Aleutian Islands RISK ASSESSMENT

Recommending an Optimal Response System for the Aleutian Islands: Summary Report

February 2015

ALEUTIAN ISLANDS RISK ASSESSMENT

Author
Nuka Research and Planning Group, LLC

Contributors
Pearson Consulting, LLC
Baldwin & Butler, LLC
Moran Environmental Recovery
Moran Towing
The Glosten Associates, Inc.
Northern Economics, Inc.

Executive Summary

The National Fish and Wildlife Foundation (NFWF), U.S. Coast Guard (USCG) and State of Alaska Department of Environmental Conservation (ADEC) launched and led the Aleutian Islands Risk Assessment (AIRA), a multi-phase risk assessment of marine transportation in the Bering Sea and the Aleutian Archipelago, to identify measures to reduce the risk of oil spills from large vessels operating in the region. The AIRA was funded as part of the plea agreement from the 2004 *M/V Selendang Ayu* grounding and oil spill, and followed guidelines established by the Transportation Research Board (TRB) of the National Academies as presented in the report, Risk of Vessel Accidents and Spills in the Aleutian Islands (SR 293). Phase A of the AIRA, the Preliminary Risk Assessment, was conducted in 2010-2011 and resulted in a series of recommendations that narrowed the focus in Phase B, a Focused Risk Assessment. Phase B focused on defining an Optimal Response System for the Aleutian Islands by recommending emergency towing, salvage, and spill response services to reduce maritime transportation risks through the region.

A group of technical experts collectively known as the Analysis Team conducted a series of separate, but related, analyses to develop a recommended Optimal Response System. This report synthesizes the outputs from 13 supporting technical reports. The recommendations and supporting analyses were vetted through the AIRA Advisory Panel and Technical Peer Review Panel, both high-level stakeholder groups with deep local knowledge and expertise related to marine transportation risks in the Aleutian Islands. This report documents the Advisory Panel's level of endorsement for each of the key findings.

The Aleutian Islands is a remote and challenging operating environment. Because the Great Circle Route between western North America and East Asia intersects the island chain, vessel traffic through Unimak Pass in the central Aleutian Islands, in particular, includes a significant proportion of large commercial vessels. A review of 2012 vessel traffic data showed that 1,961 large vessels made 4,615 transits through Unimak Pass that year. Of these, approximately 45% of vessels were engaged in "innocent passage," which means that although passed through U.S. territorial waters, they were not subject to U.S. oil spill prevention and response regulations. For example, innocent passage vessels are not subject to requirements to have contractual access to oil spill response or salvage resources, nor are they required to follow certain vessel routing measures. Proposed and pending marine transportation projects in Washington State and British Columbia have the potential to significantly increase annual vessel transits through the region over the next 20 years. Vessels traveling to or from Canadian ports will be in innocent passage, unless they stop in Alaska or another U.S. port as part of their voyage through the Aleutian Islands region.

The challenging operating environment of the Aleutian Islands simultaneously increases the potential for incidents to occur and complicates emergency response. A response gap analysis was completed in 2014 to estimate the period of time during which various emergency towing, salvage, and oil spill response operations would be impossible given historical weather and oceanographic data characterizing four locations across the Aleutians region. The results showed that conditions would rarely preclude emergency towing, but that certain spill response options, such as on-water mechanical recovery and aerial dispersant application, would be prevented by weather nearly 75% of the time.

Emergency towing represents a bridge between prevention and response, as a tow vessel may be used to rescue a stricken ship prior to a grounding or allision, or to support salvage or oil spill response efforts. Several related analyses conducted in 2013-2014 considered the optimal capabilities for emergency towing vessels to assist a distressed vessel and to evaluate the availability of tugs of opportunity to respond to stricken vessels across the study area. Minimum towing vessel specifications were determined to be 110 MT bollard pull, with a service speed of 16 knots or greater. The Analysis Team identified Adak as the preferred homeport for a rescue tug to enhance access across the entire Aleutian Islands region.

Salvage covers a wide range of services related to mitigating the risks of pollution in the event of a vessel accident and recovering the vessel and associated equipment and materials. Salvage services include: lightering, marine fire fighting, and salvage and wreck removal. Based on review of previous salvage operations in the region, including the response to the *Selendang Ayu*, lightering by heavy lift helicopter was identified as one of the key activities likely to be crucial to a response. A dedicated oil storage barge would provide an important resource both for lightering a damaged vessel and supporting on-water spill recovery.

The Aleutian Islands are remote with limited shoreside infrastructure. Oil spill response resources currently in the region are limited and are concentrated in the Unalaska area. Due to the significant response gap for offshore mechanical recovery, nearshore systems that focus on concentrating and removing oil closer to shore are the preferred approach to enhancing on-water spill response capability. A recent effort by the State of Alaska to develop enhanced oil spill logistics planning for remote, nearshore environments was identified as a valid approach to improving spill response in the Aleutian Islands.

The recommendations for an Optimal Response System adhered to two general principles: (1) prevention takes priority over response, and (2) all measures should be realistic and practical. The resulting recommendations from the Analysis Team are summarized below:

1. Establish a single managing entity or coordinating body to administer all of the prevention and response components of the Optimal Response System.
2. Establish vessel routing measures and areas to be avoided and monitor vessel traffic in real time to ensure compliance and quickly identify problems.
3. Station an emergency towing vessel (ETV) with a minimum of 110 MT bollard pull, 16-knot service speed, and Fifi 1 or 2 firefighting capability at Adak, Alaska.
4. Enhance salvage capability by:
    a. Stationing a dedicated oil storage barge with a capacity of 60,000 bbl in the region;
    b. Stationing a heavy-lift helicopter lightering package in the region; and
    c. Creating a heavy-lift helicopter-of-opportunity program to expedite mobilization when needed.

5. Enhance oil spill response, particularly nearshore recovery capability, by:
    a. Ensuring that, at a minimum, a nearshore spill response taskforce be available in-region;
    b. Utilizing a vessel-of-opportunity program with at least 150 member vessels to support the nearshore taskforce;
    c. Establishing a marine logistics base to support nearshore response operations;
    d. Establishing an in-region Incident Management Team; and
    e. Developing a cascading plan to bring out-of-region spill response, salvage, and marine firefighting resources in the event of a major incident.
6. Fund this system through a fee imposed on operators of large vessels passing through the region that are subject to U.S. spill prevention and response regulations.
7. The U.S. Coast Guard should approve the Optimal Response System, managed by a future Managing Entity, as compliant with federal Vessel Response Plan regulations for deep draft tank and non-tank vessels under the alternative compliance option.

An analysis was conducted to compare the costs associated with the Optimal Response System with the cost of not implementing the system (primarily those costs avoided by preventing vessel casualties or oil spills in the area). The Optimal Response System costs, estimated at $13.6 million per year (annualized), proved to be much lower than the estimated financial cost of spill damage without the system. Based on 2012 vessel traffic numbers, the per-vessel costs to implement the system for those large vessels subject to U.S. regulations amounted to approximately $13,000 per year.

The estimated costs of implementing the Optimal Response System are also less than the estimated cost of full compliance with U. S. regulations for tank and non-tank vessels at $43 million per year. Yet, the Optimal Response System is better suited to the environmental conditions in the Aleutians.

While the Advisory Panel largely agreed with the Analysis Team's recommendations, there were some areas where consensus was not reached. This report characterizes the areas of agreement and disagreement for each element of the system. With this recommendation, neither the Advisory Panel nor the Analysis Team endorses any particular organization or company that is currently operating in the region or has the potential to do so in the future.

Overview

The AIRA Optimal Response System Summary Report is supported by a series of interrelated studies as shown below.

OPERATING ENVIRONMENT

Characterizing Environmental Conditions in the Aleutian Islands

- Summarizes weather data used in Response Gap Analysis and Towing Analyses.

Impact of Environmental Conditions on Vessel Incident Response in the Aleutian Islands: A Response Gap Analysis

- Characterizes how often environmental conditions alone would preclude or significantly impede a range of emergency and oil spill response operations in the region.

REGULATORY REQUIREMENTS

Regulatory Resource Study

- Summarizes U.S. and Alaska regulations.
- Estimates cost of compliance.

VESSEL TRAFFIC

2012 Transits of Unimak Pass

- Updates Phase A vessel traffic study.
- Estimates innocent passage vessel transits.
- Informs per-vessel cost estimates.

CONTEXT CONTEXT CONTEXT CONTEXT

OPTIMAL RESPONSE SYSTEM ELEMENTS

EMERGENCY TOWING

Minimum Required Tug Studies

- 2013 study calculates minimum tug bollard pull needed to control representative vessel based on 2010 traffic data.
- 2014 study updates calculation for 75th percentile containership based on 2012 data.

Tug of Opportunity Study

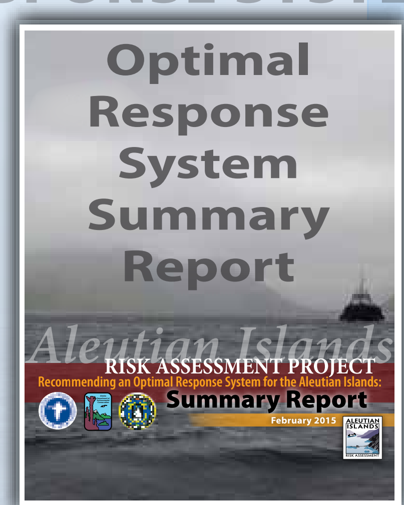
- Calculates the ability of tugs of opportunity in the region to reach various scenario locations and rescue a large ship.

Purpose Designed Towing Vessel

- Presents design and cost estimate for towing vessel intended to maximize features such as speed and seakeeping for Aleutian Islands operations.

Estimated Response Times for Tugs of Opportunity in the Aleutians

- Evaluates availability, capability, and response time for tugs of opportunity to assist 75th percentile containership at various scenario locations based on 2012 tug location data.



Best Available Technology

- Identifies best available technology tugs based on review of existing vessels and set of criteria applicable to Aleutian Islands.

Tug Location Study

- Presents geographic areas that can or cannot be reached by tugs based at different locations in the Aleutian Island.

SPILL RESPONSE & SALVAGE

Considering Options for Salvage & Oil Spill Response in Optimal Response System

- Describes approach used to identify spill response and salvage resources and system components for recommended system.

BENEFITS, COSTS, & IMPLEMENTATION

Benefit-cost Analysis of Risk Reduction Options

- Analyzes predicted benefits and costs and concludes that predicted benefits of proposed system will exceed costs of system implementation.

Considering Options for the Management & Funding of an Optimal Response System

- Describes approach used to identify nonprofit model for recommended system.

Contents

1. Introduction

In 2004, the *M/V Selendang Ayu* lost propulsion, drifted aground, and broke apart near Unalaska Island. Six lives were lost in the ensuing rescue attempt, 350,000 gallons of oil were spilled as a result of the vessel's grounding, and a local fishery was closed.

While the *Selendang Ayu* is not the only oil spill or vessel incident in the region, it remains the largest to date, and provided the impetus - as well as funding from the enforcement action settlement - for the Aleutian Islands Risk Assessment (AIRA), initiated by the U.S. Coast Guard (USCG), Alaska Department of Environment Conservation (ADEC), and the National Fish and Wildlife Foundation (NFWF) in 2010. Using a process specifically designed by the Transportation Research Board of the National Academies (TRB, 2008), these groups formed the AIRA Management Team. A multi-stakeholder Advisory Panel, including representatives from wide-ranging stakeholder groups familiar with the region, marine industries, and fisheries and subsistence use, provided input throughout the project.[1] Project outcomes were reviewed by a Technical Peer Review Panel of experts coordinated through the Transportation Research Board. See Appendix A for a list of participants on the Management Team, Advisory Panel, and Technical Peer Review Panel.

At the conclusion of Phase A of the AIRA in 2011, the Advisory Panel recommended that emergency towing, salvage, and spill response services should be enhanced in the region, which was implemented as Task 1-2 of Phase B.[2] This report summarizes the recommended Optimal Response System as developed by an Analysis Team[3] of contractors and based on a combination of their best professional judgment, key informant interviews, and diverse analyses. A series of supplementary reports informs this overall recommendation: these are referenced throughout the document. Appendix B provides the Technical Peer Review Panel's comments and the Management Team's response.

The Analysis Team's recommended Optimal Response System received almost unanimous support from the Advisory Panel members participating in an April 2014 meeting.[4] Where full consensus was not achieved, this is acknowledged and the different perspectives characterized.

---

1 For more information on Phase A of the project, including the composition of the various groups such as the Management Team, Advisory Panel, and Peer Review Panel, see: http://www.aleutiansriskassessment.com/documents/110826AIRA_SummaryReportvFINALlr.pdf

2 The Analysis Team's charge is summarized in the Phase B workplan: http://www.aleutiansriskassessment.com/documents/121205ApprovedAIRAWorkplanvF.pdf

3 Nuka Research and Planning Group, LLC facilitated the Analysis Team for this task. Pearson Consulting, LLC served as co-manager of the AIRA project, with significant input and analysis provided by Baldwin & Butler, LLC, Moran Environmental Recovery, Moran Towing, and The Glosten Associates, Inc.

4 See meeting summary at: http://www.aleutiansriskassessment.com/files/140512_AIRA_AP_Meeting_Day_1_Summary_V4.pdf.

The Analysis Team and Advisory Panel acknowledge that the Aleutian Islands context is constantly changing. These changes include the emergence of new companies and organization, the disappearance of others, and the potential for larger ships and more transits in the future. The recommendations described here are based on the current traffic and conditions in the Aleutians and are intended to achieve the Advisory Panel's request for an enhanced system at the end of Phase B. We believe that these recommendations would significantly improve the protection of valuable resources in the region. At the same time, we recognize the need for re-evaluation as the context changes and encourage that any future system should also work to maximize the benefits to local communities, environment, and economy.

2. Aleutian Islands Vessel Traffic and Operating Environment

The Aleutian Islands chain extends more than 1,000 miles into the Pacific Ocean from mainland Alaska. This is roughly the distance from Orlando, FL to New York City, or from San Diego, CA to Seattle, WA. While some communities have docks, storage, landing strips, and other related infrastructure, these resources are extremely sparse in comparison to other U.S. coastal areas.

The Aleutian Islands ecosystem also supports significant natural resources, including internationally important commercial fisheries, local subsistence use, and habitat for local and migratory species (DNV and ERM, 2011a).

A significant and growing number of vessels transit the Aleutians in service of both local and global markets. While conditions can be calm, and skilled mariners are usually capable of dealing with worsening conditions, the combination of large vessels (many on international transits and not subject to U.S. or Alaska spill response regulations), bad weather, and sparse infrastructure can challenge efforts to prevent casualties or to respond if one occurs.

This section briefly describes the large, commercial vessel traffic in the region and response gap analysis for a range of response activities based on the "2012 Transits of Unimak Pass" (Nuka Research, 2014a) and "Impact of Environmental Conditions on Vessel Incident Response in the Aleutian Islands" (Nuka Research, 2014b).

2.1 Innocent Passage

The U.S. Coast Guard requires that certain tank and non-tank vessels have Vessel Response Plans (VRP)[5] in place, ensuring either that a specified (and variable) quantity of response resources can be on-scene within set time limits, or at least that the services are, or can be, contracted quickly when needed. Vessels transiting U.S. waters within the Exclusive Economic Zone (EEZ) that are subject to these requirements must include planning for each of the Captain of the Port Zones through which they travel.

However, as part of customary maritime law, foreign-flagged vessels are allowed to pass through another nation's EEZ without being subject to regulations or having their way impeded. Thus, the U.S. Coast Guard's regulations exempt any non-U.S.-flagged vessels traveling between two foreign ports from the requirements mentioned above, even if they pass through the U.S. EEZ. The State of Alaska mimics this policy, exempting any vessels that are not traveling to or from an Alaska port from its spill prevention and response requirements. (Nuka Research et al., 2013).

In 2012, 853 vessels were recorded making only "innocent passage" voyages through Unimak Pass. Not all vessels use Unimak Pass or even go through a pass at all (DNV and ERM 2010a). Those vessels recorded through Unimak Pass include: 594 bulkers, 113 containerships, 110 other non-tank vessels, and 36 tankers. These vessels were not subject to any U.S. or State of Alaska oil spill preparedness and response requirements during their transit through this

5 For simplicity, "VRP" is used throughout the report to include Vessel Response Plans for both tank and non-tank vessels.

remote region. On the other hand, 1,045 vessels were recorded transiting Unimak Pass that would have been subject to these federal requirements. Many more vessels – both in innocent passage and subject to regulations - likely traveled through the EEZ south of the chain or used other passes but were not included in traffic data for Unimak Pass. (Nuka Research, 2014a).[6]

2.2 Vessel Traffic in the Aleutian Islands: Update of Unimak Pass Transits and Potential for Future Increases

During Phase A, an extensive vessel traffic study characterized the type and number of vessels moving through the study area on domestic and international voyages (DNV and ERM, 2010a). Vessels of 300 GT or greater transiting the Aleutian Islands study area are typically moving commercial goods and raw materials along the North Pacific Great Circle Route between western North America and East Asia (DNV and ERM, 2010a). Depending on conditions, vessels may choose to stay entirely to the south of the Islands or may pass through the Aleutian Island chain using the relatively narrow (10 nautical miles in places) Unimak Pass or another pass. Those that stay south of the islands often pass very close to shore.

As part of Phase B, an updated study of vessel traffic was conducted for Unimak Pass only specifically to identify the proportion of total vessel traffic that was in innocent passage (Nuka Research, 2014a). That study relied on 2012 data from the Marine Exchange of Alaska's network for monitoring the Automated Identification System (AIS) signals from passing ships. In 2012, it recorded 1,961 ships making 4,615 transits through Unimak Pass. Transits that skirted the island chain to the south were not captured via AIS.

Most of the ships recorded through Unimak Pass were non-tank vessels: 60% of the individual vessels recorded were bulkers, 24% container ships, and 13% other non-tank vessels. Fifty-two vessels, or 3% of the total individual vessels recorded, were tankers (Nuka Research 2014a). More vessels were recorded transiting west than east, indicating that many eastbound vessels likely stayed south of the chain or used other passes. See Figure 1.

There were more recorded transits through Unimak Pass in the calendar year of 2012 than those recorded in any of the fiscal years (October 1 – September 30) 2006-2009 as reported in Phase A. In previous years, the number of recorded transits varied from 3,491 to 4,471 (DNV and ERM, 2010a). See Table 1.

Vessel traffic through or near the Aleutian Islands is expected to increase further over the next twenty years. The vessel traffic assessment conducted as part of Phase A of the AIRA estimated that trade through the region would increase incrementally each year, more than doubling eastbound container and chemical traffic in the next 25 years, with additional major increases in many other categories (DNV and ERM, 2010a).

6 More than twice as many tankers were in innocent passage along this route than those traveling to or from a U.S. port.

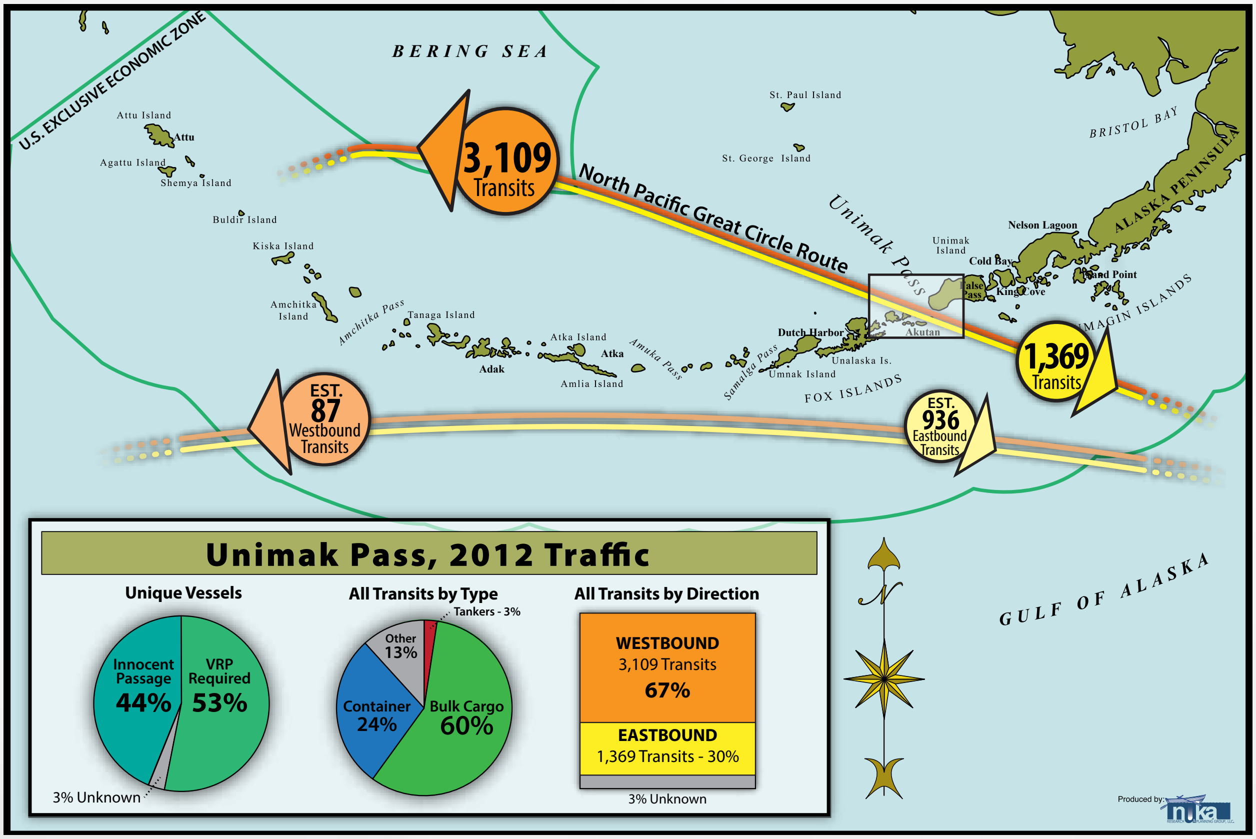


Figure 1. Summary of Unimak Pass traffic recorded in 2012, including percentage of vessels in innocent passage and by vessel type; also includes roughly estimated transits south of the island chain based on number of vessels going through Unimak Pass (routes are idealized; vessels do not follow these exact routes)

Table 1. Vessels recorded through Unimak Pass in 2006-2009 fiscal years (Oct 1- Sept 30) in DNV and ERM, 2010 and 2012 calendar year

FISCAL YEAR *unless noted*	TRANSITS		
	Westbound	Eastbound	Total
2006	2923	568	3491
2007	3851	890	4471
2008	3274	957	4231
2009	2886	1088	3974
2012 (calendar year)[1]	3109	1369	4615

In addition, several proposed or pending marine terminal development projects have the potential to significantly add to the shipping traffic through Unimak Pass. In the U.S., the Gateway bulk project may add over 480 bulk carrier transits (mix of Panama and Cape class) to and from a new Cherry Point, Washington terminal (VanDorp and Merrick, 2014). Other studies have estimated an increase in vessel traffic to U.S. Pacific Northwest ports as between 1% and 9% per year through 2030 for container and bulk dry cargo ships (BST and Mainline, 2001).

While vessels serving U.S. projects and ports will be covered under U.S. VRP requirements, new shipping traffic from Canadian ports will add to the volume of vessels engaged in innocent passage. Projected growth rates for the Port of Vancouver, BC, have been estimated at between 1-2% per year for tankers, cargo carriers, and container ships from 2012 through 2030 (Moffat and Nichol, 2013). A review of potential vessel movements associated with northern British Columbia ports, where there are several major cargo and energy terminal projects proposed or in development, shows that vessel transits may triple over the next several decades, from approximately 400 transits per year in 2011-2012 to more than 1200 transits in 2030 (Nuka Research, 2013a). Predicting the percentage of these future transits that would use the Great Circle Route through Unimak Pass is beyond the scope of this analysis, but these new shipping projects along the U.S. and Canadian Pacific coasts warrant close attention.

2.3 Responding to Incidents in the Aleutian Islands Operating Environment

Since the voyage of naturalist Georg Steller and Vitus Bering in 1741 (Ford, 1966), the Aleutian Islands region has been known for its harsh marine environment. A review of meteorological and oceanographic data showed that average conditions in the Aleutians are cloudy, with sustained winds of 7 to 22 knots, and seas of 4 to 13 feet. In extreme conditions, waves readily exceed 30 or more feet, and winds can be 50 knots or greater, with gusts of more than 70 knots. (Nuka Research, 2013b). This operating environment not only creates potential hazards for vessels underway, it also complicates the process of assisting a vessel in distress or cleaning up an oil spill, should a vessel accident occur.

Nuka Research (2014b) conducted a response gap analysis to estimate how often environmental conditions could be expected to preclude the implementation of seven different response-related activities based on a five-year hindcast of environmental conditions in the area. Environmental conditions were analyzed against a set of limits based on published literature, standards, and incident reports, and then reviewed by the Analysis Team.

The response gap analysis confirms the Advisory Panel's observations in Phase A that the operating environment in the Aleutians may often preclude traditional response activities. Based on this concern, the Analysis Team was instructed to emphasize prevention and response tactics that are suited to this unforgiving environment. Overall, it will be much less likely that weather conditions would preclude towing operations that are intended to prevent an incident from causing an oil spill at all (2% of the time) or heavy-lift lightering that is intended to keep oil from spilling from a vessel (20% of the time), than either open-water mechanical recovery or the aerial application of dispersants (both expected to be prevented by weather 72% of the time). In other words, oil spill prevention is usually possible (assuming appropriate rescue vessels can reach an incident in time), while oil spill clean up is more often impossible based on weather alone. Table 2 summarizes the results of the response gap analysis in aggregate based on weather data collected from around the region.

Figure 2 shows the results for different types of operations based on each location. This figure also shows how often key airports are closed to jet and propeller planes based on weather. This provides one indication of the potential challenge to delivering equipment from other regions or moving it around within the region by air.

7 It is important to note that these figures do not denote the time periods for which a fully effective deployment of a tactic is guaranteed, only how often it would likely to be prevented entirely based on environmental conditions alone. Local conditions may be different than the areas for which historical data is available. Ultimately, conditions suitable for response activities must be sustained in order to mount a response.

Table 2. Summary of cumulative, year round response gap estimate for four locations across the study area (Nuka Research, 2014b)[8]

RESPONSE TACTIC	Response Not Possible	Response May be Possible	Relative Frequency
Emergency Towing	2%	98%	
Helicopter Lightering	20%	80%	
Open-Water Mechanical Recovery	72%	28%	
Nearshore Mechanical Recovery -- Unalaska Bay *(Daytime only)*	52%	48%	
Aerial Application of Dispersants	72%	28%	
Vessel Application of Dispersants	64%	36%	
Air Observations -- Fixed Wing *(Daytime only)*	18%	82%	

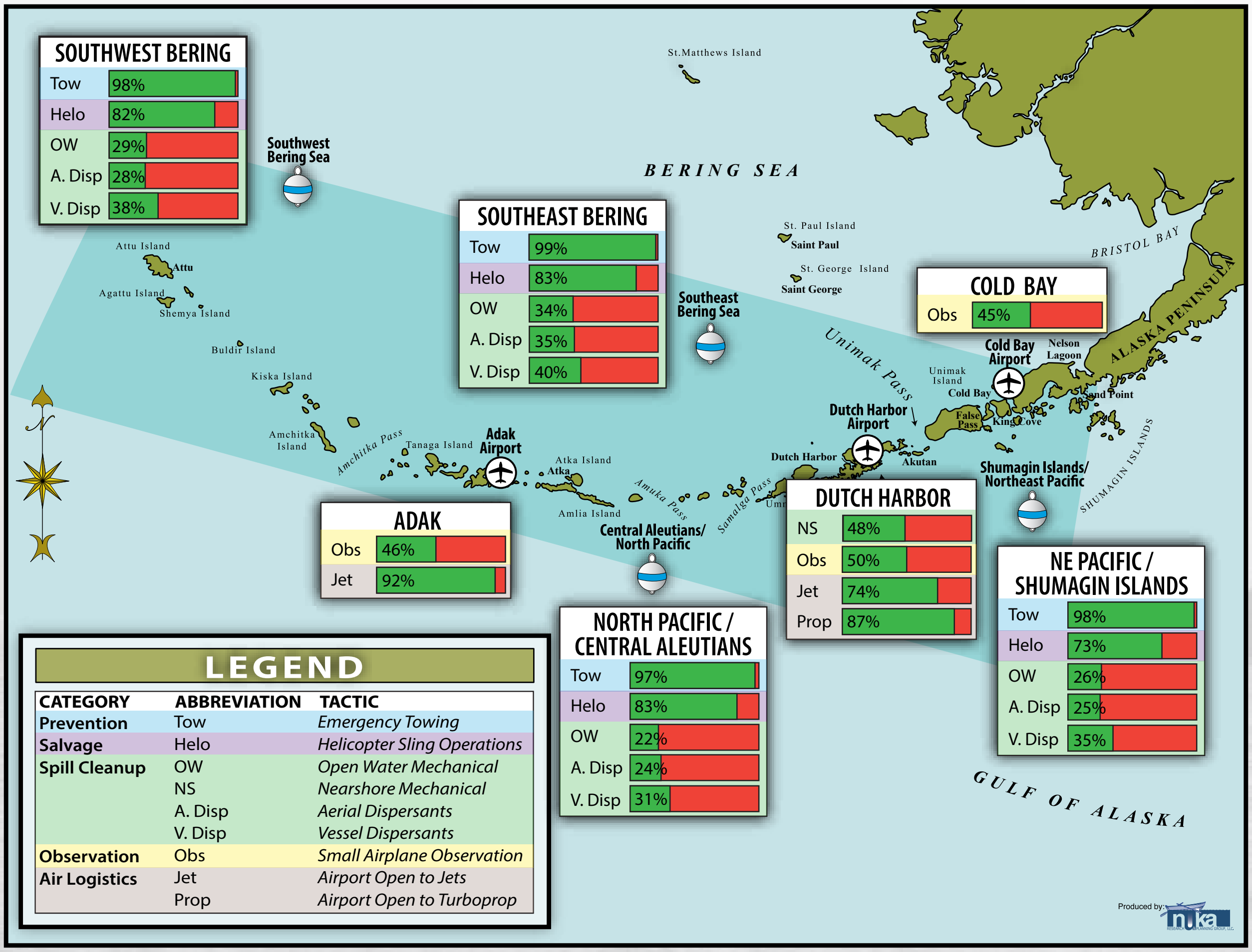


Figure 2. Response gap for different types of operations at each location with environmental data recordings. Green bars indicate the frequency with which an operation would be possible based on a five-year hindcast of environmental data (Nuka Research, 2014b).

8 It is important to note that these figures do not denote the time periods for which a fully effective deployment of a tactic is guaranteed, only how often it would likely to be prevented entirely based on environmental conditions alone. Local conditions may be different than the areas for which historical data is available. Ultimately, conditions suitable for response activities must be sustained in order to mount a response.

Optimal Response System for the Aleutian Islands

The recommended system builds a cohesive response capacity tailored to the remote Aleutian environment and vessel traffic. The overall system is managed by a non-profit organization controlled by members comprised of vessel operators transiting the Aleutians. The system incorporates a set of coordinated risk reduction measures at each stage of the accident chain.

Cascade of Response Services

- Preparation
- Incident Prevention
- Early Warning
- **Strategic Activation if an incident is identified**
- At-sea Intervention
- Damage Mitigation
- Oil Spill Response
- Long-term Management

SYSTEM COMPONENTS

Non-profit Managing Entity — $800,000/yr

Coordinates and Manages the Response System
Contracts for or directly provides for response services
Ensures response readiness, training of responders, and maintenance of equipment

Prevention & Compliance — $500,000/yr

Vessel Routing Avoids hazards and provides time to respond
Vessel Monitoring Assures compliance and rapid identification of incidents

Vessel routing & real-time monitoring provide a strong accident prevention system
Information sharing with the USCG allows for situational awareness and rapid response
Incident Management System can be activated even without a vessel distress call

Incident Operations

Command | *Tactical* | *Support*

Incident Management Team — $150,000/yr
Local IMT coordinates initial response

Emergency Tow Vessel — $7 Million/yr
Dedicated tow vessel capable of rescue even in high seas (110 MT bollard pull)
Rapid interception (dedicated, 16 knot speed)
Heavy seakeeping ability
Firefighting capability
Can also assist in salvage and spill response

Air observation & cascading support initiated at any time

Salvage Program — $1.1 Million/yr
Oil Storage Barge (60,000 bbl)
Also provides secondary storage for spill response
Heavy Lift Helicopter-of-Opportunity Program
Helicopter Lightering Package

Oil Spill Response Program — $3.6 Million/yr
Nearshore Spill Response Task Force
Vessel-of-Opportunity Program (150+ local vessels and crew)
Out-of-Region Mobilization Plan for additional resources

Mobile Logistics Base — $350,000/yr
Sustained support for salvage & spill response in remote locations

Orderly Hand-off & Long-term Management

IMT hands off incident management to the Responsible Party
Managing Entity maintains response readiness

3. Recommended Optimal Response System

At the conclusion of Phase A, the Advisory Panel and Management Team applied two key principles to their consideration of a wide-range of potential risk reduction options on the table at that time: (1) prevention takes priority over response, and (2) all measures should be realistic and practical (Wolniakowski et al., 2011). The Analysis Team sought to carry these principles forward in developing its recommended Optimal Response System in Phase B.

The key components of the recommended Optimal Response System are:

- Managing entity
- Routing measures and vessel monitoring
- Emergency towing
- Salvage services
- Oil spill response

This section briefly describes each component of the system based on supplementary studies conducted for this task throughout Phase B. See inset for a summary of the recommendation.

The overall system is estimated to cost $13.6 million annually, including annualized capital costs as well as operations and maintenance. Costs are discussed further in Section 4.

3.1 Managing Entity

Effective management of a comprehensive response system will be critical to its success, as ultimately it will be the ability to quickly activate people and resources based on careful planning and in a coordinated process that makes accident prevention – or cleanup, if needed – successful in this challenging environment.

The Analysis Team recommends that a **single managing entity** or coordinating body be established to coordinate and administer all of the prevention and response components of the Optimal Response System. The managing entity is a critical component of the overall system, as it will ensure the acquisition (directly or via contract) of the various resources and services and coordinate among them. It will also serve as the focal point of contact for both vessel operators and regulators, and work with these entities and other interested stakeholders to identify modifications to the system needed in the future based on lessons learned or changes in the overall context. Having a single entity will avoid the replication of administrative costs associated with oversight, while at the same time benefiting from the strategic and complementary use of all possible funding streams instead of potentially funding duplicative services if multiple entities were involved.[9] (Baldwin & Butler and Pearson Consulting, 2014)

Additionally, the Analysis Team suggests that this managing entity should be a **nonprofit organization** with a membership of companies operating vessels through the region.

9 In other parts of Alaska, a single entity provides services regionally based on the needs, features, and federal and state regulatory requirements that apply to operators in Alaska's diverse regions. Currently, these include Alaska Clean Seas on the North Slope, Cook Inlet Spill Prevention and Response Inc. in Cook Inlet, Alyeska/Ship Escort Response Vessel System in Prince William Sound, Alaska Chadux Corporation, and Southeast Alaska Prevention and Response Organization in Southeast Alaska.

This entity could *contract* other for-profit or nonprofit entities for services to encourage competition and (potentially) benefit from the experience of those already operating in the area, but the nonprofit structure of the overall managing entity will help to keep costs down by minimizing tax obligations, ensuring transparency, and avoiding the pressure associated with for-profit companies to maximize profit to owners or shareholders. As a nonprofit, the managing entity could charge variable fees or dues to its members (for example, based on vessel type or fuel/oil cargo capacity) as long as these are transparent and fairly applied to all. Finally, the nonprofit status may make the managing entity eligible for additional, supplementary funding such as government or private grants or oil spill settlement funds (Baldwin & Butler and Pearson Consulting, 2014).

The Analysis Team developed this recommendation based on a review of potential business models used for oil spill prevention and response in other places, or models otherwise applied to maritime operations. The Analysis Team applied its understanding of the key drivers and issues in the region and diverse experiences in other locations prior to consider the potential models and develop a recommendation to the Advisory Panel (Baldwin & Butler and Pearson Consulting, 2014).

The majority of the Advisory Panel agreed with both the use of a single managing entity and that this entity should be a nonprofit organization. A minority did not want to specify that a single managing entity is preferred, nor the type of organization. This minority preferred to keep these options open both now and in the future, and one Panel Member stated that it is not the place of this body to recommend a particular business model. In making this recommendation, neither the Analysis Team nor the Advisory Panel endorses any particular organization or company to play the role of the managing entity or service provider to that entity.

For more information see: Considering Options for the Management and Funding of an Optimal Response System in the Aleutian Islands (Baldwin & Butler and Pearson Consulting, 2014).

3.2 Routing Measures and Vessel Monitoring

Designating areas to be avoided near sensitive or hazardous shoreline and preferred routes through passes for use in transit between Asia and North America will help to prevent a vessel that loses propulsion or steering from drifting onto shore before a rescue can take place. Vessel monitoring by Automated Identification System (AIS) will facilitate the prompt detection of a vessel deviating from these routes or seeming to drift or otherwise be in danger. Vessel monitoring will also enable the Managing Entity to identify vessels transiting through the area that are not contributing to the Optimal Response System[10] as well as vessels that may provide assistance to a vessel in need of help.

Figure 3 shows an example of a 76,596 DWT bulk carrier taking a very unusual track through the Aleutians; Figure 4 shows a container ship passing very close to shore as it passes through the Western Aleutians.

10 If the Optimal Response System is implemented under U.S. Coast Guard-approved alternate planning criteria as a means of requiring vessels subject to VRP requirements to comply, then they would have to either have their own plan approved or participate in this or another approved program.

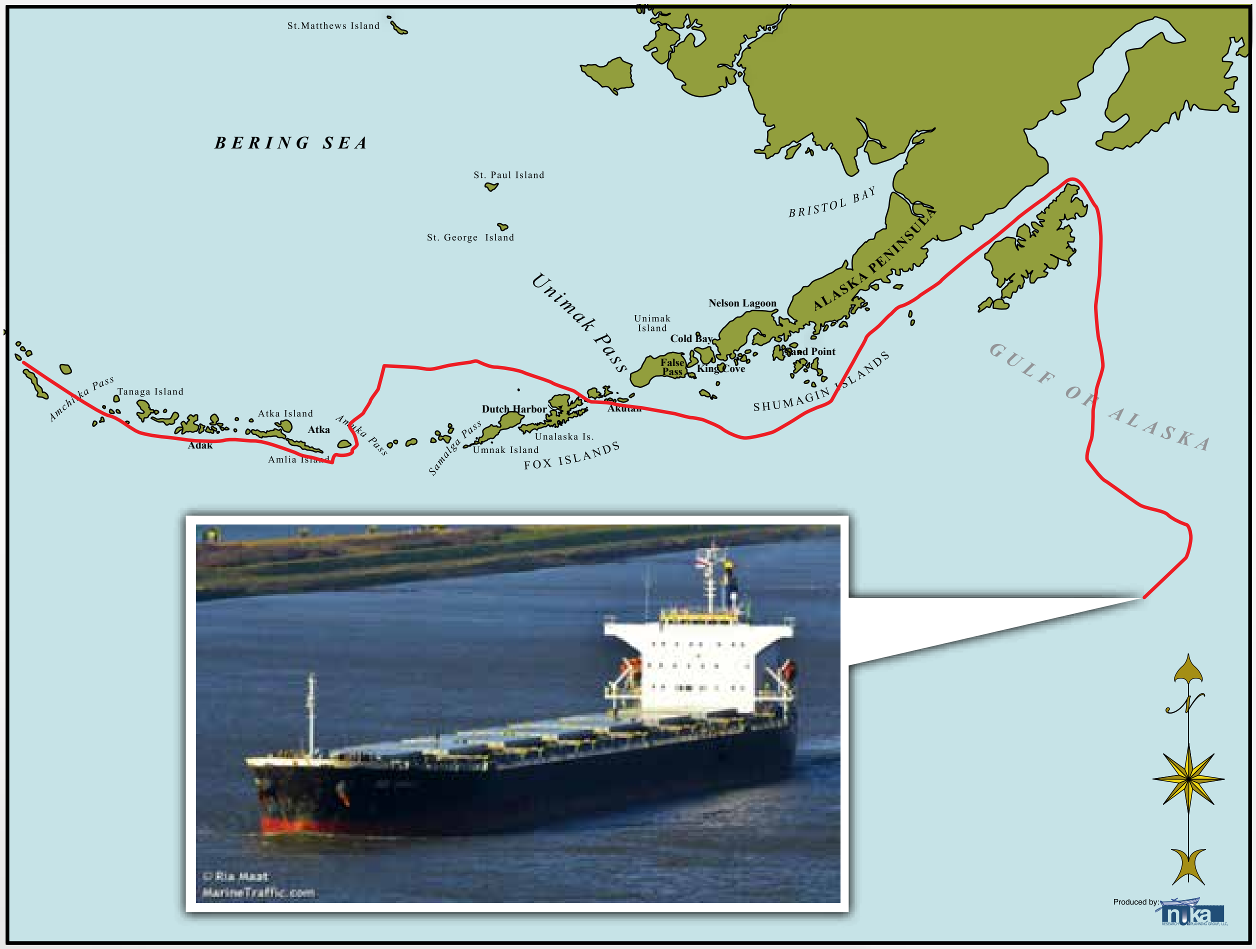


Figure 3. The bulk carrier Red Jasmine takes an unusual route through the Aleutians in January 2014 as seen on this AIS track (provided by the Marine Exchange of Alaska). Used with permission. Photo credit: Ria Maat

The Analysis Team **recommends establishing a combination of routing measures and areas to be avoided for the region**, and that these ultimately apply to all deep-draft vessel traffic engaged in international commerce through the area.[11] Figure 5 shows preliminary recommended routes and areas to be avoided for vessels making transoceanic voyages through the Bering Sea and North Pacific Ocean adjacent to the islands. The details of both the routes and the vessels to which these would be applied are being developed in a separate task under Phase B of the AIRA (Task 4), and will ultimately require approval by the International Maritime Organization to capture even those vessels in innocent passage. Within the scope of the recommended Optimal Response System, the Analysis Team recommends that participating vessel operators for vessels passing through the Aleutians on international voyages should agree to adhere to areas to be avoided and to follow routes designed to keep vessels offshore. This will increase the chance of achieving an emergency tow or regaining control of the vessel prior to grounding. Real-time vessel monitoring through use of both satellite and terrestrial Automated Identification System (AIS) data feeds will help ensure compliance with these measures and identify problems early.

---

11 Establishing areas to be avoided and ideal routes would not entirely prohibit mariners from deviating when necessary to avoid rough weather or for other reason demanded to transit safely through the area. In the event that they need to deviate from the route, they would notify those monitoring vessel traffic to indicate the reason and their intentions.

Figure 4. The container ship, M/V Costco Hamburg passes within one mile of Etienne Bay on Attu Island while in international passage through the Aleutians (May 27, 2010). Used with permission. Photo credit: Jeff Williams

The Analysis Team also recommends that the Optimal Response System should include **real-time vessel monitoring via AIS** to identify vessels that are not following the recommended routing, are traveling to or from a U.S. port but are not in compliance with regulations, or are in some way compromised or in distress. This information can then be shared with the U.S. Coast Guard in a timely manner for either rescue management or potential enforcement action.

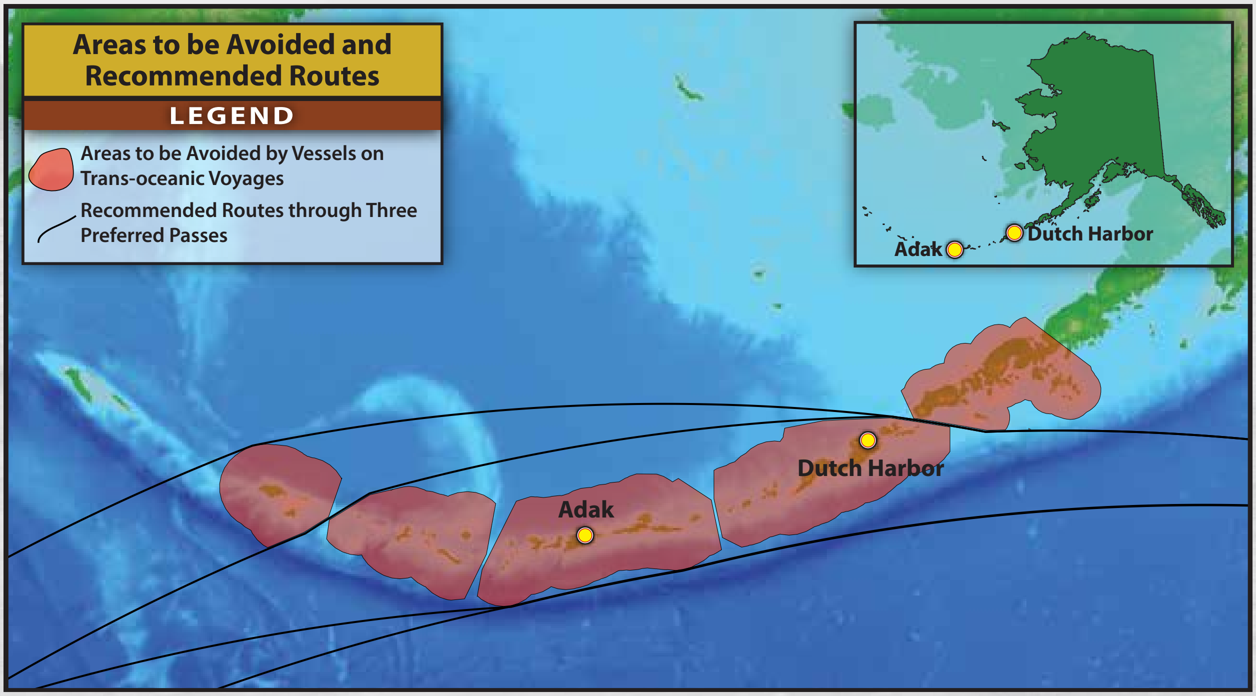


Figure 5. Potential Areas to be Avoided and recommended routes for vessels passing through the area.

The majority of the Advisory Panel concurred with both the routing measures and vessel monitoring. One panel member felt that these system elements too closely resembled the current approach used in the region and were outside the scope of what this study should recommend.

3.3 Emergency Towing

Along with vessel routing and monitoring, emergency towing rounds out the prevention element of the Optimal Response System. It also represents a bridge between prevention and response, as a tow vessel may be used to rescue a stricken ship prior to a grounding or allision, or to support salvage or oil spill response efforts if an accident or spill occurs. Emergency towing is also the most capital-intensive component of the system, and thus received the greatest analytical attention with respect to achieving desired benefits in a cost-effective manner.

The Analysis Team recommends that an **emergency towing vessel (ETV) with a minimum bollard pull of 110 MT and a service speed of at least 16 knots be stationed in the region** as a dedicated – or near-dedicated – asset. This vessel **should have FiFi 1 or 2-class firefighting capability**.

The Analysis Team first considered whether tugs already operating in the region could be counted on to implement a rescue, thus avoiding the need to invest in an additional vessel. There are some resident tugs, others that move through the region to and from Arctic operations (at least in the recent past), and towing barges serving local markets. While a tug of opportunity could usually be expected to reach a distressed within 12 hours near Unimak Pass, a drifting ship in the western Aleutian Islands would likely wait two or more days for a tug of opportunity rescue since there are many more tugs of opportunity in the Eastern Aleutian area (see Figure 6). Additionally, although the tugs of opportunity in the region

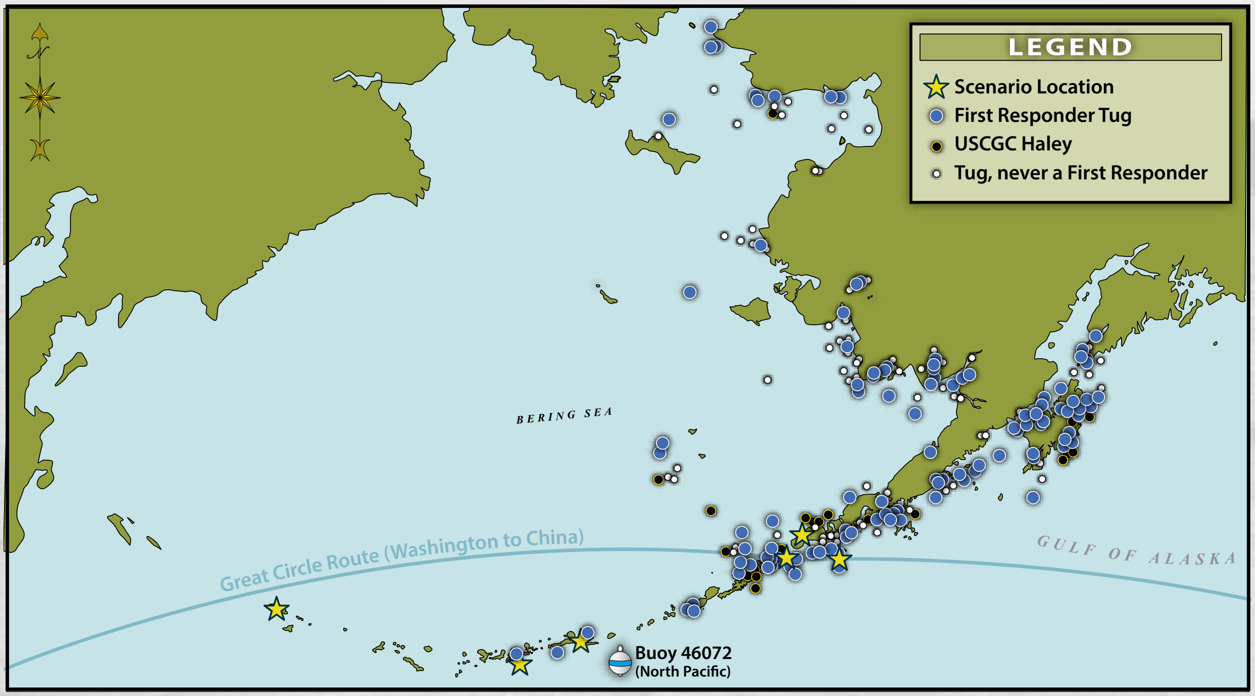


Figure 6. Locations of potential tugs of opportunity (aggregated from Wednesdays in 2012), highlighting the fact that most are found near the Alaska Peninsula and easternmost Aleutian Islands. Purple dots indicate tugs that were the first to arrive on scene to one of the six scenario locations used in Phase A at least one time based on the consideration of their capabilities in a range of weather conditions (Nuka Research, 2014c).

would likely be capable of rescuing most of the smaller ships currently transiting the region in typical wind and sea state conditions, very few potential tugs of opportunity could respond in extreme weather or be expected to assist the larger ships transiting the region (Nuka Research, 2014c and The Glosten Associates, 2014a).[12] The Analysis Team also noted that while mariners are usually willing to help each other, a tug engaged in commercial operations for a client may not always be willing or contractually permitted to leave a tow and proceed to a rescue. The Analysis Team concluded that tugs of opportunity alone are not sufficient to reduce the risk of spills from drift groundings.

In considering the potential for a dedicated ETV[13] in the region, the Analysis Team focused on determining the vessel bollard pull and speed that would enable a vessel to rescue most vessels currently transiting the region in most conditions, while also seeking to keep the cost within a level that would be practical and likely to be implemented. This resulted in the recommendation of a **dedicated ETV with 110 MT bollard pull and a service speed of 16 knots.**

Using bollard pull as the key indicator of an ETV's ability to make a save, The Glosten Associates concluded that a tug with a rated bollard pull of 109 MT (rounded in the recommendation to 110 MT) would be required to exert the necessary force on a vessel of the 75^{th} percentile containership by size (based on 2012 vessel traffic through Unimak Pass) in 40-knot winds and 33-foot seas.[14]

While bollard pull is a key component of tug capability, speed is also critical to the ability to execute an effective rescue across this vast region. At the Advisory Panel's request, The Glosten Associates developed a conceptual design for a purpose-built vessel intended to maximize speed, bollard pull, and other key features for the Aleutian Islands operating environment. This vessel would have a speed of 34 knots and the ability to hold that speed in extremely rough seas (with a bollard pull of 110 MT and other key features to enable safe operations). However, the construction cost for this vessel, if built in the U.S., would be an estimated $87.4 million (The Glosten Associates, 2013b). Instead, the Analysis Team chose to consider what a best available tug – based on a review of existing vessels across several characteristics – could accomplish for speed. This study, also by The Glosten Associates, identified a speed of 16 knots on an existing vessel in the U.S. which already had bollard pull above the 110 MT needed, for an estimated U.S. construction cost of $30.3 million (The Glosten Associates, 2013c).

Following additional input from the Advisory Panel, the Analysis Team also recommended that the ETV should have a **firefighting capability equivalent to Fifi Class 1 or 2**.

The Analysis Team also recommended that **the ETV should be based in Adak** based on technical analysis that sought to maximize the ability of the tug to make a save across the widest possible area, but the Advisory Panel raised additional practical considerations regarding the homeport option. Without building completely new infrastructure, Dutch Harbor and Adak emerge as the two most viable options to homeport a dedicated rescue tug.

---

12 The successful use of an Emergency Towing System (ETS), such as the one stationed in Dutch Harbor, would enable more potential tugs of opportunity to attempt a response. An ETS will not speed a tug's arrival on-scene, however, nor will it change the minimum tug requirements needed in terms of bollard pull and other attributes to handle large ships in bad weather.

13 "Dedicated" here does not intend to preclude the use of the vessel for harbor assist or other services to help offset costs. It is intended that the vessel would be based within the region and the operators would design its daily work and contractual relationships to allow for prompt re-deployment to a rescue if needed.

14 Forces required for both a tanker and containership were studied. Containerships typically require greater force because they are more subject to wind force than lower-profile tank vessels (The Glosten Associates, 2014). The Advisory Panel concurred with the use of this size of study vessel and these environmental conditions prior to the analysis.

Figure 7 shows the area inside of which a vessel could be expected to drift to shore before a tug traveling at 13 knots could be expected to reach it from either location. (Red shading denotes this "Zone of No Save" if the ETV was based in Dutch Harbor, and blue shading shows this area if the ETV's starting point was Adak). While both places have some infrastructure, Dutch Harbor and the community of Unalaska have significantly more, and are likely to provide more ongoing business supporting port activities and better crew support. Dutch Harbor would also position a tug close to the "choke point" of international traffic through Unimak Pass. On the other hand, Unimak Pass, the eastern Aleutians, and the Alaska Peninsula are more likely than the western Aleutians to benefit from the availability of a tug of opportunity, as already noted, and even though Adak is relatively far west, it is still only roughly halfway across the archipelago. A tug stationed at Adak is therefore *more likely* to reach distressed vessels throughout the region quickly. The ultimate decision will rest with those implementing the system and will no doubt rely on a more granular analysis of the costs associated with each port option.

While designating areas to be avoided or vessel routes to keep vessels far enough offshore that they stay out of the Zone of No Save would help, those areas would have to be well more than 100 nm offshore in order for an ETV coming from Dutch Harbor to make it to a vessel in the far western Aleutians near Attu before it could be expected to ground. An ETV based in Adak would not make it as quickly to a ship drifting off the eastern Aleutian Islands as one in Dutch Harbor, there are more potential tugs of opportunity in that area that would likely be to respond within hours instead of days. (See also The Glosten Associates, 2013d.) The deployment of a sea drogue from the drifting vessel could significantly slow the vessel's drift rate and thus increase the amount of time that a rescue tug has to reach the vessel and make a save. This should be considered in a future analysis, including the amount of time it would take and likelihood of being able to deploy the drogue to a vessel adrift in the western Aleutians.

The Advisory Panel agreed that an ETV with the specifications described above is needed, but did not reach agreement on the best homeport for the tug. Some supported having it near the choke point of vessel traffic in Unimak Pass, where logistics and housing for a crew are easier. Others saw the benefit of locating it at Adak, where it would be best able to reach parts of the region that are less likely to have the benefit of a tug of opportunity. The vessel could potentially be located in different ports seasonally. Regardless of location, the ETV could provide ongoing port services to offset costs as long as these did not prevent it from deploying a prompt response when called to a rescue. In addition to providing supplementary revenue to offset the cost of procuring and maintaining the vessel, this would keep the crew active and familiar with the vessel and area and support regular maintenance.

For more information, see: Minimum Required Rug for the Aleutian Islands (The Glosten Associates, 2014), Tug of Opportunity Study (The Glosten Associates, 2013a), Purpose Designed Towing Vessel (The Glosten Associates, 2013b), Best Available Technology (The Glosten Associates, 2013c), Tug Location Study (The Glosten Associates, 2013d), and Estimated Response Times for Tugs of Opportunity in the Aleutian Islands (Nuka Research, 2014).

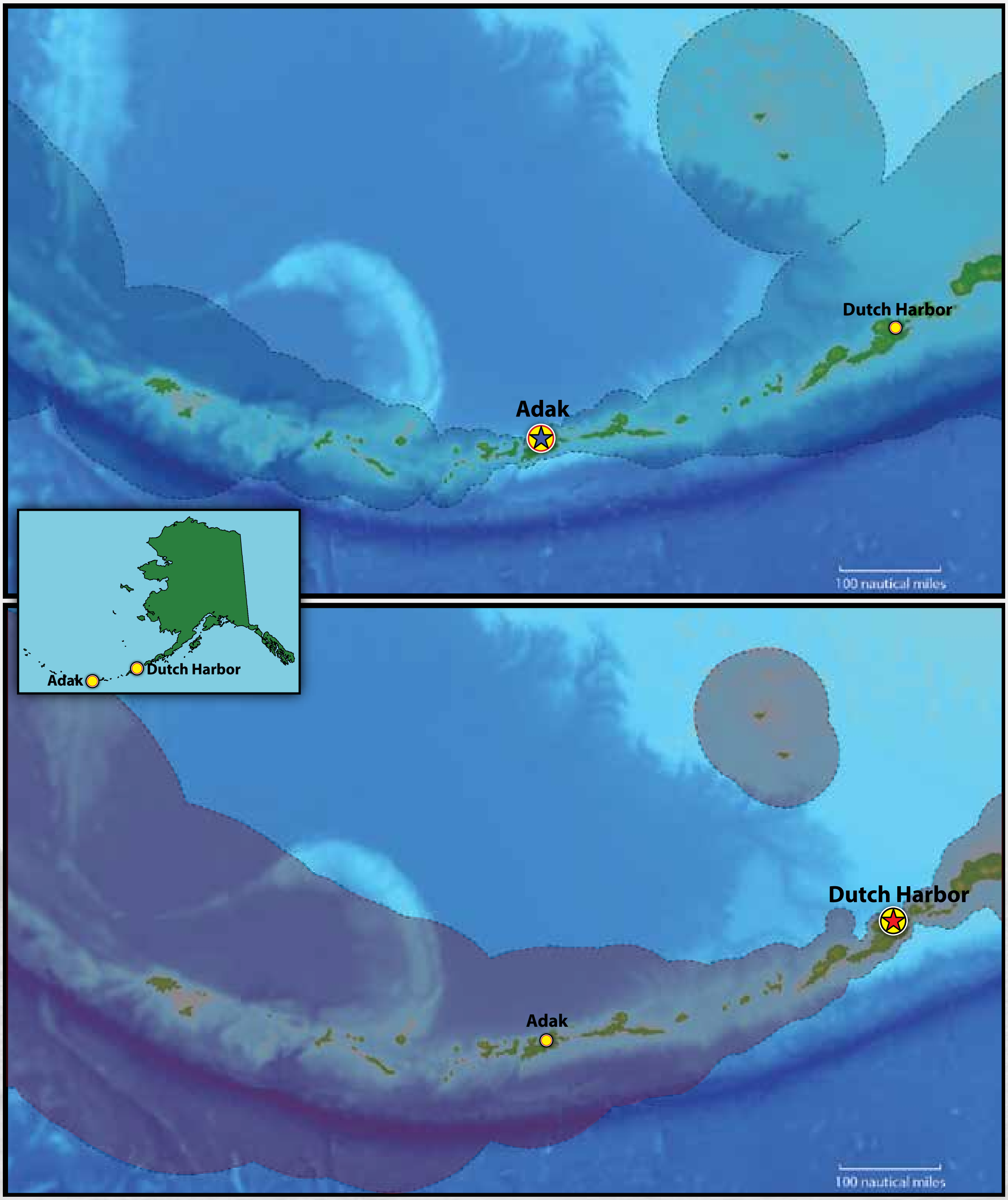


Figure 7. "Zones of No Save" comparison for tug based in Adak or Dutch Harbor. Within the shaded areas, a container ship that lost power could drift onto the shoreline of the Aleutians before a tug located at either Adak or Dutch Harbor would be able to intercept it and bring it under control.[15]

15 The Zone of No Save analysis assumes a 20-knot wind blowing directly to shore. Actual conditions in the Aleutians are less than this 99% of the time. It also assumes that the rescuing tug travels at 13 knots in those conditions, and takes one additional hour to get out of port and to gain control of the vessel in addition to travel time. See Appendix C for an overview of the methodology used.

3.4 Salvage

Salvage covers a wide range of services related to mitigating the risks of pollution in the event of a vessel accident and recovering the vessel and associated equipment and materials. These include: lightering, marine fire fighting, and salvage and wreck removal. Such operations may involve various equipment – including both vessels and aircraft – depending on the service needed and the context. Salvage may also include removing and managing containers; while important, the recommendation does not address this issue as it is outside the scope of the AIRA.

Based on review of previous salvage operations in the region, lightering by heavy lift helicopter was identified as one of the key activities likely to be crucial to a response.[16] (See Figure 8.) Emergency lightering may require pumping equipment, transfer hoses, fenders, portable barges, and shore-based tanks or other equipment as dictated by circumstances.

To support this type of lightering, the Analysis Team recommended that **a heavy lift helicopter package should be staged in the region and a heavy lift helicopter program of opportunity developed.**

Figure 8. Lightering the Selendang Ayu using heavy lift helicopter and tanks. Used with permission. Photo credit: Unified Command

16 Ship-to-ship lightering has historically been used to transfer oil and cargo, in such cases as the Exxon Valdez. Ship-to-Ship lightering was identified as an inferior option in the *Selendang Ayu* incident, due to sea state (See: Unified Command, Lightering Decision Document Memorandum, *Selendang Ayu* Choice of Salvor, January 5, 2005.) High sea states make ship-to-ship lightering much less feasible than helicopter lightering, due to the hazards of mooring vessels alongside one another.

A helicopter lightering package staged in the region would include everything, except the helicopter, needed to perform a helicopter lightering operation. This would include:

- Pumps and power-packs for use onboard a stricken vessel,
- Helicopter slings,
- Fly away tanks to move oil from the vessel to shore or a barge, and
- Pumps and power-packs to transfer oil to and from fly away tanks.

Lightering and other salvage-related heavy lift operations require the largest, or heaviest, civilian helicopters (Type 1). Civilian Type 1 helicopters suitable to and available for marine salvage can generally not be found in Alaska, and must be flown from the Pacific Northwest. Due to the cost of permanently staging such a helicopter in the region, the Analysis Team opted for the approach of establishing a heavy-lift helicopter of opportunity program. This would include:

- Identifying vendors that provide heavy-lift helicopter services,
- Establishing a contract and rates with those vendors,
- Monitoring the location and availability status of each helicopter on a monthly basis, and
- Developing a logistics plan to mobilize a helicopter to the Aleutians (carrying the helicopter onboard an aircraft or ferrying the helicopter).

In addition, the Analysis Team recommended that a 60,000 bbl storage barge be staged in the region to store oil that is lightered from a stricken vessel or recovered from a spill. The nearest dedicated response barges are based in Cook Inlet and Prince William Sound, and would take days to arrive even in Unalaska. These barges would take days longer to reach the western Aleutian Islands, assuming that the barges could be released from local obligations and the weather was conducive to transit. A barge of this size should prove sufficient to handle oil from the fuel tanks of most vessels currently transiting the region, or at least to partially lighter fuel and tanker cargoes until additional resources can be cascaded into the region. This barge should have a cargo heating system for the heavy oil that is commonly used as bunker fuel by transiting vessels.

The Advisory Panel concurred with the salvage recommendations.

For more information, see: Considering Options for Salvage and Oil Spill Response in an Optimal Response System (Nuka Research, Pearson Consulting, Moran Environmental Recovery, and Moran Towing, 2014).

3.5 Oil Spill Response

While the recommended system emphasizes efforts to prevent vessel accidents in the first place - and the prompt lightering of oil if an accident occurs – prudent planning recognizes that these efforts may at times fail due to weather conditions or other factors. The Analysis Team recommends enhancing oil spill response capacity to focus on nearshore response to protect sensitive areas, maximizes the use of vessels of opportunity in the region, and provides the necessary logistical support in remote areas. Additional resources would be cascaded in as needed, but due to environment, logistics, and transit time, it is important to have some resources in place in the region to start this process.

It is more likely that weather conditions will permit nearshore response than open-water mechanical recovery (Nuka Research, 2014b). The Analysis Team recommended that a **nearshore spill response taskforce (NSTF) should be developed** as the minimum response capability in the region, including three nearshore free-oil recovery strike teams and two shoreline protection strike teams (see Figure 9). This recommendation aligns with the State of Alaska's tactics manual (ADEC, 2014), and could be implemented largely with a vessel of opportunity program comprised of roughly 150 fishing vessels to provide the 68 vessels needed at one time in the NSTF. This program would need to be developed in advance, to ensure that a sufficient number of vessels and trained crew would be available at any given time, but initial review of the number of registered vessels in Dutch Harbor, Sand Point, and False Pass indicates that this should be feasible (Nuka Research et al., 2014). These vessels should be well suited to the nearshore environment in the area and bring the additional benefit of local mariner knowledge and experience.

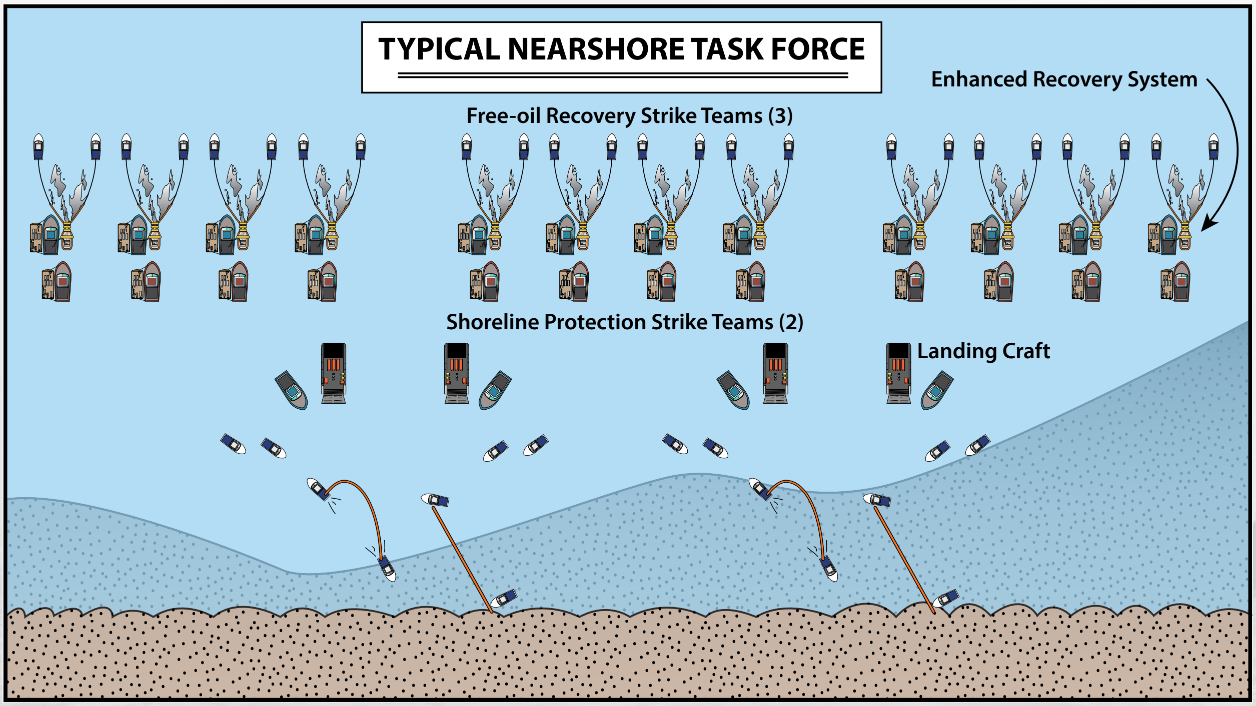


Figure 9. Equipping local vessels with the equipment and training needed to protect sensitive nearshore areas is a high priority. Using vessels of opportunity in this nearshore taskforce configuration will enhance the protection of sensitive coastal areas. (Based on ADEC, 2014.)

The Analysis Team also recommends that **a marine logistics base should be developed in the region** to provide support for a spill response even in the most remote areas. The base would consist of a set of stocked resources and pre-arranged contracts in place to acquire additional resources and vessel services. A large oil spill response in the Aleutian Islands will require significant numbers of personnel, as well as the resources to support their food, accommodations, waste generation, and other needs. ADEC describes the needs for this system component in its tactics manual, including specifying that it should be equipped to be self-sustaining for 21 days (ADEC, 2014). The logistics base could use the storage barge described in the previous section to store recovered oil and draw on other local vessels to transport supplies, house personnel, support helicopter operations, manage wastes, and provide other functions necessary to implement an effective response.

An out-of-region spill response, salvage, and marine firefighting resource mobilization program should be developed in the event of a major accident requiring additional response resources.

Finally, elements of **an Incident Management Team should be present in the region** to initiate a response until additional personnel arrive from elsewhere in Alaska, U.S., or the world,[17] especially given the frequency with which air travel to the region is delayed due to weather.

The Advisory Panel concurred with the spill response recommendations.

For more information, see: Considering Options for Salvage and Oil Spill Response in an Optimal Response System (Nuka Research, Pearson Consulting, Moran Environmental Recovery, and Moran Towing, 2014).

17 The responsible party could continue to use the IMT's services if they so chose.

4. Cost Estimates and Funding

The Optimal Response System can only provide the intended benefits if it is funded. The Analysis Team provided a first order estimate of the system cost and how this may break down among the vessel operators. The team recommends that these operators should be responsible for funding the program (possibly with a one-time appropriate from the U.S. federal government). A benefit-cost analysis of the system is described in Section 6.

4.1 Estimated Cost of Recommended System

The Optimal Response System as described in Section 3 is estimated to cost just over $13.6 million per year, with both capital and operations and maintenance costs annualized. These costs are summarized in Table 3, with details on each estimated line item in Appendix D. The largest single item is the ETV, as the cost estimates assume the financing of the actual vessel construction in addition to maintenance, operations, and associated dock facilities.

The Analysis Team estimated system costs based on published information and consultation with those familiar with the costs of the various system components. The cost estimate and per-vessel costs are provided to illustrate the approximate costs; the managing entity would develop its own detailed estimates and negotiated contracts.

4.2 Funding System

The Analysis Team recommends that **operators of large vessels subject to response planning requirements should pay for the system** that ensures readiness to respond in the region. The Analysis Team also suggests that **the U.S. government should contribute to the system given the unique situation where roughly half the large vessel transits that create risk are exempted due to innocent passage.**

Divided equally among just those large tank and non-tank vessels passing through Unimak Pass in 2012 that would be required to meet U.S. federal requirements (1,045 individual vessels in 2012),[18] the Optimal Response System represents a total cost of approximately $13,000 per year. This represents less than two days of operating costs for the average, non-U.S.-flag cargo vessels, some of which pass through the area multiple times per year. See Figure 10.

18 This assumes that the non-tank vessel requirements were in place. In other words, we use 2012 data as "current" and consider how many vessels would *now* be subject to the U.S. federal regulations requiring prevention and response in a given area.

Table 3. Estimated annual costs for Optimal Response System

	SERVICE/RESOURCE	Est. ANNUAL COST
MANAGING ENTITY	Staff and overhead	$605,597
	Professional services (legal, tax, accounting)	120,000
	Board of directors	67,500
	Subtotal	**$793,097**
PREVENTION & COMPLIANCE	AIS equipment and services	$433,097
	Staff monitoring of vessel traffic (using AIS)	88,728
	Subtotal	**$521,826**
EMERGENCY TOWING	Emergency tow vessel	6,752,053
	Tow vessel management and overhead	287,012
	Subtotal	**$7,039,065**
SALVAGE	Helicopter lightering package	$79,572
	60,000 bbl tank barge	663,968
	Helicopter of opportunity program	20,000
	Salvage management and overhead	322,421
	Subtotal	**$1,085,961**
SPILL RESPONSE	Nearshore task force equipment	$1,917,884
	Vessel-of-opportunity program	562,000
	Cascade program for out-of-region equipment	16,000
	Marine-based logistics base	325,465
	IMT program	146,516
	Spill response staff, management, and overhead	1,215,080
	Subtotal	**$4,182,946**
	TOTAL	**$13,622,895**

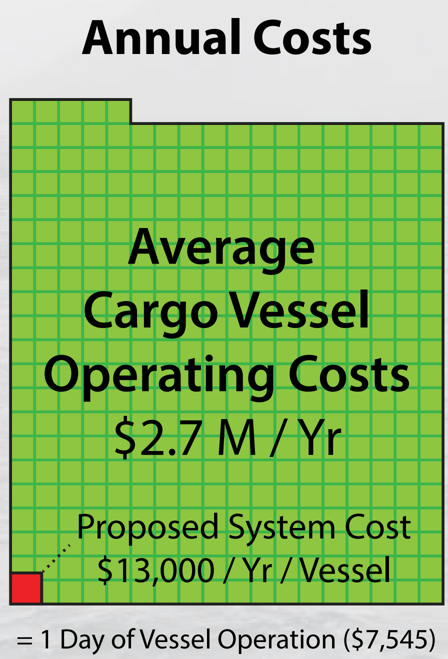


Figure 10. Comparison of maximum per-vessel Optimal Response System costs to daily operating costs (US DOT, 2011)

Figure 11 compares the estimated annual total cost of the recommended Optimal Response System with the estimated cost to implement federal regulations (33 CFR 155) for large tank vessels operating in the Aleutian Islands.

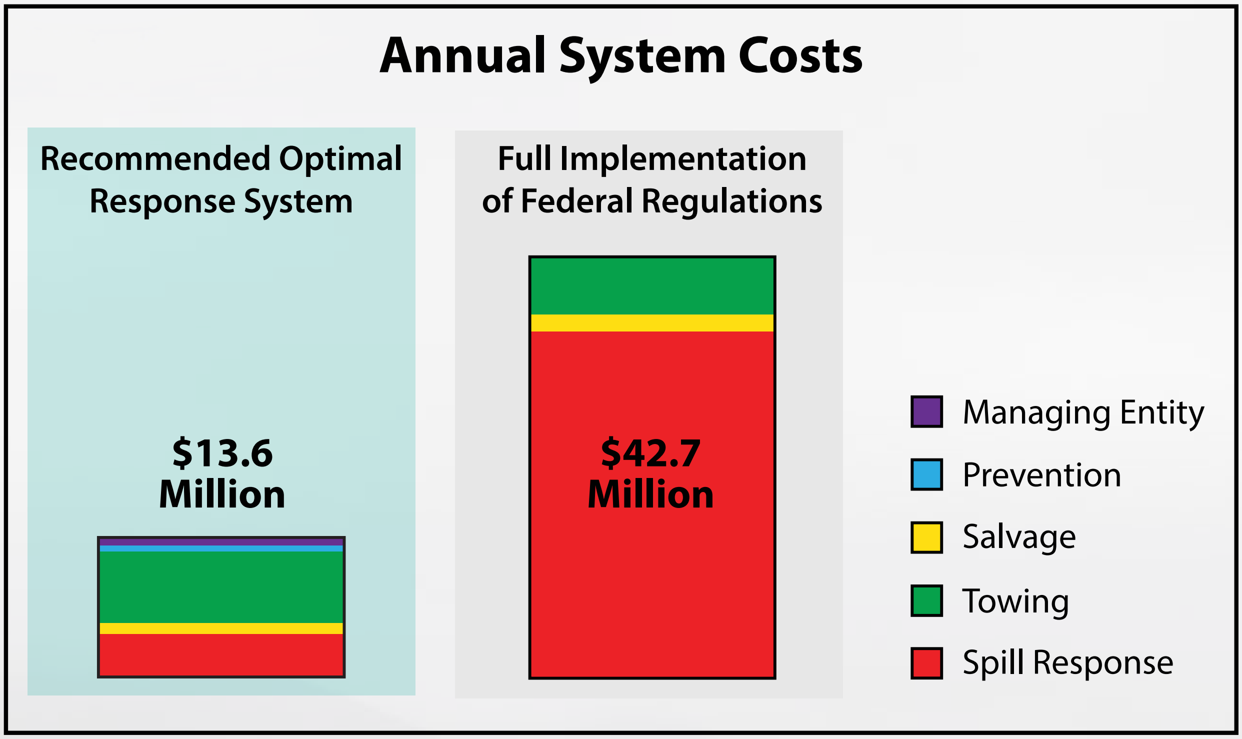


Figure 11. Comparison of the estimated total, annualized cost of the recommended Optimal Response System and the estimated total, annualized cost of fully implementing federal regulations in the Aleutian Islands for tank vessels (Nuka Research et al., 2013).

The estimate annual, per vessel cost of $13,000 represents a *maximum* cost, assuming overall cost estimates are accurate, because:

- Vessels staying south of the islands, or using a pass other than Unimak Pass, are not included in the vessel numbers used, but would still be subject to U.S. regulatory requirements unless they are in innocent passage.
- Vessels that are *not* subject to U.S. regulations could choose to contribute to the system voluntarily, potentially to gain the additional protection against accidents (and perhaps at a rate that represents a contribution only to the rescue tug and vessel monitoring services), or as an indication of "doing the right thing," Protection and indemnity ("P&I") clubs, seeking the protection and cost mitigation of an accident prevention system, may be encouraged to require their members to participate or contribute on their own. ***If all ships transiting Unimak Pass in 2012 contributed, the per-vessel cost of the Optimal Response System would be just over $7,000/year.***[19]
- Vessel traffic is likely to increase without a corresponding increase in resources within the region. (Vessel traffic associated with British Columbia export projects may bring added risk to the region, but not necessarily any financial benefit to the Optimal Response System unless these vessels in innocent passage choose to participate voluntarily.)

19 This does not include local traffic, such as fishing vessels or barges serving communities in the region.

- The nonprofit structure of the managing entity would enable acceptance of public or private grants, receipt of settlement funds from oil spills, or other sources to offset costs or speed ramp-up of the system.

The Advisory Panel agreed with the recommendations regarding funding the system. They added the suggestion that the U.S. government's contribution should represent half the capital cost of the ETV. This would require a one-time appropriation of $15.1 million (half of the $30.3 capital cost for the ETV) and would reduce the annual system cost paid by shippers by $1.4 million, or just over $1,300 dollars per regulated vessel.

5. Comparison of Recommended System with Regulatory Requirements

At the beginning of Phase B, the Analysis Team reviewed regulatory requirements that drive the development of prevention and response resources and planning in the Aleutian Islands region. The U.S. VRP requirements for tankers[20] are the primary drivers for this preparedness: more vessels are subject to federal requirements than State of Alaska requirements (Nuka Research et al., 2013) because all vessels traveling to or from a U.S. port are included even if they do not stop in Alaska on that voyage.

The Analysis Team found that VRP requirements, if fully implemented in the region, would cost approximately $42.7 million annually, as compared to the $13.6 million estimated annual cost of the recommended Optimal Response System (see Figure 11).

In addition, the Analysis Team concluded that the VRP regulatory requirements are not as well suited to the Aleutian Islands context as they may be in areas with more infrastructure or easier access for the following reasons:

- **Regulations emphasize the placement of response hubs and requirements for large, open-water capable equipment.** In the Aleutians, this would require hubs in places with no people or infrastructure, filled with equipment that likely could not be deployed due to weather conditions.
- **Regulations do not emphasize prevention, which the all parties agree is the key to success in the Aleutians.** Emergency towing and salvage resources are essentially not required in remote areas of the Aleutians because there are few or no time requirements due to the distance from the Captain of the Port Zone city (Anchorage).[21] They also do not include prevention measures such as routing or vessel monitoring which can prevent a spill before response equipment is needed.

Fortunately, there is flexibility within the regulations, granting the U.S. Coast Guard the discretion to deem a vessel to be in compliance by meeting alternative planning criteria if the operator "believes that national planning criteria…are inappropriate to the vessel for the areas in which it is intended to operate."[22] That the Coast Guard should ensure that all regions receive a high level of protection from oil spills – as is the intent behind the Oil Pollution Act of 1990 under which the regulations were promulgated – is clearly implied.

The Analysis Team recommends that **the U.S. Coast Guard should approve the Optimal Response System, managed by a future managing entity, as compliant with federal Vessel**

---

20 Non-tank vessels over 400 GT are also subject to U.S. federal Non-tank Vessel Response Plan requirements. However, while there are far more non-tank vessels than tank vessels operating in the area, the planning requirements are less for non-tank vessels. It is the tank vessel VRP requirements that are the primary regulatory driver for preparedness in the region. (Nuka Research et al., 2013)

21 Regulations are found at: 33 CFR Part 155. The "Regulatory Resource Study" conducted at the start of Phase B (Nuka Research et al., 2013) details the regulatory requirements and equipment and other resources required to meet the requirements for tank vessels. At the time of that report, the non-tank vessel regulations were not yet promulgated but they took effect in January 2014.

22 33 CFR 155.1065(f)

Response Plan regulations for deep draft tank and non-tank vessels under the alternative compliance option.

The request for approval of an "alternative planning criteria" program should include a clear plan and timeline for the ramp up of the system to the level described here within a target of 10 years. It should be conditionally approved for 10 years to allow the ramp up to be completed and evaluated. It should allow for adaption to continued changing circumstances, and seek to drive continuous improvement.

Because regulations are silent regarding how many different alternative compliance programs may be approved for a given area, this is left to the U.S. Coast Guard's discretion. The Analysis Team acknowledges that the costs necessary to implement the Optimal Response Program are high enough that this program is most likely to be successful if *all* regulated deep draft vessels engage as paying members: vessel operators will gain compliance, and Aleutian Islands communities gain the enhanced protection of a vastly improved prevention and response system. The Analysis Team also posits that if the bar for approval of alternative compliance is set at the level of the Optimal Response System, it is highly unlikely that more than one entity will be able to garner sufficient members or participants to meet the standard.

Establishing clear, long-term alternative planning criteria for the regulated vessels will enable the development of a system that is better suited to the Aleutian Islands region while also establishing more predictable costs. This predictability is important both for the regulated community and to allow any Managing Entity to secure long-term contracts requiring capital investment.

The majority of the Advisory Panel agreed that a single alternative system for large deep-draft vessels engaged in international shipping would be the most efficient. A minority did not want to specify a single system, as they wanted to leave the opportunity for innovation and market competition.

For more information, see: Regulatory Resource Study (Nuka Research, Pearson Consulting, Baldwin & Butler, Moran Environmental Recovery, Moran Towing, Northern Economics, and The Glosten Associates, 2013).

6. Benefit-cost Analysis of Recommended System

Northern Economics, Inc. developed a benefit-cost analysis (BCA) of the recommended system, as directed by the TRB (TRB, 2008). The analysis considered the potential for the recommended system to reduce the likelihood of accidents and their severity (and therefore consequences) using 16 spill scenarios developed in Phase A (DNV & ERM, 2010a and b). Potential benefits of the system are understood in terms of the avoidance of the following costs, expressed as dollar values: spilled oil, oil spill cleanup, fatalities and injuries, vessel and cargo damage, environmental damage, and socioeconomic impacts (such as fisheries closures). These potential benefits are weighed against the estimated cost of operating the system, which consists of the capital and operations and maintenance expenditures of the Optimal Response System.

The BCA considers the period from 2009-2033 as the lifecycle of the system, relying on the studies from Phase A of the AIRA, costs documented from past spills, and existing models where applicable.

Overall, the recommended system is found to have a financial benefit that exceeds its predicted costs. The BCA found that the recommended Optimal Response System would have a predicted benefit-cost ratio of 25.4, meaning that benefits would outweigh costs by a factor of 25.4 over the period from 2009-2033. This high number was driven largely by the nearly $3.8 billion in avoided costs associated with socioeconomic impacts, such as closure of commercial fisheries due to an oil spill. While socioeconomic factors have been considered important throughout the AIRA, Northern Economics also calculated a 0.93 benefit-cost ratio (meaning that costs were only very slightly higher than benefits) without incorporating socioeconomic factors into the potentially avoided costs for comparison.

The BCA was limited by challenges in quantifying the extent to which individual system components would reduce prevent or mitigate impacts. This is exacerbated by the fact that the recommendation consists of a system of multiple components, all of which may not be needed in any given situation, but any of which could prove critical in certain circumstances (Northern Economics, 2014).

For more information, see: Benefit-cost Analysis of Risk-Reduction Options for the Aleutian Islands Risk Assessment (Northern Economics, 2014).

7. Conclusion

The Analysis Team has sought to recommend a response system for the Aleutian Islands that is practical and feasible, and that reduces risks through a combination of interventions from designating areas to be avoided during normal vessel operations to training local fishing vessels to protect sensitive nearshore areas if a spill should occur. The recommended system prescribes a different mix of resources than those mandated in federal regulations, though one that is better suited to the Aleutian Islands operating environment and less expensive than implementing the regulations as-written would be. For these reasons, the recommended system should be implemented as an alternative to the regulations. The benefits of the recommended system, as proposed, are also found to outweigh the cost of implementing the system.

Importantly, the diverse Advisory Panel supported the recommendation almost entirely, including identifying areas to be avoided and preferred routes, vessel monitoring, a dedicated rescue tug, a storage barge and helicopter lightering package, a helicopter of opportunity program, and a nearshore response task force and marine logistics base developed using vessels of opportunity. A plan would also be put in place to facilitate the delivery of resources from other locations as needed. While there were different opinions about the management of this overall system, there was consensus on the need for additional resources and coordinated planning and programs to maximize the reduction of risk from international shipping traffic in this remote and important region.

8. References

Alaska Department of Environmental Conservation. (2014). Spill tactics for Alaska responders (STAR) manual. Ed., Nuka Research and Planning Group, LLC. Retrieved from: http://dec.alaska.gov/spar/perp/star/docs.htm.

Baldwin & Butler, LLC and Pearson Consulting, LLC. (2014). *Considering options for the management & funding of an optimal response system in the Aleutian Islands*. Ed. Nuka Research and Planning Group. Aleutian Islands Risk Assessment Phase B.

BST Associates & MainLine Management. (2011). *Pacific Northwest marine cargo forecast update and rail capacity assessment: Final report*. Pacific Northwest Rail Coalition.

Det Norske Veritas and ERM-West, Inc. (2011a). *Task 3-4 consequence analysis report*. Aleutian Islands Risk Assessment Phase A.

Det Norske Veritas and ERM-West, Inc. (2011b). *Accident scenario and causality study report.* Aleutian Islands Risk Assessment Phase A.

Det Norske Veritas and ERM-West, Inc. (2010a). *Task 1 semi-quantitative traffic study report*. Report no. / DNV ref no: EP007543. Aleutian Islands Risk Assessment Phase A.

Det Norske Veritas and ERM-West, Inc. (2010b). *Task 2A marine spill frequency and size report*. Report no. / DNV ref no: EP007543-1. Aleutian Islands Risk Assessment Phase A.

Det Norske Veritas and ERM-West, Inc. (2010c). *Task 2B baseline spill study report*. Aleutian Islands Risk Assessment. Phase A.

Ford, Corey. (1966). *Where the sea breaks its back: The epic story of early naturalist Georg Stellar and the Russian exploration of Alaska*. Alaska Northwest Books.

Moffat & Nichol. (2013). *Origin, destination, & marine traffic volume survey: Trans mountain expansion project.* TERMPOL Study No. 3.2.

Northern Economics. (2014). *Benefit-cost analysis of risk-reduction options for the Aleutian Islands Risk Assessment*. Aleutian Islands Risk Assessment Phase B.

Northern Gateway Pipelines Inc. (2010). *General risk analysis and intended methods of reducing risk, section 4: Marine shipping network risk analysis.* TERMPOL Study No. 3.15.

Nuka Research and Planning Group, LLC. (2014a). *Summary of large vessel transits of Unimak Pass in 2012.* Aleutian Islands Risk Assessment Phase B.

Nuka Research and Planning Group, LLC. (2014b). *Impact of environmental conditions on vessel incident response in the Aleutian Islands: A response gap analysis*. Aleutian Islands Risk Assessment Phase B.

Nuka Research and Planning Group, LLC. (2014c). *Estimating response times for tugs of opportunity in the Aleutian Islands.* Aleutian Islands Risk Assessment Phase B.

Nuka Research and Planning Group, LLC. (2013a). *West Coast spill response study, volume 2: Vessel traffic study.*

Nuka Research and Planning Group, LLC. (2013b). *Characterizing environmental conditions in the Aleutian Islands.* Aleutian Islands Risk Assessment Phase B.

Nuka Research and Planning Group, LLC., Pearson Consulting, LLC., Moran Environmental Recovery, & Moran Towing. (2014). *Considering options for salvage & oil spill response in an optimal response system*. Aleutian Islands Risk Assessment Phase B.

Nuka Research and Planning Group, LLC., Pearson Consulting, LLC., Baldwin & Butler, LLC., Moran Environmental Recovery, Moran Towing, Northern Economics, Inc., & The Glosten Associates. (2013). *Regulatory resource study*. Aleutian Islands Risk Assessment Phase B.

The Glosten Associates. (2014). *Minimum required tug for the Aleutian Islands.* Report No. 12127.03.01. Aleutian Islands Risk Assessment Phase B.

The Glosten Associates. (2013a). *Tug of opportunity study.* Report No. 12127.01.12e. Nuka Research and Planning Group, LLC. Aleutian Islands Risk Assessment Phase B.

The Glosten Associates. (2013b). *Purpose designed towing vessel.* Report No. 12127.02.12c. Nuka Research and Planning Group. Aleutian Islands Risk Assessment Phase B.

The Glosten Associates. (2013c). *Best available technology.* Report No. 12127.02.12c. Nuka Research and Planning Group, LLC. Aleutian Islands Risk Assessment Phase B.

The Glosten Associates. (2013d). *Tug location study.* Report No. 12127.02.12d. Nuka Research and Planning Group, LLC. Aleutian Islands Risk Assessment Phase B.

Transportation Research Board. (2008). *Risk of vessel accidents and spills in the Aleutian Islands: Designing a comprehensive risk assessment.* Special Report 293.

U.S. Department of Transportation. (2011). *Comparison of U.S. and foreign-flag operating costs.* Marine Administration.

Van Dorp, J., & Merrick, J. (2014). *VTRA 2010 final report: Preventing oil spills from large ships and barges in northern Puget Sound & Strait of Juan de Fuca*. Washington State Puget Sound Partnership.

Wolniakowski, K., Wright, J., Folley, G., and Franklin, M. (2011). *Aleutian Islands Risk Assessment project: Phase A summary report.* Aleutian Islands Risk Assessment Phase A.

Appendices

Appendix A – Project Participants

Thank you to the following inidividuals for their participation on the project oversight groups:

PEER REVIEW PANEL			
Name	**Organization**	**Position**	**Phase**
Dr. CJ Beegle-Krause	Environmental Research for Decision, Inc.	President	A
David Bovet	Norbridge, Inc	Partner	B
Dr. Paul S Fischbeck	Center for the Study and Improvement of Regulation Department of Social & Decision Sciences Carnegie Mellon University	Director	A & B
Dr. Beverly Huey, *Panel Coordinator*	The National Academies of Science, Transportation Research Board	Senior Program Officer	A & B
Dr. John D Lee	University of Wisconsin, College of Engineering, Department of Industrial and Systems Engineering	Professor	A & B
Dr. Thomas M Leschine	University of Washington School of Marine Affairs	Director	A & B
Mr. R Keith Michel	Herbert Engineering Corp	Chairman of the Board	A & B
Dr. Ali Mosleh	University of Maryland, Mechanical Engineering	Professor	A & B

ADVISORY PANEL				
Name	**Organization**	**Primary/ Altnerate**	**Stakeholder Category**	**Phase**
David Arzt	Alaska Marine Pilots' Association	Primary	Mariner, Pilot	A & B
Louis Audette	K-Sea Transportation	Primary	Mariner, Oil Barges/ Tankers	A & B
Mike Baker	Aleut Enterprise, LLC	Alternate	Mariner, Oil Barges/ Tankers	A
Catherine Berg	Alaska Maritime National Wildlife refuge	Alternate	Resource Manager	A & B
Reid Brewer	AK Sea Grant Marine Advisory Program UAF	Primary	Subsistence	A & B
Douglas Burn	USFWS	Alternate	Resource Manager	B
Cheryl Fultz	Delta Western Inc..	Alternate	Mariner, Oil Barges/ Tankers	B
Tom Gemmell	Marine Conservation Alliance	Primary	Fisheries	A & B
David Gregory	Community member; OC employee; City Council; LEPC Member;	Alternate	Subsistence	A & B
Pete Garay	Alaska Marine Pilots' Association	Alternate	Mariner, Pilot	A
Layla Hughes	Consultant	Alternate	NGO / Environmental	A & B

ADVISORY PANEL, cont.				
Name	**Organization**	**Primary/ Altnerate**	**Stakeholder Category**	**Phase**
Frank Kelty	City of Unalaska	Alternate	NGO – Local (A) Fisheries (B)	A & B
Simon Lisiecki	Retired	Primary	Mariner, Innocent Passage	A & B
Eugene Makarin	American President Lines, Ltd	Primary	Mariner, Containerships	A & B
Karol Kolehmainen	Aleutians West Coastal Resource Service Area	Primary	NGO-Local	A
Shirley Marquardt	City of Unalaska	Primary	Local Government	A & B
Ed Page	Marine Exchange of Alaska	Primary	Mariner, General	A & B
Brent Paine	United Catcher Boats Association	Primary	Fisheries	A
Tom Robinson	Qawalangin Tribe of Unalaska	Primary	Subsistence	B
Tom Rueter	Alaska Maritime Agencies	Alternate	Marine, General	A & B
Mike Ruiz	American Marine Corporation/PENCO	Alternate	Marine Salvor	A & B
Whit Sheard	Pacific Environmental	Primary	NGO / Environmental	A & B
Marc Smith	Private Consultant	Primary	Mariner, Tramper	A & B
Bob Umbdenstock	Resolve Marine Group	Primary	Mariner, Salvor	A & B
Mike McGlothin	American President Lines, Ltd	Alternate	Mariner, Containerships	A
Richard Wilson	American Marine Corporation/PENCO	Alternate	Marine Salvor	A
Jeff Williams	Alaska Maritime National Wildlife Refuge	Primary	Resource Manager	A & B

MANAGEMENT TEAM		
Name	**Organization**	**Phase**
CAPT Scott Bornemann	USCG District 17	B
LT Jason Boyle	USCG Inspection/Investigation Division	
LT Eugene Chung	USCG, Waterways Management Chief / Sector Anchorage	B
LT Kion Evans	USCG Planner, Sector Anchorage	B
LT Robert Fields	USCG, Inspections/Investigations Branch	A
Gary Folley	ADEC/SPAR	A & B
LT Mike Franklin	USCG Inspection/ Investigation Division	A
LCDR Gary Koehler	USCG Inspection / Investigation Division	A & B
LT Matt Mitchell	USCG Planner, Sector Anchorage	B
CDR Shane Montoya	USCG Planner, Sector Anchorage	B
Matt Odeum	ADEC/SPAR	A
CDR James Robertson	USCG, Chief, Inspections/Investigations Branch	A
CDR Patrick Ropp	USCG Inspection / Investigation Division	A & B
CAPT Adam Shaw	USCG Inspection / Investigation Division	A & B
Crystal Smith	ADEC	A&B
Krystyna Wolniakowski	NFWF	A & B
Jay Wright	NFWF	A & B

Appendix B – Technical Peer Review Panel Comments and Response

ALEUTIAN ISLANDS RISK ASSESSMENT

October 17, 2014

MEMORANDUM

TO: Aleutian Islands Risk Assessment (AIRA) Management Team

VIA: AIRA Project Manager
Jay Wright
and
AIRA Management Team Facilitators
Leslie Pearson, Pearson Consulting and
Tim Robertson, Nuka Research, Inc.

VIA: Project Coordinator from the Transportation Research Board (TRB) of *The National Academies*
Beverly Huey, Senior Program Officer

FROM: AIRA Technical Peer Review Panel
David Bovet
Paul Fischbeck
John Lee
Thomas Leschine
Keith Michel
Ali Mosleh

SUBJECT: Technical Review of the *AIRA Phase B Draft Summary Report: Recommending an Optimal Response System for the Aleutian Islands, July 2014*

REFERENCES:

1. *Aleutian Island Risk Assessment Project: Recommending an Optimal Response System for the Aleutian Islands: Summary Report*, Draft, July 2014.
2. *Benefit-Cost Analysis of Risk Reduction Options for the Aleutian Islands Risk Assessment, Nuka Research & Planning Group, Inc.*, July 2014.
3. Memorandum to AIRA Management Team by the AIRA Technical Peer Review Panel: *Technical Review of the AIRA Phase A Draft Summary Report of Tasks 1 & 2*, dated February 23, 2010.
4. Memorandum to AIRA Management Team by the AIRA Technical Peer Review Panel: *Technical Review of the AIRA Phase A Draft Summary Report of Tasks 3, 4, 5, 6 & 7*, dated May 4, 2011.

5. Memorandum to AIRA Management Team by the AIRA Technical Peer Review Panel: *Technical Review of the AIRA Phase B Draft RFP*, dated February 13, 2012.

6. *Aleutian Islands Risk Assessment Phase A – Preliminary Risk Assessment Aleutian Islands, Alaska, Draft Summary Report*, dated January 2010.

7. *Risk of Vessel Accidents and Spills in the Aleutian Islands*, *Designing a Comprehensive Risk Assessment*. TRB Special Report 293, 2008.

8. *2012 ITOPF Oil Tanker Spill Statistics*, International Tanker Owners Pollution Federation Limited, 2012.

9. *U. S. Coast Guard – American Waterways Operators Safety Partnership National Quality Steering Committee, Towing Industry Safety Statistics, 1994 – 2011*. July 30, 2014.

10. *Risk Reduction Options Evaluation Report, Phase A, Tasks 6 and 7*, dated July 2011. ERM.

11. DNV ref no: EP007543-1, Rev. 4, *Appendix B, Task 2A: Revised Draft Marine Spill Frequency and Size Report*, dated 4 February 2010.

12. *Appendix C, Task 2B: Revised Draft Baseline Spill Study Report*, dated 4 February 2010.

This document contains the review comments on the AIRA Phase B Draft Summary Report (Reference 1) and the supporting Benefit-Cost Analysis (Reference 2) from the members of the AIRA Technical Peer Review Panel (Panel). The Panel was appointed by the AIRA Management Team on behalf of the National Fish and Wildlife Foundation (NFWF). These comments are the consensus of the AIRA Technical Peer Review Panel; however, they are not to be construed or cited as representing the opinion of The National Academies, its staff, or any of its appointed committees.

The Panel previously reviewed deliverables from the AIRA Management Team and issued memoranda (References 3 through 5). These are: the *Phase A Draft Summary Report, Tasks 1 and 2* (Memorandum to AIRA Management Team of February 23, 2010), the *Phase A Tasks 3-7* (Memorandum to AIRA Management Team of May 4, 2011), and the *Phase B Draft RFP* (Memorandum to AIRA Management Team of February 13. 2012).

The Panel's February 13, 2012 review of the *Phase B Draft RFP* is particularly germane to the present review. In the Panel's view, the objective of the Phase B analysis was to quantify in detail the costs and benefits of the four potential risk reduction options (RROs) identified in the Phase A study "in probabilistic terms and to better understand their secondary effects on both the overall system and the net benefits provided by other risk reduction measures….Data and key assumptions used to construct estimates of costs and benefits should be documented and explained, so that third-party reviewers have sufficient information to verify the cost and benefit estimates."

Concerns expressed by the Panel in earlier reviews regarding transparency of methods and assumptions, the treatment and reporting of risks and uncertainties, and assumptions regarding the benefits and costs associated with various RROs remain. The report presents a recommended response system, but does not arrive at this system via a quantitative risk assessment (or other clear path that links the elements of the recommended plan to the underlying supporting logic). Nor does it provide convincing evidence that the recommended system is in fact “optimal” as the judgmental analytics behind it are not revealed. The Panel believes that both the recommended alternative and other alternatives deserve closer consideration, including *prevention* alternatives, which receive scant attention in the report. At a minimum, the limitations of the study approach and recommendations should be clearly stated.

The lack of transparency and weakness of the methods used are particularly problematic because many of the assumptions and findings contained in the report appear implausible when compared to historical spill statistics and prior risk assessments.

Specific Comments

The following are specific comments to the *AIRA Phase B Draft Summary Report* and the benefit-cost analysis (Reference 2):

1) The Phase A *Risk Reduction Options Evaluation Report* (Reference 6) identifies scenario 2 (bulk carrier collision north of Unimak), scenario 8 (crude oil tanker drift grounding off Sanak Island), and scenario 16 (bulk carrier drift ground north of Urilia Bay) as the highest risk scenarios. The benefit-cost analysis (Reference 2, table 3) shows scenario 9 as responsible for 86% of the projected oil spillage from all scenarios studied whereas the combined spillage from scenarios 2, 8 and 16 were responsible for 10% of total spillage. If the data applied in the cost-benefit analysis is correct, why was scenario 9 not deemed to pose a high risk?

2) Chapter 4 of Reference 7 describes a technical approach for conducting a comprehensive Aleutian Island risk assessment. Steps 6 through 9 are the final steps in the Phase A study, involving evaluation of RROs by estimating costs and benefits and then prioritizing the RROs to determine which options merit further study in the Phase B assessment. This work is presented in Reference 2. RROs that can be expected to be effective in reducing the risk of spillage from towed tank barges subject to drift groundings include double-hulling the tank barges, further increasing double bottom height above rule requirements, enhancing propulsion/steering redundancy on the tug, enhancing towline strength, and providing a dedicated escort tug when in the vicinity of land. None of these RROs were considered in the benefit cost analysis (Reference 2).

   The unjustified rejection of double-hulling is a concern that was previously raised by the

Panel in paragraph 10 of Reference 4 where the Panel noted: "The panel is surprised that double-hulling of the single hull tank barges was summarily rejected based on economic considerations. As spills from tank barges were identified as a significant risk, we believe it prudent that a Phase B analysis and cost-benefit assessment be conducted to justify the determination that reduction measures are not cost effective."

3) The data for spill frequency and average spill sizes that were derived from the Phase A study using the DNV MARCS accident risk calculation system are irreconcilable with spill statistics of the post- OPA90 era. It is uncertain whether this is a result of MARCS utilizing obsolete accident/spill data as its basis or an outcome of using an accident assessment algorithm without adequate calibration. Whatever the reason, the assumptions for frequency and spill size are not defensible and severely bias the cost-benefit assessment. A discussion of expected spill size and frequency based on historical spill data is provided in bullets 4 through 6 below.

4) For example, three scenarios were evaluated for crude oil tanker accidents:

Scenario		Weighted Median Frequency (Accidents/Year)	Spill Volume per Accident (gallons)
3	Crude Oil Tanker Collision: Unimak	0.0001	17,979,400
8	Crude Oil Tanker Drift Grounding: Sanak	0.0130	17,979,400
12	Crude Oil Tanker Drift Grounding: Holtz Bay	0.0001	17,979,400
		0.0132	

An assessment of spills from double-hull tankers worldwide resulting from collision and grounding accidents during the period from 2001 to 2010 reveals only 12 such accidents with an average spill size of about 330,000 gallons and a maximum spill size of 1.7 million gallons. The average spill size applied in the AIRA analysis (17,979,400 gallons) is more than 50 times larger than the historical data supports. Although the prevailing sea states and weather conditions encountered in the Aleutians may result in somewhat larger average spill sizes, the AIRA's estimates of spill volume per accident need further consideration.

The International Tanker Owners Pollution Federation Limited (ITOPF) maintains a database of oil spills from tankers, combined carriers and barges. The latest statistics through year 2013 are presented in Reference 8 and summarized in Figure 1 below.

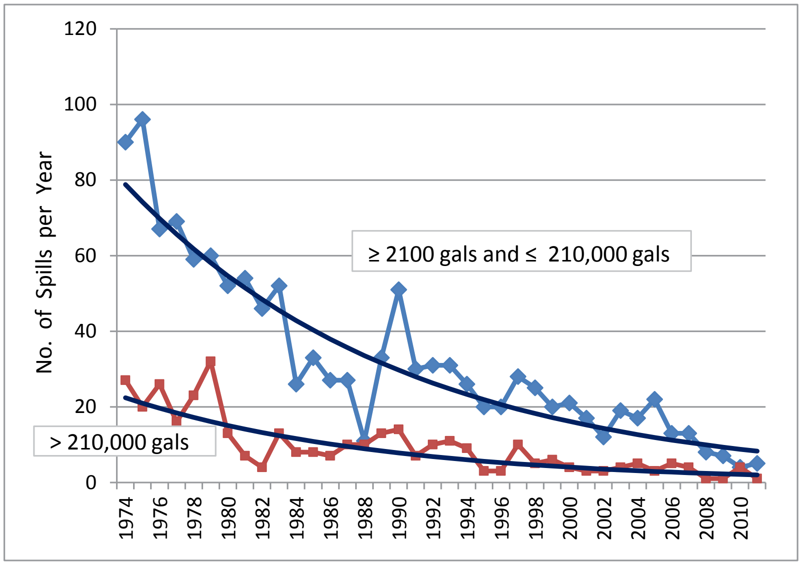


FIGURE 1 Number of oil spills from tank vessels worldwide, 1974–2012 (SOURCE: Reference 8).

Figure 1 shows the number of oil spills >210,000 gallons in size from tank vessels trading worldwide during the period 1974 to 2012. The average number of these large spills has declined dramatically over this period with only one such large spill in years 2008 and 2009 and none in 2012. A curve fit of the data indicates that approximately 2 such large spills can be expected on an annual basis by 2012. The number of spills can be expected to further decline in coming years due to the implementation of new regulations such as the requirement to double hull fuel oil tanks.

Approximately 3,300 crude oil tankers and product tankers greater than 10,000 DWT in size transit the world's oceans. These vessels average approximately 25 round trips per year. Thus, an estimate of total tanker transits per year is:

3,300 x 25 RT/year x 2 transits/RT = 165,000 RT/ year

Assuming an average of 2 large spills per year, the probability of a spill from a single transit of an oil tanker is approximately 1.2×10^{-5}. According to the Phase A traffic study (Reference 9), there were 13 crude oil transits and 59 product tanker transits through the Aleutian Island region over a one-year study period. Using these values, the likelihood that these vessels will be involved in a collision or grounding accident producing a spill over 210,000 gallons in size can be estimated as:

$$(1.2 \times 10^{-5})(13 + 59) = 8.64 \times 10^{-4}$$

Per Table 1 of Reference 2, the spill frequency from the four tanker casualty scenarios (scenarios 3, 8, 12, 13) is 0.0262 spills per year. Though the conditions and weather in the Aleutian Islands may make the probability of an accident greater than a global average, the Panel believes that it is not 30 times higher than the ITOPF derived probability; the AIRA frequency figures need further review.

5) Two scenarios for tank-barge accidents are summarized below:

Scenario		Weighted Median Frequency (Accidents/Year)	Spill Volume per Accident (gallons)
5	Tank Barge Collision: Unimak	0.0130	1,708,400
9	Tank Barge Drift Grounding: Sanak	1.2960	1,708,400
		1.3090	

Average spillage per year from tank barges due to collisions near Unimak and drift groundings near Sanak Island can be computed as follows:

1.309 x 1,708,400 = 2,236,296 gallons.

Figure 2 presents the historical spill data from tank barges operating in U.S. waters given in the August 2012 report of the United States Coast Guard (USCG) and American Waterways Operators (AWO) (Reference 9). There is a definitive decline in the quantity of spillage with no large spills in 2007, 2009, or 2010. Even though only a few smaller tank barges trade in Alaska, the projected annualized spillage of oil from the barges exceeds the highest total spillage in the entire United States in any of the last 20 years.

Similarly, the assumed weighted median frequency of a tank-barge spill with average size of 1,708,400 gallons in the vicinity of Unimak Pass and Sanak Island of 1.309 is incongruous with the tank-barge spill data contained in Reference 9.

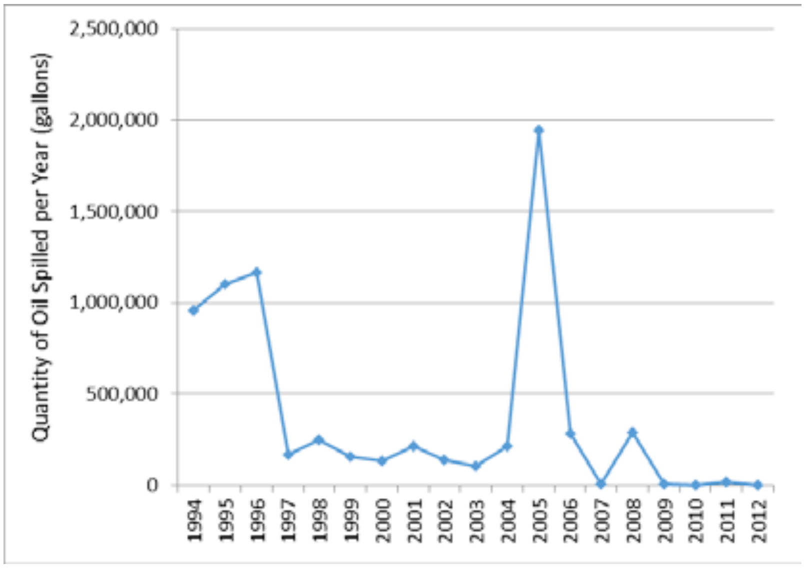


FIGURE 2 Oil spill volume (gallons) from tank barges in U.S. waters, 1994–2013 (SOURCE: Reference 9).

6) The Panel has not assessed the spill size and frequency data for the other scenarios but expect similar over-estimations for bulk carriers, containerships, and other vessels. These data should be carefully reviewed. Existing regulations requiring cargo ship newbuildings to provide double hull or equivalent protection for bunker tanks is expected to significantly reduce spillage from these vessels in future years.

7) In paragraph 5 of Reference 4, the Panel noted: "A distribution of spill size for each accident type and type of vessel would be helpful in the assessment of consequence and the comparative assessment of risk reduction options. Such a distribution should at least be provided for Phase B investigations." It appears that this recommendation was not heeded and a maximum spill-size estimate may have been applied to each spill whereas the preponderance of oil spills are small in size.

8) Scarcity of incident and accident data in the study region is a common challenge in risk assessments and generally necessitates the use of expert judgment. This is especially the case for determining RRO modifiers that are difficult to calculate on a first-principles basis. To assist in determining these factors, it is common practice to convene a panel of experts

with expertise in navigation through the study region and the design/operation of potential risk reduction measures. For this type of study, this Panel would expect such a panel to include ship masters who have navigated large cargo vessels and tug/tank barge units through the region, rescue tug operators, and salvage and spill response experts. A structured workshop is normally convened and expert opinion is solicited. For example, experts would be asked to estimate the effectiveness of rescue tugs in various conditions, and these findings would be combined in a transparent and systematic way to derive the RRO modifier. Because of the sensitivity of the findings to these estimates, it is critical that there be a high level of transparency as to the identification and professional background of the experts, the structure of the workshop, the background information provided to the attendees, and the methodology for deriving the RROs from the expert solicitation.

The Phase B draft report fails to effectively document the process on how the RROs were developed. It appears that an expert panel was not convened. There is insufficient information for a reader to understand how RROs were computed from the qualitative assessments. The recommended "Optimal Response System" consists of a variety of RROs including routing and monitoring measures, emergency towing including procurement of a dedicated rescue tug, salvage services, and spill response services. The RRO modifier for each of these individual components should be documented so that the reader can understand their contributions to the overall reduction in spills. These details were not provided.

The RRO modifiers for scenarios 6 through 16 range from 0.08 to 0.16, suggesting that 84% to 92% of the oil spillage will be eliminated or recovered for these varied scenarios. Based on member experience with prior risk assessments, the Panel considers these RRO modifiers to be overly optimistic estimates, especially when the harsh Aleutian Islands environmental conditions are taken into account. These figures need further justification.

9) Benefit estimates tied to levels of response-related spill prevention and recovery of oil releases that have not been demonstrated for Alaskan waters. The helicopter lightering system that is part of the OSRP (Oil Spill Response Plan) seems inadequately discussed. For example, what response gap is associated with the ability to make use of the oil transfer barges that are part of this option?

10) The benefits of the recommended system hinge largely on ill-specified socio-economic benefits (avoided costs of injury to fisheries, tourism, and other activities). The basis for the economic values applied in the benefit-cost analysis needs more discussion than it receives given their importance in turning what are otherwise benefits that are marginally less than the associated costs of achieving them via the recommended system into large benefits.

11) The Panel does not have the collective expertise to comment on the practicality of the proposed funding mechanism of assessing fees on vessels transiting the region. However, it is likely that a far more robust risk assessment and benefit-cost assessment is needed to convince USCG to recommend federal funding of 50% of the capital costs of this project ($15.1 million). The study states that "…operators of large vessels with response planning requirements should pay for the system.…" The justification is that the estimated $13,000 annual cost represents less than two days operating costs for the average, non-U.S. flag cargo vessel. Such a "deep pockets" approach to fee justification is counter to the systematic nature of a comprehensive risk assessment. If 90% of the spill risk is generated by tank barges, then one expects that 90% of the costs of the spill response system should be borne by this segment of the industry. If tank-barge service is critical to the socioeconomic well-being of the Aleutian Island region and the industry is unable to bear the cost, then it may be reasonable to expect government to bear the costs given appropriate justification.

12) The Panel believes the Phase B assessment would benefit generally from greater attention to *prevention* measures such as the imposition of rules that would keep single-hull, oil-laden barges away from sensitive areas like Sanak Island in light of the risks they pose. Other comments above also speak to this point.

13) Greater transparency regarding key points upon which the estimated benefits of the proposed response system depend is needed. Little information is provided in Reference 2 on either the nature of the socioeconomic benefits said to accrue from enhanced spill response capability, or the basis for their estimated value. The Panel was unable to judge the realism of the imagined scenario on the basis of the information provided.

In summary, the Panel believes that the analytical process underlying the report's main conclusions lacks rigor and transparency. Failure to vet the findings against historical data and perform benefit-cost assessment on alternative risk reduction measures is of concern. As a result, the claim that the recommended response system is in fact "optimal" in comparison to other reasonable alternatives employing different risk reduction measures is not justified. As stated at the beginning of this review, the Panel believes a quantitative risk assessment along the lines it recommended in earlier reviews of the Phase A work and the Phase B RFP (References 3-5), and as outlined in TRB Special Report 293 (Reference 7), is required in order to assess the optimality of the response system.

Management Team Response to TPRP Comments

January 22, 2015

TO: AIRA Technical Peer Review Panel

David Bovet | Thomas Leschine
Paul Fischbeck | Keith Michel
John Lee | Ali Mosleh

VIA: Project Coordinator for the Transportation Research Board (TRB) of *the National Academies*

Beverly Huey, Senior Program Officer

FROM: AIRA Project Managers and Management Team

SUBJECT: Technical Peer Review Comments on the AIRA Phase B Draft Summary Report and Response to Comments

The AIRA Management Team would like to thank the Technical Peer Review Panel (TPRP) for the comments received on October 17, 2014. The Management Team and Phase B Project Managers discussed the Panel's comments and provide the attached responses to the thirteen specific comments.

There are several methodologies available for conducting risk assessments of maritime or transportation systems. The AIRA followed the process the Transportation Research Board (TRB), which was a semi-quantitative/qualitative methodology, with extensive reliance on expert judgment and the goal of consensus among the multi-stakeholder groups prescribed in the TRB. It favors the collective expert judgment of the Advisory Panel members who are informed by semi-quantitative studies over a strictly quantitative approach. The AIRA Phase B work plan approved by the Management Team emphasized a stakeholder/expert judgment approach to considering the complexities of the of marine transportation system in the Aleutian Islands. The Management Team recognized that a quantitative methodology would inevitably rely on incomplete or inappropriate data and non-transparent modeling assumptions, as well as requiring more money, without necessarily gaining any input or buy in from those who would be involved in the implementation of risk reduction options or whose livelihoods, communities, and business operations would be directly impacted by the results. The Management Team believed this approach to be in line with the TRB's intent, and was concerned that a strictly quantitative analysis would not yield actionable recommendations, and while it may result in essentially the same conclusions it would lack the consensus, or near-consensus, achieved through the expert judgment process.

As noted in the your memorandum, the TPRP believes a quantitative risk assessment as recommended in earlier reviews of the Phase A work and Phase B RFP, and as outlined in TRB Special Report 293, should be conducted to assess the recommended response system for the Aleutian Islands. The Management Team and Advisory Panel reached a consensus decision at the October 2012 meeting to emphasize the use of expert judgment during Phase B rather than re-analyze the data and results from the Phase A studies. This approach also emphasized moving ahead to develop actionable recommendations and pursuing risk reduction options (RRO) without further evaluation where the Advisory Panel and Management Team agreed that the way forward did not require further analysis. Following the October 2012 meeting, the AIRA Analysis Team developed a work plan for Phase B, which was approved by the Management Team. The work plan describes the approach, methodology and schedule for each task and sub-task for options to reduce the risk of maritime incidents in the Aleutian Islands. The primary tasks of Phase B (based directly on the results of Phase A) were:

- **Task 1 - 2. Increase Rescue Tug, Salvage, and Spill Response Capability.** The Team will analyze existing and potential future resources providing the following services to the Aleutian Islands: emergency towing, salvage, and oil spill response. The team will also consider options for organizational management and funding for a potential future system to provide these services. The task will conclude with a detailed description of a recommended Optimal Response System (ORS) that considers operating environment, logistics, cost, and benefits, along with a proposed organizational structure for the system. *This task addresses RRO 1 and RRO 2 from Phase A.*
- **Task 3. Strengthen the Subarea Contingency Plan.** This task will begin with reconvening the Alaska Regional Response Team's (AKRRT) Subarea Committee to guide the revision and update of the Aleutian Islands Subarea Contingency Plan (SCP). The Subarea Committee will consider incorporating findings and recommendations from Phase A of the AIRA, develop new sections and complete currently unfinished sections, and incorporate additional Geographic Response Strategies and Potential Places of Refuge. *This task addresses RRO 3 from Phase A.*
- **Task 4. Initiate the Process for Establishing Particularly Sensitive Sea Areas (PSSA) and Associated Protective Measures (APM).** The Analysis Team will develop a communications and outreach plan to build consensus among key stakeholders about the development of associated protective measures for establishing a PSSA in the Aleutian Islands area. The PSSA must provide a mechanism through which to implement associated protective measures and law enforcement strategies that are amenable to respective regulatory and law enforcement agencies. *This task addresses RRO 4 from Phase A.*

Although the TPRP reviewed the Aleutian Islands Risk Assessment Project: Recommending an Optimal Response System for the Aleutian Islands: Summary Report, Draft July 2014 and the Benefit-Cost Analysis of Risk Reduction Options for the Aleutian Islands Risk Assessment prepared for Nuka Research and Planning Group and prepared by Northern Economics, July 2014, thirteen additional technical reports were developed to specifically support the findings and recommendations of Task 1-2 described above. While these were highlighted and summarized at the start of the Summary Report, and referenced

Management Team Response to TPRP Comments

throughout, it is unclear that the TPRP considered these supporting analyses in their review. These additional technical reports are:

Baldwin & Butler, LLC and Pearson Consulting, LLC. (2014). *Considering options for the management & funding of an optimal response system in the Aleutian Islands*. Ed. Nuka Research and Planning Group. Aleutian Islands Risk Assessment Phase B.

Nuka Research and Planning Group, LLC. (2014a). *Summary of large vessel transits of Unimak Pass in 2012.* Aleutian Islands Risk Assessment Phase B.

Nuka Research and Planning Group, LLC. (2014b). *Impact of environmental conditions on vessel incident response in the Aleutian Islands: A response gap analysis*. Aleutian Islands Risk Assessment Phase B.

Nuka Research and Planning Group, LLC. (2014c). *Estimating response times for tugs of opportunity in the Aleutian Islands.* Aleutian Islands Risk Assessment Phase B.

Nuka Research and Planning Group, LLC. (2013b). *Characterizing environmental conditions in the Aleutian Islands.* Aleutian Islands Risk Assessment Phase B.

Nuka Research and Planning Group, LLC., Pearson Consulting, LLC., Moran Environmental Recovery, & Moran Towing. (2014). *Considering options for salvage & oil spill response in an optimal response system*. Aleutian Islands Risk Assessment Phase B.

Nuka Research and Planning Group, LLC., Pearson Consulting, LLC., Baldwin & Butler, LLC., Moran Environmental Recovery, Moran Towing, Northern Economics, Inc., & The Glosten Associates. (2013). *Regulatory resource study*. Aleutian Islands Risk Assessment Phase B.

Nuka Research and Planning Group, LLC. (2014a). AIRA Recommending an Optimal Response System for the Aleutian Islands: Summary Report. Aleutian Islands Risk Assessment.

The Glosten Associates. (2014). *Minimum required tug for the Aleutian Islands.* Report No. 12127.03.01. Aleutian Islands Risk Assessment Phase B.

The Glosten Associates. (2013a). *Tug of opportunity study.* Report No. 12127.01.12e. Nuka Research and Planning Group, LLC. Aleutian Islands Risk Assessment Phase B.

The Glosten Associates. (2013b). *Purpose designed towing vessel.* Report No. 12127.02.12c. Nuka Research and Planning Group. Aleutian Islands Risk Assessment Phase B.

The Glosten Associates. (2013c). *Best available technology.* Report No. 12127.02.12c. Nuka Research and Planning Group, LLC. Aleutian Islands Risk Assessment Phase B.

The Glosten Associates. (2013d). *Tug location study.* Report No. 12127.02.12d. Nuka Research and Planning Group, LLC. Aleutian Islands Risk Assessment Phase B.

The Management Team takes seriously the TPRP's concerns regarding the transparency of assumptions used in the project, but asserts that a heavily quantitative, model-driven approach is just as susceptible to a lack of transparency as one driven by expert input and consensus-driven decision-making, especially where proprietary models are used. The Management Team has sought to be as transparent as possible by referencing the sources of expert input and assumptions wherever these came from individuals as opposed to being considered general knowledge, clearly identifying those making recommendations and decisions (whether on the Management Team, Advisory Panel, or Analysis Team), inviting the public to participate in project briefings in conjunction with Advisory Panel meetings, and posting meeting summaries on the public website. The Management Team also found that local knowledge was critical to the development of the recommended system, and that the complexity of that system and its direct reliance on the people, infrastructure, and environment of the Aleutian Islands was ill suited to traditional, quantitative analyses.

At the conclusion of Phase A, the Advisory Panel and Management Team concluded that any large oil spill in the Aleutian Islands would have adverse consequences to the region regardless of source, and that it was necessary to move forward in Phase B to develop a system to reduce the risk of marine casualty and resulting pollution, protect the fragile and unique environment of the Aleutian Islands, and facilitate the ability to respond to maritime emergencies.

In addition, the Management Team would like to emphasize that significant emphasis was put toward spill prevention, counter to the TPRP's assertion otherwise. The establishment of routing measures and real-time Automated Identification System monitoring are entirely focused on prevention of spills from large, commercial vessels of the types expected to increase in the region over time. A capable emergency-towing vessel stationed in the region would aid the prevention of spills from both self-propelled vessels and barges. These resources combine to represent the greatest overall dedication of resources in the recommended system.

As we conclude Phase B of the risk assessment project, the Management Team sincerely appreciates the input and direction provided by members of the Technical Peer Review Panel. The Management Team has considered this valuable input from technical experts in risk assessment while also incorporating input from the marine and spill response experts on the Analysis Team, and, most important, those representing the interests of the communities, business interests, and unique resources and habitats of the Aleutian Islands region. We do not assume that the recommendations resulting from this process will be applicable elsewhere, but instead have focused on developing recommendations that are as actionable and appropriate as possible in the Aleutian Islands area and with the intent that a devastating and tragic event such as the *M/V Selendang Ayu* will not happen again.

Management Team Response to TPRP Comments

AIRA Task 1-2 Optimal Response Comments and Responses

TPRP Specific Comments	Response
1. Why was Scenario 9 not deemed to pose a high risk?	Phase B of the risk assessment did not re-analyze spill frequency, size, consequence scores and ranking. The Phase A documents show that Scenario 9 ranked 16 (low) for total consequence score. The MARC frequency indicated a scenario of this type is probable once every 10-years. This scenario was based on a diesel spill from a single-hull tank barge. The BCA identifies that Scenario 9 is an outlier based on model parameters and a sensitivity analysis was conducted with and without Scenario 9, which showed that Scenario 9 did not have much of an effect on the final benefit cost.
2. RRO of double hulling of tank barges	Consideration was given to the effects of the OPA-90[1] single hull phase out requirements on barges servicing Alaska. The use of double-hull barges significantly reduces the likelihood of a spill due to a collision or grounding incident. The major Alaska operators have already made a significant investment in new barges to service Alaska, well in advance of the January 1, 2015 deadline. Even with the Western Alaska exemption to OPA-90 single hull phase out requirements, it is anticipated that this exception will result in only a handful of remaining single hull barges of relatively small capacity operating in River and Inland environments. As noted in the Phase A, Task 6-7 report (July 7, 2011) on Page 22; the deadline for double-hull tank barges under OPA 90 is 2015; therefore, single hull was not considered to be an issue in the study region.

[1] *46USC3703a (b) (5) provides that a barge of less than 1,500 gross tons carrying refined petroleum product in bulk as cargo in or adjacent to waters of the Bering Sea, Chukchi Sea, and Arctic Ocean and waters tributary thereto and in the waters of the Aleutian Islands and the Alaska Peninsula west of 155 degrees west longitude is exempt from the tank vessel construction standards of OPA 90 (double hull requirement)*

TPRP Specific Comments	Response
Items 3-6. Phase A spill frequency and average spill sizes derived during Phase A are irreconcilable with post-OPA 90 spill statistics. The assumptions for frequency and spill size are not defensible and severely bias the cost-benefit analysis	The Advisory Panel and Management Team decided on October 2, 2012 not to conduct any additional review or reconciliation of spill frequency and baseline data from Phase A. It was recognized that finite funded were available to complete the risk assessment and that more than 1/3 of the funds had been allocated to Phase A. All members present believed that re-analyzing and evaluating the data would provide little value assessing and implementing risk reduction options in Phase B. A sensitivity analysis was conducted with the BCA study with the intent of determining the effect of Phase A data and outliers. The sensitivity analysis showed there was no significant effect on the final benefit cost.
7. TPRP recommended, "a distribution of spill size for each accident type and type of vessel would be helpful in assessment of consequence and comparative assessment of risk reduction options." Recommendation was not considered and maximum spill size estimates applied.	See response above regarding the Advisory Panel and Management Team's decision regarding Phase B.
8. Use of expert judgment for determining RROs and modifiers. Need for further justification.	The AIRA relied heavily on expert judgment, as was understood to be intended by TRB Special Report No. 293. The Management Team recognizes the potential weaknesses of relying on expert judgment, and the Facilitation Team applied practices described in Appendix C of the TRB Special Report No. 293 to maximize the benefit of this approach. This included careful selection of experts, aggregating input from experts with diverse backgrounds, educating experts on the subject generally to enable those with diverse specializations to make recommendations informed by each others' input, ensuring participation and expression of individual viewpoints, and examining the problem in smaller pieces as well as considering the whole. The RROs were identified during Phase A of the risk assessment using expert judgment solicited from the Advisory Panel, Management, Analysis and

Management Team Response to TPRP Comments

TPRP Specific Comments	Response
	Facilitation members. During Phase A six in-person meetings and ten web conferences were conducted. Five of the 10 web conferences and one meeting focused specifically on the identification and justification of RROs, which included potential modifiers. RRO development is further discussed in the approved Phase B work plan as well as the technical reports that support the Phase B summary report. During Phase B, three in-person meetings and eight web conferences were conducted. When topics arise and expert opinion wasn't available within the Project Team, then the Analysis Team elicited expert opinion elsewhere to educate team members and allow them to made informed and unbiased decisions regarding the RROs. Expert judgment has been utilized throughout Phase B and is reference in the technical reports, as well as Advisory Panel meeting and web conference summaries. All of the project documentation and meeting summaries are posted on the AIRA public website.
9. Helicopter lightering system inadequately discussed. What response gap is associated with the ability to make use of the oil transfer barges that are part of this option?	Helicopter lightering is discussed in the report titled, "Considering Options for Salvage & Oil Spill Response in the Optimal Response System." The recommendations for the salvage component were based on the resources already in the region, services, resources used in two recent salvage operations in the region (for the M/V Kuroshima in 1997 and M/V Selendang Ayu in 2004), interviews with experienced salvors and operators of vessels and equipment typically used in salvage operations. Lightering operations were a focus. See 4.4 Ship-to-Ship Lightering in the report titled, "Impact of Environmental Conditions on Vessel Incident Response in the Aleutian Islands: A Response Gap Analysis, January 30, 2014"
10. Socio-economic benefits in the benefit cost report need to be more specific and discussed further.	The Phase A Consequence Analysis Report developed a probability table describing the probability of an oil spill impacting each of five main receptor groups: habitat, mammals, seabirds, fish, and socioeconomic. However, the Phase A

Management Team Response to TPRP Comments

TPRP Specific Comments	Response
	report only provides a qualitative evaluation of benefits from the various RROs related to these impacts. To develop a quantitative estimate, Northern Economics conduct a literature review, including natural resource damage assessments, to identify, where possible, a value or range of values for each of the receptor groups.
11. Justification for funding mechanism or assessing fees warrants additional discussion.	Details regarding the funding mechanism are included in the technical report titled, "Considering Options for the Management & Funding of an Optimal Response System in the Aleutian Islands".
12. Phase B assessment would benefit generally from greater attention to prevention measures such as imposition of rules that would keep single hull oil laden barges away from sensitive areas.	See response to #2 regarding oil-laden tank barges in the region. A guiding principle for Phase B was that prevention takes priority over response and that all measures should be realistic and practical. Recommended prevention measures include vessel routing and vessel monitoring. Vessel routing & real-time monitoring provide a strong accident prevention system. Information sharing with the USCG allows for situational awareness and rapid activation of response measure such as a tug with emergency towing capability and assets.
13. Greater transparency regarding key points upon which the estimated benefits of the proposed response system depend is needed. Little information is provided in the BCA on either the nature or the socioeconomic benefit said to accrue from enhanced spill response capability, or the basis for their estimated value.	As stated in the BCA report, a key limitation of the analysis was the lack of expert assessment of the specific effects of individual RRO's on the reduction of spill frequency and severity for individual spill scenarios. Section 2 of the report notes that oil spill cost analysis consider cleanup costs, environmental damages and socioeconomic losses and the estimation methodology depends primarily on availability of data. The analysis documents where shortcomings of data exist and its effect on the estimation of BCR.

Appendix C – Zone of No Save Methodology

Concept

A ship without power will drift with the wind until a rescue vessel capable of towing it arrives. If the vessel drifts ashore before rescue, it might spill cargo or fuel or suffer casualties or damage. Whether a rescue prior to grounding is possible depends on the location of the distressed vessel, the location and capability of response tug(s), and the wind conditions at the time of the incident. The Zone of No Save is the area in which rescue could be expected to be impossible, given a certain set of tug locations and wind conditions. This zone is dependent on the distribution of wind speeds and directions, on the location of the shore or other hazard, and on the time it would take a vessel to arrive at the hazard. It is generally expressed as a probability, where the "1% Zone of No Save" is the area in which 1% of the time, the wind conditions are such that a tug could not reach the hazard site before the vessel would hit it. Outside this zone, the Optimal Response System will allow a vessel to be rescued even in the extreme conditions found in the region, and when winds are directed to blow it towards shore. Inside the Zone of No Save, rescue may be possible but will be dependent on weather. Because a successful rescue can occur any time before a vessel hits the hazard, response times are based on the distance from the starting point of the rescue vessel to the hazard, rather than to the location where a hypothetical vessel lost power.

This analysis was developed to inform the Analysis Team's consideration of the potential location for a dedicated rescue tug. The locations of Dutch Harbor and Adak were chosen as those with the most suitable supporting infrastructure already in place. This study does not consider potential tugs of opportunity, which may be located anywhere in the area.

Inputs and assumptions

Rescue Vessel Transit: In this analysis, we assume that the towing vessel used for rescue is at either or both Dutch Harbor and Adak. These rescue vessels are assumed to have either 10 or 13 knot transit speeds, and to spend one hour getting out of port. They are also assumed to be able to follow a path not significantly longer than the great circle route between the port of origin and the shoreline where they execute a just-in-time save. Therefore, no additional time is added to account for navigating around obstacles, or to account for not accurately predicting the exact location where a just-in-time rescue might occur.

Vessel Drift Rate: Vessels are assumed to drift at 2.3 knots in 20-knot winds, based on an analysis considering force balance on a container ship (Garth Wilcox. The Glosten Associates, via email September 6, 2013). This corresponds to the 1% Zone of No Save, because in an analysis of past weather conditions, the wind exceeds 20 knots in any particular direction around 1% of the time.

Hazard: This analysis used an approximate Aleutian shoreline compiled from several sources and hand-checked for missing islands. Because the analysis does not consider reefs or shallows, the actual Zone of No Save is probably larger, since a vessel would likely run aground before it reached the shoreline hazard used for this analysis.

Wind Conditions: Historic weather data from four buoys in the Bering Sea and North Pacific provided quantitative constraints for a 99th percentile, or worse, wind conditions (Nuka

Research, 2013). Because both wind direction and strength are important, we characterized the wind speed for which there was a 1% chance it would be exceeded in each of 36 directional bins used by the National Oceanic and Atmospheric Administration in recording weather conditions. Winds in the Aleutians blow in all directions with similar probability, and the 99th percentile condition is in most cases close to 20 knots, so we used a uniform 20-knot wind for this analysis. This choice delineates a 1% Zone of No Save, in which 1% of the time, the wind in a given direction is equal to or greater than the 20-knot wind analyzed, and the vessel cannot be saved.

Because wind direction is binned in ten-degree arcs, this approach in effect assumes that a given hazard occupies 10 degrees of the horizon. So a large island that extends over more of the horizon will pose a greater hazard than this approach assumes, while a distant rock that's very small will pose a lesser hazard.

Results

The Zone of No Save is typically very small near the starting location of a rescue tug, since it could reach that area most quickly, and expands further from those ports. In the Aleutians, even with a rescue tug at Adak, the Zone of No Save extends nearly 100 nautical miles from shore in the far Western Aleutians.

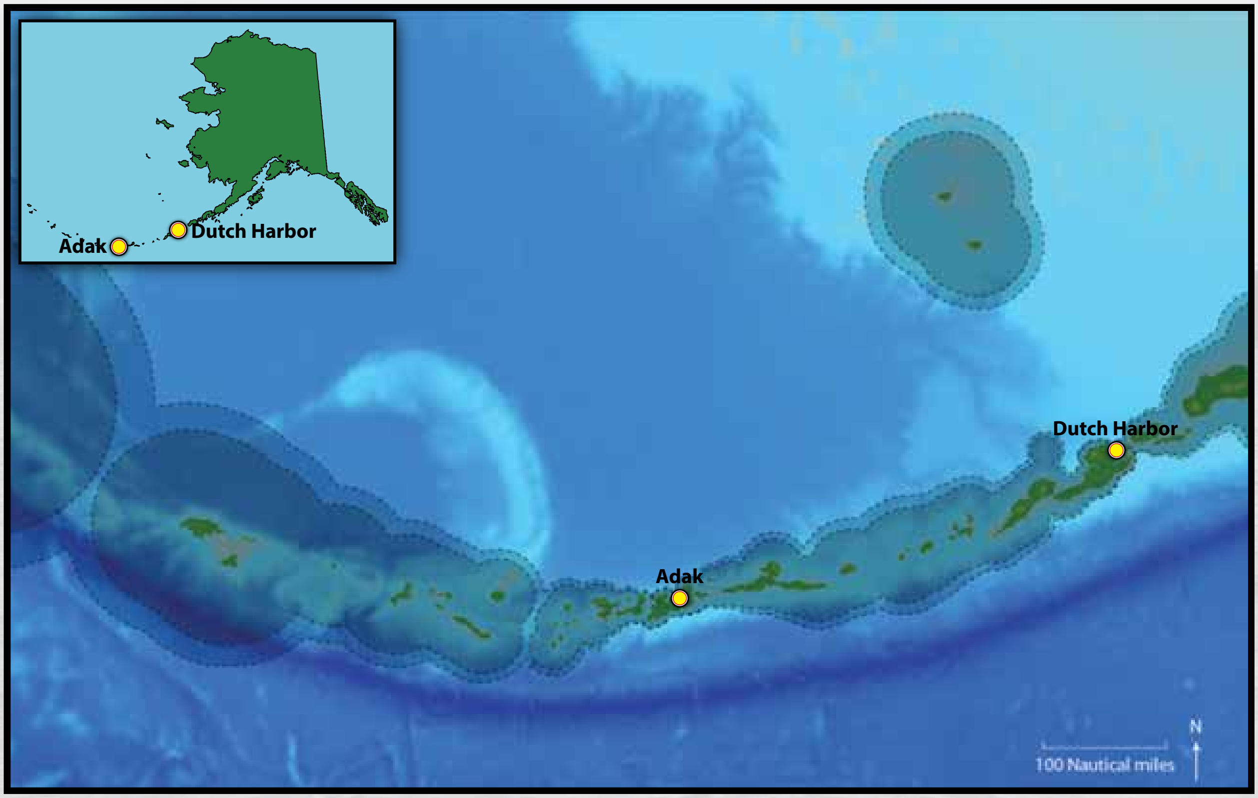


Figure 1: 1% Zone of No Save, assuming a rescue tug is stationed in both Adak and Dutch Harbor. Larger area assumes both vessels transit at 10 knots, while the smaller darker area assumes both vessels transit at 13 knots.

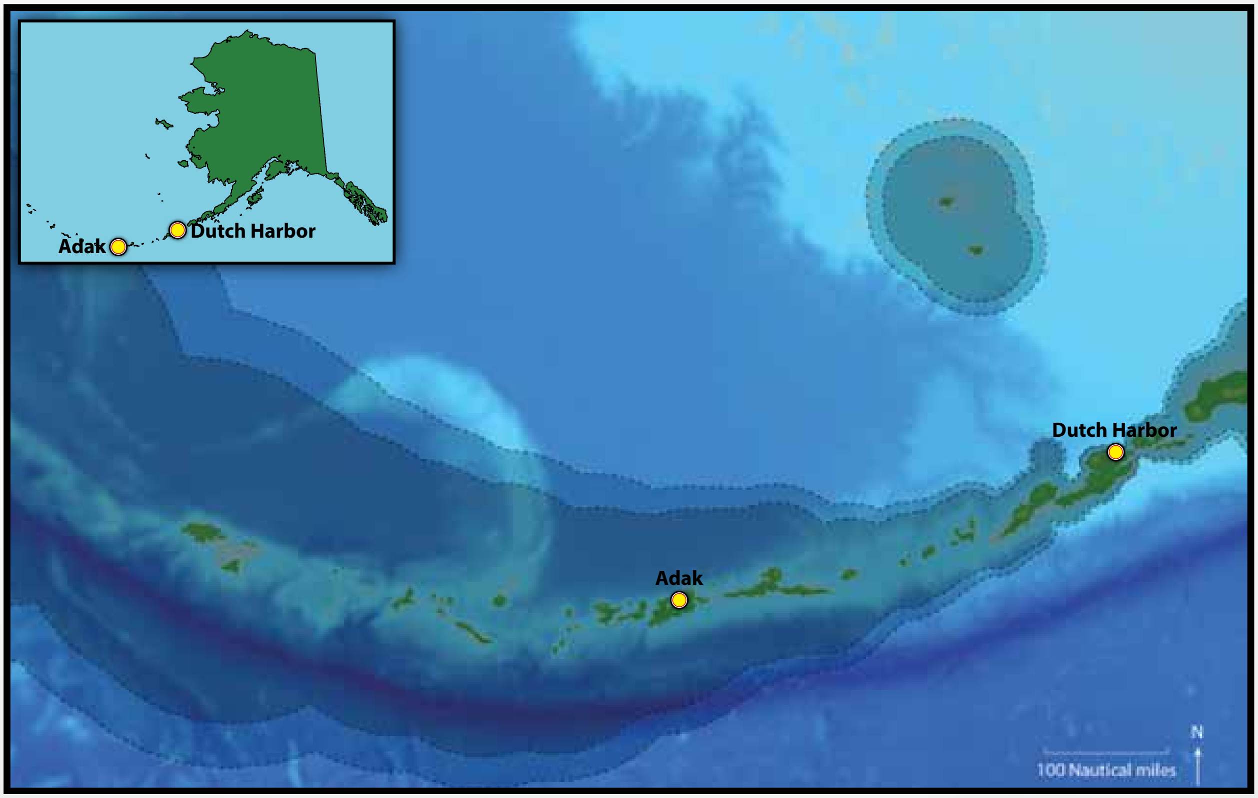


Figure 2: 1% Zone of No Save for a 10 and 13 knot rescue vessel in Dutch Harbor.

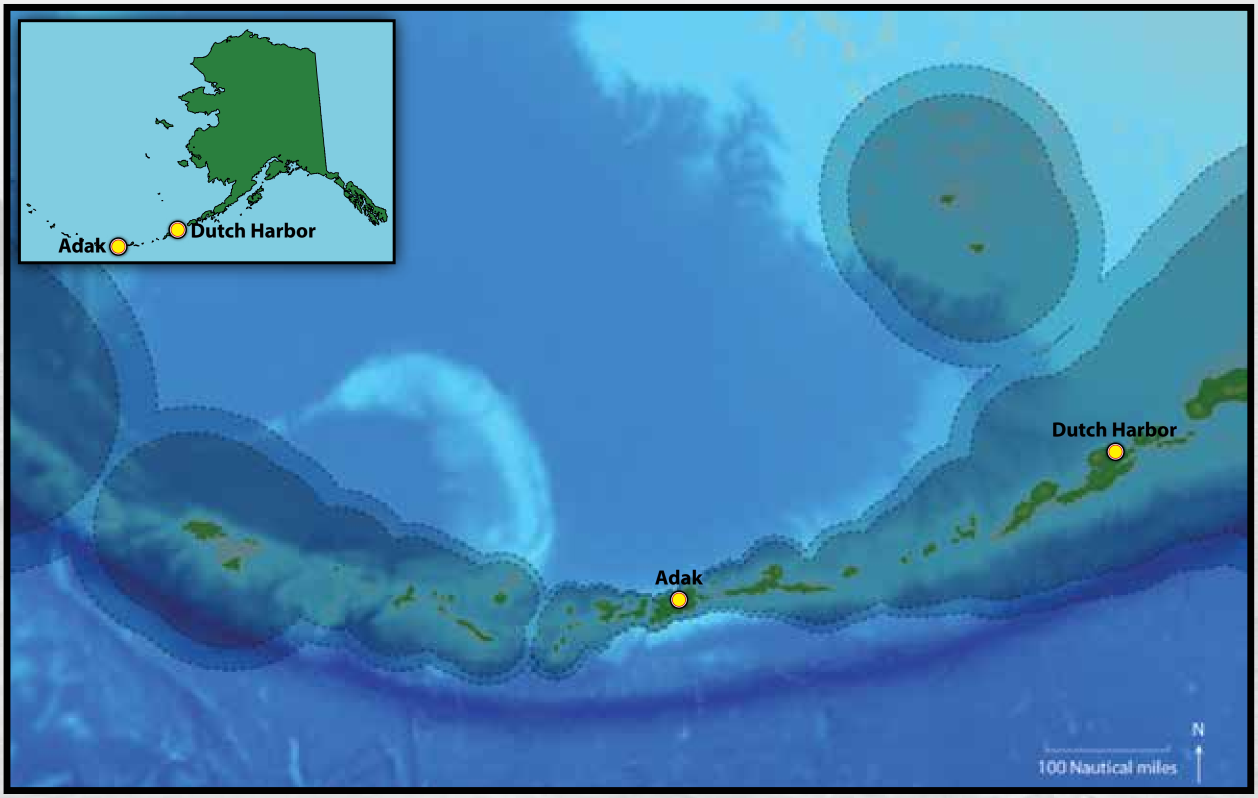


Figure 3: 1% Zone of No Save for a 10- and-13 knot rescue vessel in Adak.

Appendix D – Cost Estimate Details

MANAGING ENTITY

Management Staff

Variables

Interest Rate: 5%
Overhead Rate: 25%

MANAGEMENT STAFF	Number	Unit Cost	Capital Cost	Loan Period (years)	Amortized Capital Cost ($/yr)	Personnel ($/yr)	Fuel ($/yr)	Operating & Maintenance ($/yr)	Overhead ($/yr)
General Manager	1		$0	0		$175,000			$43,750
Chief Financial Officer	1		$0	0		$110,000			$27,500
Administrative Assistant	1		$0	0		$45,000			$11,250
Office Equipment	1	$30,000	$30,000	5	$6,929				
Office Rent	1		$0	0				$48,000	
Utilities and Communications	1		$0	0				$14,400	
Vehicles	2	$35,000	$70,000	5	$16,168		$4,800	$4,800	
Travel	1		$0	0				$48,000	
Insurance (General Liability, E&O, Pollution)	1		$0	0				$50,000	
Operating Reserve	1	$0	$0	15	$0				
			Total Capital Cost (Principal)		**Annual Capital Cost**	**Annual Personnel Cost**	**Annual Fuel Cost**	**Annual Operation & Maint.**	**Annual Overhead**
		TOTALS:	**$100,000**		**$23,097**	**$330,000**	**$4,800**	**$165,200**	**$82,500**

MANAGING ENTITY, *continued*

Professional Services

Variables

Interest Rate: 8%
Overhead Rate: 25%

PROFESSIONAL SERVICES	Number	Unit Cost	Capital Cost	Operating & Maintenance ($/yr)
Legal	1		$0	$50,000
Tax/Accounting	1		$0	$25,000
Engineering	1		$0	$15,000
Naval Architect	1		$0	$10,000
Travel	1		$0	$20,000
			Total Capital Cost (Principal)	**Annual Operation & Maintenance**
		TOTALS:	**$0**	**$120,000**

Board of Directors

Variables

Interest Rate: 8%
Overhead Rate: 25%

BOARD OF DIRECTORS	Unit Cost	Capital Cost	Personnel ($/yr)	Operating & Maintenance ($/yr)	Overhead ($/yr)
Directors' Stipend - 9 Directors		$0	$18,000		$4,500
Directors Travel		$0		$36,000	
Meeting Costs - two meetings per year		$0		$4,000	
Insurance		$0		$5,000	
		Total Capital Cost (Principal)	**Annual Personnel Cost**	**Annual Operation & Maint.**	**Annual Overhead**
	TOTALS:	**$0**	**$18,000**	**$45,000**	**$4,500**

ROUTING MEASURES AND VESSEL MONITORING

Vessel Monitoring Program

Variables

Interest Rate: 5%
Overhead Rate: 25%

AIS SERVICES & EQUIPMENT FOR VESSEL MONITORING	Number	Unit Cost	Capital Cost	Loan Period (years)	Amortized Capital Cost ($/yr)	Operating & Maintenance ($/yr)
AIS Services			$0			$400,000
AIS Equipment	1	$100,000	$100,000	5	$23,097	$10,000
			Total Capital Cost (Principal)		Annual Capital Cost	Annual Operation & Maintenance
		TOTALS:	$100,000		$23,097	$410,000

Vessel Monitoring Program – Personnel

Variables

Interest Rate: 5%
Overhead Rate: 25%

COMPLIANCE PROGRAM	Number	Unit Cost	Capital Cost	Loan Period (years)	Amortized Capital Cost ($/yr)	Personnel ($/yr)	Operating & Maintenance ($/yr)	Overhead ($/yr)
Compliance Staff	1		$0			$60,000		$15,000
Travel	1		$0				$12,000	
Office Equipment	1	$10,000	$10,000	7	$1,728			
			Total Capital Cost (Principal)		Annual Capital Cost	Annual Personnel Cost	Annual Operation & Maintenance	Annual Overhead
		TOTALS:	$10,000		$1,728	$60,000	$12,000	$15,000

EMERGENCY TOWING

Towing Management

Variables

Interest Rate: 8%
Overhead Rate: 25%

TOWING MANAGEMENT STAFF	Number	Unit Cost	Capital Cost	Loan Period (years)	Amortized Capital Cost ($/yr)	Personnel ($/yr)	Operating & Maintenance ($/yr)	Overhead ($/yr)
Manager – Emergency Towing Services			$0			$125,000		$31,250
Travel			$0				$25,000	
Office Equipment	1	$30,000	$30,000	7	$5,762			
Insurance			$0				$100,000	
			Total Capital Cost (Principal)		**Annual Capital Cost**	**Annual Personnel Cost**	**Annual Operation & Maintenance**	**Annual Overhead**
		TOTALS:	**$30,000**		**$5,762**	**$125,000**	**$125,000**	**$31,250**

Dedicated Tug Stationed at Adak

Variables

Interest Rate: 5%
Overhead Rate: 25%
Charter Profit Rate: 15% applied as overhead

DEDICATED TUG at ADAK	Number	Unit Cost	Capital Cost	Loan Period (years)	Amortized Capital Cost ($/yr)	Personnel ($/yr)	Fuel ($/yr)	Operating & Maintenance ($/yr)	Overhead ($/yr)
Construction of Vessel	1	$30,300,000	$30,300,000	20	$2,431,350				$520,703
Crew	9		$0			$1,040,000			$260,000
Fuel			$0				$500,000		
Berth			$0					$1,000,000	
Maintenance			$0					$1,000,000	
			Total Capital Cost (Principal)		**Annual Capital Cost**	**Annual Personnel Cost**	**Annual Fuel Cost**	**Annual Operation & Maint.**	**Annual Overhead**
		TOTALS:	**$30,300,000**		**$2,431,350**	**$1,040,000**	**$500,000**	**$2,000,000**	**$780,703**

SALVAGE

Salvage Staff

Variables

Interest Rate: 8%
Overhead Rate: 25%

SALVAGE STAFF	Number	Unit Cost	Capital Cost	Loan Period (years)	Amortized Capital Cost ($/yr)	Personnel ($/yr)	Operating & Maintenance ($/yr)	Overhead ($/yr)
Salvage Specialist - Tankerman	2		$0			$170,000		$42,500
Office Equipment	1	$10,000	$10,000	7	$1,921			
Travel	1		$0				$8,000	
Insurance			$0				$100,000	
			Total Capital Cost (Principal)		Annual Capital Cost	Annual Personnel Cost	Annual Operation & Maintenance	Annual Overhead
		TOTALS:	$10,000		$1,921	$170,000	$108,000	$42,500

Helicopter Lightering Package

Variables

Interest Rate: 5%
Overhead Rate: 15%

HELICOPTER LIGHTERING PACKAGE	Number	Unit Cost	Capital Cost	Loan Period (years)	Amortized Capital Cost ($/yr)	Operating & Maintenance ($/yr)	Overhead ($/yr)
Pump Equipment	1	$200,000	$200,000	10	$25,901	$10,000	$3,885
Fly-away Tanks	10	$20,000	$200,000	10	$25,901	$10,000	$3,885
			Total Capital Cost (Principal)		Annual Capital Cost	Annual Operation & Maintenance	Annual Overhead
		TOTALS:	$400,000		$51,802	$20,000	$7,770

SALVAGE, *continued*

60,000 bbl Oil Storage Barge

Variables

Interest Rate: 5%
Overhead Rate/Charter Profit: 15%

40K-60 STORAGE BARGE	Number	Unit Cost	Capital Cost	Loan Period (years)	Amortized Capital Cost ($/yr)	Personnel ($/yr)	Fuel ($/yr)	Operating & Maintenance ($/yr)	Overhead ($/yr)
Barge	1	$5,000,000	$5,000,000	15	$481,711		$10,000	$100,000	$72,257
Personnel detailed in Salvage Staff			$0			$0			
			Total Capital Cost (Principal)		Annual Capital Cost	Annual Personnel Cost	Annual Fuel Cost	Annual Operation & Maintenance	Annual Overhead
		TOTALS:	$5,000,000		$481,711	$-	$10,000	$100,000	$72,257

Helicopter of Opportunity Program

Variables

Interest Rate: 8%
Overhead Rate: 25%

HELICOPTER OF OPPORTUNITY PROGRAM	Unit Cost	Capital Cost	Operating & Maintenance ($/yr)
Staff detailed in Salvage Staff	n/a	$0	
Heavy Lift Helicopter monitoring program	n/a	$0	$20,000
		Total Capital Cost (Principal)	Annual Operation & Maintenance
	TOTALS:	$-	$20,000

OIL SPILL RESPONSE

Oil Spill Response Staff

Variables

Interest Rate: 5%

Overhead Rate: 25%

SALVAGE STAFF	Number	Unit Cost	Capital Cost	Loan Period (years)	Amortized Capital Cost ($/yr)	Personnel ($/yr)	Operating & Maintenance ($/yr)	Overhead ($/yr)
Manager - Oil Spill Removal Organization	1		$0			$125,000		$31,250
Technicians, VOO Program Manager, LBS Program Manager	7		$0			$595,000		$148,750
Admin Staff	1		$0			$60,000	$50,000	$15,000
Travel			$0					
Office Equipment	7	$20,000	$140,000	5				
Vehicles	5	$50,000	$250,000	5				
Insurance							$100,000	
			Total Capital Cost (Principal)		Annual Capital Cost	Annual Personnel Cost	Annual Operation & Maintenance	Annual Overhead
		TOTALS:	$390,000		$90,080	$780,000	$150,000	$195,000

OIL SPILL RESPONSE, *continued*

Nearshore Oil Spill Response Equipment

Variables

Interest Rate: 5%
Overhead/Profit Rate: 15%

NEARSHORE STRIKE TEAM COMPOSITION	Number	Unit Cost	Capital Cost	Loan Period (years)	Amortized Capital Cost ($/yr)	Fuel ($/yr)	Operating & Maintenance ($/yr)	Overhead ($/yr)
Current buster-type enhanced booming	12	$175,000	$2,100,000	10	$271,960			$40,794
Fuzzy disk high-efficiency skimmers and power packs	12	$105,000	$1,260,000	10	$163,176			$24,476
249 bbl mini-barges for primary storage	24	$150,000	$3,600,000	10	$466,216			$69,932
Protected-water boom for shoreline protection	10,000	$10	$100,000	10	$12,950			$1,943
Snare-boom for shoreline protection	10,000	$1	$10,000	5	$2,310			$346
Anchoring Systems	100	$300	$30,000	5	$6,929			$1,039
Shoreseal boom	1,000	$53	$53,333	5	$12,319			$1,848
Mini barge lightering system	4	$35,000	$140,000	10	$18,131			$2,720
Consumables - initial inventory	1	$100,000	$100,000	5	$23,097			$3,465
Co-op owned vessels	6	$200,000	$1,200,000	5	$277,170	$30,000		$41,575
Misc	1	$500,000	$500,000	5	$115,487			
Annual Operation and Maintenance			$0				$100,000	
Shop, office, utilities, consumables							$250,000	
(Personal cost are detailed in with Oil Spill Response Staff)			Total Capital Cost (Principal)		Annual Capital Cost	Annual Fuel Cost	Annual Operation & Maintenance	Annual Overhead
		TOTALS:	$9,093,333		$1,369,745	$30,000	$350,000	$188,139

OIL SPILL RESPONSE, *continued*

Vessel of Opportunity Program

Variables

Interest Rate: 8%
OverheadRate: 25%

VESSEL OF OPPORTUNITY PROGRAM	Number	Unit Cost	Capital Cost	Operating & Maintenance ($/yr)	Overhead ($/yr)
VOO Program Manager/Trainer - part of OSRO staff in 01	1		$0		$0
Training Base Budget	1		$0	$50,000	
Per Vessel Training Costs - 3,000 per year	150		$0	$450,000	
Travel	1		$0	$12,000	
Insurance				$50,000	
			Total Capital Cost (Principal)	Annual Operation & Maintenance	Annual Overhead
		TOTALS:	$-	$562,000	$-

Logistical Support Base

Variables

Interest Rate: 8%
OverheadRate: 25%

LOGISTICAL SUPPORT BASE	Number	Unit Cost	Capital Cost	Loan Period (years)	Amortized Capital Cost ($/yr)	Fuel ($/yr)	Operating & Maintenance ($/yr)	Overhead ($/yr)
Personnel to be provided by OSRO Staff			$0					
Program Travel			$0				$6,000	
Program Budget			$0				$25,000	
Vessel Charter Budget			$0			$120,000	$100,000	
Equipment Budget	1	$500,000	$500,000	10	$64,752			$9,713
			Total Capital Cost (Principal)		Annual Capital Cost	Annual Fuel Cost	Annual Operation & Maintenance	Annual Overhead
		TOTALS:	$9,093,333		$1,369,745	$1200,000	$131,000	$9,713

OIL SPILL RESPONSE, *continued*

IMT Program

Variables

Interest Rate: 8%

OverheadRate: 25%

LOGISTICAL SUPPORT BASE	Number	Unit Cost	Capital Cost	Loan Period (years)	Amortized Capital Cost ($/yr)	Operating & Maintenance ($/yr)	Overhead ($/yr)
Individual IMT member training	12		$0			$36,000	$9,000
Annual internal exercise			$0			$24,000	$6,000
Agency exercise			$0			$50,000	$12,500
Equipment	12	$3,000	$36,000	5	$9,016		
			Total Capital Cost (Principal)		Annual Capital Cost	Annual Operation & Maintenance	Annual Overhead
		TOTALS:	$36,000		$9,016	$110,000	$27,500


ALEUTIAN ISLANDS
RISK ASSESSMENT