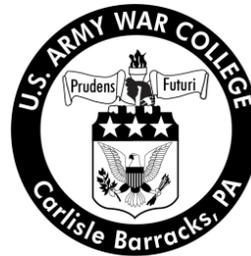


Civilian Research Project USAWC Fellow

ASSESSING THE RESOURCE GAP IN A CHANGING ARCTIC

by

Colonel Michael Thomas Wright
United States Army



United States Army War College
Class of 2013

DISTRIBUTION STATEMENT: A

Approved for Public Release
Distribution is Unlimited

This manuscript is submitted in partial fulfillment of the requirements of the U.S. Army War College Fellowship. The views expressed in this student academic research paper are those of the author and do not reflect the official policy or position of the Department of the Army, Department of Defense, or the U.S. Government.

The U.S. Army War College is accredited by the Commission on Higher Education of the Middle States Association of Colleges and Schools, 3624 Market Street, Philadelphia, PA 19104, (215) 662-5606. The Commission on Higher Education is an institutional accrediting agency recognized by the U.S. Secretary of Education and the Council for Higher Education Accreditation.

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

The public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing the burden, to Department of Defense, Washington Headquarters Services, Directorate for Information Operations and Reports (0704-0188), 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number. **PLEASE DO NOT RETURN YOUR FORM TO THE ABOVE ADDRESS.**

1. REPORT DATE (DD-MM-YYYY) xx-04-2013		2. REPORT TYPE CIVILIAN RESEARCH PROJECT		3. DATES COVERED (From - To)	
4. TITLE AND SUBTITLE ASSESSING THE RESOURCE GAP IN A CHANGING ARCTIC				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S) Colonel Michael Thomas Wright United States Army				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Dr. Karen Feste University of Denver Korbel School of International Studies				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) Dr. Antulio Echevarria U.S. Army War College, 122 Forbes Avenue, Carlisle, PA 17013				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION / AVAILABILITY STATEMENT Distribution A: Approved for Public Release. Distribution is Unlimited.					
13. SUPPLEMENTARY NOTES Word Count: 12,202					
14. ABSTRACT The receding Arctic ice cap illustrates the impacts, both positive and negative, of a changing global climate. Environmental changes have brought new challenges and opportunities including transportation, tourism, exploration, and access to previously inaccessible natural resources. These new opportunities will result in increased human activity in the region from tourism to mineral extraction. Chances for military conflict remain low, however an array of potential large scale man-made crises are increasing with the opening Arctic. Potential Search and Rescue (SAR) and environmental crises include oil spills, airline emergencies, and foundering cruise ships. Currently, the Arctic has little infrastructure or resources to provide any substantial response to these events and the demand will only grow in a busier Arctic. This paper will explore the issue of emergency logistics shortfalls throughout the region. Specific points include analysis of the supporting participants and requirements driving them, the resource gap, approaches to bridging that gap, storage and deployment options. The assessment concludes with a conceptual model for addressing the resource gap across the region within a budget-constrained environment and the impacts of inaction.					
15. SUBJECT TERMS Arctic, Logistics Shortfall, NORTHCOM, Spill National Significance, Mass Rescue Ops, SAR, Preposition Stock					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT UU	18. NUMBER OF PAGES 70	19a. NAME OF RESPONSIBLE PERSON
a. REPORT UU	b. ABSTRACT UU	c. THIS PAGE UU			19b. TELEPHONE NUMBER (Include area code)

USAWC CIVILIAN RESEARCH PROJECT

ASSESSING THE RESOURCE GAP IN A CHANGING ARCTIC

by

Colonel Michael Thomas Wright
United States Army

Dr. Karen Feste
University of Denver Korbel School of International Studies
Project Adviser

Dr. Antulio Echevarria
U.S. Army War College Faculty Mentor

This manuscript is submitted in partial fulfillment of the requirements of the U.S. Army War College Fellowship. The U.S. Army War College is accredited by the Commission on Higher Education of the Middle States Association of Colleges and Schools, 3624 Market Street, Philadelphia, PA 19104, (215) 662-5606. The Commission on Higher Education is an institutional accrediting agency recognized by the U.S. Secretary of Education and the Council for Higher Education Accreditation.

The views expressed in this student academic research paper are those of the author and do not reflect the official policy or position of the Department of the Army, Department of Defense, or the U.S. Government.

U.S. Army War College
CARLISLE BARRACKS, PENNSYLVANIA 17013

Abstract

Title: ASSESSING THE RESOURCE GAP IN A CHANGING ARCTIC

Report Date: April 2013

Page Count: 70

Word Count: 12,202

Key Terms: Arctic, Logistics Shortfall, NORTHCOM, Spill National Significance, Mass Rescue Ops, SAR, Preposition Stock

Classification: Unclassified

The receding Arctic ice cap illustrates the impacts, both positive and negative, of a changing global climate. Environmental changes have brought new challenges and opportunities including transportation, tourism, exploration, and access to previously inaccessible natural resources. These new opportunities will result in increased human activity in the region from tourism to mineral extraction. Chances for military conflict remain low, however an array of potential large scale man-made crises are increasing with the opening Arctic. Potential Search and Rescue (SAR) and environmental crises include oil spills, airline emergencies, and foundering cruise ships. Currently, the Arctic has little infrastructure or resources to provide any substantial response to these events and the demand will only grow in a busier Arctic. This paper will explore the issue of emergency logistics shortfalls throughout the region. Specific points include analysis of the supporting participants and requirements driving them, the resource gap, approaches to bridging that gap, storage and deployment options. The assessment concludes with a conceptual model for addressing the resource gap across the region within a budget-constrained environment and the impacts of inaction.

ASSESSING THE RESOURCE GAP IN A CHANGING ARCTIC

The global climate is changing, and no region more clearly demonstrates this fact than the Arctic. Maps of this region showing an earlier and more recent period illustrate a significant ice-cap melt. The United Nations Weather Agency reported that at the end of 2012, an area of the Arctic Sea ice larger than the Continental United States had melted. Warming temperatures and melting ice have negative consequences, from an increase of erratic and severe weather events, to further acceleration of warming.¹ However, the Arctic ice melt has also brought new opportunities as Arctic waters become more accessible. These opportunities include transportation, tourism, exploration, and access to formerly inaccessible natural resources and have resulted in increased human activity in the Arctic from cruise ships to new ventures in off shore oil drilling.² The increase and potential gains from this activity have also renewed tensions over disputed borders and claims of sovereignty, specifically in the Northwest Passage and the Northern Sea Lane.³ To be clear, the risk of armed conflict over these tensions is minimal since affected countries currently adhere to the open water tenants outlined in the UN Convention Laws of the Sea (UNCLOS), the development of “free economic zones,” and the successful management of disputes through diplomatic channels.⁴

The risk of militarized disputes is unlikely. A more likely danger is the possibility of large-scale man-made disasters such as an oil spill, airline emergencies, and/or foundering cruise ships. The lack of basic and organized response capability throughout the Arctic region may preclude any substantial and timely response to such incidents and could lead to potentially catastrophic consequences. The US Northern Command (NORTHCOM) 2012 analysis conducted by the Arctic Assessment Working Group

(CAWG) identified four key capability gaps encompassing communications, maritime domain awareness, infrastructure, and active security presence that confront American policy in the Arctic. Resources are currently tied to infrastructure as one key issue that includes logistics required to sustain large-scale multi-day Search and Rescue (SAR) operations and the mobility platforms to move those resources.⁵ Internationally, many countries have begun to allocate resources for the changing Arctic, and the seminal 2011 *Agreement on Cooperation on Aeronautical and Maritime Search and Rescue in the Arctic* between the eight Arctic bordering countries (Canada, Denmark, Finland, Iceland, Norway, Russia, Sweden, and the United States; also known collectively as the “Arctic-8”) indicates a strong commitment to address the new realities of the region. However, the SAR agreement contains minimal discussion of resources or logistical components required; in fact to meet the new challenges, the resources backing the SAR agreement are sparse and uncoordinated.⁶

In the 2012 internal assessment, the NORTHCOM Commander’s Arctic Capabilities Assessment Working Group (CAWG) White Paper on the topic recommended an in-depth analysis for multi-use infrastructure and a preliminary logistical analysis.⁷ In a statement referencing the preparedness for Mass Rescue Operations (MROs) in the Arctic and the likely relevance to all Arctic-8 nations, Ron Wallace, a senior fellow and Arctic expert with the Canadian Defence and Foreign Affairs Institute stated, “We’re just dancing with the devil here. It’s a low probability but a high impact event.”⁸ Mr. Wallace emphasizes that “we have elements of it (a SAR plan), it’s hanging together, but it’s not as comprehensive or anywhere near as material as I think would be needed to respond to a major incident.”⁹

This paper will explore the issue of US logistics shortfalls for major Search and Rescue (SAR) Mass Rescue Operations (MRO) and environmental threats posed by oil spills, specifically a Spill Of National Significance (SONS), categorized and known as a Tier III spill severity level in order to provide a starting point for NORTHCOM's resource analysis and assessment. The study is focused on describing the essential participants, their requirements, current resources, additionally required resources, the logistical challenges to meet these emerging risks, resource staging, and deployment options, followed by a logistical concept recommendation. The recommendation addresses timely response, the type of Arctic-capable resources required for complex emergencies, and proposes a comprehensive solution for the current budget-constrained environment, that incorporates industry, community, and the all-of-government or "all-hands" burden-sharing approach. The proposed solution could serve as a foundational model for other Arctic-8 nations and possibly serve as a framework for addressing logistics in the International SAR agreement. In conclusion, the potential consequences of inaction and recommendations for future logistics to meet the threats of an open and busy Arctic are examined.

Methodology

During the course of the research, it was apparent that a full understanding of the problem, current state of affairs, and all the required information could not be obtained with the available literature and without walking the ground. In conjunction with a review of congressional testimony, the 2011 International Search and Rescue Agreement, unclassified government/military documentation, regulations, industry

documentation, and other open source literature, I interviewed fourteen key personnel from relevant Alaska organizations over a five day period in December 2012. The interviews included officials at US Alaska Command, Alaska Rescue Coordination Center, Shell Oil Alaska, Army Corps of Engineer Cold Region Environmental and Engineering Laboratories, North Slope Borough Disaster Management Office and Search and Rescue, United States Coast Guard 17th District Operations, Northern Command, and the Mayor of Barrow Alaska. In additions to the valuable face-to-face interviews, I was able to visit the Search and Rescue organizations and coordination centers in order to see how, key infrastructure such as existing in-use and dormant hangers in Barrow, low cost man-camps, existing preposition sites, local infrastructure key to large scale emergency, operations transportation assets were set up, how they functioned in the Arctic, and to understand the environmental challenges of the Arctic region. This on-the-ground assessment and in-person interviews, combined with detailed research of the literature, contributed to the development of this paper.

One shortfall in the research was a lack of an interview with the cruise and airline industry. Repeated attempts to organize these interviews were un-successful. As a result, the analysis of these areas is limited to a review of open-source documentation. Additionally, direct interviews scheduled with Alaska State agencies had to be cancelled due to time conflicts. Although these organizations provided valuable documentation in response to the proposed interview sessions, they were reluctant to conduct phone interviews. The lack of in-person meetings prevented a comprehensive understanding of the industries and agencies that written documentation alone cannot provide. Yet, it

was possible to address these organization's roles, assets, and responsibilities in large scale Arctic emergency crises.

This multi-pronged research approach provided the necessary information to build an assessment of the issue. The internet, newspaper, and journal articles provided a clear description of the problem, examples, and historical background. Congressional Reviews, testimony, and supporting documentation provided comprehensive overviews of the issue, key organizations and leadership views of the problem, and the Navy's detailed environmental review that is unequalled in level of detail compared to other literature. The regulations and industry open-source documentation showed what assets are currently required and available while allowing for analysis of what is missing. The information provided by Northern and Alaska Command, the state, and local communities also helped clarify what reasons are available (or not) to address these major crises and the effects to deal with the shortfalls. The interviews and site visits, in particular, were invaluable for understanding the broad issue overall.

The Arctic Region and Climate Change

The Arctic is defined as:

“The region as the land and sea area north of the Arctic Circle (a circle of latitude at about 66.34° North). For surface locations within this zone, the sun is generally above the horizon for the 24 continuous hours at least once per year (at the summer solstice) and below the horizon for 24 continuous hours at least once per year (at winter solstice). This definition includes the northernmost third or so of Alaska, as well as Chukchi Sea, which separates

that part of Alaska from Russia, and U.S. territorial and Exclusive Economic Zone (EEZ) waters north of Alaska. It does not include the lower two-thirds or so of Alaska or the Bering Sea, which separates that lower part of the state from Russia.”¹⁰

Besides the obvious difficulty of operating in twenty four continuous hours with no sun, the definition fails to convey the region’s harsh environment of sub-zero temperatures, rough seas, and the challenges of Arctic ice. While there might be a perception that these challenges will decrease with global climate change, the reality is the changes in the Arctic are only exacerbating these challenges by causing further fluctuations and extremes in the temperatures, winds, seas, ice, and even permafrost.

Year-round Arctic ice dates back over 800,000 years.¹¹ Over one recent century (1906-2006), the mean global surface temperature increased 0.74° C. Eleven of the warmest recorded years occurred during 1999-2011. The increase is more dramatic in the Arctic where average temperatures increased at almost twice the global average during that time. Since 1991, the average Arctic temperature has increased 5° C and ice coverage has decreased by 2.7% per decade.¹² This means that the ice coverage has shrunk more than 11% per decade since the 1970s, with ice receding “at a pace exceeding even the most dramatic predictions of scientists”.¹³ The average size of the September ice cap (the time of the year when it is most reduced in size), has decreased more than 30% since 1979 when recorded satellite measurements began.¹⁴ The years 2007 and 2011 set records for melting. The former saw open water over 40% of the Central Arctic Ocean.¹⁵ This warming has not only reduced the size of the ice cap, but since 1970, has also affected the sea ice thickness. “As of summer 2010, sea ice

volume was 70% below the mean from 1979.”¹⁶ These changes produce what is known as the Albedo Feedback Loop. The “loop” is a cycle of increased melting of sun-reflecting ice that, in turn, exposes dark water, which then absorbs and retains solar energy. This solar absorption further heats the ocean and melts more ice, exposing more heat-absorbing water. This heating and melting generates a cycle of continued warming compounded by atmospheric heating from greenhouse gases released in the form of water vapor. The entire process is further accelerated during the continuous sun of the summer season.¹⁷

Other Arctic areas have been affected, including the permafrost that covers 24% of the terrestrial surface of the Northern Hemisphere. A 2002 US Arctic Research Commission found significant widespread warming and thawing of permafrost; the progressively deeper thawing resulted in shoreline and structure instability. The changes will “have serious long-term implications for Alaska’s transportation network, for the Trans-Alaska Pipeline, and for the nearly 100,000 Alaskan citizens living in areas of permafrost.”¹⁸ Additionally, a 1% increase in precipitation per decade, decreased salinity of the water, an increase in sea level, and significant changes to ice movement contribute to the changing Arctic.¹⁹

Projections for the future Arctic predict more of the same: temperature warming expected to increase from current levels by 2° C to 9° C by 2100 with a 3% decrease in summer ice per decade and overall 40% decrease in ice volume.²⁰ Climate models predict more than half of the current permafrost area could thaw by 2050, with up to 90% by 2100.²¹ Most significantly, far greater human activity is likely in the region in an

Arctic-free summer ice season that might develop as early as the decade 2020 to 2030.²²

Opening of the Arctic

Despite the warmer temperatures and increasingly open water, the key challenges of the Arctic environment are still present. The changing conditions present more danger when combined with the compounding effects of increasingly erratic weather events. The expected growth of human activity drawn to an open Arctic ocean also promises a future region ripe for catastrophe.

Consider the following two scenarios used in a training exercise: (1) A Search and Rescue Satellite Aided Tracking (SARSAT) relayed an emergency transponder beacon to US Coast Guard District 17 in Juneau, Alaska. The distress call was from the *Dig Deep* (an oil drill ship). The Coast Guard received no answer to their calls because weather prevented the North Slope area air response and inhibited satisfactory imagery. Four hours later, the C-130 Hercules sighted the burning hulk of a ship surrounded by a very large and growing oil slick.²³

(2) In September 2012, a group of 154 “Make Peace” activists had chartered the research ship *Kobayashi Maru* and headed to the Beaufort Sea to protest the *Dig Deep*’s offshore Arctic drilling. Eighty nautical miles from Prudhoe Bay, the ship hit a plate of drifting multi-year ice that tore a gash in her double hull and started a fire, injuring twelve passengers. The distress call channeled through Russia to Maryland finally alerted Coast Guard District 17 Joint Rescue Coordination Center. Weather prevented an air rescue response, but an already airborne F-22 Raptor fighter-jet was

diverted from training to find the ship listing 90 degrees, with half of its under-equipped life boats submerged and the remainder being loaded into the frigid water to head toward shore.²⁴

These disasters demonstrate the types of risks common to all ocean exploration and travel. The harsh and unforgiving Arctic significantly compounds the response, containment, and survival in these situations. The incidents listed above are hypothetical scenarios used in a recent “table-top” exercise. The intent of the Arctic Collaborative Workshop’s (ACW) exercise was “war-gaming” various response options. Many questions still remain on the “how and what” of those options.

Arctic accidents are increasingly becoming a reality: (1) In August 2011, a chartered Boeing 737 crashed outside a rural airport in the Canadian high Arctic, killing 12 of the 15 passengers. The three survivors lived, in part, due to a large contingent of soldiers who were, ironically, in the area conducting an Arctic emergency response exercise.²⁵ The fate of the survivors would have been dramatically different had the aircraft crashed in a more remote site, later in the year, fully loaded, and without the timely assistance of trained rescuers.

(2) In December 2012, the 266-foot Royal Dutch Shell oil rig, *Kulluck*, tore free from one of its tow lines and grounded on the Alaskan shore. Headed back to port for the winter after drilling Arctic test wells and still fully loaded with 139,000 gallons of diesel fuel on board, the salvage lines had to be removed due to the force of 70 mile per hour winds and 40 foot waves. The vessel grounded, further increasing the fear of a spill.²⁶ This incident effectively demonstrated the relevance of the table top exercise and challenges of responding to these events in the Arctic.

(3) The cruise ship *Clipper Adventurer* with 197 passengers aboard ran aground in 2010 on uncharted, submerged rocks in Canadian Arctic waters, demonstrating the dangers increased Arctic tourism brings. All the passengers were rescued by the Canadian Coast Guard, but it took two days for the rescue vessel to arrive, four hours to transfer passengers, and almost six hours to ferry them to an airport. Despite the risk of being idle for over 60 hours from grounding to recovery, the ship was undamaged and the weather was calm with flat seas so the threat of sinking was minimal. A rescuer cautioned, “things may not have had such a happy ending had the weather been bad.”²⁷

Clearly, none of these incidents resulted in a Mass Rescue Operation (MRO) or Spill Of National Significance (SONS), or overwhelmed the response services, but Arctic experts agree that “it’s only a matter of time until a modern-day *Titanic* or *Sir John Franklin* catastrophe occurs”.²⁸ The Arctic environment continues to contain difficult and dangerous risks as always, despite the macro level climate changes.

Why are industries taking these risks in the Arctic? The answer for many is the abundant natural resources that exist in the region, including: natural gas, diamonds, coal, gold, zinc, other minerals, and 20% of US oil.²⁹ As the ice recedes, the ocean floor opens to exploration of areas that, in some projections, holds “15% of the world’s undiscovered oil reserves and 30% of its natural gas”.³⁰ Currently the trans-Alaska pipeline has seen a two-thirds reduction in oil production from the existing, but diminishing, North Slope fields. Interest has turned to new off-shore drilling to recover that loss. The enthusiasm for new off-shore drilling in Alaska is understandable considering that 90% of the revenue for Alaska’s general state fund comes from oil earnings.³¹ Shell estimates over \$96 billion in future revenues at each of the two drill

sites and \$145 billion in cumulative payroll for 54,700 jobs over a 50-year period.³² With 26.6 billion barrels and 130 trillion cubic feet of natural gas now accessible, the monetary benefits may warrant the risks.³³

Air travel over the Arctic using cross-polar air corridors is also increasingly profitable. It provides a significant reduction in fuel costs and travel time, providing an obvious financial benefit for the industry. The air traffic between North America and Asia is likely to double by the end of 2025 from its current rate of approximately 50,000 flights a year. A key contributor to this projection is "The Pacific Project," an International Air Transportation Association proposal for addressing travel demands between the two continents.³⁴ A finding from a 2011 joint Canadian and Russian study illuminates the financial benefits of trans-polar flight. The finding states that "a flight leaving Vancouver for Delhi would currently take almost 18 hours. Using polar routes, the same flight would take place in 13.5 hours, saving 4 hours and 15 minutes. This translates into potential savings of over \$40,000 (Canadian) per flight."³⁵ Another example shows over \$50,000 (US) in savings per flight and a reduced flight time of five hours on the trans-polar route from New York to Hong Kong.³⁶

In addition to air travel, the tourism and shipping industries are also expanding their presence in the Arctic. A 10 - 15% yearly increase is expected from the average of 25 ships a year reported crossing between the Alaska and the Yukon maritime Arctic Boundary.³⁷ In 2012, "There has been a tenfold increase in the number of vessels using the Northern Sea Route during 2011 and 2012. In the 2012 season 46 vessels have sailed the route, compared to 34 in 2011 and only four in 2010."³⁸ Polar trips for tour ships doubled over the last eight years with 65,000 passengers booked in 2010 from

Svalbard (Spitzbergen), Norway, and Greenland according to the Greenland Tourism Bureau. The last remaining chance to experience an “untouched region” that holds exotic and endangered species draws these passengers.³⁹ With the Arctic opening, it is likely this desire will drive the cruise ship industry to increase Arctic operations to meet demand and accept the increased risk to do so. Benefits for commercial shipping are enticing as well. Open Arctic waters allow for significant cuts in transit distances and provide an alternate route for super-tankers that have to transit the dangerous southern tip of South America because their size prohibits the use of the Panama Canal. A stark example of these advantages is the 4,450 mile shortcut from Rotterdam, The Netherlands to Yokohama, Japan. The route runs along the Siberian coast rather than through the traditional Suez Canal. Trimming days off the trip and the associated savings in fuel costs reduces the inherent risks of Arctic oceanic voyages in light of the progressive advantages of the disappearing icepack.⁴⁰ The increase in traffic is evident in tonnage shipped, with a 53% increase in tonnage from 2011 to 2012. In 2012, over one million tons were shipped; 894,000 thousand tons of it was various fuels, with the next largest commodities being iron ore and coal.⁴¹

Advantageous new ventures and the continued yearly increase of this Arctic traffic set the conditions for the probability of a disaster. Curtis Smith, a Shell Alaska spokesman, summed up the attitude of these industries stating, “the company (Shell) has a long, successful history of working offshore in Alaska and is confident it can build another multi-decade business in the Arctic. Our success here is not by accident. We know how to work in regions like this, having said that, when flawless execution does not happen, you learn from it, and we will.”⁴² All indications are this confidence and drive

to take advantage of the newly accessible Arctic will continue to grow across these industries. However, not all industries may be as successful, as ready, and as able to recognize the risks or be willing to prepare to meet them as Shell Alaska.

Industry—Crises First Responders

As industry benefits, it also bears the primary responsibility to be prepared to respond to these crises. Industries operating in the Arctic are the first responders in a crisis, using the emergency response system as an analogy. The future reality for industries in the Arctic could likely necessitate a response to a situation that is not related to their operation, which is unlike most operations elsewhere. A general consensus derived from multiple interviews with Arctic SAR experts asserts there is too much territory, in too harsh an environment, with too many incidents involving environmental degradation or loss of life and limb, with too few assets to respond with, for anyone to get territorial or selective about their role in responding.⁴³ Despite this consensus, any efficient enterprise works off the premise that a requirement must exist to put assets against. The discussion above makes clear that an ever-increasing requirement that is appropriately expanded from that of a closed Arctic is necessary. The new requirements will outstrip existing capabilities if the general consensus of the current projected state is accurate. How is industry postured to meet these demands?

In the wake of the severe effects of the Deep Water Horizon, Macando Oil Spill in 2010, the oil industry faces stringent regulations developed in order to conduct oil operations off the coast of the US.⁴⁴ The new regulations adopted as a result of the Macando spill include significant changes in workplace safety rules and oil well control

(subsea and surface blowout preventers, well casing and cementing, secondary intervention, unplanned disconnects, record keeping, well completion, and well plugging).⁴⁵ These requirements are projected to increase yearly operations cost for operators by 183.4 million.⁴⁶ These changes are substantial, but cost, equipment, and procedures are all based on operations conducted in non-Arctic conditions.

There is growing realization that work place safety, procedures, and equipment need to be designed and tested specific to the Arctic. There are currently no regulations specific to the Arctic oil exploration or production to ensure this. The Department of Interior's Ocean Safety Advisory Arctic Subcommittee is pushing for regulators to "adopt baseline standards that would govern a new era of drilling and possibly production in Arctic waters."⁴⁷ The specter of the Deep Water Horizon, the Exxon *Valdez* spill in 1989, and now the *Kulluck* grounding in 2012, revealed that "drilling in the Arctic was different than anything else".⁴⁸ Currently Shell Alaska is the only company working off the North Slope of Alaska, and they have voluntarily adopted safeguards and steps not required by regulation, including an oil spill containment system and significant upgrades. These voluntary steps may have prevented an oil spill when the *Kulluck* grounded.⁴⁹ Shell is not alone in its interest in the Arctic; Conoco-Phillips, Statoil, and Repsol are all planning ventures. If they do not follow Shell's example of voluntary regulation, it is quite likely they will not be ready for that first response when needed.

What is the Shell plan to ensure adequate first response? Their philosophy toward preparation is concisely and succinctly expressed by Shell Alaska's Superintendent of Emergency Response, "if you need it, bring it with you".⁵⁰ Shell developed a multi-layered approach to resourcing spill response and SAR for its new

venture into Alaska's Arctic Chukchi and Beaufort Sea. Set for a one-hour response time, there are five heavy open ocean and ice re-enforced vessels dedicated to immediate response. In addition to stringent prevention measures, they have positioned early warning detection technology, oil containment equipment, skimming, storage, and both the Chukchi and Beaufort sites can employ dispersant and/or controlled "in-situ" (surface oil burn off) burning of oil.⁵¹ Shell agreed to posture for a worst-case scenario that called for the ability to respond to a spill for 30 days. It is not feasible to store all the equipment necessary to do that on site. However, to ensure rapid response, the company employed fully loaded barges and associated tugs, prepositioned and manned for a 24/7 response in safe coves along the North Slope in Alaska. This prepositioned stock forms a secondary response with another layer for backup available from lower Alaska Dead Horse, Dutch Harbor ports, and assets in the lower 48 states.⁵² For SAR, Shell uses search boats and landing craft and employs a state-of-the-art SAR helicopter. In all, Shell has dedicated 19 vessels, four helicopters, and a Boeing 737. Additionally, they have established a 75-person transient man-camp in Barrow, Alaska, which can be employed (*or deployed*) for emergency uses.

The recent grounding of the ice hardened *Kulluck* is a lesson in challenges faced by oil companies operating in the Arctic. Five vessels, two rescue helicopters, a C-130 Hercules, and \$292 million in upgrades to the *Kulluck* did not prevent the 20-foot waves and 40 to 50 knot winds from grounding it on a rocky outcropping along the Alaskan coast. Those same tumultuous conditions meant the rescue of the 18-person caretaker crew from the stranded ship was delayed over 24 hours.⁵³ Had any of its approximately 150,000 gallons of diesel, oil, or hydraulic fluid been breached and leaked, equipment to

contain the spill would not have been able to do so in those conditions. The lack of containment and subsequent delay in response would have allowed a steady flow of pollutants into a remote but environmentally sensitive area, most likely resulting in a suspension of operations, as well as an environmental disaster.⁵⁴ Compounding this setback was the failure of their main oil skimming system that delayed exploration a year. Although repaired and Coast Guard certified, doubts still exist about its ability to function in Arctic extremes.⁵⁵

The difficulty of recovering oil from underneath the ice in cold waters is only surpassed by the difficulty of first locating that loose oil.⁵⁶ Ben Ayliffe, a Greenpeace campaigner, went as far as to say “The technical difficulties of responding to a disaster a mile beneath the ice make the kind of operation BP (British Petroleum) had to do in the Gulf impossible in the Arctic”.⁵⁷ If not impossible, oil recovery in these conditions indicates extreme challenges in simply finding and removing the pollutants. Recovery is further complicated by ensuring the safety of the recovery personnel on and off the shore. Although Shell has SAR capability, it is severely limited and has little immediate backup. The nearest Coast Guard station is 1,000 miles away, and the North Slope Borough’s (NSB) SAR capability is extremely limited in over-water rescue.⁵⁸ Additionally, the region has limited capability for on-shore man-camps to facilitate an on shore clean-up. If the weather or failure of equipment designed to cap a “blow-out” fail to prevent a hasty stop to the spill, the resulting spill could quickly overwhelm industries’ ability to contain it. It would develop into an Arctic version of the 2010 Mancado SONS.

Shell and others are determined to continue the exploration despite these challenges, environmental groups’ pressure, and the cost of future regulations. Shell

anticipates production by 2020. Summing up its attitude toward the challenges, a Shell website discussing the December 2012 *Kulluck* disaster quotes Thomas Edison, “I have not failed. I’ve just found 10,000 ways that won’t work.”⁵⁹ Despite Shell’s optimism and self-regulation, the Arctic dictates that procedures, technology, and resources be improved and augmented to ensure as minimal a risk as possible.

Arctic-specific requirements to enable ships to act as their own first responder must also catch up with the increase of traffic in the Arctic. As Vice Admiral Brian Salerno, Deputy Commandant for Operations, Coast Guard expressed at an Arctic leadership conference in April 2012, “It is not just academics and conservationists who are concerned. The sharp increase has caught the US Government without a clear national policy”.⁶⁰ The International Convention for the Safety of Life at Sea (SOLAS) is the legal framework currently governing the Arctic with no binding treaty for regulations. The UN’s International Maritime Organization is considering establishing standards into a “Polar-Code” as part of SOLAS to increase Arctic-specific safety equipment, ice hardening, and steps to lessen ships’ environmental impact. SOLAS does include specifications for passenger ships, but there are no specific requirements governing Arctic operations. For example, there are no requirements for ships to be ice hardened to transit the Arctic. In addition to construction specifications, the new guidelines would include safety equipment and procedures, such as improved and redundant navigational and communication equipment, protective clothing, group survival kits, enclosed life boats, tarpaulins, crew training, and a certified Ice Navigator.⁶¹ The “Arctic Guidelines” non-mandatory standards were adopted by the International Maritime Organization (IMO) in 2008. Formally titled, *Guidelines on Voyage Planning for*

Passenger Ships Operating in Remote Areas, it calls for development of detailed trip plans that include contingency and emergency plans. The intent is for shipping in general, but especially passenger ships, to follow the *Enhanced Contingency Planning Guidance for Passenger Ships Operating in Areas Remote from SAR Facilities*. Besides keeping responders abreast of their location and intentions, this mitigation measure urges “pairing” of ships for a voyage for mutual support in an emergency.⁶²

Enforcement of these guidelines and initiatives poses the most significant challenge for Arctic countries. The guidelines are non-binding and rely on the nation flag the ship sails under for enforcement. Currently the only designated safety and environmental standards set apart from international standards and adapted for specific waters rest with Canada and Russia.⁶³ The “Arctic Expedition Cruise Operators” insist Arctic travel is safe. Organizational spokesman Ilja Leo Lang stated, “The organization represents strictly expedition cruise vessels of no more than 318 passengers...none of the association’s 23 members use heavy diesel fuel.” However, the largest risk may not rest with these safety-conscious self-regulating operators.

Large cruise ships driven by demand and economic gain, ill equipped and untrained, and not as self-controlled as conditions require will present the greatest risk for the self-regulating industry, SAR organizations, and the Arctic. Dr. Lawson Brigham, Professor at the University of Alaska, Fairbanks, commented, “It is the larger ships carrying more passengers that could represent the biggest threat to human life.” He provides a poignant example, “What we’re really concerned about is the big cruise ship that comes up from Miami. It doesn’t appear to be the right vessel for polar waters, but it can carry a lot of people and make a lot of money. The question is how safe is it?”⁶⁴ The

unlikely enforcer that may prevent this scenario is the insurance industry that adopts and, by default, normalizes the otherwise non-binding guidelines as conditions for coverage.⁶⁵ These challenges and others, such as lack of navigation charts, marker buoys, and maritime way-stations comprise the myriad of challenges facing Arctic maritime travel. As the media continues to broadcast the allure of the Arctic and the demand to travel there rises, the risk of an MRO significantly increases.

The Airline Industry is more regulated and has standardized regulations for safety; however, it still faces the issue of enforcement by the nation of origin. Insurance companies, airports, and airline safety ratings tied to the airlines' reputations keep most in adherence. All US carriers currently have a minimum of ten Arctic-specific requirements. Of note, Arctic travel requires a detailed recovery plan for passengers on diverted flights; the plan should include sufficient capacity and alternate airports able to handle the aircraft; a fuel freeze strategy and ability to monitor it accepted by the Federal Aviation Administration, an enhanced communication capable of working in the Arctic; air crew training that includes route-specific training on weather patterns and use of cold-weather anti-exposure suits; considerations and training for effects of in-flight radiation exposure resulting from solar flares; and most importantly, for a diverted landing in an Arctic environment, two anti-exposure suits for crew coordination outside of the aircraft.⁶⁶

Unlike the life vest or rafts that are standard on a commercial aircraft for emergency water landings, equipment for survivors and crew facing an Arctic emergency is missing from this list of requirements. Cost, weight, and space will likely prevent the inclusion of the necessary kit for a downed aircraft to act as its own first

responder. The challenge then becomes how fast can rescuers arrive? Additionally, what assets do they have to immediately remove survivors out of the environment and then conduct follow-on recovery and investigation operations? These requirements are essential because the benefits of transpolar flight described earlier promise to make Arctic flight an expanding venture. However, environmental concerns may drive traffic to routes around the Arctic. Even with these diversions, the SAR issues remain, as the environment on the fringes of the Arctic can be as treacherous as within.

Arctic Community—Multiple Responder

An Arctic Mass Rescue Operations (MRO) or Spill Of National Significance (SONS) will inevitably involve North Slope Borough Arctic communities such as Barrow, Ft. Wainwright, and Purdue Bay. In August 2011, the town of Barrow could have easily found itself in the role of a first responder when hundreds of German tourists unexpectedly arrived on their shores in small Zodiac boats launched from a cruise ship that was not being tracked by any US authority and after the season was thought to be closed. The cruise ship apparently opted to meet customer demand and risk a trip through treacherous Arctic waters. Ignoring the legal issues of customs and immigration and ability or inability of Barrow to absorb the group (if an emergency had occurred during the trip to Barrow or back to the cruise ship), the town would have inevitably found itself in the role of an MRO first responder.⁶⁷

Although in this instance, Barrow may have had to play the role of first responder, it is more likely Northern communities will contribute in a backup role. That role would most likely include use of public facilities, such as schools, community

centers, medical clinics, and city government centers. Schools, clinics, and gyms could serve as medical triage or temporary holding facilities with the civic infrastructure as temporary command and control centers. Additionally, any air or sea and port-type structures would immediately need to serve as staging bases, fuel points, and transfer points. Local expertise and SAR assets would be vital in the early stages to augment first responder, state, and federal assets.⁶⁸

The Northwest Arctic Subarea Contingency Plan provides a comprehensive list of each community's resources including lodging, vehicles, communications, harbors, spill-response equipment, and even assets of corporations prominent in the local area. What it shows is a myriad of capabilities and assets, from the moderately robust to the extreme minimal, and little in the way of standardization. However, the implication of the comprehensive list is the realization and willingness of communities to assist when needed.⁶⁹

As an example, Barrow is an incorporated city and is one of the most robust and capable communities on the North Slope. With a population of over 4,000, it is the seat of the North Slope Borough Government and Emergency Response Control Center and has a reliable natural gas energy supply, an airport, sewage treatment plant, developed infrastructure, and soon, a substantial medical facility.⁷⁰ Like many of the coastal communities, it hosts functioning and mothballed military facilities. Besides property that houses a radar station, there is a derelict runway with two substantial and sound hangars built between the late 1940s and 1960.⁷¹

Many Arctic communities are Spill Response capabilities are tied to prepositioned assets controlled by the Alaska Department of Environment and

Conservation. While communities of the North Slope rely on response agencies sponsored and resourced by industry. The city of Barrow and NSB utilize organic equipment for local issues, but rely on “Village Support Kits” and Village Response Teams from these industry consortiums for non-local spills that impact other communities. The North Slope Borough’s first responder kits and small local teams are provided and employed by the Arctic Slope Regional Cooperation and backed by the significant resources of the Alaska Clean Seas organization. Over 80 booms, 150 sorbents, and support and personal safety equipment make up the Village Support Kits.⁷² Like most communities, they also maintain backup oil-containment resources as part of a prepositioned plan for local spills. Composed of 12 oil industry members, the Arctic Slope Regional Cooperation has \$25,000,000 in equipment including 280,000 feet of oil-containment booms, over 160 skimmers, 95 vessels, 250 barges, over 90 vehicles (tracks, trucks, sleds, tractors, forklifts), and 250 storage tanks. This significant pool of assets is available through a North Slope Mutual Aid Agreement that exists between communities and the Arctic Slope Regional Cooperation to meet a North Slope-wide oil spill crisis. The local SAR resources are not as abundant.

The North Slope SAR is one of the largest of the local Arctic search and rescue organizations. They can mobilize two helicopters (not winch capable), two Lear medical evacuation jets, and a small fleet of near-shore boats. Additionally, the North Slope Borough Emergency Management Team acquired a 24-foot trailer containing sea rescue equipment (life boats, emersion suits, and life preservers) through an Alaska state grant initiative.⁷³

The North Slope Borough and Arctic community obviously face significant search and rescue resource issues if faced with mass rescue operation incident. These organizations and assets are not designed for mass rescue types of operations and would quickly be overwhelmed.⁷⁴ The town of Barrow would be easily overwhelmed with responders and victims of a Mass Rescue Operation (MRO) and Spill Of National Significance (SONS), despite its infrastructure. Additionally, the future of Barrow's infrastructure itself is questionable when considering the environmental impact of thawing permafrost. Ironically, the pilings for the older hangers are deeper and sturdier than many new structures.⁷⁵ The Coast Guard's use of a newer hanger at Barrow's airport could barely fit its two rented helicopters because it had sunk several feet into the permafrost.⁷⁶ With current environmental projections and permafrost degradation, the city's infrastructure is a serious concern and consideration for future planning. In response to a SONS, there are significant assets on hand between industry, Alaska Clean Seas (ACS) organization, and the communities. The availability of trained, on-hand SONS teams add to this. Barrow has the most personnel with 50; the seven other communities with response personnel are below 20 and Point Lay has only one. The North Slope Spill Response Team (NSSRT) forms another pool of potential help. In all, over 300 trained personnel are theoretically accessible for spill response from across the NSB. Combined with ACS personnel, it provides potentially 115 personnel daily. This seems ideal, but a recent local spill generated a request for five team members. That request went unfilled and resulted in a hasty training of public works personnel to fill the requirement.⁷⁷

Organizing, deploying, and manning trained personnel would likely present a significant challenge. Maintaining the appropriate quantity of equipment, especially items with a limited storage life that requires rotation, and ensuring equipment is exercised presents a greater challenge for local communities. Other challenges are a matter of simple coordination and follow through. A prime example is the fact that key NSB officials were not aware the 24-foot trailer of sea rescue equipment was at the Barrow airport and that the trailer did not come with a sustainment plan on how to maintain the supplies or a means to deploy the assets.⁷⁸

The future of the North Slope communities could be what Barrow experienced in July 2012 when the Coast Guard conducted “Exercise Arctic Shield”. A number of Coast Guard officials moved into Barrow and stationed patrolling cutters off the coast. Occurring concurrently to the exercise was a new routine of activities. Shell conducted operations in the Beaufort and Chukchi Sea, merchant and cruise ships operated in the area, and Greenpeace performed research activities.⁷⁹ In short, the future of Arctic communities will be a busier one.

State Assets and Resource Gaps

The majority of search and rescue and government oil response capability available to the Arctic rest within the State of Alaska in the form of the US Army and Air National Guard, Alaska State Troopers, Alaska Department Environmental Conservation, Alaska Department of Fish and Game, and the Civil Air Patrol of Alaska. In parallel to Alaska’s prepositioned spill response assets, air SAR centers are located around Alaska and respond to the Rescue Coordination Center (AKRCC) located at

Joint Base Elmendorf Richardson. The AKRCC has access to three on-call rescue squadrons composed of HH-60G Helicopters, HC-130s, and the specialized Guardian Angel rescue team they can call on before asking for Federal assets. The state also has a sizeable fleet of boats and ships from across multiple state agencies to pull from.⁸⁰

Alaska's significant investment in SAR and spill response is surely a result of years of lessons learned. Not discounting Alaska's natural disasters, the countless rescues resulting from one of the harshest environments and events, such as the 1989 Exxon *Valdez* spill, have produced a substantial capability for saving the environment and lives. Alaska recognizes the requirement and is not waiting for another *Valdez* or a major rescue before addressing the issues emerging from an opening Arctic.

Federal Assets and Resource Gaps

The US Coast Guard District 17 is the primary maritime SAR organization for Alaska and the Arctic with substantial supporting assets. They are also equipped for oil spill responses. Operation "Arctic Shield 2012" serves as a prime example of what the Coast Guard provides and the initiative they are taking to ensure a safer Arctic. Over five ships and their supporting aircraft, two MH-60 Jayhawks, limited oil containment booms and three oil skimmers are committed to support the Alaskan waters. The exercises included training on and testing of oil-containment equipment. The force conducted ten actual rescues and tested new amphibious vehicles for use in the Arctic. "For the first time," states Rear Admiral Thomas Ostebo, "we had Coast Guard crews standing the watch and ready to support search and rescue, environmental protection, and law-enforcement operations in the Arctic".⁸¹

As an example of unique assets available from the larger Coast Guard, District 17 could call on the 35-member Coast Guard National Strike Force, based in Los Angeles, which is trained for immediate response to oil spills.⁸² It is evident the Coast Guard plays a vital role in the total response capability for the Arctic, but like most organizations wrestling with supporting the changing Arctic, it is hampered by a mission that is broader than the resources available to address it. A lack of forward-basing infrastructure, unique Arctic equipment, and ice breakers are their most substantial shortfalls, and all require substantial investments. However, when the question of who has the Federal lead for a future Arctic, the answer is nearly unanimous that it is, and will continue to be, the Coast Guard.

Department of Defense Assets and Resource Gaps

The Department of Defense's (DoD) assets are well known. The US Army's CH-47 Chinooks and skid-mounted UH-60 helicopters out of Fairbanks, Alaska, are some of the most valuable assets, especially for medical evacuation according to the AKRCC. In an MRO or SONS event, the additional heavy-lifting capacity of the US Air Force's C-130, C-17s, and other cargo aircraft will be critical. The DoD also maintains a significant SAR and oil-spill response capability to handle military requirements.⁸³

Despite this capability stationed in Alaska, use of DoD assets beyond military needs is not clear. DoD is prohibited by law from procuring and maintaining items for Defense Support to Civil Authorities (DSCA) unless those same resources are also required for military use. To utilize these resources, DoD internal directives stipulate that, "in the event of a natural disaster or other domestic emergency, state resources

must be overwhelmed or exhausted as a precondition to providing Federal military resources.”⁸⁴ The intent is to ensure military resources are used for their primary military mission.⁸⁵

National Security Presidential Directive (NSPD)-66 and Homeland Security Presidential Directive (HSPD)-25 provide the basis for DoD support of the SAR and Environment. NSPD-66, Para. F, 1, a & c, directs, “To facilitate safe, secure, and reliable navigation” and “To protect the environment”. To that end, Paragraph 4, b states:

Commensurate with the level of human activity in the region, establish a risk-based capability to address hazards in the Arctic environment. Such efforts shall advance work on pollution prevention and response standards; determine basing and logistics support requirements, including necessary airlift and icebreaking capabilities; and improve plans and cooperative agreements for search and rescue.⁸⁶

The United States Northern Command Theater Strategy shows the requirement for support of civil authorities nested in one form or another in the National Security Strategy, the Unified Command Plan, Quarterly Defense Review, Guidance for the Employment of Force, and the National Military Strategy. In his Theater Strategy Campaign Plan, General Charles Jacoby, Northern Command Commander, recognizes the changing Arctic environment, need for international cooperation and to resource search and rescue capabilities across the polar ice pack.⁸⁷ Furthermore, the new SAR agreement lists the Coast Guard and DoD as the SAR agencies for the US.⁸⁸ The requirement for DoD as a

secondary responder in the event of a major crisis is clear; its role for resourcing is not. The active military has an internal SAR requirement for water, aircraft, and land rescue, and with it, the obligation to resource for the mission. The military even has a requirement to be prepared to respond to an oil spill of its own making, and the Office of the Supervisor of Salvage (SUPSALV) has warehoused significant spill-response capability in Anchorage for that very response.⁸⁹ Given the response challenge Alaska presents in time, distance, versus coverage assets, a case could be made for an exception to increase and augment these assets as further backup. At a minimum, the existing assets should be packaged and stored for quick response, which leads to the next significant resource issue, which is time.

Time Shortfalls

When one considers all of the existing resources from industry, community, state, Coast Guard, and other Federal assets, it appears there are sufficient resources to respond to a ship disaster, spill, and in the right circumstance, even an aircraft crash rescue. Unfortunately, that assessment would be inaccurate according to interviews of experts from the Alaskan SAR community and the Army Corps of Engineer's Cold Region Environmental and Engineering Laboratories (CREEL).⁹⁰ The reasoning behind the faulty assessment relates to time even more than a dearth of arctic capable resources.

The most limiting shortfall in the Arctic regions is time. Response time is critical in these crises due to the speed at which the elements can take a life or

compound the effects of a spill. Reducing the notification-to-rescue-time gap is crucial in all of these scenarios, even in summer. The extreme lethality and remoteness of the Arctic is well known, but often underestimated. Even to a well-resourced first responder, the Arctic and its ice could turn a containable Tier I spill into a Tier III SONS. This is evident with the difficulties faced in trying to prevent the 2012 New Year's Eve grounding of the *Kulluck* and rescue of its crew.

When a Canadian C-130 crashed in clear weather 12 miles short of the flight line in September 1991 while in sight of the lights of a landing strip deep in the Arctic, all on board survived. However, the difficult terrain, a sudden blizzard, and the destruction of the limited survival gear contributed to five of the 18 survivors freezing to death. The lack of proper equipment to reach them was also responsible for the 30 hours it took for paramedics to arrive on scene and another 10 hours to evacuate.⁹¹

Assuming an ice pack and 150 nautical miles from the north coast of Alaska, it takes 12 hours (including a crew change in Barrow) for two HH-60s from Joint Base Elmendorf Richardson (JBER) to arrive on scene.⁹² It can take over six hours, weather permitting, to load and launch with an Arctic Sustainment Package (ASP) and Para-Rescue (also known as Para-Jumpers or PJs forces, an HC-130 or C-17 to drop and/or land at an accommodating airstrip in the Arctic.⁹³ A Coast Guard CH-130 from Kodiak, dropping only survival and communications gear, reduces that time by just an hour.⁹⁴

When studying the average time of existing contingency plans that state, community, and industries provide for coordinated agreements and reasonable visibility of the assets, there is little evidence the system is adequately tested and thus operating effectively, especially at the community level. Loose coordination and questionable exercising of the forward resources seem to explain the most significant negative impact owing to the loss of time in mobilizing and activating these resources. The average survival time for a human being submerged or floating in cold water is one to three *hours* given no injury, moderate clothing, and a life preserver. On land, survival expectations are one to three *days* for a person with injury, and two to three *weeks* for an ambulatory person with adequate backwoods knowledge. This grim survivability assessment was developed for a missing pilot in the more survivable conditions of 25-45°F October weather, far from Arctic extremes.⁹⁵ When considering Arctic extremes such as a decrease in the temperatures to below zero with wind chill, and the on-land survival time alone would be reduced to hours. Hence, this underscores the importance of an extremely rapid response time for Arctic crisis events.

The damage of an oil spill not contained in a timely manner has been documented in countless news articles and broadcasts. The North Slope Borough Multi-Agency Passenger Vessel Emergency Quick Response Card has a Federalized Unified Command and many actions in motion within two to four hours.⁹⁶ However, what is not mentioned is the length of time before resources are activated and actually reach the distressed. Closing this time gap of resource arrival at the crisis, as much as possible, is essential to survival.

Equipment Shortfalls

The lack of ice vessels, air assets, aircraft hangers, a possible deep water port, and forward Coast Guard infrastructure is a critical part of this gap. The cost, long lead time, planning, construction, and coordination with local tribes, makes these resources a challenge of great magnitude. If the Arctic continues on the projected track and transforms as early as 2020, the lack of these resources will have to be addressed in the short term.

Infrastructure Shortfalls

Compounding any planning of infrastructure is the continued degradation of the permafrost. This type of challenge may require unique solutions such as the Arctic Mobile Offshore Base, proposed by Dr. Andrew Metzger, a University of Alaska Fairbanks Professor, at a briefing to Alaska Command.⁹⁷ The Coast Guard and the State of Alaska is pushing forward on many of these needs, but it needs national focus and attention to meet the long-term requirement. Lead times for construction in the Arctic are two to three times longer than in non-Arctic areas. Planning time for the Department of Homeland Security and DoD is approximately five years.⁹⁸ Much of the preparatory work in studies, costs, permits, agreements with local communities, etc. can be set in motion, ready for

execution, or even completed now, so that adequate infrastructure and equipment is in place when it is needed.

Basic Resources Shortfalls

Shortfalls also exist in less daunting areas. Temporary or semi-established man-camps with all the Arctic-capable supporting assets such as power, heating, protection, and mobility are not available in sufficient supply. These assets are needed for lodging of shore clean-up crews, a remote incident that requires a shelter for medical triage, temporary medical care, warming shelter, onward movement center, or command and control center. Canada has led the way in developing this capability. The Major Rescue Operations Shelter Kit (MAJAID) supports ten casualties each for a total of 32 available kits that provide 72 hours of care and survival. The kits are air droppable in three to four HC-130 loads and includes all life-support, as well as an eight-wheeled Argo snow vehicle. The MAJAID Kit is designed to be loaded in two hours and on scene in six hours, including five flight hours. The US is not far behind with an initial kit labeled the Arctic Sustainment Package (ASP) designed for 25 passengers per kit, one kit per HC-130, also for 72 hours of survival. The State of Alaska and Alaska Command (ALCOM) are attempting to secure the necessary funds to build additional kits (approximately \$100,000 each), with the goal of making it a sustained permanent system.⁹⁹ Arctic communities, in general, are very few in number, and the ability of existing communities to support a large influx of support personnel or act as a logistics staging base is minimal or nonexistent.

This shortfall dictates a requirement for the alternate means an Artic Sustainment Package type system provides. An Arctic-hardened vehicle to move these man-camps and personnel to a crisis is essential and demonstrated by the Coast Guard's active testing of two vehicles at around \$3 million apiece to meet this need.¹⁰⁰ The nature of resources for on-land, on-water requirements demands a multi-use, amphibious vehicle to adequately fill this need.

Other Significant Shortfalls

Lack of communications and domain awareness are two critical resources identified in the Northern Command White Paper. In a December 2012 advocacy meeting, the Northern Command Commander made them a high priority for his combatant command's advocacy for funding and resourcing.¹⁰¹ They are critical to Arctic military operations and essential to any crisis response. To be truly effective in these situations, they will have to be standardized and resourced not only to DoD users, but down to the user level and compatible across all responding organizations, civilian or military. There is definitely a logistical requirement to fill these communication and domain awareness assets, however, operational requirements are most pressing and must be addressed prior to making before decisions about what assets to acquire. The compositions of these assets are beyond the scope of this paper. However, the absences of these assets make any logistical concept impractical if not addressed. Domain awareness is required to better tracking traffic in the Arctic and standardized

communications down to the lowest level essential to reducing response time and safely and efficiently conducting operations.

Recommendations for Resourcing the Resource Gap

The Coast Guard's Commander for the 17th District, Rear Admiral Thomas P. Ostebo, said of the resource gap, "In Alaska, we constantly adapt to the environment around us. We're going to find the right mix of resources to protect mariners, the environment and our Nation's interests in the vast Arctic Region."¹⁰²

Although the Coast Guard was the focus of this statement, obtaining a comprehensive mix can only be achieved by adapting how we approach the solution. In general, organizations interviewed tended to focus on individual agencies for comprehensive solutions. The mix will include existing resources, but at a minimum the basic resources such as an Arctic Sustainment Package and a deployment vehicle have to be filled to meet the new requirement.

Temporary Infrastructure has to be established. Communications, domain awareness, issues have to be addressed in the short term. Even these short term resource solutions will be prohibitive for a single agency solution. In discussions, the rapid realization that single agency solution is not currently monetarily feasible coupled with the general tendency to not look beyond it, ended most discussions of even short term solutions. The lack of funding is not going to change, but the requirement is ever pressing. The solution rests in a collaborative government and industry approach. International resources may also be involved, considering location and severity of the situation, in accordance

with the new SAR Agreement. As stated, the Arctic is different; it is a “new frontier” to use General Jacoby’s words.¹⁰³ It requires a new approach to address its unique complexity. The “mix of resources” has to be just that, incorporating all assets. Industry would act as the first responder, and community, state, and federal resources would act as key parts of the secondary and sustaining responses. Complimenting this mix is the promise of international resources responding in the framework of the SAR Agreement.

The cooperative solution should center on a comprehensive or “all-hands” approach where each party tied to the changing Arctic by requirement, duty, gains, losses, or livelihood contributes in areas where they are capable. Spreading the burden would not only disperse the financial costs of the resources, it would help in placing the resources where they can be distributed best for deployment and exercise. The QDR identifies this need as, “a unique opportunity to work collaboratively in multilateral forums to promote a balanced approach to improving human and environmental security in the region.”¹⁰⁴ A pointed example of this type of opportunity is Alaska’s interest in a joint venture possibly involving private, public and federal agencies to finance and build a joint aircraft hangar facility on the North Slope for year-round use. Reportedly, the projected contribution requested of DoD is little more than an approximate \$100,000 a year for sustainment costs.¹⁰⁵

Logistical Synchronization Concept

How resources are synchronized and utilized across multiple organizations is critical to the ability to respond quickly and efficiently to crises. Those resources must be banded together by agreements, procedures, and regular exercise of the assets. Government cannot force binding agreements on private industries or local organizations, but existing mutual aid agreements could be enhanced to form a more cohesive picture of what assets are available and to refine how these assets could be called for support during a federalized MRO or SONS. The After Action Report (AAR) for the 2012 Arctic Collaborative Workshop's, Arctic Oil Spill & Mass Rescue Operation Table Top Exercise recognized this need in its recommendation for an "in-depth analysis" of the overall response infrastructure and resources.¹⁰⁶ There are existing agreements and structure, but few appear to be linked effectively enough to ensure efficient, timely, and unique responses to Arctic demands. The inability for the North Slope Borough to organize five spill responders out of a supposed 115 available personnel is a local example of this disconnect.¹⁰⁷ It is likely that this example belies many other problems in response processes that, although may be addressed in written form, are not fully vetted, coordinated, or tested. An inability to coordinate, mobilize, and deploy assets, human or otherwise, for major crises further increases the response time and ultimately will result in environmental disaster and lives lost.

Shell and the Coast Guard both agreed they worked well together during the summer of 2012, but that was reportedly not the case between the North

Slope Borough and Shell.¹⁰⁸ A lack of common language between non-Department of Defense supporting agencies' use of the National Contingency Plan and DoD's use of the National Response Plan caused confusion during the Arctic Response Table Top Exercise.¹⁰⁹ The National Response Framework, which replaced the National Response Plan, is based on the principles of engaged partnerships, a unified command, a readiness to act, flexible operational capabilities, and tiered response.¹¹⁰ There is the potential for confusion and disconnect even within the Defense Department and especially within the otherwise disconnected tiers. As an example within the defense structure, the current Unified Command Plan splits the Anchorage-based Alaska Command and Joint Task Force Alaska between Northern Command and Pacific Command. "A 'pooled' headquarters working for two different combatant commanders violates the principles of simplicity and unity of command."¹¹¹ Synchronizing efforts among organizations is often difficult. The Arctic effort is substantially more complex when the whole of government is considered."¹¹² Northern Command's calls for coordination and cooperation in its Table Top Exercise After Action Review underscore the need.¹¹³ Adjusting and using existing agreement structures such as the Emergency Management Assistance Compact, a national interstate mutual aid agreement, as a framework for cooperation between industry, community, and governmental organizations, could curtail many of the gaps across these organizations.¹¹⁴ There is ample evidence that the motivation to cooperate exists between all these organizations. This desire should be harnessed and refined to optimize resource response and

deployment. To capitalize on this motivation, a program akin to the Emergency Management Accreditation Program, which is a voluntary accreditation initiative designed to improve emergency management through a review and accreditation program at the state and local level, could be developed. Incorporating a comprehensive review of the viability and effectiveness of the processes, agreement, and timeliness of response to include the Federal role in the system, will ensure existing emergency plans, revisions of plans, or future plan development are operationally effective enough to deliver the required resources in time to make a difference.¹¹⁵ In a situational response, confusion between agencies, disconnects between steps of processes, and inadequate resources could be overcome with time, but the Arctic does not afford that time in even the most minor of situations, much less in substantial crises such as an MRO or SONS. The enhancement, strengthening, accreditation and further development of these agreements and processes are essential to ensure effective immediate and flexible response.

Logistical Coordination Concept

Any logistical concept for an Arctic MRO or SONS has to close the time gap of the event to resources on hand for rescue or response. Much of that time can be gained by refining the response processes and should be explored in further research. As the primary responsible agent, industry's disaster preparedness is currently far from fully developed or proven. This same refinement of processes, coordination, and joint government and community

exercises could greatly improve these capabilities and increase confidence in the system to respond collectively and immediately with a sustained response window of 24 to 72 hours.

Logistical Conceptual Model

When the rescue or spill overtakes this first response capability due to weather, numbers of people, or malfunctioning response equipment, timely secondary responses for these scenarios becomes critical and is far from developed. That response requires an immediate “push package” of critical response equipment via air or from an establishment of prepositioned stocks (PREPO-stocks) tied to North Slope infrastructure. Currently there is only adhoc, if any, local community response to a sea incident or downed aircraft rescue. Local available equipment is loosely, if at all, part of any organized response, and the ability to deploy it in a timely manner is also questionable. To date, the Arctic Sustainment Package (ASP) is currently a one-of-a-kind kit and not pre-established as a ready-to-deploy push package. Multiple kits at locations that can rapidly load and deploy them are needed for the push package concept to meet large scale emergencies and reduce the response time to any substantial degree. If sufficient quantities are available, organized as push packages and pre-staged next to air terminals, it can quickly load and launch to arrive on a major crisis scene in hours to re-enforce the first response assets. For example, the HC-130-capable ASP could arrive in Barrow, Alaska from Joint Base Elmendorf Richardson in just six hours. The current ASP timeline represents a

critical gap in the resources needed for an MRO.¹¹⁶ Forward, prepositioned ASPs can fill the requirement and augment the air package in the event aircraft cannot fly. The ASP components (tents, foodstuffs, snowmobiles etc.) require minimal upkeep. Existing military infrastructure in North Slope could serve as PREPO-stock, and training sites. Use of local labor contracts could provide the workforce to conduct periodic maintenance, shelf life management, and facilitate rapid deployment of the Arctic Sustainment Package equipment to local or other rescuers.

There is precedence for PREPO-stocks going as far back as the early 1950s when the Air Force Office of Special Investigations (AFOSI), using local labor, established above and below ground caches storing a vehicle and 107 different pieces of equipment for over five years. Enough resources were stored to equip local native agents to survive a year in the Alaskan wilderness.¹¹⁷ Like the AFOSI caches, minimal storage options are required, ranging from prefabricated climate controlled structures to the use of refurbished pre-existing buildings. Relative low cost, prefabricated structures, such as Shell's canvas hanger to the refurbished possibilities of Barrow's two unused military hangers, are prime examples of low impact solutions. Recent assessment of the Barrow hangers indicate the facilities are structurally solid and would need soil contamination clean-up (required regardless of use), replacement of mat flight line, and basic refurbishment of the structures.¹¹⁸ The Barrow fabric covered recreation center, similar to Shell's hanger, has weathered the elements for years according to the mayor and provides sufficient shelter from the elements.¹¹⁹

These facilities provide unique possibilities and flexibility for storage of PREPO-stocks, options for forward basing, or temporary use for Arctic Shield Exercises without the high cost of new construction.

Deployment of the Arctic Sustainment Package or sea rescue equipment stranded in the 24-ft. trailer would require the acquisition of an amphibious vehicle similar to those tested by the Coast Guard. Use of a hovercraft has generally been ruled out for a number of reasons, and the flexibility of land or sea movement is key to ensuring the rapid deployment of the prepositioned equipment. For example, one of the Coast Guard vehicles is the 50 foot bi-hull ARKTOS Evacuation Craft, capable of carrying 52 evacuees or 11,000 pounds over land and double that amount over water. The craft can be modified to fit specific requirements, speeds, and ranges. In one application, it is carrying sleeping quarters in front and a hovercraft on top of the back section.¹²⁰ The relative low cost and capability of equipment such as this would allow PREPO-stock to also be versatile and responsive.

PREPO-stock for a spill of national significance is largely in place today. Shell and others feel the amount in place would be adequate enough to handle an Arctic spill or well blowout due to differences in how oil reacts in the Arctic versus how it spreads in the gulf.¹²¹ Scientists at the Cold Region Environmental and Engineering Laboratory caution that the challenge of oil loose in Arctic waters under or in ice should not be underestimated, especially when you add unpredictable weather.¹²² The Supervisor of Salvage and Diving (SUPSALV) under the US Navy's Naval Sea Systems Command has a robust oil containment system in Anchorage that should be packaged and ready

as an air-push package to augment the existing systems and Coast Guard capability available during Arctic Shield and the drilling season.¹²³

Rounding out this logistical concept is the requirement to respond to multi-day MRO or SONS that would likely require evacuation, further re-enforcement, and follow-up sustainment. Industry, state, and federal resources would all contribute to this sustainment, and local communities would inevitably find themselves in support roles or actively responding to water and shore clean-up in the event of a spill.

Conclusion

At some point, the US will require additional Federal or Coast Guard presence along its Arctic coast, with expanded and lasting infrastructure, new icebreakers, increased Arctic capable aircraft, and other assets requiring substantial investment. A major step in this direction would be to adopt the small measures suggested in this logistical concept, combined with an “all-hands” resource approach through comprehensive and refined mutual aid agreements that spread the financial burden while increasing the speed and efficiency of major disaster response.

The all-hands concept was best demonstrated at the international level with the 12 May 2011 signing by all Arctic-8 countries of the Agreement on Cooperation on Aeronautical and Maritime Search and Rescue in the Arctic. The agreement includes twenty Articles that cover all aspects of rescue within each Arctic border country’s SAR area of responsibility outlined in detail in the agreement’s annex. The agreement addresses cross border re-fueling, rescue,

and specifies each countries responsibility for funding the cost associated with conducting a rescue within their area. Despite the example of cooperation the agreement demonstrates, it lacks discussions of the resources available across each signatory or shortfall of resources and ways to address the issue collaboratively.¹²⁴

The other Arctic-8 countries are expanding their infrastructure with new research, military, industrial, tourist, and SAR facilities. Like the US, international support would likely be forthcoming in the event of a severe disaster requiring extended support. Deputy Secretary of State, John D. Negroponte, expressed the importance of international cooperation in the Arctic in his comments following the May 2008 signing of the Ilulissat Declaration:

The increased use of Arctic waters for tourism, shipping, research and resource development also increases the risk of accidents and, therefore, the need to further strengthen search and rescue capabilities and capacity around the Arctic Ocean to ensure an appropriate response from states to any accident. Cooperation, including on the sharing of information, is a prerequisite for addressing these challenges. We will work to promote safety of life at sea in the Arctic Ocean, including through bilateral and multilateral arrangements between or among relevant states.¹²⁵

Despite this declaration identifying the need for more joint exercises and increased cooperation, it is quite likely that Arctic-border countries struggle with the same resource shortage issues and financial constraints as the US. A new international effort and example of an “all hands” solution is the Arctic oil

response agreement that media reported in February 2013 as in development. Although the document has not been released, the second Arctic Council agreement effort has been criticized as inadequate for lack of operational and performance standards, enforcement mechanisms and “complex issues involved in a potential spill.”¹²⁶ Like the SAR agreement, the draft spill response agreement reportedly “fails to outline any essential response equipment,” among many other shortfalls.¹²⁷ The failure to address resources in these international agreements may be a matter of willingness or financial commitment. However, using an “all-hands” approach to acquiring, coordinating, and developing mutual aid processes, combined with a layered logistical concept, as a burden sharing model for other Arctic countries, the reluctance to address resources in these agreements may be mitigated.

Consequences of Inaction

If no immediate further action is taken to address the problems of resources, infrastructure, and communications shortfalls addressed here, the consequences of inaction would first and foremost risk incredible loss of life. Additionally, a SONS would also result in severe ecological contamination and economic loss for industry, the State of Alaska, and the US Government. Finally, the US Government’s inability to protect its citizens from obvious threats and prepare for future environmental catastrophes would be an excruciating embarrassment.

In his September 2011 congressional testimony, Commandant of the Coast Guard, Admiral Robert Papp, expressed that “an oil spill, a collision, a ship sinking in the Arctic keeps me awake at night because we have nothing to respond or, if we respond, it is going to take us weeks to get there”.¹²⁸ He summed up the Arctic resource shortfall by answering his own question on how the United States would respond to an Arctic accident today, “...we’ve got zero capability to respond in the Arctic right now. And we’ve got to do better than that.”¹²⁹ Alaska based biologist and Oil Spill expert, Richard Steiner’s assessments on spill response stated, “I am afraid they (industry and government) are going to wait for a big spill disaster before putting the right systems in place,” this attitude seems to mirror the general consensus on spill preparations thus far.¹³⁰ The Capabilities Assessment Working Group succinctly stated the repercussions of failing to act on these gaps in their Table Top Exercise After Action Report which stated,

“Failure to upgrade the Arctic emergency response infrastructure to meet increasing Arctic operational demands will impede emergency response efforts, potentially resulting in unnecessary deaths, preventable damage to the environment, and negative publicity for the government agencies involved.”¹³¹

The Arctic is unquestionably changing and with that change comes increasing exploitation and traffic. The Arctic remains a challenging and dangerous region to operate; this fact, combined with the increase in activity, will inevitably result in a substantial MRO and/or SONS. Preparation and

response for these types of events will require a comprehensive approach and a new logistical model. In today's limited financial conditions, a collective interagency public and private approach is essential to satisfy the required response resources and the processes to deploy them. Additionally, the Arctic-8 and other international communities committed to the Arctic must make preparations for meeting the obligations of the SAR agreement; multilateral approaches for burden sharing could serve as a model to fill those resources. With the realization of a future rescue or environmental event occurring, it is a matter of when, rather than if, we face one or both of these major catastrophes.

Initial preparations have started to deal with the minimal level of basic requirements necessary for adequate crisis response. Resourcing these basic resources is within reach given their relative low costs. They will need to be resourced substantially enough to adequately respond to the most likely manifestation of these Arctic emergencies. Steps to posture for more substantial and costly resources for the future should be set in motion now. It is essential to prepare a more robust readiness posture for the future, a posture that ensures the current resource gap is bridged and adequate safety and environmental protections for the projected increase in human activity are set. There are many issues facing the Arctic today. Bridging the resource gap to facilitate safe operations and protection of the environment is essential to meeting the future demands on an increasingly open and active Arctic.

Abbreviations

AAR	After Action Report
ACS	Alaska Clean Seas
ADEC	Alaska Department of Environment and Conservation
AFOSI	Air Force Office Of Special Investigations
AKRCC	Alaska Rescue Coordination Center
ALCOM	Alaska Command
ASP	Arctic Sustainment Package
CAWG	Commander's Arctic Capabilities Working Group
CREEL	Cold Region Environmental and Engineering Laboratories (Army Corps of Engineer)
DHS	Department of Homeland Security
DoD	Department of Defense
DSCA	Defense Support to Civil Authorities
EMAC	Emergency Management Assistance Compact
EMAP	Emergency Management Accreditation Program
GEF	Guidance for Employment of Force
HSPD	Homeland Security Presidential Directive
IMO	International Maritime Organization
JBER	Joint Base Elmendorf Richardson
MAJAID	Major Rescue Operations Shelter Kit
MEDEVAC	Medical Evacuation
MROs	Mass Rescue Operations
NCP	National Contingency Plan
NMS	National Military Strategy
NORTHCOM	Northern Command
NRP	National Response Plan
NSB	North Slope Borough
NSPD	National Security Presidential Directive
NSR	Northern Sea Route
NSS	National Security Strategy
NSSRT	North Slope Spill Response Team
PJ	Para-Jumper
PREPO	Preposition
QDR	Quadrennial Defense Review
SAR	Search and Rescue
SARSAT	Search and Rescue Satellite Aided Tracking
SOLAS	Safety Of Life At Sea
SONS	Spill Of National Significance
SUPSLAV	Office of the Supervisor of Salvage; Navy
TTX	Table Top Exercise
UCP	Unified Command Plan
UNCLOS	United Nation Convention Laws of the Sea
USCG	United States Coast Guard

Endnotes

¹The Associated Press, (*Colorado Springs*), "Arctic Sea Ice Larger Than United States Melted in '12," *Gazette*, November 29, 2012.

²Peter Ohotnicky, Braden Hisey, and Jessica Todd, *Improving U.S. Posture in the Arctic*, Joint Forces Quarterly Issue 67, 4th Quarter (Washington, DC: National Defense University Press, October 31, 2012), 57-58.

³Brian Case, "Sovereignty Issues Loom as Arctic Sea Ice Shrinks," September 12, 2012, <http://www.cbc.ca/news/business/story/2012/09/12/f-franklin-who-owns-the-arctic.html> (accessed November 26, 2012)

⁴Matthew Ford, "Engaging With The Arctic," August 29, 2012, <http://www.currentintelligence.net/analysis/2012/8/29/engaging-with-the-arctic.html> (accessed January 14, 2013).

⁵U.S. Northern Command, J35, David L. Raugh, "Arctic Capability Gaps and Way Ahead," Information Paper for Commander U.S. Northern Command, Peterson Air Force Base, CO, October 9, 2012.

⁶Arctic Council Task Force for the Development of an International Instrument on Cooperation in Search and Rescue Operations in the Arctic. "Agreement on Cooperation on Aeronautical and Maritime Search and Rescue in the Arctic," May 12, 2011.

⁷United States Northern Command Commander, Charles H. Jacoby, Commandant United States Coast Guard, Robert J. Papp, Jr. "Arctic Capability Assessment Working Group," Arctic Capabilities Working Group Memorandum with attached White Paper, Peterson Air Force Base, CO, March 13, 2012, 9-10, *US Coast Guard Home Page*, <http://www.CoastGuard.mil/seniorleadership/news.asp?id=Wed%2c%2014%20Mar%202012%2013:36:49%20EST> (accessed Jan 5, 2013).

⁸Michelle Zilio, "Someday 'Your Number is Going to Come Up': Lagging Arctic SAR Risks Much," January 3, 2013, <http://www.ipolitics.ca/2013/01/03/someday-your-number-is-going-to-come-up-lagging-arctic-sar-risks-much-experts/> (accessed January 10, 2013).

⁹Ibid.

¹⁰Ronald O'Rourke, *Changes in the Arctic: Background and Issues for Congress* (Washington, DC: U.S. Library of Congress, Congressional Research Service, August 1, 2012), 1.

¹¹Ohotnicky, Hisey, and Todd, *Improving U.S. Posture in the Arctic*, 57.

¹²Department of the Navy, Chief of Naval Operations D.W. Titley, "Navy Arctic Environmental Assessment and Outlook," memorandum in support of Navy Arctic Road Map Action Item 5.7, Washington, DC, August 2, 2011, 2, Ibid., V.

¹³Ibid., 6.

¹⁴Ohotnicky, Hisey, and Todd, *Improving U.S. Posture in the Arctic*, 57.

¹⁵*Ibid.*

¹⁶D.W. Titley, "Navy Arctic Environmental Assessment and Outlook," 2.

¹⁷*Ibid.*, 4.

¹⁸*Ibid.*, 13.

¹⁹*Ibid.*, 3.

²⁰*Ibid.*, 6.

²¹*Ibid.*, 14.

²²*Ibid.*, V, Ohotnicky, Hisey, and Todd, *Improving U.S. Posture in the Arctic*, 57.

²³Arctic Collaborative Workshop, 10.

²⁴*Ibid.*, 16.

²⁵*CBCnews Homepage*, "Plane Crash Near Resolute Bay Kills 12," August 20, 2011, <http://www.cbc.ca/news/canada/north/story/2011/08/20/north-air-crash.html> (accessed November 28, 2012).

²⁶Will Oremus, "Shell's Drilling Rig Runs Aground Off Alaskan Coast," January 1, 2013, http://www.slate.com/blogs/future_tense/2013/01/01/kulluk_runs_aground_shell_arctic_drilling_rig_hits_alaskan_island.html (accessed January 1, 2013).

²⁷Tobi Cohen, "Canadian Rescue Capacity Questioned in wake of Arctic Ship Grounding," August 29, 2010, <http://www.canada.com/news/Canadian+rescue+capacity+questioned+wake+Arctic+ship+grounding/3457291/story.html> (accessed November 28, 2012).

²⁸Michelle Zilio, "Someday 'Your Number is Going to Come Up': Lagging Arctic SAR Risks Much," (accessed January 10, 2013). Michelle Zilio, "Someday 'Your Number is Going to Come Up': Lagging Arctic SAR Risks Much," January 3, 2013, <http://www.ipolitics.ca/2013/01/03/someday-your-number-is-going-to-come-up-lagging-arctic-sar-risks-much-experts/> (accessed January 10, 2013).

²⁹P. Schlosser, eds., et al., *Logistics Recommendations for an Improved U.S. Arctic Research Capability* (Fairbanks, AK: The Arctic Research Consortium of the U.S., June 1997), 9.

³⁰The Economist Printed Edition, "Climate Change in the Arctic: Beating a Retreat," September 24, 2011, <http://www.economist.com/node/21530079> (accessed December 11, 2012).

³¹Dan Joling, "Shell Ship Grounding Fuels Arctic Drilling Debate," January 3, 2013, http://www.salon.com/2013/01/03/shell_ship_grounding_fuels_arctic_drilling_debate/ (accessed January 5, 2013).

³²Northern Economic, Inc. and Institute of Social and Economic Research, *Potential National-Level Benefits of Alaska OCS Development* (Prepared for Shell Exploration and Production, February, 2011), ES-1.

³³Dan Joling, "Shell Ship Grounding Fuels Arctic Drilling Debate," (accessed January 5, 2013).

³⁴Arctic Portal, "Transpolar Flights, a Shortcut Through the Arctic," <http://www.arcticportal.org/features/898-arctic-aviation> (accessed November 28, 2012).

³⁵PR Newswire, "NAV CANADA and Federal Aviation Authority of Russia Release Polar Routes Feasibility Study," October, 2011, <http://www.prnewswire.com/news-releases/nav-canada-and-federal-aviation-authority-of-russia-release-polar-routes-feasibility-study-74879912.html> (accessed November 28, 2012).

³⁶Ibid.

³⁷Ronald O'Rourke, *Changes in the Arctic: Background and Issues for Congress*, 37.

³⁸Trude Pettersen, "46 Vessels Through the Northern Sea Route," November 23, 2012, <http://barentsobserver.com/en/arctic/2012/11/46-vessels-through-northern-sea-route-23-11> (accessed December 5, 2012).

³⁹David Rosenfeld, "Cruising the Arctic; Experts Warn the Arctic is Ill Equipped to deal with a Potential Cruise Ship Disaster," July 23, 2012, <http://www.dcbureau.org/201207237493/natural-resources-news-service/cruising-the-arctic.html> (accessed December 5, 2012).

⁴⁰Ohotnicky, Hisey, and Todd, *Improving U.S. Posture in the Arctic*, 57.

⁴¹Trude Pettersen, "46 Vessels Through the Northern Sea Route," (accessed December 5, 2012).

⁴²Dan Joling, "Shell Ship Grounding Fuels Arctic Drilling Debate," (accessed January 5, 2013).

⁴³LTC Karl Westerlund, Alaska National Guard, Commander, Alaska Rescue Coordination Center (AKRCC), 11th Air Force, interview by author, December 10, 2012.

⁴⁴Tom Fowler, "After Spill, Gulf Oil Drilling Rebounds," September 20, 2012, <http://online.wsj.com/article/SB10000872396390443890304578008573749823206.html> (accessed December 8, 2012).

⁴⁵Bureau of Safety and Environmental Enforcement, *Oil and Gas and Sculpture Operations on the Outer Continental Shelf-Increased Safety Measures for Energy Development on the*

Outer Continental Shelf; Final Rule, Federal Register, Vol. 77, No. 163, Part III, 30 CFR Part 250, (Washington, DC: U.S. Department of the Interior, August 22, 2012), 50884.

⁴⁶Ibid., 50857.

⁴⁷Jennifer A. Doughy, "Salazar: 'So Many' Shell Arctic Mishaps 'Troubling'," January 9, 2013, <http://www.adn.com/2013/01/09/2747153/salazar-so-many-shell-arctic-mishaps.html> (accessed January 12, 2013).

⁴⁸Jason Plaits, "Federal Drilling Panel May Disband Even as Concerns Mount," January 9, 2013, <http://www.bloomberg.com/news/2013-01-09/federal-drilling-panel-may-disband-even-as-concerns-mount.html> (accessed January 12, 2013).

⁴⁹Jennifer A. Doughy, "Salazar: 'So Many' Shell Arctic Mishaps 'Troubling'," (accessed January 12, 2013), Geoffrey T. Merrell, Superintendent Emergency Response, Shell Exploration & Production, Alaska Region, interview by author, December 11, 2012.

⁵⁰Geoffrey T. Merrell, "SHELL ALASKA 2012 Exploration Drilling," Washington, DC, National Defense University, March 13-15, 2012.

⁵¹Ibid.

⁵²Geoffrey T. Merrell, Superintendent Emergency Response, Shell Exploration & Production, Alaska Region, interview by author, December 11, 2012.

⁵³Lisa Dimer, "Risky struggle to save Kulak crew," January 4, 2013, <http://www.adn.com/2013/01/04/2742726/xg.html> (accessed January 5, 2013).

⁵⁴Matt Smith, "No Leaks from Grounded Drill Rig Off Alaska, Coast Guard Says," January 2, 2013, <http://www.cnn.com/2013/01/01/us/alaska-drilling-rig/index.html> (accessed January 5, 2013).

⁵⁵Sean Church field, Alaska Operations Manager, Shell Exploration and Production Company, interview by author, December 10, 2012, Chris Polashenski, Research Geo-Physicist, U.S. Army Cold Regions Research and Engineering Laboratory, interview by author, December 12, 2012.

⁵⁶Chris Polashenski, U.S. Army Corps of Engineers, Research Geo-Physicist, U.S. Army Corps of Engineers', Cold Regions Research and Engineering Laboratory, interview by author, December 12, 2012.

⁵⁷Joe Hitchon, "Draft Arctic Oil Spill Agreement 'Inadequate'," Inter Press Service Report; posted Truth-Out.org, February 9, 2013, <http://truth-out.org/news/item/14448-draft-arctic-oil-spill-agreement-inadequate> (accessed February 15, 2013).

⁵⁸CAPT Gregory J. Sanial, United States Coast Guard, Chief of Response, Seventeenth Coast Guard District, interview by author, December 14, 2012, Price E. Brower, North Slope Borough, Director North Slope Borough Search & Rescue, interview by author, December 13, 2012.

⁵⁹Shell United States, “The ‘Classic Kulluk’; It’s Not Just the Oil-It’s the Challenge,” <http://arcticready.com/classic-kulluk> (accessed 5 January 2013).

⁶⁰David Rosenfeld, “Cruising the Arctic,” July 23, 2012, <http://www.dcbureau.org/201207237493/natural-resources-news-service/cruising-the-arctic.html> (accessed 5 January 2013).

⁶¹Oystein Jensen, *Operating in Arctic Ice-covered Waters; From Voluntary to Mandatory Tool for Navigation Safety and Environmental Protection?*, Fridtjof Nansen Institute (March 2007): 12.

⁶²“Governance of Arctic Shipping,” *Arctic Marine Shipping Assessment*, Executive Summary; (April 29, 2009): 55-56.

⁶³*Ibid.*, 62.

⁶⁴David Rosenfeld, “Cruising the Arctic,” (accessed January 5, 2013)

⁶⁵CAPT Gregory J. Sanial, United States Coast Guard, Chief of Response, Seventeenth Coast Guard District, interview by author, December 14, 2012.

⁶⁶Areo Magazine, No. 16, “Flight Operations; Polar Routes,” http://www.boeing.com/commercial/aeromagazine/aero_16/polar_story.html (accessed November 29, 2012).

⁶⁷Jerry Beilinson, “What if a Cruise Ship Wrecked in Alaska?,” January 25, 2012, <http://www.popularmechanics.com/technology/engineering/extreme-machines/what-if-a-cruise-ship-wrecked-in-alaska-6645471> (accessed December 12, 2012), Robert Harcharek, Barrow Alaska, Mayor and Chief Administrative Officer, City of Barrow, interview by author, December 13, 2012.

⁶⁸*Northwest Arctic Subarea Contingency Plan; Resources Section*, Resources: part 4, (June 2001), B-107.

⁶⁹*Ibid.*, Index.

⁷⁰Joe Stankiewicz, *City of Barrow Local All Hazard Mitigation Plan*, (August 13, 2009), 5.

⁷¹Kevin Bejella, *NARL, Aircraft Hangers – Barrow, Alaska*, U.S. Corps of Engineers’, Cold Region Research and Engineering Laboratory, Preliminary Investigation, (Fairbanks, AK, CRREL, July 26, 2011), 2.

⁷²*Ibid.*, 34.

⁷³Raymond M. Atos, North Slope Borough, Disaster Coordinator, North Slope Borough, Administration & Finance, Risk Management, interview by author, December 13, 2012.

⁷⁴Price Brower, “North Slope Borough,” briefing slides with scripted commentary, Barrow, AK, September 9, 2011.

⁷⁵Kevin Bejella, U.S. Corps of Engineers, Research Civil Engineer, U.S. Army Corps of Engineers', Cold Regions Research and Engineering Laboratory, interview by author, December 12, 2012.

⁷⁶Kirk Johnson, "For Coast Guard Patrol North of Alaska, Much to Learn in a Remote New Place," July 21, 2012, http://www.nytimes.com/2012/07/22/us/coast-guard-strengthens-presence-north-of-alaska.html?_r=0 (accessed December 12, 2012).

⁷⁷Raymond M. Atos, North Slope Borough, Disaster Coordinator, North Slope Borough, Administration & Finance, Risk Management, interview by author, December 13, 2012.

⁷⁸Ibid.

⁷⁹Kirk Johnson, "For Coast Guard Patrol North of Alaska, Much to Learn in a Remote New Place," (accessed December 12, 2012).

⁸⁰Karl Westerlund, "Alaska (11th AF) Rescue Coordination Center (AKRCC)", briefing slides, Anchorage, AK, 11th AKRCC, December 10, 2012.

⁸¹Hannah Heimbuch, "Coast Guard Leaves Arctic for Winter Season, November 9, 2012, http://www.thearcticsouder.com/article/1245coast_guard_leaves_arctic_for_winter_season (accessed December 13, 2012).

⁸²*Unified Plan; The Alaska Federal/State Preparedness Plan for Response to Oil and Hazardous Substance Discharges/Releases*, Alaska Region Oil and Hazardous Substance Pollution Contingency Plan May 1994 (Anchorage, AK: Alaska Regional Response Team, January 27, 2010-Change 3), E-30.

⁸³LTC Karl Westerlund, Alaska National Guard, Commander, Alaska Rescue Coordination Center (AKRCC), 11th Air Force, interview by author, December 10, 2012.

⁸⁴Alice R. Buchalter, *Military Support to Civil Authorities: The Role of the Department of Defense in Support of Homeland Defense* (Washington, DC: Federal Research Division, Library of Congress, February 2007), 18.

⁸⁵Ibid.

⁸⁶George W. Bush, *National Security Presidential Directive-66/Homeland Security Presidential Directive-25, Arctic Region Policy* (Washington, DC: The White House, January 9, 2009).

⁸⁷Charles H. Jacoby, *NORAD and USNORTHCOM Theater Campaign Strategy* (Peterson Air Force Base: US Northern Command, November 11, 2011), 6., GEN Charles H. Jacoby, Jr., U.S. Army, Commander U.S. Northern Command, interview by author, December 18, 2012.

⁸⁸Ohotnicky, Hisey, and Todd, *Improving U.S. Posture in the Arctic*, 62.

⁸⁹MAJ Rick Walsh, Alaska Command (ALCOM), Maritime and Arctic Specialist, J5, Alaska Command (ALCOM), 11th Air Force, interview by author, December 10, 2012.

⁹⁰Chris Polashenski, U.S. Army Corps of Engineers, Research Geo-Physicist, U.S. Army Corps of Engineers', Cold Regions Research and Engineering Laboratory, interview by author, December 12, 2012.

⁹¹Clyde H. Farnsworth, "After a Plane Crash, 30 Deadly Hours in the Arctic," November 5, 1991, <http://www.nytimes.com/1991/11/05/world/after-a-plane-crash-30-deadly-hours-in-the-arctic.html> (accessed December 10, 2012).

⁹²Commander, Alaska Rescue Coordination Center (AKRCC), 11th Air Force, LTC Karl Westerlund, "Alaska Arctic Search and Rescue Considerations," bullet background paper for Commander ALCOM, November 29, 2012, 2.

⁹³*Ibid.*, 3.

⁹⁴*Ibid.*

⁹⁵Greg Avey, e-mail message to LTC Karl Westerlund, Alaska National Guard, Commander, Alaska Rescue Coordination Center (AKRCC), 11th Air Force, October 19, 2012, forwarded by LTC Karl Westerlund to author January 28, 2013.

⁹⁶Rick Janelle, *Arctic Mass Rescue Operation (MRO) Workshop 2011; Summary Report*, Sample MRO Plan, North Slope Borough, Alaska; Mass Rescue Operation (MRO), Shore-Side Response Plan, App. A, COAST GUARD District 17 (Barrow, AK, June 15, 2011), 17.

⁹⁷Andrew T. Metzger, "Marine Infrastructure in the U.S. Arctic," briefing slides, University of Alaska Fairbanks Civil and Environmental Engineering Department Institute of Northern Engineering/Alaska University Transportation Research Center, November, 2012.

⁹⁸Arctic Collaborative Workshop, *Arctic Collaborative Workshop / Arctic Oil Spill & Mass Rescue Operation Tabletop Exercise (TTX)*, Arctic Collaborative Workshop; After Action Review, (Peterson Air Force Base, CO: NORAD and USNORTHCOM, May 7, 2012), 39.

⁹⁹"Major Rescue Operations Shelter Kit," briefing slides, Peterson Air Force Base, CO, Northern Command, July 20, 2011, "AKRCC ASP," briefing slides, Joint Base Elmendorf-Richardson, Anchorage, AK, 11th RCC, December 10, 2012.

¹⁰⁰Alex DeMarban, "Coast Guard Considers Arctic Amphibious Vehicles as Far North Gets Busier," August 12, 2012, <http://www.alaskadispatch.com/article/coast-guard-considers-arctic-amphibious-vehicles-far-north-gets-busier> (accessed December 14, 2012).

¹⁰¹GEN Charles H. Jacoby, Jr., U.S. Army, Commander U.S. Northern Command, notes from meeting and briefing by U.S. Northern Command (NORTHCOM) J6 to U.S. NORTCOM Commander, December 18, 2012.

¹⁰²Hannah Heimbuch, "Coast Guard Leaves Arctic for Winter Season, (accessed December 13, 2012).

¹⁰³GEN Charles H. Jacoby, Jr., U.S. Army, Commander U.S. Northern Command, interview by author, December 18, 2012.

¹⁰⁴Robert M. Gates, *Quadrennial Defense Review* (Washington, DC: U.S. Department of Defense, February 2010), 86.

¹⁰⁵United States Northern Command Commander, Charles H. Jacoby, Commandant United States Coast Guard, Robert J. Papp, Jr. "Arctic Capability Assessment Working Group," Arctic Capabilities Working Group Memorandum with attached White Paper, Peterson Air Force Base, CO, March 13, 2012, 9-10, LTC Karl Westerlund, Alaska National Guard, Commander, Alaska Rescue Coordination Center (AKRCC), 11th Air Force, interview by author, December 10, 2012.

¹⁰⁶Arctic Collaborative Workshop, *Arctic Collaborative Workshop / Arctic Oil Spill & Mass Rescue Operation Tabletop Exercise (TTX) After Action Review (AAR)*, (Colorado Springs, CO: NORAD and USNORTHCOM, May 7, 2012), 39.

¹⁰⁷Price E. Brower, North Slope Borough, Director North Slope Borough Search & Rescue, interview by author, December 13, 2012, Raymond M. Atos, North Slope Borough, Disaster Coordinator, North Slope Borough, Administration & Finance, Risk Management, interview by author, December 13, 2012.

¹⁰⁸CAPT Gregory J. Sanial, United States Coast Guard, Chief of Response, Seventeenth Coast Guard District, interview by author, December 14, 2012, Sean Church field, Alaska Operations Manager, Shell Exploration and Production Company, interview by author, December 10, 2012, Raymond M. Atos, North Slope Borough, Disaster Coordinator, North Slope Borough, Administration & Finance, Risk Management, interview by author, December 13, 2012.

¹⁰⁹Arctic Collaborative Workshop, *Arctic Collaborative Workshop / Arctic Oil Spill & Mass Rescue Operation Tabletop Exercise (TTX) After Action Review (AAR)*, V.

¹¹⁰David A. McEntire, *Introduction to Homeland Security: Understanding Terrorism With An Emergency Perspective*, (Hoboken: John Wiley & Sons, Inc. 2009), 206.

¹¹¹Ohotnicky, Hisey, and Todd, *Improving U.S. Posture in the Arctic*, 59.

¹¹²*Ibid.*, 61.

¹¹³Arctic Collaborative Workshop, *Arctic Collaborative Workshop / Arctic Oil Spill & Mass Rescue Operation Tabletop Exercise (TTX) After Action Review (AAR)*, 40.

¹¹⁴*Emergency Management Assistance Compact*, Public Law 104-321, 104th Cong. 2nd sess. (October, 1996), 1.

¹¹⁵McEntire, *Introduction to Homeland Security: Understanding Terrorism With An Emergency Perspective*, 207.

¹¹⁶Commander, Alaska Rescue Coordination Center (AKRCC), 11th Air Force, LTC Karl Westerlund, "Alaska Arctic Search and Rescue Considerations," bullet background paper for Commander ALCOM, November 29, 2012, 2.

¹¹⁷Kurt K. Kunze, *The Alaskan Project*, July 15, 1977, The AFOSI Reliance; Historical Notes From the Files of AFOSI, 6.

¹¹⁸Kevin Bejella, *NARL, Aircraft Hangers – Barrow, Alaska*, U.S. Corps of Engineers', Cold Region Research and Engineering Laboratory, Preliminary Investigation, 4.

¹¹⁹Robert Harcharek, Barrow Alaska, Mayor and Chief Administrative Officer, City of Barrow, interview by author, December 13, 2012.

¹²⁰Alex DeMarban, "Coast Guard considers Arctic Amphibious Vehicles as Far North gets Busier," August 12, 2012, <http://www.alaskadispatch.com/article/coast-guard-considers-arctic-amphibious-vehicles-far-north-gets-busier> (accessed December 15, 2012), Remote Expeditions, "Ultimate Arctic Expedition, Power Point Presentation no date, http://remote-expeds.com/web_documents/uae_pdf.pdf (accessed December 15, 2012).

¹²¹Sean Church field, Alaska Operations Manager, Shell Exploration and Production Company, interview by author, December 10, 2012

¹²²Chris Polashenski, U.S. Army Corps of Engineers, Research Geo-Physicist, U.S. Army Corps of Engineers', Cold Regions Research and Engineering Laboratory, interview by author, December 12, 2012.

¹²³MAJ Rick Walsh, Alaska Command (ALCOM), Maritime and Arctic Specialist, J5, Alaska Command (ALCOM), 11th Air Force, interview by author, December 10, 2012.

¹²⁴Arctic Council Task Force for the Development of an International Instrument on Cooperation in Search and Rescue Operations in the Arctic. "Agreement on Cooperation on Aeronautical and Maritime Search and Rescue in the Arctic," 12 May, 2011.

¹²⁵"Governance of Arctic Shipping," *Arctic Marine Shipping Assessment*, Arctic Marine Infrastructure; (April 29, 2009): 172.

¹²⁶Joe Hitchon, "Draft Arctic Oil Spill Agreement 'Inadequate'," <http://truth-out.org/news/item/14448-draft-arctic-oil-spill-agreement-inadequate> (accessed February 15, 2013).

¹²⁷Ibid.

¹²⁸Ronald O'Rourke, *Changes in the Arctic: Background and Issues for Congress* (Washington, DC: U.S. Library of Congress, Congressional Research Service, September 2, 2011), 36.

¹²⁹Ibid.

¹³⁰Joe Hitchon, "Draft Arctic Oil Spill Agreement 'Inadequate'," <http://truth-out.org/news/item/14448-draft-arctic-oil-spill-agreement-inadequate> (accessed February 15, 2013).

¹³¹Arctic Collaborative Workshop, *Arctic Collaborative Workshop / Arctic Oil Spill & Mass Rescue Operation Tabletop Exercise (TTX) After Action Review (AAR)*, App E, 40.

References

- 11th Regional Coordination Center. 2012. "AKRCC ASP," briefing slides, December 10. Joint Base Elmendorf-Richardson, Alaska.
- Alaska Department of Environmental Conservation. 2010. "Alaska Region Oil and Hazardous Substance Pollution Contingency Plan, Change 3, January 27.
- Alaska Department of Environmental Conservation. 2001. "Northwest Arctic Subarea Contingency Plan," June. Juneau, Alaska.
- "Arctic Capabilities Working Group Memorandum with attached White Paper". 2012. Peterson Air Force Base, CO, March 13. Arctic Capabilities Working Group. Accessed January 5, 2013.
<http://www.CoastGuard.mil/seniorleadership/news.asp?id=Wed%2c%2014%20Mar%202012%2013:36:49%20EST>.
- Arctic Collaborative Workshop. 2012. *Arctic Collaborative Workshop / Arctic Oil Spill & Mass Rescue Operation Tabletop Exercise (TTX) After Action Review*, May 7. Peterson Air Force Base, Colorado: U.S. Northern Command.
- Arctic Council. 2009. "Governance of Arctic Shipping," *Arctic Marine Shipping Assessment*, Executive Summary; April 29. Tromsø, Norway.
- Arctic Council Task Force for the Development of an International Instrument on Cooperation in Search and Rescue Operations in the Arctic, 2011. "Agreement on Cooperation on Aeronautical and Maritime Search and Rescue in the Arctic," 12 May.
- Arctic Portal. 2012. "Transpolar Flights, a Shortcut Through the Arctic." Accessed November 28, 2012.
<http://www.arcticportal.org/features/898-arctic-aviation>.
- "Arctic Sea Ice Larger Than United States Melted in '12." *Colorado Springs Gazette*, November 29, 2012.
- Beilinson, Jerry. 2012. "What if a Cruise Ship Wrecked in Alaska?," January 25. Accessed December 12, 2012.
<http://www.popularmechanics.com/technology/engineering/extreme-machines/what-if-a-cruise-ship-wrecked-in-alaska-6645471>.
- Bejella, Kevin. 2011. "Preliminary Investigation: NARL, Aircraft Hangers – Barrow, Alaska," July 26. Fairbanks, Alaska: U.S. Corps of Engineers', Cold Region Research and Engineering Laboratory.
- Brower, Price. 2011. "North Slope Borough," capabilities overview briefing slides with scripted commentary, September 9. Barrow, Alaska.

Buchalter, Alice R. 2007. *Military Support to Civil Authorities: The Role of the Department of Defense in Support of Homeland Defense*, February. Washington, DC: Federal Research Division, Library of Congress.

Bureau of Safety and Environmental Enforcement, *Oil and Gas and Sculpture Operations on the Outer Continental Shelf-Increased Safety Measures for Energy Development on the Outer Continental Shelf; Final Rule*, Federal Register, Vol. 77, No. 163, Part III, 30 CFR Part 250, (Washington, DC: U.S. Department of the Interior, August 22, 2012), 50884.

Bush, George W. 2009. *National Security Presidential Directive-66/Homeland Security Presidential Directive-25, Arctic Region Policy*, January 9. Washington, DC: The White House.

Case, Brian. 2012. "Sovereignty Issues Loom as Arctic Sea Ice Shrinks." September 12. Accessed November 26, 2012.
<http://www.cbc.ca/news/business/story/2012/09/12/f-franklin-who-owns-the-arctic.html>

CBC News. 2011. "Plane Crash Near Resolute Bay Kills 12," August 20. Accessed November 28, 2012.
<http://www.cbc.ca/news/canada/north/story/2011/08/20/north-air-crash.html>.

"Climate Change in the Arctic: Beating a Retreat." 2011. *The Economist Printed Edition*, September 24. Accessed December 11, 2012.
<http://www.economist.com/node/21530079>

Cohen, Tobi. 2010. "Canadian Rescue Capacity Questioned in wake of Arctic Ship Grounding," August 29. Accessed November 28, 2012.
<http://www.canada.com/news/Canadian+rescue+capacity+questioned+wake+Arctic+ship+grounding/3457291/story.html>.

DeMarban, Alex. 2012. "Coast Guard Considers Arctic Amphibious Vehicles as Far North Gets Busier," August 12. Accessed December 14, 2012.
<http://www.alaskadispatch.com/article/coast-guard-considers-arctic-amphibious-vehicles-far-north-gets-busier>.

Dimer, Lisa. 2013. "Risky struggle to save Kulak crew," January 4. Accessed January 5, 2013.
<http://www.adn.com/2013/01/04/2742726/xg.html>.

Doughy, Jennifer A. 2013. "Salazar: 'So Many' Shell Arctic Mishaps 'Troubling'," January 9. Accessed January 12, 2013.
<http://www.adn.com/2013/01/09/2747153/salazar-so-many-shell-arctic-mishaps.html>.

Emergency Management Assistance Compact. 1996. Public Law 104-321, 104th Cong. 2nd sess., October, 19.

- Farnsworth, Clyde H. 1991. "After a Plane Crash, 30 Deadly Hours in the Arctic," November 5. Accessed December 10, 2012.
<http://www.nytimes.com/1991/11/05/world/after-a-plane-crash-30-deadly-hours-in-the-arctic.html>.
- Flight Operations: Polar Routes," Boeing Aero Magazine, No. 16. Accessed November 29, 2012.
http://www.boeing.com/commercial/aeromagazine/aero_16/polar_story.html
- Ford, Matthew. 2012. "Engaging With The Arctic," August 29. Accessed January 14, 2013.
<http://www.currentintelligence.net/analysis/2012/8/29/engaging-with-the-arctic.html>.
- Fowler, Tom. 2012. "After Spill, Gulf Oil Drilling Rebounds," September 20. Accessed December 8, 2012.
<http://online.wsj.com/article/SB10000872396390443890304578008573749823206.html>.
- Heimbuch, Hannah. 2012. "Coast Guard Leaves Arctic for Winter Season," November 9. Accessed December 13, 2012.
http://www.thearcticsounder.com/article/1245coast_guard_leaves_arctic_for_winter_season.
- Hitchon, Joe. 2013. "Draft Arctic Oil Spill Agreement 'Inadequate'," February 9. Accessed February 15, 2013.
<http://truth-out.org/news/item/14448-draft-arctic-oil-spill-agreement-inadequate> .
- Jacoby, Charles H. 2008. *NORAD and USNORTHCOM Theater Campaign Strategy*, October 1. Peterson AFB: US Northern Command.
- Janelle, Rick. 2011. *Arctic Mass Rescue Operation (MRO) Workshop 2011; Summary Report*, June 15. Barrow, Alaska.
- Jensen, Oystein. 2007. *Operating in Arctic Ice-covered Waters; From Voluntary to Mandatory Tool for Navigation Safety and Environmental Protection*. Oslo: Fridtjof Nansen Institute.
- Johnson, Kirk. 2012. "For Coast Guard Patrol North of Alaska, Much to Learn in a Remote New Place," July 21. Accessed December 12, 2012.
http://www.nytimes.com/2012/07/22/us/coast-guard-strengthens-presence-north-of-alaska.html?_r=0
- Joling, Dan. 2013. "Shell Ship Grounding Fuels Arctic Drilling Debate," January 3. Accessed January 5, 2013.
http://www.salon.com/2013/01/03/shell_ship_grounding_fuels_arctic_drilling_debate/.
- Kunze, Kurt K. 1977. *The Alaskan Project*, July 15. The AFOSI Reliance; Historical Notes From the Files of AFOSI.
- McEntire, David A. 2009. *Introduction to Homeland Security: Understanding Terrorism With An Emergency Perspective*. Hoboken: John Wiley & Sons, Inc.

- Merrell, Geoffrey T. 2012. "SHELL ALASKA 2012 Exploration Drilling," briefing to the National Defense University. Washington, DC, National Defense University, March 13-15.
- Metzger, Andrew T. 2012. "Marine Infrastructure in the U.S. Arctic," briefing slides, November. University of Alaska Fairbanks Civil and Environmental Engineering Department Institute of Northern Engineering/Alaska University Transportation Research Center.
- Northern Economic, Inc. and Institute of Social and Economic Research. 2011. *Potential National-Level Benefits of Alaska OCS Development*. Prepared for Shell Exploration and Production, ES-1.
- Ohotnicky, Peter, Braden Hisey, and Jessica Todd. 2012. "Improving U.S. Posture in the Arctic." *Joint Forces Quarterly* Issue 67, 4th Quarter.
- O'Rourke, Ronald. 2012. "Changes in the Arctic: Background and Issues for Congress," Congressional Research Paper, U.S. Library of Congress, August 1
- Oremus, Will. 2013. "Shell's Drilling Rig Runs Aground Off Alaskan Coast," January 1, Accessed January 1, 2013.
http://www.slate.com/blogs/future_tense/2013/01/01/kulluk_runs_aground_shell_arctic_drilling_rig_hits_alaskan_island.html.
- Pettersen, Trude. 2012. "46 Vessels Through the Northern Sea Route," November 23. Accessed December 5, 2012.
<http://barentsobserver.com/en/arctic/2012/11/46-vessels-through-northern-sea-route-23-11>.
- Plaits, Jason. 2013. "Federal Drilling Panel May Disband Even as Concerns Mount," January 9. Accessed January 12, 2013.
<http://www.bloomberg.com/news/2013-01-09/federal-drilling-panel-may-disband-even-as-concerns-mount.html>.
- PR Newswire. 2011. "NAV CANADA and Federal Aviation Authority of Russia Release Polar Routes Feasibility Study." Accessed November 28, 2012.
<http://www.prnewswire.com/news-releases/nav-canada-and-federal-aviation-authority-of-russia-release-polar-routes-feasibility-study-74879912.html>
- Raugh, David, 2012. "Arctic Capability Gaps and Way Ahead," Information Paper for Commander U.S. Northern Command, Peterson Air Force Base, CO, October 9.
- Remote Expeditions. No date. "Ultimate Arctic Expedition," Accessed December 15, 2012.
http://remote-expeds.com/web_documents/uae_pdf.pdf.
- Rosenfeld, David. 2012. "Cruising the Arctic; Experts Warn the Arctic is Ill Equipped to deal with a Potential Cruise Ship Disaster," July 23. Accessed December 5, 2012.
<http://www.dcbureau.org/201207237493/natural-resources-news-service/cruising-the-arctic.html>

- Schlosser, P. 1997. *Logistics Recommendations for an Improved U.S. Arctic Research Capability*. Fairbanks: The Arctic Research Consortium of the U.S.
- Shell United States. 2013. "The 'Classic Kulluck'; It's Not Just the Oil-It's the Challenge." Accessed 5 January 2013.
<http://arcticready.com/classic-kulluk>.
- Smith, Matt. 2013. "No Leaks from Grounded Drill Rig Off Alaska, Coast Guard Says," January 2.
Accessed January 5, 2013.
<http://www.cnn.com/2013/01/01/us/alaska-drilling-rig/index.html>.
- Stankiewicz, Joe. 2009. *City of Barrow Local All Hazard Mitigation Plan*, August 13. The North Slope Borough Risk Management Division.
- Titley, D.W. 2011. "Navy Arctic Environmental Assessment and Outlook," memorandum in support of Navy Arctic Road Map Action Item 5.7. August 2.
- U.S. Northern Command. 2011. "Major Rescue Operations Shelter Kit," briefing slides, July 20. Peterson Air Force Base, Colorado.
- U.S. Department of Defense. 2010. *Quadrennial Defense Review*, by Robert Gates. Washington, DC: Government Printing Office.
- Westerlund, Karl. 2012. "Alaska Arctic Search and Rescue Considerations," bullet background paper, November 29. Joint Base Elmendorf-Richardson, Alaska.
- Westerlund, Karl. 2012. "Alaska (11th AF) Rescue Coordination Center (AKRCC)", briefing slides, December 10. Anchorage, Alaska.
- Zilio, Michelle. 2013. "Someday 'Your Number is Going to Come Up': Lagging Arctic SAR Risks Much," January 3.
Accessed January 10, 2013.
<http://www.ipolitics.ca/2013/01/03/someday-your-number-is-going-to-come-up-lagging-arctic-sar-risks-much-experts/>.

