

The Center for Secure and Resilient Maritime Commerce (CSR)



DHS Center of Excellence for Port Security
11 Institutions – Maritime Domain Awareness & Resiliency

Maritime Domain Awareness

Approach –
Multi Use Technologies
Demonstrate Nested Vessel Detection
Global > Approaches > Port

University of Miami –
Global Satellite Coverage,
Visible & Microwave

Rutgers University –
Over-the-Horizon Compact
High Frequency Radar Networks

Stevens Institute of Technology –
Local High-Resolution Optics &
Shallow Underwater Acoustics



The National Center for Secure and Resilient Maritime Commerce



The Center for Secure and Resilient Maritime Commerce (CSR)



Rutgers University – CODAR Ocean Sensors
Academic – Industry Partnership since 1998

CSR's HF Radar Mission:

1. Develop the HF Radar Multi-Use Capability for Current Mapping & Vessel Tracking.
2. Transition these Capabilities to Operational Use for Search And Rescue (SAR) and Maritime Domain Awareness (MDA).
3. Educate the Workforce Required to Operate these National Systems.



The Center for Secure and Resilient Maritime Commerce (CSR)



HF Radar Team

Rutgers University -

Scott Glenn, Josh Kohut, Hugh Roarty, Mike Crowley, John Kerfoot, Ethan Handel, Mike Smith, Colin Evans

CODAR Ocean Sensors -

Don Barrick, Pete Lilleboe, Chad Whelan, Belinda Lipa, Bill Rector, Jimmy Isaacson

University of Puerto Rico - Mayaguez

Jorge Corredor, Julio Morell, Miguel Canals

Applied Mathematics, Inc -

Bill Browning

University of Alaska -

Tom Weingarter, Hank Statscewich

Ocean Power Technologies -

Debbie Montagna, Bruce Downie

Naval Research Laboratory

Michael Lovellette, Dan Newton

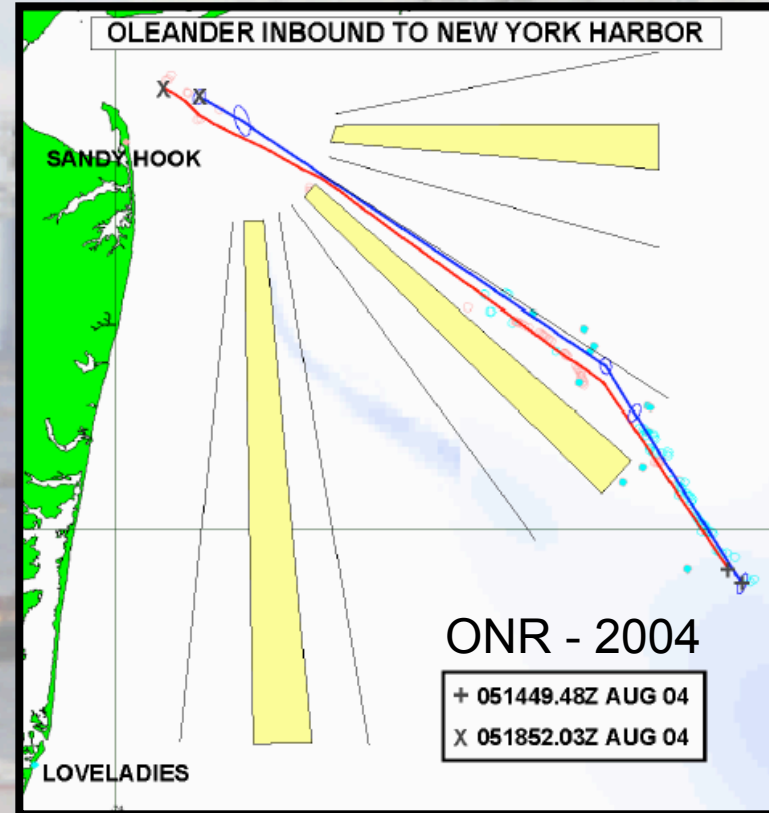
Norwegian Defence Research Establishment (FFI)

Terje Johnsen, Walther Asen

CODARNor

Anton Kjelaas

Rutgers University – CODAR Ocean Sensors
Academic – Industry Partnership since 1998



CODAR Compact HF Radar Antennas



25 MHz



13 MHz



5 MHz

Combined Transmitter & Receiver

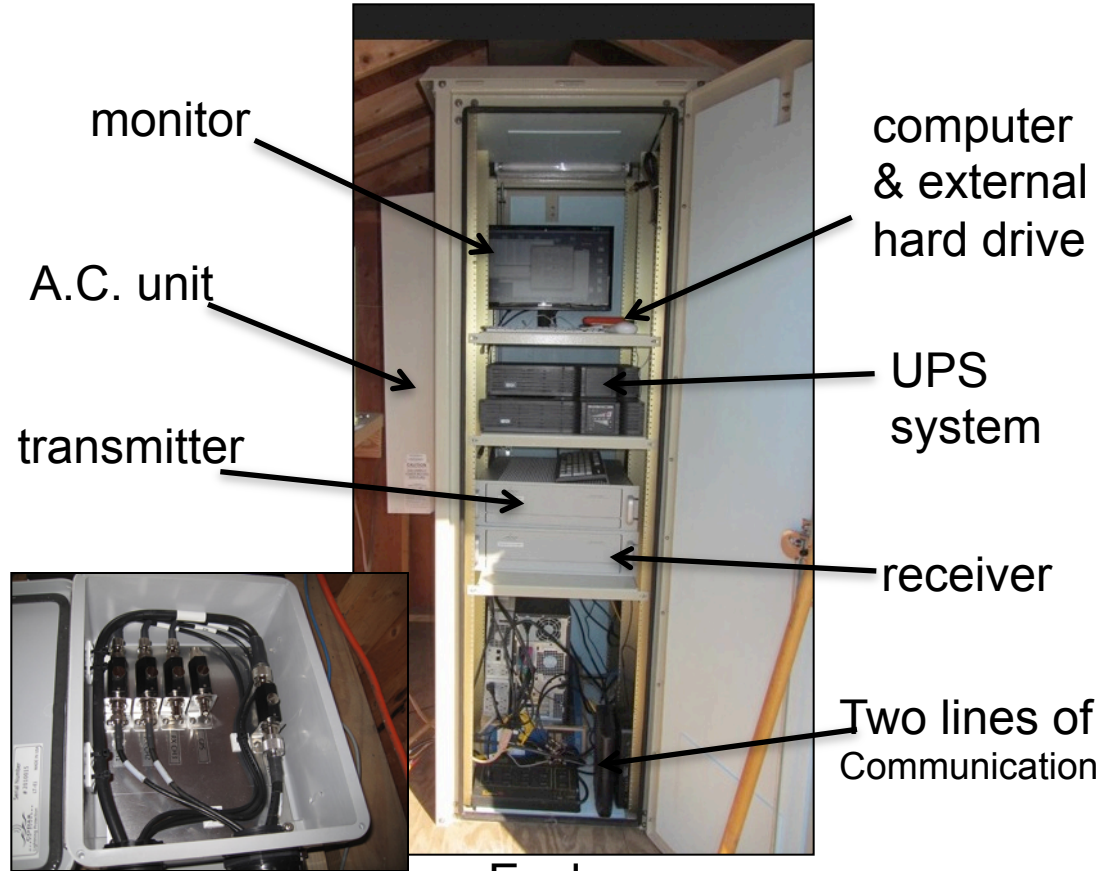
Separate Transmitter & Receiver



Shed and Enclosures



Shed

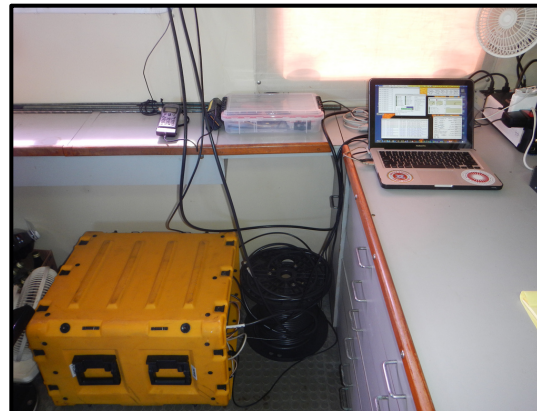


Lightning Protection

Enclosure



Bistatic Transmitters



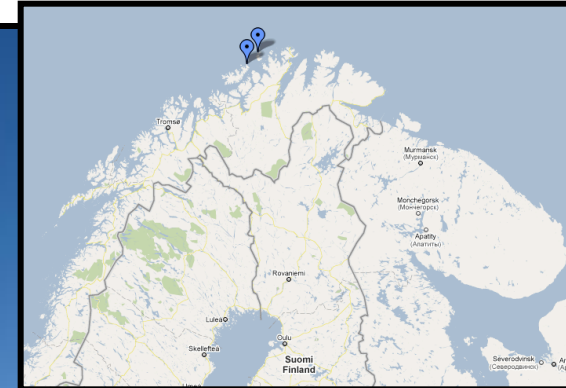
Oil Spill Rapid Response



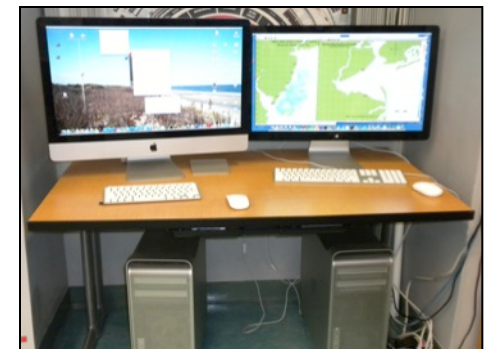
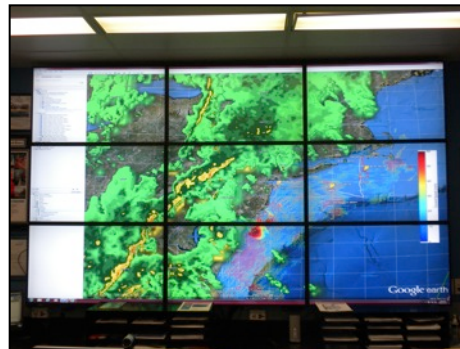
- Norwegian Clean Seas Association for Operating Companies (NOFO)
- Propane generator
- Satellite Communications



Oil Spill Rapid Response

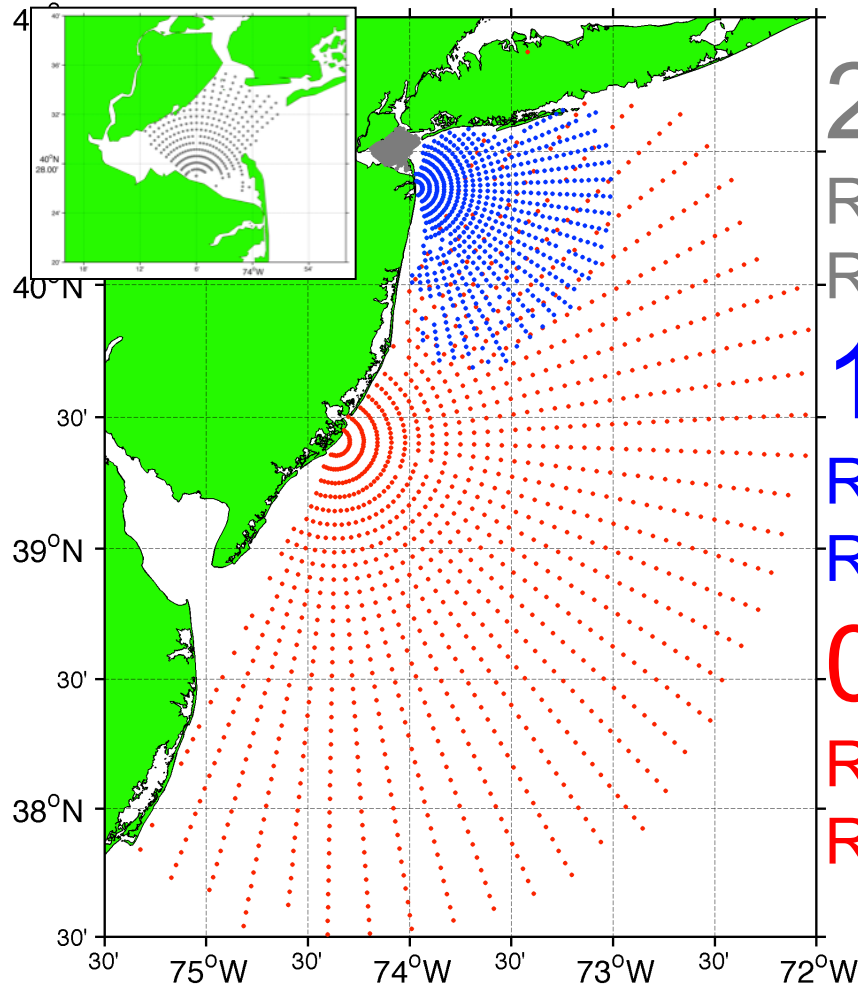


Data Aggregation Center



The Center for Secure and Resilient Maritime Commerce (CSR)

Surface Current Mapping Capability



25 MHz

Radar λ : 12 m

Range: 30 km

Ocean λ : 6 m

Resolution: 1 km

13 MHz

Radar λ : 23 m

Range: 80 km

Ocean λ : 12 m

Resolution: 3 km

05 MHz

Radar λ : 60m

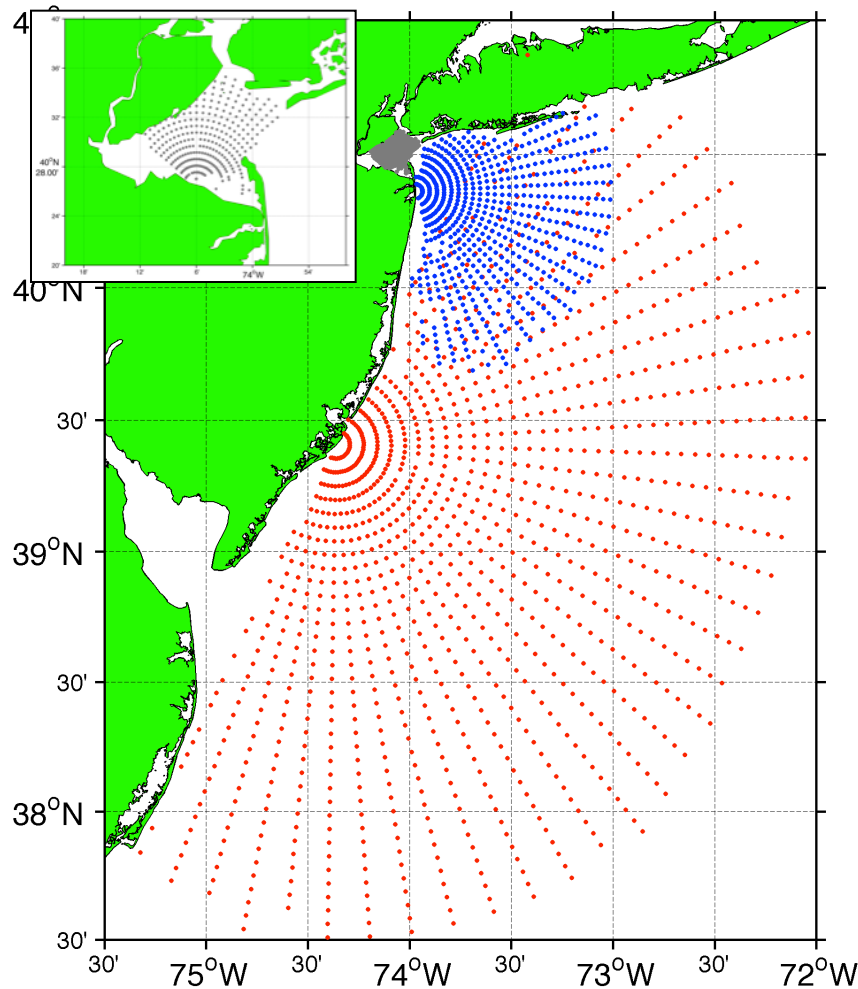
Range: 180 km

Ocean λ : 30 m

Resolution: 6 km



Vessel Detection Capability



25 MHz

Range: 11 nmi
Height >10 ft



13 MHz

Range: 43 nmi
Size: 19 ft

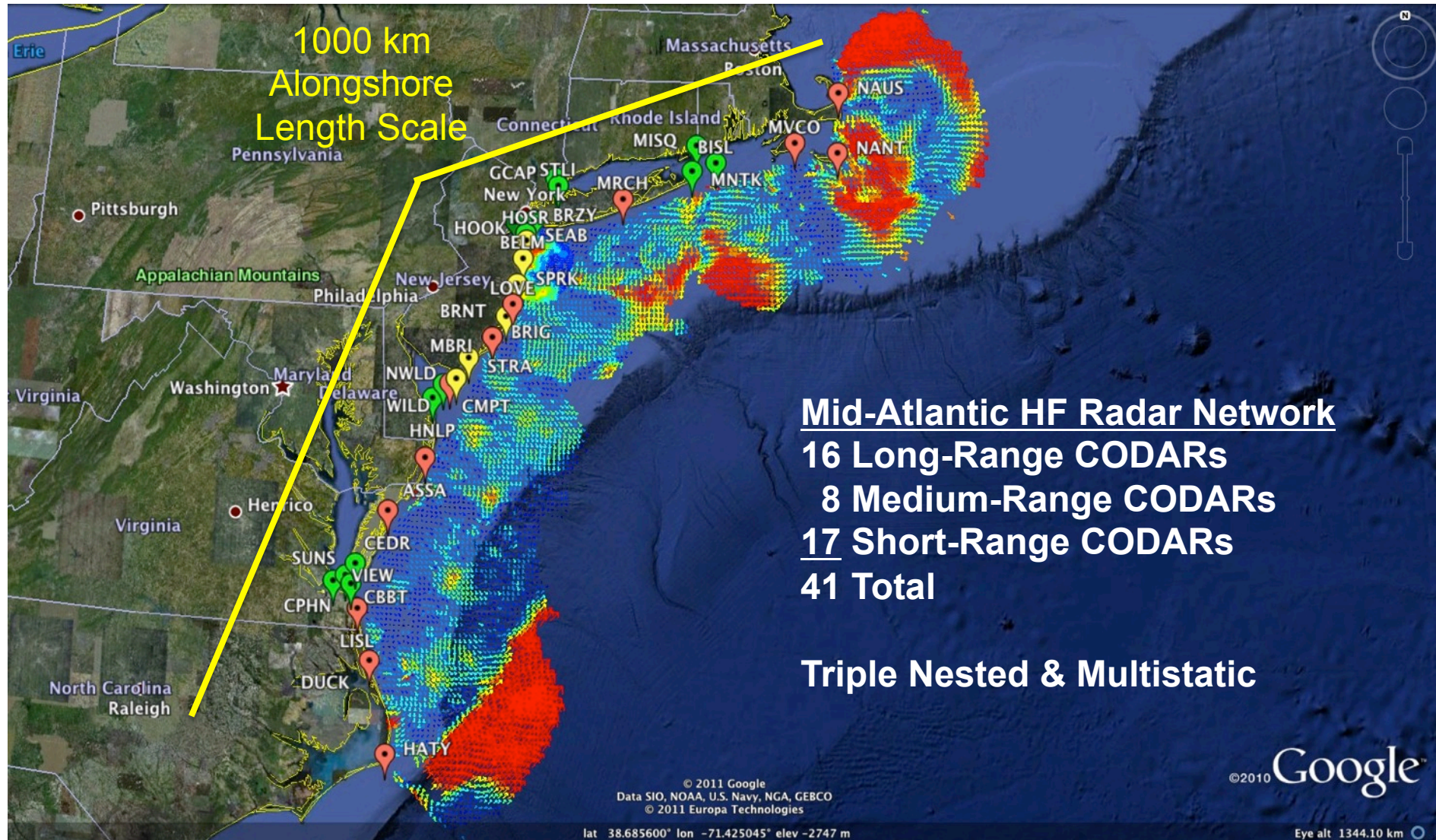


05 MHz

Range: 65nmi
Size: 50 ft



Mid-Atlantic Bight HF Radar Network



The Center for Secure and Resilient Maritime Commerce (CSR)

Success Stories – Making a Difference

Optimizing HF Radar for SAR using USCGC Surface Drifters



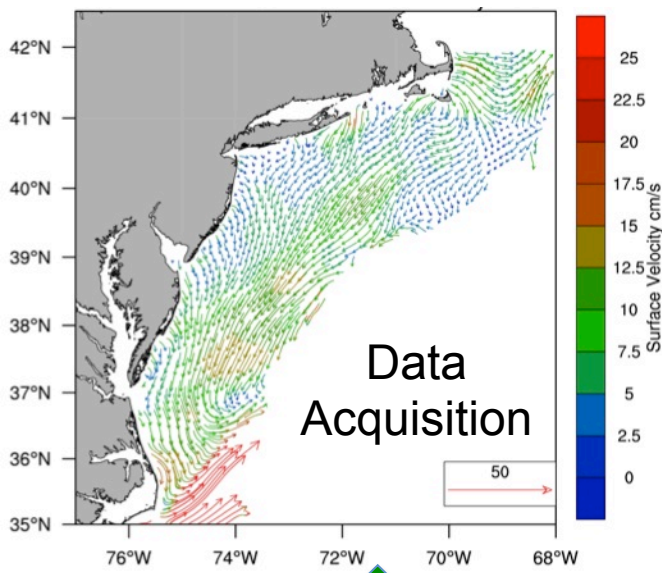
Art Allen
U.S. Coast Guard

Scott Glenn
Rutgers University

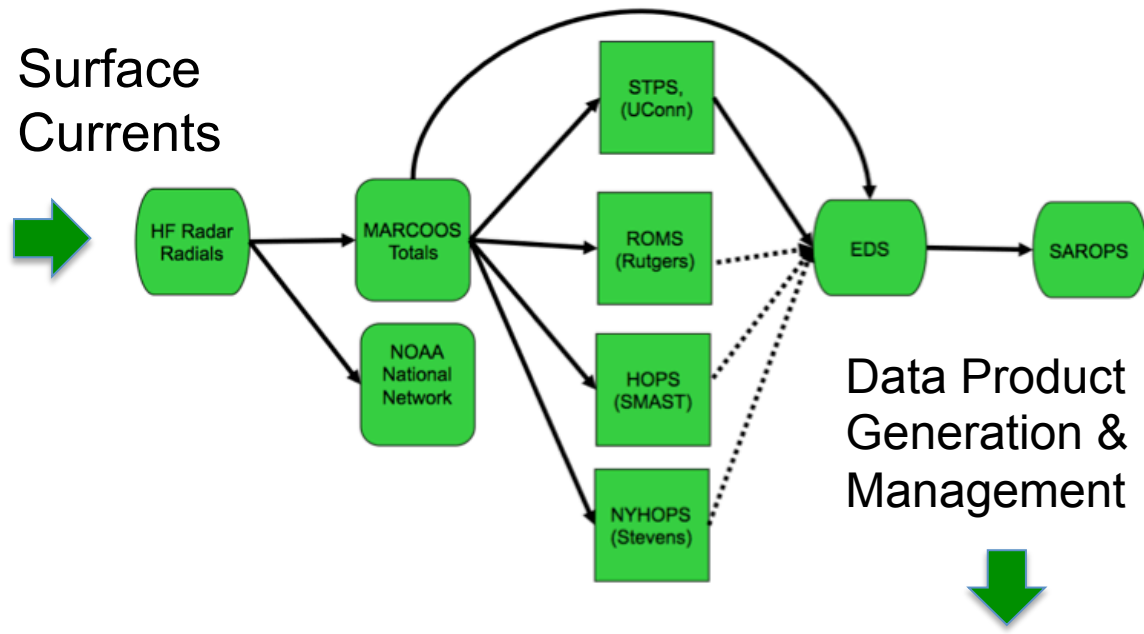
Mid-Atlantic Regional Association
Coastal Ocean Observing System



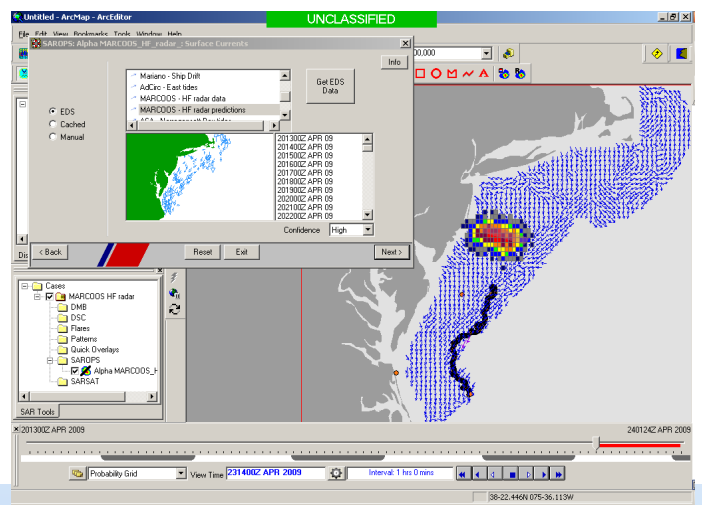
Transition Objective – Operational Use of HF Radar Surface Currents for Search And Rescue



Surface Currents



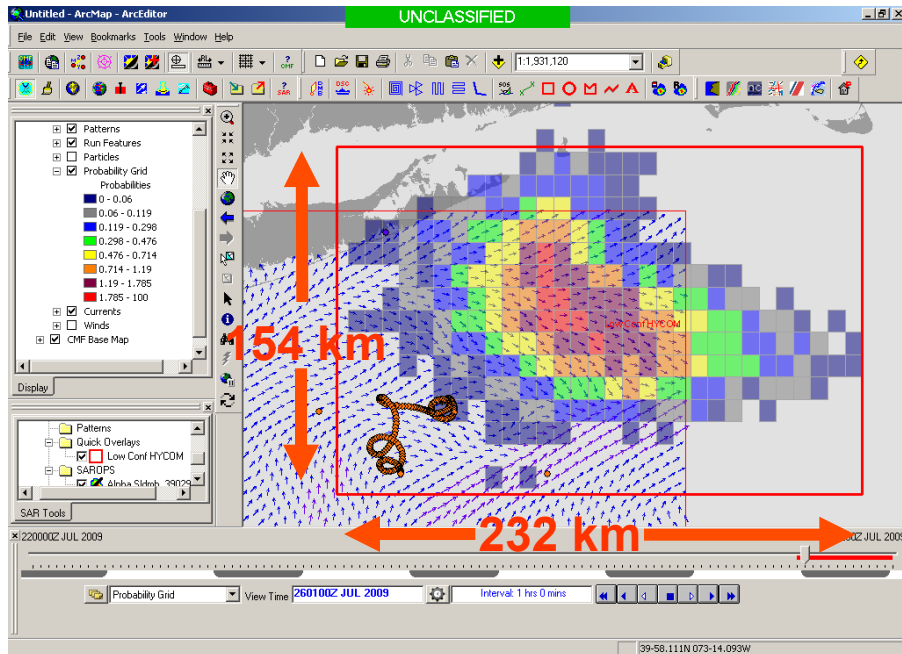
Search And Rescue
Optimal Planning
System (SAROPS)



The Center for Secure and Resilient Maritime Commerce (CSR)

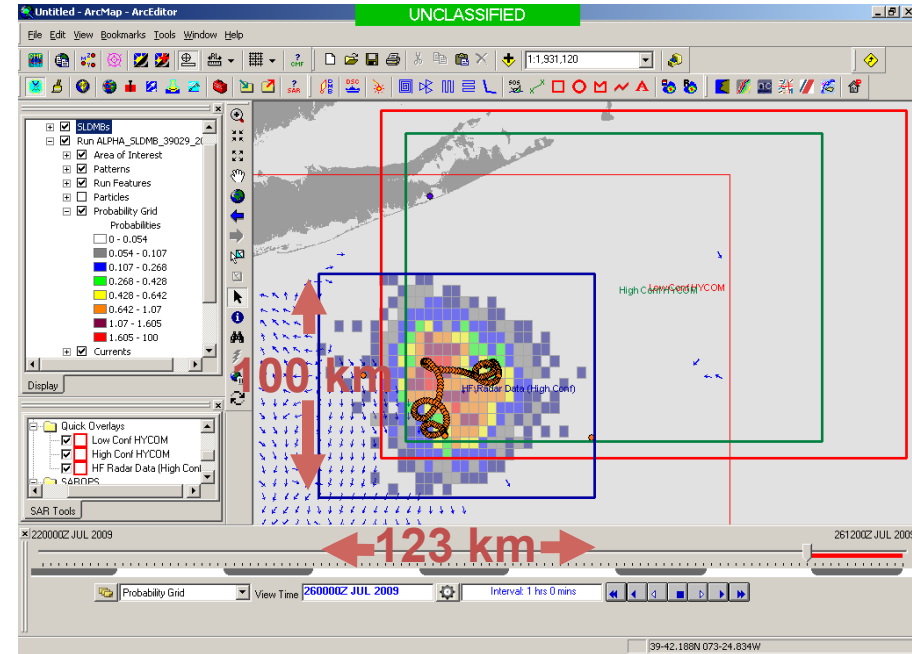


5000 Virtual Drifters – Search Area After 96 Hours



HYCOM

36,000 km²



CODAR

12,000 km²



The Center for Secure and Resilient Maritime Commerce (CSR)

May 4, 2009: After a year of testing, NOAA Announces on U.S. Department of Commerce Website that Rutgers CODAR is Operational in SAROPS

United States of America
DEPARTMENT OF COMMERCE

DTV Info

Home | Noticias en español | Careers | Person Finder | About Commerce | Contact Us | Site Map | FAQ

You Are Here: Department of Commerce

Top News

NOAA, U.S. Coast Guard: New Ocean Current data to Improve Search and Rescue Activities
Washington (May 4)—A new set of ocean observing data that enhances the ability to track probable paths of victims and drifting survivor craft should improve search and rescue efforts along the U.S. coast. The data comes from the Integrated Ocean Observing System (IOOS®), part of a joint effort among NOAA, the Mid-Atlantic Coastal Ocean Observing Regional Association, the U.S. Coast Guard, and the Department of Homeland Security. The new data sets include surface current maps from high frequency radar systems. [\(More\)](#)

Secretary Locke Sworn in at White House Ceremony by Vice President Biden
Washington (May 1)—U.S. Secretary of Commerce Gary Locke and U.S. Health and Human Services Secretary Kathleen Sebelius were sworn in by Vice President Joe Biden in ceremonies at the White House. President Barack Obama also attended the ceremonial swearing-in event in the East Room. "My Cabinet is now full of energetic innovators like Kathleen and Gary. . . I am thrilled to have them by my side as we continue the work of turning our economy around and laying a new foundation for growth that delivers on the change the American people asked for, and the promise of a new and better day ahead," President Obama said. Locke, a key member of the President's economic team, is the department's 36th Secretary, leading its 12 agencies and bureaus and more than 52,000 employees. [\(President's Remarks\)](#)

Secretary Locke Discusses Trade Promotion Agreement with Colombian Minister for Trade
Washington (May 1)—U.S. Commerce Secretary Gary Locke hosted a meeting with Colombia's Minister for Trade, Industry and Tourism, Luis Guillermo Plata, at the Commerce Department today. This was the first meeting between Minister Plata and Secretary Locke. The Secretary and Minister Plata reaffirmed the commitment of both governments to move forward on progress towards the U.S.-Colombia Trade Promotion Agreement. The two leaders also underscored the importance of building stronger business ties through activities like joint cooperation in trade capacity-building for small- and medium-sized enterprises and good governance programs. [\(More\)](#)

Last Updated: May 4, 2009
 Questions regarding this section may be directed to the [Department of Commerce Webmaster](#)

White House | Privacy Policy | FOIA | USA.gov | No FEAR Act | Disclaimer | Forms | Information Quality | Fair Act | ESR System | Inspector General

Present Activity:

Bring all sustained regional-scale HFR networks up to operational status in USCG SAROPS

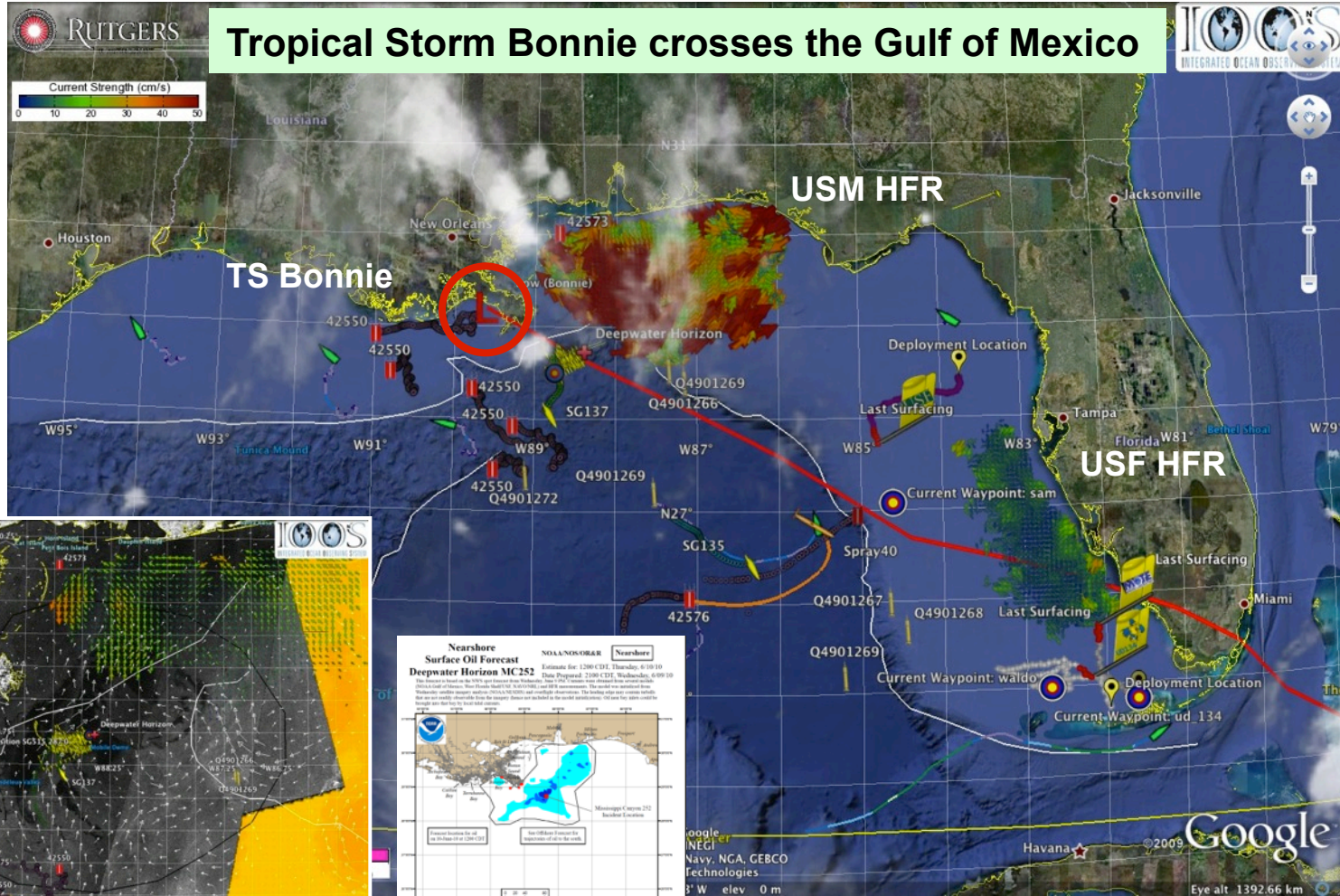
3 West Coast Regions for California & Oregon are ready.

orce (CSR)

IOOS Coordinated Rapid Response: *Deepwater Horizon Oil Spill*

Contributed Assets:

- HF Radar Networks
 - USF, USM
- Gliders
 - iRobot, Mote, Rutgers, SIO/WHOI, UDeI, USF
- Drifters & Profilers
 - Horizon Marine, Navy
- Satellite Imagery
 - CSTARS, UDeI
- Ocean Forecasts
 - Navy, NCSU
- Data/Web Services
 - ASA, Rutgers, SIO



HFR used for Oil Slick Forecasts by NOAA/NOS/OR&R



The Center for Secure and Resilient Maritime Commerce (CSR)

IOOS Coordinated Rapid Response: *Deepwater Horizon Oil Spill*

Contributed Assets:

HF Radar Networks

USF, USM

Gliders

iRobot, Mote, Rutgers,

SIO/WHOI, UDel, USF

Drifters & Profilers

Horizon Marine, Navy

Satellite Imagery

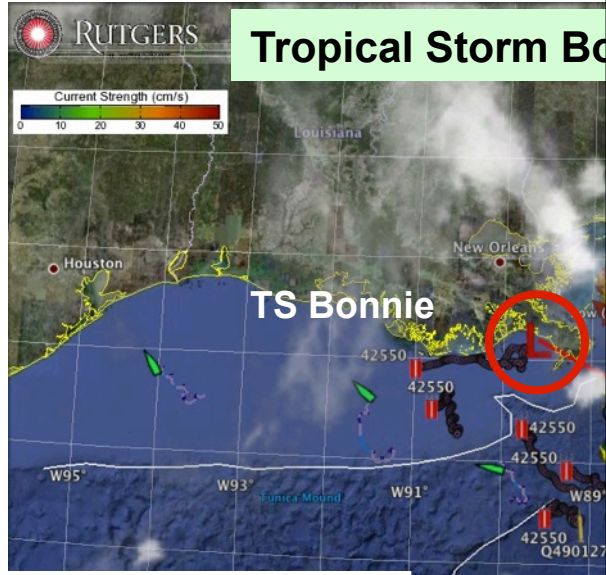
CSTARS, UDel

Ocean Forecasts

Navy, NCSU

Data/Web Services

ASA, Rutgers, SIO



U.S. DEPARTMENT OF HOMELAND SECURITY

S&T Impact Award

Center for Secure and Resilient Maritime Commerce (CSR)

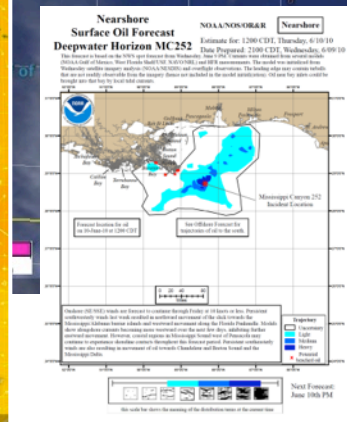
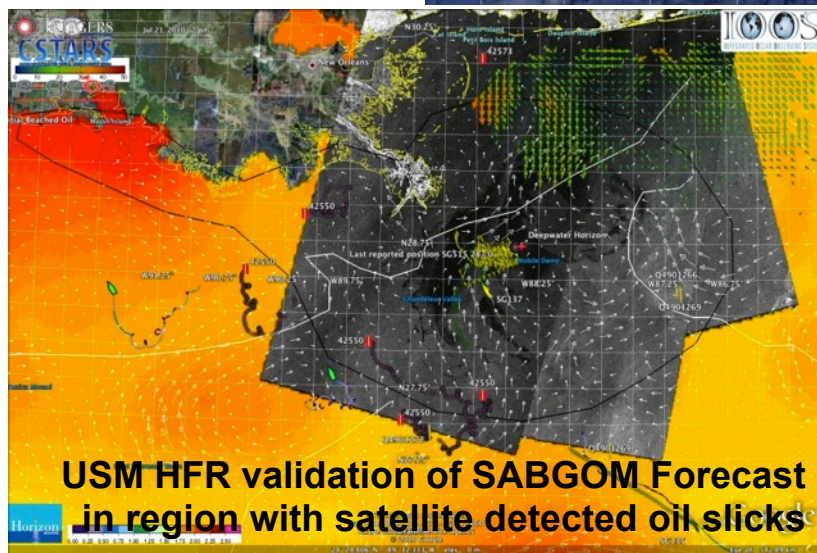
Rapid Response to the Gulf of Mexico Oil Spill

The DHS Center for Secure and Resilient Maritime Commerce (CSR) at the Stevens Institute of Technology (SIT) provided the U.S. Coast Guard and other stakeholders with data and analysis, which quickly became central to the Federal Government's coordinated response to the Deepwater Horizon Oil Spill in the Gulf of Mexico. Three research labs, all partners with the Center, at the University of Miami, Rutgers University and SIT, provided surface and underwater monitoring of the oil spill using space-based surveillance, ground-based High Frequency Radar and underwater gliders. The basic image data was used to generate daily maps, keep track of the spill and support forecasts of the spread and landfall of oil along the coastline and wetlands.

Matthew Clark

Matthew Clark, Ph.D.
Director, University Programs
Science and Technology Directorate
Department of Homeland Security

March 30, 2011



The Center for Secure and Resilient Maritime Commerce (CSR)

WRITTEN STATEMENT OF
JANE LUBCHENCO, Ph.D.
UNDER SECRETARY OF COMMERCE FOR OCEANS AND ATMOSPHERE
AND NOAA ADMINISTRATOR
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
U.S. DEPARTMENT OF COMMERCE

ON THE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION'S
FY 2012 BUDGET REQUEST

BEFORE THE
COMMITTEE ON NATURAL RESOURCES
SUBCOMMITTEE ON FISHERIES, WILDLIFE, OCEANS, AND INSULAR AFFAIRS
U.S. HOUSE OF REPRESENTATIVES

March 31, 2011

From Page 10:

Also in support of oil spill response, NOAA requests a **\$5.0 million** increase to implement the U.S. Integrated Ocean Observing System (IOOS®) **Surface Current Mapping Plan** using high frequency (HF) radar surface current measurements. HF radar provides information vital to oil spill response, national defense, homeland security, search and rescue operations, safe marine transportation, water quality and pollutant tracking, and harmful algal bloom forecasting.

www.legislative.noaa.gov/Testimony/Lubchenco033111.pdf

**U.S. National
HF Radar
Network**



Summer
2011 Coverage
131 Radars

Global HF Radar Coverage





Maritime Wide Area Surveillance

- 2005 Report
- Network of compact sensors more effective than few large phased arrays
- POC Mr. Gary Hover

1. Report No.	2. Government Accession Number	3. Recipient's Catalog No.	
4. Title and Subtitle Maritime Wide Area Surveillance Study		5. Report Date June 2005	
7. Author(s) H. Abusalem, S. Borchardt, D. Grant, G. Hover, I. Stiglitz, J. Teti, G. Thomas, S. Thomas, J. Thomason		6. Performing Organization Code 7732	8. Performing Organization Report Number RDC 690
9. Performing Organization Name and Address U.S. Coast Guard Research and Development Center 1082 Shennecossett Road Groton, CT 06340-6048		10. Work Unit No. (TRAVIS)	
12. Sponsoring Organization Name and Address U.S. Department of Homeland Security Homeland Security Advanced Research Projects Agency Science and Technology Directorate Washington, DC 20528		11. Contract or Grant No. DTCG32-02-D-R00010 DTCG39-00-D-R00009	
15. Supplementary Notes The Coast Guard program sponsor for this work is: Commandant (CG-7M) U.S. Coast Guard Headquarters Washington, DC 20593-0001 The RDC's technical point of contact is Mr. Gary Hover, (860) 441-2818, email: ghover@rdc.uscg.mil.		13. Type of Report & Period Covered Final	
16. Abstract (MAXIMUM 200 WORDS) This report presents the results of an expert panel study sponsored by the Homeland Security Advanced Research Projects Agency. The panel examined research and development options for sensor technologies that can be used to conduct persistent and effective wide area surveillance (WAS) of the U.S. maritime borders in the region from approximately 12 nautical miles (nmi) to 90 nmi offshore. The study focused primarily on land-based, high frequency surface wave radar (HFSWR) and multi-sensor airborne system options. High frequency, over-the-horizon sky wave radar was also considered for applications further offshore.		14. Sponsoring Agency Code Mission Support Office Homeland Security Advanced Research Projects Agency	
17. Key Words Maritime Domain Awareness (MDA), wide area surveillance (WAS), over-the-horizon (OTH) sensors, high frequency (HF) radar	18. Distribution Statement WARNING: This record contains Sensitive Security Information that is controlled under 49 CFR parts 15 and 1520. No part of this record may be disclosed to persons without a "need to know," as defined in 49 CFR parts 15 and 1520, except with the written permission of the Administrator of the Transportation Security Administration or the Secretary of Transportation. Unauthorized release may result in civil penalty or other action. For U.S. government agencies, public disclosure is governed by 5 U.S.C. 552 and 49 CFR parts 15 and 1520.		
19. Security Class (This Report) UNCLASSIFIED - SSI	20. Security Class (This Page) UNCLASSIFIED - SSI	21. No of Pages	22. Price



CSQ_SEAB_09_02_26_001521.cs

Information

Ant	dBm	Noise	S/N	∂	∂ Phase	∂ Amp		
A1	-123.39	-149.27	25.89	∂ 12	102.75	10.828	Fq:	0.3906Hz
A2	-134.22	-150.57	16.36	∂ 13	-22.14	1.346	Bin:	356
A3	-124.73	-152.85	28.12	∂ 23	-121.22	-9.482	V:	17.369 cm/s

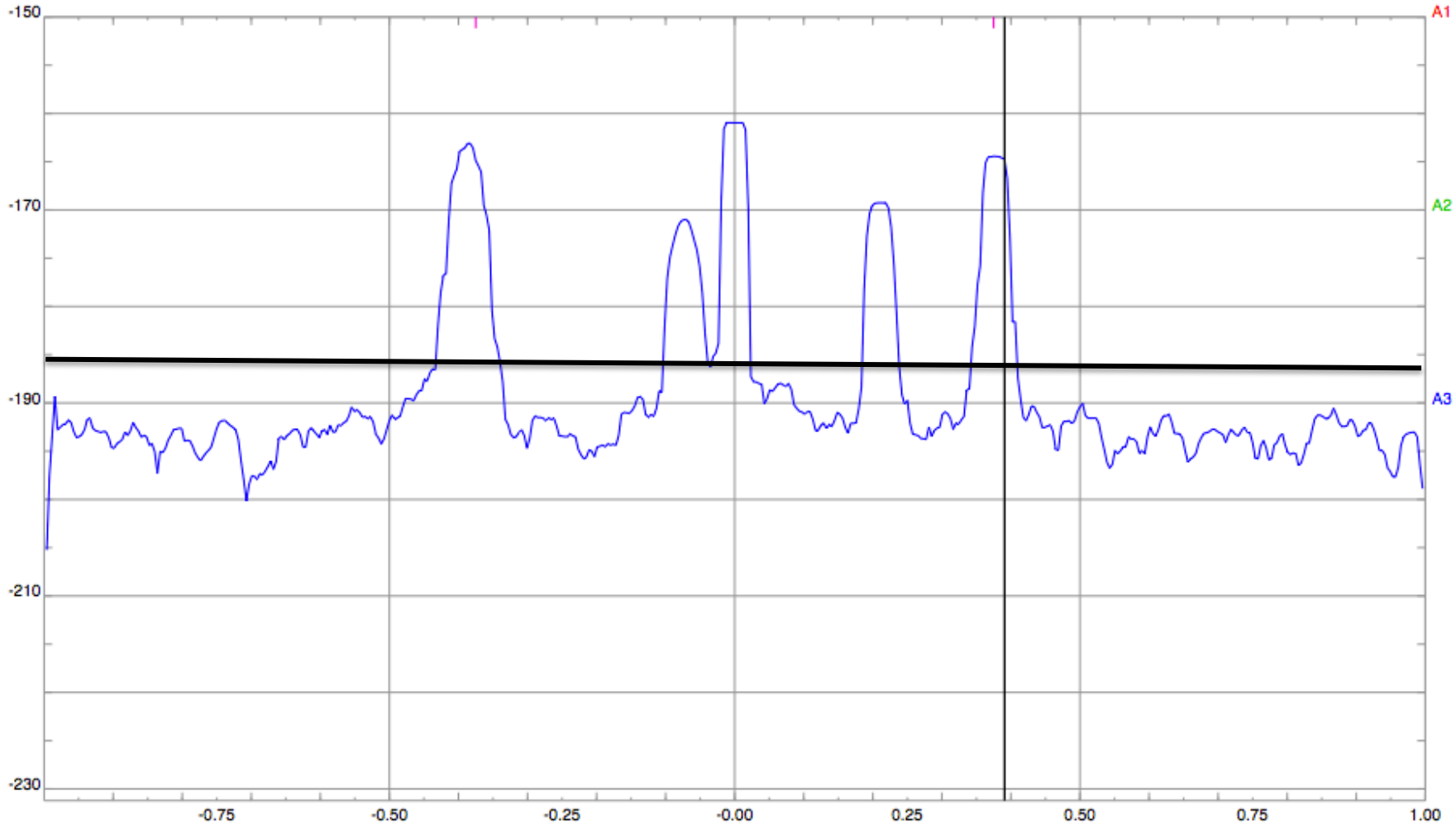
Smooth

 Smooth

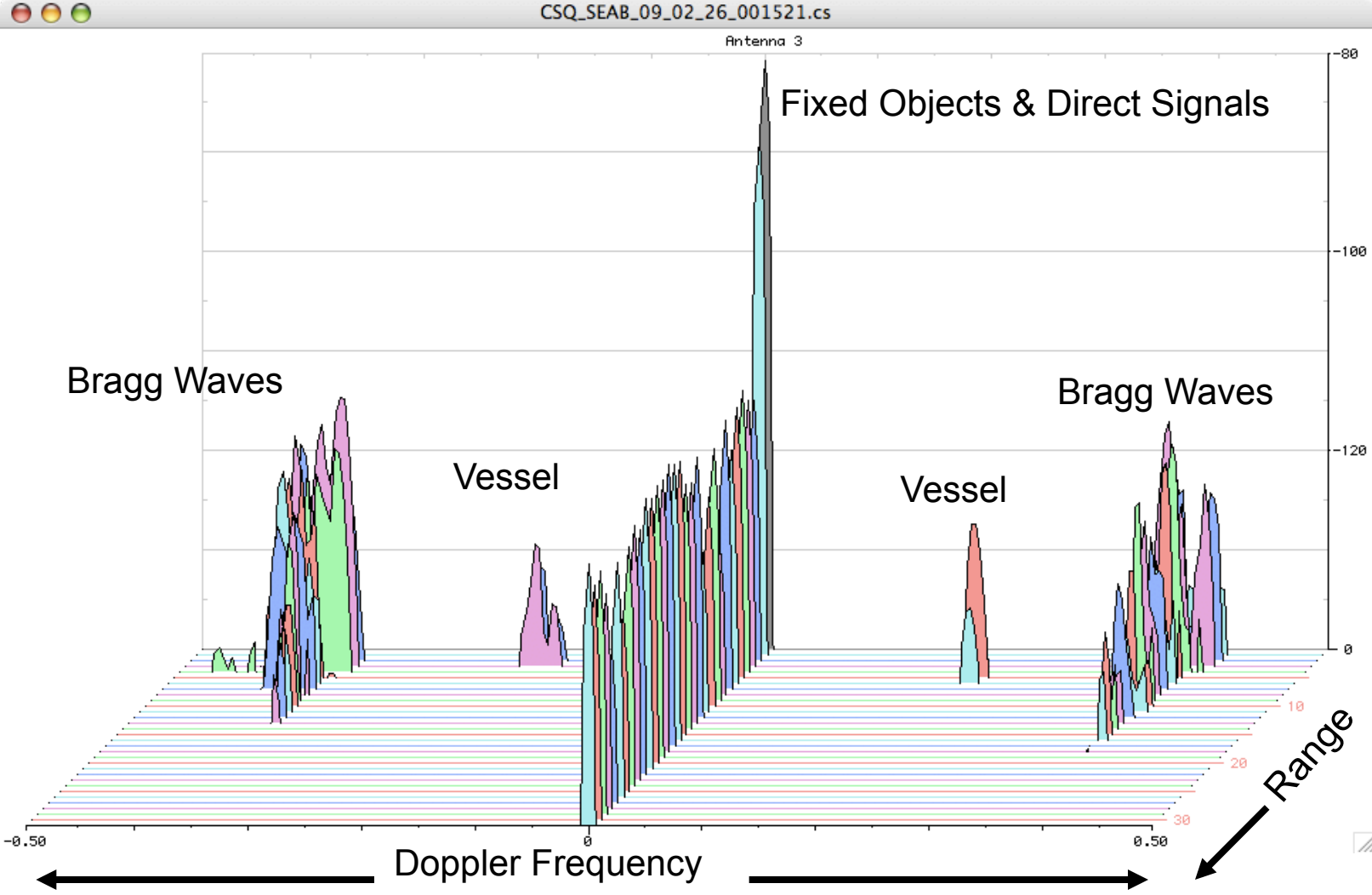
Factor:

4

Visibility

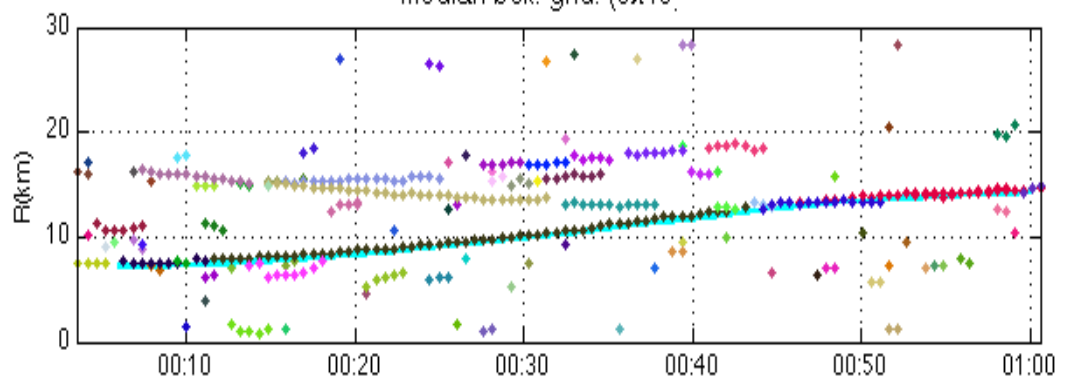
 Antenna 1 Antenna 2 Antenna 3

Doppler Spectra from all Range Cells with Detection Threshold Applied

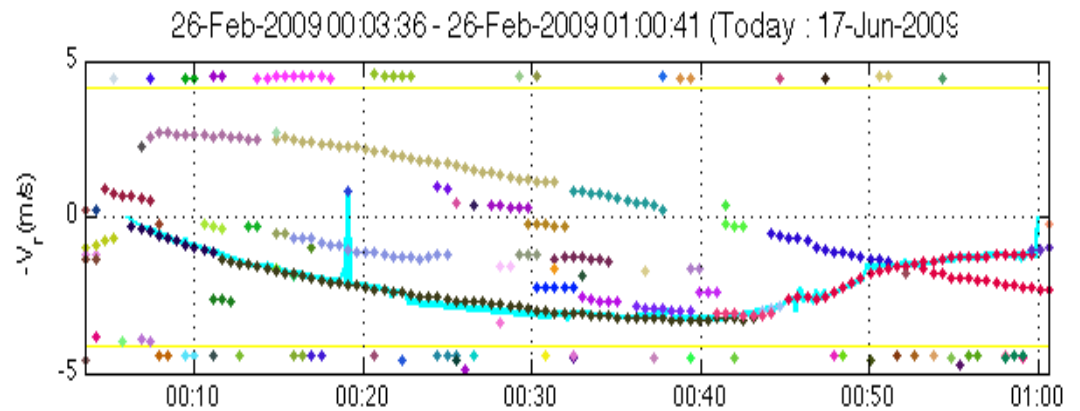


**Median Method FFT
256 Threshold 11 dB**

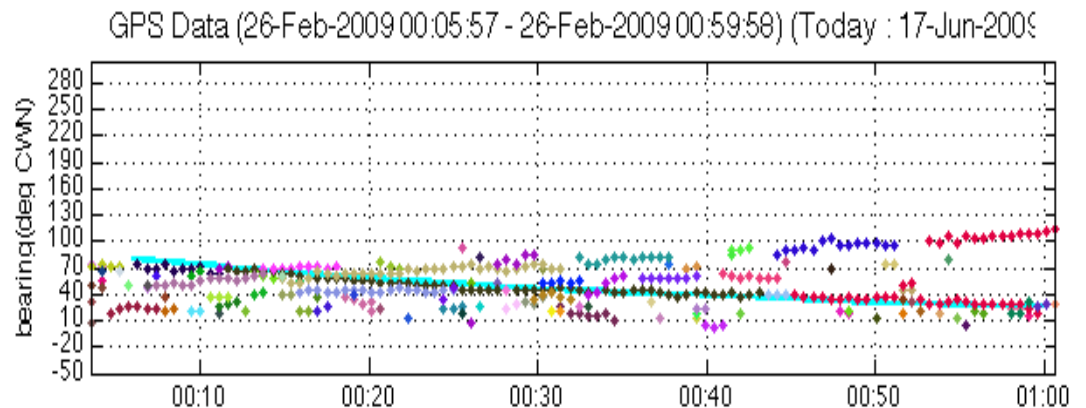
**Range
(km)**



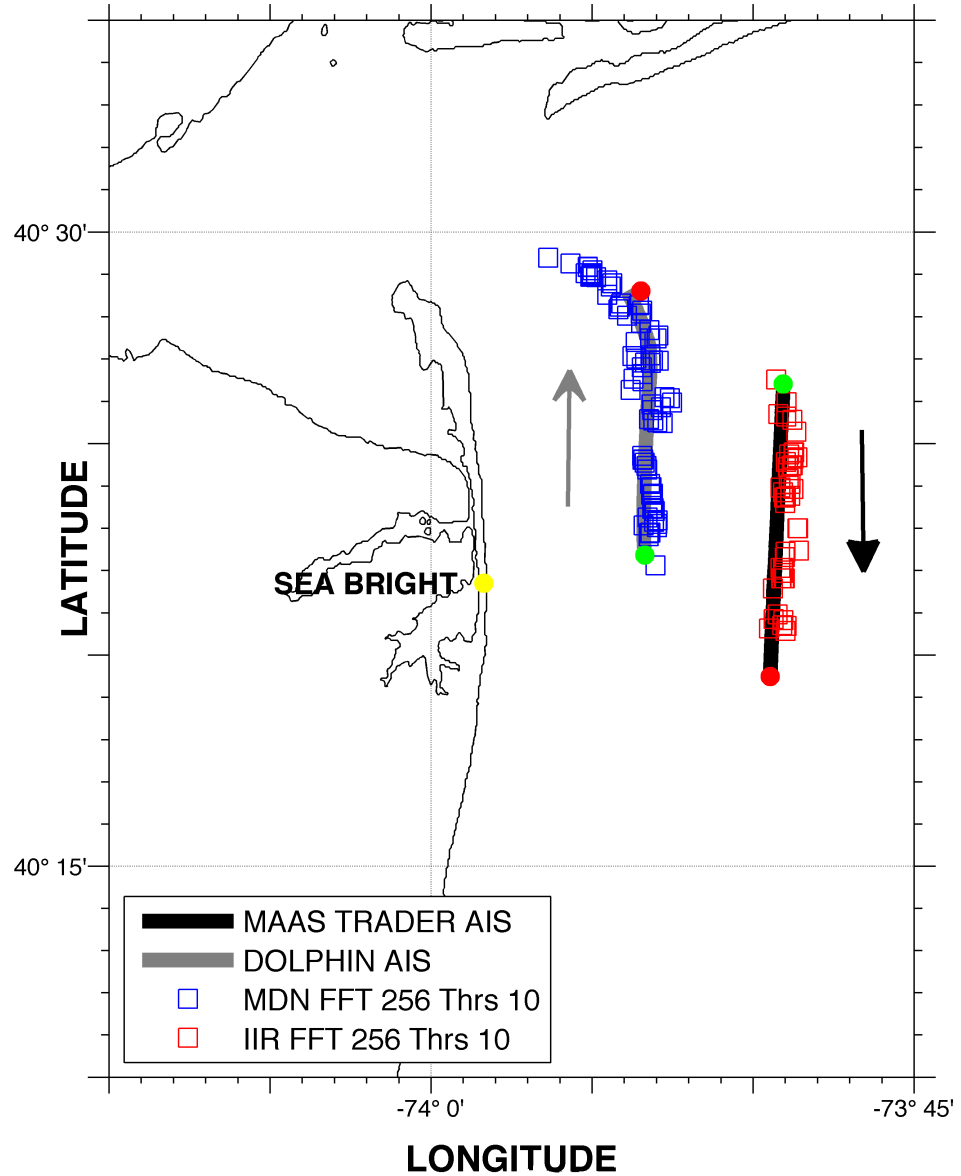
**Radial
Velocity
(m/s)**



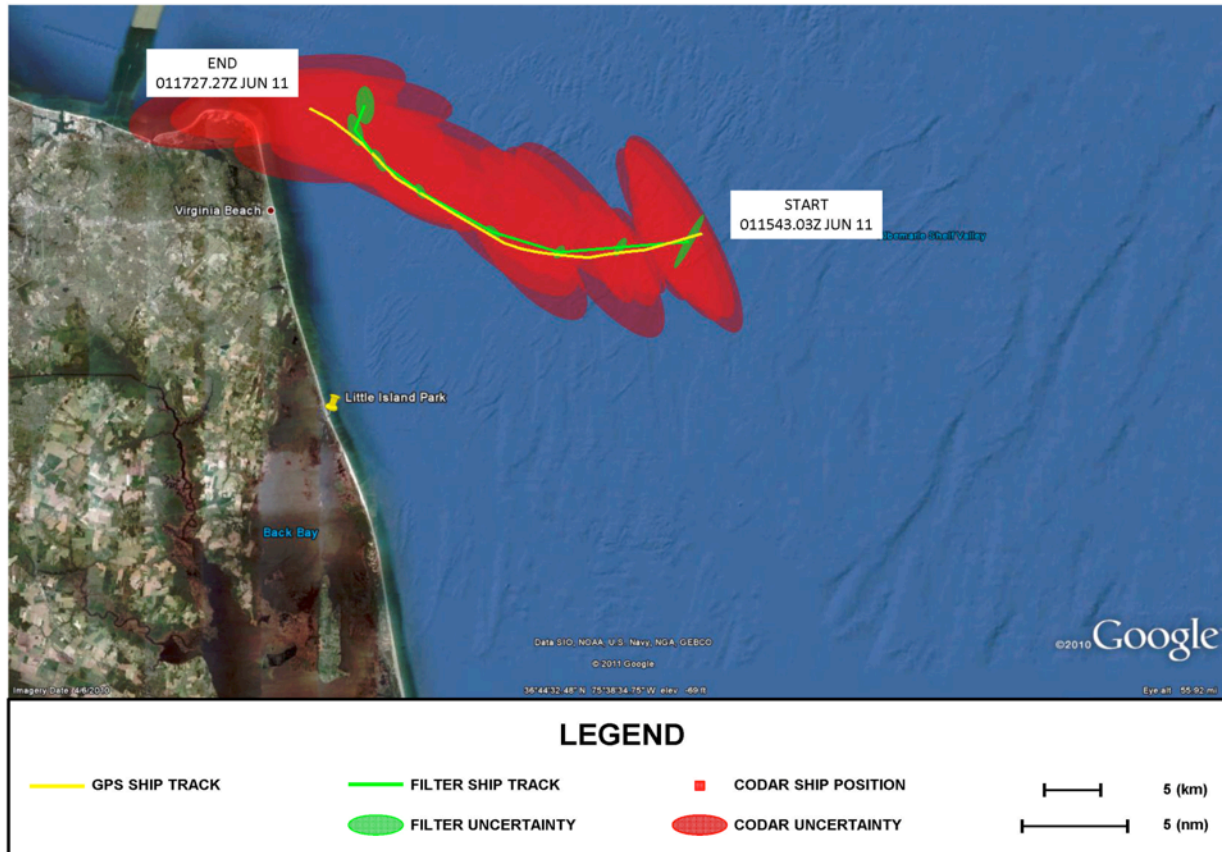
**Bearing
(°CWN)**



TRACK OF MAAS TRADER and DOLPHIN



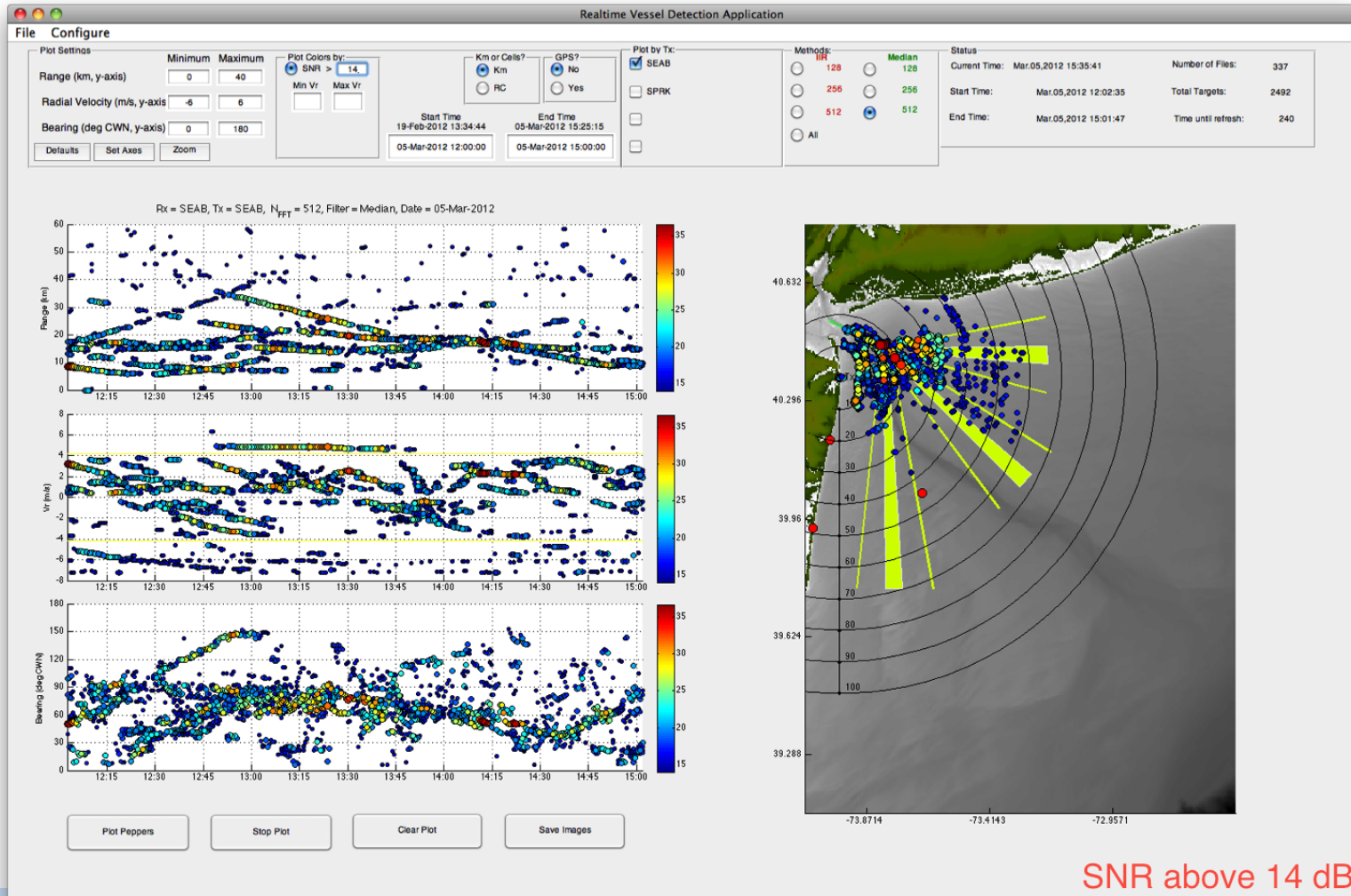
M/V Victorious: Tracking Results

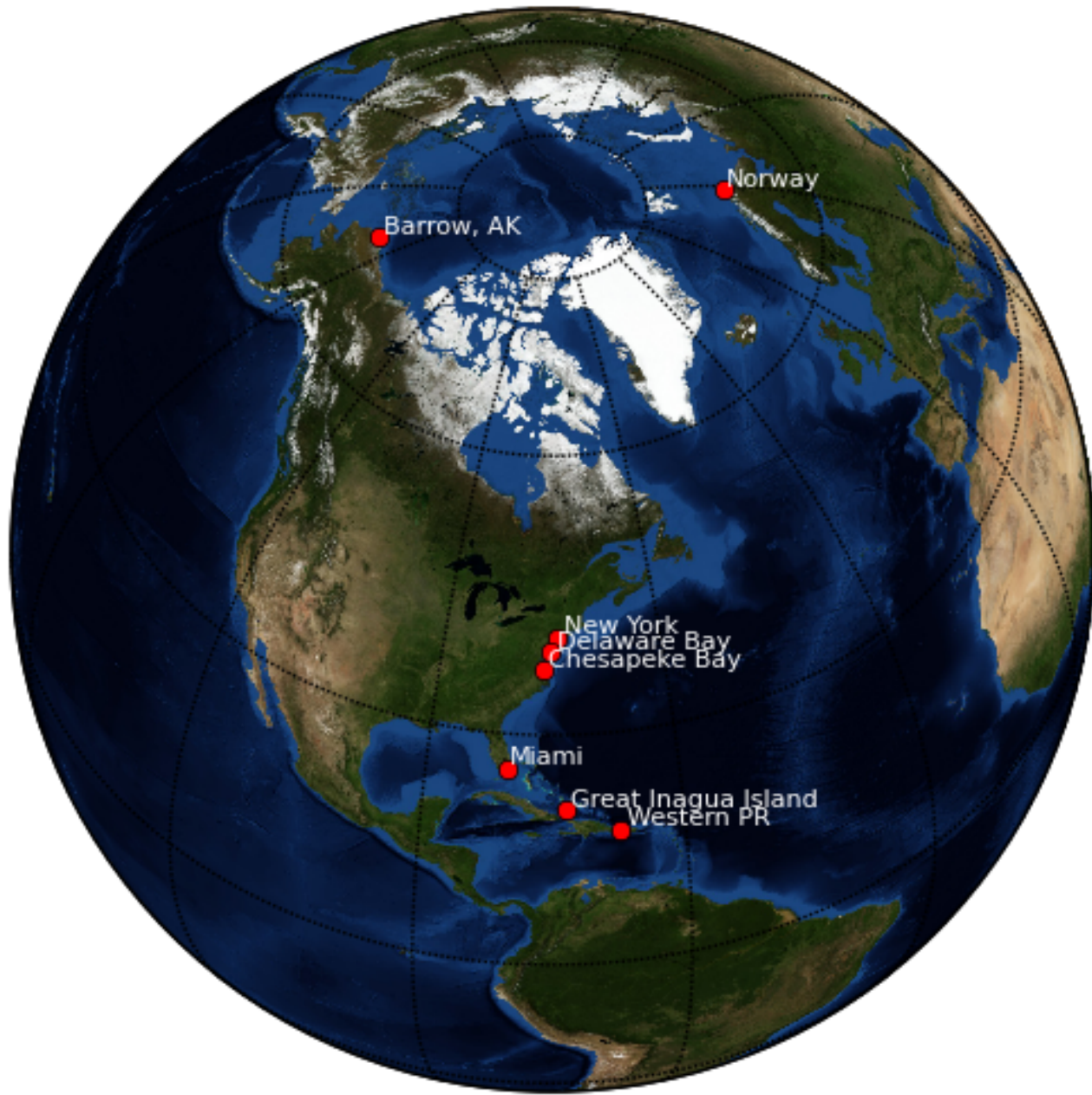


M/V VICTORIOUS: GPS Track, CODAR Data, and Ship Tracker Solution with Uncertainty Ellipses



Adjusting the Signal to Noise





Current Testbeds

New York Harbor

Delaware Bay

Chesapeake Bay

Port of Miami

Western Puerto Rico

Barrow Alaska

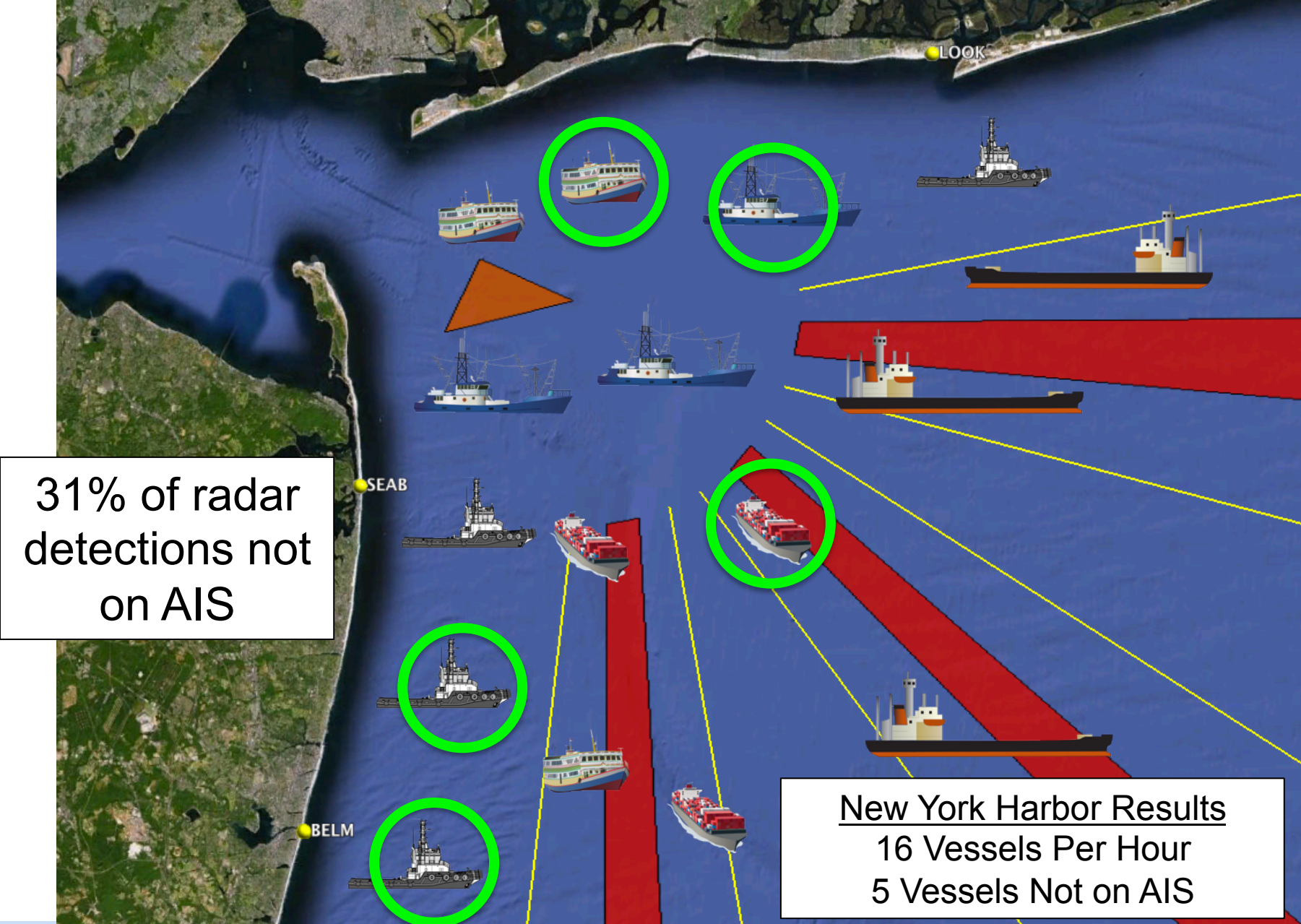
Proposed Testbeds

Great Inagua

Norway

San Diego





31% of radar detections not on AIS

New York Harbor Results
 16 Vessels Per Hour
 5 Vessels Not on AIS



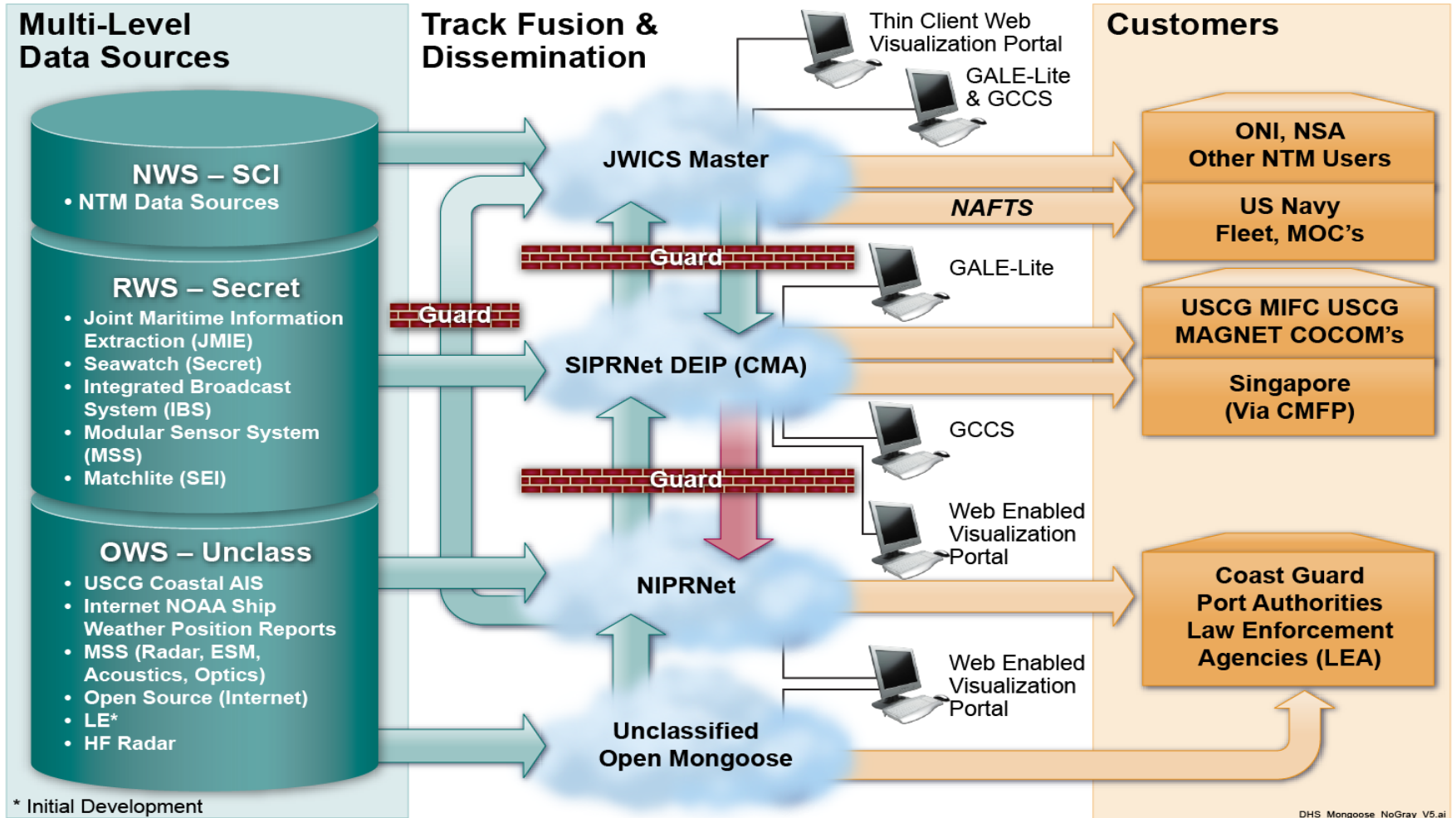
Current Activities



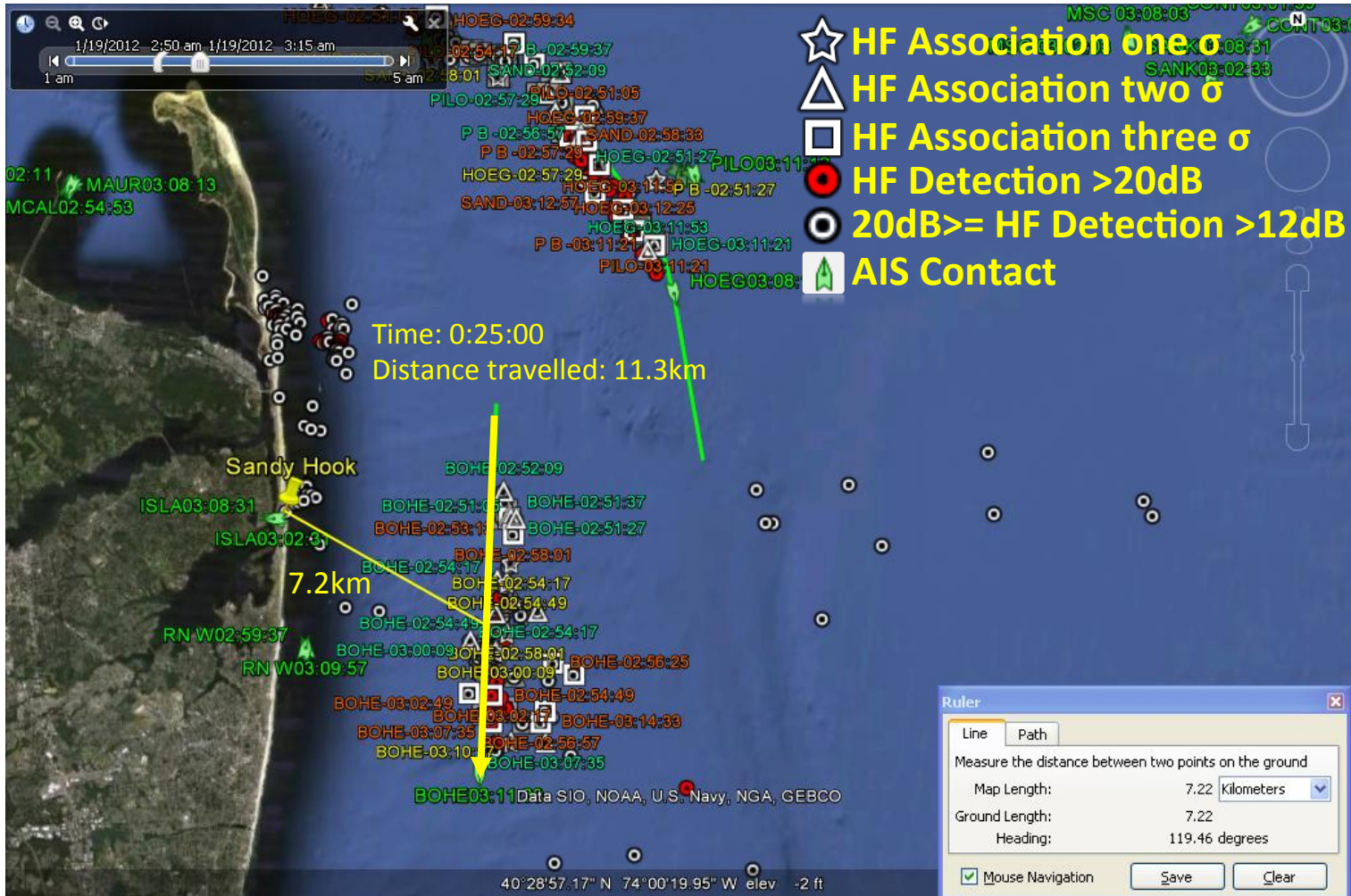
The Center for Secure and Resilient Maritime Commerce (CSR)

Multi-Level Access and Information Sharing with Open Mongoose (MDA CONOP)

(U) Multi-Level Enclaves Provide Appropriate Level Data to Customers

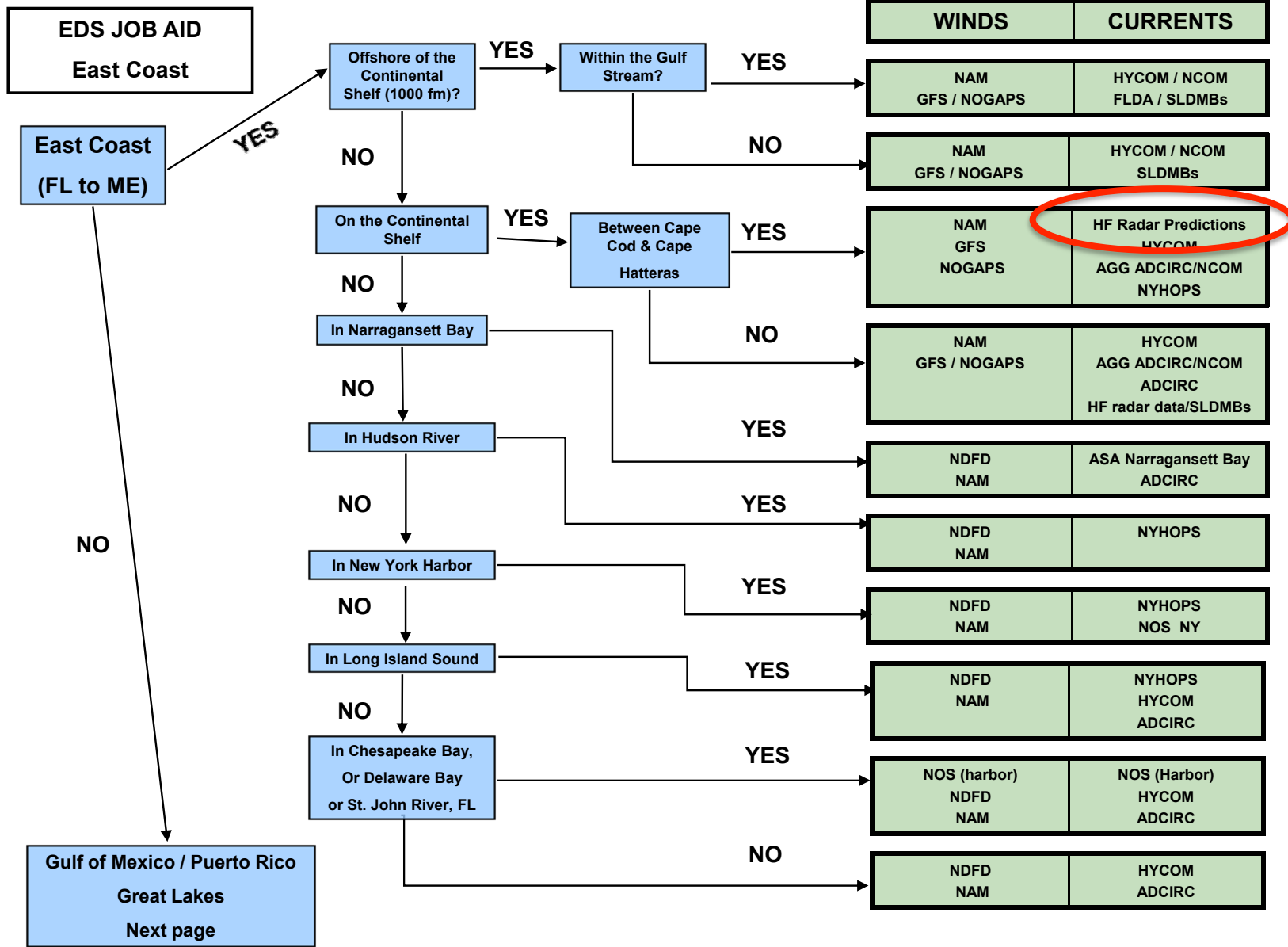


Bohemia AIS Track SNR>9

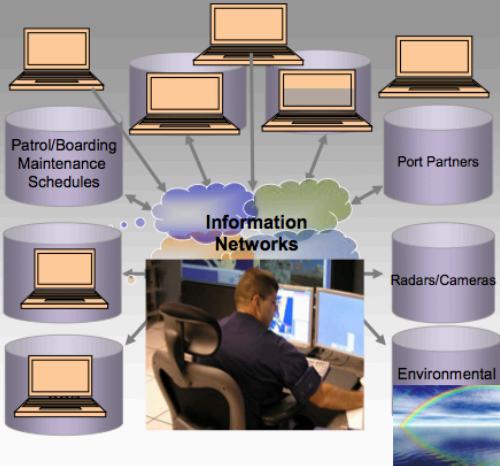


AIS Bohemia Velocity Range: 10.3KTS up to 10.4KTS. Several HF Radar detections associated by one, two and three standard deviations, Radar Characteristics: SNR>9, Distance from radar when tracked: 7.2 km





Watchkeeper



Today

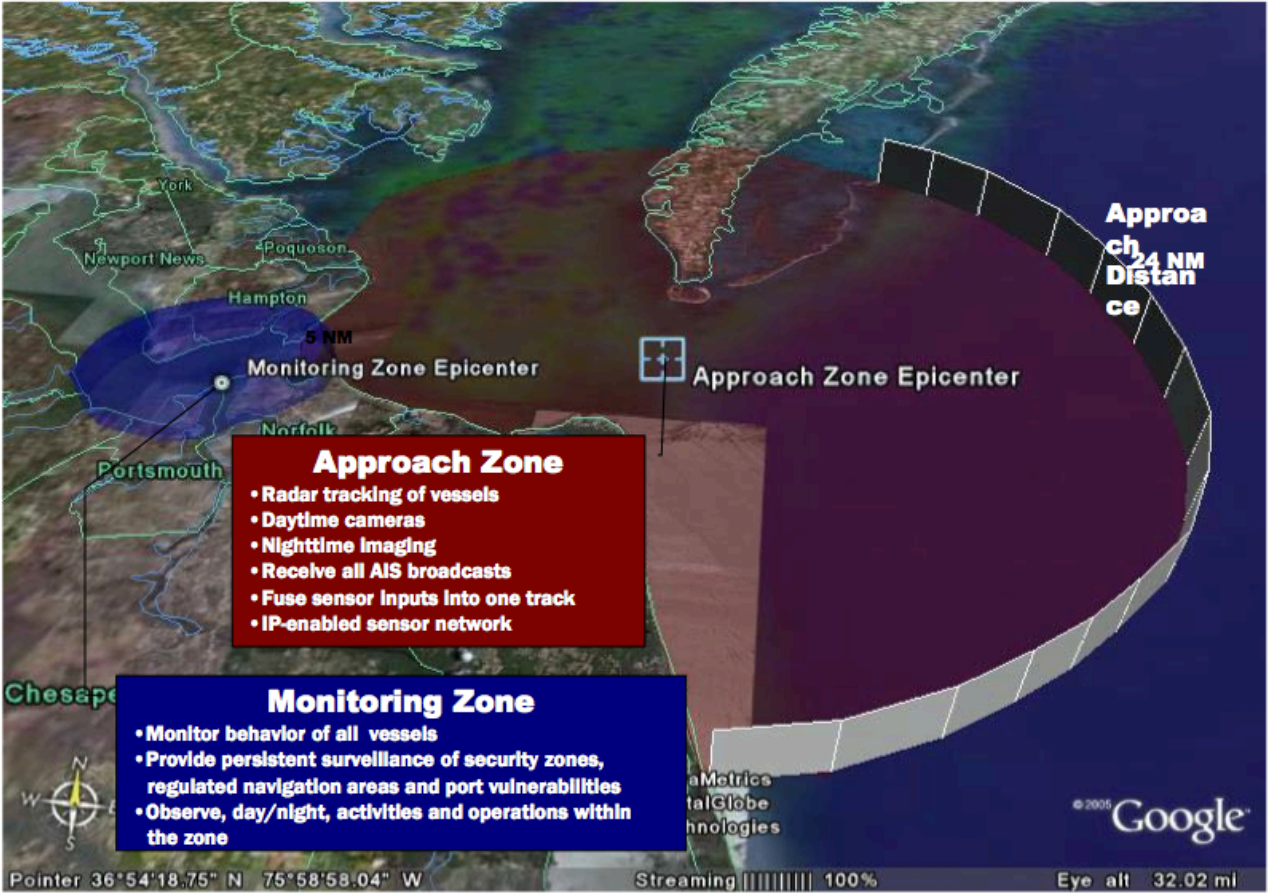
Operator is the Integrator

WatchKeeper



Tomorrow

Operator is the Evaluator



CSR Ship Detection Visualizer

Data Selection

Site: SEAB **A**

Background: IIR

FFT Length: 512

Threshold: 18

Start Time: 2012-06-11 02:44

End Time: 2012-06-11 05:44

Get Detections

Color/Size by:

- SNR3 (km)
- RCS (dBsm)
- Range (km)
- Velocity (m/s)
- Bearing (deg CWN)

