2010-08-01

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Monterey, California, Research and Sponsored Programs, Office of the Vice
President and Dean of Research, Naval Postgraduate School (U.S.)

http://hdl.handle.net/10945/15493

RESEARCH
NAVAL POSTGRADUATE SCHOOL

RESEARCH AT NPS

Sponsored programs continue to grow. Although the fiscal year is not over yet, receipts to date exceed $270M, an increase of twenty percent over FY09. DoD remains the top sponsor dollar-wise, with a good deal of its funding supporting a single program: the SMART Scholarship for Service Program, of which NPS is executive agent. The primary sponsoring service continues to be DoN, with the Office of Naval Research, SPAWAR, NAVSEA, and the USMC leading the way. Final figures for FY10 will be presented in October in the NPS Sponsored Program Annual Report.

As we continue to grow our sponsored programs, compliance requirements become increasingly important. Many of you have asked why "accountability training" is required each year. The completion of accountability training and the attestation process are two corner-stones of NPS accountability compliance. These two processes assure that principal investigators/program managers receive information on their responsibilities (accountability training) and have the opportunity to review their expenditures to assure all transactions are appropriate to their accounts (attestation).

The accountability modules for FY11 will be online in mid-September; an announcement will be sent to all faculty when the site is available. The modules should not be completed until the announcement for FY11 is received.
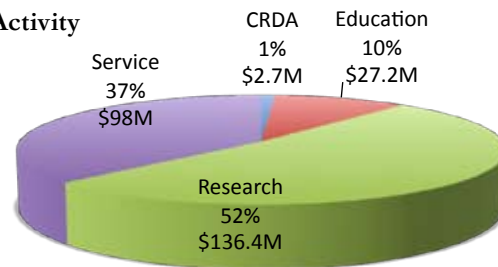
RESEARCH UPDATE

- **Export Control** A comprehensive export-control program, consisting of NPS export-control instruction, a website, an online course, and information pamphlets, is in final draft. These will be ready for comments by NPS personnel on a Sharepoint site in late September. The anticipated rollout date is ~ 1 October with briefings to various NPS management beginning ~ 1 September.

- **Use of Human Subjects** CAPT John Schmidt, USN, an Assistant Professor in Operations Research, is assuming the Institutional Review Board chairmanship. Maiah Jaskoski will continue as vice-chair. Senior Lecturer Larry Shattuck will continue to serve on the IRB. Larry is commended for his outstanding work as chair during the interim period.

- **Event Support Contract** An IDIQ Contract has been awarded to RHP Enterprises LLC to provide event support at NPS's Monterey campus, as well as at satellite offices in the National Capital Region and San Diego and locations worldwide. Event support includes:
  - ✓ Planning and Management (assistance from inception [pre-event] through delivery [post-event]).
  - ✓ Logistics (location, transportation, technology, meals, breaks, receptions, shipping, security)
  - ✓ Services (promotion, websites, materials, registration support, proceedings).
  - ✓ Participant Support (invitations, travel, clearances).
  Additional information will be provided on the range of services provided and how to obtain support.

SPONSORED PROGRAMS STATUS, AUGUST 2010

FUNDS AVAILABLE: $264.4M

By Type of Activity

- CRDA 1% $2.7M
- Education 10% $27.2M
- Service 37% $98M
- Research 52% $136.4M

By Sponsor

- Other-Fed 4% $10.6M
- Other 1% $1.2M
- NSF 4% $11.6M
- Air Force 4% $9.4M
- Army 3% $9M
- CRADA 1% $2.6M
- Navy 26% $68.9M
- DoD 43% $114.3M
- Joint 5% $12.6M
- DHS 9% $24.3M

By School

- GSBPP 5% $13.5M
- SIGS 12% $33M
- Institutes 16% $41.4M
- GSEAS 24% $62.2M
- GSOIS 14% $37.9M
- Other 29% $76.4M
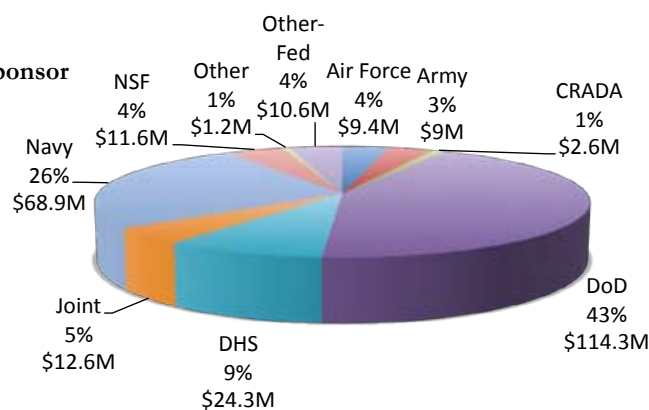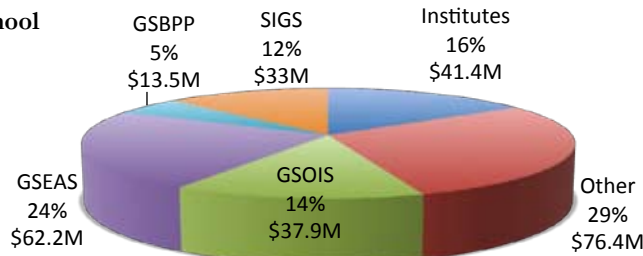
Graduate School of Engineering and Applied Sciences

Funds available to date: $62.2M

By Department

Physics 20% $12.7M
Systems Engineering 13% $7.8M
Space Systems 4% $2.3M
GSEAS Dean 1% $791K
Electrical/ Computer Engineering 13% $8M
Applied Math 1% $831K
Mech/ Aerospace Engineering 16% $9.7M
Oceanography 23% $14.6M
Meteorology 9% $5.4M

By Sponsor

Other 1% $720K
Other-Fed 8% $4.8M
Air Force 7% $4.4M
Army 2% $1.6M
DoD 11% $6.9M
CRADA 2% $1.2M
DHS <1% $62K
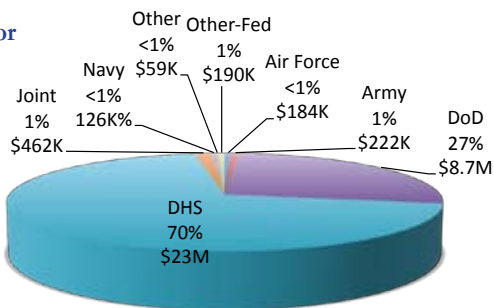Joint 3% $1.8M
NSF 12% $7.2M
Navy 54% $33.5M
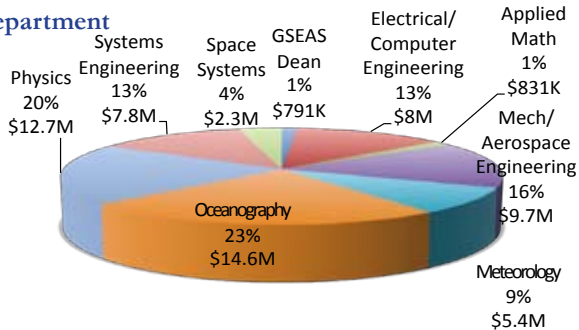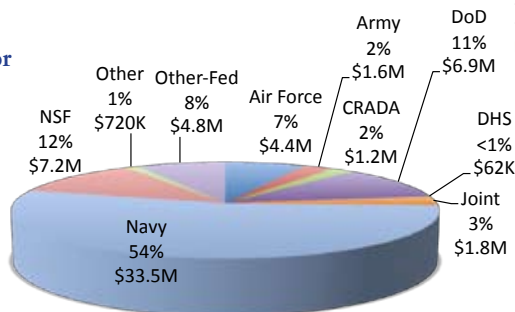
Projects funded in June/July/August:

- Electromagnetic Aircraft Launch Systems Electronics Performance Evaluation, *Robert Ashton, ECE* (NSWC-Carderock)
- Nonlinear Model of a 12-Phase Transformer and 24-Pulse Diode Rectifier, *Alexander Julian, ECE* (DRS Technologies)
- Cueing Receiver for Faster EA-Response Management, *Philip Pace, ECE* (ONR)
- Efficient High-Order Time-Integrators for Local High-Order Discretization Methods, *Frank Giraldo, MA* (AFOSR)
- Optimal Motion Planning in Obstacle-Rich Environment, *Wei Kang, MA* (National University of Singapore)
- Numerical Solution of First Order Partial Differential Equations of Nonlinear Control, *Arthur Krener, MA* (AFOSR)
- Directed Energy Summer Internship Program, *Brij Agrawal, MAE* (HEL Joint Tech Office)
- Steady and Unsteady Flow Experiments on Rotors, *Muguru Chandrasekhara, MAE* (USA Aeroflight Dynamics Directorate)
- Modal Parameter Estimation from FSST Data, *Joshua Gordis, MAE* (NSWC-Carderock Division)
- Design Study of Autonomous Combat Systems, *Douglas Horner, MAE* (OSD)
- Panel Line Module Structural Optimization, *Young Kwon, MAE* (Northrop Grumman Shipbuilding, Inc.)
- Evaluation of NIAl Propeller Bronze Friction-Stir Processing, *Terry McNelley, MAE* (NSWC-Carderock Division)
- Advanced Marine Gas Turbine Technology Programs, *Knox Millsaps, MAE* (NSWC-Carderock Division)
- Pseudospectral Feedback Control for Space Applications, *Isaac Ross, MAE* (AFOSR)

- CMG Experiment and Mission Support, *Isaac Ross, MAE* (SAF)
- Passive Imaging System to Measure Atmospheric Scatter and CFLOS, *Paul Frederickson, MR* (HEL Joint Tech Office)
- Long-Range Forecasting Support, *Tom Murphree, MR* (AFWA)
- Lightning Launch Commit Criteria Climatology (LLCCC), *Tom Murphree, MR* (45th USAF Weather Squadron)
- High Fidelity Active Sonar Simulation for Improved Synthetic Training, *Benjamin Jones, OC* (ONR)
- Bering Sea Studies and Data Collection, *Jeffrey Paduan, OC* (University of Alaska-Fairbanks)
- Observation of Upper Ocean Temperature, Salinity and pH Structure in the Central Arctic, *Timothy Stanton, OC* (ONR)
- Special Capabilities Support to USD (I), *Richard Olsen, PH* (OSD)
- Special Program Support, *Richard Olsen, PH* (OSD)
- Technical Support to the SCO, *Richard Olsen, PH* (OSD)
- Overcoming Architecture and Operational Problems with UAVs, *Gary Langford, SE* (National University of Singapore)
- Software Cost-Estimation Metrics, *Ray Madachy, SE* (AFCAA)
- Mobile CubeSat Command and Control, *Jim Newman, SP* (NRO)
- Cyber Effects Short Course, *Vicente Garcia, Electrical and Computer Engineering* (NIOC-MD)
- ECE Distance Learning Program, *Ralph Robertson, Electrical and Computer Engineering* (Various)
- Inertial Reference Unit, *Brij Agrawal, Mechanical and Aerospace Engineering* (AFRL)
- Missile Guidance and Control Short Course, *Christopher Brophy, Mechanical and Aerospace Engineering* (NAWC-Weapons Division)
- Spacecraft Experiments, *Isaac Ross, Mechanical and Aerospace Engineering* (SAF/FMIB)

School of International Graduate Studies

Funds available to date: $33M

By Sponsor

Other <1% $59K
Other-Fed 1% $190K
Navy <1% 126K
Air Force <1% $184K
Army 1% $222K
DoD 27% $8.7M
Joint 1% $462K
DHS 70% $23M

Projects funded in June/July/August:

- Enabling a Center on Contemporary Conflict-Advanced Systems and Concepts Office Partnership, *Anne Clunan, NSA* (DTRA)
- Homeland Security Master's Degree Program, *Ted Lewis, NSA* (Department of the Treasury)
- Strategic Studies: Open-Source Research and Nuclear Weapons Design, *James Russell, NSA* (LLNL)
- US China Strategic Dialogue, *Christopher Twomey, NSA* (NASIC)
- Political Advisement to the Canadian Forces, *Thomas Johnson, National Security Affairs* (Canadian Armed Forces)

Graduate School of Operational and Information Sciences

Funds available to date: $38M

By Department

By Sponsor
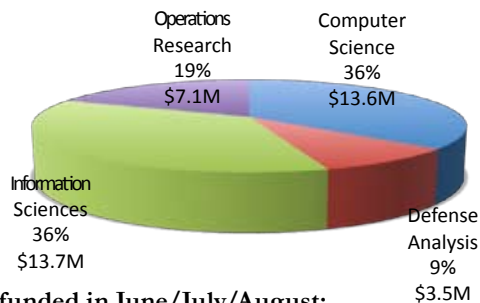
Projects funded in June/July/August:

- Identity and Database Challenges for Force Protection, *Cynthia Irvine, CS* (DMDC)
- Software Engineering Distance Learning Program, *Loren Peitso, CS* (Various)
- Behavioral Analysis of Network Traffic, *Geoffrey Xie, CS* (NSA)
- ISR NET-T Field Experiment, *Shelley Gallup, IS* (Air Force Pentagon)
- C3F Sea Trial Experimentation Support (FY10-11), *Richard Kimmel, IS* (Commander Third Fleet)
- Support for Edge Power C2 Chair, *Mark Nissen, IS* (OSD)
- Lightning Weather Warning Optimization, *Lt. Col. Karl Pfeiffer, IS* (NASIC)
- Performance Analysis of Ground Soldier Mobile AD-HOC Networks, *David Alderson, OR* (TRAC – Monterey)
- Modeling the Impact of Events on the Simulated Afghanistan Population, *Rachel Johnson, OR* (TRAC – Monterey)
- Total Life Cycle Working Group Modeling and Simulation/ADCI, *Edward Lesnowicz, OR* (USMC – MARCORSYSCOM)
- Improving the Integrated Training Center Model for Usability to Enable Accurate Time to Train Modeling, *Thomas Lucas, OR* (USMC – MARCORSYSCOM)
- Distributed Learning MS Cost Estimating and Analysis Development Phase 1, *Daniel Nussbaum, OR* (NAVSEA)
- USMC Performance Pricing Model, *Daniel Nussbaum, OR* (USMC – Logistics Support Resources Branch)
- Navy Certifier Program Special Offering, *Karen Burke, CS* (SSC-Atlantic)
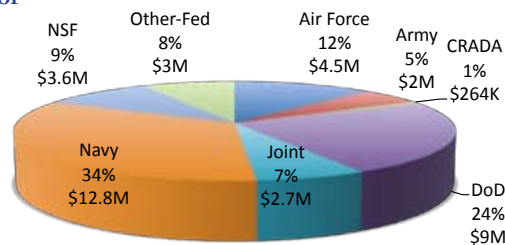
- Navy Certifier Program Special Offering, *Karen Burke, CS* (NCTS Far East)
- Navy Certifier Program Special Offering, *Karen Burke, CS* (NAWC-Weapons Division)
- Identity and Database Challenges for Force Protection, *Christopher Eagle, CS; Simson Garfinkel, CS; Brian Greenshields, DA; Cynthia Irvine, CS; Craig Martell, CS; David Tucker, DA* (DMDC)
- Information Assurance Scholarship Program Support-2010, *Cynthia Irvine, CS* (NSA)
- Solutions and Acquisitions Office Field Experimentation, *Shelley Gallup, IS* (SAF)
- Joint Intelligence Operations Center Operational Users Group Support, *Richard Kimmel, IS* (DIA)
- Maritime Information Sharing Taskforce (MIST) New York/New Jersey, *Jeffery Kline, OR* (DoT)
- Statistical Training and Support to the Yuma Test Center, *Robert Koyak, OR* (Yuma Proving Ground)
- Total Lifecycle Working Group Modeling and Simulation/ADCI, *Edward Lesnowicz, OR* (USMC – MARCORSYSCOM)
- Distributed Learning Master of Science in Cost Estimating/Analysis II Course Development, *Daniel Nussbaum, OR* (NAWC-Aircraft Division)
- Optimization of Brigade Combat Team Assignments, *Javier Salmeron, OR* (TRADOC)
- Course Development Efforts for OA4414: HSI Case Studies and Applications, *Lawrence Shattuck, OR* (SPAWAR)
- Stochastic Optimization Support, *Alan Washburn, OR* (TRADOC)

Graduate School of Business and Public Policy

Funds available to date: $13.5M

By Sponsor
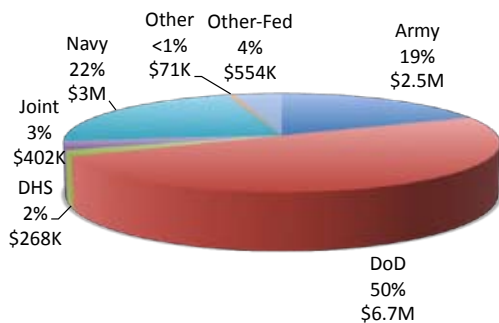
Projects funded in June/July/August:

- The Enterprise Concept for Business Transformation in the Navy: An Analytical History, *Douglas Brook, GSBPP* (NAVSUP)
- Advanced Acquisition Program 45-11, *John Dillard, GSBPP* (PEO CS CSS)
- Cost of Attrition, *John Enns, GSBPP* (OSD)
- Contract and Program Management Distance Learning Program, *Walter Owen, GSBPP* (Various)
- OPAM - Analysis of DOE'S Cost Proposal Requirement for Competitive Environmental Operating and Capital Projects, *Keith Snider, GSBPP* (DOE)

Research and Education Institutes, Centers, and Other

Funds available to date: $117.8M

By Department

GPPAG 2% $1.9M
NSI 6% $7.1M
Cebrowski 11% $12.7M
Meyer 2% $2.3M
MOVES 9% $10.4M
NPS/ USSOCOM 1% $1.2M
CIRPAS 3% $4.2M
Other 66% $77.5M

By Sponsor

DHS 1% $972K
Joint 6% $7.3M
Navy 17% $19.5M
NSF 1% 763K
Other <1% $343K
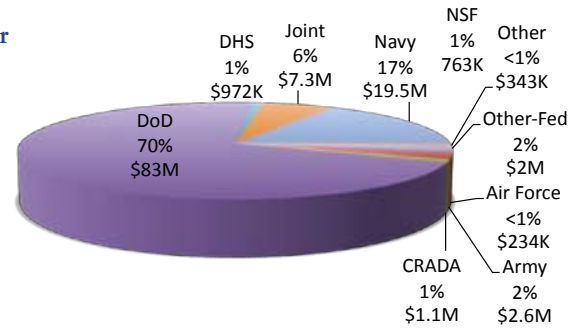Other-Fed 2% $2M
Air Force <1% $234K
Army 2% $2.6M
CRADA 1% $1.1M
DoD 70% $83M
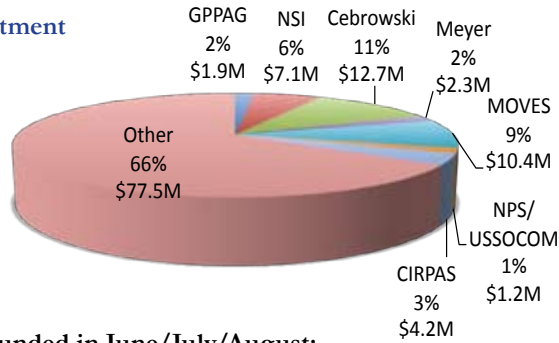
Projects funded in June/July/August:

- CA Homeland Security Consortium, *Charles Kimzey, NSI* (DHS)
- Assessment of Unmanned Systems for Wildland Firefighting, *Dan Boger, NSI* (AUVSI)
- Cyber Attack and Security Exercise, *Dan Boger, NSI* (INFRAGARD Los Angeles Members Alliance)
- Challenges in Technology Transition, *Peter Denning, Cebrowski* (DARPA)
- Establishing an Enterprise Center of Excellence for Military Wireless Communications, *John Gibson, Cebrowski* (USMC–MARCORSYSCOM)
- Transformational C2 Services for Understanding the Impact of Globalization on Stability and Security, *Sue Higgins, Cebrowski* (SSC-Atlantic)
- Assessment Federation Support, *Scot Miller,* Cebrowski (SPAWAR)
- NPS ASW Certificate Program, *Daphne Kapolka, Meyer* (NAVSEA)
- Massive Multiplayer Online War Game Leveraging the Internet Project, *Don Brutzman, MOVES* (NSWC-Carderock Division)
- Healing Heroes: Support and Consultation, *Paul Chatelier, MOVES* (DARPA)
- Creative and Novel Context Generation for Sense Making Using Conceptual Blending Theory, *Chris Darken, MOVES* (Nat. University of Singapore)
- Damage Control Visualization Prototype, *Perry McDowell, MOVES* (NSWC-Carderock Division)
- FEPSO Hybrid Education Pilot, *Raymond Buettner, NPS Field Experimentation Program* (USSOCOM)

- Basset UAV Flight Testing, *Robert Bluth, CIRPAS* (NextGen Aeronautics)
- Flight Testing Support, *Robert Bluth, CIRPAS* (UC Berkeley)
- Command and Control Technology Integration for a Common Tactical Picture by the Salinas California Police Department, *Shelley Gallup, NSI* (DHS)
- Technical Support for a Collaborative Sensor Visualization Capability, *Alan Jaeger, CAW* (NAWC-Weapons Division)
- Reduction in Total Ownership Cost (RTOC), *Clifford Whitcomb, Meyer* (ONR)
- Marine Corps Warfighting Laboratory, *William Becker, MOVES* (ONR)
- Massive Multiplayer Online War Game Leveraging the Internet (MMOWGLI) Project Execution, *Don Brutzman, MOVES* (ONR)
- ADL Research and Technical Support, *Paul Chatelain, MOVES* (DHRA)
- Synthetic Environments for Assessment: Prototype Infrastructure and Scenario Development, *Rudy Darken, MOVES* (ONR)
- Landing Signal Officer Automated Pass and Recovery Tracking System Replacement, *Michael McCauley, MOVES* (ONR)
- FEPSO, *Raymond Buettner, NPS Field Experimentation Program* (USSOCOM)
- Logistics/Range Fee Support at Camp Roberts, *Robert Bluth, CIRPAS* (Navy Special Wafare Group One)
- Scan Eagle Operations at Camp Roberts, *Robert Bluth, CIRPAS* (NAWC-Weapons Division)
- UAV Operations at Camp Roberts, *Robert Bluth, CIRPAS* (AFRL)

AIAA AWARD BESTOWED ON NPS PROFESSORS

Professor Isaac M. Ross (Mechanical and Aerospace Engineering) and Professor Fariba Fahroo (AFOSR) have won the 2010 Mechanics and Control of Flight Award. This accolade is the highest given by the American Institute of Aeronautics and Astronautics (AIAA) for the mechanics and control of flight and is jointly awarded by three AIAA technical committees: namely, the Guidance, Navigation and Control; Astrodynamics; and Atmospheric Flight Mechanics committees.

Ross and Fahroo won the award for their contributions to optimal-control theory through the use of pseudospectral methods to achieve infinite-order accuracy, thereby facilitating very accurate methods to compute switching times, bang-bang controls, and other foundational elements of autonomous marine, land, and space systems. They are the first professors at NPS ever to have won this award. Congratulations and thanks for giving top national visibility to NPS and to the U.S. Navy.

INTEGRATING CELLULAR TECHNOLOGY WITH U.S. MILITARY TACTICAL COMMUNICATIONS

New research by the Military Wireless Communications Research Group, an interdisciplinary team of NPS faculty and students, is exploring the feasibility of integrating the commercial, off-the-shelf (COTS) cell phone with Marine Corps tactical data networking. The principal investigators are Capt Joshua Dixon, USMC, whose thesis broke ground for the project, Lecturer and Program Manager John Gibson and Professor Geoffrey Xie (Computer Science), and Professor Frank Kragh (Electrical and Computer Engineering).

Fully exploited cellular technology can send and receive real-time voice communication, voice and text alerting and messaging, and email, while providing a collection platform for remote manned and unmanned reconnaissance and surveillance through embedded sensors, e.g., audio, seismic, and imagery. While significant support for such usage exists within several military service organizations, adoption of COTS cellular capabilities by the military has been slow. Among the challenges are that cellular communications technologies are customarily weighted towards fixed infrastructure; tactical military communication equipment generally requires very rugged user devices; COTS systems lack emissions, communications, and operational-security measures standard on military networks; and that technical and operational issues may lead to non cost-efficient or tactically viable solutions. These concerns inhibit the adoption and deployment of COTS alternatives, leaving their associated benefits untapped.

Network diagram for COTS-based communications

Funded primarily by the Marine Corps Systems Command, this research will establish an Enterprise Center of Excellence for Military Wireless Communications Research and Experimentation at NPS to determine whether highly mobile, cellular communications and computing technologies may be adapted to fill a secure, valuable, and novel role within highly mobile or dismounted combat units. Consideration will be given to the potential gains and costs associated with integrating emerging cellular technologies into a tactical wireless network, as well as to how these capabilities might be leveraged to support the deployment of JTRS-compliant systems.

While cellular technology has the potential to supplement standard military communications, it can by no means handle full-scale combat operations alone. Even if all technical challenges were solved, COTS cellular technology would fail the security requirements of many operations. Combat operations, for example, will continue to require military tactical radios for critical voice communications. However, where mission requirements allow, cellular technology may prove a cost effective and adaptive extension of current capability. This research will incorporate cellular handsets into the tactical network by bridging mobile base stations with the tactical radios, without the deployment overhead and physical security vulnerabilities of a full-scale, fixed cell-tower infrastructure.

Adaptations of this topology may make it more suitable for military application. For example, it is possible to put base stations in air platforms to provide extended reach-back or cellular coverage areas;

attach small, portable, scalable base-stations to vehicles assigned to specific areas of operations; or install more capable, portable, base-stations at forward operating bases. These capabilities will be explored in the lab and in field exercises, e.g., TNT experiments.

A critical consideration in tactical wireless communications is the availability of the wireless links in operational environments. This work proposes to measure and compare the robustness and suitability of the wireless links of various radios for back-haul communications to enable quantitative comparison, based primarily on packet error rate and channel conditions. Channel conditions may be emulated in a controlled laboratory environment using an industry-standard channel emulator; faded channels will be emulated including Doppler effects for urban, rural, and ground-to-air channels. Additional experimentation will be accomplished in the field.

Security will also be addressed, particularly, adaptation of a developmental multi-level security operating system kernel to extremely small form-factor computing and communications devices, such as cell phones, leading to a proof of concept. Such capability would bring sensitive information to forward elements while preventing inadvertent compromise. Other issues include emission security relative to cellular protocol and individual platforms; user authentication using voice identification; application prototyping and experimentation; problems in transient tactical access to sensitive information; and scarce infrastructure in austere environments.
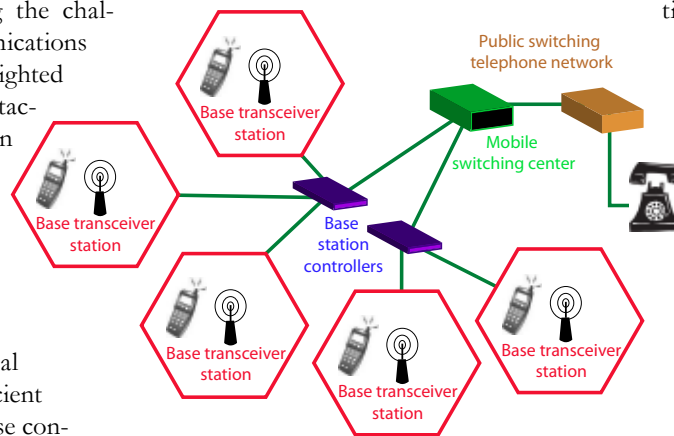
The project also seeks to stimulate development of applications that leverage cellular capabilities, such as multiple phenomenology sensors (acoustic, seismic, and visual), to provide combat relevant information and improve the situational awareness of the device holder and those to whom content is forwarded. To this end, questions such as the following will be examined:

- In general, what capabilities arise in the field when a new SIM card is added to a cell phone, such that it can access a "private" network employed by the tactical formation?
- What capabilities are feasible for tactical networks accessed via cell phone?
- How might this advance be exploited by adversaries?

Preliminary research demonstrates a method for connecting a cell phone device, via an added SIM card and bridge device, to our current tactical radios.

These results verify the plausibility of using tactical data networks as back-haul extensions to local-area networks among dismounted units using cellular handsets as both voice and data production and consumption devices.

However, continued research is required to increase the security level to match that of tactical radios without significant cost, as well as developing a methodology for producing viable combat-relevant applications for rapid insertion in the toolkit of under-served deployed forces.

LOW-TEMPERATURE TRANSIENT PERFORMANCE OF A POLYMER, LIGHT-EMITTING DIODE

Karl O. Burnett–Lieutenant, United States Navy
M.S., Engineering Science, NPS, 2003
Master of Science in Applied Physics–June 2010
Advisor: Nancy M. Haegel, Physics
Second Reader: Peter P. Crooker, Physics

Covert nighttime operations have a high potential for friendly fire incidents. Interest has arisen in developing devices to mitigate this risk. Previous work identified polymer organic light-emitting diodes (P-OLEDs) as a new class of materials that emit an infrared (IR) signal and can be used in small lightweight "individual identification, friend or foe" (IIFF) devices with low power requirements. The P-OLED material must be selected for brightness, power consumption, and pulsed operation at temperatures lower than those required for commercial applications. The goal of this work is to characterize the transient behavior of a PPV-based P-OLED emitter as a function of temperature. The formation and decay processes of the internal junction were captured in real time with transient current, voltage, and light intensity measurements for operational times of 0.2 ms–40 s and temperatures of 257–297 K. A P-OLED device emits light only after an external bias both injects charge carriers and forms a p-n junction, resulting in emissive recombination. The time required for *in-situ* p-n junction formation depends on the ionic mobility and internal electric field strength and has an Arrhenius temperature dependence. The activation energy for ion mobility and light emission at a bias of 30 V was found to be 1.6 eV, based on measurements of transient light response as a function of temperature. At lower temperatures or biases, the time required for *in-situ* doping increases significantly, which could limit the IIFF performance during cold-weather operation. Once the p-n junction has formed and the bias is removed, the dopant ions remain in position. If bias is reapplied, the junction already exists and light emission starts quickly. At decreased temperature, lower ionic mobility causes a greater memory effect, and the junction can be sustained in excess of twenty-four hours in the absence of an applied field. This freeze-in phenomenon may suggest chemistries that operate better at low temperatures. *LT Burnett received the Naval Sea Systems Command Award for Excellence in Combat Systems.*

STRATEGIC UTILIZATION OF NORWEGIAN SPECIAL-OPERATIONS FORCES

Kjetil Mellingen–LCDR, Royal Norwegian Navy
Master of Science in Defense Analysis–June 2010
Master of Science in Information Operations–June 2010
Advisor: Kalev I. Sepp, Defense Analysis
Second Reader: David C. Tucker, Defense Analysis

Norwegian Special Operations Forces (NORSOF) are national strategic assets that require certain conditions in order to optimize their strategic utilization. Based on the 2008 NATO SOF Study, and case studies of "lessons learned" from the creation of the Canadian Special Operations Forces Command and the Polish Special Operations Command, a "world-class SOF" for Norway requires a national-level joint SOF command. This command can provide coherent, long-term stewardship, authority, and direction over all aspects of Norwegian special operations. Evaluating governing documents and policy, Norway's relationship with NATO, the security environment, and different types of national SOF leadership, this thesis recommends organizational changes to optimize the strategic utilization of NORSOF.

LCDR Mellingen received the NPS Outstanding Academic Achievement Award for International Students.

LOGISTICAL RISK PLANNING TOOL: OPTIMIZING THE DEPLOYMENT OF CARGO UNMANNED AERIAL SYSTEM IN LOGISTICAL SUPPORT MISSIONS AT THE TACTICAL LEVEL

Timothy J. Merkle–Captain, United States Marine Corps
Master of Science in Operations Research–June 2010
Advisor: Moshe Kress, Operations Research
Advisor: Johannes O. Royset, Operations Research
Second Reader: Stephen Pilnick, Operations Research

In this thesis, we developed the Logistical Risk Planning Tool (LRPT) to analyze the CUAS, ground vehicle, manned aviation platforms and the Joint Precision Airdrop System (JPADS) as a mixed integer program. The LRPT consists of an Excel based user input/output interface, route enumeration, and mixed integer program. The MIP is implemented in the Generalized Algebraic Modeling System (GAMS) to optimally solve vehicle mission allocation, and vehicle utilization in order to satisfy demand in a defined time horizon. The GAMS model is solved by CPLEX and returns all outputs to Excel for analysis and display. We implemented the LRPT using four data sets. Each set was unique and designed to challenge the LRPT by changing the vehicle availability, characteristics, demand size and location. The scenario based inputs incorporate a Battalion Landing Team (BLT) operating in Enhanced Company Operations. All logistical demand is computed using the table of organization and equipment accompanying a Battalion with enhanced companies. The analysis of the impacts on demand at supported units shapes the employment considerations for the CUAS. At the present capabilities the CUAS is better suited for employment at the tactical level, supporting platoon sized elements. As a continuation of the analysis it is found the LRPT outputs detail the importance of cargo capacity and speed within a logistical network. Specifically, the impacts of increasing the cargo capacity of the CUAS definitively increase selection of the CUAS to perform delivery missions. Additionally, the increase of cargo capacity and speed of the CUAS allow the CUAS to carry higher percentages of cargo when supporting deliveries to the BLT. *Capt Merkle is the winner of the Military Operations Research Society Stephen A. Tisdale Graduate Research Award.*

AN ECONOMIC ANALYSIS OF INVESTMENT IN THE UNITED STATES SHIPBUILDING INDUSTRY

Nicholas A. Meyers–LT, United States Navy
Master of Business Administration–June 2010
Co-Advisor: Daniel A. Nussbaum, Operations Research
Co-Advisor: Joseph G. San Miguel, Graduate School of Business and Public Policy

Amid the global economic recession and sizeable injections of federal stimulus packages, the U.S. Navy's budget for ship construction has experienced only modest real growth. While the 2010 Quadrennial Defense Review has reaffirmed a fleet size goal of 313 ships, some suggest that $20 billion or more per year is needed to attain this level of strategic resources. This research has analyzed the United States' shipbuilding industry as a potential source of economic stimulus using measures applied in the United Kingdom

by economists at Oxford Economics. First, monetary impacts from the "ship building and repairing" sector were analyzed using U.S. Bureau of Economic Analysis (BEA) input–output data and the "Leontief inversion process" modeled at Carnegie Mellon University. This sector was compared with five alternative investments. Second, the benefits of the shipyard-related labor market were analyzed using data from the Bureau of Economic Analysis and Naval Sea Systems Command. Measures of capital intensity and capacity were then applied to companies representing five industries. The results suggest that U.S. shipbuilding generates monetary benefits comparable to alternatives, while supporting more labor than other sectors. Finally, excess capacity shows a clear ability to absorb an increase in demand, providing prompt and positive impact on sustainable economic recovery. *LT Meyers was awarded a Conrad Scholar Award for Distinguished Academic Achievement in Financial Management.*

AN ANALYSIS OF RETURN ON INVESTMENT OF THE CONSOLIDATED AFLOAT NETWORKS AND ENTERPRISE SERVICES (CANES) PROGRAM
Aleron B. Rognlie–Lieutenant, United States Navy
Master of Business Administration–June 2010
Advisor: Kenneth Euske, Graduate School of Business and Public Policy
Associate Advisor: Douglas Brinkley, Graduate School of Business and Public Policy

The purpose of this thesis is to calculate a value for the return on investment (ROI) of the Consolidated Afloat Networks and Enterprise Services (CANES). The research examines previous work performed by the CANES team in the development of a business case for CANES. This thesis also discusses some of the intangible benefits of CANES and difference between cost savings and cost avoidance. The thesis focuses on quantifying the possible benefits of upgrading the current shipboard network system to the CANES system, and determining whether those benefits are likely to be realized in actual operations. The researcher calculated a CANES ROI of 73 percent. A sensitivity analysis was performed to examine how ignoring cost avoidance affects the calculated value of ROI, along with how much other input factors would have to change in order to make the CANES investment unattractive. *LT Rognlie was awarded a Conrad Scholar Award for Distinguished Academic Achievement in Financial Management.*

ESTIMATING THE FULLY BURDENED COST OF FUEL FOR A NAVAL AVIATION FIXED WING PLATFORM
Daniel R. Truckenbrod–CDR, United States Navy
Master of Business Administration–June 2010
Co-Advisor: Daniel A. Nussbaum, Operations Research
Co-Advisor: Joseph G. San Miguel, Graduate School of Business and Public Policy

This thesis provides the background and motivation for furthering the Fully Burdened Cost of Fuel (FBCF) cost estimating methodology and calculations in the context of a naval aviation fixed wing platform. The FBCF contribution to Total Ownership Cost in the Analysis of Alternatives for Major Defense Acquisition Programs requires steady advancement to meet an October 2011 implementation deadline. Applying OSD guidance and calculator mathematical process facilitates comparison of the additional costs to deliver and protect fuel demanded by the F/A-18E/F aircraft with those added costs for a ship platform. Total costs throughout a realistic operation and support lifecycle and applying a notional scenario to the newest calculator demonstrate a range of cost estimating methods. Our conclusions support previous analysis that air refueling contributes significantly to logistics support costs and that investment in fuel conservation technologies and platform endurance can be a strategic opportunity for the DoD and the DoN. The aircraft FBCF is multiple times higher than the fuel commodity price as compared to the FBCF for ships, which is only fractionally higher than the fuel commodity price. Assured Delivery Price of supplied fuel calculations are complicated for platforms that require multiple refueling support assets. *CDR Truckenbrod was awarded a Conrad Scholar Award for Distinguished Academic Achievement in Financial Management.*

TECHNOLOGY TRANSFER: JUNE/JULY/AUGUST 2010 ACTIVITY

COOPERATIVE RESEARCH AND DEVELOPMENT AGREEMENTS (CRADAS)

Title: Bering Sea Studies and Data Collection
Partner: University of Alaska
POC: Jeffrey Paduan, Oceanography
Summary: NPS and UAF will collaborate on studies of the Bering Strait and a data collection effort in and around the Bering Strait. The project will assess the mass, heat, salt, and nutrient fluxes through the strait. The collection and analysis of data regarding the inflow into the Arctic Ocean via the Bering Strait is important for understanding climatic change both locally and in the Arctic. The collections of nutrient data should advance the understanding of the biological systems in the Bering Strait and surrounding areas.

Title: Understanding Routing Designs of Operational Networks

Partner: AT&T Labs, Inc.
POC: Geoffrey Xie, Computer Science
Summary: This collaboration between NPS and AT&T is to advance the fundamental understanding of network design and operational practices of routing design. The research will focus on how routing parameters are configured. Models will be developed to characterize and understand rationales of the routing design.

TECHNICAL SERVICE AGREEMENTS (TSAs)

Title: Basset UAV Flight Testing
Partner: NextGen Aeronautics, Inc.
NPS POC: Robert Bluth, CIRPAS
Summary: NPS/CIRPAS, through contractor CalTech, will provide preflight coordination, flight coordination, range management, flight safety, and facility management of NextGen's flight-testing activities at the CIRPAS facility.

TSAs, continued from p.7

Title: Berkeley Unmanned, Aerial Vehicle Flight Testing
Partner: Regents of the University of California, UC Berkeley
NPS POC: Robert Bluth, CIRPAS
Summary: NPS/CIRPAS will provide preflight and flight coordination, range management, flight safety, and facility management of UC Berkeley's Center for the Cooperation Control of Unmanned Vehicles flight-testing activities at the CIRPAS facility.

Title: WiMAX/WiFi Development Program
Partner: Alcatel-Lucent USA, Inc.
NPS POC: Robert Bluth, CIRPAS
Summary: NPS/CIRPAS will provide pre-flight coordination, flight coordination, range management, flight safety and facility management of Alcatel – Lucent, USA, Inc. WiMAX/WiFI system testing activities at the CIRPAS facility.

MEMORANDA OF UNDERSTANDING/ AGREEMENT (MOUs/MOAs)

Partner: Naval Warfare Integration Group (N00X)
NPS POC: LCDR Schramm, USN, Chair Incumbent
Summary: The purpose of the MOA is to create a Naval Warfare Integration Group Chair for Strategic Maritime Analysis at NPS. The collaborative efforts will provide valuable opportunities for faculty and student professional development at NPS while enhancing N00X's mission. The agreement will also allow NPS to conduct research and analysis to support the N00X Analytic Agenda.

Partner: Armament Research Development and Engineering Center and Naval Undersea Warfare Center, Newport
NPS POC: Alex Bordetsky, Information Sciences
Summary: This MOA develops joint proposals and defining roles and responsibilities for the engineering, installation, and technical support of a prototype force-protection system for NEPTUNE test bed, with network-centric decision support tools and technologies, network sensor integration, processing, visualization, etc.

Partner: Department of Energy, Office of Procurement and Assistance Management (OPAM)
NPS POC: Keith Snider, Graduate School of Business and Public Policy
Summary: Provides research in support of OPAM and professional development of faculty and students in acquisition management and related curricula in topics of concern. Stimulates research that enhances graduates' ability to assume management and policymaking positions within the the DoD acquisition workforce.

Partner: U.S. Department of State
NPS POC: Scott Jasper, Center for Civil–Military Relations
Summary: The agreement allows funds to be transferred to NPS/CCMR Global Peacekeeping Operations Initiatives (GPOI) activities as directed by the Department of State.

Partner: Defense Information Systems Agency
NPS POC: Geoffrey Xie, Computer Science, and LCDR Derby Luckie, USN
Summary: This agreement defines relationships, roles, responsibilities, and resources of the parties with regard to access to unclassified Netflow data by select NPS personnel for research purposes.

Partner: U.S. Army Contracting Command
NPS POC: Keith Snider, Graduate School of Business and Public Policy
Summary: The purpose of this agreement is to continue an established relationship with NPS Acquisition Research Program and provide services in support of the mission of the Army Contracting Command and related sponsorship of the NPS Acquisition Chair.

Partner: Association of Old Crows (AOC)
NPS POC: Philip Pace, Electrical and Computer Engineering, and CDR M. Herrera, USN
Summary: The agreement establishes roles and responsibilities in cosponsoring the Winter 2010 Low Probability of Intercept and ELIN/SIGNIT Conference, February 2011, at NPS. Professionals from the military, government, and industry will discuss issues related to electronic warfare programs, platforms, and operations.

LETTERS OF ACCORD

Partner: The University of Bundeswehr, Germany
NPS POC: Peter Purdue, Graduate School of Operational and Information Sciences
Summary: The universities intend to develop research and academic programs concerning issues of globalization, security, public policy, technology, and other issues of common interest.

Partner: Technical Institute of Aeronautics, Brazil
NPS POC: Gary Roser, School of International Graduate Studies
Summary: The universities intent to establish an international educational alliance to enhance the common education mission of both institutions and foster cooperation in research defense issues.

TECHNICAL REPORTS PUBLISHED

NPS-GSBPP-10-012	Analysis of Tuition Assistance Program: Does Method of Instruction Matter in TA Classes?	S. Mehay, E. Pema
NPS-GSBPP-10-013	Classroom Computing Using On-Demand Desktop Streaming	D. Brinkley
NPS-CS-10-007	UML-Based Specification, Validation, and Log-file based Verification of the Orion Pad Abort Software	D. Druskinsky
NPS-OC-10-002CR	Project Report of Virtual Experiments in Marine Bioacustics: Model Validation	T. Cranford, P. Krystal
NPS-OR-10-005	A Multistatic Sonobuoy Theory	A. Washburn

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