



## **FINAL REPORT**

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## EXECUTIVE SUMMARY

This was the 5<sup>th</sup> in what has become an Arctic Symposium series sponsored by the National Ice Center and the Arctic Research Commission. It was acknowledged as one of the best Arctic conferences in the U.S. for bringing top Arctic scientists and practitioners together with policy-makers. It was the first to assemble the multiple agencies with Arctic interests and activities together and has been instrumental in raising awareness about the importance of the Arctic to U.S. national interest. This year's Symposium featured 8 keynote addresses and 32 presentations, 2 panel discussions and 9 posters. One hundred and sixty-six people attended the event.

There is no question that major change is happening in the Arctic and the rate of change is accelerating. In 2012, the extent of the sea ice reached another record minimum, the second in 5 years. More critically, the volume of ice has decreased by some 75% and the Arctic pack is now predominantly first-year, or seasonal, ice. The Arctic Ocean is in the process of transitioning from having a permanent ice-cover to being seasonally ice-covered. An ice-free summer is on the horizon, possibly within a decade.

However, the future is already here in Alaska. For the past 5 years, there has been at least 200 nautical miles of open water to the north of Alaska's shores. Ocean temperatures off the North Slope have increased by 5-6 degrees Celsius. Animals in the Alaskan littoral zone are altering their traditional habits. The changes that are happening to the Arctic cannot be stopped. We have transitioned from a *mitigation* mode to an *adaptation* mode.

There will always be a winter ice cover in the Arctic because of the lack of solar radiation. Offshore activities will have to contend with sea ice for some part of the year along with the uncertainties about when and where the winter ice will melt and freeze again. The period from July to November represents the approximate upper limit for an open navigation season in the Arctic.

The U.S. National Arctic Strategy has united the Arctic strategies of various federal agencies behind its lines of effort to advance U.S. security interests, pursue responsible Arctic region stewardship, and strengthen international cooperation. All of the federal agencies with Arctic interests and activities have released, or are in the process of completing, Arctic strategies. For the maritime environment, the U.S. Coast Guard is acknowledged as having the lead role with the Department of Defense as a strong supporter. Significantly, for the next decade the U.S. Coast Guard Arctic strategy will rely on ships to provide a mobile infrastructure and a seasonal presence rather than developing new coastal infrastructure.

The Arctic Council is growing in importance as an Arctic institution. Even though it has no legal foundation of its own, it has become the primary forum for Arctic cooperation. It has brokered multi-national legal agreements and is establishing policies in the Arctic that will be respected by all nations. The United States is in the process of developing its agenda for when it assumes the chair of the Council in 2015.

There was a unanimous call at the Symposium for United States accession to the UN Convention on the Law of the Sea. The U.S. is the only Arctic nation that has not signed on and, as a result, suffers in its credibility as an Arctic leader. By not being party to the Treaty, the U.S. does not have access to a legal basis for claiming a large extension to its continental shelf in the Arctic together with the seabed and water column resources contained therein.

## IN MEMORY OF ARCTIC COLLEAGUES

In opening the Symposium, Dr. Pablo Clemente-Colón recalled three distinguished Arctic scientists who passed away unexpectedly in 2013 – Dr. Seymour Laxon on January 2, Dr. Tim Boyd on January 27 and Dr. Katherine Giles on April 8. The participants honored them with a minute of silence.

## KEYNOTE ADDRESSES

### **SYMPOSIUM OPENING AND WELCOMING REMARKS: CDR TIMOTHY B. (TIM) SMITH, DIRECTOR AND COMMANDING OFFICER, U.S. NATIONAL / NAVAL ICE CENTER (NIC)**

(see presentation)

CDR Smith welcomed participants to this, the 5<sup>th</sup> Symposium on the Impacts of an Ice-Diminishing Arctic on Naval & Maritime Operations. He noted that operating in the Arctic is not a new adventure for the United States. The Navy and Coast Guard have had a presence there for many years. Canada, Russia, Norway and Greenland have all established their presence in the Arctic. However, environmental changes are forcing an increased awareness and focus on the Arctic. Its sheer geographic size is fostering a need for collaboration politically from a policy standpoint and from a scientific standpoint.

Everyone agrees that change is happening in the Arctic, even if they don't agree on the cause of the change. Sea ice in the Chukchi and Beaufort Seas is thinner and/or weaker than in past years. The portion of the Arctic pack that is multi-year ice has diminished from roughly 75% in the mid-1980's to approximately 45% today. Less old, thick ice means more melt allowing more ocean area to be exposed to the summer sun, heating the ocean and accelerating warming and ice-melt even further.

An updated U.S. National Strategy for the Arctic was released in May of this year. It states that the U.S. will assert a more active and influential national presence in the Arctic, with emphasis on advancing U.S. security, pursuing responsible stewardship and strengthening internal cooperation. Additionally, the U.S. Coast Guard published its Arctic Strategy in May and the Navy is working on its strategy. NOAA and other agencies continue to pursue the improvement of modeling and forecasting sea ice in a time of unprecedented and rapidly changing environmental conditions.

There is increasing geopolitical interest in the Arctic. In addition to the eight circumpolar nations and the indigenous peoples' permanent participants, the Arctic Council has welcomed many non-Arctic nations to observer status. Canada currently chairs the Arctic Council and the U.S. will assume the chair in 2015. The United Nations Convention on the Law of the Sea (UNCLOS) has not been ratified by the United States.

There are many issues to be addressed including sovereignty and strategic issues, policy issues, national issues, regional issues and other factors will shape policies, national and international, set forth for the Arctic

Arctic tourism is very active. Eight cruise ships are scheduled for 2013 visits to the Canadian Archipelago. NORAD has observed annual increases in the air domain, now exceeding 115,000 polar transits yearly. In 2012, Canada's Maritime Safety Operations Center reported a 50% increase in small boat activity, with adventurers intending to proceed as far north as 81 degrees.

It is estimated that the Arctic contains 30% of the world's undiscovered gas, 15% of the world's undiscovered oil and 20% of the undiscovered natural gas liquids. Eighty-four percent of these resources are located in less than 500 meters of water. Royal Dutch Shell attempted to drill in the summer of 2012 and Conoco-Phillips plans to do so in 2014.

What issues do we need to consider as an Arctic nation? How will we and other countries react to the changing environment, keeping in mind both the dangers and the resources it has to offer? Who is responsible for an environmental disaster that crosses multi-national boundaries? Who will maintain safety of navigation and ensure the security of people working in the Arctic. What issues will affect coastal communities, resource management and development, weather and climate forecasting and climate change researchers?

The experts you will hear over the next few days will shed light on these issues and provide us all with a wealth of information to take back to our respective agencies. I hope that you enjoy your time here and that you leave with a sense of knowledge gained and an understanding of how to use this in your work.

## **USARC WELCOMING REMARKS – AM EMERGING ARCTIC: DR. FRAN ULMER, CHAIR, U.S. ARCTIC RESEARCH COMMISSION (USARC)**

(see presentation)

Dr. Ulmer welcomed everyone on behalf of the U.S. Arctic Research Commission. She thanked everyone for coming to share what they know and to learn from others to advance our understanding collectively of the challenges and opportunities in the Arctic.

In looking at the Arctic as defined by Congress, we note that it is unique and must be thought of as a unified ecosystem. The U.S. Arctic also includes the Bering Sea because of the large interaction between the Bering and Chukchi Seas.

The rate of change in the Arctic is dramatic and it is incredible to think of how the species that live in the Arctic – including the 4 million people who live there – must deal with this rapid change. The change is not just climatic but also includes increasing economic interests as well as the curiosity of people in this emerging region. The amount of investment and activity associated with oil and gas around the Arctic is huge. Companies recognize the potential there but also recognize the risks that must be kept in balance. We must also remember the indigenous people of the north who have relied on fish and animals in a healthy ecosystem for centuries – not just for food and sustenance but as the very basis for their culture.

Shipping particularly is receiving a lot of attention and has an increasing trend. Safety of navigation implies a great demand for significant infrastructure improvements and all the Arctic nations are looking at these needs. It must be remembered that the Arctic is different from other parts of the world in terms of the severity of the environment, the great distances involved and the lack of infrastructure. Working in the Arctic is not “business as usual”. This also heightens the importance of the Arctic research that is critical to understanding. We need to understand what the impacts of development will be and how we mitigate undesirable impacts.

The *Oil Spills in Arctic Waters* report that the U.S. Arctic Research Commission published in 2012 is an overview of what work has been done in responding to oil spills in icy waters and lays out the research that needs to be done. The National Academy of Sciences is doing a study right now looking at the broader issue of the most pressing Arctic research items.

Unfortunately, this is all happening at a time when budget cuts are facing all of the agencies that have long traditions of funding arctic research. They have sustained significant budget cuts that impact not only the agencies but also the academic community, industry and communities that need the information that comes from accumulating better data. To deal with this, we need to look for new ways of doing business. An example is the agreement signed by NOAA and the oil industry to share data – something that has not been done very much but must be. Similarly, we need to declassify some of the data that is held in the Department of Defense, particularly the Navy. We need to do a better job of taking advantage of these data for scientific research that can feed back into addressing DoD’s needs as well as that of others. We must get out of the comfort zone of the way in which we have worked in the past and get to a different platform of shared resources.

The U.S. Arctic Research Commission was created by Congress in 1984 to give advice and assistance to Congress, the President, federal agencies, academia and the private sector on important areas of research for the Arctic. USARC works closely with the Interagency Arctic Research Policy Committee to develop the five year research plan that was recently released. USARC also produces “Arctic Update” – a daily electronic newsletter on all things Arctic as well as the Arctic portal where you can find information about research going on in Arctic.

Dr. Ulmer concluded her remarks by thanking everyone for contributing to the effort to be prepared for the emerging Arctic.

**REMARKS FROM THE ALASKA CONGRESSIONAL DELEGATION: HON. LISA A. MURKOWSKI, U.S. SENATOR FOR THE STATE OF ALASKA**

Senator Murkowski opened by commenting that she is glad to see that circles are expanding with more and more people recognizing the importance of the Arctic and the important role of the U.S. as an Arctic nation. She noted that there is a story in the Arctic numbers.

“According to the National Snow and Ice Data Center, since 2000 the minimum sea ice extent in the Arctic polar cap has been cut in half and reached a record low last year. Perhaps just as importantly, the Norwegian Polar Institute – Norway’s national institution for polar research – reports that the amount of multi-year ice has also been cut in half, and that multi-year ice is roughly the same thickness as first-year ice – right around two meters. The NPI suggests that when multi-year ice thickness equals first-year ice thickness, an ice-free summer is on the horizon.

“With the amount and thickness of ice decreasing, there has been a corresponding increase in the level of maritime traffic in the Arctic, particularly via the Northern Sea Route. In 2007, there were zero transits across the Northern Sea Route. In 2011, there were 41, and last year 46.

“In 2011, Russia was the primary user of the route, with 26 of the 41 transits flying the Russian flag, but in 2012 the route took on a more international flavor, with ships registered in the more traditional flag states – Panama, the Marshall Islands, and Liberia – using the route on 15 occasions. The Nordic states of Norway and Finland also increased their usage with 11 transits compared to 4 in 2011.

“It is also worth noting that the number of transits heading from East to West nearly doubled from 2011 to 2012 – from 11 (out of 41 total) to 21 (out of 46 total). The number of transits that were “in ballast” also dropped from 15 in 2011 to 6 in 2012. These numbers suggest that the Arctic route is becoming part of a shipping network, rather than a one-way, one-time event.

“When it comes to circumpolar navigation in the Arctic, regardless of which route is taken – the Northern Sea Route, the Northwest Passage, or perhaps across the pole if we see an ice-free summer, they all converge on one end at the Bering Strait between Russia and Alaska. As these routes become increasingly more viable and more user friendly, I personally believe that there is great potential for an Arctic trans-shipment facility along the Aleutian Chain.

“Imagine cargo transiting the Arctic from Europe being offloaded in Adak or Dutch Harbor and loaded onto ships transiting the Great North Pacific Circle Route to and from the West Coast – and vice versa. Ice-strengthened ships could be used entirely within the Arctic rather than traveling all the way to Singapore or Hong Kong, saving time, money, and allowing for an increased number of transits.

“Whether a hub is developed or not, however, the level of maritime traffic is likely to increase and we are woefully behind in our infrastructure needs; from navigational aids to deep water ports and search and rescue capabilities. We need to be more creative in how we address these deficiencies. With the belt tightening coming from Washington, DC, and the increased asks and responsibilities being placed on existing assets, the federal government needs to be more flexible in how and with whom it partners.

“NOAA is working on mapping the Arctic, but the timeframe for completion is decades away. Are there ways to partner with the Navy or commercial shipping interests to share data along the most traveled corridors?

“I was able to include an amendment in the Senate’s version of the Water Resources Development Act (WRDA) to enable the Army Corps of Engineers to pursue partnerships with non-federal public entities to work together on deep draft ports – from initial surveys and designs all the way to maintenance and operations. This will allow states and local communities to leverage their assets and participate in these projects. I am hopeful that at some point we will be able to similarly engage the private sector on these initiatives as well.



"I would like to touch on one more topic before I conclude, and that is the Arctic as a 'Zone of Peace.' The Arctic is not presently subject to the type of long-standing disputes and entrenched views that make international cooperation in the region difficult - quite the opposite. The Arctic is so new to the international arena that we are still in the process of drawing up the rules of the road. As evidenced by the admission of six non-Arctic nations (Japan, China, South Korea, India, Italy, and Singapore) as permanent observers to the Arctic Council at its most recent ministerial, however, it is an area that is starting to garner increased international attention and recognition of its tremendous potential.

"That makes it even more important that the United States take the lead in guiding international policy decisions relating to the Arctic, particularly as we look to take the Chair of the Arctic Council in 2015. With the admission of these nations, the Arctic Council has been reaffirmed as the primary forum for Arctic cooperation. The council is more than just a regional body – it is setting policies for the Arctic that will be abided by all nations, and the U.S. needs to be at the forefront of the council's activities.

"And I would be remiss if I did not mention that the increased interest by other nations only enhances the need for the United States to become a party to the Convention on the Law of the Sea, which will ensure our military's freedom of navigation in international waterways and provide certainty for U.S. rights in the Arctic, including the potential to lay claim to an additional area of the Arctic twice the size of California."

Sen. Murkowski concluded by thanking all those present for what they are doing together and individually to raise awareness of the exciting and challenging opportunities in the Arctic.

### Questions

*Is there anything that this group can do to help with ratification of the Law of the Sea?*

YES. It has not been the subject of conversations outside of circles like this and it needs to go beyond. It is not acceptable to just wait for the composition of the Foreign Relations Committee to change. We cannot let the issue founder. We need to keep pressing its importance and significance and keep it on people's minds and in the headlines. Take every opportunity you can to speak out to the public, to speak with a member of Congress. Be dogged and persistent.

*Is the U.S. assumption of the chair of the Arctic Council in 2015 contingent on ratification of the Law of the Sea?*

NO. We will take the chair as a routine rotation - although it does make other countries look at the U.S. strangely. We are the only nation with any coastline that has failed to ratify.

**REMARKS FROM THE ALASKA CONGRESSIONAL DELEGATION: HON. MARK P. BEGICH, U.S. SENATOR FOR THE STATE OF ALASKA**

Senator Begich expressed his pleasure in addressing this Symposium once again. He recalled how, two years ago, he had spoken of his frustration with the lack of engagement by government and the public. He remarked that it is almost like the country has discovered, in the last couple of years, that the U.S. has an Arctic Ocean. He knows that Agency officials are now engaged and understand the importance of the issues but it is still a challenge to get elected officials to understand the value of why we need to be engaged, to invest and to look long term.

Senator Begich praised the progress made to support development in the Arctic but warned the White House to redouble its efforts or get left behind as other countries prepare to stake their claims to Arctic resources.

“Humans have dreamed of the promise of the Arctic,” said Sen. Begich. “They’ve explored the margins of the polar icepack in ships, and tried to push to the pole in dogsleds and balloons. ... But the changes we’ve seen over the past decade have made the Arctic more accessible in a way that others only dreamed about. And not unexpectedly, it’s attracting interest from around the globe. At this critical juncture, our nation has a responsibility to take full advantage of this promise and assert our leadership in the changing Arctic. That will take significant time, intelligence and investment.”

Sen. Begich also cited signs of progress such as investment in Coast Guard vessels, an increase in commercial and leisure traffic, and additional research opportunities.

Two Coast Guard Cutters: “The Coast Guard’s Polar Star is out of dry-dock and sailing again. We’re still behind the curve on the icebreaker front, but that’s twice as many icebreakers since I spoke to you last.”

Northern Sea Route Traffic is increasing: “In 2010, just four ships carrying just over 100 thousand tons of cargo crossed Russia’s Northern Sea Route. Last year, 46 ships did, 10 times as many, carrying one and a quarter million tons. This year a German cruise line is booking tours through the Northwest Passage atop Canada - Nome to Iceland in three weeks. Book now if you’ve got \$50,000 burning a hole in your pocket.”

Research Vessel: “And speaking of ships, the Alaska Region Research Vessel Sikuliaq was launched and is now being prepared for sea trials in advance of its mission of Arctic research over the coming decades.”

Despite the new vessel, Sen. Begich still called for more investment in scientific work in the Arctic.

“My Arctic Research, Monitoring and Observing Act, S.272, would increase Arctic research funding by 20 percent using an existing, but underutilized endowment for Arctic research. Critics say it undercuts their plans. I say when changes in the Arctic are occurring faster than the scientific models predict, we’re not doing enough. Just this week, a new study was published which predicts an ice-free Arctic by the middle of this century, less than 50 years from now. That’s why my bill also funds Arctic Ocean observing, the baseline data that underpins other research.”

In his remarks, Sen. Begich pointed to the Coast Guard as being the key player in the Arctic. He noted that the Coast Guard needs additional resources. It cannot be given more responsibilities with reduced resources and be expected to just spread things around. He stated that the reduction in the Coast Guard budget is totally unacceptable if we believe the Arctic is a critical piece to America’s long term future.

Sen. Begich also cited proposed legislation that would position the United States as a leader in efforts to develop the Arctic.

“My Arctic Ambassador bill would put the U.S. on equal diplomatic footing with most other nations before the Arctic Council and ... will help U.S. leadership and vision in Arctic policy. Six of the eight Arctic nations already have Ambassador-level diplomats representing their interests before the Arctic Council.

Japan and Singapore now have Ambassadors to the Arctic. And they were joined by China, South Korea, India, and Italy in gaining observer level status before Arctic Council. I welcome their participation. But as the world increasingly turns its attention toward the Arctic, the United States must continue to exert strong leadership at the top of the globe. And that requires a U.S. Arctic Ambassador.”

Sen. Begich noted the legally binding agreements on search-and-rescue and oil spill prevention and response reached by the Arctic Council as positive steps. He has met with the White House and with different department heads to begin the discussion on the priorities the U.S. wants to further when it assumes the chair of the Arctic Council in 2015.

Sen. Begich mentioned the United Nations Convention on the Law of the Sea expressing his amazement that the U.S. Senate cannot agree to accession when virtually every other group is strongly recommending it. He understands the argument of some of his colleagues that this could lead to a loss of U.S. sovereignty but notes that this is not true. He pledged to work double-time to try to break the logjam.

The Senator closed by thanking the Symposium participants collectively in helping to bring the Arctic to the forefront of the public mind and encouraged them to continue to advocate and educate so policy makers have the knowledge to do the right thing.

## **SYMPOSIUM KEYNOTE ADDRESS: HON. MEAD TREADWELL, LIEUTENANT GOVERNOR OF ALASKA**

Mr. Treadwell opened by congratulating the National Ice Center and the Arctic Research Commission for maintaining this series of symposia.

“This symposium has been very important over last decade or more as Arctic has changed very quickly. The continuity in this meeting has been very important. ... This symposium was really the first place that government agencies came together to think about the North.”

Mr. Treadwell praised the National Ice Center as a great asset of the nation with tremendous capabilities that are indispensable to shipping and a great example of cooperation with Canada. Against the backdrop of an image of the 1851 Arctic Council of the British Admiralty, he related the current scientific quests of the Navy to those of the 19<sup>th</sup> century British naval commanders who, in the course of their other duties, were also charged with making observations of all natural sciences in order to increase knowledge.

Mr. Treadwell pointed to three primary policy objectives of the State of Alaska - safety, security and economy.

Concerning safety, he noted that Alaska is happy with the Arctic Council Search-and-Rescue and Oil Pollution Response agreements and the continuing work on pollution prevention research. He hopes the Arctic Council will continue to move forward on the Arctic Marine Shipping Assessment recommendations.

Mr. Treadwell expressed concern that itinerant vessels are not subject to the same regulations as U.S. vessels and are not paying their fair share to support infrastructure needs and oil pollution response capabilities. He suggested that the U.S. could perhaps use port state agreements with other nations to exercise controls on itinerant vessels and that Article 234 of the UN Convention of the Law of the Sea could be used to provide the kind of safety regime needed if the Arctic states could come to a consensus on what this Article means.

Mr. Treadwell proposed that the U.S. work with Russia to develop a vessel traffic routing system for the Bering Strait and take this to the International Maritime Organization. He also suggested that we might think about an agreement among the Arctic states akin to the St. Lawrence Seaway to promote the safety of navigation and global trade.

“We need to think about safety because it’s right. We don’t deserve to use this ocean if we don’t use it rightly.”

Turning to security, Mr. Treadwell noted that the large reserves of oil and gas in the Arctic point to the need for policies that lead to security of shipping and the prevention of future conflict. He noted that all countries need to secure energy supplies and that this means Arctic supply lanes must remain open. For security of shipping he pointed out that it is important that we build icebreakers and invest in infrastructure but that we must also think about the business model for shipping in Arctic.

“Security of Arctic shipping is one place where we certainly have to work together.”

On the economy, Mr. Treadwell noted that the Arctic puts Alaskans to work in many fields and that the Alaskan economy contributes very heavily to the U.S. economy. In future, Alaska could very well become an energy exporter. He noted the boom in cross-boundary investment with companies from many nations forming alliances and working around the globe. He expressed the opinion that the new observers at the Arctic Council must be brought to the table because we need their investment in the Arctic and noted that the business roundtable that Canada is promoting with the Arctic Council has tremendous opportunity to bring businesses together to invest in the Arctic.

“We are preparing for a new ocean – but we also need to prepare to do business successfully”

In closing, Mr. Treadwell again thanked the organizers again, stating that “whether it is the pursuit of knowledge, security, economy or protection of this breadbasket and wonderful environment, it’s very important that we keep working together.”

## Questions

Has there been any discussion of the creation of a trust fund to support infrastructure projects?

*There has been a law introduced in the Alaska legislature to create an Arctic port authority in Alaska. Senator Begich has introduced a piece of legislation that would tie the State and the federal government together on port financing. However, it is clear that the governments cannot fund it all and industry will have to share. A major concern is the itinerant shipping of oil that does not contribute to the oil pollution prevention or response because of an exception in U.S. law and an absence of international law. We need a regime that corrects this in order to be fair to U.S. industry and Alaska residents.*

Many think that the IMO Polar Code can be ready by 2016. What do you think?

*The voluntary code is out there now and it is all very good in terms of addressing appropriate Arctic shipping safety issues. The present concern is that the U.S. shipping community is not paying enough attention to the details. We need to know what we are signing up for.*

**NOAA KEYNOTE ADDRESS: DR. KATHRYN D. (KATHY) SULLIVAN, ACTING UNDER SECRETARY OF COMMERCE FOR OCEANS AND ATMOSPHERE AND NOAA ADMINISTRATOR**

In welcoming the participants and thanking the organizers and sponsors of the Symposium, Dr. Sullivan commented on how pleased she was to have at the symposium NOAA's many partners across the U.S. federal family, international collaborators, industry and academia.

"Partnerships have always been key to everything that NOAA does in the Arctic and they will only grow in importance in the years ahead."

Dr. Sullivan noted that the rapid pace of change in the Arctic brings a sense of urgency to our common work. She noted that in 2012, the benchmark level of 400 parts per million of CO<sub>2</sub> in the atmosphere was reached at 6 of the 7 NOAA Arctic Observatories, summer sea ice reached another historic low, the minimum extent of multi-year sea ice has diminished by over 50% in area and 75% in volume compared to climatology. She remarked that recent estimates for the first ice-free summer in the Arctic vary from 2030 to 2050.

"With an ice-free summer ocean nearly upon us, the Arctic is quickly becoming more accessible which is accelerating the need for environmental information and operations-oriented readiness, response and assistance within and among the circum-Arctic nations and partner nations."

Dr. Sullivan listed the many implications for NOAA including the demand for up to date nautical charts, more detailed Arctic weather forecasts and severe storm warning, better short- and long-term sea ice forecasts, integrated environmental assessments, ecosystem based management on a scientific basis, etc. All of these she called Critical Environmental Intelligence – timely and actionable information developed from authoritative science that can inform decisions. This intelligence is based on data, analysis, modeling and assessment.

Recalling NOAA's long history, Dr. Sullivan noted that its 2010 Arctic Vision and Strategy continues the emphasis on climate and weather, oceans, coasts and fisheries, foresight and stewardship, and commitment to resilient economies, ecosystems and communities. She itemized the 6 priority areas of the Vision and Strategy:

- Forecast sea ice and improve the capability to do so;
- Strengthen foundational science to understand and detect Arctic climate and ecosystem changes;
- Improve weather and water forecasts and warnings;
- Enhance international and national partnerships;
- Improve stewardship and management of ocean and coastal resources in the Arctic; and
- Advance resilient and healthy Arctic communities and economies.

Dr. Sullivan noted that science provides the foresight to anticipate arctic change and she gave a broad overview of NOAA's initiatives in the Arctic including the Arctic Observatories that, with similar effort by international partners, are monitoring the changes that are taking place in the atmosphere, ocean and ice.

"We are only just beginning to understand the ecosystem wide impacts of many of these changes. Until we have that greater understanding, it is prudent to take a precautionary stance, especially in the face of actions that might trigger changes that are irreversible or affect huge areas or last for decades to centuries."

Dr. Sullivan identified a number of scientific initiatives that NOAA is undertaking to link physical, chemical and biological changes, emphasizing the approach to integrated assessment to understand ecosystem impacts. She noted the successful partnership with Russia in the RESULCA project and international participation in the Distributed Biological Observatories to monitor ecological "hot spots".

Remarking that analysis and synthesis are essential to transform data into understanding, Dr. Sullivan spoke of SOAR – the Synthesis of Arctic Research – a program to apply analytical and modeling approaches to data that are available from a cross-section of Arctic research activities in order to test hypotheses that cross scientific disciplines. She noted that SOAR aims to deliver findings to resource managers, local Arctic residents, national and international science societies and the general public.

Dr. Sullivan noted that sparseness of observations in all environmental spheres is a major obstacle that a host of new platforms, like unmanned aerial systems and wave gliders, offer new possibilities to overcome. However, she cautioned that:

“... whatever the technologies or platforms may be, it is clear that meeting the critical environmental intelligence needs in the rapidly changing Arctic will require denser observations, sustained observations and higher spatial and temporal resolution.”

Dr. Sullivan reflected on last year’s exploratory drilling operations in the Alaskan Arctic region that provided some dramatic lessons about the importance of “robust observations, sound research and timely intelligence”. She noted that sea ice formation is a complicated process dependent on many factors and that sea ice forecasting has many uncertainties. However, she noted that ice forecasts, and especially freeze-up forecasts, are becoming increasingly important for setting the “trigger date” by which drilling operations must cease. She noted that freeze-up forecasting is dependent on a broad range of ocean and atmosphere observations and that observations cannot be “cherry-picked” to use only a few specific ones. Everyone involved learned a lot from the surprises of last year that has led to operating changes. NOAA now works more closely with the Department of Interior on determining lease arrangements and providing environmental information and forecasts.

Dr. Sullivan emphasized that no nation, agency or company can go it alone on critical environmental intelligence that we all need in the rapidly changing Arctic. She iterated that we must rely on multi-level partnerships and spoke of the agreement NOAA has reached with Arctic energy companies to share weather and ocean observations, biological information and sea ice and sea floor mapping studies. It is tremendously successful and resulted in a 50% increase in observations in just the first 4 months.

“Environmental intelligence is a common theme and critical thread in many of our partnerships. In most cases, it is the foundation that is needed to achieve any of the mutually beneficial outcomes.”

She remarked that there is now an Arctic ERMA – the Environmental Response Management Application. ERMA fuses all of the data together to create a common operating picture and is at the center of much of what NOAA does in Alaska.

Dr. Sullivan referred to the National Arctic Strategy noting that it points to the strategic position of the Arctic for U.S. national security, the importance of stewardship of its resources and environment and to the criticality of international partnerships. She noted that the Strategy calls for scientifically sound decision making and includes a specific call for integrated management of arctic resources. –

“The U.S. National Strategy for the Arctic ... recognizes the need to make our decisions rationally through an integrated approach from a position informed by the best available science – or, as we have been taking about here, critical environmental intelligence.”

Dr. Sullivan closed by noting that we must not forget about the residents of the Arctic and must call upon their knowledge, as well as the best available science, to inform decisions that will shape the future of the Arctic.

Lastly, she pointed out that the Arctic is not isolated from the rest of the planet.

“What happens in the Arctic does not stay in the Arctic. Our planet’s natural systems are richly interconnected as are the economic, social and political systems in which we live. Our decisions in the Arctic shape our world and our planet and so affect all of the 7 billion people who share it with us. We must arm ourselves with the best possible environmental intelligence and use it wisely in the emerging Arctic of the 21<sup>st</sup> century.”

## **U.S. COAST GUARD KEYNOTE ADDRESS: ADM ROBERT J. PAPP, JR., COMMANDANT, USCG**

ADM Papp opened by noting how much has changed in the two years since the last Symposium – not just the climate and the ice but also strategically and politically around the world. Interest in the Arctic has risen dramatically and the Coast Guard has ramped up its Arctic operations. He was very gratified to note that Healy is engaged with Arctic Shield 2013, Polar Star is back in service, the CGC Spar is conducting oil spill recovery exercises with the Canadian Coast Guard off Alaska, the patrol boat Naushon is operating in the Arctic for the first time and Coast Guard aircraft have been forward deployed in Alaska to conduct training exercises and maintain domain awareness. The Coast Guard has made a commitment to the National Science Foundation to do the break-out at McMurdo next February with the Polar Star.

ADM Papp expressed his strong personal interest in the Arctic going back over four decades. He has visited Alaska every year that since becoming Commandant and intends to continue. Last year, he was accompanied by Secretary Napolitano, Senator Lisa Murkowski, Senator Mark Begich and Senator Mary Landrieu from the State of Louisiana to witness Coast Guard operations and see first-hand the challenges that the Arctic presents. He noted that, while the environment is certainly different from the home state of Senator Landrieu, as a member of the Homeland Security and Governmental Affairs Committee and chairwoman of the Homeland Security Appropriations Sub-Committee, she understands the national imperative that our country faces in the Arctic.

“The changing conditions in the Arctic represent some of the most important challenges and opportunities of our new times. The newly opening ocean is emerging right before our eyes bringing with it potential but also risks and enormous responsibilities.”

ADM Papp noted that the Coast Guard has a long history in the Arctic region, enforcing our laws, conducting scientific investigation, charting the waters and providing humanitarian assistance, engaging in search-and-rescue operations and maintaining a sovereign presence. He emphasized that the diminishing ice and the increasing use of the seas by industrial, commercial, native and recreational users demands a persistent, capable Coast Guard presence in the Arctic region.

“Our mandate to ensure maritime safety, security and stewardship applies in Arctic just as it applies in the Atlantic and Pacific Oceans, the Gulf of Mexico, the Caribbean Sea or on the Great Lakes. We must be present and prepared to operate in the region.”

ADM Papp pointed out that the Coast Guard recently became the first federal agency to release an Arctic Strategy that focuses its service efforts on the goals of the U.S. National Strategy. The Coast Guard strategy document contains three strategic objectives that will guide the Coast Guard efforts in the Arctic over the next ten years - improving awareness, modernizing governance and broadening partnerships.

Achieving the first strategic objective, ADM Papp indicates, is to simply understand the Arctic operational environment, the increase in activity and the risks and opportunities that it presents. He noted the need for improved collection, analysis and sharing of maritime information requiring a collaborative network of domestic and international partners. He also noted that it requires a persistent presence of the Coast Guard to be able to rapidly detect, prevent and respond to any maritime threats or hazards - a challenge given the distances involved, the often hostile environment and the lack of shore infrastructure. He remarked that, as human activity increases in the future, we may need to make greater investments in shore infrastructure but, until that time comes, the expense of building permanent infrastructure as well as the uncertainty of the dynamic and evolving requirements counsel that the Coast Guard rely on mobile offshore infrastructure.

“For the foreseeable future, the Coast Guard’s strategy is to employ mobile infrastructure and seasonal presence of cutters, boats and aircraft supplemented by the existing shoreside infrastructure to provide a flexible and adaptable capability needed for Arctic operations.”

ADM Papp noted that the second strategic objective, to modernize governance in the Arctic, will be achieved by leading within the inter-agency family to strengthen international legal regimes, by safeguarding the maritime environment, by preserving the living marine resources and by protecting U.S. sovereignty and sovereign rights.



Noting that a legally predictable set of rights and obligations to address activity in the Arctic is paramount, he stressed the importance of the U.S. to accede to the UN Convention on the Law of the Sea.

“In order to exercise leadership, prove our ability to influence outcomes and effectively work with other Arctic nations, we urgently need the Senate to approve U.S. accession to the Treaty as soon as possible.”

ADM Papp pointed out that all of the other Arctic States have signed the Law of the Sea Convention and are now submitting claims for control of resources over extended continental shelves. The U.S. has the potential to extend its rights as far as 600 miles from the Alaska coast but has no legal forum to do so without signing the Treaty.

He noted that the recent admission of 6 non-Arctic states as observers to the Arctic Council demonstrates a clear recognition of the importance of the Arctic to global security and prosperity and the importance of broader inclusion to develop binding international regimes and standards there.

“The U.S. should join the Law of the Sea Convention to protect our national security interests of sovereignty, environmental, economic and energy concerns.”

ADM Papp further indicated that the Coast Guard will safeguard the marine environment and preserve living resources in the U.S. Exclusive Economic Zone through persistent Coast Guard operational and law enforcement presence. He stated that protecting U.S. sovereignty remains an important part of maritime governance that cannot be achieved without effective operational presence.

ADM Papp noted that the third strategic objective, to broaden partnerships, will be accomplished by developing and promoting the Coast Guard as an expert and experienced resource for our partners, leveraging domestic and international partners as force multipliers and supporting a national approach to Arctic planning. He noted that the Arctic is not just a Coast Guard issue but is a national issue that requires a whole-of-government approach – federal, state, local – as well as a whole-of-nation approach involving private industry, academia, environmental groups and other non-governmental organizations. He indicated a need to rely on leadership from outside the federal government, particularly in the native Alaska tribal governments and people of the State of Alaska.

He concluded by noting that the challenge today is to ensure that the U.S. is prepared with a Coast Guard capable and ready to meet its responsibilities in the Arctic region.

“I believe we have a national imperative in the Arctic driven by an emerging maritime frontier and the promise of opportunity and prosperity as well as risks. We need to set a course to be capable of exercising the same missions in the Arctic that we’ve done in all the waters that we have operated in during the past two centuries.”

**NAVY KEYNOTE ADDRESS: DR. FRANK HERR, HEAD, OCEAN BATTLESPACE SENSING DEPARTMENT, OFFICE OF NAVAL RESEARCH (ONR) FOR RADM MATTHEW L. KLUNDER, CHIEF OF NAVAL RESEARCH (CNR)**

Summary – see presentation

- Navy needs a better understanding of the Arctic before it can know what it will need to deploy in the Arctic
- Diminishing ice in the Arctic is creating a lot of new open water with an accompanying increase in air-sea interaction
  - Drives the atmosphere in ways that the Arctic has not experienced in at least thousands of years
  - Changes the boundary conditions of atmosphere-ocean models for temperate latitudes
  - Need to develop a new generation of fully coupled models
- As the Arctic changes to a seasonal ocean with a large marginal ice zone, need to understand the processes occurring within the marginal ice zone and how waves interact with it
- Greater expanses of open water increase the importance of Arctic waves and a greater flux of moisture into the atmosphere and the development of significant storms with lots of precipitation
  - The Arctic is no longer a desert
- Marginal Ice Zone 2014 field program will deploy an array of sensors in the spring to drift westwards across the Beaufort Sea monitoring the breakup of the ice as the season progresses
- Will begin building a new generation of dynamic models based on data assimilation of multi-sensor data to provide high resolution Arctic prediction
- NRL's DISTANCE program – Determining the Impact of Sea Ice Thickness on the Arctic's Naturally Changing Environment
  - Airborne program for ice mapping and thickness determination
- NRL's Arctic Cap Nowcast/Forecast System (ACNFS) is now operational
  - Currently improving this system by incorporating development from other centers
  - Resolution must be very fine because of the dynamics involved in the ocean and ice pack – 3.5 km is not good enough
- Investigating acoustics in the Arctic Ocean once again
  - 1994 experiment analyzed a warming in the Arctic Ocean at 200-700m depth in the 1990s but we have not had observations to compare since – would like to repeat the experiment
  - Looking at the Atlantic Water that moves into the Arctic past Svalbard
- Thin Ice Arctic Acoustic Window (THAAW) project is intended to gather the first ambient noise data in 20 years
  - With more marginal ice but without the pressure ridging will the Arctic be quieter or more noisy?
- Want to gain experience in operations with unmanned platforms in the Arctic
  - with ice and in ice
  - use the extended range of AUVs currently in development to build observational methodologies for the future
- Research in the Arctic is in a very exciting time
  - The program has been set forward to take advantage of the changes taking place
  - Have new tools, old colleagues, new colleagues to develop and new partnerships to work with others
- Looking forward to this new opportunity

Questions

What are your thoughts on the use of the near-real-time sea ice analysis done at the National Ice Center as input to the models with information on ice types, concentration, etc.?

*It is our intention to use that kind of effort in a mode that can be assimilated into the next generation fully-coupled dynamic model. We want to be able to capture the dynamics of the ice retreating and growing. The question for the data assimilation experts is whether we should use analyzed data or pre-analyzed raw data. Clearly that is the kind of data that we want to capture in the new generation of models.*

A lot of speakers have spoken of the importance of collaboration and cooperation and to raise awareness. How does ONR distribute the information that it collects in doing its research? How is the decision made as to what

remains in-house and classified versus that which is available publicly? How do you publicize your work and how do you work with other agencies and others?

*All of the work I have described is basic research available to everyone. Work is put into peer-reviewed research journals and is completely open and shared with foreign colleagues and interagency colleagues. All of the Navy centers are part of the data policy where investigators generally have 2 years to work up their data and publish. After that it is fully releasable and shareable data. The Chief of Naval Research determines how and when classified data can be released on a case-by-case basis. The Navy regularly uses the Arctic as a mode of transiting submarines from the Atlantic to the Pacific and operates the SCICEX program to provide a limited opportunity for scientists to gain access to data.*

## PANEL DISCUSSIONS

**THE IMO POLAR CODE DEVELOPMENT, STATUS, AND IMPACT:** LEAD, DR. LAWSON, BRIGHAM, DISTINGUISHED PROFESSOR OF GEOGRAPHY AND ARCTIC POLICY, UNIVERSITY OF ALASKA FAIRBANKS

### Panelists

Mr. David Jackson, Director, Canadian Ice Service

Mr. Peter Oppenheimer, Chief, International Section, NOAA General Counsel Office

Mr. Bruce Harland, Vice President, Crowley Maritime Corporation

CAPT John W. Mauger, USCG, Lead, U.S. Delegation to the International Maritime Organization (IMO) Sub-Committee on Ship Design and Equipment (DE)

### Introduction by Dr. Brigham

- Polar Code has many implications to many people
- Today every square kilometer of the Arctic Ocean has been traversed by surface ships
- Arctic shipping is not driven by sea ice even though it is ice-covered for a good portion of the year
  - Arctic Marine Shipping Assessment (AMSA) found that global commodity prices and the natural resources of the Arctic are what drives shipping
- From a regulatory point of view, the Arctic Ocean will be ice-covered, fully or partially, for nine months of the year for the rest of this century or beyond - there is no model that doesn't show at least some ice for part of the year
  - this means that operating in the Arctic will require polar class ships
- Ships operating in the Arctic today are modern but they are tankers, LNG ships, chemical bulk carriers and huge cruise ships with 4,000 passengers
  - This is the reason we need a Polar Code – currently there are no regulations today – international non-discriminatory regulations - related to shipping in the Arctic
  - The Polar Code is a seminal, and perhaps the most important point, in the development of the Arctic
- Early Polar Code development strategy was to:
  - Build on existing ship rules (SOLAS, MARPOL, etc.)
  - Augment existing standards
  - Measures to focus on the safety of life and protection of the marine environment
- Guiding principles were endorsed by IMO
- IMO voluntary guidelines for Ships Operating in Arctic Ice-Covered Waters were introduced in 2002 and extended to Polar Waters in 2009
- Arctic states agreed to 17 recommendations in the AMSA including measures for IMO i.e. the Polar Code
  - AMSA recommended mandatory application of relevant parts of the Guidelines
- Observations and Needs
  - IMO Codification of the Polar Class ship classes – single classification system
  - It should be a practical code - not a “fuzzy” convention
  - Passenger ships must be fully integrated with the requirements of the Code
  - Mandatory and comprehensive ice navigator qualifications in the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW)
    - Most important need is competency in the pilot house

### Comments from CAPT Mauger

- The strategy that was developed 20 years ago is the same strategy that is being followed today; the Polar Code is not a stand-alone instrument; it is built upon other existing regulations
- We are rapidly approaching what USCG and others think is the end of development of the Polar Code
- The Design & Equipment (DE) Sub-Committee of IMO was tasked with completing the draft in 2014 for approval followed by two years to implementation
- Committee is looking at completing the work that has been done over 20 years
  - successful international meeting last June followed by U.S. interagency meeting and a U.S. public meeting

- international meeting of the Arctic states with the idea being that if the Arctic states can get together they would be in a strong position in discussions at IMO
- Some key decisions were taken at the DE Committee last winter
  - Agreed on draft environmental chapter based upon existing MARPOL and identifying those issues that are unique to the polar regions
  - While whole Polar Code still needs work, there has been good progress on the environmental chapter that will carry things forward
- Looking forward from now, there are some key safety issues to address
  - Effects of temperature on equipment and material
  - Lifesaving equipment for cold environments
  - Operational matters to be resolved
- When Polar Code comes into effect, it will apply to all vessels covered by the International Convention on the Safety of Life at Sea (SOLAS)
  - There will be some grandfathering of old ships that will not have to meet all provisions of the Polar Code
  - New ships will have to meet enhanced Polar Code
  - Aspects relating to operations, planning and crew proficiency will apply to all ships from the beginning
- Planning some more public consultations in August and to table a draft at a special inter-sessional meeting of IMO in late September 2013 followed by a workshop in November; intention is to have a final draft ready for DE by next year
- AMSA and other work at the Arctic Council PAME was key to developing the research and ideas that could be turned to policy
- There will be a lot of public and industry engagement over the next 6 months
- While there are new ships on the horizon, the average age of ships currently in the Arctic is about 28 years; it really is necessary to develop this mandatory Polar Code now

#### Comments from Mr. Jackson

- Gratifying to see the advancement of the Polar Code
- Townhall meetings and industry meetings have been going on in Canada for some time
- Precepts are that the Arctic Waters Pollution Prevention Act and Regulations (AWPPR) should be reflected in the Polar Code
  - Discharge control, manning regulations, etc.
  - Things not dealt with in the AWPPR, such as life-saving equipment, are currently addressed on a risk based approach
- Construction regulations are well-known and should slide into the Polar Code – classification standardization would be very welcome
- Agrees with Lawson that it is the navigation aspect, the bridge competency, that is the most important aspect
- A personal issue is with the ice navigator; In Canada, there are both ice navigators and ice pilots with separate sets of qualifications – confusing to all
- Look forward to standardized training curriculum – particularly for ice navigators
  - Understand that this has been given over to the Standards on Training, Certification and Watchkeeping (STCW) committee in IMO for development
  - There is very little standardized training for ice navigators in Canada
  - Probably the best such training is at the Admiral Makarov Academy in St Petersburg followed by Sweden and Finland
- Nautical Institute has developed a comprehensive curriculum for ice navigator training including a standardized nomenclature for ice
  - Looked at what an ice navigator needs to know including physics of ice, international nomenclature for ice, interpreting ice charts, recognizing and reporting ice conditions
  - Experience qualification in addition
- Work done within International Ice Charting Working Group in standardizing and harmonizing the presentation and dissemination of ice information world-wide

#### Comments from Mr. Oppenheimer

- Coming at the Polar Code from a lawyer's perspective and from the perspective of the Arctic Council's working group on Protection of the Marine Environment (PAME)

- Arctic Council is an intergovernmental organization that has no law-making powers
  - Forum for Arctic countries to come together to discuss issues
- PAME working group has a focus that includes shipping and is the only working group has a policy formulation mandate
- Arctic Marine Shipping Assessment (AMSA) was approved by the Arctic Council and is a very important document
  - The 17 recommendations have played a role in efforts to improve shipping safety and environmental protection in the Arctic, including the development of the Polar Code
- PAME's role is to develop science to inform decision makers such as the IMO
- Polar Code has a safety part and an environmental protection part
  - Given NOAA's marine stewardship mission, NOAA has focused very much on the environmental protection part
- In May of this year, a decision was made to draft text for the Environmental Chapter for submission to the Design & Equipment Committee at IMO for eventual adoption next year
- Draft Environment Chapter currently has provisions for:
  - Additional protections for the Arctic to those contained in MARPOL Annex 1 (Oil Pollution Prevention), Annex 2 (Noxious Liquid Substances), Annex 4 (Sewage from Ships), Annex 5 (Garbage from Ships)
  - Additional requirements for the Antarctic under MARPOL Annexes 4 & 5
  - Ships are prohibited from discharging MARPOL Annex 1 & 2 wastes in Polar waters
  - Requirements for certain classes of ship under MARPOL Annex 4
  - More stringent requirements under MARPOL Annex 5 beyond even the recent revisions to this Annex
  - New language has been added with respect to permitted discharge distances from ice shelves and landfast ice, in addition to the previous reference to land
- Decision taken that it is premature to ban heavy fuels in the Arctic; there is an existing ban in the Antarctic
- PAME is also looking at measures outside of the Polar Code that could be applied to protect the polar marine environments
  - Protection of areas of heightened ecological or cultural significance
  - A report was submitted to the Arctic Council ministerial that identifies these areas
  - PAME is preparing a report that identifies actions that member governments could take in pursuing IMO action to protect these areas in the high seas – to be available in 18 months
  - Member governments could act to protect areas within their individual jurisdiction
- Arctic Council's Arctic Ocean Review was the result of a 4 year project by PAME to identify all global and regional measures in place to protect the Arctic in view of a changing environment
  - Available on Internet
  - Addresses a host of issues from living marine resources to offshore oil and gas
  - Of the 8 chapters, one addresses shipping
- Several recommendations from the AOR were approved by the Arctic Council Ministerial meeting in May including that Arctic states should:
  - Work at the IMO to promote safe, secure and environmentally sound shipping including through the adoption of ship routing, reporting measures, vessel traffic services, enhancement of weather and ice forecasting and nautical charts
  - Explore the possibility of developing guidelines and best practices for sustainable tourism including cruise ship tourism
  - Consider approaches, including at the IMO, to address safety and environmental concerns with respect to vessels that, due to size, routes or nature of activity, may not be subject to the Polar Code (e.g. pleasure yachts)

### Comments from Mr. Harland

- From a commercial perspective, the Polar Code has to make commercial sense
- A prescriptive system may drive costs too high to be supportable by the Arctic communities being served
- There is currently a tremendous pressure on manning and, if a prescriptive system came in to require a certain number of months of Arctic experience, it could have unintended consequences such as stealing crews from other vessels - which will also drive costs up
- Should consider the intended use and practice of ships
  - The risk for cruise ships with thousands of passengers who want to go close to the ice is different from those for a ship bringing re-supply products to a community and avoiding the ice

- Two very dissimilar purposes for those vessels and they should not be subject to the same regulations
- There is also a lot of Coast Guard regulation for shipping governing operations today but that same regulation is not being applied to transit ships nor to the cruise ships
  - Just stepping up the enforcement of existing rules by the Coast Guard to newcomers to the Arctic would be beneficial
- Cannot prescriptively say that anything north of 60N be subject to the Polar Code; there must be some rationalization and recognition of the geographic area of operations
  - Some areas north of 60N do not have a problem now and bringing in regulations could have undesirable effects

### Comment from Dr. Brigham

- The Arctic Marine Shipping Assessment found that only about 7% of the Arctic is charted to modern legal standards; the idea of large ships operating in the Arctic is scary
- Insurance industry has a big role to play in practical aspects in how ships operate in the Arctic in the future

### Questions

How would different ice classifications apply to different ice conditions across the Polar region?

*The issue of different ice classes is a key issue to be discussed at the meeting this fall. There are different approaches used by various Arctic states as well as different vessel uses and different geographies driving the standards for Arctic classes. It is yet to be resolved.*

*Most people who work in the field agree that you cannot leave the classification rules up to industry alone. It must be an IMO role. Classification is a tool to explain to the rest of the world the icebreaking capabilities of a ship. It is an easy thing to codify but there are objections.*

Once the Polar Code comes into force how will it be enforced practically?

*Given that the Polar Code layers on top of MARPOL and SOLAS, all of the provisions to enforce those regulations would be in place for the Polar Code. A ship transiting into polar waters would need a polar ship certificate issued by the flag administration and that would spell out the details in terms of the capability of the vessel, the intended seasonal usage, route, manning requirements, etc. It would have a polar operations manual providing specifics on where and how they will operate, how protected or sensitive areas would be handled. Enforcement of the Polar Code would be the same as for SOLAS. It would be flag state inspections, port state control for any vessels that are calling into Arctic countries or ports above the boundary.*

What happens if a Polar Code compliant ship breaks up catastrophically in Arctic? Do we just leave it there and let the companies absorb the loss?

*The fact is that there is just no infrastructure in the Arctic to deal with such an event. At the heart of the issue is the responsibility of the flag state to ensure compliance with the Polar Code and to deal with disasters. But we know that, at some time in the future, a cruise ship will go across Arctic Ocean. Even with standards in place, things can go wrong and with the lack of infrastructure, it will be a difficult situation to deal with. This is a plausible scenario.*

*It is equally plausible right now. There are ships trading in the Arctic now with no more regulation than SOLAS or a country's domestic regulations. The Polar Code will bring in standards but even with them in place, things can go wrong (e.g. Costa Concordia, Mol Comfort). Something can still go wrong and we cannot eliminate that risk with a Polar Code. However, where we can make improvements, such as increasing the strength of the ships, increasing training, improving the design and operation of equipment, requiring planning, we must go forward to reduce the risk.*

*We also have insurance companies that take a very careful look at this. The bulkers that go to Red Dog, Alaska, for example, have trading limits and are inspected by a 3<sup>rd</sup> party. They meet with insurance companies twice a year. Insurance companies take their role very seriously.*

The Polar Code will regulate ships of 500 GWT and up. How will we regulate smaller ships?

*The Polar Code sits on top of other regulations such as SOLAS and MARPOL. The Polar Code does not apply any differently. The Polar Code does have mandatory requirements and recommendations which*

*could be adopted by individual countries in their domestic regulations. In addition, IMO is preparing a document outlining guidance and recommendations for states to enhance their domestic regulations to deal with vessels that don't fall under SOLAS. Insurance will also play a significant role in regulating these vessels.*

The WMO Sea Ice Nomenclature is desperately in need of updating. It is a quaint historical document that may represent the Arctic as we once knew it but it is inadequate for this new Arctic. Are there any plans to update it?

*Agreed. The WMO Sea Ice Nomenclature is out of date and an update is on the to-do list for the International Ice Charting Working Group and the WMO Expert Team on Sea Ice. However, what are really important for the ice navigator in the Polar Code are the tables for ice concentration and stages of development. The Canadian Ice Service is doing some work to improve the description of the ice – sometimes the egg code is not adequate. In future, users should see more ice information on the ice charts. But it is agreed that an update of the WMO nomenclature is needed.*

*One of the AMSA recommendations was that Arctic states work together and individually at WMO, IHO, IALA, etc. to push improvements to ice information. Infrastructure not only includes hard physical things like ports and piers but it also includes information that is required for operations in the Arctic area.*

To open waters for commercial vessels, will there be any augmentation of COAST GUARD assets to deal with situations such as the Kulluk where the towing vessel became disabled resulting in an accident.

*In the Kulluk case, the Coast Guard was on scene but could do nothing – it is not a towing organization. There could have been a different towing plan with multiple vessels to reduce the risk. That was an important lesson learned.*

What kind of infrastructure will be required to support the Polar Code and mitigate risk?

*The Polar Code is very ship focused. We can't require an existing ship to meet impossible regulations. There must be some ship-shore harmony. We can't require a ship to be self-sufficient if there are no discharge facilities available to them. However, it isn't the business of the governments of the Arctic states to do this. It is public-private partnerships. The taxpayers of the Arctic states are not going to pay for all of this use of the Arctic Ocean. Industry is going to have to contribute even in areas such as environmental data gathering.*

Earlier this year, Novatek ordered 16 LNG ships from Korea. How will the Polar Code affect these new orders? Will there be grandfathered vessels in the Polar Code?

*The ships may be Russian register and fall under the Russian classification system which is very rigorous – they might meet the requirements of the Polar Code. Russia is pushing for their classification system to be in the Polar Code. They require it for the Northern Sea Route and feel they are in the driver's seat because they feel they are the Arctic.*

What is the latest thinking on a traffic system for Bering Strait and when might that happen?

*Marine traffic control is not likely to be a command and control system operated from shore. More likely, it will consist of voluntary route plans. In ice-covered waters, mariners need to maneuver around ice to find the path of least resistance.*

*There is a marine traffic system in Valdez and ships regularly go out of the route to avoid icebergs. Bering Strait is 60 miles wide – a very big waterway. Coast Guard is looking more at a voluntary system rather than a mandatory one.*

How can we deal with Russian acceptance of the Polar Code if it does not include their provisions?

*This is not a treaty that needs to be ratified. Once it goes through the IMO committee process, there is a two year, or perhaps a four year, implementation period. The real focus is getting it through the committees.*

Many of the issues we have talked about are Arctic-specific but we should also remember that there are more generic issues that also apply to the Arctic as well as other oceans. Port facilities, marine sound, invasive species, bio-fouling, use of industry vessels to collect and share data, air emissions, etc. are issues applicable globally that can also be of benefit to the Arctic.

The panel concluded with a show of appreciation from the audience.



**ARCTIC COUNCIL SEARCH AND RESCUE (SAR) AND OIL SPILL RESPONSE AGREEMENTS: LEAD, MS. JULIA L. (JULIE) GOURLEY, U.S. SENIOR ARCTIC OFFICIAL, OFFICE OF OCEAN AND POLAR AFFAIRS (OPA), BUREAU OF OCEANS AND INTERNATIONAL ENVIRONMENTAL & SCIENTIFIC AFFAIRS (OES), U.S. DEPARTMENT OF STATE (DOS)**

Panelists

Ms. Sheila Riordon, Minister for Political Affairs, Canadian Embassy and Former Canada's Senior Arctic Official  
CAPT Jonathan S. (Jon) Spaner, Director, USCG Office of Emerging Policy  
Mr. Paul Holtus, President, World Ocean Council (WOC)  
CAPT Timo Junttila, Defense, Military, Naval and Air Attaché Embassy of Finland

Introduction by Ms. Gourley

- We now have two legally binding agreements – the first and only agreements of the 8 Arctic states
- The “Agreement on Cooperation on Aeronautical and Maritime Search and Rescue in the Arctic” was signed on May 12, 2011 and came into force on January 19, 2013 – after all 8 countries notified the Canadian depository that they had ratified the agreement
  - Covers both air and water and is based on International Civil Aviation Authority (ICAO) and International Maritime Organization (IMO) SAR policies
  - Defines the SAR regions that each country is responsible for.
- The “Agreement on Cooperation on Marine Oil Pollution Preparedness and Response in the Arctic” was signed on May 15, 2013 but will not come into force until all 8 states notify the Norwegian depository
  - So far, there have been no notifications
  - U.S. led this initiative largely because of the Deepwater Horizon spill and the offers of foreign assistance that were received presented new challenges for the U.S. to deal with in an emergency situation

Comments from Ms. Riordon

- Was Canada’s senior arctic official for the duration of negotiations for the SAR agreement
- This is a very important agreement in an emerging area that needed to be dealt with
  - Difficult to figure out how to develop a binding agreement since the Arctic Council is not a legally instituted body
  - While Russia and the U.S. played leading roles, all of the Arctic Council participants were very engaged
  - Adoption of this agreement also changed international perceptions of the Arctic Council as being more than just a talkfest - it is capable of moving forward in concrete and tangible ways.
- From Canada’s perspective, it was also the first time that the Department of National Defence became engaged with the Arctic Council
  - Probably true of other countries as well
  - Interaction of the various militaries with each other and with other parts of the governments was a turning point for the Arctic Council
  - Arctic states are now engaging at the level of Chief of Defense Staff - not about friction but about cooperation
- Arctic states were able to develop a better understanding of their own capabilities as well as that of others
- Because of the distances and challenges involved in the Arctic, cooperation among the states is essential
  - None have the capabilities to do it all
  - Bringing everyone together and identifying specifically what capabilities each had was a real eye-opener for all involved.
- Following the signing, SAR exercises have been held to bring experts together and consider what would be done in a given situation
  - key to identifying the challenges we must deal with
  - importance of strengthening our operational linkages
  - sharing information more
  - involving each other in training exercises
  - better understanding our capabilities and those of one another
- Some of the limitations faced in the north have also been uncovered

- Limited radar coverage that is available to SAR organizations
- Long distances
- Difficulty to bring in medical help
- There is a whole series of more specific issues that have been brought to light.
- That the Oil Pollution Preparedness and Response Agreement is not in force yet does not reflect on the commitment of the Arctic states. This is a treaty which must go through a complex process in all countries
- Oil Pollution Response agreement goes somewhat further than the SAR agreement
  - operational guidelines agreed to which give the agreement life and give the Coast Guards something tangible to implement
- Signing of the Oil Pollution Response agreement also shows that the Arctic Council is on top of issues
- Ministers were clear that an incident similar to the Deepwater Horizon in the Arctic would present much bigger challenges and have much bigger impacts
  - Arctic states need to get prepared together
- The first time that industry was brought into the discussion in a specific and significant capacity
  - Participated in discussions and gave advice directly to the Council.
- Oil Pollution Response agreement was very important to the indigenous representatives on the Arctic Council
  - They were the drivers and it shows the power that they can wield

### Comments from CAPT. Spaner

- Agrees with everything voiced by Ms. Riordon
- Important to think of Search and Rescue as two different challenges
  - Most of the time is spent on the Search part - requires assets, coordination, command and control, awareness of what your own and your partners assets are doing and a readiness to respond
  - Rescue part, although always challenging, is practiced all of the time and usually plays out quickly after the search is done
  - Goal in any response is to take the search out of SAR as soon as possible
- Significance of both of these Arctic Council agreements is that they allow for preparation and planning
  - They are proactive in that they anticipate the increase in Arctic activity and the need for response mechanisms
- U.S. Coast Guard estimates that some 200,000 people will likely go into the Arctic region on cruise ships
- Greenland Sea SAR exercise held in 2012 was a very large and valuable exercise that involved the U.S., Canada, Denmark, Iceland, Norway and Russia with observers and participants
  - Situation presented was perhaps the most challenging that could be imagined - a sinking or grounded cruise ship
  - Located on the east coast of Greenland
  - Participants received a notice of distress through appropriate channels that a ship did not report as it was supposed to
  - All assets got under way to find the area of distress and affect a rescue
  - Worked out very well but some very important things were learned:
    - communications in the north are very difficult
    - there is no common operational picture that can show where all the assets are
    - command and control on the scene at the tactical level worked very well but coordination above this level was not so smooth - All the nations were willing to cooperate but it had never been exercised before and basic things like the correct phone numbers, who to contact, radio channels, etc. were not in place
- Concerning the Oil Pollution Response agreement, U.S. is moving forward with identifying all of the assets
  - U.S. Coast Guard works closely with Oil Spill Response Organizations and are sharing best practices and formulating exercises
- These are two good agreements and implementing them through exercises, coordination and training will be a priority for the U.S.

### Comments from Mr. Holtus

- World Ocean Council (WOC) is pulling together a leadership alliance of the various ocean industries to work on cross-cutting and shared issues that affect future business activities and sustainability in the oceans in future

- WOC members are very supportive of these agreements
- It is an appropriate role of governments to deal with these sorts of issues and create the infrastructure and capabilities to deal with the kinds of emergencies that may result
- This is a great development in evolution of the Arctic Council
- Business community wants stability, predictability and good partners to operate safely and in an environmentally sound way
  - For the changing Arctic, these agreements are functional and strategic but also present a very practical and operational level of interaction with the governments at a regional level in an area that presents challenges and unknowns
- Part of the challenge is to know who is doing what, where - which in most cases is industry
  - In any large commercial activity, the idea of a common operation picture is very useful
  - Specifically propose that we should start pulling the operators together to create a picture of where all the vessels and assets are
  - WOC would like to work with the Coast Guard in furthering this idea and can bring in the industry.
- There should be a broader, on-going working relationship between industry and the Arctic Council
- There are a whole host of opportunities to work together
  - Port facilities
  - Marine sound
  - Environmental challenges
  - Adaptation of ports and infrastructure to sea level rise
  - Data collection and sharing
- WOC has an initiative called “smart ocean - smart industries”
  - Aimed at getting more industry vessels, platforms, aquaculture, fishing and other facilities involved in the collection and distribution of ocean, weather and climate data
  - Highest priority finding from the recent leadership workshop
  - Focusing on bathymetry as a particular piece of this would be a good start – getting more industry ships collecting and sharing bathymetry data

### Comments from Capt. Junttila

- Much has been presented and the problem is well understood
- Issue now is to make it work
  - We have good agreements now but we must put them into action
- A comparison can be made with the Baltic Sea
  - In the 1970's, the Baltic Sea was becoming more and more polluted while ship traffic kept increasing
  - Helsinki Convention was agreed to and the commission developed plans and a roadmap
  - HELCOM Response Group was created to maintain an operational picture, ensure swift national and international response to maritime pollution incidents and, in the case of an accident, that the right equipment is available
    - Also determine requirements and make recommendations on the type of equipment that is needed, although it is up to national governments to acquire the equipment.
- There must also be a body similar to the HELCOM Response Group to implement the Arctic Council agreements
  - Should have a secretariat that keeps records, organizes exercises, maintains the common operational picture and determines the kind of equipment that is required
  - Have clearly identified people and contact information that is maintained
  - Practical coordination work needs to be done
  - Not clear from the agreements who should lead this
  - Perhaps in 10 years, there will be something similar to the HELCOM Response Group for the Arctic.

### Questions

Ms. Gourley posed the question to the panel about whether the Arctic Council should take on hard security (military) issues.

*This presupposes that there are hard security issues. The Arctic Council collectively and the 8 Arctic states individually have made it clear that the intention is to resolve differences in a peaceful fashion. The Ilulissat Declaration formalized that intention. Canada sees the Arctic as a low tension area. NATO has*

*said there is no need for their involvement. It is important that there is on-going communication so there is common understanding about what is going on as a means to enable collaboration.*

*The chance of military conflict in Arctic is very low and we want to keep it that way. As we work on soft security issues, whether it's Arctic domain awareness, information sharing or joint exercises, we build trust and relationships among nations that can help defuse potential conflict situations. The Arctic Council should definitely remain on the soft security side.*

*The Chiefs of Defense have relationships and forums that allow them to discuss cooperation and understand one another's capabilities. The states cooperate willingly and that is a form of positive security. The Arctic Council should stay out of that area.*

*There is general agreement within the Council that its whole face would change and it would take away from the science focus it has if it were to get involved in military issues.*

Ms. Gourley posed a second question about oil spill prevention. The Arctic Council took some criticism from the environmental community over the Oil Spill Response agreement because it presumes that a spill will happen. They felt that the focus should be on prevention. The Council felt that the first step should be to ensure a response mechanism was in place in case there was a spill. Now the Council's attention has turned to prevention and has created a task force to look into it. Is there a role for the Arctic Council in spill prevention or should it be left to domestic national regulations? Is there value that the Arctic Council could add given that, in the Arctic, it is probable that a spill could spread beyond a single nation's national waters?

*We need to look at the domestic arrangements to determine what kind of added value the Arctic Council could bring. What kind of international collaboration on a bilateral or circumpolar basis is needed? The transboundary nature of oil in the ocean as well as the transboundary nature of industry indicates that there likely is a need for transboundary cooperation. However, we need to assess the risk, in terms of the level of activity, before we can determine what is needed.*

*The Arctic Council has long been involved in the prevention side of oil and gas in the Arctic. The technical nature of work should not stop the Arctic Council from taking a role. The Arctic Council can't afford not to take an interest in prevention. It has a role - not to undermine the sovereign rights of a nation - but discussion could help. It is important for the public to see that the Arctic Council is considering prevention.*

*The USCG strategic plan is to "prevent/respond". Prevention cannot be separated from response. Prevention can be hard but comprehensive consistent approaches at all levels can help.*

*On a different note, the sea is a global domain. The IMO is the proper body to legislate ships and can do so in the Arctic through the Polar Code. The Arctic Council should not try to become a legislative body and create something special for the Arctic.*

Where does the estimate of 200,000 persons in Arctic come from? Has there been discussion in the industry about operating cruise ships in tandem as a means of mutual response?

*The number is the best estimate from the U.S. Coast Guard and includes only cruise ships. The Coast Guard ensures that U.S. flagged vessels have the proper equipment on board. The Arctic Council is considering doing a project with the cruise tourism industry to get at some of these issues. Increasingly larger cruise ships are becoming aware of the need for domain awareness – knowing who else is operating there and what kind of capability is available. They are also very interested in becoming involved in data collection and sharing.*

What is the future for implementation plans for the two agreements? Is it mandated or is it left up to individual countries? What is the plan for the U.S.? Is there a mandated timeline?

*The Arctic Council did not think about doing implementation plans. This is taking place through exercises at the present time to get countries up to speed as quickly as possible. Implementation plans will have to be developed in due course.*

*The agreements do involve treaties that place responsibilities on countries so they will have to develop mechanisms to live up to those responsibilities. Everything is done voluntarily in the Arctic Council and it is a question of resources within each country so there is no mandated timeline.*

Are these agreements or treaties and, if they are treaties, do you anticipate any problems with ratification in the Senate?

*Each Arctic state uses their own legal terminology. In the U.S., these are Executive Agreements and do not require ratification. One of our baselines for negotiating both the agreements was that we could not exceed existing authority so that it could be done quickly. There was also no practical need to go beyond existing authority. In Canada and some other countries, They are considered treaties and require ratification which is why they can take some time for notification.*

Several times there has been mention of the private sector getting involved in observing and sharing data. Could we have a legally binding agreement for the establishment of an Arctic Observing Network that commits all the Arctic states and observers to make available, freely and openly, their environmental data?

*That is a great idea and the Council would probably embrace the attempt to do so.*

What would make job easier? Information about who is where and when?

*Improving domain awareness and the knowledge of all the resources that are available to respond to an incident would be at the top of the list. Followed by that, we need investments in infrastructure. Canada has placed an emphasis on the north with icebreakers and other infrastructure. There is a large amount of capability and information but there is a big challenge of trust between countries. It takes time and effort to build the kind of trust we need to make sharing effective.*

The panel concluded with a show of appreciation from the audience.

# PRESENTATIONS

(In alphabetical order by presenter's last name)

**NOAA ARCTIC RESEARCH PROGRAM: STATUS AND NEW CHALLENGES:** DR. KATHLEEN (KATHY) CRANE, PROGRAM MANAGER, NOAA ARCTIC RESEARCH OFFICE, CLIMATE PROGRAM OFFICE (CPO), NOAA/OAR

## Summary – see presentation

- Arctic Research Program is located within the NOAA Climate Observations Division
  - Important objective is to build a multidisciplinary arctic observing network that integrates observations across the whole ecosystem
- Goals of the program for the period 2002-2012 were to capture transition of the Arctic from an ice-covered ocean to a seasonally ice free ocean by 2030 – which we now see is coming closer to 2020
  - Incrementally built observing networks in the Pacific Arctic focusing on Arctic atmospheric observatories to look at the ice-ocean and marine ecosystem, sea ice thinning causes and consequences
- First decade has ended and now in the period of synthesizing data and analyzing results to provide direction for the next decade
- Carried out a 10-year long observing program with Russian colleagues focused on the Chukchi Sea to document changes in the ice cover
- The NABOS program to track warm Atlantic water in Arctic also provided a driver for the program
  - Still don't know where this warm water is ending up or how it is interacting with Pacific water in the Arctic basin
- The RESULTA (Mermaid in Russian) program was designed to monitor the Pacific Arctic region over a long period to understand what is going on in this rather unknown part of the Arctic
  - Monitored fresh water, heat, nutrient fluxes and transport, ecosystem indicators of climate change, and Arctic-wide physical systems
  - An important goal was also to improve U.S.-Russian scientific relations
- Have mapped an increase of heat by 50% in volume flowing into the Arctic Ocean from the Pacific between 2002 and 2007; triggering a lot of the sea ice loss – goes together with atmospheric forcing
- Found an ice-algae ecosystem that was benthic in nature
  - More open water allows wave action to generate more mixing in the water column resulting in more zooplankton
- Found 6 types of fish in the Chukchi area that were not known to live here before
  - Don't know if they are moving in with the warm Atlantic water or if they were there all along and we didn't know it
- Found a very large uptake of CO<sub>2</sub> by the ocean on the U.S. side of the Chukchi Sea but a release of CO<sub>2</sub> on the Russian side
  - Important to look at the whole Arctic and not extrapolate from regional observations
- Higher concentrations of calcium on the U.S. side of the Chukchi Sea than on the Russian side
- Distributed Biological Observatory line through the Bering Strait found:
  - animals are moving north from the Bering Strait to the Chukchi Sea
  - seabird populations have declined with a drop in clam biomass and ice associated cod
  - grey whales are moving north into the Chukchi Sea
  - walrus are hauling out in unprecedented numbers
- This year 6 Arctic observatories recorded CO<sub>2</sub> levels of more than 400 ppm – the first on planet Earth
- In the next decade:
  - Major attempt will be made to get to the largely unknown northern RESULTA area where the Atlantic and Pacific waters meet
  - Proposing synoptic surveys of the region
  - Carry out another Distributed Biological Observatory line east-west from Alaska to Wrangell Island
  - Proposal to decode old ship logs going back 100 years and involving 20,000 citizen scientists to develop a scenario of what happened before the satellite record began

- Challenges
  - Office is currently down to one person
  - Will be defining a new 5-10 year program
  - Sea ice loss gone down together with budget and need to deal with that
  - Must create sustainable observing systems leveraging with other countries that have better financial situations
  - Work with many different people, different cultures, different languages and different laws

**MARINE MAMMALS AND DIMINISHING ARCTIC SEA ICE: DR. ANTHONY (TONY) DEGANGE, CHIEF, ALASKA SCIENCE CENTER (ASC) BIOLOGY OFFICE, U.S. GEOLOGICAL SURVEY (USGS)**

Summary – see presentation

- We have put enough carbon into the atmosphere to ensure that nothing will change for the next 40 years – ice will continue to diminish
  - Some species of marine mammals are highly dependent on sea ice – it will be a challenge just to keep them at subsistence levels for that long
- Marine mammals are important culturally and for the subsistence economy of the indigenous people
- Mammals integrate the ecosystem from the bottom up
  - They are excellent sentinels of Arctic change
  - Walrus and polar bear are highly visible species in the Arctic in the sense of public awareness and in the sense that we can see, monitor and measure them
- Marine mammals are protected under law; only Alaska natives can hunt them
  - Co-managed by Alaskan groups and various governments
  - There are complex jurisdictions and changing legal status
- As sea ice declines, the pelagic ecosystem is boosted at the expense of the benthic
  - Human subsistence activities suffer because of lack of access
  - Human commercial activities are boosted by the relatively higher value of pelagics
- As sea ice declines, species that depend on it, like polar bears, walrus and some seals, suffer while seasonally migrant species, such as most whales, are helped
- Ice seals depend on sea ice for birthing, lairs and a platform from which to feed
- Bowhead and beluga whales face competition with other whales that will have increased access to Arctic waters with less ice
  - Increased ship traffic increases the likelihood of vessel strikes and problems of ocean noise.
- Polar bears use sea ice primarily as a hunting platform
  - As ice declines, they are spending more time on land, where they face new diseases and risks, or on ice in deep offshore waters, where there is little food
  - More and more are electing to stay on shore
  - Western Hudson Bay and Beaufort Sea populations are declining
  - Prediction is that Hudson Bay and Alaska polar bears will die out but the bears north of the Canadian Arctic Archipelago will persist
- Walrus are hauling out onto shore in greater numbers
  - Prefer to stay on the sea ice but will come ashore when necessary
  - Implies greater crowding, less food, more potential for crushing of calves
  - Reduced benthic productivity means less food for walruses
  - Foraging time is much longer if walrus must travel longer distances to offshore feeding areas with little resting time
  - Prediction is that the overall outcome is negative but we will have to wait and see how it plays out
- Most populations of marine mammals are robust but some are on the endangered or threatened species lists because of the long lead times involved – model populations out to the end of the century

Questions

What does it mean that walrus were precluded from the endangered species list?

*It means the decision was put on hold until a legal decision is made in 2017.*

Is there any paleo evidence of what these animals did in ice free conditions of the past?

*We can make some speculations about what will happen with diminishing sea ice. Polar bears won't be found in the abundant numbers of today and will be restricted to the remaining ice areas north of Canadian Arctic Archipelago and Greenland. Pacific walrus don't have the luxury of being able to move that far north. There will be a reduced carrying capacity of the ecosystem. They will likely continue to reside in the Chukchi Sea but in reduced numbers.*

**STATUS OF NOAA'S ARCTIC FISH RESEARCH - THE ARCTIC ECOSYSTEM INTEGRATED SURVEY: DR. EDWARD (ED) FARLEY, JR., PROGRAM MANAGER, ECOSYSTEM MONITORING AND ASSESSMENT (EMA), NOAA ALASKA FISHERIES SCIENCE CENTER**

Summary – see presentation

- Program operates with several collaborators and funding partners
- Loss Of Sea Ice (LOSI) program comprises the standard NOAA surveys
  - Do not usually go north of Bering Strait
- In 2012 & 2013, the Arctic Ecosystem Integrated Survey (EIS) sampled on a regular grid from the Bering Sea northward through the Chukchi Sea
  - To understand marine resources and effects of climate change on marine resources
- Saffron cod, arctic cod and snow crab are potential commercial species
- In the top 25 m, Jellyfish are dominant
- Arctic Cod are distributed throughout the Arctic
  - Quite small (25 cm) and short lived; tend to stay near the ice
  - Could be one of the sentinel species for Arctic change
- Salmon starting being caught in subsistence fishing nets about 15 years ago
  - indigenous people didn't know what to do with them because they had never seen that species; now they are caught regularly
  - Salmon took advantage of warm water in the Chukchi Sea in 2007 and have been coming back in abundant numbers 3 years later
- Invertebrates make up the major biomass of species on the bottom
- There are big differences in the species being caught as one moves northward from the southern Bering Sea to the Chukchi Sea and catches are an order of magnitude smaller in the north than in the southern areas
- There are huge numbers of crabs in some areas but crab in the Chukchi Sea are not of legal size
- The Loss Of Sea Ice program will provide a more comprehensive view of the Chukchi Sea fauna
- There is a diversity of fish and invertebrate species in the Alaskan waters with a significant north-south gradient in abundance

Questions

Do you know of any commercial application for jellyfish and brittle fish?

*No. Chinese might be looking at jellyfish potential.*

Two years ago we were told that there was a thermal barrier preventing ground fish from getting into the Chukchi Sea in large numbers – is that holding?

*The ice edge in the Bering Sea extends quite far south and when the ice melts, it creates a cold pool that sinks to bottom. Pollock don't like cold water and stay south of that cold pool. It is expected that this situation will persist into the future because there will always be a winter ice cover.*

**UPDATE ON THE STUDY OF ENVIRONMENTAL ARCTIC CHANGE (SEARCH): SEA ICE THEME GOALS AND IMPLEMENTATION: DR. JENNIFER A. FRANCIS, RESEARCH PROFESSOR, INSTITUTE OF MARINE AND COASTAL SCIENCE, RUTGERS UNIVERSITY**

Summary – see presentation

- SEARCH grew out of a grass-roots organization that had a tripartite approach based on understanding, observing and responding



- Arctic Observing Network
- Modeling processes
- Human and ecological response
- Transitioning to a new framework with some similarities to the former but with a science office and an executive director to create greater synthesis of results
  - Framework is the subject of a proposal that is with the National Science Foundation now
- action teams will be focused on specific goals to have a more direct link with stakeholders
- 5-year goals are focused on “permanent ice” - permafrost, glaciers, implications of Arctic change and sea ice
- Concerning the sea ice goal:
  - Want to improve understanding of atmosphere-ice-ocean system processes, explore consequences of an ice free Arctic for human and natural systems, understand Arctic and mid-latitude interactions and improve sea ice predictions on daily to decadal timescales
  - Arctic amplification and how it relates to ice as well as snow cover and increased water vapor in the atmosphere – potentially one of the more important factors
  - There is no controversy about whether mid-latitude weather is affected by the Arctic – only about how – an emerging topic of research
- Sea ice prediction action team involves an international network to do a better job of predicting sea ice
  - Models can inform observations as well as vice versa
  - Scales from hourly to seasonal to decadal; this project concentrates on 3 weeks to 3 years and regional to pan-Arctic
- Besides improving the performance of sea ice prediction models, the project wants to;
  - Determine what is realistically possible and communicate that with stakeholders
  - Determine what kind of observation networks are best
  - Include estimates of uncertainty in sea ice forecasts

## Questions

Any idea when we will hear about the NSF proposal?

*Hoping very soon but not sure anybody knows the answer.*

Comment from IARPC that the Inter-Agency Arctic Research Policy Committee has benefited greatly from the SEARCH work. Need to think about strengthening the linkages even more.

**U.S. ARCTIC POLICY AND THE ARCTIC COUNCIL (ARCTIC COUNCIL):** MS. JULIA L. (JULIE) GOURLEY, U.S. SENIOR ARCTIC OFFICIAL, OFFICE OF OCEAN AND POLAR AFFAIRS (OPA), BUREAU OF OCEANS AND INTERNATIONAL ENVIRONMENTAL & SCIENTIFIC AFFAIRS (OES), U.S. DEPARTMENT OF STATE (DOS)

## Summary

- The U.S. Arctic Policy dates from January 2009 – the National Arctic Strategy implements the policy – it does not replace it
- Arctic Council is the main venue for the U.S. to conduct foreign policy in Arctic regions
- At the Arctic Council, foreign ministers meet annually to sign off on reports, recommendations and the work plan
  - more recently, Ministers have signed agreements that have been developed such as the Search-and-Rescue agreement and the Oil Pollution Response agreement - important to note that these are not Arctic Council agreements but are agreements between states that have been brokered by the Arctic Council
- One of more important documents released recently is the Arctic Ocean Acidification Assessment
  - cold water is particularly susceptible to absorbing CO<sub>2</sub> and a diminished ice cover makes it easier for the ocean to absorb it
  - acidification affects a lot of sea life but most notably shellfish
  - it also affects indigenous peoples who rely on the ocean as a food source which raises food security issues
- the 1<sup>st</sup> Arctic Biological Diversity Assessment (ABA) identified the diversity of life in Arctic as a snapshot by the Circumpolar Biodiversity Monitoring Program

- Concluded that Arctic biodiversity is being degraded but action now can slow this
- Produced 9 key findings and 17 policy recommendations
- Arctic Council will decide over the next 2 years how to implement these
- Arctic Council will structure all future work on an ecosystem basis
  - Usually studies are done on sector by sector basis
  - In future they will have a greater ecosystem approach
  - It is hoped that the Arctic Council will embrace Ecosystem Based Monitoring
- 4 new task forces were created by Ministers at the last meeting in Kiruna
  - Task force on oil spill prevention to examine whether it makes sense for the Arctic Council to take action and how this might be done; the end product will likely be a road map laying out the options on how to approach an oil spill prevention program
  - Task force on black carbon and methane to press hard for domestic measures to reduce black carbon emissions
  - Task force on business is working now to create a new forum for business and hope to attract industry to support this task force as a new entity separate from the Arctic Council
  - Task force on science cooperation to examine whether it is possible to negotiate a legally binding agreement to formalize scientific exchanges and the movement of scientific equipment and data across borders
- The Arctic and the Arctic Council has risen dramatically in priority over the past few years
  - The U.S. has always been a major player in the Arctic Council and is looking forward to assuming the chair in 2015 for the second time

## **THE CHALLENGES OF ARCTIC OPERATIONS: MR. BRUCE HARLAND, VICE PRESIDENT, CROWLEY MARITIME CORPORATION**

### Summary – see presentation

- Crowley has a long history of providing marine services globally and in the Arctic
- Typical mode of Arctic operation is to follow the ice retreat northward and then move south with freeze-up
  - Generally they try to avoid ice at all costs
  - During freeze-up, ice may be far offshore while new ice is forming along shore and preventing shore access
- Reduced ice has made weather, wave and swell issues worse
- Alaska marine operations involve shallow water along shore with no docks – typically land on a beach
- For offshore development, the shallow water requires barge operations
  - 334 barges have been delivered safely since 1968
  - Wind is the primary cause of water level changes - there are no big tides - winds can easily add or subtract a couple of feet of water depth
- Wind is also the main factor in ice movement
- Often have long hose runs to tanks that are far from shore
- Double hull reduces capacity and increases costs compared to competition but Crowley has committed to double hulls because it is the right thing to do
- North slope operations are primarily onshore and very near shore in shallow water
  - North slope fleet is kept in Prudhoe Bay so they can start work in the summer before the southern fleet can get around Pt. Barrow
- There is tremendous variability in ice conditions; it is necessary to fly over the ice at the beginning of every year
- Have found hovercraft to be very flexible during the shoulder seasons
- Developed a design for an Arctic spill response vessel to support year round oil production in the Arctic
  - Fully self-contained, ice class
  - Very expensive and likely be a shared asset among the oil companies
- Crowley is developing a deep draft port at Port Clarence jointly with Bering Straits Native Corporation to support development work in the Arctic
  - development of support infrastructure will be a key step in the safe and sustainable development of the region

## Questions

Will the new spill response vessel be able to do well intervention?

*It has a crane that could support well intervention but the Challenger has been specifically designed for well intervention and would probably do this work if necessary. The spill response vessel could be a staging platform for response logistics.*

What kind of draft will be available at Port Clarence?

*We have gotten tankers into Port Clarence with 42 feet of draft and are aiming for 35 feet at the dock.*

## **U.S.-CANADA UNMANNED AIRCRAFT SYSTEMS (UAS) ARCTIC INITIATIVE:** MS. ROBBIE E. HOOD, NOAA UNMANNED AIRCRAFT SYSTEMS (UAS) PROGRAM DIRECTOR, NOAA EARTH SYSTEM RESEARCH LABORATORY

### Summary – see presentation

- New initiative with Environment Canada looking at common research needs and common requirements
- Built on collaboration – each agency brings something to the table
- Three goals
  - Arctic maritime domain awareness
  - Improved meteorology and sea ice observations and understanding
  - Coastal mapping and observations
- Marginal Ice Zone Experiment (MIZOPEX)
  - NASA experiment to look at MIZ changes including sea surface temperature and salinity and ice conditions through the melt season
  - Seeing if the research communities could work with the FAA to get approvals
  - Plan is to fly north from Oliktok Point nearly every day to monitor the changes in the MIZ using Sierra, ScanEagle and Data Hawk aircraft
  - Data Hawk can land in the ocean and become a floating buoy to measure temperatures below the surface
  - These are not as rigorous as large aircraft platforms but the intention is to test them to see if they are good enough
- Healy oil spill drill
  - Entire experiment is to test the ability of various technologies to detect and recover spilled oil
  - Will test several different UAVs – commercial and government systems – to see how well they perform in the Arctic
- Global Hawk Demonstration Flight
  - Demonstrate ability to operate in northern areas
  - First time to have a SAR on a UAV

## Questions

Will the Healy experiment be actually spilling oil for detection?

*NO. The cruise will look for oil spills and, if found, the technology will be sent.*

## **ARCTIC CHALLENGES FOR THE ENERGY INDUSTRY:** DR. GARY H. ISAKSEN, GLOBAL OCEAN SCIENCE & POLICY MANAGER, EXXONMOBIL

### Summary – see presentation

- Massive growth projected in energy demand out to 2040 is mitigated somewhat by conservation efforts globally
  - See ExxonMobil's Energy Outlook ([http://www.exxonmobil.com/Corporate/files/news\\_pub\\_eo.pdf](http://www.exxonmobil.com/Corporate/files/news_pub_eo.pdf))
- Challenges to working in the Arctic include the inhospitable working conditions for people and the need to protect the environment
- A lot of technology has been developed to enable safe development in the Arctic

- Rosneft and ExxonMobil established a new Arctic Research and Design Center for Offshore Development in Moscow focusing on personnel safety, environmental protection, engaging indigenous people, sea ice management, ice, met-ocean and geotechnical surveys, development and design criteria
- Examine ecosystem health looking at cetaceans, pinnipeds, cod and other fisheries, etc.
  - Undertake massive impact assessments prior to any operation
- Sound is a significant issue to pay attention to – sound from shipping, seismic, construction and drilling
  - ExxonMobil is trying to lead the world in developing safe practices with respect to marine sound
  - Largest sound is from seismic activities - heavily regulated in U.S. by BOEM
  - Much of the world does not have regulation; companies generally use the Joint Nature Conservation Committee guidelines of the U.K. as a minimum
  - Sound affects marine mammals because they communicate by sound – don't want to harm them or interfere with their lives
  - Ensure no physical harm is caused and doing research to determine the behavioral impacts on mammals
  - Science-based risk assessments are done to ensure appropriate standards are in place (e.g. appropriate safety zones around vessels); followed by risk assessments to understand impacts
  - Mitigation measures include having marine mammal observers work around the clock to maintain vigilance, undertaking no night work, exclusion zones, using “soft starts” to clear mammals from the area before louder sounds are emitted and listening passively for marine life
  - Large research program involving several companies coordinated by the International Association of Oil and Gas Producers; research is publicly available at <http://www.soundandmarinelife.org>
- ExxonMobil has a long history of working in the Arctic and engaging the indigenous people
  - Reviewed history of Arctic and sub-Arctic work
  - Lot of pioneering iceberg research in the Barents Sea and east coast of Canada was given to Memorial University of Newfoundland and the Canadian Hydraulics Centre
  - Worked closely with the Norwegian Polar Research Institute and the Russian Arctic and Antarctic Research Institute on ice data
  - Generally share environmental data with universities and others
- Examining environmental DNA from sea water to determine what species may be there
- New exploration areas in the Russian Arctic are about 6 times size of the Gulf of Mexico
  - Large potential for oil and gas and are the subject of massive investments
  - Major program to avoid harm to sea life
  - Walrus and Svalbard bowhead are two critical species to protect
- Arctic Leadership
  - All slides available on-line ([http://www.exxonmobil.com/Corporate/files/news\\_pub\\_poc\\_arctic.pdf](http://www.exxonmobil.com/Corporate/files/news_pub_poc_arctic.pdf))
- World Ocean Council provides a good forum for cross sector business leaders and involves a number of direct ocean users

## Questions

Do you make weather observations over the ocean available?

*ExxonMobil cooperates with the Norwegian and Russian agencies. Not sure about North American practice.*

**THE NORTH AMERICAN ICE SERVICE (NAIS):** MR. DAVID (DAVE) JACKSON, DIRECTOR, CANADIAN ICE SERVICE (CIS) AND CO-DIRECTOR, NAIS

## Summary – see presentation

- IICWG is a collaboration between the National Ice Center, the Canadian Ice Service and the International Ice Patrol
- NAIS Mission is to “leverage the strengths of the members to provide the highest quality, timely and accurate ice analyses to meet the needs of the U.S. and Canadian governments”
  - “Leveraging the strengths” is a key phrase to reduce redundancy and manage weaknesses
  - Better together than independently
  - Tremendous benefits to all three organizations related to efficiencies and improved service
- Common goals to harmonize suite of products, modeling and research activities, production tools, communication and dissemination infrastructure

- Increased efficiency by streamlining business processes - data sharing, reduced duplication, mutual backup, coordinated science and training activities
- Joint production of ice analyses in common areas of interest
- Harmonized iceberg reconnaissance and mapping operations
- Focus for 2013 is on development of a common operational system, coordinated research and development, increased data sharing, strengthened backup capabilities and coordinated information for new Arctic METAREAs
- Future work will look at increased areas of cooperation and strengthened cross training to enhance the ability of analysts to produce seamless material

## Questions

Can you tell us more about the sub-group on ice hazards?

*The Group was just formed and is developing its program of work. It is looking at automatic iceberg detection and tracking and better modeling of icebergs.*

Is there a reason that the U.S. Coast Guard is part of NAIS while the Canadian Coast Guard is not?

*The International Ice Patrol component of the USCG is a member but the USCG proper is not. However, both Coast Guards act as advisors to the NAIS.*

If I am on a USCG cutter in the Arctic, is it possible to get a daily RadarSAT image on the cutter? Is there a cost issue and who would pay?

*YES. This is done all the time. It is technically feasible although there are copyright issues because Radarsat-2 is owned by MDA Corporation. There may be costs involved but depending on who has ordered the imagery the cost may be paid by the Canadian Ice Service or the NIC. NIC's future agreement with National Geospatial Agency may allow the NIC more flexibility to share data.*

Do we have any collaboration within NATO for ice information or data sharing?

*NO. NATO has not expressed any interest in the Arctic although some members of NATO are also members of the International Ice Charting Working Group and data sharing can be done through that collaboration. The only NATO involvement is with the Digital Geo-Intelligence Working Group (DGIWG).*

Are you referring to modeling activities at the Canadian Ice Service, the International Ice Patrol or elsewhere?

*Primarily talking about modeling efforts at CIS which is shared with NIC, IIP, Naval Research Labs and other labs with which we have a relationship. Primarily model a couple of things – iceberg and ice island movement and ice development in general. We have also coupled that modeling with weather modeling at the Meteorological Service of Canada.*

## **THE 2012 REPORT CARD ON THE STATE OF THE ARCTIC: DR. MARTIN O. JEFFRIES, PROGRAM OFFICER & ARCTIC SCIENCE ADVISOR, OFFICE OF NAVAL RESEARCH**

### Summary – See Presentation

- Change is occurring throughout the Arctic ecosystem – more than just sea ice
- Arctic Report Card is trying to communicate Arctic science to a broad audience and provide useful information on the current state of Arctic
- This is an inter-agency, international and multi-disciplinary publication
- The Arctic is warming faster than lower latitudes; very positive temperature anomalies for 2012
- There has been a steady retreat of sea ice
  - Both in the minimum and, to a lesser but statistically significant degree, the maximum extent
- Albedo effect leads to more melting; heat is absorbed by the ocean in spring and released back to the atmosphere during freeze-up contributing to global warming
- Snow cover extent in Eurasia and North America is also declining to record lows in 2012
  - Allows the land surface to warm up; heat is released back up to the atmosphere contributing to Arctic amplification of the warming
  - Extensive melting of the Greenland Ice Sheet since about 2007 with longest duration in 2012
  - In July 2012 almost the entire ice sheet was melting – even at Summit Station at 3000m altitude
  - This contributes to the continuing decline in albedo which accelerates melting
  - Fresh water from ice sheet melting contributes to sea level rise

- Permafrost temperatures have been rising almost everywhere in the Arctic
  - Concern due to de-stabilizing of surface structures including roads
  - Concern that methane stored in the permafrost will be released to the atmosphere further amplifying global warming – although there is no evidence that this is happening yet
- Since 1998 there has been an increase in vegetation in the Arctic tundra as well as increased primary production in the ocean
  - Increased microorganisms in the ocean could cause problems for ship taking in this water as well as for submarine operations due to changes in acoustics of the water
- Significant change continued to occur through the Arctic ecosystem and it is very likely that this will continue into the future
- Arctic Chapter in the State of the Climate in 2012 to be published in the Bulletin of the American Meteorological Society in August 2013

## Questions

Has there been any change in when the minimum ice extent date occurs?

*Don't believe there has been any significant shift. The range of dates is quite broad and it has not shifted appreciably.*

Is the location of sea ice melt similar from year to year?

*YES to a certain extent. Initial retreat typically occurs in the Barents and Kara Seas followed by Alaska and the Laptev and East Siberian Seas. Hudson and Baffin Bays always clear out - the lower one goes in latitude, the earlier the clearing.*

In a process to capture methane from the ocean and convert it to oil and hydrogen, what quantity of methane would have to be captured to reverse or at least limit global warming?

*Cannot answer because don't know the volumes involved. However, converting methane to oil and natural gas would not solve the problem if those products were just burned as fuel.*

## **FINNISH VIEWS ON ARCTIC OPERATIONS AND CAPABILITIES: CAPT TIMO JUNTILA, DEFENSE, MILITARY, NAVAL AND AIR ATTACHÉ EMBASSY OF FINLAND**

### Summary – see presentation

- Arctic sea routes of the future may have some similarity to the Baltic Sea today
- New Finnish Arctic strategy is shaping Finland's overall Arctic policy and is being developed because of rapid changes taking place in the Arctic
- Need for infrastructure development
- Arctic Council is the most important institution in the Arctic Region
- Arctic offers substantial potential to Finland
- International cooperation to be increased to enhance business opportunities
- Resource development must respect the rights of indigenous people
- Finland has considerable Arctic expertise
- Arctic shipping experience
  - Finnish icebreakers are necessary for export and import to the country – there is ice in the northern Baltic Sea almost every winter
  - It costs 6 million euro per year to operate an icebreaker so shippers pay for icebreaking – not taxpayers
  - All icebreakers send their information to the Finnish Marine Institute that produces the ice charts
  - Ice information from the Finnish Marine Institute via Ice-map is an essential tool
  - Finnish icebreakers have assisted Shell Oil in the Chukchi Sea
  - icebreakers are very clean – no pollution
- Arctic ship design capabilities
  - All Finnish icebreakers are built or designed in Finland
  - Aker Arctic is a spin-off from Aker Yards – all kinds of testing capability – has gathered sea ice data from all over the Arctic
  - New icebreaking technologies such as double-acting ships and oblique icebreakers
  - Aker was involved in the development of the Healy and the design for the new Canadian icebreaker comes from Finland

- Arctic oil recovery capabilities
  - There are 40 tankers every day in the Gulf of Finland going to St Petersburg
  - Critical that we do not disturb nature any more – the Baltic is already one of most polluted seas
  - Must have a good response capability because any oil spilled in the Baltic will end up in Finland
  - Finland's new oil spill recovery vessel is the newest ship of its kind in the Baltic
  - New oil recovery systems for the Arctic
- New Finnish Border Guard offshore patrol vessel
- Gulf of Finland Mandatory Ship Reporting System could be an example for a Bering Strait vessel traffic management system
  - Manages many tankers and fast ferry cross traffic
  - Russian cooperation in operating the system

## **A NEW U.S. ARCTIC STRATEGY: DR. BRENDAN P. KELLY, ASSISTANT DIRECTOR FOR POLAR SCIENCES, WHITE HOUSE OFFICE OF SCIENCE AND TECHNOLOGY POLICY (OSTP)**

### Summary – see presentation

- New strategy is a reaffirmation that is completely consistent with existing national policy on the Arctic
- Premise is that conditions are changing
  - diminishing sea ice presents opportunities and challenges
- Need to safeguard peace and stability
  - Rely on international law to provide freedom of navigation
- Make decisions based on the best scientific information
- Engage in innovative arrangements
  - test public-private and multi-national partnerships
- Consult and coordinate with Alaska natives
- Strategy involves three lines of effort:
  - Advancing U.S. security interests
  - Pursuing responsible Arctic Region stewardship
  - Strengthening international cooperation
- Next Steps are to establish role and responsibilities among the various agencies, consult with the State of Alaska and Alaskan natives and to develop implementation plans for each line of effort
- Opportunity to bring greater clarity to the partitioning of roles and responsibilities among the various agencies and Arctic interests
- Implementation will build on existing efforts such as the Arctic Research Plan

### Questions

How can NGOs, Agencies or the public-at-large contribute to these plans so that there might be more robust partnerships?

*The second line of effort on stewardship is where this is most needed and most developed. In the research object we have over 240 people working on 15 teams to implement all of the objectives. These teams meet monthly and many of the meetings are open. We are struggling to get something parallel for the Arctic management objective. In integrating across all of the lines we need a very broad participation from federal and state governments, academia, industry and local people. We are going from science based focus on management to a broader scope including economic and social objectives.*

What is the timing for the roll-out of these implementation plans?

*It is scheduled for an un-specified date this fall. Best guess is the middle of October. It is recognized that the people of Alaska have a lot of valuable input to provide and so we are adjusting to ensure that there is time to gather that properly.*

What sort of specific mechanisms do you see developing for public-private partnerships? How can industry, particularly multi-national industry, engage with governments?

*Clearly, there are some areas such as establishment of shipping lanes or development of deep-water ports where industry has a big stake. Some form of innovative partnerships is required, although it is not clear just exactly what shape those would take. People are encouraged to continue to engage with government agencies.*

## **THE NOAA'S ARCTIC TASK FORCE PORTFOLIO: MR. DAVID M. KENNEDY, DEPUTY UNDER SECRETARY FOR OPERATIONS, NOAA**

### Summary – see presentation

- There are many ways that NOAA collects, produces and uses environmental intelligence
- NOAA was one of the first agencies to have a specific vision for the Arctic
- Six Arctic Goals:
  - Accurate daily forecasts of sea ice conditions
  - Strengthen Foundational Science as a means of reducing impacts of changes
  - Improve Weather and Water Forecasts to protect Alaska coastal communities from storm surges
  - Enhance Partnerships to promote cooperation and sharing of data as a means to more rapid attainment of goals
  - Improve stewardship of ocean and coast resources by ensuring that decisions are based on sound science
  - Advance Resilient and Healthy Communities through improved geospatial infrastructure, safe navigation, oil spill response readiness and climate change strategies
- Arctic is an area of focus for the National Ocean Policy; NOAA is a responsible agency in 23 of the 26 Arctic milestones; four areas are key:
  - Enhance Communication Systems
  - Improve Environmental Incident Prevention and Response
  - Improve Sea Ice Forecasting
  - Improve Mapping and Charting
- Essential that cross line collaboration occurs within each Arctic Strategy goal
- Task Force established to enhance the ability to provide an efficient one-NOAA response concerning Arctic issues
  - Comprised of world class experts to provide better scientific understanding of Arctic issues
  - Expand world knowledge of physical, biological and ecological unknowns in the Arctic
  - Ensure integrated tracking and implementation of priorities
  - Coordinated one NOAA response
  - Interface with other agencies and responses relative to Arctic
- Comprised of an externally focused chair, internally focused deputy chair and several teams focusing on different themes
- Revitalized implementation plan to be available by fall

### Questions

Can you be more specific about what is involved in ice forecasts?

*Not only movement of ice but also how much ice we have, when it is there and where.*

Is sequestration affecting NOAA's ability to acquire all the information we need to deal with the Arctic?

*YES. There are significant impacts to all aspects of our work including the number of days at sea to do hydrographic charts and the need for more observing systems that we can't afford. The list is long and therefore it is critical to have partnerships and to share data and information.*

## **STATE AND OUTLOOK OF U.S. ICEBREAKER FLEET: LCDR MICHAEL S. KRAUSE, CHIEF, USCG MOBILITY AND ICE OPERATIONS PROGRAM**

### Summary – see presentation

- USCG operates icebreakers in the Arctic north and west of Alaska and in the Antarctic to support McMurdo Station
- Contracts Canadian icebreaker to support the sealift to Thule
- Icebreakers support all 9 general missions of the Coast Guard in high latitudes – not just icebreaking
- Expect Polar Star to be fully mission ready once crew training is completed by November 2013
  - Most of crew have never operated the ship in ice
  - Complete confidence that she will do all mission tasks
  - National Science Foundation plans to use the Polar Star to re-supply McMurdo in 2014



- Polar Star should last until about 2022
- Healy is currently the only mission-ready polar icebreaker in the U.S. fleet
  - She was purpose-built for Arctic science support and is expected to remain fully engaged in scientific activities for the near term
  - Healy should last until 2030
- Coast Guard is preparing a report to congress on what it would take to reactivate the Polar Sea
- New polar icebreaker
  - \$2 million requested in 2014 to develop operational requirements
  - This is not only a COAST GUARD asset – it is a national capability operated by the Coast Guard; CG will work closely with all Federal partners to ensure the right capability for the nation
  - Estimating \$800m - \$1B and a 2022-2025 delivery

## Questions

When other agencies use a vessel is there an actual transfer of operational control of the vessel?

*When Coast Guard operates a vessel for the National Science Foundation, for example, NSF pays for operation of the ship and directs its operation to accomplish the scientific mission. However the Coast Guard does not hand over tactical control of the vessel and can divert it in the event of an urgent situation, such as a Search-and-Rescue or oil spill. When operating to McMurdo, Coast Guard hands tactical control over to Joint Support Forces Antarctic (DoD) but NSF is still the paying partner.*

Are you seeking private funding for the new icebreaker?

*As a regulatory agency, COAST GUARD cannot easily do this because of potential conflicts of interest. Coast Guard could not easily enforce laws and regulations against a sponsor or a sponsor's competitor without risking a major conflict of interest.*

Has any consideration been given for two medium or light icebreakers rather than one heavy?

*We haven't gotten there yet although we must maintain a capability. Healy is a medium icebreaker and is not the most appropriate for the McMurdo re-supply. It is not as capable as the Polar class heavy icebreakers. As a nation, we need a concerted discussion on what size and power of fleet we need.*

Can you give an example of a mission that the Healy could not do and for which we need the Polar Star?

*The obvious one is McMurdo. Healy can't turn as easily in Winter Quarters Bay as the Polar Star.*

Russia has announced plans to build 8 new icebreakers and China is building 3. Is there a danger of the U.S. falling behind?

*It must be remembered that Russia, Finland and Sweden have economies that depend entirely on their ability to move goods over ice-covered seas in winter. The U.S. has that situation in the Great Lakes and on the east coast and so we have small icebreakers that are up to the job. The U.S. has what it needs to operate successfully in the Arctic and so does Russia – it is not a race.*

Will the Coast Guard do the McMurdo re-supply every year now? How will you schedule maintenance and dry docks?

*The National Science Foundation essentially has the right of first refusal for Polar Star. The Coast Guard must ensure that necessary maintenance is done and will schedule it along with planned missions. There is time built into the schedule to handle some unforeseen events as well.*

**THE FUTURE OF THE INTERNATIONAL ICE PATROL (IIP) MISSION: LCDR MICHAEL S. KRAUSE, CHIEF, U.S. COAST GUARD MOBILITY AND ICE OPERATIONS DIVISION (FOR CDR LISA MACK, COMMANDER, IIP AND CO-DIRECTOR, NAIS)**

## Summary – see presentation

- 100 years after the sinking of the Titanic, modern ships still hit icebergs
- Trans-Atlantic ship routes pass right through the area of iceberg danger monitored by the IIP
- Iceberg reconnaissance is shared with the Canadian Ice Service as part of the North American Ice Service (NAIS)
- Single common iceberg analysis product is produced with IIP and CIS responsible for production at different times of the year to reduce redundancy, improve efficiency and service to mariners
  - Seamless to mariners and meets IMO standards

- Initiatives for 2013 and future include refining reconnaissance strategies, replacing the Iceberg Analysis and Prediction System, evaluating the NAIS model operationally, continuing satellite/UAV evaluations and developing an ECDIS product
- Current satellite technology is not good enough for IIP use
- Iceberg area is reducing somewhat in time but extreme inter-annual variability and unpredictability remain
- In future, the Area of Responsibility could increase northward to the Arctic Circle and perhaps to all of NAVAREA 4
- Future mission execution directions:
  - 2015-2020 – incorporate commercial reconnaissance to supplement USCG and incorporate satellite and other data sources
  - 2020+ - rely primarily on satellite and other data sources (AIS, ELINT, LRIT, VMS)
- A move to satellite and other data sources will require development of infrastructure and expertise for data fusion

## Questions

Could Unmanned Autonomous Vehicles (UAV) be used in lieu of C-130? How would the cost compare to C-130s?

*Technically yes. But availability and clearance from FAA to fly in these areas are issues. Cost analysis has not yet been done. We would like to fly the Global Hawk over sea ice but this could be overkill and very expensive for iceberg reconnaissance. A full analysis is needed in terms of equipment, range, payload, costs. That work is being done in conjunction with the U.S.-Canadian initiative to investigate use of UAVs.*

Is the iceberg chart product based entirely on visual observations from C-130? Is aerial photography or SAR used?

*A combination of radar and visual observations feed the iceberg model database which is used to produce the analysis. The database must be refreshed with observations about every two weeks.*

How many unique downloads are there of the iceberg charts? How much are they used by mariners?

*IIP did a rudimentary analysis of ship tracks and found that almost all ships go around the iceberg limit indicating that they are used. Dave Jackson noted that the iceberg chart was accessed from the CIS website 54,000 times last year.*

Does the use of commercial reconnaissance refer to ships and do you get reports from ships?

*The IIP does get reports from commercial mariners which are used to update the database and the limit. The talk about commercial reconnaissance is really aimed at commercial aircraft operators to free up C-130 hours. The CG would like to replace C-130 hours with less expensive hours. However, commercial aircraft would have to be funded additionally because the C-130 hours do not go away – they would be used for other CG missions. The aircraft must fly a large area to cover the iceberg limit and there are few commercial aircraft available with sufficient range.*

Are other USCG aircraft too limited in range?

*The C144 could be used at the beginning and end of the ice seasons but its radar is not optimal for detecting icebergs. It does not have sufficient range for use at the height of the season.*

## **AFTER THE ICE - POLAR ICE AS A NEW ARENA FOR CONFLICTING INTERESTS AND SOCIAL RESEARCH: DR. IGOR KRUPNIK, ANTHROPOLOGIST, SMITHSONIAN INSTITUTION ARCTIC STUDIES CENTER (ASC)**

### Summary – see presentation

- Presenting a new vision of Arctic ice as a cultural scape for polar indigenous people
- Sea ice is often seen as the domain of scientists and tourists, forgetting the people who live there
- When ice free summers arrive, a new competition may emerge for the remaining ice
- For indigenous peoples, sea ice is a familiar space – a home and barrier against erosion, a source of food, an indicator of planet health, a place for cultural activities
  - They know the ice, have many terms to describe it and have local place names that relate to it
  - It is a source of intellectual culture and a venue for indigenous knowledge
- Arctic warming affects everybody and the record ice minimum of 2012 “rung everyone’s bell”

- People create cultural space - writers, artists, painters
  - Loss of the sea ice eradicates this cultural space
  - As sea ice diminishes, the potential for conflict to preserve the cultural space increases
- Non-indigenous people have developed new visions of the icescape as a mixed blessing
  - An Impediment to transportation but protection from coast erosion
  - A barrier to resources but an asset to tourism
- Arctic polar indigenous people are not threatened by ice changes
  - They generally live along summer ice free shores and do not travel or hunt on multi-year ice
  - Record ice extent minima were non-events to polar indigenous people
  - Environmentalist groups, ice patrols, resource developers, etc. have different views of ice and are generally looking offshore and not at the same ice as the polar indigenous people
- Arctic governments have different legal views of Arctic sea ice that are sometimes inconsistent with international law
  - Experts tend to think of it as black and white – the Canadian vision of ice is that it is like land – the U.S. vision is that it is water
  - Both definitions ignore the indigenous vision of ice as a place to live, historical habitat, place of sustenance and culture
  - There is no distinct provision in SOLAS for the ice-covered oceanscape
  - No country takes the role of polar indigenous people into account in defining the icescape
- Conflicting views of sea ice appeared many years ago as a result of a planned National Science Foundation cruise to the Chukchi Sea off Barrow
  - Inupiat hunters objected to the ship coming in because of disruption to leads that would impact whale migration
  - Hunters claimed that ice would be weakened and become dangerous
  - NSF postponed the cruise
  - Inuit believe that sea ice should be maintained for the sake of communities and the subsistence lifestyle and transportation
- The World Wildlife Foundation is the only organization that has a vision for “after the ice”
  - Their “Last Ice Area” initiative received a \$2 million donation from Coca-Cola Canada
  - WWF has identified a region along the north shores of Ellesmere Island and Greenland that is expected to still have summer sea ice in 2040 when all other sea ice has melted
  - It wants this area to be designated as a special management area where habitat is preserved for ice-dependent species
  - WWF believes that polar indigenous people have the authority and should take the lead in deciding how this area should be managed
  - If it works, it would bring people together to preserve an area of ice
- As the Arctic ice keeps shrinking, it will be a new arena for conflicting views
  - People will want to keep the last ice for themselves
  - Indigenous people need it for subsistence and cultural well-being, environmentalists and game managers for protection of wildlife species, tourist companies for their business and industry and local agencies for the sake of coastal installations and transportation
- As Arctic nations see themselves becoming ice free in summer, they will realize that no international treaty protects ice – the future existence of ice was never considered
  - Should address the question as to how we should share and care for our last arctic ice before it happens and before many interested parties come to the table with their conflicting demands

## Questions

A lot of ice is formed north of the New Siberian Islands and is transported across the Arctic. It is a source of the last ice. Could some arrangement be made to limit development to preserve this area?

*From an anthropological perspective there is no response because there are no indigenous people in that part of world. From a practical perspective, people in different areas need different kinds of ice. Southerners tend to have a view of one big sheet of Arctic ice. Polar indigenous people do not view it that way. They have a view of “their” (local) ice, have very specific knowledge of their ice and view it as different from ice elsewhere. If a New Siberian ice factory produces ice, who will use that ice? Who will own it? There will also be conflicting views on whether this ice is a resource or a hindrance to transportation and development.*

**THE REGIONAL ARCTIC SYSTEM MODEL (RASM): PROGRESS AND PLANS DR. WIESLAW MASLOWSKI, RESEARCH PROFESSOR, NAVAL POSTGRADUATE SCHOOL**

Summary - see presentation

- We need a tool to understand past arctic climate and sea ice and improve short to long term prediction
  - To do both operational and climatological prediction at the same time with the same tool
  - Large computer resources are a critical need but we can get these from DoD
- Models used by IPCC have been making great advancements; there is good progress in climate prediction but we need a regional model that can work on smaller scale predictions
- Climate models give a good qualitative picture of what to expect in the future from climate but we now need to focus on processes to improve predictions
- Arctic processes are not well represented in climate models e.g. ice thickness, etc.
- Regional climate models can resolve processes better within the individual system components – ice, ocean, atmosphere, land hydrology, etc.
  - But must also address Inadequacies in the coupling between the components
  - Need to explore space scale dependent sensitivities; sub-scale processes are parameterized in models and these parameters are tuned to the space scale used
- Bottom line is that we need a suite of models at various scales that can be used in an hierarchy
- Operational test of the Arctic Cap Nowcast/Forecast System has been completed and the NIC supports moving it into operations providing forecasts out to 7 days with some skill; beyond that the skill drops significantly
- Regional Arctic System Model comprises various components representing individual processes that are linked through a coupler
  - Domain of the model covers all sea ice in the Northern Hemisphere plus river drainage to the north as well as large scale atmospheric patterns such as the Arctic Oscillation
- RASM is good at representing past ice conditions
  - Still working on improvements
- Model shows reasonable results compared to observations over 60 years
  - An objective is to arrive at consistent initial conditions across the whole system to allow better long term forecasts; current data assimilation often brings in data into various components (e.g. sea ice and land run-off) that are mutually inconsistent; RASM should improve this situation
- Models are very sensitive to minor tweaking of parameters
  - RASM is optimizing parameter space to get the best comparison with observations to improve forecasts into the future
- It is often said that heat absorbed by the ocean in summer is released in fall but that is not entirely true – only a portion of the heat is released and the rest is stored in the upper ocean (~20 m depth)
  - Some mixing to bring this warm water into contact with the ice could result in rapid melt
- Future Plans
  - Developing alternative boundary conditions for the Weather Research and Forecasting (WRF) model
  - Developing 21<sup>st</sup> century global climate model scenarios e.g. for the Community Earth System Model (CESM)
  - Working on higher resolution components for RASM including 25 and 10 km WRF and land runoff (VIC) models and 2.3 km precipitation and sea ice models
  - Addition of new components such as ecosystem and marine biogeochemical models and tidewater fiord models with ice sheet-ocean interaction

**A REVIEW OF THE EXTENDED CONTINENTAL SHELF MAPPING IN THE ARCTIC: DR. LARRY MAYER, DIRECTOR, UNIVERSITY OF NEW HAMPSHIRE (UNH) CENTER FOR COASTAL AND OCEAN MAPPING (CCOM) AND CO-DIRECTOR, NOAA/UNH JOINT HYDROGRAPHIC CENTER (JHC)**

Summary – see presentation

- U.S. has been mapping the Extended Continental Shelf north of Alaska for 8 seasons on Healy
- Driving factor is the UN Convention on the Law of the Sea (UNCLOS)
  - proceeding as if the U.S. will accede eventually
- UNCLOS Article 76 redefines the continental shelf under a somewhat complex formula

- Data, including seafloor mapping, is required to determine natural prolongations of the landmass
- Have mapped over 2 million sq. km since 2003 with the greatest effort in the Arctic where there is the largest potential for extension to the continental shelf
  - Potential for an extension the size of California
- There is no issue with Russia land claims
- Must have high resolution data to support a claim - cannot use sparse data
- Healy has a state of the art mapping system but there were doubts it could be used while breaking ice; tests in 2003 showed it was possible
- Found many differences from earlier bathymetry data
  - submarine data is plagued by errors in the inertial navigation system of the submarines
- Starting in 2009 Healy worked together with the Canadian Coast Guard Ship Louis S. St-Laurent
  - Provided cleaner mapping and seismic data
  - Data shared between Canada and U.S.
  - There will be an overlap in claims with Canada but will let the diplomats sort it out
- In 2011 there was a long transit almost to the North Pole
  - The two vessels could have gone to the Pole but were not given permission to do so by the governments
- In addition to mapping, have produced significant scientific data - dredges have brought fossil coral and several different types of rocks that are now being examined by geologists
- The area mapped since 2003 is about 389,000 sq. km
  - Much more work was done than anticipated because of the easy ice conditions
- All of the data is publicly available at [www.ccom.unh.edu](http://www.ccom.unh.edu)
- Russia has also been mapping with multibeam but is not providing the data; they say they will but never get around to it
- In 2008, for the IBCAO, approximately 6% of the Arctic Ocean had been mapped with multibeam; that is now up to about 11% - still much more to be done

## Questions

Do you have any feeling for how much of the newly mapped shelf is continental crust?

*The short answer is that, as far as UNCLOS is concerned, it is not important. Morphological continuity is the only thing that matters. Continental crust can be created in many different ways. The Chukchi Borderland is continental crust but we really don't know about the Chukchi extension.*

**NOAA'S ARCTIC ENVIRONMENTAL RESPONSE MANAGEMENT APPLICATION (ERMA): DR. AMY MERTEN, CO-DIRECTOR OF THE COASTAL RESPONSE RESEARCH CENTER, NOAA OFFICE OF RESPONSE & RESTORATION (ORR)**

## Summary – see presentation

- ERMA is a web-based mapping tool that:
  - Takes advantage of technology to integrate mapping datasets
  - Can pull information together quickly and guide decisions in emergency situations
  - Was developed by a non-GIS person
  - Is useable by an on-scene coordinator
  - Uses other organizations' web mapping servers
  - Has both a public sites and a responder site
- Site is at <https://www.erma.unh.edu/arctic>
- ERMAs can be used for developing response plans
- Has a host of linked data including geopolitical boundaries, geographic response plans, NIC ice charts, NSIDC MASIE data, NWS ice concentration, shipping routes and incident locations, Alaska ShoreZone photos
- Can take in high resolution imagery from satellite and ground radar, webcams
- Have incorporated subsistence and traditional knowledge in ERMA through a series of workshops in the communities
  - Local knowledge of currents digitized on nautical charts
- NOAA and Environment Canada have signed a memorandum of agreement for a joint project

- Edmonton workshop brought together many stakeholders in table top exercises to explore emergency response capabilities
  - Have incorporated Canadian data into ERMA
- Have worked with Shell to streamline workflow
- Stand-alone “ERMA-in-a-box” can take data to places where there is no Internet connectivity
  - Can set up a network on a ship
  - Will be tested on Healy during Arctic Shield 2013
- Next Steps
  - Continue to explore mechanisms to work with Arctic communities - everyone is getting tired of workshops
  - Find ways to incorporate outside knowledge
  - Share workloads – not duplicate efforts
  - Work toward a polar stereographic view
- Team includes command post experts – success behind tool
- Funding sources diverse – partnerships are key

**COMPARATIVE ANALYSIS OF CHANGES IN THE ARCTIC SEA ICE PACK AND THE ANTARCTIC SEASONAL ICE COVER: PROF. SON NGHIEM, ADJUNCT PROFESSOR, JOINT INSTITUTE FOR REGIONAL EARTH SYSTEM SCIENCE AND ENGINEERING (JIFRESSE), UNIVERSITY OF CALIFORNIA AT LOS ANGELES (UCLA)**

Summary – see presentation

- The loss of perennial sea ice in the Arctic in March during the 2000-2008 period was triple the loss rate in the previous three decades
  - Even in winter, perennial ice was lost due to transport through Fram Strait; this ice was replaced with seasonal ice
  - Arctic Ocean is now dominated by First Year Ice (FYI) – not Multi-Year Ice (MYI)
- In the Antarctic most ice is seasonal (FYI) but shows some minor increase
- Applying an automated classification based on Arctic ice signatures to the Antarctic does not produce a valid classification
- We must compare physical processes in the two polar regions to determine the reason for the difference
  - Ridged FYI may be desalinated and appear like MYI
  - If ice is loaded with snow, there is a strong backscatter because the scattering model is sensitive to snow
  - Need more in situ observations to understand the situation
- Pattern of sea ice distribution can be an imprint of the bathymetry - not just on a local scale but also across 1000s of km
  - Arctic is an ocean surrounded by land; Antarctic ocean is not bounded
- Arctic currents bring cold and warm water in and out of the Arctic basin; currents in the Antarctic mainly circle the continent in a counter-clockwise direction
- In the Arctic, atmospheric pressure patterns determine wind patterns that drive the sea ice; in the Antarctic, it is mostly katabatic winds off the ice sheet that drive the sea ice
- Both Arctic and Antarctic are now mostly seasonal sea ice but the Arctic ice is decreasing while the Antarctic ice is increasing
  - Different physical processes drive the two regions
  - Need more measurements – in situ and continuing satellite – to understand the differences

Questions

Is summer ice increasing in the Antarctic?

*It is increasing a very little but it is very variable.*

Comment – We should not over-emphasize the increase in Antarctic sea ice. It is a very small increase in very large numbers. A definite increase in the Ross Sea is offset by losses of sea ice elsewhere.

## **AN UPDATE ON ARCTIC CLIMATE AND ICE PROJECTIONS: DR. JAMES E. (JIM) OVERLAND, OCEANOGRAPHER, NOAA PACIFIC MARINE ENVIRONMENTAL LABORATORY (PMEL)**

### Summary – see presentation

- As of 2012 there was a 50% loss of sea ice extent as compared to climatology and a 75% loss of sea ice volume
  - It is the thinning of the sea ice that is really responsible for the Arctic becoming ice free
- The ocean north of Alaska will likely be open water from July to November within 10-20 years
  - This is probably the limit of the length of the open water season because of the cold, dark winter
- With respect to Alaska, the future is already here
  - There has been 200 miles of open water north of Alaska for the past five years
  - Water temperatures have increased 5-6 degrees – some of largest temperature anomalies on the planet
  - Easterly winds have been sweeping ice away from Alaska north shore
  - Although, last year the easterly winds were restricted west of Barrow allowing MY ice floes and ice islands from Canada to be deposited in the Chukchi Sea
- Wide range of sea ice extent predictions from models with an average about 2060 for ice free conditions
  - Models don't reflect reality of observations; too slow in bringing about sea ice loss; the difference is too great to ignore
  - Models are helpful qualitatively but not quantitatively
  - Need much better sea ice and climate models for the Arctic
  - Main shortcoming of models is the lack of physics to account for regional processes that promote Arctic amplification of warming
- Carbon dioxide lasts for hundreds of years in the atmosphere so we are locked into continuing arctic change for next few decades
  - We have transitioned from a mitigation mode to an adaptation mode
  - Mitigation is still important but will not have effect until the last half of the century
- New ice free areas impact global extreme weather although it is difficult and controversial to attribute mid-latitude changes to Arctic sea ice loss – don't understand the mechanisms
  - Loss of reflection of solar energy from sea ice results in increased net storage of heat in the ocean
  - This heat is released to the atmosphere in the fall affecting wind patterns and the jet stream
- Increase in heat from the ice free Arctic Ocean has broken down the Polar Vortex slowing the jet stream and increasing its amplitude
- More heat in the atmosphere gives a greater chance for mid-latitude extremes but because of the chaotic nature of weather we don't understand how that will work

## **NWS SUPPORTING DECISION MAKING IN THE ARCTIC: MR. EUGENE M. PETRESCU, REGIONAL SCIENTIST, NOAA NATIONAL WEATHER SERVICE (NWS) ALASKA REGION**

### Summary – see presentation

- NWS Alaska Sea Ice Services provide 24/7 support to Alaskan customers including the public
  - Integrate sea ice and weather
  - Sea ice position is incorporated into wind-wave forecasts
- Major Sea Ice Decision Support Services in FY12/13 included:
  - Nome Winter Refueling
  - Daily USCG ice and weather support December-January
  - Coastal ice shoves with Bering Sea storm
  - Integrating sea ice into coastal hazard warnings
  - Record ice extent and opilio crab fishery
  - Support to National Marine Fisheries Service, Alaska Dept. of Fish & Game, Bering Sea crab fleet
  - USCG Point Barrow spill response exercises
  - NOAA FAIRWEATHER Arctic mission routing support
  - Situational awareness for BOEM on weather and ice conditions during Shell's operations
- NWS Sea Ice Services are coordinated with NIC
- Much of the marine forecast area is covered with ice for portion of the year

- Fishery is a major customer
  - Crabbing is better in the Marginal Ice Zone
  - Ice provides safe havens from high seas and freezing spray – the top threat to Alaska mariners
  - Frequent phone conversations with fishing captains
- NWS has many key partnerships in Alaska
- Agreement with industry for the exchange of observations and services
- Specific forecast was provided to the Bureau of Energy Management (BOEM) for freeze-up at the Burger drill site
  - Used to set the trigger date by which all drilling must stop
  - Previously, November 1 had been used as a static date based on climatology
  - Historically, the ice pack tends to rapidly advance toward Burger and then hold there for some time before progressing further
  - In 2012, freeze-up occurred rapidly Oct 30-31 as a result of cold, windy conditions that removed a lot of heat from the water, followed by cold, calm weather ideal for freeze-up
  - Northerly winds likely caused upwelling of cold water over the Hanna Shoal contributing to the flash freeze
- During this situation, ice desk forecasters handled discussions with Shell while NWS headquarters held the discussions with BOEM to avoid a potential conflict of interest
- Length of the open water season is the most important parameter for operations planning
- Need more observations in the Arctic
  - Local weather is the driver for short term ice conditions
  - Numerical weather prediction models are pretty consistent over land but differ greatly over the Arctic Ocean because there are few observations to establish initial conditions
- Loss of sea ice will allow much higher sea states that on- and offshore structures will have to account for
  - Coastal locations can be at risk giving a need to evacuate people and equipment

#### Comment from Martin Jeffries

*Burger was pre-conditioned for freeze-up because there was less heat in the water to begin with due to cold temperatures over Siberia. Water temperatures indicated an earlier freeze-up than air temperatures did. WHOI and others have water column data available that could be useful for a retrospective.*

#### **EXPANSION AND EVOLUTION OF THE ARCTIC OCEAN BUOY OBSERVING NETWORK: DR. IGNATIUS RIGOR, COORDINATOR, INTERNATIONAL ARCTIC BUOY PROGRAM (IABP), UNIVERSITY OF WASHINGTON POLAR SCIENCE CENTER (PSC)**

##### Summary – see presentation

- International Arctic Buoy Program is a collaboration of 42 institutions
- Buoys are deployed by whatever means possible
- A cluster of buoys is deployed every spring at the North Pole to get as full a picture as possible of the influences on thickness distribution
  - Includes a webcam that is useful to watch the weather conditions and instruments
- The oldest ice in the Arctic Ocean is now only 2-3 years old
  - Have lost a solid platform for buoys and now lose a good number of buoys
  - It is hard to maintain a network of buoys on the Russian side of the Arctic because the ice motion keeps drifting them out
- In 2013, the ice pack is conditioned for a severe melt; a large fracture event in March allowed new ice to grow but it was very thin and weak
  - There was less snow on the surface
  - Very dynamic leads allowed the creation of a lot of thin First Year Ice
- Ice islands coming from the disappearing ice shelves in the Canadian archipelago present a significant hazard
  - Measured a 4 km long ice island that was 30 m thick
  - Some of these big pieces caused Shell to pull out
- Have been trying to develop buoys that can survive in the Arctic Ocean
  - New Air droppable buoy (AXIB) has a lifetime of 3-5 years
  - Measures surface temperature and 2 m air temperature



- Coast Guard also deploys expendable CTDs that provide the ocean temperature profile down to 500 m
- Cheaper buoys measure the temperature of the upper layer ocean designed to calculate the amount of heat in the ocean
- Have been trying a range of new buoys but realize that a more robust assessment of accuracy is needed
  - This year are planning an extensive test site at Barrow to assess very types of buoys against a highly accurate reference
- There is a big hole in the Arctic Ocean buoy network on the Russian side;
  - Trying to send as many buoys as possible to Russian icebreakers for deployment
  - Real need is for winter deployments so that the buoys will survive in the Arctic longer
- There is also a data hole in the Bering Sea – Healy will deploy 5 buoys there when transiting this year
- Inter-agency and international collaboration is the major reason for the success of the IABP
  - It provides a data set that everybody needs – weather and ocean forecasting, reanalysis, climate change, satellite surface truth

**CANADA'S ARCTIC COUNCIL CHAIRMANSHIP PROGRAMME: MS. SHEILA RIORDON, MINISTER FOR POLITICAL AFFAIRS, CANADIAN EMBASSY AND CANADA'S FORMER SENIOR ARCTIC OFFICIAL**

Summary

- Sweden returned the reins to Canada recently bringing the Arctic Council chair rotation full circle
  - The Prime Minister is personally committed and very engaged in the North – it is a very high priority
  - Exhibiting the empowerment of northern people, Leona Aglukkaq, was appointed Minister of Environment and the first designated minister for the Arctic Council
- When Arctic Council was formed, no one foresaw the enormity of the change in the Arctic
  - 1<sup>st</sup> Arctic Council meetings in the North took place in small rooms in local centers
  - today they are in larger conference rooms and more controlled
  - 32 accredited observers participate regularly
  - Permanent secretariat has been established
- Arctic Council now has role in shaping policy
  - The legally binding SAR and Oil Pollution Response agreements
- Canada wants an agenda that places people of the North at the forefront
  - Minister is intent on engaging people of the North in the development of the Agenda
  - Theme will be “Development for the People of the North”
  - Want to create conditions to enhance community growth
- Responsible Arctic resource development is not just oil & gas
  - GDP in 3 territories is expected to outpace the Canadian average
  - Yukon is the fastest growing region
  - In the short and medium term, the mining sector presents tangible opportunities for the people of the North
  - Nunavut mining investment is about \$400 million per year
  - Canada has decided to place a high priority on responsible resource development through the creation of a circumpolar business forum
    - The business community should play a larger role in the Arctic Council through new ways of cooperating and sharing unique technologies
    - Establishing a task force to implement this
- Agreement on oil spill response is a significant milestone but there should be a focus on prevention
  - Creating task force to examine this
- Ensure safe arctic shipping
  - There is increased volatility of arctic shipping – in Canada, it is totally destinational but that will change
  - Very big changes in tourism activity
  - Given shipping potential and the increase already seen in the Northern Sea Route, want to strengthen support to the Polar Code
  - In parallel, want to develop guidelines for Arctic tourist ships
- Developing sustainable circumpolar communities
  - It is directly about the people of the North - protecting them and preserving their lifestyle, language and showcasing northern culture

- Adapting to a changing climate;
- Deal with black carbon and other short term hazards
- Science will remain critical
  - Want to develop more cooperative arrangements
  - Traditional knowledge must become more important and included
- Will work closely with the U.S. as a preeminent partner and to ensure a smooth transition in 2015

## Questions

Greenland is currently boycotting the Arctic Council because Denmark removed them from the negotiating table. What is Canada planning to do to facilitate the return of Greenland?

*In the past, Greenland contributed very significantly. Canada will be working with Denmark to resolve the matter.*

How will the permanent secretariat of the Arctic Council work?

*It is located in Tromsø and the head is from Iceland. It will have a staff of 4-5 people. Its purpose is to provide greater on-going support to the Chair program. As the Council has evolved with an increased number of observers, greater depth of issues, more public awareness, it has become necessary to have a more continuous presence. The secretariat is to be an administrative body to assist the Chair. It will not be a policy body.*

## **THE U.S. NATIONAL/NAVAL ICE CENTER (NIC) - OPERATIONAL CHANGES IN AN ICE-DIMINISHING AREA OF RESPONSIBILITY: CDR TIMOTHY B. (TIM) SMITH, DIRECTOR AND COMMANDING OFFICER, NIC AND CO-DIRECTOR, NORTH AMERICAN ICE SERVICE (NAIS)**

### Summary – see presentation

- NIC is a tri-agency organization comprised of Navy, Coast Guard and NOAA
- NIC mission is to provide global ice and snow analyses and forecasts
  - Wherever sea ice poses a hazard to navigation
- Sea ice is part of the global climate system and influences the global environment
  - Also tied to global economy through commercial maritime activities
- Sea ice extent is declining in both summer and winter
  - Most significantly in the Chukchi, Beaufort, Kara and Laptev Seas
- Less ice means more marine traffic placing a greater demand on safety and security services
- There are challenges to almost every aspect of military operations in the Arctic
- Vastness of the Arctic and the many challenges it presents make collaboration among agencies absolutely essential
  - Ice Services in U.S. are provided by the National Weather Service in Alaska (regional ice forecasts), the National Snow and Ice Data Center (climatological analysis), the International Ice Patrol (icebergs) and the National Ice Center
- Limitations to the analysis and forecasting of sea ice must be understood
  - The 2 most important factors in forecasting ice are the ice conditions at the start of the season and the upper ocean
- Considerable overlap between Naval and National clients
  - Customers are mainly concerned with tactical information about the ice
  - Satellite Synthetic Aperture Radar data are very important; passive microwave radiometers miss a lot of ice; regions of interest are dark most of the year; robust partnership with Canadian colleagues to acquire SAR data
- International Ice Charting Working Group (IICWG) is one of the most important annual meetings that NIC attends
  - National ice services cooperate to share data and standards and make products look consistent
- NIC is a member of the JCOMM Expert Team on Sea Ice (ETSI) – a forum for the formal coordination of ice activities within the World Meteorological Organization and Intergovernmental Ocean Commission
- There are challenges with collaboration including distance and language barriers, different areas of interest, differing methodologies, rules of thumb, commercialization, etc.
  - Addressed and resolved at the IICWG and ETSI
- International Arctic Buoy Program is coordinated through NIC

- Polar Science Center at University of Washington manages the publicly available data and operates the web site

**UNITED STATES ARCTIC SEARCH AND RESCUE RESPONSIBILITY AND CAPABILITY: MR. JOSEPH SOKOL, JR., CHIEF OF SEARCH AND RESCUE AND PERSONNEL RECOVERY, UNITED STATES NORTHERN COMMAND (USNORTHCOM) FUTURE OPERATIONS**

Summary – see presentation

- U.S. Northern Command area of responsibility encompasses all of North America and the surrounding seas including the Bering Sea, Chukchi Sea and the Arctic Ocean north of Alaska to the Pole
- Mission is two-fold - Homeland defense and civil support
  - Deeply involved in civil support ever since Hurricane Katrina changed the paradigm for what the military could and should do
  - Northern Command coordinates the DoD response everywhere in its area of responsibility
- Responsibility to arrange for, or provide, SAR services to persons in potential or actual distress
- Governed by binding international SAR agreements
  - U.S. has a national SAR plan that was agreed to as the Arctic SAR agreement for the Arctic Council
- Most agencies don't have their own capability and come to DoD
- SAR cooperation works very well
  - Based on the International Convention for the Safety of Life at Sea (SOLAS)
- More activity in the Arctic means more potential for SAR incident – not if but when
  - More air routes over the Arctic, increased shipping, increased drilling
- SAR is all about time – must get people to place of safety as soon as possible
- However, because of great distances involved, SAR in the Arctic is approached somewhat differently
  - First locate people in distress, then stabilize the situation, and only then move people to safety
- USCG is responsible for marine areas; military commands look after land areas
- Rescue Coordination Centers in Elmendorf and Juneau share capabilities and work together
- Coast Guard, Alaska Air National Guard, U.S. Army, Alaska Civil Air Patrol and the North Slope Borough aircraft are deployed around Alaska to conduct SAR missions
  - Helicopter are the most useful asset – especially air refuellable ones that the National Guard has for long range response
  - Personnel are trained to jump into situations and provide immediate aid and support
  - Air-droppable Arctic Sustainment Packages can provide 72 hours of life support for up to 25 survivors
- Must keep in mind that the military commands are subject to battle deployment elsewhere
- DoD was asked to help respond to the Deepwater Horizon oil spill because the responsible party did not have access to everything that they needed
  - Planning teams for both near and long term
  - Mobile aerial spray system (C-130 outfitted like a crop-duster) to spray oil dispersant
  - Incident awareness and assessment through civil air patrol and Navy airships to scope where the spill was and where it was going
  - Undersea capability
  - Air coordination capability to assist civil air traffic control because the air space was very busy
  - Skimming vessels and booms
  - Strategic lift capability
  - Incident support bases at military bases
  - Manpower for cleanup
- Expects that DoD will be asked to assist in any future oil spill
  - Not in a lead role but in a heavy supporting role

**THE RUSSIAN ARCTIC STRATEGY FOR THE PERIOD UP TO 2020: MR. VADIM A. SOKOLOV, THIRD SECRETARY, POLITICAL SECTION, EMBASSY OF THE RUSSIAN FEDERATION TO THE UNITED STATES OF AMERICA**

Summary – see presentation

- Main goals of Russia in its Arctic policy are:
  - Use Russia's Arctic as a source of resources
  - Protect its ecosystems
  - Use it as a transportation system in Russia's and global interest
  - Ensure that it remains an area of peace and cooperation.
- Russia has long used the Arctic for transportation and fishing and it plans to exploit the large offshore resource deposits in the Arctic
- This strategy lays out an implementation plan for the sustainable development and national security of the Russian Arctic
- Main factors influencing socio-economic development in the Arctic regions include extreme climate, ice in the ocean, localized nature of industrial development, long distances from major industrial areas, etc.
- Main risks to socio-economic development include a negative demographic trend in most of Arctic Russia, undeveloped transportation infrastructure, icebreaker fleet and the lack of small scale aviation, high energy costs, low efficiency of natural resource extraction and high cost of production
- Compared to the developed industrial areas of Russia, the Arctic lags in technical resources, technological capabilities, scientific understanding, development and management of Arctic areas and lack of preparation for transition to innovative development
- Development priorities include:
  - Improvements in governance and quality of life for the indigenous population
  - Development of a natural resource base, modern telecommunication infrastructure and transportation on the Northern Sea Route
  - Development of new technologies in environmental management, mineral resources and water resources; prevention and elimination of oil spills
  - Reduction of the effects of global climate change under the influence of natural factors in the medium and long term, including improving infrastructure facilities
  - Participation of Russians in global and regional research in the Arctic
  - Establishment of a system of communication, navigation, and information services, including coverage of the ice conditions, throughout the Russian Arctic and along the Northern Sea Route to provide for the prediction and prevention of natural and man-made disasters
  - Effective control of economic and other activities in the Arctic through the use of the Global Navigation Satellite system GLONAS and to develop the multi-purpose space system "Arctic"
  - Protecting the environment in the Russian Arctic through conservation of biological diversity, expansion of Arctic protected areas, monitoring of ecosystems and vegetation, and elimination of past environment damage
  - Promoting mutually beneficial bilateral and multilateral cooperation on the basis of treaties and agreements
  - Combining the efforts of the Arctic states in a single coordinated Search-and-Rescue system
  - Preventing man-made disasters and elimination of their consequences by coordinating disaster response forces
  - Promoting efficient use of transit and transpolar routes, including the Northern Sea Route, for shipping under the laws of Russia and in accordance with international treaties
  - Development of international tourism
  - Maintenance of military forces and development of military infrastructure appropriate to ensure security, defense and protection of the border in accordance with existing and projected threats to the Russian Arctic
- Implementation of the strategic plan will include public-private partnerships, development of international institutions, investment in infrastructure and protection of the environment and will involve:
  - Improving the legal framework for governance in the Russian Arctic
  - Establishing special regimes of natural resources and environment
  - Government regulation of navigation along the Northern Sea Route
  - Improving regulatory procedures in traditional fisheries, indigenous communities, land use and protection of traditional homelands and economic activities

- First phase of the implementation plan to 2015 involves creating the necessary conditions for strengthening national security and the integrated development of the Russian Arctic including:
  - Improvement of the legal basis and efficiency of public administration
  - International legal registration of the Russian continental shelf in the Arctic Ocean
  - Establishment of the Coast Guard in the Russian Arctic including the creation of rescue coordination centers
  - Development of a unified national system of monitoring and policing of the Russian Arctic synchronized with similar international systems
- Second phase from 2015 to 2020 focuses on:
  - Using the competitive advantages of Russia to develop mineral resources on the Russian continental shelf
  - Developing border infrastructure and technical re-equipment
  - Establishing the multi-purpose space system “Arctic”
  - Modernizing the long range radio navigation system “RSDN-20
  - Improving the infrastructure of the Northern Sea Route and the Navy, including icebreakers, to meet the challenges of transportation within the Russian Arctic as well as Eurasian transit
- All stages of the implementation of the strategy include measures aimed at the national use of resources and the preservation of the natural environment based on comprehensive and systematic research
- Government will ensure systematic monitoring of the implementation through annual reports on the progress and results

### Questions

Is there an opportunity under the Obama-Putin presidential commission to establish a separate working group to look at collaboration that would enable the U.S. and Russia to jointly implement their Arctic strategies?

*This is very good idea. We already have good international connections but this is worth thinking about.*

Is the Russian Federation considering conducting experimental oil spills in the Arctic?

*We are going to work on oil spills and oil spill response centers and dedicate a lot of local attention to it. Industrial development is aware that they must maintain environmental security in the Arctic.*

Russia enthusiastically agreed to co-chair an Arctic Council task force on scientific cooperation. What do you hope to achieve from that task force?

*We want to see good cooperation among all the Arctic states on all of these issues.*

How will the Russian government work with the oil and gas industry?

*We really can't do anything without the industry and are trying to involve the business community in the development of the Arctic. The government is focused on environmental issues and industry has adopted a large number of the government recommendations.*

Can you explain the reasons for the negative demographic trends in the Russian Arctic zone? Is it related to a decrease in the number of indigenous people?

*Much of the infrastructure was built under the Soviet Union and is now getting very old. There is not much industry in the Arctic zone so people are leaving for opportunities to work in the south. The harsh climate discourages people from staying in the Arctic. There is not a decrease in population overall – just people moving from north to south. Russia has adopted a new program to encourage more people to the Arctic through better salaries.*

### **ARCTIC COLLABORATIVE ENVIRONMENT (ACE): MR. STEPHEN L. SPEHN, DEPUTY SCIENCE ADVISOR, U.S. EUROPEAN COMMAND (USEUCOM)**

#### Summary – see presentation

- ACE is largely funded by DoD but works closely with other agencies and academia
- Provides an Arctic-focused website that everyone can access to share data, analyses and understanding
  - No new data is created by ACE
  - Free to end users and openly-accessible through public Internet
  - Open source for community development

- Allows users to organize data in ways that make sense to them as well as collaborating together on that data
- Working across the international Arctic community
  - ACE has been endorsed by multiple agencies as well as by the Canadian embassy and Russia's Arctic and Antarctic Research Institute
- Apps to send data to ACE from mobile devices
- Currently have 350 data sources that can be linked, overlaid and grouped by end users
- Sustained through future collaborative research proposals and workshops
- Site has moved to the University of Alaska Fairbanks but plan to transition to a cloud environment in 2014
- ACE is about bringing information together to understand what you have – identify what you know and what you need to know – inform a knowledge strategy

## Questions

Is there any connection to the European Commission?

*NO. – Mr. Spehn works for the European Command as a science advisor in order to keep the project manageable*

How does this relate to security of the U.S.?

*The Arctic is one of the priority areas for the European Command for security. It was recognized that there would be issues in the Arctic and there was no single place to go to bring together information to create a picture to suit European Command requirements. Specifically, the intention was to work with Russia to develop an open-source, freely accessible tool that the international community can use to enable cooperation. By enabling cooperation and collaboration, we can enhance security of the Arctic region.*

Is there an active internet site where people can access ACE?

*The open website is very close to becoming available. It will be given to Pablo for dissemination as soon as possible.*

## **OPERATION ICEBRIDGE: DR. MICHAEL STUDINGER, PROJECT SCIENTIST FOR ICE BRIDGE, NASA GODDARD**

### Summary – see presentation

- Operation IceBridge is a data continuity mission to span the gap in laser altimetry measurements from ICESat1 to ICESat2
- Intention is to link the data from the ICESats and CryoSat with aircraft data and connect the datasets in a consistent way
- Funded until 2017
- Flying multiple instrument suites taking advantage of a large aircraft platform
- Sea Ice Science Goals are to document changes in sea ice thickness and improve sea ice thickness retrieval algorithms
- Total of 7 aircraft and 19 science instruments – about to add an 8<sup>th</sup> aircraft
- 40 publicly available data products
- All data are available free from NSIDC 6 months after data collection
- IceBridge data portal provides access to data via the Internet and an easy user interface
- Increasing amounts of data have been collected over the past few years in both Arctic and Antarctic
  - This year will fly out of McMurdo to cover Ross Sea
- IceBridge provides a quicklook ice thickness product in the Arctic Ocean to aid seasonal ice forecasting activities
  - Data from March-April flights are made available in May /June
- Snow depth is becoming a critical data set to be able to compute ice volume changes

## Questions

To what extent is IceBridge working with the Navy to compare ice thickness data from submarines?

*ICEX did exactly that. Airborne data was collected in addition to in-situ data over an ice camp with submarines below. Preliminary data shows agreement to within two centimeters.*

Is this a true ice thickness measurement or is it a freeboard measurement used to calculate thickness?

*It is a freeboard measurement combined with snow thickness that agrees very well with in-situ measurements. The product comes with confidence limits and typically we have a 50 cm confidence.*

Are any of the instruments planned for ICESat2 being flown on IceBridge?

*No. The main problem is that space instruments want to fly very high to have as much atmosphere below them as possible – typically at 60000 ft. IceBridge instruments cannot fly that high. We are collecting coordinated data with the ICESat2 instrument and find a very good comparison.*

**A GRIDDED DATABASE OF ARCTIC SEA ICE EXTENDING BACK TO THE 1800s:** DR. JOHN WALSH, CHIEF SCIENTIST, ALASKA CENTER FOR CLIMATE ASSESSMENT & POLICY, AND CHIEF SCIENTIST, INTERNATIONAL ARCTIC RESEARCH CENTER (IARC), UNIVERSITY OF ALASKA FAIRBANKS (UAF)

Summary – see presentation

- Brief progress report on data synthesis project with Bill Chapman and Florence Fetterer
- Challenge is to develop a sea ice trend that predates the satellite era using data that are diverse, not gridded and in many different forms
  - Objective is to develop digital atlas on a monthly basis going back 160 years
- Primary sources include a variety of types of datasets including satellite passive microwave, ice service charts, previously developed databases and ship observations
- Approach is to create monthly master files on a common grid
- Areas where there is no data will create two versions – one where missing data is left blank and another with interpolation in space and time
- Attempting to go from ice edge information to ice concentration by keying the concentration to a reference period where concentrations are available; best reference is the National Ice Center charts
- The initial product that has been developed shows that the recent reduction in ice is unique
  - Not much evidence of the 1920s ice loss because the two sides of Arctic tended to offset one another
- Prototype is available at the National Center for Atmospheric Research: <https://climatedataguide.ucar.edu>

Question

The forthcoming IPCC report does not include ice volume and will underestimate the impact of climate change. How can the Arctic scientific community react to this without undermining the IPCC process?

*In the U.S. National Assessment, which is almost in parallel with the IPCC, the reviewer comments hammered the authors on this point – asking that ice volume loss be considered. Some recent papers have estimated the ice volume loss as a percent over the last decade or so. These are working their way into the U.S. Assessment. Those comments led the authors of the U.S. Assessment to modify the statement about ice loss to say that it is “very likely” (90% or better) that the Arctic ice will be gone by 2050. That may still be too conservative.*

**ENERGY OUTLOOK: U.S ARCTIC OUTER CONTINENTAL SHELF (OCS):** MS. SHARON WARREN, DEPUTY REGIONAL DIRECTOR, ALASKA OCS REGION, BUREAU OF OCEAN ENERGY MANAGEMENT (BOEM), DEPARTMENT OF INTERIOR (DOI)

Summary – see presentation

- BOEM role is to manage the outer continental shelf for both energy and minerals
- Revenue from offshore development could be used to construct new Arctic infrastructure
- Of 15 planning areas under BOEM responsibility, 11 are in the Arctic representing 1 billion acres
- Current 5-year plan proposes lease sales in the Chukchi Sea and Cook Inlet in 2016, Beaufort Sea 2017
- Potential for oil & gas resources is very high in the Arctic
  - Beaufort and Chukchi Seas are viewed as the last major area for extraction

- For comparison, the Gulf of Mexico has produced 16 billion barrels of oil; 16.5 billion barrels have already been pumped through Alaska pipeline
- There has been considerable exploration drilling in the Alaska outer continental shelf in the past but it has been very sporadic from year to year
- There has been no production on the outer continental shelf
  - Northstar is closest to production
  - The first opportunity for development on the outer continental shelf is the Liberty prospect proposed to come online in 2020; but it has been in the making for many years
- There are many challenges to producing oil and gas in the Arctic
- BOEM has conducted research on the Alaska outer continental shelf for some 40 years to enable science-informed decisions
  - Ongoing environmental studies
  - Value traditional ecological knowledge - listen to natives talk about what it was like before and now
- Research partnerships are extremely important for leveraging resources and sharing information
  - Many inter-agency and international partnerships
- Follow a system of “adaptive scientific considerations”; as an example, the establishment of the “trigger date” for Shell
  - Exploration plan is first filed by industry and reviewed by BOEM
  - BOEM had concerns about an uncontrolled well incident late in the season not allowing enough time and opportunity to clean up a spill in open water
  - Shell’s plan was to use a spill containment system and so BOEM estimated how long it would take to activate that and effect a clean up
  - Another consideration was the length of time Shell said it would take to drill a relief well – the last resort to kill an uncontrolled well
  - Determined they needed to end drilling 38 days before freeze-up; used hindcast to determine the date of Sept 24
  - Told Shell that they would monitor the ice starting Sept 24 and adjust the date if appropriate
- New studies to better understand ice and ocean circulation in the Arctic
  - Produced a 30-year hind cast (1979-2009) using the Weather Research and Forecasting Model for the Beaufort and Chukchi Seas
- BOEM is a partner, along with other federal agencies and Shell, in the Marine Arctic Ecosystem Study (MARES) – there is still time for funding partners to join
- Looking at developing better operational forecasts with NOAA
- There are many reports on the Arctic that show that everyone understands the importance of the Arctic and the need for a holistic approach in research, shipping, resources, regulation, etc.
- There is no exploration drilling going on in 2013 but there is still considerable activity in preparatory work
- Considering renewable energy, Alaska has excellent wind power potential and the largest wave energy potential in the U.S.
- Outlook for the outer continental shelf is positive because the resources are there

**NAVY IN THE ARCTIC: RADM JONATHAN WHITE, OCEANOGRAPHER OF THE NAVY AND DIRECTOR, TASK FORCE CLIMATE CHANGE FOR CHIEF OF NAVAL OPERATIONS**

Summary – see presentation

- On behalf of ADM Jon Greener to communicate how important the Arctic is and what the Navy is doing
- The Coast Guard is definitely the lead in the Arctic and the Navy fully supports that
- The Chief of Naval Operations’ tenets are: warfighting, operate forward and be ready
  - The Arctic represents a new ocean and the Navy must be able to operate there
  - When the Arctic needs us, we need to be ready – we’re not quite there yet
- Salutes the Naval Ice Center for placing a focus on the Arctic long before the rest of the Navy was aware of its importance
- There is a lot of new interest in the Arctic spurred by the rapid decrease in sea ice
- Much uncertainty in predictions for when the Arctic will become “ice free”
  - Range from 2016 to about 2050
  - Personal estimate (with low confidence factor) is 2022



- Must get after the uncertainty and better predict when and where ice free and navigable conditions will occur
  - Different definitions for ice free – 0%, 10% 15% - must come to a consensus about what it means
- Navy Arctic Roadmap Update 2013 is going to outline what the Navy is going to do in the Arctic
  - Not just address what it will take to get there
- Strategic objectives are all aligned to create a safe, stable and secure Arctic
- Greater access means more maritime activity
  - Need to think about the chokepoints in the Arctic and a future where the Bering Strait has the same level of activity as the Strait of Hormuz
- It is difficult to work in the Arctic
  - Forecasting weather in the Arctic is much more difficult than anywhere else
  - Navy relies on the research community to inform them on how to deal with the challenges – materiel, people, communications, sensing, navigation, charting, understanding what is happening with the ocean
- Closing the capability gaps involves a whole of government approach
  - E.g. Navy and NOAA are responsible for hydrographic charting but neither have Arctic-capable ships – essential to partner with the Coast Guard to get this work done
- There is a lot of commonality between the various Arctic strategies – National, Navy, Coast Guard
  - Partnerships are key
- The Arctic Council is an important organization but it does not deal with military issues
  - No militarization of Arctic does not mean there should be no military there – Navy believes that the presence of a well-meaning Navy is good thing for safety, security and stability
  - Other fora, such as the Chiefs of Defense, are meeting to discuss the Arctic
- There are no adversarial relationships in the Arctic
  - Nations know they must work together
- Accession to the UN Convention on the Law of the Sea is extremely important
  - U.S. will be in charge of the Arctic Council in 2015 and is the only Arctic nation that has not acceded
- We now have a Search-and-Rescue agreement for the Arctic that defines areas of responsibilities
  - It is not a matter of “if” we will have a SAR incident but “when”
  - Must determine how we will respond when it happens – especially considering the lack of infrastructure
- The Arctic Council recently brokered an Oil Spill Response Agreement that requires each party to maintain a national system for responding promptly and effectively to oil pollution incidents
  - How could we respond to a Deepwater Horizon incident in the Arctic? Don’t know but we must get ready because it is a fragile ecosystem
- Partnerships are key to operating in the Arctic
  - With other Arctic nations
  - With academia, other Agencies
- We need to reduce the cone of uncertainty in earth system predictability
  - where and when ice free conditions will happen in the Arctic
  - Proposed that we pool federal resources to create a single operational model or ensemble of models for earth systems prediction – weather, ocean, ice, climate – research and operations – single model from global to regional scale
- Arctic is exciting – we’re not ignoring as a nation, as a Coast Guard nor as a Navy
  - We have made a lot of progress lately but we still have a long way to go

## Questions

Looking at the Arctic as a whole changes one’s perspective because it becomes clear that the loss of ice, glaciers, snow and permafrost has global consequences.

*Very true. People around the country have different understandings of the Arctic that are often very wrong. I encourage all of you to keep talking about the whole system and educating people.*

## POSTERS

### **ARCTIC SEA ICE: IN SITU MEASUREMENTS OF SEA ICE THICKNESS DURING NAVAL ACADEMY ICE EXERCISE 2013 IN BARROW, AK**

MIDN 1/C Dagmara Broniatowska; LCDR John Woods, USN - United States Naval Academy

### **SEARCH: STUDY OF ENVIRONMENTAL ARCTIC CHANGE**

Helen Wiggins; Reija Shnoro - Arctic Research Consortium of the U.S.

Hajo Eicken - University of Alaska Fairbanks

... on behalf of the SEARCH Science Steering Committee.

### **VARIABILITY OF THE MASIE PRODUCT VERSUS AUTOMATED RETRIEVAL ALGORITHMS**

Brian M. Jackson; Sean R. Helfrich; Pablo Clemente-Colón - National Ice Center, NOAA

Florence M. Fetterer; Mathew Savoie - National Snow and Ice Data Center, University of Colorado

### **COMPARISON OF THERMOCHRON AND MODIS SURFACE TEMPERATURE MEASUREMENTS DURING BROMEX**

Dorothy K. Hall - Cryospheric Sciences Laboratory, NASA/Goddard Space Flight Center

Ignatius G. Rigor - Polar Science Center / APL, University of Washington

Son V. Nghiem - Jet Propulsion Laboratory, California Institute of Technology

Judy Hoon-Starr - SSAI, Inc.

### **USNA ARCTIC BUOY**

MIDN 1/C Phillip Reynolds; MIDN 1/C Molly Solmonson; MIDN 2/C Sharon Bong - United States Naval Academy

Professor David Kriebel; LCDR John Woods, USN - Department of Ocean Engineering, United States Naval Academy

### **ICEKID AUTONOMOUS POLAR OBSERVATION PLATFORM**

MIDN 1/C Morgan C. Oblinsky; MIDN 1/C Charles E. Newman; CDR Bob Bruninga, USN (ret); LCDR John Woods, USN - United States Naval Academy

### **GETTING A BETTER RETURN ON INVESTMENT IN SEA ICE DATA**

Florence M. Fetterer - National Snow and Ice Data Center, University of Colorado

### **THE NAVY'S FIRST SEASONAL ICE FORECASTS USING THE ARCTIC CAP NOWCAST/FORECAST SYSTEM**

Pamela G. Posey; Ruth Preller; E. Joseph Metzger; Richard Allard; David A. Hebert; Alan J. Wallcraft - Naval Research Laboratory, Stennis Space Center

Michael W. Phelps - Jacobs Technology Inc., Stennis Space Center

Jennifer K. Hutchings - International Arctic Research Center, University of Alaska Fairbanks

Ole Martin Smedstad - QinetiQ, NA, Stennis Space Center

Ryan K. Wilkins - United States Naval Academy

### **REGIONAL ARCTIC SYSTEM MODEL (RASM) FOR OPERATIONAL AND CLIMATE PREDICTION**

W. Maslowski; J. Clement Kinney; A. Roberts; A. Craig; D. DiMaggio; T. Mills - Naval Postgraduate School

J. Cassano; A. DuVivier; M. Hughes; S. Knuth - University of Colorado at Boulder

W. Gutowski; B. Fisel – Iowa State University

D. Lettenmaier; B. Nijssen; J. Hamman – University of Washington

W. Lipscomb; J. Fyke – Los Alamos National Lab

W. Robertson; A. Carolina Barbosa – University of Texas at El Paso

S. Tulaczyk; S. Hossainzadeh – University of California, Santa Cruz

X. Zeng; M. Brunke – University of Arizona

R. Osinski - Institute of Oceanology, Polish Academy of Sciences

J. Renteria – DoD High Performance Computing Modernization Program (PETTT)