



# The Center for Secure and Resilient Maritime Commerce (CSR)



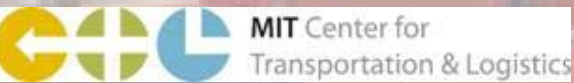
## *A DHS National Center of Excellence for Maritime Security*



### Research & Education Overview



## Julie Pullen, CSR Director Stevens Institute of Technology



# Mission

The CSR supports the Department of Homeland Security's efforts to secure the nation's maritime borders, **promote safe navigation and commerce, protect ocean resources and maritime infrastructure,** and provide for the **safe and secure use of US coastal and offshore areas,** as well as inland waterways, through the advancement of the relevant sciences and technology, and the **professional development of our nation's maritime domain workforce.**



# Academic & Industry Partners



The Center for Secure and Resilient Maritime Commerce (CSR)

# Primary Activities

- Research in support of technology development & transition for **Maritime Domain Awareness (MDA)**
- Research in support of **Marine Transportation System (MTS) resilience.**
- **Education, Training & Outreach** to the enhance the knowledge, skills and technical capabilities of the current and prospective maritime security workforce.



# Technology & Knowledge Development for MDA

Integrating sensor technologies to provide a layered approach to vessel detection, classification & tracking.

## **Team responsibilities and capabilities:**

**Stevens Institute-** Near-shore, harbor surveillance, utilizing multi-sensor systems including underwater **Passive Acoustics & Electro-Optics (IR & visual light)**;

**Rutgers & UPRM-** Coastal and Island border and over-the-horizon surveillance using **High Frequency Radar**;

**Univ. of Miami-** Space-based, multi-frequency sensors, (**Satellites/SAR**), over-the-horizon, high-resolution, all weather, day/night, global maritime surveillance;

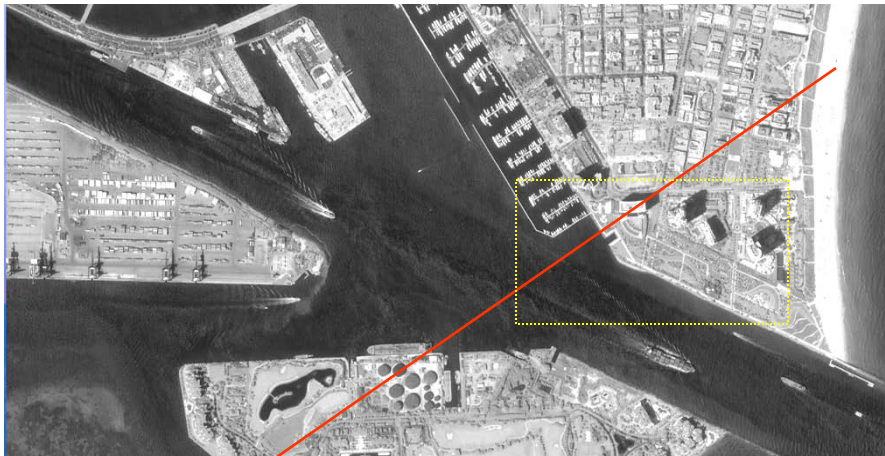
**Monmouth University-** Emergency response and decision support through **dynamic visualization tools**.



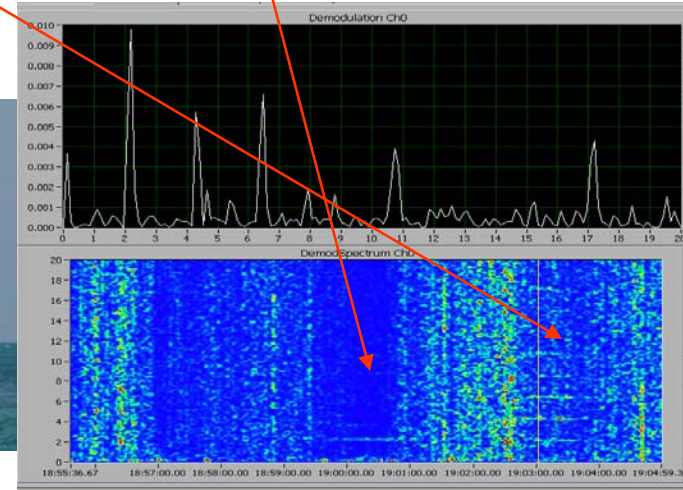
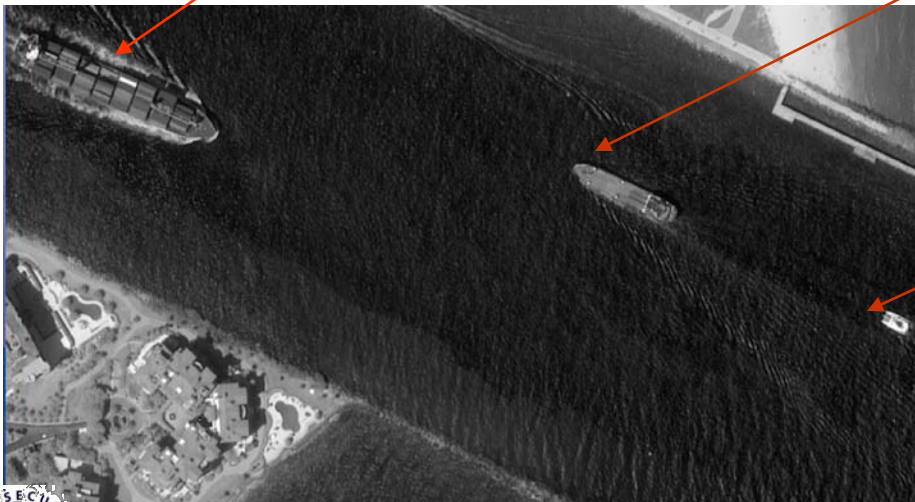


# Example of Layered Approach to Port Security Port of Miami Experiment

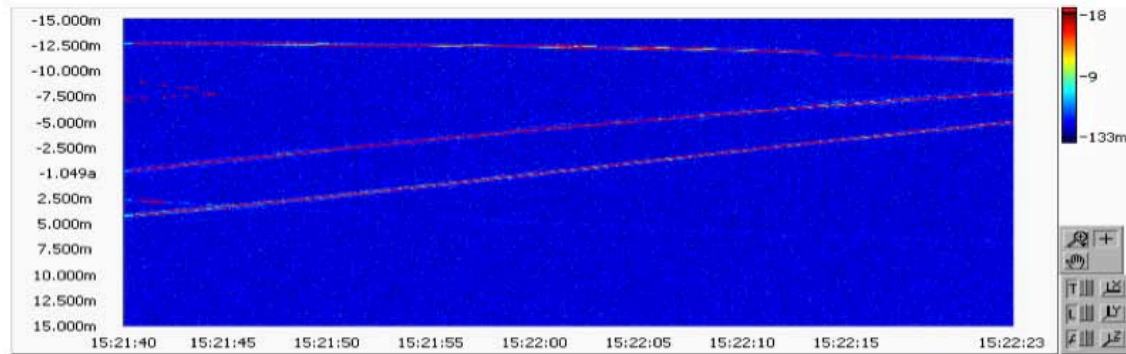
EROS-B flyover 4/12/2011 19:01UTC



zoom



# Real-Time Ship Tracking in the Hudson River: Acoustics, Radar, AIS, Cameras



# Products, Algorithms, New Knowledge

## Stevens Passive Acoustic System

- ❖ Patented and in process of commercialization
- ❖ Transitioned to the field via Naval Undersea Warfare Center, in partnership with industry, for diver detection
- ❖ Applications: surface vessels, SPSS/SPFS, low flying aircraft (all supported by DHS S&T Borders and Maritime)



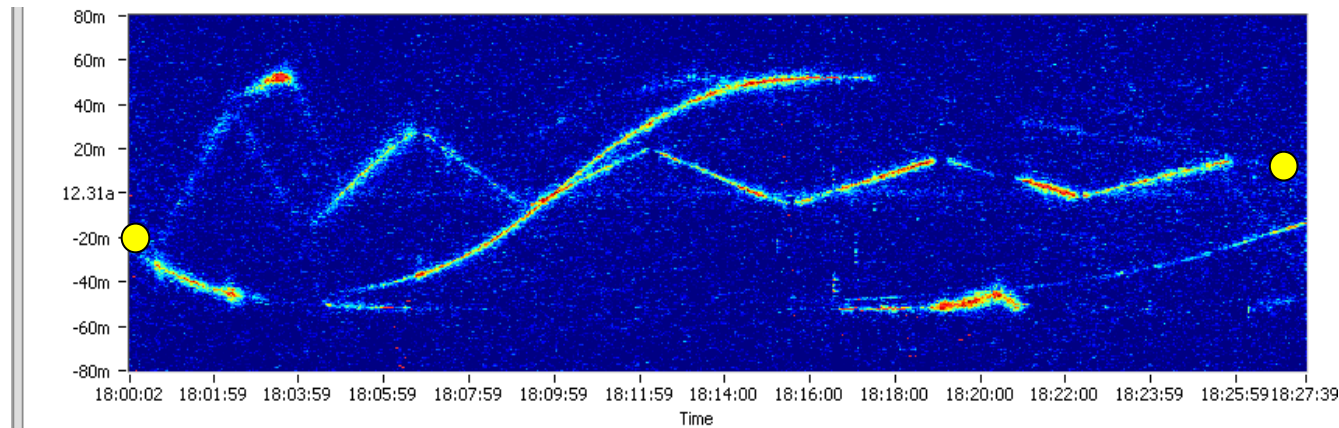


# Acoustic Vessel Detection & Tracking

## Phoenix vessel trajectory

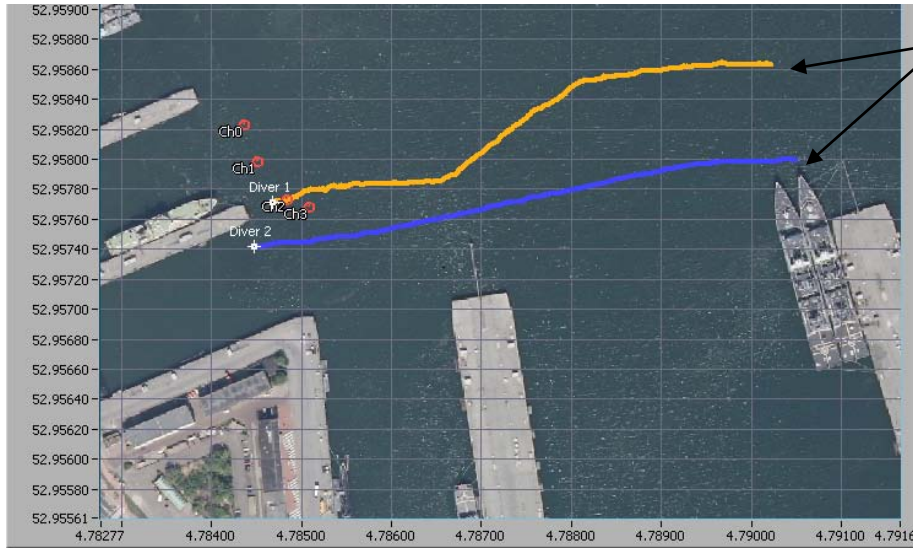


Cross-correlogram of boat around the acoustic system. Yellow circles show start and end of the Phoenix trajectory



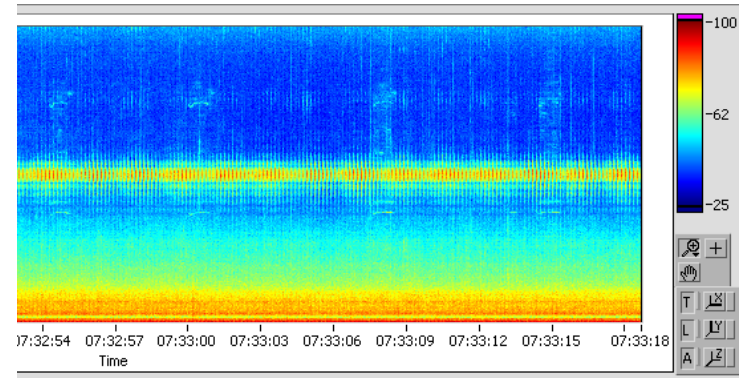
# Acoustic SCUBA diver detection

Diver tracking test , Noisy harbor, conditions, Various divers

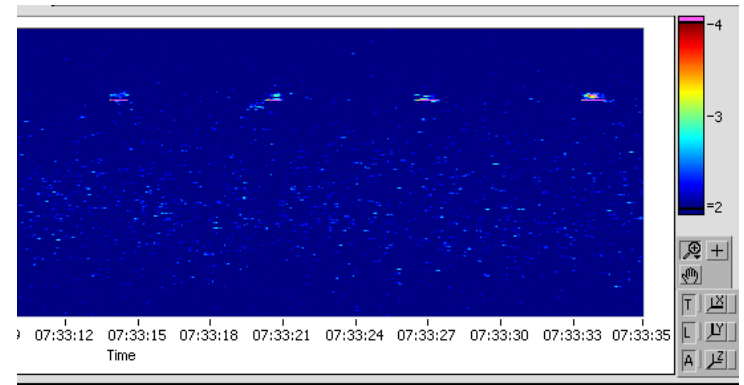
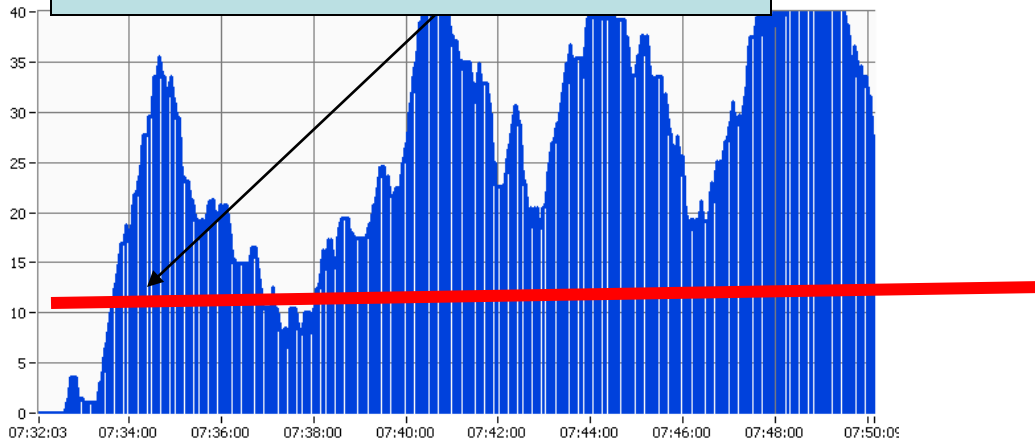


Detected divers at ~400m

Spectrogram and correlograms of diver signal



Automated Diver Alert



# Products, Algorithms, New Knowledge

## Rutgers HF RADAR

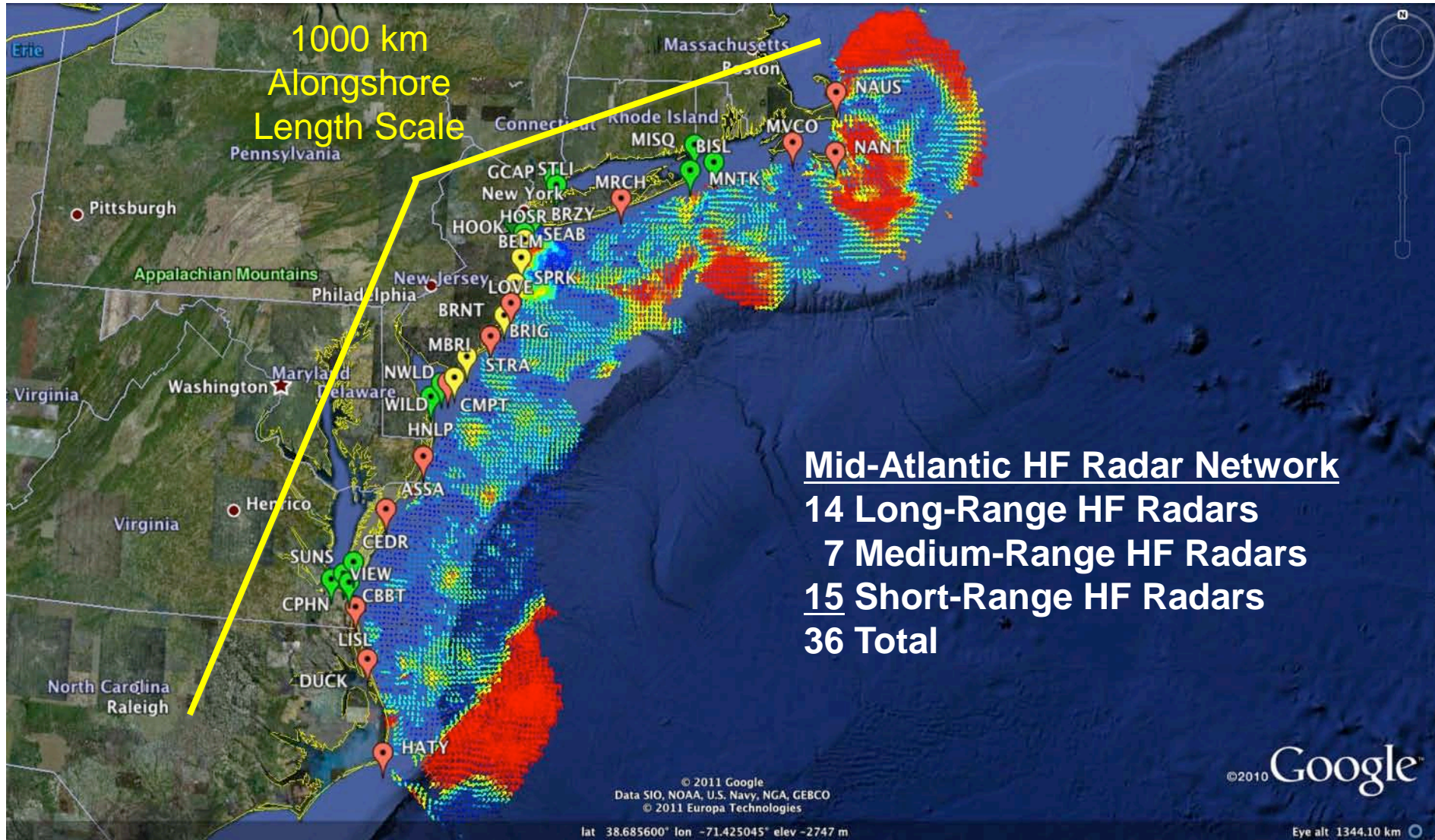
- ❖ First in the world to demonstrate a dual-use (surface currents & vessel detection) real-time capability in a multi-static HF Radar network
- ❖ First surface current mapping network for operational use in USCG SAROPS
- ❖ Coordinated the U.S. IOOS response to the Gulf of Mexico Oil Spill





# Mid-Atlantic Bight HF Radar Network

1000 km  
Alongshore  
Length Scale



## Mid-Atlantic HF Radar Network

14 Long-Range HF Radars

7 Medium-Range HF Radars

15 Short-Range HF Radars

36 Total

©2010 Google

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Data SIO, NOAA, U.S. Navy, NGA, GEBCO  
© 2011 Europa Technologies

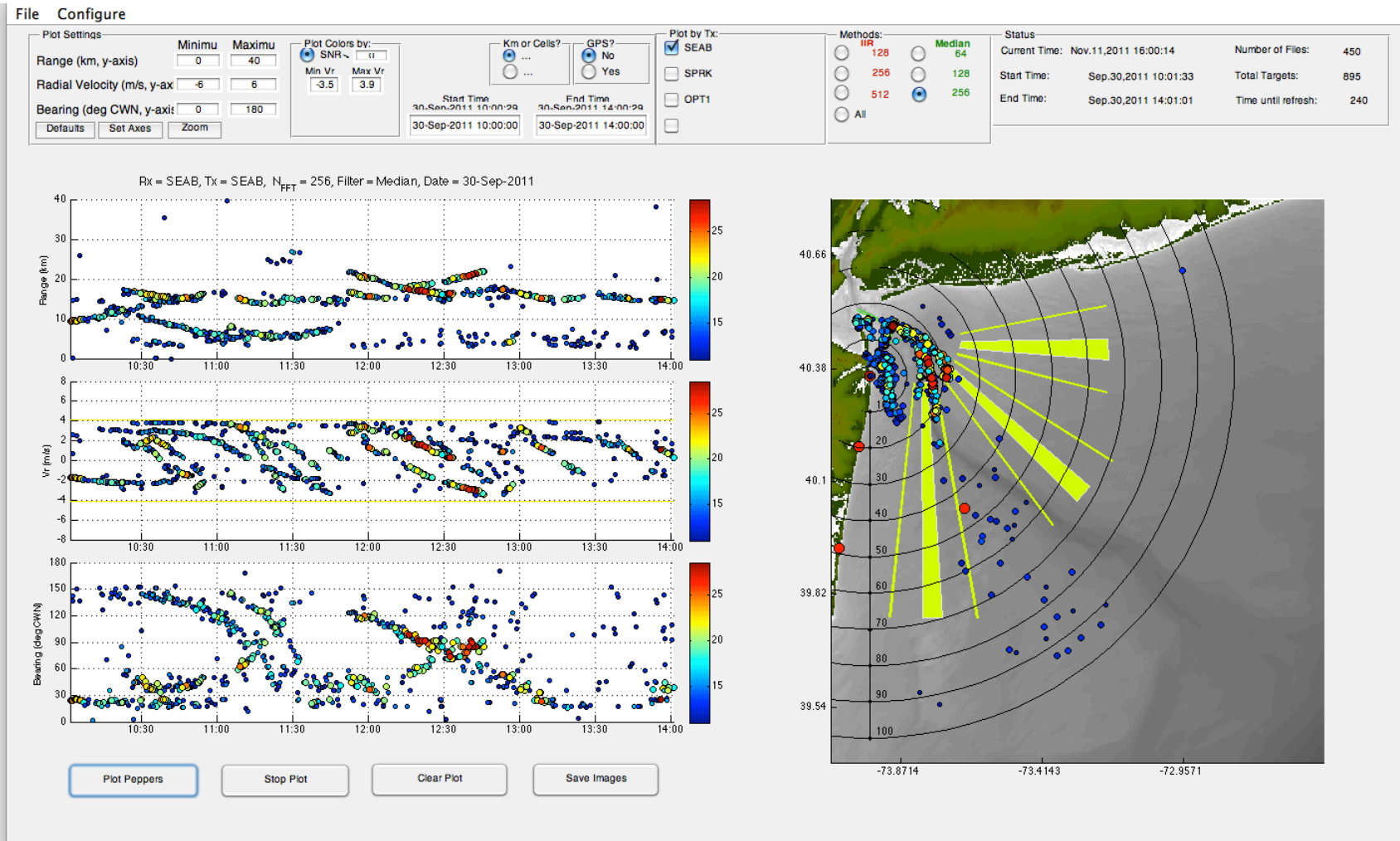
lat 38.685600° lon -71.425045° elev -2747 m

Eye alt 1344.10 km



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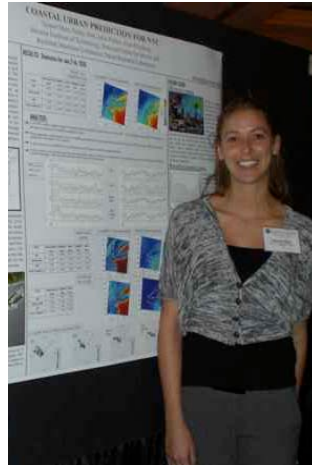
# Radar Vessel Detections in Real-Time





# CSR Education Goals & Objectives

- Transfer research into **relevant education programs**.
- Provide programs that **enhance technical skills & leadership capabilities**.
- **Increase opportunities** for women & minority students.
- **Build the pool** of future Maritime Security practitioners.



# Summer Research Institute



## Highlights

- 57 participants
- 50% women and minority students
- 10 U.S. universities
- Diverse Engineering & Science disciplines, degrees, backgrounds.

## Curriculum:

- Faculty lectures
- Guest speakers
- Field visits  
(CBP, OEM, FDNY, RCPT)
- Experiments/  
Projects

## Program Outcomes:

- Development of a web-based tool of high-res air/sea forecasts for spill/contaminant dispersion (Magello).
- Development of a database used to characterize and archive acoustic signatures of vessel traffic.
- DHS student awards & recognition.





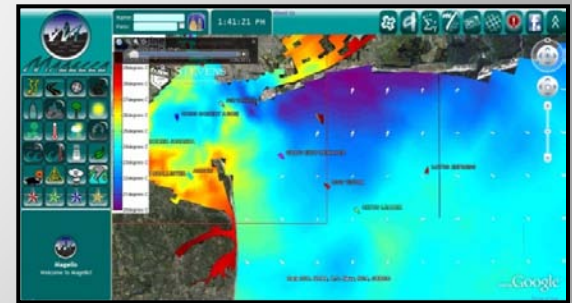
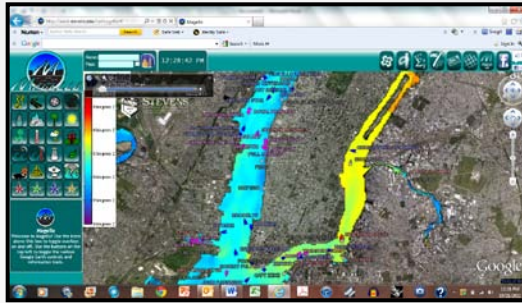
STEVENS  
INSTITUTE of TECHNOLOGY



MAGELLA



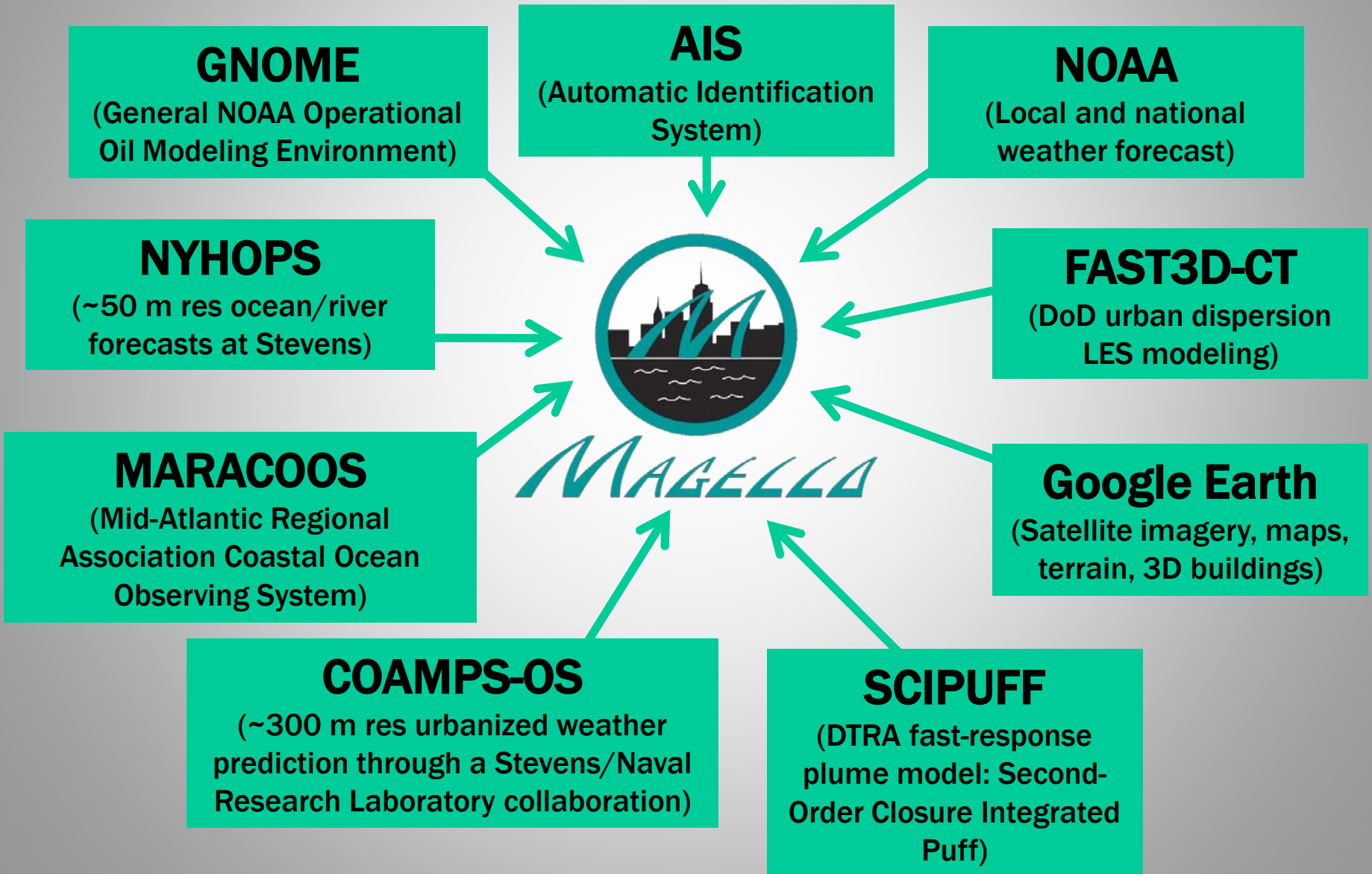
## A USER-FRIENDLY WEB-BASED TOOL FOR EMERGENCY RESPONSE



*Magello* allows the end user to visualize *ultra-high-resolution* environmental data on an easy-to-read Google Earth™ platform. Explosion, waterborne spill, and atmospheric plume modeling capabilities make *Magello* an indispensable emergency management tool.



# WHAT DRIVES *MAGELLA* ?



# Maritime Security Graduate Certificate Program

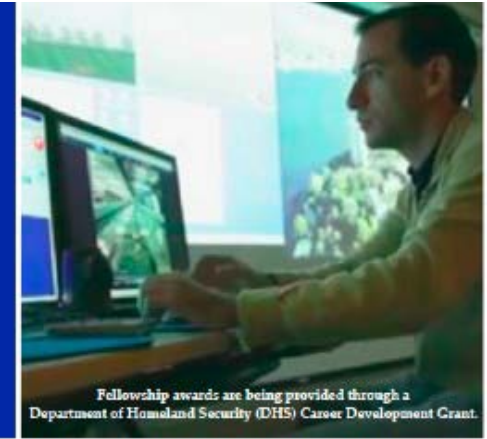


- Courses include:
  - Maritime Safety & Security
  - Fundamentals of Remote Sensing
  - Technologies for Maritime Security
  - Advanced Maritime Security
- Courses delivered Online & On-Campus
- Stepping stone for the Master's Degree program





# Maritime Systems Master's Degree Fellowship



## DHS Career Development Grant Awards

- 6 Full-time students
- Tuition & Stipends
- Master's thesis
- Internships (at government labs) & post-graduation homeland security employment required



# Professional Development Programs



The Center for Secure and Resilient Maritime Commerce

Spring 2011 Course Offering:

**PORT SECURITY SENSING TECHNOLOGIES**

April 4 - 6, 2011

Ronald Reagan Building, Washington, DC

- Taught by a team of CSR researchers
- Tailored to maritime industry & gov practitioners
- Delivered in convenient 3-day formats
- Courses held at Stevens in Washington, DC & at the Port of LA Regional Maritime Training Facility



The Center for Secure and Resilient Maritime Commerce (CSR)

# Education Summary



- Transferring research into innovative & relevant programs.
- Enhancing skills & capabilities of the current & prospective workforce.
- Increasing the participation of women & minority students through outreach.
- Building the pipeline & enhancing the pool of next gen Maritime Security practitioners.



MIT Center for  
Transportation & Logistics

