

**SPONSORED-PROGRAM EXPENDITURE TRENDS SINCE 2004 (IN MILLIONS)**

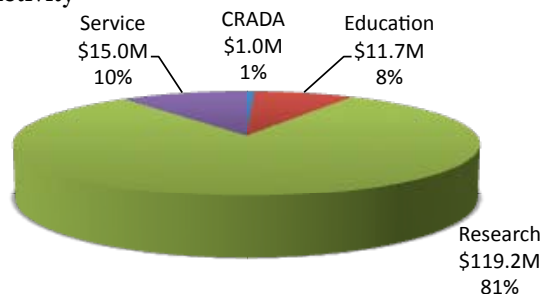
Preliminary analysis of FY11 data indicates \$185M in sponsored funding executed. While this is a slight decrease in execution from FY10, the decrease is primarily attributed to a reduction in spending in a single program. Overall the trend indicates that NPS is “holding its own.” Data is currently available for each department/school/institute and will be forwarded to the chairs/deans next week.

**BROWN-BAG SEMINAR SERIES**  
WA-302, 1200-1300

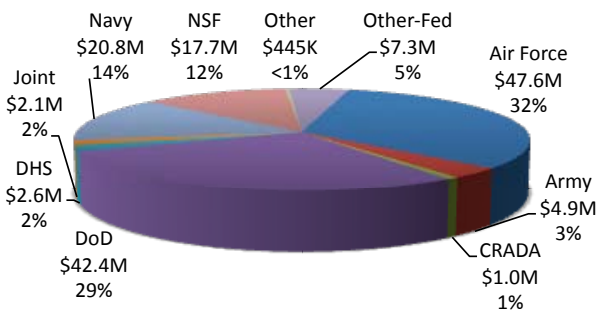
- Tuesday, 17 January, National Research Council Program
- Tuesday, 14 February, Responsible Conduct of Research
- Tuesday, 13 March, Intergovernmental Personnel Act Agreements

**SPONSORED PROGRAMS STATUS, DECEMBER 2011**  
FUNDS AVAILABLE: \$146.9M

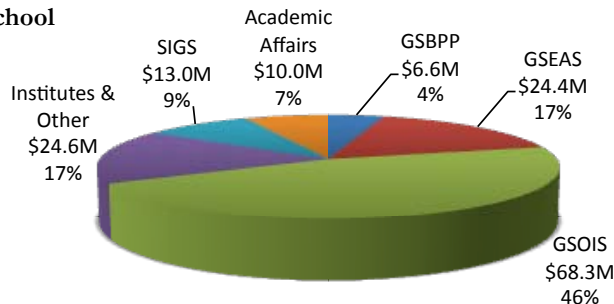
**By Type of Activity**



**By Sponsor**



**By School**



**RESEARCH UPDATES**

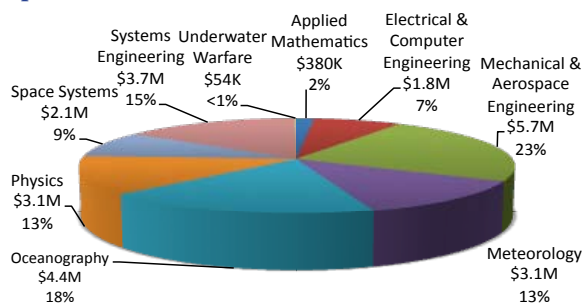
- **Interim Dean: Professor Douglas Fouts** has agreed to serve as interim Vice President and Dean of Research. **Professor Phil Durkee**, Dean of the Graduate School of Engineering and Applied Sciences, is heading the search committee for Dean van Bibber’s replacement.
- **Report on Defense Priorities:** *Sustaining U.S. Global Leadership: Priorities for 21st Century Defense* was released in January 2012 by the White House and Secretary of Defense. Discussed are primary missions of the armed services and a leaner, technologically advanced military. See [www.nps.edu/research/ResearchBoard/Reports/Defense\\_Strategic\\_Guidance.pdf](http://www.nps.edu/research/ResearchBoard/Reports/Defense_Strategic_Guidance.pdf).
- **Navy Patent Portfolio:** The Institute of Electrical and Electronics Engineers (IEEE), the world’s largest technical professional organization, publishes an annual study/analysis of the strength of patent portfolios in a variety of economic sectors. The 2011 IEEE Spectrum Patent Power Scorecard report ranked DoN as first in governmental agencies worldwide for the second year in a row. See page 10 of the scorecards at <http://spectrum.ieee.org/ns/pdfs/2011.PatentFinal.pdf>. This accomplishment is a tribute to the efforts of the DoN technical community and the OGC IP attorneys who support them. The Naval Postgraduate School received four patents in FY11 and filed eighteen.



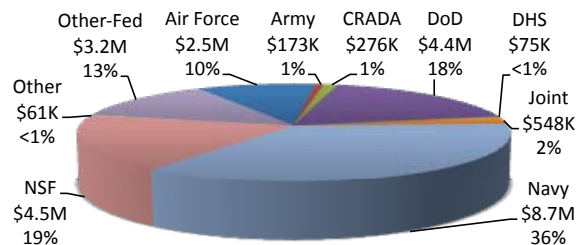
## Graduate School of Engineering and Applied Sciences

Funds available to date: \$24.4M

### By Department



### By Sponsor



### Projects funded in December

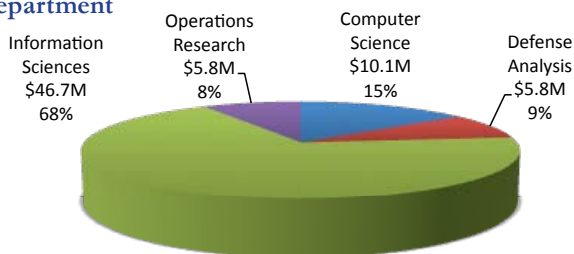
- NCWDG Liaison/Support Project, *Clark Robertson, EC* (Navy Cyber Warfare Development Group)
- Adaptive Optics Center of Excellence for National Security, *Brij Agrawal, MAE* (ONR)
- Coupling of Waves, Turbulence and Thermodynamics Across the MIZ, *Tim Stanton, OC* (ONR)
- First-Principles Simulation of Aluminum–Water Reaction Rates

- in Reactive Shaped-Charge Jets, *Joseph Hooper, PH* (ONR)
- MEMS Bimaterial Focal-Plane Array for Real-Time THz Imaging, *Gamani Karunasiri, PH* (ONR)
- Technology Joint Center of Excellence (JCOE), *Chris Olsen, PH* (NSWC–Crane Division)
- Naval Chair of Systems Engineering and Systems Engineering Research Program, *Dan Burns, SE* (Strategic Systems Program)

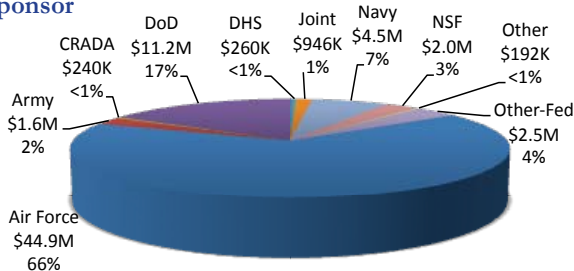
## Graduate School of Operational and Information Sciences

Funds available to date: \$68.3M

### By Department



### By Sponsor



### Projects funded in December

- Language Evidence for Social Goals: A Linguistic Approach to Persuasion Moves in Discourse, *Craig Martell, CS* (University of Maryland)
- ISO/IST Certificate Program, *Steve Iatrou, IS* (Various)
- Purple Rain, *Bill Roeting, IS* (USAF Advanced Capabilities Office)
- CPAT Technical Verification, *Lee Ewing, OR* (PEO Ground

- Combat Systems)
- Support for Agile Decision Making in Complex and Dynamic Environments, *Eva Regnier, OR* (ONR)
- Modeling and Simulation Support for Reset and Lifecycle Management, *Paul Sanchez, OR* (USMC - Headquarters)

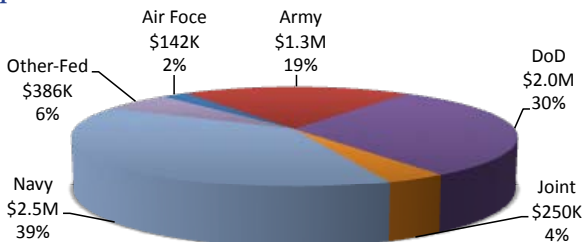
## Graduate School of Business and Public Policy

Funds available to date: \$6.6M

### Projects funded in December

- Advanced Acquisition Program Phase 1–3, *John Dillard* (CECOM)
- Army Cost-Management Certificate Program, *Terry Rea* (OASA (FM&C))
- Acquisition and Research Program Chair, *Keith Snider* (PEO IWS)
- AR&R–Budget Interrelationship, *Keith Snider* (Office of Acquisition Resources and Analysis)
- PEO IWS 7 Analyzing Performance Metrics, *Keith Snider* (PEO Integrated Warfare Systems 7.0)

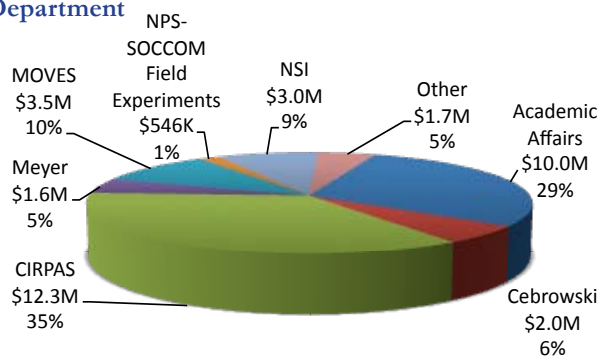
### By Sponsor



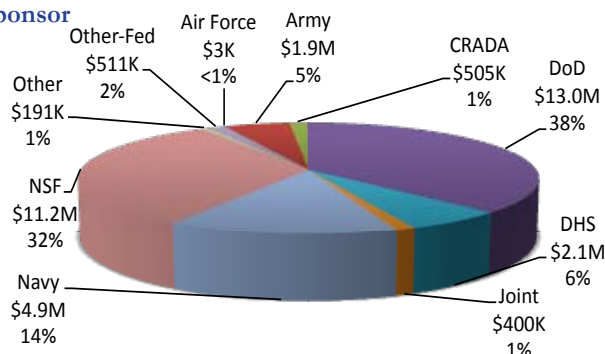
## Research and Education Institutes, Centers, and Other

Funds available to date: \$24.6M

### By Department



### By Sponsor



### Projects funded in December

- Nathan Leites and China Sourcebook and Some Application, *Mie Augier, GPPAG* (OSD)
- Strategic Culture Presentation to Inter-American Defense College Class 51, *Alan Howard, USPTC* (Inter-American Defense Board)
- Undersea Warfare Research Support, *Jerry Ellis, Meyer* (CNO)
- CombatXXI Behavior Development & Technical Support, *Imre Balogh, MOVES* (TRAC - Monterey)
- Open-DIS Support for High-Performance Simulation Testing, *Don Brutzman, MOVES* (NAWC-China Lake)

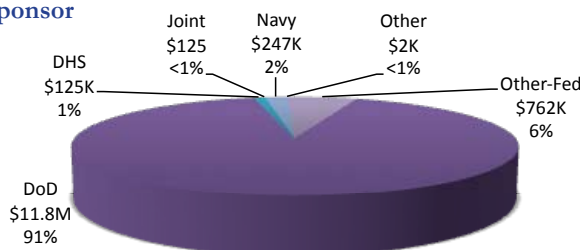
## School of International Graduate Studies

Funds available to date: \$13M

### Projects funded in December

- Public Perspectives on Security and Defense in Latin America, *Harold Trinkunas, NS* (US Southern Command)

### By Sponsor



## ENERGY SEED PROPOSAL COMPETITION

As reported in the December edition of *Research News*, the Research Board has endorsed a proposal to use a portion of the Dean of Research initiative funding to hold a competition for a limited number of awards for “seed funding” or “feasibility studies” in the area of energy. The purpose of the awards will be to develop, or further advance, new concepts to a level of maturity such that they could be submitted as highly-competitive proposals to sponsors for external funding. There were sixteen submissions from across campus, of which seven were selected this year. The following proposals received FY12 funding:

- Bimaterial MEMS Solar Generators, **Assistant Professor Dragoslav Grbovic**, Physics
- Novel Metal-Oxide Aerogel/Graphitic Hybrids for Supercapacitive Energy Storage, **Associate Professor Claudia Luhrs**, Mechanical and Aerospace Engineering
- Enhancing the Performance of Proven Battery Chemistries with Semi-Solid Flow Cells for Mission-Critical Naval Applications, **Assistant Professor Sebastian Osswald**, Physics and Mechanical and Aerospace Engineering
- Optimization of Vertical-Axis, Wind-Turbine Arrays,

**Professor Garth Hobson**, Mechanical and Aerospace Engineering

- Multi-Material Dielectrics: Super High Dielectric Constant Materials, **Research Professor Jonathan Phillips**, Physics
- Optimal Design of Piezoelectric Materials for Maximal Energy Harvest, **Associate Professor Hong Zhou**, Applied Mathematics
- Flexible, Low-Cost Solar Cells for Expeditionary Energy: New Tools for Optimizing Performance, **Distinguished Professor Nancy Haegel**, Physics, and **Professor Sherif Michael**, Electrical and Computer Engineering

The seeding of proposal development for these energy topics will yield successful sponsored activities in the future. The “investment” funds available to the Dean of Research have enhanced several successful reimbursable programs, such as the Acquisition Research Program, Materials Research initiatives, and field experimentation. Investment funds available to the Dean of Research also enable expanded capabilities for sponsored research. The new capability of the WaveGlider USV (see p. 10) was assisted through the Research Recap Program.

## CRUSER: “FROM TECHNICAL TO ETHICAL... FROM CONCEPT GENERATION TO EXPERIMENTATION”

At the direction of the Secretary of the Navy, the Consortium for Robotics and Unmanned Systems Education and Research (CRUSER) was inaugurated at the Naval Postgraduate School in March 2011.

CRUSER is a forum that incorporates all aspects of unmanned systems including ethical, cultural, and social issues; manpower and human–systems integration; acquisition costs; employment concepts; experimentation; education; and an extensive variety of technical areas.

The five member CRUSER coordination team is led by Director **Jeff Kline**, Director of Research and Education **Timothy Chung**, and Director of Innovation and Concept Development **Carol O’Neal**. The CRUSER administrative team consists of **Lisa Trawick**, operations manager, and **Lyla Englehorn**, technical editor.

CRUSER provides:

- a source for unmanned systems employment concepts for operations and technical research
- an experimentation program to evaluate unmanned system employment concepts
- a venue for Navy education in unmanned systems
- a DoD forum for collaborative education, research, and experimentation in unmanned systems



*The Singapore Straits, an important maritime focus*

As a community of interest (CoI), CRUSER welcomes participation from a variety of people working in unmanned systems. The community currently has over 425 members with a wide range of interests and involvement. CoI member benefits include:

- e-newsletters with articles on unmanned systems by academic and industrial researchers and military organizations, provides a venue for sharing new research and products and discussions of semantics and ethics.
- information exchange across operational, academic, and engineering disciplines
- invitations to symposia of interest
- participation in unmanned systems experimentation
- aid in development of concept generation

In September 2011, CRUSER held a warfare-innovation workshop that united fifteen engineers from naval labs and industry with twenty NPS faculty and students on four teams. These teams developed over forty concepts for unmanned-systems research. Their after-action report is available at: <https://wiki.nps.edu/display/CRUSER/CRUSER+Publications>

The workshop produced concepts in the following five broad mission areas, which will be the focus of the May 2012 CRUSER Technical Continuum: counter-UAV, ISR, information assurance, knowledge and management, and non-kinetic strike. All unmanned-systems specialists are invited to submit related abstracts for presentation at the continuum. Abstracts are due by 31 Jan 2012.

Fiscal Year 2012 was the first opportunity for CRUSER seed funding to unmanned systems research. Of the many quality unmanned systems research projects at NPS, we provide several examples to demonstrate the breadth topic areas.

Described below are a CRUSER-sponsored experiment, and the six research proposals that received seed funding this year.



*Joe Rice*

**Lead Researcher: Research Professor Joe Rice, Department of Physics**

**Title: Maritime In Situ Sensing Inter-Operable Networks (MISSION) Project**

Persistent maritime surveillance is a challenging problem that requires the deployment of autonomous underwater sensor networks. The MISSION project will develop and test national through-water

acoustic communications and networking capability with emphasis on operations in noisy environments and cross-nation interoperability. MISSION is a bilateral research development test and evaluation (RDT&E) project that involves collaboration by NPS and National

University of Singapore in advancing state-of-the-art, through-water acoustic communications and networking technology. Project goals include:

- Study noisy underwater environments.
- Achieve acoustic communications through adverse channels.
- Integrate U.S. Seaweb and Singapore UNet networks.
- Demonstrate in situ environmental and surveillance sensor networks in Singapore Strait.
- Enable distributed wireless architectures for maritime-domain awareness (MDA) and undersea warfare (USW)

Researchers will study noisy and variable acoustic communication channels, perform collaborative studies, and conduct long-duration in situ measurements. This project also explores channel-tolerant and -adaptive acoustic communications and enables controlled signaling experiments (i.e., utilizing Signalex scientific method with parametric analysis of signals and careful measurement of envi-

ronmental factors) in acoustically challenging and operationally relevant maritime environments (e.g., Port of Singapore, Strait of Singapore, Strait of Malacca).



Timothy Chung

**Lead Researcher: Assistant Professor Timothy H Chung, Department of Systems Engineering**

**Title: Aerial Battle Bots: A Testbed for Swarm vs. Swarm Concepts and Tactics Generation**

Recent reports in the public domain identify the potential use of “saturation attacks,” where dozens of unmanned aerial vehicles (UAVs) execute precision strikes nearly simultaneously, as a serious threat to the Navy’s superiority in the maritime domain. This and other swarm threats, such as coordinated small-boat attacks, represent a growing

concern for our military forces. A future concept lies in not only countering these types of threats but using defensive swarms to do so. In the context of this emerging many vs. many scenario, a large-scale, operationally realistic testbed offering field experimentation capabilities does not yet exist anywhere in the world. This research seeks to develop a unique “swarm vs. swarm” testbed to experimentally provide tactics and concepts generation for future capabilities relying on innovative swarm technologies to defend against imminent saturation attacks. A key thrust of this work involves the establishment of a large-scale robotics competition dubbed Aerial Battle Bots, which is designed to foster and inspire high caliber research and education opportunities leveraging the swarm vs. swarm testbed. Opportunities include advances in areas such as complex system of systems analysis, networking, multi-agent and cooperative control, CONOPS development, autonomy science, systems engineering, and modeling and simulation, among many other cross-cutting avenues. This research actively combines mathematical and operational analysis of swarm vs. swarm scenarios with a unique and perennial field experimentation program involving 50 vs. 50 aerial robots battling over the skies.

**Lead Researchers: Professor Roberto Cristi, Department of Electrical and Computer Engineering and Professor Oleg Yakimenko, Department of Systems Engineering**

**Title: Passive UxV Navigation Using Visual Sensors**

This project concentrates on incorporating passive (EO/IR) sensors into integrated inertial system to allow unmanned vehicles to “see”



Roberto Cristi

obstacles/targets and estimate their relative positions for further collision free/intercept guidance. The single most important near-term technical challenge of developing an autonomous capability for any UxV is to assess and respond appropriately to near-field



Oleg Yakimenko

logic for estimating relative dynamics of the detected objects and computing collision free or intercept maneuvers. The framework proposed to be developed will be applicable to a variety of unmanned platforms and missions such as recovery of an unmanned surface vehicle onto the moving ship, autoland onto a ship’s deck, multiple unmanned vehicles rendezvous planning, and intercept planning.

objects in unmanned systems path of travel. For an unmanned aerial vehicle, that near field could extend to many nautical miles all around it, whereas for an unmanned ground vehicle or unmanned maritime vehicle, near field could mean the next few yards directly in front of it. However, significant technical challenges remain in developing real-time assessment tools and



George Lucas

**Lead Researchers: Adjunct Professor George Lucas, Graduate School of Business and Public Policy and Research Associate and Research Associate Mark Dankel, National Security Institute**

**Title: Programming the Laws of Armed Conflict (LOAC) for Unmanned Systems**

Developing an accurate and reliable system of target discrimination is

...continued on page 6

## 2012 CRUSER TECHNICAL CONTINUUM

The CRUSER Technical Continuum will be held 7–10 May 2012 in Monterey, CA. as part of the annual Mine Warfare Symposium. Attendees of this symposium are also invited to attend the “Robots in the Roses Research Fair” scheduled on 10 May at NPS. This one-day event is designed for researchers, naval warfare centers, and industry to showcase their research projects to NPS students, faculty, and other symposium attendees. Additional information about the CRUSER Technical Continuum can be found on the website: <http://www.nps.edu/research/cruser/TechnicalContinuum.html>.

Selected technologies from the CRUSER Technical Continuum will be targeted for field experimentation in 2013.

In addition to these events, ONR and OPNAV N2/N6 will sponsor an upcoming CRUSER education symposium titled “Robo-Ethics: Rhetoric vs. Reality” in the Pentagon Conference Center on 25–26 January 2012. Four independent two-hour panels will discuss various aspects of the legal, cultural and ethical issues related to unmanned system employment in warfare to a DoD audience.

For additional information about CRUSER or to join the community of interest, please visit the CRUSER website at <http://CRUSER.nps.edu>.

CRUSER, *continued from page 5*



Mark Dankel

one of two principal obstacles to arming unmanned, autonomous systems (the other is developing a highly reliable system of character recognition). Our present inability to achieve, or even fully conceptualize how to operationalize this goal, however, constitutes the chief obstacle to the development of autonomous systems armed with lethal force, and constitutes a potentially grave source of product liability to military and defense contractors otherwise engaged in the development and deployment of unmanned systems. This project aims to reify the problem of “programming the laws of war” by (1) identifying and isolating the broad concepts in international law that incorporate the relevant ethical principles constraining combat operations (e.g., proportionality; discrimination or “distinction;” and “last resort”); (2) examining how these broad (and vague) principles are successfully translated into operational and actionable form in “rules of engagement” for human combatants in specific zones of conflict; and (3) examining the degree to which a coherent body of well-formulated ROEs for human combatants can be formalized as programmable algorithms and translated into operational language governing the behavior of unmanned systems.



Peter Chu

**Lead Researcher: Distinguished Professor Peter Chu, Department of Oceanography**  
**Title: Joint Optimization of**

**Sensing and Sampling with Unmanned Undersea Vehicles**

Surveillance systems, in general, are deployed to provide information about the presence of intruders (targets such as mines, submarines, etc.) within a fixed region of interest. Historically, this surveillance has been performed with large scanning sensors. To ensure accurate detection of targets by these sensors, the ocean environment (such as the sound speed profiles) needs to be measured. Usually, sampling of the environment is conducted by another independent system such as in situ measurements or unmanned undersea vehicle (UUV) measurements. Thus, development of a combined system of sensing and sampling provides a potentially cost-effective, enhanced UUV capability, which will contribute to establishing the LCS as a mission-focused UxS platform in concert with mission module development plans.



Dan Nussbaum

**Lead Researcher: Visiting Professor Dan Nussbaum, Department of Operations Research**

**Title: Road map for Reduction of Total Ownership Cost (TOC) to Support Acquisition Decisions of Unmanned Autonomous Vehicle**

This focus of this research is to reduce total ownership costs (TOC) of autonomous platforms through the intelligent design and use of advanced automation. While TOC for DoN platforms and systems includes costs of R&D, acquisition, and Operations and Support (O&S), we will focus on the use of design tools that concentrate on reducing costs which consist mainly of spare parts, maintenance and fuel. This focus aligns well with the objective of the Department of Defense and the US Navy, in particular, to provide a significant increase in the affordability of current and future naval systems by reducing costs while maintaining or improving system performance and platform availability to execute assigned missions. (DoD FY2009-2034 Unmanned Systems Integrated Roadmap, March 2009) To implement our objective, we will identify the main cost drivers of O&S for DoN platforms and systems, and

then analyze cost reduction opportunities, within the manufacturing, manpower, and material arenas.



Patrick Harr

**Lead Researcher: Associate Professor Patrick A Harr, Department of Meteorology**  
**Title: Tropical Cyclone Reconnaissance with Global Hawk: Operational Requirements, Benefits, and Feasibility**

In this proposed project, the use of the Global Hawk aircraft for tropical cyclone reconnaissance over the region of the western North Pacific is investigated. The Joint Typhoon Warning Center (JTWC) and the 17th Operational Weather Squadron (17th OWS), both based at Pearl Harbor HI, have operational responsibilities to provide the most efficient and comprehensive protection of Department of Defense assets from tropical cyclones throughout the western North Pacific. Recent science results have highlighted the utility of enhanced observations in the region of tropical cyclones for producing improved initial conditions that lead to increased accuracy of numerical forecasts of tropical cyclone characteristics. These numerical forecasts serve as the primary guidance for operational forecasts over the western North Pacific. Therefore, the Global Hawk provides a unique capability that could potentially improve performance with respect to significant operational requirements. The proposal outlines a plan that engages the operational weather commands, operational reconnaissance commands, science laboratories, and relevant civilian institutions to define the operational benefits, science background, operational feasibility, and the most appropriate instrumentation that would provide for improved tropical cyclone reconnaissance over the western North Pacific. The project design depends significantly on graduate student research to analyze various requirements and constraints, and coordinate interdisciplinary and interagency commands. The proposed project is designed to engage students from several curricula.

**Lead Researchers: Research Assistant Professor Doug Horner and Visiting Professor Noel Du Toit, Department**



Doug Horner

**of Mechanical and Aerospace Engineering**

**Title: Extended Autonomy Capability for the ScanEagle UAV**

A new research program is being developed at NPS Center for Autonomous Vehicle Research (CAVR), aimed at a multi-vehicle, multi-tier system for autonomous, persistent, wide-area surveillance support for tactical forces engaged in maritime visit, board, search, and seizure (VBSS) and close-quarters combat (CQC) for military operations in urban terrain (MOUT).

This project is a step towards this objective and is focused on extending the autonomy capability of the ScanEagle UAV platform. The platform is extensively used in theater, having logged 500,000 combat flight hours. CAVR maintains and operates seven of these vehicles, which are often employed during USSOCOM-



Noel Du Toit

NPS TNT experimentation. However, the utility of this platform for autonomy research is limited due to semi-autonomous operation: a dedicated human pilot operates the vehicle remotely, with the option of a few basic autonomous behaviors (such as loitering). For the multi-tier ISR system objective, the ScanEagle platform is ideal for the mid-altitude asset, but this requires a higher level of autonomy (e.g., for

dynamic persistent surveillance).

This project will integrate a new autopilot into the ScanEagle platform and define a programming interface (API), which enables rapid extension of the platform's autonomy capability. Real-time trajectory generation and execution will be implemented as an initial extension of the autonomy capability of the platform.

**BASE-IT EXCELS IN FINAL ORLANDO DEMO**

In December 2011, the BASE-IT (Behavioral Analysis and Synthesis for Intelligent Training) project team presented their final Year 4 review for the Office of Naval Research and two transition customers, USMC's Training and Education Command and Program Manager for Training Systems. The project was led by NPS MOVES Institute, joining research teams from SRI International Sarnoff and the University of North Carolina, Chapel Hill.

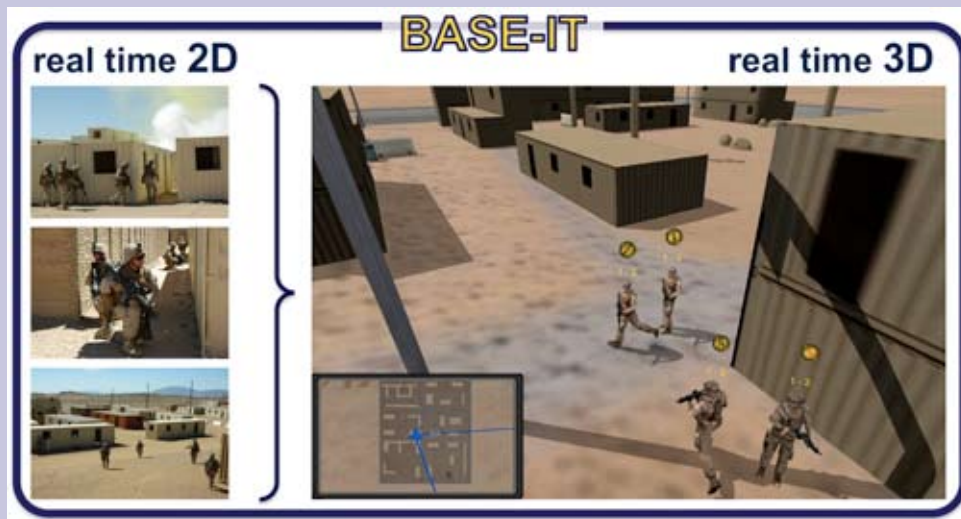
The team visited several USMC training ranges for urban warfare, designed and developed a set of novel concepts that brought sensor technologies to the ranges, and created radically new capabilities for the training force. The idea was to manage a set of sensors (fixed and point-tilt-zoom cameras, GPS, and inertial measurement units) to track every participant in a training exercise and collect data sets necessary for the analysis of unit performance. Automated analysis (sense-making) included a recognition of operations executed on the range and quantization of selected individual and team performance traits. This automated sensing and sense-making represented the most comprehensive approach in encoding and analyzing an analog event from a physical world—unit operations on training ranges—and bringing that event into a digital domain. The capabilities of contemporary training-management systems reserved for computer-supported training simulations have now been fully extended to training on physical ranges.

Upon completion of training, instructors gain quantitative understanding about the events, including the answers to 'who did what, how well, and how often'. With the BASE-

IT system, no performance is unregistered, even if events are not seen by instructors. As an example of BASE-IT system functionality, the system is able to provide information about teams that were bunching up (inadequate dispersion on terrain), Marines being too close to a door or window, or the instances of incorrect procedure when crossing the danger zones. The entire training can be played back using a typical 3D-visualization system, and searched for points in time where certain events happened (e.g., all places where weapon flagging/muzzling happened). The hours of watching multiple DVDs with the footage recorded on the range—a luxury no busy unit can afford—can now be replaced with a fraction of that time using BASE-IT visualization system. A number of active-duty Marines and NPS students also took part in several user studies designed and executed by the NPS team.

During the I/ITSEC conference in December 2009, the BASE-IT team was hosted in the USMC/PM TRASYS booth,

*...continued on page 12*



**APPLIED MATHEMATICS**

**C.O. Aguilar, A.J. Krener**, "Power Series Solutions to the Time-varying Dynamic Programming Equations," *Proceedings of the 50th IEEE Conference on Decision and Control*, 2011, pp. 397–402.

**COMPUTER SCIENCE**

**Arijit Das, Tony Kendall, Greg Belli, Erik Lowney, Riqui Schwamm**, "Hardware and Software Tools for the Oracle Fusion Middleware Architect," to be presented at North California Oracle User's Group (NOCOUG), Feb 23, 2012.

**Arijit Das, Greg Belli**, "Collaboration Using Oracle Beehive/WebCenter (hands-on lab), to be presented at Independent Oracle User's Group (IOUG), Las Vegas, April 22-26.

**Arijit Das, Tony Kendall**, "Building a Small KM Collaboration Portal," paper to be presented at Independent Oracle User's Group (IOUG), Las Vegas, April 22-26.

**CENTER FOR DECISION, RISK, CONTROLS AND SIGNALS INTELLIGENCE (DRCSI)**

**Kumarasamy Sakthivel** and **Pani Fernando** are teaming with Meng Xu of Rockefeller University to organize a multi-part mini symposium entitled "Advances in Theoretical and Computational aspects of Stochastic Analysis" in the forthcoming SIAM (Society of Industrial and Applied Mathematics) regional meeting in Huntsville, Alabama, March 24-25th of 2012.

**S. S. Sritharan** will present the keynote speech in the forthcoming American Mathematical Society Sectional Meeting, Stochastic Analysis, Tampa Florida, March 10–11, 2012. The title is "Stochastic Navier-Stokes Semimartingale: Control Theory and Large Deviations."

National Research Council Fellow **Kumarasamy Sakthivel** has been selected by the Indian Government to receive the Fellowship

INSPIRE (Innovation in Science Pursuit for Inspired Research), which will provide salary and research support to teach and research at any institution in India. The fellowship starts upon completion of Sakthivel's NRC fellowship at NPS. Sakthivel has published seventeen journal papers and is coordinator for the NPS-DRCSI Young Scholars Network and seminar series.

**ELECTRICAL AND COMPUTER ENGINEERING**

**Preetha Thulasiraman** will give a seminar, "Multiobjective Optimization for Resource Allocation in Wireless Multihop Mobile Networks" as part of the NPS-DRCSI Young Scholars Network. Naval Postgraduate School, January 27th, 2012, 11–11:50 AM.

**Visiting Research Professor Grace Clark** taught an invited two-day short course on signal processing in acoustics at the 162nd meeting of the Acoustical Society of America, San Diego, CA October 31–November 4, 2011. Clark also co-chaired the Signal Processing in Acoustics, Underwater Acoustics, and Biomedical Acoustics special session, "Fusion of Acoustic Signals with Data from Various Sensor Modalities."

**GRADUATE SCHOOL OF BUSINESS AND PUBLIC POLICY**

**John Khawam**, presentation, "New Product Introduction, Modularity, and Sustainability" at the 2011 Annual INFORMS Conference in Charlotte, NC, November 14, 2011.

**John Khawam**, "Warranty Inventory Optimization for Hitachi Inc." Presidio School of Management, San Francisco, October 2011

**Uday Apte, John Khawam, Murat Mise**. Model-Based Optimization for Pilot Training. Western Decision Sciences Institute, Forty-First Annual Meeting, April 3–6, 2012.

**METEOROLOGY**

**Chang, C.-P.** and M.-M. LU, 2012: "Intraseasonal Predictability of Siberian High and East Asian Winter Monsoon and its Inter-Decadal Variability." *J. Climate*, 24

Use of the A-10 Thunderbolt for atmospheric research is featured in an article at the American Meteorological Society blog, posted December 8, 2011. <http://blog.ametsoc.org/uncategorized/plane-has-combative-attitude-toward-storms/>.

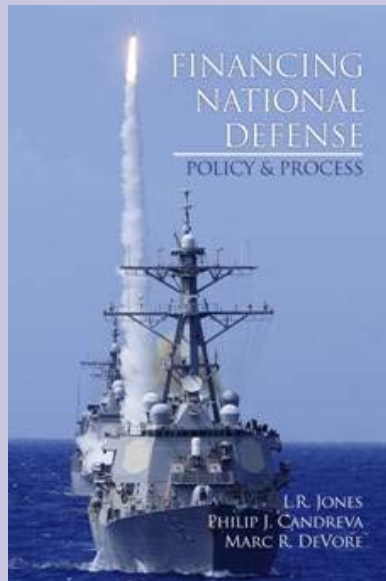
**MOVES**

**Perry McDowell, R. Eric Johnson, Jared Freeman**,

**BOOK PUBLISHED ON DEFENSE FINANCE**

**Distinguished Professor Larry Jones** and **Senior Lecturer Phil Candreva** of the Graduate School of Business and Public Policy collaborated with Professor Marc DeVore of the European University Institute (EUI) to author a new book.

*Financing National Defense: Policy & Process* is printed by Information Age Publishing and covers the processes, actors, politics, and policy dimensions of budgeting for national defense. Providing a historical and theoretical foundation, coupled with practical approaches, the text will be used in public budgeting courses in the MBA and EMBA programs at NPS beginning in 2012.



Cover, Financing National Defense



Larry Jones



Phil Candreva

Matthew Roberts, Zachary Horn (2011). *Building a Game to Educate Senior Officers in Counterpiracy*, I/ITSEC 2011, Orlando, FL

P. Gustavson, H. Rutherford, R. Daehler-Wilking, **C. Blais** (2011). "M&S Asset Discovery: Services, Tools and Metadata," I/ITSEC 2011, Orlando, FL

The MOVES Institute and NPS fielded two booths at the Interservice/Industry Training, Simulation, and Education Conference (I/ITSEC), the largest conference dedicated to domain of modeling and simulations

Amela Sadagic (2011). "Deconstructing Game-Based Systems: What are They? What Really Matters?" (tutorial), I/ITSEC, Orlando, FL

### NATIONAL SECURITY AFFAIRS

Malcolm Chalmers, Camille Grand, Teng Jianqun, Rajesh Basrur, **Feroz Khan**, "Small Nuclear Forces: Five Perspectives," *Royal United Services Institute*, 2011.

**Zachary Shore**, "Yoda in the Pentagon," *Armed Forces Journal*, December 2011.

**Zachary Shore** was appointed to a committee of the American Historical Association for selecting the year's best book in European international history and made a presentation to Stanford University's Center for Advanced Study in the Behavioral Sciences on international history.

**Ear, Sophal**. "Towards Effective Emerging Infectious Disease Surveillance: Cambodia, Indonesia, NAMRU-2." Monterey, CA: Center on Contemporary Conflict, 2011



John Colosi

### OCEANOGRAPHY

**Professor John Colosi** has been named the 2012 recipient of the Acoustical Society of America's Medwin Prize in Acoustical Oceanography, to be received at the Fall 2012 ASA meeting. The prize is named after NPS's Hank Medwin and recognizes the effective use of sound in the discovery and understanding of physical and biological parameters and processes in the sea.

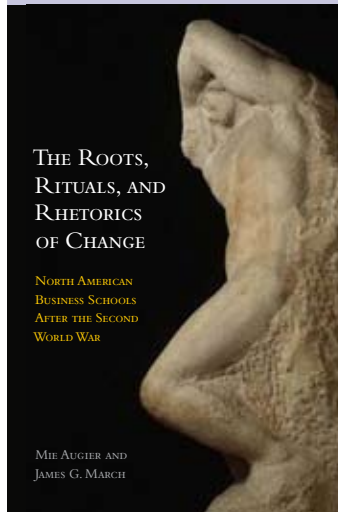
### OPERATIONS RESEARCH

**Paul Sanchez, K. Preston White, Jr.**, "Interval Estimation Using Replication/Deletion and MSER Truncation," Winter Simulation Conference, Phoenix, Arizona, December 11-14.

### PHYSICS

**Kruse, F.A.**, 2012, "Mapping Surface Mineralogy Using Imaging Spectrometry," *Geomorphology*, v. 137, p. 41-56.

### NEW BOOK: BUSINESS SCHOOL CHANGES EXAMINED



Book Cover

Remarkable changes took place in North American business schools between 1945 and 1970, during which business schools became more academic, analytic, and quantitative.

**Research Associate Professor Mie Augier** and Professor James March of Stanford University consider these changes in *The Roots, Rituals, and Rhetorics of Change* (Stanford University Press, 2011). The book ponders questions such as whether business schools should concern themselves

primarily with experiential or academic knowledge, what vision of managers and management should be reflected by business schools, and how managerial education connects its teaching to some version of reality. Among the laudatory reviews:

- "Augier and March offer a nuanced and mind-opening history of American business schools..." (Philip E. Tetlock, University of Pennsylvania).
- "Mie Augier and Jim March have written... a history of the radical changes in major business schools that is as exciting as a detective novel! A must read for anyone interested in the evolution of knowledge and ideas in the United States" (Richard Swedberg, Cornell University).
- "This is a great story that has never been told with such clarity, empirical support, and conceptual breadth." (David F. Labaree, Stanford University).
- "This book has a distinct sensibility and depth that will make it important. The authors' nuance of ideas and range of perspective is excellent." (Anne Miner, University of Wisconsin).

Please submit your faculty and research news  
(published articles, conference proceedings, conference presentations,  
books, honors received, accomplishments, milestones, etc.)  
to [research@nps.edu](mailto:research@nps.edu).

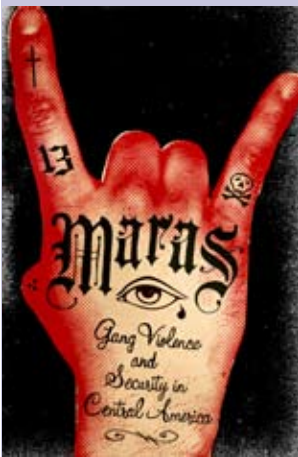
## CENTRAL-AMERICAN GANGS STUDIED IN NEW BOOK



*Distinguished Professor Bruneau*

**Distinguished Professor Thomas Bruneau**, National Security Affairs, is a coeditor with Lucia Dammert and Elizabeth Skinner of a compilation of essays entitled *Maras: Gang Violence and Security in Central America* (Austin: University of Texas Press, 2011). The book discusses the phenomenon of Central American street gangs, and mainly the “maras.” The “Mara salvatrucha” and “M-18” are the most vicious and serious gangs in El Salvador, Guatemala, and Honduras. The maras were founded in Los Angeles, California, but have spread and established themselves in the economically underdeveloped and politically fragile states of Central America. They account for much of the record-high homicide rates in at least El Salvador and Honduras and seriously challenge the democratic stability of countries in the region.

The maras have spread to several regions of the U.S. including California, Texas, and Northern Virginia. This is the first book in English on this phenomenon.



*Cover, Maras*

The chapter authors, mainly from Central America, are recognized experts on the maras in one or more countries in Central America. This book provides a basis for an objective and non-sensational understanding of the maras and security in Central America.

## BMD COURSE ON TAP

**Senior Lecturer Jeffrey Kline**, NWDC Chair of Warfare Innovation, has invited the Missile Defense Agency to NPS to conduct a three-day course ballistic-missile defense (BMD) on 27-29 March. Classification is secret.

BMD history; legal, treaty, and policy considerations; fundamentals; threats; current sensors and active defenses; communications; command and control; readiness; planning factors; and BMD future forces will be covered, as well as the importance of BMD in the joint fight and how BMD contribute to military objectives.

The course contains six modules and a lab and is designed for general staff officers and those seeking a broad foundation in BMD to complement their specialties.

Class size is limited to twenty, with priority to students and faculty conducting research in BMD. Contact Melissa Otte, mbotte@nps.edu or phone 656-7946 for details.

## PHYSICS CELEBRATES NEW CAPABILITIES



*USW Chair Professor Ellis introduces new resources for NPS research*

The Department of Physics and the Undersea Warfare Research Center announce three exciting new experimental resources: a WaveGlider USV, provided by Office of Naval Intelligence; a WaveGlider USV, procured with cost-sharing by Liquid Robotics, Inc.; and the NPS Seaweb Lab.

Seaweb research at NPS is concerned with developing through-water acoustic communications, primarily for underwater sensor networks. Other USW applications include submarine communications at speed and depth, deployable underwater ranges, and remote control of underwater instruments. Seaweb research at NPS includes Project MISSION (maritime, in-situ sensing, interoperable networks, a U.S.–Singaporean project); Project NGAS (next-generation autonomous systems, a NATO ASW project); and the Deep Seaweb JCTD proposal.

The weak link in the Seaweb system has been the radio-communications gateway node. In the Seaweb network, this node is the interface between the underwater, acoustic domain and the terrestrial, SATCOM domain. The WaveGliders will fill the need for a deployable, long-endurance, station-keeping gateway node.

A WaveGlider is a two-body craft consisting of a surfboard-like surface unit tethered to an submerged unit twenty-five feet underwater. This coupled system harnesses vertical wave motion and transmits it as forward propulsion. The surface unit contains the electronics, sensors, and rudder and is solar powered. This ingenious watercraft offers true “persistence,” the ability to stay afield and operate for indefinite periods without the need for fueling or other intervention. The WaveGlider is unperturbed by weather, waves, obstacles, or biological or mechanical fouling and can travel at about two knots.

With USW Research Center’s endorsement to develop this capability, NPS provided \$70k in lab recap funding to purchase a new WaveGlider, with the manufacturer, Liquid Robotics, sponsoring the balance. David Jackson of ONI contributed a second glider. The NPS WaveGliders are identified as “SHARCs,” an acronym for “Sensor-Hosting, Autonomous, Remote Craft,” and have been christened “Mako” and “Tiburón.”

These tools, with the addition of the Seaweb lab in Spanagel Hall, will greatly enlarge the scope of research efforts and attract avid students to the program. In his remarks at the January 11th ribbon-cutting, **USW Research Center Chair Professor Jerry Ellis** noted that NPS will be able to do valuable research that will significantly impact the Navy overall, but particularly in warfighting. “Officers working in this area and then returning to the fleet with their new knowledge will help accomplish the Navy’s objectives for unmanned systems, especially in helping integrate unmanned systems into the culture of the Department of the Navy.” Contact: **Research Professor Joe Rice** (Physics), jarice@nps.edu. Information on Wavegliders: <http://liquidr.com/technology/wave-glider-concept/>

**SCENARIOS FOR RUSSIAN AGRICULTURAL DEVELOPMENT TO 2021****Joshua Hensley—Lieutenant Commander, USN****Master of Arts in Security Studies—December 2011****Advisor: Mikhail Tsyarkin, Department of National Security Affairs****Second Reader: Robert Looney, Department of National Security Affairs**

Russia's agricultural sector has experienced profound and fundamental change over the past two decades in response to the dissolution of institutions built under the Soviet regime. The relative chaos of the 1990s gave way to increased state intervention under presidents Vladimir Putin and Dmitri Medvedev, contributing to a broad agricultural recovery. The present study examines the possible course of agricultural development by presenting three scenarios of the challenges and opportunities the sector may face within alternative development contexts. *LCDR Hensley won the Louis D. Liskin Award for Excellence in Regional Security Studies.*

**BEST-VALUE ANALYSIS OF MOVEMENT STRATEGIES FOR CARRIER AIR WING FIVE (CVW-5) FROM IWAKUNI TO YOKOSUKA, JAPAN****Shawn A. Coleman—Lieutenant Commander, USN****Gentry D. Debord—Lieutenant Commander, USN****Justin A. Hodge—Captain, USAF****Master of Business Administration—December 2011****Lead Advisor: Keebom Kang, Graduate School of Business and Public Policy****Support Advisor: E. Cory Yoder, Graduate School of Business and Public Policy**

In 2005, a U.S.–Japanese Security Consultative Committee agreed to shift the Carrier Air Wing Five (CVW-5) homeport from Atsugi Naval Air Station (NAS) to Marine Corps Air Station Iwakuni (MCASI) in 2016. Current emergency deployment plans exist for loading CVW-5 from Atsugi NAS to Commander, Fleet Activities Yokosuka (CFAY), 35 miles away. The CVW-5 load from MCASI to CFAY requires new standard and emergency deployment plans to account for the increased distance. This study examines transportation options to move 1,500 personnel and 300 short tons of equipment over 537 miles to meet deployment timelines. The most stringent case involves emergency carrier deployments where the CVW-5 has 96 hours to move personnel, parts, and material necessary to the host aircraft carrier in Yokosuka, Japan. This study analyzed alternative means of movement for best-value solutions. Primary and secondary transportation costs, risks due to weather and natural disasters, and time required for each method were analyzed. Thirty-seven possible courses of action (COA) for standard carrier movements were developed and nine found viable under the time constraints of emergency deployment. A recommended COA is presented. *Capt. Hodge won the Naval Postgraduate School Superior Service Award.*

**NUMERICAL MODELING OF ION DYNAMICS IN A CARBON-NANOTUBE, FIELD-IONIZED ION THRUSTER****Sarah F. Michael—Lieutenant Commander, USN****Master of Science in Astronautical Engineering—December 2011****Advisors: Dragoslav Grbovic, Department of Physics****Marcello Romano, Department of Mechanical and Aerospace Engineering****Second Reader: Oscar Biblarz, Department of Mechanical and Aerospace Engineering**

Carbon-nanotube field-ionization technology has the potential to make ion propulsion feasible for use in micro- and nano-satellites. To understand the phenomenon and optimize the ion thruster design, an accurate model of the system is useful. Numerical modeling of large-scale electron bombardment ion engines is a relatively mature field, but modeling of field-ionized ion engines is in its infancy. A simpler code may be appropriate for the early modeling stages of carbon nanotube field ionization technology; one such software package is spiffe. Spiffe is intended for modeling axisymmetric radio frequency guns, but it contains all the code necessary for basic modeling of ion optics in a field-ionized ion thruster.

This work analyzes the feasibility of spiffe for modeling field-ionized ion thrusters and provides detailed procedures for use. Spiffe is first verified to agree with theoretical predictions of limits in a one-dimensional approximation using electrons. Two primary geometries and their boundary conditions are investigated. The geometry is then varied to test the limits of the one-dimensional approximation and further altered to simulate singly-charged argon ions and verified against theoretical one-dimensional limits.

A user's guide was developed to aid students with minimal programming experience to quickly become familiar with the methods used in spiffe and the effect of program options. A guide to quickly post-processing the data was also developed. *LCDR Michael won the Monterey Council Navy League Award for Highest Academic Achievement.*

**OPTIMIZING THE GROUND MOBILE RADIO BASIS OF ISSUE PLAN FOR THE U.S. ARMY HEAVY BRIGADE COMBAT TEAM****David A. Jimenez—Major, USA****Nicholas E. Prisco—Major, USA****Jason B. Wamsley—Major, USA****Master of Business Administration—December 2011****Lead Advisor: John Khawam, Graduate School of Business and Public Policy****Support Advisor: Susan Heath, Graduate School of Business and Public Policy**

The ground mobile radio (GMR) is a communications system that enhances data throughput and communications in the armed forces. The GMR uses the wideband-networking waveform (WNW) and the soldier-radio waveform (SRW) to increase throughput while emulating up to four current force radios. This study investigates the appropriate basis-of-issue plan (BOIP) for fielding the GMR to a heavy brigade combat team (HBCT). Optimization modeling is used to generate the appropriate BOIP, based on an objective function to minimize radio costs, decision variables to assign radio types and quantities to each platform, and constraints in platform requirement and radio capabilities. We create multiple variations of the optimization model to determine the optimal BOIP for different levels of requirements and then make recommendations regarding the best radio mix for an HBCT under each set of requirements. We find that the majority of the four channel simultaneity requirements for the GMR are not required in an HBCT and that only three of fourteen were used in the optimal solutions. Our analysis also indicates that adding a new simultaneity that had not previously been considered offers a potential cost savings for each HBCT. *MAJ Jimenez was awarded the Association of the United States Army, General Joseph W. Stillwell Chapter, award for Most Outstanding Army Student.*

**MEMORANDA OF UNDERSTANDING/  
AGREEMENT (MOU/MOA)**

**Title: Support for the Chair of Acquisition Research Program at NPS, PEO Littoral Combat Ships**

**Partner: Program Executive Office of Littoral Combat Ships**  
**NPS Contact: Associate Professor Keith Snider, Graduate School of Business and Public Policy**

Summary: This agreement establishes a relationship for the sponsorship of the Chair of Acquisition at the Naval Postgraduate School in the Graduate School of Business and Public Policy and provide support for a program in acquisition research. RADM James Green, USN (ret.) is the current Acquisition Research Chair Professor.

**Title: Joint Staff Relationship with the Chair of Technical Operations at the Naval Postgraduate School**

**Partner: Joint Staff Deputy Directorate for Global Operations**  
**NPS Contact: Associate Professor Raymond Buettner, Department of Information Sciences**

Summary The agreement establishes a liaison relationship between The Joint Staff, Deputy Directorate for Global Operations (DDGO) and the Naval Postgraduate School (NPS) to enhance the educational experience of NPS students, enabling force development of mid-grade officers and to make the resources of the Naval Postgraduate School available, as appropriate, to The Joint Staff to assist in developing solutions to operational and strategic challenges associated with our national defense.

**Title: Special Operations Technology Support**

**Partner: Chief of Staff, Office of the Under Secretary of Defense for Policy and Principal Deputy, Deputy Assistant Secretary of Defense, Rapid Fielding**  
**NPS Contact: Director Nancy Ann Budden, Department of Defense Analysis**

Summary: The purpose of the agreement is to promote and support the development, demonstration, and rapid transition of special operations and counter terrorism technologies in response to critical Department of Defense (DoD) policy directives and warfighter requirements. Nancy Ann Budden is detailed as the director,

Defense Counterterrorism Technology Office if the Secretary of Defense.

**COOPERATIVE RESEARCH AND DEVELOPMENT AGREEMENTS (CRADAS)**

**Title: Network Reconfigurability: Design, Sensing, Containment, and Recovery to Weapons of Mass Destruction Attack**  
**Partner: University of Texas at Austin**

**NPS Contact: Assistant Professor Ned Dimitrov, Department of Operations Research**

Summary: Collaborators will develop tools, theory, and methodology for a new dynamic, modular, and reconfigurable network theory, geared to enable resilience, resistance, and recovery of our network infrastructure to Weapons of Mass Destruction (WMD) attack.

**Title: Mitigating Radio Communications Interference for First Responders Broadband Global Area Network Users in an Ancillary Satellite Component**

**Partner: Inmarsat, Inc.**  
**NPS Contact: Lecturer Brian Steckler, Department of Information Sciences**

Summary: Collaborators will evaluate standard tactics, techniques and procedures regarding the use of satellite communication by local, state and federal agencies with emergency management and disaster response roles in order to develop strategies to mitigate potentially harmful radio communications interference for 4G terrestrial systems.

**LIMITED-PURPOSE COOPERATIVE RESEARCH AND DEVELOPMENT AGREEMENTS (LPCRADAS)**

**Title: Equipment Loan in Support of NPS Field Research**  
**Partner: Coraid, Inc.**

**NPS Contact: Lecturer Albert Barreto, Department of Information Sciences**

Summary: Equipment will be used for the sole purpose of establishing a proof-of-concept model for integrating a virtualized data center into an existing hastily-formed network architecture.

**TECHNICAL REPORT PUBLISHED**

NPS- CS-11-011	The New NPS LaTeX Report and Thesis Format	S. Garfinkel, T. Axtell
NPS- NSI-11-001	Maritime Defense and Security Research Program Final Report, 2004-2011	J. Kline, L. Englehorn
NPS- MV-11-001	Analysis of System Training Impact for Major Defense Acquisition Programs	R. Wisher, F. Hartman, C. Sanders, A. Ciavarelli

*Technical reports may be obtained at <http://www.nps.edu/Research/TechReports.html>*

**BASE-IT, continued from page 7**

where they presented a virtual sand table and other project modules for visitors, including Gen. James N. Mattis, USMC. Some of the team’s forty research papers were nominated for best paper category.

BASE-IT concepts are highly applicable to other training situations, operational environments, and DoD and civilian domains (e.g., airport security). A PI for the combined project

team was NPS faculty member and MOVES professor **Amela Sadagic**. Other NPS faculty were **Chris Darken, Neil Rowe, Mathias Kolsch** (Computer Science and MOVES), Juan Wachs (now Purdue U.), **Deborah Goshorn** (Electrical and Computer Engineering), and the Delta3D team. An ONR grant to the three partner institutions was executed in amount of \$6.5M. See [www.movesinstitute.org/base-it](http://www.movesinstitute.org/base-it).