org.

The concept of collecting data from drifting through the Arctic Ocean to observe the life cycle of the sea ice using a ship as a drift station is of interest to the scientific community. There is active discussion in Europe and the United States about how to accomplish this. During DAMOCLES the TARA expedition collected data through drifting in Arctic pack ice. Following DAMOCLES the ACCESS project and Expedition IceArc: Sea Ice-Ocean-Seafloor interactions in the Changing Arctic (ICEARC) will be a continuation of the effort to collect data via drift station. For more information on these projects please see: http://www.damocles-eu.org/research/TARA_ARCTIC_2007-2008_The_Great_Arctic_drift_54.shtml and http://www.awi.de/de/entdecken/expeditionsberichte/blog_polarstern_expedition_icearc/

In addition to these projects providing excellent opportunities for international collaboration, collaboration has also taken place at the local level through these and other projects cooperating with local communities and indigenous peoples. Cooperative efforts encompass a broad geopolitical range from local to international and broad disciplinary range from the physical to social sciences.

Potential Future Projects

Arctic research technology is becoming closer to the complexity of space technology. With this complexity comes expense. There is a need to share infrastructure to minimize costs and maximize research potential in the Arctic. Research cooperation can maximize the feasibility of drift stations, ice platforms, observatories, local knowledge research, and data management. The group discussed ideas for the following cooperative research efforts:

Ice Platforms: development of a network of ice platforms transmitting atmospheric data in real time from instruments using lidar remote sensing technology modeled after how the Integrated Ocean Observing System (IOOS) collects data for oceanic information.

> IOOS is a national-regional partnership working to provide new tools and forecasts to improve safety, enhance the economy, and protect our environment. Integrated ocean information is now available in near real time, as well as retrospectively. Easier and better access to this information is improving our ability to understand and predict coastal events - such as storms, wave heights, and sea level change. Such knowledge is needed for everything from retail to development planning. (http://www.ioos.noaa.gov/about/welcome.html; accessed Oct. 30, 2013)

Different groups could use the platforms for their research needs making the stations multi-functional from a disciplinary and sectoral perspective.

MOSAiC: the Multidisciplinary drifting Observatory for the Study of Arctic Climate. The project idea consists of a measurement campaign where a ship drifts through the central Arctic Ocean basin to observe the life cycle of the sea ice. It should be a multinational experiment, lasting more than one year, with several ships and periodic aerial support to achieve a process understanding of the issues in the Arctic. Atmospheric scientists conceived the project to better predict weather patterns. Other scientists, e.g., sea ice researchers including those in biology and biochemistry, also became interested and the project expanded. The scientific focus of the project would depend on who is on board. There could be one primary platform and a primary group of scientists with an exchange of people on board over time. The general idea is to achieve a process understanding using models. The Arctic research community is interested in the project and it is being discussed between the USA, Canada, and European countries.

ARICE: the Arctic Research Icebreaker Consortium for Europe. This project would involve a European or international network of joint operated icebreakers in the Arctic Ocean. It would increase coordination of available icebreaker and ice strengthened vessel capacities—the most expensive and limited commodity for Arctic research. It would help develop joint international science plans for coordinated ship operations. Twenty partners from the European Union, the United States, and Canada have expressed interest in this (Karin Lochte, session presentation, Oct. 12, 2013).

Deep Sea Observatory: development of a novel deep-sea observatory between Svalbard & Greenland combining existing research infrastructure and linking it via satellite data

transmission. Satellite linkages would ensure technology is working and help prevent data loss. Cabled instrumentation could also be used if cables are laid. This would increase real time data capacity. It would be an important initiative to integrate the different observations made in the region of Svalbard to a coherent Arctic observation system as part of a Sustained Arctic Observation Network (SAON). It would be a worldwide unique earth observation system that is greatly needed for polar research to collect reliable data required for an accurate understanding and modeling of future developments in the Arctic. Germany fully supports the initiative and offers its research capacity at the joint French-German Arctic Research (AWIPEV) Station in Ny-Ålesund and at the "HAUSGARTEN" deep-sea observatory in the eastern Fram Strait for this joint undertaking (Karin Lochte, session presentation, Oct. 12, 2013 and http://www.awi.de/en/home/).

Data storage and access: data storage, access, and awareness are issues that are difficult to solve. These challenges are not Arctic specific issues; researchers throughout the globe experience them. The International Polar Year tried to solve them but did not succeed. There are international organizations that can tackle these large scale issues, e.g., the Scientific Committee on Antarctic Research (SCAR) and the International Arctic Science Committee (IASC). IASC and SAON are currently working on these issues. There needs to be a level of realism employed to understand who is capable of tackling what issues and not be too over ambitious—we may not solve all data policy issues but making headway is valuable. IASC & SCAR found they were overambitious during IPY and are now developing more sensible data policies. IASC has changed how they address issues and are now using working groups to identify ideas for research priorities for the complete research life cycle from data collection through dissemination.

Local knowledge: can promote cooperation at local, regional, national, and international levels. Broadly defined it includes written records and visual data (including art) as well as traditional oral information. Local traditional knowledge provides another window to understand the world we live in and we need to record it before it is lost.

Priorities for Cooperation

Changes in the Arctic will affect places directly – climatically, economically, and politically. These challenges require internationally coordinated research in the Arctic (Karin Lochte, session presentation, Oct. 12, 2013). Global cooperation is a key factor in making research a success, increasing transparency, and improving information dissemination. The research community needs to broaden its geographic focus and relationships. It needs to create more links of cooperation between China, Korea, Japan, Asia and Russia. We need to expand collaboration beyond Europe and North America.

Data access/sharing

Open access to data is an on-going challenge. We need to develop funding systems to support the expensive logistical needs for data sharing and to enhance access to data. The Arctic community needs to establish a mechanism to facilitate data sharing between academic, industry, and policy arenas that is mindful of industry's need for preserving intellectual property rights. We need to establish data repositories and the necessary portals to access them. Data underutilization can be both an issue of access and awareness and we need to address both.

Funding

Funding must be increased and available over the long term for all sectors of science to support the complex and expensive research of Arctic science. Venues such as the Arctic Circle can be used to bring pressing issues to the attention of various stakeholder groups and promote the need for national and international funding. It is the responsibility of the stakeholders to suggest funding needs at national and international levels. If events like the Arctic Circle can increase interest and awareness national funding may put more emphasis on Arctic research.

Collaborative funding mechanisms where costs are shared and funding can be scaled, e.g., based on country size, will improve research in the Arctic. Identifying and targeting key research areas or issues for funding and fully funding a limited scope may facilitate success. There is a new Nordic program on Arctic research with a substantial amount of funding for Arctic research. Targeted topics, such as data sharing, could be topics for European Union funding.

Interdisciplinarity

Arctic research often requires multiple disciplines to understand complex systems. Working in multidisciplinary teams improves cooperation, communication, understanding, and ultimately interdisciplinarity in science. By asking people from different disciplines and sectors to collaborate, we can develop more diversified research groups and better address complex issues holistically. By working together, different disciplines learn from one another and break down barriers and communication differences through knowledge and understanding. Having a concrete issue, task, or question for a group of researchers from different disciplines to collaborate on can, among other things, facilitate data sharing across disciplines. Again, we must maintain a sense of what is reasonable and facilitate group dynamics by considering what size group would be best suited to complete a project. Communication is often better in smaller groups. By promoting better cooperation between different scientific sectors we can avoid duplication and achieve a more holistic view of the issues in the Arctic.

Combining research from different sectors of science can be challenging. We need to develop betters means to compare information from different disciplines. We can do this by asking people to share their information and work together.

Education & Outreach

Research collaboration should facilitate joint efforts in education and outreach. The Arctic community needs to develop ways to best transmit science to the next generation of researchers and the public. This might be accomplished through symposia, workshops, and the exchange of researchers.

Gaps in knowledge:

Research collaboration in the Arctic must involve a broad range of disciplines from the physical and biological to the social sciences and include aerial, land, and ocean based operations. Consideration needs to be given to understudied areas. For example, the progress of atmospheric research is lagging behind that of oceanic research. The lack of data in atmospheric science coupled with the great variation inherent in the atmospheric system make it challenging to understand this segment of the Arctic environment. Having missing or understudied aspects of the Arctic system make a holistic understanding impossible.

Cross-sectoral Relationships: industry, academics, policy, and community

Dialogue must be facilitated between various sectors of society. The session discussion specifically targeted the need to forge stronger relationships between the industry, academic, policy, and community sectors. The academic and industry research arenas need to come together to support increased research efforts. We need to make it a priority to find equitable ways for research and industry to collaborate. All sectors need to use venues such as the Arctic Circle, with its emphasis on open dialogue, to communicate needs to each other. One of the challenges to overcome is that of different languages being spoken by the different sectors. The more these groups communicate the more likely they are to understand one another and form mutually beneficial relationships and have greater opportunity to advance understanding of the Arctic beyond what any individual group might.

Establishing relationships between sectors must employ respect, sharing, and cooperation at local, regional, national, and global levels. We need to develop an understanding of what changes in the Arctic are important to whom and how to address those needs. For example, climate change may be more important for more northerly communities whereas economic and social changes may be more important for more southerly communities. With funding often coming from the more urbanized southern latitudes this can be a conflict of interest. Funding priorities, which can be a reflection of political interests, can influence research priorities. We need to have a mix of industry members, academia, policy-makers, and

community members represented in consortia as stakeholders rather than working in sectoral vacuums.

Innovation

The research community needs to be more inventive. We are still doing traditional science and examining current problems rather than thinking about how we can better serve future needs through current research. We need to think about what the Arctic will be like in the future so we can conduct research to help us prepare for the future Arctic. There needs to be a better balance between research that addresses current needs and research that helps prepare for potential future needs. It is also important to know what happened in the past to provide a context for what is currently happening and what may happen in the future.

Conclusions

The discussion highlighted the extensive work that is currently being done to promote collaboration in the Arctic. It also illustrated the on-going effort placed on developing ways to improve and expand Arctic collaboration. A lack of funding and institutional support (no matter the arena) are reoccurring themes that continue to be challenges that need solutions in the effort to advance cross-sectoral research cooperation in the Arctic.

Priorities for future global research cooperation activities in the Arctic need to:

- Be global
- Expand the current geographic scope
- Be mindful of realistic expectations (project scale, funding, political constraints)
- Develop flagship projects
- Develop new technology and automated systems
- Focus on long-term data collection needs and gather real time data
- Share resources—infrastructures, expertise, data
- Include education
- Be inter- and cross-disciplinary and include local traditional knowledge
- Improve funding
- Reduce individual costs
- Forge relationships between the industry, academia, and policy arenas
- Promote innovation
- Examine environmental change over time
- Address a broad range of research questions across various sectors, e.g., political, economical, social, and disciplinary sectors

Appendix A

BREAKOUT SESSION F – LIST OF PARTICIPANTS	
The Science of Ice: Global Research Cooperation	**Saturday, October 12**
Chair: Thorsteinn Gunnarsson, Icelandic Centre for Research (RANNIS)	**Harpa - Eyri Exhibition Area**

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