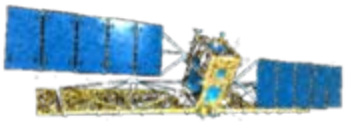

U.S. COAST GUARD
COAST GUARD
INNOVATION
UNLOCKING THE POWER OF IDEAS

UNCLASS

National / Naval Ice Center (NIC)



NIC Brief
Session on Coast Guard Missions and Tomorrow

USCG Innovation Expo
18 November 2009

Dr. Pablo Clemente-Colón, Chief Scientist

USCG

USN

NOAA

The National Ice Center (NIC) Mission and Structure

- **Tri-agency organization**
  - 50 military and civilian personnel in Washington, D.C. metro area
  - Global sea ice analysis and forecasting
- **International Partnerships**
  - North American Ice Service (NAIS)
    - Canadian Ice Service (CIS)
    - International Ice Patrol (IIP)
  - International Arctic Buoy Programme (IABP)
  - International Ice Charting Working Group (IICWG)

NAIS

IAPB

IICWG

Mission: provide the highest quality timely, accurate, and relevant snow and ice products and services to meet the strategic, operational, and tactical requirements of U.S. national interests across a global AOR.

NIC Organization Structure

United States Fleet Forces Command

Commander Naval Meteorology & Oceanography Command (CNMOC)

Naval Oceanographic Office Stennis Space Center, MS (NAVOCEANO)

NAVICECEN Naval Ice Center

NOAA

National Environmental Satellite, Data & Information Service (NESDIS)

Office of Satellite Data Processing & Distribution (OSDPD)/ Center for Satellite Applications & Research (STAR)

National Ice Center

COMMANDANT United States Coast Guard

Operations Directorate (CG-3)

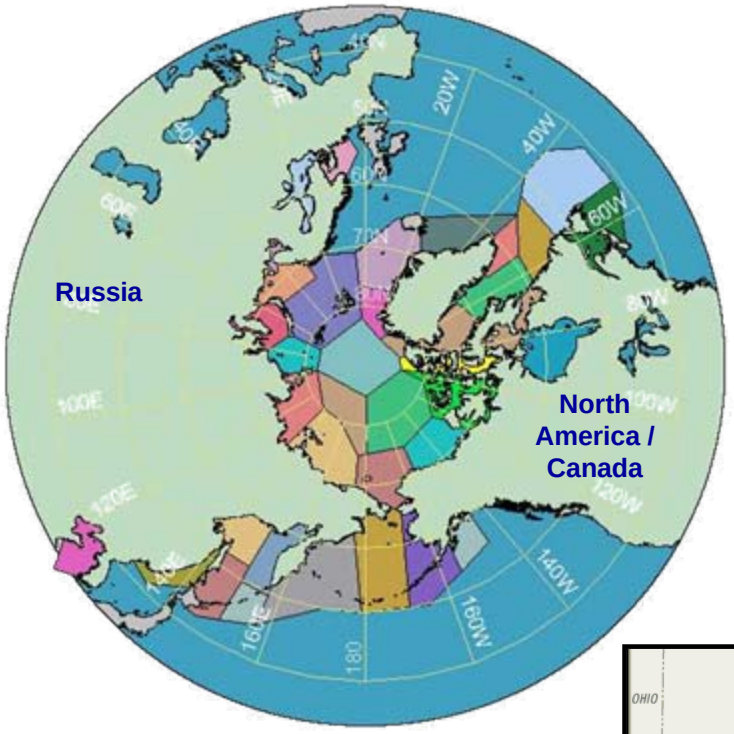
Waterways Management Directorate (CG-3PW)

Office of Maritime Transportation System (CG-3PWM)

Mobility & Ice Operations Division (CG-3PWM-3)

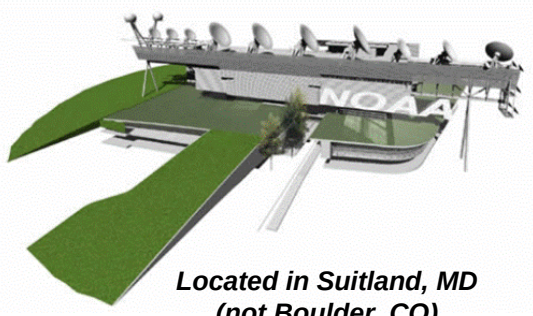
National Ice Center

NIC Area of Responsibility - Global



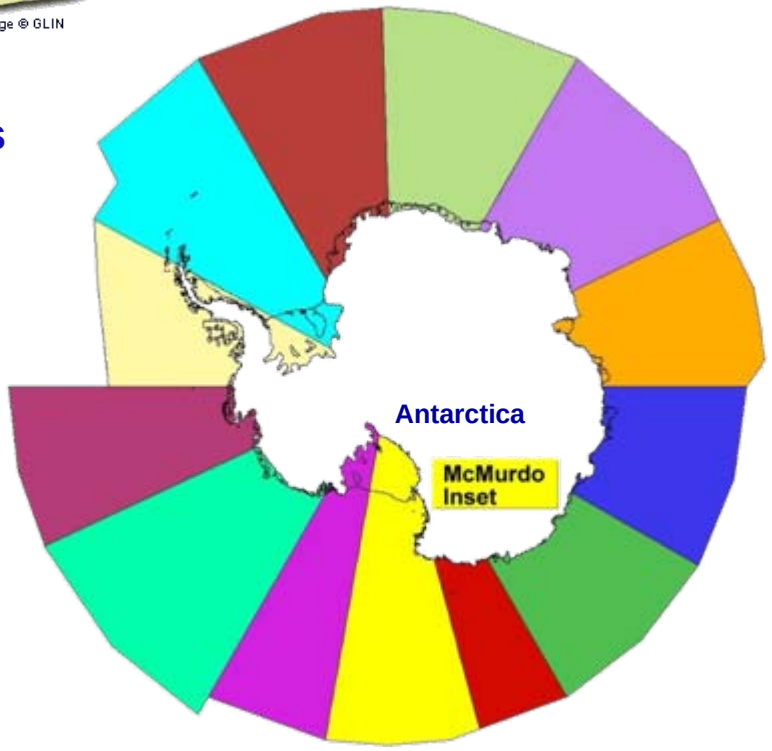
Arctic (including Sea Of Japan, Sea of Okhotsk, and Yellow Sea)

Great Lakes



Located in Suitland, MD (not Boulder, CO)

Chesapeake / Delaware Bays

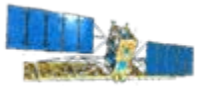


Antarctic

Operations and Product Generation

Human, Derived, Automated, and Reconfigured

Inputs

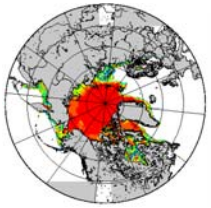


Satellites

Aircraft

Surface Obs

Buoys



Models

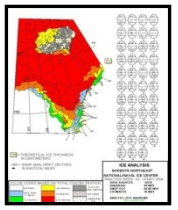
Expert Ice Analyses, Forecasting, and Quality Control

Data Fusion

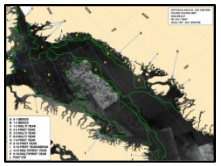
Derived Data Automation

Direct Data Dissemination

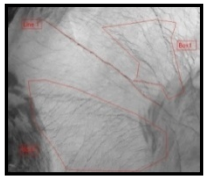
Products



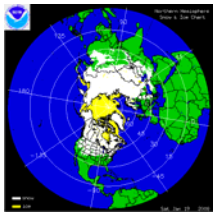
Hemispheric and Regional Ice Charts



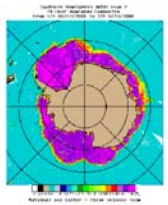
Annotated Images



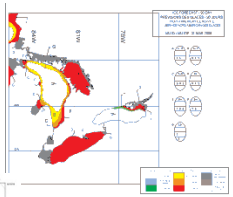
Fractures, Leads and Polynyas (FLAP)



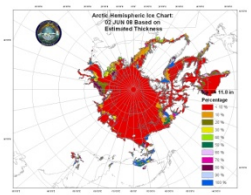
IMS snow and ice maps



Microwave Sea Ice Concentration products



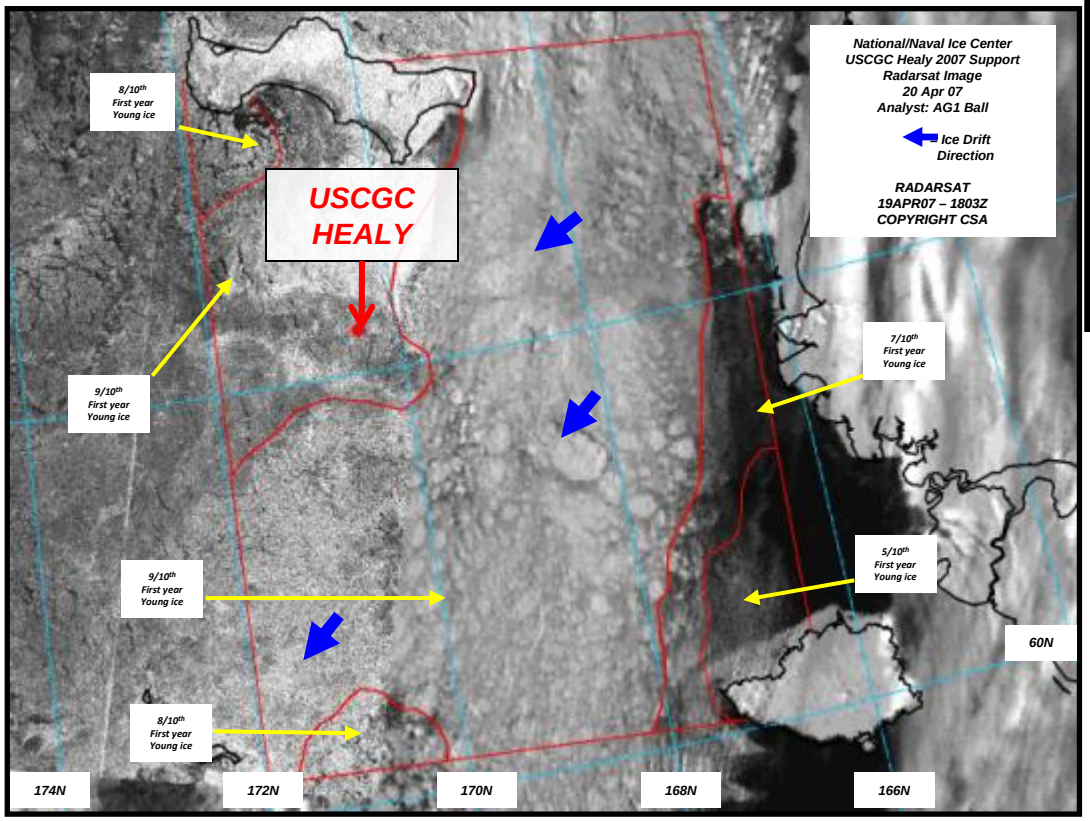
Ice Forecast Outlooks



Ice Thickness Estimations

Safety of Navigation, Life & Property

USN, NSF, CCG, USCG



Support provided for Spring 07 USCGC HEALY cruise

CCGS Wilfred LAURIER

USS ALEXANDRIA

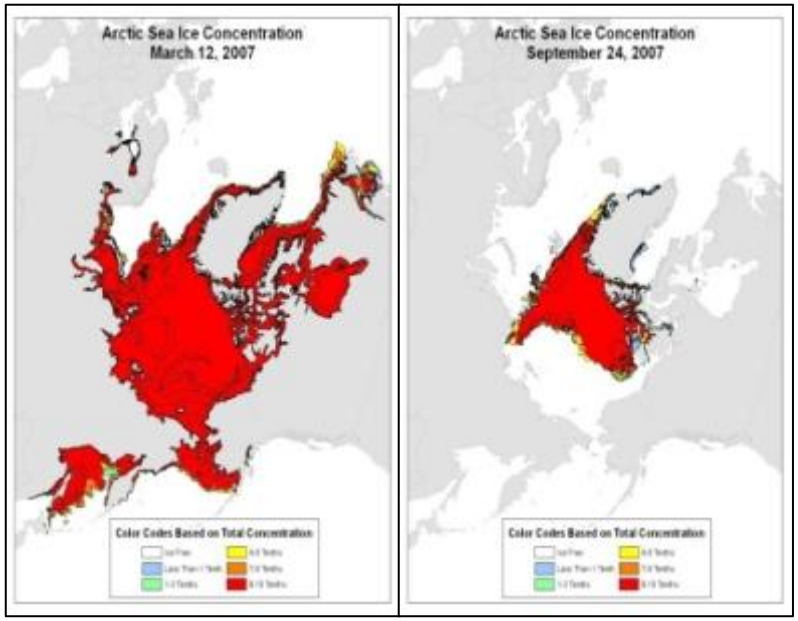
"Our use of Arctic transits to support higher presence levels in the PACOM AOR is an example of how we are making full use of every asset we have in the most productive way we can"

VADM MUNNS, COMSUBFOR

Mission Planning

US Submarine Forces, Arctic Submarine Lab, US Coast Guard

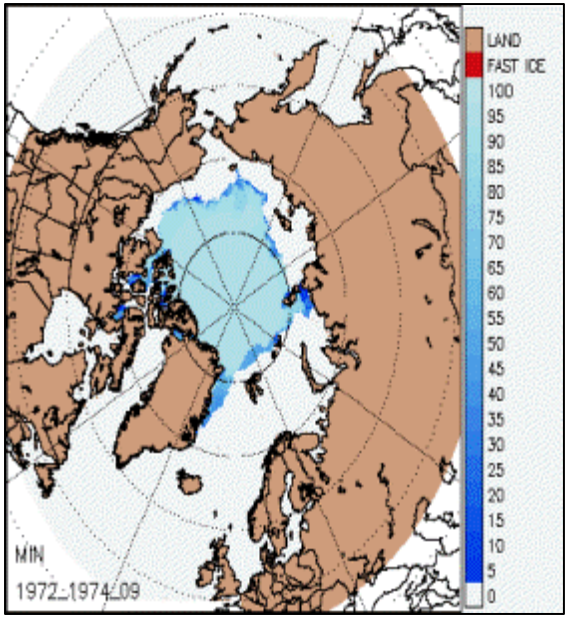
Intra-annual Extreme Ice Conditions



Ice Area = 14.16 million sq km

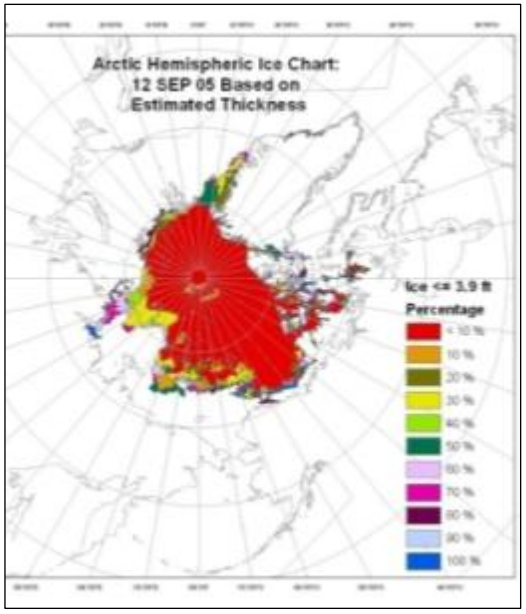
Ice Area = 3.98 million sq km

33 year Arctic Climatology dataset



Archived at NSIDC

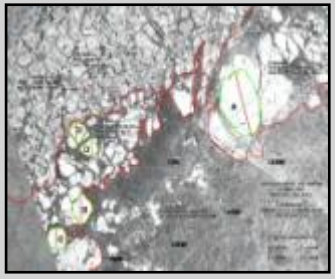
Thickness inferred from stage of development



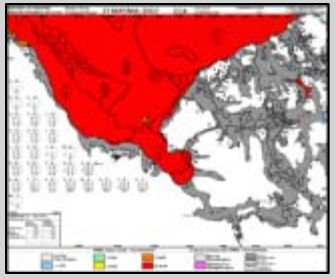
Used by ASL

Surfaced submarine in Arctic

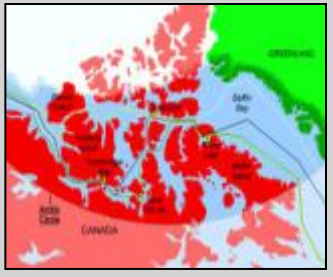
Environmental effects on ships



Floe identification for Ice Camp 2007



Arctic Seasonal Outlook

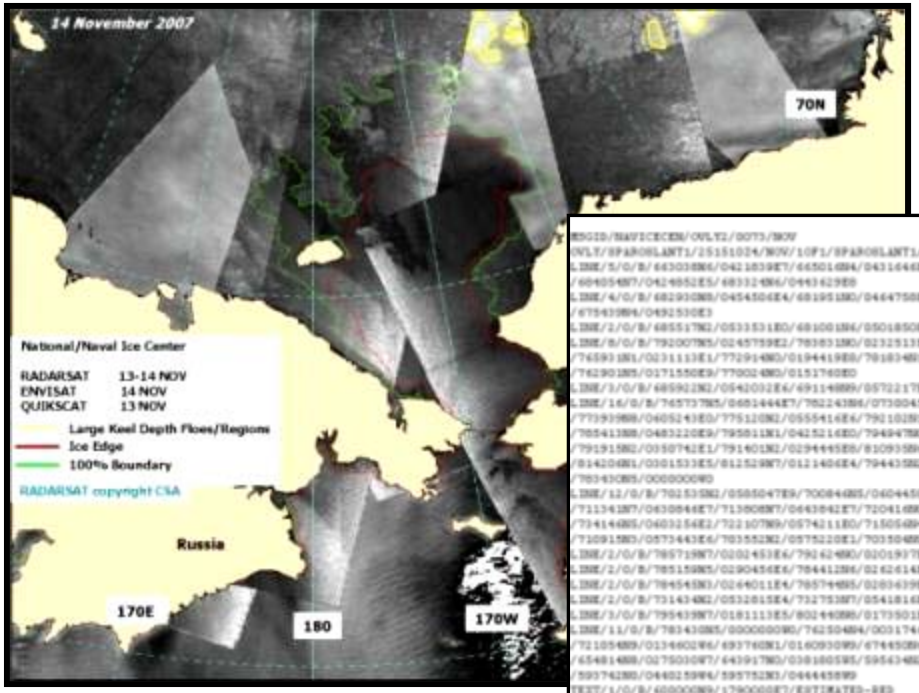


Northwest Passage Routes

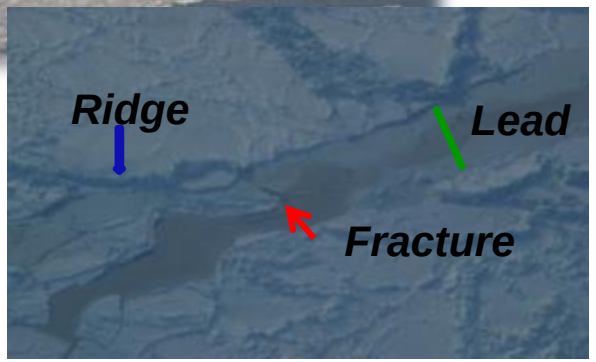
Situational Awareness

US Submarine Forces, Arctic Submarine Laboratory

US Submarine Force	
Application	**Product**
•Safety of navigation through Arctic	Fractures, Leads and Polynyas (FLAP)
•Determines operational posture	Marginal Ice Zone (MIZ)/ Ice Edge
•Determine potentially deep (hazardous) keels	Arctic iceberg/floe analysis



Annotated Ice Edge/Large Floes



"This allowed [us] to evaluate and plan the final PD trip prior to the MIZ, determine when the arctic routine would commence and when the ship would enter the MIZ and pass under the ice canopy"

– USS ALEXANDRIA

Scientific Research Support

US Coast Guard, National Science Foundation, NOAA

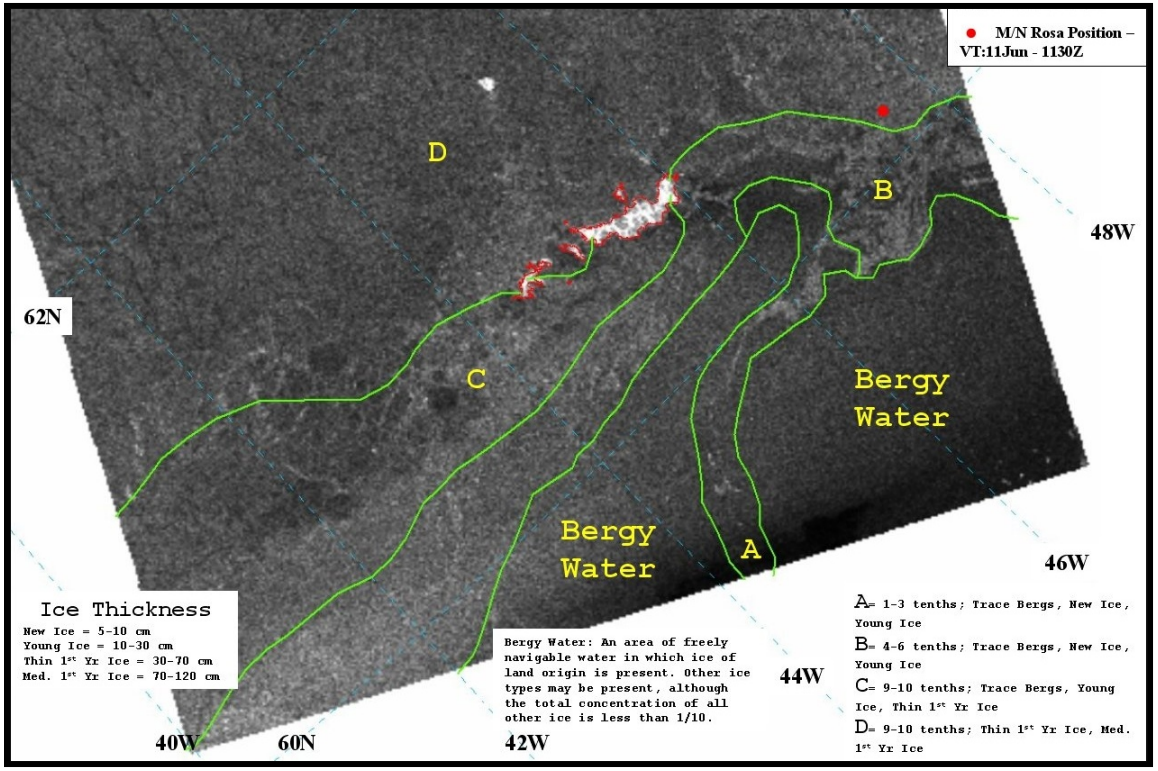
- Daily annotated RADARSAT imagery
- Seasonal outlooks and forecasts
- Onboard analyst support
- Directly liaise with OPS and Science personnel

RV PALMER during Sep '07 Antarctic cruise

USCGC HEALY conducts operations in the Arctic, Sept "07

International Emergency

M/V ROSA



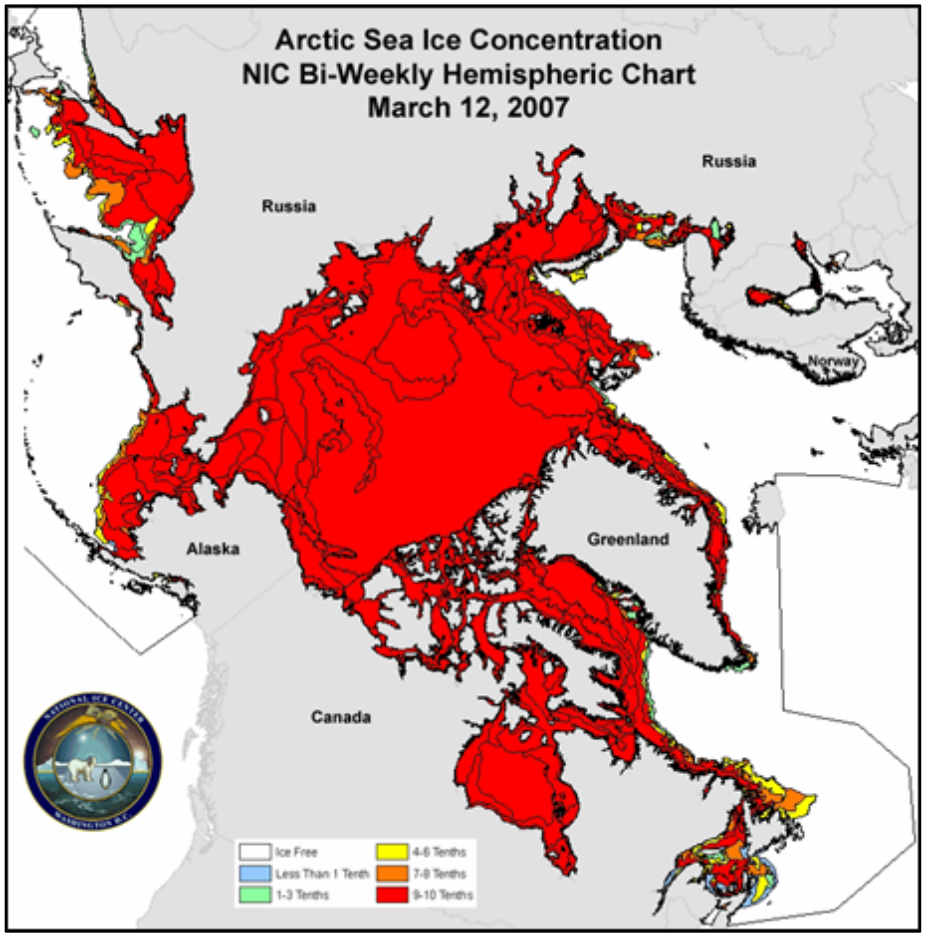
Operated by the Argentines

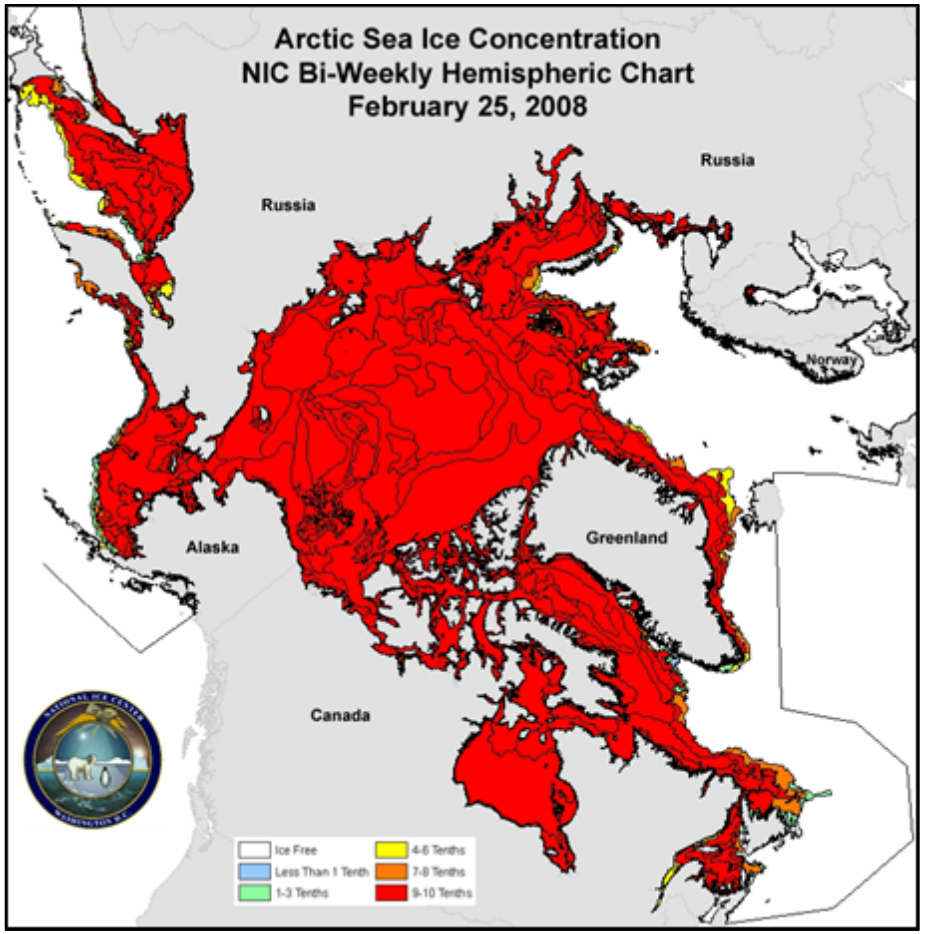
“We have received the requested satellital information and we are extremely gratiful for the important collaboration that you offered us. For your knowledge the satellital information was very useful to us. It was a relevant element in our planning during the assistance to the M/V "Rosa" ship in proximities to the Islas Orcadas during the 11, 12 and 13 june.”

-- AGENCIA NACIONAL SAR MARITIMA, FLUVIAL Y LACUSTRE ARGENTINA

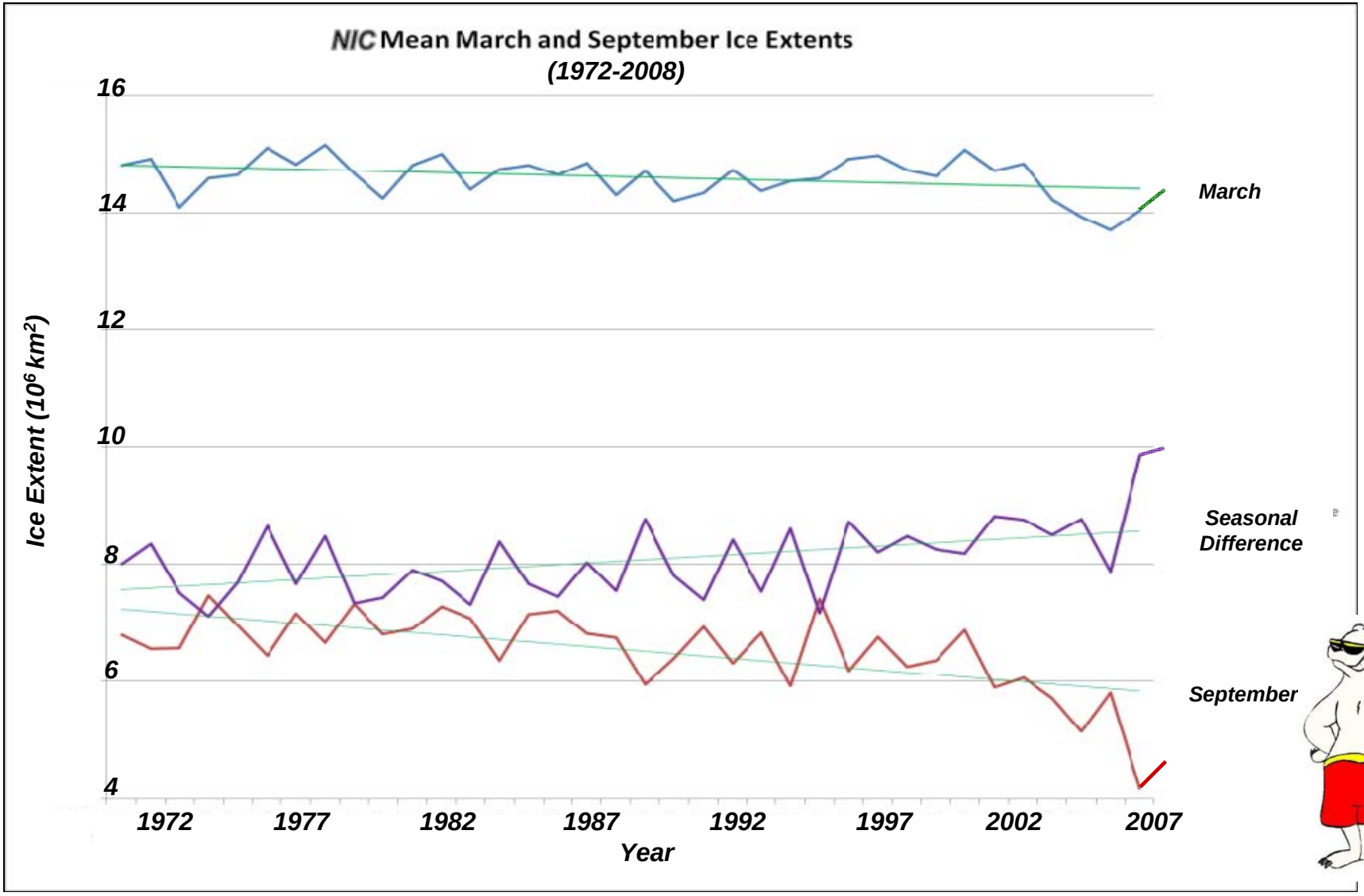
Panamanian Vessel
Refrigerated Cargo Ship

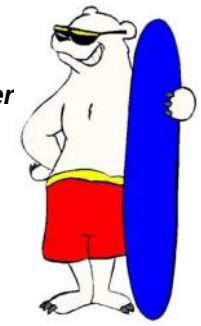
Arctic Sea Ice Retreat in 2007 and 2008



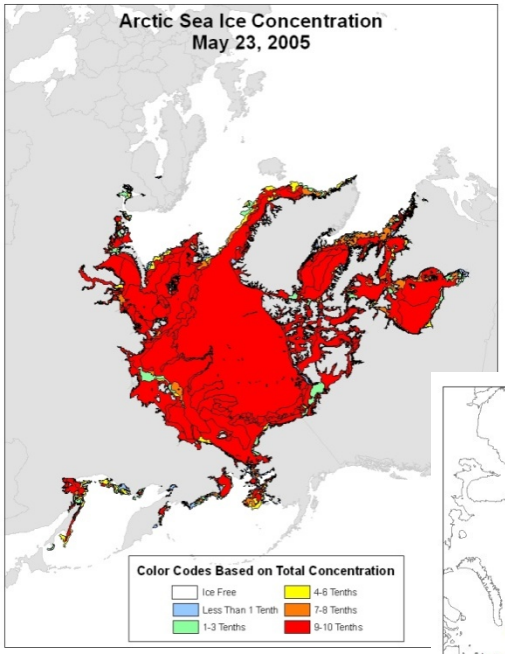


Arctic Sea Ice Extent Declining Trend

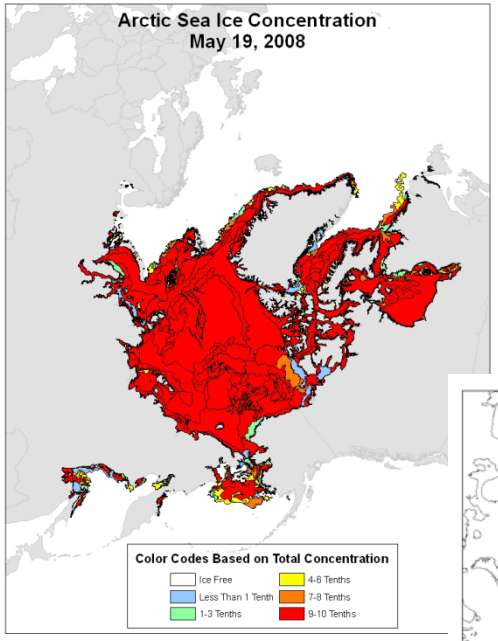




Arctic Sea Ice Extent vs. MYI Distribution

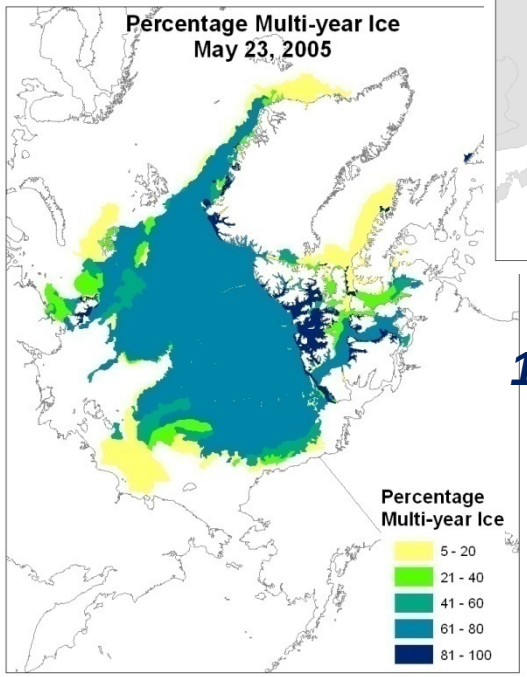


May 2005



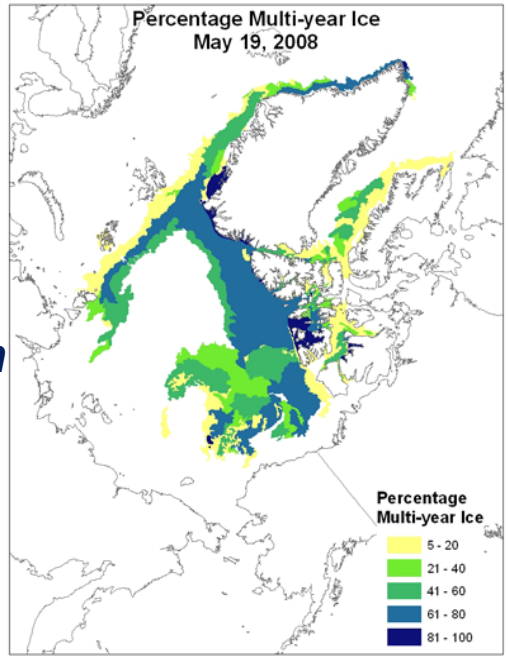
May 2008

Total Ice Extent = 11.94 million sq km



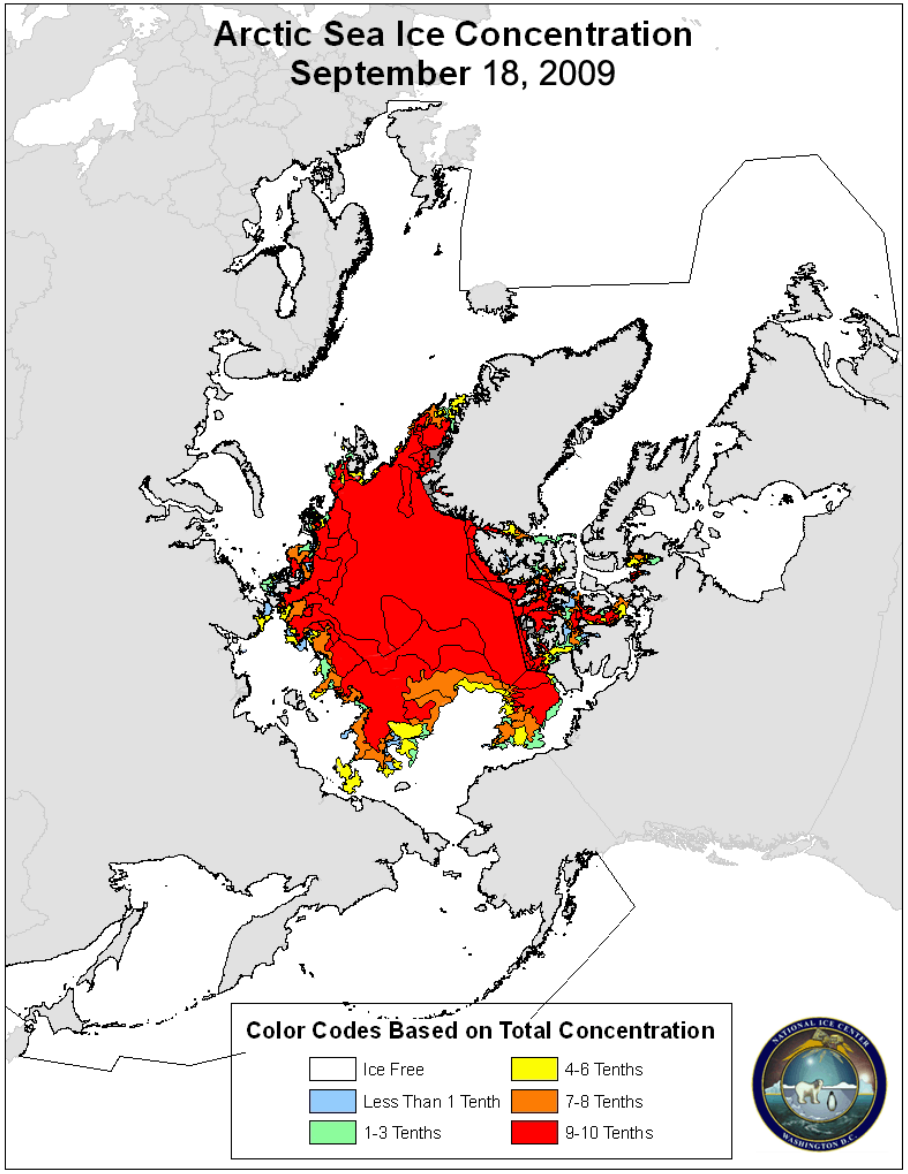
MYI Ice Extent = 6.20 million sq km

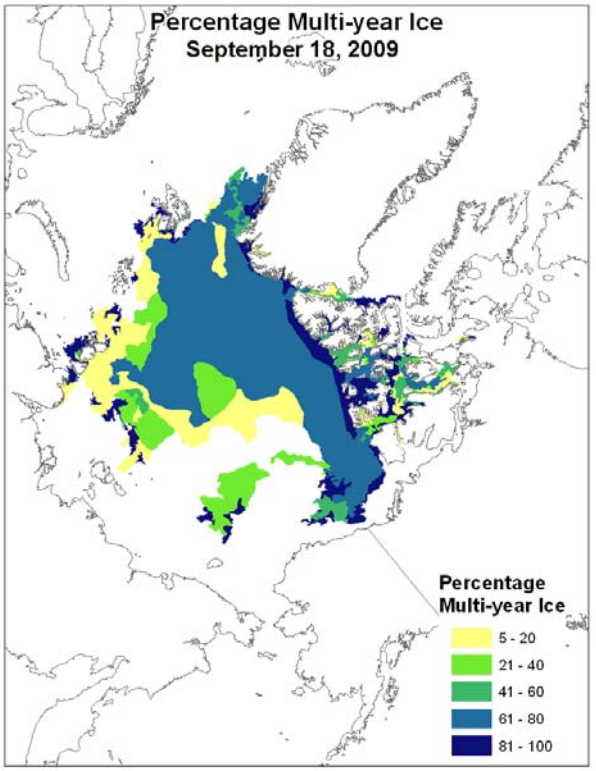
Total Ice Extent = 12.11 million sq km



MYI Ice Extent = 3.89 million sq km

2009 End of Summer Conditions
NIC Analysis - 18 September

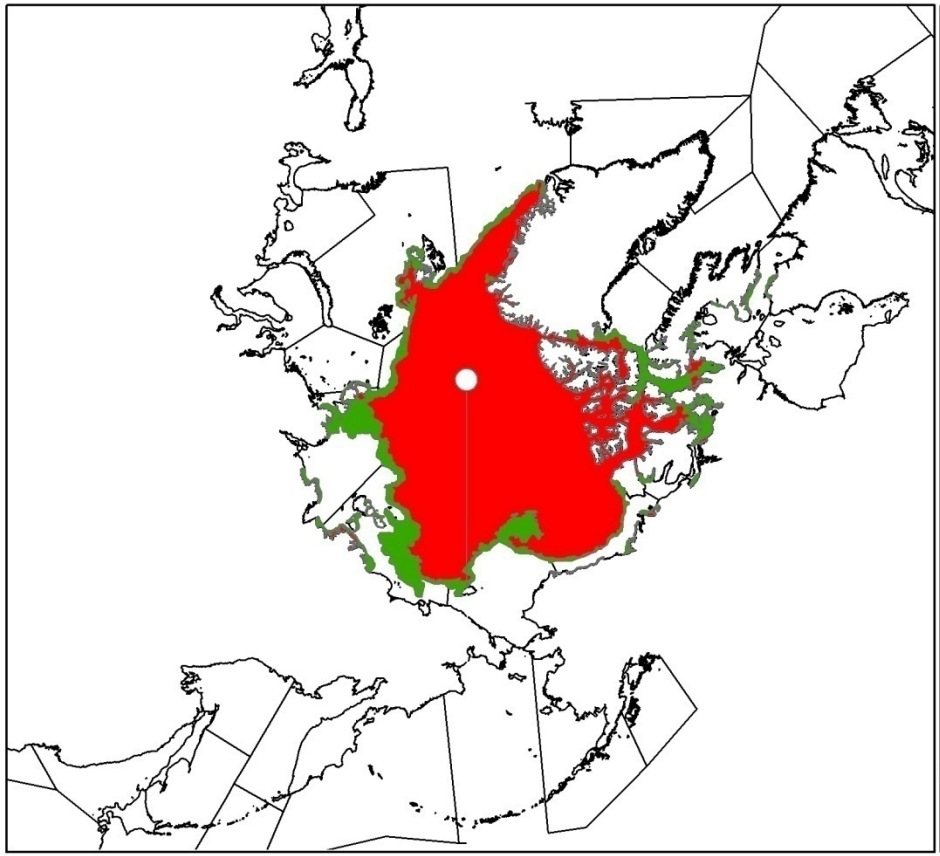




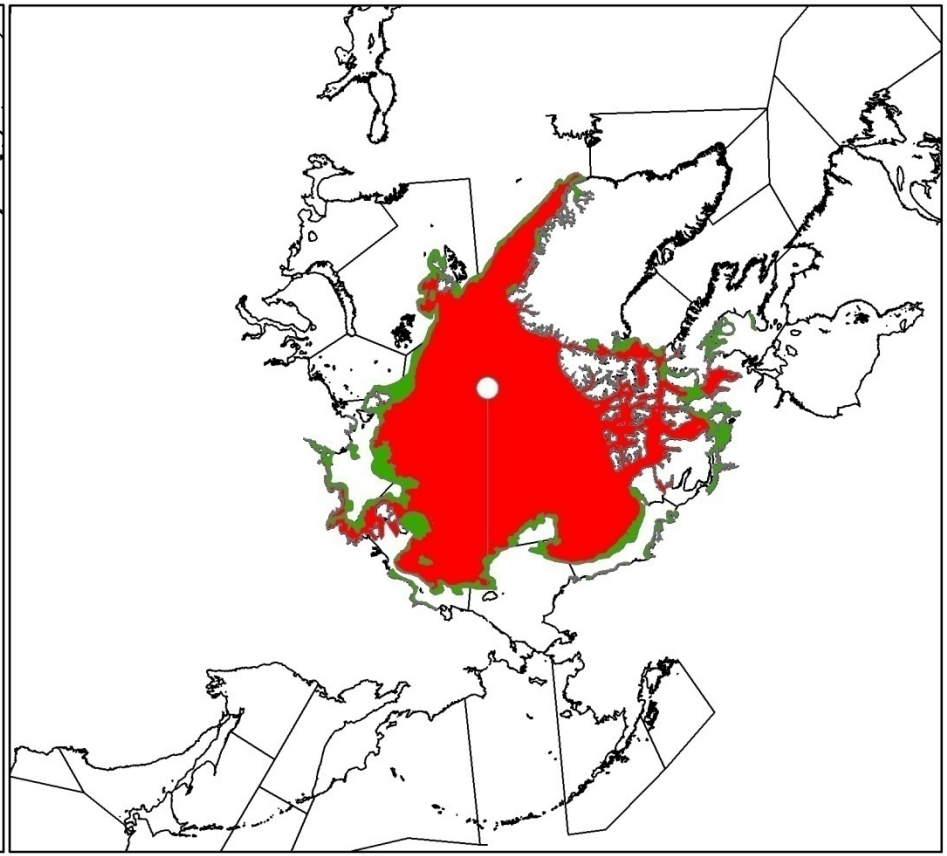
- *3rd lowest sea ice extent*
- *same or just below 2008 MYI extent*
- *more second year ice than in 2008*

Daily Ice Edge and Marginal Ice Zone (MIZ)

Changes in the Marginal Ice Zone Along the NSR



7 October 2009



13 October 2009

Ice Cover

ICECODE

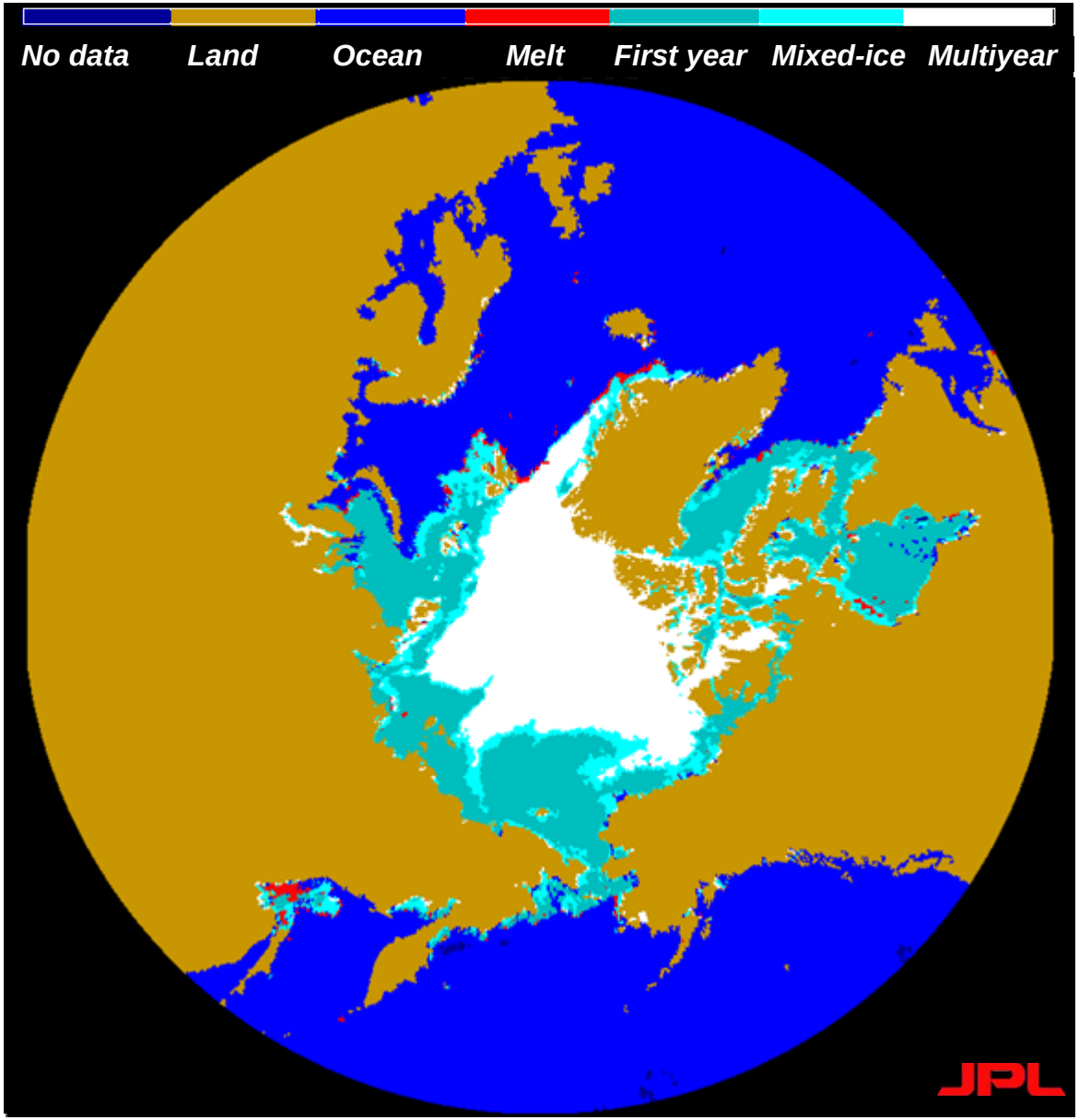
MIZ — CT18

Pack Ice — CT81

Arctic Sea Ice Cover on Winter Solstice

Sea ice class distribution on 21 December 2004

Multiyear ice class (white) represents the extent of the oldest and thickest part of the sea ice pack.



Arctic Sea Ice Cover on Winter Solstice

Sea ice class distribution on 21 December 2005

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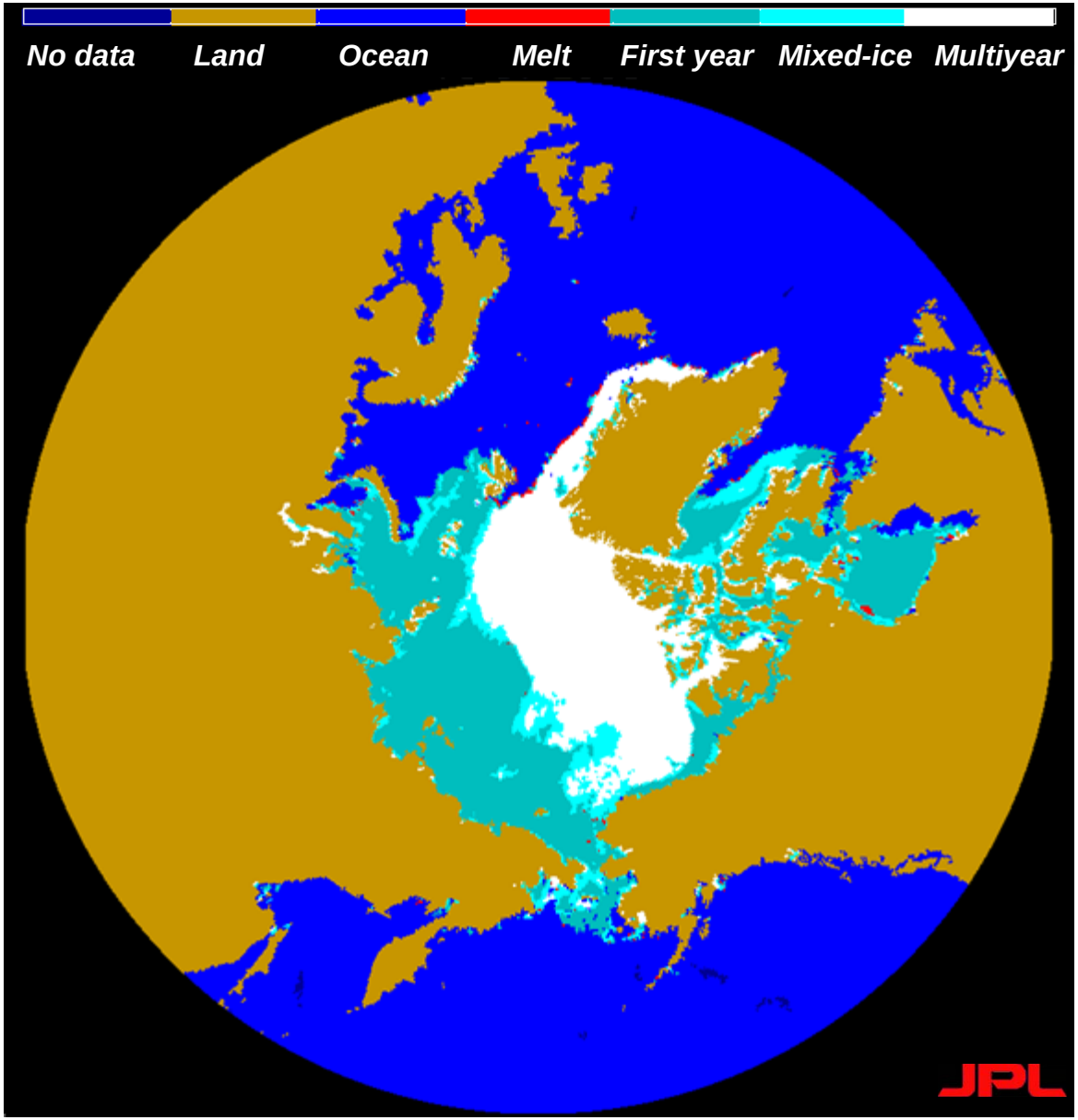
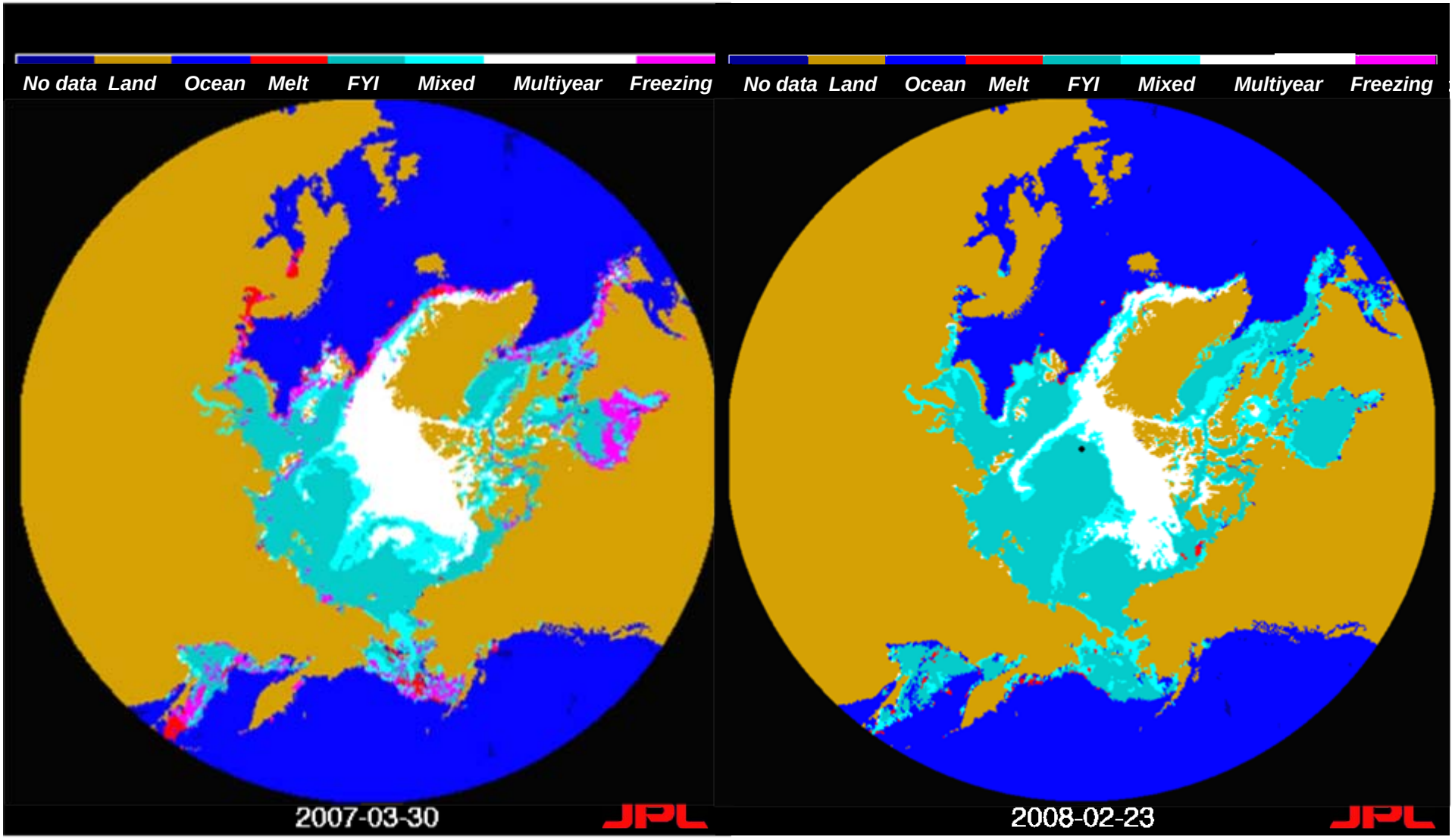
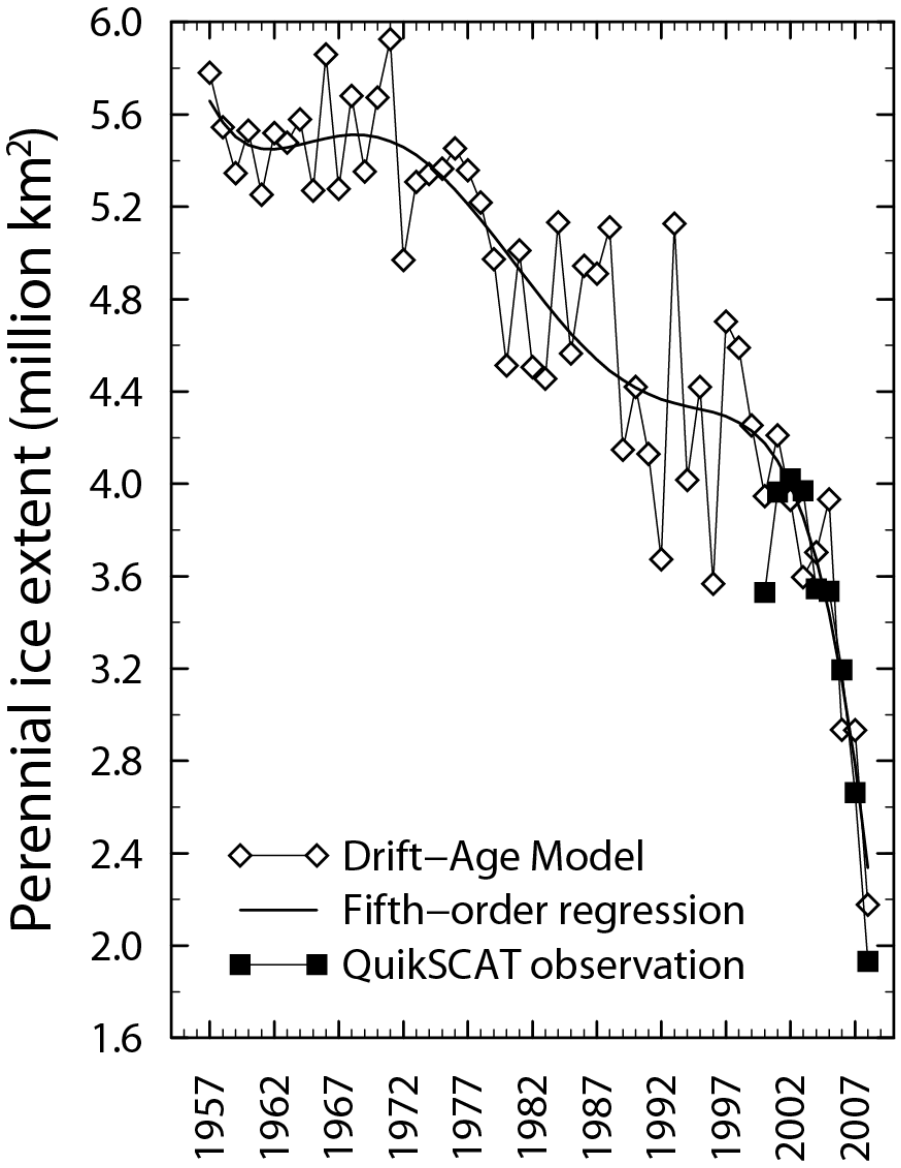


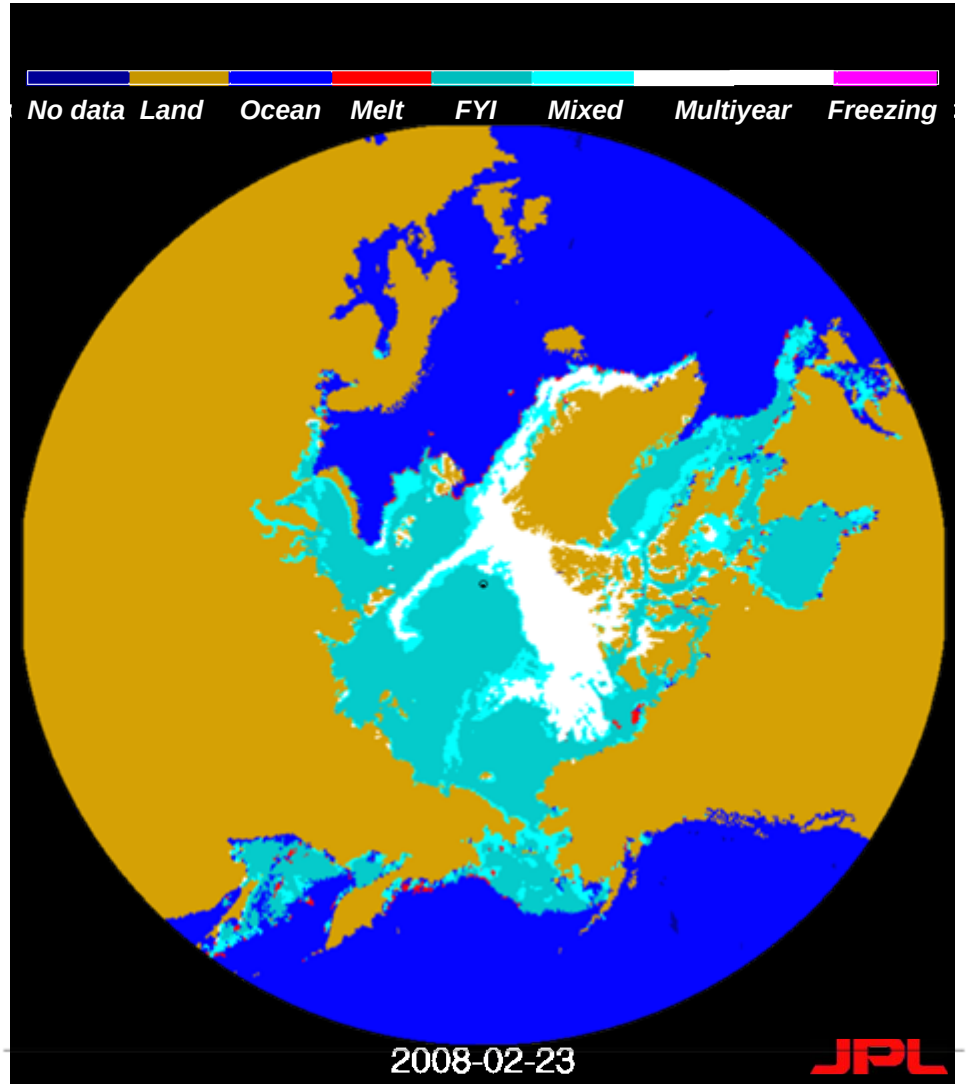
Arctic Perennial Sea Ice Change from Winter 2007 to 2008



Based on QuikSCAT Satellite Data

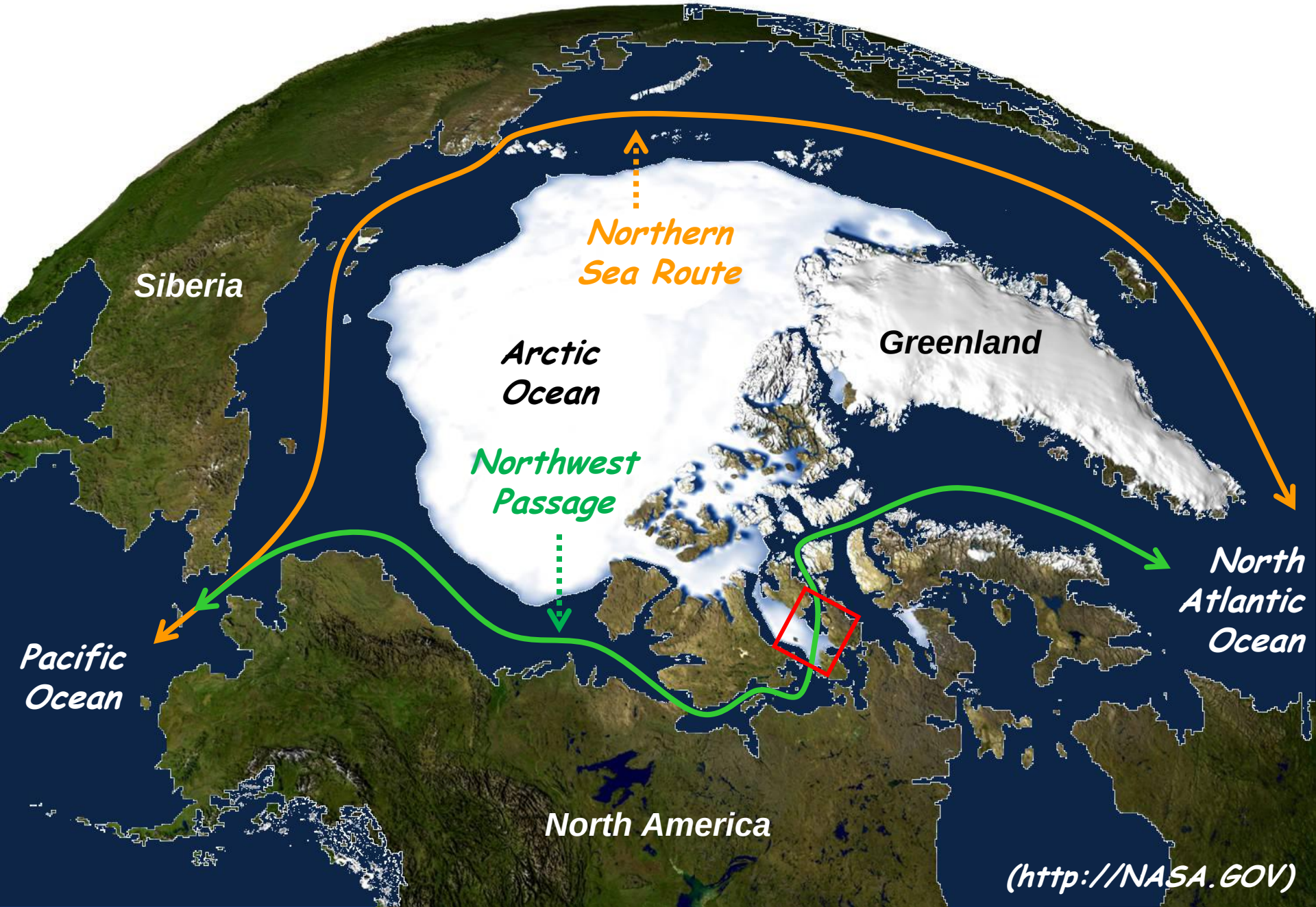
Arctic Perennial Sea Ice Change from 1957 to 2008



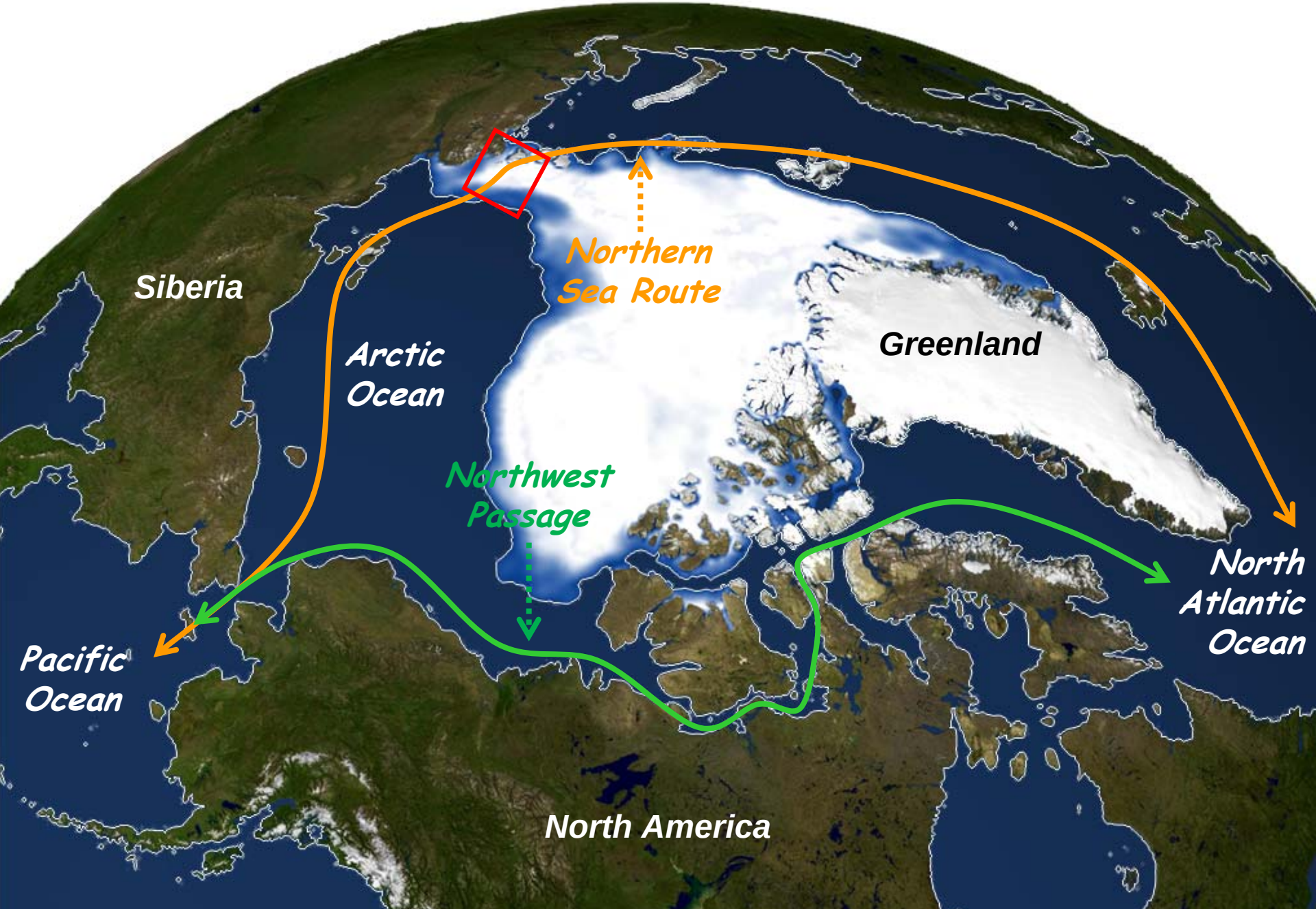


Rigor, Nghiem, Clemente-Colón, Perovich, Richter-Menge, Neumann, and Ortmeyer GRL, 2008.

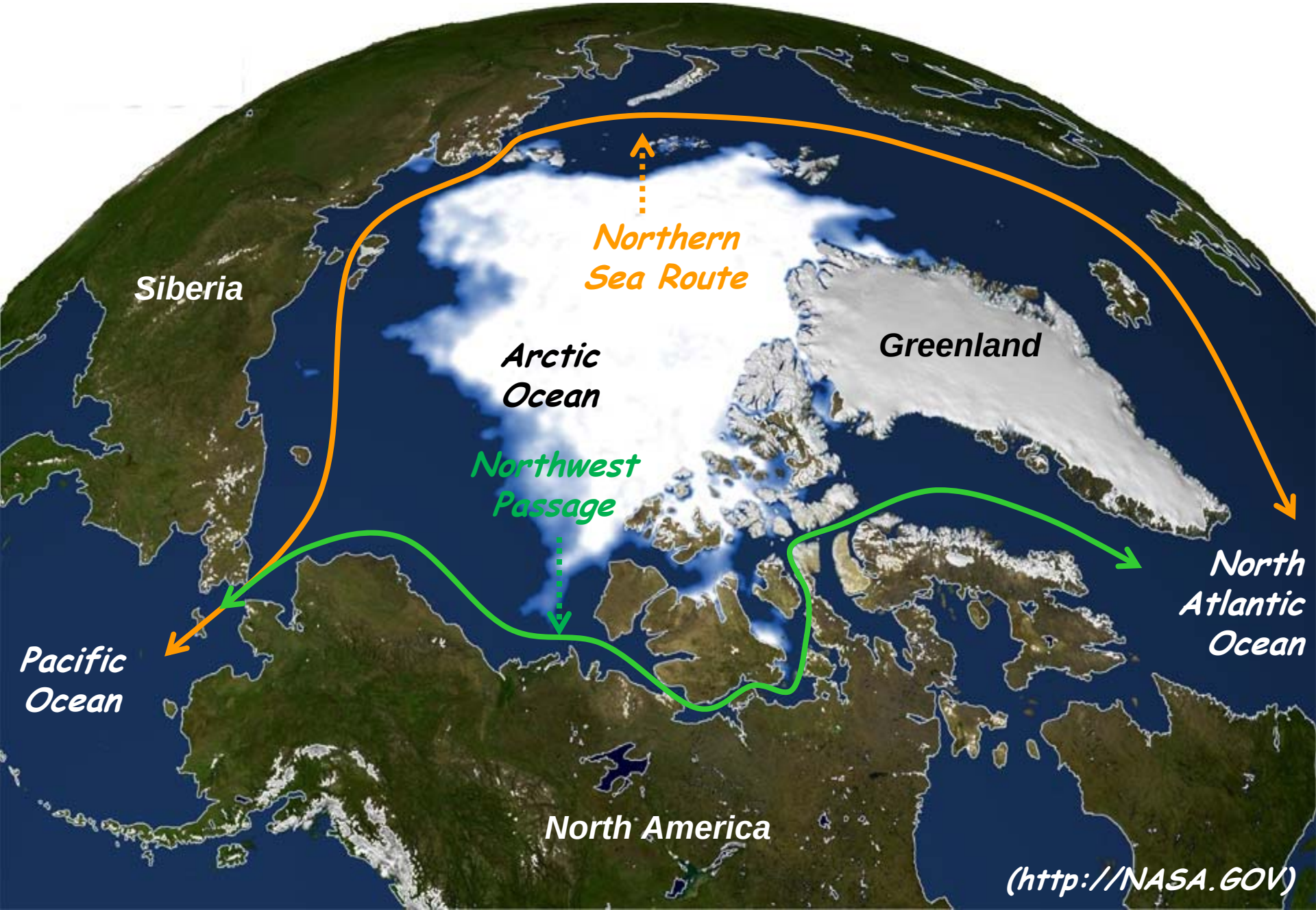
Arctic Routes and 2005 Sea Ice Minimum



Arctic Routes and 2007 Record Minimum



Arctic Routes and 2008 Sea Ice Minimum



Arctic Routes and 2009 Sea Ice Minimum

Ocean Watch Recovery and Deployment of IABP Buoys

At Gjoa Haven, Nunavut on 21 August 2009 - Sailed through ice bottle neck
Stopped in San Juan with crew visit to UPRM on 1-7 November 2009

First Commercial NSR Trans-Arctic Transit

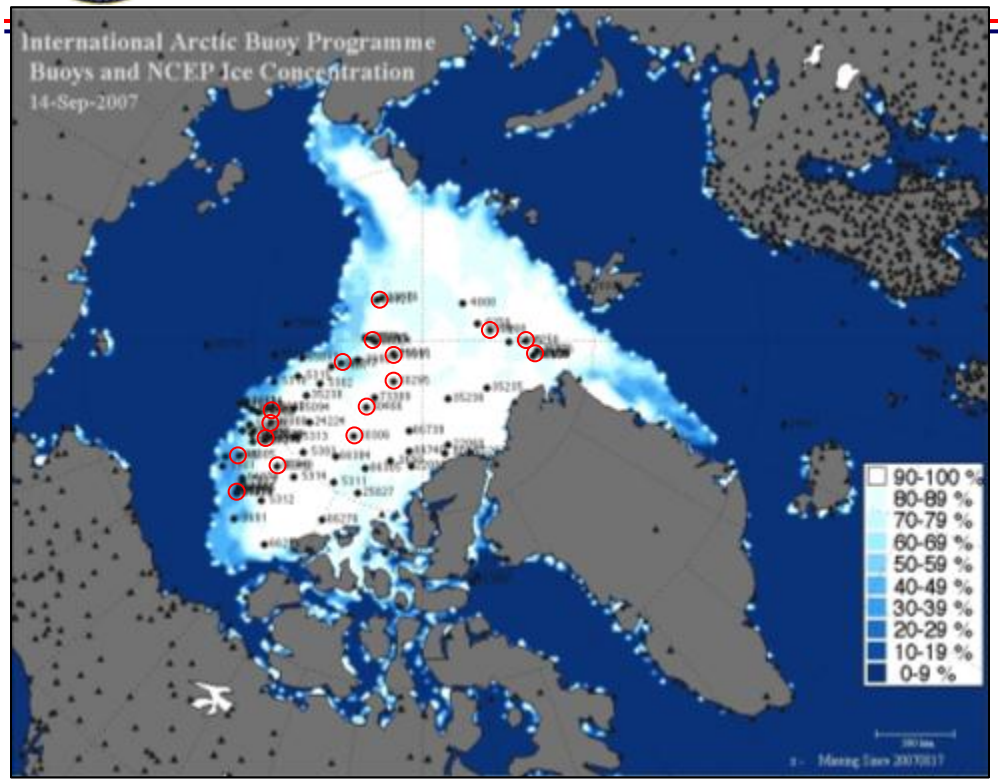
Two multipurpose heavy lift project carriers, M/V Beluga Fraternity and M/V Beluga Foresight, successfully transited the Northeast Passage in summer 2009. Both vessels reached their final destination Rotterdam, with a delivery stop in Siberia, after travelling from Ulsan, South Korea.

What is next and when???

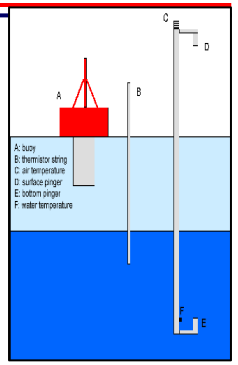
R/V XUE LONG Observed in the High Arctic 14 Miles Away from the Healy in 2008

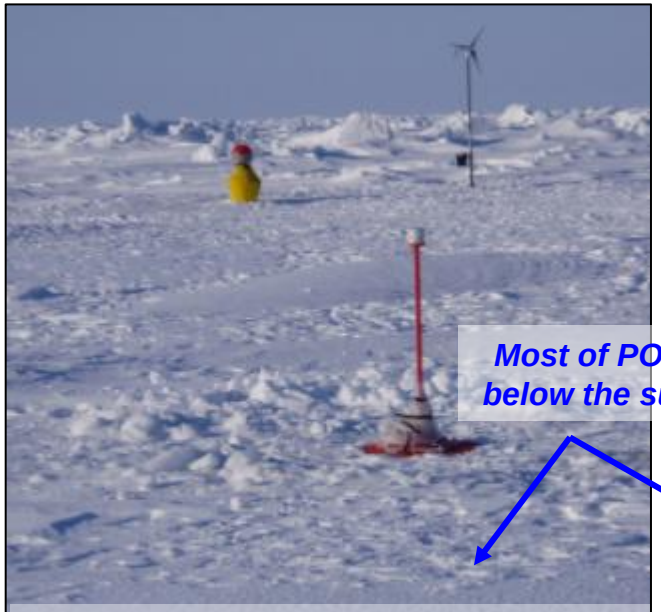
- *Chinese-flagged, icebreaking cargo ship modified for research and logistics . It is China's only polar vessel.*
- *Government-owned, but not associated with the Chinese Navy. It is commanded and crewed by civilians.*
- *Operated by the Polar Research Institute of China, subordinate to the State Oceanographic Administration.*
- *Hosted 110 Scientists and deployed buoys for the IABP.*
- *Plan for a July-September 2010 Trans-Arctic attempt.*

Sea Ice Retreat Imposes a Challenge to IABP



Ice Mass Balance buoy Monitors Air and Sea Ice (blue dots)



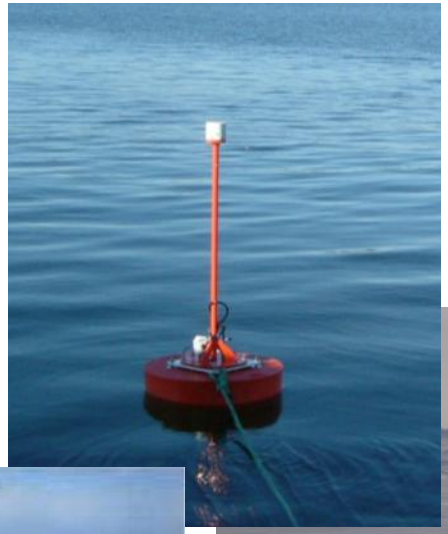


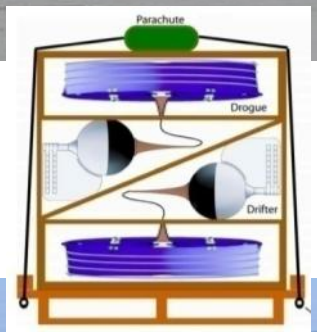
Most of POPS is below the surface

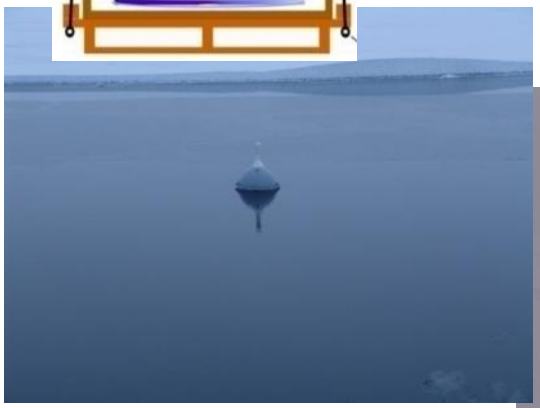
Polar Ocean Profiling System Monitors Air and Ocean (typically deployed w/ IMB buoys)

ICEX airdrop buoys are the backbone of the IABP (red dots)

New Seasonal Ice Beacons, Ocean Buoys, and Deployment Alternatives Needed







Airborne Expendable Ice Buoys (AXIB)

(NOAA SBIR)

- Provides a low cost aircraft droppable seasonal buoy (with also surface deployment capability)

- Sensors/measurements include surface air temperature, surface pressure, GPS location, and Argos transmitter

- Replaces/Complements present ice beacons providing operation in ice and open water through freeze/thaw cycles

- On the ice testing in Lake Champlain, VT and two deployments in the Arctic during HLY0805

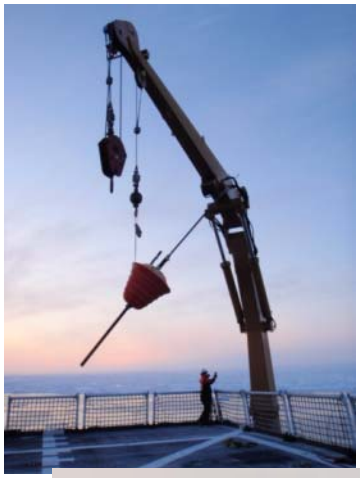
NIC co-manages the US Interagency Buoy Program with UW/PSC and coordinates US Arctic buoy activities within the IABP

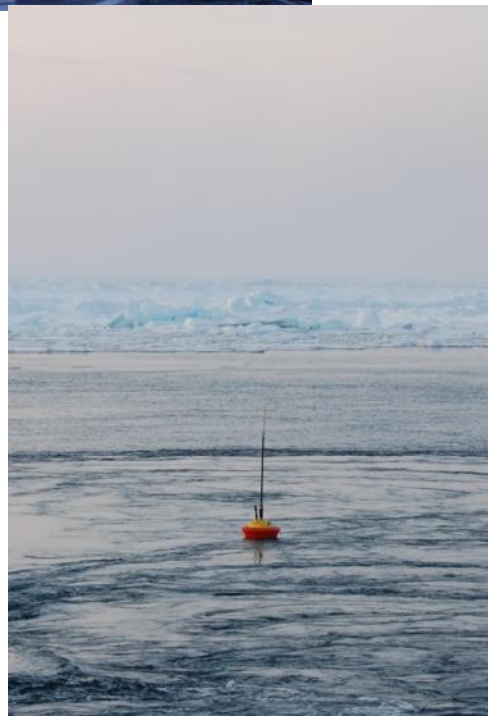
Arctic buoy data are critical to NWS and many other users providing weather forecasts, NWP, and climate modeling

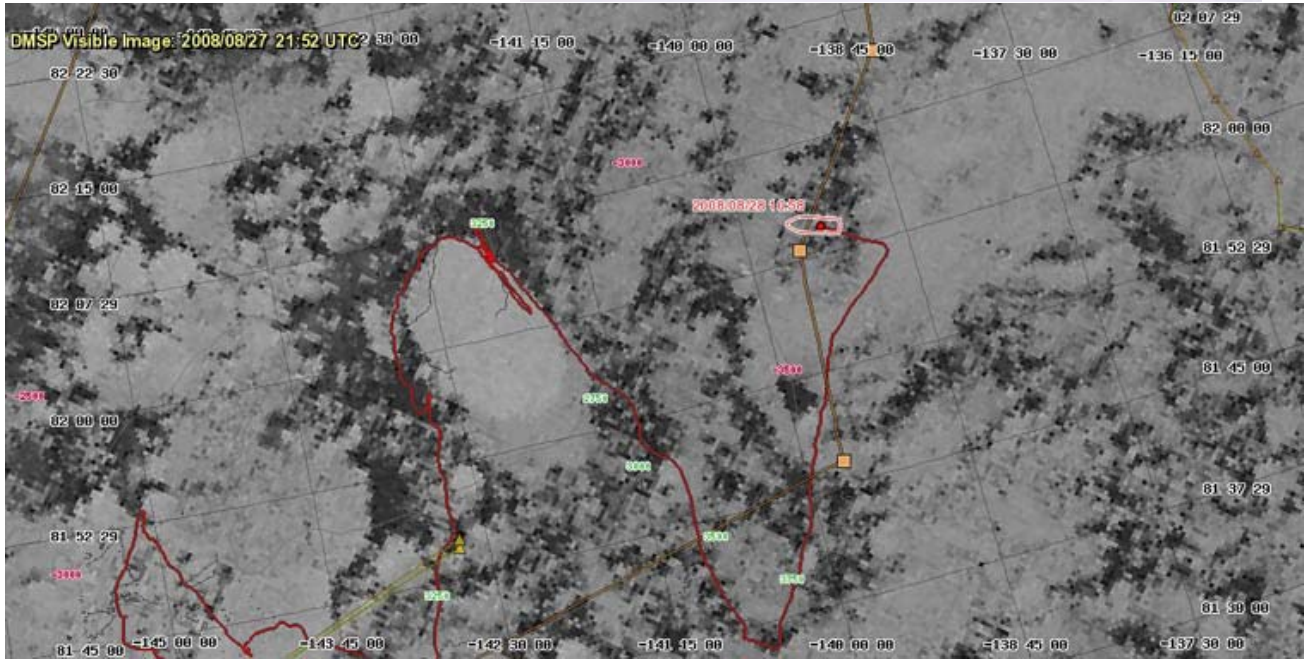
Arctic buoy data are used by NIC for operational ice chart analysis and supports the validation of satellite observations and sea ice models

Provide alternatives to present White Trident C-130 drops over MYI

Deployment of the AXIB Seasonal Buoys From the Healy in 2008

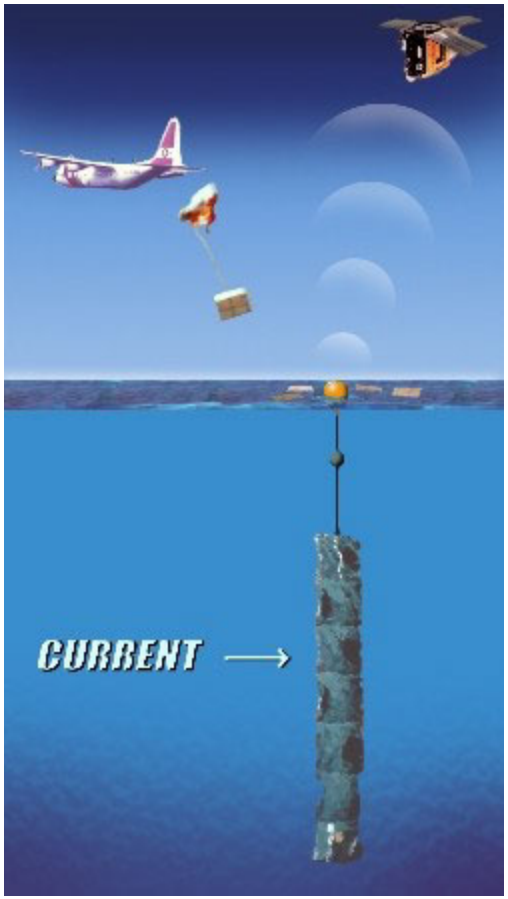






1st Buoy Airdrop by the USCG for the USIABP/IABP – WHITE TRIDENT Alternative

Buoy #89197
72.475N 157.955W
19 August 2009



Coast Guard deploys WOCE buoy in Arctic Ocean

20090819-G-0113H-WOCE Buoy Drop

Video by: Petty Officer 1st Class Jason Yonk

Edited by: Petty Officer 3rd Class Charly Hengen

Created: August 19, 2009

Released: August 19, 2009

Produced by: 17th Coast Guard District Public Affairs, Kodiak

Released by: 17th Coast Guard District Public Affairs, Kodiak

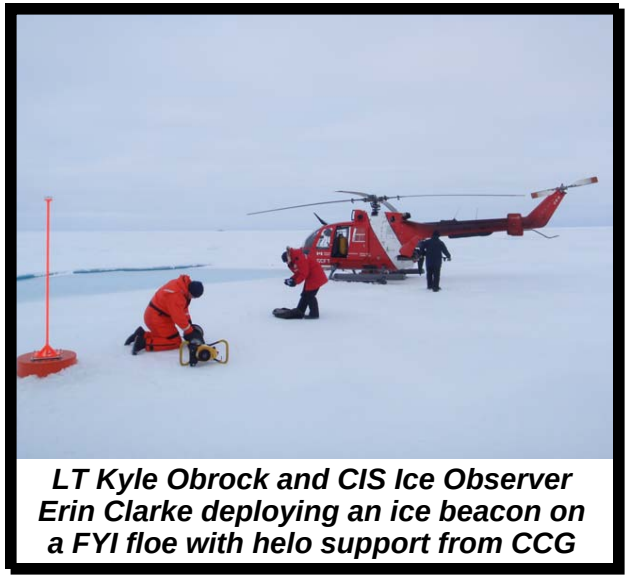
Run Time: 16 sec

NAIS Coordinated Support of U.S.-Canada UNCLOS Arctic Mapping in 2008 and 2009

Joint US-Canada Extended Continental Shelf Mapping Cruises HLY0806 and HLY0905

Photo USGS

CCGS St. LAURENT and USCGC HEALY operating in the Arctic

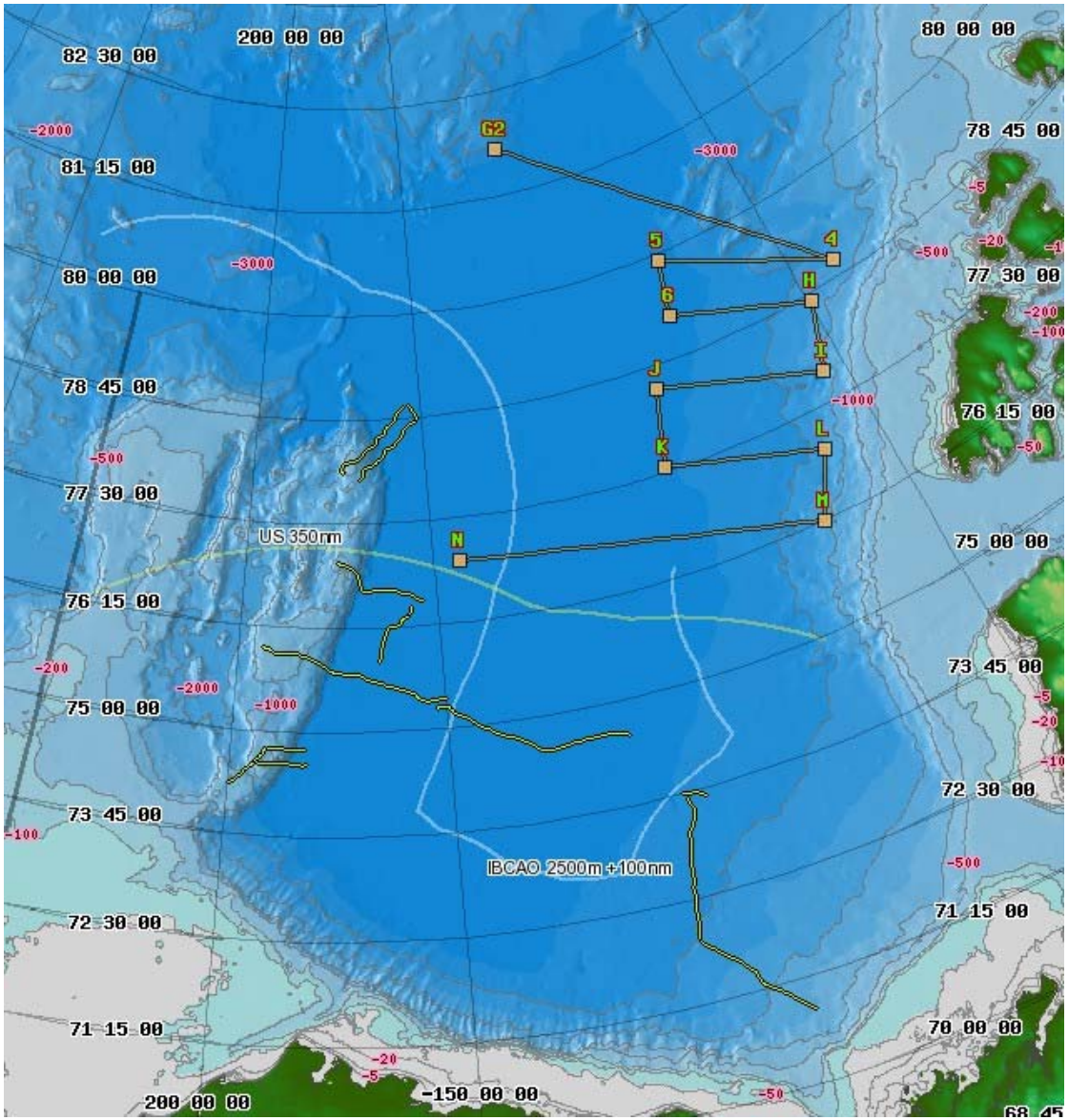


LT Kyle Obrock and CIS Ice Observer Erin Clarke deploying an ice beacon on a FYI floe with helo support from CCG

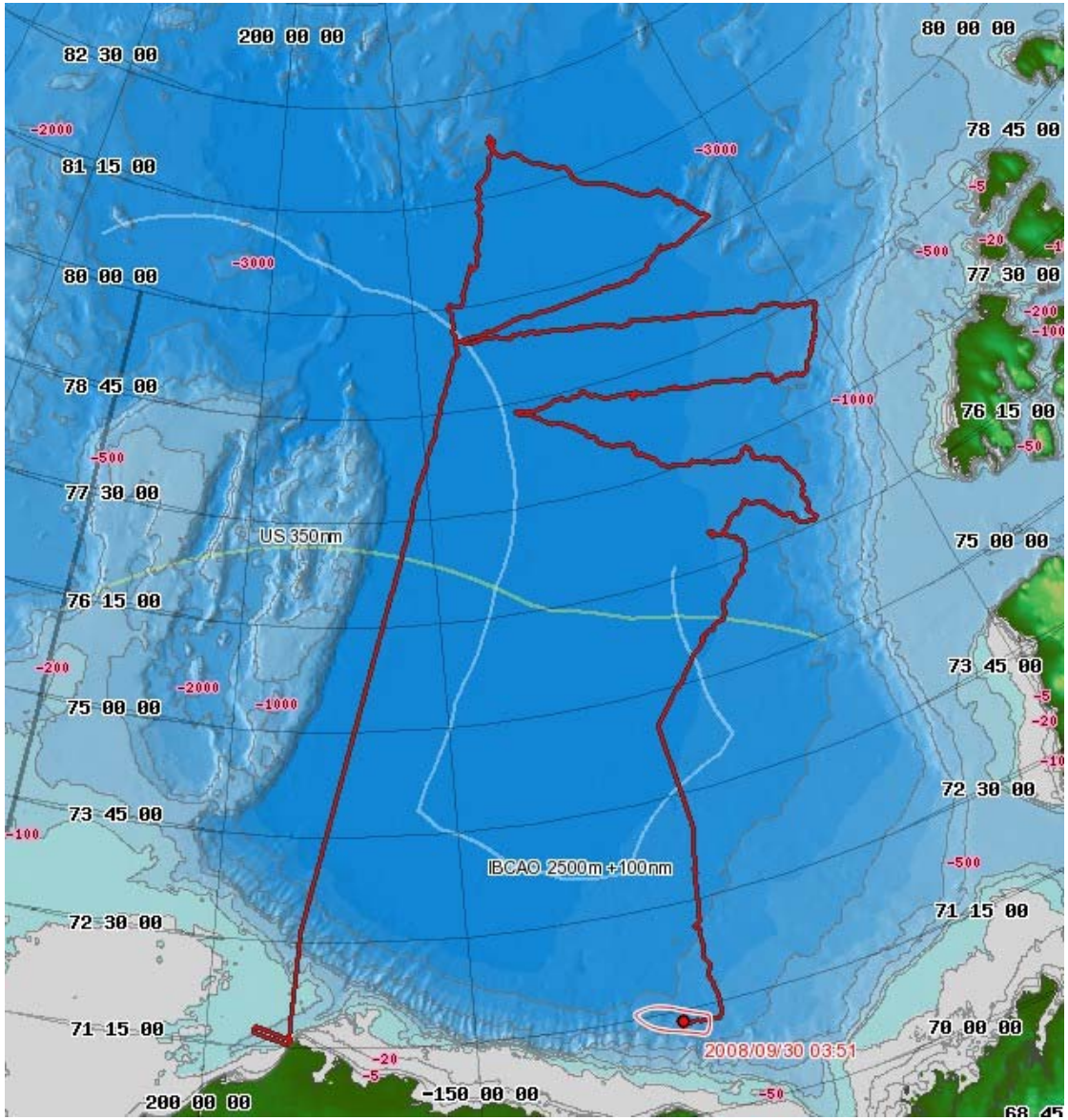
CAPT F. Sommer (USCGC HEALY) and CAPT M. Rothwell (CCGS LAURENT)

Photo USGS

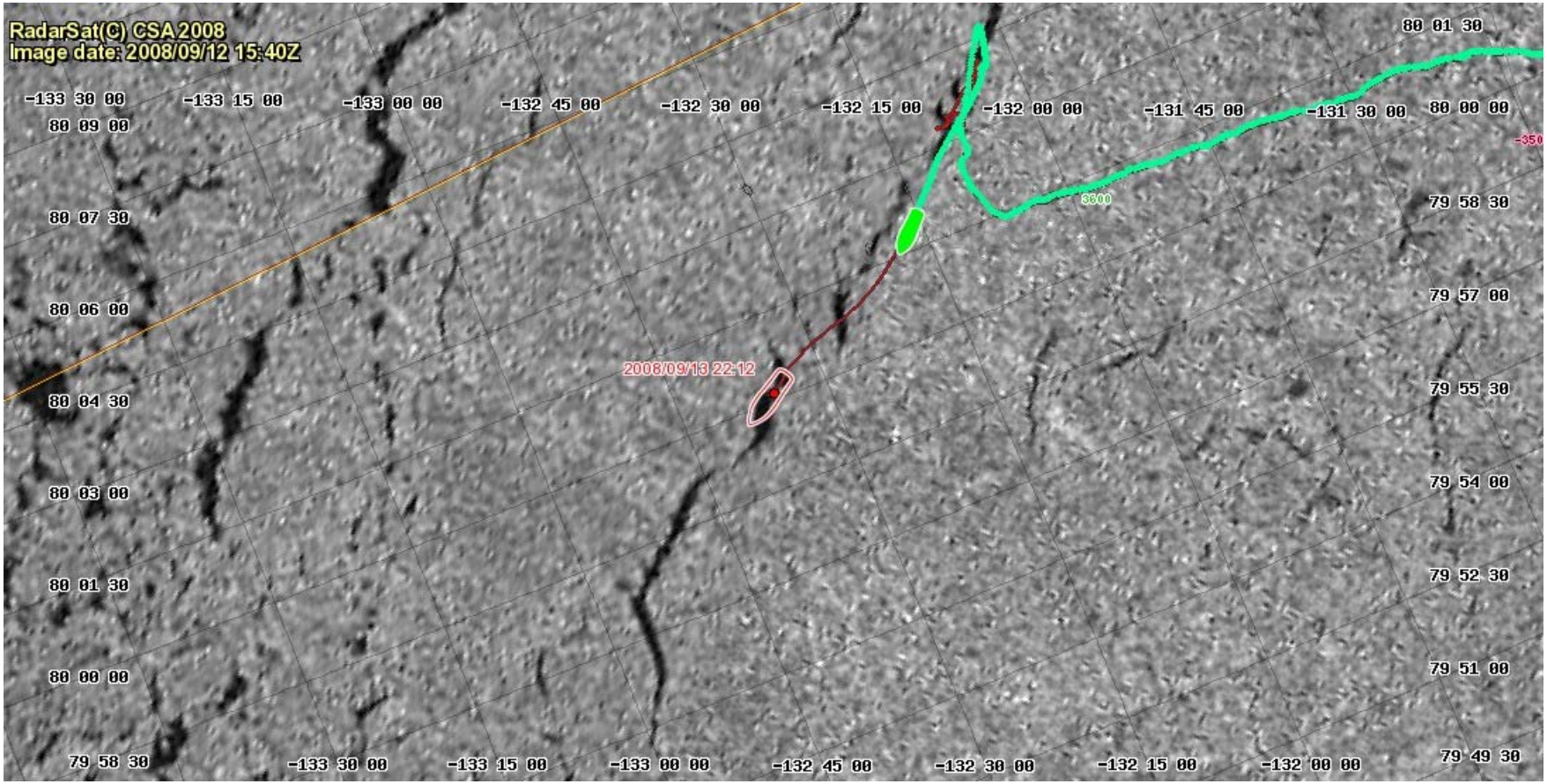
HLY0806 Cruise Track Plan



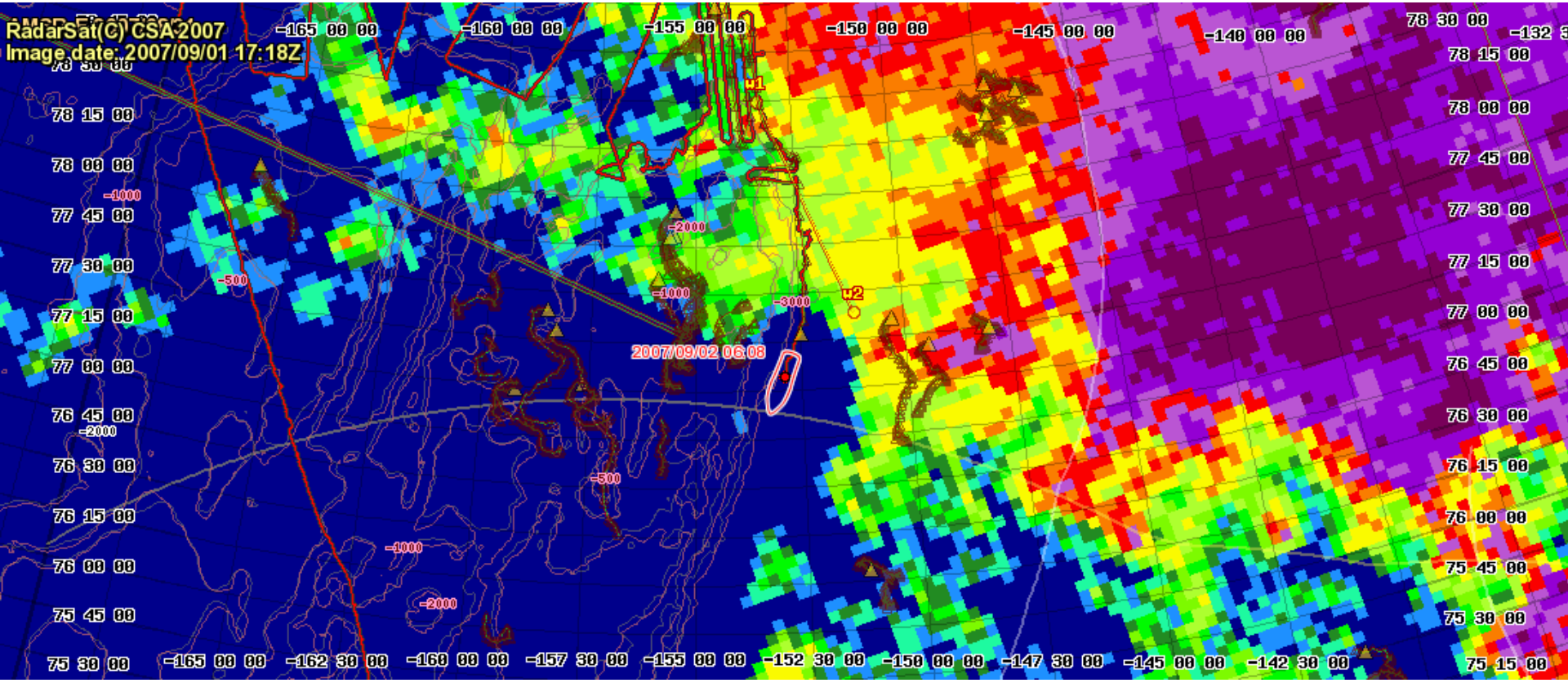
HLY0806 Cruise Actual Track



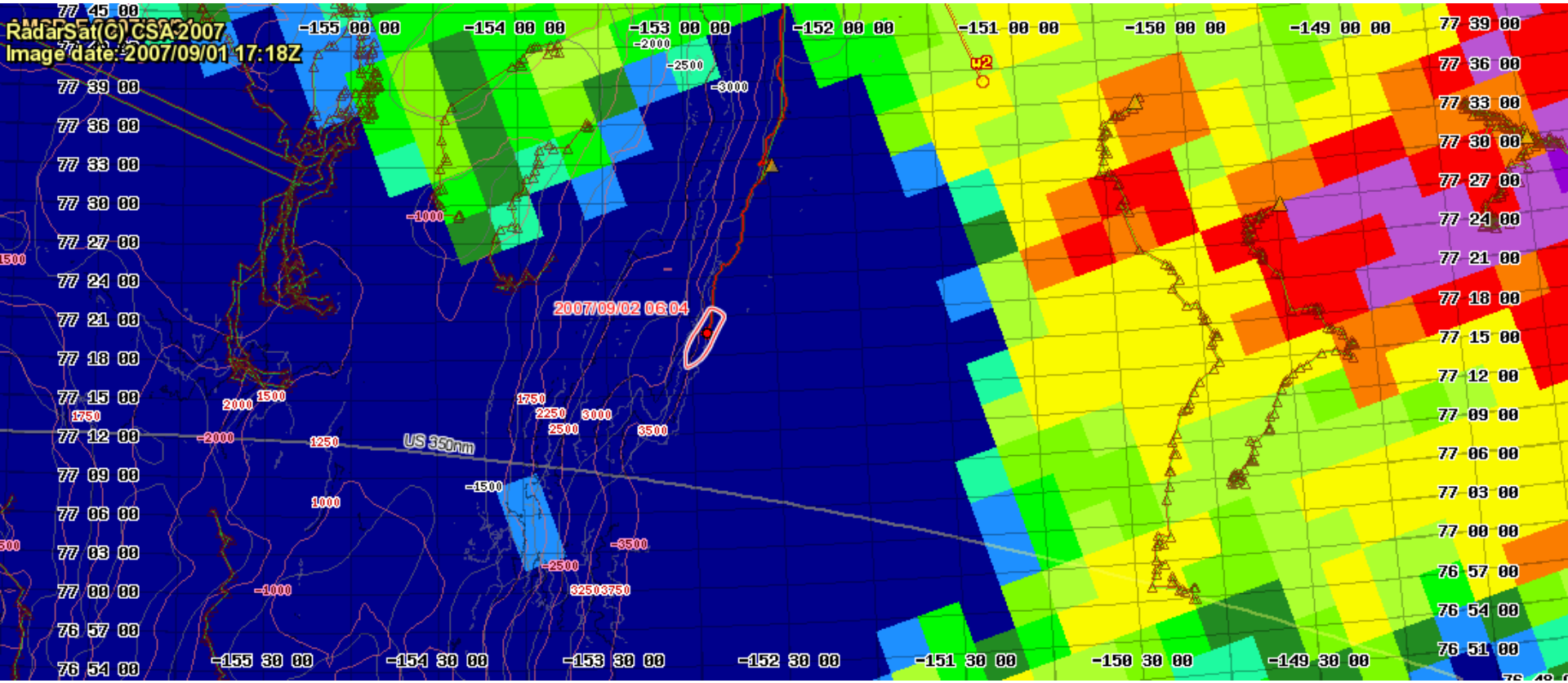
Healy Cruises Exploit Leads using SAR Imagery



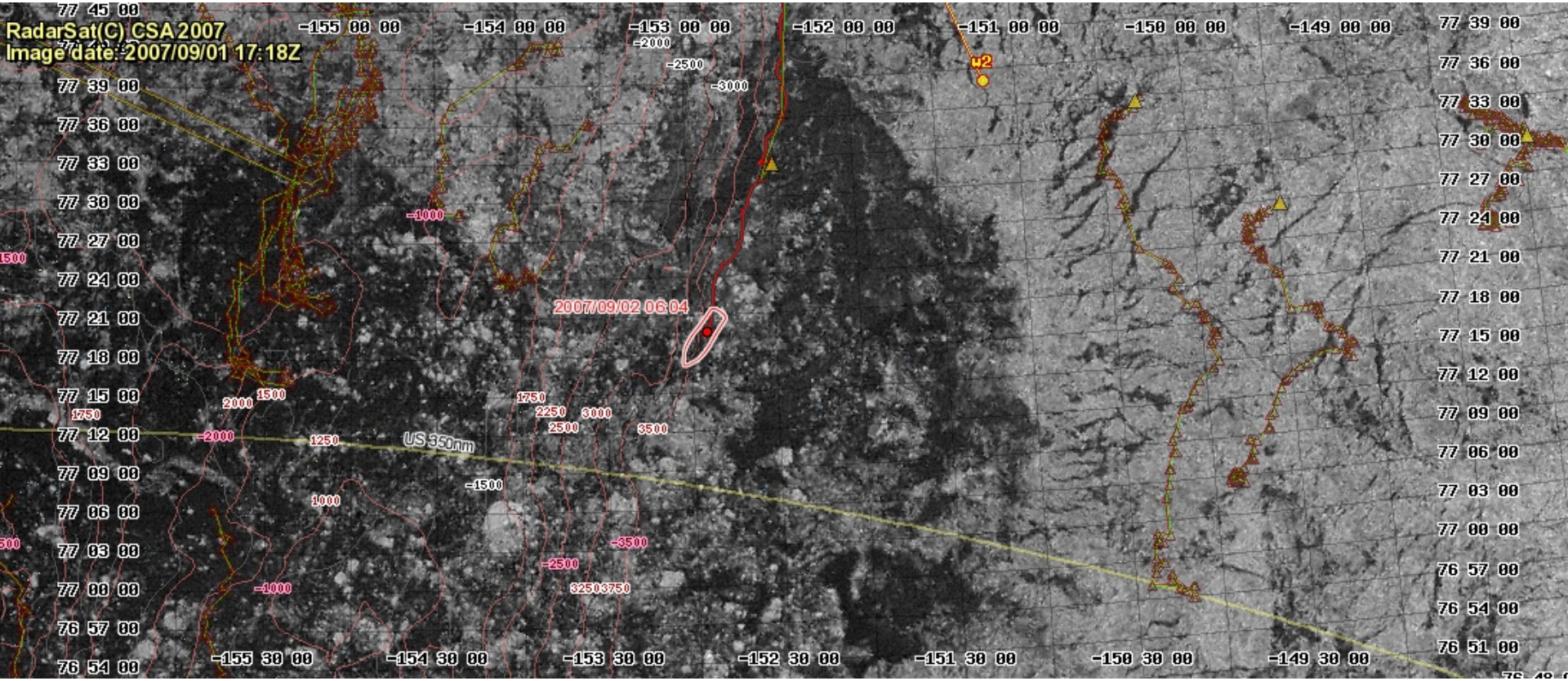
AMSR-E Passive Microwave Sea Ice Concentration



AMSR-E Sea Ice Concentration



RADARSAT-1 Synthetic Aperture Radar Sea Ice Detection




Aloft Conn 2007-08-30 00:42:01

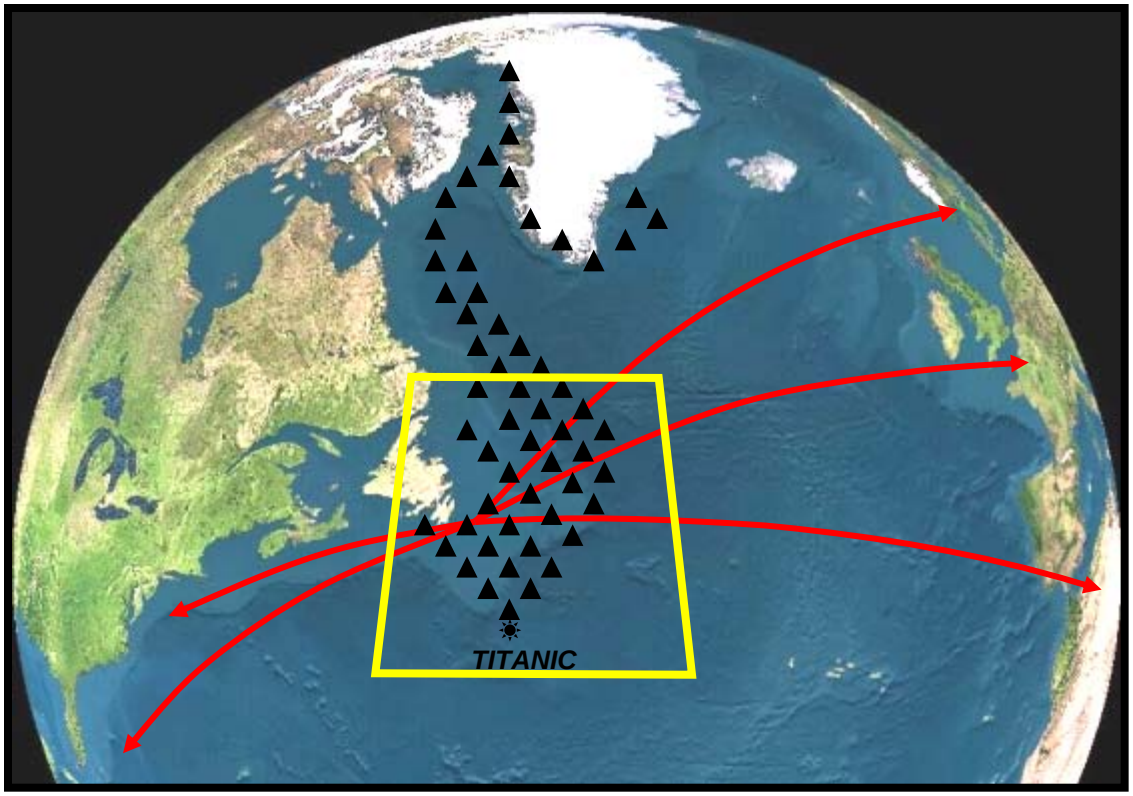
Greenland/Atlantic Icebergs

IIP main responsibility.

Under NAIS, IIP and CIS have harmonized and run real-time synchronization of the iceberg databases.

They have joint requirements for reconnaissance flight planning also.

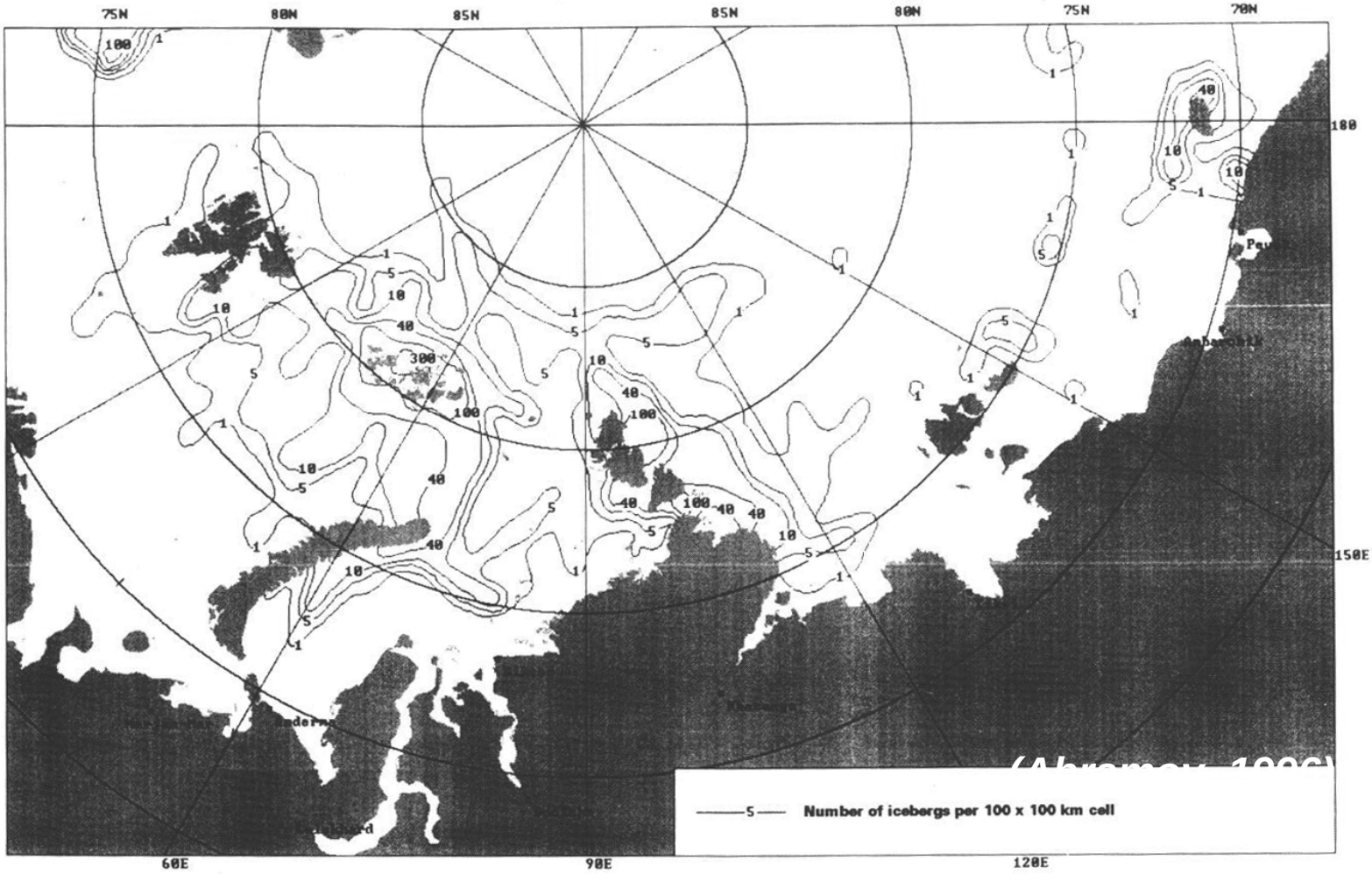
NIC provides NTM iceberg detection support.



Monthly maximum number of icebergs in August

The present number of icebergs in the Arctic Basin is much larger than that reported

t



Icebergs in the Arctic Basin – A New Challenge

North-eastern Barents Sea, April 16, 2006

North-eastern Barents Sea, April 17, 2006

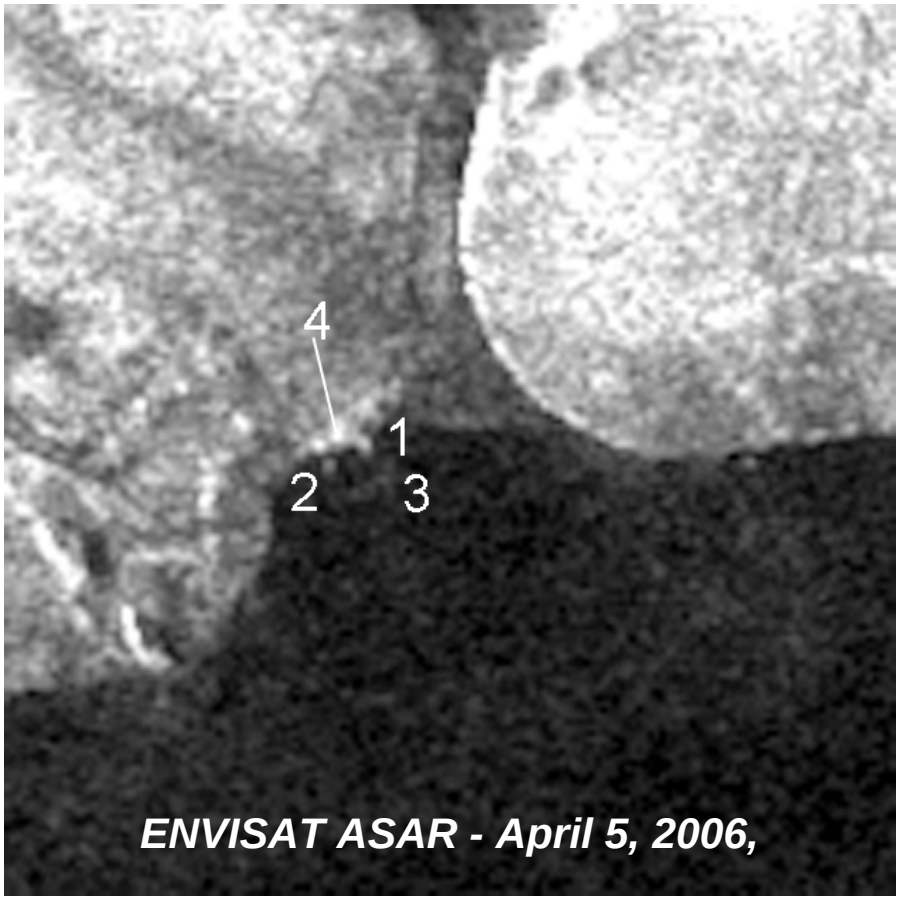
North-western coast of Novaya Zemlya, April 17, 2006

FJL, Salm island, April 25, 2006

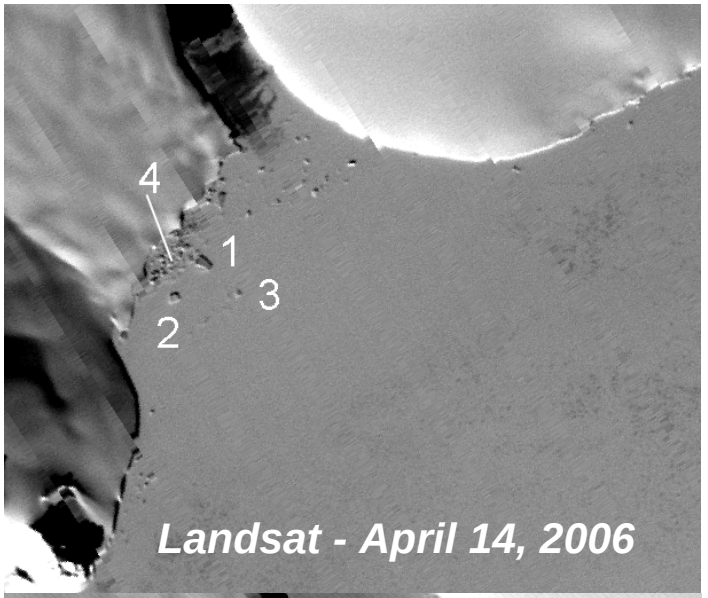
Courtesy of Vitaly Alexandrov, Nansen International Environmental and Remote Sensing Center (NIERSC)

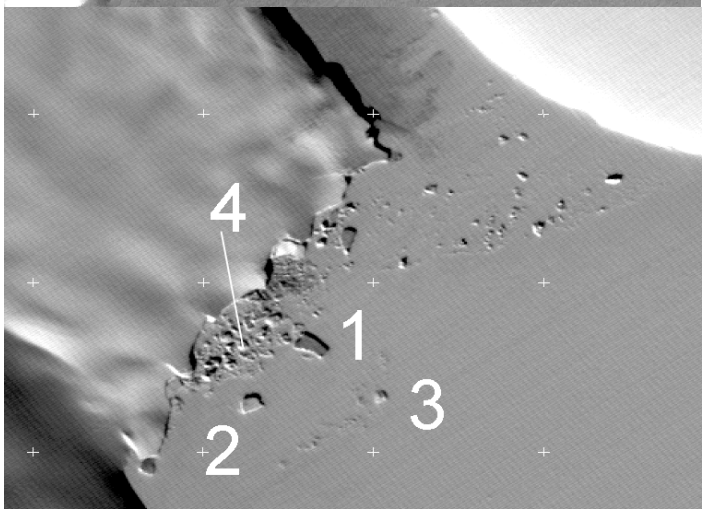
Arctic Iceberg detection

SAR and visible images



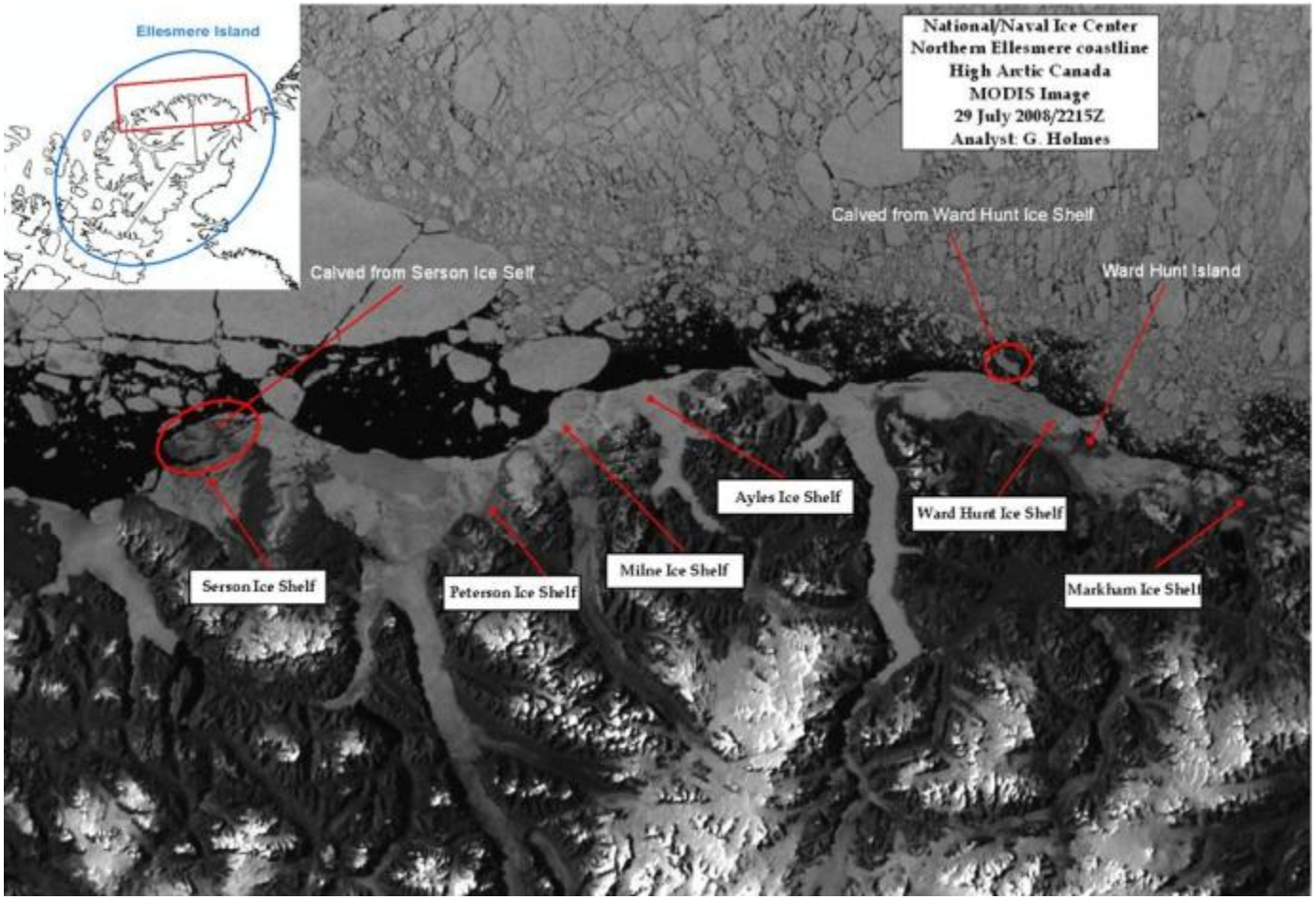
Courtesy of Vitaly Alexandrov, Nansen International Environmental and Remote Sensing Center (NIERSC)





"Monitor-E" - April 7, 2006

Ellesmere Island Icebergs



Ellesmere Is. ice shelves are also calving large icebergs into the Arctic Ocean.

Final Remarks

- **Significant changes in the seasonality of Arctic sea ice conditions as well as increased vessel presence in both Arctic and Antarctic waters are posing additional challenges to present operational ice services.**
  - **Need for increased tactical support, which heavily depends on high-res imagery, particularly from synthetic aperture radar data**
  - **Need for more frequent and higher resolution nowcasts**
  - **Need for improved or new forecasting capabilities from daily, weekly, seasonal, intrerannual, to climate time scales**
- **An ice-diminishing Arctic Ocean does not translate into an "ice-risk" free ocean.**
- **New strategies for the deployment of in-situ air-sea-ice observing capabilities, improvements of present systems to operate in high-latitude and through new seasonal conditions, and the incorporation of new technologies such as UAS may be needed.**


Preguntas?


U.S. COAST GUARD
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INNOVATION
UNLOCKING THE POWER OF IDEAS

Offshore Renewable Energy Extraction and Transport

BORN READY REQUIREMENTS FOR THE USCG

The Past & Current Missions

Oil & Gas Platform Fire Control and Rescue

AUGUST TO NOVEMBER- 2009.

OIL SLICK FROM THE RIG, ABOUT 150 MILES OFF AUSTRALIA'S COAST, NOW STRETCHES ACROSS THOUSANDS OF MILES OF OCEAN.

North Sea Oil Platform Fire Nov. 2007

Eight aircraft from the coastguard, RAF and Norwegian emergency services were involved in the operation to rescue the 159 crew trapped on the Thistle Alpha platform, 277 miles north-west of Aberdeen.

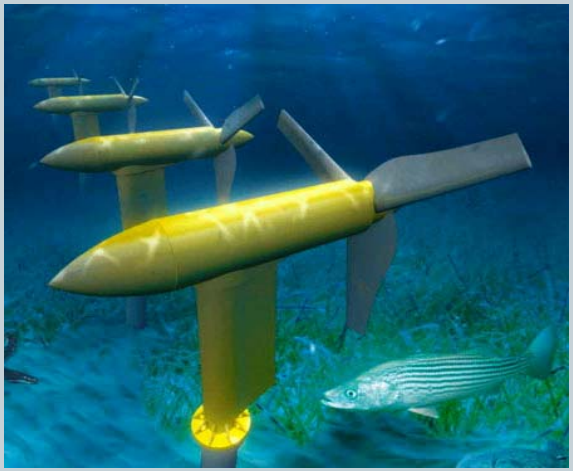
Other Recent Offshore Platform Fires

Current Energy Transport

Energy Transport Problems

More Energy Transport Problems

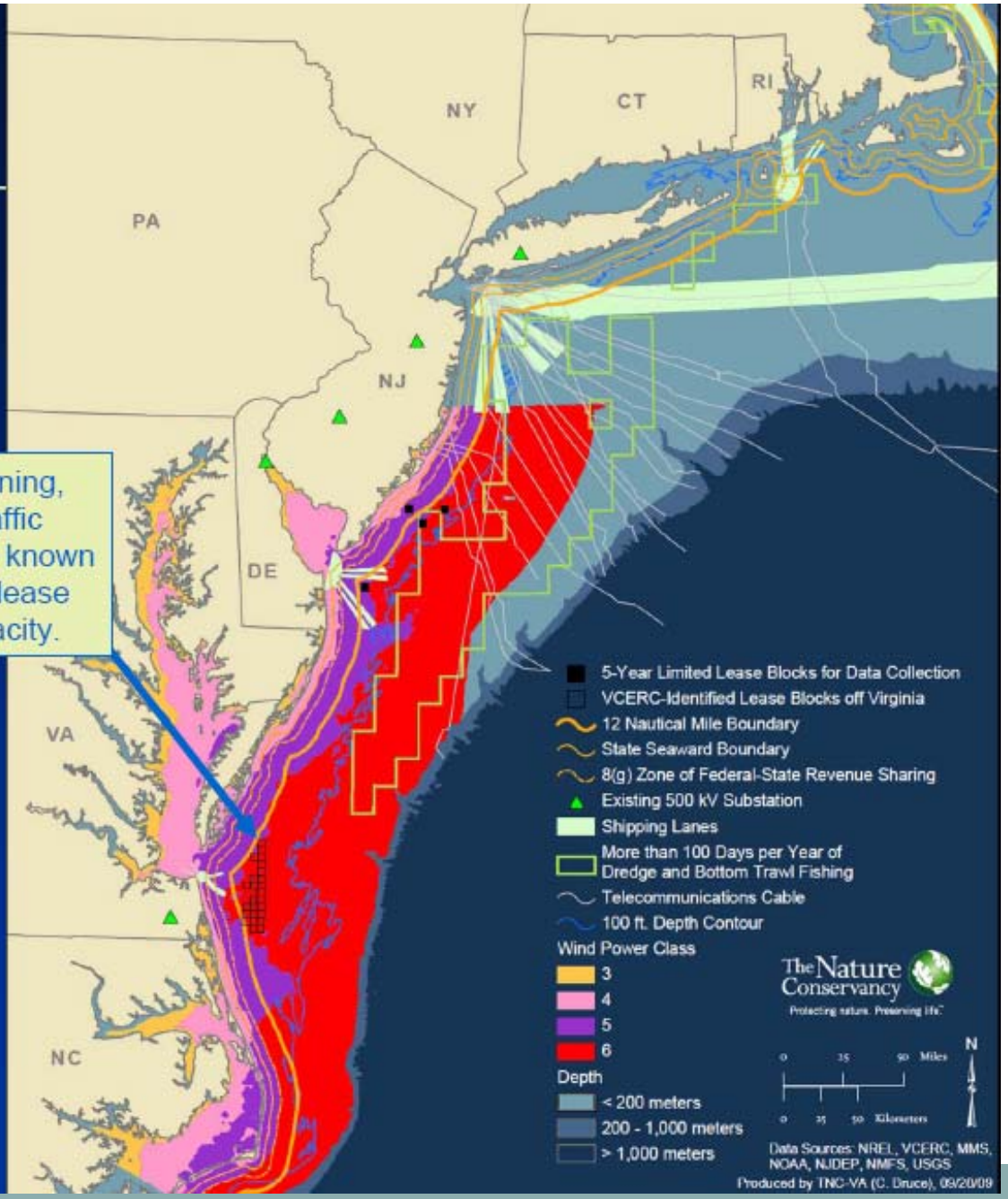
Born Ready – What's Next



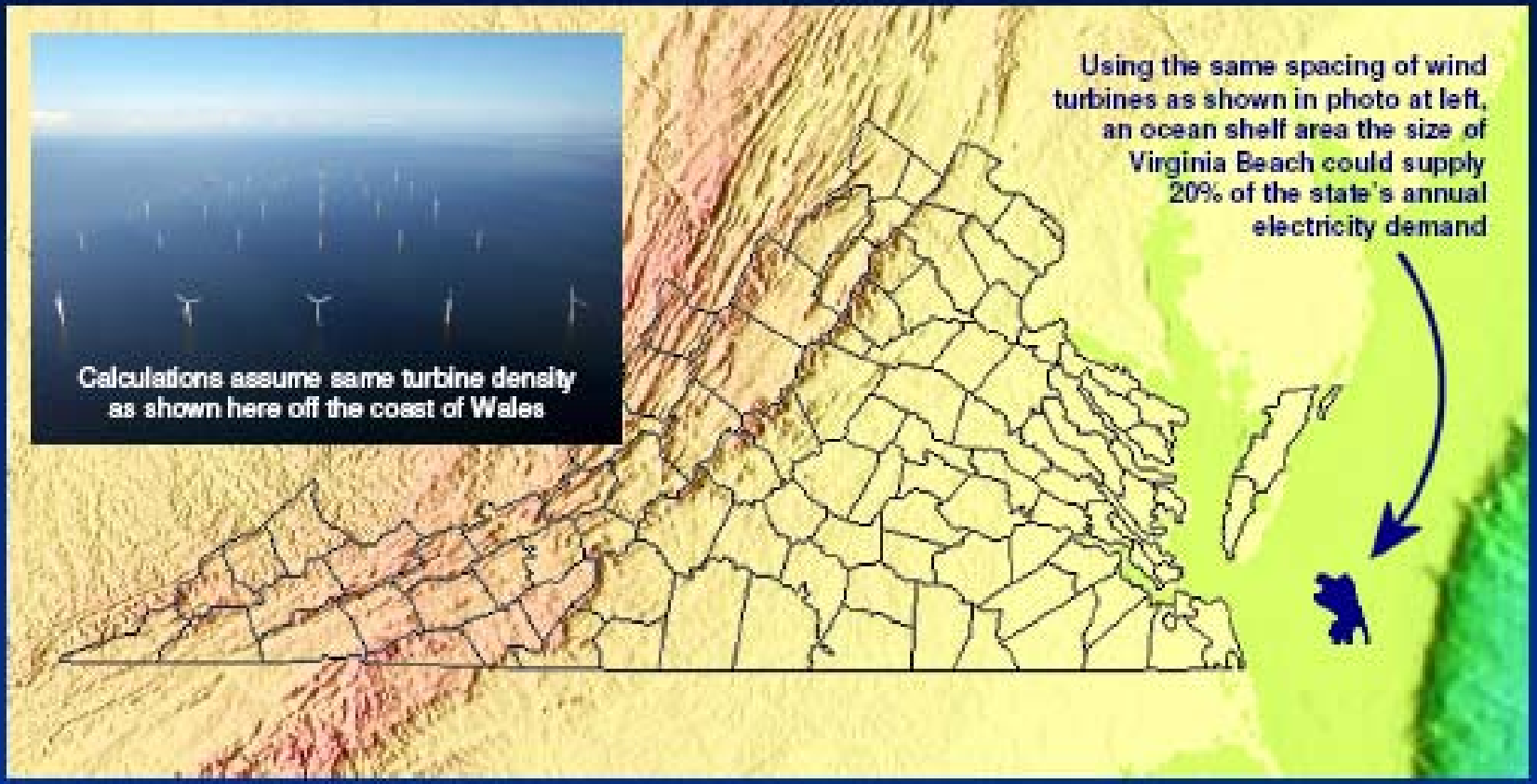
6 Megawatt (and larger) Mega Turbines

Atlantic Context for Virginia Resource

Avoiding all excluded uses (military training, dredge spoil disposal, USCG vessel traffic separation scheme, and accounting for known shipping traffic density, these 25 MMS lease blocks could support 3,000 MW of capacity.



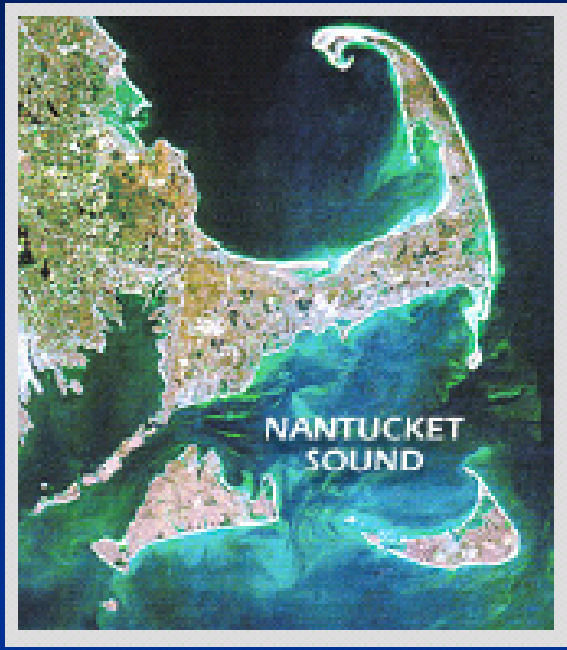
Offshore Wind Can Meet a Large Portion of Virginia's Energy Demand



With wind turbines installed at a density of 10 MW per sq.km, an ocean area of 640 sq.km could produce 21,000 GWh/yr, compared with state consumption of 104,200 GWh/yr in 2005

The proposed offshore wind energy project in Cape Cod, Massachusetts

This proposed project is the America's first and the world's largest offshore wind farm in Nantucket Sound, MASS

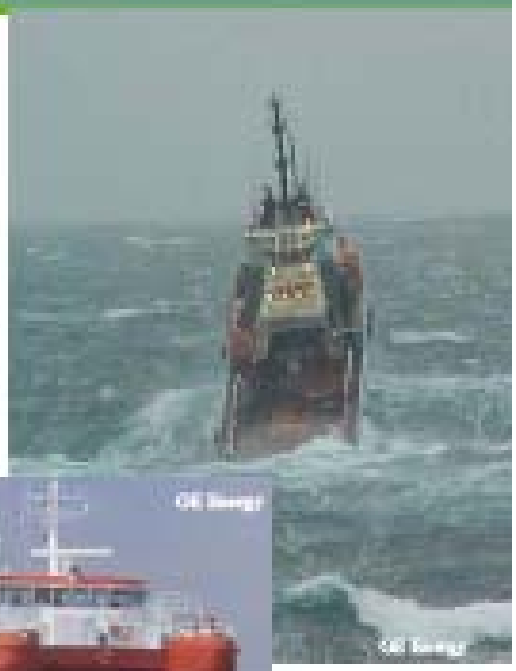


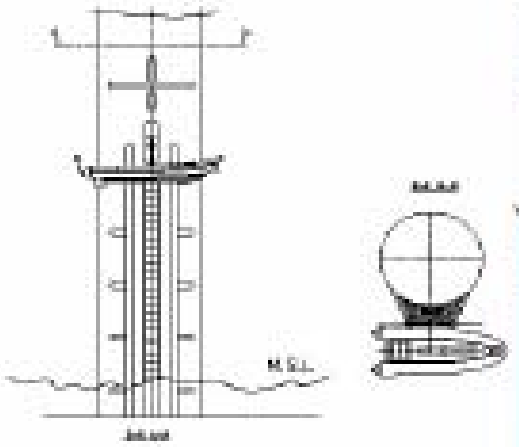
Highlights:

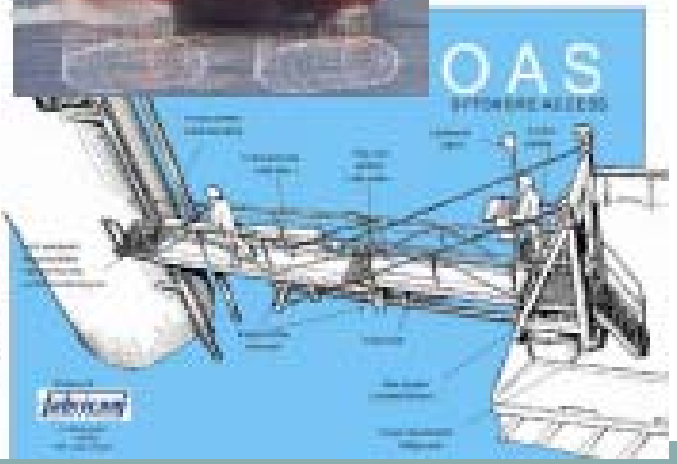
- 130 wind turbines
- 417 feet tall
- Spread over 24 sq miles
- Up to 420 MW (3/4 of the cape and Islands electricity needs)

U.S. Department of Energy
Energy Efficiency and Renewable Energy

Offshore Turbine Access







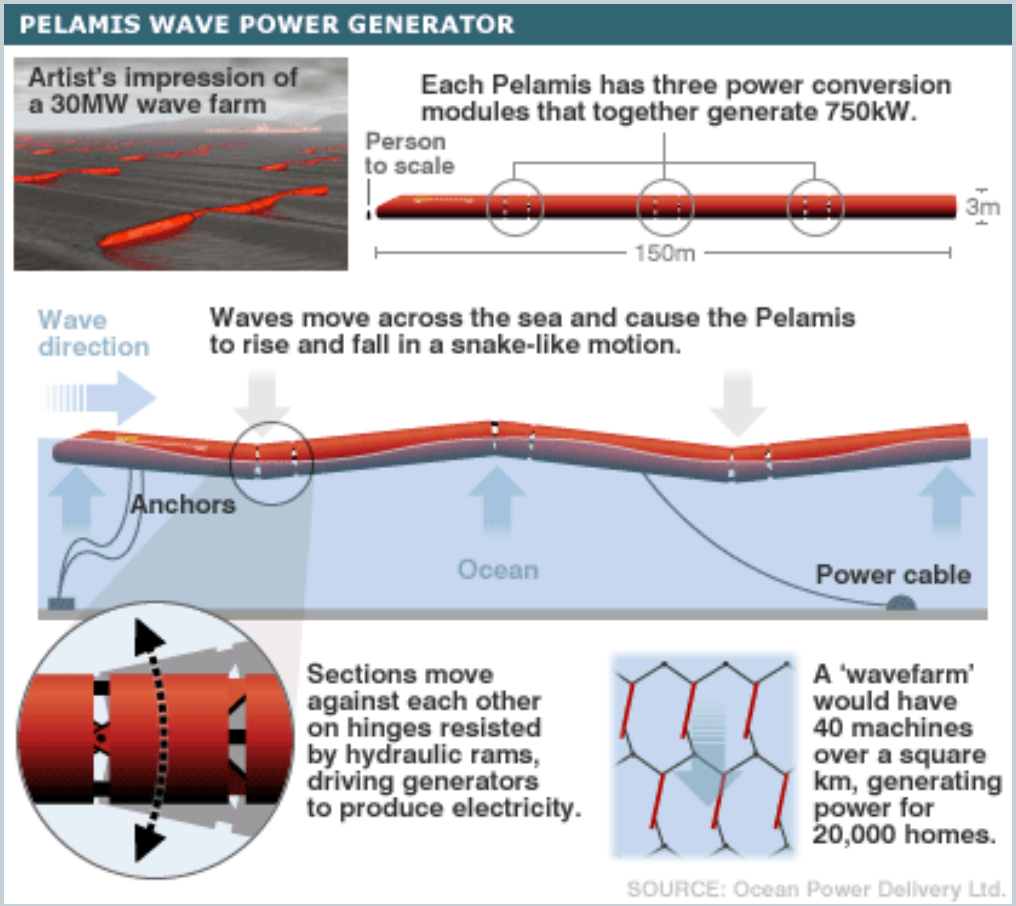
Vindeby Wind Farm, Denmark

Vindeby Wind Farm, Denmark

Offshore Wave Energy- Surface

Ocean Surface- Horizontal Systems

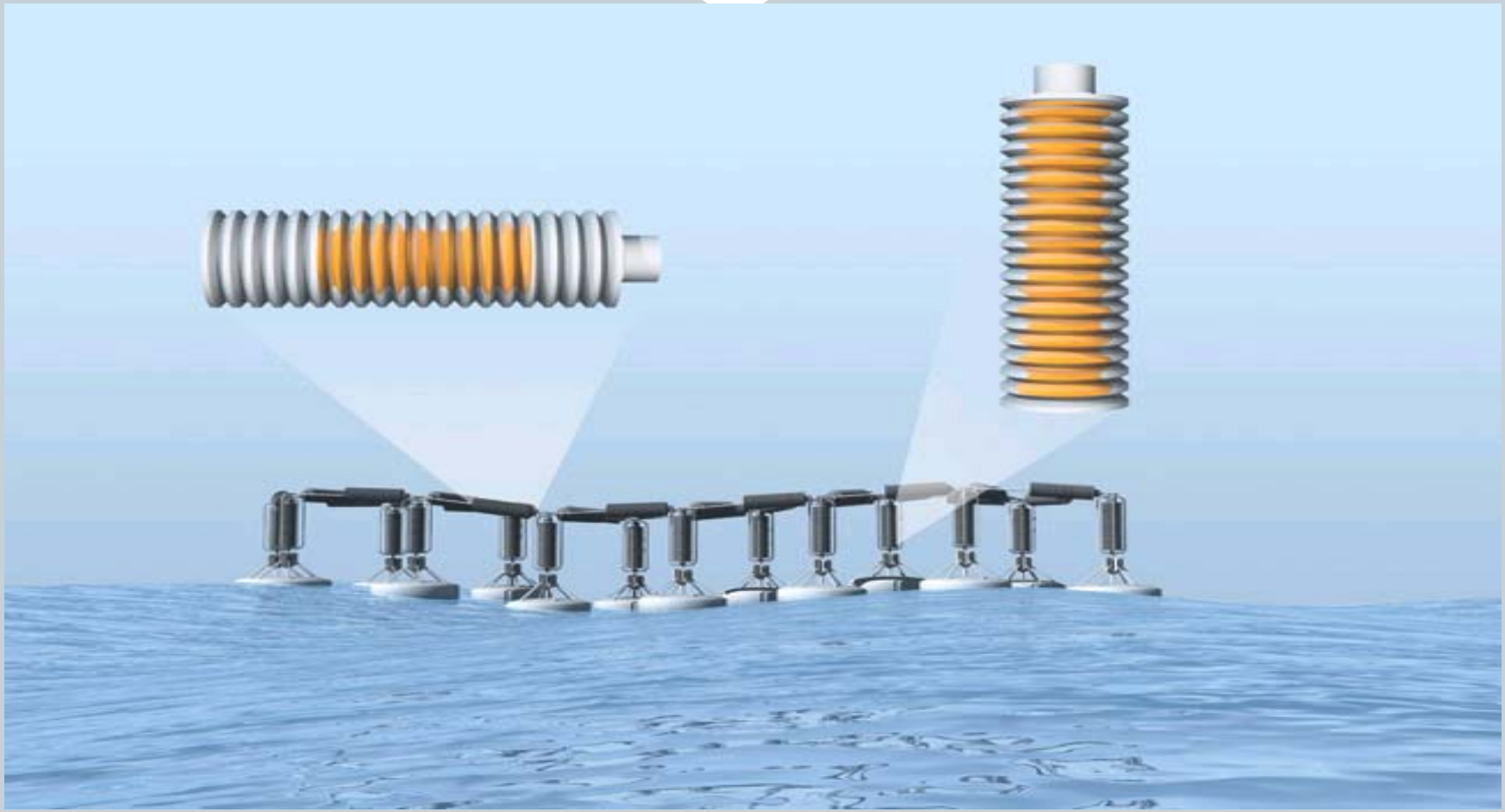
Surface Units- 475 feet long



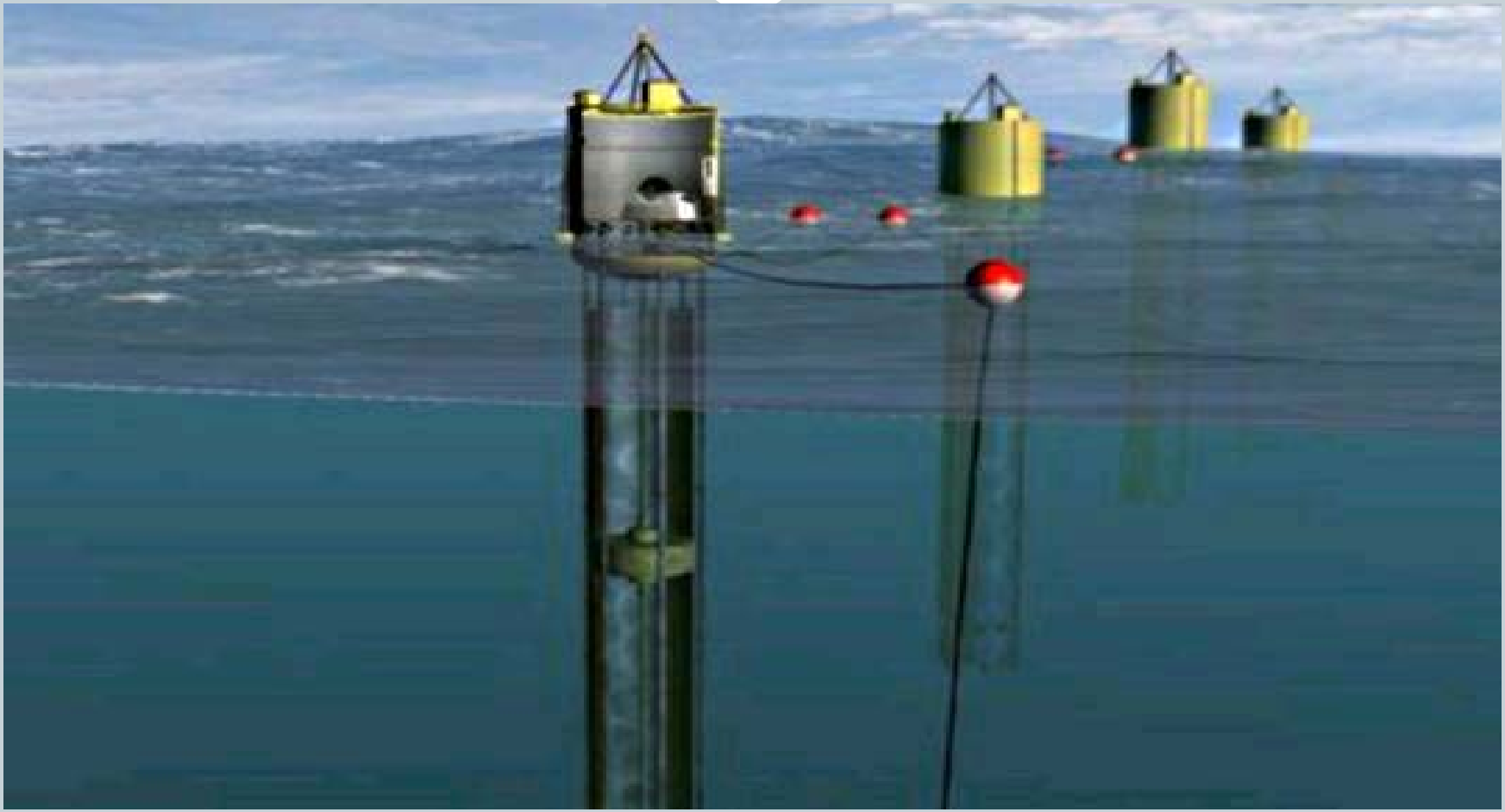
Arrayed into Wave Power Farms

And They Are Already Here

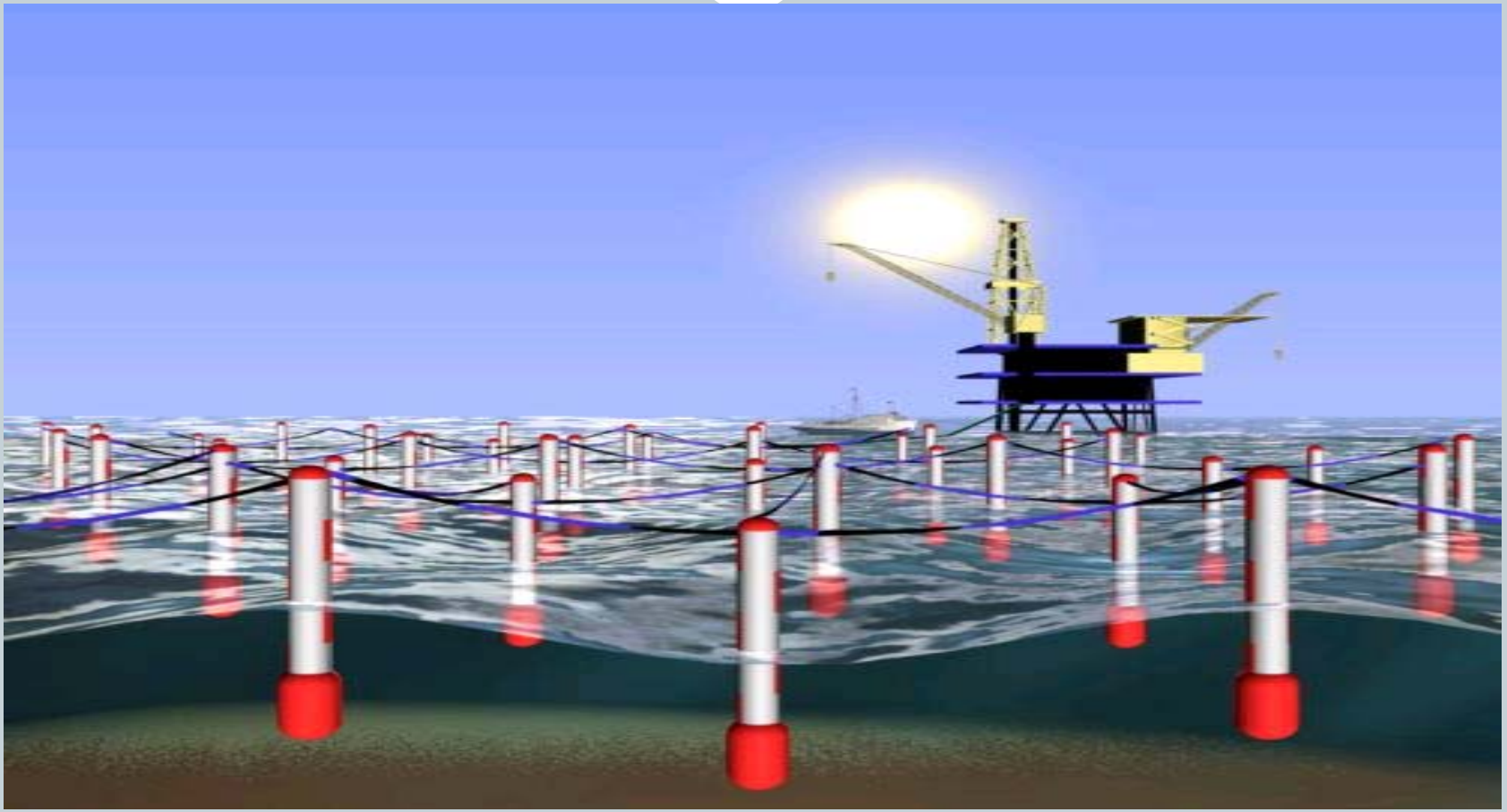
Ocean Surface- Vertical Systems



Ocean Surface- Vertical Systems



Arrayed into Wave Power Farms

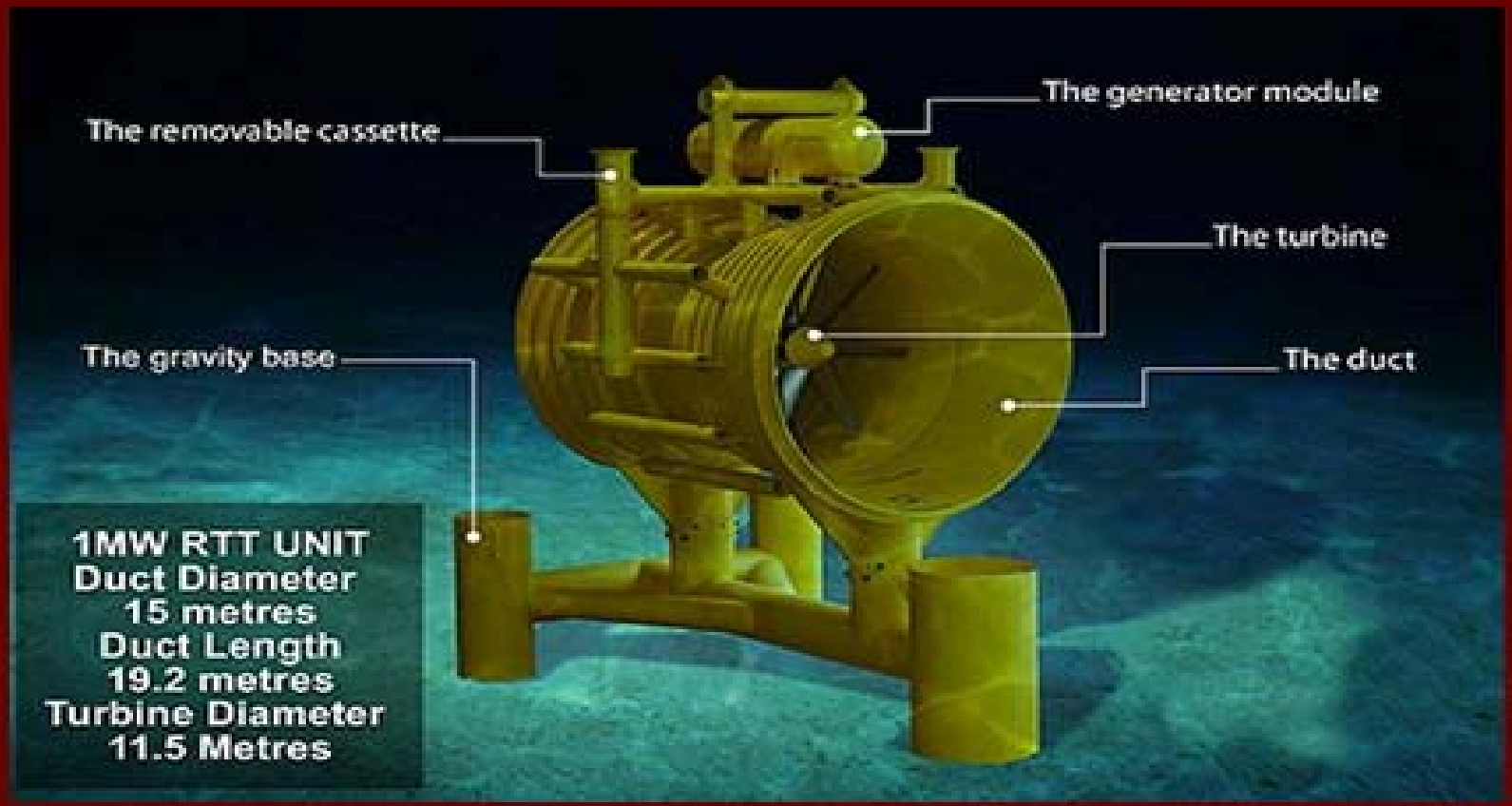


Ocean Subsurface- Vertical Systems

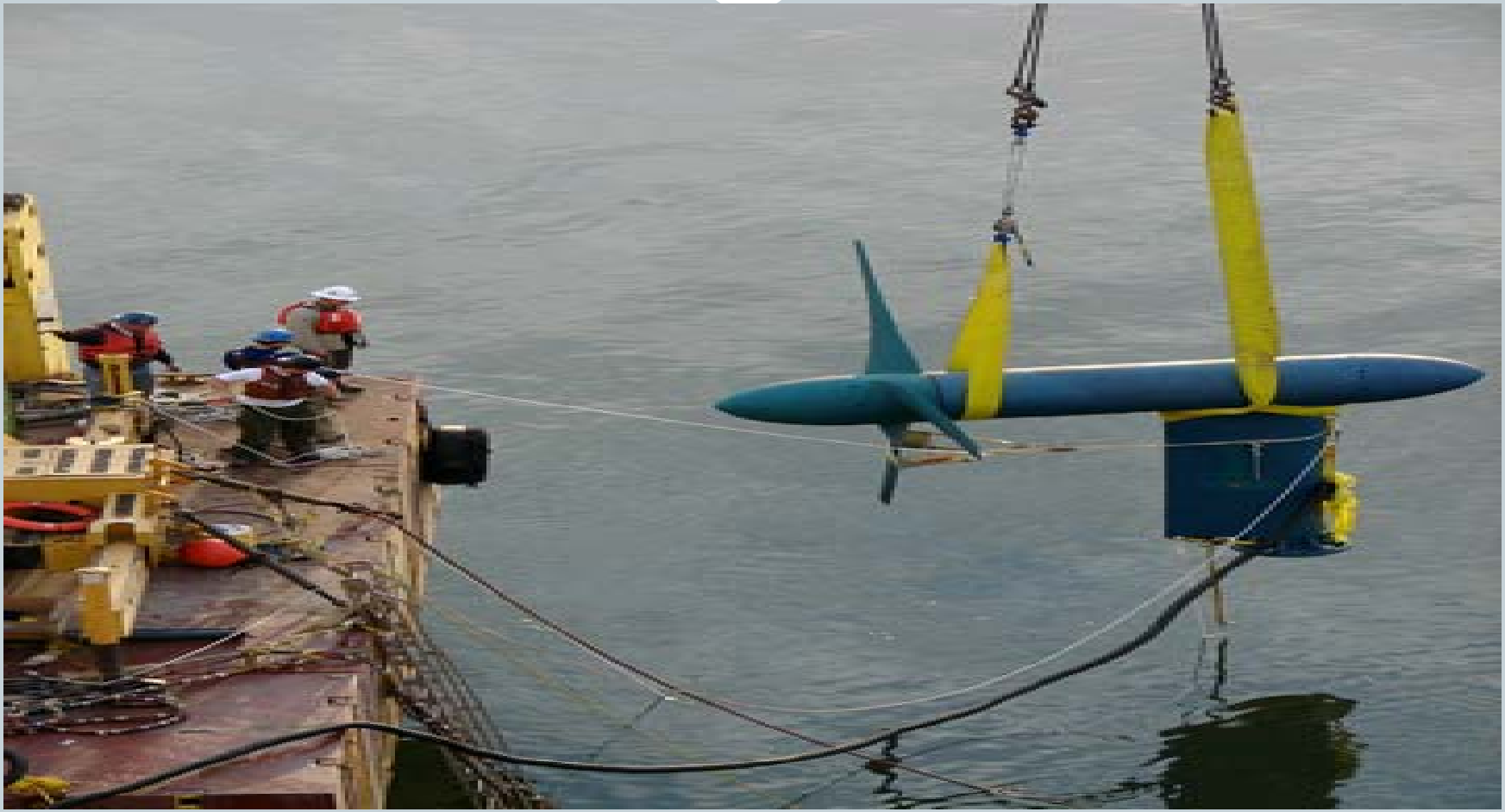
Offshore Tidal Power

Already Here

Subsurface- Tidal Power



Subsurface- Tidal Power



Ocean Algae Farming

Ocean Algae Farming

Ocean Algae Farming

Algae Harvesting- Already Here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UNLOCKING THE POWER OF IDEAS


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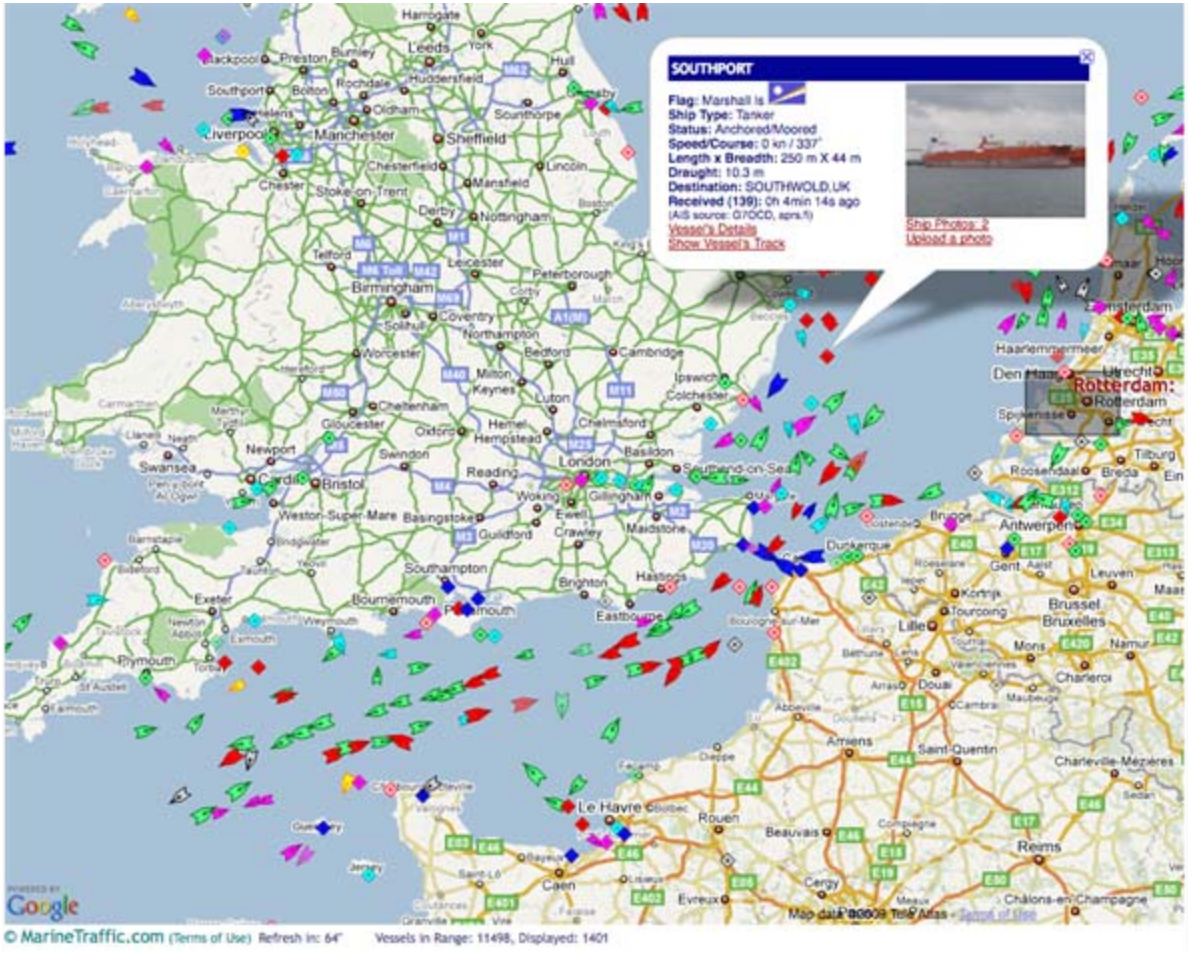
Technology and Offshore Development - Forces for Change

CDR Kurt Virkaitis
Secretary of Defense –
Office of Net Assessment

Technology advances and **offshore development** will significantly impact the Coast Guard over the next 30 years.

- The ocean surface will be less and less anonymous
- Much more will be known about fisheries management
- Oceans will become more crowded with fixed or anchored infrastructure

Decreasing Anonymity
Automatic ID System (AIS) Vessel Tracking

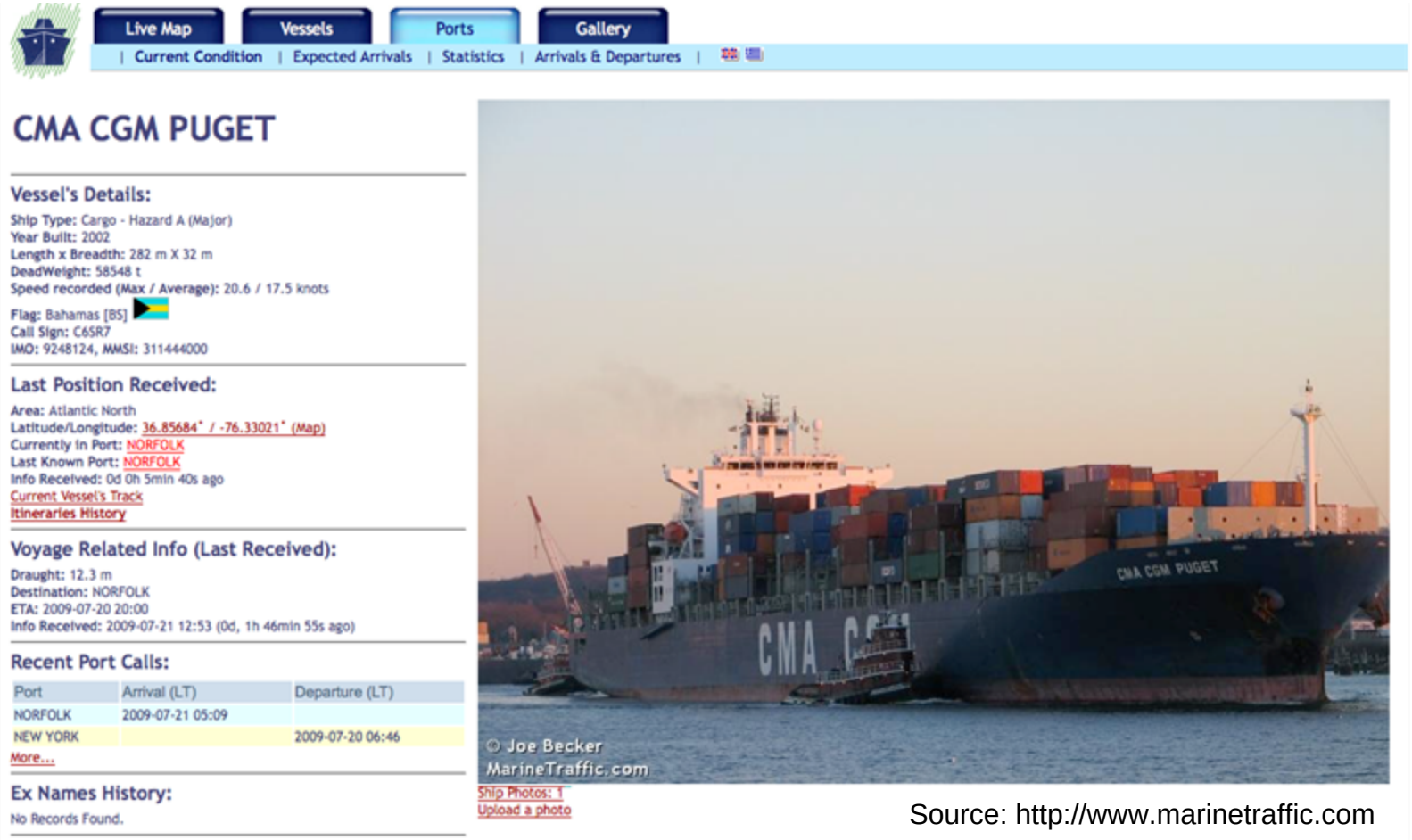


Source: http://www.marinetraffic.com

Partly required, partly voluntary by operators, readily available on-line

Anonymity:

Can zoom from basin to vessel info



Source: http://www.marinetraffic.com

Systems likely to become ever more complete, with smaller vessels reporting out of requirement or voluntarily

Eventually the surface will be almost completely transparent

- Data management & analysis will be vital. Systems/processes to manage this massive amount of data will be critical to success
- Smugglers will be forced to abandon the surface in favor of the more opaque subsurface environment

Self-propelled semi-submersibles already prevalent

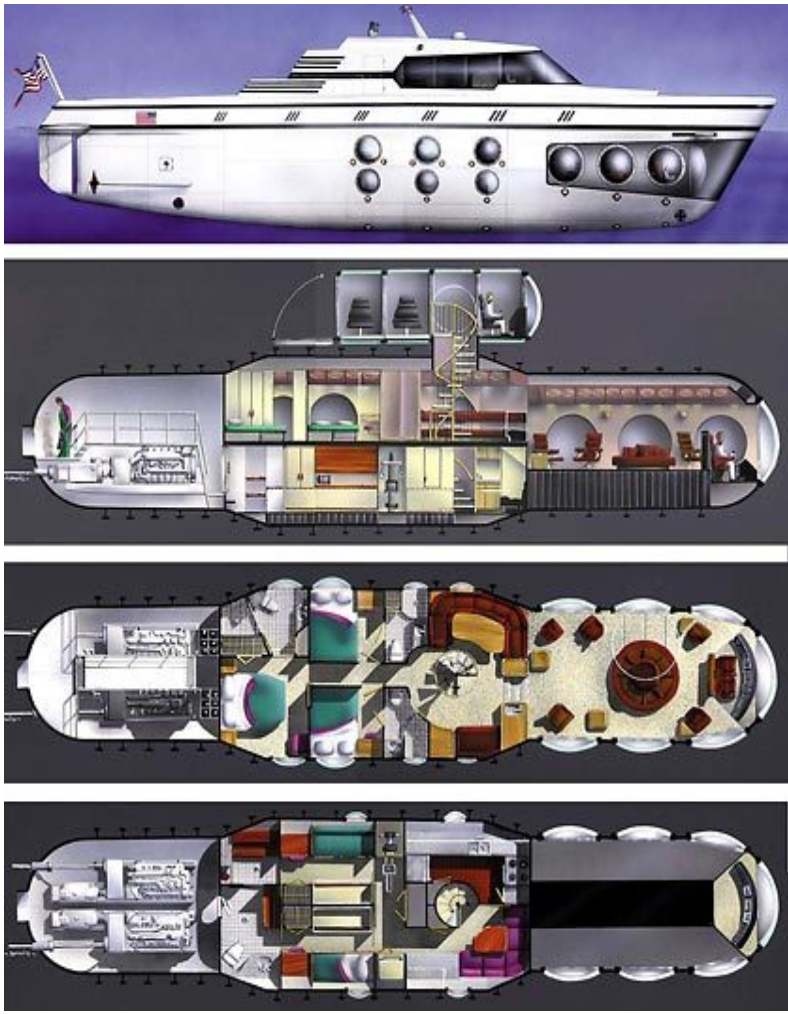
Cost ~$2 million to build and are disposable

Can land ~10 tons of cocaine worth ~$200 million

Indigenous sub manufacture is not impossible, but open market purchase is also possible

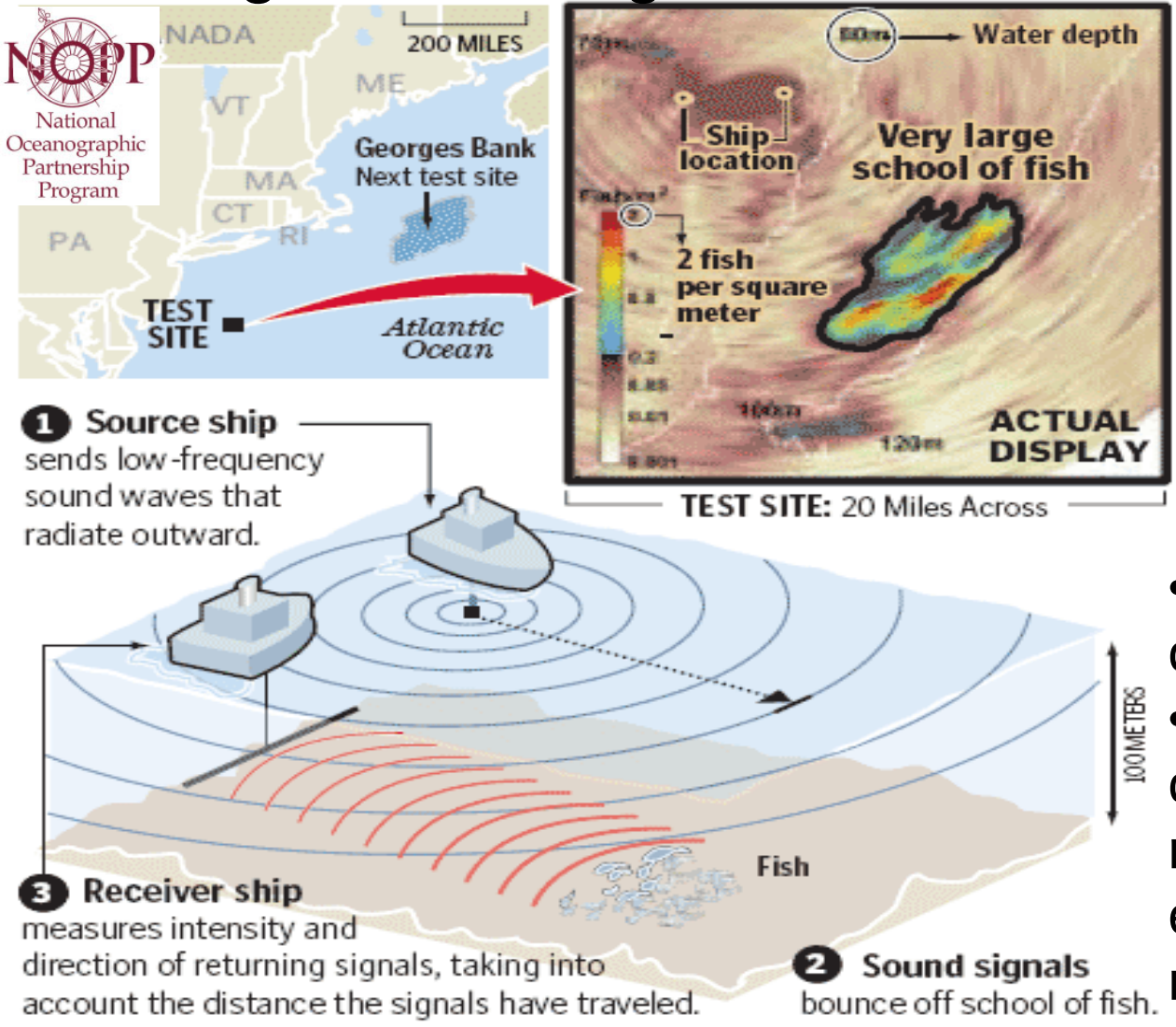
- Operating Depth ~300 meters
- Length ~120 feet
- Max Surface Speed 16 kts
- Max. Submerged Speed 8 kts
- Surface Range 3000 NM
- Submerged 5 hours at 8 kts
- Cost ~$20 Million

- Profit is lower, but can avoid capture/detection by diving
- Reusable
- Bad guys get the perk of round trip luxury transport



Source:http://seattletimes.nwsource.com/html/businesstechnology/2003783824_luxurysubs11.html?referrer=digg

Transparency: Instantaneous, continuous wide-area detection & imaging by Ocean Acoustic Remote Sensing Acoustic lighthouses with 150 km radius

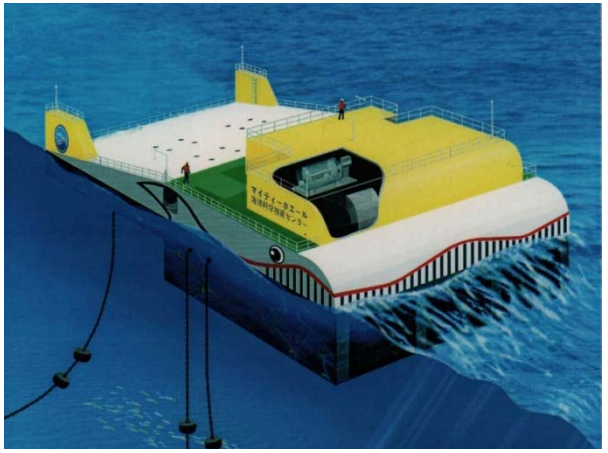


- Powerful tool for fishing or regulating fishing
- Could provide for more catch and better stock resilience; but regs/ enforcement would be more complex

Ocean Crowding

More uses, more users

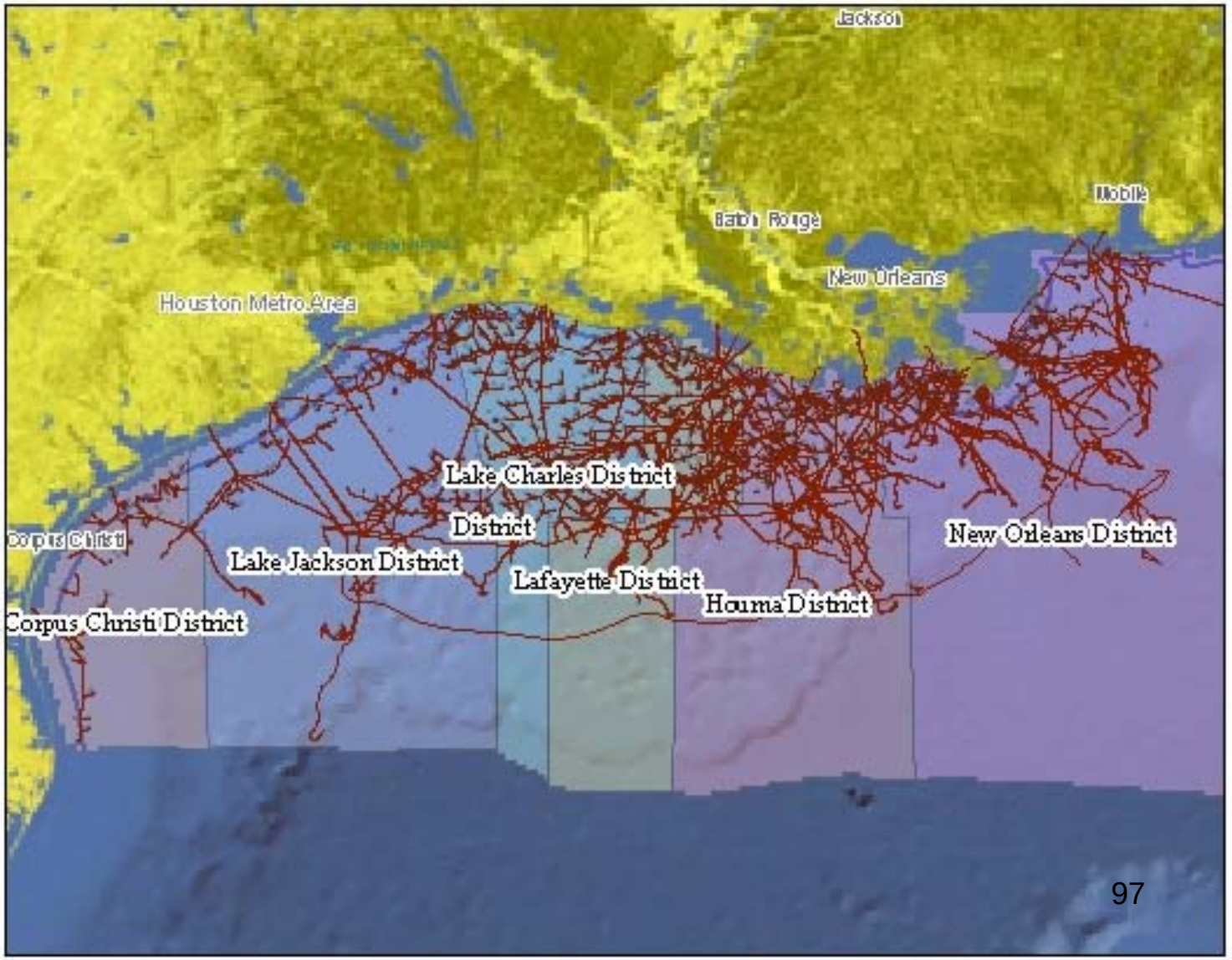
Wave energy machine (concept)



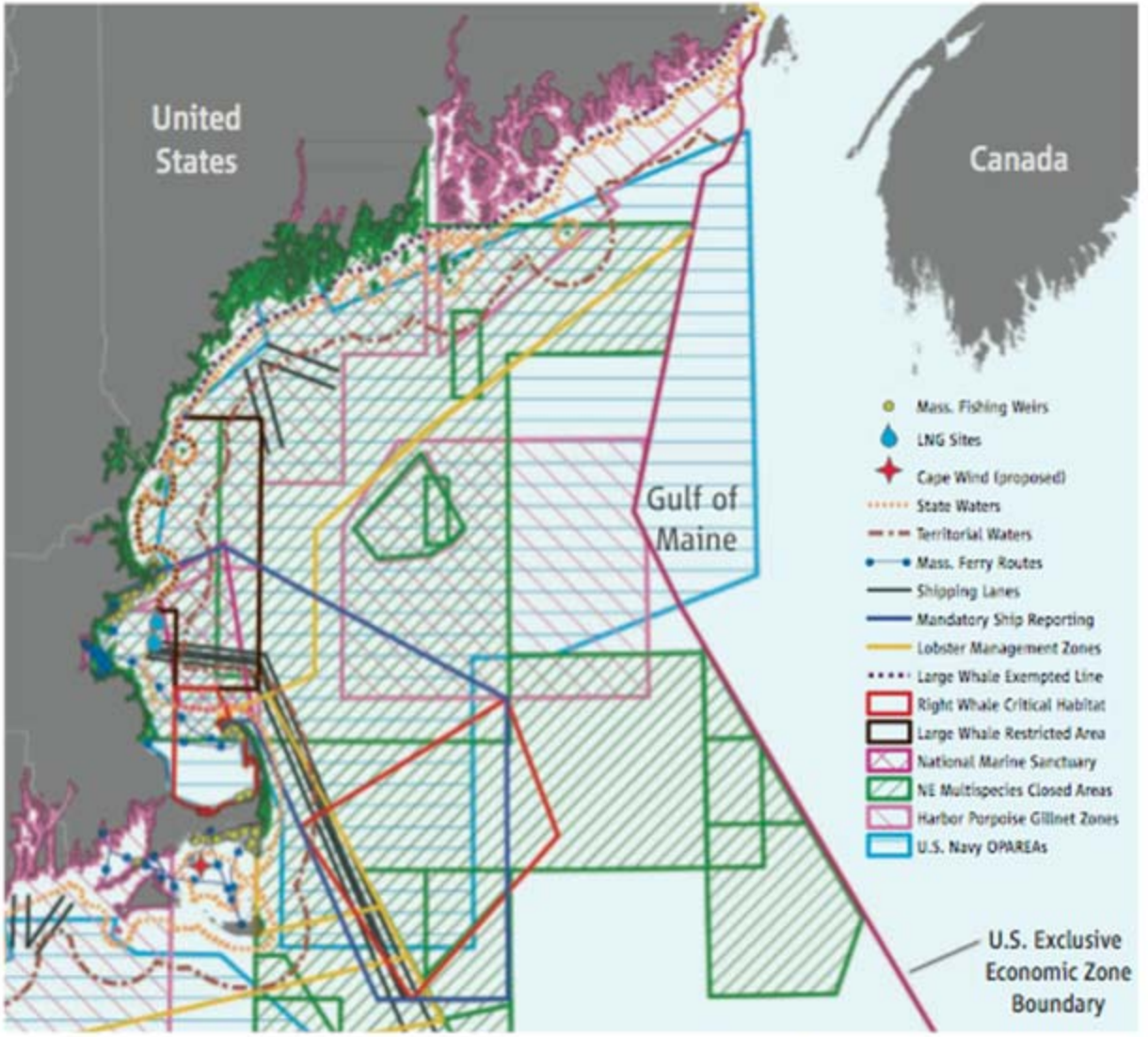
Drilling derricks

Offshore Oil & Gas: Extensive, complex networks offer vulnerability & resilience

Gulf of Mexico pipeline network



- As ocean real estate is developed; regulation will also increase
- This will require CG involvement and expertise
- New infrastructure will require some level of protection – Who will do it? Is it homeland security or homeland defense?



Uncoordinated sectoral ocean governance. A cacophony of activities, most regulated by separate federal agencies, crowd ocean waters in the Gulf of Maine. A federal public trust doctrine extended to all U.S. ocean waters would identify these agencies as trustees of the U.S. ocean public trust, unifying them for the first time under a common mandate to manage marine resources sustainably. LNG, liquified natural gas; OPAREAs, Operating areas.

Source: M. Turnipseed et al 2009 (Science)


THE JURY'S STILL OUT ON CLIMATE CHANGE.

CDR Kurt Virkaitis, Secretary of Defense – Office of Net Assessment

703-697-1313

kurt.virkaitis@osd.mil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USCG 2016

Rapid Surge Capability
Core Maritime Competencies
Member of Intel Community (MDA)
Honest Broker

Coastal & Offshore Waters

- Maritime border security
- Multi-mission platforms
- Straddle military-civilian
- LE Authorities
- Military Presence
- SAR
- Presence in EEZ

Global

- Maritime Governance Experience
- Maritime Security Experience
- Peer to most foreign navies
- Humanitarian Reputation
- Partnerships
- IMO Lead

Ports, Inland & Inshore Waters

- Nationally Distributed
- Partnerships
- Local Community Integration
- Holistic Maritime Expertise
- ATON Fleet (MTS Support)
- Authorities (COTP/FOSC/SMC/OCMI/FMSC)

Increasing Recapitalization Timeframes

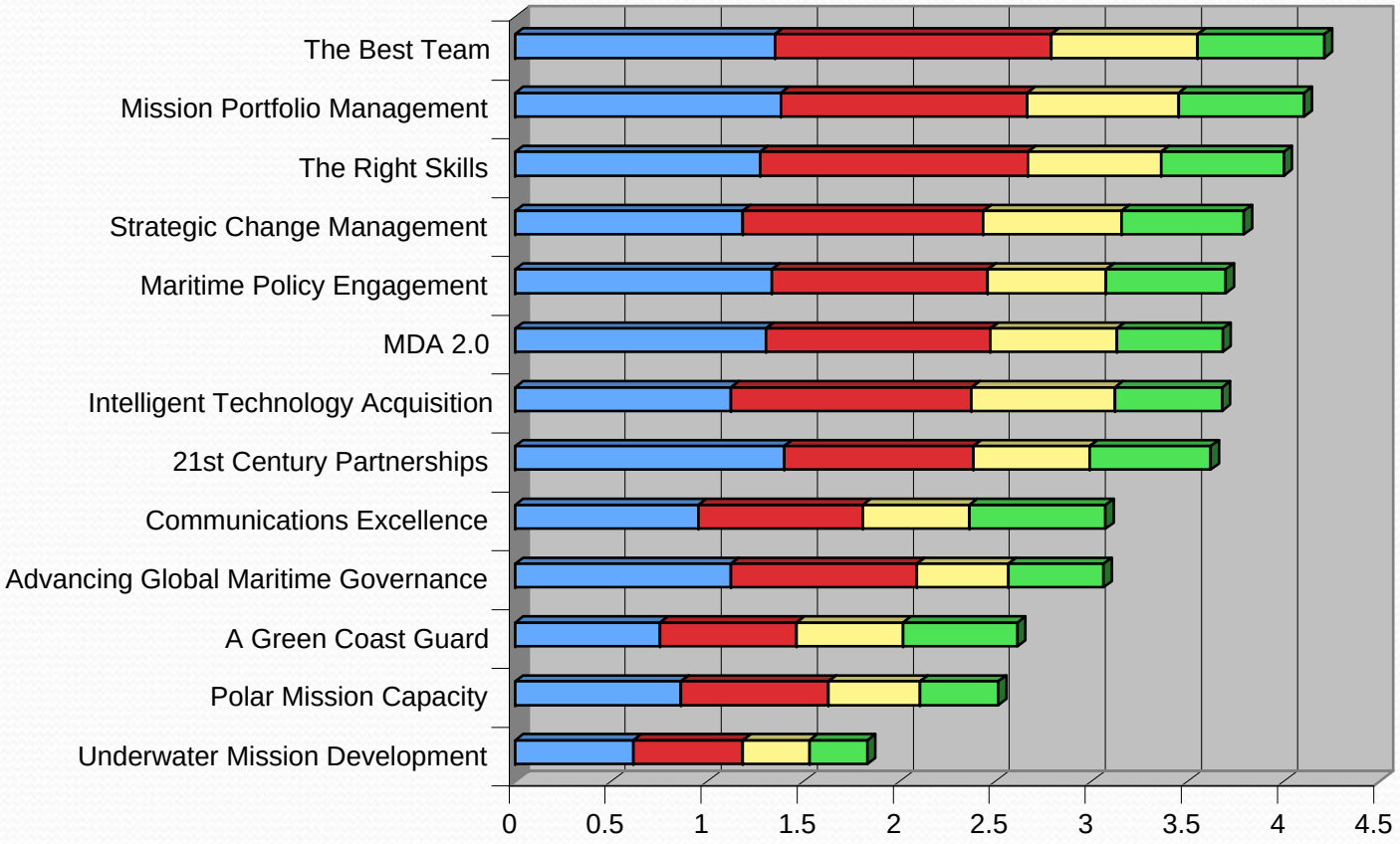
Increasing Capability Overlap with Partners USN

Increasing Coast Guard "Stock Price"

Evergreen Strategies

- 21st Century Partnership
- Advancing Global Maritime Governance
- Maritime Policy Engagement
- Strategic Change Management
- Mission Portfolio Management
- MDA 2.0
- Polar Mission Capacity
- Underwater Mission Development
- The Best Team
- The Right Skills
- Intelligent Technology Acquisition
- Communications Excellence
- A Green Coast Guard

Strategy Breakout Session - Strategy Prioritization Results

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