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
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

Stevens Institute of Technology
Rutgers Coastal Ocean Observation Lab
University of Miami
Monmouth University
MIT Center for Transportation & Logistics
Universidad de Puerto Rico
The Mattingley Group
The Port Authority of NY & NJ
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 enhance the knowledge, skills and technical capabilities of the current and prospective maritime security workforce.
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 19:01 UTC

Stadt Munchen

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

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
Radar Vessel Detections in Real-Time

The Center for Secure and Resilient Maritime Commerce (CSR)
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.
**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 Magecco?

- GNOME (General NOAA Operational Oil Modeling Environment)
- AIS (Automatic Identification System)
- NOAA (Local and national weather forecast)
- NYHOPS (~50 m res ocean/river forecasts at Stevens)
- MARACOOS (Mid-Atlantic Regional Association Coastal Ocean Observing System)
- COAMPS-OS (~300 m res urbanized weather prediction through a Stevens/Naval Research Laboratory collaboration)
- FAST3D-CT (DoD urban dispersion LES modeling)
- Google Earth (Satellite imagery, maps, terrain, 3D buildings)
- SCIPUFF (DTRA fast-response plume model: Second-Order Closure Integrated Puff)
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

- 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
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.