

Naval Postgraduate School
Monterey, California 93943-5138



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Compilation of Thesis Abstracts

June 2008



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

PREFACE

This publication contains abstracts of unrestricted or unclassified theses submitted for the degrees doctor of philosophy, master of business administration, master of science, and master of arts for the June 2008 graduation. Classified and restricted distribution abstracts are listed on the NPS SIPRnet.

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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Summary of Research, an annual compilation of research projects and publications, is also available online,
at <http://www.nps.edu/Research/SummaryRes.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:

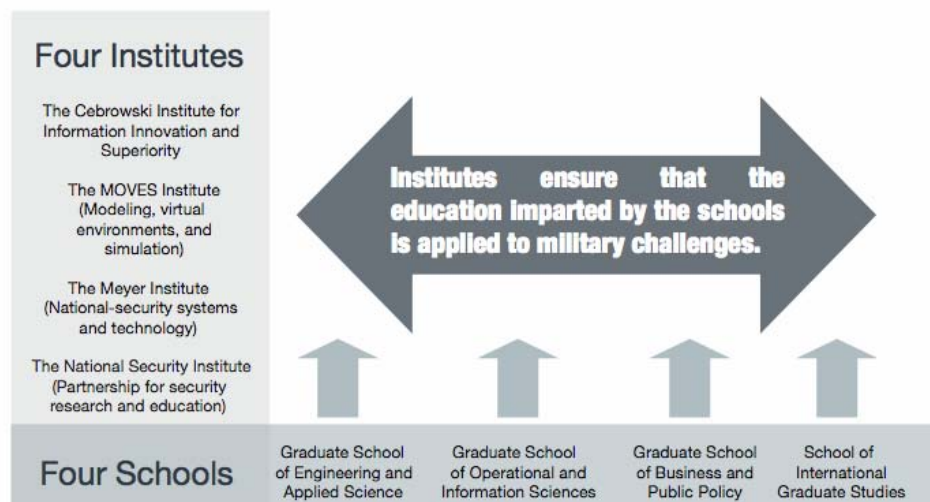
- maintains upper-division course content and programs at cutting edge;
- challenges students with creative problem solving experiences on DoD-relevant issues;
- advances DoN/DoD technology;
- solves warfare problems; and
- attracts and retains quality faculty.

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) institutes that focus on the integration of teaching and research in direct support of the four pillars of Joint Visions 2010 and 2020 and their enabling technologies; and, 3) executive and continuing education programs that support continuous intellectual innovation and growth throughout an officer's career.

Integrated • Systems Oriented • Flexible • Partnered for Strength



INTRODUCTION

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

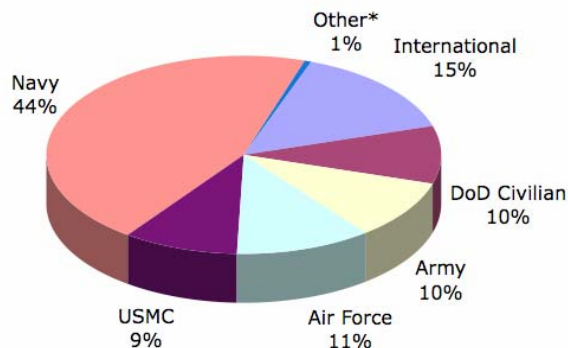
School of International Graduate Studies

- Civil–Military Relations
- Combating Terrorism: Policy, Strategy
- Defense Decision Making and Planning
- Homeland Defense and Security
- 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

Students

The student body consists of U.S. officers from all branches of the uniformed services, civilian employees of the federal government, and military officers and government civilian employees of other countries. The resident degree/subspecialty student population for June 2008 is shown in Figure 1 on the following page.

INTRODUCTION



*Coast Guard, National Oceanographic and Atmospheric Administration

Figure 1: Resident Degrees/Subspecialty Student Population for June 2008

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 Degrees

National Security Affairs
Security Studies

Master of Business Administration

Master of Science Degrees

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 Degrees

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 2008, 208 degrees were conferred. Figure 2 indicates distribution by type, Figure 3 by degree area.

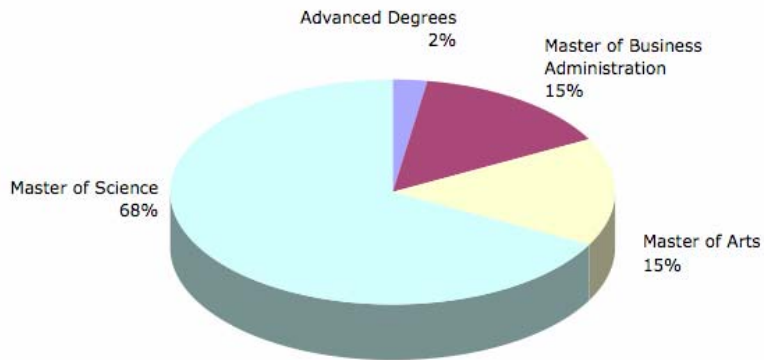
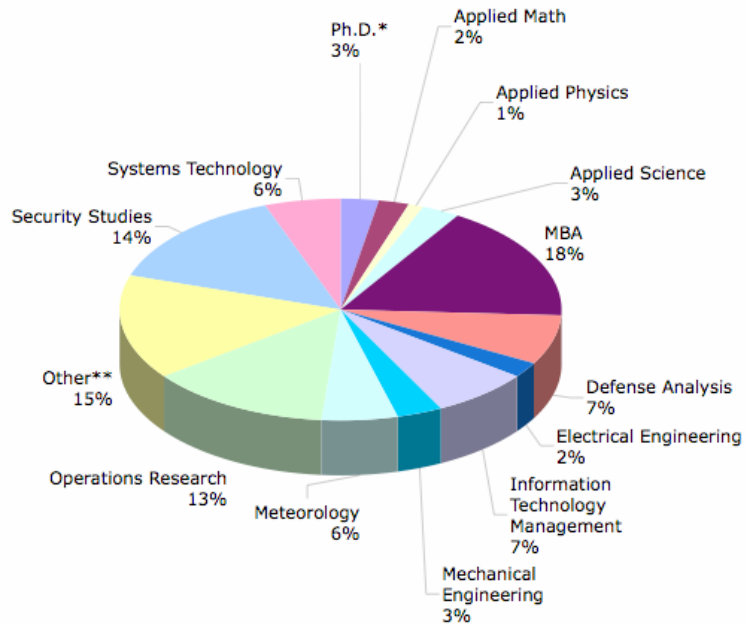


Figure 2. Distribution by Degree Type
(208 Degrees Conferred)



*Ph.D.: Applied Mathematics (1); Modeling, Virtual Environments, and Simulation (1); Physics (1); Software Engineering (2)

**Other master's degrees: Computer Science (5); Electronic Warfare Systems Engineering (1); Engineering Acoustics (2); Human Systems Integration (1); Information Operations (1); Information Systems Technology (2); Information Warfare Systems Engineering (3); Leadership and Human Resource Development (2); Management (1); Meteorology and Physical Oceanography (2); Modeling, Virtual Environments, and Simulation (1); Physical Oceanography (2); Physics (1); Program Management (1); Software Engineering (1); Space Systems Operations (1); Systems Engineering (1)

Figure 3. Degrees Conferred in June 2008
(208 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 their 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 first-hand 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.

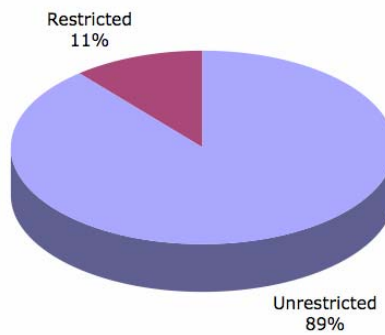


Figure 4. Classification of Theses

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ADVANCED DEGREES

Doctor of Philosophy

DOCTOR OF PHILOSOPHY

THE DEVELOPMENT OF A DECISION-SUPPORT TOOL TO INFORM RESOURCE ALLOCATION FOR CRITICAL INFRASTRUCTURE PROTECTION IN HOMELAND SECURITY

Waleed I. Al Mannai—Lieutenant Colonel, Royal Bahraini Air Force

B.S., Northrop University, 1987

M.S., Naval Postgraduate School, 1993

Doctor of Philosophy in Modeling, Virtual Environments, and Simulation—June 2008

Advisor: Ted Lewis, Department of Computer Science

Analysis of risk in critical infrastructure is one of the major problems facing homeland security today. Defining risk and applying it to systems, as opposed to individual assets, is a relatively new idea in homeland security policy. Thus, there is a need for a decision support tool to inform homeland security decision-makers of resource allocation strategies to harden assets that reduce overall network risk. Model-based risk assessment (MBRA) is a quantitative method designed to 1) identify the most critical assets of the network in such a way as to reduce expected loss over the entire network, 2) quantify allocation strategies that strategic planners and risk managers can apply across multi-sector systems, and 3) compute vulnerability and total risk reduction of the network.

The author formalizes the definition of network risk in terms of the connectivity of the network as an extension to the accepted risk equation $R=f(T,V,C)$. Node degree is used as a heuristic for criticality of an asset to the overall function of the network. The relationship between budget and vulnerability reduction is then modeled, and it is shown how an exponential reduction model compares to a linear or random model. Using the stated definition of network risk, all models rank order assets exactly the same, but they reduce risk differently. Lastly, a two-party model is introduced that combines both the defender's and the attacker's points of view using a game theory approach. Results of this model are shown and compared to a similar model referred to as the "arms race model," where both the attacker and the defender are allowed to know each other's budget. Results show that the techniques developed are useful in conducting a systematic and repeatable analysis of an infrastructure network of assets for risk and then informing resource allocations that serve to reduce risk on the entire network, not just the selected assets.

KEYWORDS: Vulnerability of Infrastructure Analysis and Risk Assessment, Allocation Distribution, Risk Problems, Critical Infrastructure Protection, Defender-Attack Model, Defender-Only Model, Independent-Objective, Joint-Objective Functions

REAL-TIME TERAHERTZ IMAGING USING A QUANTUM CASCADE LASER AND AN UNCOOLED MICROBOLOMETER FOCAL-PLANE ARRAY

Barry N. Behnken—Major, United States Air Force

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M.S., Air Force Institute of Technology, 1999

Doctor of Philosophy in Physics—June 2008

Advisor: Gamani Karunasiri, Department of Physics

Real-time imaging in the terahertz (THz) spectral range is achieved using an uncooled, 160×120 pixel, infrared, microbolometer camera and a milliwatt-scale, quantum-cascade laser (QCL). By replacing the camera's original focusing optics with a Tsurupica-based lens and minimizing diffraction effects incurred by the QCL output beam, an imaging scheme is developed in which the camera's focal-plane array successfully detects wavelengths that are more than an order of magnitude longer than those for which the

DOCTOR OF PHILOSOPHY

system is designed. Moreover, the incorporation of parabolic reflecting optics yields a capability to produce high-resolution images of objects placed within the beam path. Despite the low laser powers employed, this scheme allows high-contrast imaging of various objects concealed by a wide range of nonmetallic materials—confirming the suitability of this technology for homeland security screening applications. Furthermore, the identification of heretofore-unknown security features in British currency notes suggests that THz imaging could serve a future role as a detection mechanism against assorted counterfeiting practices. An extensive comparative analysis of experimental data produced using two QCLs (resonating at 2.8 and 3.6 THz) provides additional insight into the physics underlying these results, and suggests methods by which this imaging technology could be further improved.

KEYWORDS: THz, Terahertz, Real-Time, Microbolometer, Uncooled, QCL, Quantum Cascade Laser, Imaging, Detection, Camera, Focal Plane Array, Tsurupica, NETD, NEP, Vanadium Oxide, Silicon Nitride

**A MERIT-BASED ARCHITECTURE FOR THE AUTOMATIC SELECTION AND
COMPOSITION OF SERVICES IN SERVICE-ORIENTED ARCHITECTURE (SOA)-BASED
COMMAND AND CONTROL, COMMUNICATIONS, COMPUTERS, INTELLIGENCE,
SURVEILLANCE, AND RECONNAISSANCE (C4ISR) SYSTEMS**

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B.S., Brockport State University, 1987

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M.S., University of Louisville, 2003

Doctor of Philosophy in Software Engineering—June 2008

Advisor: James Bret Michael, Department of Computer Science

Department of Defense command and control, communications, computers, intelligence, surveillance, and reconnaissance (C4ISR) systems are responsible for supplying the right information at the right time to the warfighter. This dissertation presents a methodology for automating and realizing time-critical C4ISR applications. World Wide Web Consortium (W3C)-compliant services are introduced into the planning and battle management processes where a computer can be more efficient and more effective than a human operator. This approach is demonstrated using ballistic-missile defense (BMD) as a case study of a system in which the software services comprising the command, control, and battle management (C2BM) element of the BMD system need to operate within hard, real-time constraints. The realization of time-critical C4ISR applications is shown via continuously orchestrating individual services based on the automatically processing operational orders (OPORDs) and reports for the system to regulate itself. The system monitors, selects, and composes sub-services using a merit-based score until the mission stated in the OPORD is complete. The processing of the OPORDs for use by the C2BM element initiates and preserves the cyclic process of the kill chain used to negate threat ballistic missiles. To select and orchestrate services at runtime, the current Web Services Description Language (WSDL) standard is extended to encompass measures of performance and measures of effectiveness. In this approach the WSDL-advertised measures are continuously updated based on runtime monitoring, creating an historical basis of confidence for each of the services. The generation and use by the C2BM of continuously updating service-selection criteria is demonstrated. The composition language includes a software-design pattern for use in ensuring that time-critical processes complete within their time budget.

KEYWORDS: Service Oriented Architecture, Measures of Performance, Measures of Effectiveness, Quality of Service, C4ISR, Command and Control, Battle Management, Software Design, Software Architecture, Architecture Framework

DOCTOR OF PHILOSOPHY

MATHEMATICAL MODELING AND OPTIMAL CONTROL OF BATTLEFIELD INFORMATION FLOW

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Doctor of Philosophy in Applied Mathematics—June 2008

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The U.S. Army's future force requires information dominance to succeed, yet finds itself with an ever-increasing gap between its capacity to collect information and its information processing capacity—with little understanding of how to efficiently utilize scarce processing resources. In this investigation, a model is proposed to adequately represent the flow of information within a command-and-control context toward the end of optimally controlling this flow. The model is conjectured to be NP hard in general. Closed-form optimal solutions are derived for special cases of the model, while other cases are shown to be NP hard. A case of the model is shown to equate to a special case of the quadratic assignment problem not previously known to have a closed-form solution, and such a solution is derived. Upper and lower bounds are derived for more general cases of the model, and heuristic strategies are proposed and tested in discrete event simulation. Strong empirical evidence is produced to demonstrate the effectiveness and robustness of one heuristic.

KEYWORDS: Dynamic Information Flow, Sequencing and Scheduling, Quadratic Assignment Problem, Complexity

DATA STRATEGIES TO SUPPORT AUTOMATED, MULTI-SENSOR DATA FUSION IN A SERVICE-ORIENTED ARCHITECTURE

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The quantity of data available to decision-makers of various types is rapidly expanding beyond the pace of manual interpretation techniques. Introducing a service-oriented architecture (SOA)-based web service framework that exposes even more data without sufficient guidance will exacerbate the situation. Ontologies, data descriptions, and discovery methods alone are not enough to create the end-to-end solutions promised by SOA technologies. Software architectural patterns, in conjunction with broad data strategies, are required to harness and employ vast quantities of content. This dissertation provides two software architectural patterns and an auto-fusion process that guide the development of a distributed, accountable, and scalable SOA framework to support improved control and monitoring software. Although applicable to a wide range of software control system challenges, this dissertation focuses on maritime domain awareness (MDA) interoperability challenges. Using the U.S. Navy's MDA project as a case study, this dissertation designs, builds, and tests a prototype automated, data-fusion framework employing the trickle-up and command-and-control zone pattern that automates the discovery, pedigree assessment, and ultimate fusion of dissimilar data types in an SOA web-service supported framework.

KEYWORDS: Fusion, Multi-Sensor, Service Oriented Architectures, Software Engineering, Common Operations Picture, FORCEnet, Software Framework, Web Service Definition Language, WSDL, Universal Discovery Directory Index, UDDI, Simple Order Access Protocol, SOAP, Java, Maritime Domain Awareness, MDA, Business Process Execution Language for Web Service, BPEL4WS

**MASTER
OF
BUSINESS ADMINISTRATION**

MASTER OF BUSINESS ADMINISTRATION

A SIMULATION OF ORGANIZATIONAL COMMUNICATION PATTERNS DURING A TERRORIST ATTACK

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The purpose of this project is to provide a simulation that includes communication structures during a terrorist attack. Different communication patterns will provide different results in terms of effectiveness and efficiency. The plan is to identify some key variables to form an effective network structure in a military action. According to the key variables of an organization, centralized and decentralized structures produce different communication patterns, as well as different outputs. In a combat environment, these different patterns will produce distinct results in terms of effectiveness and efficiency. This environment can be modeled with the help of software such as Arena.

As a part of the global war on terrorism, NATO forces are conducting operations in Afghanistan. To enhance stability in Afghanistan, NATO established provincial reconstruction teams (PRTs) composed of multinational elements (partly civilian, but mostly military). These teams are static, and they form potential targets for terrorist attacks. The authors use PRTs in the model as the target of the terrorists and try to discriminate communication structures in these ambush scenarios.

KEYWORDS: Network, Centralized, Decentralized, PRT, Afghanistan, NATO, Terrorism

THE ROLE OF THE DEPARTMENT OF DEFENSE IN SOLAR-ENERGY RESEARCH, DEVELOPMENT, AND DIFFUSION

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The Department of Defense uses approximately 1.8 percent of the oil consumed each day in the U.S. and is the largest single institutional energy customer in the United States. Additionally, the U.S. has the highest per-capita oil-consumption rate in the world. Mindful of America's growing dependence on foreign oil and the geopolitical forces that threaten world supplies and national security, the DoD has vowed to convert to twenty-five percent renewable energy use by 2025. Through strategic partnerships with NGOs, commercial industry, and academia, the DoD's unique organizational capacity makes it suited not only to reach this goal, but to serve as an example for a national transformation toward a new energy future. This report examines the feasibility of niche solar-energy applications and the methods by which the DoD might positively impact solar-energy research, development, and technology diffusion.

KEYWORDS: Renewable Energy, Solar Energy, Photovoltaic Cells, Technology Diffusion, Networking, Strategic Alliances, Wind Power

MASTER OF BUSINESS ADMINISTRATION

AN ANALYSIS OF THE FACTORS GENERATING THE VARIANCE BETWEEN THE BUDGETED AND ACTUAL OPERATING RESULTS OF THE NAVAL AVIATION DEPOT OF NORTH ISLAND, CALIFORNIA

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For six of the past eight years, naval aviation depot-level maintenance activities have encountered operating losses that were not anticipated in the Navy Working Capital Fund (NWCF) budgets. These unanticipated losses resulted in increases or surcharges to the stabilized rates as an offset. This project conducts a variance analysis to uncover possible causes of the unanticipated losses. The variance analysis between budgeted (projected) and actual financial results is performed on financial data collected on the E-2C aircraft program from Fleet Readiness Center Southwest (FRCSW) in San Diego, California. The results of the variance analysis are interpreted and discussed in terms of labor sales quantity, mix, and rate variances, material-sales variance, material-expense variance, labor, production overhead, and general and administrative rate/spending and quantity variances. The results of this project reveal the factors that created the greatest variance in FRCSW's net operating results. The variance analysis suggests that the factors having the greatest affect on the operating results are the material-sales variances, material-expense variances, and the variances due to the quantity of work. Additionally, the analysis reveals that during the year analyzed (FY 2007), FRCSW was not reimbursed for twenty-one percent of its material costs.

KEYWORDS: Navy Working Capital Fund, Naval Aviation Depot, Fleet Readiness Center, Net Operating Result, Variance Analysis

THE USE OF INFORMATION TECHNOLOGY TOOLS IN SOURCE-SELECTION DECISION-MAKING: A STUDY OF THE U.S. AIR FORCE'S KC-X TANKER REPLACEMENT PROGRAM

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The source-selection phase in government acquisitions is extremely complicated because it involves multi-criteria decision making that is supposed to respond to various requirements—yet subjectivity is usually inevitable in this kind of decision-making process. The purpose of this project is to demonstrate how the current source-selection method (color-rating method) of the United States Air Force (USAF) is insufficient for showing small differences between proposed products, how this inadequacy leads to subjective decisions, and that the use of information-technology tools can augment objectivity in this process.

In this study, the USAF's KC-X tanker-replacement program is used to frame the research questions. Two models with two versions built on Microsoft Excel spreadsheets using publicly available KC-X program data are used to compare the USAF's color-rating method and weighted-sum method, which is a multi-criteria decision-making tool. It is presented that if the USAF had used the weighted-sum method as its evaluation method, the winner of the KC-X program could have been different. The findings prove that the color-rating method is not capable of reflecting small differences and that information-technology tools can help decision makers choose the best-value offer or with less subjectivity.

KEYWORDS: Source Selection, Proposal Evaluation, USAF's Color Rating Method, Multi-Criteria Decision Making, USAF's KC-X Program, Weighted Sum Method, Subjectivity in Source Selection

MASTER OF BUSINESS ADMINISTRATION

IMPROVING THE GOVERNMENT'S RETIREMENT-PLAN INVESTMENTS BY USING MINING TOOLS FOR DISCOVERY OF PRICE PATTERNS AND COMBINING METHODS OF FUNDAMENTAL AND TECHNICAL ANALYSIS

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There are many tools available to government fund managers for making investment decisions, especially regarding the retirement options available to U.S. service members, including Social Security, military retirement, Traditional Individual Retirement Accounts, Roth Individual Retirement Accounts, and the Uniformed Services Thrift Savings Plan.

This project concentrates on both long- and short-term investments by exploiting the combination of two types of investment methods. The first is to predict the future directions of prices by discovering the patterns of prices. The other is to combine fundamental and technical analysis successfully, which requires the study of their relationship.

The project consists of two independent parts. The first part introduces a knowledge representation model that codifies stock price movements in a binary format and then applies proper data mining techniques in order to discover profitable patterns of four candlesticks. The second part seeks to answer the question: If there are relationships between technical and fundamental analysis, can strategies to increase investment returns be developed?

KEYWORDS: Government Portfolio Optimization, Social Security, Military Retirement, Traditional Individual Retirement Accounts, Roth Individual Retirement Accounts, Uniformed Services Thrift Savings Plan, Codification System, Knowledge Representation Model, Hidden Patterns, Technical Analysis, Fundamental Analysis, Candlesticks

DENSITY AS A COST DRIVER IN NAVAL SUBMARINE DESIGN AND PROCUREMENT

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This thesis examines density reduction as an alternative to weight or size reduction when decision makers seek options for lower-cost submarine designs. The parameter density measures how tightly systems and equipment are placed within a hull structure. To address design characteristics unique to submarines, this research focuses mainly on submarine design and procurement—although the general concepts are applicable to surface ship designs and may be applied more broadly. Based on an examination of density as it relates to cost, this research indicates that: 1) the use of weight-reduction policies as a means to reduce cost have often generated the opposite effect; 2) increased cost schedule and performance risk and an improper mix of design capability and flexibility are the inevitable outcomes of unnecessarily dense designs; and 3) Arc-Permeability and Internal Density, measures developed for this research, are sufficient approximations of how tightly systems and equipment are placed within a compartment. Indeed, they may reveal how density represents a significant and previously underemphasized, if not unexplained, driver of historic submarine cost-growth in excess of inflation.

KEYWORDS: Density, Cost, Submarine, Weight, Cost Driver, Cost Analysis, Cost Estimating Relationship, Parametric, Cost Estimation, Design, Acquisition, Navy, Permeability, Size, Cost Growth, Cost Escalation

MASTER OF BUSINESS ADMINISTRATION

THIRD PARTY COLLECTIONS

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The focus of this thesis is the factors identified by Inspector General Audits and other research that inhibit the Navy's Third Party Collections Program from maximizing collections from third party payers as a result of failing to identify and collect other health insurance information from patients. Possible behaviors and attitudes from both hospital staff and patients that may be contributing to the problem of maximum collections are also examined.

KEYWORDS: Third Party Collections, Other Health Insurance, OHI

THE PALLET MANAGEMENT SYSTEM: A STUDY OF THE IMPLEMENTATION OF UNIQUE ITEM IDENTIFICATION/RADIO FREQUENCY IDENTIFICATION TECHNOLOGY FOR TRACKING SHIPPING MATERIALS WITHIN THE DEPARTMENT OF DEFENSE DISTRIBUTION NETWORK

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The purpose of this project is to identify the typical pallet utilization for Defense Distribution Depot San Joaquin (DDJC) shipments to the Defense Distribution Depot San Diego (DDDC). That information is used as the basis for suggesting a standardized reutilization management system for wood and non-wood pallets. This project provides analysis for the inclusion of radio frequency identification and unique-item identification, in conjunction with bar code technology, for the improvement of asset visibility within the Department of Defense's supply network.

KEYWORDS: Pallet, Pallet Management, Pallet Pooling, Radio Frequency Identification, RFID, Unique Item Identification, UID, Asset Visibility, Bar Code, Distribution Network

ENTERPRISE RISK MANAGEMENT SOLUTIONS: A CASE STUDY

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In recent years, financial risk management has received increasing attention from managers in both private and public enterprises, from regulatory agencies, and from elected officials. The purpose of this research is to prepare a case study of a firm that seeks to provide a risk management solution for organizations. The case study results in a business plan, which is strategic in scope, with a significant portion of the analysis concentrating on the firm's competitive positioning within the industry, and an assessment of the direction the firm should move to achieve future success. This case study provides the sponsoring firm's management team with a comprehensive, realistic, and unbiased strategic analysis, including recommendations for several unique courses of action for its future operating, management, and financial decisions.

KEYWORDS: Financial Risk Management, Strategic Analysis, Porter's Five Forces

MASTER OF BUSINESS ADMINISTRATION

AN ANALYSIS OF THE ORGANIZATIONAL STRUCTURES SUPPORTING PLANNING, PROGRAMMING, BUDGETING, AND EXECUTION WITHIN MILITARY DEPARTMENTS

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Each military department produces a budget submission through use of the Planning, Programming, Budgeting, and Execution (PPBE) system. Although the overall PPBE process is defined, each service conducts the process differently and is organized to do so differently. Using Mintzberg's theory on organizational structures and Nadler and Tushman's congruence model, an analysis of each department's financial management organizational structure is conducted. This analysis identifies differences in the structure of senior leadership positions, the qualifications of budgeting personnel, the centralization of decision authorities, liaison positions inherent in the organizations, the formalization of the process, and the interaction between programmers and budgeteers. Recommendations are provided to Navy financial management leadership for improved congruence.

KEYWORDS: PPBE, Budgetary Process, Department of Defense, Department of the Navy, Organizational Structure, Mintzberg, Nadler, Tushman, Congruency, Congruence Theory

AN ANALYSIS OF THE PPBE PROCESS IN THE CURRENT DYNAMIC POLITICAL ENVIRONMENT

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The Planning, Programming, and Budgeting (PPB) system was introduced in the Department of Defense (DoD) in the 1960s to link strategies to programs that best satisfy the nation's policy objectives and fit within budget constraints. Over the past 45 years, modifications were made to the PPB system, and it is now referred to as the Planning, Programming, Budgeting, and Execution (PPBE) system, but the original intent of PPB remains intact. Traditionally, wars were initially funded with emergency supplemental funding until the cost of the war could be added into the baseline budget process. The Global War on Terror (GWOT), now in its sixth year, continues to be funded outside the PPBE process through supplemental appropriations. This project identifies and examines the key factors related to this deviation from the PPBE process. The research analyzes the domestic environment in which PPB was originally implemented and the post 9/11 environment in which it currently exists. A comparative analysis is used to determine the reasons for the increased use of supplementals for baseline and GWOT funding in the last six years. The project also identifies the implications of continued deviation from the PPBE process utilizing parallel budgeting processes.

KEYWORDS: PPB, PPBE, Baseline Budget Process, Emergency Supplemental Appropriation, Global War on Terror, Deviation, Post 9/11, Environment, Budget System

MASTER OF BUSINESS ADMINISTRATION

AN ANALYSIS OF CONTRACTING PROCESSES AND ORGANIZATIONAL CULTURE AT THE NAVAL AIR SYSTEMS COMMAND

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This study assesses contracting process capabilities at Naval Air Systems Command (NAVAIR) in Patuxent River, Maryland, using the Contract Management Maturity Model (CMMM). The primary purpose of this study is to analyze NAVAIR's contracting processes to identify key process-area strengths and weaknesses and provide a roadmap for improvement. This study also focuses on assessing organizational culture at the NAVAIR Contracting Directorate. Several studies have shown that organizational factors, such as organizational culture, are strong determinants of performance. Other studies have shown that when an organization is dominated by a culture type, the most effective leaders are those that demonstrate a matching leadership style. This study uses the Organizational Culture Assessment Instrument (OCAI) to identify the organization's current and preferred culture type as viewed by the leadership at the organization. The results provide NAVAIR leaders with an awareness of culture type so that they can match their leadership style to the assessed culture for optimum performance.

KEYWORDS: Contracting, Contracting Processes, Contract Management Maturity Model, CMMM, Organizational Culture, Competing Values Framework, CVF, Organizational Culture Assessment Instrument, OCAI

AN ANALYSIS OF THE TRANSITIONING OPPORTUNITY FOR NON-TRADITIONAL FIRMS UNDER OTHER TRANSACTION AUTHORITY

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The federal government no longer dominates defense and space-based technologies as it once did. This is due to the diminishing role of the federal government as the lead developer and owner of advance technologies. What began in the 1980s with private industry starting to outspend federal government in research and development has resulted in significant technological innovations in commercial companies. As a result, government turned to private industry to access commercially developed technology. One procurement instrument, Other Transaction Authority for Prototype Development (OTAs), was authorized by Congress to help enable the Department of Defense (DoD) and other government agencies to form business arrangements with traditional and non-traditional firms to develop weapon systems and related products. While this prototyping authority has provided non-traditional firms with the opportunity to conduct business with the DoD, there is limited information available on whether these projects have provided transition opportunities for follow-on production. This research examines the transition opportunities available to non-traditional firms who have completed an OTA for prototyping.

KEYWORDS: Other Transaction Authority, Other Transaction Authority for Prototype Development, OTA, Section 845, Prototyping, Non-Traditional Defense Firms, Chemical Biological Radiological Technology Alliance, Rosettex, DFARS 212.70

MASTER OF BUSINESS ADMINISTRATION

AN ANALYSIS OF TICONDEROGA-CLASS CRUISER OPERATING TARGETS FOR OTHER CONSUMABLES, REPAIR PARTS, AND ADMINISTRATIVE EXPENDITURES

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The purpose of this project is to analyze Ticonderoga-class cruiser operating targets (OPTAR) for the Atlantic Fleet (LANTFLT) and the Pacific Fleet (PACFLT). The scope of the analysis focuses on the Ticonderoga-class cruisers – the surface combatants with the least amount of configuration differences among the class.

This project is conducted with the sponsorship and assistance of Commander, Naval Surface Forces (CNSF). The goal of this project is to provide CNSF with underlying causes that explain lower expenditures for LANTFLT than PACFLT in the sub-accounts of other consumable (SO), repair (SR), and administrative (SX). Due to levels of data available and the proportion of total expenditures that each sub-account represents, the emphasis of the analysis is concentrated on the other consumable and the repair sub-accounts.

The project develops a methodology to analyze expenditures within the cruiser class by three different levels; the sub-account level, the expense element level, and the system level. The cruisers are classified into groups based on their fleet, homeport, area classification (OCONUS or CONUS), and baseline configuration at the sub-account and expense element levels to determine if there are relationships within the different groupings.

KEYWORDS: Ticonderoga Class Cruiser, Baseline Configuration, Expenditures, Expense Element, EE, Operating Target, OPTAR, Other Consumable, SO, Repair Parts, SR, Administrative, SX, Sub-Account, Equipment Identification Code, EIC, National Item Identification Number, NIIN

DOES A PROMISE TO JOIN OR JOINING NATO IMPACT MILITARY SPENDING PATTERNS OF COUNTRIES?

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The purpose of this thesis is to identify similarities and analyze changes in military spending (patterns and structure) of the countries that have joined the North Atlantic Treaty Organization (NATO) in the past 15 years.

The thesis first addresses whether NATO membership, or a promise to join NATO, impacts a country's budgetary behavior and its defense resource allocation the same for all countries, or whether it differs by country. This question is addressed by examining changes in the spending structure five years before and after joining NATO. This research also attempts to determine if there are any common spending patterns among the countries.

Military expenditure data for Latvia, Lithuania, Estonia, Poland, Hungary, the Czech Republic, Albania, Croatia, and the former Yugoslav Republic of Macedonia (FYROM) are analyzed, and country data is cross-compared using quantitative analysis (correlation, R-square and t-test for means). The goal is to draw conclusions for whether the spending patterns and trends for the countries mentioned above are moving in the same direction. Does the percentage of GDP allocated for defense needs change in the same pattern for these countries? Are the spending patterns among groups of countries who joined NATO similar, or is there no evidence of change in budgetary behavior due to joining (or promising to join) NATO?

MASTER OF BUSINESS ADMINISTRATION

KEYWORDS: NATO New Member Military Expenditure, Baltic Country Military Expenditure, Visegrad Country Military Expenditure, Adriatic Country Military Expenditure, NATO New Member Spending Trends

CORRECT REQUIREMENTS—A FACTOR FOR SUCCESS IN MAJOR ACQUISITION PROGRAMS

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This MBA project investigates the importance of correctly deriving requirements from the capability gap and operational environment, and translating them into the processes of contracting, software and hardware design, systems engineering, the acquisition cycle, and program management. The research also examines inefficiencies in hardware and software development, acquisition management, and problems caused by organizational, systemic, and stakeholder interferences. The primary goal is to achieve an acquisition process that delivers the best quality system that is prompt, technically available, affordable, and meets the user's requirements.

This work addresses commonalities and differences of software and hardware development, inefficiencies, and a variety of influential factors for a new program from a more general perspective. The conclusions and recommendations illustrate the present difficulties in implementing constructive change. These recommendations provide the reader with alternative approaches to consider. Suggestions for further research are included.

KEYWORDS: Requirements, Requirements Development, Requirements Verification, Requirement Changes, Architecture, Acquisition Process, Budget Restrictions

DEFENSE INDUSTRY CONSOLIDATION AND WEAPON SYSTEMS COST GROWTH

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This project constitutes a survey of the cost growth of weapon systems acquired by U.S. Department of Defense (DoD) services. The goal is to assess whether the extensive consolidation of the defense industry has led to any significant change in cost growth. The primary data source for the cost of the weapon systems is the Selected Acquisition Reports (SAR), which are published by the DoD for major acquisition programs. The time period explored is from approximately 1985 to 2007. An overall assessment of the situation of the defense industry today, as a result of the consolidation, is made. The ultimate goal of the project is to reveal whether the consolidation has improved efficiency in terms of cost growth, and is thus beneficial to the DoD, or whether further restructuring of the acquisition system is necessary in response to the new conditions.

KEYWORDS: Defense Industry, Consolidation, Cost Growth, Defense Budget, Procurement, Selected Acquisition Reports, SAR

MASTER OF BUSINESS ADMINISTRATION

AN ANALYSIS OF CONTRACTOR LOGISTICS SUPPORT FOR THE P-8 POSEIDON AIRCRAFT

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This study assesses the costs as an independent variable (CAIV) of the maintenance manpower of both the original equipment manufacturer (OEM) contractor logistics support (CLS) and an estimated organic Navy complement for the P-8 Poseidon program. Comparisons to similar aircraft procurements are analyzed for possible benefits and limitations regarding a single source provider of CLS. Furthermore, current logistic acquisition culture and operational impacts are reviewed in order to determine feasibility and possible areas of further research.

KEYWORDS: P-8, P-8A, CLS, Contractor Logistics, CAIV, Cost as an Independent Variable

DEFENSE EXPENDITURE AND ECONOMIC GROWTH: AN EMPIRICAL STUDY OF THE CASE OF TURKEY

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The goal of this thesis is to identify the relationship, if any, between defense spending and economic growth for Turkey, and to discuss the policy implications of the empirical results. Since Turkey has one of the largest defense budgets within the Middle East and NATO, this question has important implications for Turkey's future economic well-being and political stability.

Taking into account the difficulties present in previous military expenditure studies, an econometric model is specified and empirically tested using Turkish data for 1969-2004. Results suggest that there is a negative link between military expenditure and economic growth. The second part of the empirical study tests the defense-welfare relationship in Turkey, using expenditures on health and education as welfare proxies. The empirical findings suggest that there are tradeoffs between military expenditures and welfare spending. However, there seems to be a positive relation between military expenditures and education.

The Turkish Republic's defense policy has been continually guided by Ataturk's proverb of "peace at home, peace in the world." However, sustaining a peaceful environment has required a high level of military expenditures. What makes Turkey's military expenditures relatively high? Is it possible to draw inferences that high military expenditures are a requirement for Turkey? To answer these questions, factors that are major reasons for high military expenditures are also discussed in this thesis. These include strategic factors, conflict with PKK terrorism, disputes with Greece, the military modernization program, and the economic environment of Turkey.

KEYWORDS: Defense-Growth Relationship, Defense Spending, Turkish Defense Expenditures, Defense Tradeoff

MASTER OF BUSINESS ADMINISTRATION

THE USE OF THE ANALYTICAL HIERARCHY PROCESS AS A SOURCE SELECTION METHODOLOGY AND ITS POTENTIAL APPLICATION WITHIN THE HELLENIC AIR FORCE

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This thesis assesses the feasibility of using the Analytical Hierarchy Process (AHP) as a dynamic tool for decision-making in defense acquisition. The gradual reductions in defense budgets; the need for efficient allocation of funds among competitive activities; the demand from public opinion for rationality, transparency, and efficiency in defense spending; and the complicated legislation concerning procurements all call for changes in the way officials make decisions. The AHP is a multi-attribute, decision-making technique developed by Thomas Saaty to support users with complex decision-making by combining their experience, judgment, and intuition with a view to selecting the best course of action from a number of alternatives. Literature suggests that the AHP is suitable for a wide variety of applications in economics, finance, politics, games and sports, conflict resolution, cost/benefit analyses, resource allocation, source selection, and resolution of everyday problems. This study focuses on the potential use of the AHP for combat-aircraft source selection by the Hellenic Air Force, analyzing legislative, acquisition, and technical issues relating to this procurement. The conclusion of this research is that AHP is a suitable decision-making tool for defense acquisitions, and it is recommended that the Hellenic Air Force evaluate its potential usefulness via a series of pilot acquisition programs.

KEYWORDS: Analytical Hierarchy Process, AHP, Source Selection, Combat Aircraft Source Selection, Hierarchies of Criteria, Multicriteria Decision Making, Key Performance Parameters in Acquisition of Combat Aircraft

MASTER OF SCIENCE

Applied Mathematics
Applied Physics
Applied Science
Computer Science
Defense Analysis
Electrical Engineering
Electronic Warfare Systems Engineering
Engineering Acoustics
Human Systems Integration
Information Operations
Information Systems and Operations
Information Technology Management
Information Warfare Systems Engineering
Leadership and Human Resource Development
Mechanical Engineering
Meteorology and Physical Oceanography
Modeling, Virtual Environments, and Simulation
Operations Research
Physical Oceanography
Program Management
Software Engineering
Space Systems Operations
Systems Engineering
Systems Technology

MASTER OF SCIENCE IN APPLIED MATHEMATICS

AN ANALYSIS OF ANALYTIC MODELS FOR THE EFFECT OF INSURGENCY/COUNTERINSURGENCY OPERATIONS ON THE GENERAL POPULATION

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Master of Science in Applied Mathematics—June 2008

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Hong Zhou, Department of Applied Mathematics

Second Reader: Moshe Kress, Department of Operations Research

This thesis proposes and analyzes mathematical descriptive models of the effect of insurgency/counterinsurgency operations on the population of a nation experiencing stability operations. The model is a system of differential equations representing insurgent activity, insurgent recruiting, and insurgent removal by the coalition; the population's tolerance for insurgent violence; occurrence of actions by the coalition and insurgency that the population perceives as beneficial and damaging; and the resulting change in the population's support for the government. The study focuses on a single population, attempting to identify and model the first order effects of stability force actions on the population. The effect of possible strategies by local government and external stability forces to influence popular support toward the government is represented and studied. It is found that the greatest increase in popular support occurs when the coalition concentrates on performing actions that are perceived by the population as beneficial *and* that mitigate the effects of its damaging actions. When the population does not perceive insurgent actions as damaging, it is found that the coalition has difficulty increasing popular support for the government. Coalition cooperation with local leaders in planning and executing beneficial actions may increase the perceived effect of coalition actions the population perceives as beneficial.

KEYWORDS: Insurgency, Counterinsurgency, Coalition, Influence Model, Stability Operations, Popular Opinion Model, Dynamic Model, Differential Equations

PASCAL POLYNOMIALS OVER GF(2)

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The Discrete Logarithm Problem (DLP) is a fundamental cryptographic primitive. The DLP is defined for any cyclic group, specifically finite fields, whether the integers modulo a prime p or a polynomial field of characteristic p modulo some irreducible polynomial $f(x)$. For polynomial fields over a finite field, also known as Galois fields, the DLP can be viewed as finding a solution to the equation $1+x^i=x^j$ for arbitrary values of i (modulo some primitive polynomial). Solutions are (relatively) easy to find for trinomials and these would be the easiest polynomials to implement in hardware. However, primitive trinomials do not exist for all degrees.

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Primitive polynomials are irreducible polynomials with an associated primitive element α that is a generator of the multiplicative group. Thus, the generator α generates all 2^n-1 nonzero elements of a Galois field whose base field is the integers modulo two. Primitive polynomials over the field of two elements, or $GF(2)$, have important applications in cryptology and coding theory.

This thesis investigates properties of polynomials with more than three terms where all but one term is a row of Pascal's triangle modulo two. In other words, a certain class of polynomials is defined by $f(x)=x^n+p(x)$, where $p(x)$ is a row of Pascal's triangle modulo two. This thesis shows that some of these polynomials also have "easy" solutions. It is observed that for a polynomial to have an associated primitive element, there are definite restrictions on the degree of a polynomial given particular rows of Pascal's triangle.

KEYWORDS: Discrete Mathematics, Abstract Algebra, Number Theory, Galois Fields, Linear Feedback Shift-Register

SOLVING THE MAXIMUM CLIQUE PROBLEM ON A CLASS OF NETWORK GRAPHS, WITH APPLICATION TO SOCIAL NETWORKS

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Social network analysis frequently uses the idea of a clique in a network to identify key subgroups of highly connected members of the network. The maximum clique problem is formulated on undirected graphs and two algorithms are developed to solve the problem: a pruning algorithm and an enumeration algorithm. The pruning algorithm successively improves an upper bound on the clique number of a graph, and the enumeration algorithm successively finds larger and larger cliques in the graph. Both terminate with a maximum clique in the graph, and, when run together, provide an interval of uncertainty on the size of a maximum clique in a graph that converges to zero. The algorithms are applied to real examples in the modeling of terrorist social networks, and it is determined that the algorithms are efficient and practical for problems of moderate size.

KEYWORDS: Maximum Clique, Clique Number, Graph, Backtracking Algorithm, Social Network, Terrorist Network

OPTIMAL JAMMER PLACEMENT TO INTERDICT WIRELESS NETWORK SERVICES

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Hong Zhou, Department of Applied Mathematics

Second Reader: W. Matthew Carlyle, Department of Operations Research

The demand for wireless networks continues to grow as the need for portable, low-cost, telecommunications systems increases around the world. Wireless networks are particularly complex because their topologies can change in response to operational requirements or environmental conditions, and also because wireless networks are susceptible to electromagnetic interference. In this thesis, the challenges associated with the operation and jamming of so-called "wireless mesh networks" are considered. In a wireless mesh network, the communication devices (denoted here as a nodes) are uniform in their ability to send and receive transmissions. Two related optimization problems are formulated and

solved for wireless mesh networks. First, the problem of the network operator is solved, namely: in order to maximize the utility of delivered network traffic, how should one set the power transmission levels for each node, and along what sequence of transmission links should the traffic flow? The second problem considered involves an intelligent adversary, the attacker, who wants to place jamming devices among a finite number of locations to disrupt the operator's traffic in the worst possible way. Mathematical programs are formulated and solved to obtain the optimal operation and jamming of these networks. A computational, decision-support tool that affords the rapid reconfiguration and analysis of various deployment scenarios is developed.

KEYWORDS: Wireless Networks, Network Interdiction, Nonlinear Programming, Simultaneous Routing and Resource Allocation, Wireless Network Jammer locations, Jammer Placement

MASTER OF SCIENCE IN APPLIED PHYSICS

CHARACTERIZATION OF THE MICRO-ELECTRO-MECHANICAL SYSTEM DIRECTIONAL SOUND SENSOR FABRICATED USING THE SOIMUMPS PROCESS

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Master of Science in Operations Research—June 2008

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Robert A. Koyak, Department of Operations Research

A micro-electro-mechanical system (MEMS) based directional sound sensor performance is characterized. The operation of the directional sound sensor is based on the hearing organ of the Ormia ochracea fly, which uses coupled bars hinged at the center to achieve the directional sound sensing.

The MEMS sensor design considered in this thesis is fabricated using a process by which the sensor has two resonant vibrational modes: rocking and bending. The sensor is simulated using finite element analysis and tested by actuating the sensor using a sound stimulus. An analysis is undertaken to describe, in mathematical terms, the relationship between the sensor's amplitude of vibration and various parameters, such as the angle of incidence, frequency, and the intensity of sound.

The experimentally observed vibrational frequencies are found to be in good agreement with the simulated data, which supports the use of the simulation in future sensor development. The observed amplitudes of vibration are significantly greater than those of sensors fabricated with the process used in previous studies. The relationship between the amplitude of vibration and the incident angle are found to agree with the theoretical predictions. The results indicate that it is possible to fabricate miniature sound sensors that mimic the fly's hearing system.

KEYWORDS: SOIMUMPs, MEMS, Ormia Ochracea, Biomimetic, Directional Microphone, Sensors, Microphone, Fly Hearing, Undersea Warfare

IN SITU OPTICAL IMAGING OF CARRIER TRANSPORT IN MULTI-LAYER SOLAR CELLS

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The goal of this thesis is to explore the utility of in situ optical imaging of charge transport imaging in multi-junction solar cells. An in situ measurement of a manufactured solar cell's key material parameters is difficult. Many sophisticated models may be used to predict the performance of new cell arrangements and suggest next generation improvements. In parallel, an experimental view into a complex, multi-layered, alloyed, semiconductor device can provide important feedback for material growth and device fabrication.

This body of work builds on the previous work of extracting estimated minority carrier diffusion lengths from multi-junction solar cell materials. Indium Gallium Phosphide double heterostructures have been previously investigated with effective results. A technique to estimate electron diffusion length from a luminescent sample intensity distribution has been developed.

APPLIED PHYSICS

This thesis investigates imaging transport and applying the diffusion length estimation directly in the triple junction device. Luminescence from individual layers is isolated using optical filters. The effect of varying temperature and applying bias during the imaging technique is also investigated. A strong dependence of effective diffusion length on environmental temperature is measured. In addition, a weak dependence of effective diffusion length on bias is measured, with the effect slightly greater in the top, as compared to the central cell.

KEYWORDS: Solar Cells, Triple Junction Solar Cells, Semiconductor, Diffusion Length

MASTER OF SCIENCE IN APPLIED SCIENCE

ANALYZING THE EFFECTS OF HUMAN PERFORMANCE UNDER STRESS

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Second Reader: LCDR David W. Meyer, USN, Department of Operations Research

Baseball players are examined in order to analyze the effects of stress on human performance. Baseball players are selected for examination because of the large body of data and many measures of performance available. Clutch hitting is examined because a baseball player batting in a clutch situation is analogous to a person who is performing in a stressful situation. The more important (or clutch) the situation, the more stress the player may feel. Statistical measures are used to determine if a player is able to perform better than his average ability in situations defined as clutch. Three different clutch definitions are used to examine eight consecutive years of baseball data. Major League Baseball (MLB) data shows an overall clutch effect; this is corrected for with a parameter, alpha, which is specific to the definition of clutch. Once each player's non-clutch average minus the clutch average is corrected for with alpha, the chi-squared test is used to examine those differences. This analysis is also performed on the quartile values for batters who are ranked according to their difference, corrected by alpha. There is no evidence to support the claim that there are certain batters who perform better in clutch situations (compared to their own performance in non-clutch situations) than other batters.

KEYWORDS: Baseball, Clutch Hitting, Binomial Proportion, Sign Test

A UNIFIED GENERAL FRAMEWORK OF INSURGENCY USING A LIVING SYSTEMS APPROACH

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Second Reader: David L. Alderson, Department of Operations Research

This thesis develops a unified general framework of insurgency. The framework is “unifying” in that it includes all the physical and social science formulations of insurgencies and both contemporary and historical insurgencies. It is “general” in that it describes all insurgencies rather than a specific one. This thesis first redefines the definition of insurgency in the context of the twenty-first century and addresses military, political, social, and economic elements. Next, it adopts the view that an insurgency is a living system. This idea is based on the characteristic that every insurgency consists of a group of people embedded in a larger society. Using this concept, this thesis argues that James Grier Miller's Living Systems Theory, from his book *Living Systems*, is the most fitting theory to study insurgency. To demonstrate the framework's effectiveness, it is applied to the Iraq Sunni insurgency. The framework is used to describe the structure of the insurgency system using three levels—insurgency, improvised explosive device (IED) unit, and IED cell—and the twenty critical subsystems that process information

and matter-energy in the insurgency's IED cell. This framework should help clarify, focus, and support the current debates about policy, operations, and tactics for insurgencies.

KEYWORDS: Insurgency, Iraq, Sunni, Living Systems Theory, James Grier Miller, Systems, Improvised Explosive Devices, IEDs

THE ALLOCATION OF UNMANNED AERIAL VEHICLE SEARCH EFFORTS USING DYNAMIC PROGRAMMING AND BAYESIAN UPDATING

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Second Reader: Moshe Kress, Department of Operations Research

As unmanned aerial vehicle (UAV) technology and availability improves, it becomes increasingly more important to operate UAVs efficiently. Utilizing one UAV at a time is a relatively simple task, but when multiple UAVs need to be coordinated, optimal search plans can be difficult to create in a timely manner. In this thesis, a decision aid is created that generates efficient routes for multiple UAVs using dynamic programming and a limited-look-ahead heuristic. The goal is to give the user the best knowledge of the locations of an arbitrary number of targets operating on a specified graph of nodes and arcs. The decision aid incorporates information about detections and non-detections and determines the probabilities of target locations using Bayesian updating. Target movement is modeled by a Markov process. The decision aid is tested in two multi-hour field experiments involving actual UAVs and moving targets on the ground.

KEYWORDS: Unmanned Aerial Vehicle, Search Model, Dynamic Programming, Bayesian Updating, Simulation, Multiple Searcher Routing

MASTER OF SCIENCE IN COMPUTER SCIENCE

AN AUTOMATED ACQUISITION SYSTEM FOR MEDIA EXPLOITATION

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Second Reader: Chris Eagle, Department of Computer Science

This thesis explores the requirements for building a highly usable acquisition system for an automated document and media exploitation system. Work to date is presented on AcqMan, an acquisition manager written in Java that uses DBUS and the Hardware Abstraction Layer (HAL) to automatically detect device insertion and start forensic imaging.

KEYWORDS: DOMEX, Media Exploitation, Automated Forensics, Forensic Imaging, Computer Forensics

EXPLORING AND VALIDATING DATA MINING ALGORITHMS FOR USE IN DATA ASCRPTION

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Master of Science in Computer Science–June 2008

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Second Reader: Craig Martell, Department of Computer Science

Digital forensics is a growing and important field of research for current intelligence, law enforcement, and military organizations. As more information is stored in digital form, the need and ability to analyze and process this information for relevant evidence has grown in complexity. Today analysis is reliant upon trained experts. This, compounded with the sheer volume of evidence obtained from the field, means that analysis frequently takes too long. Current forensic tools focus on decoding and visualization, not on data reduction or correlation. This thesis fills an important void. The first goal is to determine whether it is possible to use file metadata accurately to ascribe ownership of files based upon a hard drive with multiple users. The second is to explore and validate existing algorithms that may support and aid data ascription. The last goal of this work is to compare and measure the accuracy of these algorithms. This work facilitates further research into developing an automated analysis and reporting framework for media exploitation in computer forensics.

KEYWORDS: Data Mining Algorithms, Metadata, File Ascription, Data Carving, Multi-User Hard Drives

COMPUTER SCIENCE

A PRELIMINARY ANALYSIS FOR PORTING XML-BASED CHAT TO THE MONTEREY SECURITY ARCHITECTURE

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Master of Science in Computer Science–June 2008

Advisors: Cynthia E. Irvine, Department of Computer Science

Thuy D. Nguyen, Department of Computer Science

The Monterey Security Architecture (MYSEA) is a distributed multilevel secure (MLS) computing environment. MYSEA does not presently support chat, an internet application that provides near-real-time collaboration capability. Chat capability that implements the Extensible Messaging and Presence Protocol (XMPP) standards has been recognized by the Department of Defense (DoD) as a mandatory standard. The primary goal of this thesis is to determine if a chat server that implements the XMPP and the XMPP Instant Messaging (XMPP-IM) standards could be ported to MYSEA.

To accomplish this goal, a set of selection criteria is developed and the open-source jabberd14 server is selected for this study. Its functionality is tested on different operating system environments (Fedora 7, RedHat 8, STOP OS 7 beta). This study also includes a functional analysis of the XMPP and XMPP-IM specifications, the related XMPP extensions supported by the jabberd14 server, a preliminary security analysis, and a survey of the jabberd14 server code.

The results of this project show that implementation of the XMPP jabberd14-1.6.0 server on the MYSEA platform under STOP 7 OS is feasible. The results also provide stepping stones toward a full-scale development effort to provide MLS-aware chat services in the MYSEA network.

KEYWORDS: Information Assurance, MLS, Chat, XMPP, MYSEA, Jabber

AUTOMATED METADATA EXTRACTION

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Metadata is data that describes data. There are many computer forensic uses of metadata, and being able to extract metadata automatically provides positive forensic implications. This thesis presents a new technique for batch processing disk images and automatically extracting metadata from files and file contents. The technique is embodied in a program called fiwalk, which has a plug-in architecture that allows new metadata extractors to be readily incorporated. Output from fiwalk can be provided in multiple formats, such as ARFF and text. The plug-ins created for this thesis include one created by Simson Garfinkel for extracting metadata from .jpeg files, two for Microsoft Office documents (one for prior to the Office 2007 release and one for the Office 2007 release), and a default plug-in for extracting metadata from .gif, .pdf, and .mp3 files. To better understand the metadata available in common file formats, such as .doc, .docx, .odt, .pdf, .mp3, .mp4, .jpeg, .tiff, and .gif, an examination of these formats is provided.

KEYWORDS: Metadata, Metadata Extraction, Fiwalk, WV, Libextractor, File Formats, ARFF

COMPUTER SCIENCE

IMPLEMENTING AN INTRUSION DETECTION SYSTEM IN THE MONTEREY SECURITY ARCHITECTURE

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Thuy D. Nguyen, Department of Computer Science

The Monterey Security Architecture (MYSEA) supports a multilevel secure (MLS) network and a number of single-level networks at different classification levels. The MYSEA MLS server is the focus of policy enforcement. It implements a Dynamic Security Services (DSS) mechanism that can modulate IPsec security attributes and MYSEA security services based upon administrator choices. Use of intrusion detection technology on unprotected, single-level networks can provide administrators with actionable information to inform DSS choices.

The objective of this thesis is to design an intrusion detection system (IDS) architecture that permits administrators operating on MYSEA client machines to conveniently view and analyze IDS alerts from the single-level networks.

A progressive set of analyses and experiments is conducted that leads to a working implementation of an IDS for MYSEA. Sensors are located on the single-level networks. Their alerts are fed into the MLS server, where single-level databases are used to store and organize the data. Administrators can login from the MLS LAN and examine IDS results, which may be used to derive new DSS policies. A testing methodology is developed and functional tests are performed. Implementation considerations for future extensions of this work are presented.

KEYWORDS: MYSEA, Monterey Security Architecture, Dynamic Security Services, DSS, Intrusion Detection System, IDS

MASTER OF SCIENCE IN DEFENSE ANALYSIS

THE EVOLUTION OF THE TALIBAN

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Master of Science in Defense Analysis—June 2008

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Second Reader: Heather S. Gregg, Department of Defense Analysis

The Taliban organization has undergone a major transformation since its ouster from power in Afghanistan, and it continues to wage an effective defensive insurgency or “war of the flea.” This study uses results of a survey of knowledgeable participants in the Afghan-Pakistan arena, conducted by the authors, to analyze the current situation and prospects for success. The thesis explains the Taliban's survival and growth in the face of significant odds by analyzing the organization's strengths, weaknesses, and how it adapts in response to the counterinsurgency efforts of coalition forces. The Taliban are deeply rooted in the cultural, religious, and ethnic linkages of the Pashtun population. The thesis emphasizes that a conventional counterinsurgency strategy using large-scale military operations and a fundamentally alien system of governance out of harmony with local traditions cannot penetrate the Pashtun tribal, religious, and cultural web in which the Taliban operate. The thesis concludes with recommendations for designing and implementing a broader Coalition strategy to target identified Taliban critical linkages.

KEYWORDS: Taliban, Afghanistan, Pakistan, FATA, Pashtuns, Counterinsurgency, Strategy, ISAF, Al Qaeda, Organizational Design

HAS PLAN COLOMBIA IGNORED NEIGHBORING COUNTRIES?

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The United States government has two main concerns in South America's Andean region. The first is drug production and trafficking. The second is the insurgency conducted by Colombian narco-guerilla groups. The Colombian government is dedicated to defeating those illegal groups primarily through its military strategy, Plan Colombia, which has received about five billion dollars in U.S. funding in the last seven years. Plan Colombia, as a shortsighted policy initiative, has geopolitical impacts on diplomacy, economics, national security, and the population's well-being. Plan Colombia has resulted in second-order effects on the neighboring countries of Ecuador and Venezuela, increasing border violence, population displacement and the creation of refugees, environmental damage, black market weapons trading, and drug trafficking.

Using trust and influence theory and focusing on the drug supply from the Andean region, this thesis analyzes how Plan Colombia affects Ecuador and Venezuela as a result of a poor understanding of regional relationships and the actions taken by these neighboring countries to reduce, overcome, or even exacerbate

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negative second order effects. Ecuador hosts one of the U.S. SOUTHCOM's CSL/FOL in Manta. Venezuela is also important for anti-drug efforts and the battle against transnational threats.

KEYWORDS: Andean Region, Drug Trafficking, Drug Revenues, Coca Cultivation, Demand Side, Supply Side, Narco-Guerilla Groups, FARC, ELN, AUC, Andean Counter Drug Initiative, Plan Colombia, Negative Second Order Effects, Neighboring Countries, Colombia, Ecuador, United States, Venezuela

THE DETERRENCE OF NUCLEAR TERRORISM THROUGH AN ATTRIBUTION CAPABILITY

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Second Reader: Michael Freeman, Department of Defense Analysis

The state of the world is such that the pace of nuclear weapons proliferation appears to be increasing. The growing number of nuclear states and amount of nuclear material available poses a great challenge to those attempting to keep nuclear weapons out of the hands of terrorists and other non-state actors. This study examines how the development of a nuclear attribution capability using the tools and methods of nuclear forensics can address that challenge.

The prevention of nuclear terrorism is a multi-front battle. One of these fronts is preventing state sponsorship of nuclear terrorism. This can most likely be accomplished through deterrent policies where severe and credible military action is threatened against would-be nuclear sponsors. However, such threats only have meaning if the sponsors are convinced that their participation could be detected. Therefore, there is a need for a credible means to determine the source of nuclear materials from the debris of a nuclear explosion.

The current state of a national nuclear-forensics capability is lacking. A more robust database of known nuclear materials is needed, as is organizational restructuring and equipment development.

KEYWORDS: Nuclear Forensics, Nuclear Terrorism, Nuclear Attribution, Deterrence, Terrorism

THE RAJAH SOLAIMAN ISLAMIC MOVEMENT AND THE RISE OF RADICAL ISLAMIC CONVERTS IN THE PHILIPPINES: A MAJOR SECURITY CONCERN

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Master of Science in Defense Analysis—June 2008

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The rise of radical Islamic converts in the Philippines is one of the major security concerns in the Philippines today. The Rajah Solaiman Islamic Movement (RSIM) emerged from various "Balik-Islam" (revert to Islam) organizations that advocate for the conversion of the country to Islam on the belief that the Philippines was an Islamic land prior to western colonization. RSIM, which established links with various terrorist organizations both in the Philippines and in the Middle East, has been responsible for several major terrorist attacks in the country in recent years.

Despite the arrests of several key leaders of RSIM and Philippine counterterrorism successes against the movement's objectives, RSIM remains a major security concern in the Philippines due to the continued existence of social, political, and economic factors that enable the possibility of RSIM or RSIM-like groups to re-emerge. The Philippine government must address the root causes of the problem in order to reduce the grievances of the people, weaken radical organizational strength, and control the political opportunities that have led to the growth of social movements in the Philippines, including the RSIM radical Islamic converts.

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KEYWORDS: Balik-Islam Movement, BIM, Rajah Solaiman Islamic Movement, RSIM, Government of the Republic of the Philippines, GRP, Islamic Converts, Moro Islamic Liberation Front, MILF, Moro National Liberation Front, MNLF, Converts

CV OR NOT TO BE? ALTERNATIVES TO U.S. SEA-BASED AIR POWER

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Second Reader: Wayne P. Hughes, Jr., Department of Operations Research

This thesis focuses on aircraft carriers and identifying an appropriate path towards the future of U.S. sea-based air power by studying historical cases of air power integration into the warfighting capabilities of the fleet. It analyzes the current utilization and effectiveness of the aircraft carrier, given its operational requirements with respect to identified threats as described in security and strategy statements. It can be agreed upon that the U.S. Navy requires air cover; but whether air cover should be sea-based, in the form of super carriers, jeep carriers, VTOL/STOVL aircraft on many vessels, or even land-based U.S. Air Force protection in littoral settings, is the question investigated in this thesis. Proponents of U.S. super-carriers suggest that no other single asset in the U.S. military arsenal can bring as much concentrated striking power to U.S. decision-makers' ability to respond to crises nearly anywhere in the world. Despite this, a fundamental question arises: What does the future hold for sea-based air power? Aircraft carriers are among the military's costliest assets. With defense budgets under close scrutiny, policymakers are under growing pressure to fully exploit military assets and to minimize the prospects that assets may be underutilized.

KEYWORDS: Aircraft Carriers, Super Carriers, Alternative Sea-Based Air Platforms, CVL Small Fast Carrier, Jeep Carriers, Asymmetric Threats, Irregular Warfare, Special Operations Forces, CVN-21, CVN-78, STOVL Aircraft

COUNTERINSURGENCY AND ITS IMPLICATIONS FOR THE NORWEGIAN SPECIAL OPERATIONS FORCES

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Norwegian Naval Academy, 1995

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Second Reader: Douglas Borer, Department of Defense Analysis

This study explores the Norwegian Special Operations Forces' (NORSOF) capabilities in coping with today's security environment, which is characterized more by unorthodox threats, such as insurgencies, and less by "conventional" wars between nation-states. Thus, this study raises the hypothesis that NORSOF is less than optimally suited for counterinsurgency operations.

Using the dichotomy of a direct approach versus an indirect approach as a framework for how NORSOF conducts operations, this author claims that NORSOF has focused mainly on direct capabilities and less on indirect capabilities, the latter which experience has proven to be so effective and efficient in counterinsurgency operations. Analysis of the characteristics of insurgency and how to counter it leads to the conclusion that NORSOF will enhance its relevance and efficacy if it also acquires indirect capabilities, and thus can employ both a direct and an indirect approach, depending on the situation. However, although NORSOF may play an important role in counterinsurgency operations, there are several limitations that inhibit NORSOF's role in these types of operations. Accordingly, NORSOF's operations must be seen in the larger context of how to effectively quell an insurgency.

KEYWORDS: Insurgency, Counterinsurgency, COIN, Irregular Warfare, Norwegian Special Operations Forces, NORSOF, Norwegian Armed Forces

DEFENSE ANALYSIS

SECURITY CHALLENGES IN THE GULF OF GUINEA SUB-REGION: A STRATEGY FOR NIGERIA

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Master of Science in Defense Analysis—June 2008

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The Gulf of Guinea (GoG) sub-region has large deposits of hydrocarbons and other natural resources. There is now stiff international competition among industrialized nations, including the United States, some European countries, and China, Japan, and India, that are looking for new, safer, and more reliable sources of energy as a result of the Middle-East crisis. Extra-regional competitions for oil, while boosting the economy of the sub-region, have also exposed the area to increased security risks. Sub-regional resources and potential are presently undermined by multifaceted domestic, sub-regional, and international threats and vulnerabilities. These challenge the sub-regional states, including Nigeria, with limited capacity for maritime security. Assessment of sub-regional naval forces based on their order of battle shows that most of their navies cannot police beyond their territorial waters.

This study presents an integrated, collective, maritime-security strategy for the sub-region. The strategy proposes measures to protect the maritime environment from unauthorized use and develop member states' capabilities to deal with emerging security threats. Additionally, it encourages collaboration with extra-regional powers and oil majors in an effort to transform naval capabilities and improve interoperability to meet the challenges of the changing security threats within the sub-regional maritime domain.

KEYWORDS: Interest, Security, Sea Power, Strategy, Maritime Environment, Maritime Domain Awareness

DETECTING CROSS-BORDER CONFLICT IN THE HORN OF AFRICA: A CASE STUDY OF THE KENYAN–UGANDAN BORDER

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This case study analyzes the nature of cross-border conflicts and deterrence measures in the Horn of Africa, with a focus on the pastoral communities of Pokot, Turkana, and the Karamojong. These communities in northwestern Kenya and eastern Uganda are under intolerable stress and involved in a violent struggle to survive. While insecurity in this area is often characterized as arising from competition over scarce resources, there are broader dimensions to local conflicts. These revolve around a long history of social, cultural, economic, and political exclusion. The states' role in the provision of security and support to pastoral communities is, on the whole, poor. Both countries have a tendency to sometimes use excessive military force. Pastoral communities have reasons to feel alienated. Lack of political will and corruption likewise frustrate efforts to keep the peace. This study examines the interplay among raids and counter-raids, internal security, the rule of law, and democratic governance. A number of steps for achieving greater stability in the region are proposed.

KEYWORDS: Horn of Africa, HOA, Cross-Border Conflicts, Raids and Counter-Raids, Pastoralism, Pastoral/Tribal Communities, Kenya/Uganda Common Border, Karamojong, Pokot, Turkana, Water and Pasture Resource, Banditry and Cattle Warlords, NGOs, Peace Initiatives, Deterrence Measure, IGAD, EAC, Violent, Arms Proliferation and Disarmament

DEFENSE ANALYSIS

HEZBOLLAH: THE NETWORK AND ITS SUPPORT SYSTEMS—CAN THEY BE STOPPED?

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Not all terrorist organizations are rootless groups engaging only in international terrorism. Many terrorist groups are socially intertwined with the local population, highly territorialized, and compete directly for governance. Terrorist groups such as the IRA, Hamas, Mahdi Army, Sendero Luminoso, and Hezbollah are past and present examples of a socially intertwined terrorist organization. These groups present significant, but different, challenges to national security than Al Qaeda presents, and a different strategy to defeat them may be in order. Using Hezbollah as an example, this thesis addresses the question of whether the direct military approach used to combat terrorist groups, such as Al Qaeda, is appropriate to defeat a socially intertwined terrorist group as well. If not, what techniques would be the most useful?

KEYWORDS: Hezbollah, Hizbullah, Terrorism, Targeted Killing, Game Theory, Terrorist Financing, Socially Embedded Terrorist Groups, Indirect Methods

SPECIAL FORCES OFFICER RECRUITING IN A HIGH OPTEMPO ENVIRONMENT

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This thesis investigates, analyzes, and determines how the current levels of operations tempo (OPTEMPO) and the Army's efforts to mitigate OPTEMPO's negative impacts are affecting the recruitment of U.S. Army officers for service in special forces (SF). In light of the dynamic nature of the Army's operational environment today, this thesis does not attempt to provide a conclusive list of all the things that have a positive or negative impact on SF officer recruitment, but rather focuses on aspects that have been most often identified by previous research, highlighted in interviews with SF volunteers and recruiters, and demonstrated by statistical trend analysis. This thesis contends that SF officer recruiting appears promising for the next several years despite the challenges of today's dynamic operational environment. There are two main reasons behind this success: the aspects of mission satisfaction associated with SF, which appear to be consistent across time, and the benefits of SF OPTEMPO structure, which may be temporary in nature. Both of these elements are currently enhanced by SF's increased exposure to the conventional Army.

KEYWORDS: U.S. Army Recruiting, Special Forces, Officer, OPTEMPO

FOSTERING PARTNERSHIP IN HUMANITARIAN AID AND DISASTER RELIEF

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Master of Science in Defense Analysis—June 2008

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Humanitarian-aid operations are a social and interactive enterprise among a variety of international partners. There are currently many initiatives attempting to enhance collaboration between United States government agencies, foreign governments, international governmental organizations, non-governmental organizations (NGOs), and private, volunteer organizations. The diverse nature of the organizations and the numbers of groups involved in a complex humanitarian emergency is extraordinary. Participants must understand that there are multiple factors that impact the collaborative capacity of groups in humanitarian aid and disaster relief. They need to understand that some NGOs will work with the military and some will not. Military forces must respect NGO needs for independence, neutrality, transparency, and impartiality.

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However, when actors can come to an agreement regarding contact within these environments, the sum of their efforts will be greater than their individual contributions. Face-to-face contact is crucial in enhancing collaborative capacity. Individuals build trust through face-to-face contacts, which can translate to more frequent contact using other, less personal or social modes of communication. Collaboration is an iterative process. Participants must build collaborative capacity over time by focusing on developing swift trust, and they must also be aware of cultural understanding. Participants must also use face-to-face contact at the initial meeting. After swift trust is established, participants can use the media of decreasing richness over time, but should schedule face-to-face meetings to ensure that collaboration is maintained.

KEYWORDS: Collaboration, Networks, Civil Affairs, Civil Military Operations, NGO, IGO, UN, Information Sharing, Humanitarian Aid, Disaster Relief, SSTR, Community of Interest, Trust, Face-to-face Contact, IT, Communications Technology, Internet

MASTER OF SCIENCE IN ELECTRICAL ENGINEERING

PERFORMANCE ANALYSIS OF AN ALTERNATIVE TO TRELLIS-CODED MODULATION FOR WAVEFORMS TRANSMITTED OVER A CHANNEL WITH PULSE-NOISE INTERFERENCE

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Master of Science in Electrical Engineering—June 2008

Master of Science in Electronic Warfare System Engineering—June 2008

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Tri T. Ha, Department of Electrical and Computer Engineering

The performance of a communication system having almost the same spectral efficiency as a trellis-coded modulation (TCM) system with $r = 2/3$ convolutional encoding and 8-ary phase-shift keying (8-PSK) modulation is investigated. TCM is a common solution to the problem of adding forward-error-correction (FEC) coding without an attendant increase in channel bandwidth. The primary drawback to TCM is that the achievable coding gain is limited by the maximum practical number of states in the convolutional encoder. The alternative system considered uses (63, 37) Reed–Solomon (RS) encoding. The six-bit symbols at the output of the Reed–Solomon encoder undergo serial-to-parallel conversion to two three-bit symbols, which are then independently transmitted on the in-phase (I) and quadrature (Q) component of the carrier using 8-ary biorthogonal keying (8-BOK). This system has a null-to-null bandwidth of $0.993R_b$, which is 0.7% smaller than TCM with $r = 2/3$ convolutional encoding and 8-PSK modulation. The two waveforms are compared for the relatively benign case where additive white Gaussian noise (AWGN) is the only noise present, as well as when pulse-noise interference (PNI) is present. It is found that both systems have almost the same performance in AWGN, but with PNI the alternative system has better performance.

KEYWORDS: Trellis Code Modulation, M-ary Bi-Orthogonal Keying, Reed-Solomon Coding, Additive White Gaussian Noise, Pulse Noise Interference, Error-and-Erasure Decoding

HIGH-PERFORMANCE PARALLEL JAVA WITH JAVAPARTY

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Master of Science in Electrical Engineering—June 2008

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To achieve better performance with Java applications, computers can be interconnected with fast networks to form a cluster, making available multiple Java virtual machines. Unfortunately, Java does not provide an elegant, easy-to-use mechanism for parallel programming on clusters. JavaParty transparently adds remote objects to Java while avoiding the disadvantages of programming with remote method invocation (RMI) and the many disadvantages of the message-passing approach in general. This thesis presents a performance analysis of a cluster running a Java benchmark using JavaParty. It reveals quantitative performance measurements showing a decrease in application execution time by adding more machines. In addition, this thesis presents a method to increase the performance of the cluster network in the presence of network congestion using quality of service.

KEYWORDS: High Performance Computing, Cluster, Java, JavaParty

ELECTRICAL ENGINEERING

TERRESTRIAL COMMUNICATION BETWEEN WIRELESS-SENSOR NETWORKS USING BEAM-FORMING AND SPACE-DIVISION MULTIPLE ACCESS

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In this thesis, methods are presented for forming a communications link between wireless-sensor networks (WSNs) by enabling each WSN to act as a smart antenna. Each WSN is simulated as a set of randomly placed sensor nodes within a planar area. The proposed method involves a searching WSN, a receiving WSN, and a link budget for establishing the link.

The searching WSN has the task of transmitting a search beam in order to find adjacent WSNs. Like a lighthouse, this is done in a rotating, beam-style search using the sensor nodes as an aperiodic array. Results show that for a random array, a specific beamwidth and gain can be achieved as a function of the number of elements and area. It is also demonstrated that for a given required gain level, the array can be spatially thinned without significant loss of gain or the effects of grating lobes.

The receiving WSN uses a spread spectrum-based space division multiple access (SDMA) receiver. This receiver is simulated to determine the direction of arrival (DOA) from the searching WSN and to extract the location information from the searching WSN's signal in additive white Gaussian noise. From the DOA and the location information within the arriving signal, the WSN has sufficient knowledge to respond to the query of the searching WSN and form the communications link.

KEYWORDS: Wireless Sensor Network, Space Division Multiple Access, SDMA, Direction of Arrival, DOA, Spread Spectrum, Random Arrays, Smart Antennas

THE DESIGN, ANALYSIS, AND CONSTRUCTION OF A HIGH-VOLTAGE CAPACITOR CHARGING SUPPLY

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The desire to use railguns in defense applications has elevated the level of concentration in all areas of the railgun system. Necessary in any railgun is a large amount of electric power to deliver the required force to the projectile. One popular source of power is high-voltage capacitor banks. The Naval Postgraduate School's railgun lab employs a fully functioning railgun with capacitor banks as power supplies. A reliable and safe charging supply for these capacitor banks is desirable and is investigated in this paper. Construction and testing of a power-supply charger is compared to simulation results. The power-supply charger consists of a voltage source inverter connected to a high-voltage boost transformer; the output of the transformer is connected to a voltage-doubler rectifier; the output of the rectifier charges the high-voltage capacitor to 9 kV in two minutes. The power-supply controller is a field-programmable gate array with embedded control to ensure the safe operation of the power supply.

KEYWORDS: Charger, Power Converter, Railguns, High Voltage, FPGA, VSI, Capacitor, Charging

MASTER OF SCIENCE IN ELECTRONIC WARFARE SYSTEMS ENGINEERING

PERFORMANCE ANALYSIS OF AN ALTERNATIVE TO TRELLIS-CODED MODULATION FOR WAVEFORMS TRANSMITTED OVER A CHANNEL WITH PULSE-NOISE INTERFERENCE

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Master of Science in Electrical Engineering—June 2008

Master of Science in Electronic Warfare System Engineering—June 2008

Advisors: R. Clark Robertson, Department of Electrical and Computer Engineering

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The performance of a communication system having almost the same spectral efficiency as a trellis-coded modulation (TCM) system with $r = 2/3$ convolutional encoding and 8-ary phase-shift keying (8-PSK) modulation is investigated. TCM is a common solution to the problem of adding forward-error-correction (FEC) coding without an attendant increase in channel bandwidth. The primary drawback to TCM is that the achievable coding gain is limited by the maximum practical number of states in the convolutional encoder. The alternative system considered uses (63, 37) Reed–Solomon (RS) encoding. The six-bit symbols at the output of the Reed–Solomon encoder undergo serial-to-parallel conversion to two three-bit symbols, which are then independently transmitted on the in-phase (I) and quadrature (Q) component of the carrier using 8-ary biorthogonal keying (8-BOK). This system has a null-to-null bandwidth of $0.993R_b$, which is 0.7% smaller than TCM with $r = 2/3$ convolutional encoding and 8-PSK modulation. The two waveforms are compared for the relatively benign case where additive white Gaussian noise (AWGN) is the only noise present, as well as when pulse-noise interference (PNI) is present. It is found that both systems have almost the same performance in AWGN, but with PNI the alternative system has better performance.

KEYWORDS: Trellis Code Modulation, M-ary Bi-Orthogonal Keying, Reed-Solomon Coding, Additive White Gaussian Noise, Pulse Noise Interference, Error-and-Erasure Decoding

MASTER OF SCIENCE IN ENGINEERING ACOUSTICS

AN INVESTIGATION OF THE ACOUSTIC SOURCE CHARACTERISTICS OF HIGH-ENERGY LASER PULSES: MODELS AND EXPERIMENT

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This thesis is motivated by the possibility of using high-energy laser pulses as an acoustic source for naval applications. Research conducted in the 1970s and 1980s shows that sound production from laser pulses is most efficient when the energy density of the pulse exceeds the threshold required for plasma formation. The resulting acoustic wave falls into the highly nonlinear shock regime. Later work by Vogel, et al., sought a more complete understanding of the nonlinear dynamics and energy distribution of this process in an attempt to limit collateral tissue damage during laser surgery. This work includes detailed experimental data, such as photographs and hydrophone measurements, as well as numerical calculations of expected pressures, bubble dynamics, and pulse shapes.

The goal of this thesis is to further investigate the characteristics of the laser-generated acoustic pulse through experimentation and modeling. Experiments are carried out with Ted Jones at the Naval Research Laboratory to investigate the directionality of the acoustic pulse produced by a 100fs 2mJ laser pulse focused just under the surface of water. The range dependence of the pressure amplitude is also examined. The amplitude of the pulse is found to vary with direction; however, this effect is considered likely to be a result of interference between the direct path and the surface reflection. A linear, least-squares fit of the peak pressure amplitude with range reveals a $1/r^{1.2}$ relationship. This is consistent with the expected approximately $1/r$ relationship for pressure amplitudes under 100MPa. The modeling effort employs AUTODYN, a finite element program designed to handle the non-linear processes in explosions. The laser-generated acoustic source is modeled using an explosive of the same volume as the laser spot reported by Vogel for his 10mJ 6ns pulse. The internal energy of the explosive is adjusted until the pressure amplitudes agree with Vogel's measured values. The efficiency, pulse length, pulse shape, and variation of pressure amplitude with range achieved with AUTODYN are comparable to those reported by Vogel.

KEYWORDS: Laser Acoustics, Shock Waves, Acoustic Sources, Nonlinear Acoustics, AUTODYN, Acoustic Modeling, Shock Acoustics

HIGH-SPEED BLADE VIBRATION IN A TRANSONIC COMPRESSOR

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Master of Science in Engineering Acoustics–June 2008

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This experiment is conducted to measure transverse vibrations of the blades in a transonic compressor rig at the Naval Postgraduate School. The compressor is instrumented with noninvasive laser-light probes to measure changes in time of arrival of all the blades relative to an expected arrival time. These times are then converted to blade deflections. Results prove that the primary observed vibration is a first-bending mode. The frequencies that excited this mode precisely correlate with NASA predictions. It is shown that the modal frequency for the first-bending mode is dependent on engine speed as a result of the untwisting blade. Maximum observed blade deflection is proved to occur during the surge event, resulting

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in maximum blade fatigue. It is concluded that certain operating regimes, with large blade deflections, should be avoided to extend blade life by limiting fatigue.

KEYWORDS: Compressor, Transonic, NSMS, Laser Light Probes, Stall, Surge, Campbell Diagram, Bending Modes, Vibration

MASTER OF SCIENCE IN HUMAN SYSTEMS INTEGRATION

A QUALITATIVE ANALYSIS OF THE NAVY'S HUMAN-SYSTEMS INTEGRATION BILLET STRUCTURE

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Master of Science in Human Systems Integration–June 2008

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This research is conducted in response to a request by the chief of naval personnel. The Navy's human systems integration billet structure, the work requirements of the 4600 (human-systems integration)-coded billets, and the work done by officers who had a 4600 subspecialty code are examined. The research results support the hypothesis that the work requirements of the July 2007 dataset of 4600P-coded billets (billets requiring graduate education in human-systems integration) was not properly representative of the human-systems integration competencies as developed through the educational skill requirements; not all Navy human-systems integration work was identified by a 4600 subspecialty; and the 4600 billet structure did not allow sufficient career progression opportunities. Despite the focus on the defense-acquisition process in the human-systems integration curriculum at the Naval Postgraduate School, the billets did not reflect this priority. In order for human-systems integration to be a viable subspecialty requiring graduate education, relevant billets need to be identified in the Navy. The research recommends conducting an in-depth needs analysis to better identify the human systems integration work of the Navy by organization, which will lead to a better "fit" of officer category, designator, grade, education, and work experience.

KEYWORDS: HSI, Human Systems Integration, NOBC, ESR, 1200, Billets, 4600, SSP, Subspecialty, Navy Human Resources, Manpower, Needs Analysis

MASTER OF SCIENCE IN INFORMATION OPERATIONS

MILITARY DECEPTION RECONSIDERED

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Master of Science in Information Operations–June 2008

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This thesis explores the elements of military deception and defines the overarching principles that make for successful military deception. A good reference point is the six principles of military deception as defined by *Joint Publication (JP) 3-58*: focus, integration, timeliness, security, objective, and centralized control. However, the author proposes that operational advantage, consisting of surprise, information advantage, and security, are essential elements of a successful military deception. To refine the scope of the research, this analysis of deception is focused on the tactical and operational levels of war. This thesis begins with a cross-analysis of the principles of deception as defined by the U.S. military and academics, followed by historical case studies, and then an application and validity test of proposed key elements of deception against the case studies.

KEYWORDS: Deception, Operational Level Deception, Tactical Level Deception, Information Advantage, Surprise, Operational Advantage, Military Tactics, Deception Campaigns

MASTER OF SCIENCE IN INFORMATION SYSTEMS AND OPERATIONS

EXPLORING DATA SHARING BETWEEN GEOGRAPHICALLY DISTRIBUTED MOBILE AND FIXED NODES SUPPORTING EXTENDED MARITIME-INTERDICTION OPERATIONS

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After the 9/11 catastrophe, insurgents and terrorists have shown that they will continue to employ asymmetric threats to carry out their objectives by using any available equipment or any available route to their objective that remains unchecked or unchallenged, such as car bombs, suicide bombers, and commercial airplanes. In response, the United States and its allies are focusing harder on data sharing in order to improve the situational awareness (SA) of command-and-control structures, make quicker decisions, and collaborate with remote experts on chemical, biological, and radiological elements and biometrics or explosive devices.

This thesis discusses the data-sharing contributions and features of collaborative tools used on a boarding vessel in a riverine area and participating nodes for providing or enhancing the SA and decision-making process during extended maritime-interdiction operations. As maritime-operational experiments (conducted by the Center for Network Innovation and Experimentation) are more successful with each successive MIO experiment, a better understanding of methods for sharing substantial data captured during these operations with participating nodes will be reached.

KEYWORDS: Wireless, MIO, Networks, Situational Awareness, Tactical Operations Center, Command and Control, Nodes, Data Sharing, Riverine, CENETIX

MASTER OF SCIENCE IN INFORMATION TECHNOLOGY MANAGEMENT

A PERFORMANCE-MANAGEMENT ANALYSIS OF IPV6 SENSOR ON THE MOVE USING COMMERCIAL NETWORK-MANAGEMENT SOFTWARE

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Internet Protocol Version 4 (IPv4) has been the internet standard since specified nearly twenty-seven years ago. Although IPv4 has served us well, the ever-growing demand for additional IP addresses has led to the introduction of a new IP version, IPv6. Supported by the Internet Engineering Task Force (IETF) for more than ten years, IPv6 is recognized as a critical enabling technology throughout the federal government. IPv6 is also necessary in order to support the continuing growth of global communication requirements within special operations forces (SOF) and ensure that the global internet can continue to support a growing international user base and the increasing number of IP-enabled devices.

Although numerous network-management studies have been conducted, few have concentrated on tactical or edge network management. Furthermore, few studies have identified potential management tools supporting usability within the Global Information Grid. In a coordinated effort with the primary sponsor, the U.S. Special Operations Command, the Naval Postgraduate School has developed the Tactical Network Topology (TNT) field experimentation program, which is aimed at providing solutions for today's battle space. TNT facilitates the examination of network management through the functional area of performance management and will serve to identify the tool that best supports network management of IPv6 tactical networks with IPv4 components.

KEYWORDS: IP, Global Information Grid, Network-Centric Warfare, Tactical Network, Network Management, Internet Protocol Version 6

AN ONTOLOGICAL APPROACH TO DEVELOPING INFORMATION-OPERATIONS APPLICATIONS FOR USE ON THE SEMANTIC WEB

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Master of Science in Software Engineering—June 2008

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Information operations (IO) has the potential to alter the landscape of modern warfare through the sustained application of a broad spectrum of kinetic and non-kinetic effects. Operations of this type offer the benefit of reducing the scope of direct conflict by shaping the perceptions of a potential adversary. The complexity and diversity of IO make it an ideal beneficiary of software applications, but current systems have yet to truly leverage domain expertise in systems development. By expressing IO capabilities in a formal ontology suitable for use on the Semantic Web, conditions are set such that computational power can more efficiently be leveraged to better define required capabilities and more reliably predict effects. The purpose of this thesis is to identify gaps in existing IO software applications, demonstrate how IO capabilities may be represented in a software ontology, and develop a process by which an IO ontology

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may be adapted for use on the semantic Web. These objectives are accomplished by examining leading IO applications, demonstrating a process for converting the IO problem domain into an ontology using the Protege 3.3 Ontology Editor, and assessing the suitability of the ontology for use on the semantic Web.

KEYWORDS: Information Operations, IO, Psychological Operations, PSYOP, Electronic Warfare, EW, Electronic Attack, EA, Electronic Protect, EP, Electronic Support, ES, Semantic Web, SW, Resource Description Resource, RDF, Ontology, Ontology Web Language, OWL, Protege, Poseidon

IMPLICATIONS OF SERVICES-ORIENTED ARCHITECTURE AND OPEN-ARCHITECTURE COMPOSABLE SYSTEMS ON ACQUISITION ORGANIZATIONS AND PROCESSES

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The U.S. Navy is interested in acquiring systems that promote the use of services-oriented architecture (SOA) and open architecture (OA) in integrated warfare systems (IWS). The number of systems required to share data and provide reliable information in weapons systems is growing. Many systems, systems-of-systems, and families-of-systems with different software architectures are acquired and often have difficulty operating together, which causes delays, increases costs, and limits reuse. Intelligent adoption of SOA and OA may help solve integration and reuse issues in current and future acquisition programs. The commercial market is successfully beginning to implement SOA and OA in their processes and may provide examples of best practices that can be applied to the defense-acquisition system. The goal of this thesis is to explore the feasibility of implementing SOA and OA into the defense-acquisition system. Adoption of SOA and OA practices is not expected to completely alter the current defense-acquisition system; instead, it is intended to alleviate some of its constraints. This thesis focuses on utilizing SOA and OA in IWS, how SOA and OA principles relate, and the effects they will have on the defense-acquisition system's organizations and processes.

KEYWORDS: Services-Oriented Architecture, SOA, Open Architecture, OA, Integrated Warfare Systems, IWS, Defense Acquisition System, Navy, USN, Naval Open Architecture, NOA, Modular Open Systems Approach, MOSA, Horizontal Systems Engineering, Consolidated Afloat Networks and Enterprise Services, CANES

THE FRAMEWORK FOR AN INFORMATION-TECHNOLOGY STRATEGIC ROADMAP FOR THE UNITED STATES MARINE CORPS: HOW CURRENT ACQUISITIONS ALIGN TO THE CURRENT STRATEGIC DIRECTION OF THE DEPARTMENT OF DEFENSE, THE DEPARTMENT OF THE NAVY, AND THE UNITED STATES MARINE CORPS

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Development and implementation of a 21st century Marine Corps information technology (IT) roadmap may comprise a “tipping point” for future warfighting effectiveness. This thesis establishes the basis for a framework for an IT strategic roadmap for the United States Marine Corps.

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This thesis depicts how current acquisition programs align to current IT strategies. A premise, based on the theoretical foundation of general systems theory, is that the alignment of multiple IT strategic plans, roadmaps, and strategies positively affects system effectiveness. IT strategies are identified and compiled from Department of Defense, Department of the Navy (DoN), and United States Marine Corps overarching strategic documents. Major acquisition programs for the DoD, DoN, and USMC are selected and summarized. These selected current acquisition programs are related to the identified IT strategies from the DoD, DoN, and USMC overarching strategic documents in terms of their interrelationships or alignment. Based on the research, recommendations are provided for current acquisition programs to better align with the current direction of DoD, DoN, and USMC IT strategy. Future research opportunities are also identified.

KEYWORDS: Alignment, IT Strategies, Roadmap, National Defense Strategy, DoD CIO Strategic Plan, Enterprise Transition Plan, Sea Power 21, DoN Information Management/Information Technology Strategic Plan, Marine Corps Strategy 21, Commandant's Planning Guidance, USMC Concepts and Programs, Transformation, Net-Centric, Information Operations, IA, Information Sharing, Horizontal Integration, Governance, DIMHRS, JC2, Navy ERP, GCCS-M, MCEITS, GCCS-MC

INTEGRATED DATA-DRIVEN DECISION-SUPPORT SYSTEM IN A LABORATORY ENVIRONMENT

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Decision-support technologies have remained individualistic as primarily standalone platforms. The ability to access and integrate a wide range of such technologies in an integrated decision technology environment (IDTE) can potentially increase a user's ability to create more complex decision-support projects. A well-designed IDTE will allow users to identify, learn about, access, execute, and integrate disparate decision technologies. Data-driven DSS provide decision makers with the capability to store and sort vast amounts of data by leveraging data warehousing and data mining. These data-oriented decision technologies can assist decision makers in making better and more informed decisions in shorter durations of time. This thesis focuses on data-driven, data-mining decision technologies and how they can be integrated into an IDTE. In the process of identifying data-mining technology requirements, a simple taxonomy, characterized by the four categories of association, classification, clustering, and prediction, is created. A database schema is then designed for storing the requisite data about data-mining technologies, and case studies illustrating their use are presented. Finally, a simple yet effective interface is designed for navigating through the data-driven, decision-technology universe, both at the Naval Postgraduate School and beyond. SQL commands for populating the various screens of the IDTE interface are provided to show proof of concept.

KEYWORDS: Data-Driven Technology, Data Mining, IDTE, Integrated Decision Technology Environment, DSS

A KNOWLEDGE-VALUE-ADDED (KVA) METHODOLOGY AS A TOOL FOR MEASURING THE UTILIZATION OF KNOWLEDGE ASSETS ABOARD MARINE CORPS INSTALLATIONS

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Master of Science in Information Technology Management–June 2008

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The past four commandants of the Marine Corps have published their intent to adopt better business practices and transform business processes. The compelling urgency in ensuring that the Corps achieves

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optimal performance from its limited resources is supported by protracted global commitments, increasing labor and technology costs, and lawmaker and taxpayer demands for fiscal prudence.

The Department of Defense, Department of the Navy, and the Marine Corps have adopted continuous process-improvement (CPI) programs to foster a culture of ongoing business transformation and process improvement. CPI techniques, such as value-stream analysis and lean-six sigma, are being employed at a growing pace to improve processes and redirect savings towards core capabilities.

Workforce optimization is central to the success of these efforts. Personnel productivity can be measured using knowledge as a common metric to determine value. Knowledge assets include people and the information technology systems that improve their abilities to perform their work.

The knowledge-value-added (KVA) methodology calculates return on knowledge (ROK) and utilization rates of knowledge assets. A case study is explored that uses KVA to measure ROK and utilization rates as a means to monitor and set benchmarks for optimal organizational performance in support of CPI programs.

KEYWORDS: ROK, Return on Knowledge, KVA, Knowledge Value Added, Financial Management, Performance Measurement, Performance Metrics, BPR, Business Process Reengineering, ABC, Activity Based Costing, LSS, Lean Six Sigma, CPI, Continuous Process Improvement

THE ANALYSIS, DESIGN, AND IMPLEMENTATION OF A LOGICAL PROOF-OF-CONCEPT PROTOTYPE FOR STREAMLINING THE ADVERTISEMENT OF BILLETS FOR THE U.S. MARINE CORPS RESERVE

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The primary objective of this thesis is to provide the Marine Corps with a thorough, bottom-up, system analysis of the next-generation, billet-advertisement system that will replace Reserve Duty Online (RDOL). The study includes a detailed systems analysis, a generic architecture, logical data models, process models, and a system model that provides the Marine Corps with a blueprint of the requirements for the next system of record. The secondary objective of this thesis is to analyze current system architectures that advertise and fill job vacancies within the Department of Defense, and to evaluate commercial, off-the-shelf products in order to identify what architecture should be leveraged by the Marine Corps during its next build.

In the midst of a long war, it is clear that the reserve is an integral part of the Marine Corps total force. This integration hinges on the recognition that the ability for reservists to be able to easily search and identify available opportunities is of the utmost importance. The proposed architecture and requirements analysis presented in this thesis will provide a solid foundation for the development of a next-generation system.

KEYWORDS: Web Enabled, Architecture, Recruiting, Systems Analysis, Requirements Analysis, Process Model, Data Model, Use-Case, Reserve Duty Online, RDOL

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AN ANALYSIS OF RELATED SOFTWARE CYCLES AMONG ORGANIZATIONS, PEOPLE, AND THE SOFTWARE INDUSTRY

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There is a need to understand possible benefits and value-added approaches among recurring cycles in software implementation in large bureaucracies, including the Department of Defense.

This thesis acknowledges the assumption that three distinct and disjointed cycles are present: 1) the organizational ability to implement new software, 2) timelines associated with individual capabilities to adopt new software, and 3) the software industry's desires and tactics to introduce new software.

This thesis focuses on deriving possible benefits from a DoD perspective if the alignment of the cycles were possible.

The primary research question is: how are the organizational, personal, and software industry's development and adoption cycles related? Secondary research questions are: 1) how might synchronization of cycles benefit adoption of software?, 2) is technology, with respect to advances in software, moving at a pace that is too fast for large bureaucracies like the DoD to keep up with?, 3) what alternatives have branches of the DoD taken to mitigate the effects and disadvantages caused by software implementation timelines and cycles?, and 4) what financial benefit or value could be gained when disjointed cycles among large bureaucratic organizations, users within the organizations, and the software industry are aligned?

KEYWORDS: Software Implementation, Software Cycles, Software in the DoD

TRANSFORMING DATA AND METADATA INTO ACTIONABLE INTELLIGENCE AND INFORMATION WITHIN THE MARITIME DOMAIN

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At present, the Navy is unable to offer a robust, routable network that provides real-time, actionable intelligence between boarding operations and intelligence analysts. Actionable intelligence is the means of obtaining concrete knowledge that permits an individual to take action based on known information. The lack of a robust, routable network creates a lag in operational responsiveness to potential threats identified within the maritime environment. In response to current shortfalls, improved extended maritime-interdiction operations (EMIO) seek to support the secretary of the Navy's vision to streamline and improve operations and exploitation of boarding data. However, there has been no clear indication as to how the implementation of these technologies will affect command and control or current operations. This thesis examines the impact of improved EMIO technology designed to bridge together data with intelligence collected during EMIO and improve maritime-domain decision making in terms of speed and quality and, thus, improve the end user's situational awareness. The construct of business process re-engineering (BPR) is followed to frame this analysis and to provide focus in data collection. The changes to the present EMIO process are also examined by developing and implementing an organizational simulation using POWER 2.0. Results indicate that when improved Spiral-1 EMIO technologies, which significantly decrease the amount of time it takes to fuse collected boarding data into intelligence systems, are combined with a re-design of the EMIO organization, a qualitative improvement toward accomplishing the overall process can be achieved. The current process requires thirty-five hours. With the revised technological and proposed

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organizational changes, the same process can be achieved in five hours, thus realizing the naval secretary's vision of streamlining and improving maritime operations.

KEYWORDS: Business Process Reengineering, Leavitt's Diamond, POW-ER, Extended Maritime Interdiction Operations, Maritime Interdiction Operations, Maritime Domain Awareness

MASTER OF SCIENCE IN INFORMATION WARFARE SYSTEMS ENGINEERING

QUANTIFYING HUMAN TERRAIN

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Within the Department of Defense, commanders in Iraq and Afghanistan have identified a sociocultural capabilities gap. Historically, when faced with a non-Western adversary, knowledge of the adversary's asymmetric, sociocultural values has been a key component in conflict resolution. As such, a number of organizations within the U.S. government and the civilian sector have undertaken initiatives to quantify what has been termed human terrain. Multiple theories, concepts, and models reside within the confines of social sciences that describe human activities, interactions, and behavior. However, with almost endless choices, which one (or combination) provides the greatest near-term and enduring utility in defining human terrain?

One organization in particular has developed methods to quantify human terrain. The organization has uniquely been able to responsively fuse a wide array of different sciences, technology, and information systems to provide cohesive products. Utilizing a systems approach, this organization is examined to identify internal attributes, approaches, and integration techniques that describe and enumerate geocultural relationships and interactions. The identification of unique system variables is the key element in replicating the organization's capabilities. By reproducing these critical variables, other U.S. government and non-governmental organizations can leverage the examined organization's methodology and produce similar results in analyzing and quantifying other complex, human-centric problem sets, regardless of the actual geographical location of interest.

This thesis includes classified appendices that compliment Chapters III, IV, and V.

KEYWORDS: Human Terrain, Human Geography, Geo-Cultural, Culture, Society, Complex Problems, Portability, Quantitative Analysis, Sociotechnical Design, Socio-Culture, Cultural Terrain

ENHANCED CYBERSPACE DEFENSE WITH REAL-TIME DISTRIBUTED SYSTEMS USING COVERT-CHANNEL PUBLISH-SUBSCRIBE BROKER PATTERN COMMUNICATIONS

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In this thesis, a novel cyberspace-defense solution to the growing sophistication of threats facing networks within the Department of Defense is proposed. Current network-defense strategies, including traditional intrusion detection and firewall-based perimeter defenses, are ineffective against increasingly sophisticated social-engineering attacks, such as spear-phishing, which exploit individuals with targeted information. These asymmetric attacks are able to bypass current network-defense technologies, allowing

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adversaries extended and often unrestricted access to portions of the enterprise. Network-defense strategies are hampered by solutions favoring network-centric designs, which disregard the security requirements of the specific data and information on the networks. The solution presented in this project leverages specific technology characteristics from traditional network-defense systems and real-time distributed systems using publish-subscribe broker patterns to form the foundation of a full-spectrum, cyber-operations capability. Building on this foundation, the addition of covert channel communications within the distributed systems framework to protect sensitive command and control and battle management messaging from adversary intercept and exploitation is presented. Through this combined approach, the DoD and service network-defense professionals will be able to meet sophisticated cyberspace threats head on, while simultaneously protecting the data and information critical to warfighting commands, services, and agencies.

KEYWORDS: Cyberspace Defense, Network Defense, Distributed Systems, Covert Channel Communications

MASTER OF SCIENCE IN LEADERSHIP AND HUMAN RESOURCE DEVELOPMENT

ARE MIDSHIPMEN PROPERLY EQUIPPED TO ENTER THE SUBMARINE COMMUNITY? A NEEDS ASSESSMENT FOR THE SUBMARINE CAPSTONE COURSE AT THE UNITED STATES NAVAL ACADEMY

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Second Reader: Joseph Thomas, John A. Lejeune Leadership Institute, Marine Corps University

This thesis examines the perceived gap between the education and training given to midshipmen in their final semester at the United States Naval Academy (prior to commissioning), and the expectations of the stakeholders upon receiving that commission. More specifically, this study examines to what level an ensign reporting onboard his first submarine is educated and trained, and whether this meets the needs of the command and the Navy. In order to determine if a gap exists, in-depth interviews were conducted with submarine junior officers, submarine commanding officers, and professors at the United States Naval Academy. The needs of each of these stakeholders were then correlated with instructional imperatives required to fulfill each need. Based on these correlations, recommendations are offered on the design of the capstone course.

KEYWORDS: Submarine, Capstone, Midshipmen, Training, Instructional Design

AN ASSESSMENT OF THE EDUCATIONAL AND TRAINING NEEDS OF A MARINE NAVAL ACADEMY GRADUATE

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The purpose of this research is to identify the educational and training needs for a second lieutenant from the U.S. Naval Academy (USNA) entering the Marine Corps. This research is a needs assessment that identifies knowledge, skills, abilities, and attitudes (KSAAAs) that Naval Academy graduates need to be successful at The Basic School (TBS) in Quantico, Virginia. The research reviews the current Naval Academy leadership curriculum, Marine Corps accession programs, training requirements, and Marine-specific training programs at the USNA. Secondly, the research reviews past studies of USNA graduates' performance in the Marine Corps to determine if there are performance deficiencies that need to be addressed. Next, the research reviews literature on needs assessments, education and training, KSAAAs, and a study on leadership development in the Marine Corps. This review is performed as background information as it pertains to the NL404 course. The methodology of this research is based on a needs assessment model that reviews an existing course to determine if updates are needed. Surveys, interviews, and document analysis are used to gather data to determine the needs of the second lieutenant. A total of 153 class of 2005 Marine graduates and members of the TBS staff are surveyed and interviewed for the data collection. The data is analyzed using descriptive statistics and a comparison of means. Additionally, a content review of the interviews and documents is used to ascertain the needs of the second lieutenant.

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Lastly, the data is summarized and recommendations are given concerning the content of the NL404 course.

KEYWORDS: Naval Academy, Marine Corps, Leadership Training, Capstone Course, The Basic School, Needs Assessment, Knowledge Skills and Abilities, Pre-Commissioning Training

MASTER OF SCIENCE IN MECHANICAL ENGINEERING

AN EXPERIMENTAL INVESTIGATION OF HIGH-PRESSURE, STEAM-INDUCED SURGE IN A TRANSONIC COMPRESSOR STAGE

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Operational experience indicates that steam escaping from carrier catapults has the potential to induce stall or surge in the compressors of jet aircraft during takeoff. As the carrier fleet ages and the Navy transitions to the single engine F-35C variant of the Joint Strike Fighter, further investigation of steam-induced surge phenomena is necessary to avert undue risks to pilots and to obviate stall-related damage to Navy aircraft. This study investigates the effects of both throttle-induced surge and steam-induced surge in a transonic compressor stage at 70%, 80%, 90%, 95%, and 100% of the compressor design speed. The primary goals of this research are to quantify changes in the compressor stall margin as a result of steam ingestion and to develop pressure contour maps to analyze the transformation of shock structures in the blade passages as they relate to inlet throttle settings. Results of this experiment confirm that the introduction of high-pressure steam consistently reduces the observed compressor stall margin over the entire operating range of the transonic stage and produces reliable representations of the shock structure present along the compressor casing.

KEYWORDS: Compressor, Transonic, Steam Ingestion, Stall, Surge

NUMERICAL SIMULATION INVESTIGATIONS IN WEAPON-DELIVERY PROBABILITIES

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The study of weapon-delivery probabilities has historically been focused around analytical solutions and approximations for accuracy and effectiveness calculations. With the relatively recent increase in modern computing power, many of the historical expressions can be simulated quickly with similar or more accurate results than the historical expressions and approximations.

In this thesis, simulation methods are used to evaluate weapon-delivery probability parameters, including circular-error probable, range- and deflection-error probable, and weapon effectiveness in the single and salvo weapon scenarios. Comparisons of the simulation results and corresponding historical practices are made to validate simulation techniques.

Additionally, standard deviations in the range and deflection direction are extracted from weapon impact data. Weapon effectiveness calculations are performed using these extracted standard deviations.

KEYWORDS: Weapon Delivery Accuracy, Weapon Effectiveness, Salvo Formula, Aiming Error, Ballistic Dispersion, Error Probable, Probability Simulation

MECHANICAL ENGINEERING

A CONTACT ANALYSIS OF NOMINALLY FLAT SURFACES

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A proper understanding of the mechanism of contact between two or more nominally flat surfaces is crucial in the design process of many devices. Analytical and computational methods are used to model the former through the use of fractal characteristics at the contact interface. A parametric analysis of the fractal surface is completed in order to properly understand fractal geometry and its effect on surface properties. The fractal surface is simplified so that Hertz theory could be used to model surface deformation and resulting contact stresses. The data gathered from the model is then input into an existing electromagnetic railgun program to study the contact surface effect on exit velocity, temperature, electrical conductivity, and contact area ratio. Finally, a study of the fractal parameter effects on the electromagnetic rail gun is completed.

KEYWORDS: Hertz, Interface, Contact, Stress, Deformation, Fractal, Electromagnetic Rail Gun

A DYNAMIC SIMULATION OF PARTICLES IN A MAGNETORHEOLOGICAL FLUID

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The mechanical and rheological properties of an MR fluid depend on the induced microstructure of the imbedded ferrous particles. When subject to an externally applied magnetic field, these particles magnetize and align themselves in chains parallel to the applied field. The microstructure of these chains is a function of several parameters, including particle size, applied magnetic-field strength, and viscosity and velocity of the surrounding fluid. In this thesis, a model is created from a first principle approach to accurately predict the microstructure in a variety of different situations. The model investigated assumes that the particles become magnetic dipoles upon the application of the magnetic field and that particle interaction is due solely to dipole-dipole interaction. Due to the inherently small size of the particles, drag is modeled using Stokes' drag. This mathematical model is used to create a computer simulation to visualize and analyze the subsequent transient microstructures formed. The model assumes a constant magnetic field applied (i.e., no spatial or time gradients) and that the effects of this field are felt instantaneously.

KEYWORDS: Magnetorheological Fluid, Smart Fluid, Magnetic Dipole Interaction, Electrorheological Fluid

CARGO THROUGHPUT AND SURVIVABILITY TRADEOFFS IN FORCE-SUSTAINMENT OPERATIONS

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Force sustainment requires an optimum supply of resources to maintain and project power in an area. With sustainment reaching ever farther from the origin of supplies, commanders find that their logistic trains are increasingly exposed to risk. To mitigate the increased risk from hostile forces, the survivability of supply vehicles must be considered in force sustainment operations to accurately capture a true throughput projection. Development of an optimum throughput plan for littoral sustainment will reduce overall risk to supplies and maximize throughput to the warfighter. This research focuses on maximizing throughput considering the size, quantity, and risk to the cargo vehicles traversing the littoral arena. The major risk

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component studied is comprised primarily of littoral mines, though this risk is comparable to many other survivability situations. Data collected from computer modeling programs are used to compute and maximize throughput.

KEYWORDS: Throughput Analysis, Optimization, Force Sustainment, Littoral Supply, Mine Warfare, Cargo, Survivability

AN EXPERIMENTAL INVESTIGATION OF A SIX-INCH DIAMETER, FOUR-INCH SPAN, CROSSFLOW FAN

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Investigations into the use of a crossflow fan as a potential source of propulsion and lift have arisen due to the cross-flow fan's geometry, light weight and safety by shielding from bystanders. The application of a crossflow fan as the propulsion source for a fan-wing, vertical-takeoff-and-landing vehicle has drawn attention. Previous investigations have demonstrated the performance characteristics of multiple crossflow fan configurations.

During this experiment a crossflow fan with thirty blades, a six-inch diameter, and a four-inch span is tested. The performance and stall characteristics are calculated and plotted along constant speed and constant throttle setting lines. A comparison of the tested crossflow fan is made against two previously tested crossflow fans with similar design and 1.5 inch and six-inch span lengths. Performance parameters of the three crossflow fans are compared and plotted for constant speed curves. The results allow for general trends to be determined and scaling laws to be deduced.

KEYWORDS: Crossflow Fan, Cross Flow Fan, VTOL, Personal Air Vehicle Propulsion

MASTER OF SCIENCE IN METEOROLOGY AND PHYSICAL OCEANOGRAPHY

IMPROVING THE ACCURACY OF ACOUSTIC PREDICTION IN THE PHILIPPINE SEA THROUGH THE INCORPORATION OF MESOSCALE ENVIRONMENTAL EFFECTS

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An understanding of ocean acoustic fields, their statistics, and relation to the oceanographic environment is the *sine qua non* of undersea warfare. In the tactically important Philippine Sea, powerful mesoscale eddies can have strong effects on acoustic fields. To quantify eddy effects, a mesoscale sound-speed model is developed and interfaced with a parabolic-equation acoustic simulation. Eight combinations of frequency (20Hz/250Hz), wavenumber spectra (Stammer/Lorentzian), and source depth (50m/200m) are simulated through the model. For each combination, the unperturbed TL curve and composite eddy field TL curve are compared to assess acoustic variability caused by mesoscale ocean features. Eddies alter acoustic energy by shifting convergence zones, driving energy into the seabed, trapping energy in surface ducts, and increasing scintillation. These effects are greater at higher frequencies and deeper source depths, shifting both the mean TL difference and RMS variability on order 5-10dB. The wavenumber spectrum shows no significant effect on acoustic variability. Eddies also cause horizontal out-of-plane scattering. Ray equations are manipulated to demonstrate that eddy-induced, bearing-angle errors can be on order one degree at 500km, increasing as the square root of range. Target localization errors due to angle error are on order 7km at 500km, increasing as range to 3/2 power.

KEYWORDS: Ocean Acoustic Prediction, Mesoscale Eddies, Parabolic Equations, Monte Carlo Simulation, Philippine Sea, Three-Dimensional Acoustics, Undersea Warfare, Tomography, Battlespace Characterization

CLIMATIC VARIATIONS IN TROPICAL WEST AFRICAN RAINFALL AND THE IMPLICATIONS FOR MILITARY PLANNERS

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Master of Science in Meteorology and Physical Oceanography—June 2008

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Statistical and dynamical relationships between summer rainfall variations in tropical West Africa (TWA) and El Niño/La Niña (ENLN) events in the tropical Pacific are identified. The primary datasets are the National Centers for Environmental Prediction/National Center for Atmospheric Research reanalysis fields and the Multivariate ENSO Index (MEI) for the period 1970–2007. Correlations of TWA rainfall and MEI time series show that high (low) TWA rainfall is significantly correlated with LN (EN) events, with LN (EN) leading by zero to seven months. Composite analyses show that ENLN impacts on TWA occur via global-scale, equatorial, Rossby-Kelvin waves and southern-hemisphere Rossby wave trains that extend

METEOROLOGY AND PHYSICAL OCEANOGRAPHY

into the tropical African region. Regional connections are also found between positive (negative) sea surface temperature (SST) anomalies in the Gulf of Guinea and Angola coastal waters and negative (positive) TWA rainfall anomalies. These results are expected to contribute to improved long-lead rainfall predictions for TWA. This would allow military and civilian planners to construct a more effective framework for theater security cooperation in TWA, including strategies for mitigating the impacts of climate variations and climate change.

KEYWORDS: West Africa, Interannual Variability, USAFRICOM, Southern Hemisphere Rossby Wave, El Niño, La Niña, African Rainfall, Theater Security Cooperation, Military Planning, Long Term Mean, Climate Change, Precipitation Rate, Composite Analysis, Statistical Correlation, Climate Anomaly

MASTER OF SCIENCE IN MODELING, VIRTUAL ENVIRONMENTS, AND SIMULATION

SIMULATION OF FLIGHT OPERATIONS AND PILOT DUTIES IN LOW-ALTITUDE NAVIGATION AND TARGETING INFRA-RED FOR NIGHT (LANTIRN) FIGHTER SQUADRONS USING SIMKIT

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Low-Altitude Navigation and Targeting Infra-Red for Night (LANTIRN) introduces important, around-the-clock strike capability to air forces. At the same time, it strains pilot manpower requirements. The Turkish air force asked for a simulation tool that would find the necessary number of pilots and their qualifications for LANTIRN squadrons under different operational scenarios. A simulation that satisfies this request is developed. The simulation takes the pilot's ground duties and flight operations into account. The weather model inside the simulation introduces the effects of weather conditions around the airfield. The model is implemented in the Java language, using the Simkit library for the discrete-event simulation. The user interacts with a graphical user interface (GUI) to define the parameters, experiment input factors, and sizes. The output is a data table with required pilot number and qualifications. Because access to certain classified data is not possible, the thesis sets a general guideline for future analyses that would have the actual data. This study uses notional but realistic values for the parameters and input factor levels. Using the resulting output table, future analysts can expand and tailor the levels of analyses.

KEYWORDS: LANTIRN, Simulation, Pilot Manpower, Simkit, GUI, Design of Experiment, NOLH, Regression Analysis

MASTER OF SCIENCE IN OPERATIONS RESEARCH

THE OPTIMAL EMPLOYMENT OF PORT RADAR AND PICKET SHIPS TO DETECT ATTACKER SPEEDBOATS—A DEFENDER–ATTACKER OPTIMIZATION MODEL TO ENHANCE MARITIME-DOMAIN AWARENESS

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Second Reader: Jeffrey E. Kline, Department of Operations Research

The U.S. Coast Guard has deployed several hundred port-patrol vessels to protect U.S. Navy ships and other high-value assets in ports worldwide. Each vessel has an armed crew of four, is relatively fast, and features a simple surface-search radar, radios, and a machine gun. These vessels coordinate surveillance patrols in groups of two or four, perhaps working with shore-based radar. The goal is to advantageously position these vessels, and perhaps shore-based radar as well, to minimize the probability that an intelligent adversary in one or more speedboats will evade detection while mounting an attack. Attackers can use elevated obstructions to our radar detection in their attack paths, and ports feature many such restrictions to navigation and observation. A key, but realistic, assumption is made that complicates planning: it is assumed that the attackers will see or be told of our defensive positions and capabilities in advance of mounting their attack. The defender–attacker optimization is demonstrated with a fictitious port, and with Los Angeles–Long Beach, Hong Kong, the U.S. Navy Fifth Fleet in Bahrain, and the Al Basra oil terminal. In cases analyzed, any attack is almost certainly detected, even though the attacker, observing our pre-positions, plans clever, evasive attack tracks.

KEYWORDS: Optimization, Defender-Attacker, Bilevel Program, Maritime Domain Awareness, Maritime Security

AN ANALYSIS OF PORT-VISIT COSTS OF U.S. NAVY AIRCRAFT CARRIERS

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Master of Science in Operations Research—June 2008

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The United States Navy is seeking substantial cost savings in the operation of its aircraft-carrier fleet, including in the costs of port visits. This thesis analyzes data on aircraft-carrier port visits from fiscal years 2002 through 2007 to develop statistical models for characterizing and predicting port-visit costs. The models account for explanatory factors, including the ship and port, whether the ship is moored pier-side or at anchor, length of visit, and arrival date. A total of thirteen U.S. Navy carrier vessel (CV) and carrier vessel, nuclear (CVN), aircraft carriers made 118 visits to ports in twenty-five countries during the period under study. For each port visit, individual line-item expenses are aggregated into four categories and by total cost. Regression modeling is used to identify factors that explain these categorized and total costs. For total costs, the average regression-prediction error is about 17 percent. Costs are found to vary across ships and, more substantially, across ports. These findings can be used in the formulation of initiatives aimed at reducing the costs of aircraft-carrier port visits. An automated spreadsheet tool is developed to implement the modeling techniques presented in this thesis.

KEYWORDS: Stepwise Regression, Port-Visit Costs, CVN, CRAFT, PVCR

OPERATIONS RESEARCH

COMBAT-SERVICE-SUPPORT SOLDIER NETWORK-ENABLED OPERATIONS (CSNEO)

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Modeling and simulation provide a cost-effective means to gain insights into the potential benefits of network-enabled capabilities in a variety of operational settings. This research outlines a methodology and provides a use case for employing modeling and simulation in the identification of significant factors for network-enabled capabilities. The effort explores the use of the U.S. Army Training and Doctrine Command (TRADOC) Analysis Center's logistics battle command (LBC) model to examine the distribution of capabilities across an organizational structure. It leverages large, space-filling designs of experiments, in conjunction with high-performance computing clusters, to assess the impact of soldier-level, network-enabled capabilities on transportation terminal node operations within a sustainment base supporting a joint force.

Further, this research coalesces experimental design and exploratory data analysis to examine 771 variants of the operational scenario. Three network structures are examined, namely, the hierarchical, star, and hierarchical-star topologies, to quantify the impacts of network-enabled capability on the velocity, reliability, and visibility measures of effectiveness. The results suggest that increasing network-enabled capabilities yields a significant return of investment over the current capabilities. The latter network topologies show that soldiers performing terminal-node cargo operations are better connected, and this leads to more responsive distribution systems.

KEYWORDS: Capabilities-Based Assessment, CBA, Capability Gaps, Centralized Receiving Shipping Point, CRSP, Design of Experiments, DOE, Joint Capabilities Integration and Development System, JCIDS, Joint Distribution Operations, Logistics Battle Command, LBC, Simulation Analysis

AN ANALYSIS OF ANALYTIC MODELS FOR THE EFFECT OF INSURGENCY/COUNTERINSURGENCY OPERATIONS ON THE GENERAL POPULATION

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This thesis proposes and analyzes mathematical descriptive models of the effect of insurgency/counterinsurgency operations on the population of a nation experiencing stability operations. The model is a system of differential equations representing insurgent activity, insurgent recruiting, and insurgent removal by the coalition; the population's tolerance for insurgent violence; occurrence of actions by the coalition and insurgency that the population perceives as beneficial and damaging; and the resulting change in the population's support for the government. The study focuses on a single population, attempting to identify and model the first order effects of stability force actions on the population. The effect of possible strategies by local government and external stability forces to influence popular support toward the government is represented and studied. It is found that the greatest increase in popular support occurs when the coalition concentrates on performing actions that are perceived by the population as beneficial *and* that mitigate the effects of its damaging actions. When the population does not perceive insurgent actions as damaging, it is found that the coalition has difficulty increasing popular support for the government. Coalition cooperation with local leaders in planning and executing beneficial actions may increase the perceived effect of coalition actions the population perceives as beneficial.

KEYWORDS: Insurgency, Counterinsurgency, Coalition, Influence Model, Stability Operations, Popular Opinion Model, Dynamic Model, Differential Equations

OPERATIONS RESEARCH

INTERNET TOPOLOGY GENERATION BASED ON REVERSE-ENGINEERED DESIGN PRINCIPLES: PERFORMANCE TRADEOFFS BETWEEN HEURISTIC AND OPTIMIZATION- BASED APPROACHES

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The global internet is a federation of computer networks that are owned and operated by internet service providers (ISPs). Because ISPs do not share topology information for competitive and privacy reasons, researchers, operators, and policy-makers who want to assess the performance and reliability of the system as a whole must infer structure from limited measurement data. Reverse-engineering is used to infer underlying design principles of a national ISP; then, models capable of generating ISP topologies, ranging from regional to national scales, are developed. The behavior of optimal versus heuristic designs is contrasted in terms of cost and performance. Unlike previous approaches that simply replicate observed network connectivity statistics, this approach yields networks that reflect the technological capabilities, economic constraints, operational requirements, and performance objectives faced by real ISPs. The mathematics is complemented with computational tools that facilitate this network generation and analysis. To our knowledge, this thesis represents the first effort to incorporate these modeling principles in a process capable of generating realistic ISP networks at the national scale.

KEYWORDS: Internet, Topology Generation, Reverse Engineering, Optimization, IP, Network, Internet Service Provider, ISP, Motif, Heuristic, Optimal

CHARACTERIZATION OF THE MICRO-ELECTRO-MECHANICAL SYSTEM DIRECTIONAL SOUND SENSOR FABRICATED USING THE SOIMUMPS PROCESS

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A micro-electro-mechanical system (MEMS) based directional sound sensor performance is characterized. The operation of the directional sound sensor is based on the hearing organ of the *Ormia ochracea* fly, which uses coupled bars hinged at the center to achieve directional sound sensing.

The MEMS sensor design considered in this thesis is fabricated using a process by which the sensor has two resonant vibrational modes: rocking and bending. The sensor is simulated using finite element analysis and tested by actuating the sensor using a sound stimulus. An analysis is undertaken to describe, in mathematical terms, the relationship between the sensor's amplitude of vibration and various parameters, such as the angle of incidence, frequency, and the intensity of sound.

The experimentally observed vibrational frequencies are found to be in good agreement with the simulated data, which supports the use of the simulation in future sensor development. The observed amplitudes of vibration are significantly greater than those of sensors fabricated with the process used in previous studies. The relationship between the amplitude of vibration and the incident angle are found to agree with the theoretical predictions. The results indicate that it is possible to fabricate miniature sound sensors that mimic the fly's hearing system.

KEYWORDS: SOIMUMPs, MEMS, *Ormia Ochracea*, Biomimetic, Directional Microphone, Sensors, Microphone, Fly Hearing, Undersea Warfare

OPERATIONS RESEARCH

MODELING METHODOLOGIES FOR REPRESENTING URBAN CULTURAL GEOGRAPHIES IN STABILITY OPERATIONS

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This thesis addresses Department of Defense modeling and simulation (M&S) deficiencies in military and organizational societal-modeling methods. These deficiencies are even more important today due to stability operations being an extremely prevalent mission for U.S. forces in this century. Research efforts in this thesis focus on the implementation of three analytic social-theory models into the agent-based model Pythagoras 2.0.0, in an effort to provide modeling methodologies for a single simulation tool capable of exploring the complex world of urban cultural geographies undergoing stability operations in an irregular warfare environment. While the individual model mappings prove to be somewhat difficult, the consolidation of all three model mappings into Pythagoras 2.0.0 proves to be unfeasible with respect to capturing accurate attitudinal shifts. Civilian populace's attitudinal shifts are functions of issues believed important by the various subpopulations comprising the civilian populace, experienced influences, economic security, and influence exchange across social networks. With the use of simulation, statistical analysis, and cultural and societal modeling, this thesis identifies a major limitation causing significant attitude representation errors within the Pythagoras modeling environment: there is currently no direct link between experienced influences and attitudinal shifts. Funding has been allotted by TRAC–Monterey and the Marine Corps Combat Development Center in Quantico, Virginia, for Northrop Grumman to implement the recommended modifications provided from this research.

KEYWORDS: Representing Urban Cultural Geographies, RUCG, Pythagoras, Agent Based Modeling, ABM, Stability Operations, Human Behavior Representation, HBR, Irregular Warfare, IW

EXPLORING THE IMPORTANCE OF INFORMATION SUPERIORITY TO THE DECISION-MAKER

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The importance of information superiority has been emphasized as a critical capability that future joint forces must be able to achieve. No longer simply a future concept, it is being officially defined and incorporated in doctrinal publications like Joint Publication 3-13, *Information Operations*. Unfortunately, the ability to effectively measure its contribution relative to other battlefield systems remains limited. This research focuses on exploring the limits of the contributions that information superiority can make, examining the sensitivity of information superiority to varying information quality, and comparing those contributions with other contributing factors to battlefield results. Furthermore, an effort is made to identify some of the risks associated with using information superiority as a force multiplier. A simple decision model is developed, based on the concepts of a two-person, zero-sum game, to explore these questions. In the model, one side is provided varying degrees of an information advantage, while also varying degrees of information quality to the information advantage. Additionally, a variety of scenarios are considered involving varied levels of opposing-side force levels. Experimental design techniques are employed to efficiently explore the model output space, while allowing for sufficient replications of the model at each design point, in order to provide a sufficient dataset for analysis.

KEYWORDS: Information Superiority, Information Gain, Game Theory, Decision Theory, Decision Models, Measuring Information, Information Metrics

OPERATIONS RESEARCH

A NAVY ENLISTMENT-SUPPLY MODEL AT THE RECRUITING-STATION LEVEL

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Past econometric studies have sought insight into the factors that affect military enlistment supply by creating models based on econometric theory and testing them with data in order to confirm their proposed theoretical relationships. The purpose of this study is to utilize factors common to previous research, along with the additional factors of proximity to military installations and high school quality, to build the best predictive model. This study utilizes data from 2002 through 2006 to predict high-quality, male, active-duty Navy enlistments at the recruiting-station level. This study shows that neural-network models tend to predict the best, followed by regression-based models, and then tree-based models. The number of recruiters assigned per Navy recruiting station (NRS) and the male 17- to 19-year-old populations prove to be the most important predictive factors. The number of houses, veteran-population percentage, land area, percentage of high-school students receiving subsidized lunches, and Navy installation proximity and per capita are common to all predictive models. This study also finds that NRSs closer to larger Navy installations, having higher student-to-teacher ratios, having lower graduation rates (measured by “Promoting Power”), and having lower percentages of students on subsidized lunches exhibit greater high-quality, male-enlistment rates.

KEYWORDS: Recruiting, Enlistment Supply, Regression, Tree, Neural Network, Military, Navy, Manpower, Prediction, Navy

ENHANCING THE OPERATIONAL EFFECTIVENESS OF THE GROUND-BASED, OPERATIONAL-SURVEILLANCE SENSOR

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The majority of casualties in the ongoing conflicts in Iraq and Afghanistan are due to improvised explosive devices (IEDs). To counter this threat, the Marine Corps directed that a persistent surveillance capability be identified and fielded as soon as possible. As a result, the development and fielding of the ground-based operational surveillance system (G-BOSS) occurred rapidly. G-BOSS consists of a tower, multiple cameras, and a combat operations center (COC). Today, scores of these systems are in use. However, minimal guidance has been provided to operators on effective techniques, tactics, and procedures. Furthermore, the benefits of adding additional sensors to G-BOSS and networking multiple systems are not clear.

These issues are investigated through the use of an agent-based simulation. Specifically, thousands of computational experiments, utilizing a state-of-the-art experimental design, are run on a scenario based on concurrent, live, developmental tests at Twenty-Nine Palms by the Marine Corps Operational Test and Evaluation Activity. The experiments assess the ability of the system to correctly classify objects (e.g., snipers, IED emplacement, and mortar teams, as well as neutrals and friendly forces) over a variety of enemy actions, G-BOSS configurations, and tactical choices. The results indicate that the most critical factor in determining the level of situational awareness provided by G-BOSS is, by far, placement of the towers. Moreover, little benefit is seen in coordinating the towers and COCs unless motion detection radars are used. With use of the motion detection radar, the synchronization of multiple systems dramatically enhances the overall performance of G-BOSS.

KEYWORDS: Improvised Explosive Device, IED, Simulation, Design of Experiments, DOE, Ground Based Operational Surveillance System, G-BOSS

OPERATIONS RESEARCH

OPTIMIZING UNMANNED AIRCRAFT SYSTEM SCHEDULING

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Unmanned aircraft systems (UASs) are critical for future combat effectiveness. Military planners from all branches of the Department of Defense now recognize the value that real-time intelligence and surveillance from UASs provide the battlefield commander. The operations-analysis division of the Marine Corps Combat Development Command is currently conducting an overarching unmanned-aircraft-systems study to determine future force requirements. Current analysis is conducted through the use of the Assignment Scheduling Capability for Unmanned Air Vehicles (ASC-U) and several specially designed heuristics. The Unmanned Aircraft System Scheduling Tool (UAS-ST) combines these capabilities into one model and addresses several issues associated with ASC-U. UAS-ST allows the user to control all aspects of the UAS, define a scenario, and then generate a flight schedule over a known time horizon based on those inputs. All missions are assigned a user-defined value and the total schedule value is reported. The user can then quickly change a parameter of the UAS, re-solve the model, and see the impact of the proposed change on the overall value of the schedule attained. Therefore, UAS-ST is a tool for analyzing the value of future changes in UAS structure.

KEYWORDS: Optimization, Unmanned Aircraft Systems, Linear Programming

MODELING THE EFFECTS OF A TRANSPORTATION-SECURITY INCIDENT UPON THE MARINE TRANSPORTATION SYSTEM

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A simulation model is introduced to evaluate the disruptions, delays, and incremental costs inflicted on the U.S. west-coast container-shipping industry by a transportation-security incident (TSI). Each year, more than 6,000 container ships call upon west-coast seaports, handling in excess of 18.3 million containers. Current national directives do not specify uniform standards for measuring the amount of seaport cargo-handling capacity, nor decision rules to divert cargo to alternate facilities when a primary destination is degraded or unusable. Through analysis, infrastructure components are identified that are potential bottlenecks and/or vulnerable to a TSI that could potentially threaten the U.S. maritime shipping capacity. For example, a ten-day labor union dispute and longshoremen work stoppage that paralyzes the entire U.S. west coast is demonstrated. The incident induces significant port congestion from Puget Sound to San Pedro Bay, reducing the annual west-coast vessel and import container throughput by three percent (174 vessels and 237,088 containers) and increasing the incremental costs suffered by ocean carriers by \$400 million. Additional analysis identifies opportunities for commercial and government investment in additional seaport infrastructure to alleviate west coast port congestion, while ensuring the unimpeded continuity of operations of west coast shipping subsequent to a TSI.

KEYWORDS: Transportation Security Incident, Container Shipping, Marine Transportation System, Identity Simulation, Multiple Single Server Queue

OPERATIONS RESEARCH

SOLVING THE MAXIMUM CLIQUE PROBLEM ON A CLASS OF NETWORK GRAPHS, WITH APPLICATION TO SOCIAL NETWORKS

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Social-network analysis frequently uses the idea of a clique in a network to identify key subgroups of highly connected members of the network. The maximum clique problem is formulated on undirected graphs and two algorithms are developed to solve the problem: a pruning algorithm and an enumeration algorithm. The pruning algorithm successively improves an upper bound on the clique number of a graph, and the enumeration algorithm successively finds larger and larger cliques in the graph. Both terminate with a maximum clique in the graph, and, when run together, provide an interval of uncertainty on the size of a maximum clique in a graph that converges to zero. The algorithms are applied to real examples in the modeling of terrorist social networks, and it is determined that the algorithms are efficient and practical for problems of moderate size.

KEYWORDS: Maximum Clique, Clique Number, Graph, Backtracking Algorithm, Social Network, Terrorist Network

AN ANALYSIS OF THE RELATIONSHIP OF MILITARY AFFILIATION TO DEMOGRAPHICS, NEW-SAILOR SURVEY RESPONSES, AND BOOT-CAMP SUCCESS

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This study examines the relationship of military affiliation to demographics, new-sailor survey responses administered during fiscal year 2007, and graduation from boot camp. A recruit is categorized as having military affiliation if parents or siblings of the recruit had served or were serving in the military. Recruits' military affiliation shows no significant relationship with AFQT scores, age, bonus amounts, college level, graduation rate from boot camp, number of dependents, boot-camp pay grade, race, single status, or the quarter in which the recruit went to boot camp. There is a relationship between military affiliation and a recruit's being female, Hispanic, or not a U.S. citizen. In general, military affiliation does not have an unexplainable significant effect on responses to the new-sailor survey. The survey responses as a whole suggest that military affiliation does have an effect on how recruits respond; however, further data collection and analysis is necessary beyond the 2,101 data points in this study. The logistic model shows that bonuses above \$15,000 and being male are positive predictors of graduation from boot camp. Furthermore, the more a recruit felt prepared by his or her recruiter, the more likely he or she would graduate from boot camp.

KEYWORDS: Attrition, Delayed Entry Program, DEP, Military Affiliation, Recruiting, Success, Survey

OPERATIONS RESEARCH

PROJECTING OFFICER STRENGTH OF THE UNITED STATES ARMY RESERVE FROM 2008–2012

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As the Army continues to fight in Afghanistan and Iraq, its steady need for reserve-component soldiers has impacted the ranks of the Army Reserve. The officer ranks are experiencing critical shortages in the ranks of captain and major. The Army Reserve’s goal over the next five years is to not only eliminate the officer shortages, but to also increase the number of officers in its ranks. This thesis applies a combination of projection techniques to historical data for officer strengths, accessions, promotions, and losses to predict what the Army Reserve officer strengths of second lieutenant through lieutenant colonel will be over the next five years barring any administrative actions. The first finding is that second-lieutenant strength is not projected to drop below its 2007 total between 2008 and 2012. The second finding is that the maximum values of the projected end strengths show no gains through 2012. The recommendation is that the Army Reserve review all current officer positions. Possible actions are to keep a position as is, permanently combine certain duties from a group of positions into fewer positions, cut a position, or reassign a position to either another rank or a civilian position.

KEYWORDS: Manpower, Forecasting, Moving Average, Exponential Smoothing, Holt Smoothing

AN OPERATIONAL, STATISTICAL ANALYSIS OF THE UNITED STATES MARINE CORPS’ CIVILIAN-EMPLOYEE INJURY-TRACKING PROCESS AND INJURY DATA

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Organizations within the Department of Defense and Department of Labor (DoL) report safety metrics that quantify DoD civilian-employee injury incident rates and lost work time for all military services. Based on these metrics, the United States Marine Corps is experiencing high injury rates and lost work time in relation to adjacent services. This thesis recommends process improvements for tracking injuries and handling data, as well as a time-series prediction methodology for investigating the causes of injuries (e.g., slips, trips, and falls, manual handling of equipment) and the types of injuries (e.g., back conditions, burns, bruises) that may assist the USMC in focusing its safety plans and efforts and reducing civilian-employee injury rates.

KEYWORDS: Time Series, Lost Work Days, Civilian Employee Injuries, Total Case Rate, SHARE

A MULTIVARIATE ANALYSIS OF THE EFFECT OF SOURCE OF SUPPLY AND CARRIER ON PROCESSING AND SHIPPING TIMES FOR ISSUE PRIORITY GROUP ONE REQUISITIONS

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In this thesis, the authors investigate the effects of source of supply and carrier on the delivery times of high-priority requisitions to primary destinations of Navy, Military Sealift Command, U.S. Marine Corps ground forces, select U.S. Coast Guard units operating in the Fifth, Sixth, and Seventh Fleet areas of

OPERATIONS RESEARCH

operation (AORs), and major fleet concentration areas within the United States. The primary focus is on determining whether source of supply, carrier, and the interaction of these two factors have an effect on processing and shipping times of high-priority requisitions. “Source of supply” refers to a Department of Defense distribution depot and “carrier” refers to a shipper, such as Federal Express, DHL Worldwide Express, United Parcel Service, Air Mobility Command, and commercial freight forwarders. This study uses ordinary least squares (OLS) linear models, generalized linear models (GLMs), and nonparametric methods to explore the structure of the historical requisition datasets. OLS linear models are found to be inadequate, but both the GLMs and nonparametric tests prove to be valid and yield results from which inferences could be made. The GLMs indicate that source of supply has a statistically significant effect on shipping times of high-priority requisitions, and that source of supply and carrier each have a statistically significant effect on shipping times to certain destination areas. The GLMs also indicate that there is no significant interaction between source of supply and carrier. Nonparametric permutation and Friedman test results support the GLM results. Specifically, selecting DDAG, DDPH, or DDSP as a source of supply has a statistically significant effect on processing time at a 0.002 level of significance, and selecting USS *EMORY S. LAND* has a statistically significant effect at a level of 0.01. Also, at significance levels of 0.04 and 0.05, source of supply selection has a statistically significant effect on requisitions shipped to the Okinawa and Pearl Harbor destination areas. Carrier selection has a statistically significant effect on requisitions shipped to Groton, Guam, Norfolk, Pearl Harbor, and Singapore at significance levels of 0.048, 0.002, 0.002, 0.016, and 0.002, respectively.

KEYWORDS: High-Priority Requisitions, Issue Priority Group One, Source of Supply, Multivariate Regression, Generalized Linear Model, Nonparametric Analysis, Resampling, Permutation Test, Friedman Test

A HEURISTIC ALGORITHM FOR OPTIMIZED ROUTING OF UNMANNED AERIAL SYSTEMS FOR THE INTERDICTION OF IMPROVISED EXPLOSIVE DEVICES

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Improvised explosive devices (IEDs) are effective weapons for insurgents targeting conventional military and security forces. Real-time information gathering about likely use of such weapons is one approach to reduce the effectiveness of IEDs. Unmanned aerial system (UASs) may provide the information-gathering capability commanders need to interdict IEDs. Currently, UASs are not systematically utilized in that capacity. This research develops a routing tool that uses column-generation techniques and a greedy algorithm to route UASs through suspected IED locations for the purpose of IED interdiction as it transits to and from command-directed missions. In empirical studies of datasets with up to 125 IED locations and missions, the routing tool provides optimal or near-optimal solutions in all instances tested. The tool produces de-conflicted routes for up to three UASs within five minutes of computing time.

KEYWORDS: Routing, IED, Orienteering Problem, UAV, UAS, Greedy Heuristic, Column, Generation

OPERATIONS RESEARCH

REPRESENTING URBAN CULTURAL GEOGRAPHY IN STABILIZATION OPERATIONS: AN ANALYSIS OF A SOCIAL NETWORK REPRESENTATION IN PYTHAGORAS

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Civilian, human-behavior representation is the most significant gap in representing political, military, economic, social, information, and infrastructure aspects of the operational environment in urban operations. Three analytical models for different aspects of population dynamics are considered, including whether they can be implemented in the Pythagoras 2.0.0 agent-based, combat-simulation software. These analytic models are an attitudinal effect model, a social network model, and an economic model.

This study shows that the transfer of simple, analytic models into an advanced simulation software platform can bring unpredictable difficulties. A detailed investigation reveals the strengths and weaknesses of this advanced software, and shows that the current version of Pythagoras is not capable of adequately mapping all three human-behavior models. The thesis recommends code changes to overcome these limitations and points out ways to improve Pythagoras' ability to represent human behavior so that it can be used by the U.S. Army and Marine Corps for more sophisticated analyses of stabilization operations. The ultimate goal is to provide decision-makers with tools to help them make better decisions regarding stabilization operations and other issues critical to global security.

KEYWORDS: Stabilization Operation, Pythagoras, TRAC-MTRY, Urban Cultural Geography, Social Network Representation

OPTIMAL JAMMER PLACEMENT TO INTERDICT WIRELESS-NETWORK SERVICES

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The demand for wireless networks continues to grow as the need for portable, low-cost, telecommunications systems increases around the world. Wireless networks are particularly complex because their topologies can change in response to operational requirements or environmental conditions, and also because wireless networks are susceptible to electromagnetic interference. In this thesis, the challenges associated with the operation and jamming of so-called “wireless-mesh networks” are considered. In a wireless-mesh network, the communication devices (denoted here as a nodes) are uniform in their ability to send and receive transmissions. Two related optimization problems are formulated and solved for wireless mesh networks. First, the problem of the network operator is solved, namely: in order to maximize the utility of delivered network traffic, how should one set the power transmission levels for each node, and along what sequence of transmission links should the traffic flow? The second problem considered involves an intelligent adversary, the attacker, who wants to place jamming devices among a finite number of locations to disrupt the operator's traffic in the worst possible way. Mathematical programs are formulated and solved to obtain the optimal operation and jamming of these networks. A computational, decision-support tool that affords the rapid reconfiguration and analysis of various deployment scenarios is developed.

KEYWORDS: Wireless Networks, Network Interdiction, Nonlinear Programming, Simultaneous Routing and Resource Allocation, Wireless Network Jammer locations, Jammer Placement

OPERATIONS RESEARCH

COST ESTIMATES OF UNITED STATES ARMY RESERVE RETENTION INCENTIVES FOR FIRST-TERM ENLISTED SOLDIERS AND OFFICERS

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This thesis examines potential retention incentives, both monetary and non-monetary, for first-term enlisted soldiers and officers in the United States Army Reserve. The examination: systematically determines the most demanded, clearly defined, and Army Reserve-specific incentives that plausibly improve retention; identifies and describes the resulting list, along with appropriate limitations and assumptions; develops methodologies for estimating the costs of these incentives; produces cost estimates for each of the incentives based on available data; and describes follow-on analysis to construct an incentive portfolio that could be used to better allocate programming dollars over a six-year program-objective memorandum (POM) horizon.

This thesis relies on data from two concurrent studies performed by the Training and Doctrine Command Analysis Center at Fort Lee (TRAC-LEE), as well as data from the Defense Manpower Data Center. The data elements from the TRAC-LEE studies include over 20,000 surveys, 200 interviews, and information on how educational assistance impacts the Army Reserve's end strength.

The methodologies and cost estimates are the initial steps in determining a budget-feasible incentive portfolio under the applied career duration patterns of the Army Reserve. This study ignores possible interactions of the incentives and error estimates of the cost estimates.

KEYWORDS: United States Army Reserve, USAR, Retention, Incentives, Cost Estimation

LOOK AGAIN: AN INVESTIGATION OF FALSE-POSITIVE DETECTIONS IN COMBAT MODELS

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This thesis investigates the role of false-positive detections in simulated combat environments. Existing combat models tend to overlook or downplay false positives. Signal-detection theory provides the framework for analysis of an observer's hits, misses, correct rejections, and false alarms. The hypothesis is that false-alarm rates will decrease as observer experience increases, as instructions become more restrictive, and as targets become more salient. In support of this thesis, twenty-four computer images are developed containing varying numbers of human combatants in an urban environment. Sixteen students at the Naval Postgraduate School volunteer as observers for this experiment. Experimental results reveal that the factors significantly affecting false-alarm rates are scene difficulty, task instructions, and the interaction of the two. Observer experience is not shown to be statistically significant. Observers given permissive instructions generate up to 3.2 times as many false alarms as do those given restrictive instructions. This experiment shows that the practice of modeling false alarms solely as functions of target and scene characteristics is inadequate. With respect to the generation of false alarms, future combat models must incorporate an assessment of the instructions given to the observer.

KEYWORDS: False Positive, False Alarm, Signal Detection Theory, Combat Models, ACQUIRE, CASTFOREM, Visual Search, Eye Tracking, Instructions, Combat Experience

OPERATIONS RESEARCH

PROBABILITY PREDICTION OF A NATION'S INTERNAL CONFLICT BASED ON INSTABILITY

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Since the end of Cold War, predicting a nation-state's instability has been a challenging national-security issue for the United States. This thesis presents several methods to predict the conflict potential for failed nation-states by comparing their social, economic, political, and military statistics with those of the past. This study uses the Brier scoring rule to evaluate the performances of these probability prediction methods. The study provides insights into situations where one method expects to outperform the others.

KEYWORDS: Probability Prediction, K-Nearest-Neighbor Algorithm, Brier Scoring Rule

THE TOTAL-LIFECYCLE MANAGEMENT-ASSESSMENT TOOL: AN EXPLORATORY ANALYSIS

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Master of Science in Operations Research–June 2008

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It is essential for the Marine Corps to ensure the successful supply, movement, and maintenance of an armed force in peacetime and during combat. Integral to an effective, long-term, logistics plan is the ability to accurately forecast future requirements to sustain materiel readiness. The Total-Lifecycle Management-Assessment Tool (TLCM-AT) is a simulation tool that combines operations, maintenance, and logistics. This exploratory analysis gives insight into the factors used by TLCM-AT beyond the tool's embedded analytical utilities. A Java program is developed to automate multiple changes to TLCM-AT's database, execute simulation runs, and record output data. A scenario deploying LAV-25 vehicles to a tropical region, with three courses of action, provides the basis for analysis. The research includes a description of the analysis available by TLCM-AT as a standalone tool, and concludes with how design of experiments (DOE) expands the insights gained. This thesis provides a framework for using DOE with TLCM-AT, identifies a structured use of TLCM-AT for decision makers, and provides enhancements that enable more effective use of TLCM-AT. Results indicate no practical change in operational availability (Ao) when varying five factors, using 129 design points and 15,480 replications. The factors adjusted are spares, depot capacity, induction quantity, part-repair time, and part-degradation time. Results also reveal synergies between the modeled factors and numbers of spares to be the dominant factor Ao.

KEYWORDS: Lifecycle Management, Lifecycle Costs, Operational Availability, Data Farming, Design of Experiments, Nearly Orthogonal Latin Hypercube, Marine Corps Installation and Logistics, TLCM-AT, Light Armored Vehicle, Marine Corps Logistics Command, Clockwork Solutions, SEED Center

MASTER OF SCIENCE IN PHYSICAL OCEANOGRAPHY

OBSERVATIONS OF OCEAN AMBIENT NOISE (10 HZ TO 10 KHZ) AT THE SITE OF A FORMER NAVY LISTENING STATION TO THE WEST OF POINT SUR, CALIFORNIA, FROM JANUARY TO JULY 2007

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Master of Science in Physical Oceanography–March 2008

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Ocean acoustic recordings were obtained from January through June 2007 at the site of a former United States Navy listening station to the west of Point Sur, California. These data are analyzed to determine the characteristics of the ambient acoustic noise. Direct comparisons to previous studies conducted at the same location reveal a near-identical match of the pressure-spectrum level in the 50 to 120 Hz frequency band to a 1994-2001 study. Comparison to a 1963–1965 study reveals a 3 to 5 dB increase in ambient noise over the 60 to 300 Hz frequency band. As expected, relating ambient noise to wind speed reveals a significant (correlation coefficient greater than 0.5) correlation between 400 Hz and 10 kHz with a maximum correlation coefficient of 0.78 near 2 kHz. Comparing shipping data from San Francisco and Los Angeles–Long Beach ports to ambient noise in the 10 to 1000 Hz band reveals obvious patterns in the relationship of the number of ships arriving or departing each day and the noise level. Due to its proximity, the San Francisco shipping data has a greater effect on the ambient noise level at Point Sur. The largest value of the correlation coefficient between ambient noise and shipping traffic is 0.55 and occurs at 700 Hz.

KEYWORDS: Oceanography, Acoustics

INDIAN OCEAN SURFACE CIRCULATIONS AND THEIR CONNECTION TO THE INDIAN OCEAN DIPOLE, IDENTIFIED FROM OCEAN SURFACE-CURRENTS ANALYSIS REAL- TIME DATA

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Second Reader: Charles Sun, DoD Civilian, National Oceanic and Atmospheric Administration

Ocean-surface circulation is an essential component of the world climate system. In this study, the Ocean Surface-Currents Analysis: Real Time (OSCAR) data, derived from a satellite altimeter and scatterometer, is used to investigate the connection between the Indian Ocean dipole (IOD) and the eastward equatorial jet. The raw OSCAR dataset is refined using the optimal spectral decomposition (OSD) method. Data is analyzed to show the seasonal variability of the surface currents in the Indian Ocean, with emphasis on the Somali current, the North Arabian Sea, and the Bay of Bengal.

To investigate the link between the eastward equatorial jets (Wyrтки jets) and the IOD mode events, complex EOF analysis is applied to the currents in the equatorial region. This analysis reveals that the spatial anomaly of the currents along the equator can directly relate to the occurrence of a dipole mode event. Further zonal currents anomalies and vector plots for the years with dipole mode events also depict the anomalous behavior of the equatorial jets during a dipole mode event. This study demonstrates that satellite-based altimetry data can be used to refine the climatological knowledge of a certain region in the world.

PHYSICAL OCEANOGRAPHY

KEYWORDS: Oceanography, Indian Ocean, Ocean Currents Analysis Real-Time, OSCAR, Currents, Indian Ocean Dipole, IOD, Monsoon Cycle, Optimal Spectral Decomposition, OSD, Complex EOF, Somali Current, North Arabian Sea, Bay of Bengal, Wyrki Jets, Dipole Mode Index, Mine Warfare, Chemical Spill, Search and Rescue, Currents and Energy, Large Scale Climate Diagnostics

MASTER OF SCIENCE IN PROGRAM MANAGEMENT

THE IMPLEMENTATION OF THE NATIONAL-SECURITY PERSONNEL SYSTEM AT THE U.S. ARMY CHEMICAL MATERIALS AGENCY

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Master of Science in Program Management–June 2008

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This research evaluates the effectiveness of the implementation of the National-Security Personnel System (NSPS) at the U.S. Army Chemical Materials Agency at the Aberdeen Proving Ground in Maryland. Twenty-eight Chemical Materials Agency civilian employees, at various levels of responsibilities, are surveyed to determine, from their perspective, how effectively the NSPS had been implemented at the Chemical Materials Agency and if the implementation had an effect on their job performance or morale. This research identifies the areas of the implementation of the NSPS that may have fallen short of the agency's expectations. Possible areas to improve the current management/employee relationship at the Chemical Materials Agency are recommended.

KEYWORDS: National Security Personnel System, NSPS, Chemical Materials Agency, CMA, Communication, Organizational Behavior, Project Management, Implementation

MASTER OF SCIENCE IN SOFTWARE ENGINEERING

AN ONTOLOGICAL APPROACH TO DEVELOPING INFORMATION OPERATIONS APPLICATIONS FOR USE ON THE SEMANTIC WEB

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Master of Science in Information Technology Management–June 2008

Master of Science in Software Engineering–June 2008

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Information operations (IO) have the potential to alter the landscape of modern warfare through the sustained application of a broad spectrum of kinetic and non-kinetic effects. Operations of this type offer the benefit of reducing the scope of direct conflict by shaping the perceptions of a potential adversary. The complexity and diversity of IO make it an ideal beneficiary of software applications, but current systems have yet to truly leverage domain expertise in systems development. By expressing IO capabilities in a formal ontology suitable for use on the semantic Web, conditions are set such that computational power can more efficiently be leveraged to better define required capabilities and more reliably predict effects. The purpose of this thesis is to identify gaps in existing IO software applications, demonstrate how IO capabilities may be represented in a software ontology, and develop a process by which an IO ontology may be adapted for use on the semantic Web. These objectives are accomplished by examining leading IO applications, demonstrating a process for converting the IO problem domain into an ontology using the Protégé 3.3 Ontology Editor, and assessing the suitability of the ontology for use on the semantic Web.

KEYWORDS: Information Operations, IO, Psychological Operations, PSYOP, Electronic Warfare, EW, Electronic Attack, EA, Electronic Protect, EP, Electronic Support, ES, Semantic Web, SW, Resource Description Resource, RDF, Ontology, Ontology Web Language, OWL, Protégé, Poseidon

MASTER OF SCIENCE IN SPACE SYSTEMS OPERATIONS

EXPANDING THE TARGETING PROCESS INTO THE SPACE DOMAIN

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Master of Science in Space Systems Operations–June 2008

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Second Reader: Alan D. Scott, CAPT (Ret.), USN, Department of Mechanical and Astronautical Engineering

The current targeting cycle used by the services relies heavily upon the use of space assets. The Global Positioning System (GPS) and satellite communications are just a few of these assets and they are accessed thousands of times a day. With technology growing by leaps and bounds, it is a challenge for tactical and operational commanders to keep up with the growing capabilities offered by space-borne platforms. Having this in-depth knowledge can assist in all facets of combat, from the best time to attack, to acquiring and relaying battle damage assessment and combat assessment. One of the most vital roles for the warfighter is targeting. Effective targeting, with the right munitions on the right target at the right time, can make a difference in both the battle and the overall war; just as one misplaced or inaccurate bomb can fall on a peaceful village, causing unwanted collateral damage and resulting in bad publicity immediately fed back to the U.S., which can have an impact on public opinion. Properly placed effects can shorten the span of a conflict, save lives, and satisfy strategic requirements. Space is a critical link in this process and is not being effectively used to its utmost capability. This thesis discusses methods and databases through which space capabilities can be better integrated into the current targeting cycle.

KEYWORDS: Space Targeting, Space Operations, Space Capabilities, Basic Encyclopedia, Targeting Folder

MASTER OF SCIENCE IN SYSTEMS ENGINEERING

A SYSTEMS-ARCHITECTING APPROACH TO TOWING AND SALVAGE-SHIP RECAPITALIZATION

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Second Reader: Fotis Papoulas, Department of Mechanical and Astronautical Engineering

Currently, there are four salvage ships and four ocean-going towing ships maintained and operated by the Military Sealift Command (MSC) for the U.S. Navy. In 2019, the first T-ATF ships will reach the end of their forty-year life expectancy. The program manager for these vessels has a set of top-level performance characteristics that are deemed to be desirable requirements for a new ship class encapsulating both legacy ship-class capabilities.

The Department of Defense has shifted defense planning from specific, service-requirements generated systems (RGS) acquisition to a joint-capabilities integration and development system approach that focuses more on how adversaries fight rather than specifically whom they are fighting. This thesis explores how to use systems architecting to incorporate the capabilities derived from strategic guidance into a Department of Defense architecture framework (DODAF) product. A design tool named CORE is used to explain the architecting methodology and produce the DODAF v1.5 system models required for decision making and acquisition-requirement generation.

KEYWORDS: Architecture, CORE, DODAF, DoD 5000.2, Enterprise Architecture, JCIDS, MSFSC, Salvage, Systems Architecting, Systems Engineering, SUPSALV, T-ATF, T-ARS, Towing

MASTER OF SCIENCE IN SYSTEMS TECHNOLOGY

THE APPLICATION OF A GENETIC ALGORITHM AND MULTI-AGENT SYSTEM TO EXPLORE EMERGENT PATTERNS OF SOCIAL RATIONALITY AND A DISTRESS-BASED MODEL FOR DECEIT IN THE WORKPLACE

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Steven Iatrou, Department of Information Sciences**

Organizations rely on the honest operation of their members; however, in an environment where individual members cannot be observed, the opportunity for individuals to lie can lead to dishonest choices (Grover, 1993).

In this thesis, a computer-based genetic algorithm and multi-agent system is created and applied in order to test the predictions of Prof. Steven Grover's distress-based model of the antecedents of lying in organizations. Grover's model blends self-interest theories and uses role theory to identify potential antecedents to lying. The system created provides agents that encounter situations of distress such as those described by Grover's model. The agents' actions are then observed and compared to Grover's hypothesis that an individual's skill will be inversely proportional to his frequency of lying.

Social rationality has been shown to emerge in simple, self-interested agents. A hypothesis is tested that in an environment where an organization and its members are independently self-interested, the frequency of lying by members of the organization will be inversely proportional to the magnitude of feedback provided to the organization.

The results support both Grover's hypothesis and the hypothesis on social rationality. Self-interested individuals with higher skills lie less than individuals with lower skills lie. Also, self-interested individuals lie less in the presence of a higher magnitude of negative organizational feedback.

KEYWORDS: Deceit, Lying, Workplace, Genetic Algorithm, Multi Agent System, Simulation, Subterfuge, Evolution, Genes, Memes, Agents, Economics, Morality, Psychology, Social Rationality

VALIDATING A MODEL OF TEAM COLLABORATION AT THE NORTH AMERICAN AEROSPACE DEFENSE COMMAND USING SELECTED TRANSCRIPTS FROM SEPTEMBER 11, 2001

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Master of Science in Systems Technology–June 2008
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On September 11, 2001, during an exercise at the North American Aerospace Defense Command (NORAD), air-traffic controllers in New York, Boston, Washington, and Cleveland discovered that four American commercial airliners had been hijacked. Initially, the officials at NORAD's North East Air Defense Sector (NEADS) were confused as to whether the hijackings were real-world or part of an exercise. The goal of this thesis is to investigate the teamwork and collaboration that occurred between NEADS, their counterparts at the Federal Aviation Administration (FAA), and various air-traffic control

centers in order to provide military air support and ground civilian air traffic over the United States. Transcripts of recorded audio from the command-and-control center at NEADS are coded and analyzed in an effort to use a real-world example to empirically validate the structural model of team collaboration developed by the Office of Naval Research. The model focuses on individual and team cognitive processes used during collaboration; the goal is to understand how individuals and teams work together under stress to make decisions.

KEYWORDS: Team Collaboration, Team Communication, NORAD, NEADS, September 11, 2001, Cognition, Macro Cognition, Structural Model of Team Collaboration

A BUSINESS-CASE ANALYSIS FOR THE VERSATILE DEPOT AUTOMATED TEST STATION USED IN THE U.S. AIR FORCE'S WARNER ROBINS AIR-LOGISTICS CENTER MAINTENANCE DEPOT

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The objective of this paper is to perform an extended business case analysis (BCA) of the Versatile Depot Automated Test Station (VDATS). The VDATS is a test station that implements the concept of agile, rapid, global-combat support (ARGCS) by being an interoperable, open-architecture, automated test station (ATS) that can replace numerous legacy systems in a single (possibly joint) environment. A BCA is developed through: 1) consideration of the overall management of ATSS in the United States Air Force (USAF), 2) development of an enterprise architecture for the Warner Robins Air Logistics Center Depot, and 3) presentation of an economic analysis to assess the potential for savings if the USAF were to adopt VDATS in the Warner Robins Air Logistic Depot (WR-ALC). It is concluded that there is a strong business case for VDATS as a common ATS in the WR-ALC. Further study should be performed to analyze potential savings at the other two USAF depots.

KEYWORDS: Automated Test Systems, Enterprise Architecture, Business Case Analysis

REVISITING ORGANIZATIONS AS INFORMATION PROCESSORS: ORGANIZATIONAL STRUCTURE AS A PREDICTOR OF NOISE FILTERING

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By comparing the information-processing behaviors of four groups of midlevel working professionals as each undertakes a series of four complex, interdependent, computer-mediated, decision-making exercises, this thesis explores: 1) how processing of information in effective (i.e., high-performing) groups differs from the processing of information in ineffective (i.e., low-performing) groups, and 2) the characteristics of adaptation, from an information-processing perspective, within high-performing groups. The results of the exploration, though mostly inconclusive, call into question both intuition and literature regarding organizational structure, as well as literature in information- and knowledge sharing. It is predicted that meaningless (noise) information will be shared less as time passes and individuals learn. It is also hypothesized that as less noise is shared, an organizations' performance will increase.

As an explanation, this thesis proposes that the ability to filter noise not only increases over time, but is also dependent on the organizational structure, further explaining why one structure consistently outperforms another. Further experimentation is needed to test the validity of these conjectures and bring better understanding to organizational theory, information-processing, and knowledge-sharing networks.

SYSTEMS TECHNOLOGY

KEYWORDS: ELICIT, Information Sharing, Team Performance, Organization Theory, Knowledge Sharing, Information Processing Theory, Noise Filtering

**AN ADAPTIVE ARCHITECTURE FOR COMMAND-AND-CONTROL EXPERIMENT 11:
DETERMINING AN EFFECTIVE INFORMATION SURVEILLANCE AND RECONNAISSANCE
MANAGEMENT STRUCTURE AT THE OPERATIONAL LEVEL OF CONFLICT**

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This thesis on Experiment 11 concentrates on two conditions of the main independent variable: the position of the information surveillance and reconnaissance (ISR) officer. Analysis compares different performance variables under the two ISR role structures. Condition I is comprised of an ISR Coordinator (ISR Coord), a Sea Combat Commander (SCC), and a Marine Expeditionary Unit Commander (MEU). Condition II is comprised of an ISR Commander (ISR Cdr), an SCC, and an MEU. Both ISR officer conditions are examined in a HA/DR scenario. The assessment of performance includes responsiveness of the two conditions when assets are reduced. Participants are asked to plan for the allocation of ISR assets and then re-plan when assets are reduced. Thus, this experiment also examines the simulator as input for operational-level planning.

KEYWORDS: Adaptive Architecture for Command and Control, A2C2, Commander, Coordinator, Expeditionary Strike Group, ESG, Experiment 11, Information Surveillance and Reconnaissance, ISR, Marine Expeditionary Unit, MEU, Sea Combat Commander, SCC

**INCREASING OPEN-SOURCE SOFTWARE INTEGRATION ON THE DEPARTMENT OF
DEFENSE UNCLASSIFIED DESKTOP**

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The United States Department of Defense spends hundreds of millions of dollars each year on desktop-computer software. While some of this expenditure goes to fund special-purpose military software, much of it is absorbed by license fees for computer operating systems and general-purpose, office-automation applications. Although many of these tools may serve their respective purposes rather well, there are several reasons to consider adopting alternative software solutions alongside the existing standards. Improvements to cost, security, and flexibility are some of the benefits that may be realized by integrating some of the many available, mature, robust, open-source software (OSS) solutions. In particular, Linux-based operating systems have helped bring free, open-source software into mainstream use in businesses, homes, and government offices around the world, precisely because of these potential benefits. This thesis examines the feasibility of using OSS, particularly Linux-based operating systems, on unclassified DoD desktop computers. Specific attention is paid to performing office-automation tasks that are currently handled by the U.S. Air Force secure-desktop configuration, Windows-based computers. Additionally, this document examines many of the regulations and policies that shape the procurement and operational environments in which OSS must compete and function.

KEYWORDS: Open Source Software, OSS, Linux, Department of Defense, Unclassified, Desktop, Operating System, FOSS, GPL, PKI

SYSTEMS TECHNOLOGY

TRANSFORMING DATA AND METADATA INTO ACTIONABLE INTELLIGENCE AND INFORMATION WITHIN THE MARITIME DOMAIN

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At present, the Navy is unable to offer a robust, routable network that provides real-time, actionable intelligence between boarding operations and intelligence analysts. Actionable intelligence is the means of obtaining concrete knowledge that permits an individual to take action based on known information. The lack of a robust, routable network creates a lag in operational responsiveness to potential threats identified within the maritime environment. In response to current shortfalls, improved extended maritime-interdiction operations (EMIO) seek to support the secretary of the Navy's vision to streamline and improve operations and exploitation of boarding data. However, there has been no clear indication as to how the implementation of these technologies will affect command and control or current operations. This thesis examines the impact of improved EMIO technology designed to bridge together data with intelligence collected during EMIO and improve maritime-domain decision making in terms of speed and quality and, thus, improve the end user's situational awareness. The construct of business process re-engineering (BPR) is followed to frame this analysis and to provide focus in data collection. The changes to the present EMIO process are also examined by developing and implementing an organizational simulation using POWER 2.0. Results indicate that when improved Spiral-1 EMIO technologies, which significantly decrease the amount of time it takes to fuse collected boarding data into intelligence systems, are combined with a re-design of the EMIO organization, a qualitative improvement toward accomplishing the overall process can be achieved. The current process requires thirty-five hours. With the revised technological and proposed organizational changes, the same process can be achieved in five hours, thus realizing the naval secretary's vision of streamlining and improving maritime operations.

KEYWORDS: Business Process Reengineering, Leavitt's Diamond, POW-ER, Extended Maritime Interdiction Operations, Maritime Interdiction Operations, Maritime Domain Awareness

MASTER OF ARTS

**National Security Affairs
Security Studies**

MASTER OF ARTS IN NATIONAL SECURITY AFFAIRS

THE EUROPEAN-UNION ARMS EMBARGO ON CHINA FROM 2001 TO THE PRESENT: IMPLICATIONS FOR THE UNITED STATES

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Master of Arts in National Security Affairs—June 2008

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Since 2001, the status of the European Union (EU's) arms embargo on China has had important implications for the United States. As an issue in U.S.–EU, Chinese–EU, and Chinese–U.S. bilateral relationships, the status of the embargo has both been perpetuated and weakened by issues relating to security, human rights, and trade. The embargo debate continues to raise awareness on these issues, as well as on competing interests and concerns over the true intent of an EU–Chinese strategic partnership.

American security interests would be negatively affected if the EU were to lift the embargo. The strategic implications of such an action would disrupt the current regional balances of power and potentially raise the probability of conflict. The EU has great economic interest in lifting the embargo in terms of gains in total trade, weapons sales, and the export of dual-use technology. However, American pressure and increased popular awareness of human-rights issues within the EU have affected the EU's decision making about the embargo. Formal and concerted efforts to lift the embargo stalled in 2005, but it remains in Washington's interest to continue to discourage EU governments from making shortsighted efforts to obtain financial gains without first considering long-term strategic implications.

KEYWORDS: EU Arms Embargo, China, United States, European Union, Strategic Partnership, Security Concerns, Human Rights, Trade Issues, Triangular Relationship, Bilateral Relationship, Dual-Use Technology, Tiananmen Square, International Covenant on Civil and Political Rights, EU-China Summits

INNERE FUEHRUNG—A SUPERIOR CONCEPT OF LEADERSHIP

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Master of Arts in National Security Affairs—June 2008

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Second Reader: Werner Freistetter, Institute for Religion and Peace

This study describes the inner design of military forces in a German democracy—*innere fuehrung*, or “inner leadership”—in the face of new challenges. A short, historical analysis is provided, including a discussion of *innere fuehrung* is a concept of military ethics or a soldierly philosophy.

Transformation and its various manifestations, including the effects-based approach to operations (EBAO) and NCW/NCO, are contrasted with *innere fuehrung*. Contemporary NATO, U.S., and German concepts are reviewed and described and their differences are discussed. Possible connection points for *innere fuehrung* are investigated.

Some of the approaches examined are dominated by the extensive use of technology. This analysis focuses on a possible contradiction between technology and *innere fuehrung*. However, the focus is not only on *innere fuehrung* and its requirements, but also on its role as an enabler for successful interagency cooperation.

The study concludes that *innere fuehrung* is a guiding principle based on the application of the German basic law to the reality of soldierly service. In contrast to transformation or revolution of military affairs (RMA), the former emphasizes the human being as a citizen rather than technology as

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tools of war. It constitutes or largely contributes to the institutional culture of the Bundeswehr and remains applicable in the present. Citizens in uniform at home in the pluralism of state and society are best able to adapt to the security and defense challenges of the present, in contrast to an exclusive military caste or an outsourced mercenary horde.

KEYWORDS: *Innere Fuehrung*, Inner Leadership, Transformation, Effects Based Approach to Operations, EBAO, Revolution of Military Affairs, RMA, “Citizen in Uniform,” Germany, NATO, Mercenaries, Ethics, Guiding Philosophy, German Basic Law, CAFJO, Soldierly Values, Pluralism, State, Society, Conscript Forces, Institutional Culture

PORT SECURITY IN THE PERSIAN GULF

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Since 2001, the United States and the international community have implemented numerous measures designed to improve the security of maritime commerce. Special attention has been paid to the vulnerability of port facilities to exploitation by terrorists or other illicit actors. While the implementation of enhanced port-security measures in Saudi Arabia, the United Arab Emirates, and Iraq may have improved some aspects of maritime security, significant vulnerabilities remain. While strong physical security at ports and stringent inspection regimes for container cargo are important elements in protecting maritime infrastructure worldwide, port-security measures may yet be undermined by a failure to provide mechanisms that verify the identities and credentials of all individuals with access to ports, secure non-container cargo, and prevent illicit actors from accessing and exploiting port facilities.

KEYWORDS: Port Security, ISPS, CSI, Saudi Arabia, United Arab Emirates, Iraq, Maritime Infrastructure, IMO, Port Facility, Terrorism, Smuggling, Oil, Fuel, Persian Gulf, Arabian Gulf, Middle East

LUSTRATION: TRANSITIONAL JUSTICE IN POLAND AND ITS CONTINUOUS STRUGGLE TO MAKE MEANS WITH THE PAST

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Poland was the first East Central European nation to transfer from totalitarian rule to democracy. Although resistance to the communist regime had existed since 1956, it was not until 1980 that this transition began to develop. Negotiations between Poland’s communist regime and its opposition allowed for the first free elections in East Central Europe in the summer of 1989; within months, regimes throughout the region began to fall. Upon their transfer, Poland’s neighbors, Germany and the Czech Republic, immediately adopted policies concerning the crimes of the previous regime, but Poland did not. Poland’s failure to implement legislation concerning transitional justice led to almost a decade of political turmoil and infighting. In order for an emerging democracy to become effective, it must separate itself from the ideals of the old regime and those individuals and policies that enforced its repression.

This thesis examines the post-1989 governments of Poland, Czechoslovakia/Czech Republic, and East Germany during the transition to a democratic state in the 1990s. An analysis of how each of these nations held the criminal functionaries of the previous regime accountable is included. This research provides insight as to why Poland, after legislation in 1996, is still struggling with implementation of transitional justice eighteen years after transition.

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KEYWORDS: Lustration, Transitional Justice, Poland, Czech Republic, Germany, Czechoslovakia, East Germany

LESSONS FROM CENTRAL AND SOUTHEAST EUROPE FOR THE GROWING ALLIANCES

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This thesis seeks to explain what hinders former neutral and non-aligned nations from fully integrating themselves into collective security regimes, such as the North Atlantic Treaty Organization (NATO), the European Union Common Foreign and Security Policy, and United Nations Peace Support Operations: What delays or denies such nations from joining? When they do join, what keeps them from providing more than a token material and personnel contribution to alliances?

Examining three geographically close but historically distinct cases, Austria, Croatia, and Montenegro, this work assesses their common and idiosyncratic relationships. Each case study examines five characteristics that influence national acceptance of collective security: history, government objectives, public attitudes, defense structures, and operations. The study arrives at three conclusions. First, despite their proximity, the three countries exhibit substantial differences in their historical, official, and popular definitions of national security. Those differences strongly influence national leaders' and the voting public's views on individual collective-security regimes, such as the United Nations, NATO, and the European Union. Second, the three nations' historical and current experiences suggest that proponents of collective security should engage individual partner nations based on a more precise understanding of individual national-security objectives. Finally, neither the NATO nor the EU concept of long-term, European, collective security accurately captures what motivates these three states to seek international collaboration for their national defense.

KEYWORDS: Collective Security, Collective Defense, Civil-Military Relations, North Atlantic Treaty Organization, NATO, European Union, EU, Common Foreign and Security Policy, Public Attitudes toward Collective Security, Republic of Austria, Republic of Croatia, Republic of Montenegro, Defense Reform and Collective Security

MASTER OF ARTS IN SECURITY STUDIES

TURKEY'S ROLE IN NATO-EUROPEAN UNION COOPERATION
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This thesis analyzes the significant role of Turkey in cooperation between NATO and the European Union (EU). It first examines Turkish–EU relations in the period 1991–1999, when the EU relied on the Western European Union (WEU) as its instrument for security and defense matters. The years 1995–1999 were especially fruitful, because Turkey was an associate member of the WEU and participated fully in the relevant EU decision-making. After the emergence of the EU's European security and defense policy (ESDP) in 1998–1999, most WEU institutions were transferred to the EU, and Turkey's status in the WEU became irrelevant. The EU sought ready access to NATO assets and capabilities for EU-led ESDP operations. However, Turkey, as a NATO member, opposed granting this access in order to protect its national-security interests until agreement could be reached on the "Berlin Plus" arrangements. Turkey has also upheld the NATO–EU agreement on information security. That is, classified NATO information cannot be shared with states that are not members of NATO's Partnership for Peace and that have not concluded security agreements with NATO in that framework, such as Cyprus and Malta. Turkey's principled policies have thus significantly affected cooperation between the EU and NATO.

KEYWORDS: ESDP, Turkey and European Security, NATO-EU Relations

NATIONALISM, MASS POLITICS, AND SPORTS: COLD WAR
CASE STUDIES AT SEVEN DEGREES
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Second Reader: Robert E. Looney, Department of National Security Affairs

This study treats the role of sports in international relations in the Cold War. The era of nationalism and total war in the twentieth century produced one of the most violent periods in European history prior to and including World War II. The masses were mobilized around myths, legends, and symbols of extraordinary power. Sports and physical culture were initially viewed as a means of creating societies more fit for war and quickly became a tremendous social movement. Sports became the primary medium through which superiority propaganda was transmitted by various clubs, interest groups, governments, and states. Governments realized the political potential of sports and physical culture, and the U.S. and U.S.S.R. became fully engaged in a war fought on ersatz battlefields comprised of soccer pitches, track fields, and hockey arenas during the Cold War. The twentieth century, particularly the Cold War era, provides several examples of sporting events deliberately planned with political gain in mind and instances where sporting results were intentionally exploited for governmental gain. The study of the history of such events provides one with a better understanding of the appeal of nationalist movements and how they can spiral out of control, leading to violent nationalism if left unchecked.

SECURITY STUDIES

KEYWORDS: Nationalism, Mass Politics, Sport, Physical Culture, Gymnastics, Propaganda, Ideology, Olympics, De Coubertin, Hockey, National Identity, State, Government, Athlete, Symbolism, Communism, Socialism, Fascism, Cold War, Prague Spring, Czechoslovakia, Canada, United States, USA, Soviet Union, USSR, Italy, Germany, Lacrosse

THE EFFECTIVENESS AND EFFICIENCIES OF PRIVATE MILITARY CORPORATIONS

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This study investigates private military corporations (PMCs) to examine their effectiveness and efficiency as a substitute for traditional military forces. The PMC consists of a for-profit firm that provides military services ranging from combat operations to training, security, and logistics support. While the PMCs represent a solution to issues such as insufficient military resources to provide direct support to other nations, there remain a number of political and structural barriers to their widespread use.

KEYWORDS: Mercenary, Soldier for Hire, Outsourcing, Private Military Company, Civil-Military Relations

INDONESIA, MALAYSIA, AND PHILIPPINES SECURITY COOPERATION IN THE CELEBES SEA

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In this thesis, the author explores the challenges and reasons behind the current state of limited trilateral security cooperation among Indonesia, Malaysia, and the Philippines in the Celebes Sea. This study is made through an analysis of historical and current events among these nations and with external powers, national unilateral and bilateral actions, these nations' domestic political environments, and the status of their respective militaries and domestic law enforcement institutions. These nations have been successful in establishing agreements among each other to enhance security cooperation in the Celebes Sea; however, these agreements lack the necessary scope and depth needed to address the current terrorist and piracy threats in the relevant maritime and coastal areas. It is found that this lack of security cooperation is mainly due to the historical mistrust of each other's national interests, domestic political challenges, and limited force projection and interagency capabilities. Recommendations are provided for U.S. policy and theater-engagement planning in these nations.

KEYWORDS: Indonesia, Malaysia, Philippines, Southeast Asia, Celebes Sea, Sulawesi, Borneo, Mindanao, Sulu, Security Cooperation, ASEAN, Terrorism, Piracy, Seams

SECURITY STUDIES

ECONOMIC AND SECURITY REASONS WHY THE U.S. SHOULD NORMALIZE RELATIONS WITH CUBA

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Second Reader: Robert E. Looney, National Security Affairs**

Cuba's economy has not only survived the end of Soviet-era subsidies, but has thrived in the era of globalization. This thesis documents the adjustments the Cuban government has made to the economy and the increase in foreign direct investment (FDI) that has occurred as a result. The thesis also shows how China, Venezuela, and Iran continue to invest more money in the island and subsequently threaten to wield more influence over Cuba. The U.S. has the opportunity to mitigate the threats posed by Venezuela and Iran vis-à-vis Cuba. However, the policy espoused by current policy-makers is logically flawed. The Helms-Burton Act contains unrealistic benchmarks for ending the embargo, providing little incentive for Cuban leaders to liberalize. Neither presidential candidate advocates a change in this legislation. In contrast, this thesis argues that the normalization of relations with Cuba could diminish the influence Iran and Venezuela have on Cuba and keep potential threats from coming ninety miles off the coast of the U.S. The next president should call for Congress to repeal the Helms-Burton Act so that executive discretion can be exercised with respect to Cuban foreign policy.

KEYWORDS: Cuba, Fidel Castro, Raul Castro, Embargo, U.S. Foreign Policy, Venezuela, Iran, China, Security, Threat, Normalization

DRUG TRAFFICKING AND POLICE CORRUPTION: A COMPARISON OF COLOMBIA AND MEXICO

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Police officers working in countries plagued by drug trafficking are often offered a choice between *plata o plomo* (“silver or lead”). Given this option, it is not surprising that levels of police corruption are high in these nation-states. Significantly, however, levels of police corruption do differ radically between those countries where the levels of drug production and trafficking are similar. This thesis examines the case of Mexico, where corruption has been historically high and has increased in recent times; and the case of Colombia, where levels of police corruption have been relatively low and might even be said to be on the decline. Specialists in police reform and anti-corruption typically look at administrative factors, such as ethics, salary levels, the purging of corrupt officials, and the recruiting and training of “clean” officers as essential elements in the prevention of police corruption. While these factors explain some of the differences in levels of corruption, this thesis fills an important gap in the existing literature by moving beyond these conventional explanations. In particular, it introduces a country-specific approach to drug-related police corruption, including factors such as the organizational structure of the police force (centralized or decentralized), the legacy of the “political criminal nexus” in the country concerned, and both the size and “ideology” of the drug trafficking organizations involved.

KEYWORDS: Political Criminal Nexus, PCN, Mexico, Colombia, Police, Drug-Related Police Corruption, Plaza System, Partido Revolucionario Institucional, Federal Preventative Police, PFP, Agencia Federal de Investigaciones, AFI, Colombian National Police, CNP, Pablo Escobar, Medellin Drug Cartel, Cali Drug Cartel, Mexican Drug Cartels, Mexican Federation, Federal Judicial Police, De-Centralized Policing System, Centralized Policing System

SECURITY STUDIES

DECENTRALIZATION AND DEVELOPMENT: THE INDIAN BALANCING ACT

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Over the course of India's six decades of statehood, the central government granted and removed authority to and from states, resulting in a variety of development patterns among Indian states and across different periods of time. The cases presented in this thesis illustrate that when sub-national groups with well-embedded and capable governing institutions successfully lobbied the center for more authority, many developmental outcomes the group sought strengthened. In the cases where the central government did not relinquish power and responsibility to states with strong government institutions, development slowed or stalled. Conversely, development was not significantly improved in areas or states with weak governing institutions even when they requested and were granted more power from the center. This thesis examines the effect of decentralization on three aspects of development – insurgency, economic growth, and poverty reduction – and describes the conditions under which decentralization and centralization promote or impede those characteristics. Based on empirical data from Indian states and detailed analysis of India's shifting political economy over time, it is shown that the decentralization of fiscal and political authority to capable sub-national governments promotes development. Conversely, centralizing authority in the presence of capable sub-national governments, or ceding authority to incapable sub-national governments, impedes development.

KEYWORDS: Decentralization, Development, India, Insurgency, Growth, Poverty

THE RESURGENCE OF NAXALISM: HOW GREAT A THREAT TO INDIA?

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Second Reader: Anshu Chatterjee, Department of National Security Affairs

Of all the current threats to India's stability and development, the one posed by Naxalism, a Maoist insurrection active in the eastern half of the country for over four decades, is the most overlooked and analytically neglected in western academic and security circles. This thesis undertakes an historical analysis of the Naxalite movement to assess how great a danger its current iteration truly poses and what the implications might be for India's continued rise. Soberingly, it finds that the insurgency is indeed stronger and more dangerous today than at any time in the past. Furthermore, while it does not pose an existential threat to the state in the same way as its counterpart in Nepal, it will prove extremely disruptive to India's further growth and development if not swiftly and effectively countered. New Delhi's efforts in this regard are so far unimpressive, but it is not too late to act. The United States has a vested interest in the emergence of a strong and stable India, and may be able to help its new "strategic partner" address the challenge of Naxalism's resurgence.

KEYWORDS: CPI, CPI-Maoist, India, Insurgency, Insurrection, Maoism, Naxalite, Naxalism

RUSSIA'S ENERGY POLICIES AND UKRAINE'S NATO CANDIDACY

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NATO enlargement and the European Union's growing dependence on external energy supplies controlled by Russia have simultaneously developed into crucial security issues in Europe. The emerging interaction between Alliance enlargement and energy policies may yet affect the Ukraine's future relationship with NATO, as well as Russia, and may even determine which direction NATO takes regarding the Ukraine's candidacy for membership. As the leading natural gas exporter with the largest proven gas reserves in the world, Russia provides more natural gas to the European Union than any other supplier. Eighty percent of Russian-controlled gas (from central Asian countries as well as Russia) transits the Ukraine for Europe, amplifying the Ukraine's geostrategic significance. Russia and several west European members of NATO continue to augment their economic interdependence through strategic and lucrative natural gas agreements. The amalgamation of key NATO European states' strong dependency on Russian natural gas and the Ukraine's potential NATO membership makes Kyiv's political and strategic orientation a relevant and contemporary question for the United States and its NATO allies. Russian-European energy interdependence could lead to a rift within the Alliance regarding the Ukraine's candidacy for NATO membership, but cooperative solutions may yet be achieved.

KEYWORDS: NATO Enlargement, Ukraine, Russia, Europe, European Union, Energy, Natural Gas, Energy Security, Economic Interdependence, Energy Policy

THE TRANSNATIONAL PIPELINES AND NAVAL EXPANSION: EXAMINING CHINA'S OIL INSECURITIES IN THE INDIAN OCEAN

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Master of Arts in Security Studies—June 2008

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This thesis compares two potential energy-security strategies in the context of Beijing's perceived vulnerabilities associated with oil imports from Africa and the Arabian Gulf. The first strategy focuses on the diversification of energy import routes through the development of Pakistani and Burmese transnational pipelines. These pipelines would arguably strengthen China's energy security by reducing the ability of foreign powers to threaten China's oil sea-lines-of-communication (SLOCs) from Africa and the Arabian Gulf. The second strategy considers developing a People's Liberation Army Navy (PLAN) force strength capable of protecting Chinese-bound energy SLOCs in the Indian Ocean. The overall objective of this thesis is to explore and assess the feasibility of these two energy-security alternatives to determine what path, if any, proves more attractive to Beijing. As this thesis argues, both strategies prove ineffective at addressing Beijing's energy insecurities in the Indian Ocean. Yet the author submits that Beijing will still pursue these strategies for reasons of economic benefit, political stability, regional development, and national pride. In the end, Beijing's energy security does not result from transnational pipelines or strong naval capabilities, but rather, the ability to act as a responsible player on the global stage.

KEYWORDS: Chinese Energy Security, PRC Energy Security, China, Indian Ocean, PLAN Aircraft Carriers, Pakistan Pipeline, Burma Pipeline, Chinese Naval Buildup, Oil Sea Lines of Communication, People's Liberation Army Navy

SECURITY STUDIES

IMMIGRATION POLICIES IN EUROPE: IMPACT ON CRIME —A CASE STUDY OF GERMANY

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This thesis examines the complex effects of European immigration policies on crime and society. Particular focus is placed on the past and present security challenges of post–World War II, especially post–Cold War, shifts of peoples and demographics, which have literally and figuratively changed the face of Europe. The first chapter reviews the significance of the issue in the context of the historical and economic developments in which post-war immigration has assumed its familiar dimensions. The second section discusses the effects of immigrant-related crime on the security and prosperity of Germany and the failures of German policies and the German government to fully integrate the immigrants into German society. The third chapter analyzes immigrant-related economic crime and its effects on German economic prosperity. Section four addresses the effects of German immigration policies on violent crime against immigrants in Germany, as it engenders a feeling of attack among immigrants facing what appears to be resurgent German chauvinism. The final section offers a summary of German governmental and multilateral actions that address immigrant-related crime. Recommendations are provided for future coordination of immigration policies to enhance security in Europe through cooperation of governments and European security institutions. As this thesis concludes, only such coordinated, cooperative measures can provide the lasting framework needed for the successful—peaceful—integration of immigrants to Germany and Europe.

KEYWORDS: Germany, Immigration, Crime, Nationalism, Assimilation, Integration, History, Nazi, Reunification, Media, Underground Economy, Black Market, Criminal Activity, Police Force, EUROPOL, EU, Parallel Society, Education, Culture, Identity, Violence, Honor Crime, Muslim, Arab, Non-National, Migrant Background, Racism, Hate, Political Parties, Education, Language

NORTH KOREA’S JUCHE IDEOLOGY AND THE GERMAN REUNIFICATION EXPERIENCE

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This thesis analyzes potential socio-cultural discord upon eventual Korean national reunification, owing to the predominance of the cultic state ideology of Juche in North Korea. Juche has become the fundamental framework of orientation for North Koreans. The hypothesis investigated is that, upon eventual Korean reunification, significant problems of national social cohesion, at least as serious as those faced by reunified Germany since 1990, should be expected. To this day—nearly two decades and an estimated €1.5 trillion after the fall of the Berlin Wall in 1989—reunified Germany is recurrently affected by socio-cultural conflicts, based on ingrained values, past ideological conditioning, and resulting emotional ties and behavior patterns of the former East and West German societies. Juche could foster similar or graver phenomena in a reunified Korean society, manifested in mutual and estranging grievances, ultimately impeding successful reunification. However, the Kim dynasty’s established virtuosity in adapting and developing Juche might, in some circumstances, combine with Juche elements of potential appeal to both Korean societies, such as national self-reliance. Instead of constituting an ideological barrier, Juche’s pan-Korean components might hypothetically be transformed into a common ground to alleviate societal conflict and eventually facilitate Korean national reunification.

KEYWORDS: Juche, Chu-ch’e, Utopian Idea, Ideology, Cult, Fundamentalism, Kim Dynasty, Kim Cult, Kim Il-Sung, Kim Jong-Il, North Korea, South Korea, ROK, DPRK, East-Germany, West-Germany, FRG, GDR, Re-Unification, Socio-Cultural Re-Unification, Unification Crisis, Wall Inside the Minds, Ideological Barrier

SECURITY STUDIES

SCRUTINIZING AND ASSESSING THE PERFORMANCE OF THE GERMAN AND U.S.-LED PROVINCIAL RECONSTRUCTION TEAMS IN AFGHANISTAN

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This thesis analyzes the performance of German and U.S.-led Provincial Reconstruction Teams (PRTs) currently deployed in Afghanistan. The major conclusion of this thesis is that the PRTs are limited in their capabilities to significantly reconstruct or bring stability to Afghanistan. Despite their initial success between 2003 and 2005, they are currently unable to address the challenges in Afghanistan. Utilizing systematic case studies, this thesis examines the structure, strategy, and experiences of German and U.S.-led PRTs. The assessment focuses on four different performance criteria: capacity-building, stability, relationship-building, and aid projects and coordination. Research is based on reports of international organizations, such as the United Nations and NATO, as well as on various non-government organization reports. It is found that the PRTs' limitations are not only a consequence of their structural limitations, but are also the result of Afghanistan's dynamic environment, with all its facets and requirements. The main external factors influencing PRTs are Islam, tribal structures, poor governance, and a sobering economic situation. This thesis contributes to an advanced understanding of how PRTs function and updates available information on PRTs and Afghanistan.

KEYWORDS: Provincial Reconstruction Teams, Afghanistan, United States, NATO, Germany, NGOs, Assessment, Performance, Islam, Islamization, Taliban, Al Qaeda, Afghan Economy

MARITIME SECURITY COOPERATION IN THE STRAIT OF MALACCA

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This thesis examines maritime security cooperation among Singapore, Indonesia, and Malaysia in the Strait of Malacca. Southeast Asian states have traditionally considered multilateral military cooperation among themselves as taboo because of tensions arising from territorial and other political disputes. However, this thesis demonstrates that their aversion to multilateral forms of military cooperation has decreased in the post 9/11 period. This change can be attributed to the relaxation of historical tensions, the recognition of a common threat in piracy and maritime terrorism, an increase in extra-regional pressure to cooperate, and changes in the strategic environment since the end of the Cold War. This thesis also examines the three countries' maritime assets and their procurement strategies to enhance their capabilities to patrol and defend their maritime areas. Although assets are limited, it is found that efforts to coordinate maritime patrols have contributed to a sharp decline in attacks on shipping in the Malacca Strait since 2004.

KEYWORDS: Singapore, Malaysia, Indonesia, ASEAN, Strait of Malacca, Malacca Strait, Defense Cooperation, Maritime Security Cooperation, Military, Regional Cooperation, Piracy, Sea Lines of Communication, Terrorism

SECURITY STUDIES

COERCION, CASH CROPS, AND CULTURE: FROM INSURGENCY TO PROTO-STATE IN ASIA'S OPIUM BELT

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This thesis is a comparative study of conflict and opium in the Golden Crescent and Golden Triangle, focusing in particular on Afghanistan-Pakistan and Burma. It takes a state-building approach to analyze the formation and composition of opiate-funded “proto-states” in the two regions, with case studies on the Taliban and the United Wa State Party. Historic, political, ethnic, and cultural factors are explored in relation to each region and proto-state case. The basic argument is that opium and opiate trade provided capital for the formation of basic state-like entities that conduct all the basic state-building activities as defined in the literature. What are often called “insurgent groups” are actually armies of proto-states. What are often called “insurgencies” are actually conflicts between infant states in areas that never contained nation-states. This paradigm suggests an alternate method to study these two areas: a method that emphasizes history and anthropology to understand the basic motivations and attributes of the proto-state actors.

KEYWORDS: Afghanistan, Burma, Insurgency, Opium, Drugs, State-Building, Golden Triangle, Golden Crescent, Proto-State, States-within-States, Taliban, UWSA, UWSP, Wa, Shan State, Ethno-Nationalism, Pashtun, Pashtunistan

POLAND'S ROLE IN THE EUROPEAN AND WORLD SYSTEM OF STATES FROM 1979–2007

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The present study is a work of contemporary history. It describes and analyzes the personalities, events, and broader social and political trends that have helped reconcile Poland's interests in Europe with its desire to maintain a close friendship with the United States. It considers Poland's role in European and world affairs between 1979 and 2007, with a special focus on political events that have taken place between 2003 and 2007. In both of these periods, Poland was a driving force behind changes occurring in Europe. From 1979-1989, Poland's aspirations to independence were a signal for other Eastern European nations to begin a similar process. For the next fourteen years, Poland conducted a strongly pro-American and pro-western policy. Thanks to correspondingly strong support from the United States, Poland became a NATO member and a strong, democratic European state. Subsequent events, including the decision to send Polish troops to Iraq and to accept some parts of America's missile-defense shield in Poland, have been viewed negatively by some European NATO states. The result has been a gradual change in Poland's attitude towards the Common Foreign and Security Policy/European Security and Defense Policy and increasingly active Polish participation in European policies.

KEYWORDS: Poland, Iraq, U.S.A., Ballistic Missile Defense, Common Foreign and Security Policy, European Security and Defense Policy

SECURITY STUDIES

THE INFLUENCE OF KEY INTERNATIONAL ACTORS (U.S.–EUROPEAN UNION) AND KEMALISTS ON TURKEY’S ATTITUDE TOWARD ITS KURDISH MINORITY

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This thesis seeks to examine the way key international actors (U.S.-European Union (EU)) and the Kemalists have shaped and currently influence Turkey’s attitude toward its Kurdish minority. The tough negotiations on Turkey’s accession to the EU since 2005, and the de facto establishment of an autonomous Kurdish entity in northern Iraq following the 2003 U.S. military intervention, have brought the Kurds’ plight into the limelight. These developments have involved the United States and the EU in the management of Turkey’s Kurdish question to an unprecedented extent. The research demonstrates that Turkey’s concessions to the Kurds in the 2000s have been moderate, and that Ankara is still reluctant to recognize the existence of a Kurdish minority that deserves special rights. The research also reveals that, despite U.S. rhetoric concerning human rights and the treatment of the Kurds, the United States, in line with the rationalists’ approach, continues to view a Turkish–U.S. strategic partnership as vital to America’s interests. The EU’s socialization strategy seeks to reform Turkey’s human rights regime, as the Europeans have reached the conclusion that Turkey’s Kurdish question is an issue of denied cultural rights, as opposed to an issue of forced assimilation.

KEYWORDS: Turkey, United States, European Union, Kurds

BELEAGUERED MUSLIM FORTRESSES AND ETHIOPIAN IMPERIAL EXPANSION FROM THE 13TH TO THE 16TH CENTURY

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J.S. Trimingham has famously described Ethiopia as a “beleaguered fortress in the midst of a sea of Islam,” implying that Christians in Ethiopia have consistently been besieged by Muslims, not vice versa. This thesis challenges this common conception by demonstrating that throughout Ethiopia’s medieval period (1270-1555), the time of greatest conflict between the Ethiopian Empire and its Muslim neighbors, Muslim forces did not besiege the Ethiopian Empire. On the contrary, the Ethiopians militarily subjugated their neighboring Muslim sultanates, most prominently Ifat and Adal, and politically divided the sultanates’ ruling families to keep them weak. These tactics, designed to wrest control of trade from the sultanates, were resoundingly successful until Muslims unified around military/religious leaders, primary among them being Imam Gran, who conquered the Ethiopian Empire in 1531. Though imperial forces reversed the conquest by 1543, a historical focus on this event still feeds the misperception that Ethiopia’s history is that of a Christian kingdom ensconced in a fortress to protect itself from a beleaguering “Muslim menace.” This thesis concludes to the contrary that the Ethiopian Empire waded aggressively and purposefully into the sea of Islam to beleaguer its many Muslim neighbors.

KEYWORDS: Adal, Ahmed, Amhara, Amlak, Christian, Dahlak Islands, Dengel, Ethiopia, Expansion, Fortress, Ifat, Gran, Imam, Islam, Mahfuz, Maryam, Medieval, Missawa Muslim, Sabradin, Seyon, Sultanate, Sultan Muhammad, Shawa, Tigrai, Trade, Trimingham, Zeila

SECURITY STUDIES

CLOSING THE GAP: THE EFFECT OF CHINA'S RISE ON TAIWAN'S INDEPENDENCE POLICY

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Master of Arts in Security Studies—June 2008

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This thesis examines the shifts in Taiwan's independence policy since 1991 to determine whether Taipei has been more restrained at times of military vulnerability. The objective is to determine whether Taipei's actions favoring independence are dependent on threats to its security from offensive actions by the People's Republic of China (PRC), and if so, to determine the effect of the PRC's growing military capability on those independence policies. The level of U.S. support for Taiwan is a significant component of its relative security. Therefore, shifts in that support are evaluated and the resulting implications for U.S. policy are assessed.

Taipei's official policy has hovered around the status quo, with occasional excursions toward independence since 1991. These excursions occurred for the most part when Taipei was relatively secure from PRC threats, and were curbed when concerns were expressed by Washington. PRC military strength and the level of U.S. support not only influence Taiwan's independence policy, but also Taiwan's domestic politics. For peaceful resolution, Washington must continue its policy of strategic ambiguity and, as a new KMT regime in Taiwan eases the tension of recent years, it should reconsider noninvolvement and be prepared to play at least a passive role in PRC–Republic of China negotiations.

KEYWORDS: Republic of China, Taiwan, People's Republic of China, Independence, United States, "One China," Strategic Ambiguity

THE PRESIDENT AND THE CHANCELLOR: GERMAN–AMERICAN RELATIONS, THE 2002– 2003 IRAQ CRISIS, AND THE ROLE OF PERSONALITY IN STATECRAFT

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This thesis investigates the influence of personal bias by political leaders in the U.S.–German dispute in 2002–2003 over the Iraq campaign. The nature of the Atlantic Alliance in the 21st century, in the face of a new international security environment, is also analyzed.

The focus of this research is on the life experiences and the crucial influence of the two national-level decision makers, President George W. Bush and Chancellor Gerhard Schröder. The thesis examines the course of events and shifts in foreign policy in the two countries after the terrorist attacks on 11 September 2001 in order to analyze the origins of the dispute. The study finds that the personalities and personal biases of the two protagonists at times outweighed and at times reflected political, strategic, and cultural factors during the escalation of the dispute between the traditionally close transatlantic allies. Examples of relationships between German and U.S. national leaders from the 1970s to the 1990s show that personality had always been a decisive factor in the bilateral relationship, but that statecraft and diplomacy prevented the escalation of policy disagreements and avoided the immoderate personalization of politics.

KEYWORDS: George W. Bush, Gerhard Schroeder, Gerhard Schröder, President, United States, America, U.S.A., Chancellor, Kanzler, Federal Republic, Germany, FRG, Deutschland, Statecraft, Discord, Dispute, Iraq, Crisis, War, Personality, International Relations, German-American, Atlantic Alliance, Transatlantic, Relationship, Foreign Policy, 11 September 2001, 9/11, United Nations, Preemptive, Preventive, Coalition

SECURITY STUDIES

SWARM TACTICS AND THE DOCTRINAL VOID: LESSONS FROM THE CHECHEN WARS

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Swarming concepts and swarm tactics have been used for centuries. Swarming is essentially a convergent attack on an adversary from multiple axes. Swarming attacks are usually conducted either by force or fire, or a combination of both. Swarming is not new to military scholars and historians, but the idea of formally incorporating swarming concepts into military doctrine and tactics by the Marine Corps and other U.S. armed forces has never been given serious thought beyond limited experimentation. The most recent and relevant use of swarm tactics occurred during the Chechen wars against the Russians, which have proved a serious challenge to the Russians. When one examines Marine Corps doctrine, warfighting concepts, and experiments, a doctrinal void emerges that should truly be addressed. The Marine Corps distributed operations (DO) concept is reviewed with the idea of contributing toward a future swarming doctrine. While we watched the Chechen wars unfold, even writing articles and books about all the lessons we should have learned, none of those lessons related to swarming ever translated into real doctrinal changes, embracing both offense and defense. This thesis asks if there is potential to develop doctrinal swarming concepts, while bringing forth additional lessons learned from the Chechen wars and highlighting gaps and weaknesses in warfighting doctrinal publications and warfighting experiments.

KEYWORDS: Swarming, Warfighting, Concepts, Swarm, Tactics, Chechnya, Chechen Wars, Russia, Russian, Military, Doctrine, Experiments, Experimentation, Distributed Operations, OEF, OIF, GWOT, Terrorism, Iraq, Marine Corps

FROM TOTALITARIANISM TO DEMOCRACY: THE CASE OF POLAND—CONTROVERSIES AND HERITAGE OF COMMUNISM

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Poland's transition from totalitarianism to democracy began in the late 1970s and brought about the staged end of the communist system by 1989. The 1976 strikes by Polish workers against increasing food prices, backed by a dissident intelligentsia, sparked a chain of events that, barely thirteen years later, led to the first non-communist government in Poland in over forty years. Although this change of political system was conducted in a peaceful manner, there has always been a camp who have posed the question of why Polish democracy had to be based on compromise with the old regime and whether compromise was really the only possible solution. After eighteen years, Poland still faces issues of lustration and de-communization that were avoided in 1989, when secret police agents and collaborators were allowed to remain on the political scene and continued influencing many aspects of life in Poland.

This thesis examines how Poland's peaceful revolution happened as it did and discusses how to handle collaborators with the communist regime. It also probes the new debate about de-communization and lustration, launched after the 2005 election, which gave victory to the vehemently anti-communist Peace and Justice Party.

KEYWORDS: Poland, Communism, Roundtable Talks, Lustration, Decommunization, Solidarity

SECURITY STUDIES

THE BALANCE OF POWER THEORY: IMPLICATIONS FOR THE U.S., IRAN, SAUDI ARABIA, AND A NEW ARMS RACE

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As a study in the Bush doctrine of preventive warfare, the conflict in Iraq has been of great interest. However, the unintended consequences and the impact on regional instability also demand attention. There is a balance of power struggle taking place between Iran and Saudi Arabia, which, because of Iran's nuclear ambitions, has drawn the attention of the international community and the ire of the United States. As a result, policymakers in Washington are compelled to determine a course of action that would, at best, prevent the proliferation of nuclear weapons or, at worst, return the region to a modicum of calm. Indeed, the issue has become the most divisive matter between presumptive presidential nominees Barack Obama and John McCain.

It is necessary then, to examine the behavior of Iran and Saudi Arabia against the tenets of realism and state behavior through the lens of political scientists John Mearsheimer, Kenneth Waltz, and Stephen Walt. By reviewing offensive, defensive, and balancing behavior within the Middle East system, the predictive analysis should enable policymakers to determine the appropriate measure of sticks and carrots that would achieve U.S. national interests in the region.

KEYWORDS: Balance of Power, Realism, Offensive, Defensive, Balancing, Buck-Passing, Neo-Realism, Arms Race, Iran, Saudi Arabia

THE UNTOLD STORY OF MEXICO'S RISE AND EVENTUAL MONOPOLY OF THE METHAMPHETAMINE TRADE

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The purpose of this thesis is to tell the untold story of the ascendance of Mexican drug-trade organizations (DTOs) over the production and distribution of methamphetamine. By adding this dimension to a story that has typically focused on the role of Mexican DTOs in the cocaine trade, it explains the spread of meth use in the U.S. and the challenges currently facing U.S. law enforcement officials attempting to combat the illegal methamphetamine trade. It concludes that the trick is to formulate an international anti-drug policy that incorporates the "balloon effect" and anticipates the creation of a new challenge, even as the old one is being laid low. If nothing else, the untold story of how the Mexican cartels rose to monopolize the methamphetamine trade in the United States demonstrates that the formulation of anti-drug policy needs to bridge the gap between tactical success and strategic failure. Drug lords come and drug lords go, but the war on drugs goes on. If real progress is to be made, then the specifics, such as the story of how the Mexican DTOs took over the methamphetamine trade, need to be told and retold and integrated into the broader anti-drug policy initiative of the day.

KEYWORDS: Methamphetamine, Drug Trade, Mexico, Mexican Drug Trade Organizations, Mexican Cartels, Cocaine, Colombian Cartels, NAFTA, Plan Colombia, "Balloon Effect"

THE PEOPLE'S REPUBLIC OF CHINA'S OVERSEAS-CHINESE POLICY

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This thesis examines the People's Republic of China's (PRC) overseas-Chinese policy from its founding to the present. Over time, China's overseas-Chinese policy has evolved to reflect changing migration patterns and favorable international conditions. The overseas Chinese have been both a problem and an instrument of China's domestic and foreign policy agenda. The one constant in Beijing's domestic agenda has been the need to attract foreign exchange—primarily through the overseas Chinese in the form of remittance or investment. Moreover, there has been significant continuity in its foreign policy and corresponding overseas Chinese policy. One of Beijing's primary foreign policy objectives has been to restore relations with its neighbors. Therefore, China sought diplomatic relations with its Southeast Asian neighbors and made efforts to solve the overseas Chinese dual-nationality problem. Finally, China's third and fourth generation leaders have undertaken a more pragmatic, sophisticated, and subtler foreign policy approach to achieving Beijing's ambitions. China's "new diplomacy" is changing the way its neighbors view the emerging power and their overseas Chinese communities. Thus, the estimated 35 million overseas Chinese have become assets in connecting China to the outside world.

KEYWORDS: China, PRC, Overseas Chinese, Ethnic Chinese, Diaspora

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