U.S. Perspectives on International Collaboration
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[Slide 1: title slide]

Thank you, Mary Beth for organizing this important session.

Good morning everyone. I've been asked to talk about U.S. perspectives on scientific international collaboration in the Arctic and I'm pleased to have this opportunity to do so. I'll do that partly by talking briefly about U.S. policy, partly by describing how funding agencies and the science community have worked together to help partnerships grow in the past, and partly by describing what I see as future challenges.

Let's start with Policy. The Director of the National Science Foundation, Arden Bement, opened the conference Tuesday morning with a quote from the U.S. Arctic Policy document that was issued just a little over a year ago. We began developing this revised policy nearly three years ago largely because of the environmental changes that were taking place in the Arctic, changes that weren't quite so obvious when the previous policy was developed in the mid-1990's. It was signed by President Bush in 2009 and reaffirmed by the Obama Administration as U.S. Policy for the Arctic. I'm happy to note that it has an entire section on promoting international scientific cooperation. We worked hard to bring that focus into the policy now we're working to implement it.

I'll say more about our new Arctic policy in a few minutes, but first, let's take a moment to look at some data about international collaborations, data derived from looking at authorship of scientific papers.

[Slide 2: SEI 2010 cover]

Shown here is the cover page of a study, carried out by the Statistical Resources Section at NSF under the auspices of the National Science Board that was published last month. Based on a detailed survey of the scientific literature, the study concluded that, and I quote:

"Collaborative research is becoming the norm, as indicated by the increasing coauthorship of journal articles … In 1988, only 8% of the world's S&E articles had international coauthors. By 2007, this share had grown to 22%."

The percentage of international papers nearly *tripled* in two decades.

The *number* of international papers went up also – as the research enterprise grew and scientists in more countries became involved.

[Slide 3: international research papers]

Now let's turn specifically to international *Arctic* research publications. In 1988, 14% of the world's *Arctic* research articles had international coauthors, versus the 8% I just mentioned for world science. So in the Arctic we were already ahead of the curve, by nearly a factor of two. By 2007, the Arctic international fraction had grown to 41%. Thus, as measured by coauthored papers in the peer-reviewed literature, international Arctic research collaborations nearly tripled as well. In the 20 years covered by the two studies from which I drew these numbers, you've been almost *twice* as engaged internationally as your lower latitude colleagues.

[Slide 4: International co-authorship, polar research papers]

This slide has details from one of the studies that gave us the percentages I just showed. In addition to the rise in percentage, there's a nine-fold rise in the annual *number* of international polar articles from 1981 to 2007, from 90 to 1,400.

Roughly the same increase holds for international research in the *Antarctic*

We've become a lot more productive and we've come a long way toward learning how to work together across national boundaries. How did this happen? It had to start with the research community but funding agency support helped move it forward. I will come back to some examples in a few minutes.

But first, let's look back in time 10 years, to the year 2000.

[Slide 5: NSF role in international S&E]

Back then, the National Science Board recommended, in a policy report titled *Toward a More Effective NSF Role in International Science and Engineering,* that the Agency assign higher priority to supporting international science and engineering collaborations -- and that we reallocate resources to that end.

Not long after the Board issued this policy guidance we began planning for the International Polar Year. One of the actions we took at NSF was to set ourselves the goal of making U.S. participation in IPY truly international in nature. We decided to require that anyone requesting funding from us had to specify who their international collaborators were and what roles they would play in making the proposed projects successful. And – we included the reviewers' evaluations of those plans as we decided which proposals to fund.

The results are shown on this slide: NSF-supported scientists engaged in IPY projects with collaborators from 28 other nations.

[Slide 6: NSF's 2007-2009 IPY partners]

Now remember that those survey results I showed a few moments ago stopped with 2007, when the International Polar Year *started*. We won't know the full impacts until the IPY publications have flowed into the literature but It seems certain that the fraction of publications with international authorship will be substantially higher than the 41% reported in 2007.

There have been other NSF responses to NSB recommendations as well. One is a program called International Research Network Connections that's expected to award $32.5-million for 10 to 15 projects over the next five years to enable state-of-the-art services that complement domestic research networks. [1]

Another is a program called Partnerships for International Research and Education, or PIRE, that committed $40-million in its last funding cycle.[2] to integrate research and education activities across national borders, preparing

[1] IRNC, solicitation 09-564. Full proposal deadline was 21 August 2009. 10-15 awards expected totaling $32.5-million over fiscal 2010-2014. Predecessors: IRNC solicitation 04-560; High Performance International Internet Services solicitation 97-106.
[2] PIRE solicitation 09-505. Predecessor: PIRE solicitation 05-533.

and mentoring students so that they can thrive in this new environment, as well as to develop international communities of scholars at U.S. universities.

I don't have time today to discuss these programs but I would encourage you to check them out on the NSF web site.

These and other *specifically* international grant programs are in addition to the disciplinary programs at the Foundation, most of which support international cooperative projects.

Across the U.S. government we're seeing increased attention to international collaboration, at NASA, at NOAA, in the other agencies, and certainly in the State Department where Mrs. Clinton has expanded State's Embassy Science Fellows Program and set up a Science Envoy Program for distinguished US scientists to seek cooperation on science and technology. The former president of the National Academy of Science, Bruce Alberts, is one of the first envoys.

[Slide 7: U.S. Arctic Region Policy: image of document]

Let's go back where I started – the U.S. policy for the Arctic as it relates to international science. You can find this document on the White House web site so I'll just highlight its main points concerning today's topic. .

[Slide 8: U.S. Arctic Region Policy: bullets]

The policy directive recognizes that international collaborations and partnerships advance U.S. interests and enable the sharing of research platforms, samples and data. It notes the importance of creating a circumpolar observing network – we call it the Arctic Observing Network – in order to predict change on a regional basis. AON has been one of NSF's biggest Arctic investments during the IPY, and as you'll hear later it's a building block in the international Sustaining Arctic Observing Network, or SAON.

Other parts of the policy directive deal with national security, international governance, boundary issues, maritime transportation, and economic issues including energy. Except for environmental protection these topics fall outside my area of competence so I mention them just for completeness but

those of you who are interested can find the policy document on the White House web page

The policy directive is a powerful authorizing and motivating statement. We have a Presidential-level instruction to strengthen international cooperation and to enhance scientific monitoring and research – *in the Arctic*. It's up to the community and government agencies to translate those words into programs that work.

So now let's talk about building and implementing international partnerships, taking as examples a few that developed over the last decade or two to see what we can learn from them

[Slide 9. Bathymetric and topographic map of the Arctic.]

Here's a map of the Arctic with the political boundaries taken off. Of course we know they exist, we also know that science knows no borders but the fact of the matter is that that those of us in the granting agencies have other kinds of boundaries that we have to work across. For one thing each of us who funds Arctic research, whether in the U.S. or in another country, has different processes and different timelines for making funding decisions. The good news is that we're gradually learning how to work across those boundaries. A different factor is that each of us is separately accountable for assuring that the money is allocated for the support of science that advances the interests of our separate nations in one way or another. We have to be ready and able to articulate how the partnerships do that. When international Arctic science collaborations have been identified as a key national goal in a policy statement like the one I just discussed makes this task much easier, as I'm sure you can appreciate.

[Slide 10. Boreas, Greek god of the north wind.]

The Boreas project is a good example to start with because it shows how the funding agencies and the science community worked together to bring it about. You may recall the Aesop fable about the contest between Boreas (the North Wind) and Helios (the Sun) to see who could strip a wayfaring man of his clothes. Boreas blew, and of course the traveler wrapped his cloak tighter. Then Helios shone, and the traveler took off one garment after another. Maybe there's a message for us today in this old fable

Boreas the project got going in 2005. The name this time is shorthand for "histories from the North: environments, movements, narratives," and the project probes the concept that the circumpolar North is a unique early warning system for changing relations between society and the environment.

This project started not with a contest, but with a few scientists who had a new idea. They discussed it with officials at the European Science Foundation, who encouraged them to propose a workshop to develop the idea. ESF agreed to fund it through its Eurocores program, and the workshop was held in 2004 in Cambridge, where something like 60 scientists participated.

Program officers from NSF and the Canadian Social Science granting council participated in the workshop and expressed interest in joining with the ESF to support a follow-on activity.

ESF subsequently announced a call for proposals to implement Boreas that included a requirement that turned out to be very significant: in order to be considered for funding, each proposal had to link together three different projects led by scientists in three different countries. The goal was to build Boreas as a EuroCores network.

[Slide 11. Boreas September 2007 catalog: see PowerPoint notes page.]

The national funding agencies – including the ESF, NSF, and the Canadian Social Science and Humanities Research Council – developed a merit review process that allowed them to make coordinated funding decisions. The result was support for seven (or maybe eight) collaborative programs involving investigators from 14 countries in 40 research projects, truly a large-scale and multinational collaborative project.

[Slide 12. Boreas final conference]

Boreas concluded with a highly successful all-PI workshop – more than 120 scientists – that was convened last fall at the Arctic Center in Rovaniemi, Finland.

I hope we'll learn more later today from BOREAS participants about what made the collaboration work so well, what they hope to do next, and if there are ways to make the process more efficient and effective the next time around

Here's a different example, one that led directly to our being here today in Miami

[Slide 13. SEARCH 2005 workshop cover]

SEARCH, *The Study of Environmental Arctic Change,* evolved in a series of interactions between scientists and the funding agencies that began over 15 years ago in the U.S. Like BOREAS it began with a champion, in this case Jamie Morison, who began urging increased attention to changes taking place in Arctic atmospheric and ocean circulation patterns. Together with scientists from 24 other institutions, he called for an international effort they called the "Study of Arctic Change." NSF's Arctic Systems Science Program agreed to sponsor a workshop, the first of several, where the community could continue to develop the concept.

The report from one of the first workshops, held a dozen years ago, included the statement, and I quote: "The motivation for the meeting was the growing sense that the Arctic is undergoing significant change. This change appears to involve the atmosphere, sea ice, and ocean." [End quote.] Unfortunately the message wasn't heard clearly in Washington, where the old Arctic Policy Statement was being developed at the same time.

In any event the community continued to develop a science plan while, in parallel, within the U.S. government, the U.S. Interagency Arctic Research Policy Committee was considering how the federal agencies should respond to this planning effort. (I should explain that this committee, which we call IARPC, is composed of the heads of the U.S. Federal agencies that support scientific research in the Arctic -- NSF, NASA, NOAA, USGS, the Smithsonian Institution, DOE and so on -- and that it's chaired by the NSF Director.)

[Slide 14. SEARCH and DAMOCLES]

In 2001 the IARPC Agency heads formally established "The Interagency Working Group for SEARCH," and directed it to prepare an interagency plan for supporting the research. Then in 2002 congress appropriated funds for SEARCH in response to a request from NSF that enabled the agency to issue a request for proposals the following year to implement SEARCH.

At this point SEARCH was on its way and *international links* began to grow progressively stronger. In 2003, the first SEARCH Open Science Meeting took place in Seattle (as an aside I think it's correct to call this Miami meeting the second SEARCH Open Science Meeting). Over 440 scientists from 17 nations participated in the Seattle meeting, which concluded by calling for international organizations of scientists -- IASC and the AOSB, in particular -- to work to bring a related international effort into reality.

The Open Science Meeting also called for the creation of the International Study of Arctic Change, or ISAC, whose Executive Director Maribeth Murray organized today's meeting and got us off to a good start with her opening remarksto help catalyze and organize the international effort.

POINT TO DAMOCLES

In fact, as SEARCH was coming into existence here in the U.S., plans were developing in Europe that led to funding by the EU of the DAMOCLES project. Not surprisingly many of the scientists involved in SEARCH and DAMOCLES had strong collaborations and these projects quickly became linked, both informally and formally.

[Slide 16. ArcticNet]

Also in parallel with those developments, links developed with Canada's ArcticNet project and each of these developed links with many others: we were seeing the seemingly spontaneous growth of an informal network of international collaborations. It has been fascinating to watch the connections among these projects grow over time and I hope the participants in these projects will share their iinsights with us later today on how these linkages developed.

In addition to these important links, hat resulted was the emergence of a set of building blocks – combined with a spirit of cooperation – that set the stage for building the circumpolar observing system called for in U.S. policy and that we all want to see become a reality.

One way to look at the building blocks is to classify them according to what they are observing.

The Atmosphere

[SLIDE 17.- ATMOSPHERIC monitoring stations]

The Ocean

[SLIDE 18. OCEAN monitoring]

And terrestrial sites:

[SLIDE 19.–TERRESTRIAL monitoring]

We have all these marvelous building blocks. The next challenge is to combine them and the many other extant observing systems into a Sustaining Arctic Observing System.

[Slide 20. Siku-Inuit-Hila, list of names]

In doing so it will be especially important to draw in projects like the Siku-Inuit-Hila – or sea ice, people, weather – project, in which scientists and native scholars in Alaska, Nunavut, and Greenland maintain collaborative studies taking place in all three countries.

[Slide 21. Siku-Inuit-Hila three study sites.]

These interdisciplinary and cross-cultural studies focus on the dynamics of human-sea ice relationships in northern communities as key aspects of local environments change – sea ice in particular. The project brings together traditional knowledge, science, and methods from social science, so that such methods such as interviews and participatory observation are complemented by physical-science tools like remote imagery and meteorology. Local residents are active members of the project, operating monitoring stations in Alaska, Canada and Greenland to collect data on sea ice changes and documenting the experience of the communities as they respond to the changes.

[Slide 22. Siku-Inuit-Hila, two photos of fieldwork .]

The project also is increasing the capacity of local hunters' and trappers' associations to take a substantial role in Arctic research, strengthening the

network of researchers and Arctic residents across three countries, and contributing data sets and analysis to ongoing research by the Canadian Ice Service and the Inuit Circumpolar Council.

[SLIDE 24 OBSERVING THE ARCTIC]

This brings us back to the question of the day: how can we bring all these observations – all these building blocks together? That's the goal of the SAON project that the Arctic Council has endorsed and that David Hik will talk about later today.

Colleagues from many countries convened here in Miami in side meetings yesterday and again this morning to plan next steps toward making SAON a reality. A Sustaining Arctic Observing system is essential to obtaining the data we need to truly understand and better predict the changes taking place in the Arctic and I know we all look forward to hearing the outcomes of these meetings.

[Slide 25. Low sun over sea ice, from Healy]

Perhaps a way to wrap up these topics is to go back to the observation I reported at the beginning, "International collaborations are becoming the norm." U.S. Policy encourages them and history shows that we have found ways to build and fund them but doing so is hard work: It takes time, commitment and effort on all sides. In the funding agencies and in the science community we have to assure ourselves in each case that the rewards of international collaborations outweigh the difficulties inherent in creating them.

I hope later today we can discuss ways to minimize those difficulties, along with the pros and cons of each.

Building SAON is another challenge for the future, and building the capability to preserve and easily access the data coming from the collaborations is yet another.

We have work to do. Thank you for your attention.