# Responding to Emergencies in the Arctic 2015 – An Alaska Perspective

The National Academies of
Sciences · Engineering · Medicine
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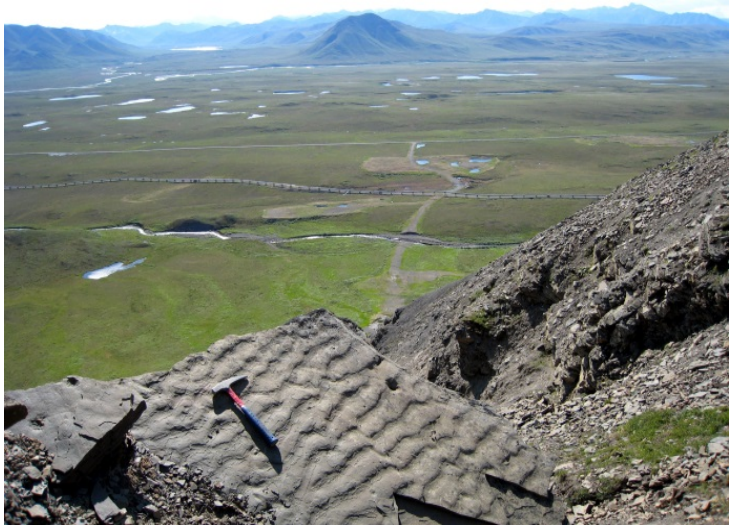
Alaska Department of Natural Resources

# Overview

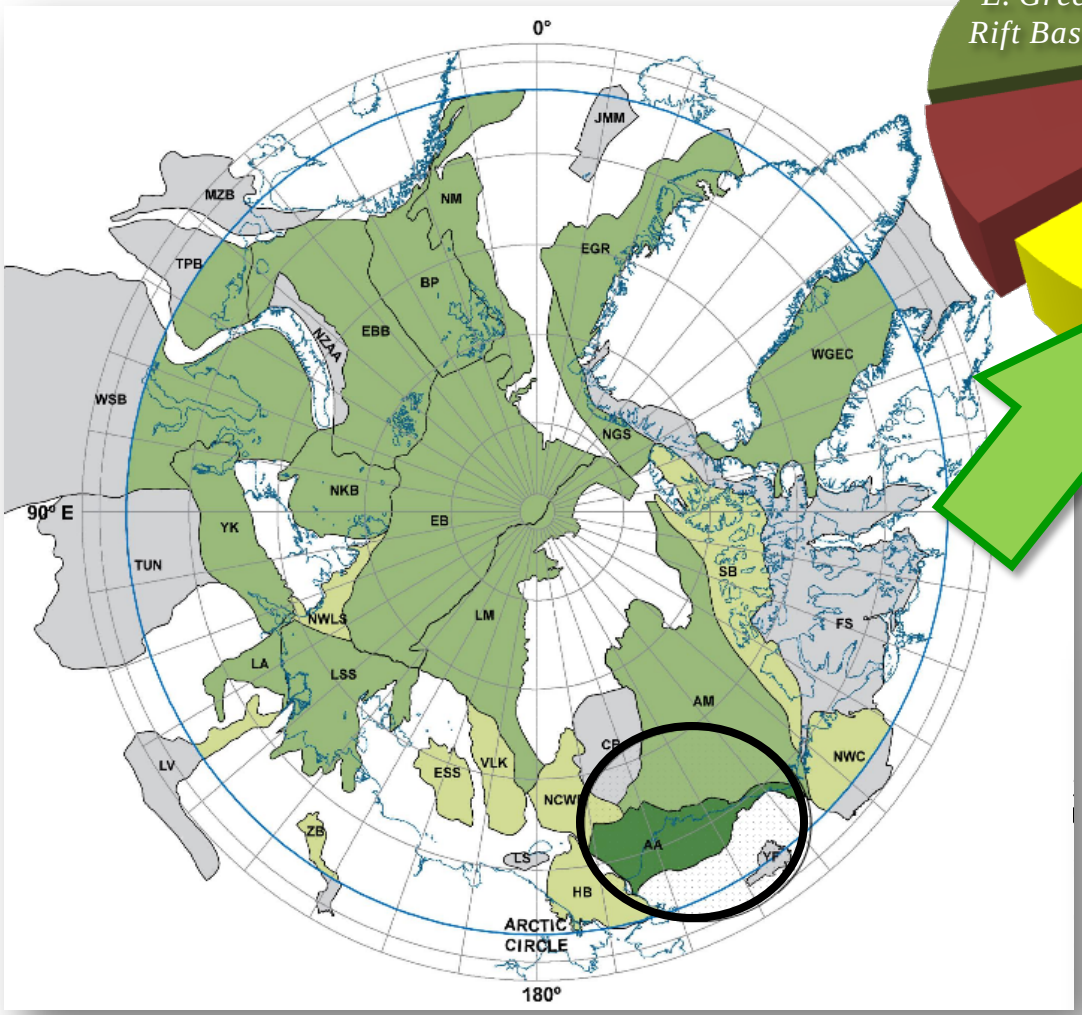
- Increased shipping in Arctic and Western Alaska
- Oil spill risk and response
- Tsunami / earthquake risk and response
- Deepwater port and vessel traffic
- Need for enhanced USCG presence in the Arctic
- Lack of high resolution charting and mapping in Arctic

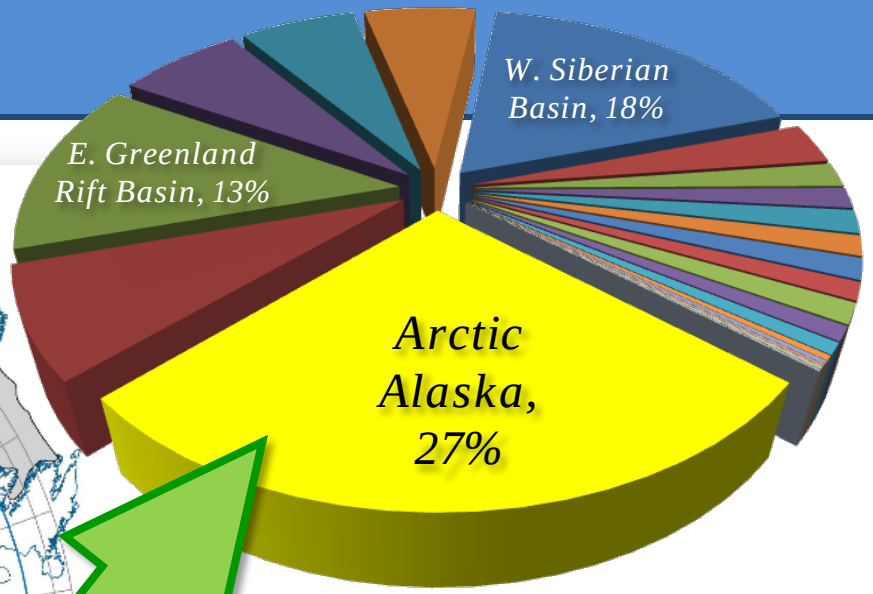
# Resource Deposits That May Lead To Increased Shipping

- World class onshore and offshore oil and gas resources
- Hard rock mineral resources in Western Alaska
- Red Dog Mine – 24 vessel trips in 2014



# USGS Circum-Arctic Resource Appraisal



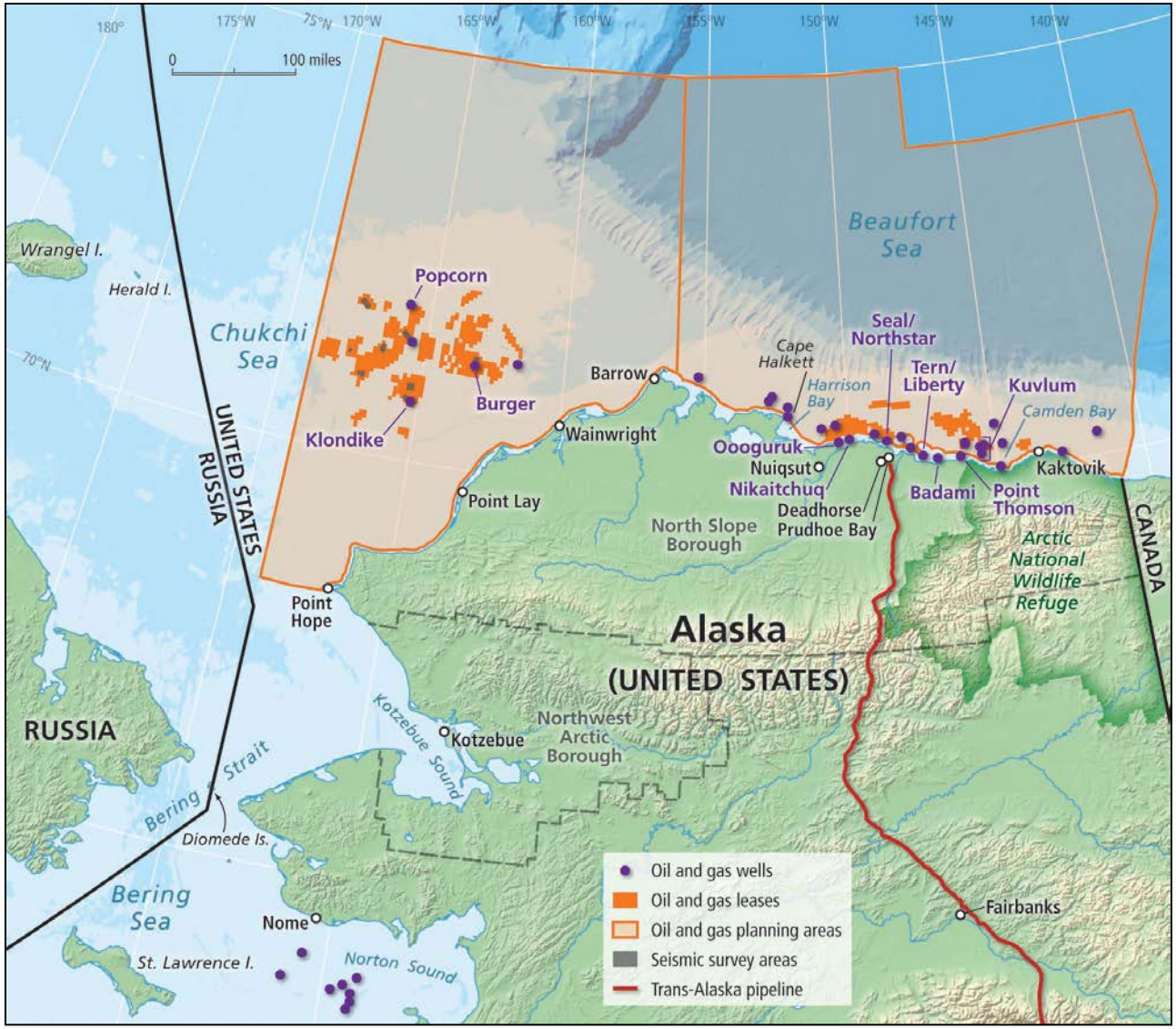

Arctic Alaska Oil + NGL
30 BBO + 6 BBNGL mean

**UNDISCOVERED OIL**
(billion barrels)

- >10
- 1-10
- <1
- Area not quantitatively assessed
- Area of low petroleum potential

*after USGS, 2008*

# Oil and Gas Activity




*Source: Responding to Oil Spills in the U.S. Arctic Marine Environment*, National Research Council (2014).

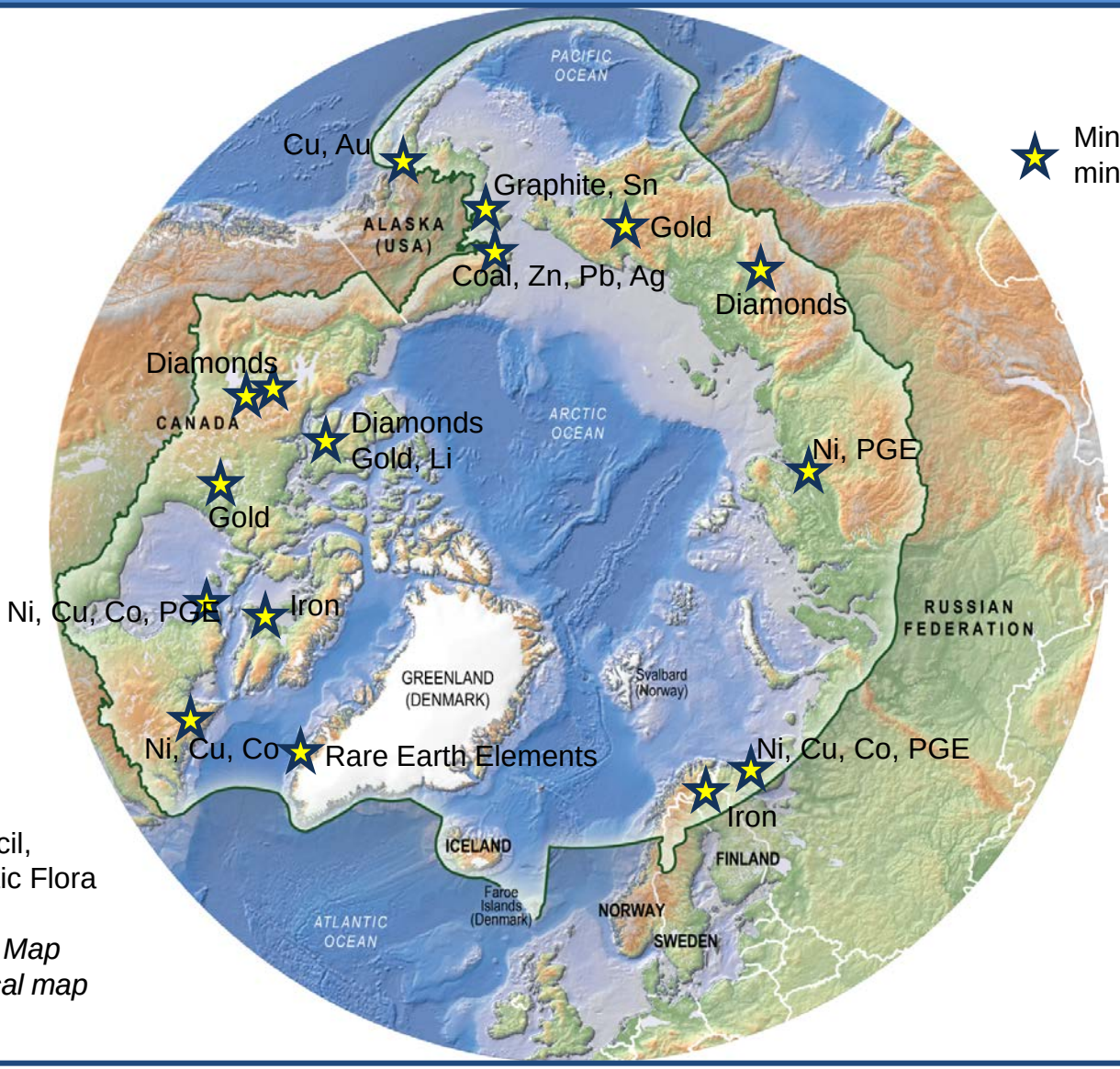
# U.S. Arctic Alaska
## -Undiscovered Resources-

**Technically recoverable undiscovered conventional oil and gas resource***

| Region and Assessment Segment | | Oil, MMSTB (million stock tank barrels) | | | Gas, BCF (billion cubic feet) | | |
|---|---|---|---|---|---|---|---|
| | | Probabilty Distribution | | | Probabilty Distribution | | |
| **North Slope Onshore & State Waters[2]** | | **F95** | **Mean** | **F05** | **F95** | **Mean** | **F05** |
| Central North Slope | *Oil & Associated gas* | 2,565 | 3,984 | 5,854 | 2,681 | 4,198 | 6,092 |
| | *NGL & Non-associated gas* | --[3] | 478 | --[3] | 23,939 | 33,318 | 44,873 |
| Nat'l Petrol Reserve Alaska | *Oil & Associated gas* | -- | 896 | -- | -- | -- | -- |
| | *NGL & Non-associated gas* | --[3] | -- | --[3] | -- | 52,839 | -- |
| ANWR coastal plain[2] | *Oil & Associated gas* | 5,724 | 10,360 | 15,955 | -- | 4,764 | -- |
| | *NGL & Non-associated gas* | --[3] | 190 | --[3] | 0 | 3,841 | 10,852 |
| total - North Slope Onshore | | --[3] | 15,908 | --[3] | --[3] | 98,960 | --[3] |
| **Arctic Alaska Outer Continental Shelf (OCS)** | | | | | | | |
| Chukchi Shelf | *Oil & all gas* | 2,320 | 15,380 | 40,080 | 10,320 | 76,770 | 209,530 |
| Beaufort Shelf | *Oil & all gas* | 410 | 8,220 | 23,240 | 650 | 27,640 | 72,180 |
| Hope Basin | *Oil & all gas* | 0 | 150 | 600 | 0 | 3,770 | 14,980 |
| total - Arctic OCS (offshore) | | --[3] | 23,750 | --[3] | --[3] | 108,180 | --[3] |
| **TOTAL - Arctic Alaska** | | --[3] | ***39,658*** | --[3] | --[3] | ***207,140*** | --[3] |

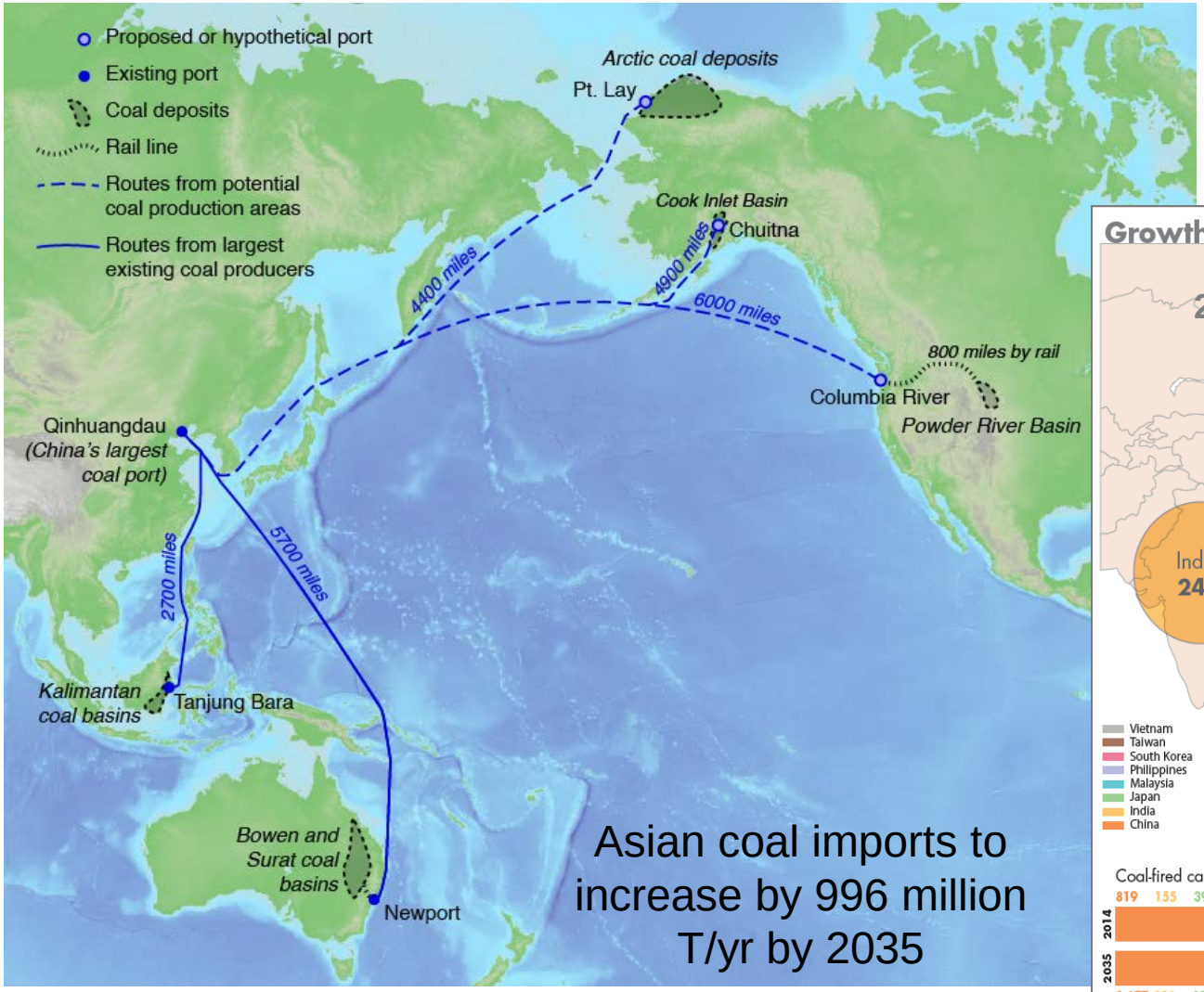
** Compiled from multiple USGS and BOEM assessments by Alaska Division of Oil & Gas*

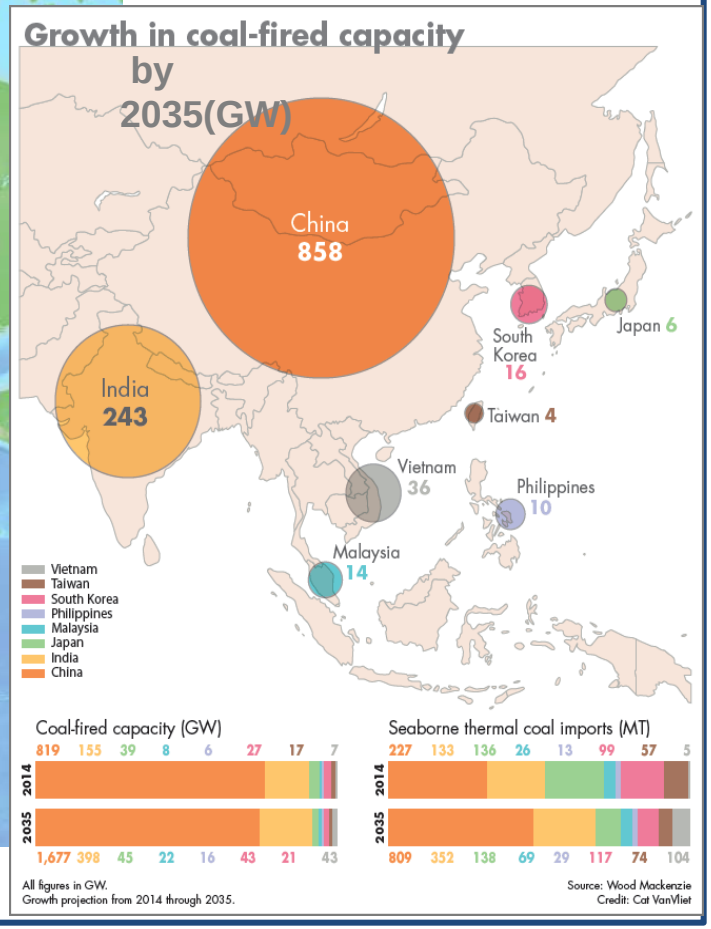
# Mineral Resources




Source: Arctic Council, Conservation of Arctic Flora and Fauna Working Group (2000) *CAFF Map No.14 - Topographical map of the Arctic.*

# Shipping Routes



# Arctic Oil Spill Context

- Rapid climate change increasing Arctic water accessibility for commercial activities
  - Oil and gas
  - Shipping
  - Fishing
  - Tourism


- Arctic oil spills threaten broad range of US interests and all Arctic nations

*Source: Responding to Oil Spills in the U.S. Arctic Marine Environment,* National Research Council (2014).

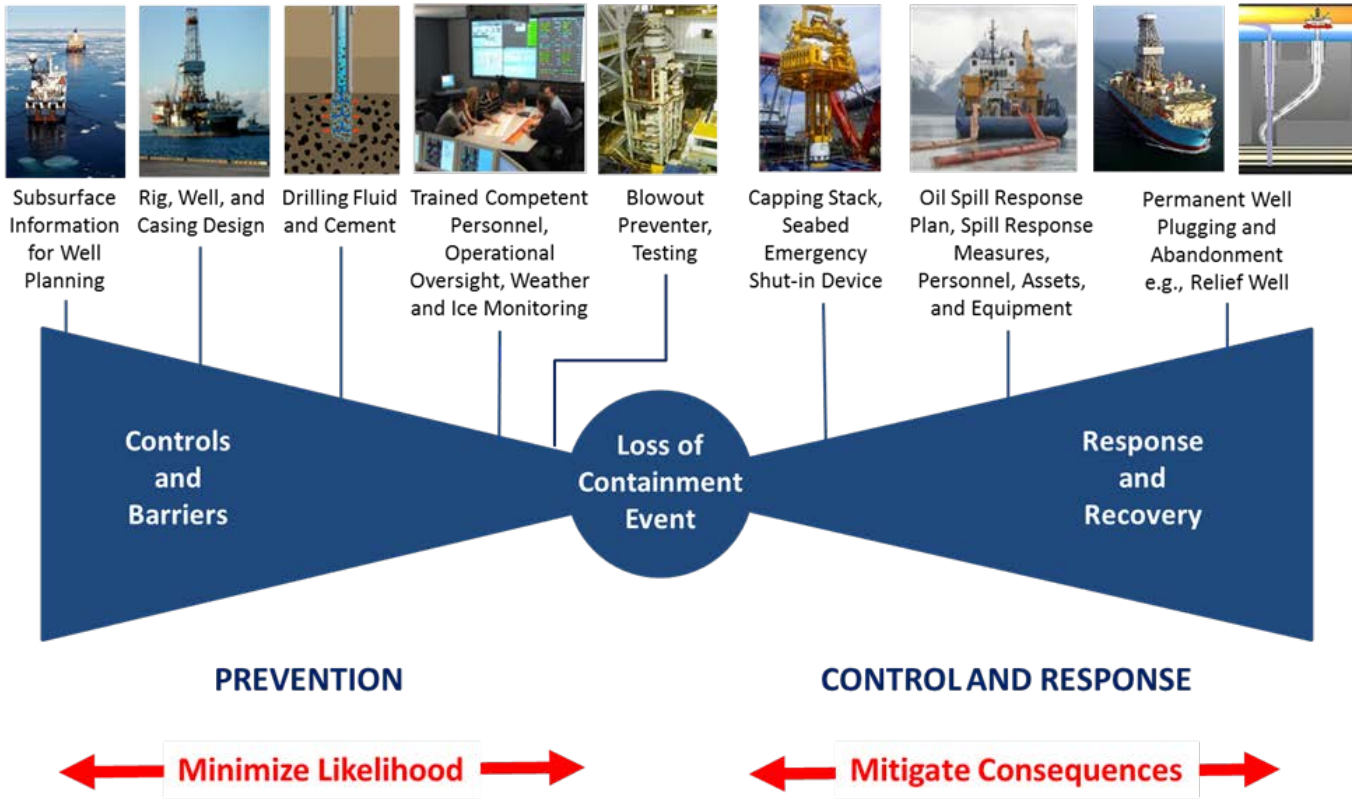


*Image sources: NOAA, BOEM*

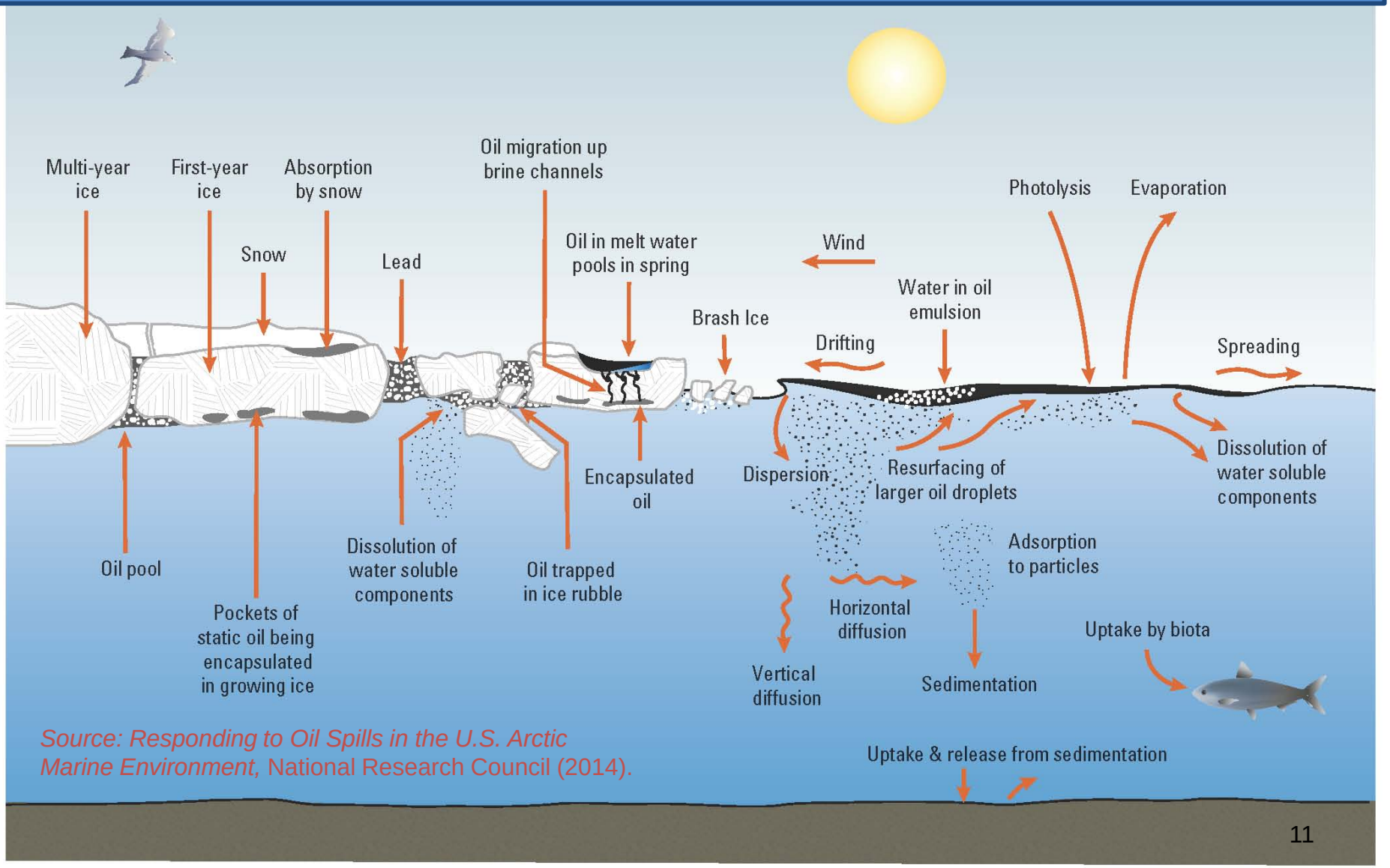
# Addressing Oil Spill Risks

***"There have been substantial recent technology and regulatory advancements to reduce the risk and consequences of a spill."***

*Arctic Potential, Realizing the Promise of U.S. Arctic Oil and Gas Resources,* (National Petroleum Council, 2015)

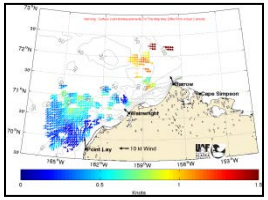


# Oil interacts with the environment in complex ways




*Source: Responding to Oil Spills in the U.S. Arctic Marine Environment,* National Research Council (2014).

# Long-term Monitoring Needs



- What is needed?
  - A system that integrates Arctic data in support of oil spill preparedness, response, and restoration and rehabilitation
  - International standards for Arctic data collection, sharing, and integration
  - A long-term, community-based, multi-use Arctic observing system
  - Release of proprietary monitoring data from oil and gas exploration activities
  - When appropriate, release of native community fishing, hunting, and cultural site data

*Source: Responding to Oil Spills in the U.S. Arctic Marine Environment,* National Research Council (2014).



*Image sources: NOAA, UAF*

# Local Training

- Local knowledge is key during planning and response to avoid missing significant environmental information
- Developing and maintaining trained village response teams would integrate local knowledge and utilize existing human resources for effective oil spill response.
- The USCG and Alaska Department of Environmental Conservation should undertake the development of an oil spill training program for local entities so as to develop trained response teams in local villages.
  - Industry should continue to participate in local training initiatives
  - Local officials and trained village response teams should be included in the command process during a response
- Input from community experts should be actively solicited for inclusion in response planning and government- and industry-led exercises in the Arctic

*Source: Responding to Oil Spills in the U.S. Arctic Marine Environment,* National Research Council (2014).



*Image sources: NOAA, USCG*

# Arctic Infrastructure

- Infrastructure to support oil spill response should be enhanced in the North Slope and Northwest Arctic Boroughs, including marine facilities.
- Multi-use facilities (schools, community buildings, gyms) could be used as response centers
- Prepositioning response equipment and fuel throughout the Arctic would increase immediate access and extend aircraft/helicopter range.

**Scope, scale and location of needs should be determined through structured decision processes and risk assessments**

*Source: Responding to Oil Spills in the U.S. Arctic Marine Environment,* National Research Council (2014).



*Image source: NOAA*

# International Agreements

- Formal contingency planning and exercises with Canada have enabled both countries to refine procedures and legal requirements
- Russia's expansion of vessel traffic through the Bering Strait leads to greater potential for accidents and environmental impacts in U.S. waters
- Resolving anticipated response problems with Russia (e.g., communications, translators, people and equipment) needs to be done before an event, through an active exercise program
- The Coast Guard should expand its bilateral agreement with Russia to include Arctic spill scenarios and conduct regularly scheduled exercises to establish joint responses under Arctic conditions, and should build on existing bilateral agreements with Russia and Canada to develop and exercise a joint contingency plan.

*Source: Responding to Oil Spills in the U.S. Arctic Marine Environment,* National Research Council (2014).

# Oil Spill Countermeasures

- No single technique will apply in all situations.
- Effective oil spill response requires flexibility to evaluate and apply multiple response options, whether on their own or concurrently.

*Source: Responding to Oil Spills in the U.S. Arctic Marine Environment,* National Research Council (2014).

*Image source: USCG*

# Net Environmental Benefit Analysis (NEBA) Processes

- Identify effective countermeasures, analyze environmental trade-offs through prioritization criteria
  - Protect sensitive/important ecosystem components
  - Include information on oil transport, fate, and effects
  - Knowledge of operational limits
  - Weigh pros and cons of each countermeasure
  - Consider logistical constraints and cleanup intensity
- Response options with least adverse environmental impacts
  - Impacts on Arctic food webs, dynamics at different trophic levels
- Process should involve regulators, resource managers, health authorities, technical specialists, scientific experts, and local experts.

*Source: Responding to Oil Spills in the U.S. Arctic Marine Environment*, National Research Council (2014).

# RESEARCH NEEDS

- Oil Spill Response Research
  - Detection, Monitoring, Modeling
  - Biodegradation
  - Dispersants
  - In situ burning
  - Mechanical containment
  - Natural recovery

*Source: Responding to Oil Spills in the U.S. Arctic Marine Environment*, National Research Council (2014).


*Image sources: NOAA, BOEM*

## High Frequency Radar (HFR)

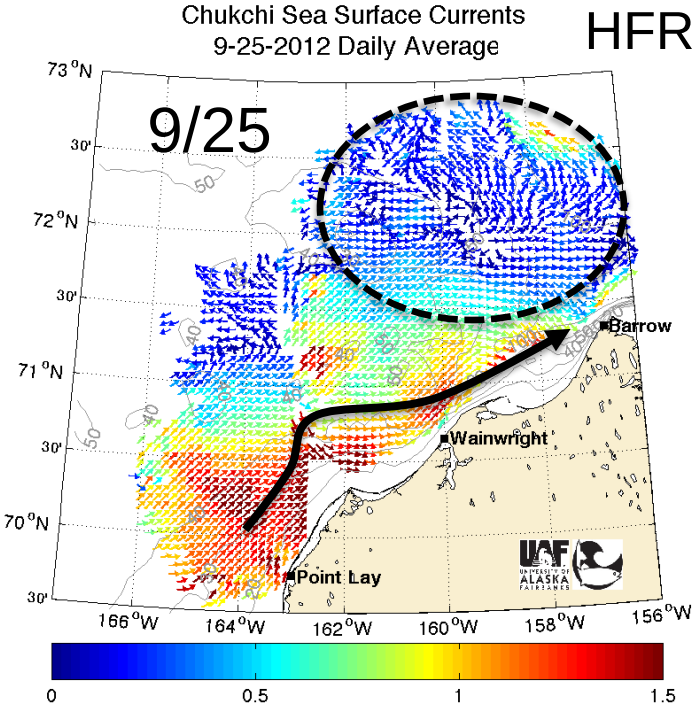
Land-based radars producing hourly 2-D current maps over 150 km offshore at 6 km horizontal resolution.

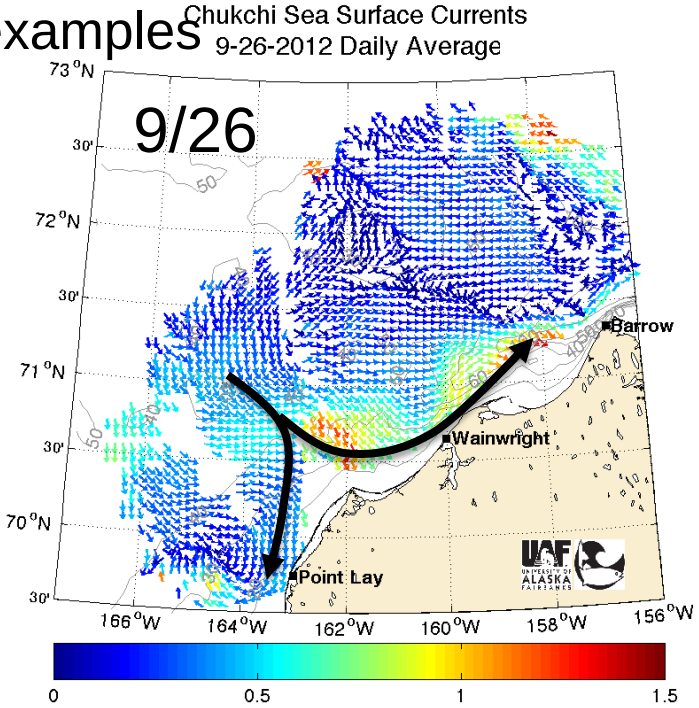
Operated 5 units 2009-2013 in remote Arctic Alaskan regions (Barrow, Wainwright, Point Lay, Cape Simpson) from June to October, and since 2013 at Cape Simpson.

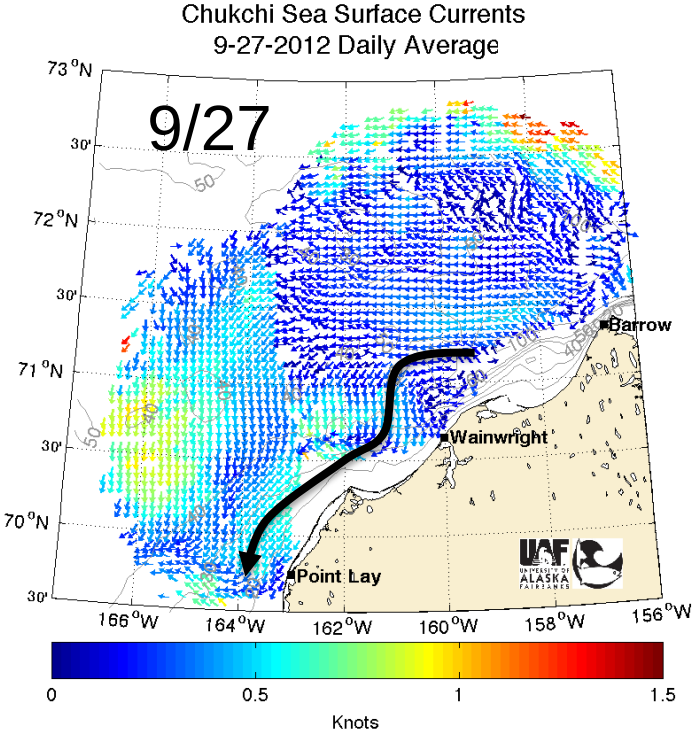
## Remote Power Module (RPM)

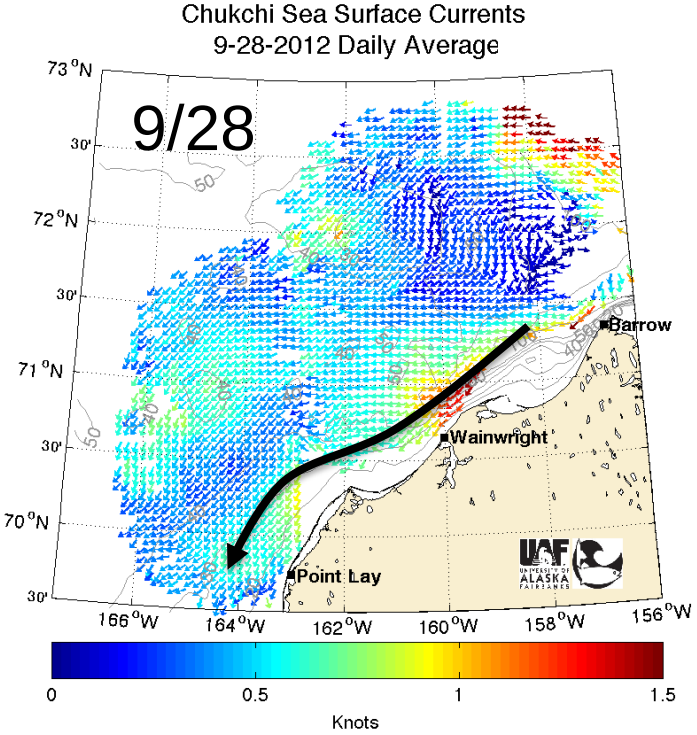
Fully-automated, renewable (solar and wind) hybrid power station provide power to HF radars. Designed to operate in arctic and sub-arctic maritime environments.

# HFR 2D fields examples

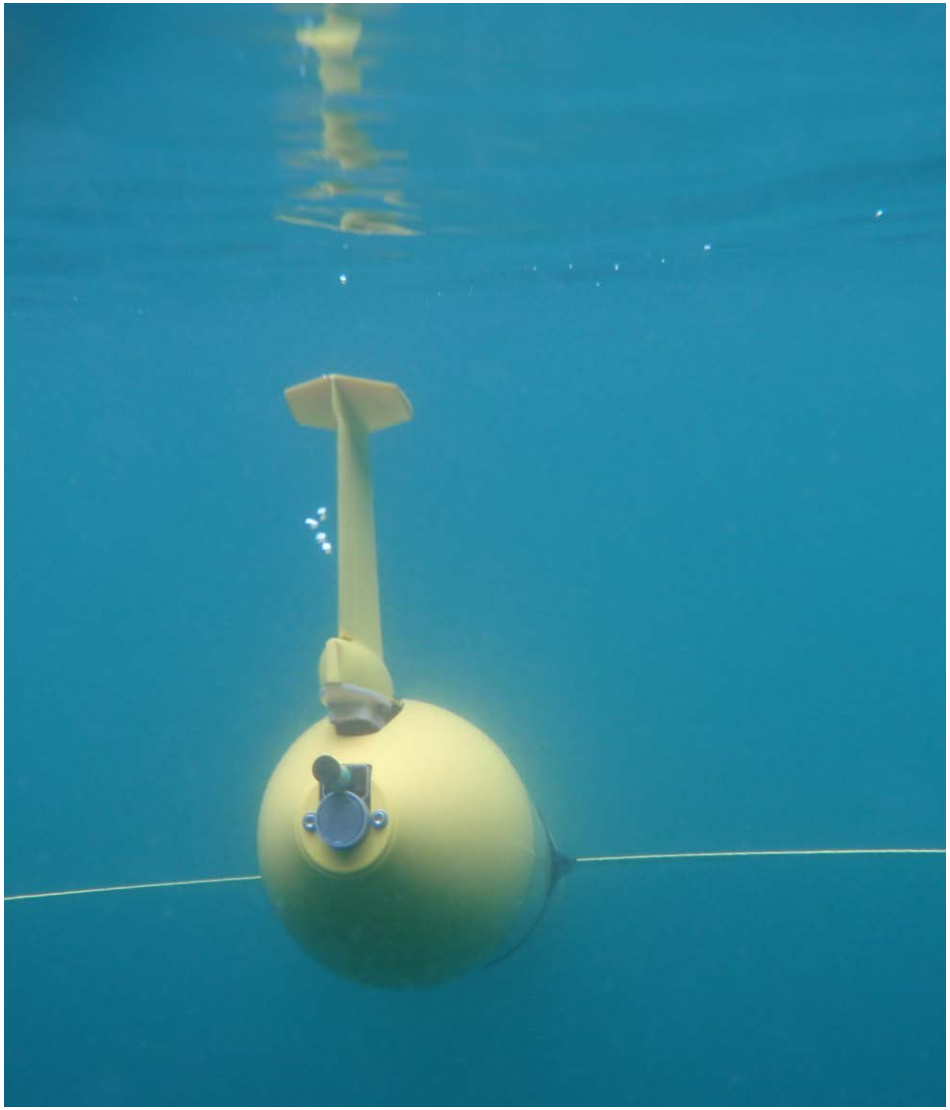


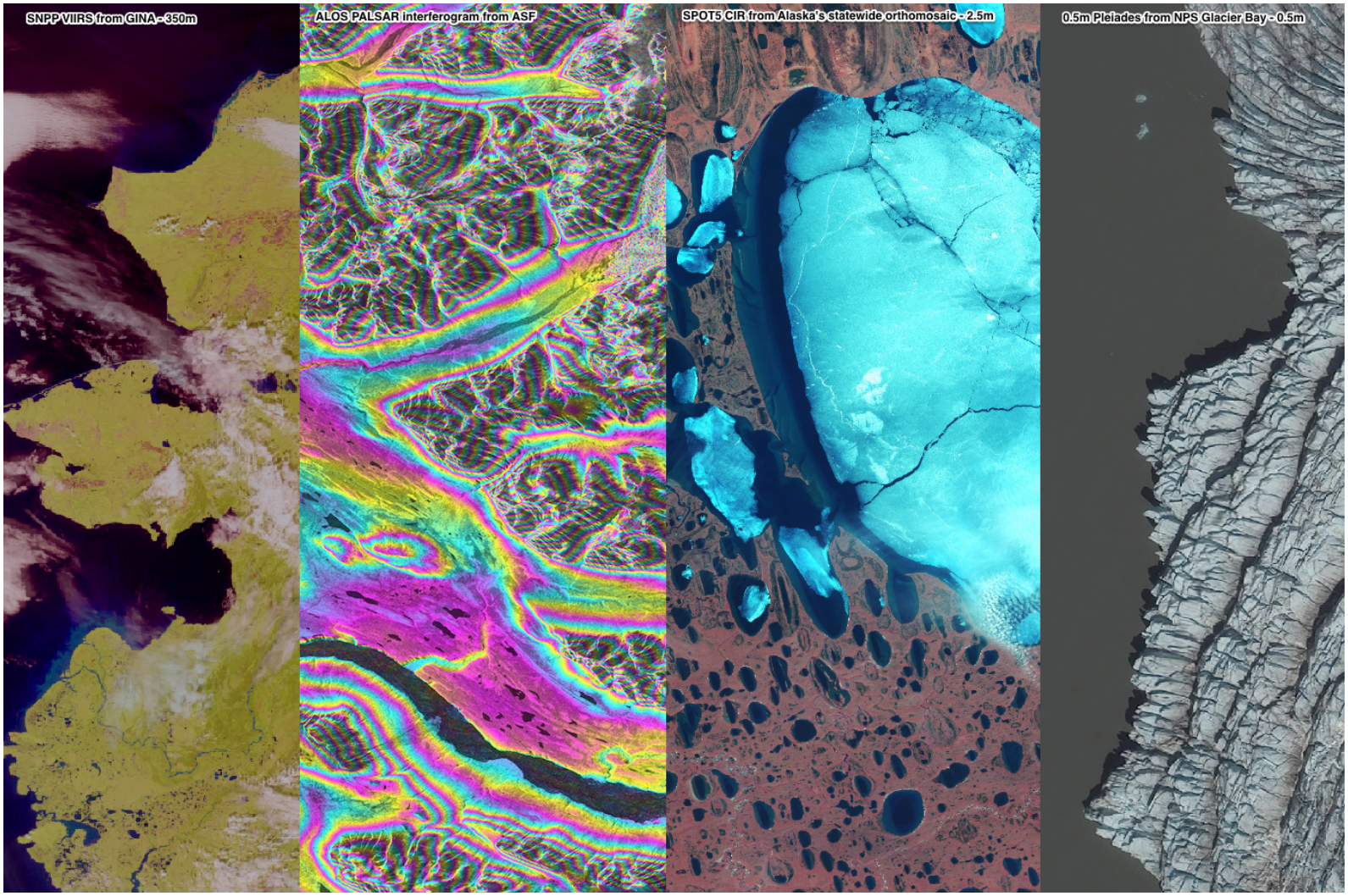



# AUV & UAV



# Satellite Remote Sensing

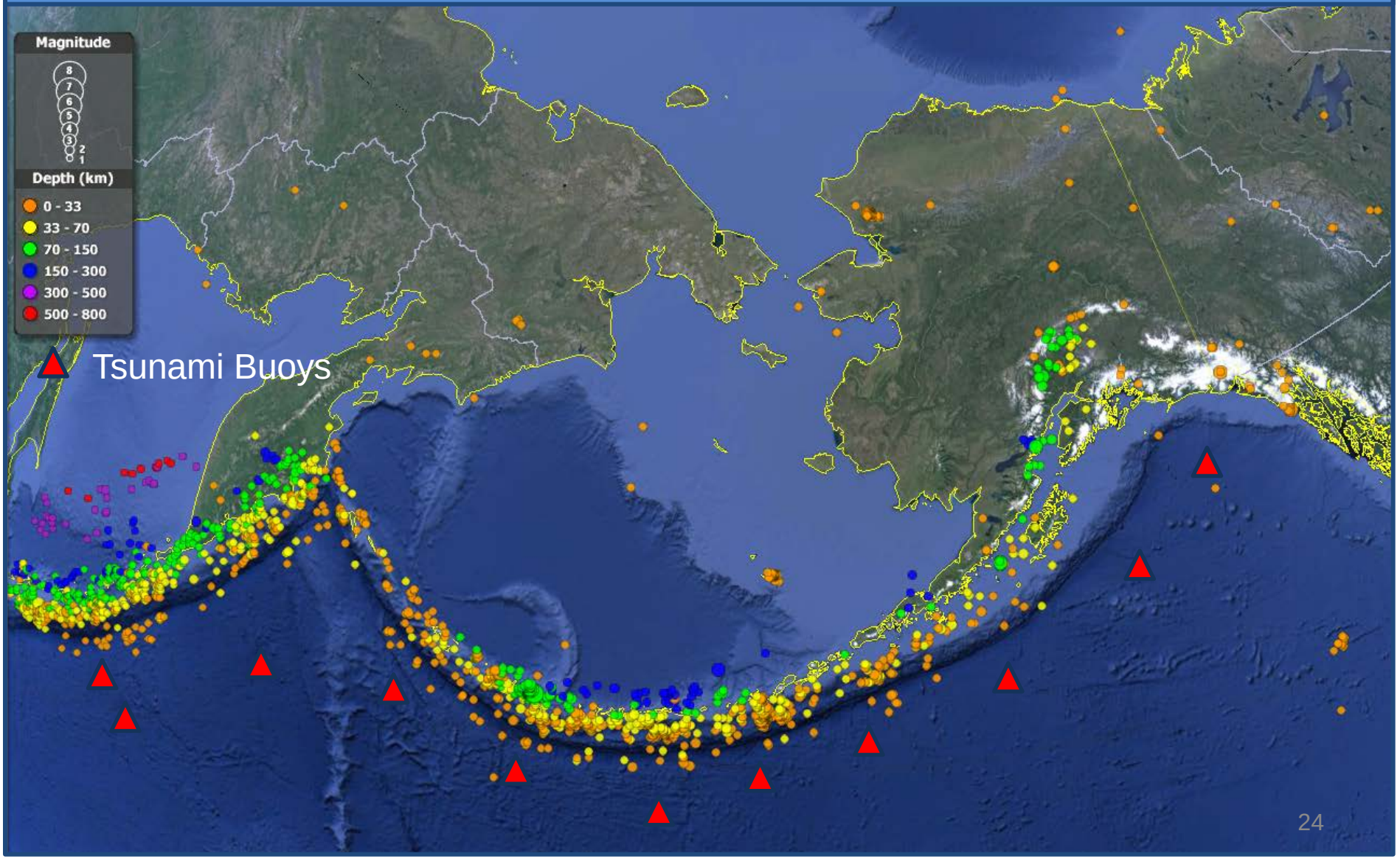


# TSUNAMI RISK

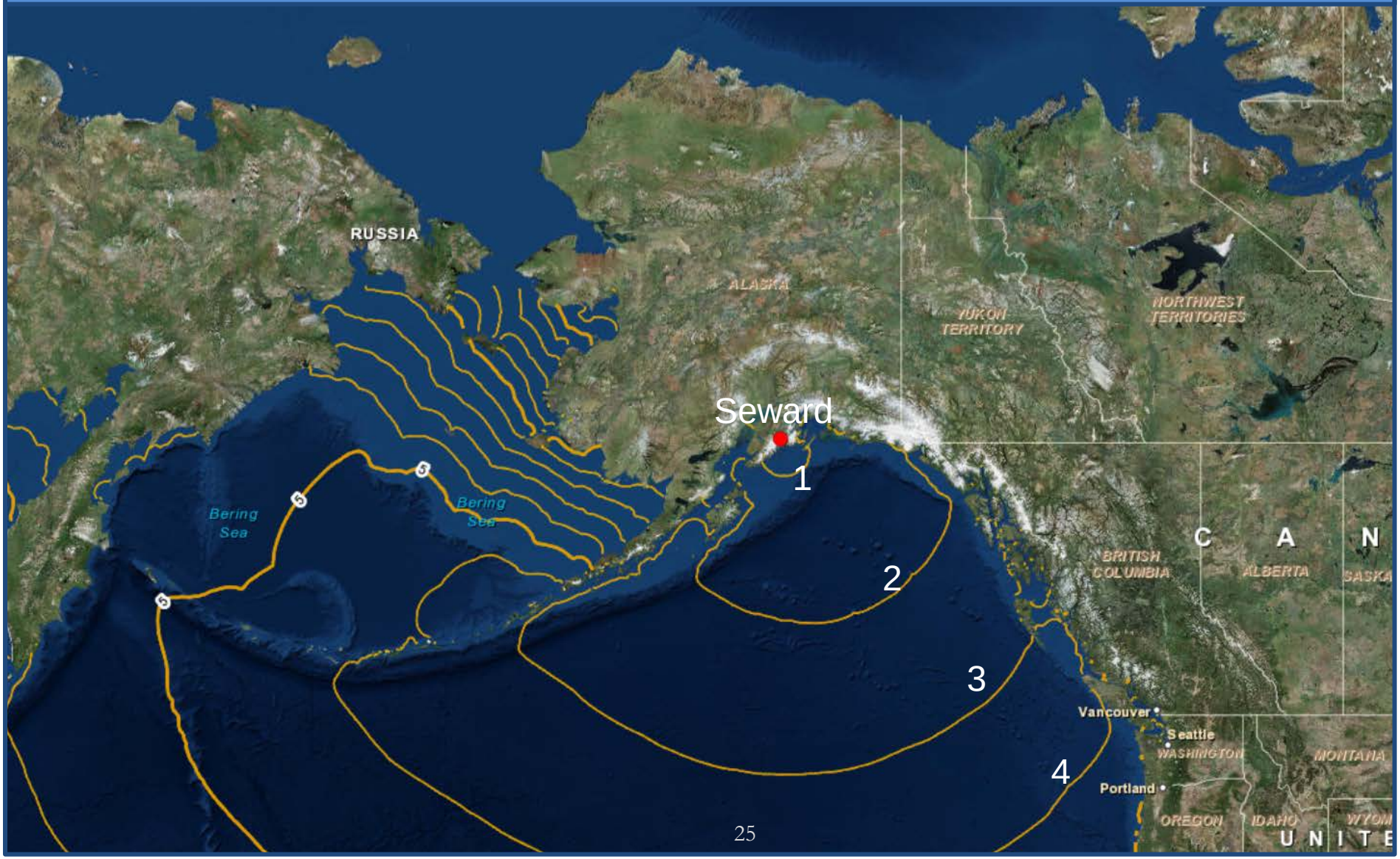
- Alaska is a seismically active region
  - ~ 24,000 per year
  - 11% of the world's earthquakes; 52% of U.S. earthquakes
- Alaska Earthquake Information Center (Geophysical Institute, University of Alaska, Fairbanks) – www.aeic.alaska.edu
- Alaska Arctic region located a long distance from Aleutian Megathrust

- City of Kodiak following 1964 9.2 magnitude earthquake.
- Photo by U.S. Navy, March 30, 1964 (photo credit: NOAA).

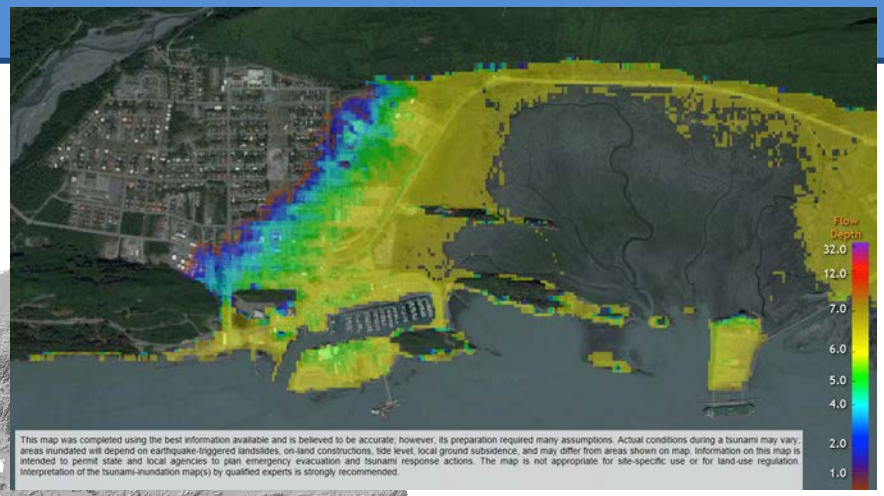
# M4+ Earthquakes, 2014-2015



# Tsunami Travel Time (hours)



# Tsunami Inundation Modeling







Important for:

- ➢ Public safety
- ➢ Community resilience

Needs:

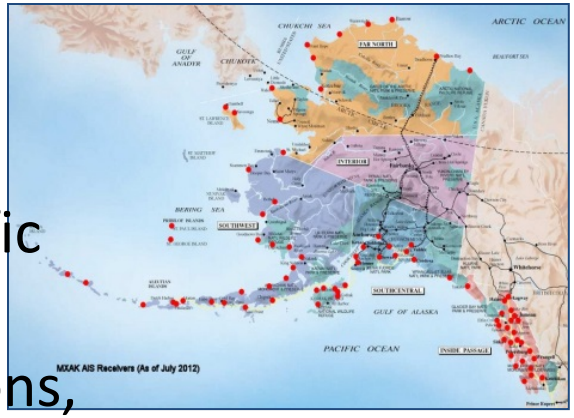
- ❖ Continued funding

# Arctic Alaska Deepwater Port

- USACE recently announced 12-month pause in Alaska Deep-Draft Arctic Port System feasibility study (Nome deepwater port)
- State of Alaska supports deepwater port development

# Vessel Traffic

- Not actively managed or monitored in the Bering Strait or in the U.S. Arctic
- No comprehensive system for real-time traffic monitoring
- Significant vulnerability for U.S. Arctic missions, including oil spill response, with regional "blind spots"
- The Coast Guard should expedite its evaluation of traffic through the Bering Strait to determine if vessel traffic monitoring systems are warranted
  - VTS (if warranted) coordinated with Russia
  - Broader satellite monitoring of AIS signals—govt, private




*Source: Responding to Oil Spills in the U.S. Arctic Marine Environment,* National Research Council (2014).



*Image source Alaska Marine Exchange*

# Shipping Traffic

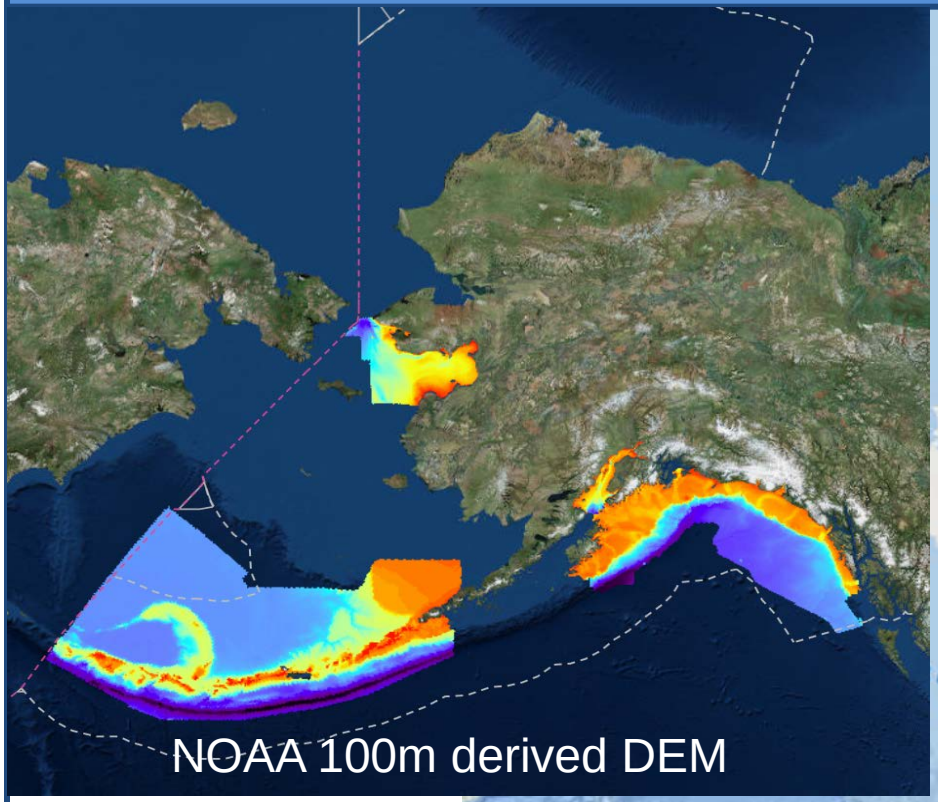
Dutch Harbor, Alaska. Photo credit NMFS.

- Increasing deep-draft vessel traffic in the Arctic environment
- Number of deep-draft vessels passing the Northern Sea Route has increased from 4 in 2009 to 70 in 2013 (http://www.arctic-lio.com).
- In 2012, 1,961 large vessels made 4,615 recorded trips through Unimak Pass (Nuka Research and Planning Group, LLC).
- Lack of deep water port and associated infrastructure exposes risk for lengthy response time for emergencies
- USCG's Kodiak station is 800 air miles from Chukchi Sea
- Dutch Harbor located 1,000 miles from Chukchi Sea

# Sea Routes and Infrastructure


*Source: Responding to Oil Spills in the U.S. Arctic Marine Environment,* National Research Council (2014).

# Bathymetric Coverage



# Coast Guard Needs

- Low level of presence in Arctic, especially in winter
- Current resources aren't adequate for overseeing Arctic oil spill response
- Coast Guard will need enhanced presence in the Arctic
  - area-specific training,
  - icebreaking capability,
  - improved vessel availability, and
  - aircraft and helicopter support facilities--open water, year-round
- Arctic assignments for trained and experienced personnel and tribal liaisons should be of longer duration
- Sustained funding will be needed to increase the USCG presence in the Arctic and to strengthen and expand their ongoing Arctic oil spill research programs

*Source: Responding to Oil Spills in the U.S. Arctic Marine Environment*, National Research Council (2014).

*Image source: USCG*