Alaska and the New Maritime Arctic Executive Summary

Executive Summary of a Project Report to the State of Alaska Department of Commerce, Community and Economic Development

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Photo by Ethan Roth

TABLE OF CONTENTS

2 Introduction
4 Key Drivers to Arctic Marine Traffic
6 Arctic Marine Shipping Assessment (AMSA)
8 Importance of the IMO Polar Code
10 U.S. National Strategy for the Arctic Region
12 Changing Marine Access and Sea Ice
14 Marine Traffic
16 Northern Sea Route and Northwest Passage Developments
18 Links to U.S. Arctic Offshore Development
20 U.S. Maritime Arctic Infrastructure Needs
22 Maritime Workforce Potential
24 Major Findings of the Study and International Workshop
30 Recommendations of the Project

American Seafoods Group

Alaska and the New Maritime Arctic
Executive Summary

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INTRODUCTION

Globalization and climate change are impacting the maritime Arctic in extraordinary ways early in the 21st century. The Arctic is 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 a host of infrastructure improvements to ensure safety and efficiency. This fact is especially true in the U.S. maritime Arctic off the coast of Alaska where there is very limited marine infrastructure. The rapid changes in the Arctic pose an array of challenges and implications for the maritime Arctic of the United States and the State of Alaska. Offshore hydrocarbon exploration and increased marine traffic along Russia's Northern Sea Route are bringing new and extended seasonal marine operations to the region. The absence of and any international rules and standards will change on 1 January 2017 when a new, mandatory International Maritime Organization (IMO) Polar Code (for ships operating in polar waters) will come into force. This project report explores several key challenges and opportunities that the State of Alaska and the U.S. confront in taking advantage of the economic opportunities these profound Arctic changes present, as well as responding to environmental security issues that have arisen with increased Arctic marine use.

NANA Development Corporation

KEY DRIVERS OF ARCTIC MARINE TRAFFIC

The Arctic's abundant natural wealth is attracting global attention and simulating a need for transportation systems in the maritime Arctic. Although Arctic sea ice retreat provides for greater marine access, the principal driver of today's increasing Arctic marine traffic is the development of natural resources influenced by global commodity prices, and in the longer-term, scarcer natural resources around the globe. This is the primary driver of increased marine traffic around Alaska and within the U.S. maritime Arctic. The Arctic Council's Arctic Marine Shipping Assessment (AMSA) conducted 2005-09 used a scenarios creation process to identify the main uncertainties and factor shaping the future of Arctic navigation to 2020 and 2050. Among the most influential driving forces of some 120 factors were: global oil prices; new Arctic natural resource discoveries; climate changes severity; a major Arctic marine disaster; transit fees for waterways; global (IMO) agreements on Arctic ship construction rules and standards; the legal stability and overall governance of Arctic marine use; the economics implications of seasonal Arctic marine operations; and, the entry of non-Arctic flag ships into the maritime Arctic. The AMSA scenarios effort identified two primary drivers as axes of uncertainty in the scenarios matrix used for development of four plausible futures of Arctic marine navigation: *resources and trade* (demand for Arctic natural resources influenced by the uncertainty of global commodities markets and market developments), and the *governance of Arctic marine activity* (the degree of stability of rules and standards for marine use both within the Arctic and internationally). A visible example of the primary driver being natural resource developments can be viewed in the growth of the numbers of tankers, bulk carriers and LNG carriers along Russia's Northern Sea Route.

Arctic Marine Shipping Assessment Scenarios Matrix

ARCTIC MARINE SHIPPING ASSESSMENT (AMSA)

The far reaching study, AMSA, conducted under the Arctic Council's working group Protection of the Arctic Marine Environment (PAME), focused on marine safety and environmental protection issues consistent with the Council's mandate. Ninety-six AMSA findings were presented in the *Arctic Marine Shipping Assessment 2009 Report*; each of these key findings has direct applicability to the U.S. marine Arctic. AMSA's 17 recommendations focus on three interrelated themes;

(I) Enhancing Arctic Marine Safety;
(II) Protecting Arctic People and the Environment; and,
(III) Building the Arctic Marine Infrastructure.

Notable in the AMSA report was a detailed section on the Bering Strait region indicating that the region is a natural chokepoint for maritime traffic, marine mammals, and seabirds. Required in the region are a comprehensive survey of marine use by coastal communities, and identification of areas in the U.S. maritime Arctic that could be considered of heightened ecological and cultural significance.

The AMSA effort can be viewed in three important perspectives: first, as a *baseline assessment* and snapshot of Arctic marine use early in the 21st century; second, as a *strategic guide* to a host of states, Arctic residents, users, stakeholders and actors involved in current and future Arctic marine operations; and, third, as a *policy framework document* of the Arctic Council and the Arctic states focused on protecting Arctic people and the marine environment.

Key Findings of the Arctic Council's Arctic Marine Shipping Assessment (AMSA 2009 Report). All have relevance to the U.S. Maritime Arctic.

Governing Legal Regime ~ The Law of the Sea, as reflected in the 1982 United Nations Convention on the Law of the Sea (UNCLOS), sets out the legal framework for the regulation of (Arctic) shipping according to maritime zones of jurisdiction.

Key Drivers of Arctic Shipping ~ Natural resource development and regional trade are the key drivers of increased Arctic marine activity. Global commodities prices for oil, gas, hard minerals, coal, etc. are driving the exploration of the Arctic's natural wealth.

Destinational Shipping ~ Most Arctic shipping today is destinational (vice trans-Arctic), moving goods into the Arctic for community resupply or moving natural resources out of the Arctic to world markets. Nearly all marine tourist voyages are destinational as well.

Uncertainties of Arctic Navigation ~ A large number of uncertainties define the future of Arctic marine activity including: the legal and governance situation; degree of Arctic state cooperation; climate change variability; radical changes in global trade; insurance industry roles; an Arctic maritime disaster; new resource discoveries; oil prices and other commodity pricing; and, future marine technologies.

Retreat of Arctic Sea Ice ~ Global climate simulations show a continuing retreat of Arctic sea ice through the 21st century; all simulations indicate an Arctic sea ice cover remains in winter.

Arctic Community Impacts ~ Marine shipping is one of many factors affecting Arctic communities, directly and indirectly. The variety of shipping activities and the range of social, cultural and economic conditions in Arctic communities mean that shipping can have many effects, both positive and negative.

Most Significant Environmental Threat ~ Release of oil in the Arctic marine environment, either through accidental release or illegal discharge, is the most significant threat from shipping activity.

Marine Infrastructure Deficit ~ A lack of major ports and other maritime infrastructure, except for those along the Norwegian coast and the coast of northwest Russia, is a significant factor (limitation) in evolving and future Arctic marine operations.

Lack of Charts and Marine Observations ~ Significant portions of the primary Arctic shipping routes do not have adequate hydrographic data, and therefore charts, to support safe navigation. The operational network of meteorological and oceanographic observations in the Arctic, essential for accurate weather and wave forecasting for safe navigation, is extremely sparse.

Ice Navigator Expertise ~ Safe navigation in ice-covered waters depends much on the experience, knowledge and skills of the ice navigator. Currently, most ice navigator training programs are ad hoc and there are no uniform, international training standards.

Special Areas ~ There are certain areas of the Arctic region that are of heightened ecological significance, many of which will be at risk from current and/or increased shipping.

IMPORTANCE OF THE IMO POLAR CODE

The development of a mandatory IMO Polar Code for ships operating in polar waters is the most critical component in a matrix of strategies and measures to protect Arctic people and the marine environment. A process to develop special rules for ships sailing in polar waters began in the early 1990s with an IMO Outside Working Group of technical experts and polar mariners (meeting from 1993-97). The IMO in 2002 released its *Guidelines for Ships Operating in Arctic Ice-Covered Waters*; however, by 2009 the voluntary measures had been expanded to *Guidelines for Ships Operating in Polar Waters*. This was a fundamental shift from 'ice-covered waters' to 'polar waters' recognizing that ships operating in remote polar seas, often devoid of adequate charting and key infrastructure, do not have to be sailing in sea ice for higher risks to be present. One of the key outcomes of the Polar Code to be in force in January 2017 will be a set of international and unified (and mandatory or binding) rules and regulations that are non-discriminatory to the global maritime industry. The importance and relevance of the Polar Code to Alaska and the U.S. cannot be overstated. While Russia and Canada each have their own set of special rules and regulations for their Arctic waterways, the U.S. has never developed a separate set of special ship rules or standards for commercial ships in the U.S. maritime Arctic. The new mandatory IMO Polar Code will provide the U.S Coast Guard with a set of international rules and standards which it can implement for U.S. waters defined as polar within the language of the Code (north of 60 degrees in the Bering Sea). The flag states and port states in the Arctic will be responsible for uniform application and enforcement for all commercial carriers and passenger vessels of more than 500 tons.

Keppel Offshore and Marine, Singapore

U.S. NATIONAL STRATEGY FOR THE ARCTIC REGION

Released by the White House in January 2014 the *Implementation Plan for the National Strategy for the Arctic Region* provides guidance to a host of federal departments and agencies. For the maritime domain, the Plan presents a 10-year horizon that will be used to prioritize federal infrastructure in the U.S. maritime Arctic. This will be a very challenging task given the great number of economic, environmental, and geopolitical uncertainties influencing Arctic marine operations as identified in AMSA. Include in the Plan are major initiatives on: developing telecommunication 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.

A comparison is made of the AMSA recommendations with themes and key issues with the U.S. *National Strategy for the Arctic Region* signed by President Obama on May 10, 2013. There is an excellent match between the two efforts even though the AMSA recommendations are more focused on marine safety and environmental protection. Nearly all of the AMSA recommendations are mentioned either specifically or in the broader context of a national goal or line of effort. This comparison suggest that the set of AMSA recommendations (which the U.S. agreed to at the Arctic Council) is a tailor made policy framework for the U.S. federal agencies to use in addressing the environmental security challenges in its maritime Arctic at a time of expanding marine use. AMSA represents a reasonable strategic guide for all federal and State of Alaska agencies in addressing in a holistic approach the many marine environmental and safety issues confronting the new maritime Arctic.

Comparison of the AMSA Recommendations with the Elements of the U.S National Strategy for the Arctic Region (Strategy Page Number in Parentheses).

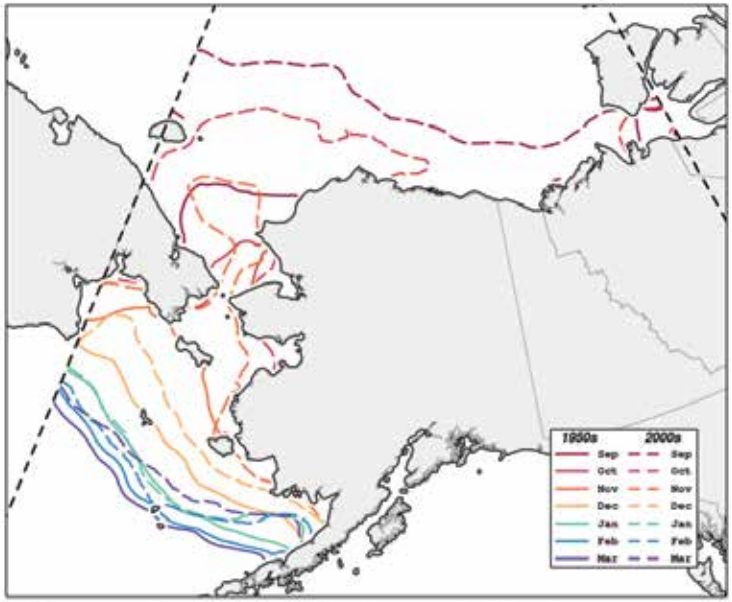
AMSA Recommendations	National Strategy for the Arctic Region
I. ENHANCING ARCTIC MARINE SAFETY	
A. Linking with International Organization	• Strengthening International Cooperation (2)
B. IMO Measures for Arctic Shipping D. Strengthening Passenger Ship Safety in Arctic Water	• Promotion of safe, secure and reliable Arctic shipping, a goal that is the best pursued through the IMO (10)
C. Uniformity of Arctic Shipping Governance	• Preserve Arctic Region Freedom of the Seas (6) • Accede to the Law of the Sea Convention (9)
E. Arctic Search and Rescue Instrument	• 2011 Arctic Search and Rescue Agreement (9)
II. PROTECTING ARCTIC PEOPLE & THE ENVIRONMENT	
A. Survey of Arctic Indigenous Marine Use B. Engagment with Arctic Communities	• Consult & Coordinate with Alaska Natives (11) • Policy emphasizes trust, respect and shared responsibility (11)
C. Areas of Heightened Ecological and Cultural Significance	• Protect the Arctic Environment and Conserve Arctic National Resources (7)
D. Specially Designated Marine Areas E. Protection from Invasive Species F. Oil Spill Prevention	• Use Integrated Arctic Management to Balance Economic Development, Environmental Protection and Cultural Values (8)
G. Addressing Impacts on Marine Mammals H. Reducing Air Emissions	• Contribute to the identification of ecologically sensitive areas (8)
III. BUILDING THE ARCTIC MARINE INFRASTRUCTURE	
A. Addressing the Infrastructure Deficit	• New thinking on public-private partnerships and multinational partnerships (10) • Carefully tailor regional infrastructure as well as our response capacity (6)
B. Arctic Marine Traffic Systems	• Enhance Arctic Domain Awareness (6) • Develop Arctic waterways managment regimes (7)
C. Circumpolar Environmental Response Capacity	• 2013 Arctic Marine Oil Pollution Prepardness and Response Agreement (9) • Capacity to respond to natural and man-made disasters (6)
D. Investing in Hydrographic, Meteorological and Oceanographic Date	• Better earth system-level knowledge (8) • Chart the Arctic region (8)

CHANGING MARINE ACCESS AND SEA ICE

During the last three decades observations have shown that Arctic sea ice has continued to decrease in extent and thickness. 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. Global climate models simulate a continued reduction of Arctic sea ice extent, and an entirely ice-free Arctic Ocean for a short period of time in summer is projected to occur before mid-century. Such an occurrence would mean that no more multi-year or 'old' sea ice will remain in the Arctic Ocean and the region will be left with a seasonal, first year ice cover in subsequent years.

Sebastian Menze, Alfred-Wegener-Institut

Mean Decadal 15% Sea Ice Concentration Edge



Edges are estimated 15% contour lines for mean decadal sea ice concentration.

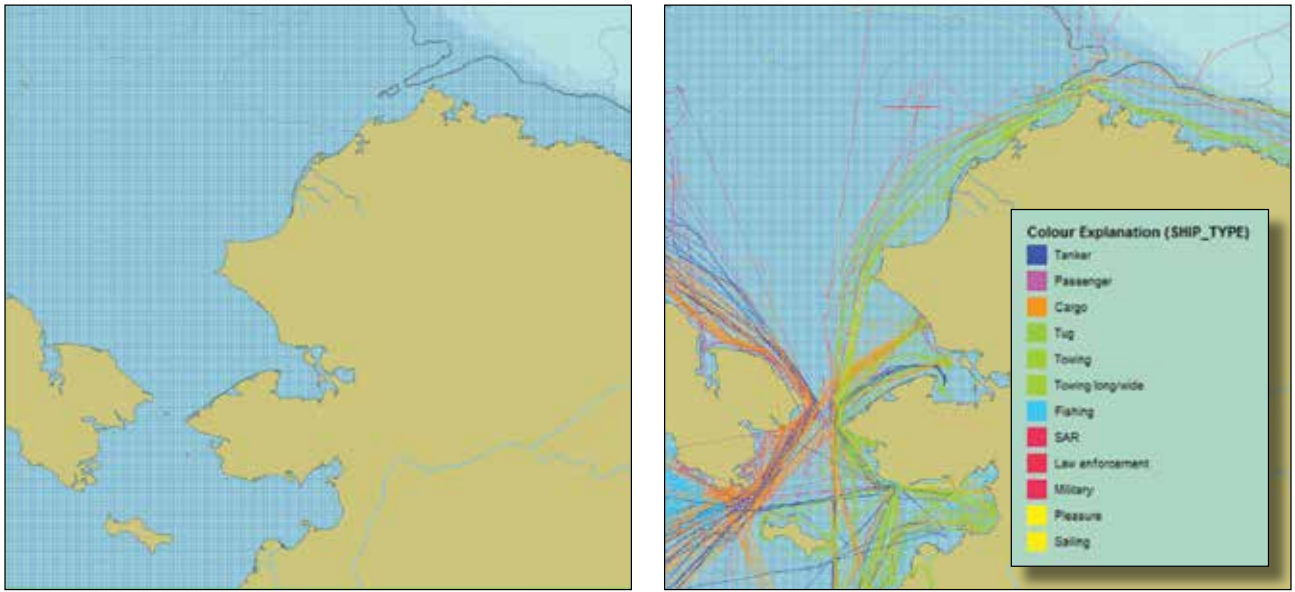
Analyses of the sea ice in the U.S. maritime Arctic (comparing observations of the 1950s with the 2000s) indicate: (1) the Bering Sea maximum ice edge in the winter has not changed significantly for five decades despite regional and global warming; (2) the mean decadal summer ice edges in the Chukchi and Beaufort seas have retreated significantly northward into the central Arctic Ocean during the past five decades. For the U.S. maritime Arctic these trends mean plausible, longer ice-free seasons in the autumn for offshore hydrocarbon exploration and seasonal barge supply of coastal communities. Marine traffic in the U.S. maritime Arctic is directly correlated to the seasonal ice conditions in the region. For six months (December to May) the presence of sea ice hinders or prevents the passage of all but a handful of vessels. The seasonal pattern of U.S. Arctic marine operations is unlikely to change substantially unless federal regulators allow future hydrocarbon exploration and development in ice-covered waters.

MARINE TRAFFIC

The Marine Exchange of Alaska makes use of the Automatic Identification System (AIS) required by IMO for large commercial ships. The AIS data indicates that ship transits in the U.S. maritime Arctic are almost entirely concentrated in the ice-free season (June to November). The AIS data shows that for the Bering Strait region ship traffic begins to appear in late May, peaks in July and August and ends by November. An analysis of U.S. seasonal traffic indicates a high concentration of tugs and barges which is the nature of resupply of coastal communities and the North Slope during summer. There are a small number of bulk cargo carriers (20-28) that sail to Kivilina and carry zinc ore out from the Red Dog Mine complex to global markets. And, the data indicates a small number of coastal tankers in U.S. waters. On the Russian side of the Bering Strait region the Marine Exchange data indicate the summer (June through October) passage of tankers, bulk carriers, liquefied natural gas (LNG) carriers, icebreakers, and support vessels into and out of the Northern Sea Route (NSR). The 2012 traffic data indicate a total of 154 northbound and 162 southbound transits of the Bering Strait region (316 total transits) between 26 June and 18 November; 30 transits are directly attributed to Shell offshore operations during the summer (additional U.S. Coast Guard cutter transits can be correlated to the federal response to Shell's 2012 exploration in the Chukchi Sea. The 2013 marine traffic data for the Bering Strait region shows a slight transit increase from 2012 with 339 ships of all types (167 northbound and 172 southbound).

An analysis of marine traffic was performed for the busiest day of the 2013 navigation season in Bering Strait. There was considerable variability in the ship corridors used within the 23.6 nautical mile distance between the Alaskan mainland and Little Diomede Island. On 25 July 2013 two vessels transited northbound and four transited southbound. During the 2013 navigation season there were many days when only one or two ships transited the Bering Strait region on the U.S. side. Off Point Barrow during the 2013 navigation season there were 124 vessels transiting (69 westbound and 55 eastbound); most transits were within 30 nautical miles of Point Barrow and a majority within 10 nautical miles.

In summary marine traffic in the U.S. maritime Arctic is directly correlated to the seasonal ice conditions and a six-month navigation in ice-free waters is normal. Most of the ship traffic moving north through Bering Strait on the U.S. side is coastal and domestic, or cabotage (tug-barge operations). The Red Dog Mine operation brings bulk carriers (20-28 large ships) to the U.S. maritime Arctic during a short summer navigation season. Shell's 2012 offshore hydrocarbon exploration efforts in the Chukchi and Beaufort seas accounted directly and indirectly for approximately 60 seasonal north and southbound transits through the Bering Strait region.



Marine Exchange of Alaska

Maritime traffic in the Bering Strait & northwest Alaska region. Left: 1 January to 31 May 2013. Right: 1 June to 30 November 2013.

NORTHERN SEA ROUTE AND NORTHWEST PASSAGE DEVELOPMENTS

The paradox of the opening of Russia's Northern Sea Route (NSR) is that it provides both a potential economic opportunity for Alaska and an environmental security challenge to the Bering Strait region. An increase in the length of the NSR summer navigation season provides a more reliable operational timeframe to potentially ship Alaska's natural resources to European markets. Zinc ore from the Red Dog Mine complex and coal from northwest Alaska (if developed) could be shipped along the NSR in summer by bulk carriers. It is also plausible that lower transportation costs could be realized in summer by shipping Alaskan seafood products along the NSR to key markets in central and western Europe. However, it not likely the NSR will be functioning year-round in its eastern seas and a 5-6 month navigation season is envisioned for the coming decades. *Therefore any NSR shipping opportunities to and from Alaska (between the Atlantic and Pacific) must be conceived and evaluated to be economically viable on a seasonal basis*. The fundamental driver of the NSR remains Arctic natural resource development, especially the pace of that development in the Russian Arctic. The development of a major port on the Yamal Peninsula (Sabetta) is a strategic location to facilitate the shipping of LNG eastward along the NSR to Asia Pacific ports in an extended summer navigation season; the port can also operate year-round with LNG carriers sailing westward to European ports and potentially to ports in North and South America.

Future marine routes to global markets out of the Port of Sabetta (Yamal Peninsula) in the Russian Arctic.

The NSR faces a number of significant challenges including:

- Determining a viable fee system for services provide on NSR voyages;
- Replacement of the Russian icebreaker fleet which plays a key role in the escort of ship convoys;
- Application of the new IMO Polar Code to the operation and regulation of the NSR;
- The pace of Russian Arctic maritime infrastructure to enhance marine safety and environmental protection along the NSR;
- How the marine insurance industry and underwriters will deal with risk management for ship voyages along the NSR; and,
- Establishment of a reliable length of the navigation season so that shippers can create a viable and economic operating season.

The Canadian Arctic and Northwest Passage (NWP) present many challenges to future Arctic marine navigation. It is remarkable that since the first NWP complete transit (1903-06 by the Norwegian Amundsen), only 184 complete transits have been accomplished by the end of the 2012 season. A majority of recent voyages have been conducted by adventurers in small vessels sailing in minimal summer ice conditions. One key issue limiting commercial traffic has been the observed record of high year-to-year variability of sea ice coverage. The complexity of the various routes of the NWP, draft restrictions, highly variable and difficult sea ice conditions (present for 9-10 months), lack of marine infrastructure, lack of comprehensive charting, and high operational costs (including marine insurance) are all factors that make regular commercial traffic through the Canadian Arctic uncertain at best. Anticipated increases in marine shipping in the region are related to future mining developments in the Canadian Arctic and thus linked to global commodities prices. The linkages of the NWP to the U.S. maritime Arctic will not likely yield a flow of large commercial ship traffic in the decades ahead. Relatively modest numbers of support vessels, research ships, adventurers and small cruise ships will cross the U.S. maritime Arctic on their voyages to and from the Canadian Arctic and the multiple routes of the NWP.

Institute of Arctic Logistics at Youngsan University in Busan, Korea

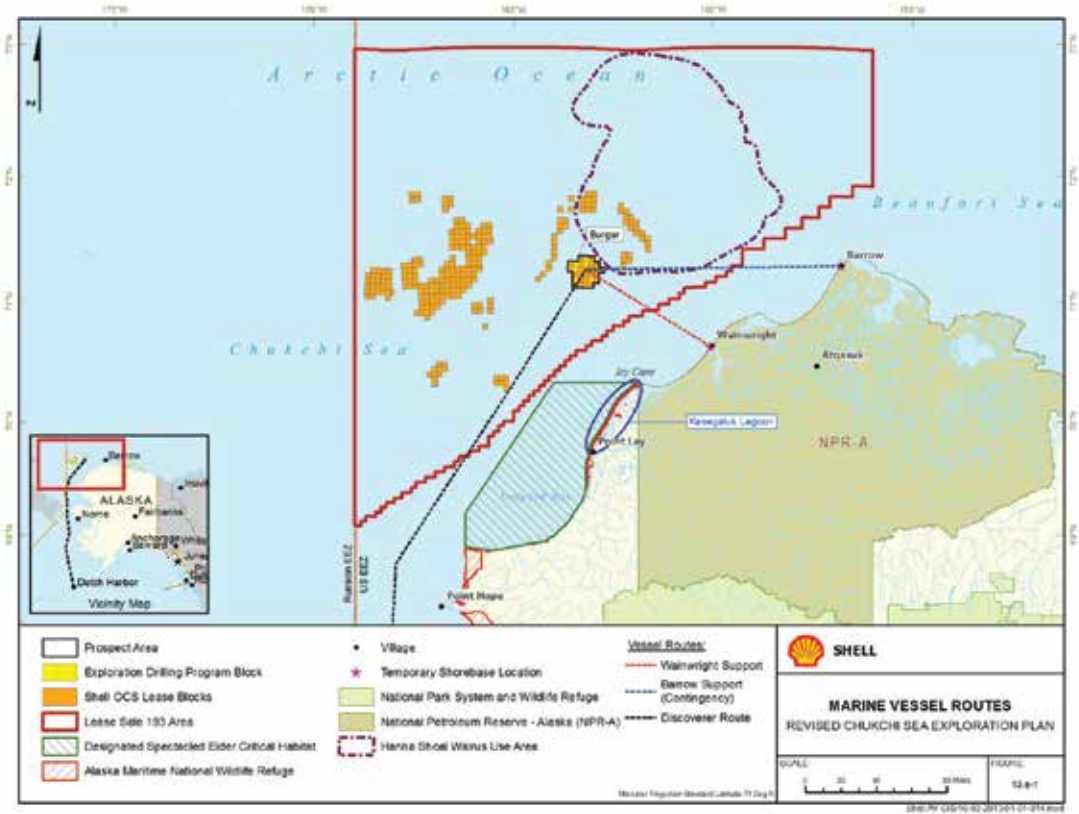
LINKS TO U.S. ARCTIC OFFSHORE DEVELOPMENT

Oil and gas exploration/production will be the primary driver of any significant increases in ship traffic through Bering Strait and in the U.S. maritime Arctic. This is highly probable for the next 10 years; it is also likely that the hydrocarbon industry will remain the biggest driver of shipping and marine operations in the U.S. maritime Arctic for the next 30 years, though the less defined impact of currently undeveloped mining enterprises could also have a significant impact. The proposed Shell drilling plan of August 2014 envisions an armada of 25 support ships for two drilling vessels during a six-year exploratory drilling phase. It is plausible that high success by Shell in this phase could induce accelerated activity by other major lease holders in the Chukchi Sea (Statoil and BP). Production success in the Chukchi Sea could also renew interest in the offshore Beaufort Sea outer continental shelf (OCS) lease areas. Moving to the production phase in the OCS Chukchi Sea areas would likely entail construction of platforms that would be serviced by pipelines to shore. Pipe laying vessels and other support ships would increase ship traffic in Chukchi Sea and through Bering Strait, and increase seasonal marine operations throughout the region. In the transition from the exploratory phase to the production phase, there would be a plausible spike in offshore operations ramping up to platform installation and support. The transition period can be expected to last a decade, in which drilling activity could increase from five to approximately over 30 wells per year.

Shell Gulf of Mexico Inc.

An approximation of the future of OCS development in the Chukchi Sea assumes eight platforms in production operations by 2025 and some fifteen subsea interconnected templates. Using the support fleet requirements proposed by Shell in its 2014 plan, approximately 100 support vessels could be operation within the lease areas (12 per drilling rig required in Shell's exploration plan). This could directly relate to an increase of 100 seasonal transits of Bering Strait. Another option could be the sustained harboring of some of these vessels in a location north of Bering Strait. During the peak of marine operations the required support fleet could grow to as many as 150 vessels to construct the platforms, lay pipelines on the seabed and develop the support infrastructure to the offshore. In summary future OCS development in the Chukchi Sea can drive greatly increased marine traffic in the region.

Chukchi Sea Outer Continental Shelf Exploration and Operational Plan by Shell



U.S. MARITIME ARCTIC INFRASTRUCTURE NEEDS

The U.S. maritime Arctic is generally understood to lack a broad array of marine infrastructure to support long-term economic opportunities and address key environmental security challenges. Seven key requirements include:

Hydrography and Charting ~ Having modern marine charts is fundamental to providing a safe operating environment and for facilitating coastal development of ports and navigable waterways. This is key, specific requirement that is recognized in the *National Strategy for the Arctic Region*. Mapping the entire U.S. maritime Arctic to attain international navigation standards in this large region will require significant, long-term funding for NOAA. The NOAA budget for geodetic referencing in Alaska, shoreline surveys, and hydrographic surveys must be increased for the long-term so that an adequate safety net can be established in America's Arctic coastal regions.

Arctic Observing Networks ~ Investment in the international Sustaining Arctic Observing Network (SAON) by the Arctic and non-Arctic states should be considered an investment in enhancing Arctic marine safety and environmental protection. SAON would be an important advance in enhancing safety and environmental response especially in the Bering Strait region and across the U.S. maritime Arctic. Providing advanced and timely environmental information to Arctic coastal users and stakeholders is a critical requirement for the U.S. maritime Arctic. The U.S. has developed the Alaska Ocean Observing System (AOOS) with NOAA funding as part of a national-regional partnership (the Integrated Ocean Observing System). AOOS has four areas of focus: safe marine operations; coastal hazard mitigation; tracking ecosystem and climate trends; and, monitoring water quality. Long-term funding for AOOS is crucial to maintaining adequate observations in the remote and sparsely monitored northwest Alaska coast and regional seas.

Marine Domain Awareness ~ Strengthening the systems for the monitoring and surveillance of ships, pollution, and emergency situations in the Arctic is of paramount concern for the Department of Homeland Security, the U.S. Coast Guard and a host of federal and State of Alaska agencies. To be effective, Marine Domain Awareness (MDA) requires the integration of information from many data categories: vessels; cargo; maritime personnel and organizations; infrastructure; and the environment. Two of the key challenges to enhanced MDA are its complexity and the expanse of the marine environment; the remoteness and harsh operating environment of the maritime Arctic add considerably to monitoring and surveillance requirements. The Marine Exchange of Alaska provides key ship traffic information to the maritime industry, the Coast Guard, and the State of Alaska. Investment is required for improved communication networks, effective maritime tracking technologies, improved information processing tools, enhanced AIS-satellite monitoring in northern latitudes, and additional AIS land-based receiving sites.

Alaskan Arctic Deepwater Port ~ A recent joint federal-state study conducted by the U.S. Army Corps of Engineers and the Alaska State

Department of Transportation and Public Facilities (*Alaska Deep-Draft Arctic Port System Study*) underscored the long-term need for a U.S. Arctic port that would be linked to natural resource export in a new era of demand for Arctic resources by global markets. Future scenarios out 50 years were created with two key driving forces emerging: Arctic natural resource development and collaborative investment (public and private investment). Recommendations of the study included: public-private partnerships to finance the construction of an Arctic port and associated infrastructure; increased funding for NOAA for hydrogaphic and bathymetric surveys; and, needs for navigational tools to support Arctic infrastructure developments.

Search & Rescue and Environmental Response Capacity ~ Locating adequate Coast Guard search & rescue (SAR) and environmental response units closer to the U.S. maritime Arctic is a logistical and funding challenge. The vast size and remoteness of the northern coast of Alaska places a premium on the use of mobile ship assets rather than shore facilities. The maintenance of a physical presence of the Coast Guard within the U.S. maritime Arctic will become a more urgent requirement when offshore oil and gas exploration increases. The use of seasonal deployments of small boats and helicopters to coastal communities will likely be one strategy to employ. Long-term planning for strategically-positioned shore facilities includes the possible co-location of response assets at a future Arctic port.

Polar and Coastal Icebreaking Capacity ~ The replacement of America's polar icebreakers (the two *Polar Class* ships, *Polar Star* and *Polar Sea*) has been a long-standing issue. However, this requirement for federal icebreaking capacity in large, high powered ships, masks a plausible need for shallower-draft, but ice capable (smaller) Coast Guard cutters for operations in the coastal areas of northwest Alaska and the Beaufort Sea. The United States has national interests in the Arctic and Antarctic and Coast Guard polar icebreakers (past and current) provide visible and effective strategic maritime presence in these remote regions. Within the territorial sea and exclusive economic zone around Alaska, the Coast Guard's polar icebreakers provide a credible, sovereign presence and a platform for law enforcement, SAR, emergency response, scientific research, and any special maritime operation required in ice-covered waters. The role of commercial ship escort by icebreaker in U.S. waters requires re-examination in the light of advances in Arctic marine technologies and new operational strategies. Most of today's Arctic commercial ships are designed as icebreaking ships capable of independent operations (without icebreaker escort). Most of the Arctic commercial carriers operating in the Canadian and Russian Arctic regions do not require icebreaker escort during a 3-4 month navigation season. The future of U.S. icebreaking operations will likely require a mix of federal ships operated by the Coast Guard (principally for U.S. sovereign presence, law enforcement, emergency response and research) and commercial icebreakers in support of economic development of Alaska's Arctic (offshore hydrocarbon exploration and escort of commercial carriers if needed).

Arctic Transportation Corridors ~ Transportation systems, or corridors, have been advocated for the U.S. Arctic, particularly along Alaska's west coast and North Slope. Existing infrastructure relies on shallow-draft barges. The systems or corridors would be a mix of all modes of transportation: roads, rain. marine, air, pipelines, and energy. Three corridors have been proposed: (1) a Northern Shipping Corridor with services to include traffic monitoring, SAR, spill response, and salvage; (2) A North Slope Corridor, a multi-modal transportation system focused on oil and gas production; and (3) a Western Arctic Corridor, a multi-modal transportation system with offshore development and onshore mining.

MARITIME WORKFORCE POTENTIAL

Alaska's maritime employment opportunities are heightened in light of the potential increases in Arctic activity during the coming decades. A majority of recent reports note that an expansion of skilled labor force is necessary to capitalize on the future economic potential and even to maintain the status quo due to the aging of the workforce. OCS development could generate 35,000 new jobs over the next 50 years with a cumulative payroll of $72 billion dollars. OCS exploration and development of oil and gas is the primary sector requiring substantial additional workforce and training. State support for OCS development is a key arena for intervention to expand the economic opportunity and the need for a skilled workforce. It is clear from several studies that the existing population of Alaska cannot meet the potential demand for a skilled workforce (for replacement of an aging workforce or to capture skilled OCS jobs if they emerge). Developing training and career pathways is a long-term process. Inventories and pathways are in place in many occupations, but there is no specific implementation leadership and strategic plans to strengthen these in the future. The uncertainty in the timing of development of the U.S. Arctic presents multiple challenges to defining new opportunities for marine occupations and support industries in Alaska.

Helge Hansen / Statoil

MAJOR FINDINGS OF THE STUDY AND INTERNATIONAL WORKSHOP

1. Arctic natural resource development is primary driver of the need for Arctic marine transportation systems. This finding is consistent with recent marine traffic along the Northern Sea Route and in other Arctic regions, and also consistent with a key finding of the Arctic Council's Arctic Marine Shipping Assessment.

2. The Arctic Ocean is an ice-covered ocean that requires international (ship) rules, regulations and standards, not an ice-free environment. There are no current Arctic-specific rules and regulations (domestic or international) that are applied to the U.S. maritime Arctic.

3. The Arctic Council's Arctic Marine Shipping Assessment (AMSA) provides a solid framework and strategy for enhancing marine safety and environmental protection in the U.S. maritime Arctic. AMSA's 17 recommendations formulated within three themes (Enhancing Marine Safety; Protecting Arctic People and the Environment; and, Building the Arctic Marine Infrastructure) is a blueprint for Federal and State of Alaska agencies.

4. The AMSA recommendations are compared (Table 1.2) with the themes and key issues within the U.S. National Strategy for the Arctic Region issued in 2013. There is an excellent match between these two efforts; all of the 17 AMSA recommended actions are mentioned either specifically or in the broader context of a national goal or line of effort.

5. The mandatory International Maritime Organization's Polar Code for ships operating in polar waters will be critical to enhancing the protection of Arctic peoples and the marine environment within the U.S. maritime Arctic and throughout the Arctic Ocean. Since the U.S. has never developed a separate set of Arctic-specific ship rules for its Arctic waters (as have Canada and Russia), the Polar Code to be implemented between May 2015 and 1 January 2017 fills that critical need for U.S. Arctic waters.

6. The U.S. must fully implement in its maritime Arctic the elements (including response infrastructure) of two binding Arctic agreements: the Agreement on Cooperation on Aeronautical and Maritime Search and Rescue in the Arctic (2011); and, the Agreement on Maritime Oil Pollution Preparedness and Response in the Arctic (2013). The elements

and requirements of both Arctic treaties need to be integrated into U.S. strategies and plans for emergency response in the U.S. maritime Arctic.

7. The new *Historical Sea Ice Atlas for Alaskan Waters* is a key strategic resource for evaluating past changes in sea ice within the U.S. maritime Arctic. The database in the Atlas can be used to determine periods and any trends in ice-free conditions around Alaska.

8. The seasonal Arctic sea ice edge in the Bering Sea at its maximum in the spring (March and April) has not changed substantially during the past five decades. Earlier seasons of navigation (in ice-free conditions) in the spring are not anticipated for the coast of Alaska.

9. The seasonal Arctic sea ice edge in the Chukchi and Beaufort seas at its minimum in the autumn (September) has retreated dramatically during the past five decades. Once located in the Chukchi Sea in September in the 1950s, the ice edge has retreated hundreds of nautical miles north of Alaska's coast. Later seasons of navigation (in ice-free conditions) in the autumn are anticipated in the Beaufort and Chukchi seas for offshore drilling operations and coastal resupply.

10. Increases in Arctic marine traffic in the U.S. maritime Arctic and the Bering Strait region during the last five years has been driven by offshore hydrocarbon exploration and the growth in numbers of ships along the Northern Sea Route that are carrying Arctic natural resources to global markets. Hydrocarbon activity in the U.S. maritime Arctic will likely remain the most significant factor in increases in marine operations for at the next several decades.

11. Marine traffic in the U.S. maritime Arctic is directly correlated to the seasonal sea ice conditions in the region. For six months (December to May) the presence of sea ice hinders or prevents the passage of all but a handful of vessels from sailing in these waters. This seasonal pattern of U.S. marine operations is unlikely to change unless federal regulators allow future hydrocarbon exploration and development in ice-covered waters.

12. The vast majority of the marine traffic in the U.S. maritime Arctic consists of tugs, barges, support vessels, federal vessels, research ships, and a handful of small cruise ships. The only large commercial ships in the region are sailing to the terminal at Kivilina (for the export of zinc ore from the Red Dog Mine) and occasional small tankers in Alaskan coastal waters. Future increases in traffic during the next two decades are expected to be drill ships and support vessels related to U.S. offshore hydrocarbon exploration and development.

13. A majority of marine traffic along the Russian coast of Bering Strait consists of tankers, bulk carriers, LNG carriers, icebreakers and ice capable support vessels that are using the

Northern Sea Route. Increases in the length of navigation season for the Northern Sea Route (beyond six months) could lead to increases of marine traffic in ice-covered wares of the Bering Sea region during the months of December and June. There are no indications today that the navigation season in the Laptev, East Siberian and Chukchi seas of the Northern Sea Route will be extended beyond six months.

14. Arctic shipping routes are unlikely to revolutionize the global container shipping trade routes. The Northern Sea Route is viewed by Russian and international experts as a seasonal supplement to the Suez Canal route. The NSR will not replace the Suez or Panama canals, but should be viewed as a viable and new seasonal alternative marine route despite key constraints such as: the variability of regional sea ice, shallow water depths in select straits, a high fee system, and lack of marine infrastructure.

15. Hydrocarbon activity in the offshore Russian Arctic is not likely to significantly increase NSR shipping or otherwise impact the U.S. maritime Arctic for the next decade or more.

16. The Northern Sea Route is emerging as a seasonal (summer) Arctic shipping route with significant potential for destinational shipments of Arctic natural resources out of the Russian Arctic and northern Europe to global markets especially in the Pacific. There may also be opportunities for trans-shipment of natural resources (such as iron ore).

17. An opportunity exists for both Norwegian and Alaskan maritime interests to use the Northern Sea Route for trading during summer and as a marine connection between Europe, northern Norway, and Alaska. Enhanced cooperation with Norway on Arctic marine transportation (and international trade) issues will be mutually beneficial.

18. The Aleut Corporation and Adak should establish links with Russian Arctic oil and gas interests in Yamal (particularly out of the new port of Sabetta). The objective would be to explore the potential for oil and gas deliveries along the Northern Sea Route to Adak for possible servicing western Alaska communities.

19. Due to its complex geography, highly variable sea ice environment, short navigation season, and lack of infrastructure, the Northwest Passage (NWP) does not have the same level of interest by global shipping interests and investment as the Northern Sea Route. There are no indicators that large numbers of commercial carriers will be making full transits of the NWP and sailing to/from the U.S. maritime Arctic during the next two decades.

20. The Chukchi Sea Outer Continental Shelf (OCS) has an estimated potential of total oil reserves of 15 billion bbls, approximately double the potential for the Beaufort Sea OCS, and is currently the only lease area in the Alaska OCS with an exploration plan submitted for approval. By comparison, the

total production from Prudhoe Bay during the last 35 years has been approximately 17 billion bbls.

21. For the next six years offshore hydrocarbon development in the OCS will remain in an exploratory drilling phase, if it proceeds at all under the current regulatory regime. These operations are well characterized in Shell's proposed exploratory drilling plan of August 2014. That plan envisions a support armada of approximately 25 supporting ships for two drilling vessels and double the vessel transits out to the drill ships during operations.

22. Canadian-driven exploratory oil and gas drilling and its support marine operations (in the Beaufort Sea) do not appear an immediate or significant marine traffic factor for the U.S. maritime Arctic within the next ten years.

23. Exploration and drilling ashore in the Arctic petroleum Reserve would likely have modest impact on marine traffic as plans include overland access to position equipment (seasonal ice roads) for pipeline construction. Unlike the Trans-Alaska Pipeline System (TAPS) in the early 1070s, an overland corridor now exists for much of the logistical requirements (along the Dalton Highway).

24. Assuming eight platforms in production operations in the Chukchi Sea OCS in 2025, and their 15 subsea interconnected templates (as a benchmark), with a comparison of the support fleet requirements in the Shell 2014 plan, approximately 100 support vessels could be in operation in the lease areas. This would translate to approximately 100 Bering Strait seasonal transits. These estimates provide some measure of the future level of traffic associated with offshore development in the U.S. maritime Arctic.

24. The necessary legal and structural preconditions required to set the stage for increased economic development in the U.S. maritime Arctic are not yet in place.

25. The U.S. maritime Arctic is essentially void of crucial marine infrastructure. Substantial investments and future public-private partnerships will be essential to provide adequate funding for a robust safety net and for facilitation of regional economic development.

26. A major Arctic port in western Alaska is a key to regional economic development, servicing the offshore hydrocarbon industry, export of Alaska's natural resources/wealth to global markets, and connections to the new maritime Arctic. Intermodal links (road, rail, air) to those resources are essential to the economic viably of an Arctic port in western Alaska.

27. Hydrography and charting of the U.S. maritime Arctic is critical to safe navigation, and for facilitating coastal development of ports and navigable waterways. NOAA's federal budget for hydrographic surveys, shoreline surveys, and geodetic

referencing in Alaska is essential to America's Arctic environmental and economic security.

28. Strengthening and investing in the monitoring and surveillance of marine traffic in the U.S. maritime Arctic and Bering Strait region is of paramount importance. A critical component of marine domain awareness in the region is the Marine Exchange of Alaska which derives some operating costs from the U.S. Coast Guard and State of Alaska. Two key users and stakeholders of the Exchange's real-time database. The region requires improved communication networks, effective tracking technologies, improved information processing tools, enhanced AIS-satellite monitoring, and additional AIS land-based receiving sites.

29. The future of U.S. icebreaking operations will likely require a mix of federal ships operated by the Coast Guard (principally for U.S. sovereign presence, law enforcement, emergency response, and research), and commercial icebreakers in support of economic development of the U.S. Arctic (supporting offshore hydrocarbon exploration and the occasional escort of commercial carriers). Most of the modern Arctic commercial carriers are icebreakers in their own right and are designed for independent operations, a finding of the Arctic Marine Shipping Assessment. Few of these modern polar ships will require routine icebreaker escort in the U.S. maritime Arctic, but assistance might be required in emergency situations.

30. Arctic environmental observations are crucial to understanding the changing regional climate and supporting marine operations. Investment in the Sustaining Arctic Observing Network (SAON) by the U.S. should be considered a long-term investment in enhancing marine safety and environmental protection. A multi-national, coordinated network designed for monitoring regional climate change and local environmental conditions will have synergies and direct value to a myriad of operational requirements to increased Arctic marine traffic.

31. The international workshop held during the project concluded that a number of preconditions must exist for investment in Alaska: broadband telecommunications; regulatory certainty; public and private partnerships; year-round all-weather airports statewide (in place); tax structures and incentives; education and workforce training; enhanced working relations with Canada and Russia; improved State and federal working relationships; and, a major oil discovery in the Chukchi Sea or Cook Inlet (a catalyst for investment).

32. Federal support for Arctic marine infrastructure is anticipated to be limited for the next ten years or more. Nonetheless, there is much active planning on key topics such as Arctic deep-draft port development, maritime safety, and information infrastructure. All Arctic marine infrastructure investments by the federal government will have direct influences on the long-term economic development of America's Arctic.

33. More capacity for oil spill response capability must be established north of Dutch Harbor. Focus should be on the near-shore environment of western Alaska. Response systems must utilize local knowledge and hold enhanced training sessions in coastal communities. Response equipment must be strategically located in coastal ports and communities, especially in areas of current and future offshore hydrocarbon development and increased marine traffic.

34. Only offshore Arctic hydrocarbon exploration and development will likely drive significant expansion of a skilled maritime workforce. The State of Alaska support of OCS development is a key arena for intervention to expand the economic opportunities and the need for a skilled workforce. One economic analysis of OCS development in the Chukchi and Beaufort seas indicated 35,000 new jobs could be created over the next 50 years.

35. The existing population in Alaska cannot meet the potential demand for a skilled workforce. The existing population available for training is insufficient to meet the need for the replacement of an aging workforce, or to capture skilled OCS jobs if and when they emerge.

36. The Alaska Arctic Policy Commission report makes numerous references to the need for a future maritime workforce to support spill response, offshore development, search and rescue, and marine navigation. Five key industries have been identified where maritime infrastructure requires Arctic training and expertise: commercial shipping, commercial fishing, offshore hydrocarbon development, the cruise ship industry and mining.

RECOMMENDATIONS OF THE PROJECT

Near-term (2015-2023)

1. **U.S. Coast Guard:** Working with the State of Alaska fully implement the IMO Polar Code in the U.S. maritime Arctic meeting the 1 January 2017 date imposed for the Code to enter into force.

2. **State of Alaska & University of Alaska:** Develop strategic partnerships with commercial and research/university interests in Norway and Singapore related to offshore development, emergency response, and Arctic marine transportation issues.

3. **Alaska's Fishing Industry:** Explore the economic opportunities for trade with Europe by shipping products during the summer navigation season along the Northern Sea Route.

4. **Aleut Corporation and City of Adak:** Enter into discussions with Russian gas authorities in the Yamal to explore the economic feasibility of shipping gas to Adak along the NSR in summer for further distribution to communities in western Alaska.

5. **State of Alaska:** Establish a Task Force, including industry and federal representatives, to explore the funding of Arctic marine infrastructure using all forms of public-private partnerships. Include in the discussions strategies for funding an Arctic port.

6. **State of Alaska:** Fund and conduct a comprehensive indigenous marine use survey as called for in the Arctic Council's Arctic Marine Shipping Assessment. Compile all available data from local communities, industry, State agencies, and Federal agencies.

7. **State of Alaska:** Establish a position for an Arctic marine transportation coordinator on the Governor's staff or within a State of Alaska Department. The coordinator would track Arctic transportation trends and develop strategies for Arctic marine infrastructure working with a host of stakeholders and actors including Federal agencies, industry and foreign partners.

8. **NOAA/NOS:** Work with the State and other Federal agencies to ensure that hydrographic survey plans take in account the needs of Arctic coastal ports and communities. Regional marine charts are crucial to the facilitation of economic development in many coastal communities.

8. **State of Alaska:** Determine long-term funding to enhance marine domain awareness in Alaska's waters. One element would be to continue as a user and co-funder of the Marine Exchange of Alaska. Future marine traffic data will be critical to the long-term environmental economic security of the State.standards for a certified ice navigator.

Long-term (2024-2035)

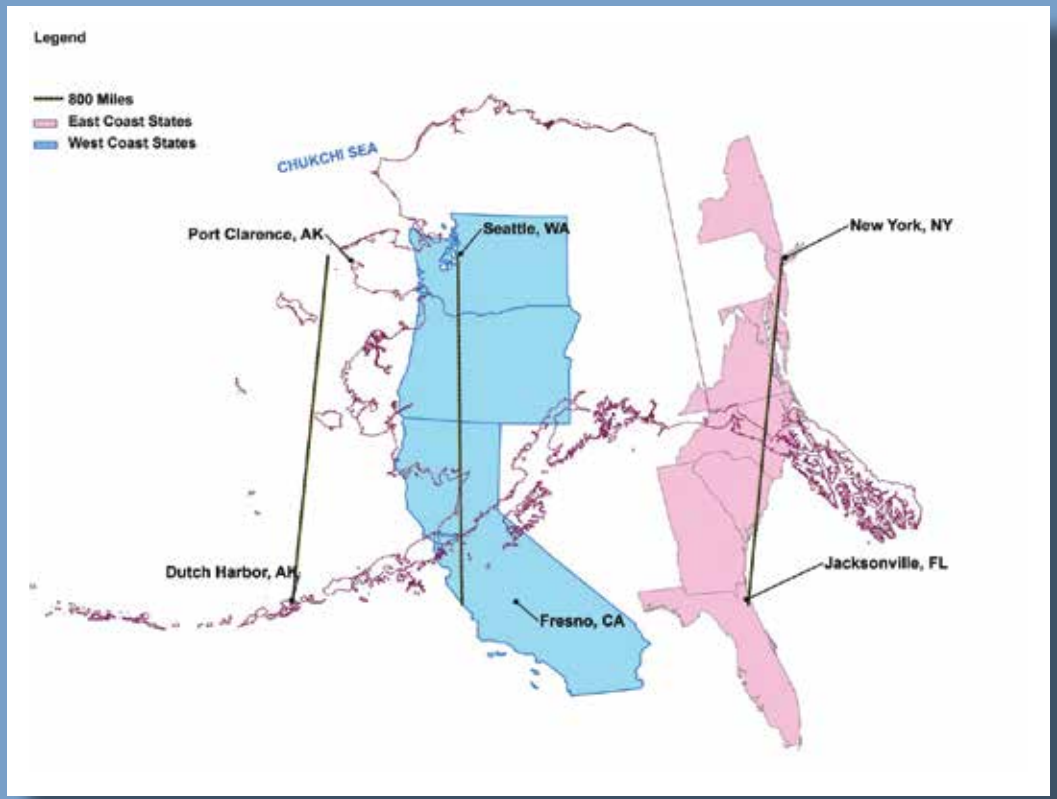
1. **State of Alaska:** Develop a comprehensive strategic plan for intermodal transportation networks to link with an Arctic port that focuses on the export of Alaska's natural resources (offshore and onshore) to global markets.

2. **Maritime Industry and State of Alaska Partnership:** Establish a joint task force to study the opportunities and economic benefits of using the Northern Sea Route for longer seasons of navigation for trade and the movement of natural resources during the summer. Invite the participation of Russian icebreaker companies and administrators to work with interested parties in enhancing trade to/from Alaska.

3. **State of Alaska and Offshore Industry Partnership:** Develop a joint strategy for training workers for the potentially expanding offshore hydrocarbon developments. Involve all State training programs and the University of Alaska system.

Shell Gulf of Mexico Inc.

Tom Cronin, USGS



Alaska District, U.S. Army Corps of Engineers

Comparison of Alaska's Vast Coastline with the U.S. East and West Coasts.

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ALASKA DEPARTMENT OF COMMERCE, COMMUNITY, AND ECONOMIC DEVELOPMENT

Alaska and the New Maritime Arctic

A Report to the State of Alaska Department of Commerce, Community and Economic Development

School of Natural Resources and Extension
University of Alaska Fairbanks
Fairbanks, Alaska

31 January 2015

Project Leader: Dr. Lawson W. Brigham

Table of Contents

1.0 Introduction……3-15

2.0 Sea Ice Changes in the U.S. Maritime Arctic……16-26

3.0 Marine Traffic in the U.S. Maritime Arctic……27-41

4.0 Northern Sea Route and Northwest Passage Developments……42-46

5.0 Projected Impact of U.S. Arctic Offshore Hydrocarbon Development…..47-99

6.0 U.S. Maritime Arctic Infrastructure Issues……..…100-108

7.0 Alaskan Arctic Maritime Workforce Potential……..109-140

8.0 Major Findings of the Study and International Workshop……141-148

9.0 Recommendations of the Project……149-150

10.0 Key Project Report References…….....151-152

11.0 Appendix: *Alaska and the New Maritime Arctic* Workshop Report.....153-180

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1.0 Introduction

Globalization and climate change are impacting the maritime Arctic in extraordinary ways early in the 21st century. 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. This is especially true in the U.S. maritime Arctic off the coast of Alaska. 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 (southern tip of Novaya Zemlya) 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. 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. 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 an era of anthropogenic warming. These changes in sea ice provide greater Arctic marine access and potentially longer seasons of navigation throughout the maritime Arctic.

These rapid changes also present a host of implications and challenges for the maritime Arctic of the United States and the State of Alaska. This is a large maritime region defined by the Arctic Research and Policy Act of 1985 as all waters north of the Aleutian Islands and the waters within the U.S. Exclusive Economic Zone to the U.S.-Canada border in the Beaufort Sea. Such a broad definition includes the entire Bering Sea, a sub-polar, but seasonally ice-covered sea with a highly productive marine ecosystem. Federal offshore leasing has already occurred in the Chukchi and Beaufort seas. Initial exploratory operations were conducted by Shell during the summer of 2012 bringing a small armada of support ships into this remote maritime region. Increased marine traffic

from the Northern Sea Route (NSR) has been observed to be sailing along the western reaches of the Bering Strait region. New ice capable liquefied natural gas (LNG) carriers, oil tankers and bulk carriers are using Bering Strait as their entrance or departure point on voyages along the NSR, taking advantage of new summer (seasonal) shipping routes.

One of the critical challenges and deep concerns is that all these new Arctic marine operations are evolving at a time where there are no international shipping rules and standards that have mandatory or binding International Maritime Organization (IMO) provisions specific to the Arctic or polar waters. Hopefully this will change on 1 January 2017 when a new, mandatory IMO Polar Code will come into force. Also, a lack of fundamental marine infrastructure - for example, navigation charts, communications, aids to navigation, ports, environmental observations, emergency response, salvage, and SAR capacity - in most Arctic regions, including the coast of Alaska, is a serious limitation for safe operations and adequate responses to maritime emergencies. This project report explores several key challenges and opportunities that the State of Alaska and the U.S. confront in taking advantage of the economic opportunities these Arctic changes present, as well as responding to environmental security issues that have arisen with expanded Arctic marine use.

1.1 Changing Arctic Marine Access

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 when Arctic sea ice is at its minimum extent in September. 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 such as 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 remains in the Arctic Ocean and the region will be left with 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 by Stephenson and colleagues has focused on how changes to Arctic marine access can be evaluated by using sea ice simulations from GCMs and a range of polar class ship types. Higher class ships (Polar Class 3 on a scale of 1 to 7) are found to gain significantly greater marine access, nearly year-round for select regions of the Arctic Ocean. Changing sea ice conditions by midcentury may also allow lower polar class vessels (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 regular trade routes are possible, only that certain type ships may or may not have marine access for 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 the U.S. maritime Arctic and Alaska this increase in marine accessibility plausibly means longer ice-free seasons for offshore hydrocarbon exploration in the decades ahead, specifically in the autumn. 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 (NSR) in the Laptev and East Siberian seas. This expanded NSR operation will potentially result in commercial ship traffic sailing through Bering Strait earlier in the spring and later each autumn. The ice-class bulk carriers and tankers sailing the NSR

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 Bering Strait region.

1.2 Key Drivers of Arctic Marine Traffic

The Arctic’s abundant natural wealth is attracting global attention and stimulating the need for transportation systems in the maritime Arctic. Although Arctic sea ice retreat provides greater marine access, the driver of today’s increasing Arctic marine traffic is principally the development of natural resources influenced by global commodity prices, and in the long-term, scarcer natural resources around the globe. This is the primary driver of increased marine traffic around Alaska and in the U.S. maritime Arctic. The Arctic Council’s Arctic Marine Shipping Assessment (AMSA) conducted 2005-09 used a scenarios creation process to identify the main uncertainties and factors shaping the future of Arctic navigation (to 2020 and 2050). Among the most influential driving forces of some 120 factors in AMSA were: global oil prices; new Arctic natural resource discoveries; the marine economic implications of seasonal Arctic marine operations (compared with year-round operations); global trade dynamics and world trade patterns; climate change severity; a major Arctic marine disaster; transit fees for Arctic waterways; the safety and security of other global maritime routes; global (IMO) agreements on Arctic ship construction rules and standards; the legal stability and overall governance of Arctic marine use; and, the entry of non-Arctic flag ships into the maritime Arctic.

Significant to the AMSA scenarios effort was the identification of two primary drivers as the axes of uncertainty in the scenarios matrix that was used to develop four plausible futures of Arctic marine navigation. Among the many uncertainties and drivers, degree of plausibility, relevance to Arctic maritime affairs, and being at the right threshold of influence were three criteria used by expert teams in the selection of two primary factors: *resources and trade* ~ demand for Arctic natural resources influenced by the uncertainty of global commodities markets and market developments; and, *governance of Arctic marine activity* ~ the degree of stability of rules and standards for marine use both within the Arctic and internationally. Climate change and Arctic sea ice retreat were

fully considered by the AMSA scenarios as key to improving marine access, and these changes were understood to continue through the century and beyond. However, throughout the conduct of AMSA, global economic factors driving Arctic natural resource developments consistently loomed large as the major determinant of future levels of Arctic marine traffic. A visible example today is the growth in numbers of large tankers and bulk carriers along the Russia's Northern Sea Route in summer. The fact that large oil tankers, LNG carriers and bulk carriers will be sailing sooner through Bering Strait and into Arctic waters in greater numbers requires complex regulatory measures (both regional and international at IMO) and much greater cooperation between the Arctic states, all maritime nations, and the maritime industry. And, these Arctic voyages demand that marine infrastructure improvements will have to be made much earlier than anticipated to keep pace with the rapid increase in use of Arctic coastal routes and to provide adequate systems for safe navigation. This last point is a major challenge for the United States as there is very limited marine infrastructure anywhere north of the Aleutian Islands.

1.3 AMSA's Relevance to the U.S. Maritime Arctic

The Arctic Council under its technical working group Protection of the Arctic Marine Environment (PAME) conducted the far reaching study, AMSA, that focused on marine safety and environmental protection issues, consistent with the Council's mandate. AMSA was led by Canada, Finland and the United States with more than 200 experts contributing (AMSA, 2009). Thirteen major workshops were held on such key topics as: future scenarios of Arctic marine navigation; environmental impacts; marine infrastructure; indigenous use; marine insurance; and, Arctic marine incidents. Importantly, the AMSA team reached out to Arctic coastal communities in Alaska (Nome and Barrow), northern Norway, northern Canada, and Iceland and held fourteen AMSA town-hall meetings to gain insights into the concerns and shared interests of indigenous and non-indigenous residents. Ninety-six AMSA findings were presented in the *Arctic Marine Shipping Assessment 2009 Report* and a selection of key findings is presented in Table 1.1. Each of these key findings has direct applicability to the U.S. maritime

Table 1.1 ~ Key Findings of the Arctic Council's Arctic Marine Shipping Assessment (AMSA 2009 Report).

- **Governing Legal Regime ~** The law of the Sea, as reflected in the 1982 United Nations Convention on the Law of the Sea (UNCLOS), sets out the legal framework for the regulation of (Arctic) shipping according to maritime zones of jurisdiction.
- **Key Drivers of Arctic Shipping ~** Natural resource development and regional trade are the key drivers of increased Arctic marine activity. Global commodities prices for oil, gas, hard minerals, coal, etc. are driving the exploration of the Arctic's natural wealth.
- **Destinational Shipping ~** Most Arctic shipping today is destinational (vice trans-Arctic), moving goods into the Arctic for community resupply or moving natural resources out of the Arctic to world markets. Nearly all marine tourist voyages are destinational as well.
- **Uncertainties of Arctic Navigation ~** A large number of uncertainties define the future of Arctic marine activity including: the legal and governance situation; degree of Arctic state cooperation; climate change variability; radical changes in global trade; insurance industry roles; an Arctic maritime disaster; new resource discoveries; oil prices and other commodity pricing; and, future marine technologies.
- **Retreat of Arctic Sea Ice ~** Global climate simulations show a continuing retreat of Arctic sea ice through the 21st century; all simulations indicate an Arctic sea ice cover remains in winter.
- **Arctic Community Impacts ~** Marine shipping is one of many factors affecting Arctic communities, directly and indirectly. The variety of shipping activities and the range of social, cultural and economic conditions in Arctic communities mean that shipping can have many effects, both positive and negative.
- **Most Significant Environmental Threat ~** Release of oil in the Arctic marine environment, either through accidental release or illegal discharge, is the most significant threat from shipping activity.
- **Marine Infrastructure Deficit ~** A lack of major ports and other maritime infrastructure, except for those along the Norwegian coast and the coast of northwest Russia, is a significant factor (limitation) in evolving and future Arctic marine operations.
- **Lack of Charts and Marine Observations ~** Significant portions of the primary Arctic shipping routes do not have adequate hydrographic data, and therefore charts, to support safe navigation. The operational network of meteorological and oceanographic observations in the Arctic, essential for accurate weather and wave forecasting for safe navigation, is extremely sparse.
- **Ice Navigator Expertise ~** Safe navigation in ice-covered waters depends much on the experience, knowledge and skills of the ice navigator. Currently, most ice navigator training programs are ad hoc and there are no uniform, international training standards.
- **Special Areas ~** There are certain areas of the Arctic region that are of heightened ecological significance, many of which will be at risk from current and/or increased shipping.

Arctic. The AMSA effort can be viewed in three important ways: first, as a *baseline assessment* and snapshot of Arctic marine use early in the 21st century (this was developed from data collected by the Arctic states and contributed to the AMSA team; data included ship type, marine use, season of operation, and Arctic region of operation); second, as a *strategic guide* to a host of states, Arctic residents, users, stakeholders and actors involved in current and future Arctic marine operations; and, third, as a *policy framework* document of the Arctic Council and the Arctic states focused on protecting Arctic people and the marine environment.

The key aspect of the *AMSA 2009 Report* is that the 17 recommendations were negotiated by the Arctic states and consensus reached so that the final AMSA report could be approved by the Arctic Ministers at the April 2009 Arctic Council Ministerial meeting in Tromso, Norway. The work of AMSA continues as status reports have been requested by the Ministers and Senior Arctic Officials; two AMSA implementation status reports have been issued by PAME and the Council in May 2011 and May 2013, and a third will be released in April 2015. AMSA remains a living policy document of the Council with a long-term goal of implementing all 17 recommendations, each an integral part of a whole Arctic Council policy strategy. The AMSA recommendations focus on three interrelated themes:

(I) Enhancing Arctic Marine Safety;

(II) Protecting Arctic People and the Environment; and,

(III) Building the Arctic Marine Infrastructure.

Table 1.2 (left column) lists the three AMSA themes and the specific recommendations under each of the themes. Since the release of AMSA, two key recommendations have been acted on by the Arctic states using the Arctic Council process (with Permanent Participant and observer involvement) to negotiate agreements. A treaty on Arctic search and rescue (SAR), the *Agreement on Cooperation on Aeronautical and Maritime Search and Rescue in the Arctic*, was signed by the Arctic Ministers during the Arctic Council Ministerial meeting in Nuuk, Greenland on 12 May 2011. It is a binding agreement to strengthen SAR cooperation and coordination in the Arctic and establishes areas of SAR responsibility for each of the Arctic states. The lead

Table 1.2 ~ Comparison of the AMSA Recommendations with the Elements of the U.S. National Strategy for the Arctic Region (Strategy Page Number in Parentheses).

AMSA Recommendations	National Strategy for the Arctic Region
I. Enhancing Arctic Marine Safety	
A. Linking with International Organizations	-Strengthening International Cooperation (2)
B. IMO Measures for Arctic Shipping D. Strengthening Passenger Ship Safety in Arctic Waters	-Promotion of safe, secure and reliable Arctic shipping, a goal that is best pursued through the IMO (10)
C. Uniformity of Arctic Shipping Governance	-Preserve Arctic Region Freedom of the Seas (6) -Accede to the law of the Sea Convention (9)
E. Arctic Search and Rescue Instrument	-2011 Arctic Search and Rescue Agreement (9)
II. Protecting Arctic People & the Environment	
A. Survey of Arctic Indigenous Marine Use B. Engagement with Arctic Communities	-Consult & Coordinate with Alaska Natives (11) -Policy emphasizes trust, respect and shared responsibility (11)
C. Areas of Heightened Ecological and Cultural Significance D. Specially Designated Marine Areas E. Protection from Invasive Species F. Oil Spill Prevention G. Addressing Impacts on Marine Mammals H. Reducing Air Emissions	-Protect the Arctic Environment and Conserve Arctic Natural Resources (7) -Use Integrated Arctic Management to Balance Economic Development, Environmental Protection and Cultural Values (8) -Contribute to the identification of ecologically sensitive areas (8)
III. Building the Arctic Marine Infrastructure	
A. Addressing the Infrastructure Deficit	-New thinking on public-private partnerships and multinational partnerships (10) -Carefully tailor regional infrastructure as well as our response capacity (6)
B. Arctic Marine Traffic Systems	-Enhance Arctic Domain Awareness (6) -Develop Arctic waterways management regimes (7)
C. Circumpolar Environmental Response Capacity	-2013 Arctic Marine Oil Pollution Preparedness and Response Agreement (9) -Capacity~respond to natural/man-made disasters (6)
D. Investing in Hydrographic, Meteorological and Oceanographic Data	-Better earth system-level knowledge (8) -Chart the Arctic region (8)

negotiators of this process were from the United States and Russia. A second agreement negotiated under the auspices of the Arctic Council (the lead negotiators were from the United States, Russia and Norway) is the *Agreement on Cooperation on Marine Oil Pollution Preparedness and Response in the Arctic* signed by the Arctic Ministers in Kiruna, Sweden on 15 May 2015. Both agreements fulfill AMSA recommendations that called for greater cooperation in the practical aspects of Arctic emergency response. The elements of both Arctic agreements need to be integrated into U.S. strategies and plans that address the maritime Arctic and the international relationships regarding Arctic emergency response with Canada and Russia.

Each of the AMSA recommendations require increased international cooperation among the Arctic states, among the maritime nations at IMO (and other international maritime bodies such as the International Hydrographic Organization), and in the development of new public-private partnerships. There is little doubt the most significant recommendation under theme I is for mandatory IMO standards and requirements for all ships operating in Arctic waters, and the augmentation of IMO ship safety and pollution prevention conventions (such as MARPOL) with Arctic-specific requirements. Another key recommendation flags the importance of strengthening passenger ship safety in Arctic waters. Theme II has a key recommendation for the need to conduct comprehensive surveys of indigenous marine use. These surveys are essential if integrated, multi-use management principles, or marine spatial planning concepts, are to be applied to Arctic marine areas. There are also calls for identifying areas of heightened ecological and cultural areas (such as the entire Bering Strait region), and exploring the need for specially designated Arctic marine areas (for example IMO Special Areas or Particularly Sensitive Sea Areas). The elements of Theme III on marine infrastructure were believed by the AMSA team to be of critical importance. Most of the Arctic marine environment is poorly charted and requires increased hydrographic surveying to support safe Arctic navigation. The Arctic region is in need of a host of key investments for: improved communications; an effective ship monitoring and tracking system; more observed environmental information (weather, climate, sea ice, and more); environmental response capacity; new ports; and aids to navigation. The

infrastructure initiatives, particularly those required in the U.S. maritime Arctic (where there is little to no baseline infrastructure), are all complex projects and long-term, and each will require significant funding.

Notable in AMSA was a section on the Bering Strait region. The section emphasized that the Bering Strait is an international strait and a significant, natural chokepoint for maritime traffic, marine mammals and seabirds. The region is on the continental shelf of Russia and the United States, and the surrounding shallow seas are highly productive ecosystems. All of the coastal indigenous communities on both sides of Bering Strait are reliant on marine resources for subsistence and vulnerable to ecological disruption. Hunting for large marine mammals can take place 50-80 nautical miles from shore and thus interaction with large ship traffic is perhaps inevitable. The human, cultural, ecological and commercial complexities in the Bering Strait region make it one of the most challenging Arctic areas for application of enhanced marine safety and environmental protection measures. Critical to applying integrated management of marine uses in the region are requirements (two recommendations from AMSA) for two essential needs: (A) a comprehensive survey of Arctic marine use by coastal indigenous communities to include a current, baseline assessment and also projected areas of future uses with continued Arctic climate change; and, (B) continued identification and refinement of areas in the U.S. maritime Arctic that should be considered of heightened ecological and cultural significance.

Table 1.2 is also a comparison of the AMSA recommendations with themes and key issues within the U.S. *National Strategy for the Arctic Region* (NSAR, 2013). There is an excellent match between the two efforts even though the AMSA recommendations are more focused on marine safety and environmental protection. Nearly all of the AMSA recommended actions are mentioned either specifically or in the broader context of a national goal or line of effort. This comparison suggests that the set of AMSA recommendations (and the three over-arching AMSA themes) is a tailor made policy framework for the U.S. federal agencies to use in addressing the environmental security challenges in its maritime Arctic at a time of expanding marine use. And, of course, the U.S. agreed to the AMSA recommendations in consensus with the seven other Arctic

states, and was a leader in the execution of the AMSA effort from its inception. AMSA represents a reasonable strategic guide for all federal and State of Alaska agencies in addressing in a holistic approach the many marine environmental and safety issues confronting the new maritime Arctic.

1.4 Importance of an IMO Mandatory Polar Code

The development of a mandatory IMO Polar Code for ships operating in polar waters is the most critical component in a matrix of strategies and measures to protect Arctic people and the marine environment. Of the 17 AMSA recommendations that were approved by the Arctic Ministers in 2009, reaching agreement for a mandatory Polar Code at IMO was deemed most essential to provide unified and enhanced Arctic marine safety and environmental protection. A process to develop special rules for polar ships began in the early 1990s with an IMO Outside Working Group of technical experts that met from 1993-97. The Working Group's strategy at the outset was to build on existing IMO ship rules. The Polar Code was never intended to duplicate or replace existing IMO standards for safety, pollution prevention, and training. The additional measures focused equally on the safety of human life and the protection of the marine environment and included three key elements: polar ship construction standards; polar marine safety equipment; and, ice navigator standards for training and experience. These elements were included in the IMO's voluntary *Guidelines for Ships Operating in Arctic Ice-Covered Waters* (2002) and in the latest voluntary measures adapted for both polar regions, *Guidelines for Ships Operating in Polar Waters* (2009). It should be noted that the shift from 'ice-covered waters' to polar waters' was a fundamental recognition that ships operating in remote polar seas, often devoid of adequate charting and key infrastructure, do not have to be sailing in sea ice for higher risks to be present. Recent Polar Code work has focused on defining the risks for various class ships operating in ice-covered and ice-free waters, identifying hazards, and then relating how the marine hazards can be adequately mitigated to lower (and acceptable) levels. It is intended that all ships that might operate in polar waters would be included in the Polar Code, including such vessels as cruise ships on summer voyages and research ships (naval and government vessels are excluded). One of the significant outcomes of a Polar Code

will be an international and unified set of mandatory rules and regulations that are non-discriminatory to the global maritime industry.

The importance and relevance of an IMO mandatory or binding Polar Code to Alaska and the U.S. maritime Arctic cannot be overstated. Russia and Canada each have their own set of special rules and regulations for their Arctic waterways justifying the application of these rules on Article 234 of UNCLOS (which allows the coastal state within its Exclusive Economic Zone EEZ to adopt and enforce non-discriminatory rules and regulations for the prevention, reduction and control of marine pollution from vessels in ice-covered seas). The U.S. has never developed a separate set of special ship rules or regulations for polar operators in the U.S. maritime Arctic. No U.S. Arctic specific rules or standards for commercial ships have been developed today to respond to recent increases in vessel operations in the region. A mandatory IMO Polar Code will provide the U.S. Coast Guard with a set of international rules and standards which it can implement for U.S. waters defined as polar within the language of the Code. Even if the U.S. were today a party to UNCLOS, it is unlikely it would develop a set of special Arctic ship rules using Article 234 as a legal basis, preferring instead to use standards and rules agreed upon at the IMO and applicable to all polar waters (and all ships navigating in polar waters). Future application of the Polar Code regulations for all foreign and domestic ships will be consistent throughout the U.S. maritime Arctic and hopefully uniform enforcement will be applied by the Arctic coastal states throughout the entire circumpolar region.

1.5 National Strategy Implementation Plan

Released by the White House in January 2014 the *Implementation Plan for the National Strategy for the Arctic Region* provides 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 non-governmental organizations. For the maritime domain of interest to this review, the Plan presents a 10-year horizon that will be used to prioritize federal infrastructure in the U.S. maritime Arctic. The Plan also calls for a 10-year projection of Arctic maritime activity to

be completed by the end of 2014 (Plan, 2014). This will be a very challenging task given the great number of economic, environmental, and geopolitical uncertainties influencing Arctic marine operations as identified in AMSA. 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. These are just a subset of the many tasks presented in the Plan but it is clear the maritime domain requires special and timely attention using integrated approaches that can respond to a broad array of security challenges.

1.6 Report Sections

The following report sections focus on aspects of the current and future of the maritime Arctic around Alaska: Arctic sea ice; current marine traffic; the Northern Sea Route and linkages; offshore hydrocarbon development; marine infrastructure; and the maritime workforce.

2.0 Sea Ice Changes in the U.S. Maritime Arctic

A team of researchers at the University of Alaska Fairbanks (included in the research were scientists at the University of Washington, University of Illinois, National Snow & Ice Data Center, and NOAA) has created an *Historical Sea Ice Atlas for Alaska Waters*. The digital sea ice atlas maximizes the useful information on historical sea ice conditions in the waters surrounding Alaska from monthly observations back to the mid-1800s, and weekly observations for 1953 to today. Sources of the sea ice data for the atlas include: (1) whaling ship/shore reports for the 1800s onward; (2) aircraft surveys from the 1900s onward; and, (3) satellite observations from the 1970s onward. A host of data sources have been used in this synthesis effort including sea ice maps created by Denmark, Russia and the United States. The atlas has a web site (http//seaiceatlas.snap.uaf.edu/) and the online tool allows an interactive selection of information for each sea ice map. A user can select graphs and animations as well as derive sea ice information, for example, open/close dates, breakup dates, and the length of the open water season.

This historical data base can also reveal trends and comparisons using advanced modeling and programming techniques. For this project the atlas team was asked to create a set of maps that would compare the ice edges for sea ice around Alaska between the 1950s and 2000s (2000 to 2009). The maximum advance of sea ice in the Bering Sea occurs in March; the minimum ice edge (or maximum retreat) usually is observed in September in the Beaufort Sea north of Alaska. Eight sea ice maps follow and the information is derived from the rich database for the new *Historical Sea Ice Atlas for Alaska Waters*. The following reviews of the sea ice maps reveal key information that can influence the future of marine operations around Alaska in the decades ahead.

- Figures 2.1 and 2.2 compare sea ice edges in the Bering Sea for March and April between the 1950s and 2000s. The mean decadal ice concentration edge for March has retreated a short distance in five decades. However, overall the ice edge shows high spatial variability and generally remains close to the self break in the Bering Sea. Again in April (Figure 2.2) the mean decadal ice edge for the

2000s has not retreated significantly from its observed position for the 1950s. The key message is that the Bering Sea maximum ice edge has not changed significantly for five decades despite regional and global warming.

- Figures 2.3 and 2.4 compare sea ice edges in the Bering Sea and through Bering Strait for May and June between the 1950s and 2000s. The mean decadal ice edge for May (Figure 2.3) shows a northern retreat in the Bering Sea ice edge in five decades. However, in the 2000s the mean ice edge is generally located south of St. Mathew Island. High spatial inter-annual variability is observed for the decade of the 2000s. The comparison for June (Figure 2.4) indicates that the mean decadal ice edge for the 2000s can be found father north in the Chukchi Sea: in contrast, the mean decadal ice edge for the 1950s remains near St. Mathew Island in mid-Bering Sea. The decadal ice edges for both periods show high inter-annual variability in location.

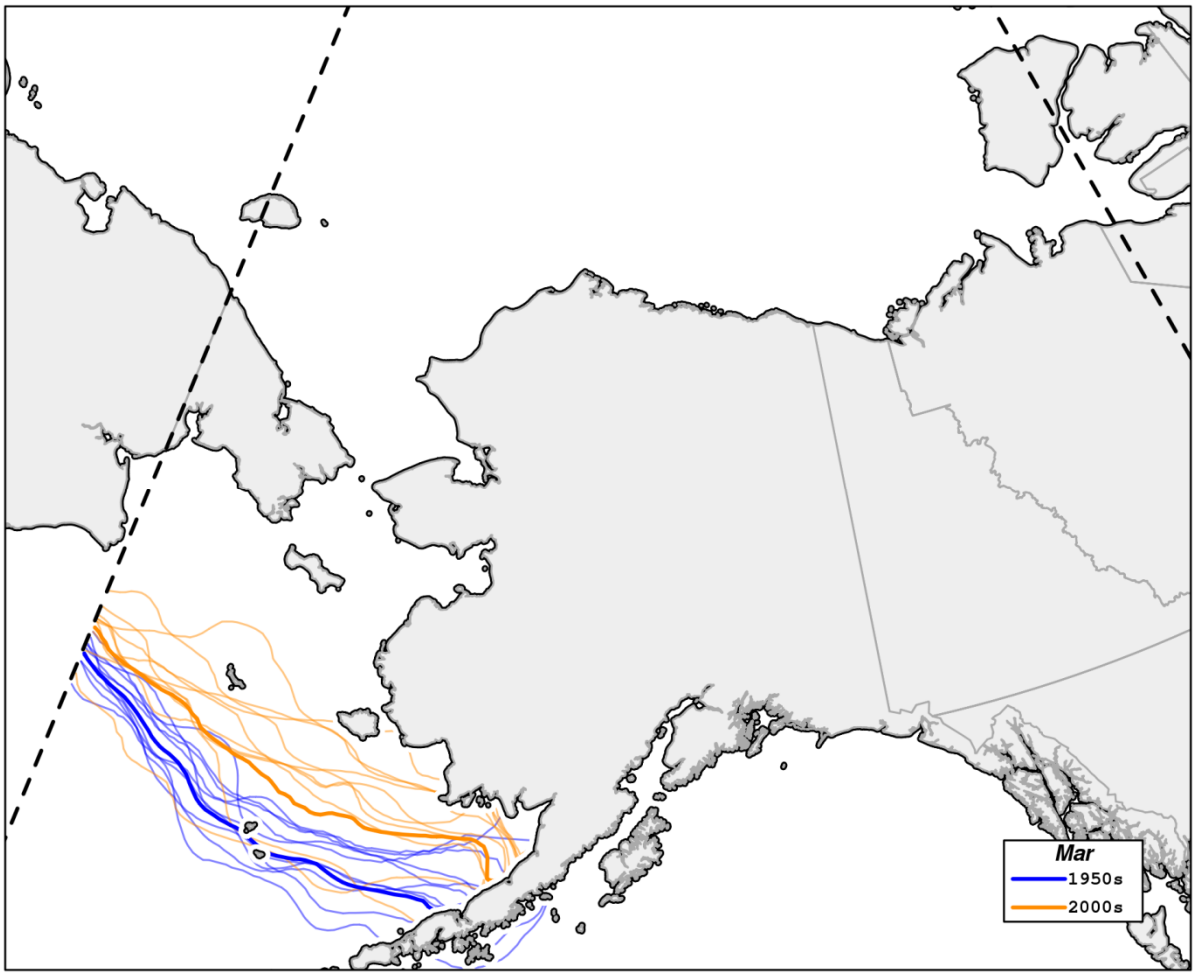
- Figure 2.5 displays the annual and mean decadal ice edges for September in the 1950s and 2000s. The mean decadal ice edge for the 1950s is located in the north Chukchi Sea while the corresponding ice edge for the 2000s has retreated a significant distance offshore into the central Arctic Ocean (north of the Beaufort Sea). This change potentially represents earlier ice-free conditions in the Chukchi and Beaufort seas for marine operations. Figure 2.6 enhances this retreat by comparing the mean decadal ice edges for each of the decadal periods (1950s, 1960s, 1970s, 1980s, 1990s, and 2000s). All indicate a steady retreat of the minimum ice edge northward from the coast of Alaska in the Chukchi Sea and hundreds of nautical miles north of the north coast of Alaska. This change is a significant change in the operational and navigation season for the U.S. maritime Arctic.

- Figure 2.7 is a map illustrating the advance of sea ice for September through March – the advance from the mean decadal minimum ice edge in the Arctic Ocean (in autumn) to the mean decadal maximum ice edge in the Bering Sea (in winter). A slower advance is confirmed by comparisons between the 1950s data

with the 2000s. For marine navigation this corresponds to potentially longer periods of ice-free conditions remaining later in the autumn during the past five decades.

- Figure 2.8 is a comparison of the seasonal retreat of sea ice between the 1950s and 2000s (March to August). For June, July and August there is a much more rapid retreat of sea ice during the 2000s, compared with the 1950s. Earlier seasonal marine operations along the Alaskan coast may be feasible.

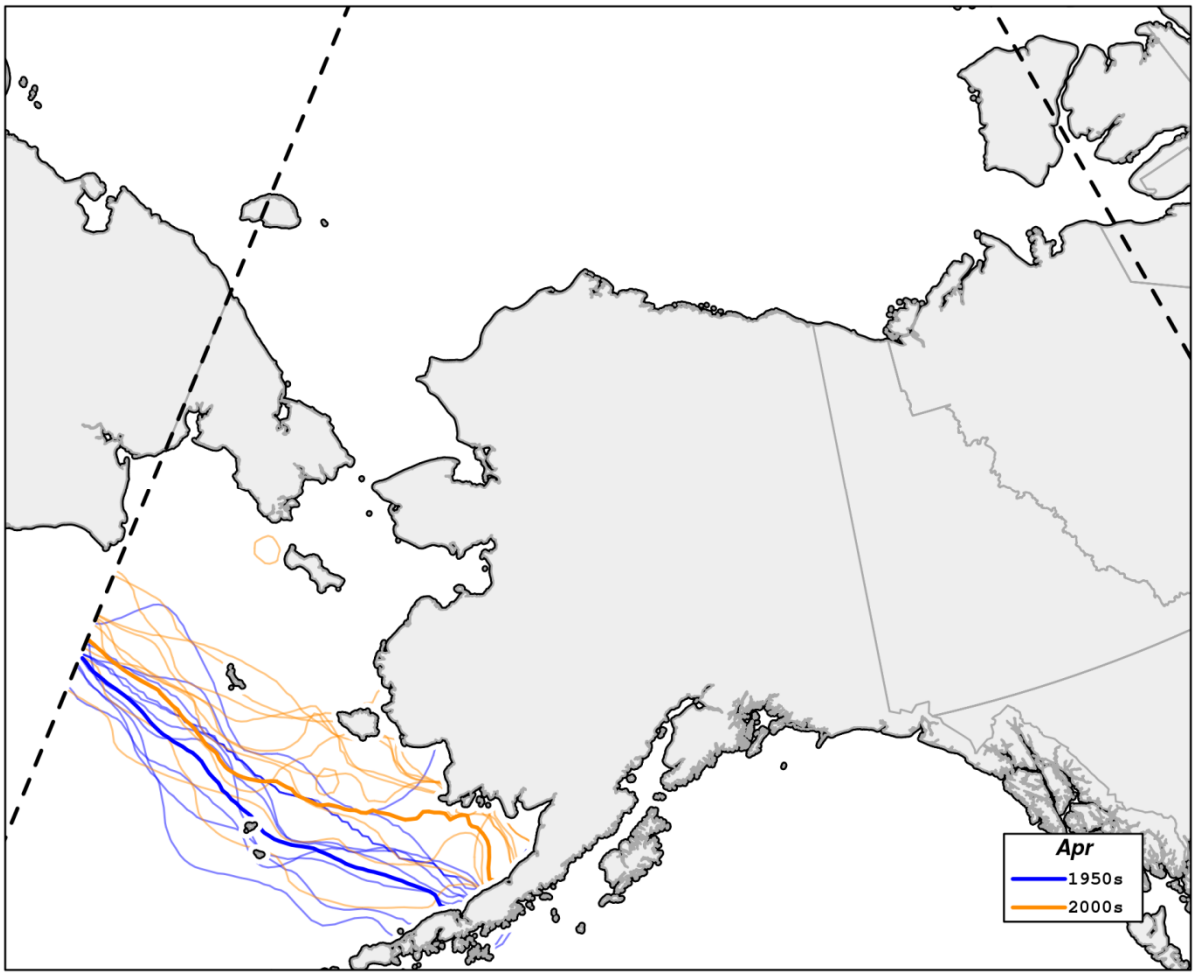
Annual and Mean Decadal 15% Sea Ice Concentration Edges



Edges are estimated 15% contour lines for mean decadal sea ice concentration.

Figure 2.1 ~ March 1950s and 2000s Comparison

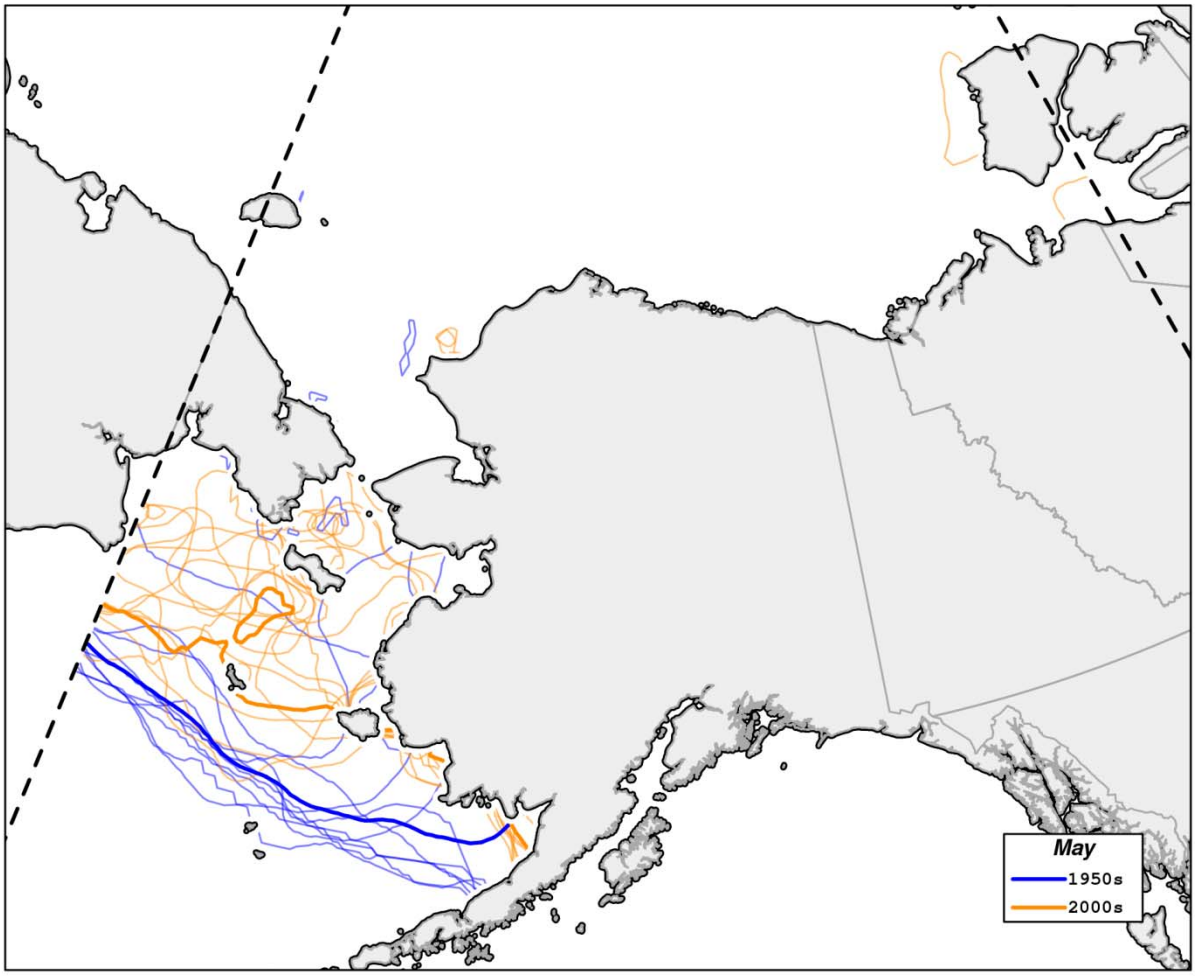
Annual and Mean Decadal 15% Sea Ice Concentration Edges



Edges are estimated 15% contour lines for mean decadal sea ice concentration.

Figure 2.2 ~ April 1950s and 200s Comparison

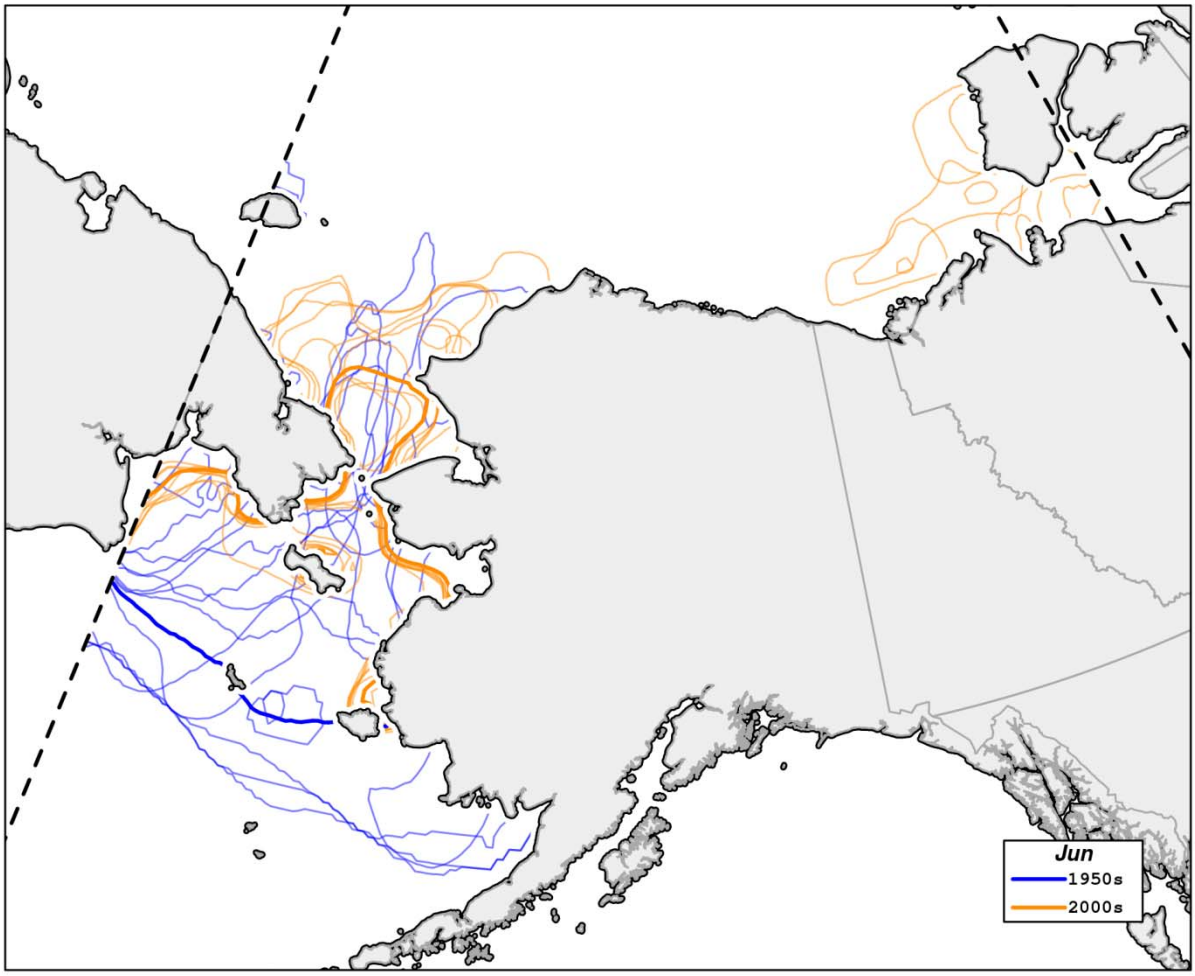
Annual and Mean Decadal 15% Sea Ice Concentration Edges



Edges are estimated 15% contour lines for mean decadal sea ice concentration.

Figure 2.3 ~ May 1950s and 2000s Comparison

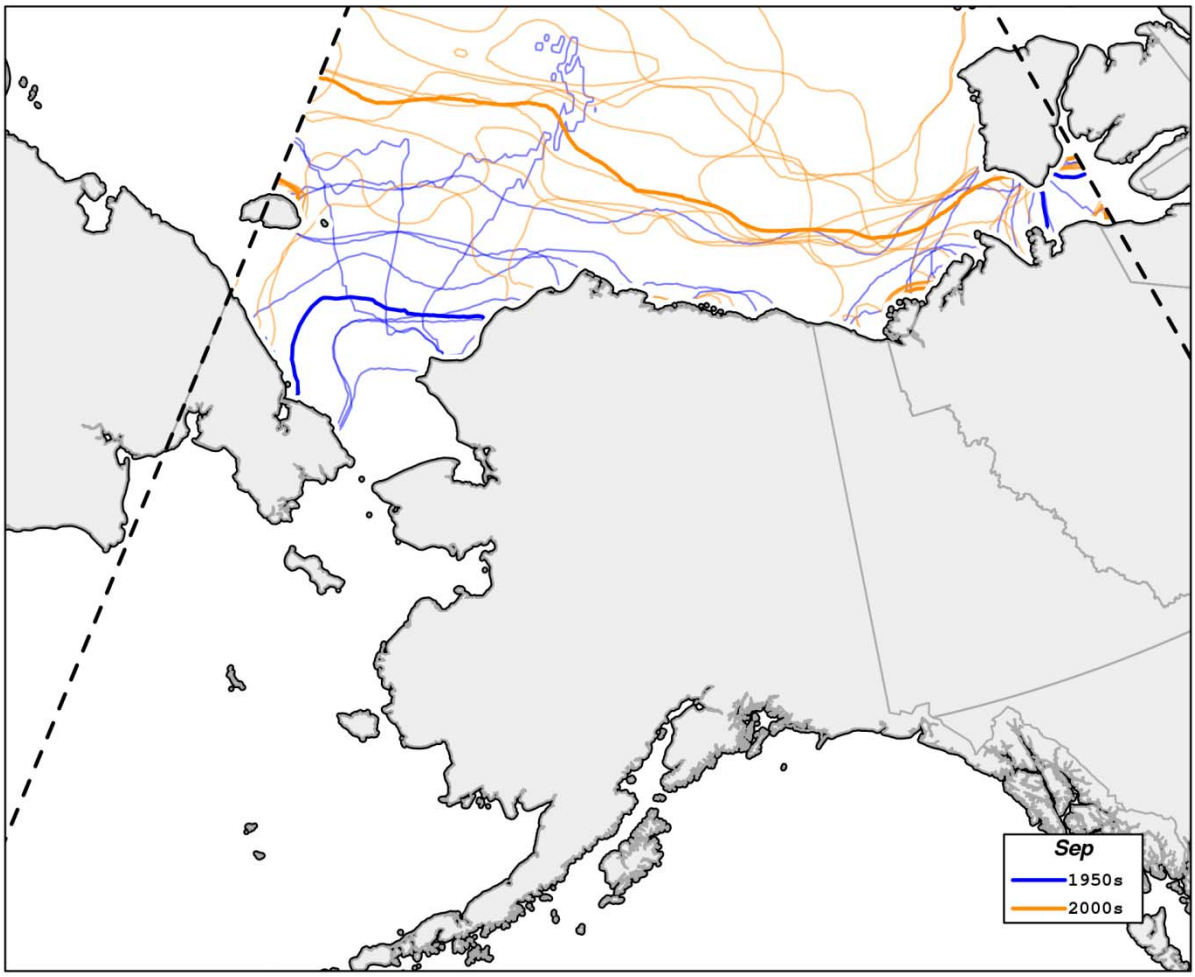
Annual and Mean Decadal 15% Sea Ice Concentration Edges



Edges are estimated 15% contour lines for mean decadal sea ice concentration.

Figure 2.4 ~ June 1950s and 2000s Comparison

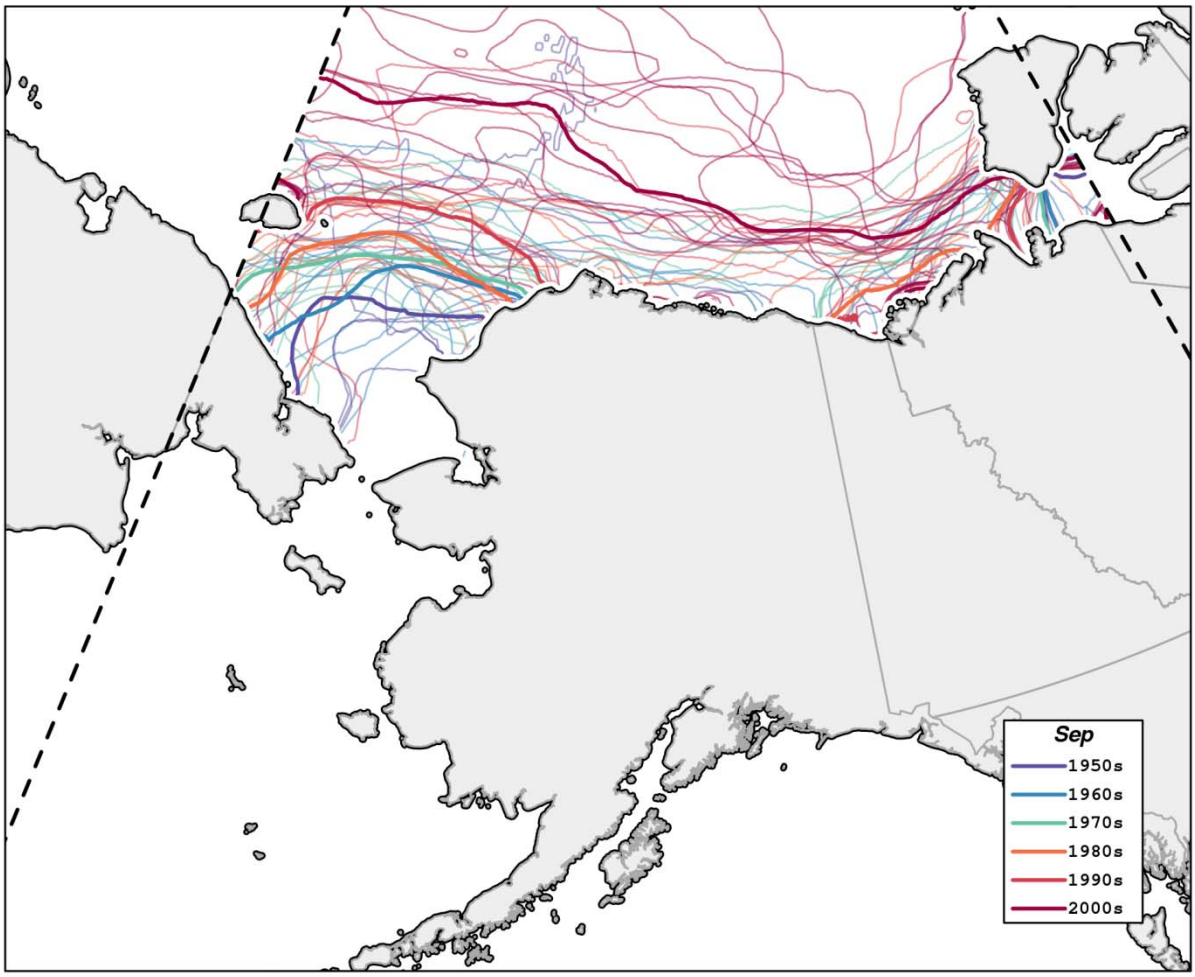
Annual and Mean Decadal 15% Sea Ice Concentration Edges



Edges are estimated 15% contour lines for mean decadal sea ice concentration.

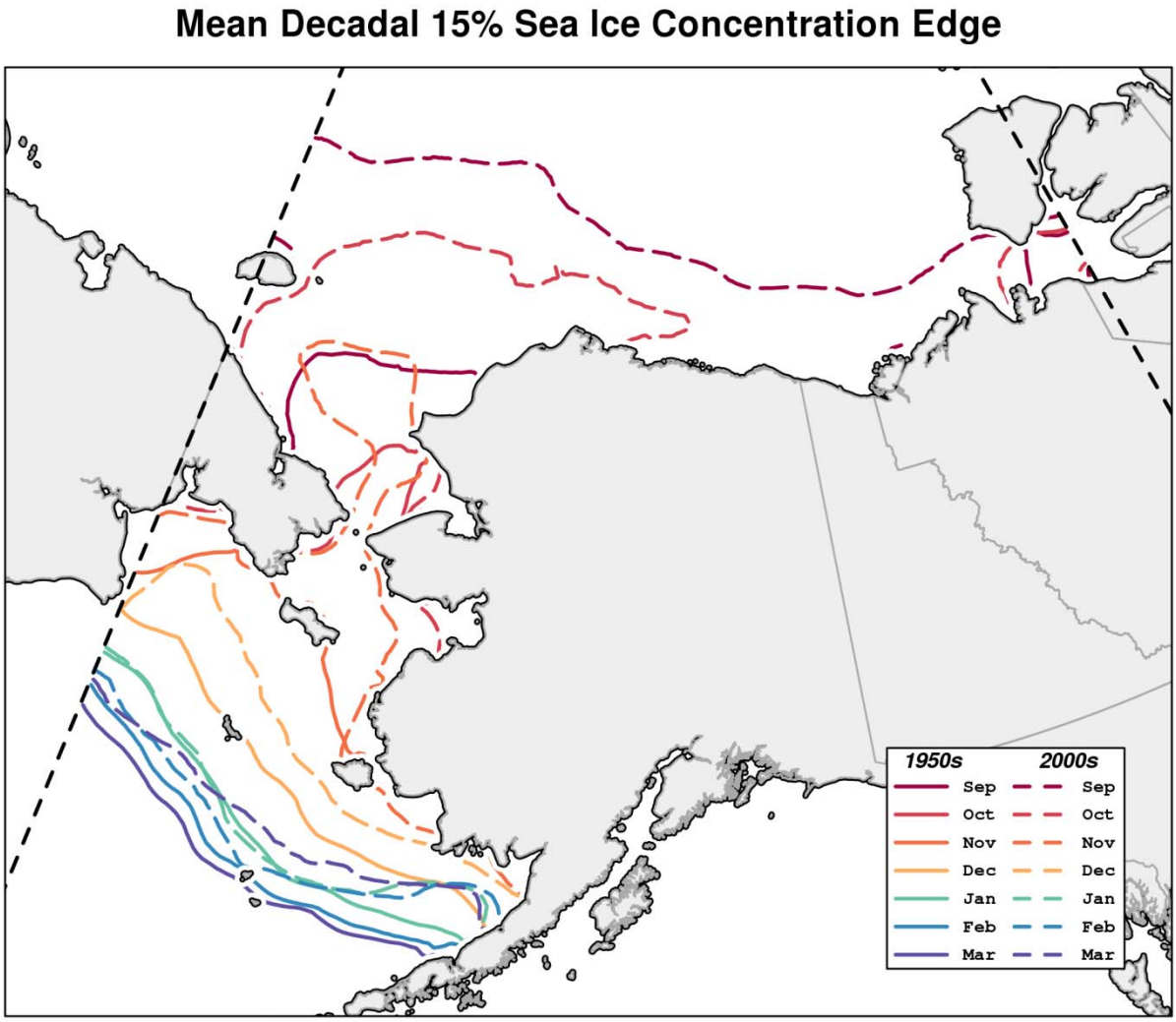
Figure 2.5 ~ September 1950s and 2000s Comparison

Annual and Mean Decadal 15% Sea Ice Concentration Edges



Edges are estimated 15% contour lines for mean decadal sea ice concentration.

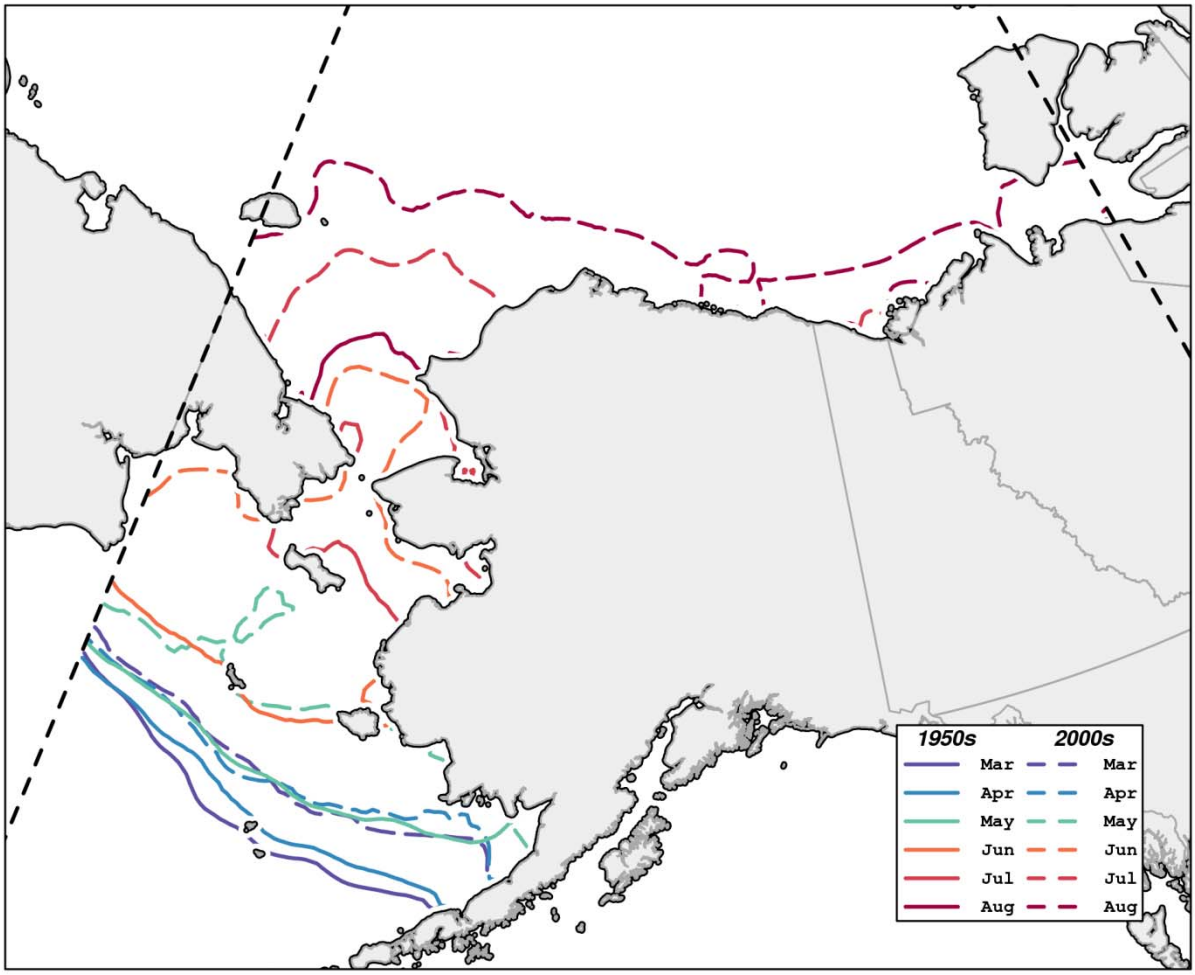
Figure 2.6 ~ Retreat of the Ice Edge in September, 1950s to the 2000s.



Edges are estimated 15% contour lines for mean decadal sea ice concentration.

Figure 2.7 ~ Ice Edge Advance September to March for the 1950s through 2000s

Mean Decadal 15% Sea Ice Concentration Edge



Edges are estimated 15% contour lines for mean decadal sea ice concentration.

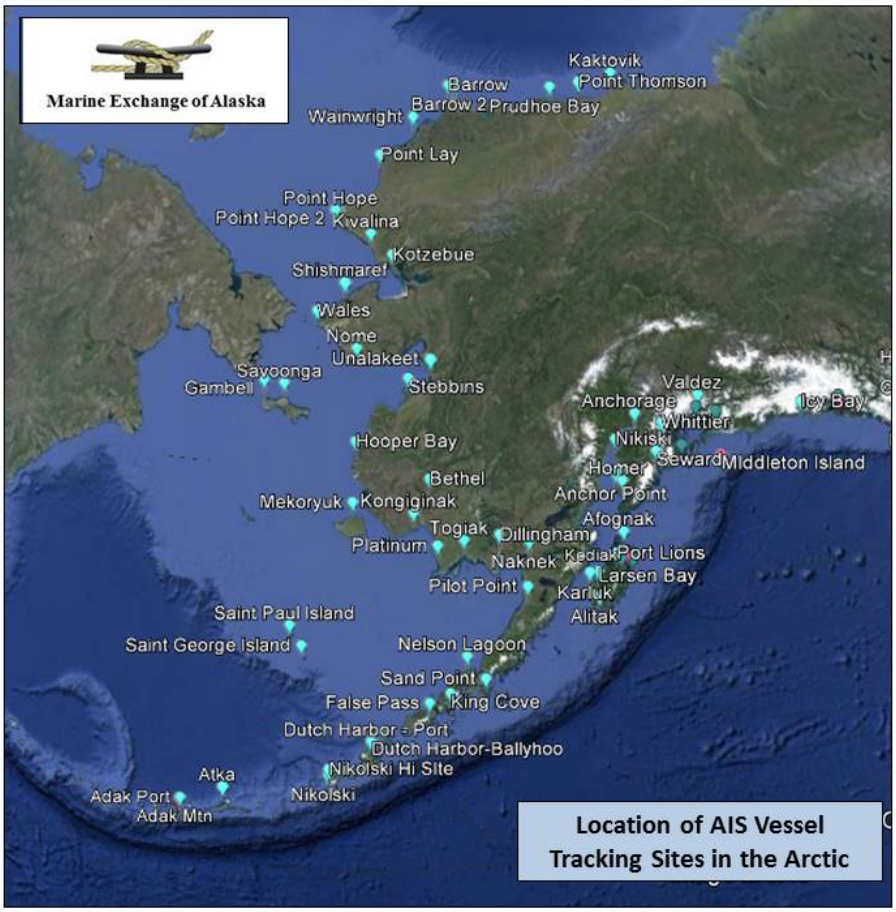
Figure 2.8 ~ 1950s and 2000s Comparison of the Seasonal Retreat of Sea Ice

3.0 Marine Traffic in the U.S. Maritime Arctic

3.1 Introduction

The following analysis of marine traffic in the U.S. maritime Arctic made use of Automatic Identification System (AIS) data compiled by the Marine Exchange of Alaska (2011-2014). Seasonal variation in traffic was demonstrably dramatic and pronounced. Though there was a spike in traffic in the ice-free months of June to November in 2012 correlating to Shell's exploratory drilling in the Chukchi and Beaufort Seas, the increase in traffic was minor but evolutionary. Most shipping in 2011 was coastal and domestic in nature (resupply of coastal communities) as it proved to be in 2014. The Automatic Identification System (AIS) sites utilized for this study were compiled using the sites indicated below in Figure 3.1 by the Marine Exchange of Alaska.

Figure 3.1 ~ AIS collection sites used by the Marine Exchange of Alaska



3.2 Seasonal Variation is a Key Finding

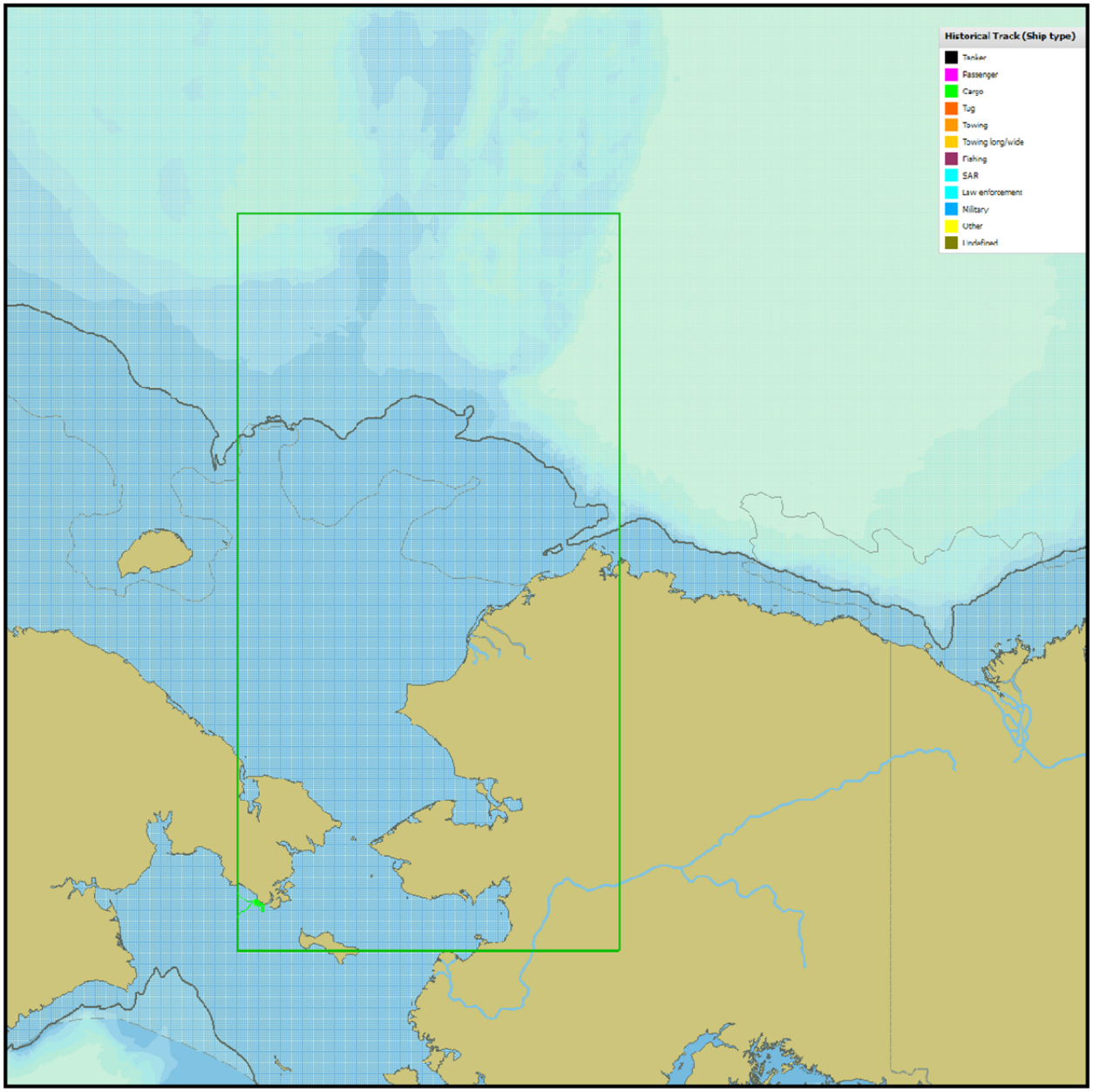
The data indicates that shipping transits in the U.S. maritime Arctic are almost entirely concentrated in the ice-free season (June to November). *Shipping activity in the U.S. maritime Arctic remains entirely seasonal*. The AIS data for the Bering Strait, for example, begins to increase in late May, peaks in July and August, and ends by November. AIS track data indicates the seasonal dynamic and coastal nature of most of the traffic. Additionally, the pattern of both Russian shipping as well as U.S. traffic tend to remain in their own waters, likely for fuel, shorter transits and perhaps, simplicity of regulatory compliance. The following time capture of tracks from 1 June 2014 to 1 December 2014 illustrates these patterns in the U.S. maritime Arctic.

The U.S. seasonal traffic on the maps indicates a high concentration of tugs and barges which is the nature of resupply of coastal communities and the North Slope during summer. There are a small number of bulk cargo carriers (20-28) that sail to Kivilina and carry out zinc ore from the Red Dog Mine complex to global markets. The data also indicates a small number of coastal tankers on the U.S. side. These operations are conducted in ice-free waters during a short window of 6-7 weeks in summer. On the Russian side of the Bering Strait region the Marine Exchange data clearly indicates the passage of tankers, bulk carriers, LNG carriers, icebreakers and additional commercial support vessels. This flow of traffic during summer reflects traffic sailing to and from Russia's Northern Sea Route (defined in Russian law as the waterways between Kara Gate in the west and to the Bering Strait in the east). Any ships coming out of the Russian Arctic to the Pacific, and any ships making a full transit of the Northeast Passage (across the entire Russian Arctic from Atlantic to Pacific) must use the Bering Strait.

3.3 Seasonal Case Studies of Marine Traffic

The following is an examination of AIS shipping traffic over a two year period broken up into four case studies; winter 2013, summer 2013, winter 2014 and summer 2014. The first case study, Figure 3.2, is a compilation of AIS tracks from January through May 2013 in the Bering Strait Chukchi Sea. The scarcity of tracks is revealing and highlights the seasonality of regional traffic.

Figure 3.2 ~ 1 January through 31 May 2013 in the Bering Strait and Chukchi Sea



The next case, summer season of 2013, is illustrated in Figure 3.3. This data map encompasses a normal open water season from June to November.

Figure 3.3 ~ 1 June through 31 December 2013 in the Bering Strait and Chukchi Sea

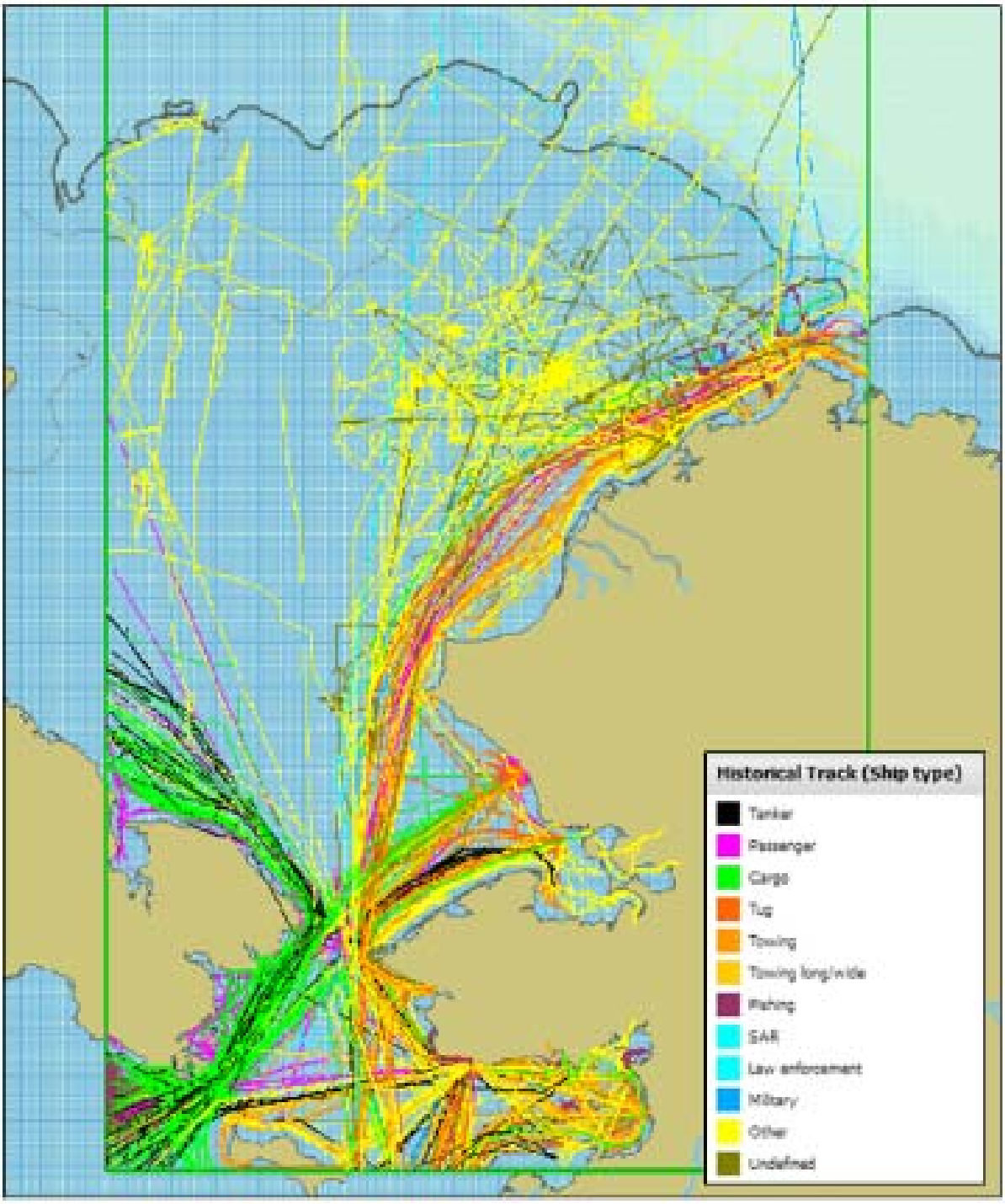
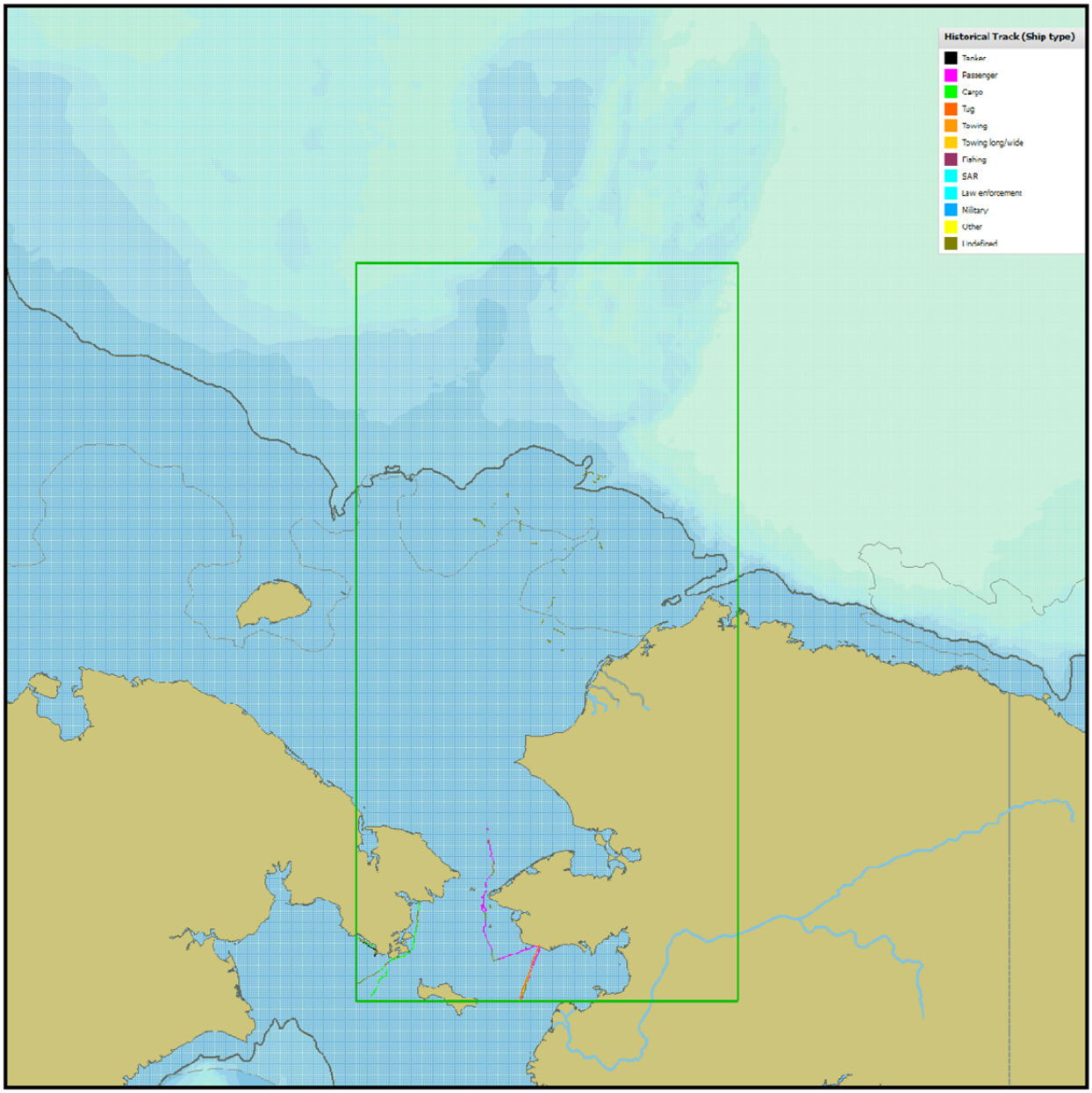
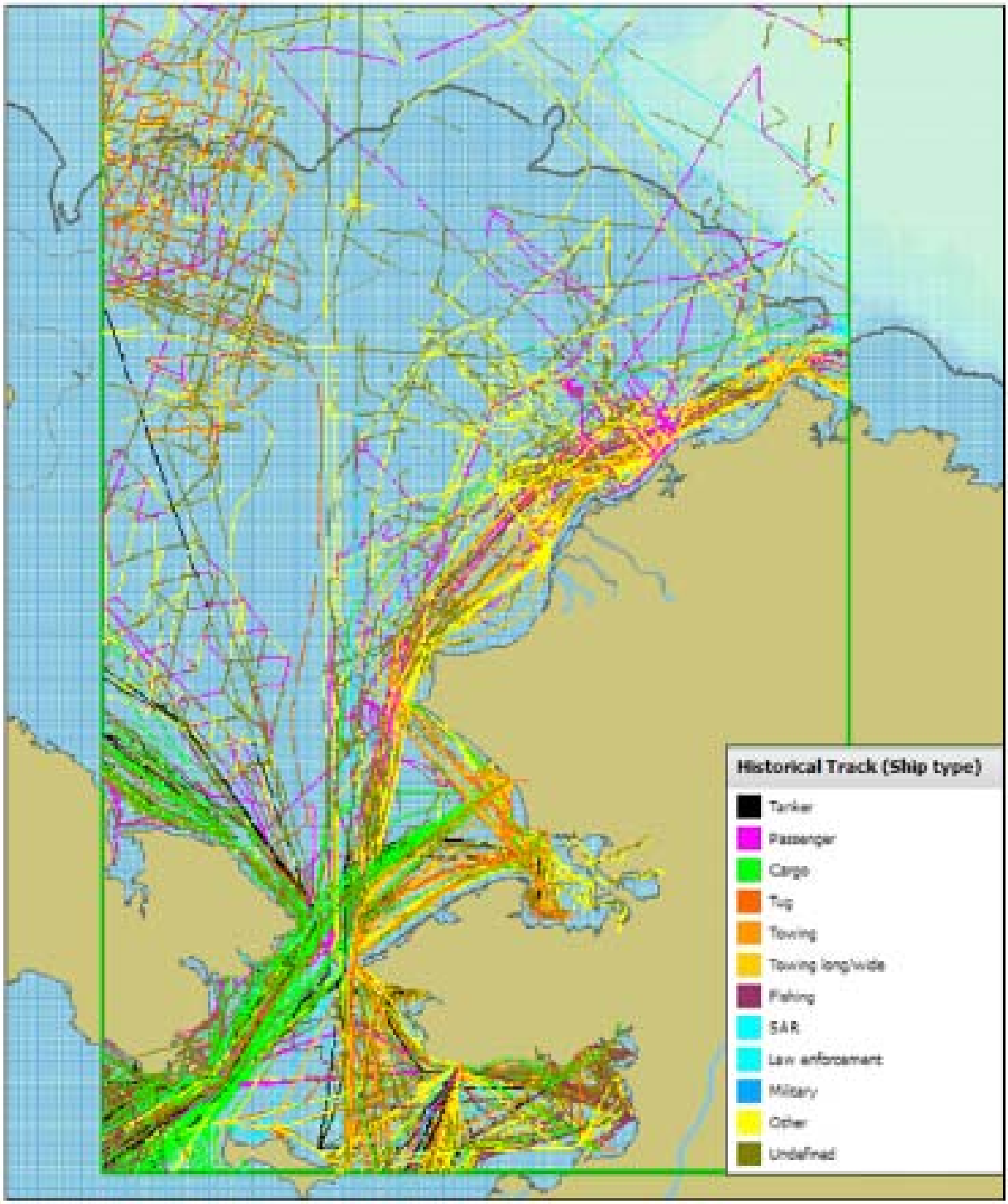


Figure 3.4 ~ 1 January through 1 June 2014 in the Bering Strait and Chukchi Sea



It is important to note that no tracks were recorded until the very end of the data collection period on 31 May 2014. From January until very late May 2014, there was virtually no surface ship activity in the region.

Figure 3.5 ~ 1 June to 1 Decemeber 2014 in the Bering Strait and Chukchi Sea



Going back one year for an analysis of 2012 data, the summer navigation season of Shell's exploration activity, there was a total of 154 northbound and 162 southbound transits (total of 316) between 26 June 2012 and 18 November 2012. Sixteen

northbound and 14 southbound (total 30) are directly attributed to Shell operations. There was one Northern Sea Route LNG southbound transit recorded and consistent numbers for Red Dog mine (both 26 southbound and northbound). There were six southbound U.S. Coast Guard cutter transits (they sailed north before study window of 26 June). Local U.S. towed vessel traffic was totaled 26 northbound and 26 southbound. Compared to 2011 AIS tracking indicated there were roughly 70 more transits in 2012. About half of that total *increase* in 2012 can be directly attributed to Shell's offshore operations. A good portion of other transits, such as U.S. Coast Guard cutters for example, can also be correlated to a federal response to Shell's exploration.

3.4 Bering Strait Shipping Patterns and Character

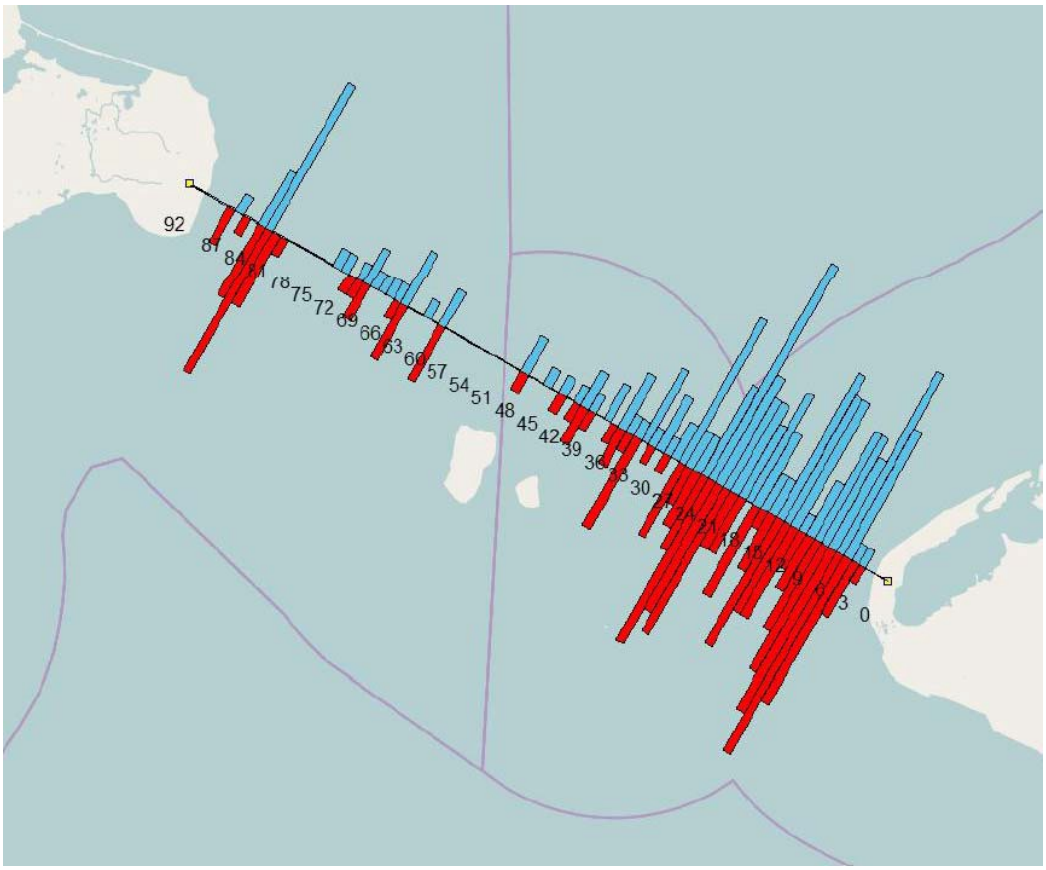
The histogram in Figure 3.6 depicts traffic densities crossing the Bering Strait for the entire navigation season of 2013 which extended from 11 June 2013 through 5 November 2013. During that time approximately 344 vessels were tracked through the Bering Strait. Industry trade magazines indicated that the Russians had granted as many as 530 licenses to transit the Northern Sea Route during this period. Nothing of this magnitude was observed by the Marine Exchange data. Granting permits to transit the Northern Sea Route does not mean the voyages actually took place. *At first glance it would appear that the Bering Strait is a high traffic area, but a closer look reveals that is not truly the case.*

A look at the Bering Strait total transits in 2013 indicates much greater traffic on the U.S. side of the Strait and about equal north and south traffic. On both the Russian and U.S. sides of the border the majority of transits are in the "coastal" *half* of the Strait (the portion shoreward of the respective continental littorals rather than the Diomede Islands). Northbound traffic peaks in July and August with 50+ transits in each of those months. The largest portion of vessels are being "towed." Somewhat logically, southbound traffic peaks in August and September, towed vessels also being the greatest category. Figure 3.6 below indicates the corridor used to transit in 2013 and an axis drawn across the approximately 50 nautical mile strait. The larger the column the greater number of vessels using that corridor, spaced across the Strait, at .5 nautical

mile intervals. The histogram is further divided into northbound (blue) and southbound (red).

The passenger vessel *BREMEN* transited at the highest speed of 14 knots. *BREMEN* was followed by the bulk carrier *UNITED CHALLENGER* and the small passenger vessel *CALEDONIAN SKY* both making 13 knots. The remainder of the traffic on this day consisted of tugs and barges and landing craft and one Russian tanker moving at 10 knots or less. These are not very high speeds which lessens the possibility of a collision. Also important to observe is the passage of time between transits of the data passage line. On occasion it was as long as 4 to 5 hours between transits which again militates against the possibility of two vessels attempting to occupy the same space at the same time.

Figure 3.6 ~ Bering Strait histogram in 2013



Tables 3.1 and 3.2 detail all the identified transits north and southbound in the 2013 navigation season through the Bering Strait.

Table 3.1 ~ Northbound Traffic Bering Strait 2013

NORTHBOUND TRAFFIC BERING STRAIT 2013							
	JUNE	JULY	AUGUST	SEPT	OCT	NOV	TOTAL
BULK CARRIER	1	9	6	5	4		25
FISHING		2	3				5
GENERAL CARGO		2	4	6	2		14
ICEBREAKER		6	4	1	3		14
LANDING CRAFT		5					5
LNG TANKER			1				1
PASSENGER		3	2	2			7
REEFER					1		1
RESEARCH		6	3		2		11
RORO					1		1
TANKER		3	8	4	1	2	18
TOWING	5	20	23	9	1		58
TRAINING			1				1
USCG		1					1
UNKNOWN	3						3
YACHT			1	1			2
MONTHLY TOTAL	9	57	56	28	15	2	167

These tables show a breakdown of northbound traffic in the Bering Strait by vessel type by month. Notice that the greatest amount of vessel traffic occurred in July.

Table 3.2 ~ Southbound Traffic Bering Strait 2013

SOUTHBOUND TRAFFIC BERING STRAIT 2013							
	JUNE	JULY	AUGUST	SEPT	OCT	NOV	TOTAL
BULK CARRIER		9	9	3	4		25
FISHING			1	5			6
GENERAL CARGO			6	6	2	2	16
ICEBREAKER		1	3	5	2		11
LANDING CRAFT		2		2			4
LNG CARRIER					1		1
PASSENGER		1	4	4			9
RESEARCH		6	1		6		13
TANKER		2	7	5	4		18
TOWING		10	24	18	8		60
USCG		1					1
UNKNOWN	4						4
TRAINING				1			1
YACHT				3			3
MONTHLY TOTAL	4	32	55	52	27	2	172

The greatest amount of southbound traffic occurred in the month of August. The total traffic northbound (167) and southbound (172) for the year was 339 ships of all types.

In Figure 3.7 *the busiest day of the 2013 navigation season, 25 July* is examined in detail. The period covered 24 hours and time separation between transits varied between 5 hours and less than a quarter of an hour. There was considerable variability in the corridors used within the 23.6 nautical miles between the Alaskan mainland and Little Diomede Island as the histogram for 25 July has large horizontal separations between vessels. One vessel northbound actually transits between the Diomede Islands. All the tracks (four) headed southbound are in the half of the Strait closer to the mainland. Note the columns in the figure below are quantitive for specific corridors, so in this case, they indicate one vessel in each colomn.

Figure 3.7 ~ Bering Strait histogram 25 July 2013

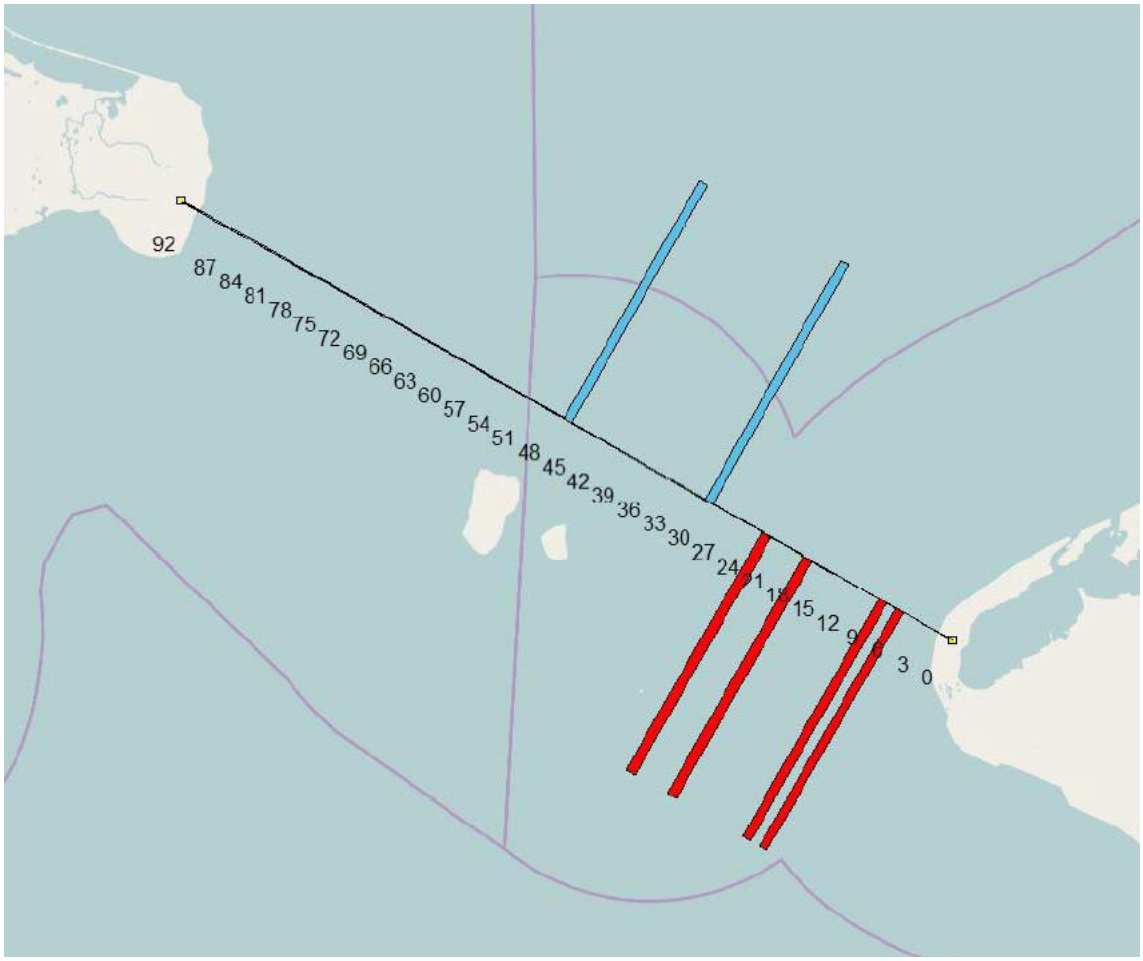


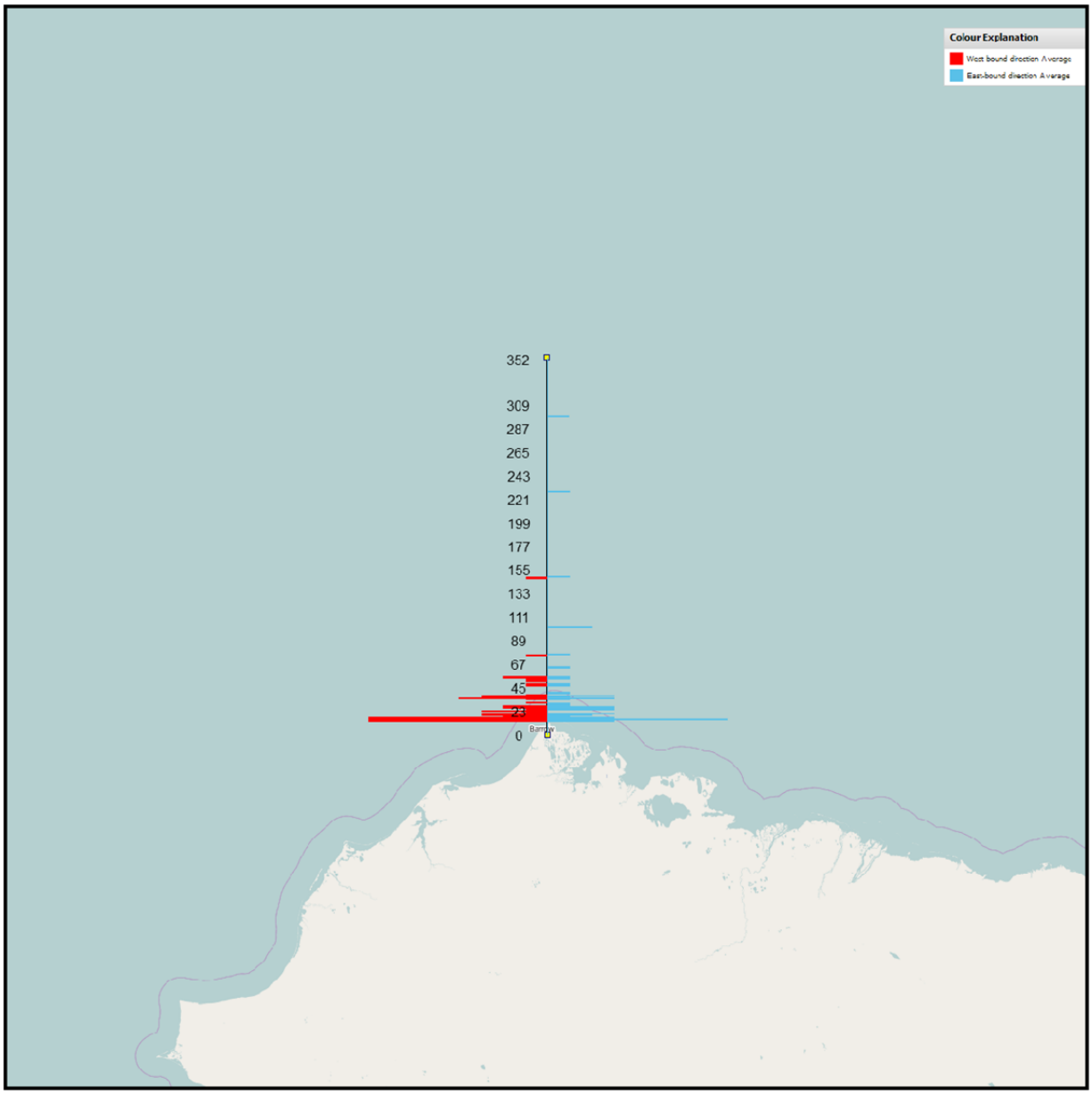
Figure 3.8 illustrates the actual tracks of all vessels transiting the Bering Strait during 25 July 2013. Again, these tracks cover a 24 hour period and that the time separation between transits varied anywhere between 5 hours to less than a quarter of an hour. Also importantly, the horizontal separation of these transits shows considerable variability in this area which actually is 23.6 nautical miles wide between the Alaska mainland and Little Diomede Island. It is important to note this depiction of vessel tracks is for the day with the most traffic during the entire navigating season. There were numerous days when only one or two ships actually transited the Bering Strait region.

Figure 3.8 ~ Actual tracks on 25 July 2013 through the Bering Strait

3.5 Point Barrow

An analysis of shipping traffic AIS tracks off of Point Barrow in 2013 on the littoral of the North Slope of Alaska indicates vessel traffic roughly equal west (69) and east (55) bound for a total of 124 vessels. By far most of the transits were within 30 nautical miles of the Point, a majority within 10 nautical miles. This is illustrated in the histogram in Figure 3.9. This histogram is constructed in a similar manner to the Bering Strait histograms, with spacing at .5 nautical mile interval for columns which are a quantitative count of transits. The histogram indicates 123 total transits east and west bound in 2013, with one less east bound vessel. There was virtually no traffic at all between January and the end of May 2013 (ice conditions) as well as no traffic the last week of December.

Figure 3.9 ~ Histogram off Point Barrow 31 January to 30 December 2013

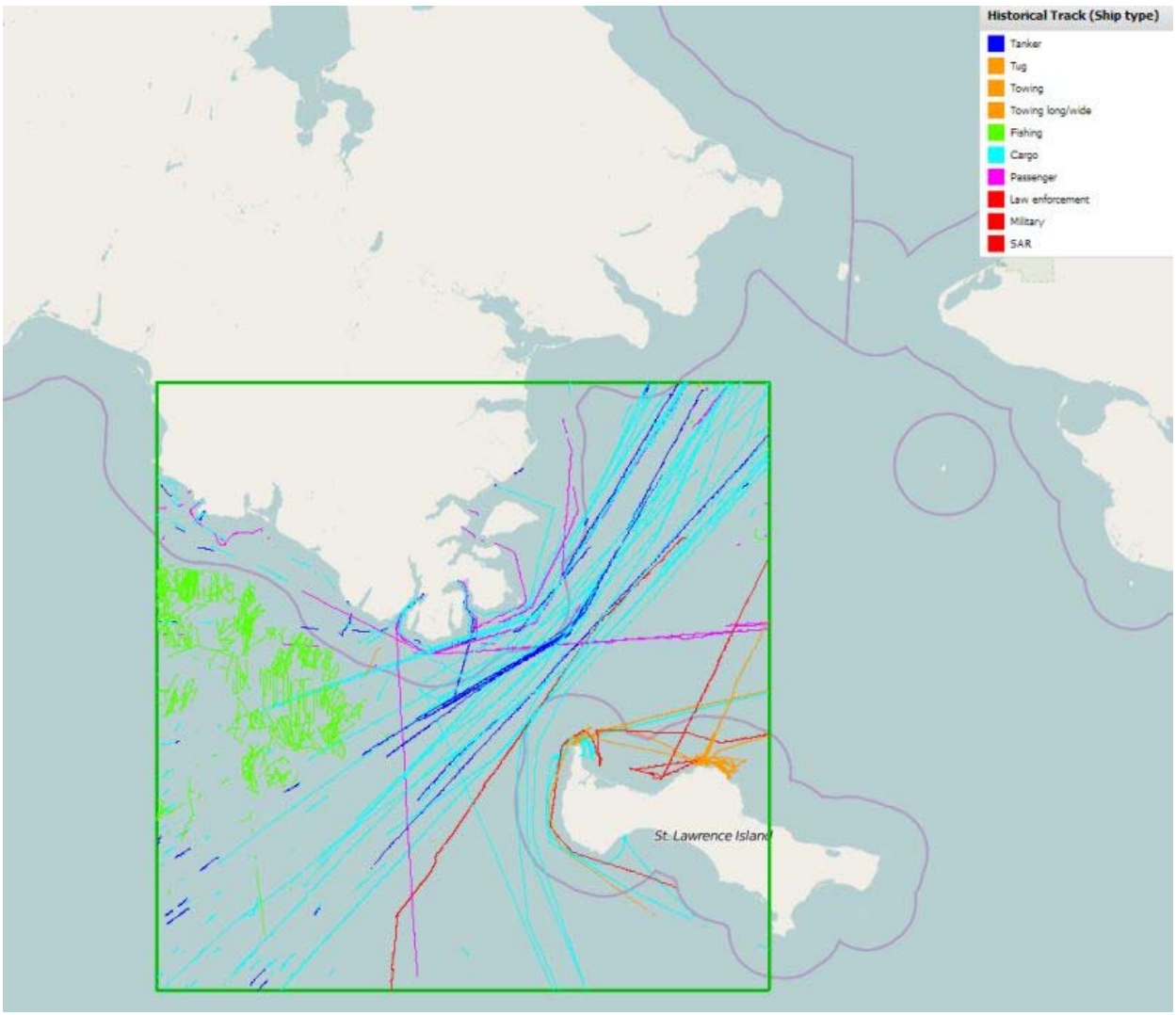


3.6 Saint Lawrence Island

Analysis further to the south of the Bering Strait is a good indicator of the destination nature of the traffic funneling in and out through that Strait. Approximately 30 vessels were tracked, as shown in Figure 3.10 below, using Russia's Northern Sea Route (NSR). All of this NSR traffic plotted at greater than 172 degrees West longitude. The halfway point between Saint Lawrence Island and the Russian mainland is about 45 nautical miles west of the island at 172 10' 36" W in longitude. AIS tracking in 2014

indicated most of the NSR traffic transits were about 45 miles or more from Saint Lawrence Island along the mainland coast of Russia. Only four vessels, all U.S. flagged, were located near 171 W on U.S. side.

Figure 3.10 ~ Saint Lawrence Island Track History in 2014



3.7 Conclusion for Marine Traffic in the U.S. Maritime Arctic

Shipping volumes in the U.S. maritime Arctic is directly correlated to the seasonal ice conditions. For six months the presence of sea ice hinders or prevents the passage of all but a handful of vessels. Most all of the shipping moving north through the Bering Strait on the U.S. side is coastal and domestic, or cabotage (tug-barge operations). These operations support coastal community supply requirements, support to the Red

Dog Mine, and traffic supporting the North Slope. The Red Dog Mine operation is the most significant single purpose driver of current traffic (both coastal traffic and foreign carriers), about the same annually as direct support for Shell's 2012 drilling in the Chukchi and Beaufort Seas (though different types of ships and traffic). *Support of hydrocarbon exploration and drilling directly or indirectly generates about 60 seasonal north and southbound transits through the Bering Strait, at the same level of intensity for Shell's 2012 offshore hydrocarbon operations.*

Figure 3.11 ~ Ship tracking through the Bering Strait region

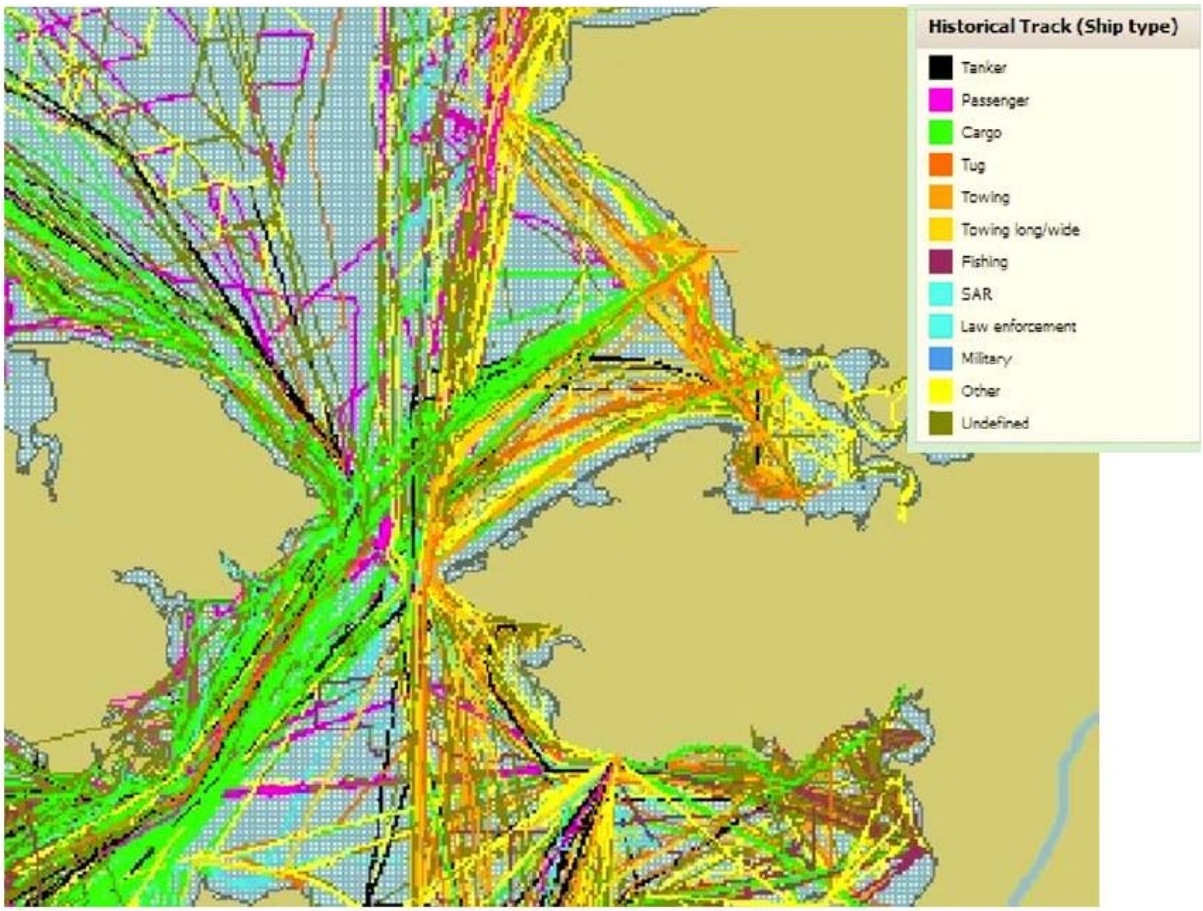


Figure 3.11 derived from AIS data provided by Marine Exchange of Alaska indicates much more traffic on the U.S. side of the Bering Strait. There is every indication that in the current situation Russian ship transits along Northern Sea Route have no incentive

or intent to enter U.S. waters or seek support from U.S. ports (baring specific and local emergency).

Passenger voyages and other non-scientific voyages are increasing but remain comparatively small in numbers in the U.S. maritime Arctic. As elsewhere in Arctic maritime regions, these type of ships may drive disproportionate challenges for governance and administration (SAR requirements, inadequate shore support, etc.). The Marine Exchange data illustrates the increasing importance of marine domain awareness for the U.S. maritime Arctic. A close review of the recent annual ship traffic reveals a strong seasonal pattern with no surface operations for a six-month winter season.

4.0 Northern Sea Route and Northwest Passage Developments

4.1 Implications of Opening the Northern Sea Route

The paradox of the opening of the NSR is that it provides both a potential economic opportunity for Alaska and an environmental security challenge to the Bering Strait region. An increase in the length of the summer NSR navigation season provides a more reliable operational timeframe to potentially ship Alaska's natural resources to European and even to east coast North American markets. One possibility might be shipping zinc ore from the Red Dog mine complex (near Kivilina, a community on the Chukchi Sea coast) by icebreaking bulk carriers west bound along the NSR to European ports. Coal from northwest Alaska (if developed) could also be shipped along the NSR in summer by bulk carriers. It is plausible that lower transportation costs could be realized in summer by shipping Alaska seafood products along the NSR to key markets in central and western Europe. It is not likely the NSR will be functioning year-round within its eastern region as a 5-6 month navigation season (with icebreakers extending the season) is envisioned for the coming decades. Therefore the NSR shipping opportunities to and from Alaska (and between Atlantic and Pacific) must be conceived and evaluated to be economically viable on a *seasonal basis*. Recent bulk carrier transits along the NSR from northern Norway and the Russian Arctic to ports in China indicate the viability of moving hard minerals along this summer Arctic passage. *The fundamental driver of the future of the NSR remains Arctic natural resource development, especially the pace of that development within the Russian Arctic.*

The ongoing construction of a major port in Sabetta on the western shore of the Ob Bay in the Yamal Peninsula will potentially add significant LNG carrier traffic along the NSR. The new LNG port is a public-private partnership between Novatek (Russia's largest independent gas producer), other private investors, and the federal government, which is responsible for dredging a navigable channel to the port in the shallow waters of the Ob estuary (President of Russia, 2013). The major LNG plant near Sabetta will be supplied with gas from fields in the Yamal Peninsula and will be built to handle annually more than 30 million tons of cargo (Petters, 2013). The strategic location of Sabetta will facilitate the shipping of LNG eastward along the NSR in an extended summer

navigation season to Asia Pacific ports. Consequently more LNG carriers will be using Bering Strait on a regular basis during a longer season extended by icebreaker escort. The Yamal port can also operate year-round with LNG carriers sailing westward to European ports and potentially to ports in North and South America.

Most traffic entering or departing the NSR will surely hug the Chukotka coast in the Russian Far East on track lines that are the shortest distances between markets and ports. Therefore nearly all the NSR traffic will be west of the U.S.-Russia maritime boundary in the Bering Sea. One concern is the possible interaction of large ships with subsistence hunters both in American and Russian waters in the region west of St. Lawrence Island. Also, there is a higher risk of marine accidents and subsequent spills with the large increases in traffic in the region and a longer season of navigation along the NSR. Operations could entail navigation in ice early and late in the seasons in the Bering Strait region. Potential voluntary ship routing measures are possible in the future after vetting them through the IMO by Russia and the United States. However, more immediate attention should be given to enhancing the communication between subsistence hunting vessels and transiting ships. Providing better and timely information to commercial mariners, such as seasonal hunting areas, the location of coastal communities, and areas of concentrations of marine mammals and seabirds, can also be a successful strategy to mitigate future interaction of users in this sensitive and complex strait.

4.2 Challenges Facing the Northern Sea Route

The internationalization of the NSR remains under a long-term development process, despite the outside appearance of a stable, carefully managed marine transportation system. Several key challenges are recognized by Russian and outside experts, and each of these will influence the levels of traffic through Bering Strait and the potential links with maritime Alaska:

- Determining the actual fees for sailing the NSR continues to be a complex process. Compulsory icebreaker fees (15 November to 31 July) are to be imposed regardless of the actual use of icebreaker services. Individual commercial companies continue to negotiate their NSR fees with the icebreaker

service companies. Lack of transparency in the NSR fee system continues to be a key issue for international shippers.

- The Russian polar icebreaker fleet is an integral component of the NSR. Within the current fleet of five nuclear icebreakers, four are to be replaced in the near-term. The overall aging of the icebreaker fleet is a critical issue since these ships play a key role in the escort of ship convoys along the NSR, a mainstay in the tight control of shipping in the region.

- The application of the mandatory IMO Polar Code to the NSR (to come into force 1 January 2017) may involve a complex process to mesh with the national rules and NSR regulations. The implementation period of the IMO Polar Code will be from May 2015 through 1 January 2017. How Russia will handle ships sailing under the new Polar Code and how fast the international maritime community can adjust to the new requirements, especially for training and experience of the ice navigators, may influence the traffic levels along the NSR.

- The pace of Russia's Arctic maritime infrastructure development is crucial to enhancing NSR marine safety and environmental protection. The current plan for building ten SAR and response centers along the Russian maritime Arctic coast is a major step forward. Increased hydrography and charting of the many (shallow) NSR routes is a critical investment in the safety net for this remote region of the Arctic.

- How the marine insurance companies and underwriters will deal with risk management for ship voyages along the NSR remains a crucial question. The NSR is generally outside standard insurance coverage, resulting in higher costs. And, the number of insurers for Arctic voyages and use of the NSR is very limited. However, the new IMO Polar Code will provide a framework of international rules, regulations and standards and present a level playing field for global shippers who may wish to operate their vessels along the NSR.

- The shipping of LNG out of the new port of Sabetta being constructed on the Yamal Peninsula will provide a number of clues as to the future of marine traffic in summer along the eastern sections of the NSR (and to markets in China, Korea and Japan). One of the challenges will be to establish a reliable length of the navigation season so that shippers will understand and create a viable and economic operating season.

4.3 Marine Operations in the Canadian Arctic and Northwest Passage

It is important to note the context in which the Canadian Arctic is viewed today for marine navigation. It is remarkable that since the Norwegian Amundsen's first Northwest Passage (NWP) transit in 1903-06 only 184 complete transits of the NWP have been accomplished to the end of the 2012 navigation season. A majority of the recent voyages have been conducted by adventurers in small vessels which were able to make a NWP full transit in summer along the coast (close along the northern coast of North America) in minimal ice conditions.

Observations in the Canadian Arctic have shown negative trends in sea ice coverage during the past three decades but the region also exhibits a high year-to-year variability, as noted in the Arctic Marine Shipping Assessment. This variability is a key factor when considering regulations, setting marine insurance rates, and planning investments in transportation systems. In addition, projections show sea ice through the winter and nine months of ice coverage through the year. The unique geography of the Canadian Archipelago with many of its northernmost channels oriented north-south, adds to the complexity of the regional sea ice regime (where mobile sea ice can be swept from the central Arctic Ocean into the southern routes of the NWP). Access to the NWP will continue to be controlled by the prevailing ice flow conditions. Additionally, the Canadian Arctic is projected to be one of the last regions where multi-year sea ice will be present in the Arctic Ocean until sometime near mid-century. The complexity of the various routes of the NWP, draft restrictions, highly variable and difficult sea ice conditions (for 9-10 months), lack of marine infrastructure, lack of comprehensive charting, and high operational costs (including marine insurance) all are factors that make regular commercial traffic through the Canadian Arctic (and between the Atlantic

and Pacific) uncertain at best. The Arctic Marine Shipping Assessment outlines in a special section on the Canadian Arctic the many challenges facing use of the NWP for commercial operations.

Commercial shipping in the Canadian Arctic today is focused on four activities: community resupply during summer; bulk shipments of natural resources out of the region; support to exploration and resource development; and, marine tourism. The only vessels that regularly transit the NWP in summer are several small, specialized cruise ships. The Mary River iron ore mine complex on Baffin Island in the eastern Canadian Arctic has been sending ore by bulk carriers to European ports (for regional steel mills) and occasionally wheat has been shipping to the east from the Hudson Bay port of Churchill, Manitoba during summer. During AMSA a regional future outlook for the Canadian Arctic noted that the NWP is not expected to become a viable trans-Arctic maritime route. However, destinational shipping is expected to increase during the decades ahead through: dry bulk carriage related to regional mining developments; increasing resupply shipments to growing populations in northern communities; increases in shipments of equipment and supplies supporting natural resource exploration; and modest but unpredictable growth of marine tourism. Significantly, any future oil and gas production from the Beaufort Sea would be expected to be carried by pipeline out of the Arctic to southern markets, not by tankers. Anticipated increases in marine shipping are related to future mining developments in the region and thus linked to global commodities prices; seasonal shipping, but also year-round shipping to the Mary River mine are plausible futures for Canada's Arctic. The linkages of the NWP to the U.S. maritime Arctic will not likely be a flow of large commercial ship traffic in the decades ahead. Relatively modest numbers of support vessels, research ships, adventurers and small cruise ships will cross the U.S. maritime Arctic on their voyages to and from the Canadian Arctic and multiple routes of the NWP.

5.0 Projected Impact of U.S. Arctic Offshore Hydrocarbon Development

5.1 Introduction

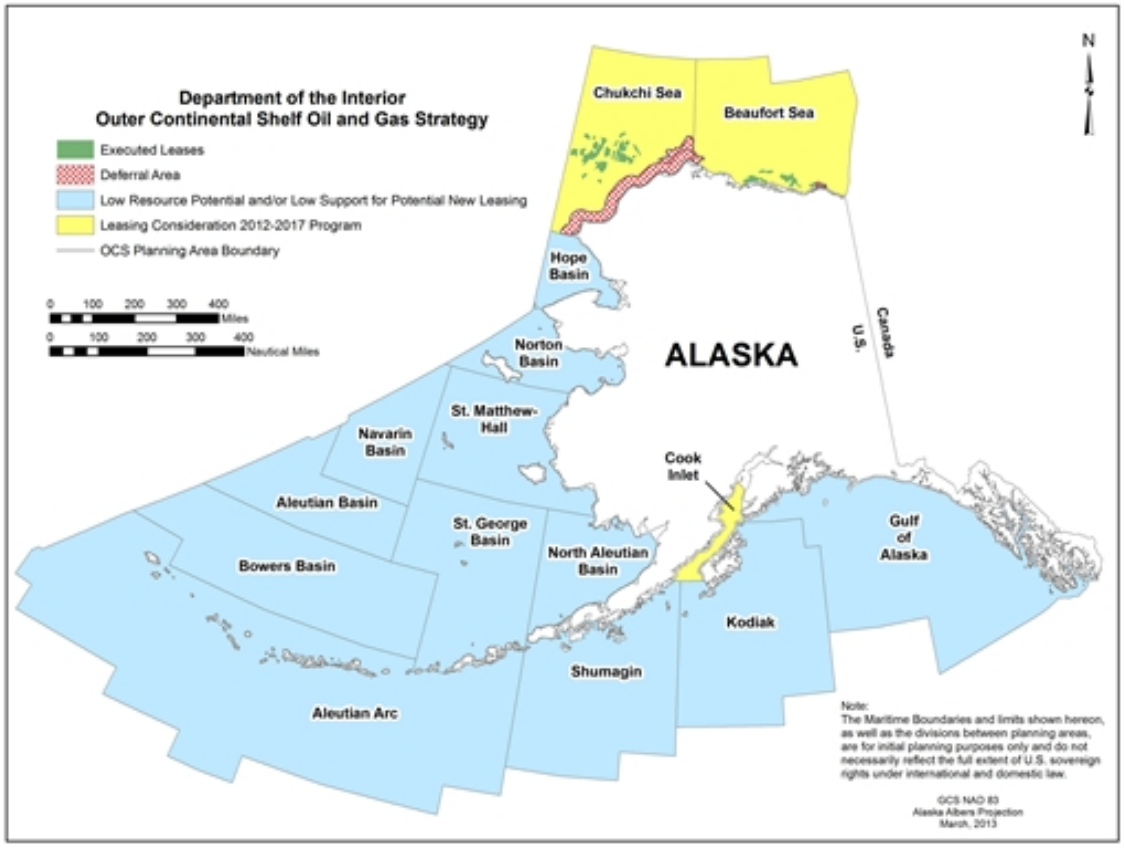
Oil and gas exploration/production will be the primary driver of any *significant* increases in shipping through the Bering Strait and along the NW Alaskan and North Slope littoral for the next ten years, and most likely, well into the foreseeable future. This chapter will focus on the current and projected future of hydrocarbon exploration and production in the Alaskan Outer Continental Shelf (OCS) region and its impact on shipping there. Though there is some continuing exploration and production expansion in the near shore Beaufort Sea, the Liberty Prospect in particular, these are close to shore and will be integrated into the well-established Prudhoe Bay region and are therefore unlikely to drive significant *shipping* flow changes. Furthermore, though natural gas has been found and is a significant resource within the Alaskan OCS leasing areas, it is the potential for *crude oil* production that is the catalyst for the very significant capital investment required to bring the Alaskan offshore Arctic region to production. There are already ample natural gas fields ashore that could be exploited, at much less cost, should there be a market competitive transport system (as the proposed Liquid Natural Gas (LNG) might be). This chapter will also discuss, in less detail, the potential for oil exploration and production activity in the Russian Chukchi Sea in a regional shipping context. Finally, throughout, an attempt will be made to characterize the specifics of shipping required for exploration and eventual production in the Alaskan OCS region.

5.2 Regional Hydrocarbon Potentials in the Arctic Beaufort and Chukchi Seas

Before an analysis of shipping changes driven by hydrocarbon exploration and production offshore Alaska's Arctic coast, the character of these crude oil reserves needs to be established in a market and geographic context. The graphic below identifies the two lease areas, the Chukchi and the Beaufort Sea, which are inclusive of all current and planned oil and gas leases in the U.S. Arctic. The other shelf areas are not within leasing or proposed leasing plans nor are they estimated to be as bountiful in hydrocarbons, or as intricately linked to an overall "Arctic" specific infrastructure or shipping requirements. Lease areas are not entirely based on hydrocarbon potential as

some areas have been excluded for environmental buffering, such as the depicted 25 mile coastal zone in the Chukchi Sea in Figure 5.1 below.

Figure 5.1 ~ Alaska Outer Continental Shelf Region

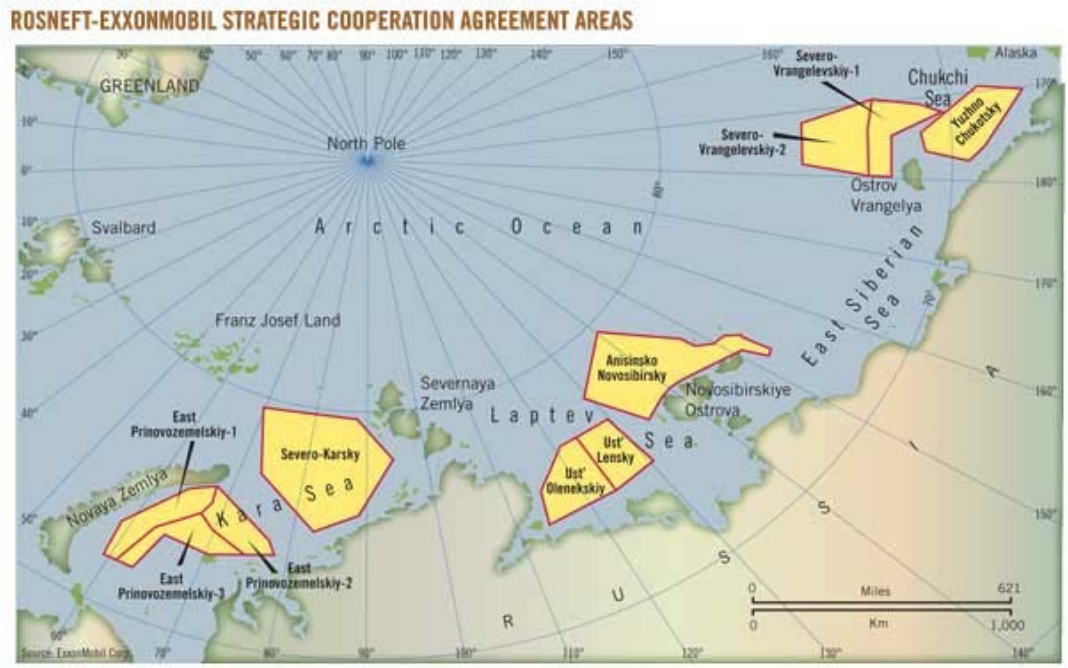


Source: BOEM 2013

Within the Federal Bureau of Ocean Energy Management's (BOEM's) leasing areas, the Chukchi Sea is expected to be the more lucrative of the two seas with an estimated 15 billion Barrels (bbls) in unproven oil reserves, second in the U.S. OCS only to the Gulf of Mexico region. The Beaufort Sea offers an estimated eight billion bbls. As a bench mark, to date, over the last 35 years roughly 17 billion bbls has been produced from Alaska's North Slope and transported south via the Trans-Alaska Pipeline System (TAPS). To the east, Chevron has two exploration licenses in the Canadian Beaufort Sea regions and has been active in seismic surveying.

To the west, the Russian Chukchi Sea region, offers very good prospects for the discovery of hydrocarbon fields, but is even more challenging than the U.S. Chukchi Sea. Though aggregate numbers for estimates for Russia's Arctic wide offshore oil reserves are legitimately huge, sometimes quoted as 100 billion bbls or more, the Chukchi estimates specifically, are less precise and refined than on the North American side of the dateline. In regional terms it can be stated that the hydrocarbon industry is much further along in exploiting offshore resources in the Alaska OCS than its Russian counterpart, though the political will to develop is more unambiguous in Russia. Figure 5.2 below depicts in the top right corner the three current lease areas in the Russian Chukchi Sea.

Figure 5.2 ~ Rosneft-ExxonMobil Strategic Cooperation Areas



Source: Oil and Gas Journal 2013

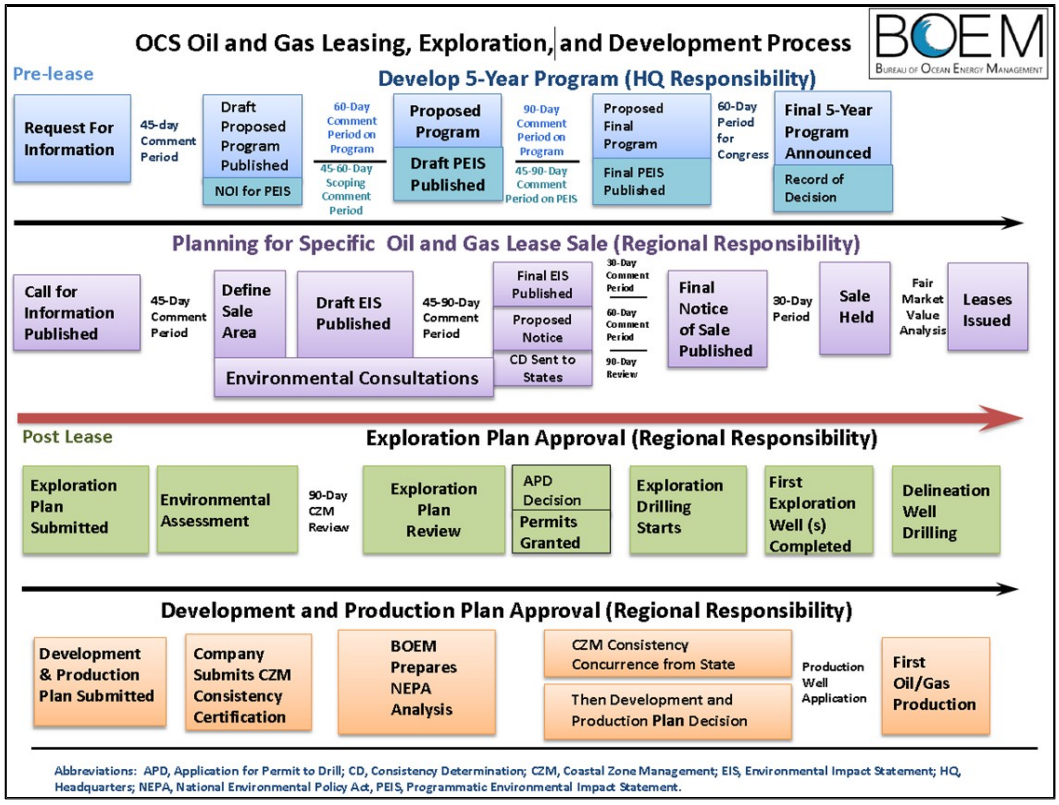
5.3 Lease Sale Process for the OCS Region

For Alaska, the offshore regulatory environment is not as complex as the onshore environment as ownership is not in question. It is a federal matter, though there are competing interests with that federal ownership. The Department of the Interior's (DOI) BOEM is the clear and designated agency chartered with establishing offshore leasing

on the OCS. BOEM's Five Year OCS Oil and Gas Leasing Program establishes specific leasing areas and a sales timeline. An area must be included in this approved five year planning structure to be open for commercial exploration or production activity. Typically, on the Arctic offshore shelf, leases are sold for a ten year period, as opposed to eight years for the Cook Inlet. However, the length of the lease is at the discretion of the Secretary of the Interior. It is relevant to note, that a lease period is generally administratively extended by the DOI when halted by court moratoriums or other regulatory actions in proportion to the suspension in operations.

BOEM's Alaska Region Office is responsible for managing, in an environmentally and economically responsible manner, the development of oil, natural gas, renewable energy and mineral resources on Alaska's Outer Continental Shelf. BOEMS's charter includes lease management, resource evaluation, exploration plans, environmental science and analysis and resource evaluation. The flow chart in Figure 5.3 below details the oil and gas leasing process.

Figure 5.3 ~ OCS Oil and Gas Leasing, Exploration and Development Process



Source: BOEM 2014

5.4 Regulatory Process

To best coordinate, manage, and where applicable, regulate exploratory drilling operations in the Alaska OCS, an Interagency Working Group on Alaska Energy development was established for the 2012 Shell operations by Executive Order 13580 and included, and continues to include the following federal agencies.

Department of the Interior
Department of Defense
Department of Commerce
Department of Agriculture
Department of Energy
Department of Homeland Security (includes U.S. Coast Guard (USCG))
Environmental Protection Agency
Office of the Federal Coordinator
Council on Environmental Quality
Office of Science & Technology Policy
Office of Management and Budget
National Security Staff
Department of Transportation

Outside of the Federal Government, other stakeholder reviewers include the Alaska Department of Natural Resources, the Department of Environmental Conservation, the State Legislature, and the Alaska Whaling Commission and the North Slope Borough. The need for such coordination was exemplified by the multiple and major involvement directly impacting actual operations throughout Shell's 2012 drilling operations in 2012 by the U.S. Coast Guard and the Environmental Protection Agency (EPA) among others. The following chart, taken from Shell's current Environmental Impact Statement (EIS) submitted with Revision 2 for the 2014 Chukchi Sea drilling season (suspended and now under court moratorium) characterizes the complexity of the required permitting process for the hydrocarbon industry. Note that State of Alaska permits are also required as a significant portion of supporting operations occur within State jurisdiction (onshore or within the three mile littoral). Following, in Table 5.1 from Shell's Chukchi

Sea Exploration Plan (EP) Revision (2), August 2014, details the status of the required permitting process:

Table 5.1 ~ Permit Applications Pending or Approved

Permits & Authorizations	Agency	Submittal Date	Authorization Date	Document Location
Chukchi Sea Exploration Plan Revision 2	BOEM	August 2014	EP Revision 1 approved 15 December 2011	This document
APD	BSEE	Six (6) Burger APD applications submitted – Jan-Sep 2012 Dates to seek amendments to APDs to be determined (TBD)	Burger A – 30 August 2012[1] Burger J – 27 September 2012[1] Burger V – 18 October 2012[1] Amendment authorizations (TBD)	Separate cover
OSRP	BSEE	Biennial review updates submitted on 8 December 2013 Administrative updates to be filed following submittal of EP Revision 2	17 February 2012; Biennial review updates approved June 2014	Separate cover - 17 February 2012 approved plan found at BSEE Website[2]
NPDES GP AKG-28-8100	EPA	NOIs Not yet submitted	To be determined	Separate cover
Marine Mammal Protection Act (MMPA) - IHA	National Marine Fisheries Service (NMFS)	Not yet submitted	To be determined	Separate cover
MMPA – Letters of Authorization	United States Fish and Wildlife Service	Not yet submitted	To be determined	Separate cover
Section 10/404 Nationwide Permit (NWP)#8	United States Army Corps of Engineers	Not yet submitted	To be determined	Separate cover
Land Use Permit – Dutch Harbor area	Alaska Department of Natural	Not yet submitted	To be determined	Separate cover
Land Use Permit – Kotzebue Sound area	ADNR	Not yet submitted	To be determined	Separate cover

[1] BSEE approved APDs for three wells Burger A, J, and V; all only to the depth of the 20-in, casing in each well. These three APDs, plus the APD applications for the remaining three Burger wells (Burger F, R and S) will be amended with applications to seek drilling to TD. Dates to seek amendment are TBD.

[2] BSEE website at http://www.bsee.gov/uploadedFiles/BSEE/OSRP/Chukchi%20OSRP%20-%20February%202012.pdf ADNR = Alaska Department of Natural Resources

Source: Shell Chukchi Sea Exploration Plan (EP) Revision (2) August 2014

Currently there is no formal "Arctic" specific regulations within BOEM's OCS process, though Shell complied with specific conditions in its 2012 exploratory drilling in the Alaska OCS and follow on planning. However, there is an ongoing effort to codify aspects of Arctic exploratory activity and planning. Currently the draft of these Arctic specific Federal requirements is undergoing Interagency review.

5.5 Current Leases

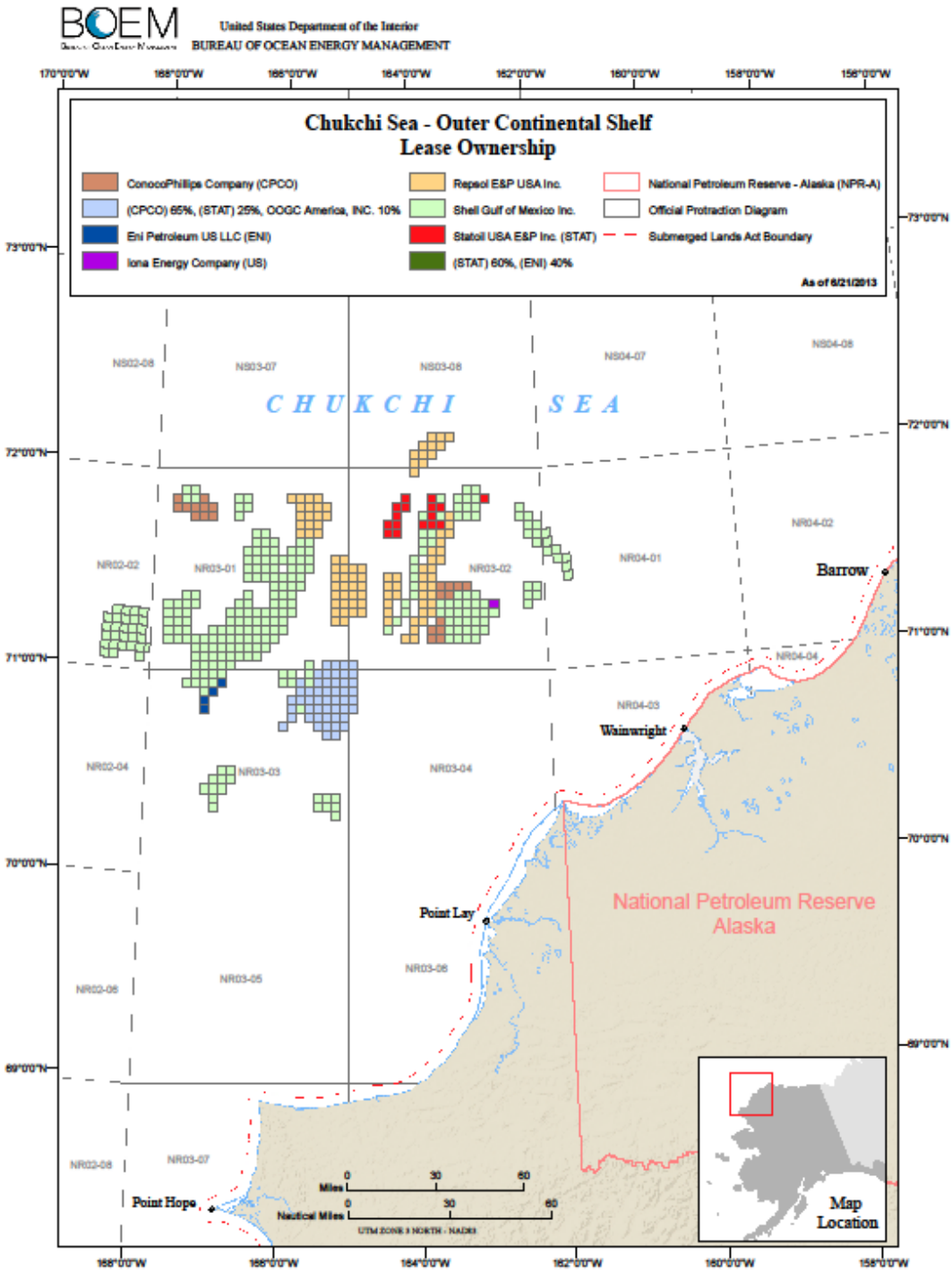
5.5.1 Beaufort Sea: The Beaufort Sea planning area overlaps significant subsistence use areas and has been incorporated into sales and operational planning requirements. The majority of exploratory drilling in the U.S. Arctic has been in Beaufort Sea in the 1970s and early 1980s. Prior to Shell's 2012 exploratory drilling the last well drilled in the Alaska OCS was in 2003 near Prudhoe Bay. These early wells did discover recoverable hydrocarbons but also were deemed uneconomical at the time. Most of this exploratory drilling was in the Prudhoe Bay area in water generally 100 feet or less. Shell owns or has an interest in 138 active leases in the Beaufort Sea OCS and the focus of effort has been the Camden Bay area. Near shore, BP Exploration (Alaska) (BPXA) operates Northstar, which is a currently producing joint Federal/State of Alaska unit about 12 miles northwest of Prudhoe Bay. The Federal wells fall under Bureau of Safety Environmental Enforcement (BSEE) regulation while the State of Alaska regulates their portion (BOEM). Further to the east, the Liberty Prospect lies about five miles offshore in about 18 feet of water. Though within Federal OCS jurisdiction, the concept for production is to use of an artificial island directly integrated into the existing Endicott infrastructure, and therefore, will have minimal impact on shipping. Further exploitation of these near shore areas is also not likely to have a significant impact on future shipping as operations are also directly supported from the ashore industry infrastructure that includes both air and road infrastructure. (The map depicted in the following Planned Future Sales section also depicts these current active leases)

5.5.2 Chukchi Sea: The biggest lease holder in the Chukchi Sea OCS is Shell, which has by virtue of its 2012 operations, and continued effort for regulatory approval for future drilling, become the lead industry player in the Alaska OCS. Currently, Shell's operations, managed by Shell Gulf of Mexico, has been placed in moratorium by the 9th District Court of Appeals. A Supplemental Environmental Impact Statement (SEIS) was mandated which required BOEM to account for more comprehensive impacts should the lease holders move from exploration drilling to actual production. That supplemental review draft has been released to the public and is currently open for public comment. There has been a "wait and see" attitude expressed informally by officials from the other

lease holders in the Chukchi, as well as the Beaufort, letting Shell lead the way and test the regulatory process, as much as the geology, before committing additional resources. Shell's current 275 Chukchi Sea leases, by far the largest holdings in the Chukchi Sea, were purchased in Sale 193 in 2008. A recent development has been the announced partnership of Shell and the Arctic Slope Regional Corporation (ASRC) in a joint venture. The agreement allows the participating Inupiat corporations on the North Slope the option to buy into all 275 leases.

In addition to Shell, Norway's Statoil obtained 16 leases as the high bid in the 2008 sale and has obtained the right to operate another 14 in partnership with Italian ENI. These leases are 30 to 40 miles north of Shell's Burger Prospect (where Shell's planned 2014 drill season was focused). Statoil is also a 25% partner with ConocoPhillips in their 50 leases. Shell, Statoil, and ConocoPhillips cooperate together in baseline environmental monitoring studies. ConocoPhillips in a May 2013 letter to BOEM and BSEE requested a deferment of the processing of its Exploration and Oil Spill Response Plan for the Devil's Paw Prospect in the Chukchi Sea which they had submitted in 2012 citing permitting and regulatory uncertainties. Current Chukchi Sea lease holders are depicted in Figure 5.4 below.

Figure 5.4 ~ Chukchi Sea – Outer Continental Shelf Lease Ownership

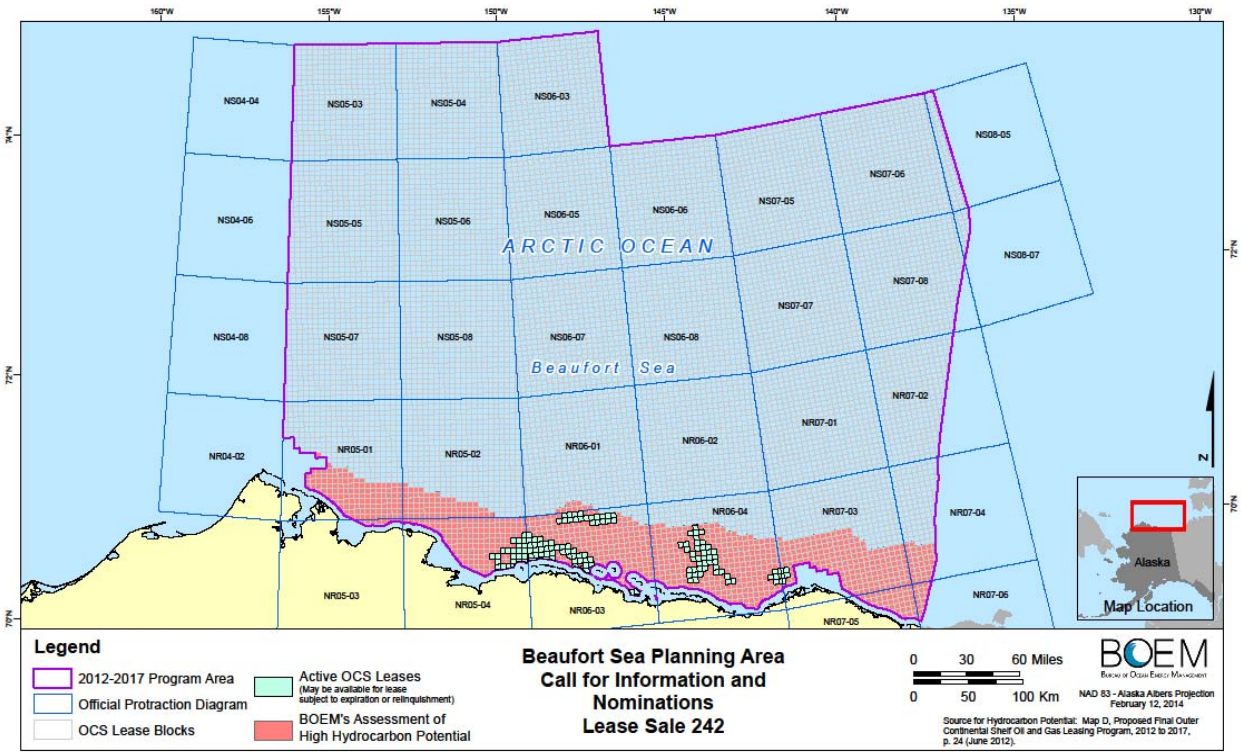


Source: BOEM 2013

5.6 Planned Future Lease Sales

5.6.1 Beaufort Sea: Within BOEM's planned 2012-2017 OCS lease sale, Sale 242 (Beaufort Sea) has been postponed until 2017 to allow time for further consideration of subsistence use on the North Slope littoral, in addition to the already protected whaling areas, to ensure they will not be negatively impacted. The map below depicts the Beaufort Sea Oil and Gas Lease Sale 242. Current active leases are also shown in Figure 5.5 as well as an estimate of high hydrocarbon potential.

Figure 5.5 ~ Beaufort Sea Planning Area Lease Sale 242

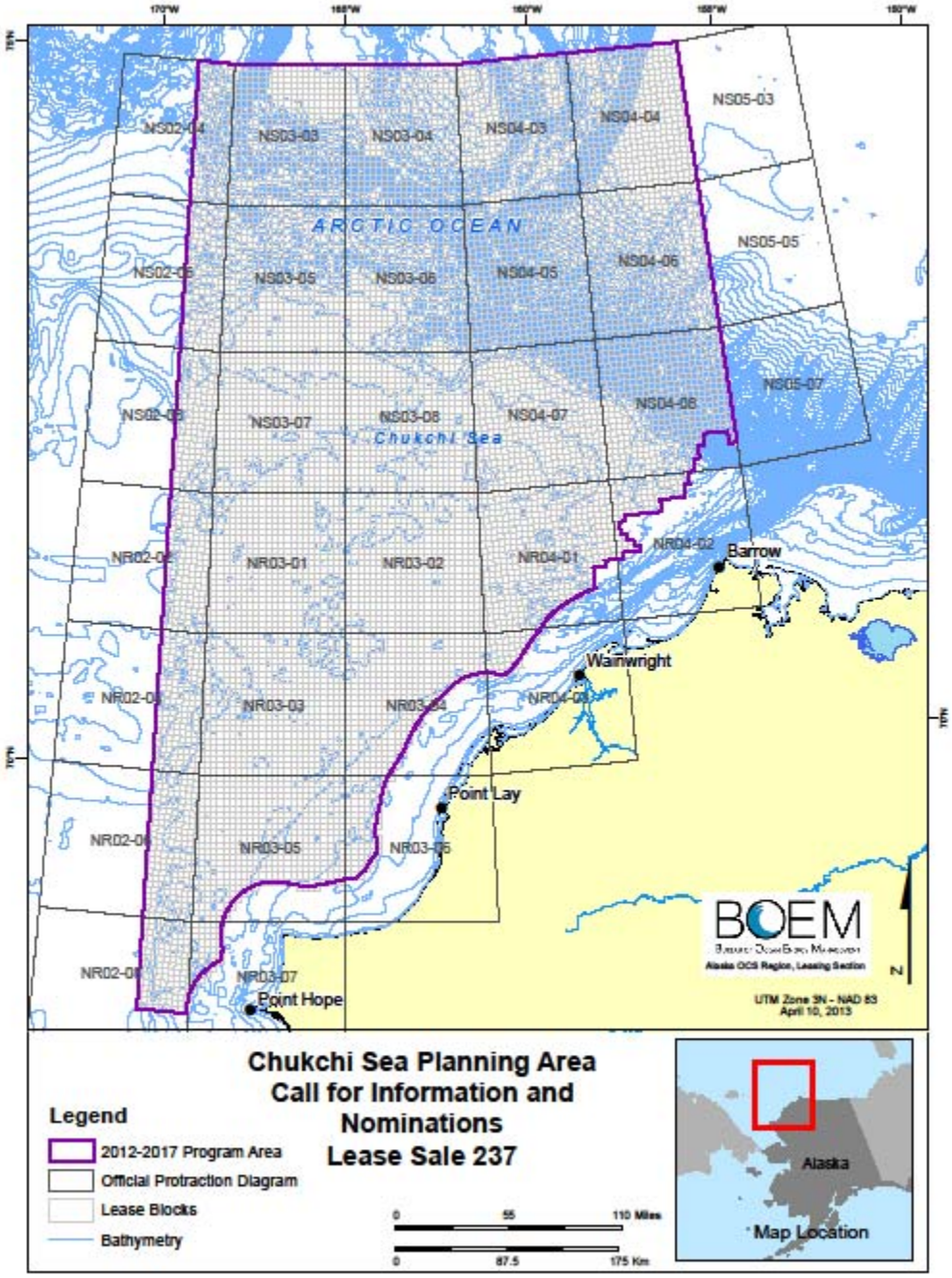


Source: BOEM 2012

5.6.2. Chukchi Sea: A future BOEM lease sale for the Chukchi Sea is scheduled for 2016. These sales have not generated the same level of interest and suggested areas as was noted in the previous lease sales of 2008. It is suggested by some engaged in working these sales, that there is a "wait and see attitude" primarily focused on

observing the results of Shell's currently suspended efforts (in the previous still active lease areas). Figure 5.6 below depicts the lease areas solicited for nomination bids.

Figure 5.6 ~ Chukchi Sea Planning Area Lease Sale 237



Source: BOEM 2013

5.7 Shell's 2012 and Suspended 2014 Operations as a Case Study

Going back a decade, the only exploratory drilling conducted in the Alaska OCS was Shell's 2012 operations in both the Beaufort and the Chukchi lease areas. Since then, the only other fully *planned* effort has been Shell's 2014 Chukchi Sea Exploration Plan. For an understanding of the magnitude and qualitative characteristics of a two drill rig offshore operation in the Alaska OCS, a close look at Shell's 2012 planning, operations and measured outcome is worth a close look. It is the best, most recent and geographically relevant example of such an enterprise. Our focus here is not the geology of the effort, but rather on the character of the shipping and air support requirements. The lessons learned in 2012, much of which were directive in nature by multiple federal regulatory agencies such as the USCG and EPA, in addition to the DOI, were presented in a somewhat severe report to the Secretary of the DOI in a March 8 2013 review. Shell's proposal for 2014 Chukchi operations (now held in moratorium by court action), the *Revised Chukchi Exploration Plan – Revision 2*, and the specifics of required revisions, is also revealing of the nature of a drilling effort in similar regional Arctic Offshore areas. The regulatory requirements were not incidental to the overall maritime operation in 2012 or to proposed future operations, but proved in fact to be key determinants in the number and types of ships required. Similar future efforts in the Alaska OCS by Shell and/or other lease holders are highly likely to face at least as stringent regulatory requirements and will therefore require similar operational plans in terms of maritime support (though the drilling specifics themselves may follow a different technological course, as for example envisioned by Statoil's prospectus). It should also be noted, that Shell's maritime footprint in 2012 and its planned 2014 effort are for *exploratory drilling*, not actual production. Though there is likely a strong corollary of shipping required for such exploratory drilling in other parts of the world, the specific harsh Arctic offshore character of the Alaska OCS and its unique U.S. regulatory standards are not necessarily replicable, for example, in Russian Arctic offshore areas such as the Barents Sea.

5.7.1 Shell's 2012 Operations in Hindsight: There has been much coverage in the press about Shell's struggles with meeting its operational objectives during the 2012

drilling season which resulted in failure to meet USCG certification requirements for the Arctic Containment System (ACS) as well as EPA violations during operations. The dramatic and in one case, near disastrous, return voyages of its two drilling vessels did not bolster investor confidence either. The March 2013 DOI report to the Secretary concluded that Shell was not fully prepared. Its reliance on sub-contractors for most of the non-drilling portions of the operations and inadequate oversight (as determined by DOI) prevented Shell from drilling into hydrocarbon zones (drilling was therefore limited and resulted in only one top hole in the Chukchi and Beaufort Seas respectively --- not the planned four wells). The 2012 operation also suffered air emission EPA violations on *Noble Discoverer* and the grounding of the towed *Kulluk* off Sitkalidak Island (Kodiak). But BOEM expressed confidence that Shell can make corrections for future drilling seasons with a few additions to include a Comprehensive and Integrated Operation Plan and a Third Party Management System Review. Shell was also commended for demonstrating respect and coordinating well with local communities.

Shell's 2012 Beaufort Sea exploration plan was to utilize one drilling rig for four wells approximately 20 miles offshore in the Camden Bay area. There were *11 Arctic-specific conditions and mitigation measures* that governed the drilling operation. These measures required, specific to impact on shipping, that Shell obtain approval from BSEE, EPA, National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (USFWS), confirm availability of relief well rig, demonstrate by field exercise ability to utilize ACS procedures and a suspension of drilling by August 25 to minimize impact during subsistence whaling activities (could potentially be resumed after harvest). The Chukchi proposal was for six wells approximately 85 miles NW of the village of Wainwright and was subject to 15 conditions. Highly significant, was the requirement to stop drilling in the hydrocarbon bearing zone 38 days before trigger date of November 1, which BOEM determined from historical data, was the best estimate for ice encroachment on the Burger site. Other drilling outside the zone was permitted to October 1st. Significantly, EPA air emission permits were/are required for rigs while attached to sea floor and the rigs *supporting vessels* within 25 miles of the rig when so attached. These permits required significant effort and diligence to obtain as well as

continued monitoring. The geographic application (within 25 miles of drilling) also impacted transit patterns. Clean water permits were also required to a high standard. Compliance with the Marine Mammals Act necessitated authorization from NMFS. The Oil Spill Response Plan (OSRP) went through detailed BSEE review and required revision. To support Shell's two floating rigs, over 20 other vessels were required including icebreakers, supply ships, tankers, tugs and specialized oil spill response boats (multi-mission). Over 1,000 flights to shift personnel within the two operational regions were also required as well as for species and ice observations. Note: a breakout of specific ship and aircraft types will be developed in this chapter for Shell's "current" Chukchi Sea Exploration Plan (a revised and modified laydown of the 2012 maritime assets).

5.7.2 Analysis of the Revised Chukchi Sea Exploration Plan- Revision 2: Shell's suspended 2013 planned operations in the Alaska OCS pending review of the problematic and only partially successful 2012 operations in both the Beaufort and Chukchi Seas. Planning focused only on Chukchi Sea operations in 2014. Court action ended possibilities for 2014 but the very extensive planning revisions provide a detailed footprint of the direct shipping support Shell envisions to execute, a comprehensive two drill ship - six well exploratory drilling effort in the Chukchi Sea. Planning has evolved and now Shell's August 2014 plan includes simultaneous drilling operations by the *Discoverer* and *Polar Pioneer* for the six wells. Both of these ships will serve as their own primary relief well drilling unit. They will also mutually support each other as back up drill rigs (neither can be further away than Dutch Harbor, to the other, while drilling is being executed into the hydrocarbon zones). Previous planning proposed that all drilling would be done by the *Discoverer* while the *Polar Pioneer* was to be positioned outside the Chukchi in Dutch Harbor as an emergency response and back up drill vessel (it was estimated to take 10 days for the *Polar Pioneer* and support vessels to reach the drill sites in the event of need). Shell performed modifications to the *Discoverer* to make it Arctic-ready and correct all 2012 non-compliance deficiencies cited by the USCG and EPA. Vessel changes between EP Revision 1 and EP Revision 2 also includes the use of additional support vessels and oil spill response (OSR) equipment in direct response

to Shell's experiences during the 2012 drill season. Under EP Revision 2, the expected frequency of visits by Offshore Supply Vessels (OSVs) to the drilling units has been increased from 17 round trips per season to 30 round trips per season. There have also been changes in the designated locations of some support vessels and the frequency of their use, with some being moored in Kotzebue Sound.

There is also an increase in aircraft planned in Revision 2. Shell plans to utilize an additional helicopter for crew changes, and increase the frequency of these flights from 12 round trips per week up to 40. An additional fixed wing aircraft is also provided for conducting ice reconnaissance flights.

5.7.2.1 Planned Vessel and Aircraft List ~

- Drilling units: *Discoverer and Polar Pioneer*
- Ice management vessels (x2)
- Anchor handlers (x3)
- OSVs (x3)
- Science vessels (x2)
- MLC ROV system vessel
- Support tugs (x2)
- Shallow water vessels (x2)
- Supply tugs and barges (x2)
- OSRV (x1)
- OSR tugs and barges (x2)
- OST (x2)
- Containment system (tug and barge) (x1)
- SAR helicopter
- Crew change/resupply helicopters (x3)
- Fixed wing aircraft for ice reconnaissance
- Fixed wing aircraft for PSO flights
- Fixed wing aircraft for crew change between Barrow and Wainwright

Table 5.2 ~ Comparison of the Exploration Drilling Program Under Shell's Approved Exploration Plan (EP) Revision 1 and EP Revision 2

Parameter	Approved EP Revision 1	EP Revision 2
Drilling Units	*Discoverer*	*Discoverer* and *Polar Pioneer*
MLC Construction	*Discoverer*	*Discoverer*, *Polar Pioneer, MLC ROV system*
Support Vessels	Drilling Support Vessels: • Ice Management vessel (x1) • Anchor handler (x1) • OSVs (x2) • Shallow water landing craft (x1) Oil Spill Response Support Vessels: • Oil spill response vessel (OSRV) (x1) • OSR tug and barge (x1) • Oil storage tanker (OST) for recovered liquids (x1) • Oil spill containment system tug and barge (x1) • Oil spill containment system Anchor handler (x1)	Drilling Support Vessels: • Ice Management Vessels (x2) • Anchor Handlers (x3) • Supply Tug and barges (x2) • OSVs (x3) • Support Tugs (x2) • Science vessels (x2) • Shallow water vessels (x2) • MLC ROV system vessel (x1) Oil Spill Response Support Vessels: • OSRV (x1) • OSR tug and barge (x1) • OSTs (x2) • Oil spill containment system tug and barge (x1) • OSR tug and barge for near shore response (x1)
Aircraft	• S-92 or AW139 for crew change • S-61, S92 or EC225 for Search and Rescue (SAR) • Fixed wing aircraft for protected species observer (PSO) flights • Fixed-wing aircraft – crew change from Wainwright to regional jet service in Barrow	• S-92 Helicopters (or similar) for crew change (x3) • S-92 Helicopter (or similar) for SAR • Fixed wing aircraft for PSO and ice monitoring flights (x2) • Fixed-wing– crew change from Wainwright to regional jet service in Barrow
Aircraft Flights	• Helicopter Crew Change Flights- Approximately 12 round trips/week for crew change/resupply • Fixed wing aircraft for PSO • Fixed wing aircraft crew change between Barrow & Wainwright up to 4 times per week	• Helicopter Crew Change Flights- Approximately 40 round trips/week for crew changes/resupply • Fixed wing aircraft for PSO and ice monitoring flights daily • Fixed wing aircraft crew change between Barrow and Wainwright once every 3 weeks
Drilling Unit Discharges	Discharges as listed in Section 6 of EP Revision 1	Revised discharges volumes/rates in Section 6 of EP Revision 2
Drilling Unit Authorizations	Burger drill sites were authorized under National Pollutant Discharge Elimination System (NPDES) exploration facilities General Permit (GP) AKG-28-0000	Notices of Intent (NOI) to discharge certain wastes at the Burger drill sites will be filed under the new NPDES exploration facilities GP AKG- 28-8100

Drilling Fluid Components	List of approved components are in Table 6.c-1 of EP Revision 1	Additional drilling components have been added and are in Tables 6.c-1 and 6.c-2 of EP Revision 2
Shorebase	Barrow – 75 person man camp	• Barrow – lease 40 person man camp; add a kitchen unit to the 75 person man camp; add hangar space for an additional helicopter • Wainwright – additional existing yard space has been leased for response equipment storage
Secondary Relief Well Unit for the *Discoverer*	Kulluk	*Polar Pioneer* will serve as secondary relief well unit for *Discoverer*, and *Discoverer* will serve as secondary relief well unit for *Polar Pioneer*
Air Emissions Authorization	Air emissions approved by EPA under authorization R10OCS/PSD-AK-09-01	Jurisdiction for regulating air emissions for projects on the OCS in areas off the coast of the NSB in Alaska was changed from EPA to BOEM (Consolidated Appropriations Act)
Containment System Location	Centrally located in the Chukchi Sea or Beaufort Sea	Located in or near Goodhope Bay within Kotzebue Sound
H2S Classification	Requested 'H2S Unknown' classification	Requests 'H2S Absent' classification; H2S Contingency Plan removed

Source: Shell Chukchi Sea Exploration Plan (EP) Revision (2) August 2014

5.7.2.2 Offshore Drilling Program Activities and Emissions Units ~ The offshore drilling envisioned will be conducted by two drilling units, the *Discoverer* and the *Polar Pioneer*, with support from ice management vessels, anchor handlers, oil-spill response (OSR) vessels, offshore supply vessels (OSVs), tugs, tankers, science vessels, MLC ROV System vessel, and aerial transport. For the drilling units, the *Discoverer* and *Polar Pioneer*, the actual vessel to be used and the types of emission units on board are defined. Support vessels are contracted on a yearly basis, therefore, for the support vessels, a candidate vessel and the anticipated emission units are identified.

The *Discoverer* is a turret-moored drilling unit that underwent significant upgrades in 2007 and 2013 so that it could operate in the Arctic. The *Discoverer* has its own propulsion engine for self-transport. The *Polar Pioneer* is a semisubmersible vessel designed to operate in the arctic environment. The *Polar Pioneer* is transported by a towing vessel. The support vessels are equipped with diesel-fueled primary and emergency power generation engines, and in some cases incinerators and/or diesel-fueled boilers.

Ice management vessels and anchor handlers will assist with management of the drilling unit anchors, bow washing of any ice buildup on the drilling units, and some ice floe fragmenting in support of the ice management vessel. One anchor handler and one ice management vessel provide primary close support for each drilling unit with regard to these tasks. The ice management vessels are needed in order to provide protection for the drilling units, or other assets critical to the safety of the exploration. Up to two ice management vessels may be tasked to fragment any manageable ice floes so that the ice will flow around the drilling units. These ice management vessels may work at distances of 25 miles or more upwind of the drilling unit to monitor the leading edge of any ice floe of possible concern. These activities are necessary for managing ice at distances that provide adequate response time for drilling units to get off a well and anchor in case of encroaching ice that cannot be managed.

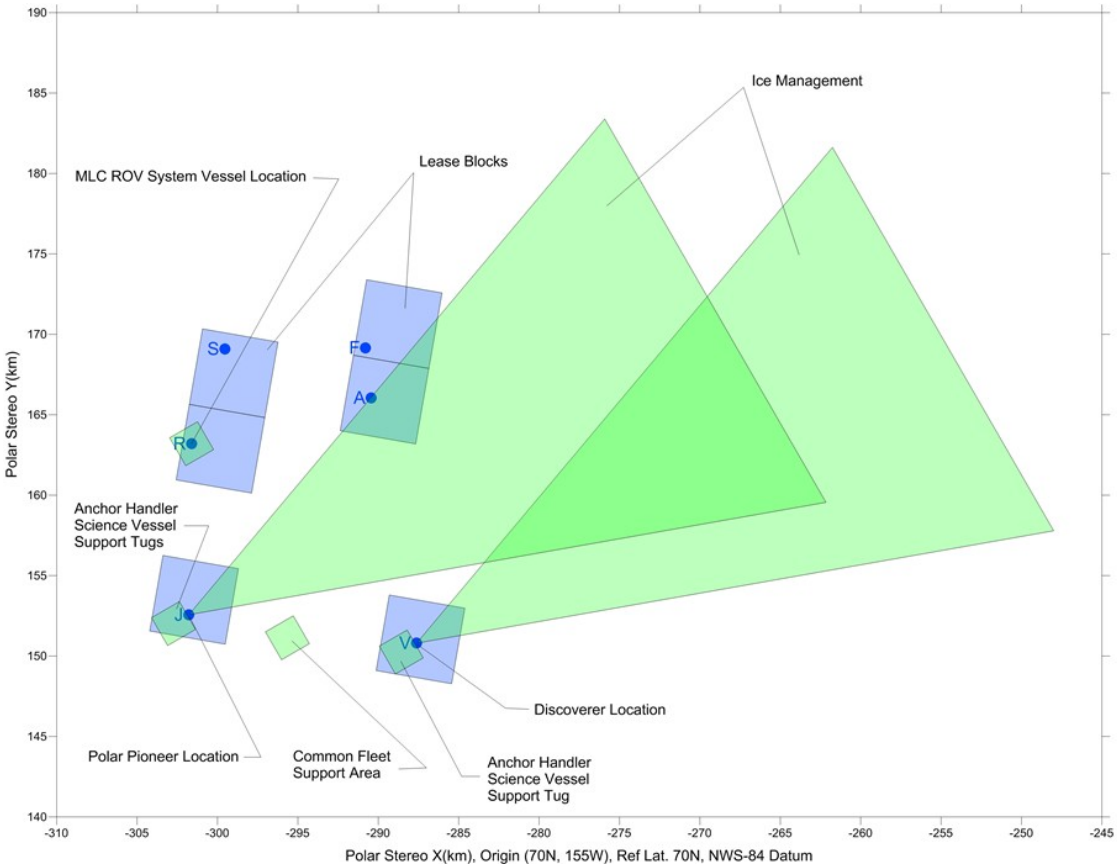
An oil-spill response vessel or vessels will be anchored nearby, typically between the two drilling units. During season, these vessels will primarily be used during refueling operations to protect against possible spills and will be located near the refueling Arctic oil fuel storage tanker. The OSR vessels are expected to be used in the unplanned and unlikely event of an oil discharge to the water. These vessels will be available to both the *Discoverer* and the *Polar Pioneer*.

Other support vessels include those for resupply and material transfer to shore. The OSVs would travel to the drilling units, then “park” in dynamic positioning (DP) mode beside the drilling unit for material or personnel transfer. The OSVs may operate in DP mode beside the drilling unit and would remain there for approximately one day. It is anticipated that up to two vessels similar to the OSVs will be primarily used to monitor discharges from each drilling unit as required by the National Pollutant Discharge Elimination System (NPDES) General Permit. These vessels may remain within a few miles of each drilling unit for these sampling periods or conduct secondary tasks, as needed. Two tugs will be operated in standby mode on-location in case the *Polar Pioneer* must leave location quickly because of encroaching ice. Another tug will escort the *Discoverer* to the drill site, assist during mooring and conduct other activities outside the Chukchi Sea. A fuel and oil tanker is expected to be located in an area between the

two drilling units to resupply the drilling units and support vessels.

During the 2012 drilling season, mud line cellars (MLC) were excavated with large drills aboard the *Discoverer*. As described in Shell's EP Revision 2, an MLC may also be excavated by a separate vessel (MLC ROV System vessel) supporting a specially designed subsurface excavator. If the ice management vessels or OSVs travel beyond 25 miles from the drilling units, air emissions would be dispersed to a greater extent than when the vessels are closer to the drilling units. Because the dispersion modeling analysis concentrates all ice management and OSV emissions within 25 miles of the drilling units, it results in predictions that are higher than those expected if some vessels venture outside the 25 mile radius. Figure 5.7 following is a model of emissions sources in the drilling area which is also useful to envision the vessel positions during drilling operations.

Figure 5.7 ~ Shell Support Vessel Locations



Source: Shell Chukchi Sea Exploration Plan (EP) Revision (2) August 2014

5.7.2.3 Crew Rotations ~ Primary vessels not directly engaged in operations, such as anchor handlers, tug and barge, will be located near the drilling vessel or containment barge outside the lease sale area in Kotzebue Sound (three temporary moorings will be positioned in Goodhope Bay). Shore support for the moorings will be provided from Kotzebue. They will resupply and support the drilling operations periodically. A science (oceanographic research) vessel will monitor waste stream discharges in the drill area during operations. The OST *Affinity* (or similar), rather than being centrally located between the Chukchi and Beaufort Sea as was described in the EP Revision 1, will now be positioned closer to the drilling unit. Landing craft will be used for crew transfers for vessels in Kotzebue Sound or as needed for logistics for the fleet.

Crew rotations vary depending on the specific job responsibilities and the vessel, aircraft, or terminal at which the crew member is stationed. Crew rotation on the drillship is expected to be 21 days for most personnel. Crew changes are planned to be carried out primarily by helicopter. The frequency of crew change helicopter flights may be up to 40/week. Shell may, as a contingency, conduct crew changes using a vessel to transport crew members from the drillship or offshore vessels to the beach at Barrow. In a contingency, such as bad weather, crew changes might use a vessel for transport from offshore vessels to Barrow. Resupply will be from Dutch Harbor using OSVs. Additional resupply support may be provided via Kotzebue Sound while aviation operations will be conducted primarily from Barrow.

5.7.2.4 Depiction of Vessels ~ The following photographs and accompanying charts detail the primary drill vessels, the *Polar Pioneer* and *Discoverer*, respectively, followed by the supporting class of vessels. These photos and depictions were provided by Shell and included in the ***Shell Chukchi Sea Exploration Plan (EP) Revision (2) August 2014***.

Figure 5.8 ~ *Polar Pioneer*

Source: Shell Chukchi Sea Exploration Plan (EP) Revision (2) August 2014

Figure 5.9 ~ *Discoverer*

Source: Shell Chukchi Sea Exploration Plan (EP) Revision (2) August 2014

Table 5.3 ~ Specifications of the Discover and Polar Pioneer

Specification	*Discoverer*	*Polar Pioneer*
Dimensions		
Hull Length	514 ft. (156.7 meters [m])	279 ft. (85 m)
Hull Width	85 ft. (26.0 m)	233 ft. (71 m)
Height	274 ft. (83.2 m)	319 ft. (97.3m)
Derrick Height	175 ft. (53.3 m)	170 ft. (51.8 m)
Draft		
Transit Draft	26.9 ft. (8.2 m)	30 ft. (9.15 m)
Operating Draft at Load line	26.9 ft. (8.2 m)	75.4 ft. (23 m)
Berths	124 berths	114 berths
Storage Capacity		
Potable Water	1,670 barrels (bbl) (266 cubic meters [m^3])	4,843 bbl (770 m^3)
Drill Water	5,798 bbl (922 m^3)	11,140 bbl (1,770 m^3)
Liquid Mud	2,400 bbl (382 m^3)	6,180 bbl (982 m^3)
Bulk Cement	6,400 cubic feet (ft^3) (180 m^3)	12,678 ft^3 (359 m^3)
Fuel	6,497 bbl (1,033 m^3)	11,290 bbl (1,794 m^3)
Propulsion Engines	(1) MAN Diesel B&W l, 6,480 horsepower (hp)	Not Applicable
Power Plant	(6) Caterpillar 3512 1,476 hp	(5) Bergen KVG-18 3,890 hp
Mooring		
Anchors	9 – 15 metric ton (mt) Stevshark, 8 each	9 – 15 mt Stevshark, 8 each
Anchor Lines	2.75-inch (in.) (7-centimeters [cm]) wire rope 2.5- in. (6-cm) chain	3.3 in (88 mm) K-4 chain
Anchor Line Length	(8 each) 2,750 ft. (838 m) wire + 1,150 ft. (351 m) chain (useable) per anchor	(8 each) 6,458 to 6675 ft. (1,969 to 2,035 m) chain per anchor
Transit Speed	8.0 knots	N/A (non-self-propelled)
Marine Sanitation Device	OMNIPURE Series 55	Piranha WRS-40

Source: Shell Chukchi Sea Exploration Plan (EP) Revision (2) August 2014

Table 5.4 ~ Comparison of Support Vessels

Specification	Ice Management Vessels (x2) [1,2]	Anchor Handlers (x3) [1,3]	OSVs (x3) [1,4]	Science Vessels (x2) [1,5]	Shallow Water Vessels (x2) [1,6]	Support Tugs (x2) [1,7]	Supply Tug and Barges (x2) [1,8]		MILC ROV System Vessel [1,9]
							Tug	Barge	
Length	380 ft. (116 m)	361 ft. (110 m)	300 ft. (91.5 m)	300 ft. (91.5 m)	134 ft. (40.8 m)	146 ft. (44.5 m)	150 ft. (45.7 m)	400 ft. (122 m)	280 ft. (85.3 m)
Width	85 ft. (26 m)	80 ft. (24.4 m)	60 ft. (18.3 m)	60 ft. (18.3m)	32 ft. (9.7 m)	46 ft. (14m)	40 ft. (12.2 m)	99.5 ft. (30.3 m)	60 ft. (18.3 m)
Draft	27 ft. (8.4 m)	28 ft. (8.5 m)	15.9 ft. (4.9 m)	15.9 ft. (4.9 m)	6 ft. (1.8 m)	21 ft. (6.4 m)	19.5 ft. (5.9 m)	25 ft. (7.6 m)	16.5 ft. (5 m)
Accommodations	82	64	50	50	22	13	11	--	26
Maximum Speed	16 knots (30 km/hr.)	15 knots (28km/hr.)	13 knots (24 km/hr.)	13 knots (24 km/hr.)	10 knots (18 km/hr.)	16 knots (30 km/hr.)	12 knots (22km/hr.)	--	13 knots (24 km/hr.)
Available Fuel Storage	14,192 bbl (2,256 m^3)	11,318 bbl (1,799 m^3)	5,786 bbl (920 m^3)	5,786 bbl (920 m^3)	667 bbl (106 m^3)	5,585 bbl (888 m^3)	4,800 bbl (774 m^3)	--	6,233 bbl (991 m^3)

[1] Or similar vessel
[2] *Based on Nordica*
[3] Based on *Aiviq*
[4] Based on the *Harvey Champion*
[5] Based on the *Harvey Champion*
[6] Based on the *Arctic Seal*
[7] Based on the *Ocean Wave*
[8] Based on the *Lauren Foss* (tug) and *Tuuq* (barge)
[9] Based on the *Harvey Spirit*

Source: Shell Chukchi Sea Exploration Plan (EP) Revision (2) August 2014

Table 5.5 ~ Comparison of Support Vessels *(continued)*

Specification	OSRV [1,2]	Offshore OSR [1,3]		Tug	Barge	OST [1,5]	OST [1,6]	Containment System [1,7]	
		Tug	Barge					Tug	Barge
Length	301 ft. (91.9 m)	126 ft. (38.4 m)	333 ft. (101.5 m)	90 ft. (27.4 m)	205 ft. (62.5 m)	748 ft. (228 m)	813 ft. (248 m)	150 ft. (45.7 m)	316.5 ft. (96.5 m)
Width	60 ft. (18.3 m)	34 ft. (10.4 m)	76 ft. (23.1 m)	32 ft. (9.8 m)	90 ft. 27.4 m)	105 ft. (32 m)	141 ft. (48 m)	40 ft. (12.2 m)	105 ft. (32 m)
Draft	19 ft. (5.8 m)	17 ft. (5.2 m)	22 ft. (6.7 m)	10 ft. (3 m)	15 ft. (4.6 m)	66 ft. (20 m)	69 ft. (21 m)	19.5 ft. (5.9 m)	12.5 ft. (3.8 m)
Accommodations	41	15	--	8	25	25	25	11	72
Maximum Speed	16 knots (30 km/hr.)	12 knots (22 km/hr.)	--	12 knots (22 km/hr.)	--	15 knots (28 km/hr.)	15 knots (28 km/hr.)	10 knots (19 km/hr.)	--
Available Fuel Storage	7,692 bbl (1,223 m^3)	1,786 bbl (284 m^3)	390 bbl (62 m^3)	1,286 bbl (204.5 m^3)	--	16,121 bbl (2,563 m^3)	20,241 bbl (3,218 m^3)	4,800 bbl (763 m^3)	6,630 bbl (1,054 m^3)
Available Liquid Storage	12,245 bbl (1,947 m^3)	--	76,900 bbl (12,226 m^3)	--	17,000 bbl (5,183 m^3)	106,000 bbl[8] (16,852 m^3)	670,000 bbl (106,518 m^3)	--	--
Workboats	(3) 34 ft. work boats		--	-	(1) skim boat 47 ft. (14 m) (3) work boats 34 ft. (10 m) (4) mini-barges	--	--	--	--

[1] Or similar vessel
[2] *Based on Nanuq*
[3] Based on the tug *Guardsman* (tug) and *Klamath* (barge)
[4] Based on the *Point Oliktok* (tug) and *Endeavor* (barge)
[5] Based on a Panamax type tanker
[6] Based on an Aframax type tanker
[7] Based on the *Corbin Foss* (tug), *Arctic Challenger* (barge)
[8] Total available storage is 350,000 bbl; however, 244,000 bbl of ULSD or a fuel with equal or lower sulfur content (used to refuel the drilling units and support vessels) will take up storage space, leaving 104,000 bbl for recovered liquids. Storage space for recovered liquids will increase as fuel is dispensed for refueling.

Source: Shell Chukchi Sea Exploration Plan (EP) Revision (2) August 2014

Figure 5.10 ~ Photograph of an Ice Management Vessel

Two primary ice management vessels will support the drilling units (photograph is the M/V *Nordica*). These vessels will enter and exit the Chukchi Sea with the drilling units or before and will generally remain in the vicinity of the drilling units during the drilling season. Ice management and ice reconnaissance is expected to occur at distances of 20 mi (32 km) and 30 mi (48 km) respectively. However, these vessels may be to expand beyond these ranges depending on the ice conditions.

Source: Shell Chukchi Sea Exploration Plan (EP) Revision (2) August 2014

Figure 5.11 ~ Photograph of an Anchor Handler

Three anchor handlers (photograph of *Aiviq*) will support the drilling units and the containment system tug and barge. These vessels will enter and exit the Chukchi Sea with the drilling units or before, and will generally remain in the vicinity of the drilling units during the drilling season. When not anchor handling, these vessels will be available to provide other general support if needed.

Source: Shell Chukchi Sea Exploration Plan (EP) Revision (2) August 2014

Figure 5.12 ~ Photograph on an OSV

The planned exploration drilling operations will require three OSVs for resupply of the drilling units and support vessels. Drilling materials, food, fuel and other supplies will be picked up in Dutch Harbor (with possible minor resupply coming out of Kotzebue) and transported to the drilling units and support.

Shell plans to use up to two science vessels to monitor discharges from the drilling units during drilling. The science vessel specifications are based on a large OSV (*Harvey Champion* [photograph] or similar) but may be a smaller vessel. This vessel will help sample drilling discharges that are defined in the EPA NPDES exploration facilities GP AKG-28-8100.

Source: Shell Chukchi Sea Exploration Plan (EP) Revision (2) August 2014

Figure 5.13 ~ Photograph of a Shallow Water Vessel

Shell plans to use two shallow water vessels, based in Kotzebue Sound (photograph of the *Arctic Seal*). These vessels will be used to transport supplies and crew between Kotzebue and the vessels moored in Kotzebue Sound. These vessels will have a shallow draft and be capable of entering shallow water.

Source: Shell Chukchi Sea Exploration Plan (EP) Revision (2) August 2014

Figure 5.14 ~ Photograph of a Support Tug

Two support tugs will tow the *Polar Pioneer* to the Burger Prospect. After the *Polar Pioneer* is moored, the tugs will remain in the vicinity of the drilling units to help move them in the event that either drilling unit has to be moved off a drilling site due to ice or any other event.

Source: Shell Chukchi Sea Exploration Plan (EP) Revision (2) August 2014

Figure 5.15 ~ Photograph of a Supply Tug

Shell plans to use two tugs and supply barges (photograph is of the tug *Lauren Foss*) that may be based in Kotzebue Sound. The barges will house well material for the drilling vessels and for the containment system tug and barge, provide contingency accommodations for personnel in Kotzebue Sound, and carry mooring equipment for the containment system barge.

Shell also plans to use an OSV type vessel to support an MLC ROV system that may be used to construct some of the MLCs. If used, this vessel will be located at a drill site on the Burger Prospect. When not in use, the vessel will be outside the Chukchi Sea lease sale planning area.

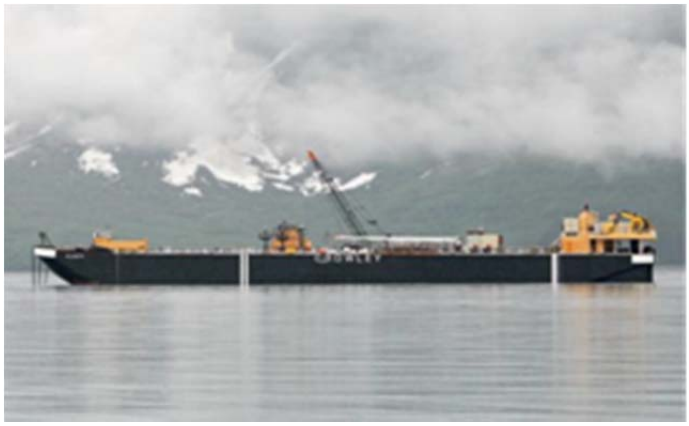
Source: Shell Chukchi Sea Exploration Plan (EP) Revision (2) August 2014

Figure 5.16 ~ Photographs of OSRV

An OSRV such as the *Namuq* (or similar) will be staged in the vicinity of the drilling units when either is drilling in liquid hydrocarbon bearing zones. This will enable the OSRV to immediately respond to a spill and provide containment, recovery, and storage for the initial operational period following a spill event.

Source: Shell Chukchi Sea Exploration Plan (EP) Revision (2) August 2014

Figure 5.17 ~ Photographs of Offshore OSR Tug and Barge



An OSR tug and barge, (photograph is of the *Guardsman* tug and *Klamath* barge), will be staged in the Chukchi Sea. Together with the OSRV, it will have sufficient containment, recovery, and storage capacity for the initial operational period in the event of a spill.

Source: Shell Chukchi Sea Exploration Plan (EP) Revision (2) August 2014

Figure 5.18 ~ Photograph of an OST

Shell plans to use up to two OSTs. As planned, one OST with specifications of a Panamax tanker will be staged in the vicinity of the Burger Prospect. This tanker will hold fuel for Shell's drilling units and support vessels in addition to storage space to store collected recovered liquids if there is a well control event. A second OST, with specifications of an Aframax tanker, will be stationed outside the Chukchi Sea lease sale planning area. The Aframax tanker will be sited such that it will be able to respond to a well control event before the Panamax tanker reaches its recovered liquid capacity.

Source: Shell Chukchi Sea Exploration Plan (EP) Revision (2) August 2014

Figure 5.19 ~ Photograph of a near shore Tug and Barge

A tug and barge (*Endeaver* barge is pictured) will be used for near shore OSR. It will carry a 47-ft (14-m) skimming vessel, three 34-ft (10-m) workboats, four mini-barges, and boom and duplex skimming units for near shore recovery. This tug and barge will be moored in Kotzebue Sound.

Source: Shell Chukchi Sea Exploration Plan (EP) Revision (2) August 2014

Figure 5.20 ~ Photograph of containment system barge

Shell's oil spill containment system tug and barge, housed on the *Arctic Challenger* barge, will be accompanied by the tug Corbin Foss (or similar). The containment system tug and barge will be moored in or near Goodhope Bay in Kotzebue Sound.

Source: Shell Chukchi Sea Exploration Plan (EP) Revision (2) August 2014

The precise location of mooring vessels in Goodhope Bay, Kotzebue Sound is yet to be determined; however, it will be in the vicinity of the potential place of refuge (PPOR) in the Northwest Alaska Subarea Plan (e.g., approximately 66° 13' N 163° 28' W), which is in excess of 7 mi (11 km) from land, in a water depth of approximately 30 ft. (9 m). Setting of four mooring buoys is anticipated with each buoy having up to three anchors. The vessels expected to moor in this location include the containment system tug and barge, near shore OSR tug and barge, and two supply tugs and barges.

Setting and retrieval of the anchors will result in some disturbance of the seafloor. Shell selected the area in large part because it has been selected and approved as a PPOR. The review process for selecting PPORs considers the existence of sensitive resources such as historic properties. Subsea surveys have not been conducted at the location, but it is the conclusion of an archaeological review requested by Shell that there is low potential for any effect to historic resources from the planned moorings and staging in Goodhope Bay.

Vessels will remain compliant with the existing waste management plan, MARPOL regulations, and NPDES Vessel GP for any discharge of gray water or effluent. Crew changes will occur throughout the season using shallow water vessels (yet to be

contracted) transiting out from Kotzebue to the vessel locations in Kotzebue Sound. Vessels may also receive resupply of food stores via a shallow water vessel.

The exact location of mooring vessels in Goodhope Bay, Kotzebue Sound, cited in the last figure, has not been established, but is likely to be about 7 miles from shore and will be centered on four anchored buoys in 30 feet of water.

Table 5.6 below defines the specific six lease blocks proposed by Shell in their current planning.

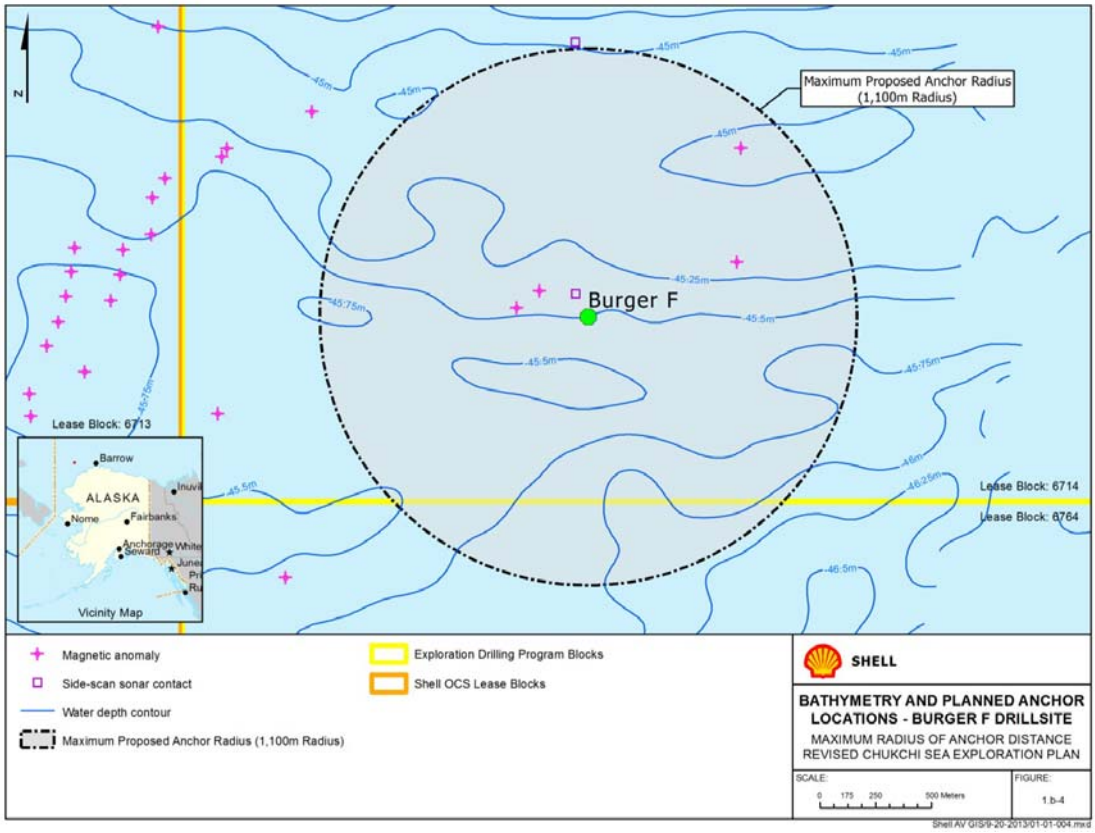
Table 5.6 ~ Shell Lease Blocks and Drill Sites Covered in the EP Revision 2 for the Exploration Drilling Program Started in 2012 (Protraction NR03-02, Posey Area Block)

Proposed Drill Site	Block	Lease Number	Coordinates (meters)[1] X	Y	Latitude	Longitude
Burger A	6764	OCS-Y-2280	563945.26	7912759.34	N71° 18' 30.92"	W163° 12' 43.17"
Burger F	6714	OCS-Y-2267	564063.30	7915956.94	N71° 20' 13.96"	W163° 12' 21.75"
Burger J	6912	OCS-Y-2321	555036.01	7897424.42	N71° 10' 24.03"	W163° 28' 18.52"
Burger R	6812	OCS-Y-2294	553365.47	7907998.91	N71° 16' 06.57"	W163° 30' 39.44"
Burger S	6762	OCS-Y-2278	554390.64	7914198.48	N71° 19' 25.79"	W163° 28' 40.84"
Burger V	6915	OCS-Y-2324	569401.40	7898124.84	N71° 10' 33.39"	W163° 04' 21.23"

Source: Shell Chukchi Sea Exploration Plan (EP) Revision (2) August 2014

Figure 5.21 identifies the following specific anchorage area chart for one of the six planned Burger Prospect exploratory drilling sites in the Chukchi Sea is provided for illustrative purpose and representation size of the actual maritime operational footprint:

Figure 5.21 ~ Bathymetry and Planned Drillship Anchor Radius - Burger F

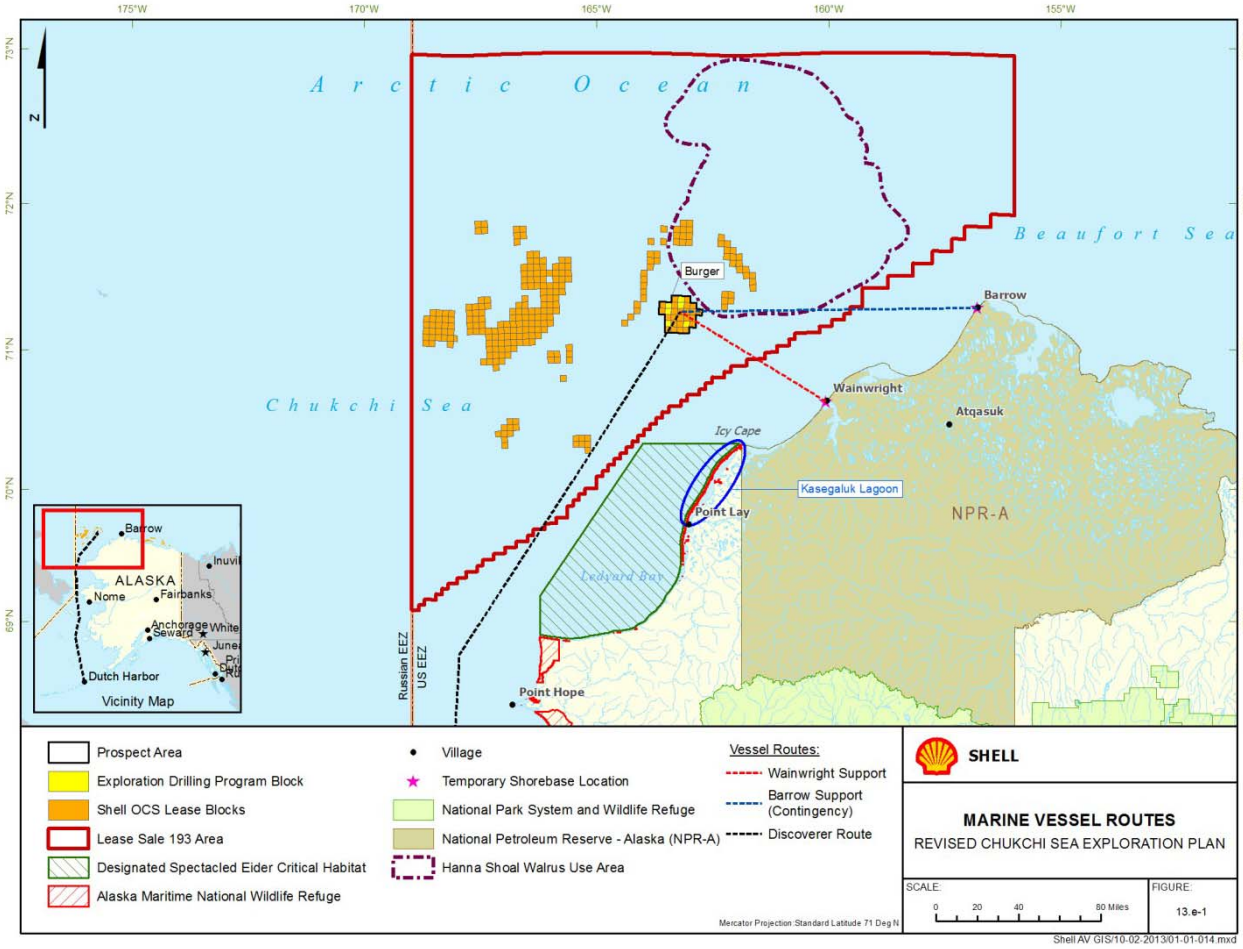


Source: Shell Chukchi Sea Exploration Plan (EP) Revision (2) August 2014

5.7.2.5 Aircraft ~ Offshore operations will be serviced by an additional helicopter operated out of onshore support base locations. The helicopter will either be a Sikorsky S-92 or Euro copter EC225 capable of transporting 10- 12 persons; it will be used to transport crews between the onshore support base and the drillship or support vessels with helidecks. The route chosen will depend on weather conditions and whether subsistence users are active on land or at sea. These routes may be modified depending on weather and subsistence uses. The helicopter will also be used to haul small amounts of food, materials, equipment, and waste between vessels and the shore base. The primary helicopter support base is located at the Barrow airport, however there will be aircraft support in Wainwright. Shell may need to use hangar space at the Deadhorse airport if space is not available in Barrow. In this case, one of the crew change helicopters may make a once daily round trip from Deadhorse to Barrow then back to Deadhorse.

5.7.2.6 Support Corridors ~ Figure 5.22 gives an estimate of planned support vessel transit corridors during drilling operations:

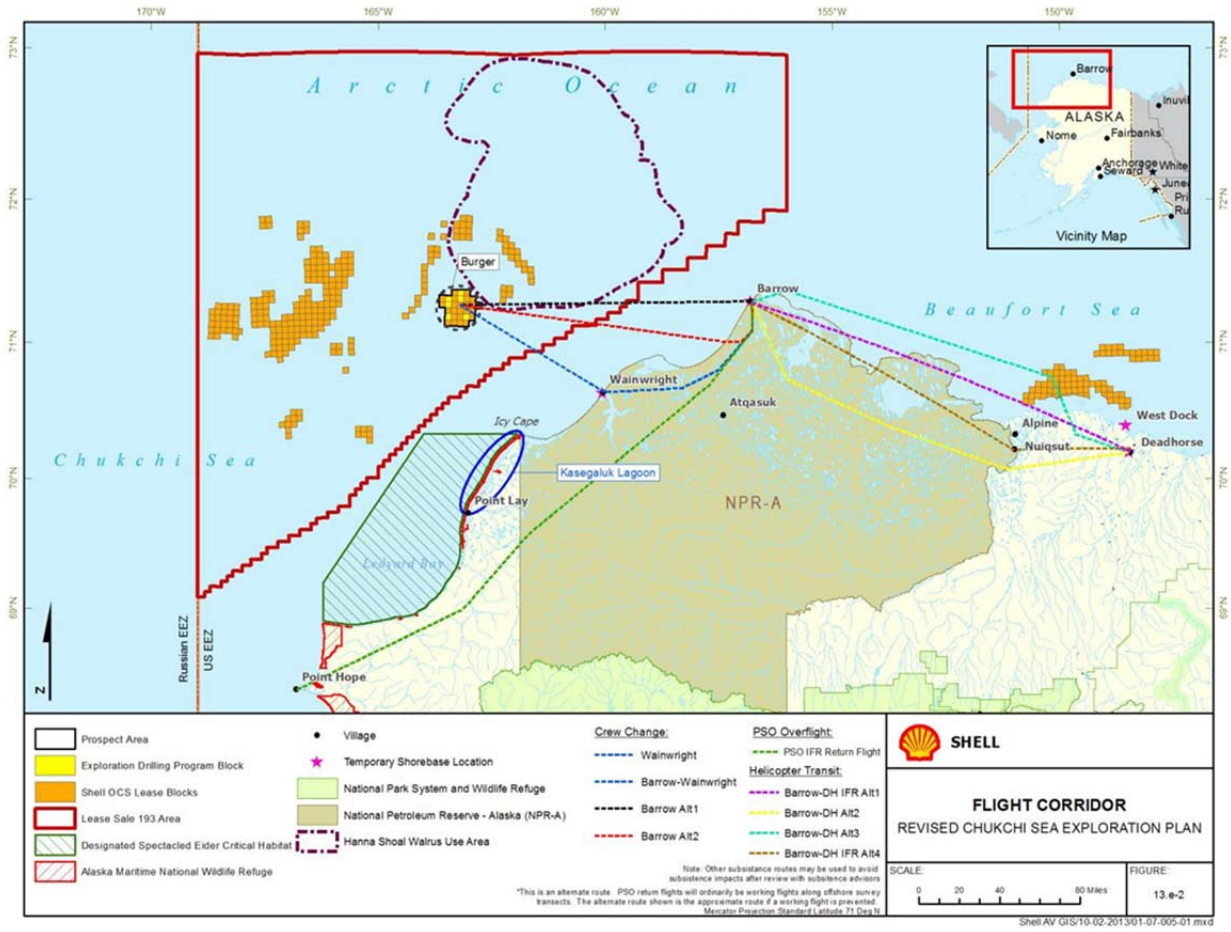
Figure 5.22 ~ Support Corridors in the Chukchi Sea



Source: Shell Chukchi Sea Exploration Plan (EP) Revision (2) August 2014

5.7.2.7 Flight Corridors ~ Figure 5.23 details the flight corridors for the Chukchi Sea planning.

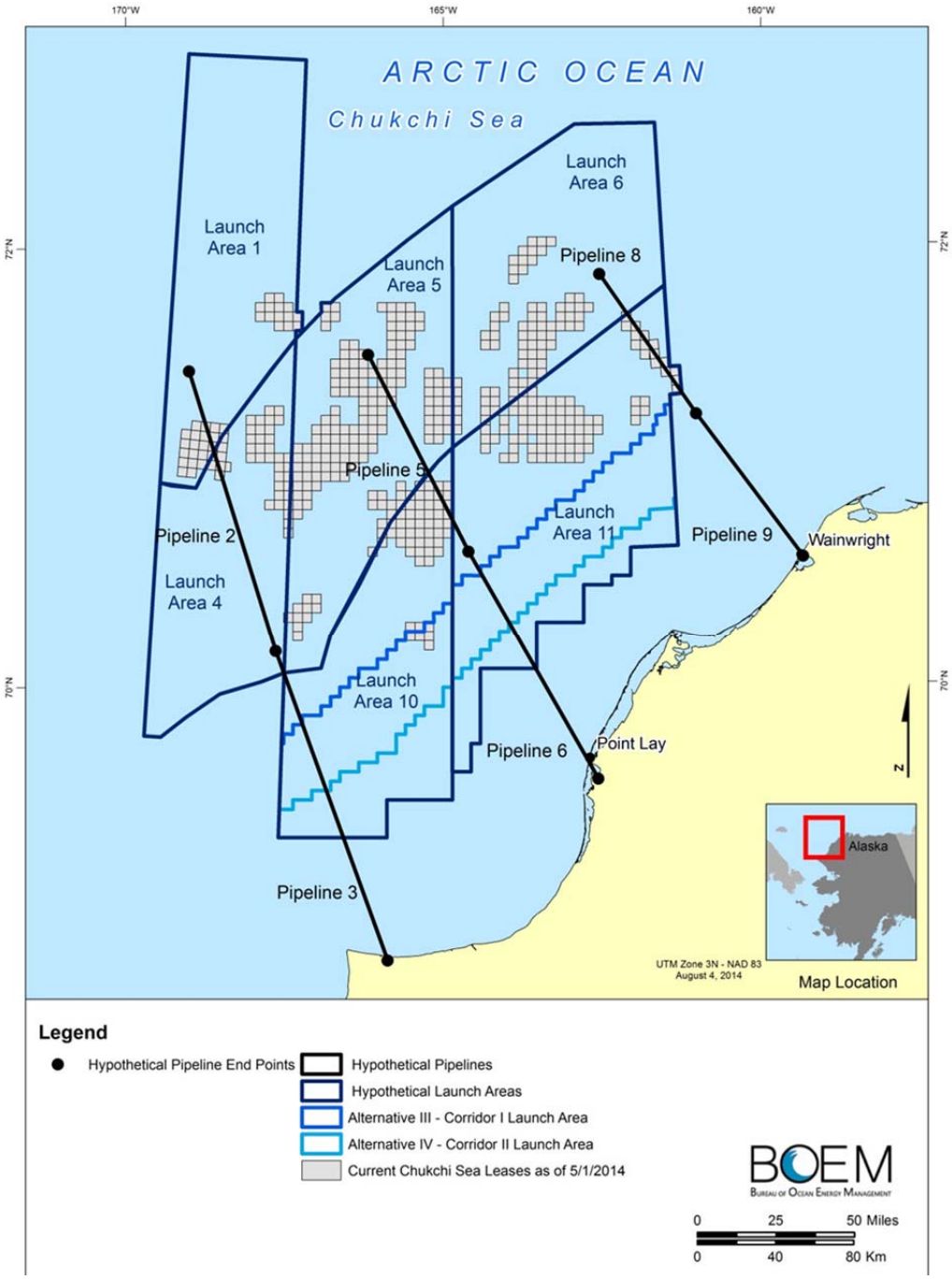
Figure 5.23 ~ Chukchi Sea Supporting Flight Corridors



Source: Shell Chukchi Sea Exploration Plan (EP) Revision (2) August 2014

5.7.2.8 Hypothetical Launch Areas and Pipelines Used in the Oil-Spill Trajectory Analysis ~ These pipeline paths proposed in Figure 5.24 are illustrative of the likely production extractive concept of an integrated sea to shore pipeline system.

Figure 5.24 ~ Proposed Pipelines for Chukchi Sea Extraction



Source: ***Draft Second Supplemental Environmental Impact Statement,*** **Chukchi Sea, Lease Sale 193, BOEM, October 2014**

5.8 Potentials: Future Transition Scenarios from Exploration to Production

5.8.1 Scenarios for Planning: The following scenarios were developed in 2009 by Northern Economics in its paper ***Economic Analysis of Future Offshore Oil and Gas Development: Beaufort Sea, Chukchi Sea, and North Aleutian Basin*** for Shell. Though the timeline is somewhat dated, the substance of implied shipping support is a valid contribution to current analysis.

5.8.1.1 Beaufort Scenario ~

- Exploration drilling occurs over 15 years with 1 to 3 drilling rigs per season.
- Development includes construction of seven offshore production platforms, offshore pipelines, as well as an onshore pipeline system that connect to the Trans-Alaska Pipeline System (TAPS).
- Production assumes first oil in 2019 and first gas in 2029, with seven fields producing a total cumulative volume of about five billion barrels of oil and seven trillion cubic feet of gas through 2057 (a 2019 production target is no longer feasible but the timeline overall is a useful assessment).

5.8.1.2 Chukchi Scenario ~

- Exploration drilling occurs over 24 years with 1 to 2 drilling rigs per season.
- Development includes construction of four offshore production platforms, offshore pipelines as well as an onshore pipeline system across the National Petroleum Reserve – Alaska (NPR-A) to connect to the TAPS. A new shore base on the Chukchi coast is assumed to be constructed to support offshore exploration and development; other onshore facilities are also assumed to be required to support production activities.
- Production assumes first oil in 2022 and first gas in 2036, with four fields producing a total cumulative volume of 4.8 billion barrels of oil and 7.8 trillion cubic feet of gas through 2057.

Table 5.7 below reflects the underlying numbers used in Northern Economics 2009 assessment.

Table 5.7 ~ Summary of OCS Development Scenarios

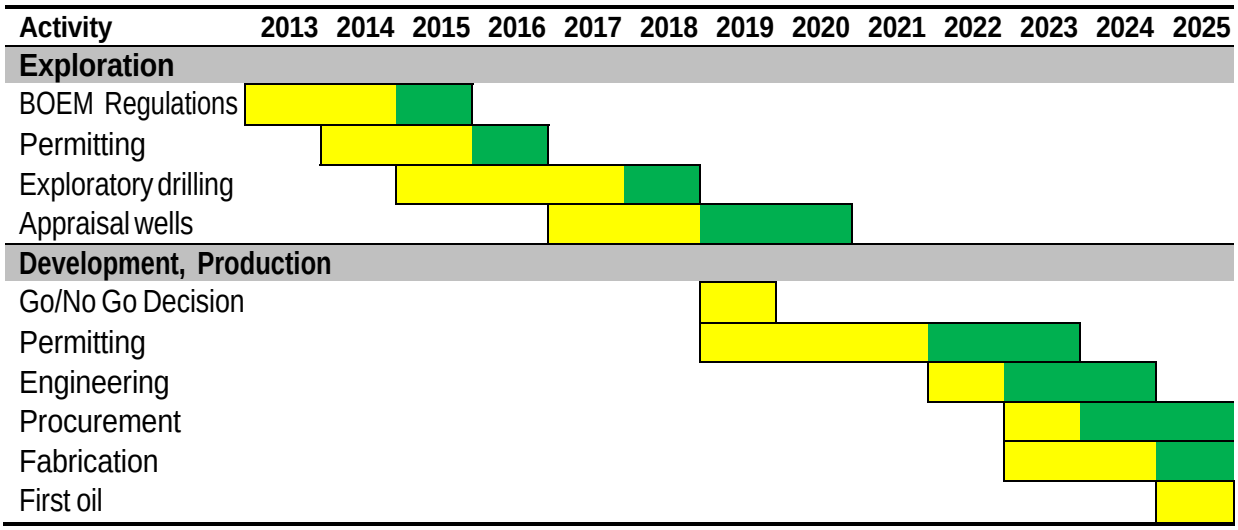
	Beaufort	Chukchi	North	Total
Resource Size (Mean)				
Oil and condensates (billion barrels)	5.97	8.38	0.71	15.06
Gas (trillion cubic feet)	15.94	34.43	7.65	58.02
Exploration				
Exploration/Delineation wells	47	43	10	100
Exploration rig seasons	31	27	8	66
Development				
No. of offshore production platforms	7	4	2	13
Offshore/Onshore pipelines (miles)	235	680	300	1,215
Shore bases / facilities				
Marine terminal	*yes*	*yes*	*yes*	
Liquefied Natural Gas (LNG) facility	*no*	*no*	*yes*	
Production facility	*yes*	*yes*	*yes*	
Support base	*yes*	*yes*	*yes*	

Source: *Economic Analysis of Future Offshore Oil and Gas,* Shell *(*Northern Economics) March 2009

The production scenario for the Beaufort Sea assumes six oil fields and 1 gas field. The Chukchi development scenario assumes construction of both offshore facilities and onshore facilities along the Chukchi coast. This scenario assumes new shore base and support facilities would be constructed to serve all four fields. An estimated 680 miles of onshore and offshore pipelines are built to transport the oil and gas resources, with the oil pipelines built first and the gas pipelines built when gas production commences. The Chukchi scenario used in this analysis includes two pipelines across the North Slope connecting to facilities at Prudhoe Bay. Around 250 miles of onshore oil pipeline would be built before oil production begins, followed by approximately 250 miles of gas pipeline prior to natural gas production. No platforms are abandoned during the study period in this scenario for the Chukchi Sea.

5.8.2 Future Scenario Timelines: One developed scenario of a timeline from exploration through production in the Alaska OCS was developed for the Bering Straits Corporation by Northern Economics and is depicted in Figure 5.25 below. The following graphic depicts their estimate and is displayed for general, illustrative purposes. (Note: there are no scheduled activities for the Beaufort Sea and Shell's Chukchi operations are under court moratorium)

Figure 5.25 ~ Potential Oil and Gas Development, Chukchi and Beaufort Seas



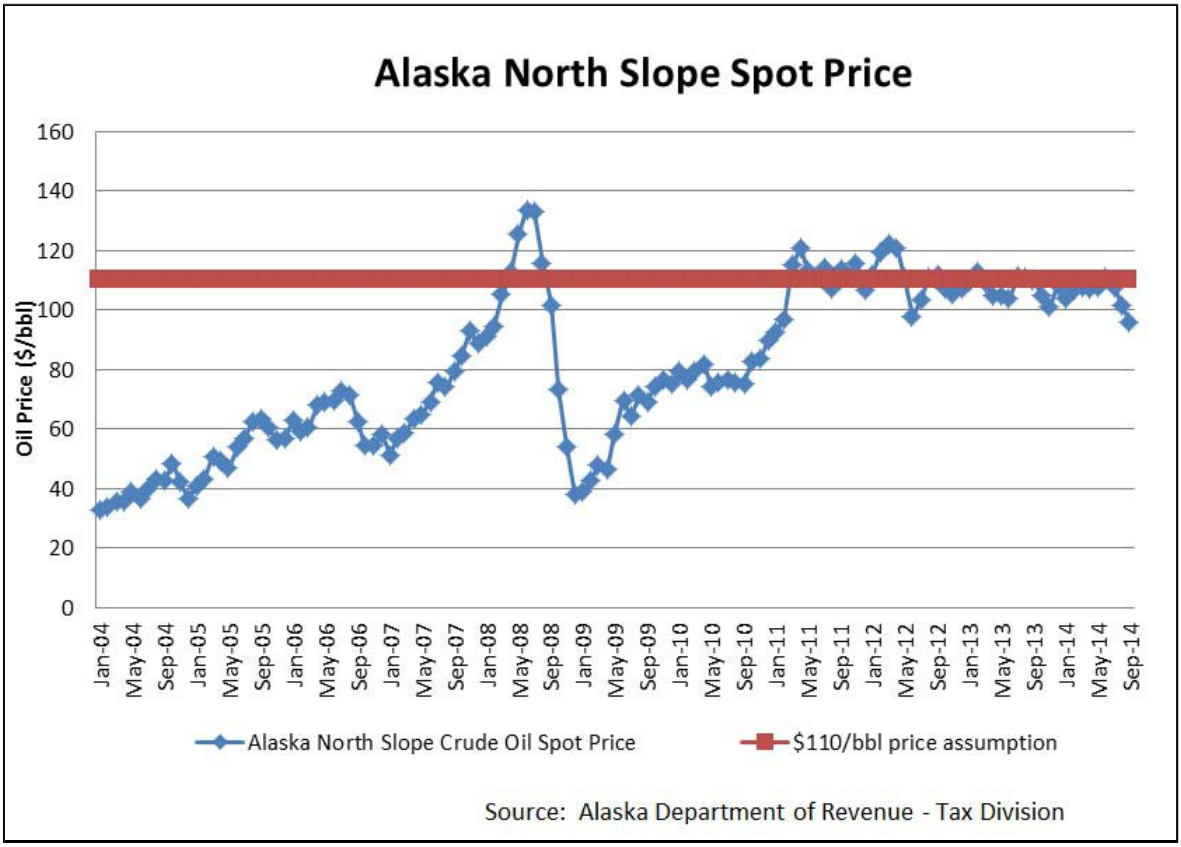
Note: Yellow (lighter) cells indicate scheduled activities while green (darker) cells represent possible delay.

Source: *Feasibility Port Clarence Support Base, Bering Straits Native Corporation* (Northern Economics) June 2014

5.8.3 Analysis of Macro-Economic Drivers: The character, intensity and rapidity of exploration and production of hydrocarbons in the Alaska OCS is dependent on global economic, hydrocarbon market specific, and geopolitical factors outside the parameters of the Alaska OCS region and its regulatory regime. BOEM was directed by federal court order to reassess the impact of oil and gas leasing in the OCS, with special attention to the impact of the *production* phase. The resulting *Draft Second Supplemental Environmental Impact Statement*, currently in a public comment phase, modeled production paths and provided relevant analysis that bears both on the timeline of extraction as well as the magnitude. Monte Carlo modeling did not demonstrate the normal high correlation or elasticity to changes in between oil prices and forecasted production. Importantly, when running data with a lower starting oil price,

production must have a *high volume* to be economic. The rapid current decline to below $60 bbl is in contrast of the long sustained period of high oil prices demonstrated in the chart below. For the purposes of modeling therefore, BOEM utilized an inflation adjusted oil price of $110 bbl for North Slope Crude Spot Prices from January 2004 until September 2014. The red line indicates $110 bbl in Figure 5.26 below.

Figure 5.26 ~ Alaska North Slope Spot Price



Source: *Draft Second Supplemental Environmental Impact Statement,* Chukchi Sea, Lease Sale 193, BOEM, October 2014

BOEM analyzed several different sequential drilling scenarios between fifteen prospects in Lease Sale 193 (Chukchi Sea and areas of Shell's most recent exploration plans). The fifteen prospects were separated into one of two categories, termed anchor and satellite (non-anchor) fields, based on their geologic and economic potential. An anchor is judged capable of being developed under a given price per bbl assumption, regardless of whether any of the other prospects is drilled successfully. Therefore an

anchor, unlike a satellite field, is capable of supporting offshore infrastructure that may or may not currently exist. A satellite is judged not to be economically profitable under the given price assumption, but may become profitable if an anchor is successfully drilled and its infrastructure shared by the satellite.

Six drilling scenarios were evaluated through a Monte Carlo simulation. Two of the fifteen prospects were judged by BOEM to be potential anchor fields and the remaining thirteen prospects were categorized as potential satellite fields. In Case #6, the most reasonable progression for the Chukchi Sea OCS, if one or both anchors are drilled successfully, all geologically dependent satellites are drilled at a revised chance of success. As shown below in Table 5.8 the potential oil reserves in the Sale 193 scenario is 4.3 billion bbls. This represents a substantial reserve base; by comparison the largest known oil field in the entire Gulf of Mexico lease areas, (Mars-Ursa, has estimated reserves of 1.3 billion bbls).

Table 5.8 ~ Resource Assessment for Sale 193 Leases

Hypothetical Oil Pool	Recoverable Oil (Billions of Barrels)	Recoverable Solution Gas (Trillions of Cubic Feet)
Anchor A	2.9	1.224
Satellite A-2	1.4	1.113
Aggregate	4.3	2.337

Source: *Draft Second Supplemental Environmental Impact Statement,* Chukchi Sea, Lease Sale 193, BOEM, October 2014.

The same analysis depicted in Table 5.9, also utilizing the Anchor – Satellite concept identified another 1.9 billion bbls of oil recoverable under *future* Chukchi Sea OCS lease sales for a total potential in the OCS Chukchi Sea lease areas of 6.2 billion bbls.

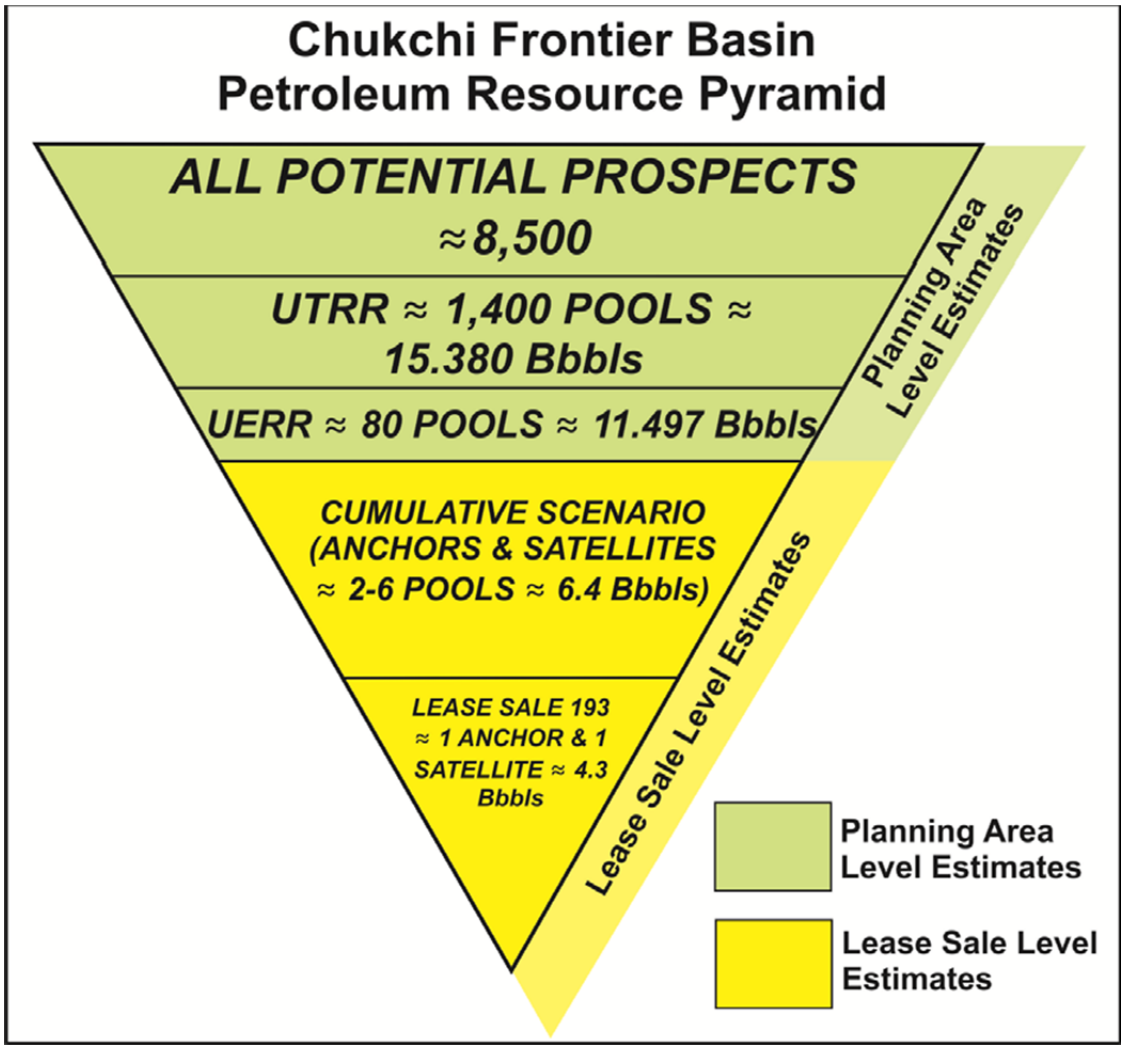
Table 5.9 ~ Resource Assessment for Future Chukchi Sea OCS Lease Sales

Hypothetical Oil Pool	Recoverable Oil (Billions of Barrels)	Recoverable Solution Gas (Trillions of Cubic Feet)
Satellite A-1	1.5	1.858
Satellite A-3	0.4	0.178
Aggregate	1.9	2.036

Source: *Draft Second Supplemental Environmental Impact Statement,* Chukchi Sea, Lease Sale 193, BOEM, October 2014

The graphic below, Figure 5.27, characterizes actual production estimates as opposed to geological potential, specific to the Chukchi Sea OCS.

Figure 5.27 ~ Chukchi Frontier Basin Petroleum Reserve Pyramid



Source: ***Draft Second Supplemental Environmental Impact Statement,*** **Chukchi Sea, Lease Sale 193, BOEM, October 2014**

5.8.4 Characterization of the Production Phase: In the event that an anchor field is discovered in a frontier prospect, development and production would proceed incrementally. Many lease sales and many years are typically required for significant production. For perspective, the first field in the Gulf of Mexico (GOM) OCS was

discovered in 1947. Since then, approximately 87% of the discovered oil and gas has been produced. This required an additional 67 years and 109 lease sales; and this GOM production benefitted by nearby infrastructure lacking in the Chukchi Sea.

A closer analogue is the Prudhoe Bay field. This extremely large discovery functioned as an anchor field, justifying the construction of the considerable infrastructure including the 800 mile Trans-Alaska Pipeline System (TAPS). The Prudhoe Bay field was discovered in 1968 after 10 years of exploration. Nine more years passed before the first oil was delivered through TAPS. As a frontier area, the Chukchi Sea OCS would likely require similar timeframes and a multitude of lease sales to achieve a similar level of development and production.

Using data from the existing leased prospects, BOEM built a projection or estimate of what development of the Chukchi Sea OCS could look like with some detail in the *Draft Second Supplemental Impact Statement*. Estimating the anchor field could contain 2.9 billion bbls of recoverable oil, and the satellite field could contain 1.4 billion bbls, development of these fields would entail the drilling of 465 oil producing wells, 93 service wells, and the *installation of 8 platforms*. The modeled anchor field and even the satellite field are larger than any field in the Gulf of Mexico OCS. The size of this Scenario represents an extreme “high case” of oil and gas activities. The discussion below explains how this Scenario would unfold over the course of several decades.

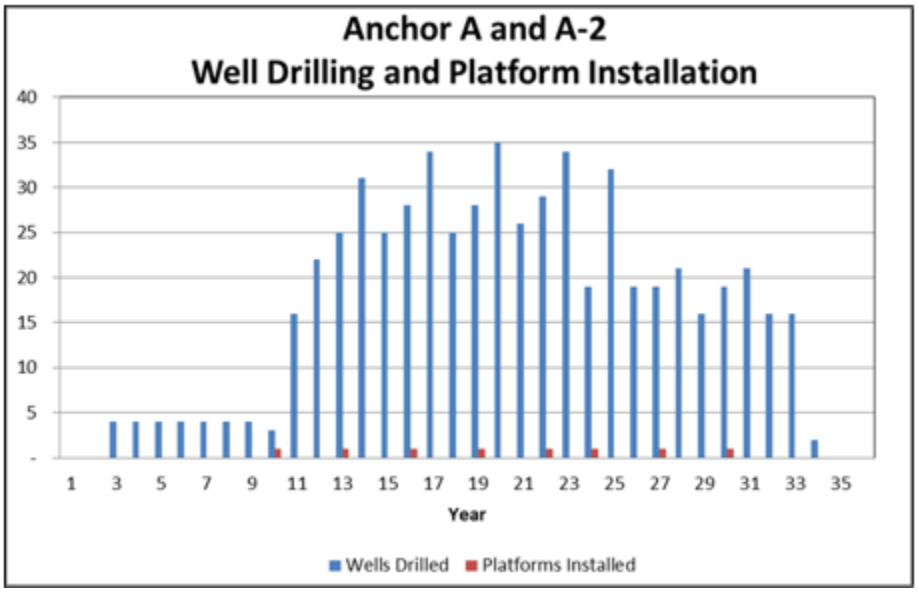
Exploration drilling operations are likely to employ Mobile Offshore Drilling Units (MODUs) with icebreaker support vessels (as Shell has proposed in their 2014 revised plan). Examples of MODUs include drill ships, semisubmersibles, and jack-up rigs. Drilling operations are expected to range between 30 and 90 days at different well sites. Drilling operations would be similar to Shell’s 2014 exploratory proposal. Operators would need to verify that sufficient volumes are present to justify the expense of installing a platform and pipelines. As many as 40 wells could be associated with exploring and delineating these prospects, including unsuccessful exploration wells on other prospects in the Chukchi Sea OCS.

Installation of subsea flow lines from *subsea templates* to the hub platform and from the hub platforms to shore would occur during summer open-water seasons. Pipeline installation operations would occur during the same timeframe as platform construction and installation. The offshore trunk pipelines (estimated total 160 miles cumulative length) would run between the central offshore hub platform and the shore. They would be trenched in the seafloor as a protective measure against damage by floating ice masses. At the coast, a new facility would be constructed to support the offshore operations and would serve as the first pump station. A likely location for the shore base would be between Icy Cape and Barrow.

Offshore construction (platform and pipeline installation) and development drilling operations would be supported by both helicopters and supply vessels from the new shore base. Support vessel traffic would be one to three trips per platform per week from Barrow, Wainwright, or the new shore base. Marine traffic would drop to about one trip every 1-2 weeks to each platform during the transition season. Marine traffic would occur during the open-water season and possibly during periods of broken ice with ice-reinforced vessels.

Assuming that barges would be used to transport drill cuttings and spent mud from subsea wells to an onshore disposal facility, BOEM estimates one barge trip per subsea template (15 templates). This means that there could be two barge trips (during summer) to the new onshore facility each year for a period of twelve years. Figure 5.28 illustrates what a time phase, moving from exploration to development, might look like including platform installation.

Figure 5.28 ~ Drilling and Platform Installation



Development Scenario Schedule of Well Drilling and Platform Installation.

Source: *Draft Second Supplemental Environmental Impact Statement,* Chukchi Sea, Lease Sale 193, BOEM, October 2014

Below characterizes the specifics of this BOEM production estimate:

- **Development:**

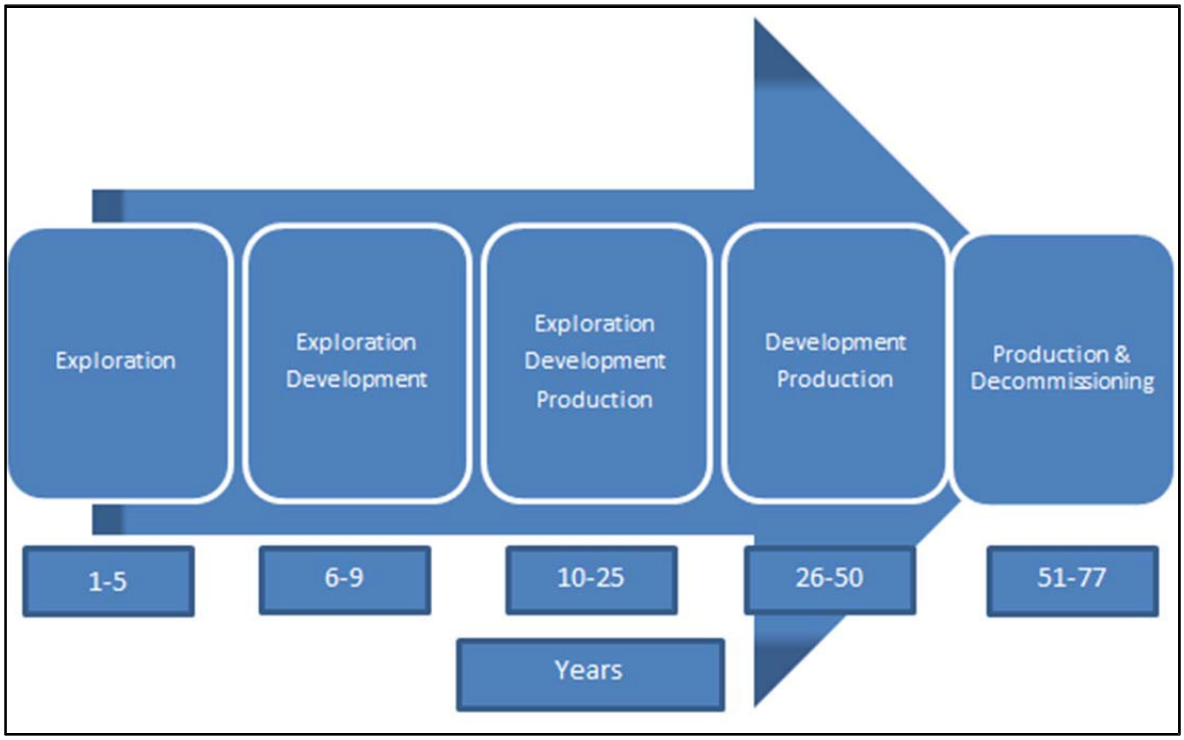
  Development includes those activities conducted to create the infrastructure necessary for production. More specifically, these activities include:

  - Installation of offshore platforms (8 over 26 years)
  - Production well drilling (400-457 wells over 25 years)
  - Service well drilling (80-92 wells over 25 years)
  - Installation of offshore oil pipelines (190-210 miles over 25 years)
  - Installation of an onshore oil pipeline (300-320 miles over 4 years)
  - Installation of offshore gas pipelines (190-210 miles over 25 years)
  - Installation of onshore gas pipeline (300-320 miles over 4 years)
  - Construction of a shore base (1)
  - Construction of a processing facility (1)
  - Construction of a waste facility (1)
  - Associated vessel and aircraft traffic

- **Production:**
  Production includes those activities conducted to extract oil and gas resources from the ground and transport them to market and are depicted in Figure 5.29 below. Also included in Production are decommissioning activities. More specifically, these activities include:

  - Oil production (4.3 Bbbl over 44 years)
  - Gas production (2.2 Tcf over 44 years)
  - Vessel traffic (8-16 trips per week – shore base to platform and back)
  - Aircraft traffic (56-168 flights per week - Barrow/Wainwright to platform and back)
  - Decommissioning (platforms/pipelines over 24 years)

Figure 5.29 ~ Oil and Gas through Time



Oil and Gas Activities through Time. *Figure illustrates the flow of types of oil and gas activities that would occur through time as the scenario unfolds.*

Source: ***Draft Second Supplemental Environmental Impact Statement,*** **Chukchi Sea, Lease Sale 193, BOEM, October 2014**

5.9 Impact of Oil and Gas on Shipping in the OCS

The Port Clarence 2014 Deepwater Port Study analyzed the shipping traffic patterns and concluded that the hydrocarbon industry was likely the only new driver of significant shipping changes well into the future that requires significant new investment in maritime infrastructure in NW Alaska. Table 5.10 below from that study highlights the impacts of Bering Straits traffic during Shell's 2012 operations:

Table 5.10 ~ Bering Strait Vessel Traffic Count, by Type and Year, 2009–2013

Vessel Type	2009	2010	2011	2012	2013
AHTS				20*	
AHTS/Icebreaker		2		8*	
ATB Tank Barge		1	2	4*	
Bulk Carrier	42	34	43	53	13
Cargo	1	2			83
Cargo/Training					3
Container			1	1	
Crude Oil Tanker		2	1		
Dredging					3
Drill Ship				2	
Fish/Research		4			2
Fishing	3	2	3	15	27
General Cargo	2	9	18	25	3
Icebreaker	9	12	11	23	22
Landing Craft	22	20	32	13	10
LNG Carrier				1	
Military					5
N/A					1
Other					6
Passenger	16	8	12	2	17
Pleasure					3
Product Tanker		1	5		
Reefer			1	1	
Research	22	33	13	29*	9
RORO	1	2	1	4	1
Sailing					2
Tanker	4	2	1	17	37
Towing	116	84	76	85*	51
Tug					50
USCG Cutter		2		9*	
Yacht	1	2	2	2	1
Total	**239**	**222**	**222**	**314**	**349**

Note: AHTS is Anchor Handling Tug Supply, ATB is Articulated Tug Barge, and RORO is Roll On, Roll Off. Source: Northern Economics, adapted from Marine Exchange of Alaska report provided to Crowley Marine, 2013 This studies author's added red font and asterisk to accentuate numbers highly likely influenced directly by Shell's operations, or indirectly, such as USCG and research ships monitoring the drilling activity.

Source: *Feasibility Port Clarence Support Base*, Bering Straits Native Corporation (Northern Economics) June 2014

Traffic in 2012 indicates a surge of transits to support the exploratory drilling program, Shell's exploratory drilling in both the Chukchi and Beaufort's Seas, especially in support vessels needed for anchor tending, supply and tugs used for towing. There were major increases in bulk carriers, general cargo vessels and both USCG and research traffic. Overall, 2012 total traffic of 314 vessel trips is an increase over the 2011's total of 222.

Earlier discussion using the case study of Shell's 2012 exploratory drilling operations and its revised 2014 plan provides a detailed case study of the exploratory drilling phase in the Alaska OCS region. However, preceding the exploratory drilling phase and eventual production, a measured amount of shipping is also driven by the requirements of exploratory seismic surveying. This effort is ongoing in the Alaska OCS lease areas as it is in the Russian and Canadian offshore areas. Seismic vessels usually tow up to three source arrays. Vessels conducting seismic surveys generally are 230-295 feet long. Typical seismic surveys cover one proposed drilling location at a time.

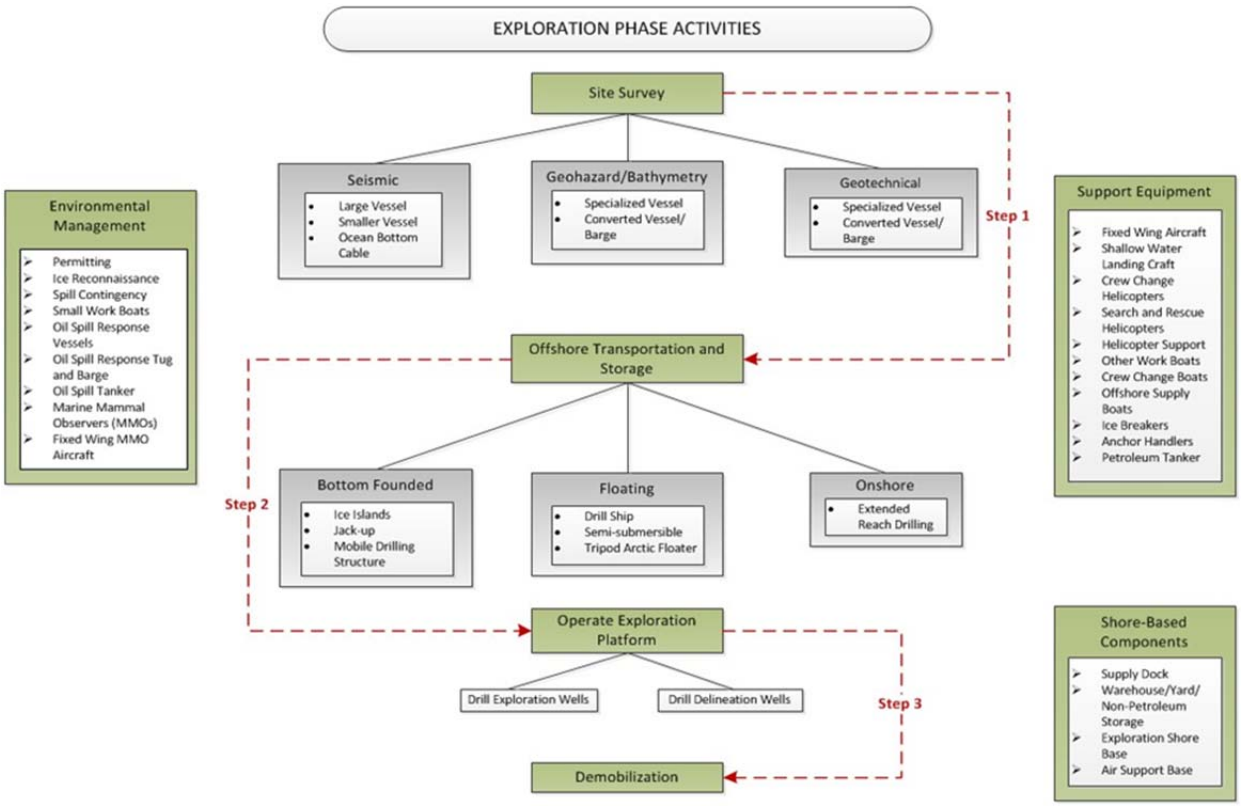
5.10 Shipping Patterns Transitioning from Exploration to Production

There are differing models for actual production vessel support based on differing forms of extraction. A key factor for the Alaska OCS will be, somewhat obviously, whether oil is indeed piped to a shore infrastructure tied in to TAPS (the preferred model in industry planning) or if extraction must rely on tankers transits. BOEM analysis suggests that a pipeline export system is the most likely scenario for transportation of oil and eventually natural gas in the OCS areas off Alaska's North Slope. There is no precedent for direct tankering of oil from locations with the ice conditions which characterize the Chukchi Sea. Ice-hardened oil tankers are used or proposed to transport oil on a year-round basis in the Barents Sea and the Southern Kara Sea, respectively, but these areas are more protected from multi-year ice floes, have much less multi-year ice overall and therefore do not experience the same level of ice hazard. For tankering to even be attempted, ice-hardened tankers either built in the U.S. (Jones Act) or non-compliance penalties paid, would still have to contend with the logistics of navigating the Bering and Chukchi seas. Loading oil onto tankers at an offshore loading facility in the Chukchi Sea in winter ice conditions would likely require the continuous presence of very large,

heavy-duty ice breakers. It is further assumed that, at minimum, 5 to 10 years of continuous reduced ice, in a particular area, would be required before companies would seriously consider tankering systems for transporting oil from the Chukchi Sea. Those conditions have not been in place for even one year since the lease sale. It therefore seems *highly unlikely* that a company would choose direct tankering over a pipeline.

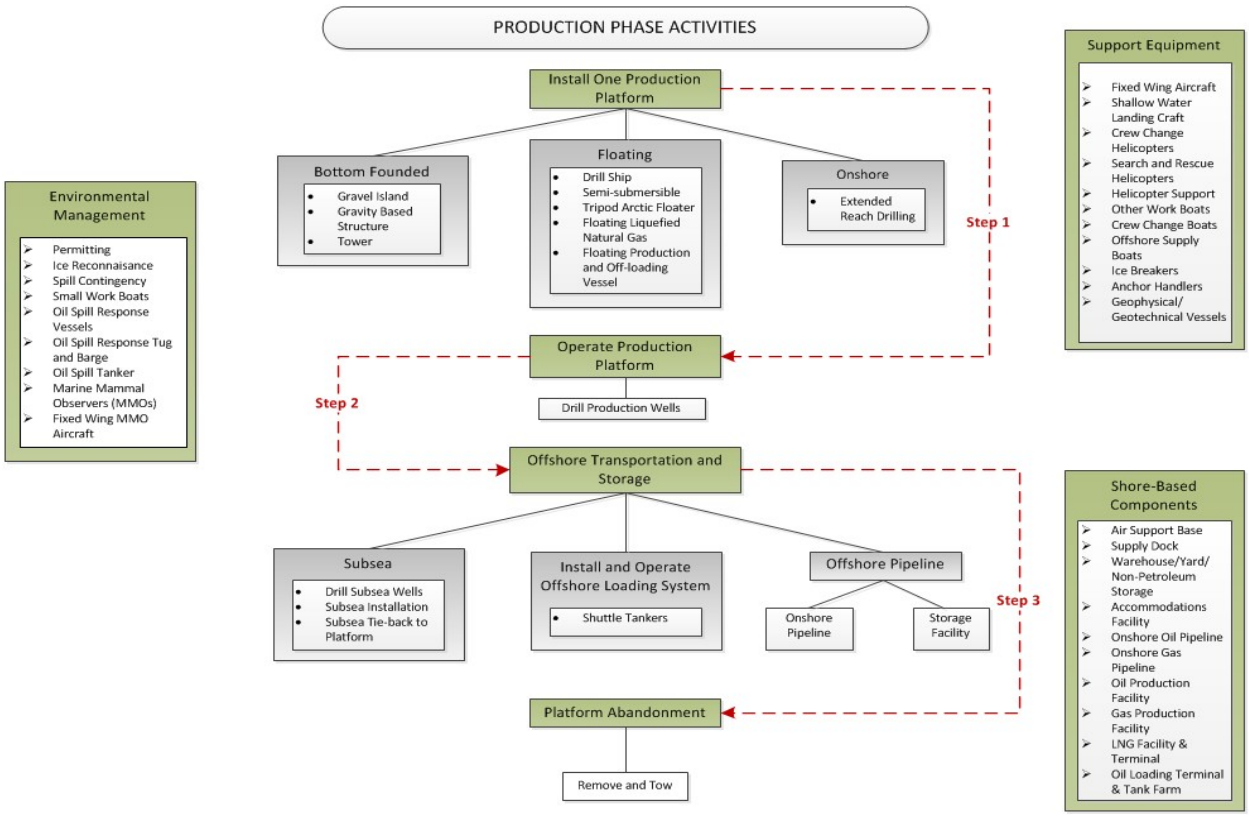
Submersed infrastructure, of which Statoil has been a leading developer, would also require specialized support vessels. BOEM's *2012 MAG-PLAN Alaska Update* to some degree explores the differing shipping specifics required in the production phase (extensive detail on actual ship platforms---but less so on traffic volume). Pipe laying vessels would have a significant presence in preparing an offshore pipeline feeder and maintaining such an infrastructure once in operation (not required in exploration). The following graphics in Figures 5.30 and 5.31) attempts to capture and differentiate the exploration from the production phase.

Figure 5.30 ~ Exploration Phase Activities



Source: *Economic Analysis of Future Offshore Oil and Gas,* Shell (Northern Economics) March 2009

Figure 5.31 ~ Production Phase Activity



Source: *Economic Analysis of Future Offshore Oil and Gas,* Shell (Northern Economics) March 2009

5.11 Findings

Projection for next 10 years (2025)

- It is highly probable that oil and gas production, especially in the U.S. Outer Continental Shelf (OCS) lease areas in the Chukchi Sea, will be the most significant driver for increased shipping along the NW Alaskan littoral in the next 10 years. It is also likely that the hydrocarbon industry will remain the biggest driver in shipping in Alaskan Arctic water for the next 30 years, though the less defined, impact of currently undeveloped mining enterprises could also have a significant impact, such as the development of the Ambler region without a land extraction corridor.

- The Chukchi Sea OCS region has an estimated potential of total oil reserves of 15 billion bbls, about *double* the potential for the Beaufort Sea OCS, and is currently the only lease area in the Alaska OCS with an exploration plan submitted for approval. By comparison, the total production from Prudhoe Bay in the last 35 years has been roughly 17 billion bbls.

- For about the next half dozen years offshore hydrocarbon (especially traditional crude oil) in the OCS will remain in an exploratory drilling phase, if it proceeds at all under the current regulatory regime, and is well characterized by Shell's latest proposed exploratory drilling plan (Aug 2014). That plan envisions a support armada of about 25 supporting ships for two drilling vessels and double the vessel transits out to the drill ships during operations (this does not directly equate to Bering Sea transits as these vessels will be moored in designated areas, for example in Kotzebue Sound).

- This compares well historically when compared with Shell's 2012 drilling season. This slightly larger support shipping plan should drive transits and hydrocarbon activity though the Bering Strait for a six year exploratory drilling phase at a consistent rate (if approved by federal regulators as well as Shell corporate leadership commencing in 2015).

- It is possible that high success by Shell in this phase could induce accelerated exploratory activity by other major lease holders in the Chukchi OCS such as Statoil and BP who currently have no formal plans submitted. The sharing of infrastructure costs would be an expected industry practice with much precedent both regionally and globally.

- Production success in the Chukchi Sea could also renew interest in the offshore Beaufort Sea OCS lease areas. The supporting infrastructure for Chukchi extraction does not provide proximity value to the Beaufort areas, though the existent Prudhoe Bay infrastructure is much better placed to integrate Beaufort Sea as opposed to Chukchi Sea production.

- The immediate decline in crude oil prices below $70 a barrel, while lower than much modeling at $110 a barrel and below the threshold for high capital/high technology oil Arctic pioneering efforts in general, it is not likely to curtail current proposed operations in the Chukchi (market driven elastic sensitivity not a show stopper at that level---would be significant if even more dramatic and sustained such as the 1980s market driven crash). The hydrocarbon exploratory cessation of operations in the Arctic in the early 1980s was largely the result of the supply driven dramatic drop in oil prices which were sustained for over two decades. Thus market change was much more dramatic than anything currently in the news cycle, governmental or industry forecasts. However, there is most probably a limit or bottom, difficult to define, that could induce delays or suspension of corporate plans---though the strategic imperative of obtaining and "booking" reserves in the offshore Arctic, is not a foreseeable event this next half century.

- Activity directly related to the oil and gas exploration and production in the Russian Chukchi Sea would likely have minimum impact on shipping patterns in the U.S. maritime Arctic though it might drive a modest amount of Bearing Straits traffic in the exploratory phase (within Russian waters). Exploratory planning for the Russian offshore Chukchi areas is less advanced but likely also faces a less severe regulatory regime. Needed international investment and extraction technology are currently impacted by the current international sanction regime against cooperation with the Russian oil industry. Depending on the duration of those sanctions, this could negate this suggested regulatory advantage (specifically imposed on ExxonMobil's joint partnership with Rosneft, the major owner of the Russian lease areas).

- Increases in Northern Sea Route (NSR) specific transits of crude oil tankers and LNG from Arctic offshore and potentially onshore areas (including Western Siberia) en route Asian markets have a plausible probability of increasing significantly over the next 10, and certainly 30 years, but will not likely impact Alaskan infrastructure in a routine commercial manner. Environmental risk however associated with NSR transits, especially oil spill and other emergency

response and planning, would drive and tax U.S. resources on the U.S. side of the international boundary line.

- Canadian driven exploratory oil and gas drilling and its support shipping would not appear an immediate or significant shipping factor for the U.S. maritime Arctic within the next 10 years.

- Moving to the production phase in the OCS Chukchi Sea areas would likely entail construction of platforms to shore serviced by pipelines which would require pipe laying ship transits during seasonal operations and increase Bering Sea transits and seasonal operations in the OCS.

- Exploration and drilling ashore in the Arctic Petroleum Reserve would likely have modest impact on shipping as plans include overland access to position much equipment (seasonal ice roads) for pipeline construction. Unlike the Trans Alaskan Oil Pipeline System (TAPS) in the early 1970s, an overland corridor now exists for much of the logistical requirements (Dalton Highway).

- The timeline from exploration to final production is estimated to be about 75 years for the Chukchi Sea OCS lease area. The concept modeled by BOEM in October 2014 to estimate long term production impacts assumed a profitable “Anchor” discovery would have a multiplier effect as it would allow for production in less profitable “Satellite” discoveries that could be connected by undersea pipelines to the Anchor platforms.

- Gas production modeling indicates that after year 31, or about 20 years after crude oil begins production, natural gas could begin as well. Therefore there is a potential production life cycle for hydrocarbon extraction in the Alaskan OCS, essentially out to the next millennium.

- In transition from the exploratory drilling phase to the production phase, there is a large spike in offshore activity ramping up to platform installation and support. This “Anchor – Satellite” concept modeled by BOEM would predict a heavy spike

in drilling at transition from exploration to production, which would last about 10 years, in which drilling activity would increase from five to roughly over thirty wells per year. After this heavy 10 year activity, it would drop off and then there would be another eight years of drilling at around 20 a year, to a final drop off during a long, but concluding production lifespan, which could last, 30 to 40 years. Shipping support would thus spike during the platform construction phase.

An approximation/predication would be, assuming about eight platforms in production operations in the Chukchi Sea OCS in 2025, and their 15 subsea interconnected templates, as a benchmark, with a comparison of the support fleet requirements proposed by Shell's 2014 plan, about 100 support vessels could be in operation in the lease areas (12 per drilling rig needed in Shell's exploration plan). This could directly relate to an increase of up to 100 Bering Sea seasonal transports. Another possibility could be the sustained harboring of these vessels in a port north of the Straits as well. During the peak of operations the required support fleet could grow to perhaps 150 in order to construct the platforms, lay the pipelines on the sea bed, etc.. These numbers do not allow for tanker extraction of production, but rely on a shore infrastructure pipeline concept.

6.0 U.S. Maritime Arctic Infrastructure Issues

The U.S. maritime Arctic requires a broad array of new marine infrastructure to support several long-term economic opportunities and to address significant, immediate environmental security challenges. The seven listed are only select and key requirements that are generally understood in a region almost devoid of modern and effective infrastructure:

6.1 Hydrography and Charting

Having modern marine charts is fundamental to providing for a safe navigating environment and for facilitating coastal development of ports and navigable waterways. This is a key, specific requirement that is recognized in the National Strategy for the Arctic Region (NSAR, 2013) and reiterated in the Implementation Plan for that strategy (IPNSAR, 2014). Mapping the entire U.S. maritime Arctic to attain international navigation standards in this large region will require significant, long-term funding for NOAA. NOAA's Office of Coast Survey has recognized the changing needs for modern charts of the U.S. maritime Arctic and has published an updated *Arctic Nautical Charting Plan* (2013). The first such strategic plan was issued in 2011. Important to charting are the requirements for establishing a geospatial framework or reference system since many areas of Alaska lack such a basic foundation. Shoreline surveys and sea level data are also critical components to NOAA's navigation products as well as Alaska regional tidal data and current predictions. Each of these components will require timely investment. The Office of Coast Survey has been using the AIS marine data from the Marine Exchange of Alaska to determine marine routing and operational patterns in the region. High density routes indicate increasing usage and can be used as one indicator of the need for updated nautical charts. New large and medium scale charts are planned for key coastal communities and the Bering Strait region. More effective use of other federal available platforms (such as U.S. Coast Guard cutters) is beginning to be realized, and additional commercial surveyors could be utilized to attain faster progress mapping this large expanse of Alaskan Arctic seabed. However, the bottom line is that NOAA's budget for geodetic referencing in Alaska, shoreline surveys, and hydrographic surveys must be increased for the long-term so that an adequate

safety net can be established in America's Arctic coastal regions. Recent Congressional budgets have begun to recognize this need and have responded to this specific requirement outlined in the National Strategy for the Arctic Region.

6.2 Arctic Observing Networks

Investment in the international Sustaining Arctic Observing Networks (SAON) by the Arctic states and non-Arctic states should be considered an investment in enhancing Arctic marine safety and environmental protection. SAON would be an important advance in enhancing safety and environmental response especially in the Bering Strait region and across the U.S. maritime Arctic. All of the scientific and marine operational agencies (both Arctic and non-Arctic states) should adequately fund a robust observing system while also improving the accessibility of environmental information by a host of stakeholders and actors. A multi-national, coordinated network designed for monitoring regional climate change *and* local environmental conditions will have synergies and direct value to a myriad of operational requirements for increased marine traffic. Such coordination will also provide improved capability for protection of Arctic coastal communities. Providing advanced and timely environmental information to Arctic marine users and stakeholders is a crucial requirement for the U.S. maritime Arctic. Fortunately the U.S. has developed the Alaska Ocean Observing System (AOOS), a component of the U.S. Integrated Ocean Observing System (IOOS) established by the IOOS Act of 2009. IOOS is a national-regional partnership that operates with contributions from federal and regional assets. AOOS has four areas of focus including: safe marine operations; coastal hazard mitigation; tracking ecosystem and climate trends; and, monitoring water quality. AOOS efforts have recently included development of a *Historical Sea Ice Atlas for Alaska Waters*, improving access to existing marine coastal data, and improving the observing and forecasting capability in the Bering, Chukchi and Beaufort seas. Long-term and enhanced funding for NOAA to improve the IOOS is critical to the future of the Nation's coastal waterways, and crucial to maintaining adequate observations in the remote and sparsely monitored northwest Alaska coast and regional seas.

6.3 Marine Domain Awareness

Strengthening the systems for the monitoring and surveillance of ships, pollution and emergency situations in the Arctic is of paramount concern for the Department of Homeland Security, the U.S. Coast Guard and a host of federal and State of Alaska agencies. To be effective, Marine Doman Awareness (MDA) requires the integration of information from many data categories: vessels; cargo; maritime personnel and organizations; infrastructure, and the environment, as noted in the *National Maritime Domain Awareness Plan* of 2013. Two of the key challenges to enhanced MDA are its complexity and the expanse of the marine environment. The remoteness and harsh operating environment of the maritime Arctic certainly add considerably to the MDA requirements for monitoring and surveillance. As noted previously, the Marine Exchange of Alaska provides key ship traffic information to the maritime industry, the Coast Guard and the State of Alaska; it is a critical component to an effective MDA capability in the U.S. maritime Arctic (and beyond). Crucial to the effective operation of the Marine Exchange of Alaska is stable, long-term funding levels from the Coast Guard and the State of Alaska (who are public users and stakeholders). Investment is required for improved communication networks (a critical need), effective maritime tracking technologies, improved information processing tools, enhanced AIS-satellite monitoring in northern latitudes, and additional AIS land-based receiving sites. A new agreement should be pursued among the Arctic states related to the sharing of Arctic maritime data. The Arctic Marine Shipping Assessment recommended that a ‘comprehensive marine traffic awareness system’ be developed and such a system requires an integrated approach to maritime awareness in a ‘circumpolar domain.’ The Arctic states should negotiate an agreement to share Arctic marine traffic information among its maritime agencies in a real-time manner. Traffic data passed seamlessly among the Arctic states could reduce the risks of potential incidents, provide timely awareness of potential marine use conflicts (for example between commercial ships and indigenous coastal communities in Bering Strait), and facilitate response to maritime accidents.

6.4 Alaskan Arctic Deepwater Port

A recent joint federal-state study conducted by the U.S. Army Corps of Engineers and the Alaska State Department of Transportation and Public Facilities, the *Alaska Deep-Draft Arctic Port System Study*, underscored the long-term need for a U.S. Arctic port that would be linked to natural resource export in a new era of demand for Arctic resources by global markets. Future scenarios out 50 years were created with two key driving forces emerging and defined as Arctic resource development and collaborative investment (a combination of public and private financing). Natural resource development as a fundamental driver is consistent with the State of Alaska's long-term strategy of increased development of Arctic oil and gas and northern minerals. Table 6.1 lists the recommendations from this joint federal-state assessment. Included are calls for: public-private partnerships to finance the construction of an Arctic port and associated infrastructure; increased funding to NOAA for hydrographic and bathymetric surveys; and, needs for navigational tools to support Arctic infrastructure developments. Such a port would also support a range of federal agencies, especially the Coast Guard, and strategically place emergency response capacities within the U.S. maritime Arctic. Public-private partnerships must be explored and private industry must be encouraged to collaborate with a range of state and federal agencies. Feasibilities studies of appropriate port sites in Nome and Port Clarence are ongoing.

A report to Congress by the Coast Guard in early 2014, *Feasibility of Establishing an Arctic deep-draft Seaport*, noted that a U.S. Arctic port would support national security interests (as a forward staging area), offshore resource development, and economic security interests as a logistics and support link for natural resource developments. Noted in the Coast Guard report was the key relationship of intermodal transportation capability associated with any future Arctic port. Both studies point directly to the linkage of an Arctic port to natural resource development in the region as a primary justification. Without this economic connection to development of Alaska's natural resource wealth (both offshore and onshore), it is difficult to conceive that an Arctic port would ever be constructed.

Table 6.1 ~ Recommendations from the Alaska Deep-Draft Arctic Port System Study

- Invest strategically to enhance the Arctic Ports System. Include deep-draft solutions for resource export and support, as well as improvements appropriate for USCG, environmental protection, SAR, and community resupply.
- Assign lead Federal agency responsibility to the U.S. Army Corps of Engineers for permitting, design, and constructing of the Alaska Deep-Draft Arctic Port system.
- Encourage private entities/banks and authorize other public agencies to collaborate in funding and constructing marine infrastructure. Use the strengths of each sector to achieve success through Public/Private Partnerships (P3).
- Increase funding to NOAA and other agencies to provide hydrographic and bathymetric mapping and needed data to support marine and infrastructure development.
- Explore and develop navigational aids, such as ship routing, vessel tracking, traffic separation, and identification of areas of concern.
- Conduct feasibility analysis of shortlisted sites (Nome and Port Clarence) using physical criteria and alignment with potential investors; P3 development; and port management authority. These two highest ranked sites will be the focus of the feasibility work for 2013-14.

6.5 Search & Rescue and Environmental Response Capacity

Locating adequate Coast Guard search & rescue (SAR) and environmental response units closer to the U.S. maritime Arctic is a logistical and funding challenge. The vast size and remoteness of the northern coast of Alaska puts a premium on the use of mobile ship assets rather than shore facilities. The maintenance of a physical presence of the Coast Guard within the U.S. maritime Arctic will become a more urgent requirement when offshore oil and gas exploration increases. Integrating the Coast Guard's polar icebreaker *Healy*, with its high on scene endurance capability, into multi-mission operations and maritime patrols may be one plausible strategy. The use of seasonal deployments to coastal communities of Coast Guard helicopter and small boat assets will likely be another strategy that has been successfully employed in summer 2012 during Shell's initial offshore exploration. *In the U.S. Coast Guard Arctic Strategy*

released in May 2013, the Service suggests that it will ‘maintain a scalable presence commensurate with risks posed by increasing activity.’ Long-term planning for strategically-positioned shore facilities, perhaps co-located at a future Arctic port, is necessary to review the range of plausible futures of Arctic marine activity. In the near-term decade deployable shore assets to the North Slope and the Nome-Bering Strait region are obvious (seasonal) strategies to enhance physical presence in the U.S. maritime Arctic.

In the international arena the Coast Guard and other agencies need to continue implementing the provisions of two recent Arctic treaties, noted again as the *Agreement on Cooperation on Aeronautical and Maritime Search and Rescue in the Arctic* (2011) and the *Agreement on Cooperation on Marine Oil Spill Preparedness and Response in the Arctic* (2013). The Coast Guard and other U.S. Federal agencies have significant responsibilities in making certain the U.S. upholds the terms of the treaties especially with the U.S. maritime Arctic.

6.6 Polar and Coastal Icebreaking Capacity

The replacement of America’s polar icebreakers (the two Polar Class ships, *Polar Star* and *Polar Sea*) has been a long standing issue. However, this requirement for federal polar icebreaking capacity in large, high powered ships, masks a plausible need for shallower-draft, but ice capable (smaller) Coast Guard cutters for operations in the coastal areas of northwest Alaska and the Beaufort Sea. The United States has national interests in the Arctic and Antarctic and Coast Guard polar icebreakers (past and current) provide visible and effective strategic maritime presence in these remote regions. Within the territorial sea and exclusive economic zone around Alaska, the Coast Guard’s polar icebreakers provide a credible, sovereign presence and a platform for law enforcement, SAR, emergency response, scientific research, and any special maritime operation required in ice-covered waters.

The role of future commercial ship escort by icebreaker in U.S. waters requires examination in light of advances in Arctic marine technology and new operational strategies. Most of today’s Arctic commercial carriers (bulk carries, tankers and LNG

carriers) are designed as icebreaking ships capable of independent operations (without icebreaker escort). Most of the Arctic commercial carriers operating in the Canadian and Russian Arctic regions do not require icebreaker escort during a 3-4 month navigation season. The availability of capable commercial icebreakers must also be taken into account when determining the requirements for a federal icebreaking capacity. One such highly capable commercial icebreaker is the M/V *Aiviq* owned and operated by Edison Chouest Offshore, and chartered to Shell for offshore support operations in its leased areas in the Chukchi and Beaufort seas. The use of privately-owned icebreakers in the U.S. maritime Arctic in support of offshore exploration and potentially the escort of commercial shipping to a U.S. Arctic port is a compelling opportunity for the U.S. maritime industry. The future of U.S. icebreaking operations will likely require a mix of federal ships operated by the Coast Guard (principally for U.S. sovereign presence, law enforcement, emergency response and research) and commercial icebreakers in support of economic development of Alaska's Arctic (offshore hydrocarbon exploration and escort of commercial carriers).

6.7 Arctic Transportation Corridors

Andrew Metzger, a civil engineering professor at the University of Alaska Anchorage, has advocated that comprehensive transportation systems, or corridors, are needed in the U.S. Arctic, particularly along Alaska's west coast and North Slope. He has noted that marine facilities do exist in these remote regions, but they are intended to support only shallow-draft barges. The systems or corridors would be a mix of all modes of transportation: roads, rail, marine, air, pipelines, and energy. Three corridors have been proposed: (1) a Northern Shipping Corridor (services to include: traffic monitoring, SAR, spill response, and salvage); (2) a North Slope Corridor, a multi-modal transportation system focuses on oil and gas production traffic monitoring, (services to include: traffic monitoring, SAR, spill response, salvage, and port services); and, (3) a Western Arctic Corridor, a multi-modal transportation system with offshore hydrocarbon operations and onshore mining (services to include: traffic monitoring, SAR, spill response, salvage, port services, a lightering terminal for seasonal operations, and connecting infrastructure such as pipelines, rail and energy distribution). This system would require

a year-round port facility (Alaskan Arctic deep-water port), suggested as being south of Bering Strait. The concept for three options is that the system will provide a range of services and levels of service to a diverse customer base. Viewing infrastructure in a holistic and unified approach such as this is critical to proper investment and sound strategic planning to mitigate risk and uncertainty with large infrastructure projects.

6.8 Conclusions

Early in the 21st century the United States is challenged to respond to a host of changes and uncertainties in its maritime Arctic where there is lack of even basic infrastructure. Economic opportunities abound to develop the region as visibly evidenced by federal leases of offshore areas for hydrocarbon exploration. Future opportunities exist that require development of a 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, a world class Bering Sea fishery, and the Arctic marine environment in an era of expanding Arctic marine use.

The range of needed policy responses and required, long-term investments confronting the U.S. maritime Arctic are significant, perhaps daunting. The United States should continue to be proactive at the International Maritime Organization in support of a mandatory Polar Code that must include all ships operating in polar waters. And, the United States should propose future IMO measures that focus on specific Arctic regulations. Timely application of a new IMO Polar Code to the U.S. maritime Arctic during 2015-17 will require expedited regulatory implementation by the Coast Guard. The United States, as one of the co-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 guide investments in much-needed infrastructure. 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 SAR and environmental response capacity are among the critical infrastructure needs for the future of Arctic Alaska. Public-private partnerships must be conceived and fostered to ensure 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.

7.0 Alaskan Arctic Maritime Workforce Potential

7.1 Introduction

This chapter discusses Alaska maritime employment opportunities in light of the potential increase in Arctic activity. With intent to sustain and enhance the economy of Alaska, this chapter summarizes and contrasts different perspectives regarding the current and future maritime workforce.

Key planning documents reviewed include:

- Alaska Maritime Workforce Development Plan (AMWFDP), Statewide agencies, University of Alaska and industry. May 2014
- Economic Analysis of Future Offshore Oil and Gas Development, Beaufort Sea, Chukchi Sea and North Aleutian Basin, UAA Institute of Social and Economic Research (SER) /Northern Economics. 2009
- MAG-PLAN Alaska Update, Bureau of Ocean Energy Management (BOEM), U.S. Department of Interior. 2012
- Feasibility Analysis: Port Clarence Support Base, Northern Economics for Bering Straits Native Corporation and Crowley. June 2014
- Maritime Infrastructure, Key Issues Related to Commercial Activity in the U.S. Arctic over the Next Decade, GAO Report to Congressional Requesters. March 2014
- Additional strategic planning reports for other Arctic nations were also reviewed for policy statements about Arctic maritime workforce.

This Alaska Maritime Documents Matrix contrasts key variables of the reports.

Table 7.1 ~ Alaska Maritime Documents Matrix

Report	Feasibility Analysis, Port Clarence Support Base	Alaska Maritime Workforce Development Plan	Maritime Infrastructure	MAG Plan – Alaska Update	Economic Analysis of Future Offshore Oil & Gas Development
Agency	Northern Economics for BSNC and Crowley	Statewide team: Fisheries, UA, industry	US Department of Interior, GAO	US DOI, BOEM	ISER, Northern Economics for Shell
Date	June 2014	May 2014	March 2014	May 2012	March 2009
Projection Duration	10-20 years	Undefined	Next 10 years	5 years	2009-2057
Purpose of Study	Support regional development related to OCS, with a focus on funding infrastructure.	Develop plan to support a strong maritime workforce. Identify range of occupations in maritime sector. Number of workers cannot meet demand.	Assess commercial maritime activity. Identify potential maritime infrastructure for investment based on proposed industry and agency activities.	Update model for analysis of costs and economic effects of OCS development in Alaska planning areas. Prepare for lease auctions.	Quantify Alaska economic benefits of OCS development: jobs, revenues, fiscal effects
Geography	Port Clarence, Bering Straits	Statewide	Statewide, primarily coastal Alaska	Chukchi and Beaufort Seas, Cook Inlet, North Aleutian Basin	Chukchi and Beaufort
Primary sectors	Bering Strait regional infrastructure related to OCS	Traditional marine and seafood jobs, no OCS-related employment.	Federal maritime infrastructure and investment	Oil and Gas exploration and production	OCS in Beaufort and Chukchi
Workforce Training	Residents 'could' be trained. No specific plans.	Focus of this Plan is maritime workforce readiness and training.	Not addressed.	Not addressed.	Not addressed.
Recommendations/ Conclusions	Site supports OSR and SAR. But, OCS activity is prerequisite for investment of $35-70M in port infrastructure. No significant local hire unless Port Clarence becomes OCS support base.	Documents 23 types and numbers of workers needed, related career pathways for 70,000 jobs now. Calls for collaboration of industry, government and education. Suggests implementation actions for specific occupations. No workplan or lead.	Federal agencies are working on separate agendas: USACE, NOAA, USCG, etc. Committee on Marine Transportation in 2013 identified information infrastructure and response activities as top priorities.	Workforce to come primarily from SouthCentral (75%) and Lower 48 (20%), with limited jobs for NSB residents.	If OCS develops, then 35,000 jobs over the next 50 years. 5% increase in statewide population. Revenues are mainly property taxes.

7.2 Alaska's Current Maritime Workforce

The Alaska Maritime Workforce Development Plan (AMWFDP) was developed by a statewide team including state agencies and regional training centers; legislators; the University of Alaska; and industry representatives. The plan reviews workforce requirements for the existing traditional maritime industries. With industry surveys, a detailed inventory was compiled. There is no direct discussion of the potential for future oil and gas and offshore development. The Plan estimated that the maritime sector currently employs over 70,000 people, urban and rural. This population is aging, and employers often find it difficult to recruit Alaskans with the required skills. The existing 70,000 jobs represent employees from 500 firms statewide, and make Alaska third in the nation per capita maritime jobs. According to the UA/McDowell 2012 Gap Analysis, half of those workers are not Alaska residents. Employment estimates for the top maritime employers in Alaska are identified in the following chart.

Table 7.2 ~ Employment estimates for top maritime employers in Alaska

Commercial harvesters	10,000 permit holders, 21,800 crewmembers
Seafood processors	25,000 employees, 300 firms
Alaska Department of Fish & Game	1,700 employees
Alaska Marine Highway System	1,300 employees
US Coast Guard	2,000 members stationed in Alaska
Saltchuk, owner of Totem, Foss, and other marine transportation related businesses	1,200 employees in Alaska
Polar Tankers	260 employees
Fish hatcheries	250 employees
Vigor Industrial operating Alaska Ship and Drydock	200 employees
North Star Terminal and Stevedoring	500 employees
SeaRiver Maritime (operates tankers for Exxon Mobil)	100 employees
Three pilotage companies	120 employees
Dock workers	400 longshoremen
Other maritime employers, including Horizon Lines, American President Line, Crowley, Foss, Cook Inlet Tug & Barge, Brice Marine, and many small oil, gas, and transportation companies	500–1,000 employees, estimated

Source: AMWFDP

The AMWFDP approach focused on sustaining and enhancing the economy of Alaska and its communities by developing a responsive maritime sector workforce. The Plan differentiated the maritime sector into four primary areas: seafood harvesters; seafood processors; fisheries research, enhancement and management; and marine occupations and support industries. For each, they then ranked the top maritime occupations where the need and opportunity is greatest.

- **Seafood harvesters**
  - Commercial seafood harvester
  - Vessel maintenance and repair service provider
  - Shellfish farmer

- **Seafood processors**
  - Seafood processing engineer
  - Refrigeration engineer and technician
  - Seafood production manager

- Electrician
- Can machinist
- Quality control and assurance manager/technician
- Baader technician
- Seafood plant manager

- **Research, enhancement and management**
  - Biometrician
  - Fish and wildlife technician
  - Fishery biologist
  - Fisheries scientist
  - Fish and game coordinator
  - Fishery economist/analyst/management specialist
  - Fisher management specialist at NOAA
  - Hatchery manager

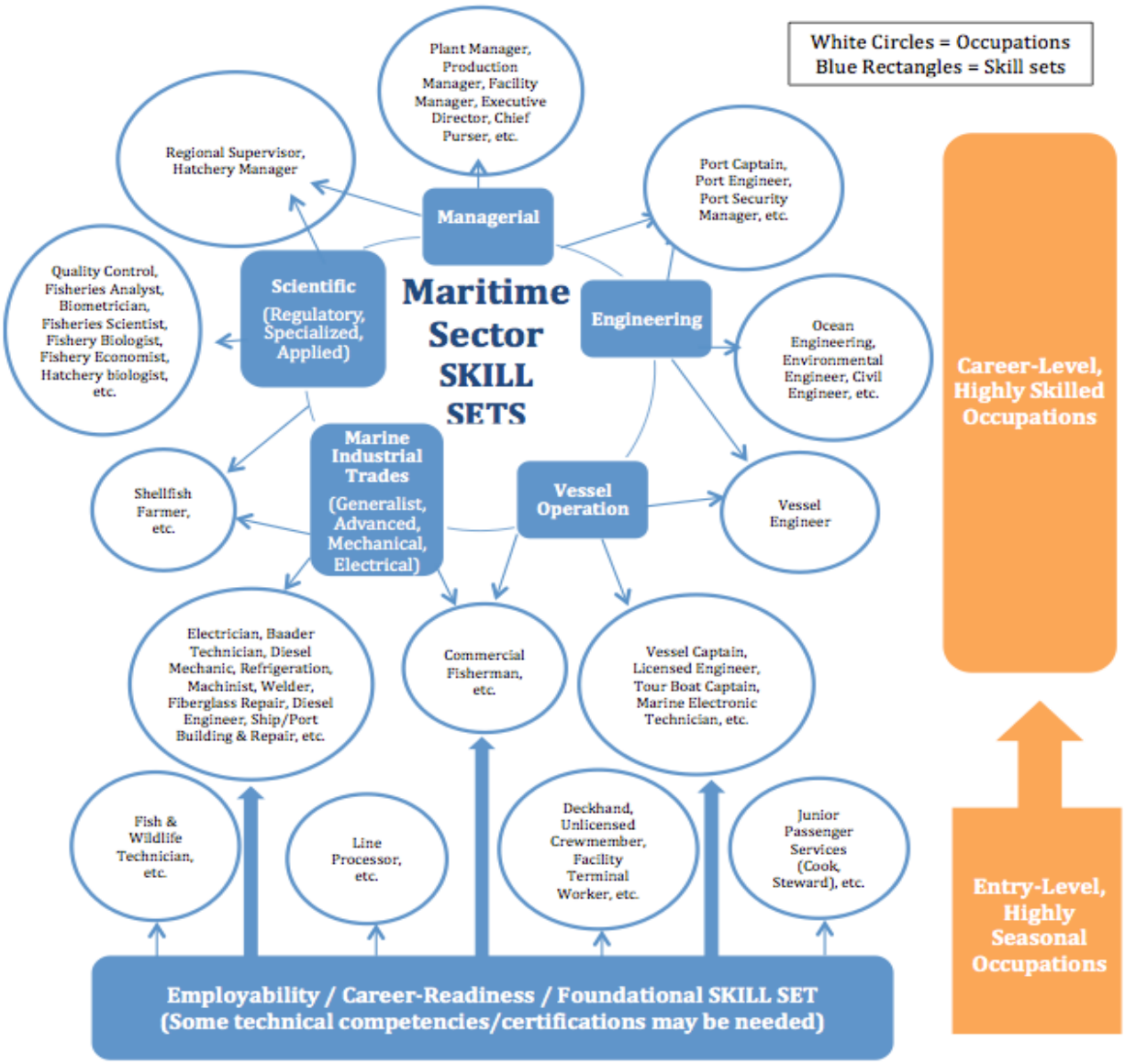
- **Marine occupations and support industries**
  - Shipbuilding and repair
  - Vessel operations: deckhand, engineer, captain, officer
  - Vessel repair and maintenance service provider

The range of marine occupations and support industries in Alaska is much broader than the four identified priority occupations. Other industries include passenger water transportation, tour and charter boat operations, cargo vessel operations, towing, salvage and vessel assist operations, port and harbor operations, marine and coastal engineering through construction and operations, marine environmental responders, marine research vessel operations, Navy and U.S. Coast Guard support activities, oil and gas exploration, fuel distribution/sales and marine equipment.

The Plan noted the transferability of many marine workforce readiness skills, as well as the similarity of working conditions in remote sites requiring long hours and physical work, and the high percentage of workers who are self-employed. The cross-cutting

skills provide a greater opportunity for year-round employment and flexibility of workforce to respond to changing opportunities. These essential skills provide the focus for training and workforce development in the traditional maritime industries.

Figure 7.1 ~ Maritime Sector SKILL SETS



Source: ADWFDP

The AMWFDP approach has received multiple endorsements and resolutions that the plan be implemented from Alaska Fish Radio, Southwest Alaska Municipal Council (SWAMC), Alaska Public Radio, Juneau Empire, Seward City News, KDLG Radio and the Anchorage Dispatch News (ADN).

7.3 Future Maritime Impact of Alaska Offshore Oil and Gas

7.3.1: The ISER study (2009) undertaken with Northern Economics, *Economic Analysis of Future Offshore Oil and Gas Development: Beaufort Sea, Chukchi Sea, and North Aleutian Basin* describes and quantifies the potential economic benefits to the State of Alaska and local communities from anticipated development of oil and gas on the Outer Continental shelf (OCS). The intent was to define a reasonable scenario of what might be expected over the next 50 years. It assumes that oil and gas development and production will occur, given appropriate petroleum prices, and no major regulatory impediments. Other relevant variables include the volumes of OCS resources that are recoverable, levels of investment made, and state tax structure.

The economic effects of OCS development are compared to the baseline of the Alaskan economy without OCS development. Key employment findings noted:

- OCS development could generate an annual average of 35,000 jobs over the next 50 years. This represents a six percent increase compared to total statewide employment without OCS development.
- These jobs represent a total payroll of $72 billion (2007$) over the 50 years.
- OCS-related employment growth could more than offset losses from declining petroleum production, and could sustain the economy for several decades.
- Opportunities would be statewide, high paying, long-term, year round and seasonal. Of the 6,000 oil and gas sector jobs, about 3,900 could be long-term and year round.
- The growth of jobs from OCS development could lead to a five percent increase in statewide population.

Table 7.3 ~ Potential Future Employment Effects of OCS Development in Alaska

Sector	Average Annual Employment
Oil and Gas (extraction and oilfield services)	**6,000**
Infrastructure	**3,000**
Support	**22,000**
State/Local Government	**4,000**
Total:	35,000

Note: Employment is rounded and expressed in annual average, 2008 to 2057. It should be noted that it could take several years before OCS employment might reach the annual average of 6,000 direct jobs in the oil and gas sector, and for the other sectors to reach the levels noted above.

Source: Economic Analysis of Future Offshore Oil and Gas Development: Beaufort Sea, Chukchi Sea, and North Aleutian Basin

The potential cumulative direct petroleum revenues from 2008-2057 is estimated to be $5.8 billion (2007$), with $4.5B going to directly impacted local governments from property taxes on onshore petroleum facilities, and $1.4B to the State of Alaska.

Table 7.4 ~ Potential Cumulative Direct Revenue Effects of OCS Development to State and Local Governments, 2008 to 2057 (in Billions of 2007$)

Entity/Source of Revenue	Amount
State of Alaska	**1.4**
Property Tax	0.4
Corporate Income Tax	1.0
Shared Lease Payments	--
Directly Impacted Local Governments	**4.5**
Property Tax	4.5
Total Alaska:	**5.8**

Notes: (1) The sum of the amounts do not equal total due to rounding. (2) For this table, *Directly Impacted Local Governments* include the North Slope Borough and the Aleutians East Borough. (3) Federal lease payments shared with the state (from 8(g) leases) are estimated to be about $20 million (2007$).

Source: Economic Analysis of Future Offshore Oil and Gas Development: Beaufort Sea, Chukchi Sea, and North Aleutian Basin

Table 7.5 demonstrates the fiscal effects of OCS development with varying price assumptions from $80-120 per barrel of oil, and $7.8 -$11.8 per mmBtu. The projected net fiscal balance projected for the State of Alaska (2008-2057) is $6.6 to $9.5 billion. Though current prices as of this writing in January 2015 have crossed below the $50 barrel of oil threshold, and could quite possibly go even lower, the fundamentals of this *50 year projection* remain sound.

Table 7.5 ~ Potential State Fiscal Effects of OCS Development: Cumulative Revenues and Expenditures Under Varying Price Assumptions, 2008 to 2057 (in Billions of 2007$)

Revenue/Expenditure Category	Base Case	Sensitivity Analysis		
		Case 1	Case 2	Case 3
Projected State Revenues	**15.3**	**16.0**	**17.1**	**18.2**
Direct OCS Petroleum Revenues	1.4	1.4	1.4	1.4
Population Related Revenues Indirect	3.9	3.9	3.9	3.9
Petroleum Revenues due to OCS development				
TAPS-Fuller Pipeline Enhanced Value of North Slope Production	5.7	5.7	5.7	5.7
TAPS-Fuller Pipeline Additional North Slope Production	2.0	2.4	3.1	3.8
Gas Pipeline Tariff Reduction Effect	1.2	1.2	1.2	1.2
Incremental Production due to OCS Infrastructure	1.2	1.5	1.9	2.3
Projected Incremental State Expenditures	**(8.8)**	**(8.8)**	**(8.8)**	**(8.8)**
Projected State of Alaska Net Fiscal Balance:	**6.6**	**7.2**	**8.3**	**9.4**

Notes: (1) The sum of the amounts may not equal the total due to rounding. (2) Base case estimates are based on the Energy Information Administration's petroleum price projection with a long-term average price of $65.50 per barrel of oil and $6.40 per million Btu's of gas (in 2006$). The sensitivity analysis considers the following oil and gas price levels through 2030; prices thereafter are assumed to increase at a rate of 0.5 percent per year (same assumption as the base case):

- Case 1: Oil: $80 per barrel and Natural Gas: $7.8 per mmBtu
- Case 2: Oil: $100 per barrel and Natural Gas: $9.8 per mmBtu
- Case 3: Oil: $120 per barrel and Natural Gas: $11.8 per mmBtu

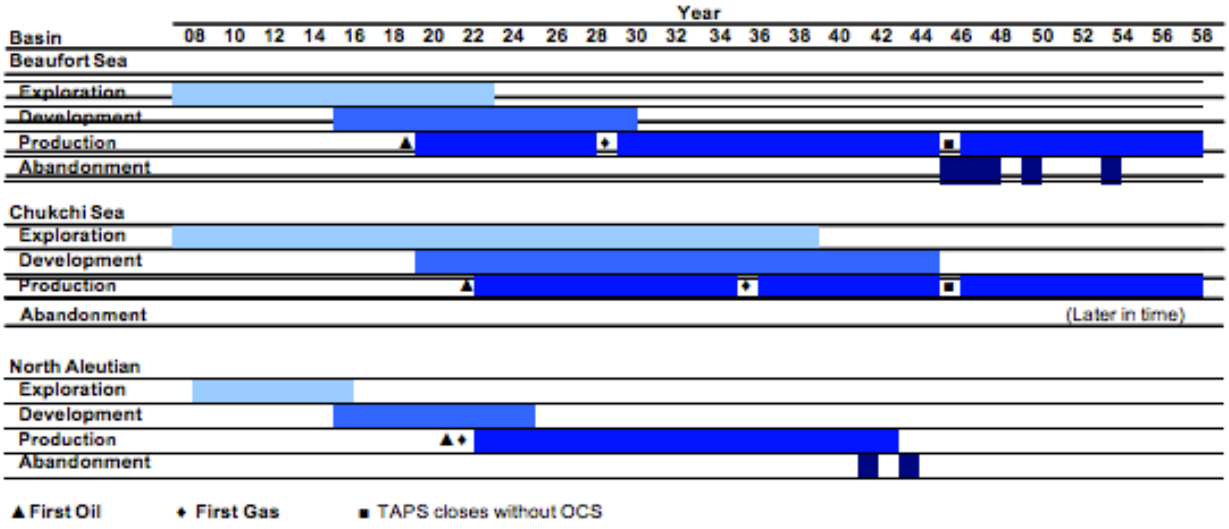
The sensitivity analysis cases estimate the effects of higher petroleum prices, holding all other factors constant.

Source: Economic Analysis of Future Offshore Oil and Gas Development: Beaufort Sea, Chukchi Sea, and North Aleutian Basin

This study was based on expansion of scenarios originally developed in the 2008 *Draft EIS for Beaufort and Chukchi Sea Planning Areas, Oil and Gas Lease Sales 209, 212, 217 and 221*. The basin scenarios include assessments of oil and gas resources, expected levels of exploration activities, levels of workforce requirements, development of oil and gas field and required infrastructure, and operations and maintenance activities at the assumed production levels.

Figure 7.2 demonstrates the anticipated schedule of activities for Beaufort, Chukchi and North Aleutian Basins between 2008 and 2057.

Figure 7.2 ~ Schedule of Activities for Beaufort, Chukchi, and North Aleutian Basins, 2008-2057



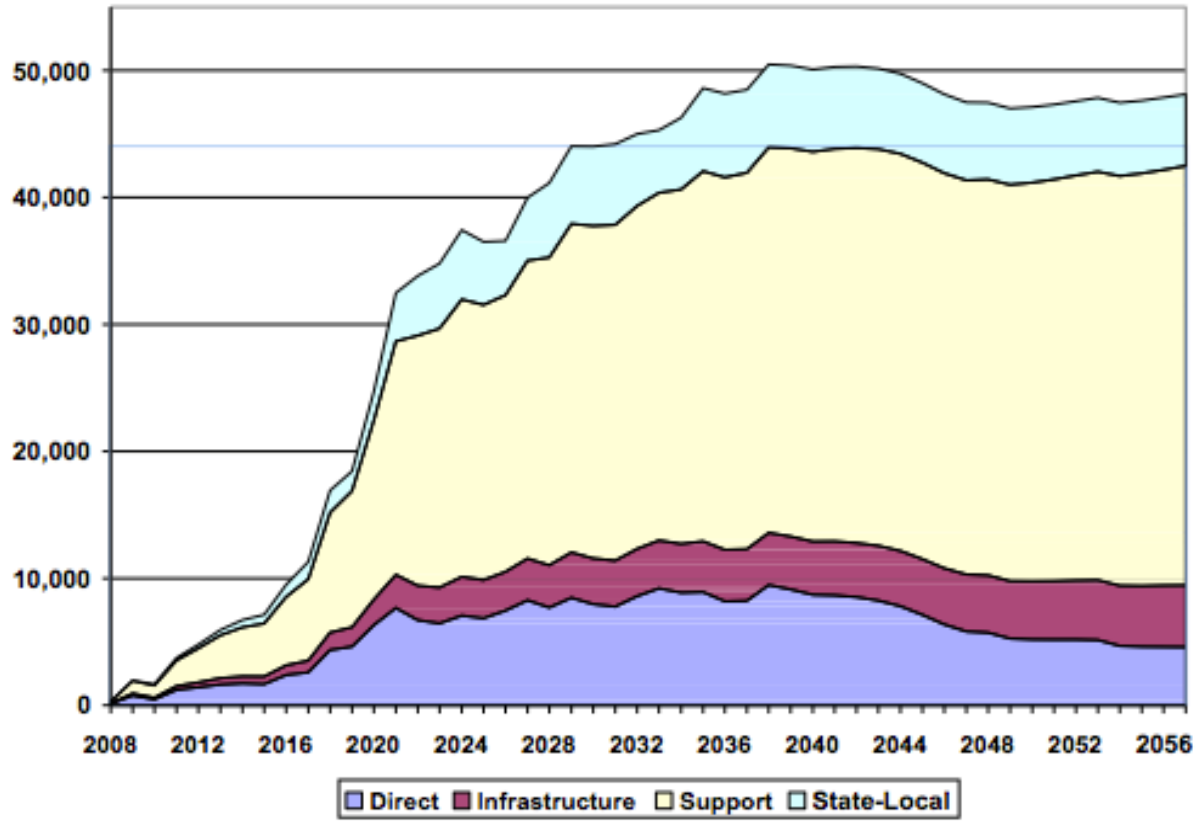
Source: Northern Economics, Inc. assumptions

Employment estimates include 6,000 direct oil and gas industry jobs, of which 3,900 are high paying and long-term. Seasonal and short-term jobs could include oil spill response, equipment operation, construction of support facilities, marine mammal observer program, camp support, seismic survey and more. On-site work would focus on building and operations of onshore facilities, production platforms and wells, and operation and drilling of exploration platforms and wells. Off-site workers would be those working in oil and gas company offices in Anchorage, as well as pipe-coating activities identified for Fairbanks.

Induced and indirect employment would be created in other sectors as a result of multiplier effects of in-state spending. This would include industry purchases from other Alaska businesses, government spending of OCS-related revenues and household spending of wages and salaries. The potential employment effects of OCS development by sector are shown in Figure 7.3. The majority of the 35,000 new jobs would be in support sector, including trade, services and other related businesses. About 3,000

workers would be added to provide petroleum-related infrastructure employment for transportation, communications, utilities and business services. About 4,000 public sector jobs are anticipated.

Figure 7.3 ~ Potential Total Employment Effects from OCS Development by Category



Source: Northern Economics, Inc. and ISER estimates

Based on historical trends, workers are anticipated to come from across the state. However, residents of the North Slope Borough and other areas in proximity to the OCS areas would take a large share of the jobs. The geographic distribution of annual average employment is portrayed in Table 7.6.

Table 7.6 ~ Estimated Annual Average Employment Generated from Potential OCS Development by Place of Work and by Place of Residence

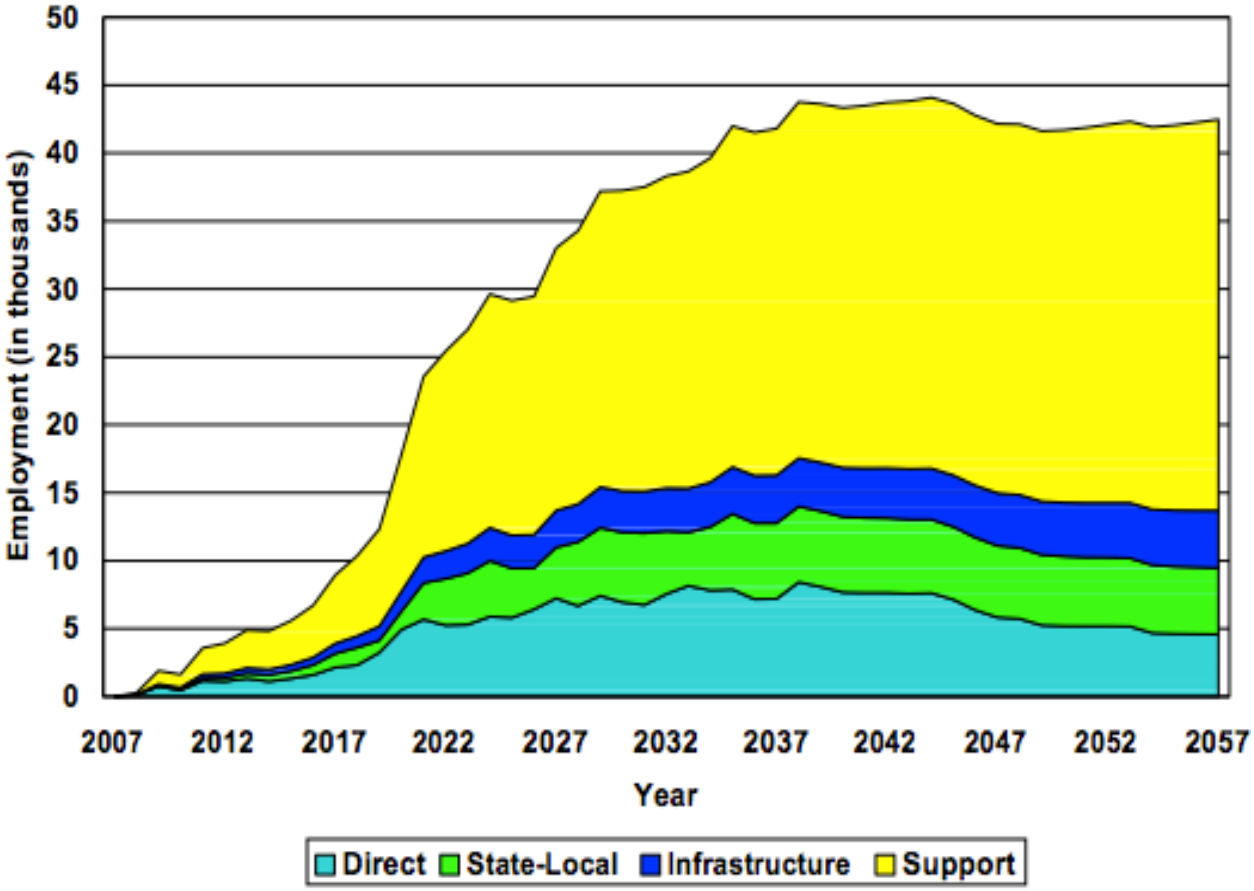
	Direct		Total Employment Direct + Indirect + Induced	
Place	Place of Work	Place of Residence	Place of Work	Place of Residence
Anchorage	800	2,500	15,000	16,000
Mat-Su Borough	--	500	3,000	3,000
Kenai Peninsula Borough	--	500	2,000	3,000
Fairbanks North Star Borough	<100	250	3,000	3,000
Aleutians East and West	600	100	1,000	1,000
North Slope Borough	4,500	<100	6,000	2,000
Balance of State	--	<100	5,000	5,000
Outside Alaska	--	2,000	--	2,000
Total	6,000	6,000	35,000	35,000

Source: Northern Economics and ISER estimates. Distribution of workers by place of residence is based on Alaska Department of Labor and Workforce Development data

Local economic impacts are most significant in the regions adjacent to the basins where OCS activity occurs. On-site employment in the North Slope Borough could average 45 percent higher with OCS development. However, most of the population impact of development would be in urban Alaska. Anchorage captures about half of all employment, with Fairbanks and Mat-Su also holding a significant share of incremental OCS employment.

There is limited infrastructure on the Chukchi Sea coast, so more facilities will need to be constructed to support OCS activities. This construction generates a substantial number of jobs. The estimated incremental employment by sector for Chukchi OCS development shows that the direct and infrastructure employment levels are stable after construction as all fields would remain in production during the study period until 2057. Figure 7.4 demonstrates the combined incremental employment for Beaufort and Chukchi OCS development.

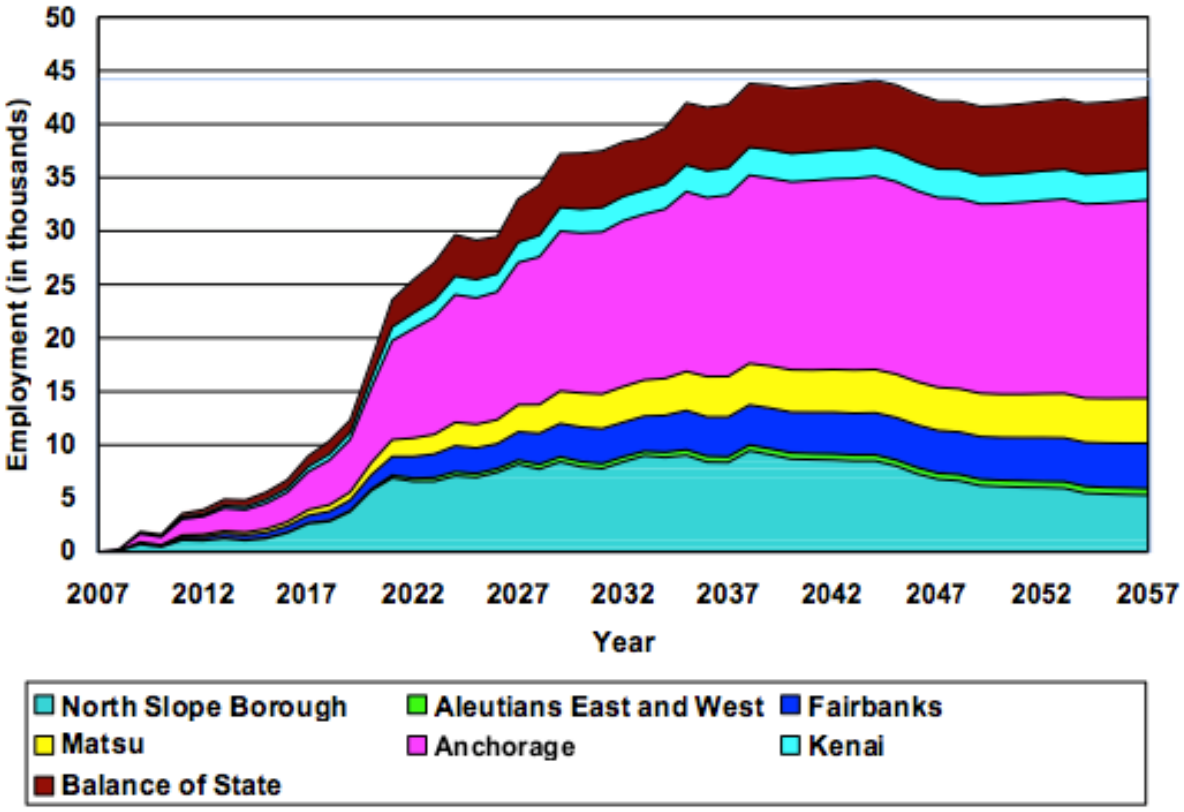
Figure 7.4 ~ Estimated Incremental Employment, Beaufort and Chukchi OCS Development



Source: Northern Economics, Inc. and ISER estimates

Figure 7.5 shows the regional breakdown of Alaska employment for the combined Chukchi and Beaufort OCS development areas. Direct employment is mostly in the North Slope Borough. Infrastructure and support employment are distributed statewide.

Figure 7.5 ~ Estimated Incremental Employment by Place of Work, Beaufort and Chukchi OCS Development

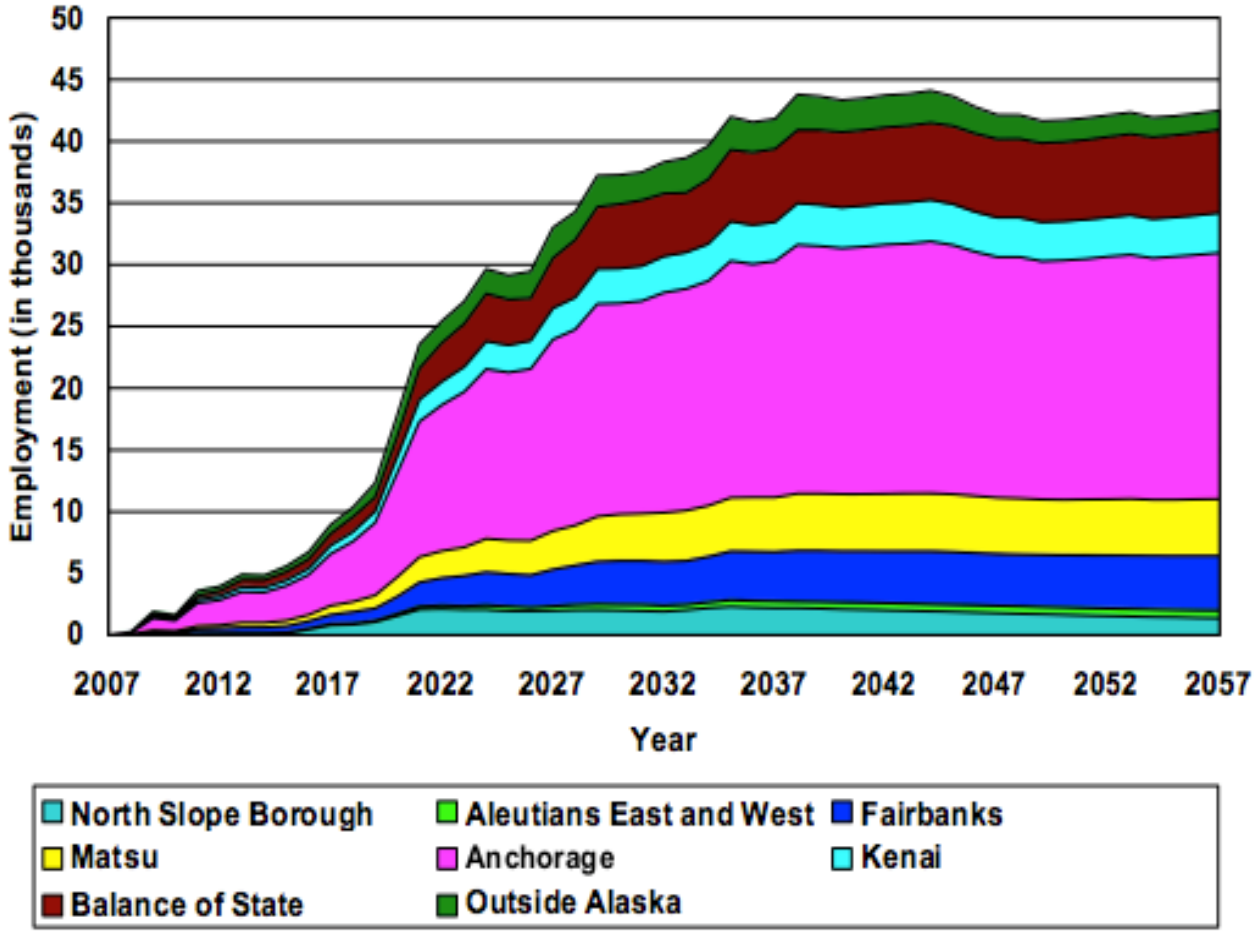


Note: Kenai is the Kenai Peninsula Borough; Anchorage is the Municipality of Anchorage; Matsu is the Matanuska-Susitna Borough; Fairbanks is the Fairbanks North Star Borough; Aleutians East and West is comprised of the Aleutians East Borough, Bristol Bay Borough, Lake and Peninsula Borough, Aleutians West Census Area, and Dillingham Census Area.

Source: Northern Economics, Inc. and ISER estimates

Figure 7.6 shows the incremental statewide employment for both Beaufort and Chukchi OCS development, including direct employment Outside Alaska. Total employment for both areas peak at 44,000 and exceeds 40,000 at the end of the study period in 2057.

Figure 7.6 ~ Estimated Incremental Employment by Place of Residence, Beaufort and Chukchi OCS Development



Note: Fairbanks is the North Star Borough: Anchorage is the Municipality of Anchorage; Aleutians East and West is comprised of the Aleutians East Borough, Aleutians West Census Area, Bristol Bay Borough, Dillingham Census Area, and Lake and Peninsula Borough; Matsu is the Matanuska-Susitna Borough; Kenai is the Kenai Peninsula Borough

Source: Northern Economics, Inc. and ISER estimates

The Alaska labor market does not have the capacity to supply all the workers potentially required by OCS activity. Many jobs would be filled by new migrants to the state, somewhat increasing the population, though some will continue as commuter workers. This study speaks to an under-utilized labor force due to the differing population

densities across the state, and due to underemployment of Alaska Natives. It concludes that the population will be only slightly increased initially, and that there will be more local hire in the geographic areas of OCS development.

In the absence of OCS development, employment in both the Beaufort and Chukchi areas is projected to grow during construction of a gas pipeline. Petroleum-related and government jobs will continue, with infrastructure and support jobs becoming a larger share over time. That said, most of the job and population growth of OCS development would be in urban Alaska. In fact, the trend at the time of this report has been for out migration from rural to urban Alaska.

It is significant to note that this document and its baseline information is 5-7 years old. Although it addresses a 50-year planning period, many changes have occurred since the assumptions were first articulated.

- Continued strength in petroleum, mining, and tourism as well as stability in seafood, military and civilian federal operations are assumed.
- Petroleum prices are estimated between $56 and $83 per barrel in 2006 dollars. Gas ranges from $5.8 and $7.4 per mmBtu in 2006 dollars through 2030.
- Crude oil production estimate is anticipated by DNR to decline at an annual rate of 4 percent, with cumulative production at 7.7 billion barrels between 2007 and 2057.
- Natural gas cumulative production between 2020 and 2057 was estimated at 62 TCF.
- ANWR production was not included. Without OCS activity, petroleum employment peaks in 2021 and then slowly declines. TAPS is anticipated to shut down when it gets to 200,000 barrels per day, possibly 2046. Any remaining oil would be moved to market by marine transport after that.
- A natural gas pipeline from the North Slope is anticipated in 2020, with assumption of the current tax and royalty regime.
- Mining activity included activity at Donlin Creek and Pebble Mine.

- A personal income tax may be re-instated, and dividend earnings of the PFD to be reduced to support state spending. Federal support will continue to decline.

These assumptions are challenged by the current realities of TAPS and SB 21, Shell's exploration experience, regulatory challenges, Alaska state budget deficit status, the Pebble Mine outcomes, the current gas line status, and the deep drop in oil prices in late 2014.

7.3.2: An update of OCS potential was made by the Bureau of Ocean Energy Management (BOEM) in their 2012 *MAG-PLAN Alaska Update*. BOEM is the federal agency responsible for leasing submerged federal lands. The OCS Lands Act requires preparation of a 5-year program. A region-specific economic model called MAG-PLAN is used in the BOEM decision-making process. It estimates the potential employment, income and economic output effects that could result from a range of development scenarios. The need for update was further driven by changes including prevailing oil and gas prices, industry interest in OCS development, proposals to commercialize stranded North Slope gas, and changes in Arctic technology, as well as changes to the assumptions made in the 2009 ISER OCS economic analysis.

As an update to the 2005 MAG-PLAN Alaska, BOEM developed this study in 2012 to evaluate potential economic impacts of oil and gas development in the OCS planning areas of Alaska. The study scope included ten major tasks designed to test the model, gather current industry expenditure data, revenue functions data, personal consumption expenditures data and develop an updated plan.

The geographic focus of this model update included Beaufort Sea, Chukchi Sea, Cook Inlet and the North Aleutian Basin, as the areas of highest potential and industry interest. This basin data was used to extrapolate economic effects for the other eleven planning areas. The updated model incorporates new technologies and practices associated with working in deep water Arctic areas, such as different costs for platform fabrication and installation, or construction by platform type, and for operations and maintenance. Other

Arctic conditions are now included in the model, such as differences in equipment and vessel types, construction season, mobilization and demobilization costs and timing, and manpower requirements. Environmental management activities and equipment were added to the model.

BOEMS's discussion of projected vessels working in the areas, included a related description of crew and technical manpower requirements for the range of exploration and production activities required for OCS development.

The manpower requirements for environmental monitoring vary depending on the wide range of potential activities. Some examples:

- Oceanographic and biological surveys, crew plus scientists of 16-30
- Airborne marine mammal observation, 2-6 observers and 2 crew
- Marine mammal observers, 2-4 on larger vessels plus crew
- Weather and ice forecasting, some contracted and some in-house
- EIS process can take 50-100 people for several years
- Regulatory permits can take 20-40 people for one-three years
- Permit compliance, 4-6 FTE annually
- Field compliance, 2-4 people on each rig/vessel while operations are active
- Subsistence advisors and Inupiaq translators, 69-90 days during the season

Offshore oil spill contingency manpower is also articulated for the Beaufort and Chukchi OCS areas, and transport of petroleum products.

- Crews and technicians on dedicated oil spill response vessels, 8-40 positions; 16-60 persons
- Oil spill tug and barge, 15-17 positions, 30-34 persons
- Oil spill tanker, 15-18 positions, 30-36 persons
- Crews of platform supply vessels, 8-19 positions, 16-38 persons
- Anchor handling tug supply, 19-29 positions, 38-58 persons
- Ice management vessels, 25-37 positions, 50-74 persons
- Extended oil spill response if activities increase for 20-78 employees
- Additional manpower for near shore and coastal spill response

Seismic surveying can require 60-90 people aboard the vessel at any one time. In addition to crew and technical surveyors, there would be owner representatives and 2-4 marine mammal observers, plus a parallel crew awaiting rotation. The number of Alaska residents onboard is generally limited to the MMOs, 1-3 residents of the North Slope.

Guard boats and supply boats have crews of 12-14 persons and rotate as the seismic vessels. Guard boats are often used for crew transfer, and also carry 2-4 MMOs. Guard and supply vessels are generally from Alaska or the Pacific Northwest and crews are often residents of the region. This on-site labor is supplemented by jobs for planning the survey, data processing and report writing. These jobs are generally in Anchorage.

Ocean bottom cable surveys staff 2-7 people on the source vessels during the operations. Several vessels are used to house the survey crew and MMOs. About 50 people are required.

Geophysical survey manpower depends on the vessel used. On the Alpha Helix, there is a crew of 8-10, with room for up to 29 individuals. On the Mt. Mitchell, up to 60 people include the survey crew and staff as well as the ship's crew. Other vessels range between these numbers. Geophysical operations require manpower of 25-39 people including the ship's crew, the technical survey crew, marine mammal observers, owner representatives and a rotation team (4 weeks on, 4 weeks off).

Geotechnical program vessels can range from a capacity of 25-70 people. Manpower for typical programs varies from 21-45 people, including the ship's crew and technical team. The duration was generally 2 weeks to 2 months.

The size of the drill platform operations crew depends on platform type. This crew maintains the drill platform and supports drilling and production. With ice island capacity ranging from 120-150 people, the support crew size is 24-30 persons. This is similar to what is required for the Kulluk, with capacity for 108 persons and a support crew of 48-60 people. Jackup rigs can have crews ranging from 12-40. Platform crews normally work 12-hour shifts, so the people required for operations would be double.

Crew size for drill ships and semi-submersibles was in the 40-50 person range.

Well-drilling crews for a typical rig will consist of 22-24 crew with an equal number of support staff and camp personnel. Approximately 50 people are on duty at a time, with a similar number available for rotation. Offshore drilling requires more support positions than land-based drill rigs. Additional people are required for the six-month planning period, and for mobilizing the equipment to and from Dutch Harbor.

Marine and onshore support includes a range of vessels for heavy lifts and ice management as well as tugs and supply boats. Crew sizes vary depending on the vessel. If a platform is supported by two ice management vessels and two supply boats, it could require 80-100 people onboard with an equal amount available for rotation.

Helicopter support is provided by several companies operating on the North Slope. A crew consists of 4 pilots, 2 mechanics, 2 ramp hands, a supervisor and one dispatcher. SAR helicopters would have 3-4 additional positions to assist in rescue efforts. A program with one SAR helicopter and two crew shifts would have 23-24 people on-site and an equal number available for rotation, in two-week shifts.

Other onshore facilities for air support are required during operations. Helicopter trips to and from the rig require staff and refueling, facilities and land use for temporary staging, landing site, fuel containment site and camp accommodations. Exploration plans have noted the need for 30 people working onshore to support exploration programs with logistics and communications. These 30 would rotate with another 30 on two-week shifts.

Construction camp manpower requirements are estimated at 15 percent of the total number of persons estimated for the production base, the supply boat terminal and the air support base.

Production platform crews for Alaskan OCS are compared to the Gulf of Mexico, with a range of 200-250 persons onboard.

Subsea installations could require 1,050 persons on-site with total employment exceeding 2,100 people.

Decommissioning a platform requires from 70 persons for removal of a pad to a range of 800-1,000 for deep water OCS platforms in the Arctic.

For the Alaskan remote OCS projects, it is anticipated that the majority of the workforce will come from Anchorage and the rest of the U.S., with 10-20 percent from the local (North Slope) area. Alaska Department of Labor (ADOL) tracks resident and nonresident workers and wages by where they live and work. They do not tie the data to specific maritime activities. The MAG model assumptions by activity and place of residence were developed through expert opinion, and are demonstrated below.

Table 7.7 ~ Estimated Percent of Production Employees by Place of Residence and Activity

	Cook Inlet Projects			Remote Projects			Remote Projects Near Labor Supply			
Activity	Kenai	Anchorage	Other U.S.	Kenai	Anchorage	Other U.S.	Local (If Near Labor Supply)	Kenai	Anchorage	Other U.S.
1. Geological Survey	25	25	50	25	25	50	0	25	25	50
2. Spill Contingency Response	100	0	0	100	0	0	0	100	0	0
3. Construct Exploration Shore Base	100	0	0	50	50	0	20	40	40	0
4. Operate Exploration Shore Base	100	0	0	50	50	0	20	40	40	0
5. Install Exploration Platform	90	10	0	40	40	20	0	40	40	20
6. Operate Exploration Platform	90	10	0	40	40	20	0	40	40	20
7. Drill Exploration Well	60	20	20	50	25	25	0	50	25	25
8. Construct Production Shore Base	100	0	0	50	50	0	20	40	40	0
9. Operate Production Shore Base	100	0	0	50	50	0	0	50	50	0
10. Install Production Platform	90	10	0	40	40	20	0	40	40	20
11. Operate Production Platform	90	10	0	40	40	20	0	40	40	20
12. Drill Production Well	70	20	10	60	20	20	0	60	20	20
13. Lay Offshore Pipeline	50	10	40	45	10	45	0	45	10	45
14. Lay Onshore Pipeline	80	15	5	60	15	25	0	60	15	25
15. Construct Onshore Production Facility	70	15	15	40	45	15	0	40	45	15
16. Operate Production Facility	80	15	5	15	65	20	10	10	60	20
17. Construct Marine Terminal	80	15	5	40	45	15	0	40	45	15
18. Operate Marine Terminal	80	15	5	15	65	20	10	10	60	20
19. Major Platform Maintenance	50	30	20	20	50	30	0	10	50	30
20. Well Workover	70	20	10	60	20	20	0	60	20	20
21. Helicopter Support	90	10	0	50	50	0	10	40	50	0
22. Large Workboat	60	30	10	40	40	20	20	30	30	20
23. Small Workboat	60	30	10	40	40	20	20	30	30	20
24. Landing Craft	60	30	10	40	40	20	20	30	30	20
25. Dive Boat	60	30	10	40	40	20	20	30	30	20
26. Camp Support	85	10	5	45	50	5	10	40	45	5

Screenshot of IMPAK model report exhibit showing model assumptions regarding residency data of Cook Inlet model OCS workers by activity.

Source: Sub-Arctic IMPAK Final Technical Report, Jack Faucett Associates, June 2003

The model accounts for on-site production labor costs, off-site non-production labor costs and fringe benefits. It also estimates the relative percentages of resident on-site labor, Alaska statewide labor and Outside labor.

The model generates the following Stage 1 outputs based on information from industry and secondary sources:

- Direct employment estimates by area, activity, year and location;
- Direct industry spending by area, activity, year and location;
- Direct government revenues by area, activity, year and location.

The model generates the following Stage 2 outputs. These are multiplier effects of industry spending on non-labor costs, household spending of labor income, and government spending of OCS-related revenues. This data is generated through IMPLAN estimates.

- Indirect and induced employment estimates by area, year, and Alaska region;
- Indirect and induced labor income by area, year and Alaska region;
- Indirect and induced economic output effects by area, year and Alaska region.

7.3.3: A *Feasibility Analysis: Port Clarence Support Base* was prepared by Northern Economics for Bering Straits Native Corporation (BSNC) and Crowley, published in June 2014. Both BSNC and Crowley have been collaboratively exploring the opportunity of support to OCS development at Port Clarence. This Feasibility Analysis looks at the specific region of the Seward Peninsula, and the area of Port Clarence, as a subset of the larger work done by the BOEM MAG-PLAN 2012 update. BSNC, one of the Alaska Native Regional Corporations, has selected but not finalized acquisition of the land at Port Clarence.

The proposed support base development is located at Port Clarence on the Seward Peninsula, about 70 miles by seasonal road from Nome. This western Alaska project was catalyzed by the ‘exceedingly rare natural deep water’ of 36-48 feet. It gained

momentum with the USACE study process to identify and develop an Arctic Deep-draft Port in this area. The site has served as a protected harbor and port of refuge since the middle 1800s, and is now being used for fueling and resupply by Crowley. Local supply vessels from regional hubs also use the bay for anchoring and refuge. The adjacent Point Spencer has been used historically as a communications center by the U.S. Coast Guard as a Long Range Navigation (LORAN) site. The bay is generally ice-free from early June through mid-October each year and the usable season could be extended with ice-breakers and ice-enabled vessels.

Northern Economics addressed market demand, potential uses, facilities and services, capital and operating cost estimates, potential funding sources and possible regional benefits. The study area included regional and northern hemisphere shipping. The project timeline was 10-20 years. Traffic included destinational shipping in or out of the Arctic for resupply or shipping of ore from Red Dog; trans-Arctic shipping; and adventure tourism. Destinational shipping is the most consistent, and the type of shipping most relevant to potential development of a support base at Port Clarence.

Northern Economics outlined potential markets for support services, including public and private companies and agencies. Their work is based on BOEM's model (MAG-PLAN 2012) of OCS activity, including seismic, geo-hazard, geotechnical, and exploration wells from 2013 to 2022. The only viable market identified was oil and gas, particularly as support to the exploration phase in the Beaufort and Chukchi Seas. After analysis of the particular facilities required for a support base, Northern Economics determined that annual revenue stream of about $5 million is required to initiate development on a dock, camp and support facilities including communications, water and wastewater, power and fuel. The only market opportunity with the capacity to generate and sustain that level of revenue was oil and gas. Specifically, the services would be attractive to medium and smaller exploration firms, as large firms are positioned at Dutch Harbor/Unalaska.

Infrastructure and services offered at comparable support bases in Norway and Nova Scotia were surveyed to develop a sense of timing and scale of required resources. The NorSea Group operates supply bases and logistical centers at nine locations in coastal

Norway, and was a reasonable development model for BSNC and Crowley.

Other potential uses of the proposed support facility beyond oil and gas were considered. Local and regional supply needs are already being met at Nome and Kotzebue. Search and rescue services and spill response could be located at Port Clarence, but with the estimated $75 million investment to set up one location for spill response, revenues would not be predictable or sufficient to support as a self-sustaining enterprise.

The study team outlined potential regional benefits, including employment, a possible lower cost of living, and use of Port Clarence as a port of refuge. Four scenarios were generated to develop estimates of local hire, ranging from fewer than ten employees at the level of minimal and startup services, to exploration estimates of 700-1,300 for about five years. This estimate includes full staffing on support vessels, aircraft and other land-based support facilities away from Port Clarence. If operations and production result from exploration by 2025, the continued jobs could be as high as 1,800, including those on vessels and other support facilities.

Forecasted vessels and crew for OCS exploration and development by Shell and ConocoPhillips are presented below.

Table 7.8 ~ Forecasted Vessels, Crew, OCS Exploration and Development

	Shell			ConocoPhillips			
Vessel Type	Number	Est. Crew	Total Persons	Number	Est. Crew	Total Persons	Example
Ice Management	2	62	124	2	62	124	Ice breakers
Ice class AHTS	2	48	96	0		0	M/V Nordica
Platform Supply	2	27	54	4	27	108	M/V Perseverance
Tug and Barge	2	28	56	2	28	56	Arctic Endeavor
Oil Spill Response Vessel	1	38	38	1	38	38	M/V Nanuq
Oil Spill Response Tug and Barge	2	32	64	1	32	32	Aiviq
Oil Spill Tanker	1	33	33	0		0	
Work boats, landing craft	4	24	96	2	24	48	
Large crew change boats	2	14	27	2	14	27	
Tug and Tank Barge	1	14	14	2	14	28	
Total	**19**	**320**	**602**	**16**	**239**	**461**	

Note: M/V = motor vessel

Source: Northern Economics, MAG-PLAN 2012

The potential jobs were not identified as Alaskan or Outside residents, and were not described in terms of particular skill sets required. Not included is the temporary surge in workforce associated with construction or the long-term nominal maintenance of the support base. Potential services for a support base vary with vessel and user needs. A comparable location is the UIC Corporation's camp at Umiat. They provide camp and logistical support for exploration and drilling sites, including staging of materials, equipment and supplies; expediting, catering, crew changes and communications.

Based on census data, existing employment for the region was documented between 2007-2011. There are more than 3,600 workers now in the local workforce, with about 900 residents working in occupations related to natural resources, construction, maintenance, production, transportation and material moving. In addition, 733 people (630 of which were Alaska Native) were documented as unemployed.

Table 7.9 ~ Employment by Occupation and Ethnicity in the Bering Strait Region, Average 2007-2011

Employment Category	Total workers	Native workers	Native/Total (%)
Management, business, science, and arts	1,365	515	38
Service	616	477	77
Sales and office	731	527	72
Natural resources, construction, and maintenance	458	224	49
Production, transportation, and material moving	441	262	59
Total	**3,611**	**2,005**	**56**

Source: Northern Economics using U.S. Census Bureau's ACS 2013

Significant local hire would occur only if active exploration results in development and production, using Port Clarence as a support base. Local hire could only be achieved if BSNC includes shareholder and local resident hiring preferences in the contracts with oil companies choosing to use support services at Port Clarence. Many of those workers are now available in the Bering Strait area. Local models of a good track-record for hiring residents include the Donlin Gold project, and Red Dog Mine. ISER (*Shareholder Employment at Red Dog Mine. ISER Working Paper 2012-2. April 2012)* emphasizes the importance of concrete goals and incentives to ensure that Alaska Native employment is a priority for project owners/operators. The key obstacles to

successful Alaska Native employment include: "*lack of skills and work experience required, and scarcity of opportunities to upgrade existing skills; racism and a tendency for managers to have other priorities over Alaska Native employment and training when allocating financial and other resources; alienation and loneliness; reluctance of Alaska Native people to forgo (sic) land-based activities such as hunting and fishing that may conflict with regular wage employment; lack of suitable accommodations; and a failure to address the needs and priorities of Alaska Native employees."*

Regionally, resulting lower fuel prices could benefit the two immediate communities of Brevig Mission and Teller, although each would need to invest in storage facilities to realize the benefit. The Port of Refuge status could generate benefits, but the increased economic activity from spills and rescue events is not predictable and requires rapid buildup of supplies and personnel as dictated by the severity of the crisis. Oil and gas exploration and development provide the only potential for sustained employment in the two local communities and regionally in Nome and Kotzebue.

7.4 Ten year Economic Activity Projection for the U.S. Maritime Arctic

7.4.1: The Government Accounting Office (GAO) 2014 report, *Maritime Infrastructure, Key Issues Related to Commercial Activity in the U.S. Arctic over the Next Decade,* concludes there will be limited commercial U.S. Arctic maritime activity over the next 10 years. The GAO report looked at current and anticipated commercial maritime activity in the U.S. Arctic, government planning and development actions to date, and federal efforts to prioritize maritime infrastructure investment.

The GAO cited the Committee on the Marine Transportation System (CMTS) report, published as the *U.S. Arctic Marine Transportation System: Overview and Priorities for Action*, *July 2013*. This report noted two near term priorities for development of maritime infrastructure: information infrastructure such as mapping and charting; and response services, as in search and rescue. Longer lead-time investment will be required for physical infrastructure, navigable waterways and vessels. Nine CMTS agencies are now working to support this agenda, including NOAA, USACE, the USCG and BOEM.

The five categories of Marine Transportation System infrastructure defined by CMTS (2 near term and 3 longer term) were further articulated as sixteen elements: places of refuge for ships, areas of heightened ecological significance, ports and associated facilities, geospatial infrastructure, hydrographic surveys and nautical charts, shoreline mapping, aids to navigation, communications, marine weather and sea ice forecasts, oceanographic and real-time navigation information, automatic identification system, icebreaking, environmental response management, search and rescue/emergency response, design standards for polar operations, crew standards/training.

Five key industries were highlighted after GAO consultation with industry representatives: commercial shipping, cruises, commercial fishing, oil, and mining. The potential commercial uses and constraints are summarized below.

Table 7.10 ~ Summary of Commercial Use of the U.S. Artic Based on Interview with Selected Industries

Industry	Current and expected levels of activity in the next 10 years	Cited factors contributing to limited activity
Commercial shipping	For trans-Arctic shipping, use of the Northern Sea Route has so far been limited, but some shippers are open to its possible future use. Few of the shipping companies we spoke with have used the Northwest Passage or have plans to use it in the next 10 years.	• Higher per-unit shipping costs for Arctic transit. • Additional vessel and crew requirements needed for Arctic transit. • Increased risk and uncertainty due to extreme and unpredictable weather.
Cruises	Cruise tourism in the U.S. Arctic is limited and is expected to remain a small niche adventure cruise market.	• Lack of demand from the mainstream cruise consumer base for U.S. Arctic cruises.
Commercial fishing	Commercial fishing is primarily focused in and around the Bering Sea, which is part of the U.S. Arctic.	• Commercial fishing is prohibited in U.S. waters north of the Bering Strait. It is unknown when, if ever, federal or state waters will open to commercial fishing in that area.
Oil	Recently, oil companies have made some investments to develop offshore oil resources in the U.S. Arctic. These development efforts, however, are generally on hold and increases in oil exploration activity are expected to be limited. The impact of oil exploration activity on the levels of maritime traffic appears uncertain.	• Timeline to oil production in the Arctic is unknown. • Future transport of oil will likely be through a sub-sea pipeline rather than a tanker ship. • Uncertainty regarding oil prices and variable industry trends.
Mining	Currently only one major mine operates in the U.S. Arctic. Two new mines are being planned or considered. However, according to industry representatives, the new mines would likely not contribute to additional maritime vessel traffic.	• Lack of intermodal connectors such as road and rail. • Lack of a deepwater port in the region.

Source: GAO analysis of agency information

Federal and state government have begun investment in U.S. Arctic maritime infrastructure. This is to remove barriers to development by private industry, such as support of the USACE and Alaska DOT&PF in their study for development of a deep-draft port seen as critical for future mining activity and OCS exploration and production. (U.S. Army Corps of Engineers and the Alaska Department of Transportation and Public Facilities, *Alaska Deep-Draft Arctic Port System Study* (March 2013). USCG also completed its report *Feasibility of Establishing an Arctic Deep-draft Seaport* (February 2014).

Table 7.11 ~ Status of Existing U.S. Arctic Maritime Infrastructure, 2013

Infrastructure components	Description
Ports	There are no U.S. Arctic deepwater ports. Most of the harbors and coastal ports north of the Aleutian Islands are shallow and primarily support barge service supplying fuel to coastal villages and are not sufficiently deep to support larger, commercial vessels such as container or tanker ships.
Aids to navigation	Currently, there are 9 fixed aids to navigation north of the Bering Strait that mark the entrance to Kotzebue Sound and support vessels bound for the Red Dog Mine. There are no federally maintained aids along the north coast of Alaska, but there are 11 privately maintained aids near Prudhoe Bay.
Polar icebreaking	The Coast Guard operates the nation's two functioning icebreakers, which are used in the Arctic for emergency response, research assistance, and patrols.
Mapping and charting, weather, water and sea ice information	Less than 1 percent of navigationally significant waters in the U.S. Arctic have been surveyed with modern technology.
Port connectors	Generally, there are few roads and no rail in Alaska north of the Arctic Circle; consequently, port connectors are fairly limited. One key connector road runs from the DeLong port facility to the Red Dog Mine.

Source: GAO

Construction challenges that could affect Arctic maritime infrastructure development include access to materials and equipment, as well as access to skilled construction labor force. GAO notes that the remote nature of many Alaskan projects, and the lack of sufficient affordable bandwidth precludes local workforce as training cannot be received in a timely and cost-effective manner. This means that skilled labor typically has to be imported from other locations and housed locally, an expensive solution. The potential access to local workforce is also often limited by the need to maintain seasonal subsistence activities.

7.4.2: It is significant to note that the *U.S. Implementation Plan for the National Strategy for the Arctic Region* of January 2014 addresses infrastructure, legal structure, diplomatic efforts and data-based management, but does not speak to the human resources required to be responsive to the challenges and opportunities of future Arctic

activities. The *Implementation Plan for the National Strategy for the Arctic Region* directs the DOT to complete a 10-year projection of maritime activities in the Arctic region, develop a 10-year infrastructure prioritization framework, and monitor agency progress in bi-annual interagency meetings.

7.4.3: The Alaska Arctic Policy Commission (AAPC) was established by the Alaska State Legislature in April 2012, to "develop an Arctic policy for the state and to produce a strategy for the implementation of an Arctic Policy". The work of the Commission will continue through 2014, resulting in a final implementation report to the legislature in 2015.

To date, the AAPC strategic recommendations are addressed to governance and indigenous perspectives, science and research, planning and infrastructure, oil and gas and mineral resources, marine transportation, response operations, energy and power, fisheries and wildlife. Within the planning and infrastructure section, development of a ready workforce to participate in the economy of the Arctic is identified as a priority, with the recommendation to provide education opportunities for ice navigation, marine mammal observation, spill response, SAR, pilotage and engineering.

Another recommendation expanded the potential activities: "the state of Alaska should continue to prepare the local workforce to participate in all aspects and all phases of resource development including research, monitoring, regulatory oversight, project development, construction, operation, remediation, and reclamation".

Recognizing the importance of local spill response, the Prevention and Emergency Response Program (PERP), is securing formal agreement with communities that provide a structure for training a response workforce, but additional work is needed to enhance first responder capabilities in Arctic communities.

7.5 Findings / Observations

- **Workforce expansion is needed.** The majority of Arctic reports noted that expansion of a skilled workforce is necessary to capitalize on the future economic potential, and even to maintain the status quo due to the aging of the workforce. OCS could generate 35,000 new jobs over the next 50 years, with a cumulative payroll of $72 billion, per Shell's economic analysis of the Beaufort and Chukchi.

- **Maritime sector includes traditional seafood and marine industries as well as oil and gas exploration and development. *Only OCS exploration and development will require significant expansion of a skilled workforce*.**
  - OCS exploration and development of oil and gas is the primary sector requiring substantial additional workforce and training. State support for OCS development is a key arena for intervention to expand the economic opportunity and the need for skilled workforce.
  - AMWFDP speaks to the traditional seafood and marine industries now operating in Alaska, with inventory of 23 specific occupations and suggestions to increase skilled workforce.
  - Five key industries were highlighted in the GAO consultation on maritime infrastructure with industry representatives: commercial shipping, cruises, commercial fishing, oil, and mining. Other Arctic expertise/services required include: support to places of refuge for ships, areas of heightened ecological significance, ports and associated facilities, geospatial infrastructure, hydrographic surveys and nautical charts, shoreline mapping, aids to navigation, communications, marine weather and sea ice forecasts, oceanographic and real-time navigation information, automatic identification system, icebreaking, environmental response management, search and rescue/emergency response, design standards for polar operations, crew standards/training.

- **Necessary legal structures are not yet in place.** Structural preconditions are required to set the stage for increased economic development: UNCLOS, Magnuson-Stevens Fishery Conservation and Management Act, Section 305. Section 305 has not yet been implemented, but is directly relevant to marine education and training for fisheries-related occupations, particularly for coastal residents and under-represented populations.

- **Existing population cannot meet the potential demand for skilled workforce.** The existing population available for training (unskilled, under-employed and/or unemployed Alaskans) is not sufficient in number to meet the need for replacement of aging workforce, or to capture skilled OCS jobs if they emerge.
  - In-migration of skilled labor is an option, but no State plan has directly addressed. This has been private industry practice throughout oil development. Of the 70,000 maritime jobs identified by AMWDP (2014), 35,000 are performed by out of state residents as commuters.
  - Conversion of 35,000 existing maritime jobs (AMWDP 2014) from non-resident to resident workers would increase skilled employment in Alaska while covering existing industries. It would not respond to future needs of OCS development, but it would keep more money and work in the state.
  - Increasing the population of Alaska has not been identified as a policy priority, yet it is another way to create critical mass required to support OCS and other maritime and economic development. What would it take to attract skilled labor as new residents?

- **Training plans now require leadership and implementation.** Developing training and career pathways takes a long time. Inventories and pathways are in place for many occupations, but there is no specific implementation leadership and plan to deliver.

- AMWFDP 2014 outlines what is needed for traditional seafood and marine industries, but does not include a workplan, timeline, specific responsibilities, budget, reporting and accountability to deliver.
- The UA/McDowell 2012 Gap Analysis (www.alaska.edu/fsmi) recommends a highly collaborative and leveraged use of existing training organizations and agency career ladders, combined with ongoing industry relationships. McDowell noted that some of the training is new, but the focus is also on the coordinated public/private approach required to successfully market and deliver it.
- The Alaska Arctic Policy Commission Report (January 2014) makes numerous references to the need for workforce to support spill response, navigation, search and rescue and resource development. Implementation planning to deliver this workforce is not articulated.

- **Other Arctic Strategies and Economic Models might have value for Alaska.**

- **Federal support is anticipated to be limited for the next ten years.** The GAO report on Maritime Infrastructure concludes that economic opportunities in the U.S. Arctic are considered to be key drivers for the development of maritime transportation infrastructure. They anticipate limited commercial activity over the next ten years, but are actively planning, such as for: the USACE Arctic deep-draft port development with benefits to commercial activity and maritime safety; and information infrastructure through NOAA; as well as USCG purchase of icebreakers.

- **There are still many variables that will affect timing of Arctic development.**

8.0 Major Findings of the Study and International Workshop

1. Arctic natural resource development is primary driver of the need for Arctic marine transportation systems. This finding is consistent with recent marine traffic along the Northern Sea Route and in other Arctic regions, and also consistent with a key finding of the Arctic Council's Arctic Marine Shipping Assessment.

2. The Arctic Ocean is an ice-covered ocean that requires international (ship) rules, regulations and standards, not an ice-free environment. There are no current Arctic-specific rules and regulations (domestic or international) that are applied to the U.S. maritime Arctic.

3. The Arctic Council's Arctic Marine Shipping Assessment (AMSA) provides a solid framework and strategy for enhancing marine safety and environmental protection in the U.S. maritime Arctic. AMSA's 17 recommendations formulated within three themes (Enhancing Marine Safety; Protecting Arctic People and the Environment; and, Building the Arctic Marine Infrastructure) is a blueprint for Federal and State of Alaska agencies.

4. The AMSA recommendations are compared (table 1.2) with the themes and key issues within the U.S. *National Strategy for the Arctic Region* issued in 2013. There is an excellent match between these two efforts; all of the 17 AMSA recommended actions are mentioned either specifically or in the broader context of a national goal or line of effort.

5. The mandatory International Maritime Organization's Polar Code for ships operating in polar waters will be critical to enhancing the protection of Arctic peoples and the marine environment within the U.S. maritime Arctic and throughout the Arctic Ocean. Since the U.S. has never developed a separate set of Arctic-specific ship rules for its Arctic waters (as have Canada and Russia), the Polar Code to be implemented between May 2015 and 1 January 2017 fills that critical need for U.S. Arctic waters.

6. The U.S. must fully implement in its maritime Arctic the elements (including response infrastructure) of two binding Arctic agreements: the *Agreement on Cooperation on Aeronautical and Maritime Search and Rescue in the Arctic* (2011); and, the *Agreement on Maritime Oil Pollution Preparedness and Response in the Arctic* (2013). The elements and requirements of both Arctic treaties need to be integrated into U.S. strategies and plans for emergency response in the U.S. maritime Arctic.

7. The new *Historical Sea Ice Atlas for Alaskan Waters* is a key strategic resource for evaluating past changes in sea ice within the U.S. maritime Arctic. The database in the Atlas can be used to determine periods and any trends in ice-free conditions around Alaska.

8. The seasonal Arctic sea ice edge in the Bering Sea at its maximum in the spring (March and April) has not changed substantially during the past five decades. Earlier seasons of navigation (in ice-free conditions) in the spring are not anticipated for the coast of Alaska.

9. The seasonal Arctic sea ice edge in the Chukchi and Beaufort seas at its minimum in the autumn (September) has retreated dramatically during the past five decades. Once located in the Chukchi Sea in September in the 1950s, the ice edge has retreated hundreds of nautical miles north of Alaska's coast. Later seasons of navigation (in ice-free conditions) in the autumn are anticipated in the Beaufort and Chukchi seas for offshore drilling operations and coastal resupply.

10. Increases in Arctic marine traffic in the U.S. maritime Arctic and the Bering Strait region during the last five years has been driven by offshore hydrocarbon exploration and the growth in numbers of ships along the Northern Sea Route that are carrying Arctic natural resources to global markets. Hydrocarbon activity in the U.S. maritime Arctic will likely remain the most significant factor in increases in marine operations for at the next several decades.

11. Marine traffic in the U.S. maritime Arctic is directly correlated to the seasonal sea ice conditions in the region. For six months (December to May) the presence of sea ice hinders or prevents the passage of all but a handful of vessels from sailing in these waters. This seasonal pattern of U.S. marine operations is unlikely to change unless federal regulators allow future hydrocarbon exploration and development in ice-covered waters.

12. The vast majority of the marine traffic in the U.S. maritime Arctic consists of tugs, barges, support vessels, federal vessels, research ships, and a handful of small cruise ships. The only large commercial ships in the region are sailing to the terminal at Kivilina (for the export of zinc ore from the Red Dog Mine) and occasional small tankers in Alaskan coastal waters. Future increases in traffic during the next two decades are expected to be drill ships and support vessels related to U.S. offshore hydrocarbon exploration and development.

13. A majority of marine traffic along the Russian coast of Bering Strait consists of tankers, bulk carriers, LNG carriers, icebreakers and ice capable support vessels that are using the Northern Sea Route. Increases in the length of navigation season for the Northern Sea Route (beyond six months) could lead to increases of marine traffic in ice-covered wares of the Bering Sea region during the months of December and June. There are no indications today that the navigation season in the Laptev, East Siberian and Chukchi seas of the Northern Sea Route will be extended beyond six months.

14. Arctic shipping routes are unlikely to revolutionize the global container shipping trade routes. The Northern Sea Route is viewed by Russian and international experts as a seasonal supplement to the Suez Canal route. The NSR will not replace the Suez or Panama canals, but should be viewed as a viable and new seasonal alternative marine route despite key constraints such as: the variability of regional sea ice, shallow water depths in select straits, a high fee system, and lack of marine infrastructure.

15. Hydrocarbon activity in the offshore Russian Arctic is not likely to significantly increase NSR shipping or otherwise impact the U.S. maritime Arctic for the next decade or more.

16. The Northern Sea Route is emerging as a seasonal (summer) Arctic shipping route with significant potential for destinational shipments of Arctic natural resources out of the Russian Arctic and northern Europe to global markets especially in the Pacific. There may also be opportunities for trans-shipment of natural resources (such as iron ore).

17. An opportunity exists for both Norwegian and Alaskan maritime interests to use the Northern Sea Route for trading during summer and as a marine connection between Europe, northern Norway, and Alaska. Enhanced cooperation with Norway on Arctic marine transportation (and international trade) issues will be mutually beneficial.

18. The Aleut Corporation and Adak should establish links with Russian Arctic oil and gas interests in Yamal (particularly out of the new port of Sabetta). The objective would be to explore the potential for oil and gas deliveries along the Northern Sea Route to Adak for possible servicing western Alaska communities.

19. Due to its complex geography, highly variable sea ice environment, short navigation season, and lack of infrastructure, the Northwest Passage (NWP) does not have the same level of interest by global shipping interests and investment as the Northern Sea Route. There are no indicators that large numbers of commercial carriers will be making full transits of the NWP and sailing to/from the U.S. maritime Arctic during the next two decades.

20. The Chukchi Sea Outer Continental Shelf (OCS) has an estimated potential of total oil reserves of 15 billion bbls, approximately double the potential for the Beaufort Sea OCS, and is currently the only lease area in the Alaska OCS with an exploration plan submitted for approval. By comparison, the total production

from Prudhoe Bay during the last 35 years has been approximately 17 billion bbls.

21. For the next six years offshore hydrocarbon development in the OCS will remain in an exploratory drilling phase, if it proceeds at all under the current regulatory regime. These operations are well characterized in Shell's proposed exploratory drilling plan of August 2014. That plan envisions a support armada of approximately 25 supporting ships for two drilling vessels and double the vessel transits out to the drill ships during operations.

22. Canadian-driven exploratory oil and gas drilling and its support marine operations (in the Beaufort Sea) do not appear an immediate or significant marine traffic factor for the U.S. maritime Arctic within the next ten years.

23. Exploration and drilling ashore in the Arctic petroleum Reserve would likely have modest impact on marine traffic as plans include overland access to position equipment (seasonal ice roads) for pipeline construction. Unlike the Trans-Alaska Pipeline System (TAPS) in the early 1070s, an overland corridor now exists for much of the logistical requirements (along the Dalton Highway).

24. Assuming eight platforms in production operations in the Chukchi Sea OCS in 2025, and their 15 subsea interconnected templates (as a benchmark), with a comparison of the support fleet requirements in the Shell 2014 plan, approximately 100 support vessels could be in operation in the lease areas. This would translate to approximately 100 Bering Strait seasonal transits. These estimates provide some measure of the future level of traffic associated with offshore development in the U.S. maritime Arctic.

24. The necessary legal and structural preconditions required to set the stage for increased economic development in the U.S. maritime Arctic are not yet in place.

25. The U.S. maritime Arctic is essentially void of crucial marine infrastructure. Substantial investments and future public-private partnerships will be essential to

provide adequate funding for a robust safety net and for facilitation of regional economic development.

26. A major Arctic port in western Alaska is a key to regional economic development, servicing the offshore hydrocarbon industry, export of Alaska's natural resources/wealth to global markets, and connections to the new maritime Arctic. Intermodal links (road, rail, air) to those resources are essential to the economic viably of an Arctic port in western Alaska.

27. Hydrography and charting of the U.S. maritime Arctic is critical to safe navigation, and for facilitating coastal development of ports and navigable waterways. NOAA's federal budget for hydrographic surveys, shoreline surveys, and geodetic referencing in Alaska is essential to America's Arctic environmental and economic security.

28. Strengthening and investing in the monitoring and surveillance of marine traffic in the U.S. maritime Arctic and Bering Strait region is of paramount importance. A critical component of marine domain awareness in the region is the Marine Exchange of Alaska which derives some operating costs from the U.S. Coast Guard and State of Alaska. Two key users and stakeholders of the Exchange's real-time database. The region requires improved communication networks, effective tracking technologies, improved information processing tools, enhanced AIS-satellite monitoring, and additional AIS land-based receiving sites.

29. The future of U.S. icebreaking operations will likely require a mix of federal ships operated by the Coast Guard (principally for U.S. sovereign presence, law enforcement, emergency response, and research), and commercial icebreakers in support of economic development of the U.S. Arctic (supporting offshore hydrocarbon exploration and the occasional escort of commercial carriers). Most of the modern Arctic commercial carriers are icebreakers in their own right and are designed for independent operations, a finding of the Arctic Marine Shipping Assessment. Few of these modern polar ships will require routine icebreaker

escort in the U.S. maritime Arctic, but assistance might be required in emergency situations.

30. Arctic environmental observations are crucial to understanding the changing regional climate and supporting marine operations. Investment in the Sustaining Arctic Observing Network (SAON) by the U.S. should be considered a long-term investment in enhancing marine safety and environmental protection. A multi-national, coordinated network designed for monitoring regional climate change *and* local environmental conditions will have synergies and direct value to a myriad of operational requirements to increased Arctic marine traffic.

31. The international workshop held during the project concluded that a number of preconditions must exist for investment in Alaska: broadband telecommunications; regulatory certainty; public and private partnerships; year-round all-weather airports statewide (in place); tax structures and incentives; education and workforce training; enhanced working relations with Canada and Russia; improved State and federal working relationships; and, a major oil discovery in the Chukchi Sea or Cook Inlet (a catalyst for investment).

32. Federal support for Arctic marine infrastructure is anticipated to be limited for the next ten years or more. Nonetheless, there is much active planning on key topics such as Arctic deep-draft port development, maritime safety, and information infrastructure. All Arctic marine infrastructure investments by the federal government will have direct influences on the long-term economic development of America's Arctic.

33. More capacity for oil spill response capability must be established north of Dutch Harbor. Focus should be on the near-shore environment of western Alaska. Response systems must utilize local knowledge and hold enhanced training sessions in coastal communities. Response equipment must be strategically located in coastal ports and communities, especially in areas of current and future offshore hydrocarbon development and increased marine traffic.

34. Only offshore Arctic hydrocarbon exploration and development will likely drive significant expansion of a skilled maritime workforce. The State of Alaska support of OCS development is a key arena for intervention to expand the economic opportunities and the need for a skilled workforce. One economic analysis of OCS development in the Chukchi and Beaufort seas indicated 35,000 new jobs could be created over the next 50 years.

35. The existing population in Alaska cannot meet the potential demand for a skilled workforce. The existing population available for training is insufficient to meet the need for the replacement of an aging workforce, or to capture skilled OCS jobs if and when they emerge.

36. The Alaska Arctic Policy Commission report makes numerous references to the need for a future maritime workforce to support spill response, offshore development, search and rescue, and marine navigation. Five key industries have been identified where maritime infrastructure requires Arctic training and expertise: commercial shipping, commercial fishing, offshore hydrocarbon development, the cruise ship industry and mining.

9.0 Recommendations of the Project

Near-term (2015-2023)

1. *U.S. Coast Guard*: Working with the State of Alaska fully implement the IMO Polar Code in the U.S. maritime Arctic meeting the 1 January 2017 date imposed for the Code to enter into force.

2. *State of Alaska & University of Alaska*: Develop strategic partnerships with commercial and research/university interests in Norway and Singapore related to offshore development, emergency response, and Arctic marine transportation issues.

3. *Alaska's Fishing Industry*: Explore the economic opportunities for trade with Europe by shipping products during the summer navigation season along the Northern Sea Route.

4. *Aleut Corporation and City of Adak*: Enter into discussions with Russian gas authorities in the Yamal to explore the economic feasibility of shipping gas to Adak along the NSR in summer for further distribution to communities in western Alaska.

5. *State of Alaska*: Establish a Task Force, including industry and federal representatives, to explore the funding of Arctic marine infrastructure using all forms of public-private partnerships. Include in the discussions strategies for funding an Arctic port.

6. *State of Alaska*: Fund and conduct a comprehensive indigenous marine use survey as called for in the Arctic Council's Arctic Marine Shipping Assessment. Compile all available data from local communities, industry, State agencies, and Federal agencies.

7. *State of Alaska*: Establish a position for an Arctic marine transportation coordinator on the Governor's staff or within a State of Alaska Department. The

coordinator would track Arctic transportation trends and develop strategies for Arctic marine infrastructure working with a host of stakeholders and actors including Federal agencies, industry and foreign partners.

8. *NOAA/NOS*: Work with the State and other Federal agencies to ensure that hydrographic survey plans take in account the needs of Arctic coastal ports and communities. Regional marine charts are crucial to the facilitation of economic development in many coastal communities.

9. *State of Alaska*: Determine long-term funding to enhance marine domain awareness in Alaska's waters. One element would be to continue as a user and co-funder of the Marine Exchange of Alaska. Future marine traffic data will be critical to the long-term environmental economic security of the State.

Long-term (2024-2035)

1. *State of Alaska*: Develop a comprehensive strategic plan for intermodal transportation networks to link with an Arctic port that focuses on the export of Alaska's natural resources (offshore and onshore) to global markets.

2. *Maritime Industry and State of Alaska Partnership*: Establish a joint task force to study the opportunities and economic benefits of using the Northern Sea Route for longer seasons of navigation for trade and the movement of natural resources during the summer. Invite the participation of Russian icebreaker companies and administrators to work with interested parties in enhancing trade to/from Alaska.

3. *State of Alaska and Offshore Industry Partnership*: Develop a joint strategy for training workers for the potentially expanding offshore hydrocarbon developments. Involve all State training programs and the University of Alaska system.

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Alaska and the New Maritime Arctic

Conference Report

Anchorage , Alaska • November 6-7, 2013

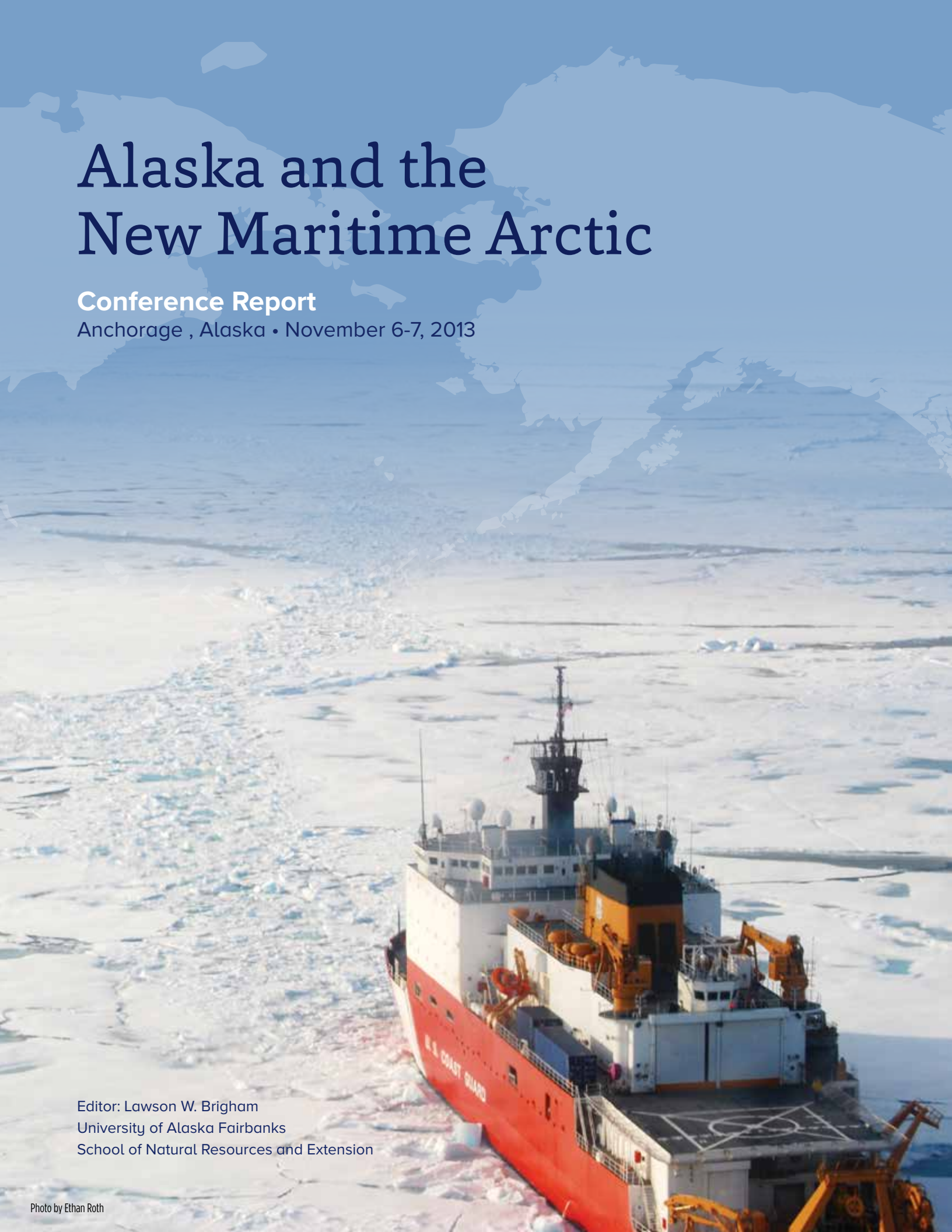

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Table of Contents

2 Introduction

3 Welcome and Conference Overview

4 Future Arctic Sea Ice, Maritime Safety, Access and Environmental Conditions

5 Economic Impacts of Arctic Shipping: Development and Trade in a Future Arctic

6 Keynote Address: Morten Hoglund on Norway's High North Development

7 A Circumpolar Arctic Marine Transportation and Logistics System

8 Future Prospects of Arctic Sea Routes: Short to Medium Term Scenarios

9 Northern Potential – Alaska's Strategic Position in the Maritime Arctic

10 Key Informants – Investment, Infrastructure and Planning Efforts

11 Keynote Speaker: Alaska's Economic Development and Trade in a Future Arctic, DCCED Commissioner Susan Bell

Breakout Sessions:

- 11 A) The Future of the NSR and Shipping Natural Resources
- 14 B) Future Arctic Trans-shipment Possibilities
- 16 C) Marine Safety and Environmental Protection
- 18 D) Potential Arctic Infrastructure Investment Opportunities

21 Closing

21 Select and Key Conference Outcomes

22 Appendix A: Agenda

24 Appendix B: Link to Presentations

25 Appendix C: List of Participants

Acknowledgements

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Alaska and the New Maritime Arctic

Conference Report

Anchorage , Alaska • November 6-7, 2013

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Introduction

The *Alaska and the New Maritime Arctic Conference* held in Anchorage on 6-7 November 2014 attracted maritime experts from Norway, Canada, Singapore, Korea, Russia and the United States. Senior Norwegian Government and commercial participants indicated Norway's interests in linking with Alaska for trade and port development. The University of Alaska Fairbanks (UAF) School of Natural Resources and Extension, the Institute of the North (ION) and the Centre for High North Logistics (Norway) organized the event, with The Royal Norwegian Embassy (Washington, DC) and Alaska Department of Commerce, Community and Economic Development (DCCED) as sponsors.

The conference focused on the emerging maritime Arctic and development of partnership opportunities between Norway and Alaska. Discussions included: use of Russia's Northern Sea Route; trans-shipment and destinational shipping opportunities for natural resources; future Arctic offshore development; infrastructure investment; and, marine safety and environmental protection issues.

This report summarizes the workshop presentations, discussions and interactive breakout sessions, and includes the workshop agenda, list of participants, and a link to the full presentations. After the Welcome and Conference Overview, the document is organized in nine major sections, as listed in the agenda:

- **Future Arctic Sea Ice, Maritime Safety, Access and Environmental Conditions**
- **Economic Impacts of Arctic Shipping: Development and Trade in a Future Arctic**
- **Keynote Address: Morten Hoglund on Norway's High North Development**
- **Future Prospects of Arctic Sea Routes: Short to Medium Term Scenarios**
- **Northern Potential – Alaska's Strategic Position in the Maritime Arctic**
- **Key Informants – Investment, Infrastructure and Planning Efforts**
- **Breakout Sessions:**
  - **The Future of the NSR and Shipping Natural Resources**
  - **Future Arctic Trans-shipment Possibilities**
  - **Marine Safety and Environmental Protection**
  - **Potential Arctic Infrastructure Investment Opportunities**
- **Keynote Address: Commissioner Bell (DCCEP) on Alaska's Economic Development and Trade in a Future Arctic**
- **Closing**

Welcome and Conference Overview

UAF Chancellor, Brian Rogers, was joined in a welcome by Alaska's DCCED Commissioner, Susan Bell, and the Norwegian Consul General, Hilde Janne Skorpen. Chancellor Rogers emphasized the importance of education in the Arctic and the roles special Arctic conferences such as this one play in building international relationships and partnerships. He also stressed the key linkages of Alaska's economic development to new opportunities in an emerging maritime Arctic with greater access. Commissioner Bell spoke to the importance of strategic planning for a future Arctic. Due to the complexity of decision-making in the Arctic, she said Alaskans must strengthen all communication efforts within the state and with other Arctic nations to understand the broad range of opportunities, responsibilities, and challenges. Consul General Skorpen focused on enhancing U.S. and Norwegian Arctic cooperation so we can better manage the risks inherent in Arctic maritime developments. Only through international cooperation can the Arctic be developed in a sustainable manner.

Arctic Marine Shipping Assessment Scenarios Matrix

Climate change, globalization and increased maritime activity along Russia's Northern Sea Route have raised the profile for Arctic resource development, safety and environmental protection, and international trade. Norway has a long history of exploring the Arctic, and has experience with successful models of public-private partnerships. Alaska and Norway share key challenges to Arctic development, including climate change, environmental concerns, lack of infrastructure, inadequate mapping, limited communications technology, and new investment.

UAF Professor, Dr. Lawson Brigham, and Felix Tschudi, Chairman of the Centre for High North Logistics in Norway provided introductory remarks. Both referenced the Arctic Council's Arctic Marine Shipping Assessment (AMSA) as a key document indicating that Arctic natural resource development is the major driver of recent traffic in the region. AMSA provides an overview of the current global interest in Arctic marine operations including new non-Arctic state observers to the Arctic Council (such as China, Japan, Korea and Singapore) and a key review of Arctic marine infrastructure that is lacking in most of the region. AMSA most importantly is a policy framework for the Arctic states in addressing Arctic marine safety and marine environmental protection issues. Despite the lack of physical marine infrastructure in much of the Arctic, the relatively stable regional situation presents an opportunity and need for substantive cooperation. Next steps are greater awareness of the requirements, and more shared infrastructure investment in sustainable ports, observing systems, communications, navigation systems, and hydrography/charting.

Felix Tschudi said the need for shared information led to the founding of ARCTIS, Arctic Resources & Transportation Information System. The ARCTIS Database (http://www.arctis-search.com),created and operated by the Centre for High North Logistics (CHNL) in Kirkenes, Norway, is a gateway to knowledge for businesses, governments, and the educational community including information on shipping, transportation infrastructure, logistics and non-living resources in the Arctic. Dr. Brigham also mentioned there is a critical need to pass shipping traffic data in real-time among the Arctic states and across borders. A new Arctic state agreement should be pursued to fill this gap in the flow of Arctic marine information. This forum and other exchanges are critical venues to discuss the benefits and risk management required for sustainable development.

1 Future Arctic Sea Ice, Maritime Safety, Access and Environmental Considerations

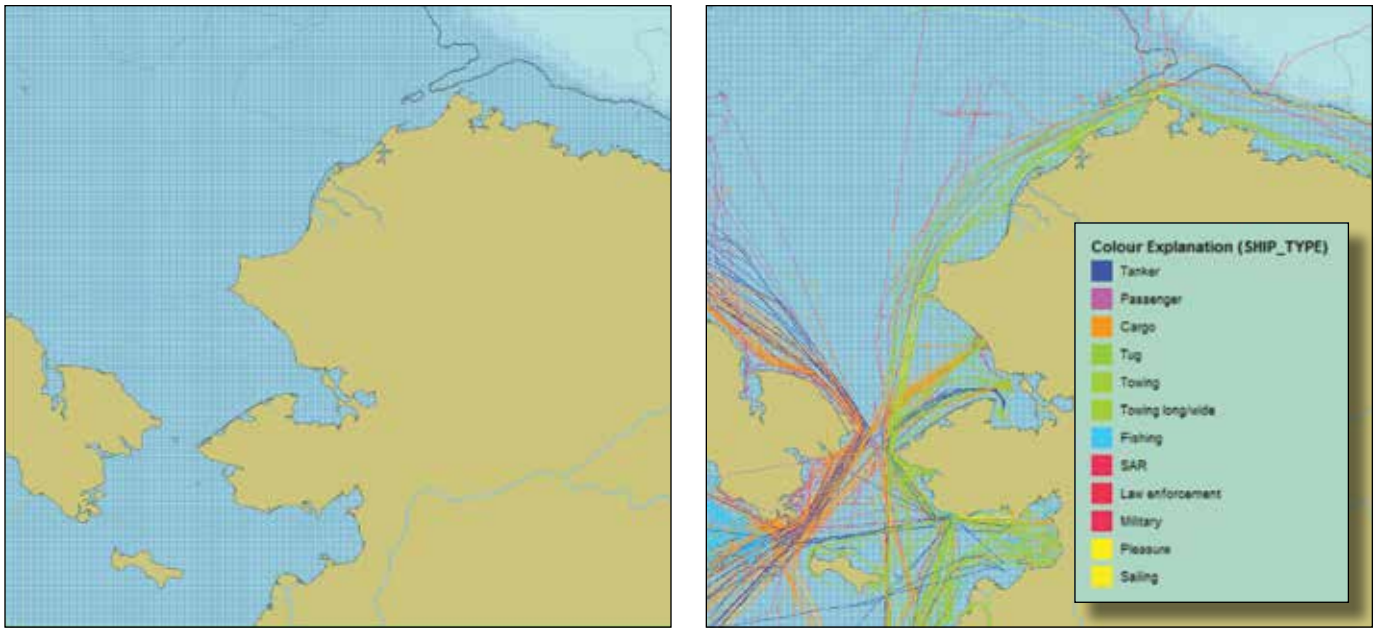
Margaret Williams, of the World Wildlife Fund, chaired this panel to look at the realities of NSR traffic, vessel tracking data and technology, and risk management for ocean resources.

- **Lawson Brigham** (UAF) presented a brief overview of changing Arctic sea ice conditions. The retreat of sea ice increases Arctic marine access during summer and provides potentially longer seasons of marine navigation. Maps of shipping data through the Bering Starit indicate the seasonal nature of Arctic marine operations around Alaska: there was no marine traffic in the region from January to May 2013, and significant traffic on both sides of the region during June through November 2013.

- **Scott Stephenson**, a UCLA geographer, discussed Russia's Northern Sea Route (NSR) in terms of traffic dating from the 1930s through 2012, and navigation constraints related to ice and depth of water for navigation. Considerable uncertainty remains regarding the length and variability of the NSR navigation season. Larger deep-draft ships sailing north of the New Siberian Islands may experience shorter summer navigation seasons.

- **Ed Page**, Executive Director of the Marine Exchange of Alaska, spoke about his non-profit maritime organization's establishment to provide information for secure, efficient and environmentally responsible operations. Real-time information is gathered through vessel-tracking at 100 sites by land and satellite, and shared with the marine industry, government and NGOs. The State of Alaska and U.S Coast Guard contribute partial funding to the Marine Exchange. He showed traffic data about what is really happening in the Bering Strait, indicating that the area is wide, deep and fairly safe in light of a limited numbers of ships.

- **Andrew Hartsig**, of the Ocean Conservancy, noted that Arctic shipping is of concern primarily because it is new, requiring attention to risk management and safety. The area is rich in migratory subsistence resources. Some mitigation could originate in legislation and regulation such as at the International Maritime organization. Other measures could be voluntary implementing of best practices of communications and ship routing.



Marine Exchange of Alaska

Maritime traffic in the Bering Strait & northwest Alaska region. Left: 1 January to 31 May 2013. Right: 1 June to 30 November 2013.

2 Economic Impacts of Arctic Shipping: Development and Trade in a Future Arctic

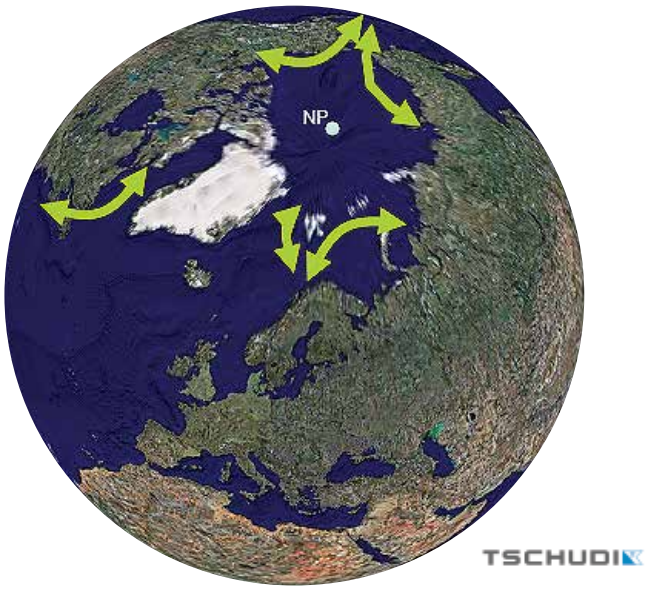
DCCED Deputy Commissioner, **Roberta Graham** chaired this panel exploring the economic realities and opportunities of Arctic shipping. Climate change and new technology will open the Northern Sea Route for regional destination shipping, and possibly trans-shipment with Asia. The development of Arctic natural resources (oil, gas and minerals) will be the largest driver of economic activity. Arctic nations must balance utilization of the NSR with environmental impacts and society's needs, noting the lack of infrastructure and safety response systems.

- **Hugh Short**, CEO of Pt Capital in Anchorage, discussed future Arctic development in partnership with local owners and stakeholders such as the Alaska Native Corporations. The interest in the Arctic is growing and so is the demand for investment. Short anticipates over $100B of Arctic investment over the next decade to respond to the 7.1% historical growth rate over the last twelve years. He outlined significant projects anticipated within the next thirty years, including gold, copper, energy transmission, oil and gas, and ports. Pt Capital works to overcome existing obstacles to market development, including rigid local politics and culture, lack of coordination and inaccessible capital.

- **Lorraine Cordova**, lead economist with the U.S. Army Corps of Engineers (Alaska Division), outlined economic development related to the Corps' and State of Alaska's current efforts to develop an Arctic Port System and deep-draft port. This 3-year study process is to be completed at the end of 2015. The major reason for such a port is future development of Alaska's natural resources and facilitating export from a deep-draft port to global markets. Increased vessel traffic coupled with limited infrastructure in northwest Alaska increases risk of accidents and emergency response time. Current analysis has highlighted the value of port development in the region of Nome and Port Clarence, potentially connected by land via the 70-mile Teller Highway. The study is balancing the overlapping interests of regional prospects for economic development and community resupply, spill response, emergency management, U.S. Coast Guard presence and national security concerns. More information can be found at: http://www.poa.usace.army.mil/Library/ReportsandStudies/AlaskaRegionalPortsStudy.aspx.

- **Dr. James Kendall** is Regional Director of the Alaska Outer Continental Shelf (OCS) Region within the Bureau of Ocean Energy Management (BOEM) in the U.S. Department of the Interior. BOEM's role is to manage OCS resources balancing both economic and environmental issues. There is an estimated 15 million barrels of oil in the Chukchi Sea (for comparison, the Trans-Alaska Pipeline, since opening in 1977, has carried 16 million barrels of oil). BOEM has invested $400 million in research in the region. Potential polar marine routes could lead to infrastructure development responsive to rising global demand for petroleum products. OCS activity in the Beaufort and Chukchi Seas is anticipated to grow and Arctic regulatory standards need to be refined.

- **Felix Tschudi**, CEO of the Tschudi Shipping Company in Norway, spoke to "The Importance of Northern Scandinavia and Russia in Future Arctic Resource and Trade Developments." Logistics is key in the high north of Norway, and the NSR will provide a new opportunity for Tschudi and others. Regional destinational shipping serving resource development will be more active as commodity prices rise and climate change affects the ability to conduct business in the Arctic. Tschudi demonstrated significant savings of 16-20 days when comparing shipment through NSR versus the Suez Canal, as



Regional destinational shipping routes in the Arctic.

long as there is minimal or no sea ice so adequate ship speeds can be maintained. He also highlighted the existing international energy cooperative ventures in the Barents region between Russian and Norway, noting that cross-border regional solutions are required for effective Arctic logistics. In addition to infrastructure and the development of emergency response systems, future challenges include the development of administrative processes, common regulations and enhanced human capital.

- **Dermot Loughnane**, CEO and Master Mariner with Tactical Marine Solutions of Canada presented "Circumpolar Resource Development Projects' focusing on Arctic oil and gas, and mining. His firm maintains a database to assess shipping feasibility for new resource development projects. Mines are potential catalysts for development of tidewater ports. Greenland is in an active stage of mining development for uranium and zinc. All of this development could spur destinational shipping out the Canadian Arctic and Greenland to global markets.

- **Hlynur Gudjonsson**, Icelandic Consul and Trade Commissioner for North America demonstrated the competitive advantages of Iceland in terms of its location, infrastructure, energy supply, social cohesion and trained labor force. Noted in a key point is that Iceland and Alaska share several, similar economic drivers and relationships to the sea. He mentioned the importance of the Arctic Council as the premier Arctic forum and the establishment of a circumpolar business forum as an essential component to Arctic cooperation. Iceland is dedicated to improved cooperation between governmental and business actors in Arctic affairs.

3 Keynote Speaker: Morten Hoglund, Norwegian High North Policy Development

Morten Hoglund, Special Advisor for Arctic Affairs within the Norwegian Ministry of Foreign Affairs, spoke to the significance of the humans in the future of the Arctic. He noted that there is seven times more maritime area than land. 80-90% of Arctic shipping is located in Norwegian waters which are generally ice-free. Fishing is the traditional industry of Norway, with record cod stocks in its coastal seas. Norway invests in the Arctic in many areas including: education, ice-class research vessels, helicopters for search and rescue (SAR), technology, and the funding of the Arctic Council secretariat in Tromso.

Intergovernmental cooperation is essential for Norway, including the new Arctic Council non-Arctic state observers from China, Japan, India, Italy and Singapore (added to those earlier observers: France, Germany, Netherlands, Poland, Spain and the United Kingdom). Russia is a key relationship for Norway. Exchange with Russia includes cooperation with the military, on environmental issues, as well as knowledge sharing regarding energy development in the Barents Sea. Record numbers of Russian students are studying in Norway, and there is a joint effort to fund an Arctic satellite communication network in the High North. This model might be of use to Alaska and the United States.

There is a fine line between national security, the desires of indigenous peoples, protecting the environment, and economic prosperity. The basis of maritime policy requires research, education, an emphasis on safety, and political alignment within each country, and strong international relationships.

Helge Hansen / Statoil

LNG terminal near Hammerfest, northern Norway, serving the Barents Sea offshore.

Keppel Offshore and Marine, Singapore

4 A Circumpolar Arctic Marine Transportation and Logistics System

Bruce Harland, Vice President with Crowley Marine chaired this panel to address the challenge of developing transportation and logistics systems to support Arctic natural resource development. This challenge has led to the development of new technology by Keppel Offshore and Marine (and others), to a model for resource infrastructure corridors along the west coast of Alaska by Metzger, and to the assessment of potential shipping opportunities for the port of Kirkenes in Norway by Henrik Falck of Tschudi Shiping.

- **T. O. Cheung**, with Keppel Offshore and Marine, described his company's response to market demands for technology compatible with Arctic conditions. Singapore has established itself as a center of excellence for the building of innovative offshore drilling rigs, vessel conversion, and ship repair. The firm has demonstrated its expertise internationally, including exploration rigs in the Caspian Sea, production platforms in Brazil and Russian icebreakers supporting oil exploration and development.

- **Dr. Andrew Metzger,** with the University of Alaska Anchorage outlined his assessment of current and future infrastructure in Alaska. With a focus on northwest Alaska, Metzger illustrated the limited available shore-side support facilities, noting deficiencies in berthing, lodging, water/wastewater, and closeness to resource development. The combination of retreating Arctic sea ice and Arctic globalization provides a basis to reconsider the transportation system. Rather than speaking to infrastructure at specific sites, Metzger introduced three potential shipping corridors linking resource development to the sea: northwest, North Slope, and western Arctic. Potential corridor assets along Alaska's west coast were defined, including an integrated rail, pipeline, energy and communications platform; a lightering terminal, and ArcMOB, a mobile offshore base as developed by the US Navy 1996-2001.

- **Henrik Falck** with Tschudi Shipping from Norway spoke about a potential for trans-shipment in the port of Kirkenes in northern Norway. Its location and deep water point to consideration as the western entry point for the Northern Sea Route, or more broadly the Northeast Passage. Major trade now ships through the Suez Canal. The NSR does not have the volume of goods or the ice support equipment required to compete with the Suez Canal. Falck noted the variable of 'direction' associated with logistics. Shipping from the Atlantic to the Pacific is at a rate of $15,000/day; from the Pacific to the Atlantic, it is only $1000/day. This fact highlights the potential of LNG development in Yamal. Another specific opportunity is trans-shipment of lead-zinc from the Red Dog Mine in northwestern Alaska. With appropriate polar class tonnage, the costs of shipping could be reduced. Fish products provide another opportunity for trans-shipment of mackerel from Norway through Dutch Harbor to the Far East. Alaskan fish could be transported from Dutch Harbor to Europe potentially in the summer along the NSR.

- **Tim Keane** is Arctic operations manager for Fednav in Canada. This firm is the largest dry cargo-shipping group in Canada, including the largest fleet of ice-classed commercial bulk carriers. Customers included the Red Dog Mine in northwest Alaska (zinc and lead products). Fednav maintains historic data on temperature, ice conditions and shipping capacity. Keane acknowledged that the Arctic will never be totally ice-free, and that the Suez Canal route carries 700 times more cargo than the NSR and Northwest Passage. Over the last 60 years, Fednav has made over 800 voyages, carrying over 33 million tonnes of cargo without any pollution incidents. Keane notes that the future of Arctic shipping is very likely to be destinational shipping, the seasonal movement of natural resources out of the Arctic to global markets.

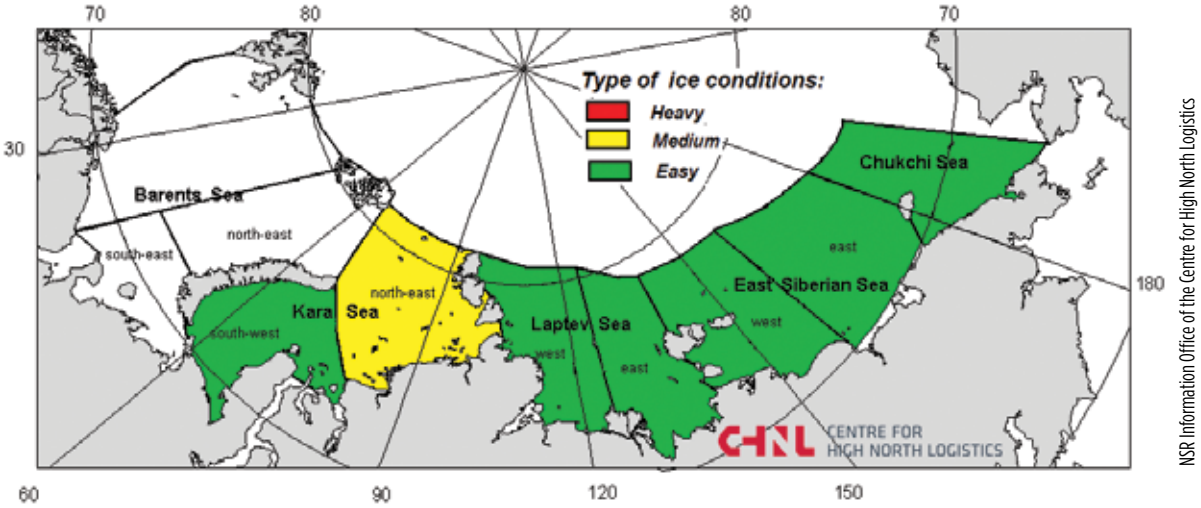
5 Future Prospects of Arctic Sea Routes: Short to Medium Term Scenarios

Dr. Lawson Brigham (UAF) chaired this panel to look more closely at what is required if seasonal traffic is to increase: the need for regulation by the International Maritime Organization (IMO Polar Code); ice-class vessels; SAR and emergency systems to support safe navigation; environmental observing networks; and, marine infrastructure including improved Arctic charts. While there are a significant number of visions for future Arctic marine traffic, there have very few comprehensive economic analyses that would indicate viable Arctic routes.

- **Sergey Balmasov** works with the Centre for High North Logistics (CHNL) at its NSR Information Office in Murmansk. Russia has reviewed its NSR regulations to focus on pollution prevention and increase safety. The NSR administrative procedures to obtain permits have been simplified in order to encourage increased activity and partnerships with Russia, and proposals have been made to modify the tariff system. Russia has also revamped its ice-class codes required for vessels to navigate the NSR. The CHNL maintains extensive information on ice conditions and forecasts. Icebreaker support is no longer mandatory in some NSR regions depending on ice conditions. However, for full NSR transit passage, icebreaker support would be required in most cases.

- **Stan Jones** presented for the Office of the Federal Coordinator, Alaska Natural Gas Transportation Project. Jones noted the significance of the NSR in light of its shorter length (without ice), proximity to hydrocarbon assets in Yamal, Russia, and increased accessibility due to ice retreat. However, increased activity may be limited for many years, even with the energy-hungry Asian markets. Alaska's Cook Inlet is significantly closer to Japan than Yamal (3800 miles to Yokohama from Alaska vice 7800 from Yamal), and, critically, this marine route is never closed due to ice. Seasonality of navigation is again a factor in determining future use of the NSR.

- **Captain David Snider**, Vice President of The Nautical Institute was unable to attend and his paper on future traffic in the Northwest Passage (NWP) was delivered by Dermot Loughnane. The NWP is a maze of passages, is remote and has limited marine infrastructure for commercial operations or emergency response. Importantly, there are no repair and substantial resupply facilities between Dutch Harbor, Alaska and Nuuk, Greenland (none for the entire NWP).The NWP will be the last ice-free Arctic region in summer and year-to-year sea ice conditions will remain uncertain. International traffic will be limited. Any future traffic will require the assistance of



NSR Information Office of the Centre for High North Logistics

Sea ice conditions projected for late summer and second half of the 2013 navigation season (September and October) along the Northern Sea Route. Such projections are provided by the Arctic and Antarctic Research Institute for distribution by the NSR Information Office (Centre for High North Logistics).

skilled navigators and sufficient ship ice class. Today there are no consistent standards for training for ice navigators and polar mariners. The Nautical Institute is working to define the training and performance standards for a certified ice navigator.

- **Dr. Sungwon Hong** is Director of the Institute of Arctic Logistics at Youngsan University in Busan, Korea. The Institute is analyzing the opportunities of shipping in the NSR. Most of the cargo through the NSR has been Russian gas condensate and oil, and iron ore from Norway. Korea is looking for seasonal cargo opportunities, noting that it has no ice-class vessels, but does have broad shipping experience. Potential industrial and cargo opportunities using the NSR could be: shipbuilding; the shipping of marine equipment and offshore equipment; providing marine services; the shipping of automobiles to European markets; the export of jet oil and diesel; and, the import of gas condensate, coal and iron ore. Korea is looking to become a strategic hub in Asia. One necessity is the securing of cargo under long term contracts.

6 Northern Potential – Alaska's Strategic Position in the Maritime Arctic

The Honorable Mead Treadwell, Lieutenant Governor for the State of Alaska, challenged the participants to dream as a precondition for manifesting the possibilities of the Arctic. He spoke to the history of Russian domestic use of the NSR for much of the later half of the 20th century. Alaskans and Arctic nations see the value, but many in the United States do not yet share this vision.

The Lieutenant Governor posed four questions: What do we have to do to make this ocean safe, including subsistence food security for indigenous communities? How can we leverage this new ocean to bring lower energy costs to Alaskans? Can we take advantage of the summer Arctic marine routes to make Alaska products more competitive in global markets, such as Red Dog ore and northwest Alaska coal? How can we leverage Arctic shipping to create jobs for Alaskans? Much work is underway to develop safe, cheaper energy, new markets and new jobs. Specific recommendations included use of the tank farm at Adak, container interchange in Dutch Harbor, positioning for polar shipping as in polar air cargo, port-twinning and spill response. The U.S. Coast Guard needs to play a greater role in Arctic marine safety, including the acquisition of more icebreakers. Communities also need to be engaged in Alaska's tie to this maritime Arctic.

- **Felix Tschudi,** Chairman of the Centre for High North Logistics, discussed the role of investing in infrastructure as a precondition for the development of mining. The iron mine in Kiruna led to the building of roads and support facilities that now drive further mining. Administrative infrastructure is needed as well as physical roads, ports and railways. An educated work force and enhanced human capital are key Arctic challenges. CHNL met with countries, shipping and insurance companies, and others to look at the business case for the NSR. It was determined that the tariffs are too high to compete with Suez Canal. Insurance and freight costs are considerations as well as fuel incentives to attract the shipping traffic to the Arctic and NSR.

Institute of Arctic Logistics at Youngsan University in Busan, Korea

7 Key Informants – Investment, Infrastructure and Planning

Sarah Barton, President of ConsultNorth, chaired this panel looking at the planning and investment needed to manifest the potential described by Mead Treadwell, Felix Tschudi and the other presenters.

What are the factors that can lead the future Arctic community to thrive? Considerations are: economic incentives; willing settlers and new residents; a stable regulatory system; viable trading partners; friendly neighbors; and, beneficial climatic changes.

- **Rear Admiral Trond Grytting,** Defense Attache at The Royal Norwegian Embassy (Washington DC), has been active in building good relations between military officials in Norway and northwest Russia, including Norway's relationship with the Russian Northern Fleet in Murmansk. Norway and Russia engage in joint training exercises, regular meetings and communications. Norway's military supports the High North Strategy, and the Norwegian Coast Guard (a component of the Navy) has one icebreaker and five ice capable ships. Their Coast Guard is responsible for fisheries law enforcement, search and rescue, oil recovery response, ship inspections (60% are foreign flag ships) and cleanup support of nuclear and contaminated environments. The Norwegian military is focused on cross-sector cooperation and the cooperation Norway has with Russia will support further Arctic development.

- **Captain Greg Sanial** is Chief of Response for District 17 of the U.S. Coast Guard in Juneau, Alaska. The U.S. Coast Guard Arctic Strategy has three pillars: improve awareness; modernizing governance; and, broadening partnerships. The Coast Guard is responsible for all coastal waters plus the U.S.200-mile Exclusive Economic Zone. The roles include: ensuring marine safety, enforcing fisheries laws, and protecting US sovereignty. Shipping through the Bering Strait will require new partnerships with the Russians and others. The greatest challenge today is the lack of Arctic marine infrastructure, from icebreakers to shore support. Positioning of capacity is primarily in Dutch Harbor, Kodiak and seasonally in Barrow. Communications are critical, requiring development of fiber optic and satellite systems to implement the requirements of the Arctic state SAR agreement.

Future marine routes to global markets out of the Port of Sabetta (Yamal Peninsula) in the Russian Arctic.

- **Petter Meier** is Deputy Director General for the Norwegian Ministry of Fisheries and Coastal Affairs. He addressed the Norwegian approach to ensuring future marine safety and environmental protection. New measures are being implemented to respond to increased traffic including: traffic separation schemes, vessel traffic service, ship reporting systems, improved monitoring (AIS), and pilotage services. The Pollution Control Act defines preparedness roles for private parties, municipalities and the national government. International cooperation is key to preparedness in the future Arctic.

- **Sergey Balmasov** (NSR Information Office) presented an assessment of the competitive advantages of using the NSR versus the Suez Canal. The time saved can be significant if there is minimal sea ice, but the volumes between the two routes are not comparable. Activities along the NSR are increasing with active development and export of oil, gas and minerals. Future development will be influenced by internal factors, such as ice conditions, infrastructure, legislation, tariffs and administration. External factors include the cargo base, freight market, fuel prices, geopolitics and the availability of large ice-class vessels. There is a need for reliable navigation data using satellite communication and shore-based stations. Sabetta on the Yamal Peninsula is the new port being developed for export of liquefied natural gas (LNG). Three new nuclear and two diesel icebreakers are being built. Russia is developing ten SAR centers along the coast, including rescue vessels and air support.

8 Keynote Speaker: Alaska's Economic Development and Trade in a Future Arctic, DCCED Commissioner Susan Bell

Commissioner Bell painted a picture of a thriving future U.S. Arctic in Alaska, including: natural resource development, sustainable and well-connected communities, global leadership in stewardship, world-class education, thriving indigenous cultures, ample infrastructure and fiscal stability. Alaska is taking significant steps to realize this vision including: oil and gas development as well as renewable energies such as Susitna Watana Hydro; commercialization of technology to respond to energy needs; partnering with USACE on development of an Arctic Port System; state ownership of the Alaska Ship and Drydock in Ketchikan; the state-owned Alaska Railroad statewide strategic rail plan; state-supported roads to resources; and, expanding communications systems including fiber optic affordable broadband. As mentioned throughout the conference, the essence is the balancing of economic development with safety and environmental protection. This requires good information, for example from the University of Alaska and the Marine Exchange of Alaska, and strengthened public-private partnerships. Alaska needs to scale appropriately and clearly define priorities for the Arctic to make best use of public and private assets.

9 A Breakout Sessions: A) The Future of the Northern Sea Route and Shipping Natural Resources

Dr. Lawson Brigham (UAF) facilitated this breakout session. The Northern Sea Route (NSR), in contrast to the Northwest Passage, is the Arctic route with significant potential for commercial shipping during a summer navigation season. Few in the marine industry believe that *regular* and *reliable* trans-Arctic voyages with containers along the NSR will be economically viable as a major international route. However use of the NSR is ongoing today with the movement of Arctic natural resources (oil, gas and hard minerals) out of Russia and northern Norway to global markets. Most traffic activity on the NSR is internal or domestic shipping (known as cabotage), and a small percentage is international or trans-arctic. Sergey Balmasov's presentation showed that significant activity is internal in northwest Russia and use is made of the NSR for supply of northern communities along the entire Russian maritime Arctic. It is important to note that year-round navigation to the port of Dudinka on the Yenisey River (serving the industrial, mining complex at Norilsk) has been maintained since the 1978/79 winter navigation season.

The emerging mandatory IMO Polar Code for ships operating in polar waters will have ramifications for all commercial ships intending to use the NSR and all Arctic routes. The Polar Code will have two sets of amendments to the SOLAS (safety of life at sea) and MARPOL (marine pollution) IMO conventions. The elements of the Code should be adopted by spring 2015 with an implementation period though 2017.

Alexander Skryabin/WWF Russia

The tanker *Two Million Ways* has sailed the Northern Sea Route carrying gas condensate from Murmansk to South Korea.

Despite potential challenges, the group determined three factors that may influence future traffic on the NSR:

A Fundamental Drivers of NSR Shipping
B Potential Connections to Alaska
C Environmental and Safety Issues

Fundamental Drivers of NSR Shipping

* **Natural resource development** is the major driver of Arctic marine transportation as identified in the Arctic Council's Arctic Marine Shipping Assessment released in 2009, and other studies. The non-renewable resources include: oil and gas, and hard minerals such as coal, zinc, copper, nickel and palladium. The NSR is being developed by Russia to facilitate the movement of Arctic natural resources in direct shipments (destinational voyages) to global markets. While some countries will focus on export (Russia, Norway, Canada and Sweden), others such as Finland will focus on becoming being a primary Arctic technology supplier. Norway has begun to emphasize building the infrastructure needed to make transport of natural resources possible along the NSR.

* **Seasonal trans-Arctic navigation** is a reality for the NSR. The length of a viable navigation season in the eastern reaches of the NSR is 4 to 6 months using icebreakers supporting commercial ships in convoy. In many respects the NSR is a *seasonal supplement to the Suez Canal* as an alternative marine route.

* **Technology and a trained workforce** play large roles as the Arctic adapts to a changing environment. Russia (and all Arctic states) will have to invest in new technology, gain additional expertise, and train its Arctic workforce.

* **Political will** is crucial for increased use of the NSR as a Russian national waterway and international route. This will from the nation's top leadership is evident in a number of Arctic strategic documents of the Russian Federation. An increased presence of foreign ships in the Arctic demands unified, international rules and these will come from adoption and implementation of the mandatory Polar Code for ships operating in polar waters in 2015-2017.

* **Economics** is the main driver of Arctic natural resource development and the new requirements for Arctic marine transportation systems. Many Arctic state policies may focus on defense, security and sustainability issues, but economic issues remain central to a future maritime Arctic.

* **Arctic marine access** has increased due to the retreat in extent, thickness and the character of Arctic sea ice. If the trend continues, the shipping season could be extended. Faster and more efficient maritime routes may provide new options for regional trade. The potential of the NSR is actively being evaluated with key experimental voyages being conducted during longer seasons of navigation.

* **Political stability** is one of the potential assets of the Arctic. Some believe regional piracy and the potential shutdown of the Suez Canal make the NSR potentially more attractive. However, the reality of the NSR is that it is a seasonal route that never can fully replace a warm water route such as the Suez Canal.

* **Long-term investments** are required to build and upgrade key infrastructure including: deepwater ports, communications, icebreaking capacity, support vessels for safety and services, aids to navigation, environmental response capacity, hydrography and charting, and more. The costs are much higher than can be funded by regional and national governments. Therefore, public-private partnerships will be required in all regions of the maritime Arctic.

* **Insurance companies and underwriters** are needed to assist in risk management. The NSR is generally outside standard insurance coverage, resulting in higher costs. Also there is a limited pool of interested insurers. The new mandatory IMO Polar Code will provide a regulatory and uniform framework that will aid the insurers and underwriters in evaluating risk in Arctic waters.

* **Non-Arctic States** are actively interested in an Arctic role. Countries such as China, India, Korea, Japan and Singapore (recent non-Arctic observer additions to the Arctic Council) have economic and strategic security interests in the region, but so do other non-Arctic states such as Germany, France, the Netherlands, Italy, and others. All can be viewed as alternative sources of expertise, funding and trade.

Potential Connections to Alaska

* **Greater risk** directly correlates with increased maritime traffic in the NSR and more ships along the western coasts of Bering Strait. Alaska lacks effective emergency services and response time for the Bering Strait region. The U.S. lacks adequate maritime infrastructure throughout its Arctic EEZ.

* **Tourism** could plausibly add increased traffic on the NSR, but not until greater emergency response and key infrastructure are established. Large numbers of NSR tourist voyages are not anticipated. Airlines could increase connections in the Russian Arctic, but ports would have to be expanded.

* **A Free Economic Zone** between northeastern Russia and Alaska could increase trade and provide a sustainable and competitive economic zone.

* **Linkages to Canada** could help Alaska build regional businesses and investments to link with offshore development and trade. The port of Prince Rupert, a non-Arctic port, is located on the Great Circle Route. It is ice-free year round and allows access to the Asian markets, offering shippers and producers a competitive advantage.

* **As a transport hub** Alaska is located conveniently close to Asian markets and LNG could be transported to Japan, Korea and China and be marketed in Asia without use of the NSR or any Arctic route. Red Dog Mine zinc could be transported west along the NSR directly (without trans-shipment) to European ports during the summer navigation season. Alaskan fish products could be transported to central Europe, filling the gap as European stocks decline, again during a summer NSR navigation season. Alaskan coal is likely not viable for NSR shipping as both Europe and Asia have internal supplies. Alaska could act as trans-shipment point for natural resources being shipped across the NSR. However, two-way trade along the route is essential for the economic viability of the NSR.

Environmental and Safety Issues

* **IMO is developing** a mandatory Polar Code and other organizations are implementing national regulations, improving communications, and developing regional cooperation and collaboration. To market the NSR, it has to be safe and reliable, with strong marine safety and environmental protection regulations.

* **Research data** needs to be gathered and sensitive areas identified. The Arctic Council's working groups PAME, CAFF and EPPR have produced a comprehensive report which has identified Arctic marine areas of heightened ecological and cultural significance. WWF is developing an atlas of marine and coastal sensitive ecological areas including subsistence resources.

* **Development of Russia's Arctic maritime infrastructure** is crucial to enhancing NSR marine safety and environmental protection. The building of ten SAR and response centers along the Russian maritime Arctic coast is a major step forward. Increased hydrography and charting of the many NSR routes is a critical investment in the safety net in this remote region.

Keppel Offshore and Marine, Singapore

9 B Breakout Sessions: B) Future Arctic Trans-shipment Possibilities

Henrik Falck of Tschudi shipping introduced the discussion of trans-shipment with a diagram and a metaphor. The diagram showed a model European route from Rotterdam to Kirkenes (five days), continuing past Yamal along the NSR to Bering Strait to Adak and Dutch Harbor (nine days), and then to Japan, China and Korea (seven days). The time required for shipping is directly translated to money, dependent on the type of ship and its cost per day. An expensive polar class ship should be moving in the ice-covered seas as much as possible to optimize its cost. Timing determines whether trans-shipment is worth doing or not, as the process of loading and unloading can take four days time. If the destination is five days or less, it makes no sense to trans-ship. There are two ways to look at the problem: finding the numbers that work, or eliminating the numbers that do not work. Falck noted that we can approach the ports in the same way.

The question of potential trans-shipment opportunity was discussed by categories of possible cargo for export. Shipping south is more economical for Alaska as there are greater markets. As Alaska does not now have infrastructure for increased shipping, it is important to look at location of potential exports to determine strategic location for port investment. Export commodities and related port opportunities are noted in the following:

* **Liquefied Natural Gas (LNG)**. LNG links in Alaska are with Nikiski at Cook Inlet and east of McKenzie in Canada. Adak has storage facilities including 20 million gallon storage underground, an airfield, and fueling facilities. It is well located to serve Asia within 7 days, but major infrastructure investment in this decommissioned former naval base would be required. A recommendation was made to the Aleut Corporation contact the Russian company Novatek about shipping Yamal LNG to Adak. Adak has sufficient harbor depth to support the large LNG carriers and large volumes that can cut shipping prices drastically.

* **Oil**. Oil can be crude (heavy) or condensate (light) and Russian oil is planned to be shipped directly from the Arctic coast along the NSR to East Asian markets. The Adak port position and facilities make it a port to also be considered by potential Arctic oil producers in Russia. Adak could then link to Asia and also refineries on the West Coast. They could cater to both the crude and condensate markets. Land to sea transfer or ship to ship transfer would be viable options, although ship-to ship transfers would attract key regulatory attention.

* **Dry Bulk**. As a major port, Adak could support bulk shipments. Some bulk vessel types are smaller than oil and LNG transport vessels, and that makes it a very challenging market for Arctic shipping. Dry bulk cargo is not effective for trans-shipment as the product is only 5 days from market and would require 4 days to load and unload. A more practical option might be to establish Adak as hub for natural resource products where cargo ships offload some bulk to send east or west, while they travel in the opposite direction. Another option could be for all the bulk cargo to be offloaded at the port, so that the transport ship goes back and forth from point A to point B. This would mean that not all ships traveling the route would have to be ice-class vessels.

* **Minerals**. Red Dog Mine lead-zinc exports 370k tons each year in lots of 70k tons. It is reasonable to look at a route from the Red Dog (Kivlina) to Kirkenes, Norway and then to Rotterdam, rather than through the Panama Canal using the NSR as a seasonal route. Ambler is another potential source of future mineral export.

* **Containers**. These ships are really floating storage and not as interesting for trans-shipment. They require a slot system at ports, as at airports, requiring precise timing that would not be predictable due to Arctic ice conditions. When the origin is the East, ships pass a market of four billion people in Far East, Mediterranean and Southern Europe on southern maritime routes. Backhaul is cheap to the East. When passing north along Arctic routes, the ships pass only four million people. It is not a sufficient or comparable market. Today, ships can carry up to 18,000 containers. Siberia's three main river systems connect remote areas to the NSR. Specialized container ships are a potential opportunity for carrying cargoes into the Russian Arctic on destinational voyages.

* **Fish Products**. Dutch Harbor exports 100,000 tons of fish annually in bulk container through the Panama Canal to Europe. Norway exports 400k tons of mackerel annually to the Far East. With summer and minimal ice conditions along the NSR, there is an opportunity for 50% savings on distance for cargo, both ways. Effectively, this means hauling fish products in both directions. Note that the cost of transportation to Japan is very high between Dutch Harbor and Japan, in comparison to Norway to Japan, due to the U.S. Jones Act. A beginning could be made with trans-shipment of fish products across the NSR to illustrate the viability of this seasonal Arctic marine route. Then a case might made to the oil companies for trans-shipment of oil and gas.

* **Offshore Exploration and Development**. There are significant quantities of equipment required in the Chukchi and Beaufort Seas to support offshore development. This represents a considerable potential cargo. Most is now procured through the U.S. mainland, but there is an interest in sourcing through Europe and Asia. Such cargo could be barged directly to Nome, lightered and broken down to smaller barges to head north. The 11 to 12 meter depth in Nome is likely sufficient for barged offshore equipment and supplies. Small modular equipment now travels north by truck on the haul road (Dalton Highway). Large modules are barged to the North Slope so this is a known method of marine transportation.

* **Energy as fuel**. Alaskan communities on the west coast and Aleutian Islands, as well as Southeast Alaska require more cost-effective fuel sources for heating and power. The State is now designing a project with direct funding and bonds to process LNG on the North Slope and truck it to Fairbanks. The system will also produce propane that could be shipped down the Yukon River and then to western Alaska. LNG storage in the villages is problematic, but propane could be shipped in certified containers. Communities are looking to resolve the problem on an individual basis, rather than considering a system. Noted is that the cost of conversion to LNG is great. Norwegian experts noted that they are processing small amounts of LNG at Sortland where it fuels three Coast Guard vessels. The scale of this operation might be appropriate for the Aleutian Islands and other remote communities. The potential of hydrogen production in the future was also noted. The Aleutians have the best potential to generate hydrogen due to geothermal energy (200 degrees Centigrade sources) and wave energy resources. Aleut Corporation is working with Iceland on geothermal conversion, as it is a very clean technology with no carbon footprint. Norway is also working on this green technology.

Related discussions and questions:

* **Ship design**. If an Arctic route is from one ice-free area to another ice-free area, longer and larger ships might be utilized. However, there are size constraints for the using the NSR: icebreaker operations limits length now to 130 meters by the Russian authorities.

* **Piracy on Southern Routes**. Is NSR an antidote to piracy? Is that a competitive advantage? Although there is less traffic, there is still time-critical cargo, as drill rigs and exploration equipment. Although the probability of piracy is low, the consequences for jeopardizing drilling operations and even a whole season of work are high. However, again the NSR is constrained seasonally and is likely a very short navigation season for specialized ships, drill rigs and other non ice-class vessels.

* **Jones Act**. The Act increases costs of operating in Alaska. Direct shipping to Asia is not a problem. Jones Act waivers are available if there is no U.S. equipment or capacity available, such as commercial icebreakers in support of offshore development.

* **Panama Canal**. Although improvements underway now will increase the Canal's capacity, the costs will remain the same or be higher. However, it is currently less expensive than the Suez Canal. And importantly, the Suez Canal is less expensive than Russian charges for use of the NSR (icebreaker escort and pilotage). However, the time saved with minimal ice can make the NSR a cost-effective route, if the vehicle is specialized. NSR fees are not prohibitive for high value vessels.

* **U.S. Imports**. A leading import to the U.S. from Europe is alcohol, both in terms of value and weight. Is this an opportunity for Alaska and could the NSR be used in summer for this commodity? What other imports come from Europe that might present business opportunities for Alaska?

9 c Breakout Sessions: C) Marine Safety and Environmental Protection

This session on marine safety and environmental protection was facilitated by **Ed Page** from the Marine Exchange of Alaska. Ed Page was a former environmental safety officer for the U.S. Coast Guard in Alaska at a time before the recent experience with an emerging Arctic. He noted that it is a new frontier with broad challenges and new issues. Maritime safety in Alaska is lacking, especially when compared to the mainland of the United States. Currently Alaska does not have up to date technology, funding or housing for that technology.

The discussion focused on safety and environmental protection measures required for the U.S. maritime Arctic:

* **Improving time and tracking capabilities.** This is a primary effort for increasing the effectiveness of emergency response services. Improved tools and communication technology allows distressed vessels to inform authorities and ensure timely response. Technology improves communication of ice and weather conditions preventively, and to support search and rescue teams. With Automatic Information System (AIS) coverage today, tracking systems can quickly notify the Coast Guard of ship emergencies. Time provides an opportunity to mobilize capabilities and thus technology is a force multiplier in Arctic – technology buys both time and distance.

* **Increase search and rescue stations.** Such an expensive strategy would enhance emergency response times. The ideal would be to establish Coast Guard SAR stations every 100 miles similar to the U.S. mainland. However, the Coast Guard's budget would preclude this type of coverage in remote areas. One major concern is a cruise ship rescue that could involve mass casualties in the remote areas of the U.S. maritime Arctic.

* **Enhance non-tank vessel regulations.** Such regulations would include salvage marine firefighting. These regulations should be applied more robustly to Alaskan waters, as currently only one half of the vessels traveling along the Aleutian Islands are subject to these regulations. Increasing these measures would help prevent oil spills through the opportunity to intervene early and often. Environmental protection and response capabilities are improved, while adding authority to ensure vessels are up to date with maritime regulations and standards.

* **Vessel traffic monitoring system (VTMS).** Such a system would monitor routes and maintain the safety of designated environmentally sensitive and prohibited areas. When a vessel enters a strait, the coast pilot would contact the captain. Ships could be monitored automatically and advised of potential hazards. Rather than having routes and corridors established, it may be more flexible to have zones. Such a zonal system allows the application of ship rules to different and varying conditions (for example by season).

* **Utilize the media.** Print and social media could assist by publishing stories of violations and best practices at sea to a broad audience. Media could influence the safety culture for Arctic companies, crew and insurers without relying only on regulations and fines.

* **Establish special marine areas.** New areas in the U.S. maritime Arctic should be established where discharge is prohibited and international environmental protection is designated. Implementation of the mandatory IMO Polar Code will provide broad protections, but regional special areas may also be warranted.

* **Improve relations with Russia.** Improved cooperation with Russia, particularly in the Bering Strait region, would positively impact both marine safety and environmental protection. The U.S. and Alaska can learn much from Norway's relationship with Russia in the Barents Sea. This would promote cross-border emergency and spill response.

* **Expand oil spill response capability.** More capacity must be established north of Dutch Harbor. Focus should be on the near-shore environments. Response systems must utilize local knowledge and hold special training sessions in coastal communities. In Norway, it is the coast authority's responsibility to make sure the entire coast has the proper oil spill response capabilities and training. Svalbard is now emerging as an area of more focus due to its vulnerability and increased traffic. Any spill in the U.S. Arctic would be a Spill of National Significance (SONS), with significant environmental as well as political ramifications.

Loading zinc ore to a bulk carrier off Kivilina, Alaska near the Red Dog Mine.

NANA Development Corporation

Key issues for the U.S. maritime Arctic to be addressed during the next five years:

* **IMO Mandatory Polar Code** ~ Implementation of the mandatory IMO Polar code during 2015-17 is crucial to enhancing marine safety and environmental protection in the U.S. maritime Arctic. There are no Arctic specific commercial ship regulations today in U.S. Arctic waters and the Polar Code will fill that void.

* **UNCLOS** ~ Ratification of UNCLOS by the U.S. Senate is key to greatly enhancing U.S. security and economic interests in the Arctic and throughout the global oceans.

* **Tracking Technology** ~ Improvement in satellite and land-based technology will support safe navigation, SAR, emergency response, and ice navigation. Improving AIS land-based and satellite tracking technology for coverage of the U.S. maritime Arctic is a critical component to enhanced domain awareness in the region.

* **Charting** ~ Improved charts are required for shipping route safety, for defining safe harbors (ports of refuge), and for planning future Arctic port infrastructure. U.S. Arctic strategic documents acknowledge these charting requirements and NOAA needs budgetary support for increased Arctic hydrography and surveying.

* **Towing Vessels** ~ A critical need is to grow a fleet of salvage and towing vessels stationed or positioned in Alaska. Seasonal positioning in the Arctic might be a viable future strategy, but funding of commercial assets will be a challenge.

* **Oil Sill Preparedness and Response** ~ International cooperation regarding Arctic spill response needs improvement. The Arctic states need to implement elements of the 2013 Arctic agreement on oil spill preparedness and response.

* **Jones Act** ~ The U.S. Jones Act needs to be re-evaluated and assessed in the light of new Arctic maritime opportunities. [The Jones Act prohibits a foreign flag vessel from engaging in U.S. trade, but waivers to the Act are possible.]

9 D Breakout Sessions: C) Potential Arctic Infrastructure Investment Opportunities

Sarah Barton, President of ConsultNorth facilitated the session with thirty participants, including representatives from state and federal government agencies in Alaska and Norway, Alaska State administration, university and industry representatives, and NGOs.

This breakout group was designed to discuss Arctic projects that might be real and plausible, as noted by DCCED Assistant Commissioner Robbie Graham. The call to ramp up cooperation and build the basis for future work together was advanced by Felix Tschudi, of Tschudi Shipping and the CHNL. Morten Hoglund outlined significant investments made by Norway to support its (High North) economic development agenda and enhance its technology research. From a perspective of the need to invest and prepare, the group began with the questions: What are preconditions for investment in Alaska? What are the early investments that might catalyze future projects and increase the potential for economic growth?

Preconditions for Investment in Alaska:

- Broadband telecommunications
- Regulatory certainty
- Public and private partnerships
- Year round all-weather airports statewide (in place)
- Tax structures and incentives
- Education and workforce training
- Enhanced working relationships with Canada and Russia
- Enhanced working relationships between Alaska and the Federal Government
- A major oil discovery in the Chukchi or Cook Inlet (would be a catalyzing influence on investment).

Potential Investments:

- **Tourism.** There could be tourism from Alaska to Europe via the NSR, a combination of air and sea travel. This suggestion was countered by: the concerns of insufficient SAR and marine safety infrastructure; potential impacts on indigenous communities; and the environmental issues of large cruise ships operating in the Arctic. Tourism is anticipated to increase within the Arctic initially in Greenland and the Canadian Arctic. Tourism also draws potential related business interests.
- **Roads to resources.** The potential offshore development in the Chukchi and Beaufort seas makes a road from Fairbanks to Nome and then north a key investment to consider.
- **Railway.** The state is currently developing an integrated rail plan. Paul Metz (UAF) has proposed a $6 to 7 billion rail route from Fairbanks north to Prudhoe. Such a railroad can serve multiple functions. Model transportation corridors across the North Slope, and along north-south routes in western Alaska must be considered to link multiple mining resources such coal, lead-zinc and copper to a southern port.
- **Broadband fiber.** When building new infrastructure such as roads and rail in the Alaskan Arctic, the developers must be attentive to add broadband fiber cables when possible (to only dig once). Also, planners should capitalize on the opportunity to extend the networks of the current subsea fiber optic project in northern and western Alaska. Norway also recognizes a similar requirement with development of its High North satellite plan to fill current satellite gaps in Arctic coverage.
- **Fish products.** The viability of trans-shipment of 100k tons of fish going east from Dutch Harbor to Europe (and 100k tons of mackerel going west from Norway to Asia) should be investigated. Direct shipping across the NSR to and from Europe is also highly feasible in summer. Significant shipping savings could potentially be achieved during a summer navigation season. An industry agreement could be negotiated now.
- **Minerals.** Northern and western mines in Alaska could be linked to Arctic bulk shipping. Examples include: Ambler copper; Graphite One near Nome; Red Dog lead-zinc. All are opportunities to ship to northern Norway, and direct shipment between Alaska and Europe, along the NSR rather than the Panama Canal.

- **Oil.** G7G (Generating for Seven Generations) is a Canadian group proposing to ship shale oil from Canada to Delta, Alaska and then south to Valdez for export. Canadian indigenous groups have supported such a venture. Alaska would need to extend its railway system east to the Canadian border, and south to Valdez. Shale oil from Prudhoe could also be carried by rail south to Fairbanks, and perhaps on to Chicago (such a route would be the fastest route to Chicago). The State of Alaska is in discussion with G7G. If north-south and east-west rail extensions were completed in Alaska, North Slope gas could be shipped south by rail.

- **LNG.** Yamal LNG is a potential customer for Adak, as are other Russian oil producers. There is significant potential savings in using existing Adak facilities of underground storage, long runways, and fuelling infrastructure. The group advised that Adak, Aleut Corporation and the State should undertake direct communications with Yamal and other Russian oil producers to determine the business potential and related investments.

- **Offshore development equipment.** Equipment now comes from the U.S. mainland. There are opportunities for import from Europe via NSR or Asia. There would be a need to stock equipment onsite at Port Clarence, and requirements for cranes and other equipment to move materials. Also it might be necessary to lighter, and to break down the cargo to smaller barges for shipping north to the Chukchi and Beaufort seas.

- **Arctic Ports.** The Nome/Port Clarence region has been identified by the State and Army Corps of Engineers feasibility study as a key location for the Arctic Alaska Deepdraft Port System. The primary reason for such an Arctic port is to export Alaska's Arctic natural resources to global markets. Additional functions of port facilities in this region include: as a place of refuge; safety equipment storage; forward base for the Coast Guard and offshore commercial operations; and, warm and cold warehousing services for drill materials and fuel. Also to be considered area what services and functions could be provided by Providenya in Russia, less than 100 miles away and far closer than the 800 miles to the Coast Guard base in Kodiak. A plan might consider Russian support for first response, and Russian collaboration in a free trade zone for staging of offshore development equipment. Providenya and Nome could also consider a twin port concept as a basis for a free economic zone with potential economic benefits to all parties. Near-term and future Russia-U.S. relations will dictate such close economic and response ties. Twinning ports is now in place between Kirkenes and Murmansk.

From U.S. Army Corps of Engineers presentation, "Alaska Deep-Draft Arctic Ports Navigation Feasibility Study," presented by Loraine Cordova.

Potential Arctic deepdraft port location ~ Nome and Port Clarence, Alaska.

* **Mobile Offshore Base.** Andrew Metzger (UAA) noted the potential for a Mobile Offshore Base that could provide refuge and marine services. This facility could function during the summer season of exploration and production activity and be moved south during the winter.

* **Offshore development.** Oil and gas development increases the need for oil spill response infrastructure. The Barents Agreement between Russia and Norway was spurred by the potential oil and gas exploration. Industry could be used as the catalyst to spur Russia and U.S. collaboration, including possible twin ports in the region. Chukotka and Alaska have a long working relationship on cultural and Beringia Park development and this cooperation could be expanded in forms of economic cooperation.

* **Energy and power.** The State of Alaska is currently investing in and developing LNG facilities on the North Slope that will truck gas from Prudhoe to Fairbanks. Investment could be made to extend this project to provide more cost effective energy sources to Western Alaska. Propane could be produced and containerized and sent down the Yukon and along the western coast. Diesel tank storage would be replaced by exchanges of ISO tanks. Conversion of equipment from diesel to propane would be required. The gas could also support regional Arctic mines that are in exploration phases.

* **Education and research.** Alaska could create a Center of Excellence to promote Arctic research of that could be commercialized. Researchers are now exploring coal liquefaction with carbon capture. Carbon capture from burning coal is another area of key research, including work at UAF's coal burning facility.

* **Regional governance.** The Bering Strait is an international strait and freedom of navigation articulated in UNCLOS is the framework for marine traffic. The St. Lawrence Seaway as a model for U.S.-Canada cooperation in the Arctic could be explored. The model of international cooperation in the Barents Sea between Russia and Norway can yield important ideas that might be applicable in the Bering Strait region.

The group concluded with three summary findings regarding productive infrastructure investments:

* **Make better use of what we already have:** fish processing and export facilities in Dutch Harbor and linkages during summer with Europe and Norway across the NSR; LNG facilities now in development by the State on the North Slope; University of Alaska education and workforce training (investing to increase human capital); and, Adak's port facilities and building linkages with Yamal LNG and oil commercial interests.

* **Use someone else's infrastructure:** potential twinning of ports of Providenya and Nome for safety and first response, as well as mutual economic benefit via Free Trade Zone for OCS equipment staging; recognize the potential investment in Nome associated with the current USACE/DOT study to develop port facilities in Nome/Port Clarence region.; and, other ports might also present the potential for collaboration and free trade zones, including Sabetta in Yamal.

* **Invest in new infrastructure:** build a railway from Fairbanks north to Prudhoe; consider collaboration with Canada and G7G on east-west route to the Alaska-Canada border and south to Valdez for shale oil export; build a Fairbanks-Nome road to support access to mineral resources, cost-effective community resupply and enhancement of the potential future regional port investments; extend a proposed new subsea fiber optic connections (due by January 2016) beyond the seven Alaska landing sites to neighboring regions; develop subsidies and incentives to support infrastructure to extend broadband capacity as stated in Alaska's Broadband Task Force Report; consider the construction of icebreakers through AIDEA and lease back to the federal government; and, consider prototyping the use of heavy (25 ton) airlift by airships for fuel supply.

Closing

Summary comments were presented to close the conference. Lawson Brigham noted that development of the NSR is a reality today, representing an extraordinary commitment by Russia in Arctic investment. The NSR as a national waterway is directly tied to the development of Russian Arctic natural resources and a means to move these resources to global markets. The conference discussions showed that Alaskans can learn much from Norway's approach to northern investment and its relationship with Russia in Arctic affairs, especially the history of cooperation between the two nations in the Barents Sea. An outcome of this workshop is that joint cooperation between Norway and the U.S.-Alaska in a range of Arctic maritime opportunities is quite feasible and mutually beneficial.

Felix Tschudi was pleased to learn from the conference more about the other side of the Arctic in Alaska. Many of Alaska's concerns are similar to northern Norway such as the levels of required Arctic investment, protecting the Arctic marine environment, and utilizing the potential of new Arctic waterways. Norway is proud of its High North with 35,000 inhabitants. It is a maritime country that has made significant investment in infrastructure and in developing close cooperation with its neighboring Arctic states.

Roberta Graham spoke to Alaskans as doers, as well as dreamers. She thanked Felix Tschudi and his colleagues for providing many ideas for new Arctic possibilities. She challenged all the conference participants to go forward and 'generate real and possible projects' to make the future Arctic a more viable place to live and work.

Select and Key Conference Outcomes

- Norway and the United States in Alaska share common Arctic maritime interests and challenges where enhanced cooperation will be mutually beneficial.
- Alaska and the United States can learn much from Norway's cooperation with Russia on offshore development in the Barents Seas.
- Arctic marine transportation is driven primarily by Arctic natural resource developments (consistent with a key finding of the Arctic Council's Arctic Marine Shipping Assessment).
- The Northern Sea Route is emerging as a seasonal (summer) Arctic shipping route with significant potential for destinational and trans-shipment voyages of Arctic natural resources.
- The Northern Sea Route will not replace the Suez or Panama canals, but can be viewed as a viable, seasonal supplement and new alternative route despite key constraints such as the variability of regional sea ice, shallow water depths in select straits, a high fee system, and lack of marine infrastructure.
- An opportunity exists for both Norwegian and Alaskan maritime interests to use the Northern Sea Route for trading during summer and as a connection between Europe, northern Norway, and Alaska.
- Due to its complex geography and environment, the Northwest Passage does not have the same level of interest by global shipping interests and investment as the Northern Sea Route, which is viewed as a national waterway with high level political support.
- The mandatory International Maritime Organization Polar Code for ships operating in polar waters will be critical to enhancing the protection of Arctic peoples and the marine environment within the U.S. maritime Arctic and throughout the Arctic.
- Most maritime Arctic infrastructure requirements (particularly in the U.S. maritime Arctic) need substantial investments and future public-private partnerships will be essential to providing adequate funding.
- A major Arctic port in western Alaska is a key to regional development, export of Alaska's natural resource wealth, and connections to the new maritime Arctic.
- The Aleut Corporation and Adak should establish links with Russian Arctic oil and gas interests in Yamal to explore the potential for oil and gas deliveries along the NSR to Adak for servicing western Alaska communities.
- Comprehensive marine economic analyses of all Arctic marine routes and trading options are required to provide decision-makers and investors with realistic information for the strategic planning of future Arctic marine projects.

Appendix A: Conference Agenda

Alaska and the New Maritime Arctic

November 6-7, 2013
Marriott Hotel • Anchorage, Alaska

ORGANIZERS
University of Alaska Fairbanks, USA
Centre for High North Logistics, Kirkenes, Norway
Institute of the North, Anchorage, Alaska

SPONSORS
The Royal Norwegian Embassy, Washington, DC
Department of Commerce, Community and Economic Development, State of Alaska, USA

WEDNESDAY, NOVEMBER 6

0800 **Welcome Address**
- Chancellor **Brian Rogers**, University of Alaska Fairbanks, USA
- Commissioner **Susan Bell**, Department of Commerce, Community and Economic Development, Alaska, USA
- **Hilde Janne Skorpen**, Consul General, Consulate of Norway to the U.S., San Francisco

Introductions and Overview
- Dr. **Lawson Brigham**, Professor, University of Alaska Fairbanks, USA
- **Felix H. Tschudi**, Chairman of the Board, Tschudi Shipping Company, Norway

0845 **Future Arctic Sea Ice, Maritime Safety, Access and Environmental Considerations**
Session Chair: **Margaret Williams,** World Wildlife Fund, USA
- *Arctic Sea Ice Changes*
  - Dr. **Lawson Brigham**, University of Alaska Fairbanks
- *Seasonal Changes in Access Along the Northern Sea Route*
  - **Scott Stephenson**, UCLA, California, USA
- *Vessel Traffic in the Bering Strait*
  - **Ed Page**, Marine Exchange of Alaska, USA
- *Maritime Safety and the Environmental Protection*
  - **Andrew Hartsig**, Ocean Conservancy, USA

1000 **Break**

1030 **Economic Impacts of Arctic Shipping: Development and Trade in a Future Arctic**
Session Chair: **Roberta Graham**, Deputy Commissioner, DCCED, State of Alaska
- *Seeking out and Investing in Future PanArctic Projects*
  - **Hugh Short,** CEO, Platinum Capital
- *Economic Development Related to Alaska Arctic Port Development*
  - **Lorraine Cordova,** Lead Economist, U.S. Army Corps of Engineers
- *Offshore Leasing in Alaska's Arctic*
  - Dr. **James Kendall,** Bureau of Ocean Energy Management, U.S. Department of the Interior
- *The Importance of Northern Scandinavia and Russia in Future Arctic Resource and Trade Developments*
  - **Felix H. Tschudi**, Chairman of the Board, Tschudi Shipping Company, Norway

- *Circumpolar Resource Development Projects*
  - **Dermot Loughnane**, Tactical Marine Solutions, Canada
- *Iceland's Trade and Investment Opportunities*
  - **Hlynur Gudjonsson**, Consul and Trade Commissioner, Consulate General of Iceland in New York

1215 **Lunch**

Norwegian High North Policy Development
- **Morten Hoglund**, Special Advisor for Arctic Affairs, Norwegian Ministry of Foreign Affairs

1330 **A Circumpolar Arctic Marine Transportation, Infrastructure & Logistics System**
Session Chair: **Bruce Harland**, Crowley Marine, USA
- *Advancing Arctic and Harsh Environment Technology*
  - **T.O. Cheung**, Keppel Offshore and Marine
- *Current and Future Infrastructure Assessment*
  - **Andrew Metzger,** University of Alaska
- *A Transshipment Port in Kirkenes*
  - **Henrik Falck**, Tschudi Shipping Company, Norway
- *Future Arctic Bulk Carrier Connections to Alaska*
  - **Tim Keane**, FEDNAV Group, Canada

1445 **Break**

1515 **Future Prospects of Arctic Sea Routes: Short to Medium Term Scenarios**
Session Chair: Dr. **Lawson Brigham**, Professor, University of Alaska Fairbanks, USA
- The New Russian NSR Regulations – What do they mean for Commercial Shipping?
  - **Sergey Balmasov**, , CHNL's NSR Information Office, Russia
- Northern Sea Route – Impact on LNG Trade
  - **Stan Jones**, Alaska Natural Gas Transportation Projects
- Future Northwest Passage Operations & Links to Alaska
  - **Dermot Loughnane**, Tactical Marine Solutions, Canada
- The Role of South-Korea in Future Arctic Trade
  - Dr. **Sungwon Hong**, Institute of Arctic Logistics, Youngsan University, South-Korea

1630 **Adjourn**

1700 **Reception**
- Mayor **Denise Michels**, City of Nome
- **Layton Lockett**, City Manager, Adak

1830 **Speaker Dinner at Ginger**

THURSDAY, NOVEMBER 7

0800 **Review of Day One**
- Dr. **Lawson Brigham**, University of Alaska Fairbanks, USA

0815 **Northern Potential – Alaska's Strategic Position in the Maritime Arctic**
- Lieutenant Governor **Mead Treadwell,** State of Alaska
- **Felix Tschudi**, Chairman of the Board, Tschudi Shipping Company. Norway

0915 **Key Informants – Investment, Infrastructure and Planning Efforts**
Session Chair: **Sarah Barton**, ConsultNorth, Alaska, USA

- *Roles of the Norwegian and U.S. Coast Guards*
  - **Trond Grytting**, Rear Admiral, Defense Attaché, Embassy of Norway in Washington, D.C.
  - Captain **Greg Sanial,** Chief of Response, District 17, Juneau, U.S. Coast Guard
- *Barents Sea Planning*
  - Deputy Director General **Petter Meier,** Norwegian Ministry of Fisheries and Coastal Affairs, Norway
- *Assessing the Competitive Advantages and Risks of Using the NSR vs. Suez/Cape*
  - **Sergey Balmasov,** CHNL's Northern Sea Route Information Office, Russia

1030 **Small Group Session**
Facilitated small group work to develop:

- Group A - *The Future of the NSR and Shipping Natural Resources*
  - Facilitator – Dr. **Lawson Brigham**, UAF, Alaska, USA
- Group B - *Future Arctic Trans-shipment Possibilities*
  - Facilitator – **Henrik Falck**, Tschudi Shipping Company, Norway

1200 **Lunch**

Alaska's Economic Development and Trade in a Future Arctic

- Commissioner **Susan Bell**, DCCED, State of Alaska

1300 **Small Group Session**
Facilitated small group work to develop:

- Group C – *Marine Safety and Environmental Protection*
  - Facilitator – **Ed Page**, Marine Exchange of Alaska
- Group D - *Potential Arctic Infrastructure Investment Opportunities*
  - Facilitator – **Sarah Barton**, ConsultNorth

1430 **Break**

1500 **Reporting of Futures Groups** - Moderated by Dr. **Lawson Brigham**
Small groups will report out in plenary to establish findings

1600 **Summary of Workshop – Review and Discussion**

- Dr. **Lawson Brigham** and **Felix Tschudi**

1630 **Closing**

- **Morten Hoglund**, Special Advisor for Arctic Affairs, Norwegian Ministry of Foreign Affairs
- **Roberta Graham**, Deputy Commissioner, DCCED, State of Alaska

1700 **Adjourn**

Appendix B: Link to Presentations

https://www.dropbox.com/sh/7spbdkwspyxg1mx/-L7pF_Cc-s

Appendix C: List of Participants

Name	Affiliation
Nils Andreassen	Managing Director, Institute of the North
Harry Bader	University of Alaska Fairbanks
Kristina Baiborodova	Institute of the North, Anchorage
Sergey Balmasov	Centre for High North Logistics, Murmansk, Russia Office
Sarah Barton	President, ConsultNorth, Anchorage
Susan Bell	Commissioner, DCCED, State of Alaska
Lawson Brigham	Distinguished Professor, University of Alaska Fairbanks
Cam Carlson	University of Alaska Fairbanks
Ruth Carter	Alaska Department of Transportation & Public Facilities
T.O. Cheung	Vice President, Keppel Offshore & Marine, Singapore
Lorraine Cordova	U.S. Army Corps of Engineers, Alaska District
Rob Earl	Alaska Arctic Policy Commission
Ivar Engan	Counselor for Trade & Industries, Embassy of Norway
Henrik Falck	Project Manager Tschudi Shipping Company, Norway
Tommy Flakk	First Secretary, The Royal Norwegian Embassy, Washington, DC
Roberta Graham	Assistant Commissioner, DCCED, State of Alaska
Alexa Greene	Alaska Department of Transportation & Public Facilities
Trond Grytting	Rear Admiral, Defense Attache, the Royal Norwegian Embassy, Washington, DC
Hlynur Gudjonsson	Consul General of Iceland in New York
Bruce Harland	Vice President, Crowley Maritime Corporation
Andrew Hartsig	Ocean Conservancy, Anchorage
Bob Herron	Alaska State Legislature, Co-Chair Alaska Arctic Policy Commission
Morten Hoglund	Norwegian Ministry of Foreign Affairs, Oslo
Sungwon Hong	Institute of Arctic Studies, Youngsan University, Korea
Stan Jones	Alaska Natural Gas Transportation Project
Tim Keene	Vice President, FENAV Group, Montreal, Canada
James Kendall	Alaska Regional Director, Bureau of Ocean Energy Management
Layton Lockett	City of Adak, Alaska
Dermont Loughnane	CEO, Tactical Solutions, Victoria, Canada
Michael Lukship	Alaska Department of Transportation & Public Facilities
Petter Meier	Deputy Director General, Ministry of Fisheries & Coastal Affairs, Norway
Andrew Metzger	University of Alaska Anchorage
Denise Michaels	Mayor of Nome, Alaska
Lance Miller	Vice President, NANA Regional Corporation
Natalie Novik	World Trade Center Alaska
Jeffrey Ottesen	Alaska Department of Transportation & Public Facilities
Ed Page	Executive Director, Marine Exchange of Alaska
Drue Pearce	Crowell & Moring, Anchorage
Larry Persily	Federal Coordinator, Alaska Natural Gas Transportation Projects
Janet Riser	Aleut Corporation
Brian Rogers	Chancellor, University of Alaska Fairbanks
Cheryl Rosa	Deputy Executive Director, U.S. Arctic Research Commission
Kristin Ryan	Alaska Department of Environmental Conservation
Greg Sanial	U.S. Coast Guard District Seventeen, Juneau
Stan Senner	Ocean Conservancy
Mike Sfraga	Vice Chancellor, University of Alaska Fairbanks
Jon Skinner	University of Alaska Fairbanks
Hugh Short	CEO, Pt Capital, Anchorage
Hilde Janne Skorpen	Consul General of Norway in San Francisco
Harvey Smith	Alaska Department of Transportation & Public Facilities
Steve Sparrow	Dean, School of Natural Resources and Extension, UAF
Lori Stender	Alaska Industrial Development and Export Authority
Scott Stephenson	UCLA Department of Geography
Ole Karsten Stubben	Consultant, San Francisco
Mead Treadwell	Lieutenant Governor, State of Alaska
Felix Tschudi	Chairman, Tschudi Shipping Company, Norway
Fran Ulmer	Chair, U.S. Arctic Research Commission
Sharon Warren	Alaska Deputy Regional Director, Bureau of Ocean Energy Management
Margaret Williams	Managing Director, WWF-U.S. Arctic Program, Anchorage

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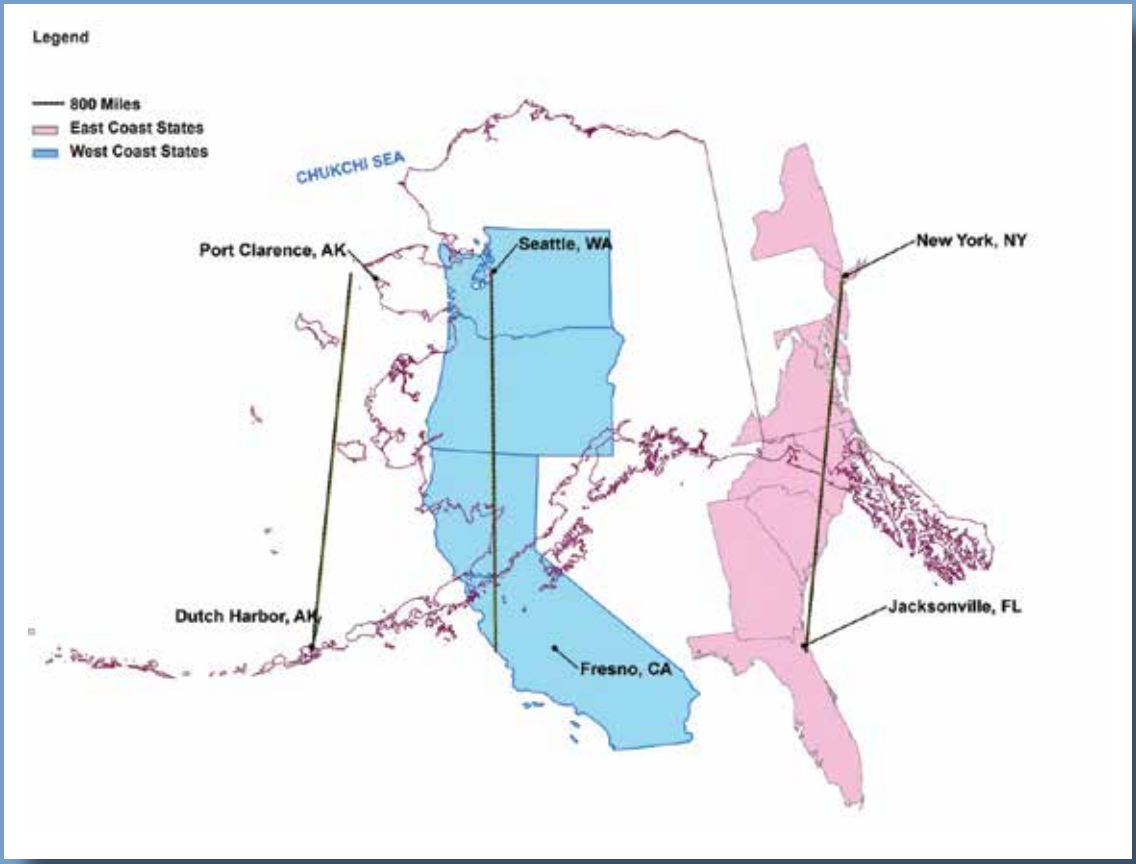

Alaska District, U.S. Army Corps of Engineers

Comparison of Alaska's vast coastline with the U.S. eastern and western coasts.

UNIVERSITY OF ALASKA FAIRBANKS

ALASKA DEPARTMENT OF COMMERCE, COMMUNITY, AND ECONOMIC DEVELOPMENT

ROYAL NORWEGIAN EMBASSY Washington, D.C.

INSTITUTE OF THE NORTH Governor Walter J. Hickel, Founder

CHNL CENTRE FOR HIGH NORTH LOGISTICS