The Research and Sponsored Programs Office’s mission is to support the faculty. While sponsored programs have previously focused on research, as can be seen by the statistics below, services and education have become a significant part of the overall sponsored activities at NPS.

The RSPO is evolving to meet the challenges and to assure adequate support as we work towards the growth in research anticipated in the NPS strategic plan.

During the last year, a position has been added to assist faculty with electronic submission of proposals for competitive programs. There are several on-line submission portals: NSF FastLane, Grants.Gov, NSPIRES, etc. While the overall concept for these portals is similar, each has its own particular requirements.

The RSPO is also expanding pre-award proposal services. Assistance in proposal formatting, budget development, compilation of proposal requirements will be made available. Competitive research opportunities are being circulated and we will continue to enhance this service.

As always, we appreciate your patience as we work towards the common goal of building the NPS research program and providing the support to sustain it. On a related note, attendance at the monthly brown bag seminars is growing. Suggestions for topics are welcome.

**NAVAL INTELLIGENCE ROTATIONAL ASSIGNMENT AS ADMIRAL B. R. INMAN INTELLIGENCE CHAIR**

The Admiral B. R. Inman Intelligence Chair (Inman chair), established by memorandum of agreement between Director of Naval Intelligence (OP-NAV N2) and President, NPS, in 1996, provides for the rotational assignment of a naval-intelligence professional to key duties at NPS.

The chair is considered an NPS faculty member dedicated to supporting and enabling effective intelligence community (IC) engagement in NPS research and education. The function of the chair is to develop topics for students and faculty research, innovation, and transformation in all disciplines. The chair will also be a focal point for outreach to the agencies and service entities of the national IC, promoting the extensive educational capabilities and resources of NPS.

Assignment of a naval IC professional offers a unique opportunity for dialogue and coordination with the national IC on educational programs and opportunities resident at NPS.

RADM Andrew Singer, USN (Ret.) will join NPS as chair incumbent. During his thirty-one years of service, he specialized in information warfare, cyber operations, intelligence, and maritime operations.
Graduate School of Engineering and Applied Sciences

Funds available to date: $35.6M

By Department

- Physics: 20% ($7.2M)
- Oceanography: 27% ($9.5M)
- Meteorology: 9% ($3.2M)
- Applied Math: 14% ($4.9M)
- Mechanical/Aerospace Engineering: 15% ($5.3M)
- Electrical/Computer Engineering: 1% ($449K)
- Systems: 2% ($793K)
- Physics: 3% ($798K)

Projects funded in January:

- Long-Term Evolution Mobile-Device Signal Analysis and Geolocation, John McEachen, ECE (NAWC-Weapons Division)
- Geolocation of Mobile WIMAX/4G Mobile Devices, John McEachen, ECE (NRO)
- N433 Threat Missile Simulator Validation Working Group, Philip Pace, ECE (NRO)
- Electric Component Failure to Prediction Tool Development, Todd Weatherford, ECE (ONR)
- Key Technologies for Large Segmented Mirror Space Telescopes, Brij Agrawal, MAE (SAF/FMBIB-AFOY)
- Application of Wavefront Sensing and Control to High-Energy Laser Control Test Bed, Brij Agrawal, MAE (HEL JTO)
- Accuracy Model Improvement, Morris Driels, MAE (USAF ASC)
- Physics-Based Modeling and Simulation System for Fleet/Force Sustainment, Joshua Gordis, MAE (ONR)
- Study of Composites Materials for Ship Applications, Young Kwon, MAE (NSWC-Carderock)
- Microstructure-Processing-Property Relationships in Friction Stir Processing of NiAl Bronze, Terry McNelley, MAE (ONR)
- TinyScope: Tiny Agile Spacecraft for Earth Imaging Applications from LEO, Marcello Romano, MAE (NRO)
- Minimum Fuel Relative Motion Trajectories near an Uncooperative Target, I.M. Ross, MAE (NRO)
- Payload-Derived Position-Acquisition for Parachute Recovery Systems, Oleg Yakimenko, MAE (Yuma Proving Ground)
- Probabilistic Parameter Estimation Framework with Spatial Analysis of Variance, Joshua Hacker, MR (ONR)
- Riverine Flow Modeling: Sensitivity of DELFT3D River Model to Bathymetric Variability, James MacMahan, OC (ONR)
- Ocean Model Numerical Guidance for ASW Decision Support, CDR Rebecca Stone, USN, OC (ONR)
- Vibration Measurements on Phalanx Block 1B CIWS during Live-Fire Testing, FY2010, Steven Baker, PH (NAVSEA)
- Dynamically Induced Super-Energetic Explosive Behavior on Shaped Charge Jetting, Ronald Brown, PH (ONR)
- Combat Systems Thesis and Curriculum Support, Andres Larraza, PH (NAVSEA)
- Numerical Modeling in Support of 3D Environmental Variability and Acoustic Vector Field Studies, Kevin Smith, PH (ONR)
- Share Transition Support and Repository Tool Design, Jean Johnson, SE (PEO IWS 7.0)
- Naval Chair of SE and SE Research, James Kays, SE (OASN)
- Phase III: Final Integration and Testing of a Flight Nano Satellite Solar Cell Array Tester, James Newman, SP (NRO)

Graduate School of Operational and Information Sciences

Funds available to date: $20.2M

By Department

- Computer Science: 39% ($2.9M)
- Operations Research: 31% ($2.5M)
- Defense Analysis: 11% ($925K)
- Information Sciences: 19% ($1.7M)

Projects funded in January:

- Risk Assessment in Software Project, Luqi, CS (NAWC)
- USMC F-35 Lightning Transition Planner, Robert Dell, OR (USMC-MARCORSYSCOM)
- Modeling the Impact of Events on the Simulated Helmand Province Population, Rachel Johnson, OR (TRAC-Monterey)
- Integration of Operational-Level Optimization Decision Aids in the Next Generation, Jeffrey Kline, OR (Johns Hopkins Univ.)
- Tailored Effects, Metrics, and Risk Management in Strategic Planning Workshop, Jeffrey Kline, OR (OPNAV)
- Cost-Analysis Support for CAPE, Gregory Mislick, OR (OSD)
- Seed Center Support, Cultural Geography and Operation Enduring Freedom Scenario, Paul Sanchez, OR (TRAC-Monterey)
Projects funded in January:

- Defense Coordinating Officer (DCO)/Defense Coordinating Element (DCE) Certification Exercise for the 196th Infantry Training Brigade, *Dan Boger*, NSI (196th Infantry Brigade)
- Study of Pakistan Army Operational Lessons Learned in Counter-IED and Counterinsurgency, *Alan Jaeger*, CAW (JIEDDO)
- Emerald Warrior 10-1, *Bob Bluth*, CIRPAS (USJFCOM)
- UAV Operations at Camp Roberts, *Bob Bluth*, CIRPAS (AFRL)
- Scan Eagle Operations at Camp Roberts, *Bob Bluth*, CIRPAS (NAVSPECWARGRU One)
- Disruptive Technology Exploration, *Sue Higgins*, Cebrowski
- On Integration of Cellular Technology with U.S. Military Communication Networks, *Frank Kragh*, Cebrowski (SPAWAR)
- Shipboard Electric System Modeling, *Giovanna Oriti*, Meyer (Northrop Grumman)
- SMART Scholarship Program Support, *Deborah Shifflett*, SMART (OSD)
The newest NPS organization, the Center for Infrastructure Defense (CID), will develop new models, and the algorithms to solve them, for (1) how regional and national infrastructure systems will respond in the face of major disruptions, whether deliberate (e.g., sabotage, vandalism, terrorism) or non-deliberate (accident, failure, natural disaster); and (2) how to invest limited defensive resources (for hardening, redundancy, or capacity expansion) to make these systems resilient to such disruptions.

The center will provide a venue for research and postdoctoral and doctoral studies, and create a new community of experts and scholars in this crucial area of national interest. The center is based in the Department of Operations Research (OR) and will, through a strong NPS affiliation with the National Security Institute (NSI), cooperate with and call upon principals from a number of NPS departments and other universities. The center has established the following relationships and is pursuing the following projects:

- Assistant Secretary of Defense, Homeland Defense, and America Security Affairs’ Office to apply CID models to Domestic Defense Critical Infrastructure Protection (DCIP).
- U.S. Department of Homeland Security, Homeland Infrastructure Threat and Risk Analysis Center (HITRAC) has advocated for the State of California to leverage the CID’s capability for assessing critical infrastructure vulnerability.
- U.S. Department of Homeland Security (DHS) Protective Security Advisors (PSA) to provide briefs to the PSA for the Los Angeles metropolitan area, as well as the PSA for Hawaii and the Pacific territories.
- U.S. Coast Guard Captain of the Port (COTP) for Honolulu and State Civil Defense in Hawaii are interested in applying the CID models specifically to systems for fuel and commodities.
- NPS is developing stronger relationships with the State of Hawaii through the University of Hawaii’s DHS Science and Technology Center of Excellence, the Pacific Disaster Center, the DoD Pacific Command, and several other local stakeholders. Working in collaboration with these agencies to address maritime-system vulnerabilities, using attacker–defender modeling and applying assessments to planning, has great potential to strengthen this relationship and demonstrate the value of this applied science.

**Center Members**

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<th>Director</th>
<th>Executive Director</th>
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<tr>
<td>David Alderson, Assistant Professor, OR</td>
<td>Gerald Brown, Distinguished Professor, OR</td>
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<td>Robert Dell, Professor, OR</td>
<td>Robert Harney, Associate Professor, SE</td>
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<tr>
<td>Javier Salmerón, Associate Professor, OR</td>
<td>Alan Washburn, Distinguished Professor Emeritus, OR</td>
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<tr>
<td>Matthew Carlyle, Associate Professor, OR</td>
<td>Jeffery Kline, Senior Lecturer, OR</td>
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<td>Kevin Wood, Distinguished Professor, OR</td>
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Not pictured: Wendy Walsh, NPS Homeland Defense and Security Coordinator

**NPS OR Department Exploits Unique Military-Modeling Capabilities**

The Department of Operations Research has exploited its unique military modeling capabilities to view the threats to our domestic critical infrastructure through the eyes of intelligent adversaries.

CID members have formed red teams to plan attacks on our own infrastructure, to reckon how to mount effective hardening and defensive efforts.

More than 125 such red-team exercises have been catalogued, addressing national infrastructure systems such as roads and bridges, electrical generation and distribution, water distribution, the national strategic petroleum reserve, gas and petroleum pipelines, the internet, bioterror attack, and social and financial networks.

Some systems have been shown to be robust, and others revealed as extremely fragile. These exercises have established and reinforced the following fundamental principles of infrastructure defense:

1. Secrecy cannot be assumed in planning critical national infrastructure defense. Our defensive preparations on a national scale involve huge sums of money, publicly invested and visibly deployed.
2. Intelligent adversaries will observe defensive preparations and plan accordingly.
3. Regardless of the replacement cost of damaged or destroyed components, critical infrastructure will eventually be rebuilt.
4. If we suffer an attack to an infrastructure system, we have “systems operators” who will discover how to best utilize surviving system functionality.
5. Thus the value of surviving infrastructure derives from its sustained function.
6. Deciding what is “critically important” to the system should be an output of analysis, not a required input.
7. Defending against worst-case attacks of an intelligent adversary also increases resilience to disruptions caused by large-scale accidents or Mother Nature.
The Commander, SPAWAR Pacific (formerly SPAWAR–San Diego), sponsors the SSC-Pacific Fellowship Program to provide partnerships with NPS that address SSC–Pacific research focus areas, lay groundwork for future technical and project management assignments, and foster long-term professional associations with SSC–Pacific technical personnel and management.

Three student-research proposals were accepted by SPAWAR in January, with fellowship appointments made to ENS William F. Jenkins II, USN, Capt Carrick T. Longley, USMC, and LT Brian E. Phillips, USN.

TIME/FREQUENCY RELATIONSHIPS OF AN FFT-BASED ACOUSTIC MODEM
Fellow: ENS William F. Jenkins II, USN
Advisor: Research Professor Joe Rice, Physics

The goal of this research is to implement MFSK modulation for underwater acoustic communications in an adaptive manner by exploiting basic time-frequency relationships. Signal parameters such as spectral bandwidth and symbol duration may be adjusted on a packet-by-packet basis such that transmitted acoustic signals are well matched to the physical through-water communications medium and its prevailing channel scattering function.

This research will be an analytical comparison of the advantages and disadvantages of using bandwidth scaling and bandwidth multiplexing at the high frequencies at which Seastar short-range underwater acoustic modems operate. As such, the scope of this research will be defined by any case studies that are modeled, and by any experimental data that are acquired either from the laboratory or from sea trials.

The immediate contribution of this research will be to determine a more efficient method of transmitting digital data at high frequencies through the short-range (50–500 m) underwater acoustic channel. Currently, NPS is in possession of two high frequency modems as part of the Seastar project. The results of this research will directly impact their operational roles in the development of the Seastar network, as well as the greater Seaweb network. Organizations that will benefit from this work include SPAWAR and NRL.

ENS Jenkins is an engineering-acoustics student in the undersea-warfare program, graduating in June 2010.

ENABLING FORCEnet WITH WIRELESS AD-HOC NETWORKS
Fellow: LT Brian E. Phillips, USN
Advisor: Professor Murali Tummala, Electrical and Computer Engineering

This research will implement MFSK modulation for underwater acoustic communications in an adaptive manner by exploiting basic time-frequency relationships.

The objective is to investigate challenges that exist in channel allocation and selection schemes currently used by the military and intelligence professionals in deployed mobile, ad-hoc networks. The challenges associated with channel allocation in mobile, ad-hoc networks cause both delay in the network and loss of data throughput. The desired output of the research will be improved algorithms and/or schemes to increase throughput in wireless, ad-hoc networks that are validated and tested. Strategies will be explored from several domains to include challenges at both the physical layer and data link layers of the OSI model. The first task to be investigated is to explore what are the physical layer challenges that cause the loss of data throughput due to channel degradation (i.e. antenna patterns and characteristics at various frequencies, orientation, selective channel fading, Doppler effects, and multi-path) and correction schemes will be explored. Second the data link layer challenges that cause the loss of data throughput due to channel degradation will be explored and correction schemes will be explored.

LT Phillips is working towards an MS in electronic-systems engineering and will graduate in June, 2011.

HUMAN-TERRAIN-ANALYSIS COLLECTION SYSTEM
Fellow: Capt Carrick T. Longley, USMC
Advisor: Research Associate Jim Ehler, Information Sciences

The objective of this thesis is to develop a software application for an iPhone or iPod touch by integrating commercially available software and hardware technologies to enhance the collection of information that can be used to accurately represent the human terrain -the social, ethnographic, cultural, economic, and political elements of the people among whom a force is operating—in a geographic area. Utilizing location-aware mobile devices with the power of social networking, this thesis focuses on the aggregation of georeferenced data to build a more robust common operational picture and map the human terrain. Furthermore, the data obtained from the HTACS devices can be used to generate customized reports based on quantifiable, field-collected attributes. In conjunction with researchers in the CORE Lab, the HTACS system looks to provide the front-end collection capability for link and social network analysis. Commercial, off-the-shelf (COTS) and government, off-the-shelf (GOTS) technologies and software solutions will also be researched to ensure a more robust, well rounded, technical solution is developed. This thesis aims to provide a technical solution to one of the problems faced by military personnel in the field today—how to collect data in order to quantifiably depict human activities, interactions, and behaviors.

Capt Carrick is pursing an MS in information-warfare systems engineering and will graduate in September, 2010.

SPAWAR Fellowship Application and Details

The next deadline for submissions is 31 July 2010. Information on submissions can be found at http://intranet.nps.edu/ResAdmin/studentresearch.html.

The fellowship awards up to $10,000 per project to support the student’s research. Two trips to SPAWAR are required, but the balance of the fellowship funds can be used for equipment or additional travel. Since the program’s inception in 1994, each SPAWAR commander has continued the tradition. To date, over one hundred and thirty fellowships have been awarded to NPS students.
COOPERATIVE RESEARCH AND DEVELOPMENT AGREEMENTS (CRADAS)

Partner: Pacific Interface, Inc.
NPS POC: Jeff Weekley, MOVES Institute

Summary: NPS will borrow various network systems to test and evaluate connectivity to CalREN networks for multiplex and multi-path streaming of ultra-high audio visual content.

MEMORANDA OF UNDERSTANDING/AGREEMENT (MOUs/MOAs)

Office of Naval Research Chair of Innovation at the Naval Postgraduate School

Renewal of this MOU continues the sponsorship of the Office of Naval Research (ONR) Chair of Innovation at the NPS. The topic of innovation continues to be most salient for the US Navy. It is in an era increasingly dominated by “unknown unknowns.” The Navy’s ability to transform incumbent organizations will be increasingly perceived as being driven by its ability to innovate, and innovation must increasingly be viewed as a key dimension of competition, both in the business world and in military affairs.

ONR has funded an innovation initiative for three years. This effort involved designing a new innovation executive program as well as establishing a repository of best practices at NPS. Continuing this innovation initiative aligns with NPS’ desire to provide a world-class leadership development platform for the defense community, a community that looks for new methodologies and concepts to turn “getting” innovation to “getting it done.” The goals partnership seeks to educate a critical mass of naval (and other) leaders to effect a state change in the effectiveness and strategic value of their innovation efforts, and to sustain an innovation initiative located at NPS that will aggregate resources and best practices so that it becomes a hub for innovation “know-how” and “know-

what.” The current chair incumbent is Neal Thornberry.

National Reconnaissance Office Chair Professorship at NPS

The MOA among the National Reconnaissance Office (NRO), Aerospace Corporation (Aerospace), and NPS was renewed to continue sponsorship of a chair professorship to expose students to expertise not readily available on campus.

For several years, the NRO has sponsored research at NPS. Additionally, Aerospace, in its role as a federally-funded research and development center (FFRDC), has long provided in-depth technical support to the NRO. Sponsorship of this chair aligns with NRO’s goals to work closely with mission partners, including the military, and foster innovative research in academia and industry. The chair incumbent is a former NASA astronaut, Dan Bursch of Aerospace.

Chair of C4I at NPS

An MOA formalized the relationship between the Program Executive Officer, Command Control, Communications, Computers and Intelligence (PEO C4I) and NPS to establish the Chair of C4I at the NPS. This chair will facilitate NPS involvement with PEO C4I Program Office science and technology (S&T) acquisition needs.

The first incumbent is Assistant Professor Rachel Goshorn of the Department of Systems Engineering.

PATENT APPLICATIONS

Triple Junction Solar Cell, Navy case #2009001
Inventor: CDR Michael H. Tsutagawa, USN, Physics

Inductive Pulse-Forming Network for High-Current, High-Power Applications, Navy case #795865D1
Inventor: Senior Lecturer Bill Maier, Physics

TECHNICAL REPORTS PUBLISHED

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<td>The Logistics Support Resources Strategy Map: A Design and Assessment Tool</td>
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