



## Year-2 Program Plan

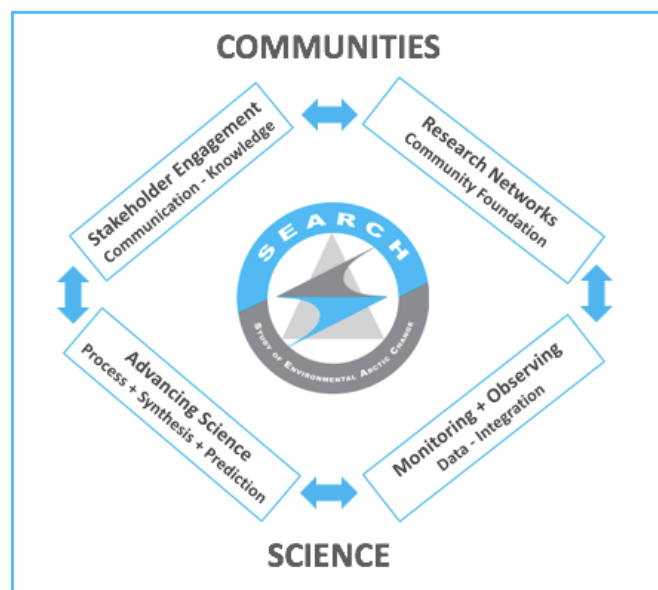
# Study of Environmental Arctic Change

### Introduction

The Study of Environmental Arctic Change (SEARCH) provides a foundation for studying Arctic environmental change by facilitating collaboration between diverse research communities, funding agencies, and stakeholders. SEARCH Action Teams and working groups generate and synthesize research findings, facilitate research activities across scales and disciplines, identify emerging issues, collaborate with other national and international science programs, and engage Arctic stakeholders to inform their responses to environmental change.

Many research efforts in the Arctic focus on isolated aspects of Arctic environmental change. SEARCH facilitates a system-level approach that connects disciplines and integrates their results. The system view is necessary to anticipate the cascading consequences of rapid changes in the Arctic environment.

SEARCH recognizes that scientific syntheses require iterative feedback between scientists advancing process understanding, observers, modelers, and communities of stakeholders (NRC, 2012). Thus, we have structured our activities around organizing research communities that advance science through process studies and modeling, inform observational networks, and build enduring conversations with stakeholders (Figure 1).



*Figure 1. SEARCH's model of integration to advance Arctic environmental change science through engagement of research networks, the facilitation of monitoring and observing, and knowledge exchange with stakeholders. The activities feed one another iteratively.*

The addition of an Executive Director allows SEARCH to support and extend the work of the Action Teams and their working groups by facilitating their research coordination efforts and by providing a common framework for system-level integration.

This Plan describes the year-2 efforts of the SEARCH Scientific Steering Committee (SSC), the Executive Director, the Project Office (ARCUS), and each of the Action Teams to facilitate integrated research in environmental Arctic change, to focus the Observing Change Panel priorities, and to advance crosscutting activities.

### **SEARCH Scientific Steering Committee**

The SSC oversees the work of the Executive Director and the Action Teams. In year-2, the SSC will focus on ensuring that the new SEARCH organizational structure is implemented in an effective manner. Specific foci will include:

- Finalizing the terms of reference for the new program structure
- Developing the role of the Observing Change Panel
- Initiating cross-cutting activities
- Defining processes for forming and dissolving SEARCH Science Goals and related Action Teams

### **SEARCH Executive Director**

The Executive Director receives office support in Fairbanks from the International Arctic Research Center, University of Alaska Fairbanks and in Monterey, California from the Center for the Blue Economy, Middlebury Institute for International Studies. The Executive Director takes direction from the Scientific Steering Committee and convenes bi-weekly in-person or by teleconference with the Science Steering Committee Chair. The Executive Director also confers regularly with the Action Team leaders.

In the first months on the job, the Executive Director assessed the state of each Action Team and noted that the teams reflect the different states of evolution of Arctic change research among the three communities they represent and have, thus, chosen to focus their efforts on distinct research priorities. Despite their different starting points, in year-2, the Director will encourage the teams to coalesce around the shared knowledge-to-action framework that emphasizes meaningful exchanges across disciplines and significant interactions between researchers and stakeholders. This common framework (Figure 1) envisions that individual Action Teams will unite strong and flexible research communities and networks that evolve with their scientific objectives. Driven by basic science questions, they will identify opportunities for advancing science, expose gaps in current scientific understanding and/or critical observational capabilities, and develop syntheses and knowledge exchanges. The Action Teams will facilitate the formation of short-lived, focused working groups to address specific issues as they emerge.

In year-2, the Executive Director will survey other research program leaders to determine best practices in the art of organizing scientific talent. The Executive Director will help the Action

Teams retain their focus on previously specified long-term goals with emphasis on synthesis and developing mileposts consistent with the goals. He will provide the SSC with read-ahead materials, draft actions, and written meeting notes specifying action items to help them ensure that teams are making progress. The Executive Director also will facilitate connections between the Action Teams (cross-cutting research) and other efforts in Arctic research (e.g., the Interagency Arctic Research Policy Committee [IARPC], the Polar Research Board, the International Arctic Science Committee, and others). Time for engaging external groups is often limited for researchers, and the Executive Director will assist Action Team members by identifying convenings with a high likelihood of return for the time invested. At the same time, the Executive Director will explore models for supporting and mentoring early career scientists, as well as models for assessing scientific communication across disciplines and to wider audiences.

The Executive Director will clarify in year-2 SEARCH's mission and structure for the broad research community. We shall increase transparency to facilitate the engagement of more scientists in SEARCH Action Teams and crosscutting activities. An updated web site will communicate regular and ongoing activities and offer opportunities for outside involvement. We shall also capitalize on existing venues (e.g., the Arctic Encounter Symposium) to reach broader audiences.

In year-2, SEARCH will continue to participate in IARPC Collaboration Teams to inform agencies about research developments and to provide information useful to the development of the next five-year Arctic research plan. Participation on IARPC Collaboration Teams also will help identify additional areas where SEARCH can enhance the work of Federal agencies. Where gaps and opportunities could be addressed in joint efforts, the SEARCH Executive Director will encourage IARPC agencies to support SEARCH activities through workshop funds and personnel support with an emphasis on postdoctoral fellows.

### **Arctic Research Consortium of the U.S. (ARCUS; SEARCH Project Office)**

ARCUS supports SEARCH in areas of strategic planning and project management, meeting planning and support, and communications (through grant #PLR-1331083). The Executive Director convenes weekly with ARCUS staff by videoconference. ARCUS activity areas are summarized in Appendix A.

### **Sea Ice Action Team**

*SEARCH Goal "Improve Understanding, Advance Prediction, and Explore Consequences of Changing Arctic Sea Ice," led by Jennifer Francis and Henry Huntington*

SEARCH led the development of a research forum to discuss, evaluate, and improve sea-ice forecasting for the research community and specific stakeholders by standing up and organizing the Arctic Sea Ice Outlook and the Sea Ice for Walrus Outlook. Those efforts are now formalized under separately funded networks, the Sea Ice Prediction Network (SIPN) and the Sea Ice for Walrus Outlook (SIWO). Overlapping membership in those networks and SEARCH's Sea Ice

Action Team (SIAT) ensures that SEARCH remains closely connected with these spin-off efforts and is able to include their work in synthesis activities. Similarly, the SIAT includes membership in the IARPC Sea Ice Collaboration Team and CLIVAR Arctic-Midlatitude working group. Together, these efforts improve our predictive abilities, particularly of sea-ice extent, and provide opportunities for new research to be informed by spatial and temporal information needs of stakeholders. With an explicit link to SEARCH (<https://usclivar.org/working-groups/arctic-midlatitude-working-group>), the CLIVAR Arctic-Midlatitude working group is assessing teleconnections of Arctic climate and its effects on mid-latitude weather through predictability studies and model assessment. Yet, the effects of sea-ice changes are more profound and affecting the Arctic in a broader way. Thus, the SIAT is filling a key gap by focusing on exploring consequences of the changing Arctic sea-ice cover. SEARCH recognizes the need for research leading to synthesis among the broad scientific community and for greatly enhanced communications with non-scientific communities, and those areas are the focus of the Sea Ice Action Team.

### ***Organizational Activities***

As the pace and diversity of sea-ice research has increased, there is a growing need to enhance communication across disciplines and to wider audiences. Making our new knowledge more accessible will help stimulate scientific syntheses and inform policy discussions. In response to this need, the Sea Ice Action Team convened in September 2015 in Bristol, Rhode Island to develop its approaches to better communicating scientific understanding of sea ice among lay and scientific audiences. The composition of the team reflects the diverse consequences of diminishing sea ice with experts in sea-ice forecasting, atmospheric interactions, ecosystem services, marine ecology, science communication, and policy. The team includes:

- Jennifer Francis (co-lead) – Rutgers University
- Henry Huntington (co-lead) – Huntington Consulting
- Matt Druckenmiller (science communicator/research enabler) – Rutgers and NSIDC
- Lawrence Hamilton – University of New Hampshire
- Bob Henson – Weather Underground
- Marika Holland – National Center for Atmospheric Research
- Martin Jeffries – Office of Naval Research
- Brendan Kelly – SEARCH Executive Director, University of Alaska Fairbanks
- Don Perovich – Cold Regions Research and Engineering Laboratory (CRREL)

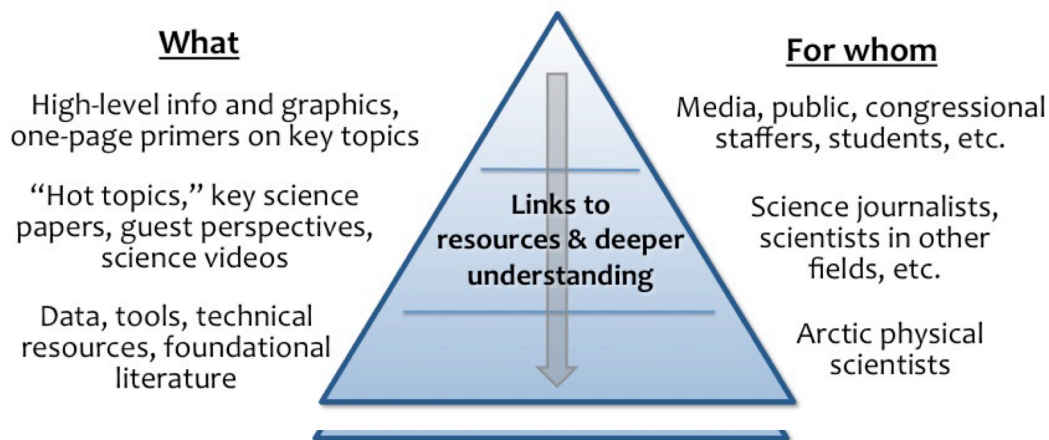
The Action Team membership will be reviewed again in year-2 to assess whether additional member(s) should be added; small, ad hoc Task Teams, which are described below, also will bring in additional expertise to Action Team activities. The SIAT recognizes that improving public understanding of sea-ice processes is important to societal responses and that improving understanding among diverse scientific disciplines concerned with sea ice will enhance synthesis efforts at the system level. Thus, the Team's communication products and resources will be designed to educate the public, policy makers, and fellow scientists.

## ***Advancing the Science***

In year-2, the Sea-ice Action Team will advance understanding by engaging scientists and stakeholders, leading and promoting scientific syntheses, and developing methods to evaluate effectiveness of the Team’s activities.

### **1. Engage science and stakeholder communities**

The Team will build a web-based framework designed to link brief, up-to-date synopses of the state of sea-ice science with primary literature and data sets concerning sea ice and the impacts of sea-ice loss on the Arctic and beyond. The resource is envisioned to enable synthesis research related to sea ice, educational materials, and summaries of the science aimed at scientists in diverse disciplines and policy makers. As a strategy for communicating with broader audiences, however, we will focus on the upper-most level—the most direct point of entry to the website—to present concise, accessible digests. The top-level products will be supported by an underlying layers organized into educational materials, reviews and syntheses, and finally, the primary literature. Starting at the top of the pyramid (Figure 2) is an effective means of making science accessible to scientists in other disciplines (thus, promoting collaborations across disciplines), the media, public, and policy makers (Baron 2010).



*Figure 2. Knowledge pyramid showing tiered science products for communicating across disciplines and with wide audiences.*

The Team—with the help of additional subject-area experts—will develop a website reflecting this structure with the entry point being a series of one-page digests – “Sea Ice and...” – summarizing what we know about sea ice and its interactions with a variety of system elements, such as:

- Sea Ice and Arctic navigation
- Sea Ice and climate variability
- Sea Ice and coastal communities
- Sea Ice and international security
- Sea Ice and sea level rise
- Sea Ice and permafrost
- Sea Ice and international relations
- Sea Ice and ocean currents
- Sea Ice and lower latitude weather
- Sea Ice and ecosystems
- Sea Ice and natural resources
- Sea Ice and forecasting and prediction
- Sea Ice and environmental stewardship

In year-2, the Team will build the framework and develop supporting materials for three of the summary documents (Sea Ice and Ecosystems, Sea Ice and Your Weather, and Sea Ice and Society), emphasizing the linkages from the top to the bottom to convey that the one-page summaries are authoritative, consensus-driven, and supported by the science community. The Team will engage appropriate members of the scientific community to select appropriate review papers and primary sources to fill in the mid and lower levels of the pyramid. Thus, scientists from other disciplines, policy makers, the media, and others will be able to enter the information pyramids at whatever levels are appropriate for their background and interest with the assurance that the upper levels are backed up by solid science.

Writing and sharing the summaries will have the heuristic value of making evident where there is community consensus and where additional research should be focused. Thus, in some cases, the information pyramid will be assembled from existing literature; in other cases, SEARCH will help the community identify gaps in need of further research and highlight topics ripe for syntheses. The approach will be tested and refined by short-term, issue-specific Task Teams that will be convened in year-2. Feedback on the effectiveness of the products will be sought from policy staffers on Capitol Hill and in the Administration. The team will work with ARCUS on the design of a sustainable website.

Beyond the website interface to the pyramid, scientists and stakeholders will be engaged through:

- Participation on the Sea Ice Outlook 2015 Post-Season Report Action Team (Oct-Dec 2015)
- Presentations on the societal and policy implications of sea-ice change at the Arctic Encounter Symposium (Seattle) and the Arctic Matters Symposium (Washington, DC) in January 2016
- A workshop in late summer 2016 to identify high-priority topics for collaborative research proposals and synthesis efforts and to develop a collaborative process to facilitate these activities; this workshop will present opportunities for involvement of the other Action Teams
- Leading up to the aforementioned workshop, the Team will prepare an overview paper that pulls together various recent sea-ice synthesis papers from a broad range of sea-ice related fields (i.e., a synthesis of the syntheses)
- A summary for the SEARCH community from a science communication workshop led by Andy Revkin at AGU 2015 Fall Meeting
- Scientific exchanges in venues including FAMOS, AOOSM, AGU, and AOS
- Participation in a SIPN conference in Palisades, NY (May 2016)

- Exploration with ARCUS’s videographer of the opportunity to create a short film on sea-ice prediction and how the Sea Ice Prediction Network is advancing science in an innovative way
- Evaluations by congressional staffers and AAAS Fellows of the one-page sea-ice digests and the underlying informational structure
- Presentations to and close collaboration with the IARPC Collaboration Teams
- Addition of SIAT members as needed to develop the information pyramid

## 2. Synthesis

During year-2, the Sea Ice Action Team will plan a Knowledge Exchange workshop to be held in year-3 bringing stakeholders and scientists together to determine the syntheses needed for greater scientific understanding of sea ice and to address stakeholder needs. Proposed topics and leads for synthesis papers will be identified and circulated in advance of the workshop to generate robust cross-disciplinary consideration. Borrowing from a model employed successfully by the Permafrost Action Team, the Sea Ice Action Team will identify a senior and junior scientist to co-lead each proposed synthesis paper. The workshop also will help develop a scenarios approach to framing research questions.

Scientific syntheses require cross-disciplinary approaches, and the Team will use the one-page sea-ice digests as a means of engaging specialists in other fields. That is, the digests will convey—without jargon—the essentials of our current understanding of sea-ice dynamics and, thereby, promote the intellectual cross-fertilization necessary for syntheses.

## 3. Evaluation

Communication of scientific knowledge across disciplines and to the public can only be improved with feedback. In year-2, the Sea Ice Action Team will seek substantial feedback by:

- Developing a strategy for evaluating the web-resources using web-analytics (web-hits and one-pager downloads) along with online user feedback
- Developing and maintaining a sea-ice media watch to track high-visibility sea-ice information sharing. The watch will provide a means for tracking direct linkages to the Team’s resources and a reference frame for what topics are getting a lot of attention
- Surveys of Congressional and Executive Branch science advisors through events with the AAAS Science and Technology Policy Fellows Program (Druckenmiller, as an alumni of the Program, is initiating a Fellows focus group on *Arctic Change*)
- Structured interviews of representatives of target audiences

### ***Linkage to Observing***

The Sea Ice Action Team will link its activities in year-2 to observing efforts through Task Teams, stakeholders, and modelers.

The Task Teams will assemble the information pyramids described previously. As part of that effort, they will be to articulate the observing needs for advancing scientific understanding of sea ice and for supporting operational efforts.

Sea-ice observation needs from the perspectives of stakeholders will be assessed via two approaches. First, the Team will map stated stakeholder needs on to available observations to identify gaps. Second, in establishing the information periods, the Team will invite guest perspectives that will include the stakeholders' own perception of observations needed. The Action Team will draw on activities and reports by the Sea Ice Prediction Network to inform this work.

Modelers rely on observations as inputs and for validation, and the sea-ice research community has been improving the iterative conversation between modelers and observers (NRC, 2012). The Sea Ice Action Team will encourage and contribute to SIPN's sensitivity studies that explore how models behave when certain datasets are withheld.

### **Land Ice Action Team**

*SEARCH Goal: "Improve Predictions of Future Land-ice Loss and Impacts on the ocean," led by Fiamma Straneo and Ted Scambos*

Within the broad and longer-term SEARCH goal of improving predictions of Arctic land-ice loss and its impact on the ocean, including sea level rise and fresh water and nutrient discharge into the ocean, the most critical gap in our understanding is Greenland Ice Sheet-Ocean interactions. Progress on these questions requires cross-disciplinary research by glaciologists, oceanographers, climatologists, paleo-climatologists, and others. In year-2, the Land Ice Action Team (LIAT) will focus on facilitating exchanges between those communities to design observational campaigns in ways that will facilitate understanding and synthesis products.

Current team members are:

- Jakob Abermann (Asiaq, Greenland; glaciologist/hydrologist)
- Andreas Ahlstrøm (GEUS, DK; lead of PROMICE weather station network)
- Gordon Hamilton (U Maine, USA; glaciologist)
- Patrick Heimbach (UT Austin & MIT, USA; ocean modeler)
- Ruth Mottram (DMI, DK; atmospheric modeler)
- Sophie Nowicki (NASA Goddard, USA; ice sheet modeler)
- Ted Scambos (NSIDC, USA; remote sensing and field measurements ice sheets)
- Fiamma Straneo (WHOI, USA; oceanographer)
- Dave Sutherland (U Oregon, USA; oceanographer)



- Martin Truffer (U Alaska, USA; glaciologist)
- Bob Bindschadler (SEARCH SSC; glaciologist)

Additional members may be added as necessary.

### ***Organizational Activities***

The scientific community engaged in understanding Greenland ice sheet/ocean interactions gathered as such for the first time at an open, international workshop held in June of 2013 organized by a US CLIVAR Working Group (GRISO) and sponsored by US CLIVAR and NSF. The workshop attracted approximately 100 scientists (1/3 early career) from 10 countries, whose expertise covered the fields of glaciology, oceanography, paleoclimate, atmospheric science, and climate modeling. Discussions held at that workshop, and subsequent input from the broader scientific community, identified four main scientific priorities for understanding ice sheet/ocean interactions: targeted process studies, megasite experiments, data compilation and sharing, and the establishment of a Greenland Ice-Ocean Observing System (GrIOOS; Heimbach et al. 2014).

The Land Ice Action Team identified GrIOOS as a major priority in addressing ice sheet/ocean interactions and SEARCH as the entity to move the effort forward. The goal of GrIOOS is to design and implement collection of long-term time series of critical glaciological, oceanographic, and atmospheric variables at key locations around Greenland. Such time series will provide much needed information on the evolving relationships between climate forcings and glacier changes.

As a first step in facilitating the establishment of GrIOOS, the Land Ice Action Team convened a workshop to identify key variables, sites, and approaches to obtaining these data, in the light of existing measurements already being made in and around Greenland. The workshop, co-sponsored by CliC and the US Arctic Research Commission, was held on December 12-13, 2015 in San Francisco. The Action Team selected over 40 participants from 7 different countries based on expressions of interest and a balancing of career stages and genders. Additional participants included two US program managers (Eric Lindstrom, NASA; William Ambrose, NSF), Inuuteq Holm Olsen (Minister Plenipotentiary for Greenland to the US), and Gerhard Krinner, co-Chair of CliC. A joint session and reception with the Ice Sheet Modeling Intercomparison Workshop (ISMIP 6) participants provided input on how GrIOOS deliverables could address the needs of the ice sheet and ocean modeling community. Workshop discussions and sessions addressed important elements for the establishment of GrIOOS by identifying: 1) the essential variables to be collected; 2) the observations already in place; 3) prioritized sites; 4) prioritized instrumentation or synthesis products.

Work by the LIAT in year-2 will focus on compiling a report that synthesizes workshop outcomes and lays the foundation for the establishment of GrIOOS. Specific steps will involve an initial draft of the report (January 2016), incorporation of feedback from the participants (February 2016), incorporation of feedback from the broader scientific community (March 2016), and final publication (April 2016 – dates are approximate). Subsequent to the compilation of the report, the LIAT will widely circulate the workshop/report conclusions to US and international funding agencies, to international scientific groups, to Greenlandic government

representatives, and international partners. A presentation to the CliC Steering Committee meeting is planned for February 2016. One important task for the LIAT is to aid international teams working in Greenland in adding GrIOOS measurements to their existing or planned measurements.

In 2016, the Team will hire a post-doctoral fellow. It is expected that the fellow will advance the establishment of GrIOOS by synthesizing existing measurements around Greenland into data products that can be used by the scientific community including the ice sheet and ocean modeling communities.

### ***Advancing the Science***

Priorities for understanding marine and atmospheric forcings on Greenland's marine-terminating glaciers were identified by the international research community (Heimbach et al. 2014) and include:

- Establishing a Greenland Ice Ocean Observing System (GrIOOS)
- Compiling and sharing bathymetric and other data
- Conducting targeted process studies
- Conducting selected megasite experiments

In year-2, the Land Ice Action Team will work with the research community, funding agencies, and stakeholders to establish the GrIOOS and will:

1. Draft, review, and publish a report on the December 2015 workshop
2. Follow up on the report's recommendations by:
  - Seeking funding from national and international agencies
  - Coordinating with existing networks
  - Participating in the CliC Steering Meeting (February 2016)
3. Discuss research plans with Arctic stakeholders in Alaska (Arctic Encounters Symposium) and Greenland with a focus on Greenlandic fisheries

### ***Linkage to Observing***

By facilitating the establishment of GrIOOS, the Land Ice Action Team is maximizing outcomes from existing observational capabilities and establishing a framework for the community-wide integration of useful observations. The international observing community will use the GrIOOS workshop report to leverage additional funding and coordinate activities. In addition, by identifying key synthesis products the GrIOOS report is expected to aid planning for future ground-based and remote sensing systems.

The Land Ice Action Team also has strong and growing connections to policy makers needing information on global sea level change. Through presentations and discussions at meetings engaging Arctic stakeholders (industry, military, and policy-makers) such as *Predicting a changing Arctic* sponsored by the Consortium for Ocean Leadership Forum in Washington DC

(March 2015) and the *Warming Arctic Conference – Leadership, Diplomacy and Science: Resolving the Arctic Paradox*, held at the Fletcher School of Business, Tufts University (April 2015), the Land Ice Action Team has provided key information on Arctic land-ice changes and their impact on the ocean including highlighting uncertainties. In addition, through the involvement of Inuuteq Holm Olsen (Minister Plenipotentiary for Greenland to the US) and Greenland fisheries scientists in the GrIOOS workshop, the Land Ice Action Team is establishing direct channels for the exchange of information between the science community and Greenlandic stakeholders. The Team will seek to better understand the full scope of stakeholder concerns through participation in the Arctic Encounter Symposium (January 2016) and similar fora. The Team will also turn to SEARCH’s Science Steering Committee and the Executive Director to help identifying opportunities to engage other Arctic stakeholders.

### **Permafrost Action Team**

*SEARCH goal: “Document and Understand How Degradation of Near-Surface Permafrost Will Affect Arctic and Global Systems,” led by Ted Schuur, Christina Schädel, and Dave McGuire*

In the first year of the award, the Permafrost Action Team set up structures to expand on the work of the Permafrost Carbon Network as well as pushed forward opportunities to expand synthesis science on the topics of permafrost degradation impacts on infrastructure and on ecosystem services. In year-2, the team will amplify those efforts by establishing a Science-to-Action Steering Committee to guide Permafrost Action Team activities, advancing synthesis science through coordinated workshops, establishing linkages between the permafrost research community and the broader Arctic observing community, as well as continuing to expand outreach to multiple stakeholders.

### ***Organizational Activities***

In year-1, the Permafrost Action Team has stood up a steering committee to guide and prioritize research activities. The committee was assembled with input from the SSC and includes members from academic institutions, Federal and state agencies, and stakeholders. Current members are:

- Cathy Wilson (DOE Los Alamos National Lab, NGEE Arctic)
- Eric Kasischke (NASA, ABoVE)
- Dave McGuire (UAF/USGS, PCN)
- Vladimir Romanovsky (UAF, GTN-P)
- Kevin Bjella (CRREL)
- Toni Lewkowicz (U Ottawa, IPA)
- Merritt Turetsky (U Guelph, PCN)
- Dave Schirokauer (Denali NPS)
- Michelle Walvoord (USGS Denver)
- Scott Rupp (UAF, SNAP, Alaska Climate Center)

The steering committee will be convened in quarterly teleconference calls with agendas and meeting notes distributed through our website.

The Permafrost Carbon Network was mature when absorbed under the umbrella of SEARCH's Permafrost Action Team. Many of the lessons learned in the establishment and operation of the network will inform the Team's work in understanding the additional topics of the impacts of permafrost degradation on infrastructure and ecosystem services. These areas will, no doubt, also require unique approaches and in particular collaboration with other groups that already have those topics as a focus. In the broader landscape of established networks, the emphasis on synthesis science that we developed through the Permafrost Carbon Network remains unique, and we will use this approach on both global and local/Arctic impacts of degrading permafrost. One striking example of how an underlying framework supported by SEARCH can facilitate contributions from other agencies is the new agreement with the U.S. Geological Survey (USGS) to support a synthesis science postdoctoral fellow. This agreement was made possible by the framework developed under the Permafrost Carbon Network that laid out a solid synthesis science foundation. This framework was recognized as an opportunity for USGS to meet its own complementary goals in an efficient manner. Coordinated research with funding across multiple agencies has always been a key goal of SEARCH, and this is an important step on that path. In year-2, we will recruit a postdoctoral fellow to organize the synthesis activities on either ecosystem services or infrastructure depending on the capabilities of the applicant pool. The synthesis science fellowship will be supported for two years with funds provided by the U.S. Geological Survey's Alaska Climate Science Center.

In year-2, the Team will advance scientific syntheses by developing scoping documents for new synthesis activities and by leading crosscutting research with the other SEARCH Action Teams on terrestrial and subsea methane fluxes, including the coastal interface zone. These crosscutting efforts in year-2 will serve as models for additional crosscutting efforts in subsequent years (see Cross-cutting Activities below).

### ***Advancing the Science***

The SEARCH Permafrost Action Team will help the community continue its productivity in generating synthesis publications through a series of meetings and other activities in year-2:

- 5<sup>th</sup> Annual Meeting of the carbon component of the Permafrost Action Team in San Francisco (December 13, 2015) – at this meeting, we have vetted 11 synthesis topics in collaboration with more than 120 scientists in the permafrost research community. Scoping documents describing the synthesis topics are posted at [permafrostcarbon.org](http://permafrostcarbon.org).
- Permafrost sessions as part of the American Geophysical Union (AGU) Fall Meeting in San Francisco (December 2015); the *XI<sup>th</sup> International Conference on Permafrost (ICOP)* in Potsdam, Germany (June 2016). These meetings build on related sessions held in *Our Common Future under Climate Change conferences* in Paris, France (July 2015).

- Kick-off meeting for the infrastructure component of the Permafrost Action Team (virtual or in person, TBD). Development of the infrastructure component in year-2 will serve as a model for subsequent development of the Ecosystem Services component.
- Arctic methane synthesis workshop (Seattle, Sept/Oct 2016)
- Lead synthesis workshop for the Permafrost Action Team prior to ICOP in Potsdam, Germany (June 2016)
- Participation in the CliC Permafrost Modeling Forum (Copenhagen, Denmark Feb 2016)

### ***Linkage to Observing***

In year-2, the Permafrost Action Team will plan observing efforts with international colleagues based on a white paper contributed by the Team leads to the Arctic Observing Summit. Based on broad community discussions at the Summit and elsewhere, the Team will also:

- Begin identification of structural and functional benchmark datasets for model evaluation such as soil carbon distribution and active layer thickness-to-temperature relationships
- Identify strengths and weaknesses of existing methane datasets
- Finalize protocols for soil incubations, identifying data and knowledge gaps
- Identify data and knowledge gaps for the eleven proposed synthesis topics

### ***Communication and Outreach***

Stakeholders affected by the state of permafrost are diverse, and developing and sustaining conversations with those communities requires translating our syntheses in multiple venues. In year-2, the Permafrost Action Team will reach audiences concerned with local and global impacts through:

- A 5-year synthesis report from the Permafrost Carbon Network written for diverse audiences and available for download and as printed hand outs
- 1-page synopses of the state of the science (modeled on the Sea Ice Action Team's template) concerning the carbon network and, subsequently, the infrastructure and ecosystem services components.
- Press releases, interviews, and articles prepared for the non-scientific community
- A presentation at the Arctic Encounter Symposium in Seattle (January 2016) to participants including: members of Congress, representatives of Alaska's legislature and

Governor's office, indigenous leaders, the academic community, industry, NGOs, and the press

- A website for the Permafrost Carbon Network component of the Permafrost Action Team ([www.permafrostcarbon.org](http://www.permafrostcarbon.org))
- A permafrost update to the Snow, Water, Ice and Permafrost in the Arctic report
- Participation in the development of the 2<sup>nd</sup> State of the Carbon Cycle Report
- A briefing to IARPC on Milestone 3.2.3., Permafrost Carbon Research Coordination Network

## Conclusion

This year-2 program plan outlines a suite of activities that will be undertaken collectively by the SEARCH program. Taken together, these activities reflect SEARCH's model to advance Arctic environmental change science through engagement of research networks, the facilitation of monitoring and observing activities, and through knowledge exchange with stakeholders. Through these efforts SEARCH will continue to broaden our interdisciplinary understanding of Arctic change, highlight emerging issues, and advance the SEARCH mission to provide a foundation of Arctic change science.

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## Appendix A. ARCUS Tasking for SEARCH Project Office Year 2



### Introduction

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ARCUS serves as the SEARCH project office and performs a variety of planning, management, and coordination activities; these activity areas are listed below. The overall priorities for SEARCH are set by the SEARCH Science Steering Committee (SSC) and ARCUS staff work closely with the SEARCH Executive Director (B. Kelly) and SSC Chair (C. Ammann) to set ARCUS priorities and tasks in support of the SEARCH vision.

The ARCUS budget supports ARCUS staff time (approximately 1.2 FTE), travel and meeting costs for SSC meetings, and communications and materials costs.

### Activity Areas

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ARCUS' SEARCH activities are summarized below; specific tasks are determined in collaboration with the SEARCH SSC Chair and SEARCH Executive Director.

- **Strategic Planning & Project Management** - Work with the SEARCH Executive Director, Science Steering Committee (SSC), and Action Teams to plan and execute strategic and organizational development of the program: develop annual work plans; develop and track resulting milestones, review progress, help guide organizational adjustments as needed to achieve evolving needs and goals.
- **Conference/Meeting Planning** - Work with relevant groups to: develop meeting goals and desired outcome(s); convene and manage organizing committees; develop agendas; invite participants; arrange logistics; meeting announcements and communications; meeting website development and maintenance; onsite meeting support, including note-taking, presenter/AV support, and web streaming/video when appropriate; and work the meeting participants to develop and disseminate final product(s).
- **Science Steering Committee (SSC) Management** - Work in collaboration with the SEARCH Executive Director and SSC Chair on all aspects of SSC management, including; manage the SSC membership rotation process; provide project management support to track SSC action items and tasks; organize twice-yearly in-person SSC meetings; organize monthly SSC teleconferences; and other project management and administrative support for the SSC.

- **Communications and Outreach** - ARCUS will: develop and maintain two-way communication and collaboration strategies between SEARCH components—the SEARCH Science Office, the SSC, the Action Teams and Working Groups, and the broader scientific and stakeholder communities (communications with agency heads and representatives will primarily be the responsibility of the SEARCH Executive Director); develop, launch, and maintain a new SEARCH website; organize and facilitate teleconferences; organize “Town Hall” activities and science sessions at large scientific conferences; and other communications activities.
- **Minor Action Team Support** - Specific support will be dependent on the group, activity, and needs beyond what is provided by the post-doctoral support through the IARC budget, but may include activities such as: provide administrative support (e.g., arranging teleconferences, drafting memos), work with individual Team members to ensure timely completion of tasks and milestones, develop communications and website content, and facilitate lines of communication with other Action Groups, the SSC, and the broader research and stakeholder communities.