United States
Arctic Research Commission

Annual Report
Fiscal Year 2005

Members of the
US Arctic Research Commission
January 1, 2005

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January 31, 2006

To: The President
The President (pro tempore) of the Senate
The Speaker of the House of Representatives

It is my pleasure to forward the Annual Report of the US Arctic Research Commission for Fiscal Year 2005 as required by the Arctic Research and Policy Act (ARPA) of 1984 (as amended).

Fiscal Year 2005 was another very successful year for the Commission. The actions of the Commission reflected our increasing interaction with Arctic research entities at the local, state (Alaska), national, and international levels. The Commission's autonomous office in Anchorage, opened in August 2003, continued to facilitate in meeting our objective of support of research conducted in, and for those who live in, America's Arctic.

A summary list of the "Highlights of Commission Activities–FY-05" follows. It briefly summarizes the Commission's expanding role as an active and integral force in the planning and implementation of the nation's Arctic research and research policies, as mandated by the ARPA and as articulated by the Interagency Arctic Research Policy Committee through the National 5-Year Arctic Research Plan.

As Commission Chair, I am both privileged and proud to lead this agency whose activity and achievements, I submit, belie its small size of seven (part-time) Commissioners and three full-time staff.

Very respectfully submitted,

George B. Newton, Jr., Chair
U. S. Arctic Research Commission

Annual Report
of the
UNITED STATES ARCTIC RESEARCH Commission
to the
PRESIDENT and CONGRESS of the United States

Fiscal Year 2005

United States Arctic Research Commission
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Preface

The Arctic Research and Policy Act of 1984 as amended (Public Law 101-609) requires that the US Arctic Research Commission, which was established by this Act, submit to the President of the United States and the Congress, not later than 31 January of each year, a report describing its activities and accomplishments during the immediately preceding fiscal year. In fulfillment of the provisions of the Act, the Commission presents the following report for fiscal year 2005 (1 October 2004 through 30 September 2005). For a description of the activities of the Commission in previous years, see its Annual Reports (Table 1 on inside back cover).

Contents

Highlights of Commission Activities, Fiscal Year 2005

- Conducted four public meetings in Durham, NH, Washington, DC, Columbus, OH and Anchorage AK.
- Negotiated the additional release to the public of Arctic Ocean bathymetry collected by the US Navy nuclear submarines during the period 1993-2000. The data came from 11 cruises covering approximately 25,000 track miles under sea ice.
- Conducted a successful and informative field trip to Finland where the Commission; met with members of Finland's Parliament; held joint meetings with ministerial, academic, and private sector Arctic researchers; sailed aboard a Finnish icebreaker in the northern Baltic; visited Arctic research centers; and co-hosted a reception for Finnish Arctic leaders at the US Embassy in Helsinki.
- Conducted a field visit to Alaska's North Slope accompanied by an industry environmental research manager. Commission was exposed to the considerable custodial methods used by industry to protect the North Slope.
- Continued proactive support for US ratification of the Law of the Sea (LOS-82) Treaty, working with both committees and individual members of the Senate, and various offices of the Executive Branch.
- Wrote the monthly Editorial for *Sea Technology* magazine in March 2005, addressing the importance of US ratification of the Law of the Sea Treaty to the United States and its citizens.
- Continued providing counsel to the North Slope Science Initiative (NSSI) as a non-voting member of the NSSI Oversight Group; worked to ensure appropriate strategic directions for NSSI and provided counsel on the selection of the members of the NSSI Science Technical Group.
- The Commission Chair and Deputy Executive Director traveled to Panama at the request of the Panama Canal Authority; briefed the Authority's Board of Directors and senior managers on the implications of Arctic climate change on the future of shipping in the Arctic and the potential implications for traffic through the Panama Canal.
- Continued an active and influential role in US involvement in Arctic Council affairs under the leadership of the State Department. Provided leadership and staff support for US involvement as a lead country in the Arctic Council's Arctic Marine Shipping Assessment (2005-2008), for which the Deputy Director serves as the US point of contact.
- Made invited presentations to the National Research Council study team established by the Polar Research Board to conduct "An Assessment of Polar Icebreaker Roles and Future US Needs."
- Completed negotiations, identified funding, and commenced the digitizing of archived (and classified) Arctic Ocean sound speed profiles collected by US Navy nuclear submarines during the period 1968-2000. This represents a significant data rescue effort, which should be released to the general science community in FY 2006.
- Participated as a full member of the Governance Board of the Alaska Ocean Observing System (AOOS); led effort to establish an Alaska sea ice subcommittee within AOOS to address stakeholder and research requirements for sea ice in Alaska's coastal seas.
- Continued to submit recommendations to oversee implementation of improvements to the Arctic Maritime Safety Information (AMSI) database system. AMSI is the International Arctic Ocean equivalent to the temperate ocean Notices to Mariners system, managed by the National Geospatial-Intelligence Agency (NGA). Motivated the US to propose creation of five new navigation areas (NAVAREAS) in the Arctic Ocean as part of the Worldwide Navigation Warning System (WWNWS).
- Continued leadership of a working group of international experts examining issues related to 'Scaling in Arctic Terrestrial Systems.'

- Participated with two presentations and assisted in shaping the agenda for the International Arctic Shipping Conference organized by Lloyd's List in Helsinki, Finland 27-29 April 2005.
- Participated in the International Scientific Symposium on Climate Change in the Arctic in Reykjavik, Iceland 9-12 November 2004.
- Oversaw the final, formal release of updated position information derived from the Submarine Ice Exercise (SCICEX) cruises conducted aboard USS Hawkbill in 1998 and 1999. These data will substantially improve the bathymetry/hydrography data collected during the two cruises.
- At the request of Japan, participated in the International Northern Sea Route Conference 28 June-1 July 2005 in Tokyo hosted by the Ocean Policy Research Foundation.
- Continued liaison with Canada and Denmark in efforts to acquire US bathymetry data of the Arctic Ocean for use in preparing each nation's claim to extend the outer limits of their continental shelf, as authorized under Article 76 of the LOS Treaty.
- Enabled the declassification and release of previously classified post-World War II, permafrost research, requested by a Professor Emeritus, thus allowing its publication and release to the science community.
- Participated as a charter member of an interagency working group on integrated Bering Sea research; worked to draft a future research strategy for the Bering Sea in response to regional climate change.
- Undertook co-sponsorship of the eighth annual workshop on "Alaska Port Engineering," held at the University of Alaska, Anchorage, in January 2005.
- Participated as a member of the North Pacific Research Board.
- Participated in the 2005 conference of the Standing Committee on Parliamentarians of the Arctic Region held in Washington, DC.
- Supported the development of the Arctic Council's 'Arctic Marine Strategic Plan.'

Major Research Priorities

During Fiscal Year 2005, USARC published its biennial *Report on Goals and Objectives for Arctic Research*, which is required by The Arctic Research and Policy Act of 1989 (as amended). The 2005 edition contains five major research priorities.

Studies of the Arctic Region and Global Change: The Arctic Research Commission supports the growth of the Interagency SEARCH program into a fully developed program with a common research agenda and an integrated budget approach. It also encourages US researchers to collaborate and coordinate with international colleagues. In addition, the Commission recommends an international program to promote the recovery and/or re-establishment of the most important hydrometeorological monitoring stations for systematic detection of contemporary and future environmental change.

Studies of the Bering Sea Region: The Commission encourages planning activities of the North Pacific Research Board and the Arctic-Yukon-Kuskokwim Sustainable Salmon Initiative (AYKSSI) related to the Bering Sea and its watershed and recommends a Bering Sea Ecosystem Summit. It also supports immediate expansion of joint Russian-US research to include annual research cruises and appropriate support for related research both within NOAA and through extramural funding paths.

Research on Health of Arctic Residents: The Arctic Research Commission supports the implementation of the third focused, interagency program to coordinate and emphasize research on health concerns in the Arctic and to build links to the health research programs of other Arctic nations. It also supports the continuation and expansion of the NIOSH program for reduction of injury and death in Alaska's important industries.

Research on Civil Infrastructure: The Commission recommends continuing support for the US Army Cold Regions Research and Engineering Laboratory and encourages their participation in infrastructure research in Alaska. It also recommends the implementation of the recommendations in the *Report on Climate Change, Permafrost and Impacts on Civil Infrastructure. In addition,* the Commission recommends that the Department of the Interior and the National Geospatial-Intelligence Agency take steps to acquire and make available precise geospatial data for maps of the US Arctic.

Natural Resources: The Arctic Research Commission recommends that Federal agencies immediately commence a comprehensive program of research on oil in ice based on the Commission's Special Report, *Advancing Oil Spill Response in Ice-Covered Waters*. It also recommends that the affected agencies include new research funding in their requests for re-authorization of OPA 90.

Background

The main purposes of the Arctic Research and Policy Act as amended (Public Law 101-609, see Appendix B) are:

1) to establish national policy, priorities and goals and to provide a Federal program plan for basic and applied scientific research with respect to the Arctic including naturals resources and materials, physical, biological and health sciences, and social and behavioral sciences

2) to establish a US Arctic Research Commission to promote Arctic research and to recommend Arctic research policy

3) to designate the National Science Foundation as the lead agency responsible for implementing the Arctic research policy

4) to establish the Interagency Arctic Research Policy Committee (IARPC) to develop a national Arctic research policy and a five-year plan to implement that policy.

The Arctic Research and Policy Act of 1984 was amended in November, 1990 to increase the number of Commissioners appointed by the President of the United States from five to seven voting members. Four members are from academic or research institutions; two members from private industry undertaking resource development in the Arctic; and one member from among the indigenous residents of the US Arctic. The Director of the National Science Foundation serves as an ex officio member.

The Commission staff consists of an executive director in Arlington, Virginia; the Deputy Executive Director and Alaska Office Director in Anchorage, Alaska; an administrative officer, and a secretary in the Arlington office. The Alaska regional office of the Commission is located in Anchorage.

The Commission holds business meetings and conducts public hearings in Alaska and elsewhere to receive input, and makes site visits and field trips to research facilities and projects throughout the Arctic. It publishes an annual report and co-sponsors a publication with the Interagency Arctic Research Policy Committee, the *Arctic Research of the United States*. Major recommendations of the Commission on Arctic research policy, program priorities, and coordination efforts are published on page 7 of this publication, as well as in letters to appropriate agencies.

Funds for the operation of the Commission are appropriated by the Congress in the National Science Foundation budget and expended by the Commission with administrative support from the General Services Administration. The budget in FY 2005 was $1,190,000.

Response to Mandate, Fiscal Year 2005

For the effective accomplishment of its mandated duties, the Commission must identify problems, needs, and make recommendations on basic and applied Arctic research. Most of the issues to be addressed emerge from public meetings regularly held in Alaska, Washington, D.C, and from field visits to relevant sites in the Arctic and institutions conducting Arctic research.

Meetings during Fiscal Year 2005:

October 5-7, 2004, 73rd Meeting, Durham, NH

January 18-19, 2005, 74th Meeting, Washington, DC

March 3-4, 2005, 75th Meeting, Columbus, OH

June 9-10, 2004, 76th Meeting, Anchorage AK

The summary of Fiscal Year 2005 Commission meetings are provided in Appendix A. Appendix B is a list of other meetings attended by Commission members and staff.

Appendix A: Summary of Commission Meetings
Fiscal Year 2005

73rd Meeting, 5-7 October 2004
University of New Hampshire
Complex Systems Research Center
Institute for the Study of Earth, Oceans, & Space
Durham, NH

In attendance:

Commissioners

Mr. George Newton, Chairman
Mrs. Michele Longo Eder
Mrs. Mary Jane Fate
Dr. Thomas C. Royer
Dr. Susan Sugai
Mr. Mead Treadwell

Staff

Dr. Garrett Brass, Executive Director
Dr. Lawson Brigham, Deputy Executive Director and Alaska Office Director
Mrs. Kay Brown, Administrative Officer
Ms. Kathy Farrow, Staff

Attendees

Berrien Moore, Director, Institute for the Study of Earth, Oceans and Space; **Charles Vörösmarty**, Director of the UNH Complex Systems Research Center (CSRC) and Water Systems Analysis Group (WSAG); **Matt Stubbs**, consultant, US Arctic Research Commission, **Mark Fahnestock**, UNH Complex Systems Research Center; **David Bartlett**, Associate Director, Institute for the Study of Earth, Oceans and Space; **Darlene Dube,** UNH Complex Systems Research Center (CSRC); **Lawrence Hamilton**, UNH sociology department; **Igor Shiklomanov**, State Hydrological Institute, Russia; **Peter Johnson**, Canadian Polar Commission, **Ann Brengle**, New Bedford Whaling Museum; **Bruce L. Mallory**, UNH Provost

Wednesday, October 5, 2004

New **Commissioners Michele Longo Eder** and **Thomas C. Royer** were installed at the 73rd US Arctic Research Commission (USARC) replacing retiring members John Hobbie and Jack Roderick.

Commissioner Michele Longo Eder, attorney, whose practice includes an emphasis in marine and fisheries law, has for the past 25 years lived on the Oregon coast representing family-owned commercial fishing businesses. **Eder** frequently appears before state and Federal regulatory agencies regarding commercial fishing issues.

In partnership with her husband, Bob **Eder**, she owns the F/V Michele Ann, a 66-foot steel vessel based in Newport, Oregon. In addition to fishing for Dungeness Crab and Sablefish, the vessel engages in collaborative fisheries research with state and Federal agencies, such as National Marine Fisheries Service and the Oregon Department of Fish and Wildlife, as well as with scientists at the University of California at Santa Cruz, and the Oregon State University.

She is also President of **Eder** Fish Company, and as a wholesale fish dealer, sells the family's crab and sablefish catch to domestic and foreign buyers. Active in her community, she has served on the Board of Directors or President of a number of groups, primarily those that provide services to children and families, including the Newport Fishermen's Wives, the YMCA, and the Newport Library Foundation. Currently, Michele is authoring a book entitled *It's Not Fish Ye're Buying, It's Men's Lives*, a journal of a fisherman's wife.

After graduating from Texas A&M University and accepting a an assistant professor position at the University of Alaska, **Commissioner Thomas C. Royer** has focused his work on measuring long waves (tsunamis) in the North Pacific and hydrography. For over 34 years, he has conducted measurements of hydrography in the NE Pacific, from Alaska to Hawaii, during all seasons of the year. This work led to the discovery of a significant coastal current along the coast of Alaska that is driven by freshwater discharge. This finding provided a reasonable prediction of the trajectory of the oil released during the 1989 EXXON Valdez oil spill.

While at the University of Alaska, he served as the Chancellor's Faculty Associate for Research in 1992-93, administering the research activities at that campus. He was awarded the Edith Bullock for excellence in service to the University of Alaska. He has served on the National Research Council (NRC) and several review committees. Presently he is the chair of the NRC committee that reviews the science plan for research and restoration of the western Alaska salmon.

Royer is presently a Slover Professor of Oceanography at Old Dominion University. He has pursued his interest in coastal and deep ocean processes in the North Pacific and continuing his research there and in the Chesapeake Bay. **Royer** is working on freshwater discharge budgets into the ocean and global sea level analyses.

Earth, Oceans and Space Study

Following introductions by other Commissioners in attendance, **Berrien Moore, III,** Director, Institute for the Study of Earth, Oceans and Space (EOS), familiarized Commissioners with the Institute, located on the University of New Hampshire (UNH) campus in Durham. The

alliance between UNH and EOS began in the late 1950s spawned and preserves an active program developing instruments for space missions including several Pioneer and Voyager exercises and the Solar Max mission.

Between 1990 and 2000, UNH was on most of the space science missions launched and partnered with the major universities and laboratories in the USA and Europe. In the early 1990's, astronauts aboard the space shuttle Atlantis launched a gamma-ray telescope into orbit, the largest payload ever taken into space. The Gamma Ray Observatory (GRO) helps astronomers detect and measure gamma rays, radiation with wavelengths even shorter than X-rays. Other UNH endeavors during the decade positioned the school for a variety of roles and applications.

WIND—understanding the sun-earth connection
SOHO—part of a large, international team that built the Charge, Element and Isotope Analysis System
FAST—particle acceleration into the Earth's aurora
POLAR—understanding the sun-earth connection
EQUATOR-S—looked at the magnetosphere out to distances of 65,000 km
CLUSTER II—built the Ion Composition and Distribution Function (CODIF) analyzer instrument for **CLUSER II—**the original Cluster experiment was destroyed when the Ariane-5 rocket exploded 61 seconds after lift-off in 1996.
ACE—built the energetic particle charge analyzer (sepica) sensor flown on ACE that provided fundamental information not only about Sun-Earth interactions but also about the internal working of the sun itself.
The involvement of students in every scientific pursuit is a prerequisite at UNH. Their contributions have played an important role in research programs on land, water or in the air. These projects include use of air balloons to study clouds and measure winds, ozone levels and pollution throughout the world.

Complex Systems Research Center
Charles Vörösmarty, Director of the UNH Complex Systems Research Center (CSRC) and Water Systems Analysis Group (WSAG), outlined his department's mission to

- study and better understand the major biogeochemical cycles of the Earth system
- uncover to role of humans in the Earth system and to assess key impacts
- support sound policy formulation and environmental management
- educate the next generation of Earth system scientists

CSRC's 15 faculty, 16 full-time graduate students and 35 full and part-time technical staff are involved in field observations and experiments, remote sensing and geospatial analysis, modeling and data integration, assessment and synthesis, data serving to the community and outreach. Their work is supported by $10.9M in extramural research grants.

Specifically, CSRC is currently involved in site-scale field experiments measuring CO_2 and atmospheric trace gas emissions to begin to infer, for example, how quickly nitrogen is cycling in the soils. Increasing levels of nitrogen have potential impact on landscape that is cascading down through river systems to the coastal zones of the world. This has very important potential influence on, for example, the health of fisheries based on the kinds of chemistry that emanates from the landscapes.

A related topic of study is the distribution of carbon that has potential for carbon sequestration and the byproducts of trying to sequester carbon. For example, while managing for carbon, researchers are simultaneously increasing the nitrous oxide fluxes, this trace gas of nitrogen, as the byproduct of trying to sequester carbon. CSRC is looking at interactions across elements in order to better understand the true environment.

The Water System Analysis Group from the CSRC is interested in filling in emerging gaps in the understanding of land surface hydrography. Across the globe there's been a net decline in the capacity to monitor stream discharge. A NASA working group on surface waters is attempting to target candidate sites around the country, generally rivers, to determine their discharge regimes. These sites would be identified by their widths, heights and slopes through orbital analysis. Even though the US does a relatively good job at stream gauging, in Africa, there has been a 90 percent decline in the reported data archives over the last 10 years. So this becomes very important in order to understand the hydrosphere elsewhere.

CSRC has instituted a teacher and student education/outreach program, a so-called forest watch, providing students from a consortium of schools with real hands-on experiential research. In one case, students looked at the health of White Pine needles. At the same time, they studied levels of ozone looking at laboratory and student collected data at UNH. The desired outcome was to piece together this very interesting inverse relationship between ozone and the health of needles.

For many years CSRC has been custodian of the state's data bank. It has collected tens of gigabits of data sets, probably hundreds of individual data layers that have been prepared at very high resolution for state planning agencies. This collection represents the service, outreach and data service that extends globally, regionally and locally.

Welcome
Provost and Executive Vice President for Academic Affairs, **Dr. Bruce L. Mallory**, formally welcomed the Commissioners to the University, and offered a brief overview of the significance of the ongoing research that is underway at UNH. He recognizes the need for continued R&D funding but was pleased to highlight the resulting work that UNH faculty and research scientists have been able to accomplish through funds they have obtained.

Arctic Research Budget Reporting
Matthew Stubbs, consultant, US Arctic Research Commission, stated that the current budget analysis done by the Interagency Arctic Research Policy Committee (IARPC) and Office of Management Budget (OMB) appears to be conducted on a field observation level; meaning they track the budget as it occurs. This is the case since most of the primary agencies in IARPC that spend money on Arctic research are doing so through grant funding that occurs following the appropriation process. As a result, they're not sure what they're spending until the funds are for the most part already spent.

The Arctic Policy Act calls for the Budget request to be reviewed, analyzed and commented on by the US Arctic Research Commission (USARC) in a timely manner following the submission of the President's Budget to Congress. In order to partially accommodate that, the Office of Management Budget (OMB) has agreed to do a data call using the current overall Arctic research budget outline. OMB will also send out a memorandum requesting the timely submission of this information and provide the budget document itself to all of the IARPC agencies to collect the information. This budget document format is the same as has been previously released in the Arctic Research Plan as compiled by Chuck Myers at NSF.

The significant change will be in the timing of this information request. Previously the budget information was collected well after the money was appropriated and spent. Greater detail was requested. However this was the extent that OMB was willing to commit to because agencies have difficulty forecasting how much will be spent in their specific areas of authority.

Chairman George Newton asked whether Stubbs believed the wording in the Act is sufficient to support what is recommended or does the wording of the law need to be changed. Stubbs said he believed the wording is sufficient to support the OMB data and because of that wording, OMB is required to have the information in a timely fashion, not after the money has been spent and appropriated.

Commissioner Mead Treadwell suggested that the process could become useful because the Commission will have an inside look at the budget. When Commissioners speak to specific committees in the House and the Senate, the various budget demands would be under the purview of those particular committees in each house thereby tying the issues together.

Matthew Stubbs submitted a second recommendation, an end of fiscal year IARPC Arctic Research Program audit. Utilizing a second request to the IARPC agencies at the end of the fiscal year, the Commission could compile a list of funded programs and research. These programs would then be checked-off as contributing to each of the Arctic Research Goals.

Stubbs believes that in implementing this type of two-step process, with a component of auditing after the fact, will result in the reporting of a greater level of funds than the amount that the agencies are pre-reporting as their budget request. He thinks that this alternative approach returns to the Commission their intended role—to comment on the research that is being done with the ability to provide adequate financial numbers.

Newton said he would like to have the opportunity to review the information presented and have an actual discussion in the future. USARC's charter is to, among other issues, to insure efficient use of resources. He recognizes that everyone who manages a program harbors concern that somebody's going to say, 'we can use it more efficiently and apply it in a different spot' or 'if you got the research to work with x why change things.' But he does want to point out that the Commission's Goals Report offers specific recommendation for agencies. Now the Commission has dollar amounts that it can put next to those recommendations and pronounce the figures sufficient, insufficient, or requires redirection.

Rapid Ice Flow in Greenland

Mark Fahnestock, Complex Systems Research Center, centered his discussion on two regions of rapid flow in Greenland:

- the relatively stable ice stream in the northeast, which has regions of rapid basal melting at its onset
- Jakobshavns Isbrae, aka "the fastest glacier in the world," which has doubled its speed and discharge in approximately the last five years.

Neither of these features is well reproduced in ice sheet models. Modeling the ice stream is problematic because of the unusually high rates of basal melting. The rapid changes on Jakobshavns Isbrae are difficult to reproduce for a number of reasons:

- rapid deformation of ice
- large amount of melt water with access to the bed
- narrow, deep fiord geometry through which the glacier runs—the channel is about as deep as the Grand Canyon, but much narrower.

Understanding of the Greenland ice sheet is improving dramatically from the observational side of things. Fahnestock sees significant improvement in researchers' understanding of what the ice shapes are doing. Despite that knowledge, when looking at big outlook glaciers, they seemingly do not possess stable features. Most of the big outlook glaciers being looked at in detail, using satellite data, show high rates of variability. Many of the mass balance

measurements that are made on ice shapes are an estimate of how much snowfall and ice flow are calculated. What is apparent is that the ice flow numbers can vary rapidly.

Predicting the future behavior of these outlet glacier systems, and their impact on the ice sheet, is not possible given present knowledge and present modeling approaches. But a system that is changing rapidly is one that has the potential to be understood.

Commissioner Mary Jane Fate asked about the impact of variables such as earthquakes and hot springs, those events occurring under the earth as opposed to above the surface. Fahnestock indicated that the very rapid changes that are seen in tidewater glacier systems are an ice dynamic signal. The speed of the ice has changed. The Geophysical Institute in Alaska has been able to sample enough glaciers to show that there is a significant draw down of glaciers in the state, occurred at high meters per year rates.

Treadwell wondered about the large new melt ponds on the surface of the Greenland Ice Cap and whether they have anything to do with glacial stability. Fahnestock is uncertain. The Greenland Ice Cap is much more closely related to the big glaciers in Alaska because of rapid surface melting. But is there enough increased melt to destabilize the sheet and explain a factor or two of increase in speed? Fahnestock thinks it's a pretty open question. Controlling factors for a particular glacier such as a summer signal where its velocity increases are different.

Commissioner Thomas Royer asked about any estimates of the total discharge out of the Greenland. Fahnestock believes the total discharge out of that glacier, as it has doubled, shows an increase in discharge of between 25 and 35 cubic kilometers of ice a year. If you look at a hundred year, a 15 cm or 18 cm sea level rise, it's enough to add about four to six percent to that number from one glacier in five years. That's a tiny fraction but it also explains that the background variability of discharges is substantial on a global scale compared to what has been seen.

Measuring Arctic Rivers

When **Richard Lammers**, Water Systems Analysis Group, UNH, looks at the Arctic region, he sees it not just from a polar viewpoint, but from a hydrological perspective as well—delivery of water to the Arctic Ocean and the northern seas, as well as boundaries of the drainage basins. That land is made up mostly of forests, tundra and grasslands. The bulk of the land area is actually contributing water to the Arctic Ocean. As a result, hydrologically, they're very important.

His focus is the primary water sources located within a domain he refers to as the Pan Arctic region. The Pan Arctic includes the Ob, Yenisey and Lena rivers in Russia, the Mackenzie and Nelson rivers in Canada, the Yukon River in Alaska/Canada, the Hudson and James bays in Canada. To monitor river networks, Lammers and his colleagues have developed semi-automated processes to extract and then help define the basin locations and verify that the network is actually accurate. This allows them to map out a series of related issues such as distance to ocean along the river lines. What they've been able to do with the network is capture the full detailed structure of the Pan Arctic.

One of UNH's river discharge data set objectives is to try and measure as many of the river discharge gauges in the Pan Arctic region for the full period of record (monthly time steps). Currently UNH receives data worldwide from more than 5,000 gauges located in very small to very large drainage basins with short to very long time series. In Russia, placement of the gauges is based on the actual hydrology where in Canada and the US, they are placed based on provincial and state boundaries.

From the mid 1930s through the mid 1980s, the number of gauges monitoring the Pan Arctic increased. However, throughout the remainder of the 1980s and 1990s, gauges were increasingly shut down in both Russia and North America—largely Canada, owner of the bulk of the North America's gauges. As a result, large amounts of data from Siberia and huge portions of Ontario were also lost. But these gauges are slowly being reintroduced.

From the data, Lammers can measure the local runoff over the entire Pan Arctic. He can also then combine this with the river network to take that local runoff and route it downstream to get an estimate of the river discharge at every section along the stream. He can also determine the hydrological contribution of major land cover to the ocean with the forest contributing most heavily, followed by tundra and grassland contributing the least.

In another project, he and his colleagues are trying to put together the full picture of this hydrological budget over the land, atmosphere and ocean of the large domain known as the Arctic Rim. The objective of the project's website at rims.unh.edu is to bring together a variety of disparate data sets that all focus on this region:

- view those data sets at a variety of time scales, daily, monthly, yearly and spatial scales of the watershed, sea and continent level
- view some animations of the data sets in a variety of time series

Looking at the real time or near real time river discharge at daily time sets offers some understanding of what is occurring in the hydrological cycle. In addition, it will allow for the design of some models that can provide forewarning on, for example, flooding over the hydrological cycle or link what is being seen on the land and ocean that has impacts on ocean currents.

By sorting all of the gauges by the largest drainage area to smallest, if one samples the 10 largest gauges over this domain, one can actually pick up about 72 percent of the drainage area. To understand what is occurs in the ocean based on what is happening on the land surface, a combination of real time data is needed and it is coming in rapidly. However, these historical data sets are needed and gauges need not to be shut down in the future. These long-term gauges provide a cohesive record of ongoing events to provide a comprehensive picture of the whole land surface in order to explain atmospheric interactions with the land and how that signals been filtered through the land to the ocean.

Newton asked Lammers to physically describe a river gauge. Lammers described them in simplest terms as measuring a base point by putting a yardstick in the water or a permanently built tube at the side of the river, containing floats, to measure the river as it goes up and down. **Newton** suggested that it's primarily the manpower expense of gathering the information that has forced these to be shut down. Lammers said in many cases in North America, the gauges have been automated but there's still the cost to actually send people out on a regular basis to gather the data. What can also be learned at these sites is the relationship between the height of the river relative to its discharge based on how erosion happens, the presence of sedimentation or erosion of the channel bed, vegetation growing on the side, etc. That takes a lot of expense, especially if many of these gauges are in a very hostile environment in the far north. By far, however, most of the gauges are in the south, near population centers. Vörösmarty added that the average cost of the USGS program comes out something on the order of $10,000 per station per year. But the Alaskan sites are something on the order of about $20,000 per year. Hence the closure of the gauge at Pilot Station was a temporary cost saving measure.

Treadwell said that his and the State Department's challenge is to ask scientists to agree and determine a desirable dollar amount based on the need for continued gauging of the river, a

projected scientific loss without these measurements and the amount of work left to be accomplished. Lammers said that the priority should be to keep the longest running gauges active. The second priority would be to measure the 25 percent of rivers that have not yet been reached.

The group discussed the need to craft a particular strategy or statement that would commit the Arctic nations to participate in continued gauging and entice the US Congress to do the same. It would also make clear an accountability requirement that could later hold participants' feet to the fire.

Royer added that equally important to the discharge volume is its phasing especially with regard to ecosystems. This information can have a very strong influence on fisheries. Lammers agreed to the importance of this data and that it is currently being collected in addition to data regarding river temperature, ice conditions, etc.

Fate expressed concern about the winter drainage, its cleanliness and how's it's monitored. In addition, she has witnessed other, smaller rivers that have been shut down.

Interpreting Ice Core Records for Arctic Climate Change
Cameron Wake, Climate Change Research Center, UNH, discussed the University's work in trying to develop an array of Arctic ice cores to better understand change on a regional scale. The GISP cores (Greenland) provided the "big picture" but there is a need for more coring in various areas in order to understand that climate change throughout the Arctic region. UNH is moving away from simply collecting records that convey generalizations toward actually calibrating them for temperature and precipitation to measure changes in the climate system. The expectation is to eventually determine ocean productivity from ice cores. However, the ice core data alone won't provide all of the information needed to develop a composite picture of change throughout the Arctic. It will have to be linked with meteorological, tree ring, lake sediment and marine sediment data to generate a comprehensive picture.

Understanding the spatial variability locally requires establishing arrays of ice cores throughout the Pan Arctic from different elevations and locations. Fortunately for Wake and colleagues, ice cores are now much more plentiful throughout the Arctic than before thanks to the research activities of a number of countries including Canada, Japan, Germany, France and Greenland. By developing this spatial network of ice cores, Wake hopes they will allow further understanding changes in the North Atlantic Oscillation, North Pacific Oscillation, the Aleutian low over time and how those have responded to events such as the little ice age including answering the question, "what kind of change happens here during those periods?" By studying these changes, along with different forcing factors, Wake believes scientists will learn how those events might inform future change in this region.

The ice cores also impart information related to the previous Arctic temperatures based on
- location of various species of seal bones
- sea ice over time by the established sea salt sodium record
- annual sulfate flux on various glaciers that historically correspond with the beginning of sulfate deposition right around 1900 and the industrial revolution from the burning of fossil fuels.

Some ice cores yield up to tens of thousands of years of records. UNH is able to better calibrate records because it can definitely identify very specific annual layers. It has time horizons provided by volcanoes or nuclear weapons testing in the atmosphere.

The next place Wake is interested in exploring is Denali. However funding, transportation and equipment access and US Park Service buy-in has delayed that possibility. It's going to affect

the science that can be done because of the inability to get the money that is needed to continue these programs.

Freshwater Initiative (FWI)
Charles Vörösmarty described a $30 million, five-year program consolidated under the NSF-Arctic System Science (ARCSS) program at UNH to study the freshwater hydrologic cycle called the Freshwater Initiative. It is currently underway under the direction of Larry Hinzman and Vörösmarty, co-chairs of the NSF, ARCSS, Community-wide Hydrological Analysis and Monitoring Program (CHAMP), and Jonathan Pundsack, Executive Director of the Freshwater Initiative. It was designed to consolidate a workshop that would lend strategic advice to the NSF on investments for hydrologic research in the Arctic. It involves 35 national and international interdisciplinary researchers.

Water is absolutely central to all the earth systems including the Arctic system. It figures prominently in the atmospheric dynamics, terrestrial ecosystems regulating biogeochemistry, regulating carbon fluxes and productivity, the cryosphere, the ice sheets and, of course, hydrology itself. So it becomes important in looking at the issue of climate change. It's also important in terms of understanding patterns of natural variability and alternatively human vulnerability in the Arctic because of the connections of the Arctic to the larger earth system society at large.

FWI asks three questions around which the research is consolidated.

1. Is the hydrological cycle of the Arctic intensifying? This issue is affiliated with the greenhouse-warming question and whether patterns of weather are becoming more extreme.
2. If so, why? This question gets to the heart of the matter. If one goes to the trouble of figuring out how much water there is, then a comprehensive analysis and results are reasonably expected.
3. What are the implications both in terms of the larger earth system? Can feedback and thresholds and surprises in the earth system be seen? Ultimately what does this mean for society and what are the human implications? Is there some policy relevance?

In trying to answer these questions, researchers took into account atmospheric boundary fluxes and the atmospheric dynamics, land service atmosphere exchange, changes in glacial mass balance and runoff, dynamics of sea ice, discharge through river networks that are well organized and runoff over poorly organized low inflow systems. They identified direct ground water inputs into the Arctic Ocean. They reviewed Arctic Ocean dynamics in general and the linkage to deep-water formations in the North Atlantic. Then they linked results to biological dynamics and food chain issues. Permafrost pervades all of the land surface hydrology. However, their discussions did not take into account the stream component of the cycle, ground water discharge directly into the Arctic or the biological dynamics.

One good example is the reason behind the systematic increase in Eurasian discharge. In terms of trying to dig into what might be occurring, one of the first attempts was to link this increase to a potential acceleration of the hydrologic cycle as evidence of the correlation between the North Atlantic oscillation and global surface air temperature. The thinking is that there is a potential to accelerate the hydrologic cycle through a more vigorous North Atlantic oscillation.

Brass indicated that warm climates are equitable climates and as such don't really heat up the equator but do heat up the high latitudes. To get the heat away from the tropics and up to the northern and southern regions requires water vapor. Right now the latent heat transport is a minor part of the global transport but it's going to grow. So as the climate warms, the guarantee

is that they'll be intensified. Vörösmarty added that the reason this measurement can be taken in Eurasia, but not North America, is because of Eurasia's longer record.

Royer discussed a model of a rough estimate of freshwater discharge in the Gulf of Alaska that shows that same trend and that record begins in 1931. In addition, another feedback model indicates that the accelerated hydrologic cycle is also increasing the heat advection. So temperature increases are seen that accompany this increased advection in the Gulf of Alaska and the Bering Sea.

There's a complex dance going on between cold freshwater coming out of the Arctic and saltier warmer water coming north. Where they meet in the Nordic Seas, the densities are sufficiently similar to promote advection and the plunging of the surface water into the abyss. This can slow down the earth's hydrologic conveyer belt and push the system to the point at which a country could actually be plunged into a temporary cold snap.

Now the question from a societal standpoint is what is the implication of this. Ten billion people live where the food growing regions of the earth have now been plunged into a cold snap. So this has a much broader strategic imperative beyond just looking at the academic nature of the hydrologic water cycle.

One of the important ingredients in terms of understanding the flow of freshwater through the Arctic has to do with the entrainment of freshwater in the region, for instance around the Beaufort Sea, through the Canadian Archipelago, and out on either side of the Greenland land mass, one of the poorest sampled regions of the Arctic. In this area different types of flow are invoked based on the condition of the North Atlantic oscillation and the Arctic oscillation. The FWI effort is bringing together models of this system as well as observational studies to look at differences year-to-year in this freshwater flux boundary about which very little is known.

Another FWI effort analyzes the history of discharge in large river systems, specifically the stratigraphy at the Lena River Delta. This is being done by taking seaward cores and attempting to unite current data in a contemporary mode with discharge measurements along transects near the mouth of the river; looking at discharge and suspended sediment fluxes, to decipher how these contemporary estimates are correlated to the different types of sediment faces that are found in the Delta. The idea is that by linking the two pieces of information together one can actually develop a set of relationships that will allow scientists to look at the sediment cores and decide what the discharges were, for example, over a 4,000-year period—by using the present as a key to the past. Through this, Vörösmarty can combine a Paleo perspective using contemporary estimates to guide that understanding.

There is a human dimension as well. Although the Arctic is not all tundra, the high Arctic is mostly tundra, a so-called polar desert. Even though it looks water logged and wet, it is not really wet by climatologically standards. In fact, elements of water stress occur in the Arctic such as water scarcity, water pollution and unsustainable water use in communities parallel what is found throughout the semi-arid and arid developing world in the lower latitudes.

The ARCSS program at NSF is undergoing a very important shift in the way its doing business. What it's trying to do now is to get away from its rather successful 20 years of disciplinary research and move into reviewing systemic behaviors of the Arctic, thinking more holistically or integratively.

The FWI effort, with 22 projects and 60-70 participants, is also going towards a synthesis. The projects are organized into two blocks:

- develop a freshwater budget of the Arctic that incorporates an inventory of the basic knowledge of contemporary stocks and fluxes, links water and energy cycles and attempts closure of the budgets.
- look at the change question and the attribution question by linking together modeling studies with observational studies in order to have full, contiguous coverage of the Arctic.

The big question is whether they link the two in some consistent fashion. As a result, FWI is working to inventory change from the early 20th century to the present, supported by Paleo reconstructions, assemble GCM/RCM/ESM attributions studies and check coherence of catalogue and modeled outputs.

Commission Reports

George **Newton**:

- attended a conference in Washington, co-sponsored by Dr. Bernie Coakley, UAF, and NSF that addressed the geophysical properties of the eastern Arctic and the Siberian shelf. **Newton** spoke with the Danish and Canadian delegations about their invitations to the United States concerning submarine acquisition of bathymetry off our coast for Article 76 submissions under the Law and the Sea.
- met with Tom Pyle at NSF and Captain Stephen Z. Kelety, USN, the new director of the Arctic Submarine Laboratory in San Diego, to discuss the future of the SCICEX program and what kind of cooperation might be anticipated and provided. In that vein, Kelety asked Dr. Pyle to prepare a brief to go to the submarine community on science needs in the Arctic.
- met at the National Geospatial-Intelligence Agency (NGA) to discuss release of US Navy Submarine bathymetry collected inside the Greenland EEZ for release to the Danish government for their Law and the Sea, Article 76 survey. During June and July, he exchanged several emails with the Danes concerning the data release.
- presented an invited paper on oil spills in ice-covered water and the needed research to litigate oil spills in that environment, based upon USARC recent report, in St. Petersburg, Russia at a meeting for the Law of the Sea, international energy policy and the Arctic, . The meeting was sponsored by the University of Virginia Law School Center for Ocean Law and Policy and the Russian Hydrographic Institute.
- met at the Commission office in Arlington, VA to discuss preparation of a Commission brochure.
- met twice at the Commission office in Arlington, VA with Matt Moon, a student at Harvard and contact of Commissioner **Treadwell**, to discuss Arctic research and his senior thesis.
- met with Booz Allen Hamilton on the state of US icebreaker fleet.
- met at NGA again but this time with the Maritime Division staff to discuss revisions on the Notice on the Mariner's website as it accommodates the Arctic maritime safety information system database.
- met with Bill Woolf at Senator Murkowski's office to discuss the Commission's activities and Law of the Sea issues.
- met with Todd Bergenson of Senator Ted Steven's staff to deliver a white paper on why the US should ratify the Law of the Sea treaty.
- traveled to San Diego to brief the new director of the Arctic Submarine Laboratory on science in the Arctic Ocean, the Commission's role in working with the Navy and also to attend the change of command, to which **Newton** was invited.
- prepared and submitted the paper for the proceedings of the St. Petersburg Conference on Law of the Sea, Arctic shipping and oil in ice.
- attended a meeting at the State Department to review and comment on Brazil's submission to extend the outer limits of its continental shelf under 76 in Law of the Sea. The submission was essentially non-controversial.

- conducted several email and telephone exchanges with the Director of the Byrd Polar Research Center at Ohio State to firm up dates for the Commission's meeting in March.
- met as the USARC representative to the Arctic policy group at the State Department regarding the International Polar Year (IPY) and the Arctic Climate Impact Assessment Report.
- met with Dr. Jim Cadkey of Senator John Warner's staff to brief him on the need for the US to ratify the Law of the Sea treaty
- delivered white paper similar to that Newton delivered to Senator Stevens staff earlier
- met with Dr. Arden L. Bement, Jr., Director of NSF and an ex-officio member of the USARC Commission to discuss the Law of the Sea, ice breaker research, Arctic marine transportation and Arctic and national security.

Treadwell asked whether the US will be present in an observer capacity at the Law of the Sea amendment session. He suggested that **Newton**, as the Commission's chair, accompany a couple of involved Senate staffers to observe the proceedings.

Commissioner Treadwell:

- attended on behalf of the Commission a congressional hearing that Senator Stevens held on the effect of climate change on infrastructure in Alaska. Regional director of the Corps of Engineers suggested that the Commission or a representative meet with the Corps' science advisory group that will be meeting in Washington DC in November.
- held several conversations with leading committee chairs in the Alaska legislature on the Law of the Sea issues; the affect of Law of the Sea on Alaska.
- dined with Steven Growls the Deputy Secretary of the Interior and briefed him on a number of Commission activities. He had been active on Law of the Sea issues before and said the Interior Department had taken a buy on this within the administration
- met with Senator Pierce who asked the solicitor of the Interior Department to prepare a briefing for him on the effects of Law of the Sea ratification on the Interior Department and the additional land jurisdiction
- attended a meeting with **Newton**, **Brass** and Stubbs and IARPC to begin the budget process that Stubbs discussed earlier.
- met Mark Fryker who discussed how Caribou modeling could help the North Slope's science plan. **Newton** arranged a meeting for him with the Interior Department and leaders of the North Slope Science Industry in Anchorage
- attended dinner with Commissioner **Fate** for Elias Zerhouni, M.D., director, National Institute of Health, who announced a grant to begin additional health studies in Alaska
- addressed the World Affairs Council National Board, which conducted a workshop on Arctic Nations and received a number of speaking requests for other presentations around the country concerning the Law of the Sea as well as the permafrost and oil and ice reports.

Finally, Commissioner **Treadwell** commended Brigham for presenting an outstanding international workshop in Cambridge. It resulted in a long list of Arctic research ideas including an Iceland-US coordinated feasibility study on northern sea route shipping.

Commissioner Susan Sugai:

- attended the Bridging the Poles Workshop in June, organized by NSF to develop strategies for handling outreach for IPY
- attended a meeting in Fairbanks to better understand research expedition to the Beringia-region in the summer of 2005 using the icebreaker Oden as a platform. The Beringia 2005 expedition can be seen as a completion of earlier tundra ecology efforts:

Tundra Ecology 1994 along the entire Eurosiberian Arctic coast, and Tundra Northwest 1999 along the Canadian Arctic archipelago and Nunavut.
- attended a meeting organized by Booz, Allen, Hamilton to solicit input regarding the use of the Coast Guard icebreaker fleet for research purposes
- attended the Arctic division AAAS meeting and participated in a roundtable discussion entitled, "How Different is the North Social and Natural Science Perspectives in Arctic Systems." Panelists were asked the questions: What is the Arctic? How is the Arctic different? It was interesting to see the variation in the way the social scientists and natural scientists define the limits of the Arctic.

Commissioner Mary Jane Fate
Attended the energy council meeting held in September where a variety of topics were discussed including Alaska Gas Pipeline research and a comparison to the oil pipeline of the early 1970s, a natural resource gas assessment, the coal bed, methane exploration, nontraditional energy sources, remote sensing technology on energy and the Trans-Alaska Pipeline system. The Minerals Management Service policy initiatives were also discussed.

Staff Reports
Executive Director Garrett Brass
- attended meeting just north of St. Petersburg in Russia titled Assessment of Topographic Highs in the Arctic Ocean, that revolved around identifying whether these typographic highs in the Arctic are extensions of the continent or not. The Russians were extremely annoyed that their claim had not been approved. It was an educational experience because a majority of Russians participants don't believe in sea floor spreading. The US ran interference so that a statement that says that the Lomonosov and Mendeleev ridges are continental and therefore should be part of the Russians claim to the sea floor in the Arctic Ocean would not reach consensus.
- attended a Polar Research Board meeting for strategic planning. Met a representative from the Institute of Medicine who wants to initiate a program on Arctic health focusing on the extreme causes of illness and death, mainly suicide and addiction.
- met with the Booz Allen team regarding the US Coast Guard and icebreaker operation and whether or not the Coast Guard is the best entity to act as research vessel operators in the Arctic Ocean.

Commissioner **Treadwell** asked if the Commission had taken an official position on this issue. This is extremely sensitive in light of a number of homeland security arguments that indicate that discussion should take place about a security initiative in the Arctic.

- attended an IARPC seniors meeting at which Arden Bement, director, NSF, asked whether or not the various agencies were "committed to IPY." A general commitment was indicated.
- attended University of Rhode Island colloquium on the Ocean Policy Commission (OCP) and its output. One participant contended that the OCP report would revolutionize fisheries. **Brass** questioned that assertion. He reminded participants that the report primarily speaks to structure and assumes that structure would affect behavior. This assumption doesn't pan out when comparing the success of the North Pacific Fisheries Management Council with the failure at the New England Fisheries Management Council, organizations with basically the same structure.
- attended the Arctic transportation meeting that brought up several issues important to the Commission. The Magnuson-Stevens Fishery Conservation and Management Act, which has expired, may be resurrected. Should this happen, the Commission will attempt to affect the Act so that there is a commitment to ecosystem management of fisheries, and follow-up ecosystem research. Also, the oil pollution act of 1990 that has expired is up for reauthorization and the Commission should work hard to get the

research-funding component back, particularly in oil and ice, which was dropped in 1995. The Commission was also unable to insert desired changes in the Arctic Research Policy Act but hopes to when the new Congress convenes and it is resubmitted.

Brass revisited the polar icebreaker issue and that both US ships need overhauls. However, no entity wants to absorb the operations, maintenance or repair costs necessary to get these ships up and running. Operations have run between $20,000 and $40,000 per day and the repair or replacement of these ships would run $.5 billion. In addition, if the Healy were deployed to resupply McMurdo station, the Arctic would be left without icebreaker capabilities.

Deputy Executive Director and Alaska Office Director Lawson Brigham
There are four boards now in Alaska in which the United States Arctic Research Commission is actually a card-carrying member: the North Pacific Research Board, the North Slope Science Initiative, the Alaska Native Science Commission and the Alaska Ocean Observing System. Department of the Interior has created an initiative to have more robust recommendations for science on the North Slope. USARC will be participating with this group in the future, as well.

- the permafrost report was published in July with CRREL serving as the technical editor. The oil and ice report really is receiving significant press attention press attention. **Brigham** was interviewed about the oil and ice report in *Science*.
- reviewing multiple drafts of the PAME Arctic Marine Strategic Plan for the Working Group Protection Arctic Marine Environment. **Brigham** advised the US, Canadian and Finish delegations about this proposed Arctic shipping assessment that will be a major project under PAME.
- made presentation on the Arctic Climate Impact Assessment on behalf of Bob Corell about the changes in the Arctic Ocean, changing sea ice, how that correlates with increased marine uses of the Arctic Ocean.
- planned Commission trip to Finland for March 6-11, 2005. The Commission will arrive in Helsinki and have two Parliamentary committee meetings: the Committee on the Future and the Committee on Arctic Affairs and hopefully with an inter-ministerial group that deals with Arctic and Antarctic research. **Brigham** has spoken with a deputy at the United States Embassy in an attempt to arrange a reception with researchers and parliamentary and ministerial representatives who are involved in Arctic-related issues. Plan to visit Helsinki and Oulu, among other sites, and hopefully in a trip on icebreaker.
- worked with Dr. John Hobbie on Commission's Scaling Task Force and the Scaling in Arctic Terrestrial Systems project. We anticipate having a draft report by the end of the year with recommendations for NASA and NSF.
- met with the Swedish Polar Secretary Anders Karlqvist .
- met with several individuals in the Federal government about the Bowden research cruise around Alaska including the involvement of the Oden and the Healy
- met with Booz Allen Hamilton team along with **Treadwell** as well as representatives from the US Coast Guard. Conducted a robust discussion about polar icebreaker research needs and the meaning of the US as a maritime Arctic country. Linked consulting firm with individual researchers who have high levels of experience with icebreakers.
- working with Dr. John Walsh at IARC on a sea ice atlas of the future. The atlas would include a range of plausible sea ice conditions for strategic purposes and speculation about the potential of marine access to the Arctic Ocean. **Brigham** anticipates a special report in the next six or eight months
- attended the Cambridge workshop with 70 people from five of the world's ice centers including four maritime administrations, the Swedish Icebreaker Service, Canadian Coast Guard, US Coast Guard, climate scientists and a group of international affairs experts and economists. The focus of the meeting was Arctic-related countries' participation before the Arctic Climate Impact Assessment is rolled out. A fairly extensive report resulting from the meeting discussion about the changing nature of the

Arctic Ocean is expected outlining a research agenda. It will be sent to the Arctic ministers and to International Arctic Science Committee (IASC).

Wednesday, October 6, 2004

Human Dimensions for Arctic Change

Lawrence Hamilton, UNH sociology department, discussed the idea that climate influences human activities which then changes the biology. For eight years, he directed the North Atlantic Arctic Project supported by the Arctic System Science and Arctic Social Sciences Programs at NSF. This project was a series of case studies of far northern Atlantic fishing communities using time as an integrating dimension to bring together narratives about the way the physical, biological and human system changes.

One case study described the herring collapse and the great salinity anomaly that occurred in Siglufjörður, Iceland in the late 1960s. The catalyst was a pulse of Freshwater and ice out of the Arctic Ocean that had circulated throughout the northern Atlantic for about twelve years. This one time event has been described as the greatest oceanographic change observed in the 20th century. It hit Iceland first that was the opening shot, if you will, in a change in the circulation patterns of the Sub-Arctic and Arctic North Atlantic. As a result, there was a shut down of production, which meant that without a Spring plankton bloom, there was no food for the zooplankton and ultimately no food for the herring.

This event, replicated in fishery after fishery, began with a bad climate event, which more or less marked the termination of the fishery. Usually these events occur on top of what some biologists call a killer spike—the point when a fishery peaks because of the technological ability to catch every fish in the sea. So it does. Hence in the case of Siglufjörður, the herring population went from around 14 million tons down to about zero over a space of about two decades. Hamilton emphasizes this is not an exceptional phenomenon in the northern Atlantic; rather at the time of big fisheries collapses, it's been the rule.

Brass wanted to clarify Hamilton's point that when surveying peoples' intentions, those are not actually what they eventually end up doing. A lot of the social science that Hamilton had discussed in terms of responding to climate change is done by surveying people's expectations of what they're going to do.

Hamilton said that surveys are good for defining what opinions are at the moment. They are not very good for predicting the future. To answer these questions, Hamilton prefers studying migration because it's physical, it's real, and it seems to stand in for a number of variables. It is harder to measure things like happiness, satisfaction and hopes and dreams.

Commissioner Michele Longo **Eder** raised the issue of trade and tariff considerations as economic issues that affect the viability of fisheries.

Hydrology and Water Resource Problems in Arctic Basin

Conducting hydrological studies of the Arctic Ocean drainage areas is difficult. Researchers must overcome severe climate and permafrost conditions that frequently result in runoff formation, sparse hydrological networks and reduced numbers of network stations, vast ungauged areas, low data quality, practical absence of reliable field experiments and hurdles encountered in obtaining operational data.

Igor Shiklomanov, State Hydrological Institute, Russia, outlined the hydrological problems faced by Russia in the Arctic basin. He noted a decline in virtually every one of the Regional Offices of Hydrometeorological Service (ROHS)/stations in Russia on rivers discharging to the

Arctic Ocean since 1986. The density of current hydrological stations within the country's territories can run from one for every 200 sq mi to one for every 50,000 sq mi.

Shiklomanov notes the reason for the downturn is economic. But other factors come into play as well. The work of collecting measurements itself is dangerous. In addition, recent migration of the population from the north to the south part of Russia makes it impossible to find observers available and willing to measure the discharge. And when observers are found, the influences on the variability on water resources including precipitation, evaporation and the runoff coefficient potentially skew collected data. Permafrost regions represent another data collection challenge. Stream flow distribution during a year in the largest Pan-Arctic rivers vary widely limiting research much of the year because of frozen conditions.

Flooding represents a significant problem, as well, from the preponderance of snow and rain. The Lena River at Lensk, a city of about 60,000 people, faces huge variability in water levels from year to year. In 2001, the city was inundated with more than six meters of water and was practically destroyed with damage running well into the millions. Researchers are working on ways to forecast this phenomenon so planning can take place. The stations on the largest rivers in Russia, the Ob, Yenisei and Lena rivers have the potential for ice events that can lead to flooding for more than two-thirds of the year.

Shiklomanov and Hudson Strait, all Arctic Basin territories, have increased inflow into the Arctic Ocean between 1988 and 1999. According to Shiklomanov's assessment for the past twelve years, 2,500 cubic kilometer of Freshwater has merged into the Arctic Ocean.

Commissioner **Treadwell** asked whether the Commission, as a result of the Arctic Climate Impact Assessment, should urge Arctic Council ministers to make a commitment to stream gauging. Shiklomanov noted that it's hard to say because he didn't feel that he had the data necessary to make that decision. Then there's the question of funding. But Shiklomanov believes it's a vast problem for which a solution must be found.

Canada's Mixed Arctic Message

Peter Johnson, Chair of the Canadian Polar Commission, CPC, discussed a recently released Speech from the Throne that included a very strong statement about Canadian government developing together, with its territorial partners, Aboriginal people and other Northern residents, the first-ever comprehensive strategy to the north. It will foster sustainable economic human development, protect the northern environment and promote cooperation with the international circumpolar community. He said the speech also referenced continuing to expand the science granting agency, natural and social sciences, the Canadian Institute for Health Research and the Canadian Foundation for Innovation. It also stated that the Canadian government is deepening cooperation with the United States for mutual assistance in the event of major natural or human caused emergencies.

Johnson outlined a variety of activities in which the CPC has been involved including organizing the Northern Research Forum where Adrienne Clarkson, Governor General of Canada, and President Olafur Grimsson of Iceland were present. This one event went a long way toward convincing those in the northern communities of Canada's serious commitment to circumpolar affairs.

The Commission has also played a major role in Canada's IPY participation, particularly concerning the social science dimension. Its steering committee is composed of representatives from the North: the Aboriginal indigenous communities, government and academic communities. A national IPY secretariat has been established at the University of Alberta and was endowed with $50,000 initial start up money. Dr. David Hick, a Canada Research Chair in the Department of Biology at the University, is heading up this Secretariat. The CPC has

also established agreements with about 10 different government departments to provide money to support the Secretariat for five years in the amount of $225,000 annually. A major concern is making sure that leadership is developed from the North rather than being imposed from the South. In order to convincingly convey this pledge, the CPC has made contact with many local communities in the North.

The CPC Executive Director, Steven Beaver, has been very closely involved with the Canadian core group on the Arctic Council in pushing a number of issues with respect to the Arctic Climate Impact Assessment and IPY.

However, Johnson said the government has communicated a series of mixed messages despite what is said in Speech from the Throne including

- the declining science and Federal government departments
- cut backs to the meteorological service of Canada
- decline in the number of reporting stations
- reductions within the country's hydrological network
- cuts to the science budget of the Department of Fisheries and Oceans
- reduced levels of support for the Nahidik, a flat-bottom research vessel

Brigham stated that these decreases are not the messages that Canada's delegation to the Arctic Council promotes. Representatives there stress renewed research and many new initiatives. Johnson explained that over the last twenty years, Canada has not been supporting government science in the Arctic and most of the scientific responsibility has fallen on the university community and the northern communities with respect to health issues, social issues.

Brass asked if there is any intention for Canada to start mapping its Archipelago and WGS84. Johnson said that there is especially considering that the hydrographic service admits that its charts are very poor and out-of-date. However, researchers tend to work on an opportunity basis so whenever there's a voyage where they can put some instrumentation on board, they will. In the inshore area, there has been much technological development in the use of wide beam sonar and mapping. Johnson said that the government's contributions to IPY's organization could be a mechanism used to move mapping along.

There's also a government commitment to provide $50 million over the next ten years for research and support of Canada's ratification of the Law of the Sea. While this is not a great deal of money, Johnson conjectures that it might be in fact a way to leverage some of the funding that's required for a joint US/Canada/Denmark/Greenland project along the northern boundary.

Finally, Johnson is working to arrange a joint meeting of the USARC and the CPC in 2005.

New Bedford Whaling Museum

Anne Brengle, Executive Director, New Bedford Whaling Museum, defined museums as institutions that are not just engines for tourism and economic development, but also centers for community and cultural understanding. They are very important in terms of community and global outreach. She encouraged Commissioners to identify the issues with which the Commission grapples that could be disseminated through cultural and scientific institutions; currently a significant movement in the museum community.

The New Bedford Whaling Museum's vision is, first and foremost, to educate and interest the public in the story of human interactions with whales worldwide. Its secondary purpose concerns local and regional maritime history. Brengle reviewed the history of whaling, its importance throughout the 19th Century and the eventual shift away from the industry as technological advances lessened the need for whale products. One of the museum's primary

projects has been taking 2,700 logbooks related to the Arctic Whale Fishery and calculating a number of facts about whaling during that time, i.e. how many Bowhead whales were taken, how many whales were spotted and what were the weather and surface conditions then. Reviewing 66,000 days of sailing records, Brengle and a throng of interns and volunteers found that between 1848 and 1914 the population was reduced from about 30,000 to 20,000. These research efforts have and will continue to provide insight into whaling and the people who depended on and were benefited by the practice.

Because of the importance of Barrow, Alaska to the story the New Bedford Whale Fishery, in 1966 when Congress established a New Bedford Whaling National Historical Park, of which the New Bedford Museum is the keystone institution, it made the Inuit Heritage Centre in Barrow a remote partner. Subsequently the Museum worked to get funding with a group of partner institutions to establish a program called Education through Cultural and Historical Organizations (ECHO). This partnership includes the Native Alaskan Heritage Center, Inuit Heritage Centre, Bishop Museum in Hawaii, New Bedford Whaling Museum, New Bedford Oceanarium and the Peabody Essex Museum. Together, these are historic whaling and trade partners who work together to explore shared cultural connections. As a result, the New Bedford Whaling Museum has programmatically been very involved with the Inuit Heritage Centre.

New Bedford Whaling Park's ECHO project will create and enhance cross-cultural learning opportunities and experiences that will model collaboration among local institutions. That's very important because the Park is a collaborative entity as well as whaling and trading partner with organizations in Alaska and Hawaii. To support ECHO, the Museum's staff worked early on to digitize its Native American, records and photography (late 19th and early 20th centuries) collections.

New Bedford is a much underserved population and providing these programmatic venues free of charge to a broad population is important to Brengle. The most exciting program involved bringing storytellers to New Bedford who through dance and historical narratives, share cross-cultural accounts from a world away.

Commissioner **Treadwell** was interested in the prohibition of selling bone handicrafts. He says it damages the Alaskan Native community's economy and denies their traditional crafts from reaching the world. He suggested a body of research that could inform Marine Mammal Protection Act and US Fish and Wildlife Service policies about the benefits trading this artwork could mean for Arctic residents. Brengle pointed out that there is a foundation based out of Nantucket that is working on this issue. She said the museum would love to carry Native Alaskan artisans' work because it would compliment exhibits and help people understand.

Commissioner Royer asked about the log data—where it resides and whether the material has been digitized. Some of the data is currently digitized and Brengle hopes at some point to have the entire collection completed. Commissioner **Treadwell** asked about cooperation with other libraries to exchange information. Brengle explained that the museum did have cooperative exchange programs with other libraries.

74th Meeting, 18-19 January 2005
Arlington, VA

In attendance:

Commissioners

Mr. George Newton, Chairman
Dr. Arden Bement
Mrs. Michele Longo Eder
Mrs. Mary Jane Fate
Mr. Duane Laible P.E
Dr. Thomas C. Royer
Dr. Susan Sugai
Mr. Mead Treadwell

Staff

Dr. Garrett Brass, Executive Director
Dr. Lawson Brigham, Deputy Executive Director and Alaska Office Director
Mrs. Kay Brown, Administrative Officer
Ms. Kathy Farrow, Staff

Attendees

Karl Erb, Director, Office of Polar Programs (OPP), NSF; **Maggie Hanna,** Liaison Officer and International Arctic Buoy Program Officer, NIC; **Blake McBride**, Lieutenant Commander, (NIC); **Kate Moran,** Ph. D., Associate Professor Of Oceanography/Ocean Engineering, University of Rhode Island; **Charles Myers**, NSF, Head, Interagency Arctic staff; **Dr. G. Carleton Ray**, Research Professor, Department of Environmental Sciences, University of Virginia; **Paul Seamore**, Command Technical Advisor, NIC; **Jim Simpson**, Digital Image Analysis Laboratory (DIAL), Scripps Institution of Oceanography, University of California, San Diego; **Neil Swanberg**, Arctic System Science Program Director, NSF; **Natalie Tomitch**, Program Officer at the HIS Fogarty International Center's (FIC) Division of International Relations; **Igor Voitov**, First Deputy Minister of Natural Resources and Environmental Protection, Belarus

January 18, 2005

Chairman's Report
George Newton, Chair of the US Arctic Research Commission (USARC), discussed his activities since the last meeting.

- 10/13/04—met with the staff of Admiral Bowman, Director of Naval Nuclear Propulsion, on Navy activities in the Arctic Ocean and submarine involvement related to the International Polar Year (IPY)

- 10/15/04—met with two Office of Naval Research (ONR) staff members and presented a Bob Corell ACIA brief about changes to the Arctic Ocean and sea ice. The effort was to create some level of Navy awareness about activities in the Arctic Ocean.
- 10/19/04—made a request to the IARPC staff to hold a seniors meeting. A meeting has been scheduled for March 1, 2005.
- 10/27/04—committed to write an editorial in *Sea Technology* magazine on why the United States should ratify to the Law of the Sea Treaty.
- 11/1/04—met with a NSF staff member to assist in the preparation of a brief to the Commander of Submarine Forces about why science needs and wants another cruise or a set of cruises.
- 11/8/04—attended the ACIA press briefing and rollout of the first overview report at the National Press Club. The briefing was given by Dr. Corell and the other principle participants.
- 11/8/04—traveled with Dr. **Garry Brass**, USARC Executive Director and Dr. **Lawson Brigham**, USARC Deputy Executive Director and Alaska Office Director, to Iceland to attend the ACIA Symposium that was heavily covered by the press. **Brigham's** presentation drew a large audience.

Brass remarked on the universal acclaim for **Brigham**'s activities in support of the ACIA report. Bob Corell has also noted **Brigham**'s significance—not just to the sections for which he held responsibility but also the overall organization and completion of the report.

- 11/18/04—acted as Bob Corell's stand-in to present the ACIA brief to Senator Lisa Murkowski.
- 12/1/04—met with the National Geospatial Intelligence Agency, Maritime Safety Division, to discuss further improvements to the Arctic Maritime safety information system. The Navy is very interested that the system become a fully accepted and operational element of Maritime safety as is the research community.
- 12/7/04—met with **Brass** at the commission offices with the Environmental Council on the Russian Embassy to discuss activities that Russia is involved in and those in which the US research community participates.
- 12/7/04—called Dr. Jamie Morison, University of Washington, about a huge floating buoy in the high latitudes that is a maritime hazard. **Newton** briefed that information was not submitted in the Arctic Maritime Safety Information (AMSI) system for posting on the notices to mariners system.
- 12/7/04—began negotiations with the Navy to gain release of certain nuclear submarine position data from the 1999 science cruise that would be valuable to improve bathymetry information quality being prepared by the University of Hawaii. The Navy has steadfastly said, for security reasons, that they would release the position data in either raw or re-navigated form. Scientists on the scene said they would take the raw data immediately. However, because the ship was one of the last in the class to go out of commission, its navigation system no longer exists in the Navy and security was not an issue. As a result, **Newton** felt confident the data release was imminent.
- 12/14/04—met with the OPP staff member to discuss ways to incorporate Bowhead Whale migrations through the Bering Strait and along the North Slope to incorporate into the Arctic Maritime Safety Information System. The NGA said they are willing to put the information in the system and as a result they are working together with NSF and Barrow Arctic Science Consortium (BASC) to make that happen.
- 12/16-17/04—traveled to the AGU meeting in San Francisco to attend a town hall conference on the science submarine program and discuss future developments.
- 12/17/04—discussed selection process for the next Executive Director with the Department of Interior staff.
- 12/20/04—began investigating US Navy bathymetry records to locate the data collected by the US Navy in support, and at the request, of the Canadian government.

This would serve as the first step in allowing Canada to put together a claim under Article 76.
- 12/28/04—called on the Russian Naval Attaché to discuss a series of issues of mutual interest including data sharing and bathymetry information under his purview. He was quite responsive.
- 12/29/04—met with the NSF OPP staff to work on the brief for the submarine force.
- 12/30/04—met with the Department of State staff to discuss the rationale for an Arctic Ambassador and the flow of such a request from the Commission to the State Department.
- 1/4/05—attended a reception for Senator Lisa Murkowski to celebrate her November victory and swearing in.
- 1/10-12/05—**Brigham** joined **Newton** on a trip to Panama to brief the Panama Canal Authority on the future of Arctic maritime transportation.

Commissioner **Thomas Royer** wondered what the response was of the science community at the town hall meeting. **Newton** said that the old problem still exists in expecting the Navy to communicate with the research community. **Brass** added that because the Navy will not announce any of deployment other than to say there might be one next year, they nevertheless want some orderly procedure for scheduling research onto the boat—which is an unworkable situation.

The Commissioners then took up a discussion of Law of the Sea issues: where it stands, where it is going, positions of proponents and opponents and behind the scenes activities underway.

Resolutions
The Commission took up four resolutions regarding:
- **Commission Policy Regarding Its Role in the Arctic Research Budget Process of the United States**
- **Commission Policy Regarding the Availability of Icebreakers for Arctic Operations**
- **Commission Policy Regarding a US Arctic Ambassador**
- **Commission Policy Regarding Arctic Policy**

The resolutions appear following this summary.

Commission Reports
Commissioner Tom Royer attended the Pisces North Pacific Marine Science Organization meeting, held annually, that comprises Pacific Rim nations including Russia, Japan, China, Korea, Canada, and the US. Pisces scientists are working in the Bering Sea and desire to organize a summit meeting on impacts of changes in the Bering Sea. **Royer** recommended that the group develop a relationship with USARC and participate in that Summit.

Commissioner Michele Longo Eder met with Oregon's Congressional representatives and Senators and familiarized or introduced them to the Commission's activities including the Law of the Sea and Oil Pollution Act language.

Commissioner Duane Laible met with a representative of the International Ship Structure Committee responsible for helping formulate information useful to ship designers. It has been difficult to develop relationships with appropriate Russians to get the ships' loads information he needs. **Laible** asked **Brass** and **Brigham** for assistance in contacting individuals who might be able to help. **Laible** also visited ONR's x-craft in Seattle with NSF staffers to assess the potential applicability as an oceanographic research ship. This vessel is a 50-knot aluminum catamaran that ONR believes could be the basis of a vessel useful to oceanographers as they develop ocean class vessels.

Commissioner Susan Sugai has taken a new position at the University of Alaska Fairbanks as Associate Director of the Center for Global Change and Arctic System Research. In this capacity, she assists in facilitating interdisciplinary research at UAF addressing global change and arctic system science. She also serves as Associate Director for the NOAA-UAF Cooperative Institute for Arctic Research (CIFAR), the only NOAA cooperative institute dedicated to arctic research. CIFAR is different from most other cooperative institutes in that it is associated with the Pacific Marine Environmental Laboratory (PMEL) in Seattle.

Responding to a request from **Newton**, **Sugai** also discussed the fact that she was in Unalaska when the 738' M/V Selendang Ayu, a Malaysian tanker, went aground outside Skan Bay on Unalaska Island. Having done oceanographic research in Skan Bay, she provided input to the response team on environmentally sensitive areas and provided input on proposed beach clean-up efforts. Like the Unalaska locals, **Sugai** was upset that tanker crew were not provided with survival suits that are standard on fishing vessels. The Commissioners expressed interest in having the Incident Commander speak to the Commission at the June 2005 meeting in Anchorage.

Commissioner Mead Treadwell referred to two memos included in the briefing book concerning:

- 4th Arctic Council Ministerial meeting
- Activities since the last Commission meeting that included
    - Meeting at Yale School of Forestry regarding a new model for tundra travel because of a shorter drilling season
    - Meeting with EPA on Arctic Contaminants
    - Meeting with Iceland delegation to make Makushkin prospect a viable business plan.
    - Preliminary meeting between Governor Murkowski's cabinet and Commission to creative a cooperative policy on Arctic science, ecological monitoring and modeling.
    - Meeting with General Chandler re: Climate Change Assessment concerning an effort by Russian chair of Arctic Council to get civilian agencies involved in current search and rescue efforts in the Arctic's Camp Lonely.
    - Meeting with Julie Kitka regarding trade of ivory.
    - Attended Rural Telecom Conference that's broad focus was to bring broadband to villages

Treadwell also addressed the Alaskan Miners Association in late November on Commission's *Report on Goals and Objectives*. He also attended, by teleconference, several EPA working group meetings for tribes on Arctic contaminants. The CITF Secretary will host a meeting on Arctic information and communication technologies in Washington, D.C. on the 24th, 25th and 26th of February. The meeting will also include a round table composed of Arctic telecom regulators regarding technologies that the nations might invest in or foster together. President Putin called for a meeting on Arctic Economics in St. Petersburg on June 16-18.

Commissioner Mary Jane Fate attended a Washington, DC meeting in October and is working on several follow-up issues related to land use and other items affecting the State of Alaska. She serves in an advisory capacity on committees concerning the 2010 census that monitors small populated areas that are extremely remote or rural and where different languages are spoken. She has also followed-up on the condition of fisheries, mostly in the interior of Alaska. She discussed a concern about the need for improved fisheries management in the interior of Alaska, especially on the Porcupine River, the Yukon River, and the areas north of the Yukon. **Fate** also commented on the outstanding research programs associated with the Museum of the North on the University of Alaska campus in Fairbanks. She encouraged the Commission to meet there once ongoing renovations are completed this Fall.

Commissioner *(Ex-Officio)* Arden Bement, Director, National Science Foundation (NSF), identified some active topics currently of interest to NSF. Concerning IPY, NSF is focusing on the logistical issues, not just science, knowing that without logistics in place, it's very difficult to do the science. He mentioned the Coast Guard in relationship to icebreaker activity. The cost of operating and maintaining the current icebreaker fleet has become very problematic. Part of the problem is that its mission, as defined by the Department of Homeland Security, has broadened much beyond what it used to be. Keeping the shipyards open in the Antarctic has gone down in priority, supplanted by issues regarding coastline protection. Regarding tsunami research, he noted that the difference between detection and warning is still an important research topic because it deals with different kinds of events—timelines, social systems, political systems--and various prediction models.

Newton outlined USARC's activities, presenting an overview of the *Climate Change, Permafrost, and Impacts on Civil Infrastructure* and *Advancing Oil Spill Response in Ice-Covered Waters* reports. He mentioned that USARC is planning to produce a "think piece" about scaling of research results to make them more accessible, and another focusing on improving access to the Arctic. He also mentioned a recent trip that he and **Brigham** took to the Panama Canal to discuss canal expansion in light of Arctic maritime access.

Bement discussed the lack of interagency participation compared to the past. He raised the issue of coastal erosion, as an example, and that engineering, remediation, and litigation are likely to be increasingly important. However, the core is under budget attack. He said it's important to be specific about the fact that this is an interagency problem; it's much broader than just one agency.

Bement and the Commission also discussed CRREL, the fact that it is a national treasure and would be short-sided of the US government to do anything to close or degrade it. They also spoke about national and international permafrost activity and tsunami research.

NSF Activities
Karl Erb, NSF, Director, Office of Polar Programs (OPP), offered to amplify many of the issues Bement discussed. He said NSF made every effort to keep the Healy in the Arctic where they feel it belongs. The agency contracted for a Russian icebreaker to come down to Antarctica to help open a channel to keep the McMurdo Station open; however, it is still possible that they won't be able to open the channel before winter and they have to therefore close McMurdo and the South Pole stations. In the meantime, NSF is working with the Coast Guard for making decisions, establishing priorities, etc.

The Arctic Council is preparing for IPY which NSF has pushed hard for them to do. Russia, as chair of the Council, is in a position to take the leadership in brokering arrangements among the Arctic nations to facilitate access to territorial waters and on land.

As **Bement** said, IPY should leave a legacy behind. In that vein, NSF proposes to focus on the following activities:

- study of environmental Arctic change (SEARCH)
- developing observation systems—understanding and monitoring climate change, providing benchmarks against which climate change can be measured over the long term
- study of ice sheet stability and dynamics

NSF also plans to follow up for IPY and beyond on the academy report, *Frontiers of Polar Biology*, taking advantage of newly developed fundamental tools and combining them with time honored sociology techniques to get a better understanding of life in the cold and dark.

The Commissioners asked Erb to explain the lack of prominence engendered by the White House where the Arctic is concerned. Erb said money and effort are being spent. He suggested that it's a problem of linking all money and interests together to create a powerful system.

Brass suggested that NSF stimulate some economic analysis through the Arctic Social Science Program. As an example, if it costs some unknown amount of money extra to ice strengthen a cargo ship, how many days does the Northern Sea route have to open for that to pay?…10 days, 100 days, never. Until these types of issues are known, the direction of this system cannot be known either. He also brought up village housing and the need to find a way to bring the social sciences into those kinds of very straightforward engineering analyses.

SEARCH: Going Global

Neil Swanberg, Arctic System Science Program Director, NSF, conducted a meeting in Fall, 2003 from which a very small working group of international bodies were pulled together for the purpose of implementing an international version of SEARCH. They produced a document called the International Study of Arctic Change (ISAC) that constructs a program that would look very much like SEARCH although it is adjusted for other countries' goals and major interests. One of OPP's major interests would implement SEARCH observation systems: terrestrial, marine, and atmospheric observation. The SEARCH scientific steering committee and the interagency working group followed-up to ensure that OPP provided enough information to actually implement an observing network and determine individuals to be convened to carry this out.

On May 23—25 the groups will reassemble in Washington DC to hammer out the implementation plan details that would be needed in order to have an announcement of opportunities for IPY. Results will be shared with the other agencies involved in SEARCH. OPP itself does plan to have some sort of announcement of opportunity for IPY.

OPP is also producing a Bering ecosystem study that is similar in many ways to, and incorporates the structures of, SEARCH. Those involved with the SEARCH interagency working group have agreed to support in the Bering Sea study. This evolved at the Ecosystem Study of Sub-Arctic Seas (ESSAS) in Victoria, British Columbia, when OPP constructed BEST. OPP recognized tension between the need for a US program and the obvious need for international efforts. So while establishing BEST, OPP simultaneously contacted the international GLOBEC program which coincidently was considering its activities in the Arctic. At a recent meeting, GLOBEC steering committee adopted ESSAS as an official part of GLOBEC and thus IGBP. BEST is the US component of that. That effort is going to compare or contrast the ecosystem issues in the Bering Sea, the Berent Sea, the areas around Canada and possibly other high latitudes, Sub-Arctic or Arctic seas.

Federal Response

Charles Myers, NSF, Head, Interagency Arctic staff, brought three items before the Commission including the policy officials meeting on March 1, 2005, the Interagency Arctic Research Policy Committee Report to Congress and the revision to the US Arctic Research Plan.

- The Interagency Arctic Research Policy Committee officials meeting will cover IPY and SEARCH. The Commission is invited make a statement. George **Newton** accepted the invitation.
- The Interagency Committee Report To Congress is one of two reports NSF is required to produce under the Arctic Research And Policy Act legislation. It contains the responses of the agencies to the Commission's recommendations and *Report on Goals and Objectives*.
- The US Arctic Research Plan was completed about a year ago. Myers understands that it has been approved and expects that the report will be forwarded to Congress soon. It is not an NSF interagency report but an administration report. Right now, the staff representatives are updating the US Arctic Research Plan with an emphasis on IPY; a

task that's made difficult because the agencies are in the process of developing their own IPY plans.

The Commission then discussed avenues by which it could impact the reports' timetables and content.

Walrus and Sea Ice

Jim Simpson, Digital Image Analysis Laboratory (DIAL), Scripps Institution of Oceanography, University of California, San Diego and **Igor Voitov**, First Deputy Minister of Natural Resources and Environmental Protection, Belarus, joined **Dr. G. Carleton Ray**, Research Professor, University of Virginia Department of Environmental Sciences, in a study detailing the special circumstances around the walrus and sea ice.

Simpson explained the variations in sea ice and their correlation to mammal habitation in the Arctic. While airplanes are the primary means for determining sustainable resources estimates, Simpson encourages the use of correlation studies using satellite data as a much more viable estimating approach. This approach requires scaling down on images as Simpson demonstrated by providing visual examples from a variety of altitudes. He also discussed data fusion—a very sophisticated set of mathematical techniques that allow mapping of data that is taken on different platforms.

Voitov, a cultural anthropologist, enthusiastically joined Ray in an opportunity to have various fields of science concentrated from one particular component of a very complex ecosystem—Bristol Bay up north to the Bering Straits and further out. The purpose for the project was to address three basic questions: what is happening to the people who are present along this chain-link line of changes; how do people themselves view what is happening to them, to the walruses, and to the environment, and, how can researchers match those local observations and combine them with scientific data to advance an understanding of what is really going on.

Voitov began noting the change in atmospheric conditions, ocean circulation or climate warming that results in less ice, thinner ice or a reduced ice season. Those conditions affect walrus and, in turn, affect migration and distribution—walrus move up north earlier and faster and southern walrus migrate north. That affects the hunters because they don't have enough access to northern walrus, they have shorter time to get access to them or they have to travel longer distance to get to walrus. As a result, their economy, subsystem and nutritional and subsistence needs suffer. This scenario articulates how the Arctic climate change affects indigenous populations. There is ample evidence to support this coming from both the science and indigenous sides.

Almost every butchered walrus is carefully examined for its health status, the condition of its skin, the condition of its blubber, and the content of its stomach to study indicators of walrus health. The studies are advantageous when an elder is present—a person with detailed foreknowledge that can significantly add to the walrus story, often for the benefit of science. There is a tremendous exchange of data going on within the native communities concerning the walrus. These communities know that they have less northern walrus and more southern walrus present and available for hunting. Voitov encourages tapping into indigenous knowledge because scientists derive a variety of responses and information. In this region, indigenous people use different terminologies that aren't available in science—something scientists have come to term as walrus diction.

Ray summarized by once again asking what is happening to sea ice and what does this do to the walrus populations. The answer is complicated and can only to found by combining scientific techniques with indigenous observations.

The Commissioners discussed various information-gathering programs with the speakers along with funding sources to help them shore up their data. Simpson pointed out the overall constraints that science has in the current budget that he believes that it will get substantially worse in the next couple of years.

Staff Reports

Brass then provided his report to the Commissioners.

- attended meeting at OSTP with the coast guard and NSF to discuss the icebreaker situation.
- attended the joint subcommittee on oceanography, which is going to be formulated as the agency committee for the Ocean Policy Committee (OPC).
- attended AGU conference where Richard Alley gave the Arctic Institute Night Lecture to a standing room only crowd of more than 2,000.

Eder asked what the OPC is and what formal relationship that the Arctic Research Commission will establish with that committee. She believed the relationship should be presidential appointment to presidential appointment—Chairs **Newton** with Mr. James Connaughton. **Brass** explained that he was asked to serve on a subcommittee on oceans that was made up of staff level appointees. **Brass** continued that the interests of the Committee are skewed in that they don't take into account the conditions of all oceans. As far as they are concerned, the south Pacific and the south Atlantic don't exist. More relevant to the USARC, they also ignored the Arctic. The Ocean Policy Commission met in Anchorage and the Commission was not invited—**Newton**'s request to speak was granted but limited 10 minutes. He believes opportunities do exist for future involvement where the Commission will attempt to have a voice.

Brigham reported next on his activities.

- made presentation at the American Geophysical Union meeting regarding that changing access in the Arctic Ocean
- reviewed the science plan of the North Pacific Research Board, along with **Royer**, and incorporated an RFP process
- devoted seven days to the selection process for new managers in the North Pacific Research Board
- reviewed the scientific plan North Slope Science Initiative
- visited the North Star at the invitation of British Petroleum where he gave a briefing to the production staff on ACIA.
- working on a Cambridge workshop report that will include the marine system component of the shipping and oil and gas assessments.
- published an article in the *Journal of Co-Regions Engineering* about the permafrost report

January 19, 2005

The Arctic's Past

Kate Moran, Ph. D., University of Rhode Island**,** presented an overview of her odyssey to unearth a climate record that captured in the sediments of the central Arctic Ocean. It took seven years and several site surveys to gather enough data to justify to the International Ocean Drilling Program that could actually drill in the Lomonosov Ridge location. The goals of the Arctic Coring Expedition (ACEX) were very basic.

- When did the Arctic start to freeze?
- What were the past Arctic temperatures and how did they relate to the rest of the global earth?

- How does the Arctic Ocean's Freshwater component interact with the rest of the world's oceans, particularly the North Atlantic?

The mission began on August 7, 2004 from Tromsø, reached the ice edge on August 10 and made it to the drill site, 250 kilometers from the North Pole, on August 31. The team had hoped to stay on location for 48 hours but instead managed a nine-day session, drilling five holes and recovering sediment cores from 430 meters beneath the Arctic sea floor. As a result, they captured an excellent record of climate covering the past 56 million years.

Anticipating the mission's biggest challenge—moving ice, in some cases three meters thick, that came in one direction, continuously putting stresses on a ship and moving it off location—ACEX contracted for three icebreakers including the Sovetskiy Soyuz, a 7500 horsepower nuclear ice breaker, Oden, provided by Sweden, and Vidar Viking, the icebreaker from which the operations were staged. The team found that the radar reflector system worked best to measure the actual rate at which ice was coming towards the vessel so that they could make a plan for breaking the ice.

Findings from the expedition included:

- The Arctic Ocean was frozen much earlier than previously thought, as early as 15 million years ago, perhaps even longer.
- The upper hundred and sixty meters represent a record of the past ~15 million years comprised of sediment with ice-rafted debris and occasional small pebbles, suggesting that ice covered conditions extended at least this far back in time.
- Drilling is possible in moving ice—the team recovered 339 meters of oceanic mud that span 80 million years of Arctic history.
- The sediment record during the late Eocene is of dark, organic-rich siliceous composition with a depositional environment dominated by ice-free, warmer surface ocean waters.
- An interval covered around 49 million years ago reveals an abundance of a freshwater fern (Azolla) suggesting that a surface fresh/low salinity water setting dominated the region during this time period.
- Drilling at the base of the sediment column at 50 million years revealed that the latest Paleocene to earliest Eocene boundary interval was recovered. During this time, about 55 million years ago, the Arctic was subtropical with warm surface ocean temperatures.
- Penetrating into the underlying sedimentary bedrock, the hypothesis confirmed that the Lomonosov Ridge crust is of shallow-water, continental origin and of Cretaceous age.

The total price tag for the scientific and technological achievement was $12 million. Moran would like to participate in the next drilling expedition, along the Mendeleyev Ridge, which she thinks might provide a much thicker, higher resolution climate record.

The National Ice Center

Lieutenant Commander **Blake McBride**, Executive Office of the National Ice Center (NIC), accompanied by Command Technical Advisor, **Paul Seamore**, and Liaison Officer and International Arctic Buoy Program Officer, **Maggie Hanna**, provided an overview of activities of the National Ice Center and the programs. Of its 55 employees, NIC employs 50 Navy active duty personnel. Most of them are involved in global sea ice analysis and forecasting, primarily using imagery. The data gleaned from their various programs and projects are then turned into ice charts. SAR imagery is its main source when they need information. NIC produces charts for the Arctic every other week.

In addition to the Arctic and Antarctica, NIC covers 13 port and harbor areas from Maine down to the Chesapeake Bay. A submission includes NIC work in the Great Lakes, Chesapeake and Delaware River to ensure continuing commerce traffic through ice covered areas in water bodies

thick with natural gas activity. Deliveries in the Great Lakes, for instance, include salt, iron, or coal, coke. A million dollars a day can be lost if those deliveries are not made because of ice.

One of the unique capacities that NIC has is its ability to do its own research and development which makes it unique from many other operational centers. One example is the International Arctic Buoy Program, the US portion, which acquired the funding to make sure that it is fiscally capable of deploying the widest possible buoy array. Unfortunately, the funding does not match the importance of the data collected. Despite the funding difficulties, the US Navy is responsible for applying a C130 that airdrops buoys over the Arctic. NIC also coordinates with a number of national and international icebreakers to deploy other buoys as well. Each year NIC deploys seven new buoys that gauge pressure, temperature and position. They have a two-year lifespan. Thirty-six are currently reporting.

NIC is also employing a new type of buoy that measures ice thickness and ocean temperatures to provide a broader ray of data. But those are more expensive and more difficult to deploy. However, in the future, NIC also plans to integrate its buoy program with instruments such as gliders that can swim around underneath the ice, hopefully expanding data sets.

NIC continues its work on data simulation, forecasting its ability to calculate ice parity and predict the future, and data simulation to improve sea ice models. It is also considering its contributions to IPY and increasing its funding potential by submitting a proposal to NSF for continuous funding.

NIH's Fogarty International Center
Natalie Tomitch, Program Officer at the NIH Fogarty International Center's (FIC) Division of International Relations, spoke to the Commission about several projects FIC is involved with related to indigenous people of Alaska and in preparing for its IPY activities. The program helps to focus on the low resource settings and to develop low-cost technologies including diagnostics, prosthetics and other devices, artificial blood, resuscitation fluid. It is also looking at long-term consequences of mental trauma and abuse. It reviews the whole spectrum of trauma.

Representing both HHS and NIH, FIC is involved in the both national and international efforts that involve native people in Alaska. Tomitch sees a growing emphasis on human health issues related to strategic or social impact as well as the whole area of interaction between biology and environment, human environment dynamics through physical and chemical and biological sciences. FIC is also trying to stimulate interest among young female investigators and post docs or even pre docs, and university students to go into science.

Tomitch also discussed the Arctic Human Health Initiative. The State Department, on behalf of the US, decided to take a lead at the last Arctic Council Meeting. The idea is to build on existing collaborations including infectious diseases surveillance and contaminants as well as tele-health and telemedicine. The National Library of Medicine supports some work in terms of maintaining a database, development of communications tools, and looking at new opportunities while leveraging existing prospects using accessible resources and trying to seek additional support.

Other areas of interest at FIC are the under-explored areas of behavioral health, hypothermia and hibernation and their links to finding ways to improve the use of the low temperature for cardiac surgery and resuscitation.

US Arctic Research Commission
Resolutions
18 January 2005

Commission Policy Regarding Its Role in the Arctic Research Budget Process of the United States

RESOLVED:

1. The Commission accepts with gratitude and thanks the work of consultant Matthew Stubbs completed in 2004 which reviewed the Arctic research Federal budget process and made recommendations for more effective analysis and improved communication between the Commission, the IARPC (Interagency Arctic Research Policy Committee) and the Congress.
2. The Commission will henceforth prepare and submit to the Congress a review of the proposed Arctic research budget and its adherence to the US Arctic Research Plan and provide a comparison to the Commission goals. Whether or not the expected cross-cut for the SEARCH program (the first of the interagency research programs in the Arctic Research Plan) is presented to the Commission in time, a draft response to the proposed FY 2006 budget will be prepared for the Commission's March meeting.
3. The Commission will continue to work with IARPC and OMB to improve the level of detail on the consolidated Arctic research budget that is made available to the public, the Commission, and the Congress. Our goal, as contemplated by the Arctic Research and Policy Act, is: to obtain thorough information at the time of submission of the President's budget to the Congress.
4. The Commission will approach IARPC to discuss means by which a more accurate account of Arctic research spending may be made available after the fact, as recommended by the consultant's report.

Commission Policy Regarding the Availability of Icebreakers for Arctic Operations

RESOLVED:

The Commission, Pursuant to the Arctic Research and Policy Act, as amended, under the FINDINGS AND PURPOSES, SEC. 102.(a)(9) *the United States has important security, economic, and environmental interests in developing and maintaining a fleet of icebreaking vessels capable of operating effectively in the heavy ice regions of the Arctic;* finds that a robust icebreaker fleet continues to be necessary to protect the security of the United States and to meet other pressing national interests including:

1. Research needs of the United States in the Arctic and Antarctic.
2. Maintaining a national presence in the Arctic and Antarctic.
3. Supporting transportation in the Arctic as marine access improves due to changing ice conditions.
4. Maintaining freedom of navigation.
5. Defining a pending US claim under Article 76 of the United Nations Convention on the Law of the Sea (UNCLOS), and enforcing any special seas requirements the FRESHWATER develops under that convention.
6. Providing for US coastal and border security, especially as ice cover thins or recedes in Arctic seas.
7. Protecting the Arctic environment, including oil spill prevention and response and fisheries law enforcement.
8. Maintaining national and international capabilities to provide Arctic search and rescue and safety of life at sea.

The Commission therefore urges the President and the Congress to continue appropriate funding to capitalize, maintain and deploy an icebreaker fleet sufficient to meet US polar needs.

Commission Policy Regarding a US Arctic Ambassador

RESOLVED:
The Commission requests the Secretary of State to consider appointing a Special Ambassador for Arctic Affairs to represent the United States in Arctic Council and other relevant international activities. The Commission finds that other Arctic nations have already taken similar action, in some cases appointing a resident of an Arctic region. International cooperation in the Arctic is necessary to facilitate many of the goals for Arctic research that have been adopted by the United States. An Arctic Ambassador could both raise the visibility of US Arctic leadership internationally, and help the US, more rapidly, follow-through on international commitments which require interagency support from within the United States.

Commission Policy Regarding Arctic Policy

RESOLVED:
The Commission notes that a comprehensive US policy for the Arctic was last developed for Presidential approval in 1994. While the Commission has no differences with that policy document as reported, it recommends that the US embark on a review of Arctic policy to respond to new situations in the Arctic. A more accessible Arctic Ocean has security implications for the United States. Likewise, it presents opportunities for commerce and global transportation. The Arctic region, inside and outside the United States, is expected to provide an increasing supply of conventional and alternative energy to our nation. Research efforts in the Arctic are more important to US climate change studies, food security, and biodiversity than realized in the current reported policy. Furthermore, to improve coordination and effectiveness, senior officials from the White House and participating agencies should review the charter and the continuing agenda of the Arctic Policy Group, and more regularly participate in that subcommittee of the National Security Council now chaired by the Department of State.

75th Meeting, 3-4 March 2005
Byrd Polar Research Center
Ohio State University
Columbus, Ohio

In attendance:

Commissioners

Mr. George Newton, Chairman
Mrs. Michele Longo Eder
Mrs. Mary Jane Fate
Mr. Duane Laible P.E
Dr. Susan Sugai
Mr. Mead Treadwell

Staff

Dr. Garrett Brass, Executive Director
Ms. Kathy Farrow, Staff
Dr. Lawson Brigham
USARC Deputy Executive Director and Alaska Office Director

Attendees

Mark Berliner, Statistics, OSU; **David Bromwich**, Byrd Polar Research Center (BPRC); **Jason Box**, BPRC; **Yo Ping Chin**, BPRC; **Noel Cressie**, Statistics Department, OSU; **Keyin Dunn**, BPRC Ice Cores/Paleoclimatology; **Lynn Everett**, BPRC; **Raimund Goerler**, BPRC; **Pam Gorder**, Research Communications, BPRC; **Anne Grunow**, BPRC; **Earle Holland**, University Relations; **Kyung In Huh**, BPRC; **Laura Kissel**, BPRC Polar Archives; **Amy Kitchell**, BPRC Polar Archives; **Ben Koether,** Chief Executive Officer, The Glacier Society.; **Sangsuk Lee**, BPRC Ice Cores/Paleoclimatology; **Dr. W. Berry Lyons**, BPRC; **Andrew Manoghan**, BPRC; **Ellen Mosley-Thompson**, BPRC Ice Cores; **Leonid Polyak**, BPRC; **Thomas Rosol**, OSU; **C.K. Shum,** BPRC; **Steve Soler**, US Navy; **Ellen Thompson**, BPRC; **Kees Vanderveen**, BPRC; **Jiahong Wen**, Shanghai Normal University; **Guong Jian Wu**, BPRC Ice Cores/Paleoclimatology; **Jan Wuite**, BPRC

March 3, 2005

Chairman George Newton announced the absence of **Commissioner Tom Royer**. **Dr. W. Berry Lyons**, Director of the Byrd Polar Research Center (BPRC) gave a brief overview of the facility and the science, research and engineering efforts underway. Founded in 1960 as the Institute of Polar Studies, the Center's focus at that time was on geology, glaciology and biology. The biology orientation has since faded and the Center has taken on a physical science focus. In 1987, the Byrd family donated Admiral Richard Byrd's memorabilia, papers, and other materials that he gathered and wrote. Raimund Goerler, head of the BPRC archival program, will speak tomorrow morning about the information housed at the Center. The University holds a colloquy each Fall every year at which scientists, historians, and others interested in exploration come and participate in an interdisciplinary discussion about polar science. The archival program not only incorporates Admiral Byrd's material, but also that of Sir Hubert Wilkins, Captain James Cooke and others. The donation from the Byrd family had to do with subject matter rather than connection. They were looking for a site that had a polar bent and, critically of an Antarctic bent and the Center was the logical choice. The glaciology program is internationally known and a high percentage of glaciologists working today have been trained at Ohio State. Lyons also highlighted the Center's strong meteorology program, paleo-oceanography group, environmental chemistry program and coastal dynamics/oceanography group as well as its more traditional geological emphasis. The Center's faculty and staff come from the school of engineering and the geography department, and the social sciences and geological sciences departments in the school of humanities.

The US Polar Rock Repository dedicated in October 2003 is adjacent to the Center. It houses specimens from all the geologic samples that are collected in both polar regions. The depository puts a great deal of information on their website so that scientists can research the collection and look at these specimens and request a sample of a particular rock. The sample could be sent to them or an individual could come to Ohio State. Lyons hopes that this is going to be an attraction for international scientists that would come to Ohio State, and with the geologists here, look at the material housed at the Center. The Center also has facilities to store ice cores that come from Antarctica, Alaska, the Asian Arctic as well as from the low latitude glaciers.

Chairman's Report

January 20— Dr. Garrett **Brass**, Executive Director of the US Arctic Research Commission (USARC), Dr. Lawson **Brigham**, Deputy Executive Director and Alaska Office Director, USARC, and **Newton** met with Dick Volker, Program Manager Shipbuilding Technology, Maritime Administration, at the Commission office to discuss the initial setup of the proposed monograph or report the Commission plans to generate on Arctic Maritime Transportation.

January 26—**Newton** continued communications with the Director of the Bedford Institute of Oceanography, Dartmouth, Nova Scotia, concerning the release of data along the Canadian Archipelago, despite an increasingly bureaucratic morass resulting from certain proprietary and classification issues argued by various factions within the United States and Canadian governments.

January-March—Met four times with Dr. Dennis Conlon, National Science Foundation, to assist him in preparing a briefing on the needs for submarine data collection in the Arctic to be presented to the Navy.

January 15—Met with Ben Koether, the Glacier Society, at J. J. McMullen Associates, naval architects, to review the drawings for the modification of the icebreaker USS Glacier.

January 16—Met with Craig Dorman, Vice President for Research, University of Alaska, Martha Stewart of the Alaska Governor's office in Washington, DC, and Paul McCarthy, Vice Provost for Research, at the Commission office to discuss a range of Arctic-related topics including University of Alaska and state and nationwide issues, including the Arctic Ocean Observing System.

January 24—Met with two researchers from the Los Alamos National Laboratory who were seeking Commission support to change the proposal process at NSF to allow government lab personnel to submit proposals. The current guidance at NSF is that individuals whose research and development centers are Federally funded cannot submit proposals to NSF.
January 17—Made a presentation on ACIA and the warming Arctic and its potential impact on the world's climate to a group of retired naval officers. This has become the prototype for any presentation **Newton** will give on this subject. **Newton** encouraged Commissioners to use that or a similar presentation in outreach efforts to those interested in this topic.
January 22—**Brass** and **Newton** attended the Arctic Policy Group meeting at the State Department where **Newton** described the four resolutions approved at the last Commission meeting and expressed concern for a weak response from the Department of State legal staff concerning the track of the ice breaker Healy for its cruise this summer into the Arctic Ocean. They were reluctant to approve proposed research stations in the area claimed by Russia for the extension of its outer limits of the Continental Shelf so as to not offend the Russians. Commissioners agreed that this is not the face we should present on this issue.
March 1—**Newton** met at Georgetown Law School with the Arctic Parliamentarians to make a short presentation regarding the Commission, its duties and recent accomplishments. He plans to use this same presentation on a future trip to Finland.
March 1—He attended the Arctic Seniors meeting at the National Science Foundation (NSF) where the International Polar Year (IPY) received the bulk of the attention from the Director of the National Science Foundation and Committee Chair, Dr. Arden Bement. In addition to discussing the previously mentioned Commission resolutions, **Newton** addressed the Commission's five prominent goals in the previous and upcoming *Report on Goals and Objectives for Arctic Research*. In addition, he discussed the need to gain a sponsor within the Interior Department for the resource assessment items. **Brass** added that, to date, there has been no Interior Department's response.
January 20 to present—**Newton** has been active in negotiating the release of the renavigated position data to support proper reconstruction of the SCICEX '99 track.

Newton continues to work to define a single system that publishes on the internet the position of maritime hazards in the Arctic Ocean, both buoys and moorings. Currently there are three in operation run by the Canadian Coast Guard, US Coast Guard and the NGA. He invited the NGA, the Navy and the Canadian Coast Guard to try to resolve this confusing set-up and develop a single system so mariners can determine what hazards are in international waters of the Arctic Ocean in order to protect their expensive ocean sensing systems.

The editorial that **Newton** drafted for Sea Technology magazine will be included in their March issue.

Newton has worked on the hiring plan for the Commission's replacement Executive Director.

Commissioners Reports
Commissioner Mead Treadwell attended a meeting at Commission offices on January 19 regarding the Commission's Arctic Shipping report.

He worked with the Interior Department (Chief Scientist Dr. Jim Tate and Assistant to the Secretary Drue Pearce) to encourage DOI to take the lead on the Arctic Resource Assessment program. By email February 22, the Department indicated it would take the lead in organizing this program.

Treadwell worked with the Federal Co-chair of the Denali Commission to offer to hold a scoping session to develop an integrated Arctic Infrastructure Research program, date to be

determined. By letter February 28, Jeff Staser indicated to IARPC they are willing to take this task on.

He consulted with Gov. Murkowski and members of his staff regarding the Commission's goals report and the idea of upgrading the Senior US Arctic official to Ambassador status. Copies of letters from the Governor and state officials on these matters were distributed at the meeting.

He worked with the CITF Secretariat as it organized and carried out a February 23-27 Washington, DC based meeting on Arctic telecom. A report on the meeting will be distributed to Commissioners when it is available. He understands that both the Arctic regulators session and the scoping session on ICT went well, and that the recommendation will be made that an Arctic-wide assessment of telecom needs and capabilities take place, with Finland taking the lead in organizing the scope.

Treadwell helped link the Arctic Parliamentarians, who met last week in Washington, with Sen. Lisa Murkowski and Alaska Gov. Frank Murkowski, Chairman Newton, and Sen. Drue Pearce from the Dept. of the Interior.

He received a call from James Harpring of the Alaska Dept. of Military and Veterans Affairs seeking assistance in convening a meeting on mapping issues. He discussed the same issue with Pearce at DOI, who agreed to have Department people join in. Given new personnel and available capabilities, there may be greater opportunity to attain the Commission's long term goals for mapping undermapped regions of Alaska.

Treadwell joined a discussion, in his capacity as a board member of the Prince William Sound Science Center, with Matt Paxton of the Commerce Committee staff on 22 February. The group discussed permanent authorization of the Prince William Sound Oil Spill Recovery Institute, with responsibilities for arctic and Sub-Arctic oil spill research. An attempt will be made to pass that legislation this year; OSRI now expires in 2012. He learned also that OPA 90 may get a look from the Committee this year; discussed the need for funding promised spill research from the first round. He was contacted by Rick Steiner of the University of Alaska with a number of ideas for a revision of OPA 90 based on problems pointed out by the December Aleutian oil spill, suspension of the tax which filled the Oil Pollution trust fund established by OPA 90. He also learned from a presentation made by Senator Stevens to Commonwealth North in Anchorage February 25 that the Chairman and the full committee, rather than any particular subcommittee of the Senate Commerce Committee which Stevens now chairs, will oversee revision of the Magnuson-Stevens Act, the Marine Mammal Protection Act, the Telecommunications Act of 1996, and a host of other laws.

He met February 24 with Starkey Wilson, owner of Alaska Renewable Energy Corporation, and Nicholas Goodman, president of TDX Power, to introduce them and to review efforts to explore for and harness geothermal resources in Alaska. Wilson is working on the Akutan prospects in the Aleutians, TDX and its joint venture partner Enex from Iceland is working on the Makushkin prospect near Unalaska/Dutch Harbor. A visit from an Enex delegation is coming to Alaska in March. Iceland is hosting a major conference April 27-28 reviewing their hydrogen program to date and talking about next steps, including the possibility of converting shipping and fishing vessels to hydrogen power. He will distribute information on this to Commissioners.

During his visit to Alaska and keynote speech at the Alaska Marine Research Conference January 24, **Treadwell** met with NOAA Administrator Adm. Conrad Lautenbacher. During that time, he made the request on behalf of the Commission that the Commission chair be included on the AQUA working group. Lautenbacher indicated he's looking to expand participation in the working groups to include all those in government working on significant oceans issues.

Treadwell made the same request to the President's Council on Environmental Quality, and will follow-up with both parties.

Commissioner Susan Sugai discussed the National Oceanic and Atmospheric Administration (NOAA) Arctic workshop put on by the directors of the NOAA cooperative institutes doing research in the arctic. These three cooperative institutes are the Cooperative Institute of Arctic Research (CIFAR) based at UAF in Fairbanks, Cooperative Institute for Research in Environmental Sciences (CIRES), Boulder, CO, and the Joint Institute for the Study of the Atmosphere and Ocean (JISAO). This workshop put on at the request of John Calder (NOAA Arctic Programs) and Chet Koblinsky (NOAA Global Change Program). The goal of the workshop was to prepare priorities for NOAA's Arctic research and global change funding for the period 2008–2012 and address NOAA's response to the International Polar Year (IPY).

Sugai also attended the Alaska regional National Ocean Sciences Bowl in Seward, February 18–20. This year's research project asked students to investigate how climate change will affect their coastal communities and what kind of research or policy response would they propose to address Once the competition is complete, a video is produced detailing how the high school students approached the different research projects. Senator Lisa Murkowski used last's year's video on contaminants to influence her Senate colleagues on funding to Alaska for rural sanitation.

Treadwell added that there is currently a Federal-State of Alaska dispute over the extension of the coastal management program that is funded by NOAA's office of Coastal Resource Management. Governor Murkowski supports the program but wants to see some changes made. **Sugai** supports the program as it brings local governments into the process and funds considerable research on coastal problems, especially in the Arctic. The Federal government has indicated its disapproval of the changes and the program may be cancelled. This issue, however, was not part of NOAA's funding discussions.

Commission Michelle Eder announced that she has been in touch with Dr. Mark Abbott who is the Dean of the College of Ocean and Atmospheric Sciences at Oregon State University. They have agreed to host the October Commission meeting in Corvallis and at their Newport facility with the assistance of **Brigham** and **Brass**. She plans to invite to University President Edward Ray as well as Governor Ted Kulongoski.

Commissioner Duane Laible attended the Arctic Marine Transportation Working Group meeting with **Treadwell** and **Brigham**. In addition, he has been working with a colleague who has been in touch with representatives from the International Ship Structures Committee to get them access to the ACIA full science report so they can use it as a reference document. He also mentioned that the maritime labor unions in Great Britain have been lobbying classification societies to increase the size of the wave that ship designers should be required to consider when building ships to accommodate higher ocean waves. **Laible** agreed to represent the Commission at the hydrogen meeting in Iceland.

Commissioner Mary Jane Fate discussed the Commission's goals and objectives with Senators Ted Stevens and Lisa Murkowski. She also discussed a series of upcoming meetings of the Fairbanks Native Association, the Chiefs conference. The issues of concern include research, low cost energy, storm damage to northwest Alaska's seawalls, breakers and runways, drug abuse and supportive programs, and fisheries. The Alaska Federation of Natives meeting will be in Fairbanks, October 17-22, 2005.

Staff Reports
Executive Director Garrett Brass attended the Joint Subcommittee on the Oceans and Ocean Resources where he continued to be the point person on Arctic matters, continuously reminding

attendees to consider policies in relationship to the Arctic and ice. USARC has recommended that its chair should be on the Aqua Committee. This joint subcommittee reports to the Aqua Committee that in turn reports to the President's Council on Ocean Policy. **Brass** argued that **Newton** should be appointed to the Aqua Committee to keep them aware of Arctic issues.

Brass also went to the State Department meeting with Ambassador Churkin. At the meeting the Russians handed out a paper that they had given to the EPPR working group called Arctic Rescue. It is something of a catchall about maritime and to some extent environmental disasters and how to recover from them. **Brass** believes that this is an attempt to turn the Arctic Council into a working or action group as opposed to consultative group. Commissioner **Treadwell** suggested that the US should bring together all parties involved in the rescue issue, including military personnel, and determine what is needed to manage these types of disasters. **Newton** argued that because of the Arctic Council's charter, these matters should be left to the military and that this issue, in general, is outside the purview of the Arctic Council. **Brass** added that the Department of Energy also put out a paper that makes the same argument about nuclear problems that will be on the table at the Eclipse meeting.

Lawson Brigham, Deputy Executive Director and Alaska Office Director, attended an Arctic Marine Transportation working group that published a report/research agenda so that US agencies can effectively respond to changing marine access in the Arctic Ocean. The group will look at the climate impact assessment and then try to massage it into what the agencies, including the National Ice Center, Coast Guard, and Federal ice breakers, should be doing. He also attended the North Slope Science Initiative and NPRB meetings.

Brigham also gave several presentations at the New Bedford Whaling Museum, the University of Massachusetts, Dartmouth, to about 40 people at their marine science program about the Arctic Climate Impact Assessment, and also in the National Intelligence Council's sponsored meeting on Arctic warming. At the latter, he discussed the changing marine access in the Arctic Ocean and what it means to the United States and the world.

He also chaired the National Research Council panel on the needs of the Arctic Observing System where stakeholders include government agencies and industry and business representatives.

He attended a meeting of the Protection of Arctic Marine Environment (PAME), a working group of the Arctic Council. PAME has the lead for this Arctic marine Shipping Assessment that was mentioned in a ministerial document from Reyjkavik in November. It's an assessment of where the Arctic shipping is today, a snapshot of marine transport, and where might it be in 2050. It asks, among other things, what are the economic drivers and what are the protection mechanisms? The three lead countries associated with the assessment are the United States, Finland and Canada. **Brigham** will be called upon to present the Arctic Shipping Assessment to the Senior Arctic Officers (SAOs). **Brigham**'s concern is that, at present, the United States is putting forward an inconsistent message to the Arctic Council, in particular to Ambassador Churkin.

For the upcoming Commission meeting, **Brigham** is working on speakers including Elaine Maimon, the new chancellor of the UA, senior representatives from the Federal government offices in Anchorage, Fran Ulmer with Institute of Social and Economic Research (ISER), Dr. Jeffrey M. Welker, the new director of Environment and Natural Resources Institute (ENRI) and also General Case of the UAA Business School, to brief the Commission about their institutes and what they do. The Commission will also hear from the Alaska Oil and Gas Association, (AOGA). Individuals from the Denali Commission will be invited to present their ideas about infrastructure.

BPRC Reports
Before the Ohio State presentations began, the Commissioners introduced themselves to the audience and the upcoming speakers.

Ice Coverage in the Arctic
Leonid Polyak, BPRC, and his colleagues are studying ice coverage in the Arctic, particularly the history of Arctic glaciations. Studying what happened in the past requires collecting sediment cores and a geophysical survey of the ocean floor. Some of this work has been done by researchers from other countries that Polyak believes have shown positive results. He credits a concerted and cooperative effort within their government agencies and research communities.

For the US to compete would require this same type of effort. During the summer of 2005, BPRC may finally be able to look at ice sheet coalescence, glacial erosion and the Arctic's hydraulic system. OSU has been able to get ship time and funding to have a trans-Arctic cruise on the Healy that will work in concert with the Swedish icebreaker Oden. There they will collect cores from specified sites that will be housed at the Center. He believes that if this cruise can help achieve a resolution of the past activity, he and his colleagues will be able to splice together historical observations to put the Arctic's climactic changes into perspective.

Arctic Sea Level Change
CK Shum, BPRC, discussed the effects of the Arctic's sea level change on global warming. He detailed the variety of ongoing methods for determining change and their variable measurements. Using gauges located throughout the world, satellite altimeters, twin satellites and modeling, researchers are able to measure sea and sea ice changes. Overall, satellite observations are much higher in terms of amplitude than the models. Specifically in the Arctic, the calculation of sea level change is generally considered about 2 millimeters per year over a data span of 1950 to 2003. The calculations incorporate adjusting for vertical motion, pressure effects, motion mass and special variations.

Remote Sensing Applications in the Arctic
Kees Vanderveen, BPRC, discussed the research currently being conducted at the Center regarding ice marginal environments or, where the ice meets the land, as well as the techniques they are using. The objective is to extend the record of glacier change further back in time than the historical record currently allows. Kees noted that while it is well know that most outlet glaciers have been thinning at substantial rates, up to 10 meters a year since the 1990s, few studies have been undertaken to reconstruct the time history of the Greenland ice sheet.

While there are a few useful instrumental records from the 1930s to present, and direct observations that date back to the 1850s, most of the data is limited to a few sites and written in Danish or Norwegian languages that vary considerably from those spoken and written today. As a result, Vanderveen is required to rely on indirect evidence. Over the last half century, LEM photography replaced aerial pictures that have now been supplanted by satellite images that allow researchers to map glacial geomorphology features on a large, ice sheet-wide scale.

Satellite images also allow researchers to begin individual local studies that are done at individual sites to ultimately derive a spatially continuous picture. This has been particularly helpful in mapping trim lines that correspond to the maximum elevations achieved during the little ice age maximum that occurred between 1850 and 1900. Trim lines are the boundaries between where vegetation starts and where the bare rock begins. By using multi-spectral satellite imagery to help map different surface sites and measure refracted light over a wide range of wave lengths, researchers can conduct surface classifications whereby different surface covers can be grouped into different groups according to their spectral signature. Then the reflectance spectra of the different surface types are measured by a spectral radiometer. To

estimate volume changes researchers can combine the mapped trim lines with a digital elevation model to determine to what elevation the surface has retreated. Rates of change cannot be assigned by this process because researchers cannot assign any age to the trim lines.

Ice Streams in Greenland
Mark Berliner, BPRC, discussed a collection of models that he and colleagues are working on that are directed and guided by physics but sensitive to the statistics. Called physical statistical modeling, this treats both physics and data as equals but in the presence of uncertainty. He wants to link all of the uncertainties in observations and in the unknowns and develop probability models for them before looking at the data and substance. The solution is not an estimate or a particular point value. Rather it's a probability distribution that will remain that way even when the modeling is completed.

In terms of ice streams, the models would be used to understand about the force acting on the glacier and the implied velocity. The main processes of interest are velocity and the geometry of the base and the surface that translates into the velocity given base and surface. Berliner's job is to make a model for the base and surface and then bring it together with data.

ANWR Concerns
Lynn Everett, BPRC, discussed the impact tourism is having on Arctic National Wildlife Refuge (ANWR) and throughout the state, in general. Everett says there is far too little emphasis on this tourism, Alaska's second largest industry, when compared to potential hydrocarbon development on the coastal plain regions of ANWR going on at the same time. Tourism on the northern side of the refuge has increased dramatically while on the southern side has remained constant. In addition, improvement of existing infrastructure on the North Slope will increase tourist accessibility and the potential for greater anthropogenic impact. As production in Alaska's current oil fields decreases, tourism will become an alternative source of revenue. In addition, the ecosystem of Denali and the North Slope are fragile and as lodging facilities, eating establishments and even stop lights enter the picture, Everett believes there needs to be an understanding of the potential impact that can occur.

Fate emphasized the importance of tourism, that visitors into the state bring in much needed revenue to deal with the state's other concerns. Everett responded that it's important to ensure that the impact of tourism is minimal so that the integrity of what Alaskans have can be maintained.

Friday, March 4, 2005

Newton welcomed Thomas Rosol, Senior Associate Vice President for Research, who thanked the Commission for coming to OSU.

High Resolution Regional Climate Simulations Over Iceland Using Polar-MM5
David Bromwich, BPRC, discussed the study of climate over Iceland using a polar mesoscale model for meteorology forecasting. He and his colleagues had to adapt the model since it was developed for mid-latitudes rather than for high-latitude's unique characteristics. These adaptations required radiation from the Sun and the Earth, description of how snow and ice conduct heat up and down and a good description of the sea. He and his colleagues have had success with the work they done over Greenland and Antarctica.

Bromwich applied this model over Iceland, focusing particularly on the winds and precipitation. There is a marked temperature difference between the cold land and the warm ocean surrounding Iceland. Based on the model simulation, Bromwich discovered a very well organized katabatic wind circulation. The model also showed, in relationship to precipitation,

that Iceland receives well over 100 inches of water per year. The larger values are on the top of the mountains. Seasonal variations are also marked. Most of the precipitation falls from October through March. Station observations, as one might expect, do not cover the high terrain since they are located primarily around the edges of the island.

However, in areas such as the central Arctic, where conditions are much quieter on average, the model doesn't do as well. The US atmospheric science community including the National Weather Service, the US Navy, Air Force, etc. is now developing the next generation of mesoscale atmospheric model called the Weather Research Forecasting Model (WARF). WARF is also developed for the middle latitudes. It experiences the same high-latitude problems as its predecessor did and as a result will require adaptations to make it suitable for polar research.

Restoring the U.S.S. Glacier

Ben Koether, the Glacier Society, announced the culmination of a seven-year effort to restore the U.S.S. Glacier to sea worthiness. In order to accomplish that, the Glacier Society has been seeking a substantial grant that would enable it to totally rebuild the ship and deploy it in the Arctic for a period of three to five years with a multiple mission purpose. The primary mission would be the delivery of medical care to the native population of the eight circumpolar nations. At the same time other endeavors would be underway including medical research, earth sciences research and broadcasting through new T2 internet real time high definition video education to classrooms around the world. A benefactor has accepted the Glacier Society's business plan and funds should be transferred to the Society by early summer.

Koether appealed to the audience, made up largely of BPRC researchers, for funding and grant writing help. In addition to small contributions, Koether asked them to write research funding requests to take advantage of the onboard opportunity.

PARCA

Ellen Thompson, BPRC, introduced the work of the Center's ice core Paleo-climatology group, reviewing the 30-year investment they have made in collecting ice cores from both poles. Paleo-climatology explores the earth's multi-faceted geologic "wrapper" to establish the earth's climate history. The beauty of these Paleo climate archive samples, whether they are from ice cores, tree rings or ocean sediment, is that they allow long-term contacts with currently on-going changes.

Ice cores archive a wealth of vital information. They mimic the conditions in the atmosphere to allow tracking of everything from changes in dust to vegetation. The group is currently working on a project in Greenland that has produced ice cores that are excellent for monitoring the anthropogenic emissions. At the same time, they are monitoring the increase in nitrate deposition in view of the fact that the nitrogen cycle is tremendously disturbed on the planet.

Thompson also discussed the ten-year old Program for Arctic Regional Climate Assessment (PARCA), funded by the National Science Foundation and by NASA. The major goal of PARCA is to assess the mass balance of the Greenland ice sheet. Since 1995, PARCA has added 77 new records. Some of the records are only 20 to 30 years long but others are multi century records. BPRC and its Paleo-climatology group were well equipped for this task because of their investment over the last 20 years in the design of lightweight structures and lightweight drills with proven depth capability of 460 meters. At one site, Camp Century, the group drilled cores in 1996 that demonstrated the seasonal variations in the nitrate influx and the existing nitrate, and oxygen isotropic ratios that essentially highlight summer precipitation and winter precipitation. One of the major products from the PARCA program was the revised accumulation map of Greenland.

In addition, they picked up the major volcanic eruptions. With the multi century cores, they have can trace the signature left in the ice from a specific volcano. This is important because of the need to know what the excess sulfate deposition is in the atmosphere. Thompson points out that one of the major climate variables is volcanic activity. It's a natural component of climate variability and it needs to be accounted for in climate models.

Brigham asked about access problems particularly in Russia. Thompson remarked about one experience in 1994 where BPRC got funding from NASA to go in and do a deep drilling and to put up automatic weather stations in Franz-Joseph Land. In 1996, when they were ready to do their reconnaissance work, they were not allowed to go. Fortunately, they had some Russian colleagues that were able to get to Franz-Josef Land to collect the core and they were lucky enough to get that ice back to Ohio State. However, they couldn't retrieve their weather stations.

Thompson questioned the worth of the investment in time and energy that could well result in nothing at the end. This is a shame because there are some tremendous archives in the Franz-Josef Land that are melting. And as the ice cap is lost, the records that are contained therein will also begin to degrade. NSF is skeptical about trying to do a project in the Russian Arctic. The chance of failure, not for mechanical reasons, is very high.

BPRC Polar Archives

Raimund Goerler, BPRC, outlined the Byrd Center's archival program the mission of which is to identify, preserve and make available the heritage of scientific exploration and investigation in polar regions. Its priorities are focused around the papers of Admiral Richard Byrd. The facility also has an oral history component to collect and preserve oral histories of scientists and others who participated in expeditions to the Arctic and the Antarctica. In addition, their comprehensive website is easily accessible and incorporates much of the collection's hard copy publications.

The collection includes a variety of individuals and events associated with the Arctic. The largest area focuses on Admiral Richard Byrd. The collection includes documentation of his expeditions. The authors of Byrd's two biographies did a great deal of their research at that facility. In addition, the collections have been mined by historians, genealogists, the general public and documentary producers. Other large focal points of the collection include Sir Hubert Wilkins and the Frederick Cook papers.

The department recently submitted a grant to the NSF to continue its oral history program over a five-year period specifically to interview as many as 250 people in cooperation with the University of Alaska, Fairbanks. The archival staff typically hosts at least one conference each year with the objective to not only serve scholars but to educate and increase the interest of the general public in scientific exploration and investigation.

Persistent Organic Pollutants in Arctic Waters

Yu-Ping Chin, BPRC, discussed the fate of persistent organic pollutants (POPS) in Arctic territories. Despite this seemingly pristine veneer, the Arctic is actually quite highly polluted with persistent organic pollutants (e.g. dioxins, DDT's, pesticides, herbicides), heavy metals, and photochemical smog. They are persistent because they don't degrade readily. What happens to these persistent organic pollutants once they reach the Arctic? The AMAP program has done a tremendous job of monitoring these organic compounds.

The way organic contaminants reach the Arctic is through a process called global distillation. A contaminant such as those commonly found in Southeast Asia where compounds aren't well regulated, is released and they volatilize and re-precipitate, then volatilize and re-precipitate and so on. Chin used ACH as an example. At zero degrees, around the equator, one

sees very low concentrations of ACH in the ocean water. However, as researchers go further north, these concentrations look larger and larger until in the Beaufort Sea you high concentrations. Since there are no local sources of ACH, all have to originate in the lower latitudes.

The question then becomes if these compounds are accumulating in the Beaufort Sea, what's that doing to the ecosystem? Chin started with lichens that are the so-called bottom of the food web. Going up to the next tropic level, the caribou consume a lot of lichens. A wolf comes around, eats a couple of caribou and guess what happens? The amplification factor goes up by orders of magnitudes. And as a result, humans are getting this type of level of contaminant in their food supply. The World Health Organization accompanied representatives from Canada taking blood samples and milk samples from lactating moms. They found that the levels of these compounds are significantly higher than a typical person's samples at mid-latitudes.

Chin then studied the fate of POPS once they arrive in the Arctic. They looked at the impact of sunlight and how it can alter the state of some of these POPS. Also, nitrates, another photon absorbing constituents, can form reactive constituents, that can react with oxygen in the water column, forming chemical radicals. They also observed the degradation effect on POPS, from water source to water source, weighing various natural environmental effects. A body of water in Alaska is going to behave very differently from a water body in the central US.

Greenland Ice Sheet Impact on Sea Level and Salinity
Jason Box, BPRC, discussed the importance of the Greenland ice sheet mass balance changes to global sea level changes and North Atlantic salinity. There is a question about the role of Greenland in abrupt climate change. In a warming climate will increased melting alter the freshwater dynamics of the North Atlantic? How important is this? Does this play a role in abrupt climate change that is observed in the past? What would be the impacts on sea level rise?

Global temperatures have increased dramatically in the last decade, 2004 being among the top four warmest years. This warming trend appears to continue.

Overall, Box's model analysis, is a physically based data assimilation scheme. He and his colleagues take in all observations, running them in a model and trying to produce a spatially located data set which agrees well enough with the observations to conclude that yes, there have been temperature and precipitation increases on the Greenland ice sheet. Melting appears to have dominated—offsetting trends and affecting the equilibrium line. Altitude has increased around much of the ice sheet as has Freshwater discharge has increased. He stresses that the need for observational networks is vital.

Box was dismayed by a recent pullout of Congressional support for a network of observing stations designed to measure climate change for the US He hopes that the USARC might be able to communicate that concern to policy makers. This reduction of support has cut off 110 new stations that were specifically designed to accurately measure environmental change in the US and in Alaska. The CO_2 measurements at Mauna Loa have lost some support. It's important to maintain these monitoring systems because this means direct observations. He recommended to the Commission that they support automatic weather stations and glacier mass balance surveys that can be as simple as people placing sticks in the ice and measuring the melt rates.

US Polar Rock Repository
Anne Grunow, curator of the new US Polar Rock Repository, described the facility and its potential to make data accessible and also to help diminish the footprint, environmental and operational, in Antarctica. The collection currently is, for the most part, made up of Antarctic samples. Grunow is hoping to build up its Arctic samples.

The repository currently contains 5000 samples with 10 to 20 thousand promised. But with current shelving, the repository can hold about 70,000 samples. It takes quite a while to get the samples in and to identify where they came from.

Once the rocks come in, the staff lays them out and weighs them. They photograph the front and back of each sample and enter the data into a database. Each is then bagged and coded with a thumbnail image of what that specimen is so that they can keep track of usage. Finally, the sample data are put online and the actual samples put on the shelves.

Grunow discussed that samples coming in should explain where the rock is collected, why it was collected and the basic field information. They have taken researchers field maps to identify where the actual samples come from. The facility also has a rock magnetic properties database for those doing geophysical modeling where they can get information about susceptibility density, for example, from the rocks.

Brass asked whether NSF is putting a notice on their grants or their grant application forms that says it's expected that BPRC will get the rocks from scientists when done working with them. Grunow said there is in nothing in writing yet, although the program strongly encourages PI's to look to the repository first to do the basic research before submitting proposals for additional fieldwork. She added that there is also nothing in writing that says they have to submit the samples to Byrd's facility. The hard rock geology community hasn't definitively decided what to do about peoples' rock samples and where to put them.

USARC Field Trip to Finland
6-12 March 2005

The Commission visited Finland and the cities of Helsinki, Rovaniemi and Oulu during 6-12 March 2005. Press conferences were held in Helsinki at the Finnish Parliament and at the University of Lapland in Rovaniemi. Interviews with the local and national press were held throughout the trip with topics focusing on Arctic environmental change and the potential for US-Finnish collaborative Arctic research.

On 7 March, USARC visited the Aker Finnyards Inc. shipyard in Helsinki for a briefing and tour of the new icebreaker *Fesco Sakhalin* (icebreaking offshore supply and standby vessel). A briefing was also held at Aker's Arctic Research Centre and the Commission observed a model icebreaker being towed through the Centre's ice tank. Joint meetings were held with the Finnish Committee on Polar Research, a group composed of ministerial representatives and academic researchers. Useful discussions were held regarding future US-Finnish cooperation in Arctic research. A reception hosted by Ambassador Mack was held at the US Embassy for USARC and invitees from the Finnish government, industry, academe, and members of the diplomatic corps from the Arctic countries.

The Commission held joint meetings with members of the Finnish Parliamentary Committees on the Future and Northern Affairs. The Finnish Environment hosted a joint meeting for USARC on 8 March that included managers and researchers from the Finnish Institute of Marine Research, VTT (research on oil spills in ice), Finnish Meteorological Institute, and ILS Oy (multipurpose icebreaker designs).

USARC flew to Rovaniemi (on the Arctic Circle in northern Finland) on 9 March for joint meetings with researchers at the Arctic Centre of the University of Lapland. Discussions were also held during visits to the Lapland Environmental Centre (focus on cross-border environmental impacts in northern Finland) and the Finnish Forestry Research Station/Ministry of Agriculture and Forestry (focus on general boreal forestry research and the impacts of atmospheric pollution on forests). USARC also met with the Governor of Lapland at a dinner arranged 120 kilometers north of Rovaniemi in the heart of Lapland. Discussions were held on Arctic health issues, regional pollution impacts, and nuclear contamination in northern Finland from Russian activities on the Kola Peninsula. On 10 March, USARC was hosted by the University of Oulu by the Vice Rector and the head of the Thule Institute whose focus is on northern research. Key discussions were head on Arctic health research and further collaboration in Arctic health issues between the universities of Alaska and Oulu was addressed. A briefing was also provided on a Saami studies program developed by the University of Oulu.

The Commission was driven to the port of Oulu and boarded the Finnish Baltic icebreaker *Kontio* (98.6-meter length, built in 1987, flight deck equipped, capable of continuous icebreaking of one-meter ice). The Finnish icebreakers are currently state-owned, but managed by a newly organized private firm, Finstarship. Finstarship arranged for USARC to observe *Kontio* icebreaking in the Gulf of Bothnia off Oulu harbor. USARC observed several hours of icebreaking with the ship maneuvering to illustrate the effectiveness of this size icebreaker.

A final meeting was held on 11 March at the Finnish Parliament with Finland's Foreign Minister, Erkki Tuomioja. Foreign Minister Tuomioja discussed the recent Arctic Climate Impact Assessment (with thanks to the US for its leadership and funding of ACIA); the work of the Arctic Council and role of the indigenous Arctic people in the Council; and, Finland's unique position in northern Europe and the EU. Noted in the discussions (which included USARC and US Ambassador Mack) was the ongoing Arctic Council's Arctic Marine Shipping Assessment

which involves Canada, Finland and the US as lead countries and key partners during the conduct of the assessment, 2005-2008.

76th Meeting, 9-10 June 2005
Anchorage, AK

In attendance:

Commissioners

Mr. George Newton, Chairman
Mrs. Michele Longo Eder
Mrs. Mary Jane Fate
Mr. Duane Laible
Dr. Thomas C. Royer
Dr. Susan Sugai
Mr. Mead Treadwell

Staff

Dr. Garrett W. Brass
Executive Director

Ms. Kathy L. Farrow, Staff

Dr. Lawson Brigham
Deputy Executive Director and Alaska Office Director
Ms. Amanda Saxton, Alaska Office Staff

Attendees

Judith Abrahams, CPAT, **Shannon Atkinson,** ASLC-UAF **Keith Bogg,** AKNHP-ENRI, **Ray Boswell,** USDOE, **Rudy Bruggemann,** Canadian Consulate, **Matt Carlson,** AKNHP-ENRI, **Tom Case,** UAA, **Robert Chaney,** AEO, **Patricia Cochran,** ANSC, **John Cologgi,** ConocoPhillips, **Cleve Cowles,** MMS, **Aron Crowell,** Smithsonian Institution, **Steve deAlbuquerque,** ConocoPhillips, **Tony DeGange,** USFWS, **Craig Dorman,** UA **Judy Gottlieb,** NPS, **Rowan Gould,** USFWS, **Brad Hahn,** Alaska Clean Seas, **Jim Hensoth,** NETL-DOG, **Carl Hild,** UAA-ICHS, **Dennis Hinnah,** MMS, **Leslie Holland-Bartels,** USGS, **Bruce Hollen,** BLM, **Warren Horowitz,** MMS, **Robert Hunter,** ASRC Energy, **Mike Illenberg,** NPRB, **Tom Manson,** USFWS, **Molly McCammon,** AOOS, **Rosa Meehan,** USFWS, **Thomas Dunning Newbury,** MMS, **Chris Oliver,** NPFMC, **Alan Parkinson,** CDC, **John Payne,** BLM, **Rachel Petro,** AK Dept. of Natural Resources, **Dick Prentki,** MMS, **Caryn Rea,** ConocoPhillips, **Scott Schliebe,** USFWS, **Brent Sheets,** Arctic Energy Office, **Peter Smallidge,** CRREL, **Orson Smith,** UAA-School of Engineering, **Ken Taylor,** NSSI, **Charles Thomas,** SAIC, **Dennis Thurston,** MMS, **Denis Wiesenburg,** UAF, **Jeff Welker,** UAA, **Terry Whitledge,** UAF, **Bob Winfree,** NPS, **James Wuebben,** CRREL, **Jon Zufelt,** CRREL

June 9, 2005

Chair's Report

George Newton, Chair, United States Arctic Research Commission (USARC), opened the meeting with a report detailing his recent activities.

March 21, 2005—**Garrett Brass**, Executive Director, USARC, and **Newton** traveled to Monterey, California for a two-hour meeting of the Science Advisory Committee for the Submarine Science Program and saw considerable improvement in the Navy's willingness to support science—civilian science—with their submarines in the Arctic.

March 22-23, 2005—They then traveled from Monterey to Anchorage and Juneau for a series of briefings. They also received positive feedback on the USARC Report on Goals and Objectives 2005 and the direction it encourages for the science community. In addition, they met with Governor Murkowski and his chief of staff, in Juneau. Murkowski stated that he endorses Arctic research, in Alaska, as much as possible.

March 28, 2005— **Newton** spoke with Brad Smith, Director of the Strategic Environmental Research and Development Program (SERDP), Arlington, VA, concerning his offer to pay for the digitizing and declassification of old Navy archived Arctic Ocean sound speed profiles. On May 25, **Newton** had forwarded a cost estimate for this action. A contractor was identified to do the work and the information will be made immediately available to the science community when it is completed—approximately six to nine months.

April 2, 2005—**Newton** attended an energy symposium at the Cosmos Club in Washington DC about alternative energy sources and projections of activities in the energy field to reduce US reliance on foreign oils. He included an energy information card in the Commissioners' briefing books for the June 2005 meeting.

April 4, 2005—Since that date and throughout the period, **Newton** has worked closely with Mineral Management Service (MMS), Human Resource Division, and the various media in the search for the Commission's new Executive Director.

April 5, 2000—**Newton** met with Dennis Conlin to assist him in preparing a briefing by the National Science Foundation (NSF) to the Commander of the Submarine Force Atlantic Fleet, concerning the importance and value to science and the nation of implementing another series of SCICEX cruises. The NSF relied heavily on the contributions made by USARC for the briefing's content.

April 7, 2005—**Newton** met with the Director of the Navigation Division of the National Geo-Spatial Intelligence Agency and staff to discuss improvement and coordination of the Arctic Maritime Safety Information System. He also discussed the US position on a Russian request to establish two navigation areas, to be included in the Notice to Mariners system, along the northern sea route, without a northern boundary. **Newton** and officials at the State Department expressed reservations about the proposal's concept.

April 19, 2005—**Newton** met with contacts at John J. McMullen Associate (JJMA), Inc. naval architects and marine engineers in Washington, to review the preliminary design of the space arrangements aboard the ex-USS Glacier, particularly the medical and dental dedicated clinic quarters.

April 21, 2005—He met with Senator Lisa Murkowski's new chief of staff, Tom Daffron, who indicated continued support for USARC activities and interests within the senator's office.

April 25-30, 2005— **Dr. Lawson Brigham**, USARC Deputy Executive Director and Alaska Office Director, and **Newton** attended the Arctic Marine Shipping Conference in Helsinki, Finland, where **Newton** delivered an invited presentation on US strategy on oil spill research in ice-infested water drawing primarily from the USARC report published in 2004. **Brigham** also presented on the topic of Arctic Maritime Shipping. While in Helsinki, they also met with American Embassy staff Mike Cleverly and John Clarkson who requested input for a co-congressional delegation visit in late May, lead by Congressman Henry Hyde. **Newton** and **Brigham** prepared several discussion points concerning Arctic maritime shipping and the

probability that Russia will export considerable amounts of crude oil to the United States within the next 8-10 years.
May 2, 2005—**Newton** flew to Austin, Texas to speak at a symposium on Marine Scientific Research and Article 76 of the Law of the Sea given by the Institute of Geophysics.
May 5, 2005—He attended the first day of the semi-annual meeting of the Polar Research Board.
May 20, 2005—He prepared and presented a briefing to the American Legion Post at Fort McNair where he discussed the Arctic's changing climate and its potential world impact as shown in the Arctic Climate Impact Assessment.

Other activities and events have included:

- telephone conversations with a staff member on the Canadian government's Prime Ministers Privy Council who was interested in the Panama Canal meeting in which **Brigham** and **Newton** participated. Their specific interest concerned the presentations the two made and the potential for Arctic vs. Panama shipping in the years ahead.
- response to a letter from Admiral Jim Watkins of the Commission on Ocean Policy and Leon Panetta, who has chaired the Pew Oceans Commission, requesting his and the Commission's reaffirmation of support for the Law of the Sea.
- **Newton** and **Brass** have encouraged the Department of State to appoint Ray Arnaudo as US Senior Arctic Official. Both were invited to the State Department to discuss that and other Arctic concerns.
- **Newton** was also asked to write a letter, as Commission Chair, recommending the appointment of Tom Hawkins, now of John Hopkins University Applied Physics Laboratory, as the COMSUBPAC Science Advisor. Hopkins has briefed the Commission on future submarine operations in the Arctic and the research requirements that the Lab will attempt to fulfill.
- **Newton** was invited to give a paper on the Law of the Sea, Article 76, and Marine Scientific Research at the Advisory Board of the Law of the Sea or ABLOS, hosted by the International Hydrographic Bureau, in Monaco, in mid-October.
- He has continued to push the Navy to release the bathymetry data collected in Canada and Denmark's exclusive economic zones in response to each nation's request. It takes an inordinate amount of time to accomplish that particular objective especially given Navy reluctance.

Commission Reports
Commissioner Mead Treadwell attended an interactive and beneficial meeting of the Denali Commission as it convened various agencies to discuss Arctic infrastructure and research priorities. In searching for a lead scientist, **Treadwell** and other participants concluded that the Denali Commission is not the appropriate source from which to find this individual. Instead, the Core of Engineers is probably the better, more appropriate choice. He also expressed his satisfaction that the Interior Department has named lead scientist, Leslie Holland-Bartels, to work on the resources assessment priority.

The USARC is on record in support of the extension laws or even supporting the renewal of the Oil Pollution Act of 1990 and especially fulfilling the research promises in the Oil Pollution Act of 1990. Senator Stevens and Congressman Young have requested that the Coast Guard report on the oil spill pollution liability fund that, despite collecting a nickel a barrel tax from 1990 to 1994 when the fund got to a billion dollars, will soon be out of funds. In meetings with the Fund director, Jan Lane, and with members of the Alaska Congressional Delegation, **Treadwell** leaned that Senator Ted Stevens is considering sponsoring potential legislation that will reinstate the nickel a barrel tax. **Treadwell** encouraged USARC Commissioners to closely follow this issue.

- **Treadwell** briefed the Adak and Aleut Corporation on Iceland's potential interest in "twinning" with an Aleutian port to develop Arctic "shuttle" service, beginning with a

pre-feasibility study. The Alaska legislature has appropriated $50,000 to help Adak take that step.
- He worked with the US Coast Guard's manager of the Oil Spill Liability Trust Fund, OSRI, and Alaska's Congressional delegation on the issue of funding for oil spill prevention and response, including spill research.
- **Treadwell** and **Brigham** arranged an extensive agenda for Senator John McCain's climate change staffer whom they hosted in Alaska to help bring him up to speed on ongoing activities within the state.
- **Treadwell** gave three talks on Arctic issues, in Stamford, CT, Valdez, AK and Fairbanks.
- He met with Chris Rose to discuss alternative energy strategies in Alaska and informed Rose about the Commission's strong support of wind energy pilot projects and the Arctic energy center in Fairbanks. Rose advocated a renewable energy atlas of the west to identify the renewal energy opportunities in Alaska. **Treadwell** asked for Commission support. **Brass** brought up a previously considered engineering atlas of Alaska that would serve as a companion piece. **Newton** also reminded the Commission about the Ice Atlas, a publication on which **Brigham** is collaborating.
- He also met with Alaska congressional delegation and Tom Daffron. One issue they discussed, that is high on Governor Murkowski's list, is the identification of someone as the congressional staffer to follow Arctic issues on a day-to-day basis. Tom Sweeney was recently named as a possibility.

Commission Susan Sugai is working on a subcommittee with **Commissioner Michele Longo-Eder** reviewing the Commission's budget.

Sugai also discussed her work in obtaining funding for the Unalaska Marine Advisory agent currently funded on a Steller Sea Lion outreach project.

She along with John Walsh, University of Alaska Fairbanks (**UAF**), have put together a group of science advisors in an effort to broaden the perspective of the Cooperative Institute for Arctic Research (CIFAR), a National Oceanic & Atmospheric Administration (NOAA)—University of Alaska (UA) cooperative institute for which **Sugai** serves as Deputy Director. The hope is that those fellows can now provide strategic input in the various research areas. However, beginning in 2006, all current cooperative institutes must re-compete for the right to retain cooperative institutes. **Sugai** is currently working to address recommendations of the CIFAR review in 2004 and prepare for the CIFAR fellows meeting.

Commissioner Thomas Royer attended the GLOBEC Symposium on Climate Variability in the Sub-Arctic Marine Ecosystems with **Brigham** in Victoria, British Columbia on May 16-20. Considerable enthusiasm was expressed in looking at the Sub-Arctic marine ecosystems. The workshop was separated into three segments:
- the Bering Sea ecosystems workshop to discuss the plans for, and pitfalls with, the upcoming BEST study including the available platforms from which to work
- climate variability in Sub-Arctic marine ecosystems
- ecosystem studies in the Sub-Arctic.

Royer also served on the Oil Spill Liability Trust Fund (OSRI) Science Committee that reviewed fellowship applications and awarded three fellowships for OSRE.

Commissioner Mary Jane Fate attended a meeting in association with the Department of Commerce on the next census count in 2010 that is especially challenging considering the state's small, transient populations. But the numbers mean dollars for education, health and other projects throughout the state. She's written some materials about the problems of counting by race since many consider themselves indigenous to several different groups.

Fate announced the building of a much needed road to Rampart that she anticipates will open in 2006. It is the first village from the pipeline, down the Yukon River, to have a road and has the potential to fuel the village's economic, commercial and community identities.

Commissioner Duane Laible attended an energy conference in Iceland where discussions focused on hydrogen as a potential fuel source. He believes that it is a very difficult technology to manage. **Laible** said, however, that reports indicate some near-term payoffs in diesel and methane powered fuel cells that may well benefit from significant increases in fuel economy that can occur through this fuel cell technology. This will probably be the first layer of payoff.

Laible added that Seattle City Light, Seattle's public utility, announced that it is considering incentives for hybrid, electric-only automobiles because the utility believes Seattle has access to an abundance of renewable energy. But some of the ACIA findings and some climate change trends show that this may not be the case in the long-term.

Newton interjected that he recently saw a Washington Post article titled "Alaska Oil Fields Falling Production Reflects US Trend," focusing on declining supply, growing imports.

Staff Reports
Brass attended the Polar Research Board (PRB) meeting that centered around International Polar Year (IPY) issues. PRB has 890 proposals to date almost entirely without funding sources. **Brass** suggests that agencies pick among those ideas that they want to advance, conduct workshops and determine independently how the ideas will be funded. **Brass** also attended the ARCUS meeting and met with Karen Craft-Sloan, who is the new Canadian Ambassador to the Arctic.

He also attended an Arctic Icebreaker Coordinating Committee meeting, which focused mostly on preparations for this summer's cruise, including a number of questions about high Arctic communications. The communications are is still a problem and not improving—making the only communications alternatives HF Radio or Polar-orbiting satellite telephones.

Brigham hosted Floyd DesChamp, senior professional staff, Senate Commerce, Science and Transportation Committee, for presentations from US Geological Survey (USGS) and Fish and Wildlife Service (FWS) as well as the Research Board for Alaska Ocean Observing System (AOOS). Icebreakers were the common theme in the talks throughout the day including discussions about the lack of logistics from Federal research components and the use of Federal icebreakers. NSF has a lock on the ships and the Federal sector hasn't been able to use the icebreakers in more than a decade. **Brass** suggested that "money talks" and any party could use the icebreakers if willing to pay. He added, however, that NSF may not be happy about it since they pay 100% of the maintenance and operations costs.

- **Brigham** got positive feedback from Finnish parliament, industry and research establishments as a result of the Commission's recent trip to Finland.
- Participated in two meetings of the North Slope Science Initiative (NSSI) with its new executive director, Ken Taylor. The Commission is a non-voting member of the NSSI board and brings a unique picture of Arctic research to the NSSI team.
- Attended a meeting of the North Pacific Research Board (NPRB) at which he briefed them on the ACIA.
- Mailed out 700 Alaska Ocean Observing System (AOOS) reports generated from the Cambridge workshop held last September that was well received around the globe. The Cambridge meeting generated a large list of research items and key issues related to retreating sea ice and what it means for use of the Arctic Ocean, principally in Arctic marine transportation.

- Worked with the US Coast Guard as they funded and had translated, with State Department translators, the USARC Oil and Ice Report into Russian.
- Worked with the Arctic Council on Protection of the Arctic Marine Environment (PAME) on the Arctic Marine Shipping Assessment (AMSA) that will run from 2005 to 2008. Analogous to the Arctic Monitoring and Assessment Programme's (AMAP's) oil and gas assessment, PAME's assessment highlights current and future shipping activities and impact. Its three lead countries, Finland, Canada, and the United States grappled with the question, 'what is meant by shipping?' since shipping can incorporate everything from fishing vessels to cruise ships to expedition ships. The Arctic Council indicated that AMAP will incorporate all these vessels but that primarily military ships will be the focus in this assessment. On a related topic, **Brigham** has worked with Dennis Thurston, MMS, on bridging this assessment with the AMAP Oil and Gas Assessment.
- Attended the Arctic Marine Shipping Conference in Helsinki, where he hosted a meeting on AMSA.
- Made a presentation about operations and ships in the Arctic and the Antarctic to about 200 people at the New Bedford Whaling Museum.
- Went to Tabor Academy and spoke to students about Arctic and Antarctic research and attended a GLOBEC meeting in Victoria with **Royer**.

Fish and Wildlife Introduction
Rowan Gould, US Fish and Wildlife Service (USFWS), representing the bureau's Alaska region, discussed the bureau's vision of Arctic research including hot-button issues surrounding marine mammals, the National Wildlife Refuge, oil and gas development issues, the natural gas development pipeline and its international coordination responsibilities.

Caring for Alaska's Fish, Wildlife and Plant Resources
Tony DeGange, USFWS**,** defined the USFWS mission which is to work with others to conserve, protect and enhance fish, wildlife and plants in their habitat for the continuing benefit of the American people. Its science activities are focused around marine mammals, specifically the polar bear, walrus, and sea otter. The bureau's major resource management programs focus on fisheries, ecological services, Marine Mammals Management (MMM), national wildlife refuges, migratory bird management and offices of subsistence management.

DeGange outlined programs and studies relating to each of these areas including
- endangered species program consisting of a breeding propensity studies
- funding studies of sea bird and fisheries interactions/distribution of sea birds and development of deterrent devices to provide relief from sea birds in certain sectors of the industry
- satellite telemetry project
- genetic studies and sea bird bycatch program involving the Steller's Eiders, Spectacled Eiders, Yellow-Billed Loons and Short-Tailed Albatross. The Bureau manages a robust fisheries and conservation genetics program enabling chum, salmon to be identified by seasonal stocks and discrimination by sex. The contaminants program in its fisheries and ecological services program focuses on on-refuge clean up projects and off-refuge contaminant projects involving different wildlife species.

Alaska's National Wildlife Refuge System encompasses 16 refuges and 77 million acres. Each refuge has a specific and unique objective.
Alaskan Maritime National Wildlife Refuges—marine birds and the marine resources on which they rely.
Yukon Flats National Wildlife Refuge—waterfowl, breeding pair surveys, moose population surveys, sheep censuses, wolf reconnaissance surveys and beaver catch twin surveys.

Arctic National Wildlife Refuge—suite of ongoing monitoring and research studies including a telemetry study on a Porcupine Caribou herd looking at habitat selection and its seasonal movements in distribution and demographic characteristics and a long-term study on musk oxen population ebbs and flows.
Kenai National Wildlife Refuge—climate, vegetation, land birds, rodents, snow pack, etc.

Grasping the Walrus Numbers
Rosa Meehan, Supervisor, USFWS/MMM, discussed the challenges and complexities of MMM's research to determine the population size of the walrus. The study currently being planned encompasses counting walruses from the air, on ice and in the sea. It is difficult because of the large area in which walruses live (Bering and Chukchi seas) and their dependence on ice-covered waters regardless of the season. The international logistics to study them in both US and Russian waters requires creative cooperation among countries and colleagues. Identifying the appropriate platform for tagging the walruses—MMM is considering icebreakers—raises challenges that frustrate the study's endurance.

Protecting the Polar Bear
Scott Schliebe, Polar Bear Project Leader, USFWS/MMM, shares Meehan's challenges, in his specialty which is polar bears. These animals are facing unprecedented levels of stress from climate change, illegal harvest in Russia and contaminants. The stress level is troubling since Schliebe does not have the basic fundamental information on abundance, life history parameters, recruitment, or viability. His objective is to gain that information and he has worked with colleagues to access this population and conduct line transect surveys to understand whether or not technology will give him the type of answers he needs and expects. Schliebe lamented the limited icebreaker ship time when competing with NSF for the same resources. He sees the need for conducting live transect surveys, marking and recapturing, and collecting basic life history information tied intimately to access to icebreakers. He and his colleagues have worked to address the over-harvest issue and their efforts were instrumental in obtaining a signed treaty between the US and Russia. They hope this treaty will be ratified by Congress soon. Despite their efforts, Schliebe faces a fairly well-defined but cumbersome process with limited chances of a favorable outcome. Like Meehan, he asked the Commission for help in addressing the icebreaker access issues.

Brass commented that NSF does not own the icebreaker; that ship is scheduled by the Coast Guard and they're going to treat all comers equally. However now that funding responsibility has been unsolicitedly passed from the Coast Guard to NSF, the cost of a day on the icebreakers will likely rise from around $22-$25,000 a day to potentially $100,000. This means that if NSF is going to pay 100% of the bill, therefore may be able to control 100% of the access. **Brass** committed to look after MMM's interests on the Arctic Icebreaker Coordinating Committee, advisors to the Coast Guard, where he represents the Commission.

USGS Activities in Alaska
Leslie Holland-Bartels, Deputy Regional Director, USGS, offered an overview of USGS activities and responsibilities in Alaska. The USGS is the science arm of the Department of Interior and has approximately 70 different groupings of ongoing studies incorporating mineral assessments, oil and gas assessments for the nation and implementation of national water network systems to provide a broader prospective of those critical resources for the national public. They are conducted by approximately 200 scientists in residence with USGS in Alaska.

Because of Alaska's unique characteristics, the USGS recognized the need to reorganize how it conducts its science. It combined all its various elements in Alaska into the Alaska Science Center, which is a relatively new construct for the USGS. These include scientific capabilities across the various disciplines that are housed in the USGS, including biology, geography science, mapping and geology hazards activities in water science. USGS invests a great deal of

effort in assessing the relationships between those characteristics, looking at key elements that may be useful for the management agencies to monitor effectively. These include water gauging stations in the North Slope, ice characteristics across certain polar areas, biological and landform characteristics and development of regional resource assessments and geologic maps for the state.

Treadwell asked about the resource assessment workshop and where it currently stands. Holland-Bartels said that the "working" scope at this point is to look at oil, gas, and mineral resources. There are many partnerships in place and she hopes that the Survey can bring what is already been accomplished to the table. However there are still many questions to answer. What remains? What are the priorities that may exist within the various agencies that are responsible for providing this information to the public? What funding mechanisms do they presently have? What partnership mechanisms exist or are required to accomplish priorities? When do they expect to complete the assessments? What are their constraints?

USGS is looking at producing a similar assessment on land cover and water. Her intent is to have a scoping meeting to discuss its scale.

She and **Brass** also discussed funding for the gauging stations and whether an increase in partnering interest from the state would help toward increasing in the number of stream gauges.

NPS' Extensive Science Program

Bob Winfree, Science Advisor to National Park Service (NPS), Alaska Region, provided a brief introduction to the existing National Park Service's Science Programs in Alaska. There are 17 units of the National Park System in Alaska. They total about 55 million acres or about 65% of the total acreage of the NPS for the National Parks System. Six of these units are in Northern Alaska including five parks, preserves, and monuments in one affiliated area. The NPS' overall mission charges the agency with conserving park resources for the unimpaired enjoyment of current and future generations. As part of this mission, NPS authorizes several National Park Service Science Programs that allow non-NPS scientists to work in parks when their activities pose no threat to park resources, visitor enjoyment, and applicable laws and policies. The challenge calls for development of several new national, interconnected programs. These include 32 inventory and monitoring networks, NPS participation in each of 17 cooperative ecosystem studies units and a growing system of science and learning centers.

NPS is a decentralized agency. While many science programs are designed, funded, and coordinated at the national and regional office levels, the authority for implementation is usually delegated from the Director to the Regional Director and to the Superintendents at the park level. Several programs areas include the inventory and monitoring program, the cooperative ecosystem studies units, science and learning centers and the Beringian International Heritage program. The inventory and monitoring program's goals are to determine the status and trend of park resources, primarily natural resources, and to provide the information and forms useful to park managers, interpreters and others.

The prospect for several other National Park Service Science Programs is decreasing for the next few years. Last Fall, the Alaska Regional Office began a review of science issues, opportunities and challenges that are expected to affect the parks in the coming decades. Five major issues of concern were voiced including climate change, atmospheric and other contaminants, exotic species, increasing human use of parks and of park resources and development around parks.

Merging Energy Distribution with Environmental Responsibility

Brent Sheets, Manager, Arctic Energy Office (AEO), discussed the role of Alaska in fulfilling the nation's energy needs and the difficulty in meeting those wishes considering the state's

harsh environment. Sheets said about 1/5th of the nation's domestic oil production comes from Alaska, mostly from the state lands. It's an area of fragile tundra, harsh climates and continuous permafrost. The conditions, lack of infrastructure and a widely diverse and well dispersed population make energy allocation a challenge and results in high electrical costs. Out of these challenges, the Arctic Energy Office was borne in 2001. Its objectives in developing Alaska's energy resources include a strong focus on environmental issues to accommodate the cold climate, fragile tundra, desire to keep Alaska pristine and science and technology to reduce the impact of development on the environment.

AEO works with university, state and Federal agencies, to identify the critical needs. The number of days between the opening and the closing of the tundra for exploration activity has declined from over 200 days, just 30 years ago, to about 100 days in 2002. A couple of its projects on the fossil energy side limit the amount of time that oil companies have to explore on the tundra. As a result, their goals include safely increasing the exploration season on the North Slope to allow an exploration program to finish in a year, enhance prevention of tundra damage and objectively measure and quantify exploration work or travel across the tundra. AEO is also attempting to characterize and quantify the potential water balance effects from mid-winter pumping of the tundra lakes.

Other problems with providing an adequate energy plan are no electrical grid system, difficult transportation options, substandard water and sewer systems and large distances between villages. AEO is investigating a variety of options including bringing coal bed methane to remote villages and working on a diesel reformer to transform the diesel to a hydrogen fuel so that it can be used to power fuel cells in villages.

Newton stated that the big problem with remote energy production for the villages is the cost and the challenge of getting diesel fuel into the field, even if the energy system requires primarily fuel cell use. In their strategic plan, Sheets said AEO wants to go into a village and determine what its existing natural resources are—river turbines, coal bed methane, coal, wind, geothermal—put together a package that takes advantage of the energy systems that are local instead of importing diesel. **Royer** suggested they look at osmotic generating systems.

Offshore Oil and Gas Exploration in Alaska

Cleve Cowles, Chief of the Environmental Studies Section, MMS, in Alaska, outlined the Service's mission to provide for environmentally sound and safe management of offshore oil and gas exploration. MMS has two lean program components—a technology and assessment research program and the environmental studies program that focuses on the human, marine, and coastal environment and knowledge for offshore oil and gas decision making.

MMS has been conducting studies in Alaska related to the Offshore Continental Shelf (OCS) program since 1973 and spent more than $286 million. Program quality is an important issue and plans are reviewed by internal and external sources. Partners are involved in more than 60 percent of their studies.

The Service is considering cooperative ecosystem studies with specific goals:

- obtain information for environmental impact assessments
- enhance decision processes
- prepare study products—specifically, scientifically prepared study reports.

To date, MMS has informed more than 60 environmental impact statements, draft and final, supporting 22 offshore oil and gas lease sales. MMS has published books on the oceanography of the Bering Sea and the Gulf of Alaska and conducted related workshops. In addition, the Service has 60 ongoing physical oceanography studies that are broken up into a variety of different disciplines including Beaufort Sea near shore currents, surface circulation radar

mapping, measurement of change in sea ice movement of shore birds along the Arctic coast and a Bowhead whale area survey.

Oil and Gas Exploration And Development
John Payne, Wildlife Program Manager, Bureau of Land Management (BLM), discussed the National Petroleum Reserve Alaska (NPRA)—the largest contiguous BLM administered lands in the country, about 23½ million acres. Since 1998, BLM has three integrated activity plans—all to support oil and gas.

In the early '90s BLM's geographic information system was being assembled with the chief goals of plugging in information they collected including earth cover, hydrography, digital elevation models, transportation and land status. BLM does have a broad mission from conducting studies that have tracked caribou into the Seward Peninsula to performing an ice road study that demonstrated significant ice road vegetation restoration.

BLM is the agency that issues permits for all onshore oil and gas exploration and conducts regular compliance of associated research activities. Permits have been granted uniformly to industry or the individual scientists. BLM is also one of the lead agencies, in conjunction with the state, participating with the joint pipeline office to monitor and survey the land.

Newton asked how soon the next portion of NPRA will be up and available for the industry to look at. Payne expected some resale in the Fall of 2005.

Abundant Reserves at NSSI
Ken Taylor, Executive Director, NSSI, updated Commissioners concerning the area's high potential for continued development considering the 7.1 million barrels of known oil reserves and 35 trillion cubic feet of known gas reserves on NSSI Federal lands. These estimates do not include reserve numbers from State lands.

The NSSI is an organized, chartered and jointly-funded entity that guides inventory, monitoring, and research activities on the North Slope in support of research management. Its oversight group is composed of the regional directors from Federal resource agencies including the Commissioners of the Alaskan Department of Fish and Game, Department of Natural Resources, the Mayor of the North Slope Bureau and the President of the Arctic Slope Regional Corporation. Its goal is to enhance the quality and quantity of the scientific information available on the North Slope and to make the information available to the decision makers about where and how developments will occur. NSSI's objectives are to develop a collective understanding of information needs for regulatory and land management agencies, local governments, and the public. It wants to improve access to ongoing research so that the area is more fully utilized and ensure that the information collected is of the highest technical quality. A database with current research inventory and monitoring efforts contains between 300 and 400 projects. Its website, www.northslope.org, includes all of the presentations that are given to the oversight group, meeting minutes and a variety of reports.

Taylor discussed the improvements made at NSSI that include bringing 65-acre field sizes down to about six to ten acres, ice roads replaced gravel roads for exploration and development and advances to tundra travel vehicles to reduce the footprint left for most developments. Ultimately he hopes to develop a program of consistency regardless of the lease or the agency involved and come up with a uniform set of rules.

Newton asked if there has been any industry interest in expanding the number of hydrology stations. Taylor said where 30-50 year-life mines like Red Dog or Kensington exist, the oil industry is very interested and they pay half of the costs to have the station there. But since they are in the oil lands for only five to 10 years and then they move on, they are less willing to

contribute there. They aren't matching dollar for dollar but are will to provide logistical support if they can be caught early enough in their budget cycles.

Managing Disease in the Arctic

Dr. Alan Parkinson, Deputy Director, Arctic Investigations Program (AIP), Centers for Disease Control and Prevention (CDCP), Anchorage, explained that the AIP is part of the National Center for Infectious Disease that's mission is prevention and control of infectious disease, morbidity and mortality in Alaska. They place special emphasis on diseases of high incidence and concern to the indigenous peoples of Alaska and other Arctic countries such as pneumonia, streptococcus pneumonia, meningitis, septicemia, hepatitis and other ailments. Monitoring is primitive, using surveillance to count cases of disease—how much disease is present, where it is, what age groups it falls into, etc. to help target needed interventions for the focus populations. Another activity is public health research, primarily stressing interventions; which addresses what can be done to prevent these diseases. Much of the time the answer is vaccines. Since 9/11, the program has incorporated emergency response and terrorism preparedness performed alongside City of Anchorage, the state and Federal agencies.

AIP developed the International Circumpolar Surveillance Project to promote human health within the Arctic Council and within the sustainable development working group. Its goal is to link hospitals, laboratories and public health entities throughout the Arctic countries—Northern Canada, Greenland, Iceland, Norway, Finland, and Sweden, and eventually the Russian Federation—so that it can monitor infectious disease. There are a number of existing multinational infectious disease agreements between Arctic countries to manage long-term effects of human health from environmental pollution and climate change.

For IPY, Parkinson discussed an opportunity for the United States to lead an international program, the Arctic Human Health Initiative. The idea is to expand on the health interests of the Arctic Council: telemedicine, health communication, International Circumpolar Surveillance Project, food security and children's health.

Fate asked why there has been no study performed in cases of substance abuse overdose that would identify substances taken and ingestion amounts. Parkinson indicated that that same subject had come up many times and is being considered. **Brass** stated that Warren Zapol, Harvard Medical School, who sits on the Polar Research Board, is very interested in coordinating a Joint Institute of Medicine and Polar Research Board study on what ought to be done in relationship to Arctic mental health.

Smithsonian's Research-Focused Cultural Influence

Aaron Crowell, Alaska Director for the Arctic Study Programs (ASP), Smithsonian Institution, discussed the strong focus on ASPs' co-design of research and educational programs with indigenous communities on a circumpolar scope. They have conducted projects in Greenland, Canada, Alaska and Russia and partnered with NPS, NOAA, indigenous organizations, universities and the social science research community. There are more than 50,000 items of Alaskan Native cultural heritage that are contained in Smithsonian collections, both at the National Museum of Natural History and National Museum of the American Indian. One of the ways that Crowell has worked with the Smithsonian collections and other resources in Washington, DC is through an exhibition programs. The model for this work is to bring together local knowledge—oral traditions, local resources and activities—and combine them with archeological and anthropologic research to create a variety of dynamic programs such as that at the Alutiiq Museum in Kodiak. Approximately 1,500 items will travel from Washington DC to Anchorage by 2010 to be housed in 10,000 square feet of the currently-under-expansion Anchorage Museum. This space will not only include the exhibit but also an ongoing cultural research center.

In addition, the Smithsonian is involved in a number of research projects, primarily in archeology, anthropology, and interrelated environment studies. One project, on the Kenai Fjord, is designed to combine oral historical information about this outer coast and descendent communities with paleoenvironmental studies and archeology. Primary areas of interest are the earthquake history of this coast and salmon spawning in lakes over the last 2,000 years.

Treadwell asked Crowell about exhibits with an Arctic Research focus and if the Smithsonian has done or contemplated an exhibit centered on language preservation. Crowell has been discussing an exhibit on natural history with the Arctic Museum but agrees that a permanent gallery that would focus on research **and** Arctic natural sciences would be outstanding. The Smithsonian has created resources for language programs but has done nothing directly. He sees that being carried out primarily on a local level.

ConocoPhillips Environmental Studies

Caryn Rea, Senior Staff Biologist, Environmental Studies Program, ConocoPhillips, Anchorage, explained that her company conducts environmental studies to

- obtain the permits
- meet stipulations for permits that require studies
- assess whether its activities have the potential to impact a species of wildlife that concerns a particular agency.

In essence, the company does this work to support development and that means a footprint. So while studies in some ways represent a means to an end, ConocoPhillips does take them seriously, beginning every project, whether it pertains to exploration, development or ongoing operations, in face-to-face meeting(s) with pertinent state, Federal, or local regulatory agencies to ascertain worrisome issues. The company's process requires substantial collaboration.

They've been documenting their "face, chase, and recovery" activities over the last three years to ensure efficiency, practicality and environmental prudence. For instance, in reviewing the impact of seismic trails on tundra at the Colville River Delta, they can substantiate recovery of certain types of vegetation in that area. Once the exploration phase is complete, they move on to development—putting gravel down for a pad, building an ice road, etc. When an issue of concern is identified, Rea takes the cue to get started by putting together a comprehensive program that takes into account the various facets of environmental issues.

The same diligence occurs with ConocoPhillips' wildlife studies where routine transect surveys analyze distribution and abundance. Caribou, swans, Spectacled and Steller's Eiders are now or are expected to be placed on the endangered list. Landform surveys identify different land terrain units and combined with vegetation information, provide voluminous data to produce extensive habitat maps with over 16 different classifications. These maps show Rea which habitats are important, which the wildlife prefer and also those they'll avoid.

According to Rea, most of the studies have shown little impact on wildlife resulting from ConocoPhillips' operations. For instance, concern for caribou that were disturbed by vehicles and were therefore avoiding the road, was the subject for one study to obtain a permit. However, after three years, mitigation efforts proved less effective than just slowing down and passing the caribou. Likewise, monitoring for water quality and fish presence in alpine developments and determining the effect of aircraft noise disturbance on the tundra nesting birds found adjacent to an airstrip has not shown any significant impact variations since operations commenced.

Newton asked if there was any effort to ensure that no duplicate studies have been done on a particular subject before ConocoPhillips takes on a study. Rea said they do search but there is rarely anything that duplicates what they intend to do. He also asked if each oil company

does its own studies or if she does them for all companies on the North Slope. Rea said that there is limited cooperation and ConocoPhillips does the majority of the existing studies. Rea added that she also sends out all reports that she produces to pertinent agencies and several environmental groups. **Treadwell** asked whether there is any strategy in place now on the Slope to reduce Carbon emissions in the exploration/production side. Steve deAlbuquerque, ConocoPhillips, said that there is a program in place to address that issue. Right now, ConocoPhillips is sorting through constituents that they can actually reduce in a meaningful way and to uncover what their associated costs are.

Offshore Oil and Gas Guidelines Assessment

Dennis Thurston, geophysicist, MMS, outlined the Service's past and present collaboration with the Arctic Council, or the Arctic Environmental Protection Strategy (AEPS) as it was known at the time, when the Service helped develop the offshore guidelines for environmental impact assessments followed by the creation of the offshore oil and gas guidelines. Written in cooperation with DOI and NOAA, the guidelines cover the industry from cradle from to grave, laying out guidance on policy, process, and practices as they relate to environmental impact assessments—how to deal with Arctic communities, indigenous peoples, and conservation of flora and fauna—when making land available for oil and gas or permit activities.

In addition, MMS is involved in the creation of the Arctic Marine Strategic Plan that details the effects and potential effects from oil and gas activities. The United States volunteered to lead the chapter on oil and gas activities and the chapter on social economic impacts or consequences. Other chapters outline essentially what pollutants are associated with oil and gas? How do they transfer into the environment? What is their concentration? What happens to them once in the system? Because of its comprehensive nature and international involvement, the Plan, when completed, is expected to exceed size expectations.

Brigham noted that Thurston is the intellectual leader of this international effort and deserves credit as such.

Cold Region Engineers

Jon Zufelt discussed the activities of the Technical Council on Cold Region Engineering (TCCRE), one of several committees within the American Society of Civil Engineers (ASCE). This group is made up of engineers that share a passion for working on cold regions problems. TCCRE's subcommittees include:

- Hydraulics and hydrology committee—coastal issues to rivers and river ice
- Frozen ground committee—permafrost and seasonal frost related problems
- Environment and public health
- Transportation and infrastructures—pipelines, roadways, airfields, etc.
- Geo Institute—a geo-technical engineering emphasis with a permafrost and foundations focus
- Publications—*Journal of Cold Regions Engineering*, one of ASCEs smaller, quarterly journals.

The committee also generates monographs that are compendiums of engineering knowledge on a variety of topics and cover the primary concerns facing engineers when operating in cold climate scenarios. *Thermal Analysis, Construction, and Monitoring Methods for Frozen Ground* was most recently published. Future topics include:

- Field Properties and Site Investigations for Frozen Ground
- Updated Cold Region's Hydrology and Hydraulics
- River Ice
- Water Treatment in Cold Regions
- Ports and Coastal Processes in Cold Regions
- Cold Weather Concreting

Treadwell suggested that a recurring theme he hears is the idea of an Arctic building code. He wondered if there are any efforts underway or if it is a viable idea. Zufelt said that there could and probably should be such a code. He pointed toward the need when citing a new standard on frost protected shallow foundations that require significant amounts of insulation and take engineering right out of the whole process. But there doesn't seem to be any unified code consensus now.

Developing a Comprehensive Marine Observing System

Molly McCammon, Executive Director, AOOS, part of the Integrated Ocean Observing System that examines various ways of monitoring the ocean and identifies how it can do a better job of integrating those observations. AOOS would then like to standardize those observations across the country and the globe to make better products for users of the marine environment. The System's US component has two pieces—the national backbone which is made up of activities that occur on a regular, routine basis and a series of nested regional observing systems designed to meet regional and local needs.

AOOS' focus in the last two years has been to identify the stakeholders, meeting with them, distinguishing their needs and determining what an ocean observing system in Alaska would look like. Its community incorporates the full spectrum of Arctic interests including offshore oil and gas, shipping and navigation, subsistence hunting, resource managers, native communities, planners and climate change researchers. In addition, AOOS has been developing an organizational structure incorporating data management, education and outreach that would support increased observations for issues such as search and rescue models, oil spill response, and safe navigation. It has identified issues of primary concern to their stakeholders such as coastal erosion, seasonal and long term forecasts, currents, an ecosystem approach to managing fisheries, improved satellite, data management and communication systems, mapping and charting.

Where is the AOOS niche? With the exception that fisheries and ecosystem productivity are much larger needs in the Bering Sea environment as compared to the Aleutian Islands, these two regions share the same concerns in terms of better imagery and charts, long term, using high frequency radar at certain pulse points such as in the Bering Strait. For the Gulf of Alaska, other considerations such as tourism, aquaculture, recreational boaters, in addition to oil and gas and search and rescue are introduced into the equation.

Treadwell asked whether AOOS had looked at upstream data. McCammon said that it is an important issue and that the service will be identifying which ones should be needed and where. She expects to have it done in the late Fall. He asked **Newton** that a follow-up presentation be done on this information once it becomes available. **Treadwell** also asked whether anything has been done on the R&D side to get nano-sensors and smaller items issued to users more broadly. McCammon said AOOS is working with the Alliance for Coastal Technology, which is focusing on sensor development and technology development. But this research is not at the nano-technology level yet. They're looking at trying to improve dissolved oxygen sensors in various conditions. McCammon thinks it is an important to consider because most of the questions that AOOS gets Congress now about this issue revolve around program costs. When ramping up the costs associated with a fully-implemented program over a 10-year period, it comes out to over $300 million a year, which in a grand scheme of things is not all that much considering what is already being spent, probably well over $100 million just in earmarks and various other issues.

Cleanup After a Spill

Brad Hahn, General Manager and President, Alaska Clean Seas, described the company's role in the oil spill response, primarily in Prudo Bay off of the North Slope, as ideal. Its nine-

month annual ice cover makes cleanups easier, almost mechanical. Over the years, Alaska Clean Seas has sought to discover efficiencies where it can. Technologies have come and gone, but Hahn believes in smaller systems because of the vessels' speed, steering performance and improved encounter rates.

It all comes down to getting the right mix of equipment to match the consistency of the oil. For instance, the oil that is produced at Endicott is extremely viscous, whereas the oil from the North Slope is actually closer to diesel. In the Kurashima spill, Alaska Clean Seas had significant difficulty pumping the oil because of its thickness. Hahn and crew developed injection rings that mount onto the pumps that allow for injecting the water which forms a sleeve around the oil as it moves through the lines and acts as a lubricant. It was actually a great advancement to allow for the pumping of thick viscous oil.

Alaska Clean Seas' primary focus has been on in situ burning and fire booms. The company frequently uses them for tundra spills, as well. The downside of in situ burning is the amount of air pollution the method produces. Alaska Clean Seas would much rather recover the oil physically, if possible, anyway. The company has and is investigating a number of alternatives including dispersants and oil detection in under the ice.

June 10, 2005

University Welcome
Elaine Maimon, Chancellor, UAA, welcomed the Commission, acknowledging the Commissioners contributions to the Arctic and Arctic research that made it possible for everyone to have a better understanding of the environment in which they live. She appreciated the strong bond between the Commission and the university.

Maimon discussed the unique nature of UAA, in addition to UAF, and UAS, and its interdisciplinary approach. It is the research-based teaching that attracts faculty to UA. Its focus on specific research areas allows it to be a true policy think tank for Alaska and the Arctic. One of these areas that is receiving considerably more attention is behavior health.

Doug Causey, Vice Provost for Research and Graduate Studies, emphasized the gradual and increasing amount of research and other external funds coming into the university. He noted that UAAs research will need to be community based—not just the community of Anchorage, but the larger community of Alaska.

Tom Case, Dean, UAA College of Business and Public Policy, explained that the college sets out to weave the business and public policy domains together by establishing a strong tie between the two, incorporating values and ethics in their teaching and research. This philosophy comes to play in three areas of emphasis in which their research efforts are currently engaged.

Global Supply Chain Management—Case points to an example of a micro sensor system that, in collaboration with UAF, has implications for the curriculum in the master's of science and global supply chain management programs, undergraduate logistics degrees and the certificate level logistics program. The portion the school locked onto was and is radio frequency identification technology or RFID tags—a very small processor with a small antennae that can be manufactured for about a nickel each. These RFID tags allow one to program basic information about a product onto the tag. For example, sensors can be inserted into a product that might allow tracking of temperature from origin along transportation routes to its destination. The school focused on the seafood logistics challenge. Alaska's wild salmon are considered high quality products yet have a 30 percent wastage component in the best of

seafood delivery distribution plans. UAA started a small scale research project to apply RFID temperature tags to the catch on a vessel and then track the temperature of that product all the way to the restaurant.

Experimental Economics—For three years the school has been associated with Vernon Smith, the Nobel Laureate co-winner in 2002, and the discipline of experimental economics. His concept has effected a whole generation of economists and created a new way of thinking about studying the economy. The discipline sets up a replica of an economy in an artificial environment with actual individuals engaging in economic dynamics. Currently he's taking on a significant research assignment, which is to model Alaska's oil industry—the pipeline, leasing structure, drilling and development locations. Students are learning how the components of the industry work together, mapping it as it is now in a computer model to set the basis for economics experiments with various industry policy issues.

Continuing relationship between Alaska and Siberia—creating an Alaskan native and cultural connection. The American/Russian Center has been in operation for over 10 years and is supported by strong connections and collaborative and applied research activities in the Russian Far East.

How the Arctic Half Lives

Fran Ulmer, Director, UAA Institute of Social Economic Research (ISER) discussed the Survey of Living Conditions in the Arctic (SLiCA), an international survey that compares living conditions of people who live in the Arctic, specifically, sustainability of Arctic communities, traditional knowledge, contaminants, assessment of potential affects of oil and gas activities in the Arctic, and education projects. To date, the survey incorporates indigenous people from Russia, Canada, the United States, Greenland, Norway, and Sweden. This is accomplished through a partnership with native people and researchers working together to provide a better picture of what living conditions set Arctic people apart from others and how these living conditions affect quality of life. The end goal is assisting decision makers in all jurisdictions to understand how governmental programs can be structured to be more effective and responsive to the needs of people in the Arctic.

The SLiCA themes that arose from nearly 700 interviews include

- importance of social relationships, standard of living, mixed cash and harvest-based economy.
- importance of subsistence to understanding the relationship between social problems in the Arctic and the living conditions in the Arctic
- an understanding of the missionaries' role in structuring the school systems in the Arctic—how do people now feel about education

Preliminary results indicate the importance for people living the Arctic to hunt and fish and to do this close to home. This result alone seems to have tremendous effect on depression, alcoholism, and other social problems associated with the rather rapid change that people in the Arctic have experienced over the last several decades.

Other projects currently underway or being planned are:

- Sustainability of Arctic communities—looks at the question of how climate change and development can affect the sustainability of Arctic communities
- Cooperative effort with ISER and the Alaska Native Science Commission under an EPA grant to understand some of the concerns about contamination, nutrition, and other relevant information associated with utilization of traditional foods
- The study of environmental Arctic change
- An assessment of potential effects of oil and gas activities on the Arctic people
- Long-term affects of Alaska's boarding school system

- Economic feasibility to apply telemedicine in the Arctic

Environmental Watchdog
Jeff Welker, Director, the Environment and Natural Resource Institute, focuses on applied and basic research activities that address environmental and natural resource issues in Alaska, the region and globally. The Institute consists of research groups that address conservation biology, climate change and biogeochemistry, hydroecology in addition to programs in human dimensions that focus on cultural aspects of Alaska Natives. It supports several programs including the cultural heritage, aquatic ecology, bio-geosciences and seismic data analysis programs and is home to the Alaska Climate Center.

The Cultural Heritage Program conducts many basic and applied archaeological and anthropological studies; thematic history investigations related to the indigenous populations in the north. It develops strong collaborations with the native communities and has engaged teachers from the K-12 grades to participate in research activities and bring that "new" knowledge back to the classroom. The Program has uncovered broad findings such as the impact of climate change on the area's whaling communities to such secondary concerns that show the effect the accelerating erosion in the Arctic has on some of the native gravesites.

Alaska National Heritage Program has a mandate to monitor inventory and map the spatial and temporal distribution of plants and animals in Alaska. It's part of a large national and international program, looking at the distribution and abundance of plants and animals in the north as well as in the lower 48 areas. Invasive species program is one of the critical issues in the Arctic. In the Kenai Fiords, invasions of Spruce Bark Beetles are changing the ecology of the forest, making it more vulnerable to fires. Non-native invasive plant species have already become established in the Arctic and, as the climate changes, so their abundance will change and that will start to change the fundamental attributes of the forest.

The Aquatic Ecology program monitors river and stream invertebrates. By examining the organisms that are in the water one can get a sense of the water's health and well being and how it impacts species up the food chain.

Welker encouraged the Commission to support the National Ecological Observatory Network, an initiative that's being supported by the National Science Foundation to monitor and observe the environment for about 30 years. It's a program that will be committed to monitoring the environment in many ways and will focus on terrestrial, coastal as well as atmospheric processes.

Guiding Health Research
Carl Hild, Associate Director, UAA Institute for Circumpolar Health Studies (ICHS) explained the Institute's mission which is to improve health through instruction and basic and applied research. It does not try to build its own infrastructure but instead acts as a catalyst for bringing researchers together, working on teams with a variety of different groups. The Institute focuses on community-identified needs. Over the past 15 years, there has been a big shift to health research. As a result, the Institute has moved toward community-based participatory health science research. Staff works with communities, listen and then build research programs to work collaboratively.

For instance, the Center for Alcohol and Addiction Studies (CAAS) was specifically established to sort out the issues of substance abuse throughout the state. It's the only institute of its kind that has a circumpolar charge to look and engage health research, both in practice as well as education. The National Resource Center for American Indian, Alaskan Native, and Native Hawaiian Elders is putting together a proposal to the National Institutes of Mental Health to study elder disrespect.

In addition, the Institute is considering telemedicine and tele-health systems as a way to recruit and retain health personnel in remote Alaskan settings and also grow their own health researchers. The Afghan project is another effort to attend a patient being transported from the scene of trauma through the entire medical system during the first few hours and days of care.

More Questions Than Answers
Orson Smith, UAA School of Engineering, discussed the school emphasis on port and coastal engineering. He asks the basic question, 'How do you design for accelerating warmth and an increasing rate of permafrost melting?' And the more dramatic impact of climate change on the coast of Alaska actually has to do with the receding ice. More open water means more wind energy into the ocean to generate storm surges, increase water levels and wave energy striking the coast. It's a grave danger to the coast of Alaska. Hydrology of the interior is also changing with warming and more winter rainfall. Drainage basins that used to be frozen for more of the year spend more time in an unfrozen state where they're more susceptible to erosion. As a result, sediment loads increase throughout these drainages and ultimately into the coastal ocean.

UA's Activities
Craig Dorman, Vice President of Academic Affairs and Research, UA, outlined a series of staffing changes, newly created positions or those that have bee recently filled at UAA and UAF. He discussed the ongoing impact of the Arctic Climate Impact Assessment and the Arctic Human Development Report—that even though they are complete, their results generated new research to be carried forward. He noted that China has agreed to host the secretariat for the next Arctic Science Summit Week; a noteworthy item with China paying more attention to Arctic and Antarctic issues. Dorman welcomes collaboration with the Chinese.

Dorman addressed International Polar Year (IPY), discussing various participants, proposals submitted and the role each party plays. He stressed the importance of USARC involvement in this and all other events related to the Arctic. He asked for Commission support of IPY as a very important program and a commitment that USARC will do all it can to promote the program to the President and Congress. **Newton** affirmed that support.

Treadwell asked what Dorman would urge the Commission to do in terms of promoting IPY Dorman suggested that the priorities listed in the Commission's Goals Report should correlate with IPY initiatives. He also encouraged enhanced activism on the part of the Commission to persuade the President, Congress, OSTP and NSTC to promote IPY and to fund its current and potential programs. **Brass** indicated that a significant problem is that the agencies with money are not aggressively stepping forward to fund the programs under consideration for IPY, despite the merits of the proposals.

Alaska Regions Research Vessels
Denis Wiesenburg, Dean, School of Fisheries and Ocean Sciences, UAF, described the program's fieldwork for the faculty as global—in the Arctic, Antarctic, Aleutians and the Gulf of Alaska. The Coastal Marine Institute funds research important to the oil and gas industry to study the outer continental shelf related interest: North Slope, Cook Inlet and the Gulf of Alaska projects are primarily in physical oceanography, some chemical oceanography, and some in biology. Pollock Conservation Cooperative Research Center, (PCCRC), funded by the At-Sea Processors Association—the different seafood companies that deal with the Bering Sea Pollock Industry—has made donations to the university to fund a research effort to better understand the commercial fisheries of the Bering Sea. The West Coast and Polar Regions Undersea Research Center, is a national underwater research program that funds tools including remotely operated vehicles, submarines, and also scientific diving. The Kasitsna Bay Lab contains diverse ecosystems where the school's marine biologists primarily work. It also

houses the scientific diving program that supports approximately 2,000 dives per year for research purposes.

The Census of Marine Life is a sea, air, land modeling and observing network that houses a number of projects, including the SALMON project, which is part of a 70-nation, 10-year initiative funded by the Sloan Foundation to look at diversity and distribution of marine life throughout the world's oceans. Wiesenburg ended his discussion asking the Commission whether or not the School should retire its current, inadequate research vessel, the Alpha Helix, in favor of the soon to be built Alaska Region Research Vessel (ARRV).

Newton questioned the disfavor of the Alpha Helix. Wiesenburg said that NSF gave the School a half-million dollars last year just to keep the ship tied up at the dock even when they were very stretched for money. The question is, is that a good investment? **Royer** echoed Wiesenburg's concerns since at a recent meeting he attended, commenters specifically said that they would not use the Alpha Helix for their work in favor of a Russian vessel. **Brass** stated that NSF pays per day of ship time use, and while many of the costs of running a ship depend on the days of ship time use, about ½ of a full year costs are fixed costs. Therefore, as the number of days the ship is used decrease, the day rate increases. Pretty soon the rate of the Alpha Helix becomes uneconomical.

Ready For ARRV

Terry Whitledge, Institute of Marine Science, UAF, discussed the ARRV and its unexpected rise to the top of the National Science Board's (NSB) list of priorities. Even though the ship has better ice breaking capability than it was designed to have (can break about 2 ½ feet of ice at about 3-knots) and its design modification to make it a floating laboratory system, UAF was having difficulty getting funding off the ground. On May 25-26, 2005, following a closed-session meeting, the NSB announced that the ARRV was its top priority and FY07 is possibly the year funding will materialize. Whitledge believes that happened because the ship's design report was ready when the NSB met, Arctic climate change news, it is time to build a ship to go work in the Arctic and the Board wanted to get the ship moving and have it be working for IPY.

Whitledge asked why science needs the ARRV. His "present-day" scenario suggests the

- inability to conduct fisheries and oceanographic sampling at the same time
- operational limits in rough weather
- inability to work in ice covered waters to some degree
- limitations to science payload
- mismatch between size of the vessel and its typical mission
- major and minor mechanical problems on other ships
- safety issues

Whitledge believes it should be the ideal research vessel with its built-in dynamic positioning system, multi-beam systems for bathymetry, broadband communications not to mention its ability to support a 45-day mission with 25-30 scientists. It has a combined fisheries and general oceanographic design that should make it be able to conduct trawls. Keeping the ship acoustically quiet was a priority to ensure that the seismic equipment and acoustics will work effectively. The back deck has approximately 3200 square feet of beam of more than 50 feet and 40 to 50 feet of clearance from the stern to the back bulkhead.

All this adds up to a big price tag. When the ARRV is approved, there'll be a punch list of sorts to finalize and improve the ship's design. The electronics for the propulsion systems are being redesigned, the over-the-side handling system is being updated with state-of-the-art features and ADA accommodations are being added to the laboratory design.

Laible asked for an update the funding prospects for the ARRV and 2007. Whitledge said that if this new information that's been leaked out of the NSB is correct, ARRV would be at the top of their list and the process would start for the FY07 budget. That would mean that the contract process could begin after the first of the year in 2007 and then with an approximate two-year period of construction and trials, the ship could probably be operating in 2009 or something of that order. **Brigham** questioned the preparedness of the ship's potential crew to take the ship to ice without proper training. He suggested that the Coast Guard's method of sending officers and crew wherever in the world it makes sense for them to acquire substantial and proper training be employed in this case.

Alaska Sea Life Center

Shannon Atkinson, Professor of Marine Science, UAF and Science Director, Alaska Sea Life Center, outlined the Center's research priorities which are aimed primarily at species at the higher trophic levels—marine mammals and sea birds, especially sea ducks in the Gulf of Alaska. However the Center does have several projects throughout the North Pacific and Russian Far East. Research focuses on declining species; some of which are listed as threatened or endangered under the Endangered Species Act or depleted under the Marine Mammal Protection Act.

Working with a number of partners has allowed the Center to broaden its reach.

Partner	**Research Focus**
National Marine Fisheries' Service	Steller Sea Lion, Harbor Seal Northern Fur Seal
Fish and Wildlife Service	Eiders
National Park Service	environmental monitoring

The Sea Life Center became a reality thanks to funds bequeathed by the Exxon Valdez Oil Spill (EVOS) Trustee Council that agreed that the Center would hold 4,000 square feet in perpetuity to conduct research that may related to EVOS or other oil spill type activities. This long-standing partnership will remain there for as long as the Sea Life Center is in operation.

Atkinson begins all the Center's programs by trying to define a conceptual model and determine a road map. When analyzing a declining species, it is hard to know where to begin. What is it that's causing the decline? Is there not enough to eat out there? Are the animals competing with the fisheries? Is there any credence to the decline from a scientific basis? Is it predation? Is there impact from environmental change? Are pollutants affecting these animals and, if so, is this a concern that needs to be communicated to the human residents? Is it disease?

The Center's well-funded Steller Sea Lion Program has been able to address all of these areas. On the other hand, the Harbor Sea Research Program has been limited by less funding, despite the species suffering a 90 percent population decline during 1970s to 1990s. (The population has since then shown some signs of rebound at about 3% a year.) The Eider Research Program focuses on the threatened Steller's and Spectacled Eider populations. The reproduction in the Eider species are down and there have been four years of unsuccessful breeding on the North Slope. The Center's Sea Duck budget allocation is spent on artificial propagation and breeding facilities. The Center is also developing marine dive tanks so that it can start looking at foraging ecology in these animals throughout the column of water. Sea Otters in the Commander Islands have seen a decline over the last 7-10 years but have yet to be listed on the list of endangered species.

The Sea Life Center has a very active rehabilitation program where animals, brought in from the wild that are either stranded, injured, ill—through disease or trauma. They are rehabilitated and returned to the wild fitted with radio tags or satellite telemeters to track them and see how they're utilizing a particular habitat.

Future of Polar Ice Breakers and Research Vessels
A discussion was scheduled to thrash out concerns regarding polar icebreakers and research vessels. **Brass** gave an overview of the current situation and the new funding responsibilities NSF faces now that will be accountable for the cost of operating the polar icebreakers, approximately, $75 million next year. While $23 million has been transferred from the Coast Guard homeland security budget line to NSF to partially defray these costs, it leaves NSF with a $52 million bill. **Brass**' concern is the possibility that that $52 million might threaten the ARRV. He said that the fact that Kathy Olson is going to replace Joe Bordogna as NSF deputy director should help, not only in solving the McMurdo re-supply problem but also in keeping the ARRV on the schedule. **Brass** understands that the House Science Committee has told NSF that it needs to find some method of McMurdo re-supply independent of the Coast Guard. That may mean the end of the polar class icebreakers if that happens. It's clear at Office of Polar Programs that a complete breakdown in the Antarctic re-supply system will be very threatening to science. **Brass** said it's peculiar that the major threat is to the Antarctic program, yet Arctic scientists have to be very careful because it potentially threatens both Healy and ARRV operations which are Arctic concerns.

Commissioners and the audience raised several questions about the viability of Russian icebreakers doing America's work and, in the process, reducing their value as a national asset; IPY and its budget realities considering NSF's financial responsibilities; other agencies and programs that require NSF financial support; the idea that IPY is as much about legacy as activity and solving the icebreaker problem could leave as much of a legacy as anything else; Best Programs introduction in relationship to IPY, and the replacement of the Nat Palmer with a more capable research vessel.

Arctic Related Studies
Brigham presented upcoming special studies and reports that will have USARC involvement.

- **USARC Study: Scaling in Arctic Terrestrial Systems**—ongoing report that covers scaling issues from the small plots of terrestrial Arctic all the way up to satellite observations. John Hobbie, former USARC Commissioner, is instrumental in drafting this report but has been pulled away by responsibilities for the National Ecological Observing Network. **Brigham** hopes to have a draft by the AGU conference.
- **USARC Study: Federal Research Agenda for Future Arctic Marine Transportation**—developing a research agenda for Federal agencies, changing marine access in the Arctic Ocean and determining what it means for future Arctic marine transport. The plan is for a kickoff meeting in July. **Brigham** believes the piece might generate a few ideas, issues and research elements for a number of agencies. He expects it will cover just the Federal agencies but could be expanded to include state agencies and industry if warranted.
- **Bering Sea Integrated Ecosystem Research and Working Group on Sea Ice in Alaska's Coastal Seas**—creating a database to answer the biological and ecological communities' need for sea ice data, not only extent, trends and texture, but habitat applications as well. The data would be derived from the Bering, Beaufort and Chukchi seas, and potentially Cook Inlet. Alaska is the only region in the circumpolar world that had a lack of detail and robust sea ice measurements and historical trends. **Brigham** believes that there is a record in the US but it requires massaging, synthesis and compiling. He hopes to have a teleconference in June and another workshop in July or August.
- **Arctic Sea Ice Atlas of the Future**—a joint venture between IARC and USARC and subsequent offshoots of the Arctic Climate Impact Assessment.

Future North Pacific Research
Clarence Pautzke, Executive Director, North Pacific Research Board, indicated that the Board's priority research is on the fisheries and ecosystems of the North Pacific, Bering Sea and in the Gulf of Alaska. Pautzke believes it must address pressing fishery management issues,

marine ecosystem needs and information concerns. The Board's activities span the spectrum from applied science to overall marine ecosystem research.

Fisheries related research, analyzing fish habitats and mapping them, is very expensive. Pautzke plans to conduct a review of salmon funding programs enumerating how salmon money is spent in the state of Alaska, uncovering where it flows, who's getting it, what they're doing with it, and compile a database of all the resources. He wants to take the same approach with marine mammals and sea birds to get a better understanding of where the funding gaps are and where the money is coming from in the first place. He also plans to involve the Board in ecosystem and general oceanographic studies as well as education, outreach, and synthesis toward a comprehensive program.

Right now Pautzke is trying to determine where the Board's focus should be in the Arctic and where they want to put their funds. It is involved in a number of activities including forage fish studies, bi-catch video monitoring to relieve observer's responsibilities, protecting Fur Seals and their habitats, sea bird diet studies, defending huge areas of water in the Aleutians designated by the North Pacific Council from trawlers and other fishing and determining the economic and social costs of these and other projects. They are using the Bering Sea Integrated Research Plan as a guide.

Eder asked about the most recent announcement from Dr. William T. Hogarth about Bering Sea ecosystem research needs and NPRB participation. Pautzke said that NPRB's science plan has an entire section on aquaculture so that's a basis for the research. He added that the Board has the flexibility to respond to research priorities when they're brought forward. **Eder** suggested that it seems like a major regime shift has occurred in terms of commercial fisheries management, and its impact in the Bering Sea. She wants to make sure that NPRB has the mechanisms set up to address some of those projects. Pautzke answered that they do have the mechanism to do them and they could end up in their RFPs very easily.

Ongoing Fisheries Management

Chris Oliver, Executive Director, North Pacific Fisheries Management Council, explained that the NPFMC is one of eight regional councils around the country that develops, maintains, and implements the fishery management plans for the Federal waters, three to two hundred miles out for commercial fisheries and others in the context of habitat, marine mammal and sea bird considerations. This is accomplished through extensive analysis and proposed management actions since they have to comply with standards of the national or Magnuson Stevens Fisheries Conservation Management Act, National Environment Policy Act, Endangered Species Act. He plans to create a more formalized and focused mechanism for getting the Council's laundry list of general priorities into something more specific and management oriented.

What Oliver has found is that restrictive measures in the Gulf of Alaska are making it difficult for many small boat fleets to maintain economically viable operations. The Council is working to remove the existing closures and putting a notice on the industry to give them a chance to use their own information and real time technology to move their fleets around and avoid the salmon. In conjunction, NPFMC is interested in revamping its onboard/shore-side observer program by imposing an across-the-board fee on everybody participating in the fisheries. This will eliminate the practice of those who enjoy the benefits of an observer program but do not pay for it.

The Council conducted a comprehensive, programmatic-level environmental impact statement looking at the whole suite of its ground fish fisheries and the cumulative effects of the existing management regime, going back from 1977 to current. As a result, a revised set of goals and objectives were adopted that overlay the fishery management plan. Specifically, the Council

committed to examine the Aleutian Islands area, devise special area management or a separate management plan for the Bering Sea and more explicitly to develop ecosystem management approaches. Oliver believes that is possible by adhering to

- conservative catch quotas
- comprehensive monitoring enforcement plan
- limits the Council has on bi-catch and target species in protected areas, closed areas that have been set aside for habitat and other protection
- marine mammal protection measures
- prohibitions on forage fish

Eder stated that the North Pacific Fisheries Management Council is ahead of the curve on the ecosystem management approach and asked if the Federal Government made money available to staff its ability to get out ahead on this issue. Oliver said the councils have been fairly level-funded for a few years now and there was a small amount of money $200,000 to $300,000 made available to each of the four East Coast councils last year to start developing ecosystem plans. The Council's current baseline budget is insufficient to do the work that they are doing now. In the North Pacific, they have had the luxury over the last couple of years of getting some special funding to the North Pacific, through Senator Stevens influence. Oliver hopes that the 2006 budget is going to have an appropriation to put them in a better budgetary position.

Meetings and Additional Activities During FY 2005

In addition to those meetings and other activities reported in the minutes, the Commission is represented, when possible, at the monthly meetings of the

- State Department's Arctic Policy Group
- Interagency Arctic Research Policy Committee's staff meetings
- *Ad hoc* Alaska Arctic Council Working Group.

The Commission's staff attends all meetings of the National Research Council's Polar Research Board and Ocean Studies Board. The Commission continues to attend the annual (spring) Arctic Summit Week, an international gathering of Arctic scientists coordinated by the International Arctic Science Committee.

The Executive Director and Deputy Executive Director have participated, as the Commission's representative(s), at all meetings of the North Pacific Research Board. They have also participated in workshops for the development of a National Climate Change Program.

Several Commissioners and staff have attended meetings of the Arctic Council and meetings of the various working bodies under the Council:

- Emergency Prevention, Preparedness and Response working group (EPPR)
- Arctic Climate Impact Assessment (ACIA)
- Arctic Monitoring and Assessment Program (AMAP)
- Protection of the Arctic Marine Environment (PAME)
- Circumpolar Infrastructure Task Force (CITF) under the Sustainable Development Working Group.

In addition, they continue to attend meetings of the American Geophysical Union, and other science gatherings such as the

- Arctic Institute of North America
- The Oceanography Society
- US Permafrost Association
- Alaska Marine Science Symposium
- International Bering Sea Conference
- Biennial Meetings of the Advisory Board of the Law of the Sea.

Appendix C: The Arctic Research and Policy Act, As Amended

PUBLIC LAW 98-373 – July 31, 1984
Amended as
PUBLIC LAW 101-609 – November 16, 1990

An Act

To provide for a comprehensive national Policy dealing with national research needs and objectives in the Arctic. Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled:

TITLE 1-ARCTIC RESEARCH AND POLICY

SHORT TITLE

SEC. 101. This title may be cited as the "Arctic Research and Policy Act of 1984, as amended."

FINDING AND PURPOSES

SEC. 102(a) The Congress finds and declares that:

1) the Arctic, onshore and offshore, contains vital energy resources that can reduce the Nation's dependence on foreign oil and improve the national balance of payment;
2) as the Nation's only common border with the Soviet Union, the Arctic is critical to national defense:
3) the renewable resources of the Arctic, specifically fish and other seafood, represent one of the Nation's greatest commercial assets;
4) Arctic conditions directly affect global weather patterns and must be understood in order to promote better agricultural management throughout the United States;
5) industrial pollution not originating in the Arctic region collects in the polar air mass, has the potential to disrupt global weather patterns, and must be controlled through international cooperation;
6) the Arctic is a natural laboratory for research into human health and adaptation, physical and psychological, to climates of extreme cold and isolation and may provide information crucial for future defense needs;
7) atmospheric conditions peculiar to the Arctic make the Arctic a unique testing ground for research into high latitude communications, which is likely to be crucial for future defense needs;
8) Arctic marine technology is critical to cost-effective recovery, and transportation of energy resources and to the national defense;
9) the United States has important security, economic, and environmental interests in developing and maintaining a fleet of icebreaking vessels capable of operating effectively in the heavy ice regions of the Arctic;
10) most Arctic-rim countries, particularly the Soviet Union, possess Arctic technologies far more advanced than those currently available in the United States;
11) Federal Arctic research is fragmented and uncoordinated a the present time, leading to the neglect of certain areas of research and to unnecessary duplication of effort in other areas of research;
12) improved logistical coordination and support for Arctic research and better dissemination of research data and information is necessary to increase the efficiency and utility of national Arctic research efforts;
13) a comprehensive national policy and program plan to organize and fund currently neglected scientific research with respect to the Arctic is necessary to fulfill national objectives in Arctic research;
14) the Federal Government, in cooperation with State and local governments, should focus its efforts on collection and characterization of basic data related to biological, materials, geophysical, social, and behavioral phenomena in the Arctic;

15) research into the long-range health, environmental, and social effects of development in the Arctic is necessary to mitigate the adverse consequences of that development to the land and its residents;
16) Arctic research expands knowledge of the Arctic, which can enhance the lives of Arctic residents, increase opportunities for international cooperation among Arctic-rim countries, and facilitate the formulation of national policy for the Arctic; and
17) the Alaskan Arctic provides an essential habitat for marine mammals migratory waterfowl, and other forms of wildlife which are important to the Nation and which are essential to Arctic residents.
b) The purposes of this title are

1) to establish national policy, priorities, and goals and to provide a Federal program plan for basic and applied scientific research with respect to the Arctic, including natural resources and materials, physical, biological and health sciences, and social and behavioral sciences;
2) to establish and Arctic Research Commission to promote Arctic research and to recommend Arctic research policy;
3) to designate the National Science Foundation as the lead agency responsible for implementing Arctic research policy; and
4) to establish an Interagency Arctic Research Policy Committee to develop a national Arctic research policy and a five-year plan to implement that policy.

ARCTIC RESEARCH COMMISISON

SEC. 103(a) The President shall establish an Arctic Research Commission (hereinafter referred to as the "Commission").
b)(1) The Commission shall be composed of seven members appointed by the President, with the Director of the National Science Foundation serving as a nonvoting, ex-officio member. The members appointed shall include:
(A) four members appointed from among individuals from academic or other research institutions with expertise in areas of research relating to the Arctic, including the physical, biological, health, environmental, social and behavioral sciences;
(B) one member appointed from among indigenous residents of the Arctic who are representative of the needs and interests of Arctic residents and who live in areas directly affected by Arctic resource development; and
(C) two members appointed from among individuals familiar with the Arctic and representative of the needs and interests of private industry undertaking resource development in the Arctic.
(2) The President shall designate one of the appointed members of the Commission to be chairperson of the Commission.
(C)(1) Except as provided in paragraph (2) of this subsection, the term of office of each member of the Commission appointed under subsection
(b)(1) shall be four years.
(2) of the members of the Commission originally appointed under subsection
(b)(1)
(A) one shall be appointed for a term of two years;
(B) two shall be appointed for a term of three years; and
(C) two shall be appointed for a term of four years.
(3) Any vacancy occurring in the membership of the Commission shall be filled, after notice of the vacancy is published in the Federal Register, in the manner provided by the preceding provisions of this section, for the remainder of the unexpired term.
(4) A member may serve after the expiration of the member 's term of office until the President appoints a successor.
(5) A member may serve consecutive terms beyond the member's original appointment.
(d)(1) Members of the Commission may be allowed travel expenses, including per diem in lieu of subsistence, as

authorized by section 5703 of title 5, United States Code. A member of the Commission not presently employed for compensation shall be compensated at a rate equal to the daily equivalent of the rate for GS-18 of the General Schedule under section 5332 of title 5, United States Code, for each day the member is engaged in the actual performance of his duties as a member of the Commission, not to exceed 90 days of service each year. Except for the purposes of chapter 81 of title 5
(relating to compensation for work injuries) and chapter 171 of title 28 (relating to tort claims), a member of the Commission shall not be considered an employee of the United States for any purpose.
2) The Commission shall meet at the call of its Chairman or a majority of its members.
3) Each Federal agency referred to in section 107(b) may designate a representative to participate as an observer with the Commission. These representatives shall report to and advise the Commission on the activities relating to Arctic research of their agencies.
4) The Commission shall conduct at least one public meeting in the State of Alaska annually.

DUTIES OF THE COMMISSION

SEC. 104(a) The Commission shall

1) develop and recommend an integrated national Arctic research policy;
2) in cooperation with the Interagency Arctic Research Policy Committee established under section 107, assist in establishing a national Arctic research program plan to implement the Arctic research policy;
3) facilitate cooperation between the Federal Government and State and local governments with respect to Arctic research;
4) review Federal research programs in the Arctic and recommend improvements in coordination among programs;
5) recommend methods to improve logistical planning and support for Arctic research as may be appropriate and in accordance with the findings and purposes of this title;
6) recommend methods for improving efficient sharing and dissemination of data and information on the Arctic among interested public and private institutions;
7) offer other recommendations and advice to the Inter-agency Committee established under section 107 as it may find appropriate;
8) cooperate with the Governor of the State of Alaska and with agencies and organizations of that State which the Governor may designate with respect to the formulation of Arctic research policy;
9) recommend to the Interagency Committee the means for developing international scientific cooperation in the Arctic; and 1 0) not later than January 31, 1991, and every 2 years thereafter, publish a statement of goals and objectives with respect to Arctic research to guide the Interagency committee established under section 107 in the performance of its duties. b) Not later than January 31 of each year, the Commission shall submit to the President and to the Congress a report describing the activities and accomplishments of the Commission during the immediately preceding fiscal year.

COOPERATION WITH THE COMMISSION

Sec. 105(A) (1) The Commission may acquire from the head of any Federal agency unclassified data, reports, and other nonproprietary information with respect to Arctic research in the possession of the agency which the Commission considers useful in the discharge of its duties.
2) Each agency shall cooperate with the Commission and furnish all data, reports, and other information requested

by the Commission to the extent permitted by law; except that no agency need furnish any information that it is permitted to withhold under section 522 of title 5, United States Code. b) With the consent of the appropriate agency head, the Commission may utilize the facilities and services of any Federal agency to the extent that the facilities and services are needed for the establishment and development of an Arctic research policy, upon reimbursement to be agreed upon by the Commission and the agency head and taking every feasible step to avoid duplication of effort. c) All Federal agencies shall consult with the Commission before undertaking major Federal actions relating to Arctic research.

ADMINISTRATION OF THE COMMISSION

Sec. 106. The Commission may –
1) in accordance with the civil service laws and subchapter III of chapter 53 of title 5, United States Code, appoint and fix the compensation of an Executive Director and necessary additional staff personnel, but not to exceed a total of seven compensated personnel;
2) procure temporary and intermittent services as authorized by section 3109 of title 5, United States Code;
3) enter into contracts and procure supplies, services and personal property;
4) enter into agreements with the General Services Administration for the procurement of necessary financial and administrative services, for which payment shall be made by reimbursement from funds of the Commission in amounts to be agreed upon by the Commission and the Administrator of the General Services Administration; and
5) appoint, and accept without compensation the services of, scientists and engineering specialists to be advisors to the Commission. Each advisor may be allowed travel expenses, including per diem in lieu of subsistence, as authorized by section 5703 of title 5, United States Code. Except for the purposes of chapter 81 of title 5 (relating to compensation for work injuries) and chapter 171 of title 28 (relating to tort claims) of the United States Code, and advisor appointed under this paragraph shall not be considered an employee of the United States for any purpose.

LEAD AGENCY AND INTERAGENCY ARCTIC RESEARCH POLICY COMMITTEE

SEC.107(a) The National Science Foundation is designated as the lead agency responsible for implementing Arctic research policy, and the Director of the National Science Foundation shall insure that the requirements of section 108 are fulfilled.
(b)(1) The President shall establish an Interagency Arctic Research Policy Committee (hereinafter referred to as the "Interagency Committee").
(2) The Interagency Committee shall be composed of representatives of the following Federal agencies or offices:

(A) the Nations Science Foundation;
(B) the Department of Commerce;
(C) the Department of Defense;
(D) the Department of Energy;
(E) the Department of the Interior;
(F) the Department of State;
(G) the Department of Transportation;
(H) the Department of Health and Human Services;
(I) the National Aeronautics and Space Administration;
(J) the Environmental Protection Agency; and
(K) any other agency of office deemed appropriate.

(3) the representative of the National Science Foundation shall serve as the Chairperson of the Interagency Committee.

DUTIES FO THE INTERAGENCY COMMITTEE

SEC. 108 (a) The Interagency Committee shall
(1) survey Arctic research conducted by Federal State, and local agencies, universities, and other public and private institutions to help determine priorities for future Arctic research, including natural resources and materials, physical and biological sciences, and social and behavioral sciences;
(2) work with the Commission to develop and establish an integrated national Arctic research policy that will guide Federal agencies in developing and implementing their research programs in the Arctic;
(3) consult with the Commission on-
(A) the development of the national Arctic research policy and the 5-year plan implementing the policy;
(B) Arctic research programs of Federal agencies;
(C) recommendations of the Commission on future Arctic research grants;
(4) develop a 5-year plan to implement the national policy, as provided in section 109;
(5) provide the necessary coordination, data and assistance for the preparation of a single integrated, coherent and multi agency budget request for Arctic research as provided for in section 110;
(6) facilitate cooperation between the Federal Government and State and local governments in Arctic research, and recommend the undertaking of neglected areas of research in accordance with the findings and purposes of this title;
(7) coordinate and promote cooperative Arctic scientific research programs with other nations, subject to the foreign policy guidance of the Secretary of State;
(8) cooperate with the Governor of the State of Alaska in fulfilling its responsibilities under this title;
(9) promote Federal interagency coordination of all Arctic research activities, including–
(A) logistical planning and coordination; and
(B) the sharing of data and information associated with Arctic research, subject to section 552 of title 5, United States Code; and
(10) provide public notice of its meetings and an opportunity for the public to participate in the development and implementation of national Arctic research policy.
(b) Not later than January 31, 1986, and biennially thereafter, the Interagency Committee shall submit to the Congress through the President, a brief, concise report containing

(1) a statement of the activities and accomplishments of the Interagency Committee since its last report; and
(2) a statement detailing with particularity the recommendations of the Commission with respect to Federal interagency activities in Arctic research and the disposition and responses to those recommendations.

5-YEAR ARCTIC RESEARCH PLAN

SEC.109(a) The Interagency Committee, in consultation with the Commission, the Governor of the State of Alaska, the residents of the Arctic, the private sector, and public interest groups, shall prepare a comprehensive 5-year program plan (hereinafter referred to as the "Plan") for the overall Federal effort in Arctic research. The Plan shall be prepared and submitted to the President for transmittal to the Congress within one year after the enactment of this Act and shall be revised biennially thereafter.
(b) The Plan shall contain by need not be limited to the following elements:
(1) an assessment of national needs and problems regarding the Arctic and the research necessary to address those needs or problems;
(2) a statement of the goals and objectives of the Interagency Committee for national Arctic research;
(3) a detailed listing of all existing Federal programs relating to Arctic research, including the existing goals, funding levels for each of the 5 following

fiscal years, and the funds currently being expended to conduct the programs;
(4) recommendations for necessary program changes and other proposals to meet the requirement of the policy and goals as set forth by the Commission and in the Plan as currently in effect; and
(5) a description of the actions taken by the Interagency Committee to coordinate the budget review process in order to ensure interagency coordination and cooperation in (A) carrying out Federal Arctic research programs, and
(B) eliminating unnecessary duplication of effort among these programs.
COORDINATION AND REVIEW OF BUDGET REQUESTS.

SEC. 110(A) The Office of Science and Technology Policy shall
(1) review all agency and department budget requests related to the Arctic transmitted pursuant to section 108(a)(5), in accordance with the national Arctic research policy and the 5-year program under section 108(a)(2) and section 109, respectively; and
(2) consult closely with the Interagency Committee and the Commission to guide the Office of Technology Policy's efforts.
(b)(1) The Office of Management and Budget shall consider al Federal agency request for research related to the Arctic as one integrated, coherent, and multi agency request, which shall be reviewed by the Office of Management and Budget prior to submission of the President's annual budget request for its adherence to the Plan. The Commission shall, after submission of the President's annual budget request, review the request and report to Congress on adherence to the Plan.
(2) The Office of Management and Budget shall seek to facilitate planning for the design, procurement, maintenance, deployment and operations of icebreakers needed to provide a platform for Arctic research by allocating all funds necessary to support icebreaking operations, except for recurring incremental costs associated with specific projects, to the Coast Guard.

AUTHORIZATION OF APPROPRIATATIONS; NEW SPENDING AUTHORITY

SEC.111(a) There are authorized to be appropriated such sums as may be necessary for carrying out his title.
(b) Any new spending authority (within the meaning of section 401 of the Congressional Budget Act of 197 4) which is provided under this title shall be effective for any fiscal year only to such extent or in such amounts as may be provided in appropriation Acts.
DEFINITION

SEC 112. As used in this title, the term "Arctic" means all United States and foreign territory north of the Arctic Circle and all United States territory north and west of the boundary formed by the Porcupine, Yukon, and Kuskokwim Rivers; all contiguous seas, including the Arctic Ocean and the Beaufort, Bering, and Chukchi seas, and the Aleutian chain.

Table 1
PUBLICATIONS OF THE US ARCTIC RESEARCH COMMISSION

Annual Reports to the President and the Congress

- *US on the Arctic Rim.* 1986
- *The United States: An Arctic Nation.* 1987
- *Entering the Age of the Arctic.* 1988.
- *Arctic Research for an Arctic Nation.* 1989
- *Arctic Research: A Focus for International Cooperation.* 1990
- *Arctic Research in a Changing World.* 1991
- *An Arctic Obligation.* 1992
- *Arctic Research Priorities.* 1993
- *Annual Report, Fiscal Years 1994 and 1995.*
- *Annual Report, Fiscal Year 1996.*
- *Annual Report, Fiscal Year 1997.*
- *Annual Report, Fiscal Year 1998.*
- *Annual Report, Fiscal Year 1999.*
- *Annual Report, Fiscal Year 2000.*
- *Annual Report, Fiscal Year 2001.*
- *Annual Report, Fiscal Year 2002.*
- *Annual Report, Fiscal Year 2003.*
- *Annual Report, Fiscal Year 2004.*
- *Annual Report, Fiscal Year 2005.*

Special Reports

- *National Needs and Arctic Research, a Framework for Action.* May, 1986
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