NAVAL
POSTGRADUATE
SCHOOL

NPS
PRAESTANTIA PER SCIENTIAM
1909

NDIA Unmanned Maritime Vehicles T&E Conference Presentation

Roger F. Bacon
Vice Admiral, USN (ret)
Chair, Professor Undersea Warfare
Naval Postgraduate School

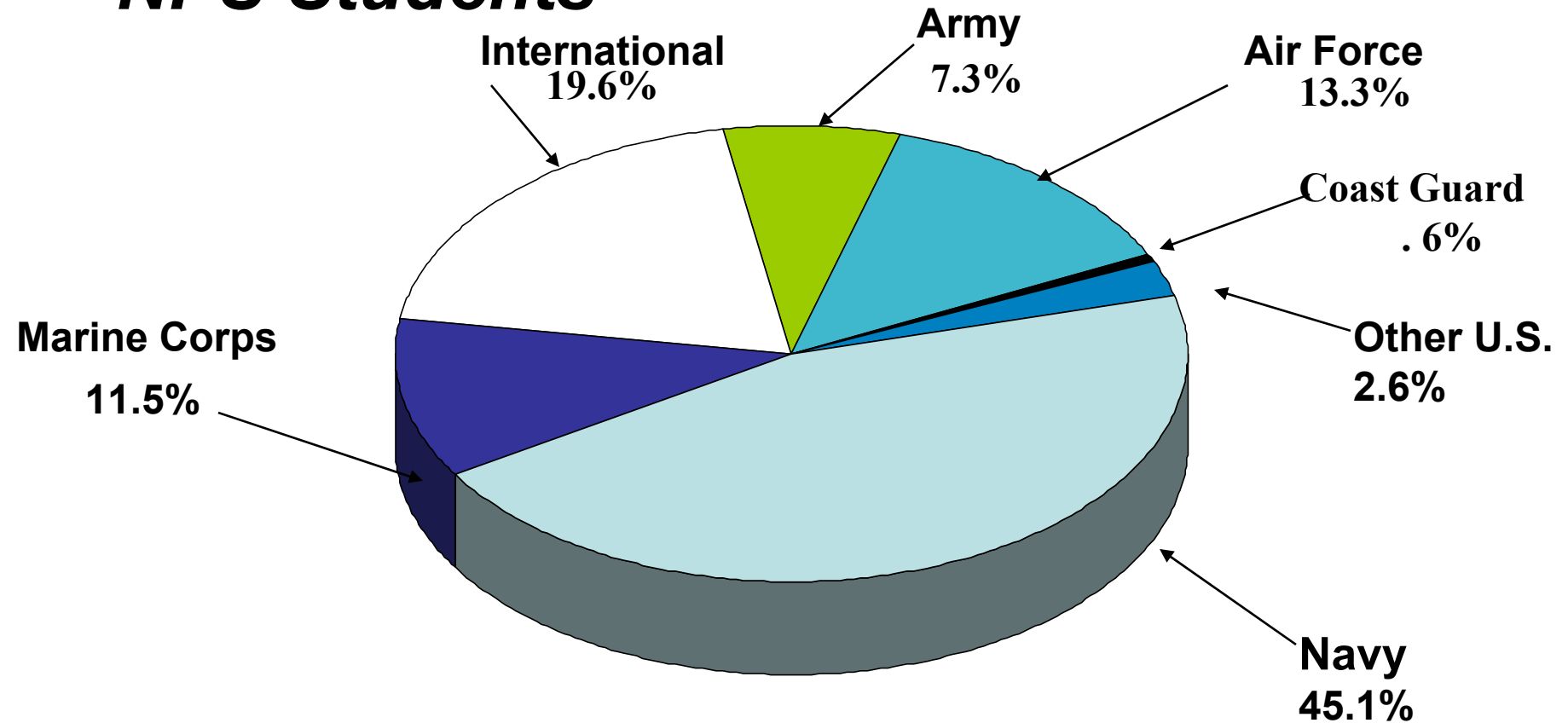16 June 2005 Naval Base Kitsap, NUWC Keyport – Undersea Museum

Naval Postgraduate School Mission

- *Relevant and unique advanced education and research programs*

- *Increase the **combat effectiveness** of U.S. and Allied armed forces*

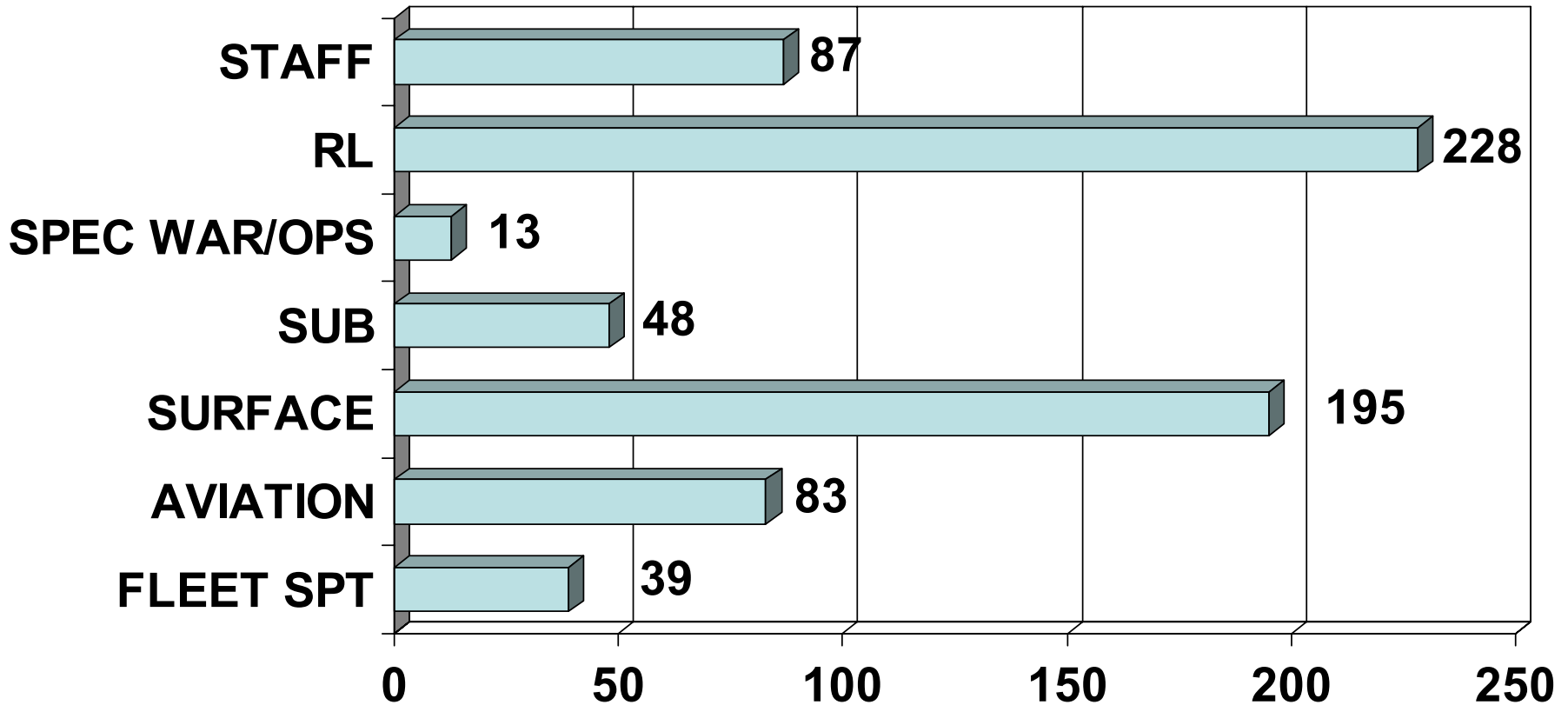- *Enhance the security of the United States.*

NPS Students

Pie chart showing NPS student distribution:
- International 19.6%
- Army 7.3%
- Air Force 13.3%
- Coast Guard .6%
- Other U.S. 2.6%
- Navy 45.1%
- Marine Corps 11.5%

Current Enrollment: 1544 plus 715 in Non-Resident Programs

Navy Resident Student Population

Category	Value
STAFF	87
RL	228
SPEC WAR/OPS	13
SUB	48
SURFACE	195
AVIATION	83
FLEET SPT	39

QTR 2 FY 05

FY04 Sponsored Research Programs Research And Education
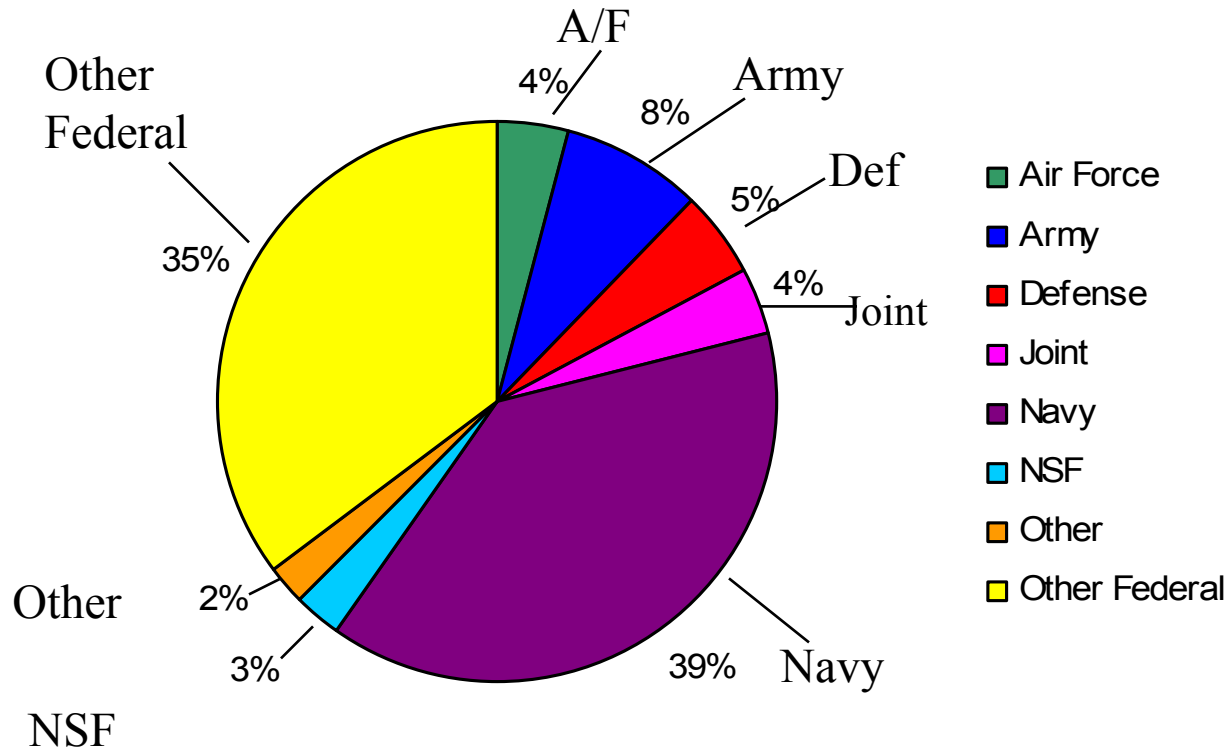
A/F 4%
Army 8%
Def 5%
Joint 4%
Navy 39%
NSF 3%
Other 2%
Other Federal 35%

Legend:
- Air Force
- Army
- Defense
- Joint
- Navy
- NSF
- Other
- Other Federal

Total: $83.7M

NPS Center for AUV Research
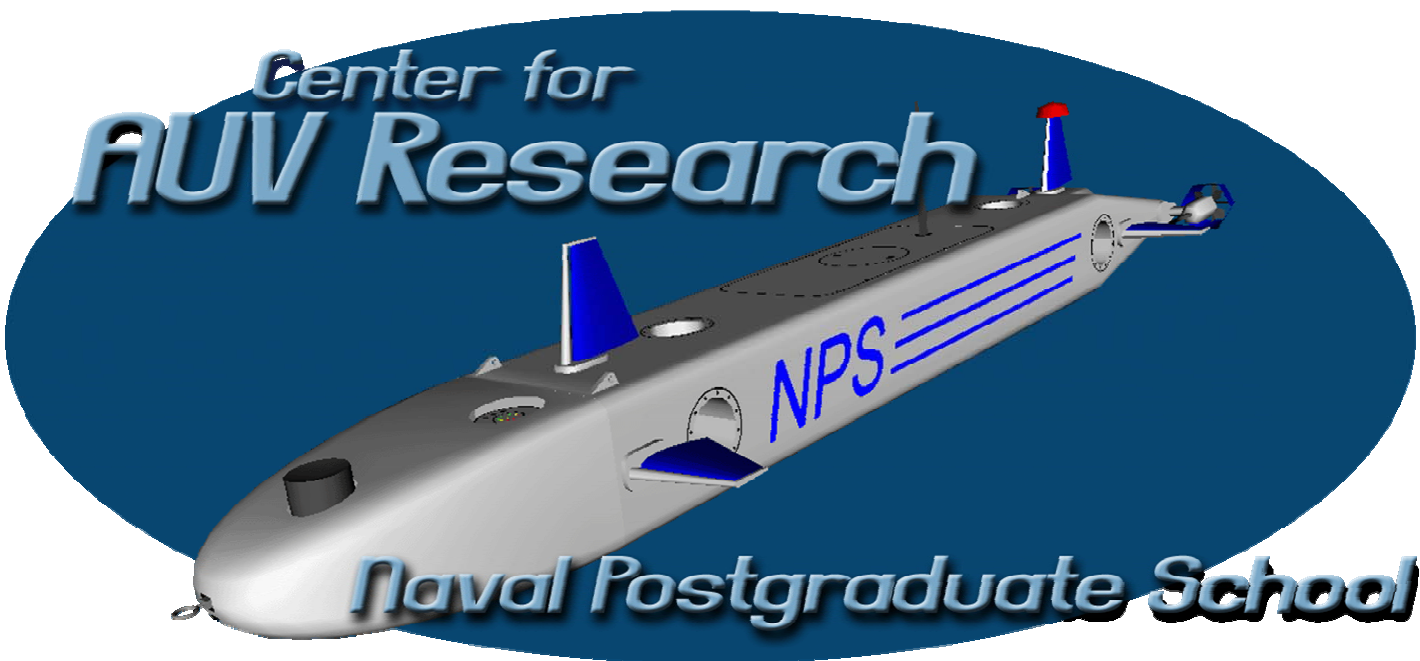
Dr. Anthony Healey Distinguished Professor
Naval Postgraduate School

Chairman of Mechanical and Astronautical Engineering
department

Director , Center of AUV Research at Naval Postgraduate
School

ONR support : Mr. Tom Swean

120 Theses in AUV technology , 5 PhD students since
1986

Mission Statement

- The primary goal of the NPS Center for AUV Research is to educate Navy and USMC officer students in the development and use of technologies needed for unmanned underwater vehicles through coursework, thesis and dissertation research.

- The secondary goal of the Center is to advance Naval UUV operations by providing:

  1. Support to the Fleet, Navy Labs and Program Offices
  2. Testing and Experimentation of Advanced Technologies
  3. Independent Verification and Validation of UUV Concepts
  4. Innovative Concept Development

- **AUV /UUV Small Vehicle Programs Have Successfully Demonstrated Organic Mine Countermeasures Capabilities. Examples are here at the Demonstrations.**

- **Larger Vehicles are now being developed with greater autonomy for more complex missions such as ISR and ASW.**

- **ASW is a current and near term focus.**

- **Persistent Presence and Surveillance is needed over larger areas.**

- **Technical Challenges lie in greater autonomy and coordination of information gathering from various assets.**

- **Think about what can be done by using the available real estate on Trident Submarines for deployment and recovery of large numbers of AUV / UUV vehicles!**

The future

UUV FEST 2005 WITH OVER 130 DEMONSTRATIONS HAS PROVEN THE SCIENCE AND TECHNOLOGY OF UNMANNED MARITIME VEHICLES IS ADVANCING RAPIDLY

HOW WILL COMBATANT COMMANDERS EMPLOY IT?

TWO OBVIOUS WARFARE AREAS:
MINE WARFARE AND ANTI-SUBMARINE WARFARE

SYSTEMS ENGINEERING AND ANALYSIS STUDENTS AT
WAYNE E. MEYER INSTITUTE Naval Postgraduate School ARE WORKING ON IT

EIGHTH INTEGRATED WARFARE PROJECT SEA8 -FOR OPNAV

Anti-Submarine Warfare in the Littorals in 2025 will present a major challenge for the United States.

Quieter and more capable submarines operating in the littoral environments will continue to challenge the Navy as it assures access.

The Navy is developing programs to assure the continued capability to establish undersea superiority.

SEA-8 Problem Statement

Develop a System-of-Systems (SoS) Architecture to:
- conduct Undersea Warfare
- in the littorals
- during the 2025 timeframe
- consistent with the CNO's ASW CONOPS for the 21st Century.

SEA8

The SEA8 team which will use campus wide support will develop this project over the next six months and

Intend to use Unmanned Maritime vehicles/systems as a major force in Antisubmarine warfare in the littorals in the next 25 to 20 years.

They will report this out in December 2005

SEA 8 is tasked with designing a system that renders enemy under water vehicles (Submarines and UUVs) incapable of preventing U.S assets from operating within the littoral region during the 2025 timeframe.

QUESTIONS?

Backup

CNO TASK FORCE ASW WARFIGHTING STRATEGY

FOUR FORCE ATTRIBUTES:

Pervasive awareness – integrated undersea domain awareness from sensors to networks

Speed – warfighter will have ability to attack immediately with precision and decisive force

Persistence – persistent detection and cueing of sub threats will initiate a detect-to-engage sequence that holds enemy submarines at risk and enables their destruction

Technological Agility – State-of-the-art and state-of-the-practice technologies will facilitate the rapid introduction and fielding of new capabilities

CNO - ASW WARFIGHTING PRINCIPLES

Battle space preparation and monitoring

nb Precise **environmental characterization: historical, predicted and in-situ**

Persistent detection and cueing

– Deployable surveillance and monitoring, **network distributed surveillance**

Combined Arms prosecution

High Search and Kill rates

Non-conventional and non-traditional methodologies

– Reconfigurable manned and **unmanned vehicles**

Defense in depth and force self-protection

USW CURRICULUM Naval Postgraduate School
AND SUBMARINE FORCE FUTURE CAPABILITY VISION Ref COMNAVSUBFOR 24 Jan 2005 JOINT LETTER

5 Technology vectors:

Payload: increase in sub payload volume and a wide and varied range of **off-board vehicles**, sensors, and weapons are key to expanding the submarine's sphere of influence. -sea shield and sea strike elements SP 21.

Modularity : adapting new weapons and sensors - using **modular approach** – do quickly and inexpensively

Connectivity: **improved connectivity between submerged submarines, off-board vehicles** and emerging shore and sea-based networks is required to better integrate submarines with the joint force.

Computing and Automation: Tactical displays and decision support systems, must be improved to make situational awareness more intuitive and less dependent on experience.

Integrated Electrical Systems: need simplified and integrated power and propulsion systems

Sea Shield – Clandestine ASW, SUW and MIW enabled by submarine stealth and access are vital to Joint Battle space preparation and combat success against an ever improving adversary

Among these improvements:

Advanced acoustic hull arrays to enable covert localization and tracking of quiet diesel submarines

- **A submarine –deployable cueing sensor system that will allow a single submarine in the hostile littoral to monitor and prosecute tactically significant areas**
- **These efforts will:**
- **Build on Acoustic Rapid COTS Insertion/Advanced Processing Build improvements**

Mine warfare:

- **Revolutionary new submarine capabilities are required to localize and neutralize mines in order to enable safe passage of a submarine platform through an enemy minefield within a period of a few days.**
- **This capability will require novel sensors and CONOPS and will employ off-board payloads and sensors such as UUVS.**

NPS: Responding to an Evolving World

Center for Homeland Security
• *Dept. of Homeland Security/Dept. of Defense sponsored program*
• *Resident study and distance learning*

Center for Stabilization and Reconstruction Studies
• *Strategies, plans, organizational arrangements, and operational doctrines for post-conflict stabilization operations and reconstruction*
• *Civil-military professionals from US government, allies and NGOs*

NATO Partnership for Peace (PfP) Training Center
• *Only NATO training center in the United States*
• *NPS is the DoD graduation education choice for all of NATO*

USW CHAIR FUNCTIONS

Review USW curriculum for appropriate content relative to undersea and anti-submarine warfare principles and technology applications

Ensure curriculum meets educational standards for post-graduate degrees and requirements for sub-specialty codes.

Revise and refine USW curriculum to reflect new curriculum sponsor initiatives

Liaison with Navy Laboratories, acquisition program managers, program sponsors, and operational commands to identify prioritized needs for research topics in USW areas.

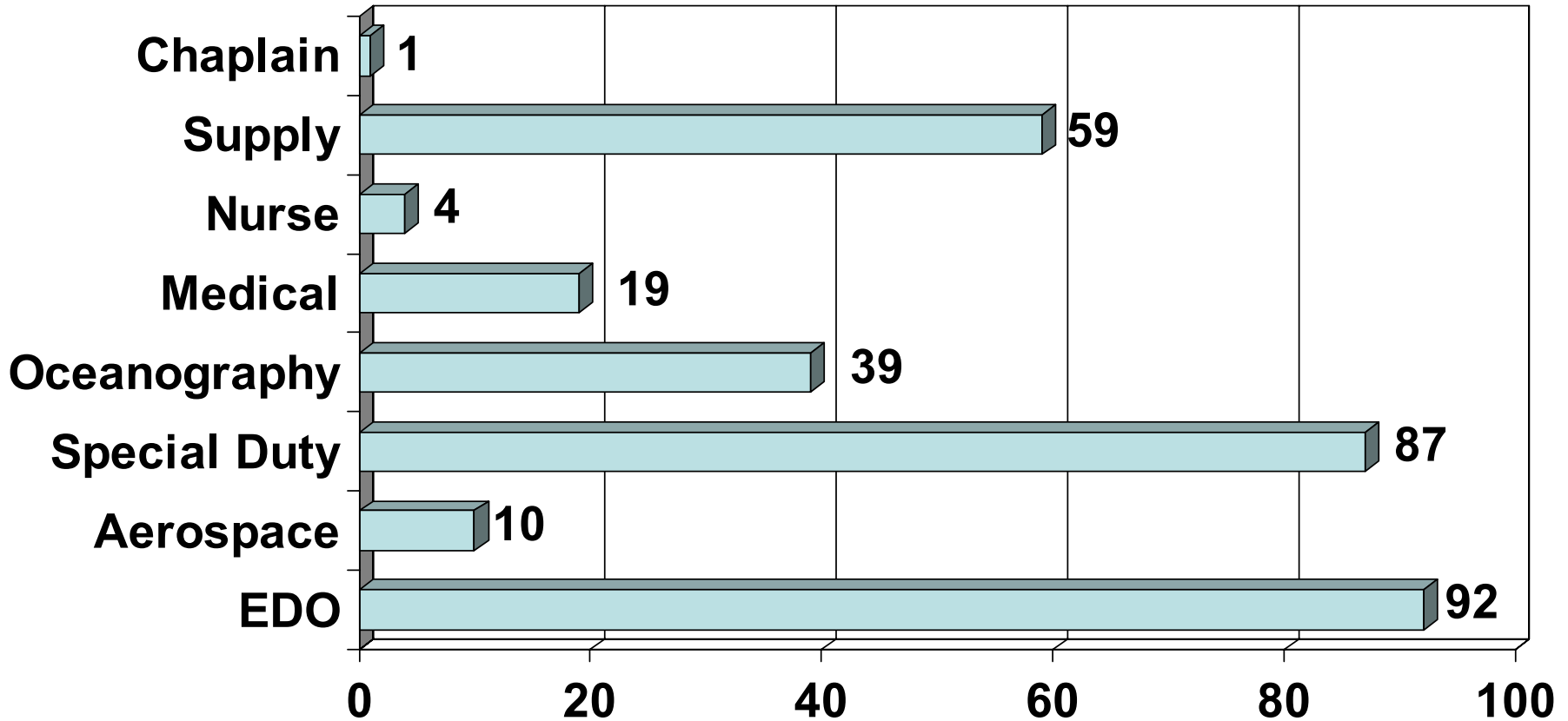Arrange for funds to support thesis work on these research topics.

Arrange for thesis Professors and thesis student participation on these research topics.

Navy Staff and RL Student Population

Bar chart showing Navy Staff and RL Student Population:
- Chaplain: 1
- Supply: 59
- Nurse: 4
- Medical: 19
- Oceanography: 39
- Special Duty: 87
- Aerospace: 10
- EDO: 92

X-axis: 0, 20, 40, 60, 80, 100

QTR 2 FY 05

NPS Distributed Learning – QTR 2 FY05

Whidbey Island, WA

Puget Sound, WA

Keyport, WA

Newport, RI

Groton, CT

Warren, MI

Ft. Monmouth, NJ

Rock Island, IL

Mechanicsburg, PA

NPS
Monterey, CA
Main Campus

Peterson AFB, CO

WrightPat AFB, OH

Washington, DC

Lemoore, CA

Crane, IN

Louisville, KY

Annapolis, MD
Pax River, MD
Aberdeen, MD
Indian Head, MD
Wash DC
 Wash Navy Yd
Crystal City

China Lake, CA

Norfolk, VA PME

-DL Degree &
 Non-Degree Progs

Camp Lejeune, NC

Port Hueneme, CA
Pt. Mugu, CA
Corona, CA
Ventura, CA
LA AFB, CA
Camp Pendleton, CA

Huntsville, AL

Virginia Beach, VA
Chesapeake, VA

San Diego, CA PME

-DL Degree &
 Non-degree Progs
-Regional Security

White Sands, NM

Ft. Worth, TX

Pascagoula, MS

Pensacola, FL

Jacksonville, FL

New Orleans, LA

Panama
City, FL

NPS Afloat Q2FY05

San Antonio, TX

Orlando, FL

**Fully Online Courses
Delivered Q2FY05**

Pearl Harbor, HI

USS Truman
USS John Stennis
USS J.F. Kennedy
USNS Bridge
USS G. Washington

★ NPS Main Campus

▲ PME Outreach Office

◉ VTE Location

▲ Proposed PME Outreach Office

✚ Homeland Security Location

•CC3000
•IS3502
•SS3011
•IO3100
•CS3006
•EC2450
•MA1113