

**Using New Ocean Technologies: Promoting Efficient
Maritime Transportation and Improving Maritime Domain
Awareness and Response Capability**

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Sub-Committee**

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Chairman Hunter, Ranking Member Garamendi, and Members of the Committee, thank you for the opportunity to appear before you today. I am grateful for your kind introduction and welcome.

It is indeed an Honor and Privilege to be here today to talk about the creation of new and emerging ocean technologies, how such technologies could improve our government performance, the expansion of maritime commerce and entrepreneurship, and broaden our understanding of the ocean environment in support of vital US interests in the Arctic Maritime domain. Additionally, I am glad to discuss what we at Hoover and the Arctic Security Initiative view as impediments that limit or constrain the use of such technologies.

My interest in the oceans and the Arctic spans my entire personal and professional life, starting with my first trip to Norway at the age of 13 and then joining the Navy at 17. I grew up living and working on the ocean and then in my professional life, operated in the maritime environment, worldwide to include the Arctic - for almost 28 years.

When we spend our time at sea, thinking about the oceans and the implications of climate change and security around the world, particularly from the standpoint of our maritime interests, one is compelled to think deeply about marine technology, the maritime environment and the Arctic.

While I was on active duty as a senior officer in the U.S. Navy – there existed two areas beyond Naval Aviation that were of significant interest. The first was energy. What were the future energy outlooks globally and nationally from the standpoint of being able to look and see where there might be conflict, strife and friction – geo-political implications?

Then the second area was climate change. And this had a couple of components to it. One, as we look around the world, and we see the changes that are taking place, those changes have effects. Effects on water supplies for many populations around the world, agricultural forecasts, and if you overlaid demographics on where the climate is likely to change significantly, then we get a good sense of where there can be friction, where there can be needs for humanitarian assistance,

disaster relief, where we will see the convergence of climate change and serious security implications, so we were looking at it from that standpoint.

Then, a large component of climate change is what is happening in the maritime domain and the Arctic. We at the Hoover Institution tend not to get into what we call the “theological discussions” of climate change. But we do look at what “is” happening to the planet. What does climate change mean for our Security, our Economy and our Environment?

And I am pleased now to be at the Hoover Institution and Stanford, where I can continue working on Energy, Climate Change and the Arctic with the great support of the Shultz-Stephenson Energy Taskforce. Moreover, I would like to say that with the extraordinary support of Secretary George Shultz, who personally is involved in this effort, has an interest in the Arctic, and brings an incredible amount of perspective, insight and leadership to the work that we are doing at Stanford. We are also fortunate to have our work informed by former Secretary of State Condoleezza Rice, our recently returned Ambassador to Russia, Michael McFaul and a number of other scholars, practitioners and professionals from Stanford, Hoover and indeed, from around the world.

What I would like to do is start with a few thoughts and some observations, related to why we are all here and the project that we are working on at Stanford; the Arctic Security Initiative. All of us here know we are experiencing the most significant physical event on our planet since the end of the ice age, it is taking place today – the opening of the Arctic. Activity in the high north will continue to increase. Fish stocks and pursuing fishing fleets will migrate and move farther north. Access to staggering amounts of resources will expand. New maritime shipping routes have the potential to reduce shipping times, cut costs and accelerate ties among commercial centers. Indigenous populations will be affected profoundly and rapidly

As recent events in Russia coupled with ongoing climate change have highlighted, the Arctic has reemerged as a significant policy issue, in part due to the region's abundant energy, mineral and natural resources. As climate change makes the Arctic more accessible, new potential maritime routes promise to reduce shipping times, costs, and accelerate ties between major commercial centers. However, the increased activity suggests that the region is likely to become the subject of intensive negotiations, possible friction and confrontation. We in the United States need to be prepared, presently – we are not.

While the issues are many and not without challenge on many levels, the interaction and cooperative tone among the Arctic states afford opportunities to open the Arctic in a safe, secure, prosperous and responsible manner. Now is the time to approach our Arctic interests and responsibilities urgently and as a national strategic priority. The Arctic Security Initiative at the Hoover Institution is addressing that strategic priority by bringing together experts in maritime law, energy, oceanography, technology, communications and shipping.

Towards these efforts, Hoover's Arctic Security Initiative will increase awareness of Arctic issues and propose policy measure recommendations that will enable industry to develop "game changing" maritime technologies, pressurize that technology thru gaming, simulation and rigorous debate to demonstrate how such technologies can change federal and international regulatory and safety regimes; make recommendations on how federal agencies review and adopt such technologies; and evaluate the impacts such technologies can have on improving efficiency and safety of the maritime industry; and how the federal government adopts such technologies to support vital US interests.

We recognize the increasing accessibility of the Arctic Ocean is leading to greater commercial activity in that part of the world. In addition, non-Arctic states are beginning to take interest in the potential advantages the Arctic may afford them. The United States finds itself in a position where it does not have the proper government assets to operate beyond a very minimal capacity in that part of the world. In order to make informed investment decisions, a comprehensive

survey of the decision environment is required. To date, no such review appears to have been accomplished.

Our team at the Arctic Security Initiative works to inform the country and the US government that the United States "IS" one of eight Arctic nations, that we will face directly the changes, challenges, opportunities and responsibilities of the Arctic evolving as a strategic territory. While access will increase, the region will remain a challenging place. The past few years have seen the least amount of ice coverage in recorded history but the stormiest one on record. This coupled with the fact only a small percentage of the Arctic has been surveyed to enable safe navigation; and navigation and communications systems, commonplace in other regions of the world, are absent or degraded in the high north. The physical infrastructure to support resource extraction, commerce, environmental response and inevitable search and rescue operations is scarce. Our Coast Guard and Navy, stretched thin by other global obligations and significant budget constraints, must now add the high north to their areas of operations.

Legal schemes for the new maritime transit routes are evolving and the basis for addressing resource claims and disagreements will be the UN Convention on the Law of the Sea, an agreement to which the United States regrettably is not party. Next year, the United States will follow Canada as the Chair of the Arctic Council, the forum that addresses issues faced by the Arctic governments and indigenous people.

Additionally, when we speak on the Arctic we remind audiences that the Arctic and the Antarctic are very different. The simple and narrative way that I like to describe them is that the Antarctic is land surrounded by water, and the Arctic is water surrounded by land. Moreover, for those of us tied to the sea, the oceans, the maritime domain - when there is more water -- we tend to get excited about that. And, we need to pay close attention to it.

To build on this overview, allow me to frame the discussion further within four domain areas we at Hoover consider quite foundational, seminal.

First, we look at the Arctic from the standpoint the tremendous resources in the high North, and we expect that people, organizations and nations will seek to develop those resources.

Next, is the environment, what is happening to this pristine geographic area on the earth, an area that really has not been greatly affected by humans over time.

Further, another deeply important aspect is the indigenous population and peoples that exists in the Arctic.

Finally, is security. And by security, our view and what we're working on at Hoover and what we talk to our government about is NOT the military dimension exclusively, but what must be in place in the high North, and the area that's opening up in an unprecedented way – what needs to be in place to ensure a safe, secure, and prosperous Arctic?

When people talk about the resources in the Arctic, it is very easy to visualize drilling rigs, and all of the activity that goes with it to extract energy from the earth, whether it is oil or gas. Nevertheless, there is a lot more in the way of resources in the Arctic. The largest zinc mine in the world is in Alaska, the Red Dog Mine. In Siberia, there are large nickel and copper mines. In Canada, a huge iron-ore mine on Baffin Island. And in southwest Greenland, there's estimated to be one billion tons of iron ore. And this is not just speculation, because the Chinese have seen fit to invest \$2.3 billion in southwest Greenland to go after that ore.

So when we talk about resources, those are significant, remembering that doesn't account for the resources that are on the sea beds. That too will be of value to individuals, organizations and world populations. And then when we look at the estimates on the undiscovered energy resources, 30% of the undiscovered gas is estimated to be in the Arctic, and 13% of the world's undiscovered oil is in the Arctic.

That leads us to the environmental issues once you move away from the resources, because people will be coming for the resources. They already are. What are some of the environmental issues that come into play? As we know - it is still a very, very harsh place. As mentioned, we

recently experienced the stormiest year in recorded history. That, coupled with the fact it is dark most of the time. The capacity and capability to move and respond to events in the Arctic, the infrastructure quite frankly is not there, and our Coast Guard has led some exercises there to test and to try to determine how the United States will respond to events that take place in the high North. Another impacted area, the shoreline. Because of the climate change taking place, the shoreline in Alaska is changing dramatically. The ice is breaking off from the shore. In some cases, the ice is crushing into the shore as it moves around. The permafrost is melting and heaving up the earth, so the structures that are already there, are being damaged and in some cases destroyed. In addition, as that permafrost is melting, there are large quantities of methane gas being released into the air. There will be, as the warming trend continues, a movement north of vegetation, migration of wildlife and insects and what will that do with regard to disease factors that may be carried by those insects?

So there are many environmental considerations that are going to come into play, how do we respond? What's the best way to respond to them?

When we look at indigenous populations in the Arctic, their way of life may be ending, a way of life that for millennia they have lived as subsistence culture of hunting, sealing, fishing, and whaling. Their communities will no longer be in positions to be able to do those activities as before. An estimated four million people live in the Arctic, and that four million is beginning to migrate a bit. In addition to this migration, the resource extraction industries that are being further developed in the Arctic, are bringing non-Arctic populations to the high North. Large numbers of people from Central Asia, Poland, there is even a large Thai community up in the high North areas working on the energy and resource development sites.

And it's that population that also distinguishes the Arctic from the Antarctic. Four million people live above the Arctic Circle. No indigenous peoples live or have ever lived in the Antarctic. A lot of penguins, but no people.

When we look at the security requirements, the US and other Arctic Nations need the capacity and capability to support, respond and react to the events that are taking place. Moreover, when we look at security – as we have said, it is about safety, adequate and able response for

environmental or other accidents that might take place in the high North, and it is there that our Coast Guard is going to be on the front lines of anything that happens in the Arctic.

So what we're doing is looking at what's the most thoughtful, what's the best and most responsible way to move forward, because the Arctic is changing quickly, and the United States is an Arctic nation. If you go to the state of Alaska, you come away knowing the United States is an Arctic nation. If you go to other places in the US, I am not sure that you come away with that same sense. Nonetheless, we are at a period of time, with these changes are taking place, that the United States needs to start making some strategic decisions, we have to start making some significant investments.

We need to decide and then "act" on how we want to posture ourselves in the Arctic, and we are having to do it at a time when we do not have a lot in the way of budgetary flexibility.

Last February, the Navy released the U.S. Navy Arctic Roadmap for 2014 to 2030, a document outlining a naval planning framework for the region. The document lays out various necessities for Naval capabilities in the Arctic, from new satellite communications equipment to cold-weather training exercises. The Navy's road map followed the Department of Defense's "Arctic Strategy" report of November 2013 and the White House's May 2013 "National Security Strategy for the Arctic Region." The documents together make up a nascent Arctic strategy.

Recognizing that more needed to be done, in January of this year, President Obama released the US Implementation Plan for the National Strategy for the Arctic Region in an effort to better direct and coordinate all of the aforementioned strategies.

The President's plan aims to provide guidance to a host of federal departments and agencies. In part, the plan can be viewed as the initiation of an "integrated Arctic management" process with a clear objective to engage with the state of Alaska, Alaska natives, and key stakeholders and actors from industry, academia, and nongovernmental organizations.

For the maritime domain, the plan presents a ten-year horizon that will be used to prioritize federal infrastructure in the U.S. maritime Arctic. The plan also calls for a ten-year projection of Arctic maritime activity to be completed by the end of 2014. This will be a very challenging task given the great number of economic, environmental, and geopolitical uncertainties influencing Arctic marine operations. Determining accurate ranges of quantitative information on the levels of Arctic traffic has proved to be elusive given the volatility of global commodities markets and the dynamic nature of the global shipping enterprise, among other key factors. It is not surprising that within the section on the maritime domain the plan calls for recommendations for federal public-private partnerships to support the prioritized marine infrastructure elements that are to be developed by the federal agencies.

This may prove to be an early indication that, without investment partnerships with the private sector, new initiatives such as U.S. Arctic economic development may be constrained or limited by the federal budget process.

The plan recognizes a number of key requirements that relate to a changing U.S. maritime Arctic and its future. Included are major initiatives on developing telecommunications services, enhancing domain awareness, sustaining federal capability to conduct maritime operations in ice-covered waters, protecting the Arctic environment and identifying sensitive areas in the U.S. maritime Arctic, increasing charting in the region and improving geospatial referencing, improving oil and other hazardous materials prevention, containment, and response, and supporting a circumpolar Arctic observing system. This is just a subset of the many tasks presented in the plan but it is clear that the maritime domain requires special and timely attention using integrated approaches that can respond to a broad array of security challenges.

Recently at the Chicago Council on Global Affairs, US Secretary of Defense Chuck Hagel stated: -

"We also must adjust our capabilities to meet new global realities, including environmental changes. Just today, the nation's top scientists released a National Climate Assessment that

warns in very stark terms that the effects of climate change are already becoming quite apparent. One area where we see this is in the Arctic. The melting of gigantic ice caps presents possibilities for the opening of new sea lanes and the exploration for natural resources, energy, and commerce, and also the dangerous potential for conflict in the Arctic. The Defense Department is bolstering its engagement in the Arctic and looking at what capabilities we need to operate there in the future - as described in DoD's first-ever Arctic Strategy that was introduced at the Halifax International Security Forum last November."

The US can ably and well develop strategies and discuss plans – as the saying goes, talk is cheap. Nevertheless, a strategy or a policy in my mind, without a budget, is nothing more than a wish, it's almost nothing. Therefore, our goal remains to inform and further motivate some of the thinking of the US Government to act, fund and fully resource a serious Arctic strategy and policy.

The areas that we are looking at in a disciplined manner at Hoover are, for example, the infrastructure piece. How do we put in place the airfields? The Ports, The bases?

The staging of equipment that may be required to respond to some of the challenges, to the recently formed Search and Rescue agreements and spill response? We only have one deep-water port in the Arctic, Dutch Harbor, Alaska and it's about as far from the Arctic as you can get in Alaska. But it's still considered to be an Arctic port, and it truly is.

Another issue that we face is that even though it appears at times most of the ice was flushed out of the Arctic Ocean, the fact of the matter remains that ice, like politics, is local. We expect to find for some time to come areas where the ice has closed harbors, or closed shipping routes. And so how do we clear that? And one of the challenges that we as a nation have and more specifically, the Coast Guard has, is our icebreaking fleet. And even though it may look as though the ice is all gone, icebreakers will be required to get in and out of places that are going to be important to us and others economically. Icebreakers will be required to respond to events, whether it is a search and rescue operation or an environmental problem. And let me just give you a sense of the Arctic nations' icebreaking capability. Russia has 43. Sweden has nine. Finland has nine. Canada has 13. And the United State has two. And one is around 40 years old,

a great ship...Forty years. And so how do we think our way through that, and what's the best way to reconstitute that Icebreaking capability that will be required? US Navy and Coast Guard Ships that operate in the oceans today aren't equipped, aren't hardened, don't have the systems on board that will allow them to operate in that harsh, cold, and at times rough Arctic climate, so those too are some of the investments that will have to be made.

Communications and navigation in the Arctic is very different as we know. When we get above about 74 degrees north latitude, the communications that are so much a part of how we move around the world today are not as robust, are not as reliable, do not have the capacity and bandwidth that we've become so used to in the world in which we live.

When we look at the bottom of the Arctic Ocean, only about 10% has been surveyed. So as we look at a nautical chart, where many surveys have been done in other parts of the world, only 10% has been done in the Arctic, and most of those surveys are between 50 and 80 years old. So we have a bit of a backlog to deal with and much work to do. But we're pleased as we look at these challenges of communication and navigation that we are embedded in Silicon Valley and Stanford University where we're getting some great support, also from the University of Alaska, University of California and Georgia Tech, where they've been thinking about this problem for quite some time. We look forward to further collaboration with the University of Tromso and the Norwegian Institute for Defense Studies and others as well.

The other area that will come into play in the Arctic is shipping. Globalization and climate change are affecting Arctic shipping in extraordinary ways. The Arctic is being increasingly linked to future global markets by the development of offshore and onshore natural resources. These developments require Arctic marine transportation systems that are safe and reliable, and, importantly, a host of marine infrastructure improvements are needed to ensure safety and efficiency.

Hydrocarbon exploration in offshore Arctic areas of Norway, Russia, Greenland, and the United States have required extensive summer marine operations using small fleets of support ships, including icebreakers. Russia's Northern Sea Route, a set of Arctic waterways across the north of

Eurasia from Kara Gate in the west to Bering Strait in the east, has experienced an increase in tanker and bulk-carrier traffic during recent, summer navigation seasons.

Most of the central Arctic Ocean is being explored in summer by icebreakers and research ships in support of the delimitation of the outer continental shelf by the five Arctic Ocean coastal states. Simultaneous to the notable increases in marine traffic driven by economic interests, Arctic sea ice has been undergoing profound changes in thickness, extent, and character in the current era.

As new sea routes open they will connect the world in different ways than we have seen before. Without question, there has been a significant change in the percentage of shipping, but I would also say that we have to be mindful that is due to the law of small numbers, those numbers will continue to increase.

Arctic tourism has taken off in recent years and the US Coast Guard's most recent Arctic strategy is forecasting over a million tourists in the Arctic in the next year. Large cruise ships and specialized expeditionary (tourist) vessels have been operating during summer in eastern Canada, along both west and east Greenland coasts, and around Svalbard in increasing numbers.

With this in mind, let's recall Costa Concordia, lying on its side off the coast of Italy, where most people could just jump off into the water and swim ashore. What's going to happen in the Arctic, where we don't have the infrastructure to go after them? And that's just one reason why the infrastructure piece is so important in my mind, to be able effect search and rescue on that scale, Humanitarian Assistance and Disaster Relief.

I think the challenges of extraction and natural resource development and the shipping that supports those efforts demand the same level of support and response. When Shell was working off the coast of Alaska, they had a number of ships up there that I think any Coast Guard or Navy would be envious to have in their service. Bottom line, these activities will require a significant amount of shipping and maritime support in the Arctic.

A little more on the Ice. During the past three decades, observations have shown that Arctic sea ice has continued to decrease in extent and thickness. Broad areas of the coastal Arctic Ocean have become ice-free during summer periods (September) when Arctic sea ice is at its minimum extent. However, the Arctic Ocean remains fully or partially ice-covered for much of the winter, spring, and autumn. It is an ice-covered ocean that requires international regulation (and standards), *not an ice-free environment*.

From the perspectives of marine safety and environmental protection, this is a critical, practical factor since future ships operating in Arctic waters will likely be required to have some level of polar or ice-class capability including suitable construction standards, ice navigator experience, and Arctic safety equipment. With this enhanced capability they can safely operate in extended seasons of navigation beyond the short summer operational period.

Global climate models (GCMs) simulate a continued reduction of Arctic sea ice extent. An entirely ice-free Arctic Ocean for a short period of time in summer is projected to occur before midcentury. Such an occurrence would mean that no more multi-year or “old” sea ice will remain in the Arctic Ocean and the region will have a seasonal, first-year ice cover in subsequent years. A plausible result is that future sea ice covers will be more navigable by ship, although this thinner ice cover will likely be more mobile under the influence of local winds.

Recent research has focused on how changes to Arctic marine access can be evaluated by using sea ice simulations from the Global Climate Models and a range of polar class ship types. Higher class ships, Polar Class 3 for example, have been found to gain significantly greater marine access, nearly year-round for much of the Arctic Ocean.

By midcentury, changing sea ice conditions may also allow lower polar class vessels, for example Polar Class 6 with a modest ice capability, and perhaps even non-ice strengthened, open water ships to cross the Arctic Ocean in September. None of these research results indicate that regular trade routes are possible, only that certain types of ships may or may not have marine access at specific times of the year, given a range of climatic projections.

However, this research does provide key information about plausible, and technically possible, seasons of navigation. The type of cargoes being carried and the economics of global shipping, along with governance and environmental factors, will determine which Arctic routes might be viable for seasonal, regular traffic.

For the U.S. maritime Arctic, this increase in marine accessibility plausibly means longer ice-free seasons for offshore hydrocarbon exploration in the decades ahead. Seasonal barge supply of coastal communities, and barge support to oil and gas projects, can expect longer summer seasons of relatively ice-free conditions for their operations along the northwest coast of Alaska. Sometime during the next two decades, an extended and reliable navigation season of six months could be attained by Russian authorities for the eastern reaches of the Northern Sea Route Specifically in the Laptev and East Siberian seas.

This expanded Arctic operation will likely result in commercial ship traffic sailing through western Bering Strait earlier in the spring and later each autumn. The ice-class bulk carriers and tankers will likely experience ice conditions along the Russian coast of Bering Strait during these early and late season voyages. This is in contrast to the normally ice-free environment during a long “summer” season throughout the strait. These are some of the challenges, and I was pleased to read recently where the International Maritime Organization has come out with an intention to have a polar code in place by 01 January 2017 for polar shipping.

But then, what are some of the indemnification rules that are going to come into play? And how do ships get insured? And what’s the best way to deal with insurance as ships move through what is going to be a fairly challenging place?

I’ve touched on infrastructure – the infrastructure on shore – a couple of times. And I think we have to look at that hard ... because of the budgetary environment we’re in, we’re going to have to look at public-private partnerships that can support the range of activities that are taking place in the Arctic.

Then, how do we power the Arctic so that we are not creating emissions that will only exacerbate the changes that we are seeing already? And so we're going to be spending some time looking at what the energy requirements are going to be in order to support this increase in activity in the high North.

And then as we develop all of this and as others use the Arctic Ocean, who pays when there is a problem? Because it will be the Arctic countries that will respond to the problem, and that will come at a cost. So what will be the roles, goals and responsibilities of the other countries that are using the Arctic?

And that brings into play the governance of that space. Right now, we often talk about the Arctic as being the most cooperative place on the planet and arguably, apart from the weather, the most benign place on the planet.

The Arctic nations, the eight Arctic nations and the indigenous communities that are represented there, it really is a model of significant cooperation. We believe that it is very important, that governance model and that level of cooperation is maintained as we go into the future. We cannot allow ourselves or the world to be significantly distracted by the recent activity of Russia and its close neighbors – however, if left unmitigated – could result in a disruptive Arctic geopolitical environment where there was once great cooperation.

Looking ahead, Canada has the chair of the Arctic Council, and in about a year's time - in May of 2015, the United States becomes the chair of the Arctic Council. Moreover, I think we have an opportunity, working closely with our friends and allies, of being able to develop a continuum of recent initiatives, work and progress that could be very, very helpful to maintain stability and an air of cooperation in Arctic matters.

On that theme, we are also looking at some of the maritime legal dimensions of the Arctic. As these new maritime transit routes come into play, and as the Maritime Arctic countries look at the routes that may come through some of their territorial seas, what are the requirements, and how does that affect our view toward what have become accepted international norms and

accepted elements of maritime law? And will there be initiatives to change that in ways that are helpful or perhaps not optimized?

Unlike in Antarctica, there is no overarching legal convention for the Arctic. The regime that now governs the region is a combination of legal arrangements including national domestic laws, bilateral agreements, global treaties (such as UNCLOS), customary law, and a variety of international maritime conventions negotiated under the auspices of the International Maritime Organization, including the International Convention for the Prevention of Pollution from Ships (MARPOL), The Safety of Life at Sea Convention (SOLAS), and The Standards of Training, Certification and Watchkeeping (STCW).

Shipowners, cargo owners, insurers, port authorities, and trade and labor union associations, among others, might also ordinarily play an indirect role as market participants in determining when and where shipping in the Arctic should occur and under what conditions. However, since the Arctic is not yet a venue for sustained shipping traffic very few commercial standards have evolved. The Arctic is still perceived as distant, remote and no concerted effort has been taken by the international business or legal communities to address the underdeveloped regulatory environment—even though the physical environment is changing rapidly!

But those are some of the governance issues that we have been taking a very hard look at.

And then of course, there's the issue of claims in the Arctic. We have talked about the resources that are in the high North and the exclusive economic zones. Then there is the subject of the extended continental shelf, what extends beyond the exclusive economic zone. And the United States is extraordinarily fortunate to have projections of an extended continental shelf that are really quite generous and quite prosperous.

However, the problem is those claims are going to be adjudicated through the Convention on the Law of the Sea, of which the United States is not a party. And the amount of area and the wealth that we are discussing is absolutely extraordinary. The estimates on the US extended continental

shelf is almost twice the area of Alaska. The big difference is, that we had to pay for Alaska. We don't have to pay for the extended continental shelf.

That being said, gaining exclusive sovereign rights over the full potential U.S. Arctic extended continental shelf will prove difficult, however, due to the close proximity among the United States, Russia, and Canada and the potential for overlapping claims to extended continental shelves, and I think that's going to be problematic.

The potential implications of this extended continental shelf regime are profound. The U.S. continental margin off the coast of Alaska alone may extend to a minimum of 600 miles from the Alaskan baseline. Alaska's extended continental shelf lies over the Arctic Alaska province, one of the many oil- and gas-rich basins in the Arctic. It is estimated that there may be almost 73 billion barrels of oil and oil-equivalent natural gas located in the Arctic Alaska province, the second highest estimated production capability of all Arctic provinces. The continental shelf within the 200-mile EEZ under the Beaufort and Chukchi Seas alone may have over 23 billion barrels of oil and 104 trillion cubic feet of natural gas.

And then the other question relative to the United States accession to the Convention on the Law of the Sea is we will become the first chair of the Arctic Council that is not party to that treaty, what are the implications of that?

So we ask, what are some of the regulations and policies that we have in place, and what is still required, that will allow a responsible, practical means of addressing the Arctic issues? And I'm not sure the United States is well positioned, because if we look at what has happened recently, some of the companies that have been interested in doing some work in the off shore Alaska area have decided that they will move elsewhere because of the legal ambiguity, and what are the implications of that ambiguity? These are the questions we are attempting to answer.

To place a finer point on the themes highlighted earlier, the United States finds itself challenged now, early in the twenty-first century - to respond to a host of changes and uncertainties in its maritime Arctic.

Economic opportunities to develop the region abound as visibly evidenced by federal leases of offshore areas for hydrocarbon exploration. Future opportunities exist that require development of the maritime infrastructure necessary to facilitate shipping Alaska's Arctic natural resources, both onshore and offshore, to global markets.

From an environmental security perspective, the United States is especially challenged to provide a robust safety net to protect Alaska's coastal communities its world class Bering Sea fishery, and the Arctic marine environment in an era of expanding Arctic marine use.

The range of necessary policy responses and long-term investments confronting the U.S. maritime Arctic is significant, perhaps daunting. Above all it is critical for the United States to ratify UNCLOS at the earliest opportunity.

With regard to Arctic shipping, the United States should continue to be proactive at the IMO in support of a mandatory polar code that must include all commercial ships operating in polar waters. The United States also should propose future IMO measures that focus on specific Arctic regulations, as well as developing port state control agreements with the Arctic states to enhance polar code enforcement. Timely application of a new IMO Polar Code to the U.S. maritime Arctic will require expedited regulatory implementation by the Coast Guard.

The United States, as one of the lead countries (along with Finland and Canada), should use the Arctic Council's Arctic Marine Shipping Assessment (AMSA) as a strategic guide and policy framework to protect the region's Arctic communities and the marine environment, and to enhance regional marine safety. Increased funding of NOAA for Arctic hydrographic surveying and charting is paramount if a safe maritime operating environment is to be secured, and coastal economic development can be initiated.

A comprehensive environmental observing system, a deep-draft port, and improved Search and Rescue and environmental response capacity and capability are among the critical infrastructure needs for the future of Arctic Alaska. Public – private partnerships must be conceived and fostered to ensure that adequate funding is available for large, maritime infrastructure projects such as a major port during a time of austere federal budgets.

Nevertheless, strategic investments in Arctic infrastructure by the federal government will be required to enhance public safety and security, and advance economic opportunity in new partnerships.

The U.S. federal government must better execute its legal responsibilities and implement its promise of using an integrated Arctic management approach in the region. These challenges will necessarily require close federal-state of Alaska cooperation and greater stakeholder engagement. The future of Alaska and the future of the United States as an Arctic nation depend on sound strategic planning at the outset of new national initiatives. Thus, the timely Implementation Plan of the National Strategy for the Arctic Region (2014) as a framework for federal process is essential. Executed in a comprehensive and integrated manner, these actions can enhance America's National Security, Economic strength and Environmental interests in its large maritime Arctic.

In closing, while the issues are many and not without challenge on many levels, the maritime industry and entrepreneurial maritime clusters of this nation afford great opportunities. Now is the time to approach our maritime and Arctic interests and responsibilities urgently and as a national strategic priority.

Thank you again, Mr. Chairman, Congressman Garamendi, and Members of the Committee, for the privilege of appearing before you today. I look forward to the remainder of the hearing and would be pleased to respond to your questions.