

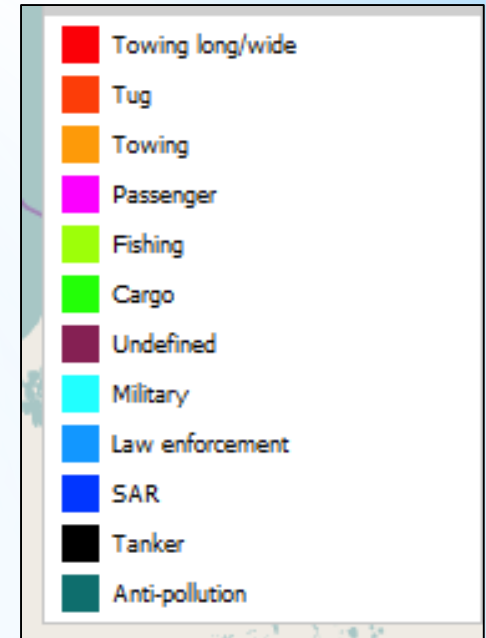
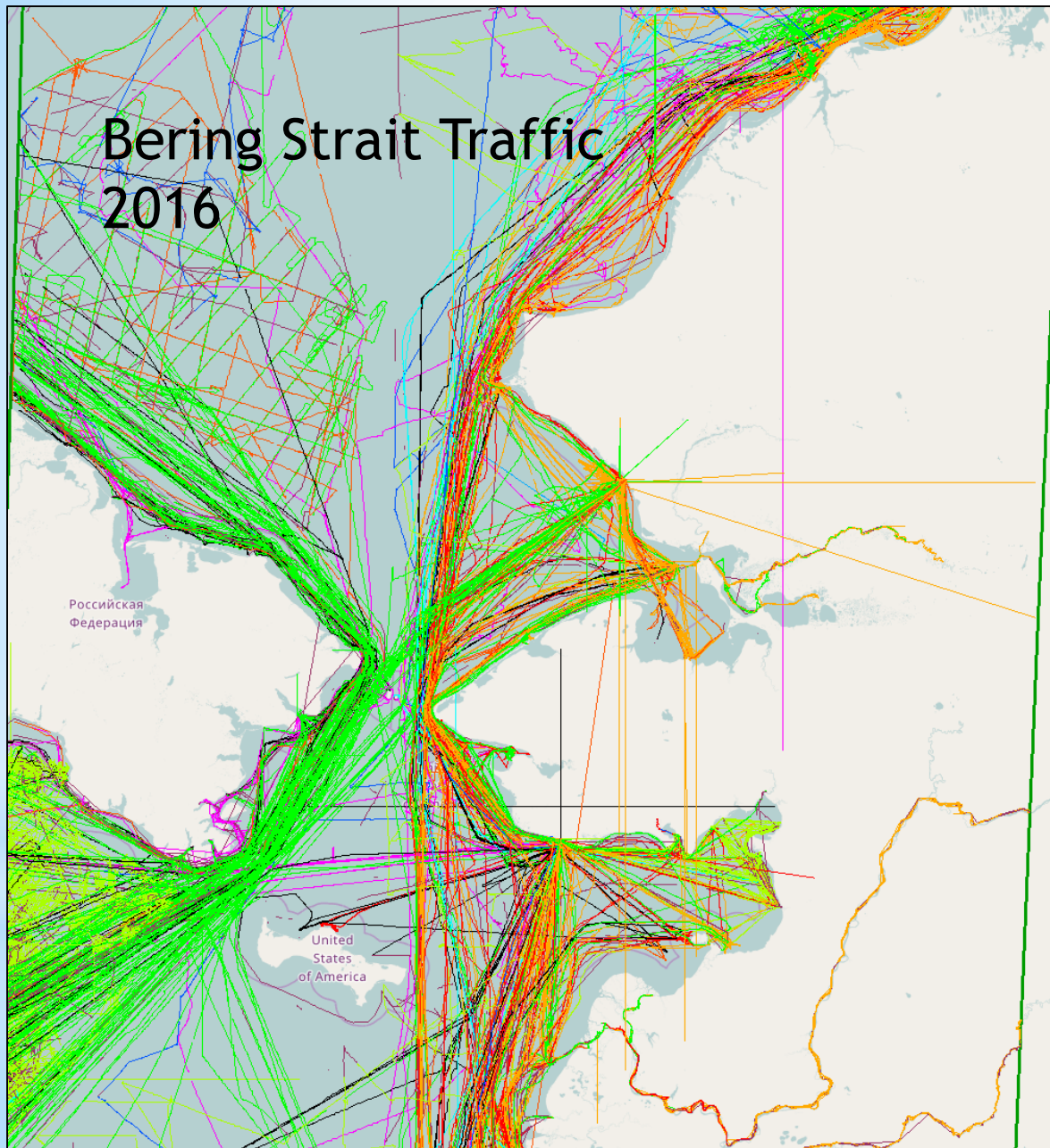


# E-Navigation

Applied Communications  
Key to Safe Arctic Shipping

AEC Top of the World  
Oulu, Finland June 14, 15 2017  
Paul Fuhs, Marine Exchange of Alaska

# Bering Strait Traffic 2016



2016

# PREVENTION IS CRITICAL

1. Oil spill response is limited.
2. Arctic response infrastructure is lacking
3. Marine mammals are the index species in the Arctic and must live at the surface of the water making them especially vulnerable.
4. These species are the basis of food security for many Arctic residents.
5. The financial and environmental cost of a oil spill in the Arctic would be catastrophic.



## Pollution Control Alaska Style





# AIS Display on Vessel



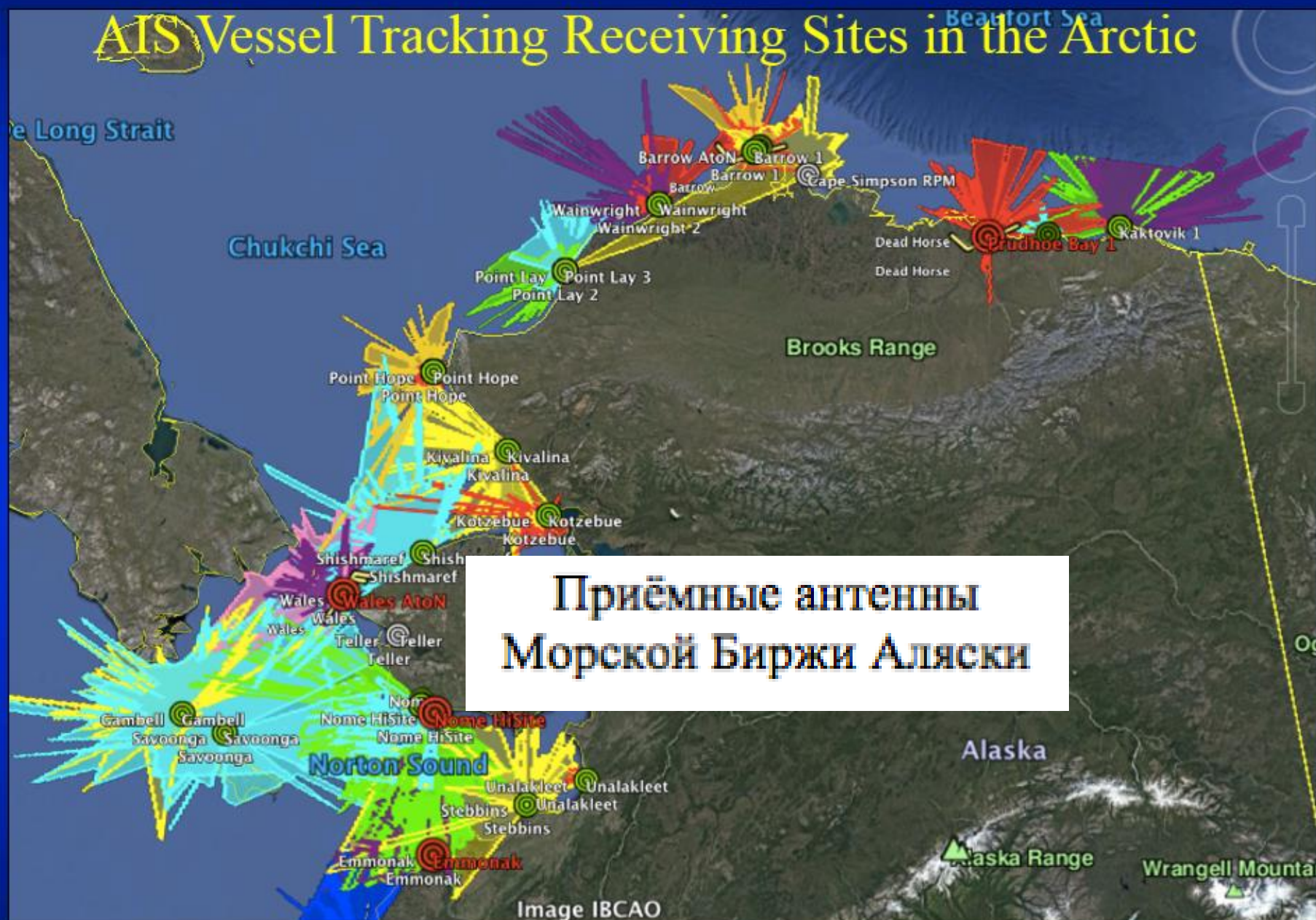


# AIS Vessel Tracking Receiving Sites in the Arctic “Maritime Domain Awareness”



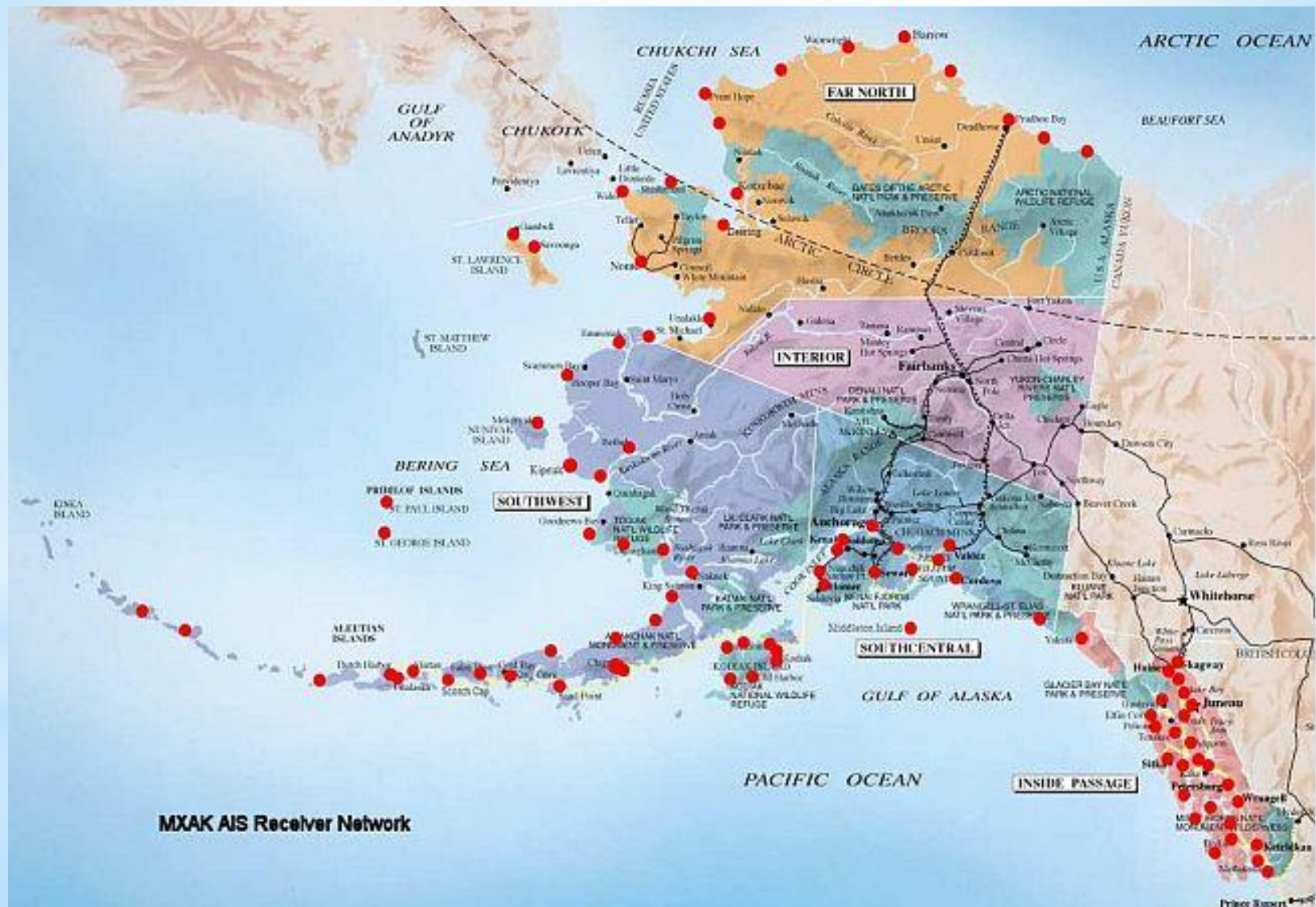
Приёмные антенны  
Морской Биржи Аляски

# AIS Vessel Tracking Receiving Sites in the Arctic



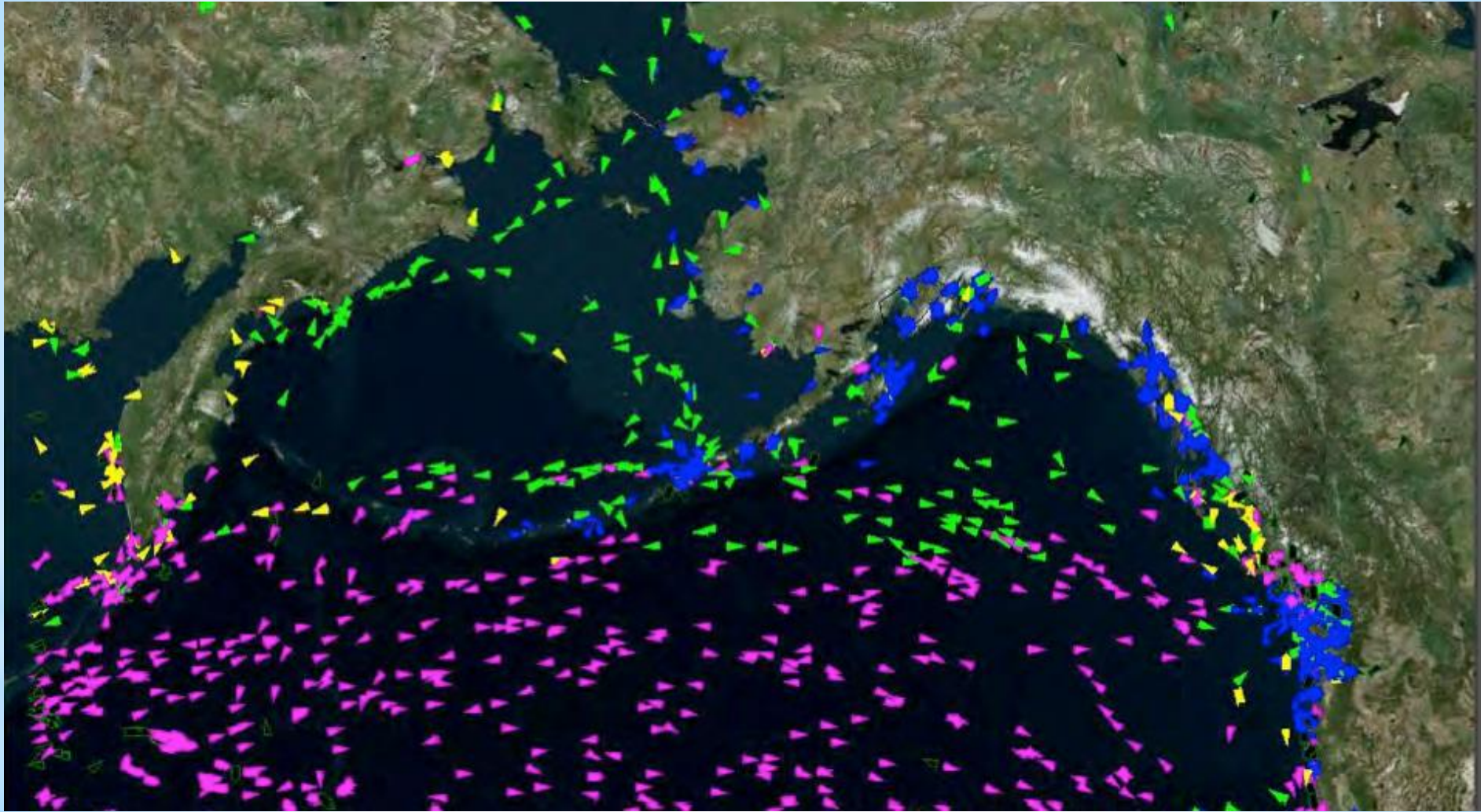


# \* MXAK Alaska AIS Network



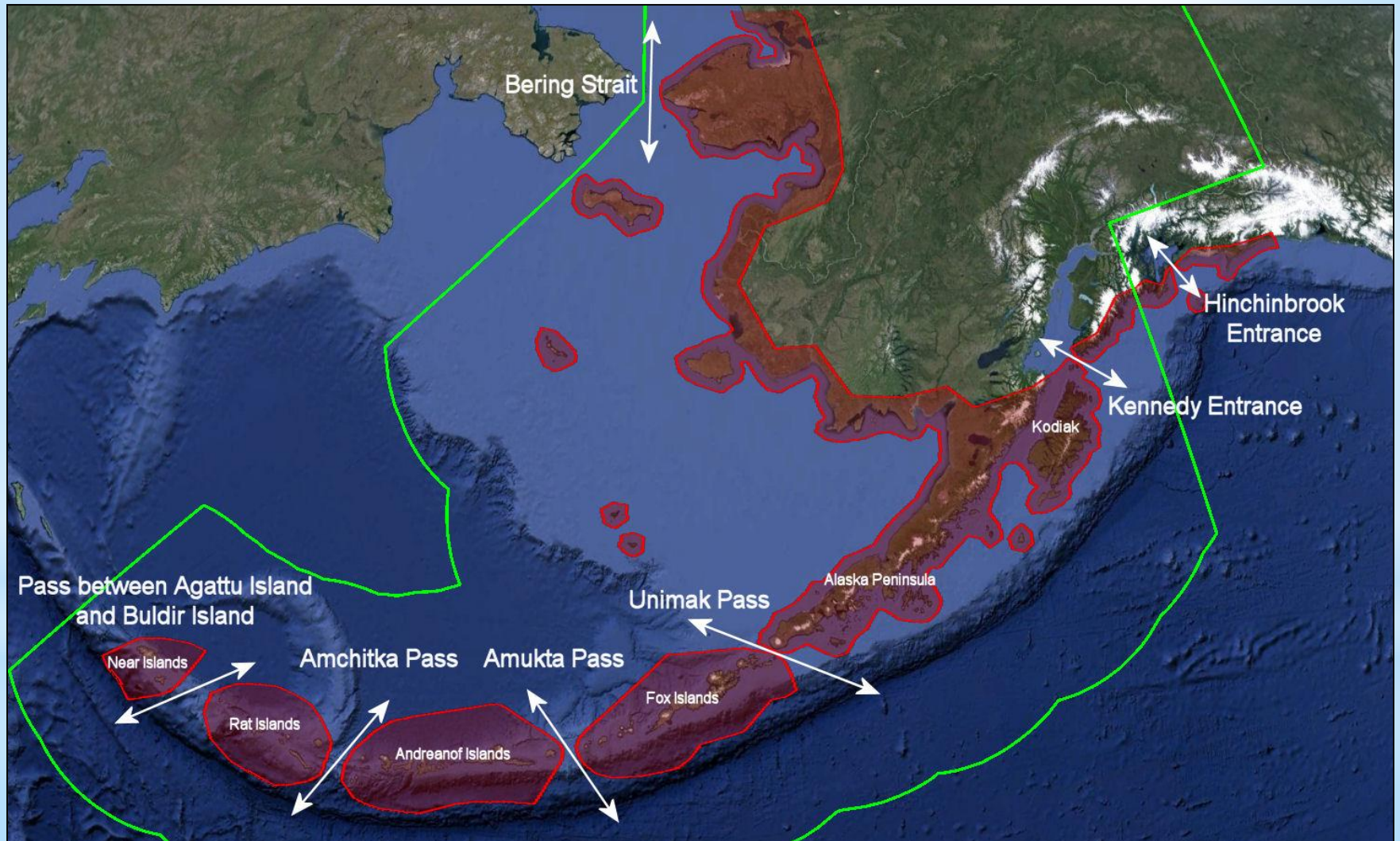


# Daily Traffic Report





# Area: 4 million Km<sup>2</sup>



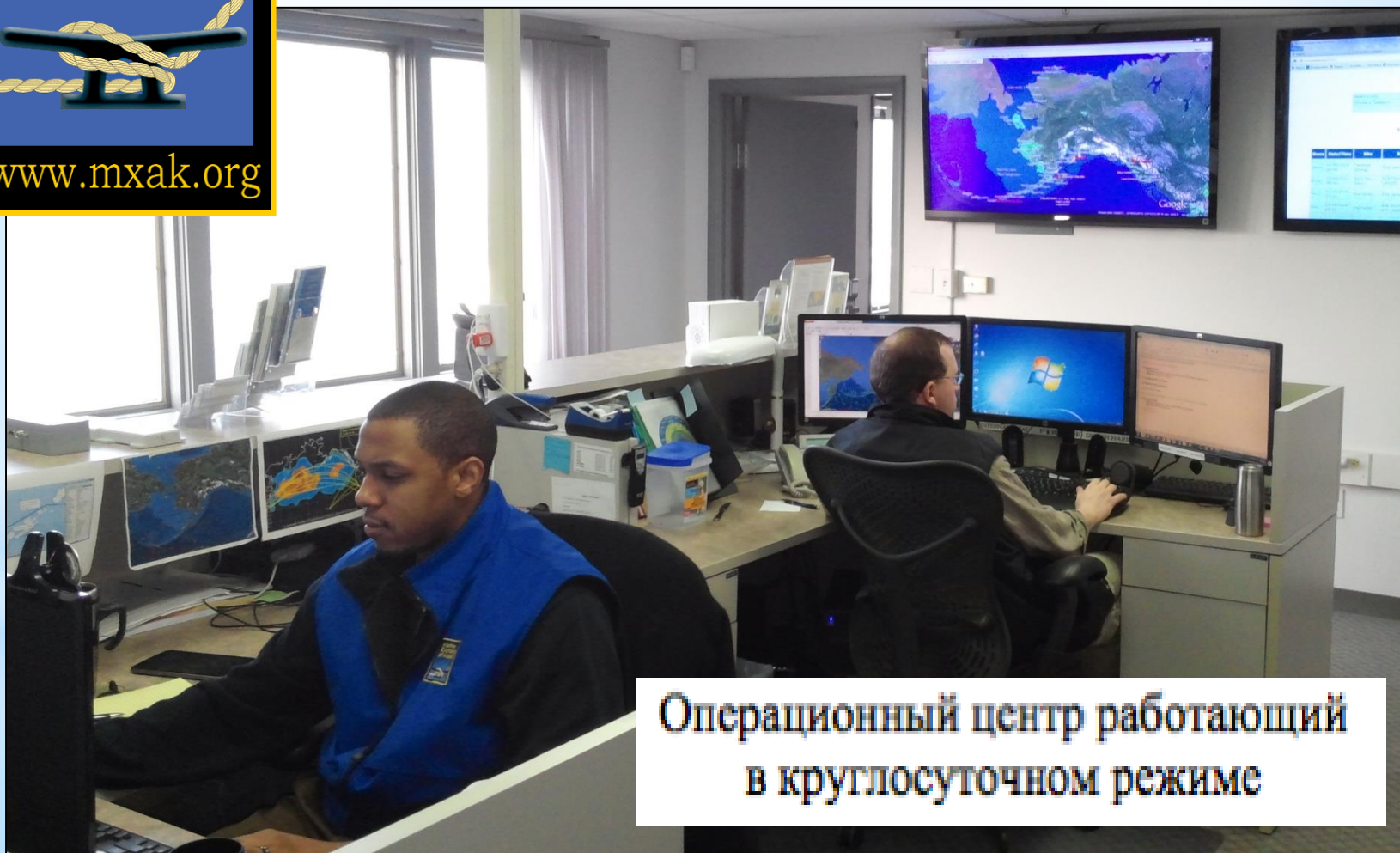


Marine  
Exchange  
of Alaska



[www.mxak.org](http://www.mxak.org)

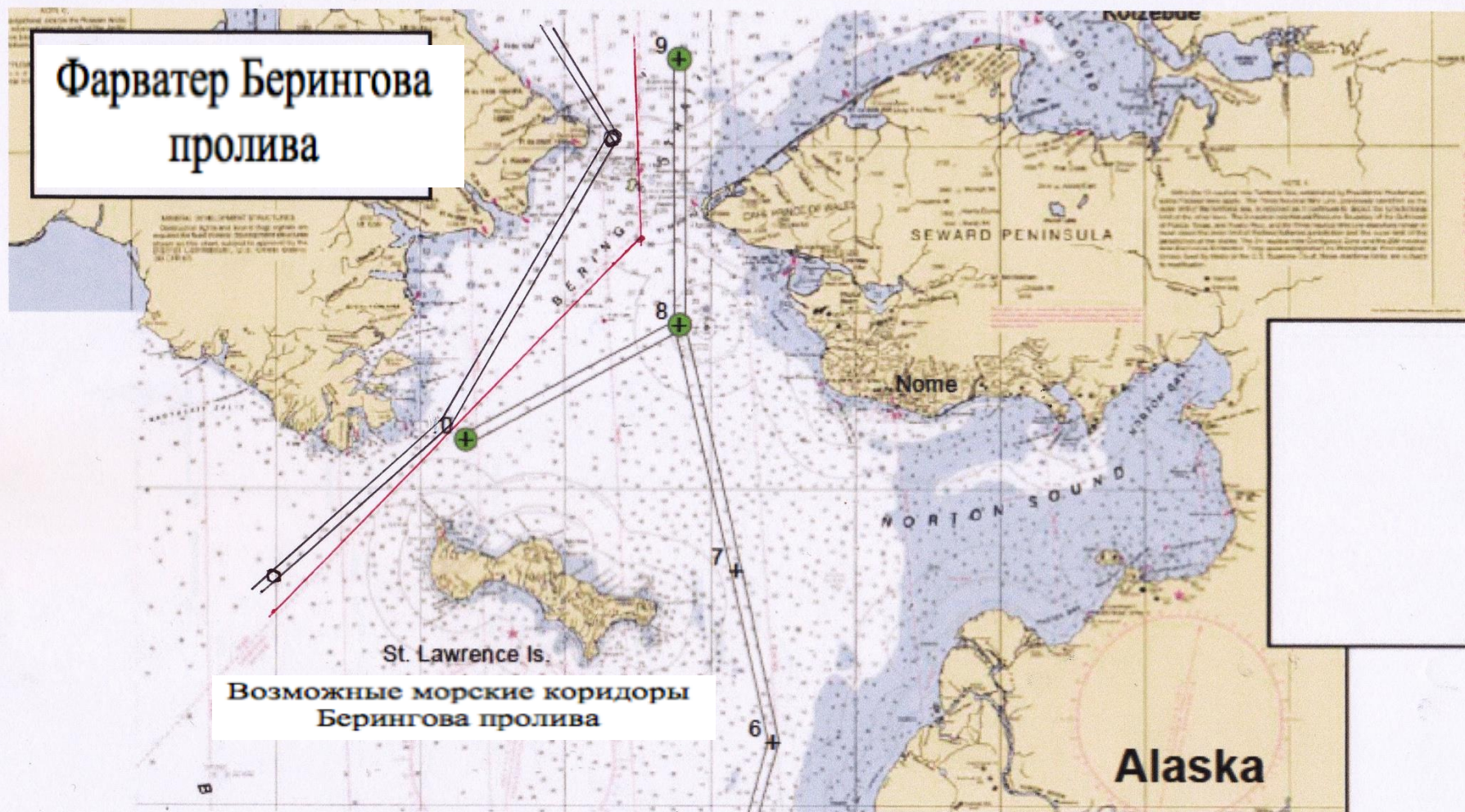
# Maritime Domain Awareness and Management



Операционный центр работающий  
в круглосуточном режиме



# Фарватер Берингова пролива



History Replay Pause



History Replay - Google C...

www.alaskaboats.org/VTS/HistoryRe...

History Replay

Date: 7/27/2016 8:46 AM  
Local: 7/26/2016 1:17:00 PM  
UTC: 7/26/2016 9:17:00 PM

Auto Manual Stop

<V <H <D <W <S <I <30s <

Y> H> D> W> 30s 1> 30s 15

Time Span: 12 Hours

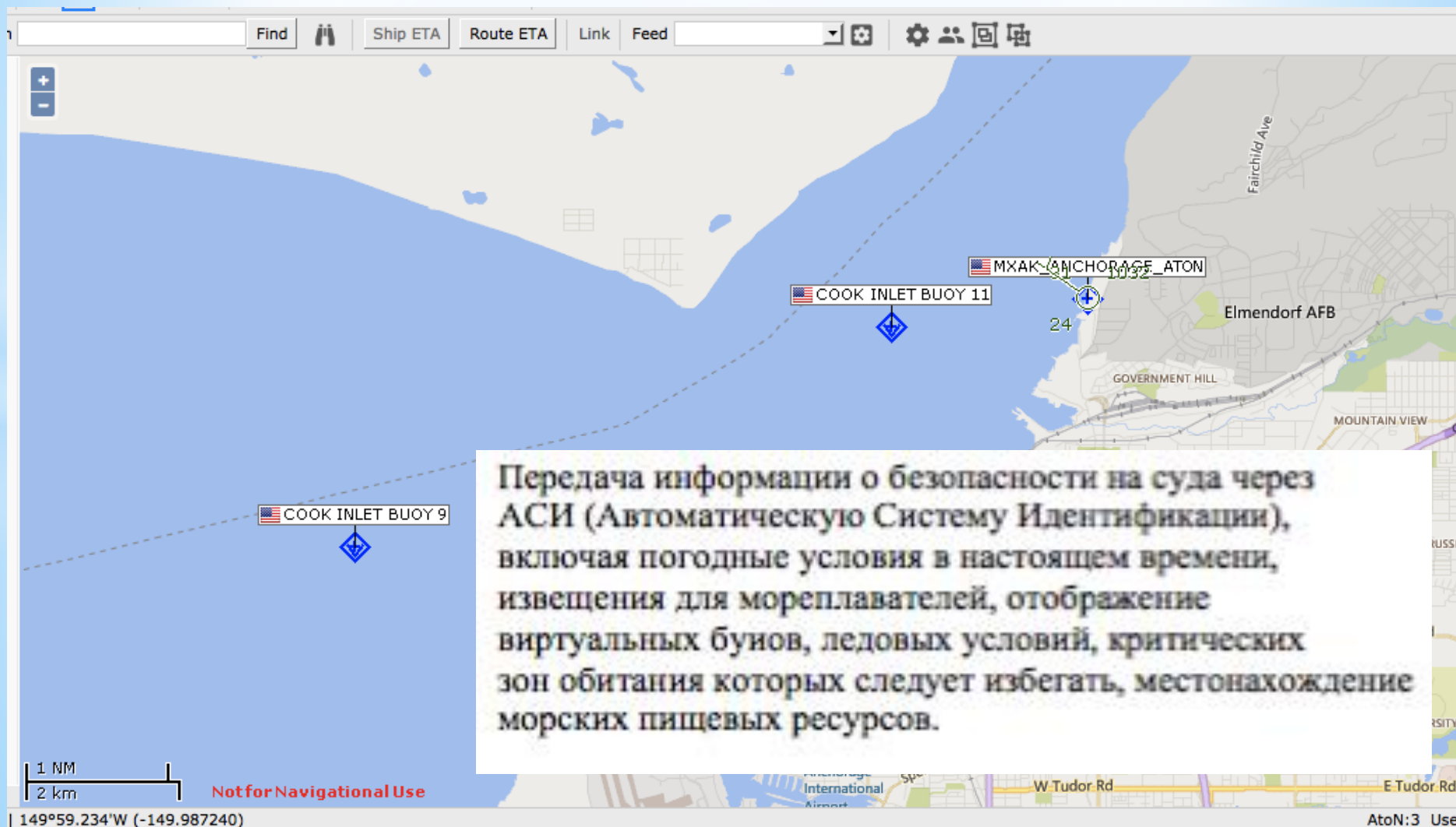
Ship Path All Paths Clear

Download Data Close

Реагирование спасательного судна



# Cook Inlet Aids to Navigation Transmitted via AIS



# Navigation Buoy in Ice





# Dynamic Resource Protection

## Shell Exploration Fleet Monitoring

AFFINITY  
AIVIQ  
ARCTIC SEAL  
CRESCENT ISLAND  
DOCTOR ISLAND  
FENNICA  
GUARDSMAN  
HARVEY EXPLORER  
HARVEY SISUAQ  
HARVEY SPIRIT  
IVER FOSS  
KAVIK RIVER  
KULLUK  
LAUREN FOSS  
NANUQ  
NOBLE DISCOVERER  
NORDICA  
NORSEMANII  
POINT OLIKTOK  
SANDRA FOSS  
SEAHORSE ISLAND  
SIDNEY FOSS  
STACEY FOSS  
TAI HARVEST  
TOR VIKING  
TUUQ







# UBER for Icebreakers





The screenshot shows a map of a coastal area with numerous vessels plotted. On the left, a list of vessel names and their distances from a point is displayed. A red box highlights this list, and a red arrow points to it with the text "Data Evaluated and Compared to Satellite AIS".

**Vessel List (Left Panel):**

- AFOGNAK (1m)
- ALASKA CHALLENGER (0m)
- APRIL LANE (3m)
- ARCTIC DAWN (0m)
- CRESCENT MOON (0m)
- DEFIANT (0m)
- DENALI (0m)
- DILIGENCE (0m)
- EIGIL B (0m)
- EL DORADO (1m)
- ENTRANCE POINT (0m)
- F/V COMMANDER (0m)
- F/V FRIGIDLAND (2m)
- F/V OWYHEE (0m)
- F/V REVIVAL (0m)
- F/V TACOMA (1m)
- FOUR DAUGHTERS (0m)
- FREEDOM (2m)
- GRACE C (0m)
- HAIDA CHIEF (0m)
- INVINCIBLE (2m)
- ISLAND DANCER (0m)
- JEAN C. (2m)
- KATHLEEN K (2m)
- LADY HELEN (0m)
- LADY KATE (0m)
- MAGIA (2m)
- MARILYN J (14m)
- MARY J (0m)
- MATILDA BAY (2m)
- MAY LYNN (0m)
- MORNING STAR (3m)
- NIGHT HAWK (1m)
- NORTHWIND (0m)
- OCEAN HARVESTER (0m)
- PACIFIC HARVESTER (0m)
- PACIFIC HORIZON (1m)
- PERSVERANCE (3m)
- ROEDDA (0m)
- SEA ERN (0m)
- SEQUEL (2m)
- SOVEREIGN GRACE (0m)
- ST. LAZARIA (1m)
- STELLA JO (0m)
- STORMBIRD (0m)
- TUGIDAK (0m)
- WINDHAM BAY (0m)
- YANKEE CLIPPER (0m)

## Data Evaluated and Compared to Satellite AIS



## Satellite AIS

## Terrestrial AIS

338108972 (1h 43m)  
ADAMANT (3h 16m)  
ALASKAN DREAM (1h 41m)  
AMERICAN PATRIOT (2m)  
ANITA (2h 11m)  
ANITA #4 12.2V (8h 16m)  
BANTER BAY (8h 55m)  
CAROLE B (45m)  
CONFIDENCE (1h 37m)  
CORAL LEE (46m)  
DEFIANT (5h 36m)  
EL DORADO (19h 12m)  
EQUINOX (45m)  
F/V FRIGIDLAND (5h 35m)  
F/V JALEO (2h 14m)  
F/V TALON (6h 28m)  
FV BARBARA (3h 56m)  
FV JENNIFER LEE (19h 19m)  
FV KIMBER (11h 13m)  
FV LOGAN T (3h 56m)  
HUKILAU (3h 52m)  
I GOTTA (20h 52m)  
ISLAND VOYAGER (46m)  
JODI MARIE (3h 56m)  
KALININ EXPRESS (5h 31m)  
KAMILAR (7h 16m)  
KAYLEIGH ANN (5h 32m)  
KENNICOTT (45m)  
LADY KATE (41m)  
LONE FISHERMAN (12h 53m)  
LYNDA (3m)  
MARATHON (3h 56m)  
MATILDA BAY (7h 8m)  
MAYA T (2h 16m)  
NORTHWIND (45m)  
PRIEST POINT (5h 37m)  
ROEDDA (7h 16m)  
SALVATION (47m)  
SEA OTTER EXPRESS (20h 55m)  
SHENANDOAH (1h 44m)  
SPIRIT (14h 26m)  
ST. NADEZHDA (1h 37m)  
STELLA JO (1h 33m)  
THERESA MARIE (2h 16m)  
TRUE LOVE (4h 50m)  
VIAGGIO (22h 34m)

338108972 (1h 43m)  
ADAMANT (1m)  
ALASKAN DREAM (0m)  
ALEUTIAN SUN (0m)  
AMERICAN EAGLE (1h 58m)  
AMERICAN PATRIOT (2m)  
ANITA (0m)  
BANTER BAY (2m)  
CAROLE B (0m)  
CONFIDENCE (7m)  
CORAL LEE (0m)  
DEFIANT (1m)  
DREAM MAID (1m)  
EL DORADO (0m)  
EQUINOX (0m)  
F/V FRIGIDLAND (3m)  
F/V JALEO (3m)  
F/V TALON (2m)  
FV BARBARA (2m)  
FV JENNIFER LEE (0m)  
FV KIMBER (2m)  
FV LOGAN T (2m)  
HUK 6 12.6V (2m)  
HUKILAU (4m)  
ISLAND VOYAGER (0m)  
JODI MARIE (0m)  
KALININ EXPRESS (4h 39m)  
KAMILAR (2m)  
KAYLEIGH ANN (2m)  
KENNICOTT (0m)  
L3\_ATON (0m)  
LADY KATE (0m)  
LONE FISHERMAN (0m)  
LYNDA (2m)  
MARATHON (0m)  
MATILDA BAY (0m)  
MAYA T (2m)  
NORTHERN SONG (0m)  
NORTHWIND (0m)  
OTTER (2m)  
PLEIADES (2m)  
PRIEST POINT (1m)  
R.B. (0m)  
REPUBLIC (1m)  
ROEDDA (1m)  
ROSIE M (2m)  
SALVATION (0m)  
SEA OTTER EXPRESS (0m)  
SHENANDOAH (2m)  
SPIRIT (0m)  
ST. LAZARIA (5m)  
ST. NADEZHDA (0m)  
STELLA JO (0m)  
TACOMA (1m)  
THERESA MARIE (0m)  
TRUE LOVE (0m)  
VIAGGIO (2m)

Columns at left show  
the vessels captured by  
satellite and terrestrial  
AIS and the time lapse

Vessels enclosed in red  
boxes were only  
detected by terrestrial  
AIS

## Examples of Reporting Delays

### Satellite AIS

ADAMANT (3h 16m)

KAYLEIGH ANN (5h 32m)

TRUE LOVE (4h 50m)

ADAMANT (1m)

KAYLEIGH ANN (2m)

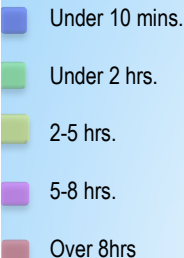
TRUE LOVE (0m)

Less  
vessels  
detected  
by  
satellite  
AIS

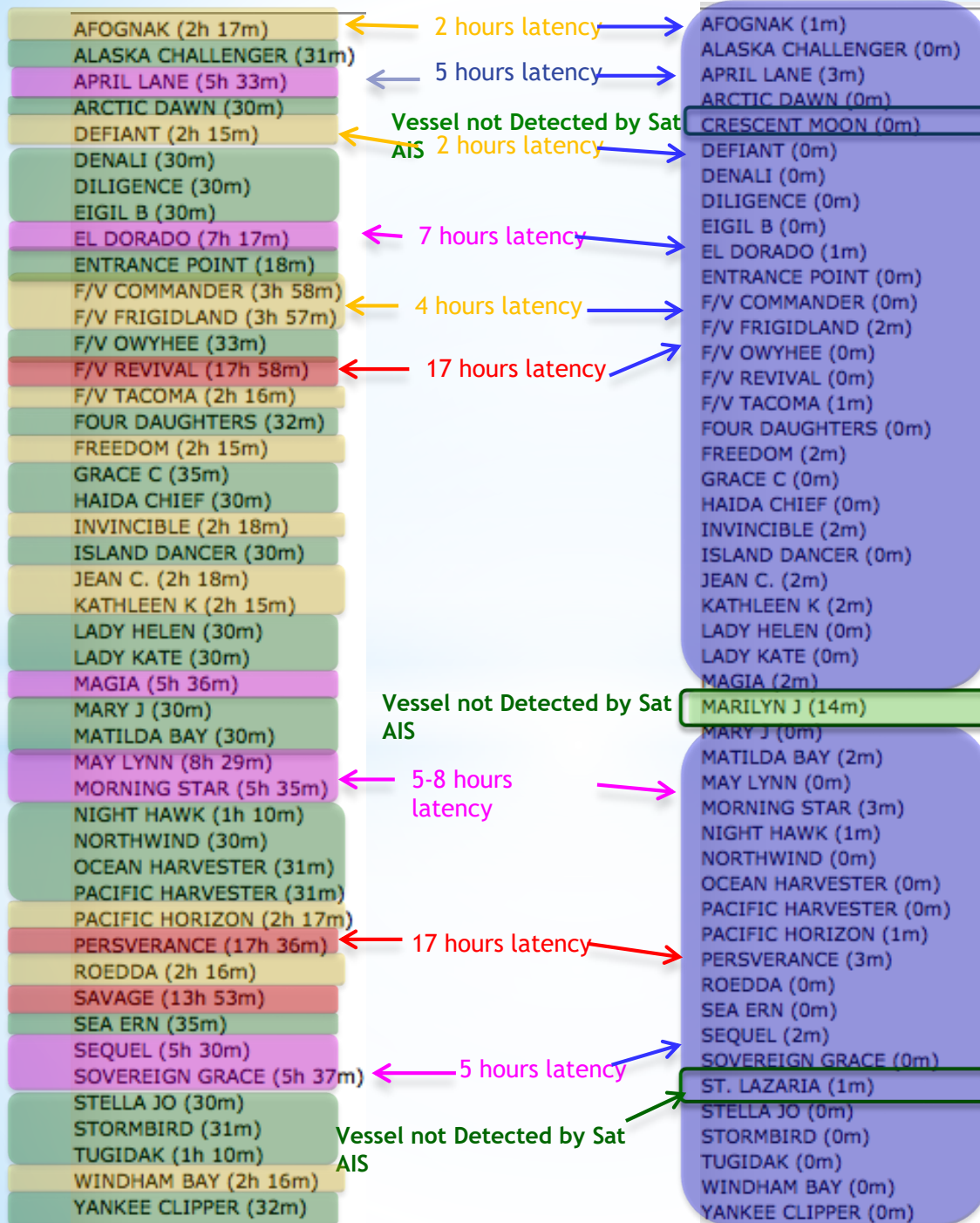
# Satellite AIS

# Terrestrial AIS

## Signal Latency



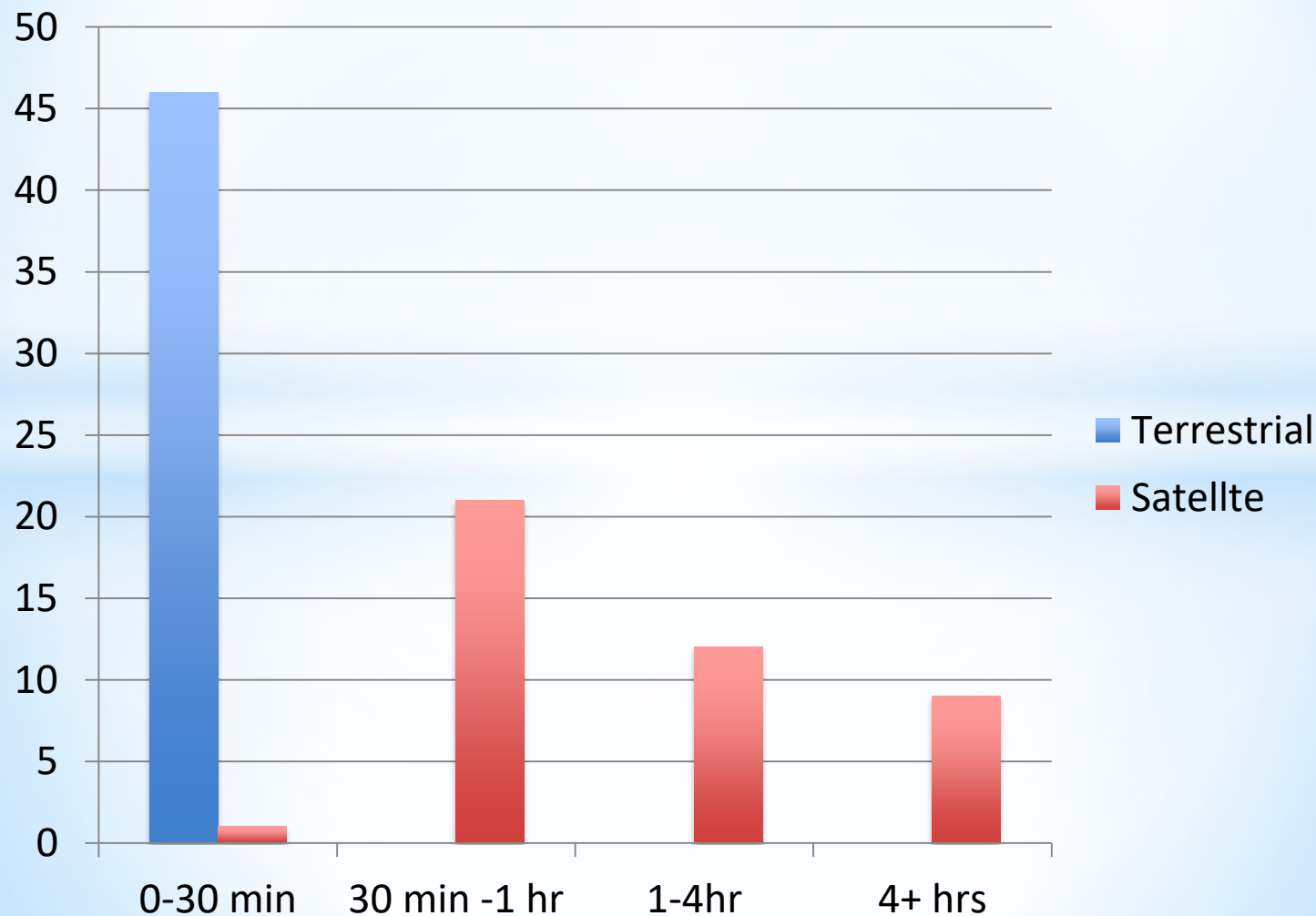
Vessels  
% over 2 hour delay





# \* Satellite and Terrestrial AIS Comparison

## Vessels in Sitka Alaska - March 2016



# Sinking of F/V DESTINATION and Loss of Crew - Feb 2017

Satellite Report 1 hour 40 minutes Delay  
Approx 20 miles off from sinking location

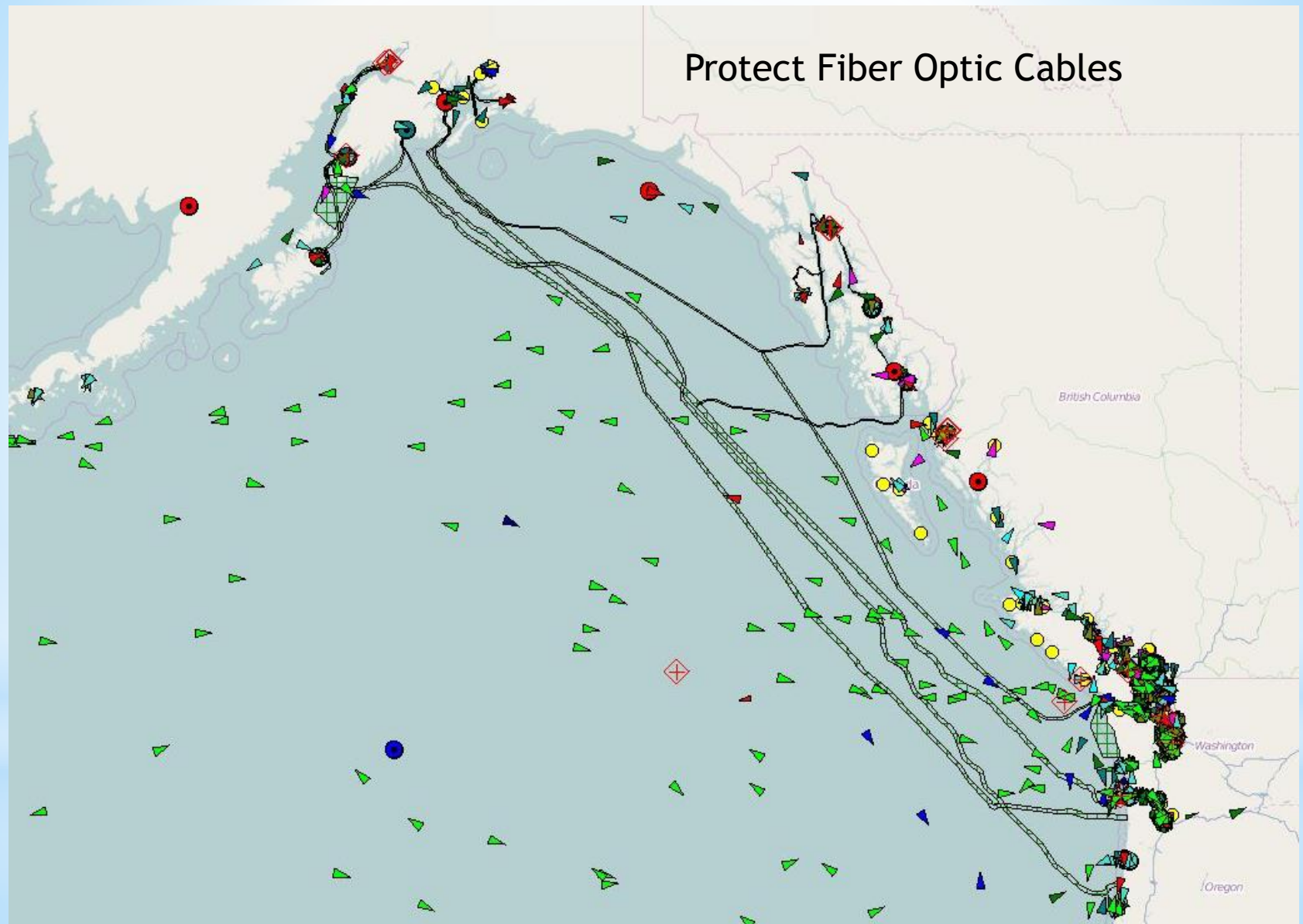




## \* Arctic Vessel Communications Policy Goals:

- \* 1. Standardized vessel tracking and monitoring requirements throughout Arctic.
- 2. Vessel AIS systems must have latest software to display weather, ice and other data from terrestrial stations.
- 3. Vessel AIS systems must be connected to the emergency power systems of the vessel.
- 4. Undersea fiber optic communications systems must be protected.
- 5. A combination of terrestrial and satellite systems provides the most reliable and accurate vessel tracking data.

## Protect Fiber Optic Cables







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