DHS Office of University Programs
USCG-Relevant Programs

Office of University Programs
Science and Technology Directorate

November 2010

Homeland Security

DHS Office of University Programs

- Programmatic Thrusts
  - Centers of Excellence
  - Education Programs
  - Minority Serving Institutions

Homeland Security

Centers of Excellence Congressional Mandate

Homeland Security Act of 2002:

"The Secretary, acting through the Under Secretary for Science and Technology, shall designate a university-based center or several university-based centers for homeland security. The purpose of the center or these centers shall be to establish a coordinated, university-based system to enhance the Nation's homeland security."

(as amended)

Homeland Security

Developing …
"A Coordinated University-Based System"

- Multi-COE, multi-division, -component, -disciplinary projects
  - Target cross-cutting areas of uncertainty and critical need
  - Integrating National Labs/others in joint COE projects
- Multi-national, multi-disciplinary workshops in U.S., EU, Asia
- Instituting transition plans for all COE project areas
- Integrating MSIs into COEs
- Transitioning COE students, scholars and fellows to DHS and Federal labs, industry, universities, foreign institutions
- Integrating Education with COEs and DHS Components

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Office of University Programs' Mission

Maximize DHS' return on investment in university-based research and education

Homeland Security

Guiding Principles to Maximize ROI Business Model

- Effective → Do the right work [quality products]
- Efficient → Do the work right [lowest cost]
- Enduring → Recoup the investment [returning customers]
- Equal Opportunity → Reflect America to Protect America [build customer base for the future]

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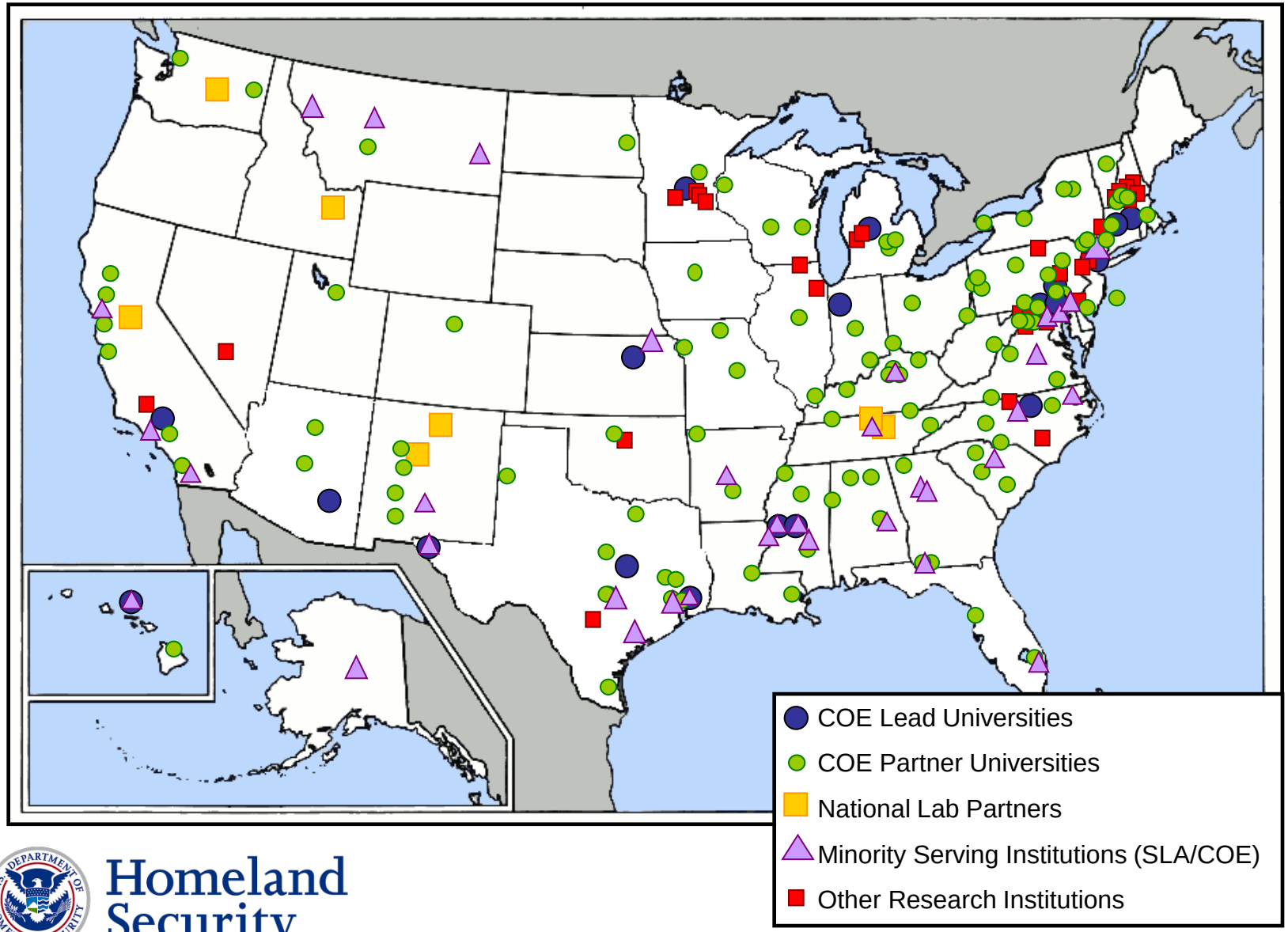
The DHS S&T University Network



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12 DHS Centers of Excellence

1. Center for Risk & Economic Analysis of Terrorism Events (CREATE)
   - Lead: University of Southern California
2. National Center for Foreign Animal & Zoonotic Disease Defense (FAZD)
   - Lead: Texas A&M University
3. National Center for Food Protection & Defense (NCFPD)
   - Lead: University of Minnesota
4. National Consortium for the Study of Terrorism & Responses to Terrorism (START)
   - Lead: University of Maryland
5. Center for Advancing Microbial Risk Assessment (CAMRA)
   - Lead: Michigan State University, in Partnership with U.S. EPA
6. National Center for Preparedness & Catastrophic Event Response (PACER)
   - Lead: Johns Hopkins University
7. Center for Awareness and Location of Explosives-Related Threats (ALERT)
   - Research Co-Lead: Northeastern University
   - Education Co-Lead: University of Rhode Island

CREATE HOMELAND SECURITY CENTER

CAMRA Center for Advancing Microbial Risk Assessment

NATIONAL CENTER FOR FOOD PROTECTION AND DEFENSE
A HOMELAND SECURITY CENTER OF EXCELLENCE

12 DHS Centers of Excellence

8. National Center for Border Security and Immigration (NCBSI)
   - Research Co-Lead: University of Arizona
   - Education Co-Lead: University of Texas at El Paso
9. Center for Maritime, Island and Port Security (MIPS) - meets Safe Ports Act
   - Maritime and Islands Co-Lead: University of Hawaii (CIMES)
   - Port Security Co-Lead: Stevens Institute of Technology (CSR)
10. Natural Disasters, Coastal Infrastructure and Emergency Management (NDCIEM)
   - Research Co-Lead: University of North Carolina at Chapel Hill (DIEM)
   - Education Co-Lead: Jackson State University (NDCIEM)
11. National Transportation Security COE (NTSCOE) – Required by HR-1
   - Research Co-Lead: University of Connecticut
   - Education & Training Co-Lead: Tougaloo College
   - Petro-Chemical Transportation Co-Lead: Texas Southern University
12. Command Control and Interoperability (C2I)
   - Co-Lead: Purdue University
   - Co-Lead: Rutgers University

NCBSI
National Center for Border Security and Immigration

CIMES

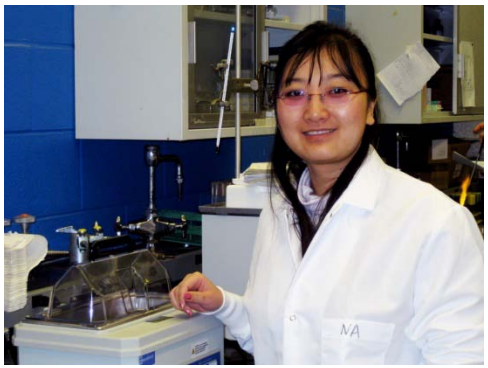
PORT SECURITY
CSR

Potential USCG –OUP Engagement

Homeland Security

Working with OUP

- Write COE FOAs with a team
- Review COE proposals (Stage 2)
- Site visits (Stage 3)
- Internships for DHS Scholars and MSI Students
- Participate on COE Federal Coordinating Committees
- Participate in COE mid-term review panels



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Centers of Excellence - Mission Relevance to the USCG

- Strengthen maritime domain awareness and safeguard populations and properties unique to U.S. Island, remote/extreme environments. (MIREES)
- Evaluation of risks, costs and consequences of terrorism and to guide economically viable investments in homeland security. (CREATE)
- Human causes and consequences of terrorism that is directly relevant to homeland security policymakers and practitioners (START)
- Medical and public health preparedness strategies, response capabilities, and surge capacity. (PACER)
- Safeguard populations, properties and economies and improve community resiliency to the consequences of natural disasters, including hurricanes, floods, earthquakes, and wildfires (NCDIEM)
- Analyze, understand and apply diverse, diffuse, and distributed data on threats and manmade or natural disasters in the presence of uncertainty (CCI)
- Explosive materials formulation and characterization; investigation of mitigation materials and techniques; improved detection of high-energy materials and associated technologies; increased understanding of unconventional explosive threats; and continued algorithm development and sensor fusion strategies for improved threat detection. (ALERT)

Homeland Security

Centers of Excellence – Current USCG Related Projects

- Center of Excellence for Maritime, Island and Remote and Extreme Environment Security (MIREES)
  - Space Surveillance
  - HF Radar and Over-The-Horizon Surveillance
  - Nearshore and Harbor Surveillance
  - Design for Resiliency
  - Satellite Detection and Tracking of Ships
  - Coastal Radar Detection
  - Harbor Acoustics Monitoring
  - Decision Support Systems
- Center for Risk and Economic Analysis of Terrorism Events (CREATE)
  - PortSec - Port Security Risk Management and Resource Allocation
- National Transportation Security Center of Excellence (NTSCOE)
  - Sustaining Resilient Inland Waterways via Renewable Energy Project
  - Emergency Response via Inland Waterways Project

Centers of Excellence – Current USCG Related Projects

- National Center for Zoonotic & Animal Disease Defense (ZADD)
  - Dynamic Preparedness Simulator (DPS)
- The National Center for Food Protection and Defense (NCFPD)
  - Consequence Management System
  - Freight Transportation Risk and Resiliency in International Food Supply Chains
- Center for Natural Disasters, Coastal Infrastructure & Emergency Management
  - Meteorological Modeling
  - Hydrologic Modeling System for Coastal Environments
  - Coastal Wave Surge Modeling
  - Application of ADCIRC Coastal Circulation Model for Predicting Near Shore and Inner Shore Transport of Oil from the Horizon Oil Spill
  - Hurricane Forecasting Methodologies

Center for Risk and Economic Analysis of Terrorism Events (CREATE)

PortSec - Port Security Risk Management and Resource Allocation

The Problem – Two Competing Needs:

- **Protection** of the ports: Ports are a critical part of our Nation's infrastructure
  - Provide jobs (locally and nationally)
  - Support import/export business
  - Critical component of the Nation's supply-chain.
  - **They are major, high-value terrorist targets**
- **Economic viability**: goods *must* flow
  - Need to minimize interruptions to business, avoid increasing costs of doing business
  - **Excessively costly/disruptive protection causes economic harm to US, satisfies terrorist aims**

Challenges:

- **System of systems**: Ports and similar operations are composed of many different components
  - Makes risk assessment and management difficult
  - Difficult to model and analyze
- **Dynamic operations**: Constantly changing, both day-to-day and long-term

Homeland Security

CREATE HOMELAND SECURITY CENTER

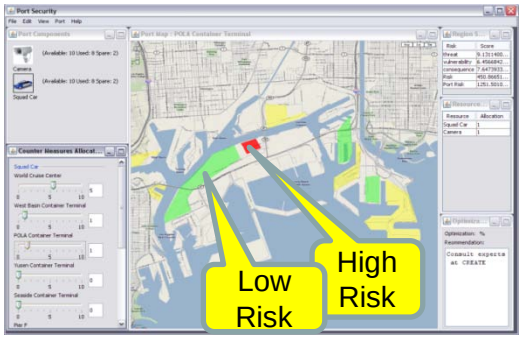
Center for Risk and Economic Analysis of Terrorism Events (CREATE)

PortSec - Port Security Risk Management and Resource Allocation

PortSec Solution: Two Modes

- **Tactical system** addresses daily security needs
  - Risk calculations based on collected intelligence
  - Continuously monitors for changes and recalculates assessed risk of attack to the port complex
  - Calculates attack risks, assesses port operations costs resulting from resource re-allocation to address risk
- **Initial prototype under evaluation at POLA/POLB**

- **Strategic system** addresses resource allocation and investment questions
  - Considers long-term picture of port operations (e.g., expansions)
  - Supports “what-if” cost-benefit analysis



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National Transportation Security Center of Excellence (NTSCOE)

University of Arkansas – Mack Blackwell Rural Transportation Center

- **Sustaining Resilient Inland Waterways via Renewable Energy Project**
  - Explore how renewable energy sources can be utilized to support inland waterway security and operations.
- **Emergency Response via Inland Waterways Project**
  - What are the emergency response capabilities of inland waterways?
  - What is the feasibility of providing emergency medical services via barge?
  - Which types of communities could benefit from such a service?

Homeland Security

Active USCG-COE Engagement

Homeland Security

Improving Port System Resiliency for the National Interest - May 2009

Objective:

- Identify the critical challenges to building resiliency of our Nation's port system as a whole
- Understand knowledge gaps to develop appropriate tools, models and methodologies for decision-makers to use in the future.

Organization:

- Participants: State, local and international stakeholders, port managers, academics and researchers, and other federal agency officials
- Focused initial efforts on a common understanding of resiliency
- Identified challenges to the port system from a national perspective based on a nationally significant scenario
- Identified failure modes, interdependencies with other systems, impacts on the global supply chain, and cascading effects of related system failure.
- Explored the relationship between individual (local/regional) port resilience and overall U.S. (national) “port system” resilience.

Outcome:

- Further develop the research needed to address future challenges by socializing the results with stakeholders with the goal of supporting future studies as appropriate.
  - Still TBD

Homeland Security

Arctic Research Workshop- September 2010

Objective:

- To explore and identify ways in which scientific research and development could improve the ability of the U.S. Coast Guard (USCG) to operate and carry out its statutory missions in the Arctic region.

Organization:

- Participation included state, local and international stakeholders, academics and researchers, and USCG and other federal agency officials
- USCG described existing challenges and capability gaps in the Arctic,
- Researchers reported on research projects underway to address these challenges
- Working groups - infrastructure, sensors, and communications - identified key areas where R&D could improve Coast Guard capabilities in Arctic
- Attendees brainstormed on research questions - virtual navigation aids, voice communications, consolidated climate and environmental data, and parameters for an Arctic response boat.

Outcome:

- The USCG and S&T have reviewed and prioritized research areas. Will follow up with requests for proposals from COEs.

Transitioning Auxiliary Stations to Stations (Small)

Problem:

- Search and Rescue (SAR) Stations Operated by CG Auxiliary are no longer sustainable based on current staffing levels.

Objective:

- Determine if requirements dictate a presence, and change the designation of needed stations to Active Duty Station (Small).

Outcome:

- USCG (LANT-7) partnered with the DHS Center of Excellence VACCINE (Visual Analytics for Command, Control, and Interoperability Environments) at Purdue University.
- VACCINE provided SAR Case Data Visualization to better understand the impact of D9's unique AUXOP Stations.
- USCG made recommendations based on the next steps for evaluating transition from Auxiliary to Active Duty Stations

Homeland Security

Great Lakes Economic Risk Study

Problem:

- The economic value of CG Prevention activities is unknown.
  - 15 major international ports and some 50 smaller, regional ports on the Great Lakes-St. Lawrence Seaway system
  - More than 60% of seaway traffic travels to and from overseas ports, (iron ore, coal, grain and steel make up about 80 percent of cargoes shipped each year)
  - Vital MTS that provides a link between the world marketplace and the industrial and agricultural heartland of North America.

Objective

- Quantify the value of CG Prevention activities and publish statistically defensible economic measures.

Outcome

- VACCINE engaged to provide visual analytics of data on boating and other incidents in the Great Lakes and development of a resourcing model projecting needs for Coast Guard ships and personnel.

Homeland Security

Boston Sector Deterrence Model

Problem:

- Currently no method of measuring the deterrent value of forces applied to executing PWCS patrols and scheduling.

Objective:

- Provide Sector schedulers with a tool to randomize patrols against weighted targets in order to maximize effectiveness while minimizing impact on operational forces.

Outcome:

- DHS Centers of Excellence at the University of Southern California (USC) – (CREATE) utilizing game theory to build complex algorithms, and
- Purdue University (VACCINE) developing data visualization interfaces
- To maximize PWCS patrol deterrence effects through randomization for use by any Operational Commander.

Homeland Security

Academic Maritime Risk Symposium

USCG/CREATE Maritime Risk Symposium, 16-18 Nov
University of Southern California, Los Angeles, CA

Purpose:

- Evaluate risk and economic consequence assessment methodologies and tools, assessment results, and policy implications and impacts, focused on the
- Maritime Domain.

Challenge:

- How can academia and government approach this issue together?

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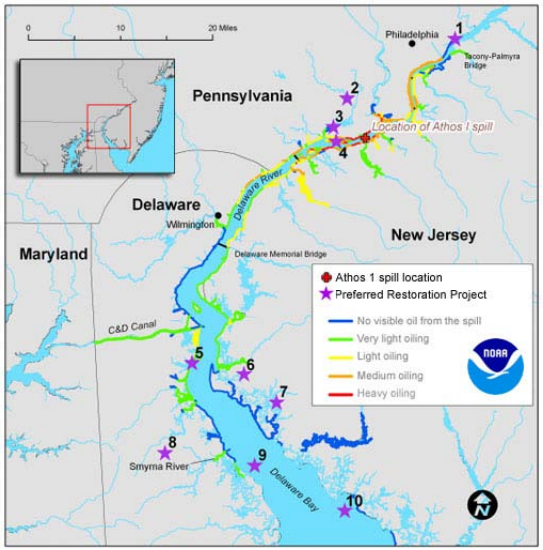
CREATE HOMELAND SECURITY CENTER

Other USCG COE Engagement

- CCICADA (Rutgers) COE on advanced data analysis:
  - Tayfur Altiok is doing research/analysis for USCG on risk assessment for the Delaware River



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Command, Control, and Interoperability Center for Advanced Data Analysis

Future Engagement

- Basic Ordering Agreements (contracts)

  https://collaborate.st.dhs.gov/oup/boa/default.aspx
- Modifications of Cooperative Agreements for Research (assistance agreements)
- Website and database of projects at:
  - www.hsuniversityprograms.org
- Educational Opportunities for DHS Staff
- Hosting COE Professors on Sabbaticals

Homeland Security

Homeland Security

NAVAL
POSTGRADUATE
SCHOOL

Innovation in Action
Collaborate-Educate-Create-Apply

Wendy Walsh
Homeland Defense & Security Coordinator
2NOV2010

Monterey, California
WWW.NPS.EDU

The Naval Postgraduate School is a . . .

- **Graduate University**
  Responsive to joint, interagency, and coalition requirements
- **Research Institution**
  Pursuing innovative technology and improving national security
- **Community of Alumni**
  Leading and defending the Nation and transforming the Department of Defense (DoD)

History Highlights

1909	Founded at the U.S. Naval Academy
1951	Moved to Monterey
1951	Operations Research Department
1956	Systems Management Department
1972	National Security Affairs Department and War-Fighting curricula (e.g., Anti-Submarine Warfare)
1996	Information Warfare Curriculum
1999	Joint Professional Military Education (JPME) campus
2003	Homeland Security Curriculum
2004	Information Operations

Core Characteristics

• Integrated • Systems-Oriented • Flexible • Partnered for Strength

4 Institutes

The Cebrowski Institute for Information Innovation and Superiority

The MOVES Institute Modeling, Virtual Environments, and Simulation

The Meyer Institute National Security Systems and Technology

National Security Institute Partnership developed for National Security research and education

Institutes ensure that education provided by the Schools is applied to military challenges

4 Schools

Graduate School of Engineering and Applied Science

Graduate School of Operational and Information Sciences

Graduate School of Business and Public Policy

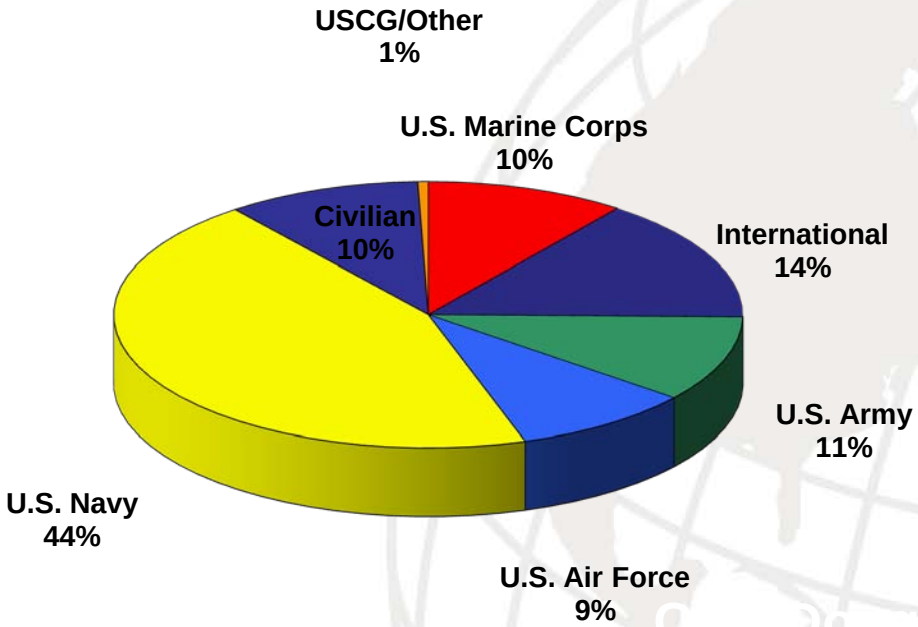
School of International Graduate Studies

Resident Degree Program Enrollment (Winter(2nd Quarter) 2010)

Total Resident: 1,488

U.S. 85% - All Military Services and Other Government Agencies

International 15% - 223 Residents from 44 countries



Collaboration in Action

- The Center for Homeland Defense & Security
- The National Security Institute
- Maritime Defense & Security Research Program
  - Information Sharing - Infrastructure Protection
  - SPSS/ Seaweb - Unmanned Systems
  - Piracy - War gaming
- Various Research and Field Experimentation
  - Example- Maritime Interdiction & Interoperability
- Collaborative Curriculum Development
  - Example- Maritime Security Certificate Course

Educate

USCG Thesis Topics: (118 total)

Covering: MDA, Situational Awareness, Manpower, Acquisition, Terrorism, Interoperability, Measures, Stall analysis, Vibration, Service Orientated Architecture, Modeling, Resiliency, Recruitment, Intelligence, Innovation, Katrina Response, Public Affairs…

Contact

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Creating Leaders for our United States Coast Guard

Kurt Colella, Ph.D., P.E.
(kurt.j.colella@uscg.mil)
Dean of Academics

United States Coast Guard Academy

United States Coast Guard Academy

Shared Learning Outcomes

- ***Leadership Ability***
- ***Personal and Professional Qualities***
- ***Critical Thinking Ability***
- ***Ability to Acquire, Integrate and Expand Knowledge***
- ***Ability to Communicate Effectively***

United States Coast Guard Academy

USCGA Core Curriculum – Components

Well Being/Physical
Professional
Leadership
Liberal Arts
Technical

United States Coast Guard Academy

Academic Majors

- ***Government*** ***(international affairs track/public policy track)***
- ***Management***
- ***Marine and Environmental Sciences*** ***(chemistry/biology/physics-2 of 3)***
- ***Operations Research and Computer Analysis***
- ***Civil Engineering***
- ***Electrical Engineering*** ***(systems emphasis/computer emphasis)***
- ***Mechanical Engineering***
- ***Naval Architecture and Marine Engineering***

Our Changing World-Curricular Evolution

Activities/Project-based study
Elective Courses
Outside Sponsorship
Enhanced Course Management Tools
Pedagogical Variations/Methodologies

United States Coast Guard Academy

Co/Extra-Curricular Experiences

- ***Scholar's Projects***
- ***Advanced Research Projects***
- ***Directed/Independent Research***
- ***Capstone Courses/Projects***
- ***Honor's Program***
- ***Internships***

United States Coast Guard Academy

Undergraduate Research

Benefits

Attracts students to majors/careers (particularly in STEM)

Strong mentoring relationships

Cross disciplinary dialogues

Develop motivation and confidence to persist

Desire to advance studies-lifelong learning

Ability to handle open ended problems-uncertainty

Costs

Strain on faculty-partnership management

200 week cadet program

Tremendous pressure on limited technician and admin support

Limited mechanisms for accepting non-appropriated resources (people/funds)

United States Coast Guard Academy

Partnerships/Connectivity

CG Field Units

CG Directorates

Government Labs

Other Colleges/Universities

Leadership Development Center

Institute for Leadership

Center for Maritime Policy and Security Studies

United States Coast Guard Academy

Unique Capacity/Capability

Tow Tank/Circulating Water Channel

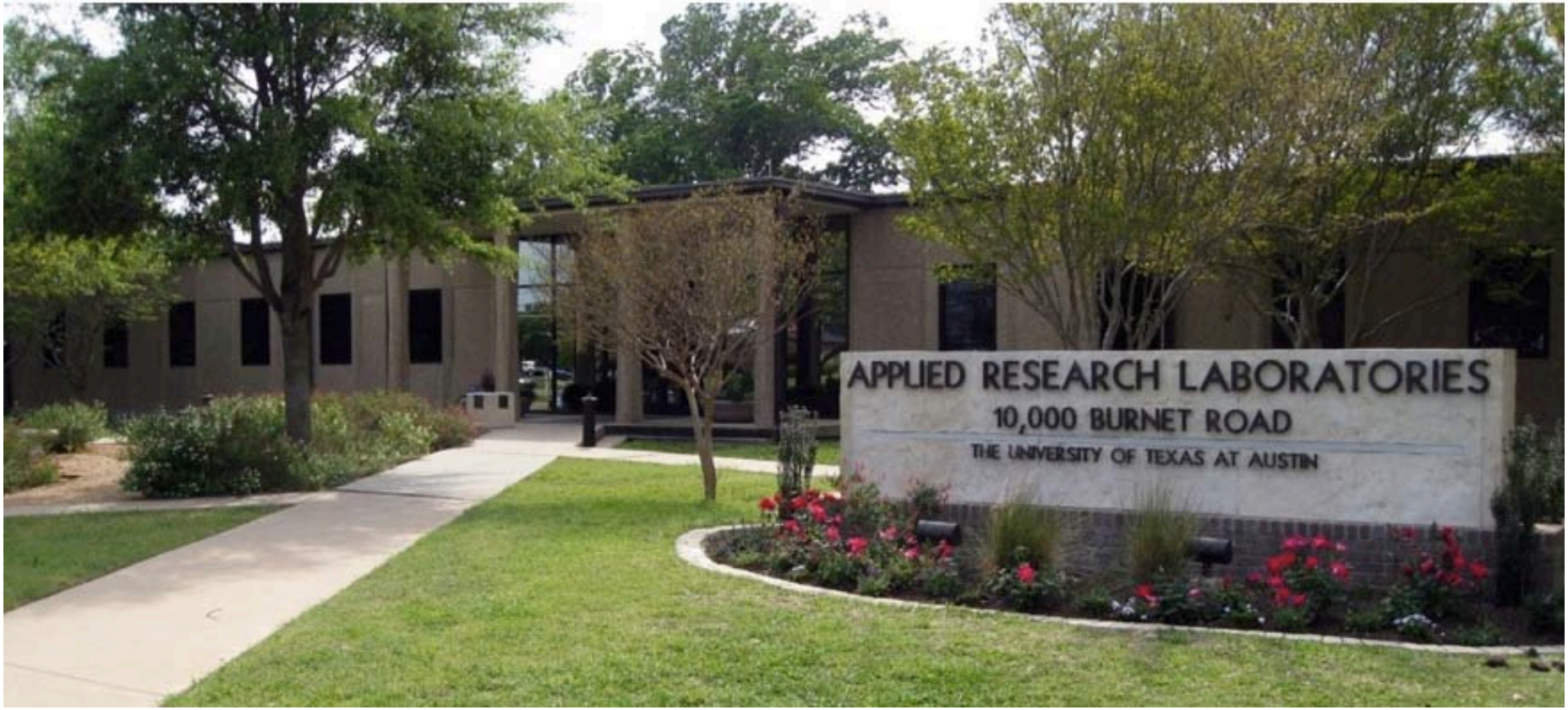
SIPRNET Classroom (Secret Internet Protocol Router Network)

Ship Bridge/Radar Simulator

Cyber-Defense/Network Security Laboratory Laboratory

Training Vessels/Boats

ARL
The University of Texas at Austin



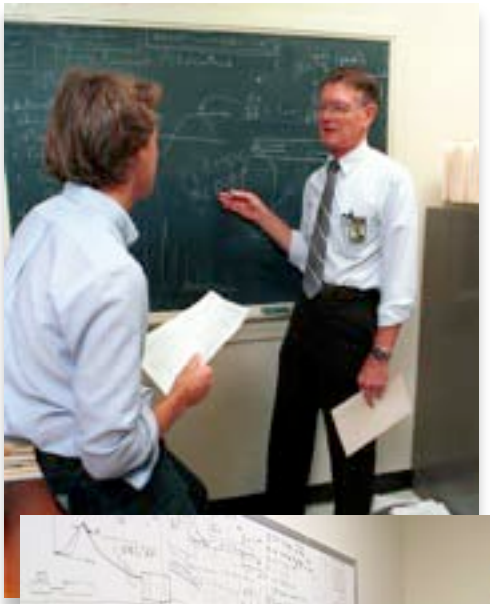
Applied Research Laboratories
The University of Texas at Austin:
A Navy University Affiliated Research Center

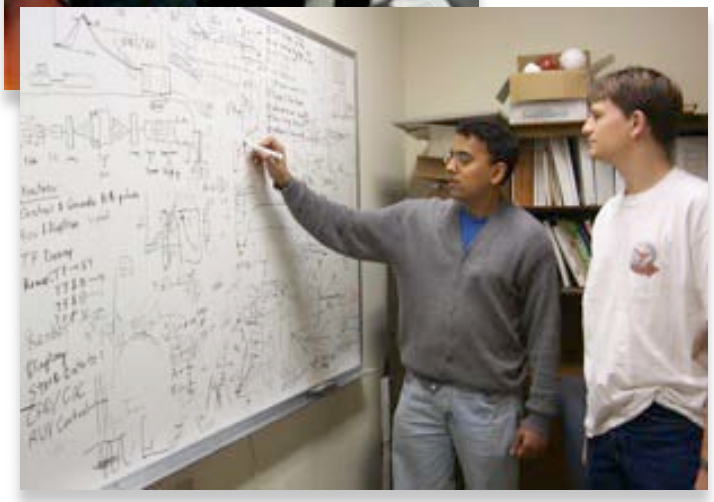
ARL:UT in Brief

- One of five Navy University Affiliated Research Centers (UARCs)
  - Operate under Director, Defense Research and Engineering (DDR&E) charter and management plan with sole-source contract
  - Maintain university-based engineering and technology capabilities deemed essential to DoD
- Technical Program Areas: Acoustics, Electromagnetics, Information Technology
  - Emphasis on basic and applied research leading to prototype development for defense and national security applications
- Organization
  - ~650 staff
    - 325 research staff (20% PhD, 50% MS/MA, 30% BS/BA)
    - 75-150 students (all U.S. citizens)
  - ~$75M/yr funding (all soft money)
  - Secure facility (all professional staff have security clearances)

UARCs, Academia, and Innovation

- UARCs are a bridge between operational needs and academic research
  - Focus on applied problems to solve operational needs, but with reach back to basic research on campus
- UARCs facilitate faculty involvement in applied problems
  - Awareness of operational needs
  - Assist with competing faculty requirements (publish, graduate students)
  - Access to classified facilities
- UARCs engage students in research relevant to national security.
  - Workforce renewal.
- UARCs can bridge Navy development with DHS needs

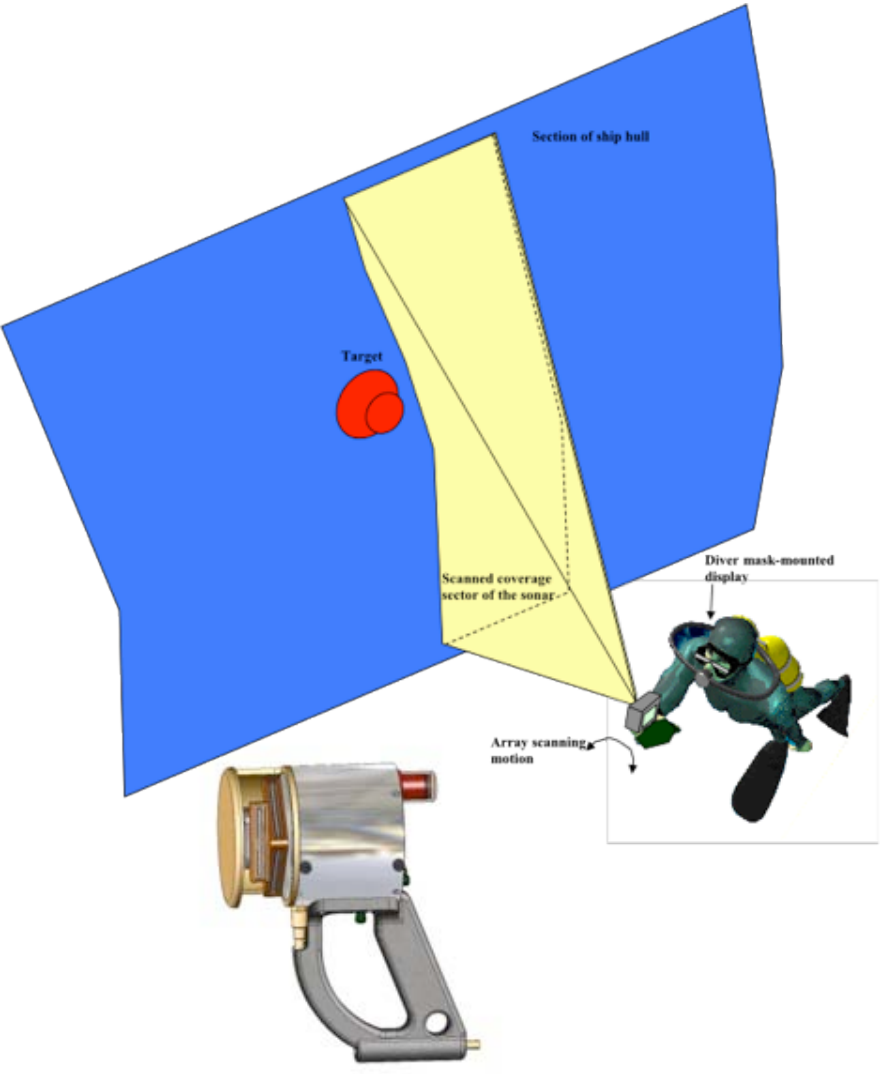




Swimmer Detection Sonar

- ARL-developed AN/WQX-2 is currently in use by USN and Coast Guard in integrated waterfront security systems.
  - Automated detection, tracking, classification and alerting for surface and subsurface intruders.
  - Installed at various Navy bases worldwide.
- Selected for use by US Allies for protection of key naval bases.

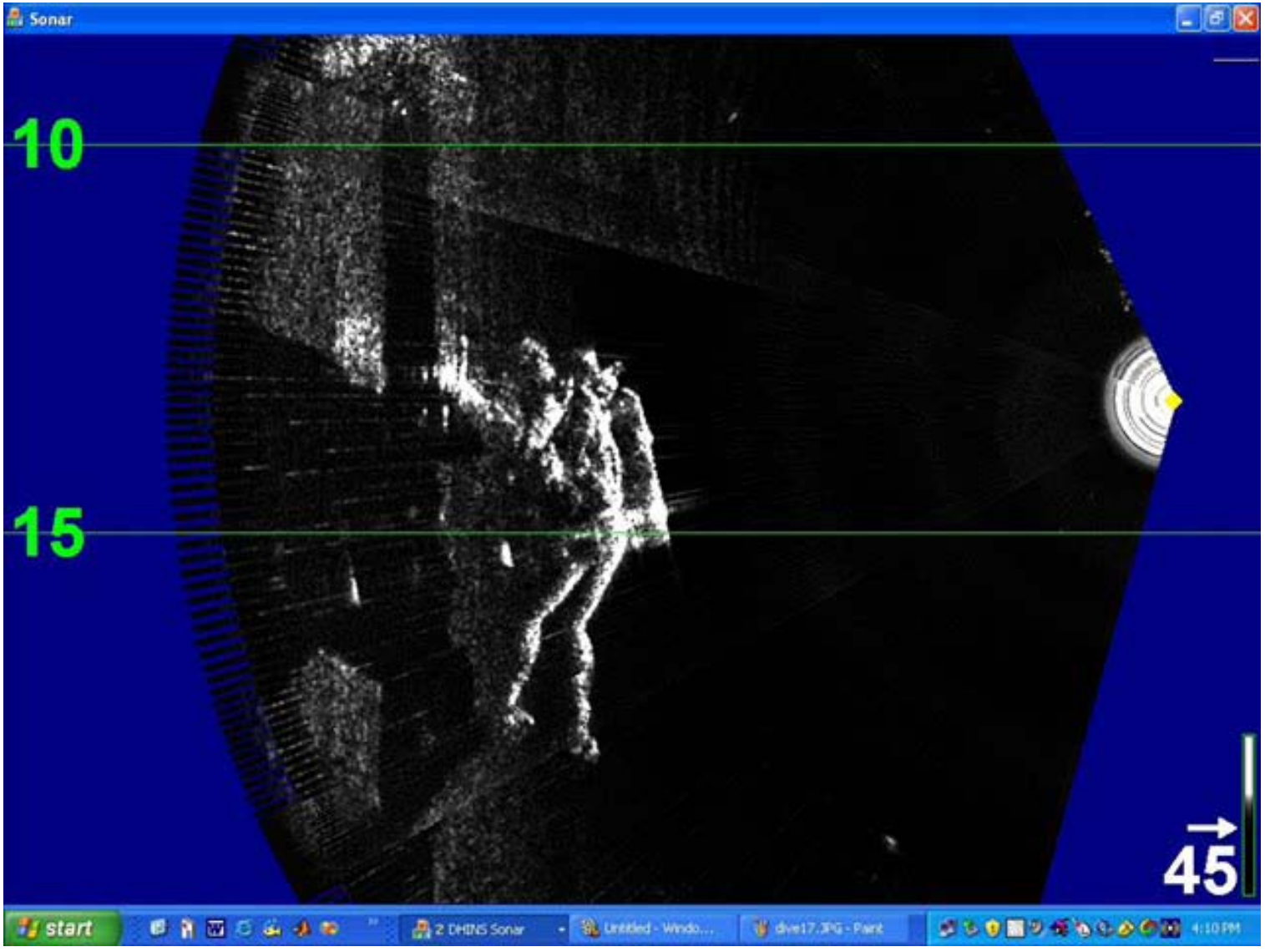
Diver Hull Imaging and Navigation Sonar



- Provides capability to inspect the hull of a ship to find attached mines or other devices.
- Current Implementation:
  - Diver held auto scanning sonar
  - Image data remoted to surface and displayed in diver face mask
  - Incorporates beacon-based acoustic navigation system with orientation & depth sensors
  - Full voice communications with diver
- Potential for AUV implementation

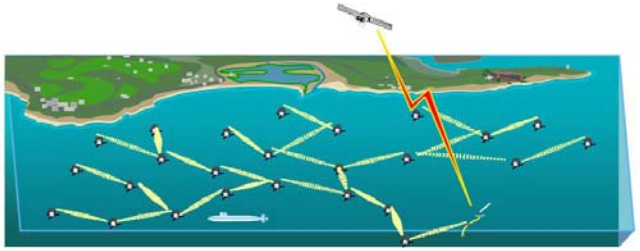
ARL
The University of Texas at Austin

DHINS Image of Diver



Seaweb

Rapidly deployable, persistent underwater acoustic surveillance network for illicit trafficking



Distributed undersea surveillance sensor network

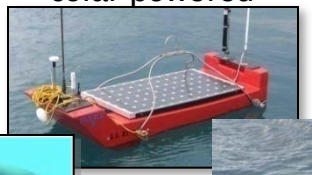
COTS Telesonar repeater

- Collaborative development with Naval Postgraduate School
- Mature system: TRL 6-8
- Networked acoustic communications for near-real-time contact reporting
- Deployable, autonomous, distributed sensors with in-sensor detection and classification

Sensor nodes

Radio/acoustic communications (Racom) gateway buoy options

solar powered



Low Profile USV

Submerged

Navigation buoy

Academic Collaboration with the US Coast Guard

Professor Ananth. V. Iyer
Susan Bulkeley Butler Chair in Operations Management
Director DCMME and GSCMI
Krannert School of Management
Purdue University
West Lafayette, IN 47907
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(all projects co-authored with Professor Deshpande)

Projects between 2001 and 2009 Resources

- Five Sponsored Projects between ARSC (Elizabeth City) and Purdue University
- All projects focused on the Air Assets Supply Chain (ARSC) at Elizabeth City and airstations
- Masters Students from the Krannert School of Management and School of Industrial Engineering at Purdue University
- PhD student from the Krannert School
- Student interns worked at ARSC in the summer and went to airstations when necessary
- Faculty – Professors Deshpande and Iyer
- USCG officers at Krannert for MSIA degree – independent study projects to test completed projects and push results

Focus on one project

- **HH-65 B to C conversion and CG2 to CG4 conversion**
- Initial problem – Timeline for conversion, shortage of Gearbox conversion kit
- Possible Choices – full flexibility, partial flexibility
- Rate of conversion of aircraft, overhaul interval for converted aircraft
- Model showed the impact of kit constraint, overhaul interval, repair time on aircraft availability
- Mathematical programming model generates performance estimates, shadow prices, impact of changes in parameters
- Decisions regarding number of new kits to purchase and impact on performance
- Justification for congressional request for additional funding for gearbox kits

Academic Impact

- Modeling product transitions in a supply chain
- General model and results
- Doctoral thesis (Asima Mishra) who now works for Intel Research
- Two academic papers under review or revision
- The general problem of product transitions is now being applied to EPA regulation and product impact (another thesis)
- This is a new emerging area in Supply Chain research
- It is now taught in Supply Chain courses at Krannert and will be in a textbook I am writing (for McGraw Hill)

Our Approach

- **Original problem definition by USCG officers**
- **Collaborative definition (USCG and Purdue) of technical solution approach**, software used, tasks and timeline
- **Collaborative Definition of the scope** of the prototype solution – to be comprehensive, enable estimation of benefit, cover a range of assets
- All **projects data intensive** – focus on use of **raw data at the transaction level**
- **On site Purdue student interns** - to learn about data specifics from personnel who enter data, interpret data etc (Crucial)
- Models used (Optimization, Simulation, Statistical) and **software used coordinated with licenses at Elizabeth City**
- **All solutions, code etc handed over to USCG** – none of the solutions were property of Purdue
- **Scale up** of the prototype solutions **contracted with private companies**

Timeline of Project vs Academic Output Issues to Manage

- Project Entire Timeline usually within one year
- Academic Calendar vs Project Calendar
- Data Analysis and feedback from USCG – crucial
- On site visits and discussion with users
- Masters students role (project focused) vs doctoral students role (long term research contributions)
- Submit results for independent review (peer review), prizes (Edelman Award)
- Two papers published, two in the pipeline, one doctoral thesis
- Presentations at over 20 universities worldwide and conferences - to collect feedback

Issues to consider

- How do we keep USCG relationships beyond specific project completion ?
- Can the work with USCG be used for other USCG assets (ships) - for DHS, or at other Defense entities (Navy, Airforce) ?
- Are there mechanisms other than project based approaches that could work ?
- Any other suggestions.

THANK YOU

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