

Naval Postgraduate School
Monterey, California 93943-5138
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Compilation of

THESIS ABSTRACTS

JUNE 2011



Office of the Vice President and Dean of Research
Naval Postgraduate School

PREFACE

This publication contains abstracts of restricted or classified theses submitted for the degrees doctor of philosophy, master of business administration, master of science, and master of arts for the June 2011 graduation.

This compilation of abstracts of theses is published in order that those interested in the fields represented may have an opportunity to become acquainted with the nature and substance of the student research that has been undertaken. Copies of theses are available for those wishing more detailed information. The procedure for obtaining copies is outlined on the last page of this volume.

For additional information on programs, or for a catalog, from the Naval Postgraduate School, contact the director of admissions.

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The *Compilation of Theses Abstracts* (unrestricted) can be found online at <http://www.nps.edu/Research/More-ThesisAbst.html>.

Summary of Research, an annual compilation of research projects and publications, is also available online, at <http://www.nps.edu/Research/SummaryRes.html>. Research News, a monthly newsletter highlighting NPS research, can be found at <http://www.nps.edu/Research/Newsletters.html>.

INTRODUCTION

Mission

The Naval Postgraduate School (NPS) was established to serve the advanced educational needs of the Navy. The broad responsibility of the school is reflected in its stated mission:

Increase the combat effectiveness of U.S. and allied armed forces and enhance the security of the United States of America through advanced education and research programs focused on the technical, analytical, and managerial tools needed to confront defense–related challenges of the future.

To fulfill its mission, the Naval Postgraduate School strives to sustain excellence in the quality of its instructional programs, to be responsive to technological change and innovation in the Navy, and to prepare officers to introduce and utilize future technologies.

The research program at NPS exists to support the primary mission of graduate education. Research at NPS:

- maintains upper–division course content and programs at cutting edge;
- challenges students with creative problem solving experiences on DoD–relevant issues;
- advances DoN/DoD technology;
- solves warfare problems; and
- attracts and retains quality faculty.

Academic Programs

To meet its educational requirements, the Navy has developed a unique academic institution at the Naval Postgraduate School through the use of specially tailored academic programs, and a distinctive organization tying academic disciplines to naval and joint warfighting applications.

The Naval Postgraduate School has aligned its education and supporting research programs to achieve three major goals: 1) academic programs that are nationally recognized and support the current and future operations of the Navy and Marine Corps, our sister services, and our allies; 2) research programs that focus on the integration of education and research in support of current and emerging national security technologies and operations, and

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INTRODUCTION

education and research in support of current and emerging national security technologies and operations, and 3) executive and continuing education programs that support continuous intellectual innovation and growth throughout an officer's career. Programs of graduate studies at NPS are grouped as follows:

Graduate School of Operational and Information Sciences

- Computer Science
- Computer Technology
- Electronic Warfare Systems
- Human Systems Integration
- Information Sciences
- Information Systems and Operations
- Information Systems and Technology
- Information Warfare
- Joint C4I Systems
- Joint Information Operations
- Modeling, Virtual Environments, and Simulation
- Operations Analysis
- Operational Logistics, Joint
- Software Engineering
- Special Operations and Irregular Warfare
- Systems Analysis

Graduate School of Engineering and Applied Sciences

- Applied Mathematics
- Combat Systems Science and Technology
- Electronic Systems Engineering
- Meteorology
- Meteorology and Oceanography
- Naval/Mechanical Engineering
- Oceanography
- Operational Oceanography
- Reactors–Mechanical/Electrical Engineering
- Space Systems Engineering
- Space Systems Operations
- Systems Engineering
- Systems Engineering Management
- Undersea Warfare
- Underwater Acoustic Systems

Graduate School of Business and Public Policy

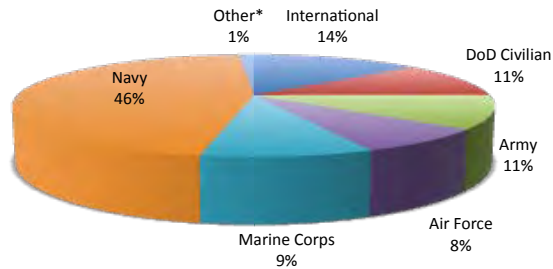
- Acquisition and Contract Management
- Contract Management
- Executive Management
- Executive Master of Business Administration
- Financial Management
- Information Systems Management
- Defense Business Management
- Defense Systems Analysis
- Defense Systems Management, International
- Material Logistics Support
- Manpower Systems Analysis
- Program Management
- Resource Planning and Management for International Defense
- Supply Chain Management
- Systems Acquisition Management
- Transportation Management

School of International Graduate Studies

- Civil–Military Relations
- Combating Terrorism: Policy, Strategy
- Defense Decision Making and Planning
- Homeland Security and Defense
- Security Studies
- Stabilization and Reconstruction
- National Security and Intelligence:
 - Middle East, South Asia, Sub-Saharan Africa
 - Far East, Southeast Asia, Pacific
 - Europe and Eurasia
 - Western Hemisphere

The student body consists of U.S. officers from all branches of the uniformed services, civilian employees of the federal government, and foreign military officers and government civilians. The resident degree/subspecialty student population for June 2011 is shown in Figure 1 on the following page.

INTRODUCTION



**Army Reserve, Army Reserve National Guard, Coast Guard, National Oceanographic and Aeronautics Administration*

Figure 1: Resident Degrees/Subspecialty Student Population for June 2011 (1,545 total)

Academic Degrees

Curricula meet defense requirements within the traditional degree framework. All curricula lead to a master's; additional study may yield an engineer's or doctoral degree. Below is a listing of the degrees offered at NPS:

Master of Arts

- Security Studies

Master of Business Administration

Master of Science

- Applied Mathematics
- Applied Physics
- Applied Science
- Astronautical Engineering
- Combat Systems Technology
- Computer Science
- Computing Technology
- Contract Management
- Defense Analysis
- Electrical Engineering
- Electronic Warfare Systems Engineering
- Engineering Acoustics
- Engineering Science
- Human Systems Integration
- Information Operations
- Information Systems and Operations
- Information Technology Management
- Information Warfare Systems Engineering
- Management
- Materials Science and Engineering
- Mechanical Engineering
- Meteorology
- Meteorology and Physical Oceanography
- Modeling, Virtual Environments, and Simulation
- Operations Research
- Physical Oceanography
- Physics

- Product Development
- Program Management
- Software Engineering
- Space Systems Operations
- Systems Analysis
- Systems Engineering
- Systems Engineering Analysis
- Systems Engineering Management
- Systems Technology

Engineer

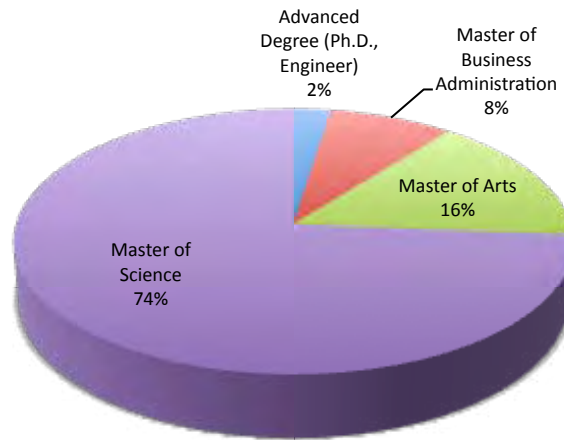
- Astronautical Engineer
- Electrical Engineer
- Mechanical Engineer

Doctor of Philosophy

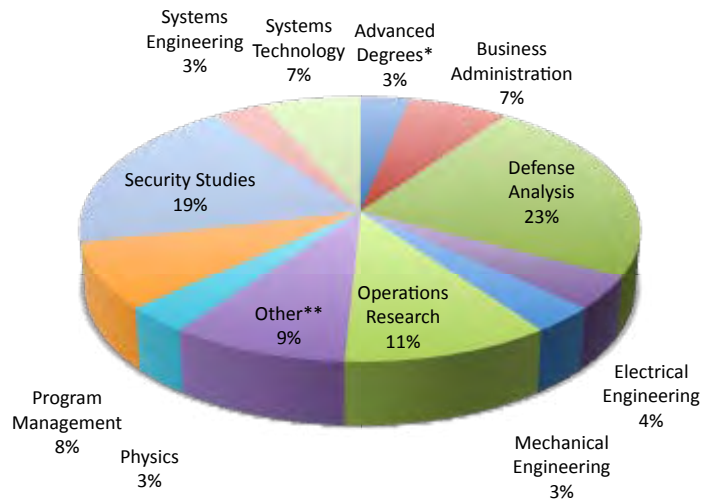
- Applied Mathematics
- Applied Physics
- Astronautical Engineering
- Computer Science
- Electrical Engineering
- Engineering Acoustics
- Information Sciences
- Mechanical Engineering
- Meteorology
- Modeling, Virtual Environments, and Simulation
- Operations Research
- Physical Oceanography
- Physics
- Security Studies
- Software Engineering

INTRODUCTION

In June 2011, 160 degrees were conferred. Figure 2 indicates distribution by type, Figure 3 by degree area.



**Figure 2. Distribution by Degree Type
(160 Degrees Conferred)**



* *Advanced degrees: doctorate in applied physics (1), engineering acoustics (1), information sciences (1), physical oceanography (1). Mechanical engineer (1)*

***Other master's degrees: Applied math (3), applied physics (3), applied science (1), computer science (3), engineering acoustics (1), human-systems integration (1), information technology management (2), management (1), meteorology and physical oceanography (1), physical oceanography (1), software engineering (2), systems engineering management (1)*

**Figure 3. Degrees Conferred in June 2011
(160 Degrees Conferred)**

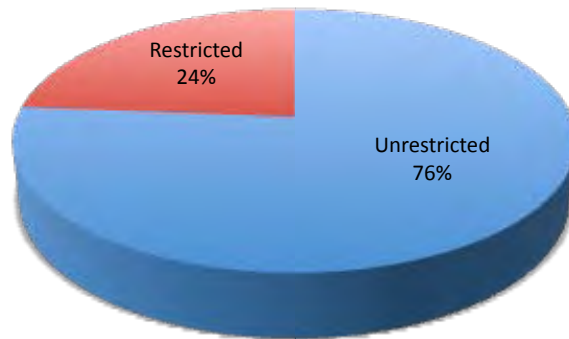
INTRODUCTION

Theses

The thesis is the capstone of the student's academic endeavor at NPS. Thesis topics address issues ranging from the current needs of the fleet and joint forces to the science and technology that is required to sustain long-term superiority of the Navy/DoD.

Aided by faculty advisors, NPS students represent a vital resource within the DoD for addressing warfighting problems, one especially important at present, when technology in general, and information operations in particular, is changing rapidly. Our officers think innovatively and possess the knowledge and skill to apply nascent technologies in the commercial and military sectors. Their firsthand grasp of operations, when combined with a challenging thesis project that requires them to apply their focused graduate education, is one of the most effective elements in solving fleet/joint-force problems. NPS graduate education encourages a lifelong capacity for applying basic principles to the creative solution of complex problems.

NPS is unique in its ability to conduct classified research. Restricted theses are available on the NPS SIPRNET.



**Figure 4. Classification of Theses
(160 Degrees Conferred)**

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ADVANCED DEGREES

Doctor of Philosophy
Mechanical Engineer

DOCTOR OF PHILOSOPHY

ADAPTIVE RECEPTION FOR UNDERWATER COMMUNICATIONS

Spyridon Dessalermos, Lieutenant, Hellenic Navy

B.S., Hellenic Naval Academy, 1998

M.S., Naval Postgraduate School, 2005

Doctor of Philosophy in Engineering Acoustics—June 2011

Advisor: Roberto Cristi, Department of Electrical and Computer Engineering

This research concerns the development of an adaptive receiver for underwater communication. In this type of wireless link, the radio channel is replaced by an underwater acoustic channel which is strongly dependent on the physical properties of the ocean medium and its boundaries, the link geometry and the ambient noise. Traditional acoustic communications have involved a priori matching of the signaling parameters to the expected characteristics of the channel. For more robust communications and high quality of service, it is necessary to develop an adaptive receiver for the acoustic link. This involves estimating the channel-scattering function by processing the received direct sequence spread spectrum (DSSS) acoustic signal. This data is used by an innovative receiver introduced for use underwater. The research also involves development of a robust acquisition system for the acoustic communication signal. The design goal is the receiver's robustness on a Doppler distorted fast-varying multipath fading channel, for applications in multiuser environments. Another important design goal is low complexity in signal processing. The proposed receiver is able to adapt in the acoustic channel variations. Experimental results prove the effectiveness of the receiver.

KEYWORDS: Acoustic Communications, Spread Spectrum, Scattering Function, Kalman Filtering

TWO-SIDED MATCHING IN HIERARCHICAL ORGANIZATIONS: AN APPLICATION FOR THE ASSIGNMENT OF MILITARY PERSONNEL

Paul A. Robards—Lieutenant Colonel, Australian Regular Army

B.ENG., University of New South Wales—1992

M.S.M., Naval Postgraduate School—March 2001

Doctor of Philosophy in Information Sciences—June 2011

Advisor: William Gates, Graduate School of Business and Public Policy

Many large organizations rely on manual assignment processes, despite the theory of bounded rationality indicating that time and cognitive constraints would limit the quality of assignments. This research used participant experiments to explore the effect of information load on assignment quality: participants, motivated by induced value theory, performed the role of decision makers; and information load was identified by the number of personnel requiring assignment and the number of attributes to be considered. Results varied considerably between participants, despite a relatively homogenous group of participants and low information loads compared to what would be experienced in actual military assignment processes. Having analyzed the shortcomings of manual assignment processes, this research examined two-sided matching as the basis for a decision support system. It was demonstrated that two-sided matching could be used to assign personnel to positions in hierarchies. Multi-attribute utility functions were used to generate position preferences based on a variety of attributes, some relevant to the organization and others to its subordinate units. Computational experiments showed that assignments are responsive to the utility function weights, allowing decision makers to quickly examine various assign-

ment sets under different conditions. The effects of preference list indifference on two-sided matching were also examined.

KEYWORDS: Two-Sided Matching, Multi-attribute Utility Functions, Preference List Indifference.

FIELD AND NUMERICAL STUDY ON NATURAL RIVER MIXING

William A. Swick–Lieutenant Commander, United States Navy

B.A., Villanova University, 1996

M.S., Naval Postgraduate School, 2004

Doctor of Philosophy in Physical Oceanography, June 2011

Advisor: Jamie H. MacMahan, Department of Oceanography

Mixing in natural rivers is investigated using comprehensive point-source dye experiments, Lagrangian GPS-equipped drifter observations, and a validated three-dimensional hydrodynamic model. The high spatial and temporal observations provide estimates previously unobtainable. River irregularities are shown to greatly enhance local streamwise and transverse diffusivity due to large scale horizontal coherent flow structures. Tracer study transverse diffusivity was initially small and increased following channel features. Model simulations compared well with field observations. Idealized bathymetric features reveal transport is dominated by the mean flow and combined channel feature influence is nonlinear. Lagrangian analysis of continuous drifter observations describes fine-scale natural river processes and provides quantitative estimates of mean flow field, pathways, and spatial variability of mixing in natural rivers. Near-field diffusivity estimates are shown as independent of drifter deployment location and the effect of river bends on streamwise and transverse diffusivity is quantified. Single-particle streamwise diffusivity increased linearly associated with turbulence and velocity shear. Two-particle streamwise diffusivity scales as Richardson-like. Reaches with numerous bends resulted in anomalously small two particle diffusivities scaling with river bends owing to surface flow convergence. Transverse length scales >20m are predominant random.

KEYWORDS: Dispersion, Diffusivity, Delft3D, Lagrangian, Drifters, Coherent Velocity Structures

**DESIGN, FABRICATION, AND CHARACTERIZATION OF A
MICROELECTROMECHANICAL DIRECTIONAL MICROPHONE**

Michael Touse–Lieutenant Commander, United States Navy

B.S. Physics, U.S. Naval Academy, 1997

Master of Science in Physics, Naval Postgraduate School, 2003

Doctor of Philosophy in Applied Physics, 2011

Advisor: Gamani Karunasiri, Department of Physics

A series of microelectromechanical system (MEMS)-based devices for acoustic direction finding have been designed and fabricated which mimic the aural system of the *Ormia ochracea* fly and its extraordinary directional sensitivity. To overcome the minimal spatial separation between its ears, a flexible hinge mechanically couples the fly's two tympanic membranes. Phase differences due to time difference of arrival (TDOA) are greatly amplified and sound-source direction is determined with unparalleled speed and accuracy. This system allows the fly to acoustically locate crickets, which chirp with wavelengths two orders of magnitude greater than the dimensions of the hearing system. MEMS sensor design using finite element modeling and experimentation to characterize the physical phenomena that affect the performance is described. Specific investigations reported include damping effects, device linearity to sound pressure, and the effects of various packaging schemes on device performance. Results include successful demonstrations of several directional sensors responsive to both sinusoidal and impulsive sources, an electronic readout scheme using capacitive comb fingers, an asymmetric design for dual frequency use, and devices effective into the ultrasonic range, all of which could ultimately contribute to a millimeter-scale device for sniper-location or a number of other defense applications.

MECHANICAL ENGINEER

STRING STABILITY OF MULTIPLE SURFACE MARINE VESSELS

Christos K. Angelopoulos–Lieutenant, Hellenic Navy

B.S., Hellenic Naval Academy, June 2001

Master of Science in Mechanical Engineering–June 2011

Mechanical Engineer–June 2011

Advisor: Fotis A. Papoulias, Department of Mechanical and Aerospace Engineering

Second Reader: Oleg Yakimenko, Department of Mechanical and Aerospace Engineering

The phenomenon of string instability is well known in the context of a platoon of cars moving forward in an automated highway system (AHS). It is also known that ships can experience a similar instability phenomenon from mis-coordination of guidance and control laws. The proposed research studies the latter phenomenon, generalized in the case of multiple marine, surface vessels moving in a platoon. The question of how it is possible for ships traveling in formation to exhibit the phenomenon of string instability is answered. Moreover, we examine under what conditions this phenomenon can be exhibited, as well as how it can be prevented.

KEYWORDS: String stability, Platoon, Surface marine vessel, Path control, Control law, Guidance law, Eigenvalues, Damping ratio, Natural frequency

MASTER OF BUSINESS ADMINISTRATION

A CONTENT ANALYSIS OF DEFENSE BUDGET RHETORIC

Corey D. Barksdale—Lieutenant, United States Navy

B.S., United States Naval Academy, May 2005

Master of Business Administration—June 2011

Co-Advisor: Philip J. Candreva, Graduate School of Business and Public Policy

Co-Advisor: Lisa L. Lindsey, Graduate School of Business and Public Policy

In accordance with federal law, the President is required to present to Congress a budget of the United States Government by February of each year. This action marks the beginning of the legislative phase of the federal budget process. This thesis provides a systematic analysis of communication between the executive branch and Congress regarding the defense budget. A quantitative content analysis of the President's budget press releases and published transcripts from the Senate Armed Services Committee (SASC) authorization for appropriations hearings on military posture from fiscal years 2001 to 2010, will demonstrate that the framework of the President's budget press releases can guide issue attention in Congressional hearings, and that Congress uses congressional hearings to frame their own issues. The SASC hearings provide the first opportunity for Congress to collectively engage in constructive dialogue with the SECDEF and the CJCS following the release of the President's budget.

KEYWORDS: Defense Budget, Content Analysis, Political Discourse, Budget Rhetoric, Political Communication, Senate Armed Services Committee

AN ANALYSIS OF THE LOGISTICS REQUISITION PROCESS

Dawn A. Burson—Lieutenant Commander, United States Navy

B.S., Southern Illinois University Carbondale, August 1998

Master of Business Administration—June 2011

Advisor: Kenneth J. Euske, Graduate School of Business and Public Policy

Co-Advisor: Danny G. Matthews, Graduate School of Business and Public Policy

The business of supporting a globally dispersed naval force is fraught with challenges and complexity. Services for warships of differing mission and size must be sourced and provided at ports all over the world. U.S. Navy ships use a formatted report called a logistics requisition (LOGREQ) to acquire those necessary services. The unconnected nature of the stakeholders that own specific portions of the process increases complexity as well, which include NAVSUP, numbered fleets, and type commanders (TYCOMs). The objectives of this thesis are to analyze the LOGREQ process in its current implementation and make recommendations that will foster standardized procedures across the fleets, improve customer service to deployed ships, provide cost controls for the TYCOMs, and facilitate increased communication among all LOGREQ participants.

Beginning in 2009, NAVSUP introduced new initiatives and IT tools aimed at improving the LOGREQ experience for customer ships and service providers. Current LOGREQ procedures, NAVSUP initiatives, TYCOM policies and Naval Warfare Development Command guidelines were reviewed for alignment and consistency. Recommendations from that analysis include formally adopting language from NTTP 3-54M "Operations Security," updating the TYCOM port-visit cost-reporting requirements, detailed upgrades to the

LogSSR website and modifying the duties of contracting officer representatives.

KEYWORDS: Logistics Requisition (LOGREQ), port-visit process, Operations Security, LogSSR, Port Visit Cost Reporting (PVCR), Contracting Officer (KO), Contracting Officer Representative (COR), Ordering Officer, Husbanding Service Provider (HSP), Naval Supply Systems Command (NAVSUP), Fleet Industrial Supply Center (FISC), Type Commander (TYCOM)

**AUTOMATIC IDENTIFICATION TECHNOLOGY: TRACKING WEAPONS
AND AMMUNITION FOR THE NORWEGIAN ARMED FORCES**

Tord Hjalmar Lien—Captain, Norwegian Air Force

B.A., Norwegian Air Force Academy, 2005

Master of Business Administration—June 2011

Advisor: Geraldo Ferrer, Graduate School of Business and Public Policy

Second Reader: Tali Freed, California Polytechnic State University, San Luis Obispo

The purpose of this study is to recommend technology and solutions that improve the accountability and accuracy of small arms and ammunition inventories in the Norwegian armed forces (NAF). Radio-frequency identification (RFID) and item-unique identification (IUID) are described, and challenges and benefits of these two major automatic identification technologies are discussed.

A case study for the NAF is conducted where processes and objectives that are important for the inventory system are presented. Based on the specific requirements in the NAF's inventory system, an analysis of four different inventory management solutions is examined. For the RFID solution, an experiment is conducted to determine whether this is a feasible solution for small arms inventory control.

A recommendation is formed based on the results of this analysis. The tandem solution, which uses IUID technology at the item level, passive RFID at the box level and active RFID when items are transported, is the recommendation. This solution uses the appropriate technologies where they are best suited and offers the best results for an accurate inventory control system with low implementation costs and risks.

KEYWORDS: AIT, IUID, Inventory Management, Small Arms, RFID, UID

**AN ANALYSIS OF CG-47 CRUISER CLASS OPERATING AND SUPPORT
COSTS TRENDS AND COST RELATIONSHIP WITH PLATFORM AGE**

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Masters in Business Administration—June 2011

Advisor: John E. Mutty, Graduate School of Business and Public Policy

Co-Advisor: Jeremy A. Arkes, Graduate School of Business and Public Policy

The purpose of this research is to identify trends in CG-47 operating and support (O&S) costs and determine if costs, specifically maintenance costs, are increasing as the platforms in the ship-class age. O&S data from FY1987 to FY2010 supplied by the Naval Center for Cost Analysis were used to analyze trends and create statistical models for analyzing the relationship between cost and age. This thesis is intended to supplement a similar statistical analysis performed by the Institute for Defense Analysis (IDA) which analyzed CG-47 O&S costs from FY1984 to FY1999 and found no significant relationship between costs and age. Additionally, concerns in the Navy's current surface fleet force-structure plans will be summarized and analyzed to establish relevance and background.

Analysis of O&S cost data in this thesis yielded results that differed from the 2002 IDA report, and showed a statistically significant relationship between platform age and maintenance costs.

This analysis is intended to aid in future naval leadership decisions on how best to achieve the desired force

MASTER OF BUSINESS ADMINISTRATION

structure of the fleet. Conclusions drawn from this thesis will contribute relevant cost prediction insight that could greatly impact future decisions between extending the life of active surface combatants versus developing and procuring new ships. Predictions of future maintenance funding requirements drawn from this thesis can be incorporated into ship-service-life decisions and potentially improve cost forecast accuracy and legitimacy.

KEYWORDS: CG-47, Cruiser, Ticonderoga, Operating and Support, Maintenance, Platform Age

AN EXAMINATION OF THE DEPARTMENT OF DEFENSE FINANCIAL IMPROVEMENT AND AUDIT READINESS PLAN USING A BALANCED SCORECARD

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B.S., University of Washington, March 2006

Master of Business Administration—June 2011

Co-Advisor: Douglas A. Brook, Graduate School of Business and Public Policy

Co-Advisor: Don E. Summers, Graduate School of Business and Public Policy

This thesis analyzes the Department of Defense (DoD) Financial Improvement and Audit Readiness Plan (FIAR) using balanced scorecard. Using Niven's methodology of applying balanced scorecard to the nonprofit and governmental sectors, the purpose of the thesis is to determine if balanced scorecard can assist in execution of the FIAR strategy to achieve the goal of asserting financial audit readiness by 30 September 2017. The analysis produced a strategy map and balanced scorecard which translated the FIAR strategy into practical objectives, performance measures, targets and initiatives. The thesis revealed that balanced scorecard can be used to assist in FIAR strategy execution, including recommendations provided to DoD leadership on ways to improve the FIAR plan.

KEYWORDS: Balanced Scorecard, Department of Defense, Financial Improvement and Audit Readiness, FIAR

AN ANALYSIS OF ADOPTING RADIO FREQUENCY IDENTIFICATION IN THE BRAZILIAN AIR FORCE UNIFORM SALES SYSTEM

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Co-Advisor: Susan K. Heath, Graduate School of Business and Public Policy

The Brazilian Air Force's uniform sales system (USS) is experiencing continuous sales growth in its points of sale at air-force bases and an intensive use of labor force in its operations, which have led the Subdirectorate of Supply (SDAB), the USS Central Organization to designate radio-frequency identification (RFID) as a viable option to improve USS operations, currently performed manually.

This project assesses the current state of USS processes, redesigns the processes considering the integration of RFID, and provides a cost-and-benefit analysis (CBA) of adopting the technology to contribute to SDAB's decision-making process and further studies. The scenario created where RFID is present, and the data (i.e., investments needed and time and operators utilized) gathered from the SDAB personnel who control and execute the tasks are the basis to assess the potential net benefit associated with the process change.

The CBA focuses on quantitative analysis by contrasting the costs necessary to implement RFID with the savings the technology may produce within the uniform sales system. The net present value (NPV) indicates that the RFID implementation intended by SDAB is sufficiently valuable to justify the investments.

KEYWORDS: Uniform Sales, Radio Frequency Identification, Cost-benefit Analysis, Net Present Value

MASTER OF BUSINESS ADMINISTRATION

BUDGETING FACILITIES OPERATION COSTS USING THE FACILITIES OPERATION MODEL

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B.S., United States Naval Academy, May 1999
Master of Business Administration–June 2011**

Co-Advisor: Daniel Nussbaum, Department of Operations Research

Co-Advisor: Raymond Franck, Graduate School of Business and Public Policy

The facilities-operation model (FOM) is used by the Office of the Deputy Undersecretary of Defense (Installations & Environment) to estimate annual facilities operation costs for the Department of Defense. This thesis analyzes the process by which the Department of the Navy forecasts facilities-operation costs and how ODUSD(I&E) uses the FOM for the same purpose. It then compares the two processes against historical data from Fiscal Year 2007–2010 to study how the DoN could use the FOM within the Program Objectives Memorandum (POM) development process. The results show the Navy would be well advised to continue its current methods to develop the POMs. The FOM is still in the process of development, and the methods used by the Navy today are providing more accurate, consistent forecasts for facility operations.

KEYWORDS: Facilities Operation Model, Base Operating Support

FINANCING NAVAL SUPPORT FOR HUMANITARIAN ASSISTANCE AND DISASTER RESPONSE: AN ANALYSIS OF COST DRIVERS AND CASH FLOWS

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Master of Business Administration–June 2011**

Co-Advisor: Aruna Apte, Graduate School of Business and Public Policy

Co-Advisor: Keenan D. Yoho, Graduate School of Business and Public Policy

The United States Department of Defense (DoD) does not budget for contingencies. The DoD does not set aside funds in the expectation of war, disaster, or other unexpected catastrophe, where obligation of those funds is contingent on the event actually occurring. This includes budgeting ahead for possible humanitarian assistance and disaster response (HA/DR) operations. Stability operations are now a core U.S. military mission, and humanitarian assistance and disaster response is one of six expanded core capabilities for the Navy, Marine Corps, and Coast Guard enumerated in *A Cooperative Strategy for 21st Century Seapower*. This represents a monumental strategic shift for an establishment traditionally defined by hard power assets.

This thesis uses a disaster categorization method based on size of the area affected and speed of disaster onset, and employs a multiple, flexible design case study method that analyzes incremental cost data from the responses to the 2004 Indian Ocean tsunami, the 2010 Haitian earthquake and the 2010 Pakistani floods. Costs are analyzed for both their timing and the associated functional service provided, and are presented in graphical format.

Despite the variety of HA/DR operations and the common belief that every disaster is different, this research identifies similarities in cost timing and function that exist across three of the four types of disaster. These findings provide insight into expected future demand, and highlight the functions that represent the greatest leverage points for future optimization.

KEYWORDS: Humanitarian Assistance, Disaster Response, Disaster Relief, HA/DR, Stability Operations, Cooperative Strategy, Oslo Guidelines, Overseas Humanitarian Disaster Assistance And Civic Aid, OHDA-CA, USAID, DART, OFDA, DSCA

MASTER OF SCIENCE

Aeronautical Engineering
Applied Mathematics
Applied Physics
Applied Science
Computer Science
Defense Analysis
Electrical Engineering
Engineering Acoustics
Human–Systems Integration
Information Technology Management
Mechanical Engineering
Meteorology and Physical Oceanography
Operations Research
Physics
Physical Oceanography
Program Management
Systems Engineering
System Engineering Management
Systems Technology

MASTER OF SCIENCE IN AERONAUTICAL ENGINEERING

ENVIRONMENTAL TESTING AND THERMAL ANALYSIS OF THE NPS SOLAR-CELL-ARRAY TESTER (NPS-SCAT) CUBESAT

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Second Reader: Marcello Romano, Department of Mechanical and Aerospace Engineering

This thesis describes the development of a working thermal model of the Naval Postgraduate School's first CubeSat, called NPS-SCAT, and the accomplishment of environmental testing that has been completed to date in preparation for space launch. The primary mission of NPS-SCAT is to act as a solar cell array tester (SCAT), providing data on solar cell performance of various solar cells in low earth orbit (LEO). As part of the satellite development process, a detailed test plan was developed and environmental modeling and testing were completed to test SCAT's ability to survive and function in the space environment. A thermal finite element model (FEM) was developed in NX-6 I-deas to analyze and predict the component thermal response to the space environment. Environmental tests, including thermal vacuum (TVAC) and vibration testing, have been completed using profiles determined by the expected launch and on-orbit conditions. The data obtained from these tests validated the thermal model and proved that SCAT would survive the launch conditions and could successfully operate in the space environment.

KEYWORDS: CubeSat, Solar Cell, Thermal Vacuum, Thermal Model, Testing, SCAT

MASTER OF SCIENCE IN APPLIED MATHEMATICS

PRIORITIZING UNAIDED HUMAN SEARCH IN MILITARY SIMULATIONS

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Second Reader: MAJ Paul F. Evangelista, USA, TRADOC Analysis Center

Search and target acquisition (STA) in military simulations is the process of first identifying targets in a particular setting, then determining the probability of detection. This study will focus on the search aspect in STA, particularly with unaided vision. Current algorithms in combat models use an antiquated windshield-wiper search pattern when conducting search. The studies used to determine these patterns used aided vision, such as binoculars or night-vision devices. Very little research has been conducted for unaided vision and particularly not in urban environments. This study will use a data set taken from an earlier study in Fort Benning, GA, which captured the fixation points of 27 participants in simulated urban environments. This study achieved strong results showing that search is driven by salient scene information and is not random, using a series of nonparametric tests. The proposed algorithm, using points of interest for the salient scene information, showed promising results for predicting the initial direction of search from the empirical data. However, the best results were realized when breaking the field of regard into a small number of fields of view.

KEYWORDS: Search and Target Acquisition (STA), unaided human search, points of interest (POI), ACQUIRE, Combat XXI

MASTER OF SCIENCE IN APPLIED PHYSICS

DYNAMIC MATERIAL PROPERTIES OF ORTHOTROPIC POLYMER AND MOLYBDENUM FOR USE IN NEXT-GENERATION COMPOSITE ARMOR CONCEPT

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Second Reader: Jose Sinibaldi, Department of Physics

Dyneema HB-25 is an orthotropic polyethylene fiber-epoxy matrix material that is being investigated for use in a next-generation, layered-armor concept. Dyneema was chosen due to its high variance in sound speeds in the through direction and along the fiber direction, thereby allowing it to be used as a wave-spreading layer in the armored-layer concept. The shock properties in the through fiber direction have been investigated using traditional window experiments and experiments using buffer materials at projectile velocities varying from 0.250 km/s to 1.800 km/s. The shock Hugoniot relationship was found to be nonlinear in the low-pressure regime that was investigated here.

The shock properties of polycrystalline molybdenum were also investigated specifically the sound speed at shock state stress level. The relationship between sound speed and stress can be useful in predicting phase changes within materials. The low pressure regime of these properties was investigated in order to provide anchor data for previous work completed on molybdenum.

KEYWORDS: Dyneema, molybdenum, Hugoniot, shock physics

THE DESIGN AND IMPLEMENTATION OF A SEMIAUTONOMOUS SURF-ZONE ROBOT USING ADVANCED SENSORS AND A COMMON ROBOT OPERATING SYSTEM

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B.S., University of Illinois, 2004

Master of Science in Applied Physics—June 2011

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B.S., Naval Academy, 2002

Master of Science in Applied Physics—June 2011

Co-Advisor: Richard Harkins, Department of Physics

Co-Advisor: Timothy H. Chung, Department of Systems Engineering

A semi-autonomous vehicle, MONTe, was designed, modeled and tested for deployment and operation in a surf-zone coastal environment. The MONTe platform was designed to use unique land based locomotion that incorporates wheel-legs (Whlegs) and a tail. Semi-autonomy was realized with data from onboard sensors and implemented through open source Robot Operating System (ROS), hosted on an Ubuntu Linux based processor. Communications via IEEE 802.11 protocols proved successful for data telemetry in line of site operations. Basic mobility and tail control of the platform was modeled in Working Model 2D. Field tests were successfully conducted to demonstrate mobility and semi-autonomous waypoint navigation. Future developments will look to improve the overall design and test water borne mobility, navigation, and communication.

KEYWORDS: Biologically Inspired, Robotics, Robot Operating System, Whleg, Autonomous, Amphibious

**GRANULAR MATERIAL RESPONSE TO DYNAMIC SHOCK COMPRESSION: A
STUDY OF SiO_2 IN THE FORM OF SAND AND SODA LIME GLASS BEADS**

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Master of Science in Applied Physics—June 2011

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Co-Advisor: Robert S. Hixson, Department of Physics

There is increased interest in the dynamic behavior of sand in scientific and engineering communities, due to its damaging mechanisms against armored military vehicles upon sudden acceleration from buried improvised explosive devices. NASA is also interested in the properties of sand as a stimulant for powdered planetary materials. This thesis develops experimental techniques to measure its dynamic response to shock impacts.

However, sand has widely variant compositions based on its geographic location and environmental conditions making it difficult to repeat experimental results. This research has examined the use of widely available commercial ‘technical sand’ composed of uniform sized, nearly spherical soda lime glass beads as a viable alternative for modeling sand. This allows for the repetition of experimental results independent of geographical location, thus providing a basis to better correlate and compare data between various focus areas of research.

The objective of this thesis was to establish/develop the required experimental setup and procedures that will account for the inherent difficulty of experimentation with this material due to their solid and fluid like properties. Additionally, the first several Hugoniot data points were measured for this technical sand at pressures below one GPa.

KEYWORDS: Sand, Soda lime, glass beads, Hugoniot, shock physics

MASTER OF SCIENCE IN APPLIED SCIENCE

AUTOMATING ASW FUSION

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Master of Science in Applied Science—June 2011

Advisor: James N. Eagle, Department of Operations Research

Second Reader: Alan R. Washburn, Department of Operations Research

This thesis examines ASW eFusion, an antisubmarine warfare (ASW) tactical-decision aid (TDA) that uses Kalman filtering to improve battlespace awareness by simplifying and automating the track management process involved in antisubmarine warfare (ASW) watchstanding operations. While this program can currently help the ASW commander manage uncertainty and make better tactical decisions, the program has several limitations. Commander, Antisubmarine Warfare Force U.S. Third Fleet/Commander, Task Force Three Four (CTF-34), seeks to use ASW eFusion's playback feature to reanalyze ASW missions by incorporating friendly (blue) submarine detections into historical target tracks generated by other ASW sensors. The problem is that, the program exhibits several system-timing problems when the operator attempts to insert time-late observation data. This thesis will evaluate ASW eFusion's problematic ability to handle time-late reports, prescribe working solutions, and investigate methods to improve the program's user interface for use on the tactical watch floor.

KEYWORDS: Kalman Filtering, Anti-Submarine Warfare, Thesis, Fusion

MASTER OF SCIENCE IN COMPUTER SCIENCE

THE IMPLICATIONS OF VIRTUAL MACHINE INTROSPECTION FOR DIGITAL FORENSICS ON NONQUIESCENT VIRTUAL MACHINES

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Master of Science in Computer Science–June 2011

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The use of virtualized servers is on the rise. This results in a need for better forensic analysis capabilities for these virtualized environments. One of the answers to that has been the development of virtual machine introspection tools. Virtual machine introspection is a relatively new technique that has some important implications for digital forensics. Since it is performed outside of the virtual machine, it can help to alleviate the observer effect that is often encountered when performing a live analysis. This thesis tests how these tools can work in a nonquiescent environment and shows that the tools tested are able to produce reliable results.

KEYWORDS: Virtual Machine Introspection, VMI, Virtual Machine, Forensics, Xen

ASSUMPTIONS, TRUST, AND NAMES IN COMPUTER SECURITY PROTOCOLS

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Master of Science in Computer Science–June 2011

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Second Reader: James Bret Michael, Department of Computer Science

A major goal of using any security protocol is to create certain beliefs in the participants. A security protocol will use techniques like cryptography to guarantee some things, but it will still require a participant to make assumptions about other things that the protocol cannot guarantee; such assumptions often constitute trust in other participants. In this thesis, we attempt to precisely identify the required assumptions of some example protocols. In the process, we find that we must consider the names that participants use to reason about each other. It turns out that naming is a complex topic with a rich body of philosophical work, and we apply some ideas from this work to the problem of identifying security protocols' required assumptions. Finally, we begin work on a mathematical model of protocols and beliefs to which a formal logic of belief could be applied. The model is left incomplete because of some unresolved problems with modeling belief caused by the design requirement that the model's elements have clear operational meanings. The solution of these problems is left as future work.

KEYWORDS: Computer security, protocol, assumption, belief, trust, naming

MASTER OF SCIENCE IN DEFENSE ANALYSIS

HOW VULNERABLE IS NIGERIA TO ISLAMIC EXTREMISM?

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Master of Science in Defense Analysis—June 2011

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Master of Science in Defense Analysis—June 2001

Advisor: Heather S. Gregg, Department of Defense Analysis

Second Reader: Jessica Piombo, Department of National Security Affairs

This thesis investigates the conditions under which a society endorses or is compliant with extremist ideology. Using social movement theory and literature on drivers of violent extremism, the thesis focuses specifically on the potential for religious extremism in Nigeria. Nigeria is particularly important because it is the most populated country in sub-Saharan Africa and it is where both Christianity and Islam, the world's two largest religions, converge. Nigeria also illustrates one of the clearest examples of religion being used politically and the potential for extremism that this presents. Examining Nigeria will test the specific conditions that make a state vulnerable to extremist ideology and offer insights into reducing the expansion of extremist religious groups within similar societies.

KEYWORDS: Nigeria, Social Movement Theory, Drivers of Violent Extremism, Islamic Terrorism

COOKING UP PSYCHOLOGICAL OPERATIONS: THE INGREDIENTS TO SUCCESSFUL PSYOP

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Master of Science in Defense Analysis—June 2011

Advisor: Heather Gregg, Department of Defense Analysis

Second Reader: John Arquilla, Department of Defense Analysis

Psychological operations (PSYOP) has been an integral part of U.S. military operations in times of war and peace. Using radio broadcasts, leaflets, loudspeakers, and other forms of media, the U.S. directs PSYOP towards the behavior of a target audience (TA), in order to influence their emotions, motives, and objective reasoning in support of the accomplishment of national aims and objectives. During war, tactical PSYOP is used to lower enemies' will to fight and ultimately lead them to surrender. Academics and practitioners have written a large body of literature over the last seventy years that addresses both successful and unsuccessful PSYOP. There has also been a large body of literature written about communication theory. What the literature fails to do is to address the importance between PSYOP and communication theory and how the relation between the two can cause an operation to be successful or unsuccessful. Drawing from communication theory literature, this thesis builds a model for evaluating PSYOP products during the development phase. The thesis then applies this PSYOP model to Psychological Operations during the 1950-1953 Korean War, in an attempt to identify the conditions under which PSYOP products are crafted and deployed successfully.

KEYWORDS: Psychological Operations, PSYOP, PSYWAR, Korea, Communication Theory

GOVERNING IN A POST-CONFLICT SOCIETY: SOCIAL FIT

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Master of Science in Defense Analysis—June 2011

Michael J. George—Lieutenant, United States Army

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Master of Science in Defense Analysis—June 2011

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Second Reader: Doowan Lee, DoD Contractor

The growing interconnectedness of nations through globalization, and the threat of international terrorism as a destabilizing force, has increased the international community's concern for stable governance in the developing world. In an era of globalization, with near instantaneous information flow, and a global court of international opinion, the options for governing a society in a post-conflict environment are limited. History is filled with rebellions, insurgencies, coups, invasions, and occupations, which result in regime change or some sort of post-conflict intervention by the international community. In each case, prior to conflict, there was an established order, or form of governance. After conflict a new order, or form of governance, has to emerge. In these societies a pre-conflict political and social order was disrupted, and a new post-conflict political and social order established. Ideally, the crafting of a new political and social order into effective governance requires the acceptance of the governed. As the United States remains committed to assisting nations with establishing governance and fostering stability, policy makers should consider the social acceptance of a post-conflict government by the people.

KEYWORDS: Governance, Stability, Society, Regime change, Post-Conflict, Intervention

FIGHTING NETWORKS: THE DEFINING CHALLENGE OF IRREGULAR WARFARE

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Master of Science in Defense Analysis—June 2011

Co-Advisor: John Arquilla, Department of Defense Analysis

Co-Advisor: Michael Freeman, Department of Defense Analysis

This study examines how networks fight, and how to counter networks. Networks, empowered by information technology, play a powerful role in many different aspects of social and organizational interaction. Notably, recent confrontations with networked opponents have strained the U.S. military, and produced time-intensive, brutally complex, and costly irregular warfare in Iraq and Afghanistan. The challenges that these fighting networks present require a close examination of how they fight, and most importantly, how to combat the threat they pose.

The primary purpose of this study is to examine the role of networks in irregular warfare, where they are central and prevalent. Regardless of its many forms, the most salient aspect of modern irregular warfare is the increasingly networked nature of the antagonists. Countering these opponents requires a detailed understanding of the organization, doctrine, methods, and information usage, which both empower networks and generate vulnerabilities.

This research generated a theoretical framework that draws on the rich bodies of knowledge that inform network theory, network-based operations, irregular warfare, organizational theory, and information strategy. Each of these theoretical areas provided hypotheses for identifying causal factors, which led to an understanding of how networks fight, and development of a systematic framework for countering them.

Comparative case studies focused on a cluster of networks engaged in irregular warfare, which served to test this framework. This cluster consists of three cases, each marked by "tough opponents," and network-based organizations operating in the information age: the Chechen separatists, Lebanese Hezbollah, and Al-

Qaeda in Iraq. Overall, this thesis advances theory in a way that provides a systematic understanding of how to counter networked opponents, while generating additional perspective about irregular warfare.

KEYWORDS: Network Theory, Network-Style Warfare, Netwar, Dark Networks, Organizational Theory, Irregular Warfare, Guerrilla Warfare, Counter-Terrorism (CT), Counter-Insurgency (COIN), Unconventional Warfare (UW), Hybrid Warfare, Asymmetric Warfare, Fusion, Swarming, Information Strategy, Intelligence

SHOULD THE UNITED STATES CREATE AN AMERICAN FOREIGN LEGION?

Brian Farrell—Major, United States Army

BBA, Eastern Michigan University, December 1998

Master of Science in Defense Analysis—June 2011

Advisor: Douglas Porch, Department of National Security Affairs

Second Reader: Heather Gregg, Department of Defense Analysis

The growing hostility and division between Islam and “the West” comes at a time when the United States and our allies need more than ever to secure vital national interests in the Middle East, to include energy resources, regional stability, and the suppression of terrorism. Our dilemma is that dispatching troops to the region has only increased hostility and fed the Islamist propaganda mill while confirming in the minds of many Americans and our allied populations that intervention in these regions is a counterproductive waste of blood and treasure. The United States needs to reduce its military footprint but at the same time maintain the ability to back its diplomacy with muscle. At present, our methods of securing our interests in the Middle East are confined to large Forward Operating Bases (FOBs) occupied by rotational units of U.S. Army Combat troops and Marines with little cultural knowledge and an operational focus. These large American forces are supplemented by Security Force Assistance (SFA) programs that are primarily conducted by U.S. Army Special Forces and counter-terrorist strategies focused on covert operations aimed at eliminating High Value Targets (HVTs)—that is, the leadership of Taliban and Al-Qaeda terrorist organizations. One partial solution to the problem of underperforming indigenous forces and an over emphasis on HVTs could be to create an American Foreign Legion. The establishment of a permanent force recruited among non-U.S. citizens and led by American officers might offer a flexible tool to allow the U.S. military to secure American interests in the Middle East, while establishing a smaller, more politically acceptable American security footprint. However, the obstacles to the creation of such a force are significant, not the least of which they go against American traditions of a society of equal opportunity, and those of the U.S. military where all soldiers serve on the basis of equality of treatment and status.

KEYWORDS: Foreign Legion, Surrogate Forces, Security Force Assistance

CREATING SOF NETWORKS: THE ROLE OF NATO SPECIAL OPERATIONS AS A TESTING GROUND FOR SOF INTEGRATION

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Master of Science in Defense Analysis—June 2011

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Second Reader: Hy S. Rothstein, Department of Defense Analysis

The North Atlantic Treaty Organization (NATO) Special Operations Forces (SOF) Headquarters and its predecessor the NATO SOF Coordination Center (NSCC) have made significant progress in special operations interoperability during its brief history. Despite the rapid progress, large gaps in communications, doctrine, intelligence sharing, equipment, and structure within NATO SOF units remain. The lessons learned from the past decade of persistent conflict and emergence of advanced communication capabilities offer an unprec-

edented window to analyze and enhance special operations interoperability within NATO and abroad.

This research analyzes what systems and procedures increase special operations interoperability among coalition special operations forces, interagency, and diplomatic partners to enhance combined operations. The overarching hypothesis proposes that special operations coalitions with high levels of camaraderie, social and technical networking, and the presence of common threats enable enhanced special operations interoperability and effectiveness in combined operations. These dynamics coalesce to produce the accelerants of trust, responsibility, and access that contribute to elevate coalitions from marginal levels of integration to become trusted special operations networks. Enhanced special operations interoperability serves as a catalyst to facilitate communication and effectiveness among military, law enforcement, diplomatic, and interagency partners collaborating against common asymmetric threats.

KEYWORDS: NATO SOF, NSCC, NSHQ, Military Networks, European Common Threats, NSTEP, BICES Network, SOF NET, SOCEUR, Afghanistan Special Operations, ISAF SOF, NSTI, Trusted Networks

HOW SHOULD SOF BE ORGANIZED?

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Co-Advisor: Erik Jansen, Department of Defense Analysis**

Special Operations Forces (SOF) today provide policy makers with Economy of Force and Expansion of Choice options. Unfortunately, not all countries are well positioned to capitalize on SOF as a strategic asset. Not all SOF organizations are appropriately structured at the national-level for the SOF system to be a whole that is greater than the sum of its parts. Organizational structure does matter. Against this backdrop, this thesis addresses: how military SOF should be organized to ensure that they can be an effective and relevant national instrument? To answer the question, the thesis examines four different organizational models used by SOF—Service-centric (Israel), National Military Staff Element (Norway), Component Command (France), and Service (Australia)—to elucidate their strengths and weaknesses. Implications are weighed and recommendations then made. These should be particularly pertinent to countries contemplating or having just begun to transform their SOF.

KEYWORDS: Special Operations Forces, SOF, Congruence Model, NATO SOF Study, Israel, Israeli SOF, Service-centric organization, Norway, NORSOE, National Military Staff Element, NMSE, France, French SOF, SO Component Command, Australia, Australian SOF, SO Service, organization design considerations.

PARTNERING WITH NIGERIA FOR A STABLE FUTURE: THE IMPORTANCE OF A PERSISTENT PRESENCE

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Master of Science in Defense Analysis—June 2011
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Master of Science in Defense Analysis—June 2011
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Second Reader: David Tucker, Department of Defense Analysis**

The purpose of this thesis is to examine how the spread of extremist groups can be curtailed throughout Northern Africa and, more specifically, how to stop Nigeria from becoming another Afghanistan. This thesis

will focus on how to engage an African government, specifically Nigeria, in order to help it engage in and develop the population. This thesis will demonstrate that one way to ensure the stability of weak states is to persistently provide security force assistance to the local government prior to the need to establish control over a populace through direct tribal engagement.

KEYWORDS: Nigeria, Persistent Presence, SOCAFR, Afghanistan, Kosovo, El Salvador, AQIM, Boko Haram, MEND

THE PROSPECTS FOR SINO-INDIAN RELATIONS 2020

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This thesis argues that territorial dispute, regional geopolitics, and economic competition, catalyzed by misperceptions, will ensure that Sino-India relations remain competitive in nature. However, the high costs of war, growing economic interaction, and the imperative for peaceful economic development will help keep the nature of competition to a pragmatic level through 2020. Worth noting is that nations engaged in pragmatic competition continue to factor in “the other” as a potential enemy for military planning purposes.

To stabilize pragmatism in Sino-India relations this thesis recommends a three pronged strategy for India: build trust; ensure credible deterrence; and, promote economic and regional cooperation. To be forthcoming without appearing weak must be India’s mantra.

KEYWORDS: China, India, International Relations, Analytic Eclecticism

CHANGING THE AFGHAN CYCLE OF CONFLICT FROM THE OUTSIDE, IN

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This study explores the cyclical nature of conflict in Afghanistan and the elusive condition of stability as coalition forces begin their anticipated drawdown in 2011, and complete transition of security to Afghan forces in 2014. Assuming that the basic societal elements of stability require a balancing of political, economic, and security structures to form a sense of national cohesion, this study seeks to determine if national cohesion is sufficient enough to break the cycle of conflict; and if so, what strategy with neighboring countries will foster this cohesion in order to disrupt the cycle of conflict? A regional approach is necessary to buttress any internal strategies attempted within Afghanistan; but to do so, the alliance of partner nations must first begin small and then grow from a strong central core. The core players in the region are Iran, India, and Pakistan, but the nature of their self-interested interactions has proven unprofitable and unsustainable in the long-term. To the

degree that these countries can be assisted to move beyond their self-interests, to form a cooperative regional alliance, then the goal of regional stability, as well as stability in Afghanistan, can become a reality.

KEYWORDS: Afghanistan, Regional Stability, Balance of Power, Karzai Dilemma, Transition, Regional Alliance, Pakistan, Iran, India, Game Theory, Afghan Security Forces, Shanghai Cooperation Organization, Economic Cooperation Organization

ATTACKING THE LION: A STUDY OF COHESION IN NAVAL SPECIAL WARFARE OPERATIONAL UNITS

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Why is it that some military organizations succeed and others do not? What characteristics elude unsuccessful fighting groups that successful ones are able to capture and translate into positive outcomes? The study of organizational theory and design spans the multiple typologies of organizational functions and forms. However, at the foundation of all groups are the individuals and the interaction of those individuals within the organization. Given this, the concept of unit cohesion can provide some insight in the search for discovering what makes organizations successful. Why study unit cohesion within Naval Special Warfare (NSW) operational units? The simple answer is because cohesion can increase performance and effectiveness. Prior to the last century, the concept of unit cohesion was based on the anecdotal observations of military commanders and historians. The rise of the fields of psychology and sociology led to an increase in the study and understanding of unit cohesion. This study utilizes survey research to investigate specific factors related to unit cohesion in NSW operational units and how they are related to current issues in the community. Ultimately, the impacts of these relationships provide a basis for recommendations intended to improve cohesion in, and overall effectiveness of NSW operational units.

KEYWORDS: Unit Cohesion, Naval Special Warfare, SEAL, Military Performance, Military Effectiveness, Special Operations Forces, Hardiness, Selection, Training, Leadership, Organizational Design

ACCOMPLISHING AMERICAN STRATEGIC GOALS IN THE MIDDLE EAST THROUGH PERSISTENT SPECIAL OPERATIONS

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As the war in Iraq draws to a close, the importance of U.S. indirect influence in the Middle East will increase. The large footprint of the U.S. military in the region since 2003 has proven unsustainable for the long term in terms of stress on the conventional Army, acceptability to the population of the Muslim world, and patience of

the American public. Further, this large-scale conflict, and the focus it has required, has diminished American ability to conduct indirect operations elsewhere throughout the U.S. Central Command area of responsibility (CENTCOM AOR). Thus, hostile networks have unrestricted access to the Middle East, which threatens U.S. interests and the stability of the region. Regional engagement provides a means to increase partner nation capacity as well as enhance indirect U.S. influence, but the program may not currently be achieving optimized, strategically significant gains that SOF have been able to achieve during other operations. This research seeks to examine how Special Operations Command Central (SOCCENT) might better conduct engagement through regionally coordinated persistent presence, and how to implement any suggested changes.

KEYWORDS: Special Operations Forces (SOF), Middle East, CENTCOM, SOCCENT, Security Force Assistance (SFA), phase zero, left of line, shaping operations, persistent presence, engagement, scalable options, Irregular warfare, OEF-P, Operation Enduring Freedom, Philippines, El Salvador, jihad, Iran, al Qaeda.

TARGETING: SOCIAL NETWORK ANALYSIS IN COUNTER IED OPERATIONS

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This research provides insights to commanders in the field for attack-the-network (AtN) operations in the fight against improved, explosive devices (IED). Established in 2006, the Joint Improved Explosive Devices Defeat Organization (JIEDDO) has spent billions to execute their operational mandate: defeat the device, attack the network, and train the force. JIEDDO has excelled in training and defeating the device, but lagged behind in providing information to facilitate attacks on network operations. JIEDDO created a Counter-IED Operation Integration Center (COIC), which provides analysis but utilizes metrics that are not necessarily intuitive. What commanders need instead is a clear understanding of what “attack the network” means in order to create lines of operations that undermine networks using IEDs. The goal of this thesis is to define attack-the-network, introduce social-network analysis, discuss how to apply social-relational information to operations, determine a targeted person’s relevance, provide operational commanders with a matrix to gain perspective on interactions of network members, and offer case studies on difficulties in network targeting.

KEYWORDS: Social Network, Counterterrorism, Attack-the-Network, Counter-IED, Leadership Targeting, Terrorist Network.

FINDING LAWRENCE: RECRUITING TALENT FOR UNCONVENTIONAL WARFARE

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From Francis Marion’s guerrilla war against the British to advising the resistance against the Nazis and Japanese, the United States has depended on unconventional warfare (UW) as a component of national defense. Today, the U.S. Army Special Forces (SF) is the premiere unconventional warfare unit in the U.S. military. With a smaller Army and increasing missions, SF must expand its recruiting efforts. This thesis analyzes the

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recruitment and selection process used by other units and finds four traits common to successful UW individuals: motivation, interpersonal intelligence, cross-cultural capability, and adaptability. SF recruiting is then examined to identify recommendations for targeting individuals who possess these traits, two of which are difficult to measure during selection—interpersonal intelligence and cross-cultural capability. A demographic profile of the Special Forces Regiment emphasizes shortfalls where more targeted recruitment may help. Through recruiter reorganization, establishment of a referral system, more accurate advertising, adoption of a long-term engagement strategy, and renewed leader involvement, SF recruiting can more effectively target those who already possess high UW potential. As it is paramount to find the right individuals for UW, targeted recruitment will help improve the short and long-term health of the Regiment.

KEYWORDS: U.S. Army Special Forces; Recruiting; OSS; SACO; Coastwatchers; SAS, U.S. Navy SEALs, Delta Force; SFAS; SORB

ESCALATION AND RESOLUTION OF BORDER DISPUTES AND INTERSTATE CONFLICTS IN AFRICA: THE MALAWI – TANZANIA CASE

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Border disputes cause strife worldwide, especially in underdeveloped countries. In Africa, border disputes are commonplace, and they produce bitter conflicts and tribulations.

This thesis investigates the border dispute between Malawi and Tanzania over Lake Nyasa. It argues that the protracted dispute is the result of inaction and poor leadership, rather than ‘colonial legacy.’ Using game theory, this thesis demonstrates that partial sum games produce the best path for resolving this border dispute through communication and cooperation. Furthermore, the thesis argues that the establishment of democracy and rule of law, responsible leadership, and strong political will should create the conditions for successful compromise between the two countries. Without a negotiated settlement, Malawi and Tanzania’s border dispute will continue to affect relations between the two countries and deplete natural resources in and around the lake.

KEYWORDS: Border Dispute, Riparian Rights, Escalation, De-escalation, Political Will, Payoffs, Nash Equilibrium, Resolution, Social Contract.

MILITARY INNOVATION IN THE RISE AND FALL OF GREAT POWERS: LESSONS FOR AMERICA

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A military’s ability to adapt its organization, doctrine, and technology strategy to meet the threats of its time influences the state’s capacity to maintain great power status. This thesis uses a historical overview of military innovation among great powers throughout history to draw lessons for the U.S. military today. In this heuristic analysis, it is determined that great powers that integrated between and among their various elements

of national power were able to maintain their positions better than those that did not. The study transitions from a descriptive to a prescriptive mode, concluding with the caution that, if the U.S. military does not begin to transform itself from a Cold War organization to an adaptable, resilient force for the future, it could hasten America's loss of global power. Measures that the U.S. military should take to innovate organizationally, doctrinally and in terms of technology strategy are prescribed. Finally, and most importantly, this study finds it essential to foster a climate and institutional culture receptive to innovation.

KEYWORDS: Great Power, Global Power, Military Innovation, Transformation, Military Organization, Doctrine, Military Technology

**THE UTILITY OF FREEDOM: A PRINCIPAL-AGENT
MODEL FOR UNCONVENTIONAL WARFARE**

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Second Reader: Kalev I. Sepp, Department of Defense Analysis

The conduct of warfare through proxies, also known as unconventional warfare, is a difficult feat for a nation to accomplish. The successful employment of surrogate forces depends to a significant degree on the relationships cultivated between the sponsor and the insurgent, and the various actors between the two. This thesis will examine the conduct of an Unconventional Warfare (UW) insurgency campaign from the perspective of Principal-Agent Theory. The case study examined will be Operation ST CIRCUS, the Central Intelligence Agency's (CIA) support for Tibetan insurgents from 1956 to 1974. The research will model the principal-agent dynamics of a UW campaign at the global, regional, and local levels, and will demonstrate the options available for the counter-insurgent to indirectly topple the insurgency by destabilizing the relationships between the principal and its agents. By applying Principal-Agent Theory concepts to UW, this research will provide a new model for the examination of potential UW campaigns, and potential methods for countering UW campaigns conducted by global adversaries against U.S. interests.

KEYWORDS: Tibet; China; CIA; Unconventional Warfare; Principal-Agent Theory; Agency Theory; Operation ST CIRCUS; Insurgency; Counterinsurgency

FIGHTING CORRUPTION IN MEXICO: LESSONS FROM COLOMBIA

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The elevated levels of violence seen recently in Mexico are not a sign of a worsening security situation in Mexico as the media would lead one to believe. Instead, they give witness that the Government of Mexico has implemented an unparalleled offensive against the deadly drug cartels. Despite the unprecedented assault against the cartels, cartel prevalence and violence is increasing when it should be decreasing. Drawbacks, such as widespread corruption within Mexican public agencies, have provided cartels with the flexibility to avoid functional elimination. The inability of the Government of Mexico to address the problem of corruption ef-

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fectively not only undermines the state's actions, but also encourages cartel influence. Similarly, Colombia has struggled against powerful drug cartels and other nefarious entities for nearly 60 years. Whilst the Government of Colombia struggled to target the criminal organizations, it was forced to tackle corruption, lack of security and other factors. The causal symptoms of Colombia's problems, while not identical to Mexico's, share several similarities identified through case studies and center of gravity analyses. Ultimately, lessons learned from Colombia's experience are scrutinized to determine their suitability for application in Mexico war against its powerful cartels.

KEYWORDS: Mexico, Colombia, Corruption, Drug Cartels, Illegal Drug Trade, Drug-Related Violence, Center of Gravity, Reform, Organized Crime, Transparency, Military Professionalization, FARC, Human Trafficking, Weapons Trafficking

MASTER OF SCIENCE IN ELECTRICAL ENGINEERING

SEGMENTED MIRROR TELESCOPE MODEL AND SIMULATION

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The Segmented Mirror Telescope (SMT) housed at the Naval Postgraduate School is a unique state-of-the-art optical instrument built to explore aggressive technologies needed for future space-based telescopes. This paper discusses a wavefront reconstruction technique developed at Lawrence Livermore National Laboratory using the Discrete Fourier Transform as applied to a hexagon aperture. This thesis also provides a Fourier domain implementation of a spatial-frequency modal controller for a simple spring-mass model of a deformable mirror surface. This technique avoids more difficult time-domain solutions. This method is computationally efficient and scalable to much larger multi-input multi-output systems than the SMT.

KEYWORDS: Space telescope, Segmented mirror, Adaptive optics, Wavefront reconstruction, Spatial-frequency modal controller, Multi-input Multi-output

THERMOPHOTOVOLTAIC ENERGY CONVERSION IN SUBMARINE NUCLEAR POWER PLANTS

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Thermophotovoltaic (TPV) cells allow for the direct conversion of infrared (IR) radiation to electricity, similar to when traditional solar cells are exposed to visible light. The objective of this thesis is the development of a computer model of a multi-junction TPV cell designed to absorb IR radiation from the primary fluid system of a naval nuclear reactor. This model is then used to determine the feasibility of using this TPV system as a supplemental source of electrical power on a next-generation nuclear submarine. The results of this simulation indicate that the design concept presented in this thesis is a viable option and warrants further consideration and research.

KEYWORDS: Thermophotovoltaic Cell, Nuclear Fission, Silvaco ATLAS, Modeling, Simulation, Indium Nitride, Indium Gallium Nitride, Indium Arsenide, Multi-junction

**MODELING AND ANALYSIS OF A CONSTANT POWER
SERIES LOADED RESONANT CONVERTER**

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Future Naval systems and ships are being designed with pulse power loads and hybrid electrical systems. There is a demand for efficient, reliable, and durable compact power converters to bridge pulse power systems with the electrical plants of the future. This thesis presents modeling and analysis of a constant power Series Loaded Resonant (SLR) converter. The modeling work presented was successfully implemented in Simulink and then prototyped in a small scale application in the laboratory. The Simulink model and prototype were tested under various conditions and may be used to reduce the risk in the design of future large scale applications.

KEYWORDS: Series Loaded Resonant Converter, SLR, Pulsed Power, Pulse Power, Capacitor Charging Power Supply.

COHERENT NOISE REJECTION IN A THREE-PHASE POWER INVERTER

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In this thesis, we discuss the design of a controller to reject the effects of high order harmonics in a three-phase power inverter. Specifically, coherent noise in the fifth harmonic is considered, as it seems to be dominant in most applications. The controller used in this power inverter operates in a reference frame synchronous with the 60 Hz line voltage. This transformation effectively changes the desired 60 Hz sine wave output into a DC value that has the same amplitude as the sine wave. The power inverter uses an optimal form of pulse-width modulation (PWM), called space vector modulation, which causes the harmonic noise.

In order to reject the distortions introduced by the space-vector modulation process, a linear quadratic Gaussian (LQG) controller is designed with the sinusoidal disturbances modeled as uncontrollable modes of the system, which are observable from the input and output signals.

The extra states in the state space model associated with the disturbance are estimated by the Kalman filter and subtracted from the control input to compensate for the disturbance.

KEYWORDS: Pulse Width Modulation (PWM), Linear Quadratic Regulator (LQR), Linear Quadratic Gaussian Controller (LQG), Coherent Noise Rejection

**AUTOMATIC TARGET RECOGNITION: STATISTICAL FEATURE
SELECTION OF NON-GAUSSIAN DISTRIBUTED TARGET CLASSES**

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Target and pattern recognition systems are in widespread use. Efforts have been made in all areas of pattern

recognition to increase the performance of these systems. Feature extraction, feature selection, and classification are the major aspects of a target recognition system. This research proposes algorithms for selecting useful statistical features in pattern/target classification problems in which the features are non-Gaussian distributed. In engineering practice, it is common to either not perform any feature selection procedure or to use a feature selection algorithm that assumes the features are Gaussian distributed. These results can be far from optimal if the features are non-Gaussian distributed, as they often are. This research has the goal of mitigating that problem by creating algorithms that are useful in practice.

This work focuses on the performance of three common feature selection algorithms: the branch-and-bound; the sequential, forward selection; and exhaustive-search algorithms. Ordinarily, the performance index used to measure the class separation in feature space involves assuming the data are Gaussian and deriving tractable performance indices that can be calculated without estimating the probability density functions of the class data. The advantage of this approach is that it produces feature selection algorithms that have low computational complexity and do not require knowledge of the data densities. The disadvantage is that these algorithms may not perform reasonably when the data are non-Gaussian. This research examines the use of information-theoretic class separability measures that can deal with the non-Gaussian case. In particular, this work shows that the Hellinger distance (a type of divergence) has very desirable mathematical properties and can be useful for feature selection when accompanied by a suitable density estimator.

The suitable density estimator for this research is the multivariate kernel density estimator. In selecting the best feature subset of non-Gaussian distributed features, results show that the Hellinger distance outperformed the other class separability measures in several instances highlighted in this report.

KEYWORDS: Feature Selection, Classification, Hellinger Distance, Kernel Density Estimation

MASTER OF SCIENCE IN ENGINEERING ACOUSTICS

TRANSFORMATIONAL ACOUSTICS APPLIED TO SCATTERING FROM A THIN ELASTIC SHELL

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We investigate the behavior of acoustic cloaks and design an acoustic cloak applied to a thin spherical shell. We begin by examining the acoustic pressure field scattered from a spherical object, consider limiting impedance situations for a homogeneous sphere, and a thin shell. This thesis focuses on acoustic cloaking theory. Our research concentrates on the application of the transformational acoustics method as a solution to model and characterize physical parameters and fields involved in an acoustics cloak parameterization. A trade-off between an elective cloak and a possible realizable metamaterial dictates the characterization of the anisotropic inertia and stiffness parameters for the cloak design. Two limiting acoustic metauids's properties are explored. Lastly, we analyze the performance of the acoustic cloak as applied to scattering from a spherical shell.

KEYWORDS: Pressure Scattering, Cloaking, Anisotropy, Acoustic Metauids, Pentamodes

MASTER OF SCIENCE IN HUMAN-SYSTEMS INTEGRATION

TRUST IN AUTOMATED SYSTEMS: THE EFFECT OF AUTOMATION LEVEL ON TRUST CALIBRATION

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Second Reader: LTC Robert L. Shearer, USA, Department of Operations Research

Automated systems perform functions that were previously executed by a human. When using automation, the role of the human changes from operator to supervisor. For effective operation, the human must appropriately calibrate trust in the automated system. Improper trust leads to misuse and disuse of the system. The responsibilities of an automated system can be described by its level of automation. This study examined the effect of varying levels of automation and accuracy on trust calibration.

Thirty participants were divided into three groups based on the system's level of automation and provided with an automated identification system. Within the Virtual Battlespace 2 environment, participants controlled the video feed of an unmanned aircraft while they identified friendly and enemy personnel on the ground. Results indicate a significant difference in the ability to correctly identify targets between levels of automation and accuracy. Participants exhibited better calibration at the management by consent level of automation and at the lower accuracy level. These findings demonstrate the necessity of continued research in the field of automation trust.

KEYWORDS: trust, calibration, automation, levels of automation

MASTER OF SCIENCE IN INFORMATION TECHNOLOGY MANAGEMENT

IMPLEMENTING JOINT BATTLESPACE AWARENESS ISR INTEGRATION CAPABILITY (JBAIIC) ARCHITECTURE: A CRIME- REDUCTION STRATEGY IN SALINAS, CALIFORNIA

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Planning, executing, and monitoring command and control (C2) is difficult to accomplish on many levels, yet much has been learned in terms of applying improved technology to achieve it. This knowledge seems directly transferable from the battlefield to any environment requiring improved C2. This thesis demonstrates how DoD information-technology architecture can be used to enhance C2 of a medium-sized urban police department (PD) struggling to reduce gang violence in the face of significant resource reductions. Using a field demonstration, researchers demonstrate how a common tactical picture (CTP) can improve officer effectiveness at the Salinas Police Department (SPD) in Salinas, California. Upon completion of the field demonstration, comparisons are made between the existing information and communications architecture of SPD and a baseline Joint Battlespace Awareness ISR Integration Capability (JBAIIC) testbed architecture to identify capability gaps that limit SPD's ability to more effectively combat violent crime. Based on this analysis, a technology implementation plan (TIP) is created, identifying courses of action available to SPD so that current and upcoming technological initiatives can be properly implemented—and potentially transferred to other municipal law-enforcement agencies needing to extend their own their limited resources.

KEYWORDS: Information Technology, Technology Integration, Common Operational Picture (COP), Common Tactical Picture (CTP), Enterprise Architecture, Situational Awareness (SA), Computer Aided Dispatch, Predictive Policing, Police, Blue Force Tracking, gang violence and crime reduction.

MASTER OF SCIENCE IN MECHANICAL ENGINEERING

STRING STABILITY OF MULTIPLE SURFACE MARINE VESSELS

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The phenomenon of string instability is well known in the context of a platoon of cars moving forward in an automated highway system (AHS). It is also known that ships can experience a similar instability phenomenon from mis-coordination of guidance and control laws. The proposed research studies the latter phenomenon, generalized in the case of multiple marine, surface vessels moving in a platoon. The question of how it is possible for ships traveling in formation to exhibit the phenomenon of string instability is answered. Moreover, we examine under what conditions this phenomenon can be exhibited, as well as how it can be prevented.

KEYWORDS: String stability, Platoon, Surface marine vessel, Path control, Control law, Guidance law, Eigenvalues, Damping ratio, Natural frequency

ELECTROCHEMICAL STUDIES OF PASSIVE FILM FORMATION AND CORROSION OF FRICTION STIR PROCESSED NICKEL ALUMINUM BRONZE

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Second Reader: Luke Brewer, Department of Mechanical and Aerospace Engineering

The Navy currently uses nickel-aluminum bronze (NAB) for its propellers. Friction-stir processing (FSP) is a proposed method of improving the mechanical properties of NAB and it is believed to improve the corrosion-resistant properties of NAB. This thesis used multiple techniques to compare the corrosion resistance of as-cast NAB with FSP NAB. Passive films were grown on the as-cast (AC) and FSP samples and modeled in order to relate the impedance data to changes in phase and microstructure resulting from FSP of NAB. Impedance modeling provides a way of measuring the passive film that forms on a metal and protects it from corrosion. In addition, cyclic polarization data was taken in order to study the stability of the films over a range of potentials. This data was then compared with SEM images to link the changes in the passive films with the changes in microstructure that occurred due to FSP.

KEYWORDS: Friction Stir Processing, Nickel Aluminum Bronze, Propeller, Corrosion, Passive Film Formation

**LASER PEENING FOR MITIGATION OF STRESS CORROSION
CRACKING AT WELDS IN MARINE ALUMINUM**

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Master of Science in Mechanical Engineering–June 2011

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Second Reader: Joseph C. Farmer, Lawrence Livermore National Laboratory

This work examines the use of laser peening (LP) for mitigation of stress corrosion cracking (SCC) in marine grade aluminum alloys (Al-Mg). These alloys can be sensitized during welding and will develop a tensile residual stress in the heat affected zone that may promote SCC in a salt water environment. Metal inert gas welded aluminum alloy 5083 (4.8wt% Mg) plate was laser peened using a variety of laser intensities to create compressive stresses. Mechanical tests were performed to investigate the SCC of the material including slow strain rate testing and potentiostatically driven, salt-water exposure. Microstructural and micromechanical tests were performed to characterize the effects of LP on the microstructure of the material. The slow strain rate testing showed a systematic decrease in ductility with increasing LP intensity. The fracture surfaces on all welded samples were indicative of ductile fracture but with a pre-crack length that scaled inversely with LP intensity. The hardness of the material increased with LP intensity. This work suggests that welded aluminum alloy 5083 does not readily stress corrosion crack. LP does affect the mechanical behavior of the material, but its full effect on stress corrosion behavior requires further study.

KEYWORDS: Stress Corrosion Cracking, Laser Peening, 5083 Aluminum Alloy

**EFFECT OF ANNEALING ON THE PASSIVE FILM STABILITY AND CORROSION
RESISTANCE OF NEW FAMILIES OF IRON-BASED AMORPHOUS METALS**

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Iron-based amorphous metals have incredible strength and hardness, and with the addition of alloying constituents, can also be formulated to have exceptional corrosion resistance. Compositions of several iron-based amorphous metals have been published, including several with very good corrosion resistance. The benefits of chromium, molybdenum, and tungsten on corrosion resistance has been previously studied and documented, however little is known about other alloying constituents and their effect upon devitrification and corrosion resistance. The compositions explored in this thesis research are the SAM40 base alloy and variations including systematic additions of nickel, yttrium, and titanium. Nickel is added to improve both mechanical properties and corrosion resistance. Yttrium is added to lower the critical cooling rate, thereby making the metallic glass easier to create and more stable once formed, thus improving the corrosion resistance. Adding titanium will enable the formation of an extremely stable protective titanium oxide film on the alloy's surface, which could enhance the corrosion resistance. Through x-ray diffraction and corrosion analysis, the effects of these alloy additions on the devitrification and corrosion resistance of this new class of amorphous metals have been quantified.

Keywords: Bulk Metallic Glass, Amorphous, Devitrification

MASTER OF SCIENCE IN METEOROLOGY AND PHYSICAL OCEANOGRAPHY

EQUILIBRIUM TRANSPORT IN DOUBLE-DIFFUSIVE CONVECTION

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This study examines mixing characteristics of double-diffusive convection for a wide range of fluids. Our approach involves direct numerical simulation (DNS) utilizing de-aliased pseudospectral method. To expedite these simulations, the numerical algorithm was parallelized using message-passing interface (MPI) calculations in both two and three dimensions. A theoretical model of equilibrium double-diffusive transport is presented, which emphasizes the role of secondary instabilities of salt fingers in saturation of their linear growth. Theory assumes that the fully developed equilibrium state is characterized by the comparable growth rates of primary and secondary instabilities. This assumption makes it possible to formulate a simple and efficient algorithm for computing diffusivities of heat and salt as a function of the background property gradients and molecular parameters. The model predicts that the double-diffusive transport of heat and salt rapidly intensifies with decreasing density ratio. Fluxes are less sensitive to molecular characteristics, mildly increasing with Prandtl number (Pr) and decreasing with diffusivity ratio (τ). Theory is successfully tested by a series of direct numerical simulations which span a wide range of Pr and τ .

Double diffusion occurs on the micro-scale and computer technology is just now reaching the processing speeds needed to fully resolve this complex phenomenon in three dimensions. In addition to the well-known “salt fingering” within the oceans, double diffusion occurs in many other statically stable regions, both terrestrially and beyond our atmosphere. Understanding this phenomenon could prove essential as we continue to discover new worlds and new areas within our galaxy, including here on terra firma.

KEYWORDS: Salt Fingers, Double Diffusion, Double-Diffusive Convection, Heat Flux, Salt Flux, Prandtl Number, Prandtl, Diffusivity, Diffusivity Ratio, Growth Rate Balance, Salt Finger Growth Rate, Thermohaline, Diffusive Convection, Buoyancy, Ocean Circulation, Ocean Convection, Turbulent Mixing

MASTER OF SCIENCE IN OPERATIONS RESEARCH

IMPROVING THE INTEGRATED TRAINING CENTER (ITC) MODEL TO ACHIEVE MORE ACCURATE TIME TO TRAIN ESTIMATES

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Master of Science in Operations Research—June 2011

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Second Reader: Thomas Lucas, Department of Operations Research

The F-35B Joint Strike Fighter is critical to the future of Marine Corps fixed-wing aviation. The ability to man the Joint Strike Fighter with properly trained pilots is as important as the development and acquisition of the aircraft itself. This thesis examines the Integrated Training Center (ITC) Model, which simulates the training process in order to determine expected time to train for Marine pilots trained at Eglin Air Force Base, Florida. First, we demonstrate that weather is an important factor in the Integrated Training Center model. Legal and financial constraints restrict modification of the ITC Model, so we create a replica that is statistically similar to the flight management process found in that model. We then modify the replica model to more accurately reflect reality.

This improved model uses a continuous-time Markov process to model weather. We show that the independent weather assumption in the ITC model is inappropriate. We recommend modifying the ITC model to reflect good weather as a resource necessary to conduct a flight, and one that is only intermittently available. Ultimately, these tools will be provided to decision makers so that they may implement these changes to make better decisions.

KEYWORDS: Joint Strike Fighter, Integrated Training Center, Weather, Pilot Training, Time to Train, Continuous Time Markov Process, Nearly Orthogonal Latin Hypercube

AN EXPLORATION OF THE COMMUNICATIONS ENVIRONMENT WITHIN THE SYSTEM OF SYSTEMS SURVIVABILITY SIMULATION (S4)

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The U.S. Army is transforming into a network-centric modular force. Developed by the Army Research Laboratory's Survivability/Lethality Analysis Directorate, in conjunction with New Mexico State University's physical-science laboratory, the System of Systems Survivability Simulation (S4) is a detailed, agent-based, Monte Carlo simulation designed to conduct survivability, lethality, and vulnerability assessments of military platforms connected via communications networks to other platforms on the battlefield. This thesis explores key parameters that make up S4's communications environment, using design of experiments and data farming tools to determine if any or all are having unintended interactions.

This thesis concludes that the explored parameters generally perform as intended, decreasing or increasing communication performance as the environment becomes respectively more or less restrictive. However, the

level of influence of the parameters varies greatly, questioning either the level of realism to how the parameters are modeled or their necessity to the simulation.

In addition, the variation across input settings and replications demonstrates the value of being able to efficiently explore multiple factors and take many replications. As a pilot study, these results and methodology pave the way for enhanced analytical capability with S4 and its continued verification, validation, and accreditation.

KEYWORDS: System of Systems, S4 System of Systems Survivability Simulation, Design of Experiments, Nearly Orthogonal Nearly Balanced Mixed Design, Survivability Lethality and Vulnerability Assessment, Communications Environment

OPTIMIZING MARINE SECURITY GUARD ASSIGNMENTS

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The Marine Corps Embassy Security Group (MCECG) assigns 1,500 Marine Security Guards (MSGs) to 149 embassy detachments annually. While attempting to fulfill several billet requirements, MCECG strives to balance MSG experience levels at each embassy detachment and assign MSGs to their preferred posts. The current assignment process is accomplished manually by three Marines and takes more than 6,000 hours per year.

This thesis presents the Marine Security Guard Assignment Tool (MSGAT). MSGAT is an Excel-based decision support tool that utilizes a system of workbooks to guide MCECG through a streamlined data collection and provide optimal assignments. MSGAT assignments result in a higher satisfaction when compared with manual assignments. MSGAT has had an immediate and quantifiable impact on the assignment process. It has reduced person-hours by 80%, increased overall assignment quality and efficiency, and improved the operational readiness of MCECG by optimizing MSG assignments..

KEYWORDS: Manpower Planning, Optimization, Personnel Assignment, Marine Security Guard, Integer Linear Program, Decision Support Tool, Marine Security Guard Assignment Tool, MSGAT, Marine Corps Embassy Security Group, MCECG

IMPROVING THE ENHANCED COMPANY FIRE SUPPORT TEAM

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This research explores the affects of current and proposed changes to equipment, doctrine, and training on the effectiveness of the fire-support process in Enhanced Company Operations (ECO). ECO envisions restructuring the Marine Air Ground Task Force around companies rather than battalions. The fire support element of the rifle companies is the fire-support team (FiST).

The researcher uses an agent-based model to develop data on the frequency and duration of contacts with enemy forces. Subsequently, it uses a deterministic fatigue model to gain insight into the effects of various rest policies over a set of noise factors. Finally, the research uses the data gathered from the agent-based and fatigue models to populate a discrete-event model. This model represents the fire-support process. It also uses

a nearly-balanced, nearly-orthogonal Latin hypercube to create the design of experiment, in conjunction with an orthogonal Latin hypercube to model noise factors.

Analysis of the results of the discrete-event model suggests that authority to clear fires needs to be pushed down to the FiST from higher levels. Further analysis demonstrates that technological aids to the FiST are not as important as suspected.

KEYWORDS: Nearly-Balanced Nearly-Orthogonal Latin Hypercube, Fire Support Team, FiST, Fatigue Modeling, Discrete-Event Models, Agent-Based Models, Enhanced Company Operations, ECO, Distributed Operations, DO, MANA, Simulation, Design of Experiments, DOE, Department of Energy, Marine Air Ground Task Force

**MODELING THE PROJECT CAPACITY
OF THE SACRAMENTO DISTRICT ARMY CORPS OF ENGINEERS**

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Every year, the Sacramento district of the United States Army Corps of Engineers must submit an estimate of its available project capacity for input to the president's budget request. Currently, the district estimates this amount based on past experience and regression analysis on limited data. We develop a project capacity and leveling model for the Sacramento District Office. We use historical data provided by the Sacramento district from 2009 to 2011 to build and test the mixed-integer linear programming model. The model assists the district with estimating its capacity for additional work for budget submission.

Results of the model show the effects of allowing projects to shift forward or back in time in the schedule and adding project work on employee utilization, contractor utilization, and leveling monthly project work. We recommend expanding the model with more detailed resource requirements for each project to identify for the Sacramento district where to allocate its scarce resources to achieve the best effects for total project portfolio management.

KEYWORDS: Project Management, Project Portfolio, USACE, Mixed Integer Linear Program, Sacramento District Office, Capacity, Budget, U.S. Army Corps of Engineers

**AGENT-BASED SIMULATION AND ANALYSIS OF A DEFENSIVE
UAV SWARM AGAINST AN ENEMY UAV SWARM**

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Master of Science in Operations Research–June 2011

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Unmanned systems, including unmanned, combat aerial vehicles (UCAVs), are increasingly important in military operations. Given the growth of unmanned systems technology worldwide, these systems may increasingly pose a real threat to U.S. and allied forces in the near future.

This thesis proposes a future concept of employing a defensive UCAV swarm, launched from a friendly sea-based platform. To simulate this defensive swarm system, an agent-based simulation model was developed, and appropriate designs of experiments and statistical analyses were conducted.

The investigated factors were drawn from the literature review to create several experimental designs with the objective of identifying the significant design factors of the blue UCAV system. The result of the analysis shows that only five of the eleven candidate factors analyzed are significant, which can be used to inform the engineering specification of preliminary requirements for potential future development.

KEYWORDS: UAV, UCAV, UAV Swarm, Agent-based simulation, Repast Symphony

A PRINCIPAL-AGENT PERSPECTIVE ON COUNTERINSURGENCY SITUATIONS

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Master of Science in Operations Research-June 2011

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Second Reader: Michael Atkinson, Department of Operations Research

The successful conclusion to the war in Afghanistan necessitates an array of solutions that includes non-kinetic actions. In particular, there is growing interest in having the local population take control of the regional security, providing protection from external threats as well as internal sources of violence. In this thesis, the principal-agent paradigm is used to model the relationship between coalition forces (principal) and local tribes (agents). These relationships are affected by the lack of alignment among the principal and the agents, and self-interest of the agents. To achieve the desired alignment, the principal must provide incentives to the agents. Two possible scenarios are considered: The simplest where the agents do not have private information and their actions can be verified.

This scenario is used to determine a baseline for the transfers offered by the principal. The second—and more realistic—scenario captures the principal's lack of knowledge about the actions taken by the agents. The last model provides qualitative insights about the cost to the principal due to unknown information.

KEYWORDS: Principal-Agent Model, Agents, Principal Counterinsurgency, Afghanistan, Tribe, Coalition Forces

OPTIMIZING LOGISTICAL PLANNING FACTORS FOR FUEL RATE CONSUMPTION WITHIN THE FIFTH FLEET AREA OF RESPONSIBILITY

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Second Reader: Ronald D. Fricker, Jr., Department of Operations Research

The purpose of this thesis is to determine if the NWP 4-01.2 or the current “On Station” planning factors within RASP provide adequate estimates of fuel consumption within FIFTHFLT for seven classes of naval warships, or would fleet planners be better served with our newly computed “GeoRegion” planning factors. The analysis concludes the NWP and the “On Station” planning factors overestimate actual fuel consumption within the FIFTHFLT AOR. The “GeoRegion” planning factors proved to be more efficient and provided a more effective optimization of RAS deliveries. There were fewer RAS events using the new planning factors, reducing JP5 hits from 50 to 45 and DFM hits from 50 to 43. There was also a substantial decrease in the number of 4-hour periods the warships spent below 50% fuel capacity.

KEYWORDS: Navy Logistics, Maritime Planning Factors, Fuel Consumption, Fifth Fleet, Optimization

**THE UNITED STATES ARMY'S MULTI-PERIOD OPTIMAL
READINESS ALLOCATION MODEL**

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Advisor: P. Lee Ewing, Department of Operations Research

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The U.S. Army has undergone unprecedented change in the last decade, completing an organizational transformation and redesigning its deployment policies. These changes and other factors have resulted in an increase of 107% in equipping requirements between 2003 and 2011, forcing the Army to update its equipping policies. We develop the “multi-period optimal readiness allocation model” (MPORAM) to maximize unit equipment readiness across the force over several years. MPORAM extends an earlier single-period model to account for the dynamic nature of unit priorities, budget, and other factors that vary over the planning horizon.

Using a small test case we observe that MPORAM distributes and/or transfers equipment in anticipation of future demand needs. For example, if one unit cannot improve its readiness in one time period, MPORAM focuses on improving other units's ratings, if possible, regardless of their priorities. Using two realistically-sized cases we observe that the multi-period solution does not differ notably from the single-period solution. Thus, we cannot make any strong conclusions about the added value of MPORAM in these cases. However, these results are strongly influenced by a large gap between supply and demand, and we expect MPORAM to improve the single-period solution in more balanced cases.

KEYWORDS: Unit Equipment Readiness, Equipping Policy, Deployment Policy, Optimization, Time-Phased Models, Multi-Period Optimal Readiness Allocation Model, MPORAM, Unit Ratings

**ASSESSING THE ACCURACY OF MARINE CORPS RESERVE ACTIVE-DUTY DATES
WITHIN THE DEFENSE ENROLLMENT-ELIGIBILITY REPORTING SYSTEM**

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Second Reader: Kris Hoffman, DoD Contractor, Defense Manpower Data Center

The Defense Manpower Data Center (DMDC) is charged with collecting, maintaining, and reporting information on over 42 million people currently and previously connected to Department of Defense. Personnel information is provided by each of the United States uniformed services to be passed to the Personnel Data Repository (PDR) to update members' records in the Defense Enrollment Eligibility Reporting System (DEERS). Records are used to support benefits provided to the members and their families including medical, dental, educational, and life insurance while they are fulfilling their service and after retirement.

This research identifies issues with overlaying active duty periods in the PDR; uses statistical data analysis techniques to determine the accuracy of the data fields within the PDR; and provides guidelines for the application of active duty periods to a member's record. This research: (1) maps all active-duty date source submissions that modify PDR records for Marine Reservists; (2) determines the business rules for applying changes to active duty date fields and recommends changes; (3) assesses and quantifies data quality of Marine Reservist active duty dates; and (4) makes recommendations for a continuous improvement methodology that the DMDC can implement for the other guard and reserve component data.

KEYWORDS: Defense Manpower Data Center, DMDC, Personnel Information, United States Marine Corps

Reserve (USMCR), Marine Corps Total Force System (MCTFS), Defense Enrollment Eligibility Report System (DEERS)

COUNTER-PIRACY ESCORT OPERATIONS IN THE GULF OF ADEN

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Master of Science in Operations Research—June 2011

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Second Reader: Jeffrey Kline, Department of Operations Research

Increased pirate activity in the Gulf of Aden (GOA) has gained the attention of the international community, and many countries are engaged in counter-piracy operations to protect vulnerable shipping and provide humanitarian aid. In February 2009, the Internationally Recommended Transit Corridor (IRTC) was established in order to introduce safer and more organized passage for all merchant vessels transiting the GOA.

This thesis uses simulation to identify the key factors involved in escorting vulnerable shipping through the Gulf of Aden (GOA). Specifically, a scenario in which a group of merchant ships travels under escort of a warship is modeled using an agent-based simulation environment. Using state-of-the-art experimental designs, over 300,000 counter-piracy escort missions are simulated and analyzed.

The results indicate that convoys are most successful when they contain fewer than fourteen merchant ships, travel at speeds greater than 18 knots, position the warship in front or on the flank of the convoy, and identify pirates at a range of no less than 4 kilometers. It is found that three or more pirate vessels are especially difficult to counter, as are pirates travelling at speeds greater than 39 knots.

KEYWORDS: Piracy, Internationally Recommended Transit Corridor, IRTC, Gulf of Aden, GOA, Agent-Based Models, MANA, Design of Experiments, Data Farming, Nearly Orthogonal Nearly Balanced Mixed Designs, Robust Designs, Modeling, Simulation, Counter-Piracy Escort Missions, Convoy Placement, Modeling and Simulation

**BUYING HEARTS AND MINDS: MODELING POPULAR SUPPORT DURING
AN INSURGENCY VIA A SEQUENTIAL VOTE-BUYING GAME**

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Master of Science in Operations Research—June 2011

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The population plays a crucial role in the outcome of an insurgency. The government needs intelligence from the population to effectively target and defeat the insurgents. In this thesis, we adapt a vote-buying model from political science to the insurgency context to analyze the level of intelligence the population will provide to the government.

The model is a two-player sequential game in which both the government and insurgents can “pay” individuals for their support. These payments can take the form of direct bribes or the provision of benefits, such as building schools and roads. In the model, an individual supports the government by providing it with intelligence.

We specify the optimal payment strategy for the insurgents and the government and determine how much support the government will receive. In an extension to the base model, we allow the insurgents to use coercion as a means to deter individuals from supporting the government. Our analysis illustrates that coercion can be an effective tool for the insurgents in some situations but may backfire in others.

KEYWORDS: Intelligence, Population, Insurgency, Hearts and Minds, Vote-Buying Model, Counterinsurgency, Game Theory, Coercion, Two-Player Sequential Game

MASTER OF SCIENCE IN PHYSICS

TRANSIENT BEHAVIOR OF LIGHT-EMITTING ELECTROCHEMICAL CELLS

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Master of Science in Physics—June 2011
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Co-Advisor: Nancy M. Haegel, Department of Physics

Recent prototypes of the individual identification, friend-or-foe (IIFF) patch use a light-emitting electrochemical cell (LEC) as the emitter. This research characterizes the transient behavior of LECs by measuring transient capacitance. The transient capacitance data are important to improve understanding of the underlying physics describing the operation of the LEC.

The research goal was to make the first transient measurements of an LEC's capacitance as a function of temperature and bias, while simultaneously measuring the transient light output and current, to monitor *in-situ* junction formation inside an LEC. Capacitance changes varying from 5-30 nF are measured, depending on applied voltage and device temperature. Strong temperature dependence of the rate of change of capacitance suggests Arrhenius-type behavior associated with ion motion with an activation energy of ~ 1.27 eV. The initial rate of change of capacitance is faster than the rate of change of light and current, suggesting that modification of the field near the contacts plays a key role in controlling free carrier injection. Initially capacitance increases monotonically upon application of bias, however, at longer times decreasing and even oscillating capacitance has been observed. This behavior provides new information on the dynamics of ion motion and carrier injection in LECs.

KEYWORDS: Transient, Capacitance, Junction, Arrhenius-type Behavior, Rate of Change, Ion Motion, Carrier Injection

REMOTELY TRIGGERED, SOLAR-BLIND SIGNALING USING DEEP ULTRAVIOLET (UV) LEDS

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Second Reader: Richard M. Harkins, Department of Physics

The purpose of the triggered individual identification, friend-or-foe (IIFF) patch is to covertly reduce fratricidal incidents and provide related remotely triggered marking or signaling capability. This research extended previous work by evaluating solar-blind UV light emitting diodes (LEDs). Due to the zero-background condition ("solar blind") from 200 to 280 nm, use of a UV source in this 80 nm window can be used to create a triggered IIFF patch that works both day and night. Additionally, due to the strong wavelength dependence for scattering reactions in air, UV light may provide a means to accomplish non-line-of-sight (NLOS) signaling.

The goal of this research was to develop a working prototype of a triggered IIFF device that can be seen from a distance of 1 km, either day or night, and explore the possibility of using this device to perform NLOS signaling. Results will be presented demonstrating prototype performance in a field exercise, as well as the device characterization required to define and optimize the prototype design. Device characterization included

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measurements of LED intensity as a function of driving current and voltage and the determination of LED performance parameters outside the standard operating specifications.

KEYWORDS: Solar blind ultraviolet, Fratricide, Intensity

MASTER OF SCIENCE IN PHYSICAL OCEANOGRAPHY

LARGE-SCALE COHERENT FLOW STRUCTURES IN A NATURAL BRAIDED REACH SECTION OF A GRAVEL-BED RIVER

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Second Reader: Edward Thornton, Department of Oceanography

Stream-wise length scales of coherent flow structures were examined to test the hypothesized 2 to 6 times the depth scale in relatively deeper (~ 1 m) and faster (~ 1.5 m/s) flows in a braided reach of the Kootenai River, Idaho. Velocities were measured using a custom acoustic Doppler current profiler, an array of six electromagnetic current meters, and an acoustic Doppler velocimeter in a variety of river depths (0.6–1.7 m) and velocities (0.3–1.6 m/s). Energetic (50% of total energy), coherent (along the array), low-frequency (< 0.05 Hz) motions were found for all deployment locations. Coherent times and lengths were 5 s and 10 m in the ~ 1.5 m/s flows and 45 s and 22 m in the ~ 0.5 m/s flows. Multi-resolution decomposition provided coarse low-frequency limit for the coherent motions and suggests the temporal scales range from 10 to 1000 s. Length scales of the low-frequency motions determined by frequency-wavenumber spectra indicate that the motions are longer than hypothesized. The coherent times and lengths were consistently less than the computed time and length scales, suggesting the energetic, low-frequency motions evolve as they propagate downstream.

KEYWORDS: Coherent Flow Structures, Gravel-Bed River, River Turbulence, Frequency-Wavenumber Analysis, Multi-Resolution Decomposition

MASTER OF SCIENCE IN PROGRAM MANAGEMENT

INCREASING RESPONSIVENESS OF THE ARMY RAPID-ACQUISITION PROCESS: THE ARMY RAPID-EQUIPPING FORCE

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Support Advisor: Robert Beckman, DoD Contractor

This joint applied project examines the US Army Rapid-Equipping Force (REF) processes, practices and lessons learned for fulfilling emerging urgent needs in the current overseas contingency operations (OCO). It compares Army rapid-acquisition policies and processes to the execution of a traditional urgent materiel release (UMR) program to identify opportunities to improve the responsiveness of rapid acquisition programs executed by traditional program management offices.

The project establishes a baseline and analyzes the implications of existing policies, processes, and practices for executing rapid-acquisition programs. It draws conclusions and offers recommendations for continuing improvements towards a more modern and responsive rapid acquisition process. The findings indicate that the Army REF is adapting and evolving processes to better respond to the urgent needs of its operational commanders and the warfighter that can be applied by traditional acquisition organizations.

KEYWORDS: Rapid Acquisition Initiative, Army Rapid Acquisition, Rapid Equipping Force, REF, acquisition process, JRAC, Capabilities Development for Rapid Transition, CDRT, Mission Based Test and Evaluation, MBTE, Forward Operational Assessment, FOA

EMBEDDED TRAINING AND THE TRAINING REQUIREMENTS FOR THE ABRAMS MAIN BATTLE TANK

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The Abrams tank has had an operational-requirements document (ORD) requirement for embedded training (ET) since 1994 and has successfully demonstrated the capability as early as 2001. The most challenging aspect of implementing ET has been to get the Abrams combat-development community (user) and materiel-development community (product manager) to equally consider the need for ET among competing combat capability. The need and priority for embedded training has not been effectively conveyed. Due to the interpretations of embedded training requirements, the direction to PM Abrams to implement embedded training

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has been weak at best, while the perceived user need for ET continues to grow. Since the technology has been demonstrated, the combat developer has begun to understand the capability and more effectively define the desired state (how they would use it and its benefits). Furthermore, the Army's style of fighting has changed; therefore, the Army's method of training must also change. Embedded training should be recognized by the materiel developer as an essential training tool necessary to keep soldiers's skills sharp in the changing training environment.

KEYWORDS: Embedded Training, Abrams Main Battle Tank, Army Requirements

THE DEPARTMENT OF DEFENSE SMALL-BUSINESS INNOVATION RESEARCH AND SMALL-BUSINESS TECHNOLOGY TRANSFER PROGRAMS: IMPLEMENTATION OF THE COMMERCIALIZATION PILOT PROGRAM AND RELATED REFORMS

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In Section 252 of the National Defense Authorization Act for Fiscal 2006, "Research and Developments Efforts for purposes of Small Business Research," Congress adopted four wide-ranging reforms to the Department of Defense Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) programs in order to increase the effectiveness of SBIR and STTR for both the DoD and the defense industry. First, Section 252 directed closer alignment between R&D and acquisition goals of SBIR and STTR. Second, Section 252 authorized and funded creation by the Department of Defense (DoD) and the military services of the Commercialization Pilot Program (CPP) to facilitate transition of SBIR technologies into the acquisition process. Congress conditioned the use of CPP funds on detailed evaluative reporting to Congress. Third, Congress codified into statutory law President George W. Bush's Executive Order 13329, "Encouraging Innovation in Manufacturing," which incentivized manufacturing technologies through the SBIR and STTR programs. Fourth, Congress clarified the authority to conduct testing and evaluation of SBIR and STTR technologies in SBIR and STTR Phases II and III. The implementation requirements were specified in the text of Section 252 and the congressional guidance letter issued by the House and the Senate small-business committees.

This study analyzes the implementation of Section 252 by the secretaries of defense, the Army, the Navy, and the Air Force. It reflects the results of literature review and a survey of SBIR and STTR program executives. The study questions are based on Section 252 text and the Congressional Guidance letter, as well as best practices identified in relevant academic and professional literature. The study finds that, while the DoD and the military departments have begun implementation of the DoD SBIR CPP program and other Section 252 reforms, progress is uneven. Specifically, agencies are not implementing section 252 CPP incentives and R&D alignment requirements to the fullest extent possible. The study recommends clarifications of legislative requirements and additional review of Section 252 implementation.

KEYWORDS: SBIR, Small Business Innovation Research, STTR, Small Business Technology Research, CPP, Commercialization Pilot Program

PROGRAM MANAGEMENT

TRAINING AND DOCTRINE COMMAND ACQUISITION MANAGEMENT AND OVERSIGHT SUPPLEMENT

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Advisor: Penny Walker, Chief Acquisition Management and Oversight, TRADOC

This research will provide a set of applicable guidance with guidelines for the Requiring Activities of the Training and Doctrine Command (TRADOC) to apply the recently implemented and updated TRADOC Regulation 5-14, Acquisition Management and Oversight. This regulation was implemented on 5 January 2009. The TRADOC G-8 Management Directorate was tasked to write, and then implement this regulation to primarily validate and document contract requirements. This Acquisition Management and Oversight process is executed to obtain approval, recommendation or certification for the acquisition of products and services that directly support the warfighter (not only TRADOC). To conduct this research project it was necessary to research: the Federal Acquisition Regulation (FAR), Defense Federal Acquisition Regulation Supplement (DFARS), Army Federal Acquisition Regulation Supplement (AFARS), and the Mission and Installation Contracting Command (MICC) websites (TRADOC's primary contracting office). MICC is a subordinate command to the Army Contracting Command (ACC) established 1 October 2008.

The goal of this Joint Applied Project, for the Naval Postgraduate School, is to assemble specific documentation through research and to present such for supplementation to the TRADOC Regulation 5-14 (TR 5-14). The approval authority of the TR 5-14 is the Deputy Chief of Staff (DCS), G-8. The Joint Applied Project will be presented to the Director of the Management Directorate for TRADOC G-8 prior to presenting to the DCS G-8 for Resource Management.

KEY DOCUMENTS: Market Research, Work Statement, Quality Assurance Surveillance Plan.

THE HISTORY OF THE DEPARTMENT OF DEFENSE CIVILIAN PERSONNEL SYSTEM: THE CONVERSION FROM GENERAL SERVICE TO NATIONAL SECURITY PERSONNEL SYSTEM (NSPS) AND THEN BACK TO GENERAL SERVICE

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Support Advisor: Charles Pickar, Graduate School of Business and Public Policy

This Joint Applied Project (JAP) examines and provides a thorough overview of the history of the Department of Defense's civilian personnel system. The research explores converting civil servants from the General Schedule (GS) pay system to the National Security Personnel System (NSPS), then converting back to the GS system. This JAP will explore the inception of the GS System and discuss the perceived advantages and disadvantages. It will also explore the reason for the change to NSPS and the enactment of NSPS through the National Defense Authorization Act for 2004. It will also discuss the effects of the transition to the new pay-for-performance system. It will then examine the concerns, perceived issues, and discuss the perceived advantages and disadvantages of NSPS. It will explore the reasons surrounding the reimplementing of the GS system and the abolishment of NSPS through the National Defense Authorization Act for Fiscal Year 2010.

The data collected and analyzed will address the preferences and the perceptions from the affected employees who experienced the implementation of NSPS. It will conclude discussing these findings with suggestions for further research into the DoD's Civilian Personnel System.

KEYWORDS: National Security Personnel System, NSPS, GS, Trust, Credibility, Change Implementation

MASTER OF SCIENCE IN SYSTEMS ENGINEERING

ON SYSTEMS ENGINEERING PROCESSES IN SYSTEM-OF-SYSTEMS ACQUISITION

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Second Reader: John S. Osmundson, Department of Information Sciences

System-of-systems (SoS) programs applying the current systems engineering (SE) process in their acquisition have met with numerous technical and program management challenges resulting in adverse consequences such as unacceptable schedule delays. To enhance the chance of success for SoS acquisition, the current acquisition process needs to be improved. Systems engineering has been a recognized contributor to successful systems acquisition and its applicability to SoS is apparent. In this research, a proposed SoS SE process comprising extensive front-end SE activities is compared with the current SoS SE process.

The interaction of stakeholders and activities in both the current and proposed SoS SE processes are presented using system modeling language diagrams. Modeling and simulation (M&S) is also used to show that the proposed SoS SE process is able to help in reducing the likelihood of schedule delays. The M&S results show that a low-risk SoS acquisition could continue with the current SE process as the benefits derived from an extensive front-end SE process are limited. Conversely, a high-risk SoS acquisition should adopt the SoS SE process proposed herein to enhance the SoS acquisition program's chances. It is high-risk SoS acquisitions such as the US Army's Future Combat System, the US Coast Guard's Deep Water System, the Joint Tactical Radio System, and Homeland Security's SBInet that would likely benefit from the proposed SoS SE process.

KEYWORDS: System of Systems, Acquisition, Systems Engineering, SysML

COMPARING THE CAPABILITIES AND PERFORMANCE OF THE ULTRA HIGH FREQUENCY FOLLOW-ON SYSTEM WITH THE MOBILE USER OBJECTIVE SYSTEM

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The Mobile User Objective System (MUOS) is the DoD's next generation military Ultra High Frequency (UHF) Satellite Communication (SATCOM) system being designed to augment and eventually replace the currently oversubscribed UHF Follow-On (UFO) System. MUOS adapts a commercial third generation (3G) Wideband Code Division Multiple Access (WCDMA) cellular phone network architecture and combines it with geosynchronous satellites (in place of cell towers) with the goal of providing a more capable UHF SATCOM system.

This research aims at investigating the differences between the legacy UFO and MUOS systems in terms of network performance and quality of service. Using modeling and simulation of both systems against input traffic loads of a hypothetical Joint Task Force, a comparative study of the performance and capabilities of each system is conducted to quantify the extent of MUOS improvements. The study finds that MUOS can tolerate a traffic

demand of about 83 calls/messages per second whereas UFO saturates at roughly 4 calls/messages per second.

MUOS's ability to offer a higher level of quality of service, assured access, and increased capacity will enable more tactical users to share timely information while reducing the uncertainty that they will be able to communicate with their intended recipient. Faster service data rates reduce delays in relaying information during time critical operations. The system represents a paradigm shift in UHF SATCOM from circuit-based, assigned networks to on-demand, global IP-based, net-centric networks. This study has shown that, as specified in its designs, MUOS can provide a level of system performance that will place the system in a preeminent role for the network-centric operations critical to the mission effectiveness of today's military.

KEYWORDS: Ultra High Frequency Satellite Communications, UHF SATCOM, UHF Follow-On

A DISTRIBUTED SENSOR NETWORK ARCHITECTURE FOR DEFENSE AGAINST SHIP AS A WEAPON IN THE MARITIME DOMAIN

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A successful terrorist attack using a ship as a weapon (SAW) on shore infrastructure in the Malacca and Singapore Straits would cause chaos to global trade, as these straits carry over one quarter of the world's commerce and half the world's oil. This calamity must be prevented. Toward this goal, this thesis aims at developing and determining the best distributed sensor network (DSN) architecture and implementing a sensor fusion algorithm for tracking a SAW intended to run into the oil and chemical terminals on Jurong Island, Singapore.

The work in this thesis involves the application of (1) an integrated systems engineering methodology for designing alternative DSN architectures, (2) Kalman and information filters for SAW tracking and sensor data fusion, (3) a track-to-track fusion algorithm, and (4) a Monte Carlo simulative study to assess the effectiveness of three distributed sensor fusion network architectures – centralized, de-centralized, and hybrid. Each distributed sensor fusion network architecture includes the various sensors that Singapore deploys in and along the Singapore Straits.

The simulative study results indicate that, with and without communication bandwidth constraints, a ship with the intent to attack Jurong can be identified accurately at an earlier time with both the centralized and de-centralized sensor fusion network architectures than with the hybrid sensor fusion network architecture.

KEYWORDS: Maritime Domain Awareness, Distributed Sensor Network, Sensor Fusion, Data Fusion, Track Fusion, Kalman Filter, Information Filter

IMPLEMENTING A FACIAL RECOGNITION SYSTEM TO IMPROVE ACCESSIBILITY AND INCREASE UTILIZATION OF ENTRY CONTROL POINTS AT MILITARY INSTALLATIONS

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Most military installations utilize an entry control point that is inefficient, time consuming, and manpower intensive. Unfortunately, as a result of the current inefficiency, traffic congestion has become a nuisance for many service members as well as government employees.

SYSTEMS ENGINEERING

Directive Type Memorandum (DTM) 09-012, “Interim Policy Guidance DoD Physical Access Control” distributed by the Undersecretary of the Navy states that biometric access to military installations shall be implemented when feasible. This thesis addresses the capability gap for an automated entry control point that increases throughput without sacrificing security. Application of the Systems Engineering process, concept of operations, functional and physical architectures provide a general solution that fills the identified capability gap. Additionally, this thesis provides a proof-of-concept prototype solution by means of simulation and modeling.

KEYWORDS: Systems Engineering, Facial Recognition, License Plate Recognition, Entry Control System

MASTER OF SCIENCE IN SYSTEMS ENGINEERING MANGEMENT

**A STUDY ON THE COMMERCIALIZATION OF SPACE-BASED
REMOTE SENSING IN THE 21ST CENTURY AND ITS IMPLICATIONS
FOR UNITED STATES NATIONAL SECURITY**

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Remote sensing from space provides critical data for many commercial space applications and has undergone tremendous growth since the early 1990s due to global market demand. The purpose of this thesis is to assess how the commercialization of space imagery, since the end of the Cold War, has led to increased intelligence gathering by adversaries and created a new series of threats against United States overseas and domestic targets. The research performed involves an analysis of the proliferation history of space imaging for growing civilian use and the threats created by its widely-available dissemination and accessibility. The analysis results, together with the findings from a review of commercial programs, initiatives, and remote sensing policy will be used to develop trends that formulate recommendations in this thesis. Specifically, in order to further develop and protect commercial space imaging capability in the future, remote sensing policy makers, systems engineers, and industry analysts must be aware of the implications to United States National Security.

KEYWORDS: Remote Sensing from Space, Commercialization of Remote Sensing

MASTER OF SCIENCE IN SYSTEMS TECHNOLOGY

USING A MODEL OF TEAM COLLABORATION TO INVESTIGATE INTER-ORGANIZATIONAL COLLABORATION DURING THE RELIEF EFFORT OF THE JANUARY 2010 HAITIAN EARTHQUAKE

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The earthquake that struck Haiti in the afternoon of January 12, 2010 devastated the nation and left the cities of Haiti in a state of ruin. Tens of thousands were killed in the wreckage, and survivors were left without the basic necessities of life. The world quickly responded with a massive outpouring of aid. However, due to the destruction of the infrastructure of Haiti, the coordination of this aid was challenging. The All Partners Access Network (APAN), an online information exchange and collaboration tool, proved useful in bringing together many aid groups, including several US government entities, to effectively address Haiti's multitude of immediate and long term needs. The transcripts of APAN recorded the collaboration that occurred between its users.

The goal of this thesis is to utilize these transcripts as a real-world example of how teams works together on unique, complex problem sets. The transcripts were coded and analyzed with the objective of empirically validating the Office of Naval Research model of team collaboration. The model describes the individual and team cognitive processes, occurring during team collaboration, which facilitate decision making in seeking solutions to multifaceted, unique, and complex problems.

KEYWORDS: Haiti, Earthquake, Disaster Relief, Humanitarian Aid, Infrastructure, Coordination, All Partners Access Network, Team Collaboration

ENSURING EFFECTIVE INFORMATION FLOW THROUGH THE JTB ENTERPRISE IN SUPPORT OF COMBAT OPERATIONS: INTEGRATING REQUIREMENTS ACROSS TECHNOLOGY, PROCESS, ORGANIZATION, AND INCENTIVES

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IEDs continue to harass, maim, and kill innocent men, women, and children, as well as numerous coalition and U.S. forces. Currently over 50% of U.S. casualties are caused by IEDs. To combat this terror, the US government has employed significant resources across a diverse range of dedicated researchers and testers. However, in working so diligently to test the separate components of an IED defeat system, opportunities are missed to effectively utilize the information available across the test enterprise and in the theater of opera-

tions. The analyses conducted by Lieutenant Robert Gill and Major Rick LaViolette showed potential areas of improvement in the business processes at the JIEDDO Test Board (JTB). The focus of this thesis is to use the results produced by the research conducted by Gill and LaViolette to develop requirements to build a set of collaboration tools and associated processes that will support the needs of the end users in the field. The objective of the analysis is to identify what requirements will support the development of web-based tools and show how the tools will provide input to enhance the JIEDDO test process system.

KEYWORDS: Knowledge Management, KM, Data Management, Collaboration, Leadership

UTILIZING S/MIME TO DEMONSTRATE TRUE END-TO-END SECURITY

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The DoD and commercial IT industries employ a fragmented approach to data security as they attempt to adapt to internet work systems that are growing ever more complex. Effective security techniques exist for securing single host machines or single network segments. These techniques struggle to scale up to an information system with multiple hosts connected to an internetwork with multiple segments. These infrastructure protection techniques are intended to create a secure enclave. Access to part of the enclave is access to the entire enclave. Additionally, the size of software source code has grown to the point that a thorough examination for covert channels is precluded.

The goal of this thesis is to advocate for the development of a security system based at Layer 7 of the OSI reference model. E-mail user agents implementing the S/MIME protocol will demonstrate the critical functionality for a Layer 7 security system. This system will protect data rather than infrastructure. Protecting data using S/MIME allows most of the user agent and host operating system functionality to handle only protected data. Thorough analysis of the remaining code for each system becomes possible. Further, the system will assist in enforcing need-to-know policies and mitigating the social engineering threat.

KEYWORDS: Secure e-mail, S/MIME, Network Security, Mail User Agent, Information Superiority, Software Engineering, Information Systems Technology

JIEDDO TEST BOARD (JTB) OPERATIONAL INTERACTIONS AND END-USER ANALYSIS OF THE INFORMATION FLOW PROCESS

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Improvised, explosive devices continue to harass, maim, and kill innocent civilian men, women, and children, as well as numerous coalition and US forces. To combat this terror, the U.S. government has employed significant resources across a diverse range of dedicated researchers and testers. The urgency of their task cannot be overemphasized. However, in working so diligently to test the separate components of a defeat system, it is hypothesized that opportunities are being missed which could effectively utilize all of the information available across the test enterprise. The purpose of this thesis is to identify the organizations and activities involved, the information shared, and the processes employed by organizations within the JIEDDO Test Board (JTB). The objective is to provide an accurate representation of the process, and where the main decision points and

bottlenecks occur. The conclusions achieved by this research are provided to enhance the JIEDDO test process system. The goal of this study of the JIEDDO process is to contribute to improving information sharing and knowledge management among stakeholders involved in the JIEDDO Test Board enterprise.

KEYWORDS: Joint Improvised Explosive Device Defeat Organization, JIEDDO, Joint IED Defeat Test Board, JTB, Collaboration, Information Sharing, Knowledge Management, Department of Defense Architecture Framework, DoDAF

**MACROCOGNITION IN TEAMS AND ANALYSIS OF INFORMATION
FLOW DURING THE HAITIAN DISASTER RELIEF**

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On January 12, 2010, a devastating earthquake struck the island nation of Haiti. Recorded at immense 7.0 Mw, the quake occurred just 16 miles from Haiti's capitol of Port-au-Prince. The destruction was widespread and the need for assistance from other nations critical. The collaborative teamwork effort that ensued was recorded via the use of the All Partnered Area Network (APAN), and consisted of a collection of official briefings, emails, chat room logs, and blogs.

The goal of this thesis was to utilize the recorded data from APAN to offer a real-world example of how a team works together on a one-of-a-kind problem. Furthermore, the transcripts from APAN were coded and analyzed in an effort to empirically validate the Office of Naval Research structural model of team collaboration. The model focuses on individual and team cognitive processes used during team collaboration, while under stress, with the goal of understanding how individuals and teams work together in order to reach a decision.

KEYWORDS: Haiti, Macrocognition, Inter-Organization, All Partnered Area Network (APAN)

**KNOWLEDGE ENGINEERING CONSIDERATIONS FOR IMPROVING INFORMATION
SHARING IN THE JOINT IMPROVISED EXPLOSIVE DEVICE DEFEAT TEST BOARD**

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Improvised Explosive Devices (IEDs) will continue to evolve as the enemy's weapon of choice. Dynamic and responsive enemies alter IEDs in reaction to our Counter-IED efforts, which results in the need for continuous accelerated testing and acquisition of Counter-IED tools. Over the last five years, an accelerated acquisition process enabled the expansion of testing entities and ranges beyond the purview of the Joint Improvised Explosive Device Defeat Test Board (JTB) established to monitor them. As a result, information sharing between JTB organizations is not efficient, which leads to less capable and slowly fielded equipment.

This research reports on the use of a cognitive task analysis and contextual inquiry focused on identifying

and mitigating information sharing impediments. The objective is to provide recommendations to improve information sharing between personnel involved with the JTB. Results indicate that the most common information sharing barriers relate to organizational culture, which leads to the recommendation of creating a JTB position specifically focused on information flow inside and outside of the organization. Results regarding information sharing enablers indicated that enhancing test range cooperation and improving information systems through more tester level meetings, use of the customized affinity diagram, and implementing user recommendations would improve information sharing.

KEYWORDS: JIEDDO, JTB, Information Sharing, Cognitive Task Analysis, Affinity Diagram, Participatory Design, Knowledge Engineering

**SOCIAL NETWORK COLLABORATION FOR CRISIS RESPONSE
OPERATIONS: DEVELOPING A SITUATIONAL AWARENESS (SA) TOOL
TO IMPROVE HAITI'S INTERAGENCY RELIEF EFFORTS**

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The earthquake in Haiti represents an event of catastrophic scale. Relief efforts were thwarted by blocked roads and ruined runways. Relief organizations assisted in the effort using adhoc approaches but could have benefited from improved Situational Awareness (SA). This thesis develops a new model and methodology, based on data collected following the Haitian earthquake that combines both text-mining methods with 3D graphics. This interpretive approach provides a qualitative improvement on the currently available graphic depictions of such data. Text mining is performed using Lexical Link Analysis (LLA) which tracks and links word pairs, and then visually depicts correlations between discovered words, themes, and entities, thus revealing how they are related to each other in terms of both relationship and content. Our findings reveal discovered patterns of self-organization within this crisis situation, and can demonstrate a dynamic, situational awareness tool—that can be executed by a thin client—to analyze and determine social-organization collaboration and self-organization for leaders to leverage. This effort can eventually help to create a real-time feedback loop to inform decision maker's organizational awareness, improve organization-to-organization collaboration, and perhaps better allocate resources to areas requiring relief operations.

KEYWORDS: Situational Awareness, Visualization, X3D, Social-network analysis, Feedback Loop, Self-Organizing, Network, User Interface

MASTER OF ARTS IN SECURITY STUDIES

THE GULF COOPERATION COUNCIL AND THE CHALLENGES OF ESTABLISHING AN INTEGRATED CAPABILITY FOR UPHOLDING SECURITY

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The Gulf Cooperation Council's abysmal performance during the last thirty years clearly demonstrates that the member-states of this alliance remain unprepared to seriously commit themselves to the establishment of a credible joint defense force able to facilitate the goal of collective security for which the GCC was established in the first place. This thesis seeks explanations as to why the GCC has made little progress in establishing mechanisms to provide collective security for its members through the lenses of Neorealist Theory and Regime Theory. Neorealist Theory does explain the GCC's stumble on the path to achieving collective security by expecting that the GCC would not succeed if there were other options for security, but it fails to explain the causes that led the GCC member-states to seek other security options. Applying Regime Theory in the case of the GCC will identify the GCC's reasons for seeking other security options. This thesis hypothesizes that the GCC failed to guarantee security to its members due to its weakness as a regime, explained by Regime Theory, which led the GCC member-states to seek other security options provided by external power through bilateral security agreements, as predicted by Neorealism.

KEYWORDS: GCC, Collective Security, Peninsula Shield, Gulf, Military, Politics, Saudi Arabia, and Decision-Making Process

A STUDY OF THE RUSSIAN ACQUISITION OF THE FRENCH MISTRAL AMPHIBIOUS ASSAULT WARSHIPS

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In 2009, Moscow opened negotiations with Paris to purchase the Mistral class amphibious assault ship. In December 2010, Russia indicated that it was prepared to move forward with an agreement to buy two Mistral class warships, with the option of building two more jointly at a Russian shipyard. Neither Russia, nor the Soviet Union ever possessed a vessel with the capabilities of the Mistral class. An amphibious assault ship would be a new addition to the Soviet/Russian naval arsenal. The fact that Russia must turn to foreign suppliers to modernize its fleet capabilities indicates that Russia's domestic arms industry lacks the capability to produce a range of modern warships. The Mistral is the first significant arms sale of a major NATO power (France) to a country that some still see as a threat. For this reason, the sale has raised fears among the smaller NATO members, who charge that Paris has brushed aside their security concerns for national and economic reasons. This thesis argues that the Mistral sale is driven by Russia's need to acquire modern command and control and

shipbuilding technologies, rather than increase its amphibious assault capabilities per se.

KEYWORDS: Mistral, Russian Navy, Russian Naval Modernization, Amphibious Assault Warships, Helicopter Carriers, NATO Arms sales, NATO solidarity, NATO Baltic relations

**EUROPEAN ENERGY SECURITY AND NORD STREAM: A CASE
STUDY OF THE NORD STREAM PIPELINE, ITS OPPORTUNITIES
AND RISKS FOR EUROPE, AND ITS IMPACT ON
EUROPEAN ENERGY SECURITY**

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This thesis focuses on the interpretation and implementation of energy security in the European context concerning the Nord Stream pipeline. Nord Stream has been highly debated across Europe because of its enormous opportunities—it will give Europe access to the largest known reserves of gas worldwide—but also because of the risks involved. Nord Stream provides Russia with an option to gain an advantageous position over Europe concerning energy policies, thus raising the fears of Nord Stream’s critics that Russia might use this leverage to promote its own position in political areas other than energy. It is, therefore, essential to analyze the opportunities and risks associated with Nord Stream for Europe, and to give thought for future mechanisms of European energy security that will assist in maximizing opportunities and minimizing risks.

KEYWORDS: Energy, Energy Security, European Union, Russia, Nord Stream, natural gas, pipeline

**MANAGEMENT OF THE SEVERELY MENTALLY ILL AND
ITS EFFECTS ON HOMELAND SECURITY**

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As a result of the events of September 11, 2001, law-enforcement agencies nationwide have been assigned a plethora of terrorism prevention and recovery related duties. Many federal documents outline and emphasize duties and responsibilities pertaining to local law enforcement. The prevention of acts of terrorism within communities has become a focal point of patrol activities for state and local police agencies. Simultaneously, local law enforcement is dealing with the unintended consequences of a policy change that in effect removed the daily care of our nation’s severely mentally ill population from the medical community and placed it with the criminal justice system. This policy change has caused a spike in the frequency of arrests of severely mentally ill persons, prison and jail population and the homeless population. A nationwide survey of 2,406 senior law enforcement officials conducted within this paper indicates that the deinstitutionalization of the severely mentally ill population has become a major consumer of law enforcement resources nationwide. This paper argues that highly cost-effective policy recommendations exist that would assist in correcting the current situation, which is needlessly draining law enforcement resources nationwide, thereby allowing sorely needed resources to be directed toward this nation’s homeland security concerns.

KEYWORDS: Law enforcement, mental illness, homeland security, assisted out-patient treatment, homeless population, prison overcrowding, New Windsor Police Department

**THE DEMOCRATIC PARTY OF JAPAN AND ITS IMPACT ON
ELEMENTS OF JAPANESE MARITIME SECURITY**

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In 2009, the Democratic Party of Japan (DPJ) rose to power in the Japanese diet, marking the first time in more than five decades that a party other than the Liberal Democratic Party controlled the government. Some would assume this monumental shift has the potential to bring about a range of policy changes, especially in the realm of security. This thesis addresses the potential for changes in security policy by evaluating two particular elements of the maritime security realm, ballistic missile defense and antipiracy. When considering the ability of the DPJ to influence security policy in Japan, the country's political environment represents a unique situation, in which party influence must be weighed against the relative influence of societal norms and external factors. Taking this into consideration, it is concluded that DPJ influence will be limited, resulting in little potential for changes in security policy, as reflected in the assessment of elements of maritime security.

KEYWORDS: Japan, Japanese Maritime Self-Defense Force, JMSDF, Ballistic Missile Defense, BMD, Antipiracy, U.S.-Japan Alliance, Democratic Party of Japan, DPJ

**NATO, RUSSIA, POLAND, AND UKRAINE: PERSPECTIVES
ON THE UKRAINE CANDIDACY FOR NATO MEMBERSHIP**

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Ukraine's NATO ambitions form a controversial but vital international issue because they implicate the contradictory perspectives of Poland and Russia. The history and self-perceptions of all three states shape and reshape the question of Ukraine joining NATO, as a key step toward westernization, integration, and independence. The challenges of accommodating these competing visions of the past and future are relevant beyond the alliance to all practitioners and scholars of international affairs; in this connection, the question of Ukraine's NATO status also can serve as a case study of the broader subject. The present analysis takes the basic form of a historical narrative that analyzes Ukrainian, Polish, and Russian views of their shared history and divergent visions of the strategic future. This thesis provides a current prognosis as to the likelihood of Ukraine joining NATO and shows the limits and potential of the westernization process, security threats in the region, Russian democratization, and Russian engagement in international relations with NATO and Ukraine.

KEYWORDS: Ukraine, Russia, Poland, North Atlantic Treaty Organization (NATO), NATO enlargement, NATO membership, Warsaw Pact, Alliance, Strategic Arms Reduction Treaty (START), Partnership for Peace (PfP)

**THE MUSLIM BROTHERHOOD IN EGYPT:
PURSUING MODERATION WITHIN AN AUTHORITARIAN ENVIRONMENT**

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The Egyptian Muslim Brotherhood (MB) is one of the biggest Islamist movements in the Middle East and North Africa, and its role in the future of Egyptian politics deserves careful consideration in light of the recent overthrow of Hosni Mubarak's regime. Over the past decades, the MB has changed their relationship with successive Egyptian authoritarian regimes by continuously renouncing violence and abiding by a moderate path as a means to achieve their objectives. This study uses competing theoretical approaches to understand the reasons behind the Muslim Brotherhood's decision to abide by a moderate strategy. The major finding of this study is that, over time, a combination of external and internal factors, such as regime repression and constraints and leadership, organizational and generational structures, as well as ideological influences, have shaped the organization's decision making. Furthermore, this study highlights the stagnation of this moderate development in the face of both regime constraints and internal leadership and generational issues, and demonstrates that the mode of recovery from this stagnation will be critical in the Muslim Brotherhood's future orientation as a movement.

KEYWORDS: Muslim Brotherhood, Moderation, Islamism, Islamist Movement, Egypt, Authoritarianism.

**THE PASHTUN BEHAVIOR ECONOMY: AN ANALYSIS
OF DECISION MAKING IN TRIBAL SOCIETY**

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Little scholarship exists regarding the ways members of conflict societies think about the economic decisions they face, and what information they value as relevant to those decisions. The literature of the emerging field of behavior economics suggest that in uncertain environments, considerable weight may be given to identity and culture factors to make decisions that will affect personal safety, income prospects and self-fulfillment. Knowledge about the important factors in play when indigenous populations are making decisions regarding their support for government-sponsored counterinsurgency efforts, for example, can lead to better strategies for communication and decision framing on the part of the counterinsurgents to improve the relative attractiveness of the propositions they present to indigenous members in environments where counterinsurgent forces wish to expand their influence. In this thesis, the nature of the decision process in rural Pashtun society will be studied, drawing from sources that study Pashtun ethnography, and behavioral economics to draw conclusions about the way people in conflict societies frame the decisions they make. Studying the Pashtun case in Afghanistan will allow generalizations and patterns to be recognized that can be used in future conflicts to craft operational and communications strategies that have the most chance of counterinsurgency success.

KEYWORDS: Tribal Society, Pashtun, Behavior Economics, Counterinsurgency, Information Operations

**MODERNIZATION THROUGH EDUCATION:
THE ANSWER FOR COMBATING TERRORISM?**

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World leaders and international and non-governmental organizations, have invested millions of private and government funds into bringing secular education into remote regions of Afghanistan and other parts of the world in hopes of combating terrorism. This is an insufficient solution to a problem of that faces all religious, economic, and social communities of the world. Focusing on secular education alone without a larger political and economic reform brings a false sense of security because education without other inputs is not sufficient in combating terrorism. A comparative analysis in this thesis illustrates that education by itself does not prevent terrorism. Other causal factors must be considered when addressing individuals who do commit terrorist acts. This thesis will use the cases of the Liberation Tamil Tigers of Eelam (LTTE) in Sri Lanka and eleven profiles of educated individuals who were involved in terrorist acts as counterexamples to the education-only theory. It will also discuss present U.S. operations in Afghanistan that focus on education, and present proposals to improve the social and economic conditions that are necessary aspects of reforms being neglected.

KEYWORDS: Education, Modernization, Sri Lanka, Terrorism

**MISSION INCOMPLETE: THE U.S. ARMY'S UNSUCCESSFUL
IMPLEMENTATION OF STABILITY OPERATIONS IN IRAQ**

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The United States Army has struggled to implement the stability operations doctrine of its counterinsurgency strategy in Iraq. Despite the emphasis in national strategic guidance documents and written Army field manuals, stability operations continue to evade the Army as a major priority. This thesis seeks to answer, why has the Army, as an organization, had such a difficult time implementing stability operations? Additionally, this thesis attempts to determine whether the Army made its best attempt to implement stability operations in Iraq between 2003 and 2007. Chapter II reviews the Army's history and its struggle to acknowledge irregular conflicts as important as conventional war. Chapter III then evaluates stability operations implementation in Iraq between 2003 and 2007 in a case study. Finally, Chapter IV concludes with recommendations for the organization in implementing stability operations in the future.

KEYWORDS: Stability operations, doctrine, counterinsurgency, Iraq, Army, organization, implementation

**PALESTINIAN REFUGEES IN THE LEVANT:
ALTERNATE THEORIES FOR DISPARITY IN TREATMENT**

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This thesis presents an analysis of factors contributing to the disparity in treatment of the Palestinian refugees in the Levant. Each case study presents a basic overview of the historical background for the Palestinian refugee migration to the state before highlighting seven factors affecting the Palestinians. The factors of legal framework, economics, politics, space within the state, relationship of the PLO, Islamists, and Palestinians, and identity are evaluated to determine their relevance for the state's treatment of the Palestinians in the Levant. Two factors emerged as the main influencers for treatment of the Palestinians. The research shows that each nation's economic situations drove the level of integration into the state. The research shows that Jordan needs the Palestinians refugees' economic provision to support their rentier economy. Syria has absorbed the Palestinians into their economy, but was not willing to afford the refugees the same rights as their citizens. Lebanon does not seek to disrupt its confessional balance through integration of the Palestinians economically. Economics also affects the second factor, the politics surrounding the Palestinians. All three cases demonstrated a willingness integrate the Palestinians only to a level that would maintain political power for the ruling party. Lebanon again uses confessional politics to justify its lack of integration. The Syrian Alawi elite seeks to maintain their political monopoly pacifying the Palestinians enough to prevent action. Jordan's authoritarian regime also seeks to maintain its political power. They seek to minimize Palestinian political action through repressive measure that ensure the authoritarian regime's survival. While all the factors bore some relevance to the treatment of the Palestinians, economics and politics emerged as the principal factors affecting the treatment of the Palestinians in the Levant.

KEYWORDS: Palestinian Refugees, Jordan, Syria, Lebanon, "Right of return"

**ANALYZING THE NEED FOR SPECIAL-OPERATIONS
TEAMS WITHIN THE FIRE SERVICE**

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Fire suppression and rescue is the primary mission of the fire service, but not all rescue efforts entail putting out fires. For this reason the fire service created special-operations teams. Special-operations teams are composed of highly trained members with advanced skills that come at a high cost to fund and operate. Using three Dallas fire–rescue special-operations teams as case studies, the findings presented are: (1) benefits and priorities of developing subject matter experts; (2) feasibility from the fire service standpoint and practicality of special operations teams in the fire service; (3) special operations teams can complement or support other special operations teams; (4) the framework for Dallas fire–rescue special operations is flexible enough for many fire departments to utilize. The conclusion and recommendations of this analysis will challenge fire service tradition. The value innovation of rank-specific organizational reform in special operations teams will save lives and property while reducing recovery costs.

KEYWORDS: homeland security, fire service, special operations, hazardous materials, explosive ordnance disposal team, bomb technician, continuing education, Dallas fire–rescue

CHINA'S SECURITY PERSPECTIVE

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The current (2010) National Security Strategy (NSS) states that: “We will monitor China’s military modernization program and prepare accordingly to ensure that U.S. interests and allies, regionally and globally, are not negatively affected.” This thesis assesses a major element of that goal. As our president’s NSS points out, an understanding of how the People’s Liberation Army (PLA) operates is critically important to the American assessment of its own security posture in Asia.

History shows that the PRC balances against what it perceives as hegemony by seeking assistance from other regional powers while developing its own military capabilities to the greatest extent possible given its economic capacity. An analysis of current PLA doctrine and capabilities shows that Beijing seeks regional dominance through a strategy of anti-access and area denial (A2/AD) in order to defend the homeland and ensure security interests at home and abroad. Taken together, these observations help to provide an explanation of what Beijing wants to do with the PLA. This is one of the most important issues facing the U.S. military today.

KEYWORDS: China, Military, Engagement, Security, Economics, Foreign Policy, Strategy

THE STRATEGIC IMPORTANCE OF BALOCHISTAN

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Balochistan, the southwestern province of Pakistan, is taking on increased importance in regional affairs. With the discovery of vast fields of natural gas, along with other valuable minerals, the region is experiencing increased interest from foreign investors and developers. Along with this, the terrain of Balochistan makes it a prime location for the development of roads, railroads, and pipelines to connect the Middle East, Central Asia and South Asia. To augment this development, the construction of a deepwater port at Gwadar has the potential of bringing globalization to the region in an exponential manner. In the face of this development and growth are the Baloch, whose continued insurgencies have created an unstable environment. Although these deter large-scale growth, interest in the region continues to grow, and with it, the threat of international politics and agendas colliding in a violent manner. As such, the strategic importance of Balochistan lies in its potential to either take the forefront in development in South Asia or be the epicenter of the next large-scale, multinational conflict.

KEYWORDS: Pakistan, Balochistan, Insurgency, Autonomy, Energy, Terrain, Culture, Strategic, China, Natural Gas, Gwadar

**PUBLIC DIPLOMACY: AN ALTERNATIVE DIPLOMACY IN FOREIGN AFFAIRS
ISSUES; GREEK PUBLIC DIPLOMACY: CAPABILITIES AND PERSPECTIVES**

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This thesis will provide the theoretical frame and some critical points regarding public diplomacy (PD), in conjunction with the target addressed and the results achieved by some developed countries through this kind of diplomacy. It will prove that PD is one of the most important tools for a successful foreign policy, having as its primary objective to inform, engage, and build mutual relations with foreign public opinion. In addition to that, this research paper will focus on Greece as a case study of PD by examining its level of effectiveness, capabilities, and perspectives. The final outcome is expected to be a proposed model of foreign policy, applicable to other small-sized countries.

KEYWORDS: Public Diplomacy, Nation Branding

**LATIN AMERICAN SPECIAL ECONOMIC ZONES AND
THEIR IMPACTS ON REGIONAL SECURITY**

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Latin America is often considered the United States' strategic backyard. However, with the advent of globalization and technology, this backyard is no longer strictly "American." As the region becomes more accessible and readily influenced by external actors and the United States' security concerns focus elsewhere, a growing opportunity is present in the Western Hemisphere for organized criminal networks and terror financing to take hold. Although globalization provides Latin American nations with ties to the world economy, it comes at a price for regional security. One of the most vulnerable products of a globalized Latin America is the special economic zones in the region.

Special economic zones (SEZs) throughout Latin America represent the delicate seesaw game that globalization and security play. Although SEZs attract foreign direct investment, fuel jobs, and grow linkages in local economies, they are also extremely vulnerable to crime and corruption. The entrenched permissive environment for criminal activity and links to transnational terrorism is a serious issue for regional and global security.

This paper will examine the vulnerabilities of SEZs in Latin America through a comparative case study approach of the Colon Free Zone and the Triple State Border Area (Zona Franca de Ciudad del Este).

KEYWORDS: Special Economic Zones, Free Trade Zones, Latin America, Colon, Panama, TBA, Ciudad del Este, Triple State Border Area, Paraguay

**WHO IS GUARDING SERBIA'S BORDERS? AN ASSESSMENT OF SERBIA'S
PROGRESS IN BORDER-SECURITY DEVELOPMENT AND REFORM**

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This study considers how Serbian border-security sector reform illuminates questions of force and statecraft in a southern European nation. In 2006, Serbia became a member of the Partnership for Peace (PfP), a step toward a North Atlantic Treaty Organization (NATO) membership. However, Serbia has indicated no intention to become a full NATO member. Also in 2006, Serbia entered into a Stabilization and Association Agreement (SAA) with the European Union (EU) as part of the process of accession to EU membership; however, Serbia must meet EU conditions regarding border security reform and must continue to cooperate with the International Criminal Tribunal for Yugoslavia (ICTY) for full membership to be realized.

This thesis evaluates Serbia's continued efforts to integrate into the EU structures. It begins with a historical overview of the leadership, politics and reform of the Serbian security sector before the 21st century. It then explores the role of the international community, including Russia, in providing assistance to Serbia during the past decade. The thesis then focuses on Serbia's progress in border security development, integrated border management (IBM), border-guard reform and customs-administration reform. This thesis argues that, despite the ongoing efforts of the international community to integrate Serbia into the EU community, due to the unique political and social circumstances specific to Serbia regarding comprehensive reform of ethics and power, the continuing border security reform efforts in Serbia—and hence, EU membership—will most likely remain another decade in the future.

KEYWORDS: Serbia, Border Security Reform, Security Sector Reform, Partnership for Peace, Stabilization and Association, Euro-Atlantic Integration, European Union

**WOLVES IN WOLVES' CLOTHING: THE ROLE OF THE CHECHEN MAFIA
IN THE FORMATION OF AN INDEPENDENT CHECHEN REPUBLIC**

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The path to Chechen autonomy has been tumultuous. Over the past 200 years, internal and external forces have played significant roles in shaping the territory and identity of the Chechen nation. Fierce resistance by Chechens has led Russian officials to label the region's inhabitants as criminals. Chechen criminality was also affected by punishments for this resistance. Chechen resistance eventually led to the mass criminalization of the entire Chechen ethnicity.

Mass criminalization exposed the Chechens to a wider Russian criminal world. Through illegal activities Chechen criminals amassed significant resources. As the Soviet Union fell, Chechen organized-crime groups were poised to support the bid for national independence led by former Soviet General Djohar Dudayev.

This thesis contends that bottom-up and top-down forces were critical in forming a perception of Chechen criminality. The perception of criminality and its attendant punishments supported the rise of actual criminality, in a time where crime made possible the amassing of significant amounts of wealth and power. It was wealth and power that Dudayev's fledgling government needed and Chechen organized crime would provide, but at a cost. While providing material support to Dudayev, organized-crime elements infiltrated government positions to further their own interests.

KEYWORDS: Crime, Mafia, Russia, Chechnya, Organized Crime, Criminality, Chechen, Criminalization, Caucasus.

**WHAT HAVE WE LEARNED FROM THE WAR ON DRUGS?
AN ASSESSMENT OF MEXICO'S COUNTER-NARCOTICS STRATEGY**

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Forty years ago, the US President Richard Nixon declared war on drugs. From the beginning, the United States has pursued a strategy focused on the supply-side of the issue, emphasizing eradication, interdiction, and incarceration and has pressured the government of Mexico to employ the same strategy at every opportunity. Over the course of time, the US and Mexican governments pursued the strategy dictated by Washington to relatively little effect. Now, in the face of increasing power and autonomy among the cartels, Mexico has acted independently to combat the rising levels of violence. Despite the apparent absence of pressure from the US, or evidence of likely success, Mexico still took action straight out of the US playbook. This thesis will examine why that has been the case.

KEYWORDS: Mexico; Counternarcotics; Strategic Choices

**DETERMINANTS AND POLITICS OF GERMAN
MILITARY TRANSFORMATION IN THE POST-COLD-WAR ERA**

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Since 1990, Germany has changed its role from a passive beneficiary of collective defense to a “co-producer” of security in international affairs. At the same time, however, Germany has been reluctant to transform its military, the Bundeswehr, into an all-volunteer force and to develop capabilities for expeditionary warfare. It has also spent less on defense in relation to its resources than other European partners. This case study attempts to elaborate on this apparent inconsistency and to answer the question of why and how the Bundeswehr has changed after 1990. The thesis argues that German military transformation during this period is informed by driving forces and limiting factors on the international level, as well as the domestic level. Given Germany's preference for multilateralism, it is unsurprising that NATO and the European Union (EU), as well as the military missions conducted by these two institutions, have had an impact on the evolution of the Bundeswehr. Against this background, the notion of a distinct German strategic culture helps to explain the ambivalence of German security and defense policy. Other variables on the national level, above all the limited defense expenditure and the political interests of key decision-makers, have affected military transformation as well.

KEYWORDS: German Military Transformation, German Military Reform, German Security and Defense Policy, German Strategic Culture, German Armed Forces, Bundeswehr, Federal Ministry of Defense

EURO-ISLAM OR ISLAM IN EUROPE: THE ROLE OF MUSLIMS AND THEIR ORGANIZATIONS IN GERMANY, GREAT BRITAIN AND THE NETHERLANDS

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Almost twenty million Muslims live in Europe. These Muslims make up diverse ethnic, linguistic, and cultural communities, many of which are struggling to define their role within Europe's secular societies and the role of their religion in this environment. The concept of Euro-Islam is one option to promote a new European form of Islam that helps Muslim citizens and immigrants integrate into Europe's civic and political fabric. This study shows that the concept of Euro-Islam is still under negotiation and diversity across Muslim communities complicates the negotiation process. Conceptions of Euro-Islam vary from a pure embrace of secularism to new forms of Islamism. The acceptance of core European values such as democracy, tolerance, and pluralism are essential prerequisites for acceptance of Euro-Islam by Europeans, but many Muslims view their situation as that of exclusion, characterized by low levels of education, high unemployment, and societal discrimination. They face governments that seek to dialogue with Muslims while simultaneously pursuing increasingly assimilative immigration policies. Muslims in Europe have developed organizational networks to represent their opinions and interests as well as to express their identity. On the one hand, these organizations naturally reflect the diversity of the communities they represent. On the other hand, these organizations are all but representative for all Muslims living in Europe. Therefore, their role in the promotion of Euro-Islam is limited. This thesis proposes a rethinking of current immigration policies, intensified discourse among Muslims over Euro-Islam, and open dialogue between Muslims and others, where secularism does not become an excuse for discrimination and integration is distinguished from assimilation. This policy requires Europeans to rethink their own identity and the role they want religion to play in society.

KEYWORDS: Euro-Islam, Integration, Assimilation, Muslims, Islamic and Islamist Organizations, Europe, Germany, Great Britain, the Netherlands, Identity.

**APPLYING PSYCHOSOCIAL THEORIES OF TERRORISM TO THE
RADICALIZATION PROCESS: A MAPPING OF DE LA CORTE'S
SEVEN PRINCIPLES TO HOMEGROWN RADICALS**

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This study contains an application of psychosocial theories to the process of radicalization among Muslim militants (jihadis) with a history of activity in the United States. Drawing extensively from De la Corte's seven psychosocial principles of terrorism, the study codes each principle into a corresponding example from case studies of American jihadism. The end result is the use of theory to create a new empirical and psychosocial perspective into homegrown jihadism. The application of De la Corte's theory is also used as a framework to suggest frameworks for detection, intervention, and interdiction when it comes to homegrown jihadi activity.

KEYWORDS: Terrorism, homegrown terrorism, radicalization, terrorist, jihad, jihadist, psychosocial radicalization, homegrown radicals, Muslim militants, Islamism, Luis De la Corte, Los Angeles Police Department

**SELF-PROPELLED SEMI-SUBMERSIBLES: THE NEXT GREAT
THREAT TO REGIONAL SECURITY AND STABILITY**

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The most effective and fastest-evolving delivery system for cocaine to move from its place of production in Colombia to the United States market has undoubtedly become the self-propelled, semi-submersible (SPSS). Often called “drug subs” or “narco submarines,” SPSSs are used to transport cocaine from Colombia’s Pacific coast into Central America and Mexico, then overland to the United States. This thesis begins with an examination of the evolution of the illegal narcotics trade in Colombia since the 1990s. It examines the actions of the United States government (USG) and the government of Colombia (GOC) to counter the production and transportation of illegal drugs through fumigation, manual eradication, air-bridge denial and maritime interdiction strategies. The success of these strategies has caused drug-trafficking organizations (DTOs) to develop and launch SPSSs, and now self-propelled fully submersibles (SPFSs). The increasing sophistication and range of the SPSS/SPFS have given rise to at least two fears: first, that cocaine may be transported straight onto U.S. shores by boats that are practically impossible to detect. Second, that a terrorist group will use SPSS/SPFS to transport weapons of mass destruction (WMDs) into the United States and other nations.

KEYWORDS: Self-Propelled Semi-Submersibles, Drug Trafficking Organizations, cocaine, go-fast boats, transit routes, Terrorism, drug smuggling, Colombia, counter tactics, drug trafficking, Self-Propelled Fully-Submersibles

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