Compilation of

Thesis Abstracts

March 2007

Office of the Associate Provost and Dean of Research
Naval Postgraduate School
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 March 2007 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.

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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.
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 March 2007 is shown in Figure 1 on the following page.
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 Sciences
- 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

**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

*Coast Guard, National Oceanographic and Aeronautics Administration

Figure 1: Resident Degrees/Subspecialty Student Population for March 2007 (1755 Total)
In March 2007, 177 degrees were conferred. Figure 2 indicates distribution by type, Figure 3 by degree area.


**Figure 2. Distribution by Degree Type of (177 Degrees Conferred)**

**Figure 3. Degrees Conferred in March 2007 (177 Degrees Conferred)**
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
BOOT CAMP FOR COGNITIVE SYSTEMS: A MODEL FOR PREPARING SYSTEMS WITH MACHINE LEARNING FOR DEPLOYMENT
Douglas S. Lange-DoD Civilian
B.S., University of California-Davis, 1983
M.S., Naval Postgraduate School, 1997
Doctor of Philosophy in Software Engineering-March 2007
Advisor: Valdis Berzins, Department of Computer Science

The vision for command-and-control and information-technology capabilities for the future includes the use of machine learning to enable systems to respond to an adapting environment. Currently, systems and software-engineering processes hinder employment of machine learning because the adaptation it provides runs counter to notions of stability. Similarly, systems must demonstrate satisfaction of requirements before deployment, rather than learn tasks while on the job.

This dissertation introduces new problems for the field of software engineering and discusses an approach for preparing cognitive systems for deployment. The model for cognitive systems being used is from the Personalized Assistant that Learns (PAL) program from the Defense Advanced Research Projects Agency. A model for a boot camp for cognitive systems is presented, along with a simulated boot camp capability. The simulation is used to experiment with the types of preparation that must be provided in order for a PAL style assistant to succeed in an operational environment. The results, providing thresholds and patterns for knowledge and observability, and the requirement for specific patterns of human use of PAL assistants, are then used to infer requirements for a boot camp and measures for the prediction of successful employment of the assistant.


FINE POINTING OF MILITARY SPACECRAFT
Timothy A. Sands-Major, United States Air Force
B.S., North Carolina State University, 1992
Certificate, University of California-Los Angeles, 1996
M.S., University of North Dakota, 2000
M.Eng., University of Colorado, 2006
Doctor of Philosophy in Astronautical Engineering-March 2007
Advisor: Brij N. Agrawal, Department of Mechanical and Astronautical Engineering

In 1923, Herman Oberth, considered by some to be “the father of it all” for spaceflight, wrote a book called “Die Rakete zu den Planeträumen” (i.e., “Dreams of Planets”). This book inspired today’s modern spaceflight. Among his suggestions was placing a telescope in space so that astronomical observations may be made without atmospheric distortion. Nearly a century later, the Hubble Space Telescope is imaging distant stars with high accuracy. If Hubble were placed on the ground of the west coast of the United States, it would be able to target a small coin placed on the Lincoln Memorial on the east coast. This startling accuracy has become useful for military spacecraft missions, even though the mission is much more challenging. Military spacecraft perform aggressive slew maneuvers to acquire targets, but the actuators are complicated by singularities that can often lead to loss of attitude control during aggressive maneuvers. After acquiring the target, the spacecraft must rapidly settle and track the target as the spacecraft races by overhead.
This dissertation addresses these challenges by introducing a new optimized geometry for installation of the spacecraft actuators to minimize the impact of singularities. Methods are discussed to orient the direction of maximum slew capability in a desired direction. In addition to the optimal geometry, a new algorithm is presented that reduces those remaining singularities that could lead to loss of attitude control. A newly developed algorithm is proven to fly through the singularities without losing attitude control. The advancements introduced here increase aggressive maneuver performance, aiding military spacecraft in rapidly acquiring earthly targets.

After acquiring the target, several new, very simple adaptive control algorithms are introduced that adjust the control strategy based on tracking errors. If the spacecraft has trouble tracking a target, the control is adjusted to eliminate the tracking error. Using simplified techniques, target-tracking accuracy is increased compared to current spacecraft control methods. While many promising, advanced techniques look good on paper, real-world factors like noisy signals and disturbances are often confounding. Most importantly, the claims made here are proven experimentally on a free-floating spacecraft simulator.

**KEYWORDS:** Spacecraft Attitude Control, Control Moment Gyroscope, Singularities, Minimum Time Slew Maneuvers, Momentum Management

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**SPREAD-SPECTRUM SIGNAL CHARACTERISTIC ESTIMATION USING EXPONENTIAL AVERAGING AND AN AD-HOC CHIP-RATE ESTIMATOR**

John Baltzer Weber-Lieutenant, United States Navy
A.S., Monterey Peninsula College, 1996
B.S., University of Arizona, 1999
B.S., University of Arizona, 1999
M.S., Naval Postgraduate School, 2003

**Doctor of Philosophy in Electrical Engineering—March 2007**
Advisor: R. Clark Robertson, Department of Electrical and Computer Engineering

This dissertation investigates two methods of spread-spectrum (SS) signal characteristic estimation for the two principle types of SS systems, frequency-hopped (FH) and direct-sequence SS. The exponential averaging detector is used to detect and estimate the hopped frequencies of an SS-FH signal in the presence of interference signals and additive-white-Gaussian-noise (AWGN). The detection method provides an estimate of the AWGN plus interference spectrum using exponential averaging, and then generates an estimate of the desired signal spectrum by combining the estimated AWGN plus interference spectrum with the composite (desired signal plus interference plus AWGN) spectrum. Finally, this dissertation evaluates the detector’s performance as a function of the exponential coefficient, the combining method, the probability of false alarm, signal-to-AWGN ratio, and signal-to-interference ratio.

The second method of SS signal characteristic estimation uses a digital ad-hoc chip-rate estimator (ACRE). The ACRE is used to estimate the chip rate of a half-sine-pulse shaped SS direct-sequence signal. The ACRE is explained in relation to its similarities and contrasts to the chip-rate detector. The components and performance of the ACRE are presented for standard-ACRE, ACRE with additional filtering, and ACRE with incrementing. The additional filtering results in a reduced chip-rate search range but yields improved estimation performance, and incrementing has the potential for parallel processing, resulting in dramatically decreased computational time without loss of performance.

**KEYWORDS:** Detection, Estimation, Spread Spectrum, Direct Sequence, Frequency Hopped, Chip-Rate, Frequency Hops
MASTER
OF
BUSINESS ADMINISTRATION
This thesis seeks to determine the impact of an auction-based retention bonus on continuation rates for general dentists completing their initial obligation. An auction-based retention bonus has the potential to improve retention rates. In lieu of actual bids from Navy general dentists, the difference between average civilian dentist salaries and Navy general dentist pay is used to represent theoretical opportunity costs. Inputting opportunity costs into a break-even formula allows approximation of the retention bonus amount needed for a one-year and/or five-year employment agreement with the Navy.

A logistic regression retention model is also estimated using data for 516 Navy general dentists commissioned between 1998 and 2001. Model results indicate that accession source significantly affects the decision to continue military service. Officers commissioned as direct accessions and participants in the Dental Student Program are more likely to stay in the Navy than participants in the Health Sciences Collegiate Program. Dentists commissioned in 2000-2001 are less likely to stay than those commissioned in 1998-1999. Those commissioned between the ages of 30 and 39 are more likely to continue service beyond their initial obligation than younger dentists. Race and gender do not significantly affect retention.

**KEYWORDS:** Multivariate Regression Analysis, Auction Theory, Manpower Planning, Continuation Rate Analysis, Retention Behavior Analysis, Dental Corps

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This thesis attempts to determine the correct number of dentists the Navy should recruit to meet projected targets. Dental Corps data were provided from the Dental Corps Manpower Office covering fiscal years 1984 through 2005. The accession sources for Dental Corps officers were a concern at the onset of this study. One goal of this research is to determine whether certain behaviors are associated with particular accession programs. Results show that no particular accession source dominated any of the five specialties selected. To develop the loss rates, data from two Excel files, “DC Total Inventory” and “DC Losses,” are merged. After merging the files, only one record per dentist remained from fiscal years 1988 through 2005. This evolution produced 3,643 records that portray each dentist’s career. Loss rate results suggest that once dental-corps officers reach their tenth year they are less likely to leave the military than in earlier years. This would suggest that retention incentives should be focused during the fourth through sixth years of the dental officer’s career. Oral surgeons, however, are more likely than the other specialties to leave the military after their tenth year.
MASTER OF BUSINESS ADMINISTRATION

KEYWORDS: Dental Corps Manpower, Manpower Planning, Loss Rates

AN INDUSTRY ANALYSIS OF THE MASTER-OF-BUSINESS-ADMINISTRATION MARKET
AND THE COMPETITIVENESS OF THE GRADUATE SCHOOL OF BUSINESS AND PUBLIC
POLICY
Garrett W. Hager-Captain, United States Marine Corps
Master of Business Administration-March 2007
Thomas T. King-Major, United States Marine Corps
Master of Business Administration-March 2007
Advisors: Peter Coughlan, Graduate School of Business and Public Policy
William R. Gates, Graduate School of Business and Public Policy

The goal of this project is to perform an industry analysis of the master-of-business-administration (MBA) market utilizing the principles of industry analysis noted in Michael Porter’s “Five Forces Analysis” model. The intent of this project is to create an awareness of how these competitive forces shape the MBA market, define the relationships between stakeholders within the market, and affect the overall attractiveness of the MBA market. The goal is to provide Graduate School of Business and Public Policy (GSBPP) policy makers a tool to assist in the understanding of the industry environment and the development of a sustainable competitive position for the GSBPP. The authors believe the GSBPP can benefit greatly from this knowledge. The starting point of this project is a comprehensive search and analysis of secondary resources for data concerning the nature of competition, incentives of buyers (students and employers/recruiters) and sellers (faculty), and threat of substitutes within the MBA market. It is noted that the nature of competition is a critical force affecting the MBA market, as an MBA program’s reputation drives almost all aspects of its strategy. Full understanding of these market forces should help enable the GSBPP to aptly compete in this market.

KEYWORDS: MBA Industry Analysis, MBA Market, Industry Analysis, GSBPP, Five Forces Analysis

AN ANALYSIS OF THE NAVY’S VOLUNTARY EDUCATION PROGRAM
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Master of Business Administration-March 2007
Advisors: Stephen L. Methay, Graduate School of Business and Public Policy
Raymond Franck, Graduate School of Business and Public Policy

The Department of Defense funds advanced education through the Voluntary Education Program. This study explores the following questions: 1) what is the economic return on the Navy’s Voluntary Education Program (VOLED), especially tuition assistance (TA)?; 2) what is the impact of TA on a sailor’s career?; and 3) what does the literature indicate about the effects of the VOLED program?

Some of the potential benefits of VOLED on sailors include improving their ability to cross-rate, improving their chances of advancement in their current rating, lowering their demotion rates and, possibly, improving reenlistment. Higher retention benefits the Navy by reducing the replacement costs for new recruits. While there is debate about the impact of VOLED on retention, the VOLED program is a service that is actively sought out by sailors, which suggests that it improves sailor satisfaction with the Navy.

The study concludes that additional funding should be given to the VOLED program based on the potential benefits to the Navy and the likely increase of usage in the future. A study should be commissioned in the Navy to statistically assess the quantifiable effects of the Navy’s VOLED program.

KEYWORDS: Voluntary Education, Tuition Assistance, PACE, Retention, Education
THE IMPACT OF THE JUNIOR RESERVE OFFICER TRAINING CORPS AND OTHER YOUTH PROGRAMS ON NAVY FIRST-TERM ATTRITION, PROMOTION, AND REENLISTMENT

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Master of Business Administration-March 2007
Advisors: Stephen L. Mehay, Graduate School of Business and Public Policy
Elda Pema, Graduate School of Business and Public Policy

This study investigates whether participation in the Junior Reserve Officer Training Corps (JROTC) and other youth programs significantly affects the performance of first-term Navy enlistees. This analysis uses multivariate models to estimate the causal effect of JROTC participation on first-term attrition, promotion, and reenlistment. The analysis uses data from the Defense Manpower Data Center (DMDC) enlisted personnel cohort files for fiscal years 1994 to 2002. The analysis finds that participation in JROTC reduces first-term attrition and increases the probability of reenlistment, but also reduces the probability of promotion. This latter result is in part due to the Navy’s hierarchical structure, which limits the number of promotions, combined with the fact that JROTC enlistees tend to enter at higher grades. Results also show that females who participate in JROTC reenlist at higher rates than males. These findings are relevant to policy-makers when determining the future of the JROTC program. By investing early in this program, the Navy could generate substantial cost savings in the form of recruiting and training costs. It is recommended that a cost benefit analysis study be conducted to determine whether the high school JROTC program is cost-effective.

KEYWORDS: Navy, JROTC, Attrition, Promotion, Reenlistment, Multivariate Models

ANALYSIS OF THE RETENTION AND AFFILIATION FACTORS AFFECTING THE ACTIVE AND RESERVE NAVY NURSE CORPS

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Master of Business Administration-March 2007
Kimberly A. Pizanti-Lieutenant, United States Navy
Master of Business Administration-March 2007
Advisors: Yu-Chu Shen, Graduate School of Business and Public Policy
Cary Simon, Graduate School of Business and Public Policy

This thesis assesses the factors affecting retention rates in the active Navy Nurse Corps and affiliation rates with the reserves among those who left active duty services. The thesis is composed of two parts: 1) an organizational analysis of the Navy Nurse Corps utilizing the organizational system framework and the organizational configurations model; and 2) an empirical analysis of characteristics of those who are retained in the active Navy Nurse Corps and those who affiliate with the reserve Navy Nurse Corps using multivariate logit regressions. Cohort data files are compiled from the Defense Manpower Data Center and the Bureau of Medical Information Systems. Three groups of factors are analyzed: demographics, professional characteristics, and military experience. Factors associated with positive retention rates include being male, a minority, having dependents, being prior enlisted, having a subspecialty beyond general nursing, and having a postgraduate degree. The best accession sources are the Medical Enlisted Commissioning Program (MECP) and direct accession. Factors associated with positive reserve affiliation rates include being prior enlisted and having a subspecialty beyond general nursing. Major recommendations for the Navy include shifting focus from accession bonuses to retention bonuses and increasing MECP accessions.

KEYWORDS: Organizational Systems Factor, OSF, Design Factors, Retention Factors, Manpower Planning, Logit Regression, Reserve Affiliation, Naval Nurse Corps
This thesis investigates the effects of graduate education on the retention and promotion of line of the Air Force (LAF) officers at the rank of captain and major. Logistic regression models are estimated to examine the effects of graduate education on the retention of captains and majors and on promotion to major using data from the active-duty-military master file for fiscal years 1992 through 2006. A difference-in-difference estimator is incorporated into the promotion model to evaluate the effects of an Air Force policy change intended to eliminate any bias towards advanced education at promotion boards. In addition to graduate education, explanatory variables include basic demographic traits and professional characteristics.

Results indicate that graduate education has a positive effect on retention of LAF officers at the rank of captain and major. Findings from the promotion model indicate that graduate education also has a positive effect on promotion, but results for the change in policy (masking education information for promotion) are inconclusive. In addition, race and career field are shown to influence both retention behavior and promotion, while gender significantly affects retention but not promotion.

**KEYWORDS:** Graduate Education, Promotion, Retention, Logistic Regression

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This study analyzes the impact of the lateral-transfer-and-redesignation process on the retention of unrestricted line (URL) officers. The analysis first attempts to identify “dissatisfying” factors that motivate URL officers to request lateral transfer or redesignation. This part of the thesis is based on a review of historic Navy-administered surveys and a survey administered to the fleet by the author. In the second part of the thesis, officer community managers (OCMs) for the URL, restricted line (RL), and staff corps are interviewed to gauge attitudes and determine the selection criteria used by the RL and staff corps in selecting URL officers applying for lateral transfer. In the third part of the thesis, regression analysis is performed utilizing application data for lateral transfer boards held between 1996 and 2006. The board data, provided by the Navy Personnel Command (NPC), is merged with officer cohort data from the Defense Manpower Data Center (DMDC) to determine retention differences between officers selected for transfer and those not selected.

A consistent theme of dissatisfying factors is found in the surveys. While several factors are inherent to Navy life, such as shipboard life and family separation, two factors, morale and leadership, offer the best opportunity for improvement. OCMs from the RL and staff corps designators, several of which do not have the ability to direct access new officers, report depending on URL lateral transfers for new accessions. The OCMs also rely on lateral transfers for the specific skills, experience, and knowledge the URL officers bring to the RL and staff corps. The results of the regression analysis indicate that officers not selected for lateral transfer and redesignation are twice as likely to leave the Navy as officers who are selected.

**KEYWORDS:** Lateral Transfer, Redesignation, Unrestricted Line, Restricted Line, Staff Corps, Retention, Officer Program Authorization, Designators, Training Attrition, Officer Community Manager
THE PRIVATE MILITARY INDUSTRY: ECONOMIC ANALYSIS, USES, AND CONSIDERATIONS
Ercan Sökmen-Captain, Turkish Army
Master of Business Administration-March 2007
Advisors: Nicholas Dew, Graduate School of Business and Public Policy
LtCol Bryan Hudgens, USAF, Graduate School of Business and Public Policy

Different customers in different ages have used private military members as part of their military operations. After the Cold War era, a new form of private military industry emerged. Companies serving in both military support and offensive operations, and morally and legally questionable military operations in conflict regions, raised many dilemmas about the industry. Without understanding the economic, legal, ethical, and contractual dynamics of the industry, there is no simple way for democratic governments to employ private military companies (PMCs). This study tries to cover these dynamics for better use of PMCs, without considering whether they are beneficial or not. A better understanding of the industry, governments, international community, and other prospective legal clients (such as non-for-profit organizations and private firms) can produce the necessary outcomes. By using Porter’s “Five Forces Analysis,” driving factors of industry are analyzed, as are the sub-factors within these areas and the competency of some key players. Then, the impacts of PMCs on military operations (i.e., legal, ethical, and entrepreneurial considerations) are explored.


A COST-BENEFIT ANALYSIS OF RADIO-FREQUENCY IDENTIFICATION IMPLEMENTATION AT THE NAVAL POSTGRADUATE SCHOOL’S DUDLEY KNOX LIBRARY
Joel D. Tiu-Lieutenant Commander, United States Navy
Master of Business Administration-December 2006
Shawn S. Bahk-Captain, United States Marine Corps
Master of Business Administration-March 2007
Advisors: Nicholas Dew, Graduate School of Business and Public Policy
Ira A. Lewis, Graduate School of Business and Public Policy

The purpose of this MBA project is to evaluate the potential of implementing radio frequency identification (RFID) technology at the Naval Postgraduate School's Dudley Knox Library (DKL). DKL is an academic library supporting a graduate student population only. This study includes both quantitative and qualitative analyses. A cost-benefit analysis (CBA) is conducted using data gathered from research, including personal interviews, site visits, and a survey questionnaire. Time and motion studies of selected library processes are conducted at DKL and a major public library. Vendors were invited to submit proposals for RFID systems to get the latest equipment available, with associated cost estimates. The qualitative analysis addresses the advantages and disadvantages of an RFID system, as well as privacy and other ancillary issues surrounding its implementation. This study does not attempt to quantify potential savings from collection management, an intangible benefit that could be addressed in future studies. Finally, the study presents several options to aid NPS decision makers on whether or not to implement an RFID system at DKL.

KEYWORDS: RFID, Radio Frequency Identification, Libraries, Cost Benefit Analysis
MASTER OF SCIENCE

Computer Science
Defense Analysis
Electrical Engineering
Electronic Warfare Systems Engineering
Engineering Acoustics
Engineering Science
Information Operations
Information Systems and Operations
Information Technology Management
Leadership and Human Resource Development
Management
Mechanical Engineering
Meteorology
Meteorology and Physical Oceanography
Modeling, Virtual Environments, and Simulation
Operations Research
Physical Oceanography
Physics
Software Engineering
Systems Engineering
On today’s battlefield, whether in Afghanistan or Iraq, ground-combat forces are dealing with an adversary that has embraced the use of computers and electronic devices. Until now, there was no package of consolidated forensic tools available to the ground-combat forces with the capability of conducting a quick interrogation of these devices. After a unit has captured a target that possesses electronic devices that require immediate exploitation, the devices are transferred to higher authority. Valuable time is lost locating and capturing associates of the target as the information is sent away to higher authority for analysis. The product of this thesis, “Interrogator,” is designed to prevent or reduce the time lost by allowing anyone to quickly retrieve data that is stored on a computer. This capability will positively aid a small-unit commander’s ability to exploit critical vulnerabilities of the enemy in a timely manner, and improve the survivability of the unit and its ability to complete the mission.

KEYWORDS: Computer Forensics, Graphical User Interface, Linux

As the Department of Defense evolves in the 21st century, the need to leverage technologies for location awareness has become more invaluable to the military commander. Any application that can accurately deliver this service is highly desirable. Wireless local-area networks (WLAN) have shown to be a promising technology that will enable accurate and reliable positioning information on a local basis.

The objective of this thesis is to research and investigate different methods of positioning using IEEE 802.11 technology. The first method involves using the 802.11 packets’ round-trip times (RTT). RTT is the elapsed time that starts when a packet leaves a wireless transmission node to a wireless receiving node and back. RTT is then manipulated to yield distances between network nodes. The distances can then be imported into a trilateration algorithm to calculate positional information. Another method of 802.11 positioning involves using signal strength measurements, which necessitates an 802.11 client-server arrangement. A site survey of a given area is first conducted during the calibration phase. Signal strength is measured at determined positions to generate a calibration map. Positioning is then achieved through an algorithm that matches the measured signal strength values to signal strengths taken from the calibration
map. The evaluation of both positioning methods is performed by conducting a number of outdoor experiments.

**KEYWORDS:** IEEE 802.11 Networks, Client Location, Signal Strength, Beacon Round-Trip Time, Packet Round-Trip Time

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**INTRUSION DECEPTION IN DEFENSE OF COMPUTER SYSTEMS**
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Master of Science in Computer Science-March 2007
Advisor: Neil C. Rowe, Department of Computer Science
Second Reader: Daniel F. Warren, Department of Computer Science

Deception in response to cyber intrusion or trespassing on computer systems is investigated. A response framework that categorizes the types of response that can be employed against intruders is presented and it is shown how “intrusion deception” has its place in this framework. To experiment, tools and technologies, such as Snort, VMware, and honeynets, are put together in a test bed open to attacks from the Internet. Some Snort rules are written and Snort is run in inline mode to deceptively manipulate packets of attackers. Results show that attackers did react to the deceptions in some interesting ways, suggesting that intrusion deception is a viable response to intrusion.

**KEYWORDS:** Deception, Intrusion Detection Systems, Intrusion Prevention Systems, Active Response Systems, Honeynet, Snort, VMware

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**AN EVALUATION METHODOLOGY FOR PROTOCOL-ANALYSIS SYSTEMS**
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Master of Science in Computer Science-March 2007
Advisors: George W. Dinolt, Department of Computer Science
Jonathan Herzog, Department of Computer Science

Current-day communication systems rely on protocols to provide secure communications among parties. Weaknesses in protocols, at first thought to be secure, have been found through deep analysis. There are many systems that have been designed to provide a means to test the various security characteristics of communication protocols. An evaluation methodology that can be used to evaluate protocol-analysis systems based on their scope, correctness, performance, and usability characteristics is presented. Portions of the methodology are applied to a set of protocol-analysis systems to show the evaluation methodology in action.

**KEYWORDS:** Evaluation Methodology, Protocol Analysis, Cryptographic Protocol Shapes Analyzer, CPSA, ProVerif

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**ROUTE OPTIMIZATION FOR MOBILE IPv6 USING THE RETURN ROUTABILITY PROCEDURE: TEST BED IMPLEMENTATION AND SECURITY ANALYSIS**
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Advisor: Geoffrey G. Xie, Department of Computer Science
Second Reader: John Fulp, Department of Computer Science

Mobile IPv6 is an IP-layer mobility protocol designed to provide mobility support, allowing an IPv6 node to arbitrarily change its location on the IPv6 Internet and still maintain existing connections by handling the change of addresses at the Internet layer using Mobile IPv6 messages, options, and processes that ensure the correct delivery of data regardless of the mobile node's location. Return Routability is an
infrastructureless, lightweight procedure that enables a mobile IPv6 node to request another IPv6 node (maybe unaware of mobility) to test the ownership of its permanent IPv6 address in both its home network and its temporary address in the current IPv6 network; and authorizes a binding procedure by the use of a cryptographic token exchange.

The main objective of this research effort is to build a test bed for investigating the vulnerabilities of the Mobile IPv6 RR procedure. The test bed shall facilitate the enactment and analysis of the effects of specific threats on the hosts and the network. While this thesis is not about discovering new vulnerabilities or evaluating countermeasures, the resulting test bed and software shall lay the necessary groundwork for future research in those directions.

KEYWORDS: Mobile IPv6, Return Routability Procedure, Test Bed, Security, MIPL 2.0.2, SUSE LINUX 10.1

STATIC-REACHABILITY ANALYSIS AND VALIDATION REGARDING SECURITY POLICIES IMPLEMENTED VIA PACKET FILTERS

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Advisor: Geoffrey G. Xie, Department of Computer Science
Second Reader: Richard D. Riehle, Department of Computer Science

The ability to statically determine what kinds of packets can be exchanged between two hosts on a network is desirable to those who design and operate networks, but this is a difficult and complex problem. Factors affecting reachability analysis are packet filters, routing policies, and packet transformations. The number of variables within and among networks is intractable for manual computation. A proposed solution by Geoffrey G. Xie is a tractable framework to map networks into, thus creating a single unified model for analysis. It depends heavily on the use of transforming the problem into a classical graph problem that can be solved with polynomial time algorithms, such as transitive closure.

This research develops an automated validation process to test the reachability upper bound calculated from a recent implementation of the framework, which focuses specifically on the packet filter aspect, namely access control lists. Real-world network configuration files and network packet flow data from a Tier-1 Internet-service provider are supplied as the data set. A significant contribution of this thesis is the application of real-world data to the proposed method for static reachability analysis as it pertains to the static testing of security policies applied via packet filters.


AUTOMATIC AUTHOR PROFILING OF ONLINE CHAT LOGS

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Master of Science in Computer Science-March 2007
Advisor: Craig H. Martell, Department of Computer Science
Second Reader: Kevin M. Squire, Department of Computer Science

Now that the Internet has become easily accessible and more affordable, a larger number of people spend more time in front of a computer. Some spend so much time on the Internet that they develop virtual friendships and relationships – people with whom they have regular contact via a computer screen and the Internet. While most of the dialogue exchanged online is not harmful or illegal, there are those with dishonest intentions lurking online. These people can be breaking the law by seducing a minor virtually or even going as far as meeting a minor in person. Terrorists can also use the Internet to facilitate communication and plan attacks. Since email is one of the original means of communication on the Internet, methods for determining the author of an email have already been studied. So far, however, no significant experimentation with online chat logs exists.
The first part of this study is comprised of generating an unbiased, random, and broad corpus of online chat logs. Having a general corpus with a wide-range of topics allows the results of this research to be applied in the most general case. Because developing a complete solution to the authorship attribution problem for chat logs is difficult, the scope is limited to predicting gender and age. The ultimate goal of this work, then, is to facilitate law enforcement in tracking down criminals who attempt to use the Internet as a hiding place.

**KEYWORDS:** Authorship Analysis, Authorship Profiling, Authorship Attribution, Natural Language Processing, Naïve Bayes, Artificial Intelligence, Forensics, Information Retrieval, Data Mining

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**DECISION-SUPPORT SYSTEM FOR THE MANAGEMENT OF AN ARMY’S TRACKED AND WHEELED VEHICLE FLEET**

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B.S., Tunisia CNI, 1992

Master of Science in Computer Science-March 2007

Advisors: Man-Tak Shing, Department of Computer Science
Arijit Das, Department of Computer Science

The purpose of this research is to define a decision-support system for the management of a military tracked and wheeled vehicle fleet. Such a system should be capable of delivering reliable information for decision making on time, and provide data related to the classification, registration, assignment, maintenance, and availability of vehicles. The system is composed of the following subsystems:

- Classification and registration of tracked and wheeled vehicles
- Transfer of tracked and wheeled vehicles
- Preventive and curative maintenance
- Retirement of tracked and wheeled vehicles

The four subsystems are installed in a client server architecture enabling partial or total access to the database and providing real-time data for decision making. The platform hosting application is Oracle, running on top of the WINDOWS operating system. The database is relational. The framework used in the design and modeling consists of:

- Object-oriented analysis, which aims to model the problem domain. The source of the analysis is a written requirements statement and use cases.
- Oracle Developer, which is a powerful tool for development and interaction with databases.

The solution to procure is implemented and executed as follows:

- Client/server architecture with the Oracle DBMS and the development tool Developer 2000.
- The application is installed on the end user’s stations.
- The database is implemented on the server side.

This software developed constitutes a solution to provide and make available necessary, instantaneous, and accurate data that will be used to derive the right decision on time.

**KEYWORDS:** Decision Support System, Fleet Management, Object Oriented Analysis, Client Server Architecture, Database, Entity-Relationship, Object Data Model, Data Dictionary, Oracle Forms, Net Services, Listener, Use Case, Sequence Diagram, Contract
Broadband Internet access has become an important service affecting the economic and social makeup of a country. Broadband penetration is becoming extremely important as globalization starts to interweave the economies and policies of nations around the world. With every month that passes, the United States fails to close the gap in the digital divide, both inside its borders and among the other countries that lead the world in broadband penetration. The lack of strong market competition among broadband providers and failing governmental policies is partly to blame. A brief overview of broadband technologies and an analysis of the United States’ broadband market is conducted and compared with some other countries in order to establish a baseline comparison. The United States has long been known as a leading innovator in technology and services. However, the lack of competition to bring higher speeds, lower costs, and universal access has pushed the United States out of the top ten worldwide in broadband Internet penetration. This thesis explores how the United States could close the digital divide and become a world leader in broadband penetration and innovation.

**KEYWORDS:** Broadband, Broadband Penetration, Internet, Digital Divide, Broadband Policy, DSL, Fiber Optics, Cable Modem, Wireless, FCC, Telecommunications, Regulation, Technology
DO PSYCHOLOGICAL OPERATIONS BENEFIT FROM THE USE OF HOST-NATION MEDIA?
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Master of Science in Defense Analysis-March 2007
Advisor: Jessica Piombo, Department of National Security Affairs
Second Reader: LTC Michael Ceroli, USA, Department of Defense Analysis

Organizing and conducting effective psychological operations (PSYOP) in support of strategic, operational, and tactical objectives is a complex endeavor fraught with many challenges. The challenges include a general negative attitude towards PSYOP/deception operations, an emphasis on kinetic platforms as the solution set for all crises (including unconventional warfare (UW)), the sheer lack of numbers in both PSYOP personnel and equipment, and a recent upsurge of negativity from the world media regarding U.S. PSYOP due to the utilization of host nation media. This thesis examines the benefits of host-nation media from World War II to the present, including the utilization of media personnel and infrastructure in mediums of radio, newspapers, leaflets, posters, magazines, comic books, radio stations, and satellite and terrestrial television. The merits of host-nation media are examined by analyzing their effect upon PSYOP from the perspective of opposing countries in previous wars, U.S. PSYOP programs in both past and present conflicts, and the impact of counter-PSYOP from an adversarial point of view. The final goal of the thesis is to illustrate the need for the use of host-nation media assets relevant to U.S. military and civil operations.

KEYWORDS: Psychological Operations, Strategic Communications

OPTIMIZING ARMY SPECIAL FORCES LEADERS IN A GLOBAL COUNTER-INSURGENT NETWORK
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Master of Science in Defense Analysis-June 2007
Joshua H. Walker-Major, United States Army
B.A., Washington State University, 1995
Master of Science in Defense Analysis-March 2007
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Second Readers: Peter Gustaitis, Department of Defense Analysis
Wayne P. Hughes, Department of Operations Research

Since the watershed events of September 11, 2001, the United States military has been engaged in fighting what has been recognized as a highly organized and networked global insurgency. These global insurgents have sought to take advantage of all the technological advances available in the current information age, combined with the innovative and adaptive advantages of networked organizations.

This study asks two questions: 1) how can global insurgent networks be countered, and 2) where might the most appropriate personnel to man a global U.S. counter-insurgent network be found? This thesis asserts that organizational considerations matter and that for the U.S. military to have the best chance to defeat these global insurgent networks it must further develop small, adaptive human networks of its own. Authors demonstrate that there exists within the Army Special Forces field-grade-officer population the capability and capacity to man and lead a small, yet globally dispersed, counter-insurgent network.
These arguments are evidenced by an examination of the networked aspects of the global insurgency, hierarchical aspects of the U.S. military, and finally, the specific manpower data within the Army Special Forces officer population. What is still needed in the evolving global war on terror, and this study hopes to contribute, is a small turn of mind towards applying networked counter-terror organizations against a very serious irregular, networked threat. To this end, the authors propose the establishment of a Special Forces global counter-insurgent network.

**KEYWORDS:** Global War on Terror, GWOT, U.S. Army Special Forces, Network, Counter-Insurgency, COIN, Fourth Generation Warfare, 4GW, Human Resources, Special Operations, Field-Grade Officers, Warrant Officers, Global Persistent Presence

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**UNDERSTANDING WARLORDISM**

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Master of Science in Defense Analysis-March 2007  
Advisor: Robert O’Connell, Department of Defense Analysis  
Second Reader: Anna Simons, Department of Defense Analysis

The purpose of this thesis is to understand warlordism, and in particular, the warlord environment in Afghanistan. Weak central authority in the state of Afghanistan has been a political tradition largely due to a patronage system of governance. This weak political structure allows warlord military organizations to draw resources from the environment. Warlord organizations use armed force to access these resources. Warlords also wield political power and use their military organizations as a base to expand their power and fame. There are numerous population bases of support, and not all are good for the growth of stable organizations. However, warlords are able to develop their political organizations reliably because of the stability provided by their military organizations. Because of these factors, the warlord Ahmed Rashid Dostum, a man with minimal formal political education, has slowly but surely built a political organization.

**KEYWORDS:** Warlord, Warlordism, Afghanistan, Dostum

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**COLOMBIA’S ATTEMPT AT PEACE: AN ANALYSIS OF THE DEMOBILIZATION OF THE AUTO-DEFENSAS UNIDAS DE COLOMBIA**

Douglas C. Judice-Major, United States Army  
B.S., University of Louisiana at Lafayette, 1997  
Master of Science in Defense Analysis-March 2007  
Advisor: Douglas Porch, Department of National Security Affairs  
Second Reader: Robert O’Connell, Department of Defense Analysis

This thesis analyzes the government of Colombia’s (GOC) demobilization of the paramilitary organizations known collectively as the Auto-Defensas Unidas de Colombia (AUC), and the re-insertion of its fighters into Colombian society. So far, this disarming, demobilization, and reintegration (DDR) process has not achieved the majority of its goals, while other problems loom on the horizon. The thesis addresses the implications for Colombia and provides recommendations for future DDR processes. The study divides the process into two elements: the agreement between the AUC and the GOC, and the implementation of the terms of the agreement. The contract between the two parties is found in Colombian Law 782 of 2002 and 975 of 2005, better known as the peace-and-justice law. The ministry of justice and of the interior is responsible for implementing the terms found in these laws.  

A central argument of this thesis is that, in order for the GOC to successfully carry out DDR of the AUC, it must not only contend with current and former paramilitary members, but must also address the societal problems that permit illegal armed groups to thrive in Colombia. Success in Colombia must be matched in the international community, which must perceive the DDR process as legitimate. In short, if the public perceives penalties as being too lenient, the process will be de-legitimized. If penalties are perceived as being too harsh by the former paramilitary members, or “paras,” they will likely stop participating and reconstitute their former organizations. In order to prevent either of these pitfalls, the GOC must develop a formula that gains control over former AUC-controlled terrain and its population,
essentially extending government control throughout the country. This is the only way to prevent both de-legitimization of the process and former paramilitary members from reconstituting their organizations. If the GOC can accomplish this, the DDR will be successful; if it cannot, the DDR will fail.

**KEYWORDS:** Disarming, Demobilization, and Reintegration, DDR, Auto Defense Forces of Colombia, AUC (Spanish Acronym), Revolutionary Armed Forces of Colombia, Peoples Army, FARC, FARC-EP (Spanish Acronym), Government of Colombia, GOC, Foreign Terrorist Organization, FTO

**SHAPING JIHADISM: HOW SYRIA MOLDED THE MUSLIM BROTHERHOOD**

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In February 1982, Syrian President Hafez Assad’s military and security forces surrounded, assaulted, and leveled the fourth largest city in Syria, Hama, killing between 5,000-25,000 Syrians in less than three weeks. It was the culmination of an escalating five-year revolutionary war between the Syrian Muslim Brotherhood and President Assad’s authoritarian rule. Through the use of overwhelming force and a government-sponsored moderate-Islamification process, the Muslim Brotherhood was transformed from a violent revolutionary opposition movement to a peace-oriented social organization calling for a representative democratic government.

Using social-movement theory (SMT) and Dr. McCormick’s “mystic diamond,” this thesis demonstrates how extreme state violence affects opposition social movements. This thesis analyzes why the Muslim Brotherhood’s revolution failed, why the Assad regime succeeded, and how the regime’s overwhelming defeat transformed the Syrian Muslim Brotherhood from a violent revolutionary organization to a peaceful social movement. The Syrian counter-insurgency model provides a viable strategy that can be applied to existing and future insurgencies throughout the Middle East.

**KEYWORDS:** Syria, Muslim Brotherhood, Insurgency, Counter-Insurgency, Social Movement Theory, McCormick’s Mystic Diamond, Middle East, Assad, Jihad, Islamic Fundamentalism
MASTER OF SCIENCE IN ELECTRICAL ENGINEERING

SOLID-STATE CAPACITOR DISCHARGE PULSED POWER SUPPLY FOR RAILGUNS
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This thesis presents a solid-state thyristor-switched power supply capable of providing 50 kJ from a high-voltage capacitor to a railgun. The efficiency with which energy is transferred from a power supply to a projectile depends strongly on power-supply characteristics. This design provides a better impedance match to the railgun than power supplies utilizing spark gap switches. This supply costs less and takes up less volume than a similar supply using spark-gap switches; it also produces a smaller electromagnetic pulse. Voltage limitations on the thyristors require two in series acting as a single switch. Railgun, snubber circuit, and gate-control systems are modeled for a 50 kJ railgun supply. These simulations yield component values necessary to protect and control the thyristors for voltages up to 10 kV, currents up to 180 kA, and changes in current with respect to time up to 109 A/s.

KEYWORDS: Railgun, Thyristor, Solid State, Gate Control Circuit, Snubber Circuit

SIMULATION OF RADIOWAVE PROPAGATION IN A DENSE URBAN ENVIRONMENT
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In this thesis, results from the simulation of radiowave propagation in the dense urban environment are presented, including details such as windows in high-rise buildings. Based on computer simulations, which include ray tracing augmented by edge diffraction, it is concluded that, on average, adding windows does not significantly change the signal distribution. Data analysis from simulations also indicates that varying frequency over the specified range would have little impact on the overall results. This thesis also analyzes the case where two antennas are used in combination and compared to the performance when only one larger beamwidth antenna is used with higher transmit power. Simulation results indicate that there is no apparent difference in performance between the two cases studied.

KEYWORDS: Radiowave Propagation, Diffraction, Reflection, Urbana Wireless Toolset, Urban Environment
ELECTRICAL ENGINEERING

SIMULATION OF COHERENT SIGNALS WITH FORWARD-ERROR-CORRECTION CODING
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This thesis focuses on the modeling and simulation of the performance of M-ary modulation techniques. In addition to the most popular coherent modulation schemes used, forward error correction (FEC) coded signals and fading channels are also considered. The channel is modeled for the two cases of fading and no fading, both with additive white Gaussian noise (AWGN). The effects of barrage noise interference are also considered. Binary phase-shift keying (BPSK), 16-PSK, and 16-QAM (quadrature amplitude modulation) communication systems are simulated and analyzed. For BPSK, both hard decision decoding (HDD) and soft decision decoding (SDD) are considered. For 16-PSK and 16-QAM, only HDD is examined. Simulation results and analytical results are compared. The result, with modeling and simulation in SystemView, shows an excellent agreement with the analytical result.

KEYWORDS: Forward Error Correction, FEC, Additive White Gaussian Noise, AWGN, Binary Phase-Shift Keying, BPSK, QAM, Quadrature Amplitude Modulation, Hard Decision Decoding, HDD, Soft Decision Decoding, SDD, Systemview

IMPLEMENTATION OF A HIGH-SPEED NUMERIC FUNCTION GENERATOR ON A COMMERCIAL-OFF-THE-SHELF RECONFIGURABLE COMPUTER
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Certain methods of realizing numeric functions, such as sin(x) or \( \sqrt{x} \), in hardware involve a Taylor series expansion or the CORDIC algorithm. These methods, while precise, are iterative and slow and may take on the order of hundreds to thousands of CPU clock cycles.

A faster method involves a piecewise approximation to the function. The function value is computed by reading pre-calculated coefficients (slope and intercept for first order approximations). Then, by multiplying the function argument by the proper slope and adding the proper intercept, a close approximation to the function solution is produced.

This thesis shows how this first order approximation technique is implemented on an FPGA-based commercial, off-the-shelf reconfigurable computer. MATLAB routines are developed to approximate the function as a set of consecutive, linear equations. The MATLAB approximation is combined with other modules designed in VHDL to construct an overall circuit.

A pipelined circuit is created on the SRC-6E computer that reduces the latency of the sin(\( \pi x \)) function by over 88% and produces a result on each clock cycle. The circuit easily implements other functions by simply exchanging the approximation and coefficients. Thus, a user-friendly environment is created for calculating functions at higher speeds than the more popular current methods.

KEYWORDS: Numerical Function Generator, NFG, Piecewise Linear Approximation, Field Programmable Gate Array, FPGA, Reconfigurable Computer
SOFTWARE-COMMUNICATIONS-ARCHITECTURE COMPLIANT, SOFTWARE-DEFINED RADIO DESIGN FOR INTERIM STANDARD 95B TRANSCEIVER
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The increasing demand for wireless services in both military and civilian sectors results in the emergence of new communication standards and protocols to support these wireless services. There is a need for modern radio receivers to have the ability to receive and recover multiple wireless signals without the added complexity of additional hardware components. Fortunately, a single radio can accomplish these tasks by using software radio architectures where the radio has the ability to reconfigure itself based on the system it will be interfacing with and the functionalities it will be supporting. These radios are more commonly referred to as software defined radios (SDRs). This thesis focuses on using software radio techniques to design and implement software components for an IS-95B wireless transceiver. Furthermore, these software components are built to comply with regulations specified by the Software Communications Architecture (SCA). The open source core framework tool Open Source SCA Implementation::Embedded (OSSIE) is used to design and build the software components necessary to implement functions of an IS-95B transceiver.

KEYWORDS: Software Defined Radio, Interim Standard 95B, Software Communications Architecture, Open Source System Implementation::Embedded

A NUMERICAL STUDY OF THE VALIDITY REGIMES OF WEAK-FLUCTUATION THEORY FOR OCEAN-ACOUSTIC PROPAGATION THROUGH RANDOM-INTERNAL-WAVE SOUND-SPEED FIELDS
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Results of the Acoustic Thermography of Ocean Climate (ATOC) project’s acoustic-engineering test (AET) experiment have shown that at 75 Hz, Rytov theory may be used for predicting the phase variations. This paper focuses on establishing the regimes of validity for Rytov theory at 75-400 Hz acoustic frequency range and up to 200 km distance. Ray paths corresponding to grazing angles of 0°, 5°, 10°, and 14° are considered, thus spanning the range of possible ray geometry from surface reflection to axial propagation. It is found that the Rytov and simulation spectra are in very good agreement in the frequency range from the buoyancy frequency up to a grazing angle dependent on the transition frequency between 1 and 0.2 cph. For frequencies less than the transition frequency, the Rytov spectra are in fairly good agreement with the simulations for all ranges and grazing angles between 0° and 10°. For the 14° beam, the Rytov theory dramatically under-predicts the spectral energy at frequencies less than 1 cph. When there is significant variability in phase and log-amplitude, it is also found that significant spectral energy can exist at frequencies greater than the buoyancy frequency. This energy is not predicted by the Rytov model, and represents the effect of strong interference and scattering not treated in the weak-fluctuation approach of the Rytov theory. This study will increase interest in the weak fluctuation theory as an acoustic-prediction tool.

Wireless-sensor networks have been widely researched for use in both military and commercial applications. They are of special interest to military planners, as they can be deployed in hostile environments to collect vital information safely and cheaply. In view of this interest, there is a need to effectively capture and categorize the data under different operational conditions. This thesis captures traffic and data from sensor motes to analyze and present characteristics of the traffic in a meaningful manner.

Specifically, this thesis studies the traffic generated by wireless-sensor networks by setting up two different commonly used network topologies; namely, a direct connection to the base and a daisy-chain connection to the base. A total of six experiments are conducted, three for each topology. The data traffic between the nodes is captured over an extended length of time. Using the captured information, analysis is performed to categorize and identify the information through anomalies and variations of traffic patterns. Data are also analyzed to study self-similarity and statistical distribution.

The experimental results show that it is possible to differentiate the two topologies by monitoring the traffic distribution or by analyzing the types of messages sent. The status of the nodes can also be determined with the traffic collected. Examples include new nodes joining the network and operational status of the nodes. Statistical analysis is also conducted, and it is found that wireless sensor network traffic is not self-similar except for the inter-arrival time of the direct connection mode.

**KEYWORDS:** Wireless Sensor Networks, Traffic Analysis, Self Similarity
Passive-infrared (IR) imagers, using intensity contrast for target detection, are often limited by low target-background contrast. Detecting stationary targets against cluttered backgrounds presents an even bigger challenge. Polarized signatures can be used as an additional discriminator, to improve target detection probability and reduce false-alarm rate. In this research, a polarimetric thermal imager, operating in the midwave infrared (3-5 μm), is set up using the Merlin InSb camera with three internal wire grid polarizers. Non-uniformity correction and radiometric calibration are performed to compensate for differences in detector response and polarizer’s transmittance. The scene consists of a heated aluminum plate in front of a large-area blackbody as background. The viewing angle, defined as the angle between surface normal and camera line of sight, is varied by rotating the plate about its vertical axis. Stokes parameters are computed from the irradiance images. Images of intensity, degree of polarization, and polarization angle are derived from the Stokes parameters. The dependence of these polarization characteristics on viewing angle is investigated. While intensity increases slightly with viewing angle, degree of polarization increases rapidly when the viewing angle is increased from 20° to 80°. The polarization angle increases with viewing angle and becomes constant at 150° for viewing angle greater than 60°. Target to background contrast based on degree of polarization increases with viewing angle and is higher than intensity contrast for viewing angle greater than 20°. Image-processing algorithms are developed to segment the target plate from its background. The target-similarity metric used is the texture-based Fisher distance, which enables the fusion of one or more data types. The performance of the fusion schemes is compared via their receiver operating characteristic (ROC) curves, which are plots of segmentation accuracy against false-alarm rate. Binary image of the target is obtained by applying a constant false-alarm rate (CFAR) threshold. Fusion of intensity and polarization data produce better segmentation accuracy and lower false-alarm rate than intensity-only data for plate at viewing angle greater than 60°.

**KEYWORDS:** Passive Infrared, Polarized Signatures, Target Detection Probability, False Alarms Rate, Wire Grid Polarizer, Stokes Parameters, Degree of Polarization, Polarization Angle, Fisher Distance, Receiver Operating Characteristics, Constant False Alarm Rate
This thesis focuses on experiments conducted in an anechoic room using AS-18-B audio-spotlight system from Holosonic. Furthermore, nonlinear theory is modeled by a linear discrete array. The beam pattern of the parametric loudspeaker, range dependence of primary and secondary signals, and total harmonic distortion (THD) are measured and then compared to theory. Experimental data for the beam pattern of the parametric loudspeaker agrees with the theory. It is also shown that the parametric array had a very narrow beam width and almost no side lobes, as opposed to conventional loudspeakers. Both primary waves and difference wave frequency signals are examined for their range dependence. Due to the complicated interference of the primary waves, it is impossible to compare experimental results with theoretical predictions. For difference wave signals, experimental data is verified by theory, which is modified in order to accommodate both wave generation and the spreading region. Finally, THD of the parametric loudspeaker is measured for different amplitude-modulation depths. Experimental results show that preprocessing should be applied in order to decrease THD and achieve clean audio-signal reproduction.

KEYWORDS: Parametric Array, Wave Wave Interaction, Audio Spotlight, Sound Scattering, Nonlinear Acoustics, Ultrasound

A NUMERICAL STUDY OF THE VALIDITY REGIMES OF WEAK-FLUCTUATION THEORY FOR OCEAN-ACOUSTIC PROPAGATION THROUGH RANDOM-INTERNAL-WAVE SOUND-SPEED FIELDS

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Results of the Acoustic Thermography of Ocean Climate (ATOC) project’s acoustic-engineering test (AET) experiment have shown that at 75 Hz, Rytov theory may be used for predicting the phase variations. This paper focuses on establishing the regimes of validity for Rytov theory at 75-400 Hz acoustic frequency range and up to 200 km distance. Ray paths corresponding to grazing angles of 0°, 5°, 10°, and 14° are considered, thus spanning the range of possible ray geometry from surface reflection to axial propagation. It is found that the Rytov and simulation spectra are in very good agreement in the frequency range from the buoyancy frequency up to a grazing angle dependent on the transition frequency between 1 and 0.2 cph. For frequencies less than the transition frequency, the Rytov spectra are in fairly good agreement with the simulations for all ranges and grazing angles between 0° and 10°. For the 14° beam, the Rytov theory dramatically under-predicts the spectral energy at frequencies less than 1 cph. When there is significant variability in phase and log-amplitude, it is also found that significant spectral energy can exist at frequencies greater than the buoyancy frequency. This energy is not predicted by the Rytov model, and represents the effect of strong interference and scattering not treated in the weak-fluctuation approach of...
the Rytov theory. This study will increase interest in the weak fluctuation theory as an acoustic-prediction tool.

**KEYWORDS:** Underwater Acoustics, Signal Processing, Oceanography, Rytov Theory, Internal Waves, Parabolic Equation, Garrett-Munk Spectrum, Phase, Log-Amplitude
This thesis investigates a method to estimate the forward velocity and heading rate of an autonomous underwater vehicle (AUV). Through relatively new technologies, small AUVs are now able to mount a forward-looking sonar (FLS) on the vehicle’s nose. This can be used for obstacle avoidance and feature-based navigation. The sensor can also be used to estimate motion of the AUV, which can be useful for undersea navigation. This thesis focuses on a template-matching technique used in computer vision. Two sequential sonar images are compared with the goal of finding the rotation and translation that best correlates the first to the second sonar image. The transformation that maximizes the correlation coefficient is then converted to forward velocity and heading rate through motion analysis.

Experimentation shows that the method provides accurate estimates for both the forward velocity and heading rate of the AUV. Accuracy of the estimates for forward velocity is at the limitation of the resolution of the sonar. Using velocities estimated through image processing applied to FLS images entirely with software, the weight and energy resources currently required by standard measurement techniques could be used to increase the vehicle’s endurance or for additional payload capacity. Another benefit would be the reduction in acoustic and electrical interference with the FLS and side-scan sonar, which would improve the vehicle’s obstacle avoidance and mine-hunting capability. The vehicle could become more flexible in its capability to support additional roles vice specific missions. This method holds the promise of permitting smaller AUVs with an FLS to navigate undersea more accurately.

MASTER OF SCIENCE
IN
INFORMATION OPERATIONS

WHY INSURGENTS FAIL: EXAMINING POST–WORLD WAR II FAILED INSURGENCIES UTILIZING THE PREREQUISITES OF SUCCESSFUL INSURGENCIES AS A FRAMEWORK
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This thesis identifies five common characteristics of successful post–World War II insurgencies: 1) a cause to fight for, 2) local-populace support, 3) weakness in authority, 4) favorable geographic conditions, and 5) external support during the middle- and later stages of an insurgency. This list is incomplete for current and future insurgencies and a sixth characteristic, 6) an information advantage, is necessary. For this study, seventy-two post–World War II insurgencies are identified, of which eleven are classified as failed. Of these eleven failed insurgencies, six are selected for analysis using the above six criteria in order to determine any trends in their failure. The six selected failed insurgencies are the Greek Civil War, the Philippines (Huk), the Malayan Emergency, the Kenya Emergency, the Dhofar Rebellion, and Bolivia. This research determines that no one characteristic stands out as the key for defeating an insurgency. Counterinsurgent forces must consider and take into account all six characteristics and plan accordingly. It is further determined that three of the characteristics—local-populace support, external support, and information advantage—must be reduced to a significant disadvantage for an insurgency in order for an insurgency to fail.

KEYWORDS: Insurgency, Counterinsurgency, Paget, Galula, Greek Civil War, Huk Rebellion, Malayan Emergency, Kenya Emergency, Dhofar Rebellion, Bolivia, Ernesto Guevara, Military-Focused, Protracted Popular War, Urban-Focused, Conspiratorial, Identity-Focused, Composite and Coalition
A SECURITY-RISK MEASUREMENT FOR THE ROLE-ADAPTABLE ACCESS-CONTROL MODEL
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The purpose of this thesis is to provide a quantification process for the risk module of the NSA role-adaptable, access-control (RADAC) model. The intent is to quantify the risk involved in a single information transaction. Additionally, this thesis attempts to identify the risk factors involved when calculating the total security-risk measurement. This list is not intended to be an all-inclusive list of every factor associated with a transaction. Rather, the intent is to supply a pragmatic list that is easily scalable to specific situations, including those factors that have the greatest effect on the total security-risk measurement. In addition, researchers asked experts in multiple fields to provide their opinion on weighting the risk factors. These weight sets and concomitant risk factors are tested for accuracy in an Excel model.

KEYWORDS: RADAC, NSA, Risk Factors, Security Risk, Quantification Process, Information Transaction

EXTENDING SIMPLE NETWORK-MANAGEMENT PROTOCOL BEYOND NETWORK MANAGEMENT: A MANAGEMENT-INFORMATION-BASE ARCHITECTURE FOR NETWORK-CENTRIC SERVICES
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The promise of the Global Information Grid (GIG) includes connecting sensors, shooters, and decision-makers who may not be physically co-located in a manner efficient for combat employment, decision-making, and information sharing. Current information-architecture strategies, such as network-centric enterprise services, have started down one path, requiring the implementation of a service-oriented architecture (SOA) and the requisite underpinnings thereof. These are, for an organization the size of the Department of Defense, a very large problem-set in and of themselves. An additional unfortunate side effect of choosing a conventional SOA as the backdrop for the GIG is that only those devices capable of running an entire web server/database stack are able to participate in the architecture, effectively excluding computationally constrained devices. Additionally, the connectivity requirements in a conventional SOA restrict participation by bandwidth-constrained and intermittently connected entities. This thesis investigates one possible solution, utilizing SNMP as the language and mechanism for sharing data between disparate systems. Specific decision-support, management-information bases (MIBs) are developed to allow transmission of decision-specific information in both push (TRAP/SET) and pull (GET) directions.

KEYWORDS: SNMP, Network Services, Hypernodes, VIRT, Smart Push, Smart Pull, GIG, FORCEnet
Social-network analysis (SNA) has been proposed as a tool to defeat transnational terrorist groups such as Al Qaeda. However, SNA is a descriptive tool that is a product of sociology and not an offensive tool used to attack a social network. SNA was not designed to destabilize covert networks that are difficult to observe and penetrate. This work presents a possible way to improve SNA’s performance against a covert social network by employing the Computer Network Attack (CNA) model. The CNA model is used by computer-network security to represent the traditional approach to hacking a computer network. Although not tested in this paper, it is argued that the CNA model should be able to improve the accuracy of SNA when applied to a covert social network by standardizing the destabilization process and allowing for frequent challenges of operating assumptions.

A history and overview of both computer networks and social networks is covered to allow for a comparison of the two networks. The networks have enough similarities to allow the application of the CNA model without major modification from its original form. Assumptions about the security of computer and social networks are examined to clarify how the CNA model can attack a social network. The model is examined for validity and the conclusion is that the CNA model can incorporate SNA into a more methodical approach to achieve better results than using SNA alone. The final portion of the paper details a possible implementation of the CNA model and how it can be used as part of an offensive effort to destabilize a covert social network.

KEYWORDS: Social Networks, Social Network Analysis, Computer Networks, Computer Network Attack, Hacking, Networks, Network Theory

Unmanned, underwater vehicles (UUV) are becoming ubiquitous in the framework of U.S. Navy operations. According to the U.S. Navy’s UUV Master Plan (2004), research and development will expand UUV capabilities to enable diverse roles from intelligence, surveillance, and reconnaissance (ISR) and mine countermeasures to anti-submarine warfare and information operations. Typical UUVs are severely limited in operational characteristics, such as endurance and range, which prevents their use in conducting certain missions.

A novel UUV is currently being designed that is projected to eliminate the endurance and range constraints. This UUV is called Seadiver, and it is being designed by Institute of Engineering Science of Toulon, France, with support from the Naval Postgraduate School (NPS). It is a glider UUV, which generates propulsion not with propellers or jet pumps, but by controlling its buoyancy. This method of propulsion is very efficient and enables autonomous operation up to 30 days with a range of around 700 nautical miles. A UUV with such endurance and range exposes military missions previously impractical for UUVs, especially when used in concert as an array of many UUVs.

This thesis creates a simulation, using NPS-produced software simulation tools Simkit, Viskit, and AUV Workbench, that analyzes the capabilities and effectiveness of Seadiver UUVs conducting these exposed missions.
Based on numerous high level concerns that the cyber threat is expected to increase, as well as the already documented uses of cyber warfare, it is necessary to ensure that U.S. Naval ships are hardened against such attacks. In doing so, an influence net model is designed to discover the likelihood of a successful cyber attack. However, first it is necessary to identify the best mitigation tools in defense of cyber attack methods. In order to do so, an expert opinion survey is designed and completed by individuals currently working in the field of network security. In combination with the expert opinion surveys and in looking at research and established security techniques, it should become apparent whether or not ships are taking all the required steps to best secure themselves against an attack.

Though the initial model is designed around a theoretical Naval Station Everett ship, with modification the model can be utilized for any Naval asset throughout the United States, and the risk for each particular U.S. asset can be evaluated. Additionally, this tool can also facilitate security funding and establish a means of prioritizing the tools for protection if the network needs to be hastily re-established after an attack. The protection of a ship’s computer networks against cyber terrorist threats is fundamental in ensuring continued effective command and control and, ultimately, in the security of this nation.

KEYWORDS: Cyberterrorism, Information Assurance, Computer Security, Influence Net Model, Situational Influence Assessment Module, SIAM
A COMPARABLE-MARKET STUDY OF RADIO-FREQUENCY IDENTIFICATION FOR MANUAL, ITEM-LEVEL-ACCOUNTABILITY INVENTORY AND TRACKING SYSTEMS
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Second Reader: Richard Bergin, Department of Information Sciences

This thesis focuses on a return on investment (ROI) strategy for radio-frequency identification (RFID) item-level tagging of assets by organizations that maintain manual inventory and tracking systems. The basis of strategy exists in leveraging benefits offered in repeated use of automated identify data and capture technology, RFID. The business model used for this thesis focuses on organizations that provide reference-material-management services (RMMS) (e.g., library reference material, employee privacy information records, laptops, etc.) to internal and external customers. Although technology has created a means to digitize reference material, many organizations are required to maintain manual record systems for various reasons. In addition, a digitized capability does not address the issue of accounting for other pilferable items, such as laptops, personal digital assistants, etc. Therefore, evaluating capabilities available in RFID technology could lead to strategic options for eliminating the challenges posed by the lack of item visibility that exist in a manual RMMS business processes. Strategy development derives from lessons learned in documented RMMS case studies that implemented an RFID solution. This thesis discusses and analyzes companies in private sector industry that have reported positive ROI with tangible benefits by implementing RFID for the purpose of asset control and management.

KEYWORDS: RFID, Passive Tag, Item-Level Tracking, KVA, Strategy, Modeling

SERVICE-ORIENTED ARCHITECTURE FOR COAST GUARD COMMAND AND CONTROL
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The Coast Guard's software architecture does not meet the organization's needs for information sharing or command and control. The Commandant of the Coast Guard recently mandated the implementation of a service-oriented architecture (SOA) to address this problem. This thesis describes a service-oriented architecture for Coast Guard command and control that integrates legacy applications and provides new capabilities. Traditional software-architecture descriptions make it difficult to identify and understand the trade-offs between quality attributes that are inherent in the design. These critical issues are clarified by using multiple scenarios and use cases, in addition to diagrams and functionality requirements. Defining the architecture in this manner enables an auditor to determine the architecture's validity. The Coast Guard also needs a plan to implement this SOA. This thesis defines a process that will deliver value in the form of usable capabilities in an incremental manner. It recognizes the constantly changing nature of both the problem and the necessary solution, and evolves accordingly. It continually plans for, adapts to, and
exploits predictable advances in technology to deliver more value. The iterative method proposed includes cyclical evaluation of the system requirements, architecture, and implementation to provide continuous improvement.

**KEYWORDS:** Service Oriented Architecture, SOA, Command and Control, C2, Coast Guard, USCG, C4ISR, Web Services, Extensible Markup Language, XML, Software Architecture Evaluation, Architecture Tradeoff Analysis Method, ATAM, Software Architecture Implementation

**PORTFOLIO-MANAGEMENT DECISION-SUPPORT-TOOLS ANALYSIS RELATING TO MANAGEMENT VALUE METRICS**

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The general area of research is maritime-domain awareness (MDA), specifically looking at the ship tracking process in prevention and interdiction functions. The objective of this research is to demonstrate that the knowledge-value-added (KVA) and real-options (RO) methodologies can be used to assess the current performance of core MDA processes. This type of approach will help with identification and valuation of future options for an MDA process. The results of this research will assist MDA managers and operational leaders in making portfolio-management decisions for allocating resources to create the correct support tools for MDA processes and support systems. The research provides a proof-of-concept test of a set of decision-support tools to support managers in the MDA ship tracking process. A new methodology for determining value added of management is also explored.

**KEYWORDS:** Return on Investment, Real Options, Management Value Added, Integrated Risk Management, Maritime Domain Awareness, Return on Knowledge

**TESTING AND EVALUATION OF DYNASIG BIOMETRIC PEN IN SUPPORT OF TACTICAL MILITARY AND LAW-ENFORCEMENT MISSIONS**

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Existing access-control methods depend on mechanisms that can be either copied or stolen. From passwords to identification cards, these forms of authentication and verification are unique only while they remain in possession of the owner. Signature-based authentication and verification, however, while not implying the two-dimensional ink on paper, but rather the method with which a signature is made, is extremely unique and provides a method that cannot feasibly be duplicated or stolen. This form of access control can be more beneficial to security issues and to the increasing awareness of identity management.

The objective of this thesis is to test and evaluate the Bio-Pen and its associated WebClient software, leveraging the Cooperative Operations and Applied Science and Technology Studies (COASTS) field-experimentation program as a vessel for equipment and idea testing, requirements, and standards definition. This thesis examines a new biometric technology (and its associated software) in terms of access control. The primary objective of this research is to develop a fundamental understanding of the doctrinal, technological, and operational considerations of how the Bio-Pen can be utilized within the Department of Defense and the Department of Homeland Defense. To accomplish this objective, the Bio-Pen and WebClient software are tested and evaluated for use in the field to determine feasibility for future applications.
KEYWORDS: Signature Verification, Behavioral Biometrics, Dynamic Signature
YOU ONLY GET ONE CHANCE TO MAKE A FIRST IMPRESSION: A QUANTITATIVE ANALYSIS OF DIVISION-OFFICER FLEET EXPERIENCES ON SURFACE-WARFARE-OFFICER RETENTION

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This thesis utilizes Bureau of Naval Personnel data to examine the determinants of surface-warfare officer retention through the department-head decision-point in year groups 1993–1997. The retention model includes demographic and background variables in order to isolate the effects of variables that serve as proxies for job satisfaction: initial homeport, initial ship type, and initial shipboard department. Logit modeling illustrates that the following characteristics improve an officer’s chance of remaining in the surface Navy: male, married or divorced with children, prior enlisted, Officer Candidate School officer, biological-sciences major, year group 1996, initial homeport of Norfolk or Little Creek, and transferred from a non-cruiser/destroyer (CRUDES) ship to a CRUDES ship during the division-officer tours. Conversely, officers with these characteristics are least likely to continue their careers in the surface Navy: female, single without children, not prior enlisted, Naval Academy or Reserve Officer Training Corps graduate, business or economics major, year group 1993 or 1994, initial homeport in the Pacific Northwest, and no CRUDES experience. The thesis recommends that the Navy should examine the retention issue not only in monetary terms, but also with emphasis on the influence an officer’s fleet experiences have on his stay/leave decision.

KEYWORDS: Navy, Retention, Surface Warfare Officer, Surface Navy
Effects of personal background characteristics on the U.S. Marine Corps' Delayed Entry Program (DEP) attrition for high-school senior and high-school graduate recruits are investigated. Policy changes to decrease DEP attrition rates are recommended. Logistic regression models explaining DEP attrition are estimated using data from the USMC Total Force Data Warehouse for all high-school graduates and seniors who enlisted between fiscal years 2000 and 2005. DEP attrition is regressed on fiscal year, recruiting district, time spent in DEP, separation month, age, gender, AFQT score, race, marital status and dependent status, day of enlistment, and unemployment rate.

Model results show that high-school seniors are more likely to be DEP losses than high-school graduates. Female recruits, single recruits, and recruits without dependents show higher attrition rates, as do those with lower AFQT scores. Recruits who enlisted in eastern recruiting districts, who spent longer time in DEP, and who enlisted on the last day or in the last week of the month are more likely to attrite. High-school seniors are most likely to attrite in March and April. Unemployment rates are negatively associated with high-school graduates' DEP attrition, but estimated effects are small.

KEYWORDS: Delayed Entry Program, Attrition, Recruiting, Marine Corps, Manpower, High School Graduate Attrition, High School Seniors Attrition, DEP

This thesis analyzes the retention behavior of first-term Medical Service Corps officers and examines the effect of the Global War on Terrorism (GWOT) on all communities within the Navy Medical Service Corps, including healthcare administration (HCA), healthcare science (HCS), and clinical-care providers (CCS).

Data are collected from the Defense Manpower Data Center for MSC officers in entering cohort years 1998, 1999, and 2001. Four logistic-regression models are estimated to capture the effects of different types of deployments on the retention of first-term MSC officers. The models include both demographic and military-experience explanatory variables. A difference-in-difference estimator is incorporated into each model to measure the effects of the deployment variables across the pre and post-GWOT periods. The post-GWOT period is defined as following the initiation of major combat operations in Iraq (March 2003).

Factors having positive effects on retention include age, having greater than two dependents, entering through the In-Service Procurement Program, and deployments including at least one hostile deployment during the first term. Negative influences on retention include serving in HCS or CCS when compared to HCA, entering through the Health Services Collegiate Program, and commissioning in the 2001 cohort.
year. While serving a first term in the post-GWOT period has a negative effect on retention, the post-
GWOT deployment indicators are inconclusive in this study.

KEYWORDS: Retention, Medical Service Corps, Global War on Terror, Logistic Regression

THE EFFECT OF ADVANCED EDUCATION ON THE RETENTION AND PROMOTION
OF ARMY OFFICERS
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This thesis examines the relationship between advanced education and the retention and promotion of
Army officers. Data from the active-duty-military master file for Army officers who were commissioned
between 1981 and 2001 and tracked until 2004 (or until they separated from active duty) is used. Results of
survival analysis indicate that survival functions differ significantly with level of education, and that
advanced education has a positive effect on both the retention and promotion of Army officers.

Compared to an officer with a baccalaureate degree, the survival time of an officer with a master’s
degree, a doctoral degree, or a professional degree is greater by 29.1 percent, 23.9 percent or 8.2 percent,
respectively. An officer with a master’s degree, a doctoral degree, or a professional degree has a hazard of
leaving the Army that is 38.3 percent, 44.4 percent, or 75.6 percent, respectively, of that of a college
graduate.

Compared to an officer with a baccalaureate degree, the length of time to promotion to O-4 for an
officer with a master’s/doctorate or a professional degree is 0.2 percent shorter or 2.4 percent shorter,
respectively. An officer with a master’s degree or doctorate has a hazard of promotion that is 115.3 percent
of that of an officer with a college degree. Having a professional degree has no significant effect on the
hazard of promotion.

KEYWORDS: Army, Army Officers, Advanced Education, Graduate Education, Retention, Promotion,
Survival Analysis, LIFETEST, LIFEREG, PHREG

AN ANALYSIS OF THE USE OF THE SOCIAL-SECURITY NUMBER AS VETERAN
IDENTIFICATION, AS IT RELATES TO IDENTITY THEFT: A COST-BENEFIT ANALYSIS OF
TRANSITIONING THE DEPARTMENT OF DEFENSE AND VETERANS ADMINISTRATION
TO A MILITARY IDENTIFICATION NUMBER
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Identity theft has become one of the fastest growing crimes in America. ID theft stems from the widespread
and growing reliance of organizations across the nation on using social-security numbers (SSN) as primary
personal identifiers. Originally intended for the very limited purpose of tracking social security benefits, the
value of the SSN as a unique identifier was quickly recognized, and its use rapidly grew. This
“functionality creep” has led to the SSN becoming an almost de facto national ID number. Employers,
universities, credit agencies, and financial institutions began using the SSN as a unique personal identifier.
The military started to use the SSN as a personal identifier in 1969 in place of the military serial number.
Today, the SSN is used pervasively throughout the military, from personnel rosters to medical records,
from administrative records to operational orders.
This thesis analyzes the elimination of the SSN as the primary personal identifier within the Department of Defense and the Veterans Administration, replacing it with a military identification number (MIN). The elimination of the SSN at all but one critical location (pay-related matters at the Defense Finance and Accounting System), would render all lost or stolen data useless to an identity thief. A cost/benefit analysis of the transition from SSN to MIN is presented. Six methods of analysis are examined; payback-period method, discounted payback period, benefit-cost ratio, net present value (NPV), internal rate of return, and a probabilistic NPV. Each method’s benefits and drawbacks are discussed and the findings are summarized. The CBA shows that the transition to an MIN is a cost-effective solution with a net present value that falls between $701 million and $554 million over a ten-year period.

KEYWORDS: Military Serial Numbers, Military Identification Numbers, SSN, Identity Theft, Primary Personal Identifier

PARTICIPATION- AND BUSINESS-CASE ANALYSIS OF THE MARINE-FOR-LIFE PROGRAM
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This thesis examines return on investment (ROI) of the newly developed Marine for Life (M4L) program, which assists discharged Marines in finding civilian employment. Additionally, the thesis analyzes the determinants of M4L participation using data from Marines registered in the program and data from the USMC total-force data warehouse during the same timeframe. The ROI analysis finds that the M4L program has an ROI of 154% in 2004 and 202% in 2005; however, analysis of ROI does include all costs and omits some of the non-quantifiable benefits of the programs, which may bias the results. If these benefits were quantifiable, the ROI would be much higher. Logistic regression results indicate that program participation is positively affected by being female, a minority, ages 24-31, having two years of college or a master’s degree, and separating after the first term of service. Results show a negative effect on participation for ages 32-39, non-high-school graduate, and combat-arms occupations. Recommendations include greater focus on encouraging M4L participation by Marines who are younger, in their first term of service, less educated, and who have served in combat arms.

KEYWORDS: Marine for Life Program, Unemployment, Veterans, Return on Investment, Business Case Analysis

FEASIBILITY OF IMPLEMENTING AN ALL-VOLUNTEER FORCE FOR THE REPUBLIC OF KOREA’S ARMED FORCES
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This research evaluates the feasibility of introducing all-volunteer military recruitment in the Republic of Korea (ROK). The ROK plans to reduce military manpower strength from 681,000 to 500,000 by 2020. The ROK’s plan to downsize military manpower could raise popular expectations for a radical change in the military personnel system, such as eliminating the draft and moving toward an all-volunteer force. Issues of military misconduct, conscientious objection, draft evasion, and unequal distribution of military service across the sexes were not fully resolved under the draft. In terms of opportunity cost, the draft imposes an economic burden on young people. Further, the present draft may not be suitable for a high-technology military that no longer needs massive numbers of personnel. This study analyzes the type of military service system Korea maintains at present, using key defining indicators, and evaluates the suitability of Korea’s current military/economic/political/social factors for voluntary recruitment through
an open-systems conceptual model. Results indicate that the draft should be maintained for the near future, but this does not preclude changes in the current system. In the long run, a gradual transition to voluntary recruitment appears necessary to develop a quality-focused approach to military resources that is in line with national defense reforms and the changing aspects of warfare. The ROK should consider a phase-to-phase transition toward volunteer-driven recruitment, as it eventually brings an end to the draft.

**KEYWORDS:** Military, ROK Manpower, Draft, Conscription, All-Volunteer Force
ELECTROMIGRATION-RELATED EFFECTS AT METAL-METAL INTERFACES:
APPLICATION TO RAILGUNS
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This thesis has two objectives. The first is to develop an experimental procedure to study electric-current-induced flow of liquid metal, similar to that found at the armature-rail contact due to local melting, to determine the kinetics of liquid flow Ga under electric current conditions. For this, a model system, comprising a bead of Ga on a Cu thin-film track, is devised in order to enable liquefaction and current-induced movement of Ga to occur along the Cu track. Upon application of current, Ga undergoes liquefaction due to Joule heating. Once liquid, it rapidly migrates along the Cu track towards the negative terminal. The Ga liquid flow is attributed to electromigration of liquid Ga under the influence of direct electric field. The kinetics of Ga flow are determined. This method will be useful in calculating the kinetics of electromigration of molten Al along Cu rails in future railgun development. The second purpose of this thesis is to analyze debris left on Cu/24Ag rails following firing of 7075Al armatures, in order to understand the compositional evolution of the debris and its role in creating surface damage to armature/rail interfacial surfaces. EDS analysis shows a majority of the debris is composed of oxidized aluminum with significant porosity. The analysis of the rail debris will benefit future studies on preventing rail debris from damaging railguns.

KEYWORDS: Railgun, Electromigration, Current Density, Thin Films

INVESTIGATION OF THE EFFECT OF FUSELAGE DENTS ON COMPRESSION
FAILURE LOAD
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The main motivation for this thesis study is that significant workload for aging transport aircrafts is related to dent removal from fuselages. This thesis is a preliminary investigation of aircraft fuselage dents using the finite-element method (FEM) via FEA ABAQUS software. A single-impact dent on the fuselage panel at various locations and impact speeds is investigated. The material used for the finite element models is aluminum alloy 2024T3, a typical material used for fuselages of older transport aircrafts. The finite-element model consists of impact analysis, buckling-prediction analysis, and postbuckling analysis successively. These analyses are performed on both stiffened and unstiffened aluminum panels. It is found that, depending on dent status in the aluminum panel, a dent may increase or decrease the buckling load of the panel compared to that of the virgin (undented) panel. The buckling load of a panel with low-velocity impact is generally lower than that of the virgin plate. As the impact velocity is increased, the buckling load of the dented panel increases, exceeding the buckling load of the virgin plate. In addition, researchers also notice the existence of critical impact velocity, at which the buckling load of the dented panel reaches maximum and after which will start to decrease.

KEYWORDS: Fuselage, Dents, Damage, Buckling, Al-2024T3, Al-2024-T3, Al-2024, Impact, Stiffened Plate, Stiffened Panel
A sounding climatology of a variety of parameters commonly used to forecast deep, moist convection using upper-air observations is developed. The dataset includes 0000 and 1200 UTC rawinsonde data (approximately 3629 soundings) from Laughlin Air Force Base (AFB), Texas, from April–September, 1995–2004. Cloud-to-ground lightning data, surface observations, and severe-weather reports from the Storm Prediction Center (SPC) SeverePlot2 program are used to categorize soundings as representative of conditions for no convection, light convection, convection within vicinity, moderate convection, or severe convection. Indices, including convective available potential energy (CAPE) and mean-layer CAPE (MLCAPE), along with sounding parameters and combinations of such as 0–2 and 0–6 km bulk shear, 700-500 mb lapse rate, lifted condensation level (LCL), and mean-layer LCL (MLLCL) heights, are examined in an attempt to distinguish between moderate and severe convection.

Results show that the 0–6 km bulk shear along with the MLCAPE and LCL height indicate some discrimination between the moderate and severe categories. The best discrimination comes from the significant severe parameter, calculated by taking the product of the 0–6 km bulk shear and MLCAPE, and the 0-6 km bulk shear versus MLCAPE, and the 700-500 mb lapse rate.

KEYWORDS: Severe Weather Forecasting, Laughlin AFB, TX, Del Rio, TX, Convective Indexes, Convective Forecasting, Sounding Parameters, Lapse Rate, CAPE, Shear, Forecasting Convection

Analysis of the eddy kinetic-energy budget for four cases of extratropical transition (ET) with North Pacific tropical cyclones (TCs) is conducted. The cases compare varying ET and midlatitude flow characteristics. Each case is examined to determine the impacts of eddy kinetic-energy generation and/or transfer on downstream development in the midlatitude circulation.

Typhoon Tokage (October 2004) was a large TC that moved into a high-amplitude midlatitude circulation. Energetics analysis reveals that the ET of Tokage influenced the development of a deep trough over the central North Pacific before Tokage moved poleward and weakened transfer. Typhoon Banyan (July 2005) was a mid-summer case that ultimately influenced downstream development over the Aleutian Islands. Typhoon Guchol (August 2005) was a small TC that was dominated by midlatitude flow. However, the merger of Guchol with a midlatitude trough enabled development downstream of a separate trough. Typhoon Nabi was an intense TC that injected significant EKE into the midlatitude circulation during ET. Through downstream development, Nabi changed a zonal pattern over the North Pacific into an amplified pattern. These cases indicate that the ET process over the western North Pacific impacts the midlatitude circulation across the entire North Pacific basin.
AUTOMATING THE SHADOW METHOD FOR AEROSOL OPTICAL DEPTH RETRIEVAL

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A new method for remote-sensing retrieval of aerosol optical depth is proposed and investigated by Vincent (2006). This shadow-based method uses the radiance difference between shadow- and non-shadow regions in QuickBird high-resolution commercial satellite imagery to estimate aerosol optical depth. Though the process is initially time-consuming, requiring a high level of user knowledge to accomplish the procedure, great potential exists for further development into a standalone operational method for overland retrievals at any location and time. The goal of this research is to automate this process to make it more operational in nature. Knowledge is gained in the realm of predicting shadow location for future times. Specific process automation is applied through computer programming to decrease the computational complexity of the method. Also, the physical variations of shadow regions are investigated in terms of their brightness change across various spatial profiles. This study of shadow region variation is termed shadow morphology and seeks to provide a user with optimum radiance sampling regions within an observed shadow region. Through the integration of these automation techniques, a more unified and operationally focused iteration of the shadow method is derived.

KEYWORDS: Aerosol, Aerosol Optical Depth Retrieval, Shadow Morphology, Automation, Over Land, Shadow, High-Resolution Commercial Satellite Imagery, QuickBird

APPLICATION OF THE COMMUNITY RADIATIVE TRANSFER MODEL TO EVALUATE SATELLITE-BASED MEASUREMENTS ACROSS THE AFRICAN EASTERLY JET OVER WESTERN AFRICA

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The Community Radiative Transfer Model (CRTM) is used to determine which polar-orbiter satellite channels are best suited to remotely sense, in a cloud-free environment, the lower-tropospheric temperature and moisture gradients that determine the location and intensity of the African Easterly Jet over West Africa. This study evaluates the capability of five microwave sensors and three infrared sensors, including both conical- and cross-track scanning instruments. Atmospheric profiles obtained during the JET2000 field experiment blended with the European Center for Medium-Range Weather Forecasting model analyses are input in the CRTM to obtain brightness-temperature outputs. To separately address the moisture (temperature) signature, the average of the northern and southern temperature (moisture) profiles are combined with the real moisture (temperature) profiles. The effects of land-surface emissivity uncertainty of +/-3% for microwave and +/-1% for infrared are tested. From the total set of 423 channels evaluated, eleven microwave and twenty-one infrared channels are found to be appropriate for obtaining moisture gradient information. However, after applying emissivity perturbations, this list is reduced to two microwave and twenty infrared channels. Temperature gradient information is determined to be available from thirty-five microwave channels and ninety-five infrared channels, with no impacts noted due to emissivity perturbations.
A new technique has been developed using high-resolution satellite imagery to derive aerosol optical depths by measuring the difference of the radiances inside and outside of shaded regions (Vincent [2006]). This approach has shown promise as a new means of providing aerosol optical depth in regions that have proven difficult using more traditional means. Initial studies have been conducted primarily over desert and arid environments, with some limited work over urban regions. This thesis takes the next step by focusing on the challenges that come along with using this technique in an urban environment and by exploring the relationship of how this technique is affected by different surface types. Four surface types are examined: dirt, grass, pavement, and “other,” which includes a random sampling of surfaces that are commonly found in urban environments. Three of these surface types act remarkably similarly, while grass surfaces deviate from the results seen with the other surfaces. Results from all the surfaces show a low bias that was not seen in the earlier study. This low bias can possibly be attributed to the aerosol model used when running the shadow-method program, Urban Effects.

KEYWORDS: Aerosol, Satellite Observations, Aerosol Optical Depth Retrieval, Shadow, Shadow Method, High-Resolution Commercial Satellite Imagery, QuickBird, Dirt, Grass, Pavement, Urban

LONG-RANGE OPERATIONAL MILITARY FORECASTS FOR IRAQ
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LtCol. Karl D. Pfeiffer, USAF, Department of Information Sciences

The military weather community is mandated by the Department of Defense to provide accurate, timely, and reliable meteorological information necessary for commanders to exploit the best window of opportunity for operations. In order to meet this mandate, the military must apply state-of-the-art long-range forecasting techniques. Composite analysis and forecasting techniques developed by the National Oceanographic and Atmospheric Association are examined for use in the continental U.S. and for their application in supporting the DoD global mission. The seasonal composite analyses completed for Iraq surface temperature and precipitation rates using the North Atlantic oscillation (NAO) index and Nino3.4 imply links between the variables and the climate oscillations. Although statistical links are demonstrated, causation cannot be assumed without further examination of the dynamical impacts of NAO and the El Niño/La Niña oscillation. That said, researchers verify that the composite analysis forecast method outperforms the use of long-term mean (LTM) outlooks as a seasonal forecast using either the NAOI or Nino3.4 indices. This study is motivated by the mission needs for long-range forecasts in Iraq. The outcome of this study is a vector for the DoD weather community to expand out from the almost exclusive use of LTM-based climatological products.

KEYWORDS: Iraq, El Niño, La Niña, North Atlantic Oscillation, Long Term Mean, Climatology, Climate Variation, Precipitation Rate, Temperature, Smart Climatology, Military Operation, Military Planning, Department of Defense, Long-Range Forecasts, Composite Analysis Forecast Method
FREEZING-FOG FORMATION IN A SUPERCOOLED BOUNDARY LAYER: SOLVING THE WINTER FOG-FORECASTING CHALLENGE FOR ELMENDORF AIR FORCE BASE, ALASKA
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Second Reader: Peter S. Guest, Department of Meteorology

Four complex freezing-fog events at Elmendorf Air Force Base, Alaska, are examined to determine the root cause of the fog. The primary goal is to provide a detailed analysis of conditions within the boundary layer that contribute to freezing-fog formation within the supercooled liquid water boundary layer. The fog is identified to be the result of moisture flux at the surface during high tide, which interacts with cold air from valleys northeast of the base. The interaction causes spontaneous condensation, and fog drains towards the base due to thermal gradients established from differential cooling from diurnal radiative properties. The strong correlation between water levels and moisture flux is strong enough that forecasters should focus on water-level data and wind speed and direction. Armed with this knowledge, the Air Force and the Department of Defense will reap the benefits of much more timely and accurate fog forecasts.

KEYWORDS: Freezing Fog, Supercooled Boundary Layer, Drainage Fog, Radiational Cooling, Moisture Flux, Mud Flats, Drainage Flow, Evaporational Cooling, Ice Crystals, Horizontal Moisture Advection

EVALUATION OF HIGH-DENSITY SURFACE OBSERVATIONS IN COMPLEX TERRAIN, AND THEIR CONTRIBUTION TO THE MM5 MODEL
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This study evaluates the data assimilation capabilities of three-dimensional multiquadric interpolation (3DMQ) and the MM5 model when incorporating mesoscale observations from the United States Air Force Academy (USAFA) high-wind-alert system (HWAS). These mesoscale observations are incorporated into a triple nested (12, 4, and 1.33 km) high-resolution model simulation, and evaluated for their impact upon analyzed and forecasted wind values at USAFA during a severe downslope wind event that occurred on 6 March 2004. This evaluation is the first step in developing future forecasting and analysis tools for use by the military in various operations in complex terrain. The development of deployable, automated, tactical weather sensors in forward deployed locations requires an evaluation of the impact and usefulness these sensors would have on analysis forecast tools and mesoscale Numerical Weather Prediction (NWP) models. The juxtaposition of the HWAS network in complex terrain and the aviation training operations at USAFA provides an ideal set of data, mission, and location for testing and evaluating a high-resolution nested-grid mesoscale NWP model. This study shows that incorporating HWAS observations into the 3DMQ data assimilation process has a significant impact upon verification of analyzed wind fields, with the biggest impact occurring at the 1.33 km grid scale. Using these analyzed fields as initial conditions for MM5 model simulations, this study shows the ability of the 1.33 km model forecast wind fields to verify significantly better than either the 4 or 12 km through 18-, 24-, and 30-hour forecasts. Additionally, this study shows the limited, yet discernable impact HWAS observations have upon forecasted winds in the first several hours of MM5 model runs during a severe downslope wind event at USAFA.

KEYWORDS: Mesoscale Observations, Complex Terrain, High Resolution Model, Tactical Weather Observations, Numerical Weather Prediction, MM5, Three Dimensional Multiquadric Interpolation, Downslope Wind, Chinook, Bora, Data Assimilation, Initial Conditions, Nested Grid Model, Mountains
A WEIGHTED-CONSENSUS APPROACH TO TROPICAL CYCLONE 96-H AND 120-H TRACK FORECASTING

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A long-range (96 h–120 h) weighted-position consensus for tropical cyclone tracks is evaluated for twenty-four western North Pacific storms in 2006. The first weighted-position technique simply weights the 96-h, 108-h, and 120-h dynamical model positions inversely to their distances from the 60-h, 66-h, and 72-h consensus positions. The second weighted-consensus technique uses the same weighting factors but is applied to the forecast motion vectors to assess 96 h–120 h track errors.

The weighted-position consensus yields modest reductions in error relative to an unweighted-position consensus at 96 h–120 h and produces smoother track forecasts. Weighted-position consensus errors are reduced when the COAMPS model and the Air Force Weather Agency MM5 model are removed from the unweighted consensus used to form the weighting factors. Including the Japan and ECMWF model tracks also improves the weighted position-consensus performance. The weighted motion-vector consensus achieves dramatic improvements over an unweighted-position consensus (9.9% at 96 h and 5.6% at 120 h). Most of the improvement over an unweighted-position consensus is from using a motion-vector consensus rather than a position consensus since large improvements are also achieved with an unweighted motion-vector consensus.

KEYWORDS: Numerical Weather Prediction, Tropical Meteorology, Tropical Cyclone Track, Tropical Cyclone Prediction, Consensus Forecasting

A DETAILED STUDY OF ADVECTION SEA-FOG FORMATION TO REDUCE OPERATIONAL IMPACTS ALONG THE NORTHERN GULF OF MEXICO

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This study creates rules of thumb for forecasting advection sea-fog development and dissipation along the northern Gulf of Mexico for the months December through March. Surface observations from Tyndall Air Force Base (AFB), Destin-Fort Walton Beach Airport, Eglin AFB, Hurlburt Field, and Keesler AFB are used, in conjunction with the National Data Buoy Center’s marine sensors, to determine the low-level atmospheric state and the sea surface temperatures during advection sea-fog events at the five locations listed above. Forecasting rules of thumb are created and then modified to maximize forecasting effectiveness. The criteria examined include sea-surface temperature, wind speed and direction, air temperature and dewpoint spread, dewpoint, and sea-surface temperature spread. Data from December 1999 to March 2004 and from December 2005 to March 2006 is used for the Keesler AFB analysis. Data from February 2005 to March 2006 is used for the Tyndall AFB, Eglin AFB, Hurlburt Field, and Destin-Fort Walton Beach analysis. Missing sea-surface temperatures limited the amount of wintertime advection sea-fog seasons that could be examined.

The averaged results from all locations indicate that fog with visibility less than or equal to three statute miles is present 86.8% of the time at the observing site within one hour of meeting the following criteria: sea-surface temperature less than or equal to 18.7 degrees Celsius; onshore surface winds less than or equal to 12 knots. or surface winds from any direction if the speed is less than or equal to three knots; surface air temperature minus surface dewpoint is less than or equal to one degree Celsius; and sea-surface temperature minus surface dewpoint is less than or equal to 1.9 degrees Celsius. Results also indicate that fog is present 85.9% of the time at the observing site within two hours of meeting the following criteria: sea surface temperature less than or equal to 19.7 degrees Celsius; onshore surface winds less than or equal to 14 knots, or surface winds from any direction if the speed is less than or equal to three knots; surface air
temperature minus surface dewpoint is less than or equal to one degree Celsius; and sea-surface temperature minus surface dewpoint is less than or equal to 3.0 degrees Celsius.

**KEYWORDS:** Air-Sea Interaction, Sea Fog, Boundary Layer, Mesoscale Forecasting, Advection Fog

**VERTICAL VARIATION OF DUST AND ITS IMPACT ON THE TOP OF THE ATMOSPHERE RADIANCE IN THE MIDWAVE INFRARED**

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The objective of this thesis is to investigate the vertical distribution of dust and its impact on the top of the atmosphere radiance and associated remotely sensed thermal variability in the midwave infrared wavelengths. Due to the inconsistent availability and coincidence of *in-situ* data with dust events, model data is used to identify vertical dust regions. The Navy Aerosol Analysis and Prediction System global aerosol model is used to determine mass concentration and vertical extent of dust. Mass concentration is converted to extinction and individual dust events are analyzed to characterize vertical distribution, extinction, and optical depth. The average height is defined for specific dust regions of Iraq and Korea. This value is used to determine the impact of the dust layer on the top of the atmosphere radiance and brightness temperature in the wavelengths of interest. Radiative-transfer software is used to determine the top of the atmosphere radiance of the modeled dust atmosphere. Resultant brightness temperature is calculated to obtain the thermal characteristics of the dust layer and associated atmosphere. The vertical distribution of the dust layer is varied with fixed atmospheric components to gain insight into the resultant variation of radiance and subsequent brightness temperature to provide a set of possible values for a regionally specific dust event.

**KEYWORDS:** Dust, Aerosol, Midwave Infrared, Vertical Variation, Radiance, Brightness Temperature

**OPTICAL- AND RADIO-FREQUENCY REFRACTIVITY FLUCTUATIONS FROM HIGH-RESOLUTION POINT SENSORS: SEA BREEZES AND OTHER OBSERVATIONS**

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This thesis utilizes high-speed measurements of the humidity, temperature, and wind speed collected on a 10 m tower at a coastal location to simultaneously examine the optical and RF Cn2. The humidity data are collected with a high-speed-infrared humidity sensor. A three-axis sonic anemometer provides wind data and a fine-wire temperature sensor, as well as the sonic anemometer-provided temperature data. All the data are sampled at 20 Hz. This study examines a subset of 251 days of data collected at Marina, California, to investigate the relative variations of optical and RF magnitudes of Cn2 and the underlying atmospheric phenomena.

**KEYWORDS:** Cn2, Sea Breeze, High Frequency Data, Optical Turbulence
This study investigates the impact of offshore cross-coast winds on the coastal jet along the central California coast, specifically Vandenberg Air Force Base. Events that resulted in synoptic-scale offshore flow over most of the central Californian coast in the late spring through early fall 2006 season are identified and considered for this study. A total of eighteen events are found along the central coast during this time frame. Two cases are selected from the eighteen events for detailed analysis by examining the cross-coast offshore winds, length of duration, the degree of marine-boundary-layer compression, and westward migration of coastal jet.

Results indicate that changes in the California coastal jet are dominantly influenced by two major processes: subsidence due to increase of low- to mid-level thickness above the boundary layer and downsloping winds directly above the marine-boundary layer from flow over coastal mountain ranges. Both processes lead to compression of the marine-boundary layer near the coast, increasing the east-west thermal gradient in the inversion above the marine-boundary layer, causing the coastal jet to migrate westward near the tightest temperature and pressure gradient.

KEYWORDS: California Coastal Jet, Marine Boundary Layer Compression, Offshore Flow, Vandenberg AFB, Subsidence, Downsloping Winds

The Air Force Combat Climatology Center produces an analysis of meteorological conditions in a column over any point on the globe. Currently, this analysis does not include aerosol impact on radiative transfer. Instead, the meteorological parameters are used to choose an aerosol representation native to MODTRAN radiative transfer software. This research investigates the impact of dust aerosol on radiative transfer in the 1-5 µm wavelength band. Theoretical radiative-transfer properties are calculated for various dust aerosols. The aerosols vary in size distribution and index of refraction. The aerosols also vary in phase functions, extinction coefficients, absorption coefficients, and asymmetry parameters. MODTRAN is used to simulate radiative transfer in the 1-5 µm wavelength band, incorporating the various dust aerosols in the bottom 1-2 km of the atmosphere. Radiance values from MODTRAN are converted into brightness temperatures, allowing interpretation of the impact dust aerosol has on remote sensing in this wavelength band. Dust aerosol does impact radiative transfer in the 1-5 µm wavelength band. Brightness temperatures vary by as much as 50 K between no aerosol simulations and certain dust simulations below 3 µm, and can vary by 1 K above 3 µm.

KEYWORDS: Dust, Aerosol, Radiative Transfer
Statistically significant signals in Afghanistan associated with two global-scale climate variations, El Niño-La Niña (ENLN) and the North Atlantic Oscillation (NAO), are investigated. The results of primary interest are in seasonal 850hPa temperatures and precipitation rates (PR), as these variables affect many military operations. The primary data sets are National Centers for Environmental Prediction (NCEP) reanalysis fields and indices of ENLN and NAO activity. Methods involve a two-step process. First, composite analyses of past events are performed in an effort to identify statistically significant (SS) relationships between climate variations and 850hPa temperatures and PRs for Afghanistan. If SS is identified, a forecast of ENLN or NAO conditions is then used to produce a probabilistic forecast of potential occurrence of the particular variable, with a two-week lead time. Statistically significant results are identified in all four seasons for both ENLN and NAO. The NAO has a larger impact on 850hPa temperatures, while ENLN has a larger impact on PRs. The ENLN impacts on PRs are associated with anomalous advection of moisture out of the Arabian Sea or out of central Asia. The NAO impacts on 850hPa temperatures are associated with variations in storm tracks over southwest Asia. Initial probabilistic forecasts of PRs and 850hPa temperatures for Afghanistan for all four seasons are generated. These serve as first steps in providing in-depth climatological-planning products to military commanders and bridging the gap between civilian and military climatological products.

KEYWORDS: Afghanistan, El Niño, La Niña, North Atlantic Oscillation, Long Term Mean, Climatology, Climate Variation, Climate Anomaly, Precipitation Rate, Moisture Transport, Smart Climatology, Climatological Support, Military Operation, Military Planning, Statistical Significance, Composite Analysis, Seasonal Forecast

This study investigates synoptic scale regimes in the forcing of 25-knot winds at Hickam and Andersen Air Force Bases (AFB). Ten years of data, from January 1996 through December 2005, as well as case studies from June, July, and August 2006, are considered for this study. Days are grouped to isolate the events of trade-wind-flow only and to alleviate days where trade-wind flow is interrupted by synoptic-scale weather events or local weather phenomena.

Of the approximately 3,650 days of observations, Hickam AFB had 258 days in which winds gusted to or above 25 knots and 1,077 days in which they remained between 15 and 24 knots. Similarly, Andersen AFB had 99 days where winds gusted to or above 25 knots and 448 days where winds remained between 15 and 25 knots. These days are then combined in their respective lists and compiled to create composite sea-level pressure surface analyses, winds, temperature, dew point, and geopotential height for each list of days.

Upon examination of the compiled charts, identifiable climatological regimes became evident for days in which winds gusted to or above 25 knots and when they remained between 15 and 24 knots. The climatological average for Hickam AFB for winds gusting to or above 25 knots consisted of the subtropical high located 894 miles almost due north of Hawaii, and the strength of the high at 1024 mb. The subsequent gradient across Hawaii produced an average geostrophic flow of 15 m s⁻¹ across. North-to-south cross sections of potential temperature and winds across Hawaii indicated low static stability and analyzed winds of 7-9 m s⁻¹. The climatological average when the winds remained between 15 and 24 knots consisted of the subtropical high located much further east and with a strength of 1022 mb. This
reduced the gradient across Hawaii and produced an average geostrophic flow of 11 m s\(^{-1}\). North-to-south cross sections indicated stronger static stability and analyzed winds of 5-7 m s\(^{-1}\).

Similarly, for Andersen AFB, the climatological average for winds gusting to or above 25 knots consisted of a protrusion of the Siberian High due north of Guam, approximately 1050 miles away. The strength of the high was 1018 mb, causing a gradient that produced a geostrophic flow of 15 m s\(^{-1}\) across Guam. North-to-south cross sections again revealed lower static stability and higher wind speeds associated with this regime. For the climatological average when the winds remained between 15 and 24 knots, the Siberian High had retreated to the west, allowing the gradient across Guam to decrease, causing the geostrophic flow to drop to 10 m s\(^{-1}\).

**KEYWORDS:** Trade Winds, Climatological Average, Gradient, Stability, Hickam AFB, Andersen AFB
The utility of using a numerical weather prediction (NWP) forecast model as an input to a simple ocean model for planning during reactive situations is studied. An oceanographic experiment called the Maud Rise Nonlinear Equation of State Study (MaudNESS) was conducted from June to September 2005 over the Maud Rise in the eastern Weddell Sea. Archived Antarctic Mesoscale Prediction System (AMPS) Polar MM5 forecast fields from MaudNESS are compared to observed conditions during MaudNESS. AMPS is found to have problems with cloud and moisture parameters, but represents the overall synoptic situation. AMPS forecast and observed forcing fields (as well as increased values for both) are input into a simple, one-dimensional ocean model at three locations in the Maud Rise area of differing stability. The ocean model is found to have good utility as a planning tool for short-term reactive situations where a high degree of accuracy is not needed.

**KEYWORDS:** Maud Rise Nonlinear Equation of State Study, MaudNESS, Antarctic Mesoscale Prediction System, AMPS, Polar MM5, PMM5

Observed oceanic acoustic wavefronts show surprising stability in long-range acoustic transmission experiments. This suggests that oceanic scattering processes tend to redistribute acoustic energy dominantly along the wavefront rather than across it. The purpose of this thesis is to elucidate the physical mechanism for this type of scattering by presenting a ray-based physical model. Analytic formulae are presented that predict wavefront distortions caused by oceanic internal waves and other processes. Applications of this study include wavefront healing near underwater obstacles, out-of-plane scattering, and the vertical redistribution of energy of off-axis sources.

**KEYWORDS:** Along Front Scattering Healing, Ocean Acoustics, Diffraction Shadow Zones
An attack on, or chemical spill near, Iraq’s oil terminals could have disastrous effects on Iraq’s economy. The impacts from a drifting mine or chemical spill are highly dependent upon environmental conditions that can either adversely effect continued operations or hinder the safety of personnel. The ability of operational planners to create legitimate scenarios to train and combat these situations is key to continued safe operation of the terminals.

To accomplish this, planners must understand the impacts of using climatology versus near-real-time data in the evaluation of the scenarios. The near-real-time environmental data are provided by the Navy’s oceanic-atmospheric operational models. This study examines the benefits of knowing the environment in order to understand its impacts on operations in the northern Persian Gulf. Three different scenarios are examined to understand the impact to oil-terminal operations in the event of drifting mines or a chemical spill. The chemical spill is examined from the outlook of a major collision with a barge that spilled either liquefied ammonia or mustard gas. The ammonia scenario is further analyzed in the atmosphere. This study demonstrates the impact that near-real-time environmental conditions can have over climatological data for operational planners.

KEYWORDS: Meteorology, Oceanography, SWAFS, Currents, COMAPS, Surface Winds, Mine Warfare, Chemical Spill, Ammonia, Mustard Gas, CHEMMAP®™, HPAC, Prediction, Chemical Propagation, Empirical Orthogonal Function, EOF, Complex EOF, Iraq, Oil Terminal
PARTICLE-FILTER-BASED TRACKING IN A DETECTION-SPARSE, DISCRETE-EVENT SIMULATION ENVIRONMENT

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One of the key abilities of agents in military simulations is to react to both detections of and counter-detections by other agents in the environment. Although methods have been developed to model these detections and counter-detections, the majority of these methods model detection and counter-detection as an all-or-nothing prospect in which an undetected entity at some point crosses an arbitrary threshold of observability and becomes fully detected. In actuality, even extremely uncertain or incomplete detections and counter-detections of opposing entities can provide enough data for entities to make reasonably intelligent decisions on the virtual battlefield. Recent developments in commercial gaming regarding artificial intelligence suggest that particle-based tracking techniques can provide accurate and computationally efficient state estimation of opposing agents within virtual environments. In this work, several particle-based methods for obtaining and tracking contacts are explored to determine the feasibility of their use as a general-purpose tracking technique in military simulations.

KEYWORDS: Particle-Filters, Agents, Discrete-Event Simulation, Active/Passive Tracking, State-Estimation.

AUTOMATED RUN-TIME MISSION AND DIALOG GENERATION

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Current mission-driven systems, be they games or training simulations, are generally restricted to using a set of training missions that are hard coded into the system. This has the unfortunate effect of limiting the number of times a person or team can be sent through a simulator before it begins to lose its training value or the number of times a person can replay a game without it becoming predictable and somewhat boring. In addition, the fact that all mission parameters must be hard coded increases the time required for scenario development. This study defines an architecture for automating the creation of missions at run time, allowing much larger variety in the number and content of missions in a given system. The architecture also allows for the creation of varied and more believable dialog with minimal scenario-creation time required. An alternate method is explored for determining agents’ attitudes towards the users’ avatar, which is more robust than the more commonly used system and can be used as an input to dialog generation, improving dialog realism. A commercial game, Neverwinter Nights by Bioware, is used to produce a proof of concept.

KEYWORDS: Artificial Intelligence, Natural Language Processing, Social Network Analysis, Simulation, Automated Scenario Generation
Unmanned, combat, aerial vehicles (UCAVs) are advanced weapon systems that can loiter autonomously in a pack over a target area, detect and acquire the targets, and then attack them. Modeling these capabilities in a specific hostile operational setting is necessary for addressing weapons’ design and operational issues. While much attention has been given to the engineering and technological aspects of UCAV development, there are very few studies on operational concepts for these weapon systems and their effectiveness and efficiency. This thesis builds probability models (Markov chains) that describe UCAV operations, defines measures of effectiveness (MOEs) for the engagement performance, maps the functional relations between the parameters and the MOEs, and obtains insights regarding the design of the UCAVs and their tactical employment. The models are used to conduct extensive numerical analysis, based on experimental design concepts and traditional sensitivity analysis. The main focus of the analysis is to investigate optimal and robust mixes of UCAVs of different types, with respect to the MOEs. While extreme-point solutions are optimal in most cases, there are cases where a balanced UCAV mix is better.


Approach training currently relies solely on manual observation and verbal feedback to the pilot. This project aims to provide both pilots and landing-signal officers (LSOs) with valuable information about individual approaches in the carrier landing environment. The project investigates fully automatic flight-path acquisition by means of computer vision-based analysis of platform-camera video. The obtained data supports enhanced LSO training, real-time approach analysis, and pilot self-improvement through advanced review capabilities.

KEYWORDS: Computer Vision, Training, Approach Training, Pilot Training, LSO Training
In aviation, spatial awareness and spatial orientation are essential for performing the task of recovering from an unusual attitude. Degraded spatial awareness, particularly in extreme flight situations, may lead to lower operational effectiveness and to loss of equipment and, in manned aviation, loss of life. Therefore, improvements in spatial awareness are important in complex 3D environments, including both manned and unmanned aviation.

The main goal of this thesis is to determine whether a new prototype display design, called WEBER-Box, is a useful alternative or supplement to traditional flight instruments for unmanned aviation. In addition, researchers combine the traditional flight instrument, as well as the WEBER-Box, with a color-coded indication when the aircraft enters an unusual attitude.

In this experiment, the participants execute typical tasks of a UAV-operator. The influence of the WEBER-Box on the UAV operator’s orientation performance is investigated. Important results are summarized as follows:

1. Significant improvement in correctly solving the orientation tasks,
2. Significant reduction in time to solve orientation tasks,
3. Color-coded indication of unusual attitude significantly decreases response time and reduces error,
4. The proposed display design is accepted, interpreted, and used to solve 3D-orientation tasks efficiently.

**KEYWORDS:** Spatial Awareness, Spatial Orientation, Spatial Disorientation, Situational Awareness, Cockpit Instruments, Flight Instrument Design, Display Design, Traditional Flight Instruments, Prototype Display Design, Unusual Attitude, UAV
A POSSIBLE SOLUTION FOR THE U.S. NAVY’S ADDICTION TO PETROLEUM: A BUSINESS-CASE ANALYSIS FOR TRANSITIONING THE U.S. NAVY FROM PETROLEUM TO SYNTHETIC-FUEL RESOURCES
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Considering the variable cost of petroleum, it is fiscally prudent for the Department of the Navy (DoN) to consider alternative energy sources for propulsion. The cost of petroleum fuels for the DoN have increased fifty-five percent from 2004 to 2005 and the increase is equivalent to the annual cost of over seven thousand personnel or three littoral combat ships. For the near-term and mid-term futures (five to thirty years), these alternative energy sources must be compatible with current power systems. The Chief of Naval Operations Strategic Studies Group XXV (SSG) proposed a Navy Synthetic Fuels Program (NSFP), which recommended embarking on a public-private venture to make synthetic fuels to satisfy the U.S. Navy’s needs. This thesis examines one aspect of SSG’s NSFP by specifically investigating the construction and operating costs of a coal-to-liquid-synthetic-fuel plant using domestic coal resources.

The purpose of this study is to show the conditions where domestic coal to liquid fuel production-facility investment is financially practical, as well where it is financially impractical. This analysis develops cost estimates, provides business-case analysis, and reviews global estimates for developing a coal-to-liquid-synthetic-fuel production facility. It identifies and qualifies risks and sensitivities. It also examines various projected coal- and crude-oil markets and how each case influences the decision to pursue a synthetic-fuel program. It concludes with a decision matrix comparing the pursuit of a synthetic-fuel program with maintaining the status quo of the use of fuel from petroleum.


MOBILE-SENSOR NETWORKS: A DISCRETE-EVENT SIMULATION OF WEAPONS-OF-MASS-DESTRUCTION THREAT DETECTION IN URBAN TRAFFIC
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The threat of a weapons-of-mass-destruction (WMD) attack on American soil necessitates new and innovative approaches to homeland security. A layered security model has been proposed in which an attacker must successfully penetrate multiple defensive constructs in order to complete an attack. As part of a layered-defensive approach, a network of sensor-equipped vehicles operating in urban traffic is considered. To date, sensor packages have been developed for vehicles without detailed, area-specific analysis of their aggregate performance measures. The possible effectiveness of this network of sensors in detecting vehicle-based WMD attacks is explored in this thesis.
A discrete-event simulation using actual roadmap data is developed and analyzed to explore various configurations for searcher employment, and, in particular, to generate a potential return-on-investment curve in the form of probability of detection generated as a function of the number of sensor-equipped vehicles. The baseline scenario centers on an attacker utilizing a vehicle-mounted WMD device. The attacker attempts a shortest-path route from a randomly selected starting point to a downtown target node. Patrol vehicles are equipped with sensors that can identify potential attacker vehicles in the adjacent lane of oncoming traffic. These vehicles patrol the roadway network, and are assumed to foil an attack when they detect an attack vehicle. The simulation model outputs data such as the proportion of foiled attacks and the distance from target, given a detection.

An analysis of performance encompassing the greater Washington D.C. area, including over 620 square miles of urban and suburban roadway systems, is conducted. Detector deployment in random search patterns in this roadway network yields an appreciable deterrent of greater than 10% probability of detection only when more than 200 patrolling agents are assigned. More optimized employment schemes, countermeasures, and counter–countermeasures are discussed, in addition to other detection statistics and summary results.

**KEYWORDS:** Mobile Detectors, Searcher Detector Model, GIS, GeoTools, Simkit, Washington D.C., Homeland Security, WMD Detection, Discrete Event Simulation

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**DISPLAYING UNCERTAINTY: A COMPARISON BETWEEN SUBMARINE SUBJECT-MATTER EXPERTS**

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This study investigates the operational implications of the differences between submarine target-motion analysis (TMA) experts. A submarine’s use of passive sonar provides uncertain data required to make certain decisions. This experiment presents four individual scenarios to three submarine TMA experts: commanding/executive officers (CO/XO), department heads (DH), and fire-control technicians (FT). Ten individuals from each expert group volunteered from the Groton, Connecticut, and Bangor, Washington, submarine bases. A between-subject design experiment compares the ranges, range envelopes, time, and over- or underestimations of range to the contact generated by each group of experts. After the experiment, subjective and objective data are analyzed to determine what, if any, differences exist between the three experts. Results indicated no significant difference among experts. Recommendations address improvements in experiment implementation that can be integrated into future studies, as well as the design of improved decision aids.

**KEYWORDS:** Decision Making, Displaying Uncertainty, Area of Uncertainty, AOU, Subject Matter Experts, Decision Aids, Target Motion Analysis
This thesis considers the problem of protecting an electrical power grid against a potential attack on its physical infrastructure. A mathematical model is developed, called “Defense of Known Interdictions” (DKI), which identifies the optimal set of components to defend in an electrical power grid, given limited defensive resources. For a small test network, it is shown that defending fewer than 10% of the buses reduces the possible disruption from an attack by over 20%. Previous research has developed optimization models, called I-DCOPF, to find optimal or near optimal interdiction plans for electrical power grids. DKI solution time is determined by I-DCOPF solution time. A model is developed, called the Network Dual Relaxation (NDR), to replace I-DCOPF and reduce solution times. NDR approximates electrical-power-grid behavior as a minimum-cost network flow and uses this approximation to quickly estimate a lower bound for the exact interdiction model. NDR is tested on a portion of the North American power grid with a computational limit of 6,000 seconds. Results with the ten buses defended show that NDR finds solutions that are, on average, 40% better than those of the exact I-DCOPF model, with a significant reduction in computational time.

**KEYWORDS:** Electric Power Grid, Bilevel Program, Trilevel Program, Mixed-Integer Program, Critical Infrastructure Protection

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The thesis identifies Navy E-2C and FA-18 squadron metrics that are affected by technical-representative (tech-rep) usage from Naval Air Technical- and Engineering-Service Command (NATEC). Six different databases are identified that contain the following types of metrics: readiness, standards and policy (RS&P); maintenance and supply-chain management (M&SCM); fleet readiness-training plan (FRTP); financial; manpower; and tech-rep usage.

From the databases, twenty-four months of data is collected for 11 E-2C squadrons and 37 FA-18 squadrons. Exploratory data analysis is conducted to visually identify trends within the metrics as well as relationships among tech-rep usage and the other metrics. At the completion of the exploratory analysis, an over-dispersed Poisson regression model is developed, with a subset of metrics, to predict the number of tech-rep assists per month. Relationships between the predicted tech-rep usage and the predictors in the model are then explored.

**KEYWORDS:** Aviation, Squadron, E-2C, E-2, FA-18, F-18, NATEC, ELAR, Regression, Data Analysis, Exploratory Analysis, Generalized Linear Model, eRIIP, NAVRIIP, EDVR, AFAST, Maintenance, Training
MISSION RESOURCE ALLOCATION IN THE GULF OF GUINEA
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Second Reader: CAPT Jeffrey Kline, CAPT, USN, (Ret.), Department of Operations Research

United States Naval Forces Europe–Sixth Fleet (CNE-C6F) is responsible for the Gulf of Guinea (GOG) in central-West Africa. CNE-C6F’s goal is to provide a persistent presence, pursuant to the global-fleet-station (GFS) concept, supporting U.S. Navy strategic priorities of maritime security and theater security cooperation (TSC). Increased presence and developmental activities will assist host nations in developing their own maritime security. Limitations on USN capacity and logistics support present a challenge to scheduling, sustaining, and allocating mission resources in the GOG. This work presents an optimization model to aid in the mission planning and scheduling process. Specifically, researchers use notional data from the GFS prototype developed by the CNE-C6F GOG Regional Planning Team, which uses an LSD as the platform to accomplish almost 100 missions over six months. The problem is constrained by a budget, re-supply needs, and transit times between countries, among other logistical requirements. Results show substantial improvements over current manual-planning methods. For example, it is demonstrated that 85% of the missions scheduled over the course of six months can be accomplished in three. Significant savings are realized by using a high-speed vessel or by relaxing the request to achieve the maximum TSC value by 10%.

KEYWORDS: Gulf of Guinea, Global Fleet Stations, Logistics Scheduling, Optimization, Phase Zero Operations, Routing Problem

AN ANALYSIS OF SMALL-NAVY TACTICS USING A MODIFIED HUGHES’ SALVO MODEL
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Master of Science in Operations Research-March 2007
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Second Reader: Thomas W. Lucas, Department of Operations Research

This thesis develops a modified version of Hughes’ salvo model and employs it to analyze the tactical disposition (concentration or dispersion) of a small-but-modern navy whose adversary is numerically superior but technologically inferior. It also identifies tactical factors and develops insights that are critical to the success of small navies when fighting outnumbered.

Quantitative results indicate that the smaller navy must fight dispersed and win by outscouting the enemy and attacking him effectively first. This requires superior scouting capability, effective command, control, and communications (C3), and the ability to deliver sufficient striking power. To ensure the delivery of sufficient striking power, a small navy must put greater emphasis on offensive firepower to compensate for small force size.

To be successful in battle, small navies must show initiative and be willing to implement bold tactics. These attributes have been demonstrated by small, successful, naval forces throughout the history of naval warfare. In addition, innovative tactical thinking can allow small navies to take advantage of useful tactical phenomena, like the “missile-ump effect,” and to design the most appropriate type of combat craft for their respective operating environments.

KEYWORDS: Hughes’ Salvo Model, Naval Combat Modeling, Naval Tactical Analysis, Small Navy Tactics, Naval Surface Warfare
LOGISTICALLY SUSTAINING AFLOAT-STAGED, SPECIAL-OPERATIONS FORCES
THROUGH AN LPD-17-CLASS SINGLE-SHIP SEABASE
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Today’s global terrorist threat has the ability to operate in denied and sensitive regions of the world, performing missions to undermine government control through acts of violence delivered via unconventional methods. Operations against this type of enemy require a quick and decisive military capability. The flexibility, scalability, and unconstrained maneuverability inherent in a seabase, coupled with the decisive, powerful, and precise combat potential of Special Operations Forces (SOF), brings together a force capable of reacting quickly to changes in an operational theater requiring military diplomacy. A discrete-event simulation is used to explore and analyze various configurations to a seabase’s structure and force compliment for the purpose of sustaining multiple SOF units engaged in a variety of land-based operations. Analysis of the data generated by the model shows that the LPD-17 class is capable of sustaining multiple SOF units operating ashore. The allocated area for SOF equipment storage designed on the LPD-17 class does not constrain the ability to sustain multiple units. Embarking the maximum number of helicopters a LPD-17 class is designed for minimizes the occurrence of and time spent in a delayed state by a unit between mission assignments, and allows accomplishment of concurrent missions beyond logistic sustainment of SOF units.

KEYWORDS: Seabasing, Special Operations Forces, LPD-17 Class Ship, Discrete Event Simulation

A LITTORAL-COMBAT SHIP MANPOWER ANALYSIS USING THE FLEET RESPONSE-TRAINING PLAN
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Second Reader: Javier Salmeron, Department of Operations Research

The littoral combat ship, in its final steps toward employment, is an entirely new breed of U.S. Navy warship. USS Freedom (LCS 1), scheduled to be commissioned in May 2007, introduces an advanced technological platform. It includes, but is not limited to, several new optimal manning and training concepts (such as SHIPTRAIN and SMARTSHIP) introduced by the U.S. Navy. The littoral-combat ship wholeness concept of operations requires a crew to certify in fifteen mission areas using its core crew, and one additional mission area applicable to both the core crew and mission-module personnel.

Using a discrete-event simulation tool called the total-crew model, this study analyzes the currently proposed “Fleet Response Training Plan for the Littoral Combat Ship.” An examination using a fourteen-day training cycle snapshot of the forty proposed crew members is found to be sufficient to sustain the ship through a training-assessment phase.

The snapshot evaluates crew endurances using 63, 67, and 70-hour work weeks. The modeling shows the 70-hour work week satisfies the manpower requirement workload, as delineated in OPNAVINST 1000.16J. This work week, however, exceeds core crew endurances by 594 hours and 42% of the crew exceed acceptable fatigue levels. The model’s results indicate that eight additional core crewmembers are required to conduct the training-assessment phase without exceeding core-crew endurance.

KEYWORDS: LCS, Seaframe, Core Crew, Mission Module, Core System, Manning Model, Training, Total Crew Model, Fleet Response Training Plan, Discrete Event Simulation, Navy Work Week, Manpower Requirements
The Strait of Hormuz is a unique waterway vital to world commerce; as such, it is of military importance as well. The strait is narrow and has turbulent currents that change in intensity and direction due to the reverse estuarine flow of the Persian Gulf. On the border between extratropical and monsoonal atmospheric synoptic influences, the wind direction and intensity are dependent on time of year, which side of the strait (due to terrain), and time of day (due to land/sea-breeze cycles). Utilization of model field inputs (from near-real-time models) to tactical decision aids greatly enhances the information output by those aids.

Using the examples of drifting mines and oil spills, the utility of these model fields is shown when compared to climatology inputs. OILMAP, the oil-dispersion model developed at Applied Science Associates, is used in this study to demonstrate how the behavior of an oil spill reacts with model field inputs for surface winds and currents from the Naval Oceanographic Office and the Fleet Numerical Meteorology and Oceanography Center, followed by comparative analysis between climatology inputs. Drift-mine behavior is analyzed utilizing a simple Lagrangian drift model, with model field inputs compared to climatology inputs.

The results from the comparisons show that the variable nature of the wind/current direction and speed through the Strait is impossible to capture using climatology inputs. Winds less than 5 m/s are not a factor in the movement of an oil slick, even compared to the slowest of currents at ~10-15 cm/s. It is determined that the tidal nature of the currents through the strait, combined with the variable strength of winds, make prediction of oil-slick or mine-drift track unrealistic using climatology data. Therefore, using operational, near-real-time environmental data is necessary for information superiority.

**KEYWORDS:** Strait of Hormuz, Drift Mine, Oil Spill, OILMAP, SWAFS, COAMPS
An inverse imaging problem for through-the-wall imaging (TWI), using frequencies between 500 GHz and 1 THz, is investigated. Starting from first principles, this thesis uses Maxwell’s equations to develop a model for the transmission Green’s function. This simplified model is then used in a Lippman-Schwinger integral equation to predict the scattered field associated with interrogating THz waves. The effects of wave propagation through isotropic media are investigated, and methods for creating images from the scattered field are presented. These methods are examined using simulated data.
MASTER OF SCIENCE
IN
SOFTWARE ENGINEERING

A SYSTEM-OF-SYSTEMS INTERFACE HAZARD-ANALYSIS TECHNIQUE
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B.Eng., University of New South Wales, 2002
Master of Science in Software Engineering-March 2007
Master of Science in Systems Engineering-March 2007
Advisors: J. Bret Michael, Department of Computer Science
Paul Shebalin, Department of Systems Engineering

The next generation of military capabilities will hinge on systems-of-systems technologies, entailing the integration of numerous large-scale systems into a complex system of systems whose capability exceeds the capabilities of the individual systems. The increase in capability is due to the emergent properties of the system of systems. However, these emergent properties also introduce hazards that must be adequately dealt with before the system of systems can be employed. The current state of hazard-analysis processes is insufficient to deal with the complexity and size of a system of systems. This thesis aims to define the nature and types of hazards associated with systems of systems and to define a technique for identifying specific hazards within a system of systems.

In addition to developing a theoretical process, this thesis applies that process to a real-world case study, the Ballistic Missile Defense System. A software application is developed to prove the concept of the hazard-analysis technique. The technique has been designed from the top down to be compatible with current system-safety processes and as such, it is directly compatible with systems of systems currently in development and familiar to practicing system-safety engineers.

KEYWORDS: Systems of Systems, System Safety, System Hazard Analysis, Emergent Hazards

A CORRELATION BETWEEN QUALITY-MANAGEMENT METRICS AND TECHNICAL-PERFORMANCE MEASUREMENT
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The quality of software management has an affect on the degree of success or failure of a software-development program. This statement has been argued successfully by Martin J. Machniak in his thesis, “Development of a Quality Management Metric (QMM) Measuring Software Program Management Quality.” The QMM metrics can be used both to characterize the quality of software management and to provide a template for improving software-management performance.

Technical-performance measurement (TPM) in the most basic form is a plan of expected technical achievement in which the actual progress is compared with periodic measurements. However, the difference between the plan and the actual measures is a technical variance, which can be considered good or bad, depending on the level of tolerance given in the requirements. TPM is breaking new ground in the development of various techniques for TPM where planning is integrated with cost, schedule, and program-impact assessment.

The QMM questionnaire is administered to measure the perceptions of program managers who have the responsibility for software-development programs within the U.S. Army. TPM data is gathered using an informal verification and validation of the same programs used for the QMM questionnaire; the results are compared and found to be inconclusively correlated.
MASTER OF SCIENCE
IN
SYSTEMS ENGINEERING

INTEGRATING THE DEPARTMENT OF DEFENSE MILITARY SERVICES’ TECHNOLOGY DEVELOPMENT PROGRAMS TO IMPROVE TIME, COST, AND TECHNICAL QUALITY PARAMETERS
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Currently, the Air Force is developing the Space Radar (SR) system, the Navy the DD(X) 21st Century Destroyer, and the Army the Future Combat Systems (FCS). While technologies developed by the research, development, test, and evaluation (RDT&E) organizations affiliated with each military service often have pervasive utility among the services, the structures of these RDT&E organizations currently do not provide for or permit any substantial degree of synergistic teaming, integration, or technology leveraging. As a result, technological development for each of the SR, DD(X), and FCS programs has failed to achieve schedule efficiency, cost effectiveness, and technical proficiency. To enable successful development of these systems in particular, and to prevent DoD system acquisition programs from failing to achieve the aforementioned parameters, a leveraged technology-development strategy is needed.

This thesis examines the potential for inter-service technology development and identifies opportunities to leverage the development of common, critical technologies across the three services within the DoD in general, and across the SR, DD(X), and FCS programs in particular.

The findings of this study show that through careful planning and coordinated technology transition, DoD acquisition programs can indeed leverage the technological development of the three services within the DoD. The identified technology-leveraging opportunities will enable significant cost savings and schedule efficiency to the Space Radar, DD(X), and Future Combat Systems programs, and help ensure deployment of these critical defense capabilities.

KEYWORDS: Technology, RDT&E, Science, S&T Lab, Space Radar, DD(X), Future Combat Systems, Acquisition, Technology Transition, Development, Integration, Schedule

A SYSTEM-OF-SYSTEMS INTERFACE HAZARD-ANALYSIS TECHNIQUE
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The next generation of military capabilities will hinge on systems-of-systems technologies, entailing the integration of numerous large-scale systems into a complex system of systems whose capability exceeds the capabilities of the individual systems. The increase in capability is due to the emergent properties of the system of systems. However, these emergent properties also introduce hazards that must be adequately dealt with before the system of systems can be employed. The current state of hazard-analysis processes is insufficient to deal with the complexity and size of a system of systems. This thesis aims to define the nature and types of hazards associated with systems of systems and to define a technique for identifying specific hazards within a system of systems.
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**KEYWORDS:** Systems of Systems, System Safety, System Hazard Analysis, Emergent Hazards
MASTER OF ARTS

National Security Affairs
Security Studies
PAKISTAN’S MADRASSAS: WEAPONS OF MASS INSTRUCTION?
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Since September 11, 2001, Pakistan’s madrassas have come under scrutiny as possible breeding grounds for militant interpretations of Islam. The madrassas are not unique to Pakistan, and are in fact found throughout the Muslim world. However, Pakistan is a particularly interesting case since it was the staging ground for the Central Intelligence Agency (CIA) in opposing the Soviet invasion of Afghanistan. During this period, from 1979–1989, the CIA worked closely with Pakistan’s I.S.I. in providing arms and training to holy warriors or mujahideen to cross the border into Afghanistan and engage Soviet troops. This proxy war was funded by the United States and the Persian Gulf countries, most notably Saudi Arabia. In the years since this war ended, the madrassas (funded by Saudi Arabia) have continued to promote an austere interpretation of Islam called Wahhabism, which has a tendency to produce graduates with little human capital and an anti-Western worldview. This paper attempts to analyze these madrassas from a historical perspective in order to understand their shortcomings, and then proposes recommendations for both the United States and Pakistan in dealing with this complex and delicate phenomenon.

KEYWORDS: Madrassas, Afghanistan, Pakistan, Mujahideen, Education Sector Reform, ESR, Curriculum, I.S.I., CIA

IMAGINING DEFEAT: AN ARABIC HISTORIOGRAPHY OF THE CRUSADES
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Second Reader: Daniel Moran, Department of National Security Affairs

This study tracks changing conceptions of the Crusades among Arab authors, from medieval through modern sources. The study examines how current, emotionally charged interpretations of the Crusades came into the literature and how they came to resonate. The study shows that in medieval Arabic sources, the campaigns and settlement of the Christian Franks is not seen as a discrete event; despite modern interpretations of a two-hundred-year struggle between two sides, the Franks are seen as just one more facet in the political scene of the era, often of less concern than “internal” enemies. The study then tracks the introduction of the concept of the Crusades as a discrete event into Arab historical writing in the mid-nineteenth century, via Christian Arabs working from western sources, and its gradual inclusion in Muslim Arab historical thought. Finally, this study examines modern Arabic interpretations of the Crusades, colored by current experiences and nationalist and Islamic fundamentalist thought.

KEYWORDS: Crusades, Arabic History, Arabic Historiography, Arab Nationalism, Islamic Fundamentalism, Colonialism, Arab-Israeli Affairs, Jerusalem
Peru’s success in first defeating the Shining Path guerrilla movement in the early 1990s and then reducing coca cultivation in the mid–1990s demonstrates the effectiveness of a sequential approach to these problems; however, is the sequential approach an effective model for handling the dual threat, particularly in Colombia? This thesis examines the overall effectiveness of two distinctly different strategies for dealing with the dual threat of drugs and terrorism in Colombia: President Pastrana’s “drugs first” strategy and President Uribe’s unified campaign against both guerrillas and drugs. It finds that President Uribe’s unified campaign was more effective than President Pastrana’s sequential strategy. While President Pastrana’s drugs-first strategy was relatively effective in targeting the illicit drug trade, it did not eliminate the illicit drug industry, nor did it achieve its secondary objective of weakening the war-making capacity of the FARC-EP. President Uribe’s unified strategy met substantial initial success as regional and national security dramatically improved and a weakening of the FARC-EP was observed. Despite such success, elimination of the FARC-EP still remains beyond Colombia’s reach and the continuation of counter-narcotic policies seem to be reaping diminishing returns. To continue making progress against both threats, a continuation of a comprehensive unified campaign is required.

KEYWORDS: Colombia, President Pastrana, President Uribe, Drug Trade, Coca, Counter-Narcotics, FARC, FARC-EP, Revolutionary Armed Forces of Colombia, Government of Colombia, Insurgency, Terrorism, Plan Colombia, Plan Patriota, Demilitarized Zone, Democratic Defense and Security Policy, DSP

Military contacts between the United States and the People’s Republic of China have presented opportunities for leaders in both countries’ defense community to share information and promote transparency. Unfortunately, domestic and international factors have blunted cooperation in the past two decades. Many are quick to argue that the political turmoil caused by internationally significant events such as the Tiananmen Square crisis, the Taiwan Strait crises, the Chinese Embassy bombing, and the EP-3 incident disrupted defense-related exchanges and cooperation. Further examination of U.S. military-relations policy displaces these casual observations in favor of explanations based on more complex domestic political agendas and bureaucratic politics in the Department of Defense, which led to more enduring changes in policy and implementation. This examination finds that the CDRUSPACOM is the most engaged and consistent advocate of increased military-to-military relations across a broad spectrum of contacts regardless of the temperament in Washington, D.C.; while internationally significant events impacted military relations for a short period, the more enduring shifts in military-to-military policy were driven by domestic politics and defense-leadership changes; and despite claims of “gaining momentum” by many of the actors in both nations, military-to-military contacts appear no better off in 2006 than in the 1980s.

This thesis examines the prospects for conflict caused by water scarcity in Central Asia. The three most recent political eras of Central Asia are analyzed: Tsarist Russia, the Soviet Union, and the independent states of Central Asia. Indicators of water tensions, including water quality, water quantity, management of water for multiple uses, the political divisions and geopolitical setting, state institutions, and national water ethos, are considered. Although water is not likely to be the sole cause of a major regional conflict, the resource may be one catalyst of conflict or instability in the already weak region. Almost every indicator studied in this thesis worsened during the Soviet era and has not improved with independence. The current water situation in Central Asia leaves the region insecure.

**KEYWORDS:** Central Asia, Water, Former Soviet Union, Environmental Security, Environmental Conflict, Amu Darya, Syr Darya, Aral Sea

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This thesis assesses the reasons for the continuous division of the two Koreas and proposes necessary policies for Korean unification. In modern times, Koreans have been unable to determine their own destiny. Many examples show that Korea’s circumstances have been influenced by other countries. Korea’s division and the North Korean nuclear standoff are not solely Korean problems, but also international issues. In this context, Korean unification requires both domestic and international efforts. Also, for successful, consensual, and peaceful unification, domestic and international efforts should not be passive and reactive. They should be practical, proactive, and comprehensive.

In other words, Korean unification has been difficult because there have not been sufficiently proactive domestic and international efforts. Internal and external efforts can be implemented in three fields: military containment and negotiation, political negotiations, and economic and social engagement. These three approaches are the fundamental pillars on which to build successful unification. Proactive and synchronous implementation of the three policies is the pivotal point in order to deal with North Korea because each policy is important and can be implemented in different fields. Strong defense is critical to supporting other policy implementation. Political negotiations can deal with the peace treaty issue. Economically, an engagement policy should be maintained to open North Korea and provide humanitarian aid. Through the proactive implementation of those policies for Korean unification by the two Koreas and four powers, northeast Asia will be more stable and peaceful. Peaceful Korean unification will be an important first step on the road to a more peaceful world in the twenty-first century.

**KEYWORDS:** South Korea, North Korea, Korean Unification, The Korean War, The North Korean Nuclear Standoff, Northeast Asia Security, U.S. Policy
PROTRACTED PEOPLE’S WAR IN THE PHILIPPINES: A PERSISTENT COMMUNIST INSURGENCY

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The Philippine communist revolutionary movement is a historical relic, the exception rather than the rule. While much of Asia has opted for capitalism over communism, the idea of a workers’ paradise persists within the Philippines’ rural heartlands and university campuses alike. Established over thirty-seven years ago at the height of Mao’s Great Proletarian Cultural Revolution, the Communist Party of the Philippines continues its armed quest for state power. Regarded as the longest-running communist insurgency in Asia, the conflict between the Philippine government and communist insurgents has claimed the lives of an estimated 40,000+.

This thesis examines aspects of the Philippine government and the Communist Party of the Philippines, and its armed wing, the New People’s Army, in an attempt to explain why the Philippine communist insurgency remains a serious threat to the government and has not significantly declined in light of a long history of democratic rule in the Philippines. Analysis of the Philippine communist insurgency will contribute to the overall understanding of why this particular insurgency has survived where others failed, and may provide some insight to help the Philippine government identify and construct a counterinsurgency strategy to eliminate the Maoist threat.

KEYWORDS: Philippines, Insurgency, Communist, CPP, New People’s Army, NPA, People’s War

THE LIKELIHOOD OF COLLABORATION BETWEEN CENTRAL AMERICAN TRANSNATIONAL GANGS AND TERRORIST ORGANIZATIONS

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This thesis focuses on the issue of the growing threat of transnational criminal gangs spreading throughout Central America and the United States. Specifically, the thesis addresses the Mara Salvatrucha (MS-13) gang, examining how this particular gang emerged as a formidable public-security threat. A common misconception holds that transnational gangs like MS-13 emerged in Central America; however, these gangs have their origins in the gang lifestyle found in the U.S. Since the early 1990s, MS-13 and similar transnational gangs have established criminal networks specializing in drug, arms, goods, and human smuggling. These operations pose a grave threat to U.S. national security: intelligence reports surfaced in 2004 indicating a possible meeting between an al-Qaeda lieutenant and members of MS-13. Due to these reports, U.S. agencies (such as the Federal Bureau of Investigation and Immigration and Customs Enforcement) are among the agencies that have started to work closely in monitoring transnational gang activity in the U.S. and the western hemisphere. While MS-13 does not hold any anti-American sentiment, the gang will work with the highest bidder without hesitation. Therefore, this thesis addresses the organized-crime/terrorist-organization discussion within the academic and intelligence communities, including how globalization serves to facilitate such a link. The thesis helps to explain how current Central American legislation is forcing transnational gangs to go “underground” to survive. Findings highlight the need to move towards a more multifaceted strategy in order to ensure long-term solutions to the proliferation of transnational gangs (not obtainable with current heavy-handed methods), while concurrently reducing the risk of a terrorist–transnational-gang link in the western hemisphere.

KEYWORDS: Mara Salvatrucha, MS-13, Transnational Criminal Gangs, Gangs, Organized Crime, Terrorism, Central America, Western Hemisphere, Globalization
As a repercussion of the phenomenal Chinese economic growth over the past few decades, China is forced to deal with the challenge of meeting an equally rapid increase in energy demand. China realizes that its continued economic expansion is reliant on its ability to meet this growing need. Over 80% of the world’s proven oil reserves are located in the Middle East, and China realizes that Middle Eastern states will play a vital role in Beijing’s ability to meet its energy demands in the future. As a result, China has aggressively pursued closer political, military, and economic ties with Middle Eastern states. China’s actions have come in conflict with U.S. policies in the Middle East, and currently, there is much debate regarding China’s intentions in the Middle East. Some believe China’s actions are intended to challenge U.S. power and influence in the Middle East. Others believe that China is simply acting in its economic interests. This thesis examines China’s policies and actions and attempts to determine whether China is acting in the offensive realism or economic interdependence school of thought. Two cases in particular are examined—Saudi Arabia and Iran—and it is concluded that China’s behavior is closely aligned to the economic interdependence school of thought.

**KEYWORDS:** United States, China, Iran, Saudi Arabia, United Nations, Oil, Energy, Natural Gas, Trade, Military, Nuclear, Foreign Aid, Investments, Political Relations, Arms Sales, Oil Equity Deals, Technology Transfer, Nonproliferation

Health capital in Russia is in steep decline. Today, the Russian population is decreasing by more than 700,000 per annum. Life expectancy has decreased significantly since it peaked in the mid–1960s. Infectious diseases, including an emerging HIV/AIDS epidemic, are threatening to worsen Russia’s health crisis and further overwhelm a dilapidated healthcare system. Soviet and Russian government policies aimed at preserving health capital have failed consistently. Government policies and intervention have contributed to the crisis. The purpose of this research is to identify a possible explanation for the continuity of ineffective government policy. The analysis indicates that the influence of a paternalistic political culture permeates the political process. As a result, the government is free to pursue its own agenda without a significant degree of accountability to the population. Issues affecting health capital are not a priority of the government. The consequence, therefore, is shortsighted, uncoordinated, and under-funded government policy and programs. Long-term improvements to Russia’s health capital will require a shift in the political culture. State–society relations must evolve to allow and encourage greater interaction between state officials and the general population. Without government accountability or individual responsibility, health capital in Russia will continue to decline.

**KEYWORDS:** Russia, Health, Health Capital, Demographics, Population, Healthcare
Since the end of the Cold War, civil–military cooperation (CIMIC) units have become more frequently involved in peace-support operations (PSOs). Moreover, they have become more deeply engaged with peoples of different national and organizational cultures. These multicultural peacekeeping environments are rife with communication difficulties. Coordination and cooperation between numerous actors present in the field, such as international organizations, non-governmental organizations, media, local authorities, tribal leaders, and other individuals, has proved to be very challenging. Moreover, considering the nature of contemporary international interventions, any CIMIC staff is required to adapt to a wide range of new, non-military skills, which would constitute a necessary “toolbox.” Culturally sensitive communications, such as negotiation and media interactions, are vital to effective coordination and cooperation in modern peacekeeping. Thus, CIMIC officers must know how to deal with the media; how, despite enormous cultural diversity, to successfully conduct their jobs; how to work efficiently with interpreters; and finally, how to resolve local conflicts using negotiations.

Besides defining the new phenomena influencing CIMIC activities in PSOs, this thesis provides suggestions or basic universal guidelines for soldiers, especially for those acting at the tactical level. At the same time, the thesis should draw the attention of those people responsible for creating and executing the entire pre-deployment training for CIMIC soldiers who are going to be working abroad. Suggestions presented in this thesis meet current needs for training.

**KEYWORDS:** CIMIC, Peacekeeping, Communication, Culture, Negotiations, Media, Interpreters
Guard. Finally, reasons why the Coast Guard succeeded are presented, along with a list of actions other agencies may take to improve their public-affairs posture.

**KEYWORDS:** Risk Communications, Crisis Communications, Hurricane Katrina, U.S. Coast Guard, Public Affairs, Media Relations

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**CHEMICAL-INDUSTRY SECURITY: VOLUNTARY OR MANDATORY APPROACH?**

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A successful attack on a hazardous-materials storage facility has the potential to cause mass casualties and panic. Although the risk and consequences vary greatly among these sites, there are a significant number of facilities with tens of thousands of individuals who live and work in the vulnerability zone. Until P.L. 109-125 was enacted on October 4, 2006, which required the Department of Homeland Security (DHS) to issue regulations establishing risk-based performance standards, the federal policy for securing chemical facilities from terrorist attack relied entirely upon voluntary actions by industry.

Though it is sure to create controversy, this thesis proposes the need for new legislation that mandates standards for chemical industry security, yet also addresses the economic and implementation impacts. DHS, in close partnership with the Environmental Protection Agency (EPA), is best suited to undertake this responsibility. In addition, state delegation of oversight responsibility is necessary to address the resources required to handle such a large number of sites. Public participation in preparedness and response activities is vital to reduce the fear and anxiety inherent to acts of terrorism. Inherently safer technology evaluations are recommended for the chemical sector through regulatory amendments to the Clean Air Act, Section 112.


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**RETHINKING INTELLIGENCE TO INTEGRATE COUNTERTERRORISM INTO THE LOCAL LAW-ENFORCEMENT MISSION**

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Law-enforcement agencies are constantly challenged by a changing threat environment, and they attempt to meet the challenges with the resources they have. For the past twenty years, terrorism has been a dangerous threat to America, while community expectations to address crime have also grown. Americans rely on local, state, and federal law enforcement to understand this threat and to incorporate counterterrorism efforts into their already full missions. In looking for the best ways to understand and combat the threat of terrorism, intelligence-led policing (ILP) has been offered as an effective strategy to improve police effectiveness. This thesis studies the ILP practices of two police departments—Metro Nashville and Chicago—and analyzes those elements of their strategies that contribute to successful ILP. This analysis validates the elements of the 3i model of effective ILP operations, and emphasizes several other elements as critical strategic elements necessary for an agency to develop and implement a successful ILP strategy.
ILP is an effective policing strategy and the critical strategic elements identified in this thesis should serve as the foundation for efforts to build capacity in an agency. This thesis furthers these critical elements and presents a framework for agencies to implement ILP.

**KEYWORDS:** Intelligence Led Policing, Law Enforcement Counter Terrorism, Crime Analysis, Law Enforcement Intelligence, Police Management

**REQUIREMENTS AND INFORMATION METADATA SYSTEM**

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This thesis proposes an adoption of a data schema called RIMS (Requirements and Information Metadata System), developed as a pilot project in the Pittsburgh field office of the Federal Bureau of Investigation (FBI), and attempts to determine whether RIMS could be an effective and efficient method to capture, catalogue, and retrieve intelligence information within the FBI. RIMS would enhance the search platform used by FBI analysts and investigators who gather or data mine existing information in furtherance of the FBI’s priorities.

The use of this coding system can be adapted for use by other U.S. intelligence and law enforcement communities for commonality and uniformity in retrieval, cataloguing, and collection of intelligence information. The use of this system can be manipulated into a non-classified code for use by state, local, and tribal law enforcement and intelligence entities. Finally, the use of the coding system within the intelligence community will consolidate and integrate information and intelligence and reduce delays in detecting and retrieving pertinent intelligence obtained and shared within the intelligence community.

**KEYWORDS:** Information Sharing, Intelligence Community, Metadata, Integrate Information, Intelligence, Information Tagging

**CITIZEN PREPAREDNESS CAMPAIGN: INFORMATION CAMPAIGNS INCREASING CITIZEN PREPAREDNESS TO SUPPORT CREATING A “CULTURE OF PREPAREDNESS”**

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Citizen preparedness has been a requirement since the events of September 11, 2001. The need for citizen preparedness was reinforced after Hurricanes Katrina and Rita in August 2005. Although National Strategy documents outline the requirement for citizen participation in national preparedness, the requirement is met through volunteerism (using the Citizen Corps). There are currently readiness programs being conducted through the Citizen Corps, the Department of Homeland Security, and the Federal Emergency Management Agency, but they are neither coordinated across the federal, state, and local organizations, nor proactive in nature. Proactive information campaigns using core and supporting elements can be one methodology to increase citizen preparedness to support the creation of a “Culture of Preparedness,” which includes citizen participation, along with all levels of government and the private sector. Homeland security stakeholders can use the Information Campaign Model (developed to formulate proactive information campaigns) to increase citizen preparedness.

**KEYWORDS:** Information Campaign, National Homeland Security Strategy, National Preparedness Goal, Benefits and Consequences, Incentives and Enforcement, Objectives, Audience Assessment, Themes and Messages, Methods
CREATING A COORDINATED GAME PLAN: IMPROVING TEAMWORK BETWEEN LAW ENFORCEMENT AND THE CALIFORNIA NATIONAL GUARD

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The author of this thesis contends that the legislative mandate for National Incident Management System compliance has created an efficient and expeditious relationship between civil authorities and military resources; however, a lack of information regarding each other’s roles and capabilities, coupled with differences in culture, communications, logistics, and command-and-control structures has resulted in subpar interaction in actual responses and exercises since the attacks of September 11, 2001. Emergency responders at the local and state level have frequent interaction, but clear protocols, guidelines, and exercises are required to create the same level of teamwork with military assets. Because of the variety of controlling legislation and political priority governing each state’s National Guard, this thesis offers recommendations for improving the interaction between California local authorities, the California National Guard, and the United States Northern Command.

KEYWORDS: Civil/Military Assistance, Law Enforcement Mutual Aid, California National Guard


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In order to commit attacks against the U.S. homeland, terrorists must enter the country. Stopping their entry is key to preventing attacks. The National Commission on Terrorist Attacks Upon the United States’s “Monograph on 9/11 and Terrorist Travel” identifies pre-9/11 gaps and weaknesses in U.S. immigration, visa, customs, and border-security systems. This thesis considers the implementation of the 9/11 Commission’s key recommendations for immigration: 1) provide standardized operational training and additional guidance to immigration, visa, and customs personnel, 2) establish a foreign-student visa-compliance and tracking system, the Student and Exchange Visitor Information System (SEVIS), and 3) develop and implement the National-Security Exit-and-Entry Registration System (NSEERS). This thesis also assesses the effectiveness of these policies as counter-terror measures to determine if they can stop terrorists from entering the U.S. Bruce Schneier’s Beyond Fear: Thinking Sensibly About Security in an Uncertain World provides a five-step model to analyze and evaluate security systems, technologies, and countermeasures. Schneier’s model is applied to assess the implementation/effectiveness of the three key recommendations. To effectively establish priorities and efficiently allocate resources, policymakers require assessments of implemented homeland security recommendations. This thesis offers such an assessment.

CAPACITY-BUILDING AND SUSTAINMENT: FOCUSING ON THE END-STATE FOR HOMELAND SECURITY
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Since 9/11, the U.S. has developed policies to counter the terrorist threat. Integral to those policies is preparedness. Homeland Security Presidential Directive 8 states that preparedness will include “capacity-building prevention activities such as information gathering, detection, deterrence, and collaboration related to terrorist attacks.” Despite the criticality of capacity-building in relation to preparedness, the term is not defined.

There has been no discussion on what capacity-building means. The term is often equated to federal assistance or used interchangeably with capabilities and capability-based planning. Capacity-building strategies, however, are distinct and link into wider economic, political, and societal issues. Despite capacity-building’s criticality to preparedness and sustainment, various or ambiguous interpretations will translate to differences in strategic priorities. This thesis examines the existing strategies to determine the linkage between capacity-building, preparedness, sustainment, capability, capability-based planning, and the envisioned end-state. It also addresses sustainment issues and homeland-security costs based on differing capacity-building interpretations. The end product is a capacity-building definition that captures the costs and variables with building and sustaining capabilities. This thesis also demonstrates how capacity-building measures serve as the foundational premise for a sound homeland-security strategic plan.

KEYWORDS: Homeland Security, Capacity Building, Capabilities, Capability-Based Planning, Strategy Sustainment, End-State

GOVERNMENT EXPECTATIONS AND THE ROLE OF LAW ENFORCEMENT IN A BIOLOGICAL INCIDENT
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Currently, government and public health are drafting emergency response plans regarding biological events (man-made and natural) that include responsibilities for law enforcement. Yet police officers are unaccustomed to working with biological agents or responding to biological incidents, and have little, if any, experience in this area. Therefore, their expectations and concerns are unknown and their willingness to respond is untested. Through the use of focus groups, officers are asked questions about their thoughts and concerns regarding responding to a bio-incident. The focus groups consist of over forty police officers, from more than five different agencies in the National Capitol Region.

Research results demonstrate that most police officers are willing to respond to a biological incident; however, they expect that their families will be properly cared for by their agency, which presents a problem if there is no vaccine available. Other areas explored include the officers’ expectations of the public and of their respective agencies in a bio-incident. The research concludes with recommendations regarding ways to prepare the public to have realistic expectations of law enforcement and the need to create a family-support unit within each agency, as well as other recommendations.

KEYWORDS: Law Enforcement, Public Health, Community, Biological Incident, Police Officer, Expectations, Government, Pandemic
SECURING NUCLEAR AND RADIOLOGICAL MATERIAL IN THE HOMELAND
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It is well established among the intelligence community that terrorists view the acquisition of nuclear or radiological materials (NRAM) as a goal in furtherance of their efforts to attack the U.S. within its borders. The use of NRAM in a nuclear weapon of mass destruction (WMD) or a radiological-dispersion device (RDD) could potentially kill and injure thousands of American citizens. The impact of such a terrorist act on U.S. soil could cause profound economic damage, and would terrify the nation.

While international efforts have been underway for many years to better secure military nuclear weapons and materials, this research finds that a comprehensive national-security strategy in the U.S. for commercial nuclear facilities and materials has lagged far behind. While some strides were made in 2005 through measures taken by the U.S. Nuclear Regulatory Commission (NRC) to better secure nuclear power-generating facilities, there is no similar comprehensive security strategy for NRAM stored or being transported in the U.S. This poses a potentially serious threat to homeland security.

This research reviews the present statutory and regulatory scheme for NRAM, and outlines a dramatic new approach that will better ensure U.S. homeland security.

KEYWORDS: NRAM, Nuclear, Radiological, Security

THE IMPACT OF CONTEXTUAL-BACKGROUND FUSION ON PERCEIVED VALUE AND QUALITY OF UNCLASSIFIED TERRORISM INTELLIGENCE
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Second Reader: David Brannan, DoD Contractor

There are millions of police, fire, public health, emergency medical, emergency management, and public-sector homeland-security professionals ready and willing to assist in the global war on terrorism, and current strategies to strengthen homeland security include the provision of unclassified intelligence products to these nontraditional recipients (NTRs). Simply pushing intelligence products to NTR is not enough—NTRs must possess adequate contextual background to effectively utilize intelligence provided by the intelligence community (IC) in implementing strategies in information-driven and risk-based prevention and response. Given the diversity of NTRs, distribution of “one size fits all” products ensures that the intelligence will fit no one’s needs.

This thesis researches the impact of intelligence contextual-background fusion (CBF) through the use of hyperlink technology and evaluates the likelihood of hyperlink acceptance by NTRs. By utilizing Department of Homeland Security and Federal Bureau of Investigation customer-satisfaction surveys regarding “quality” and “value” factors, along with previously validated technology-acceptance model (TAM) questions in “ease of use” and “usefulness” factors, this research finds that CBF significantly improves both perceived value and quality, and also finds that NTRs overwhelmingly prefer a CBF product. NTRs broadly accepted hyperlink technology in this application.

KEYWORDS: Information Sharing, Intelligence Sharing, Law Enforcement, Private Sector, Fire, Intelligence Products, Emergency Medical Services, EMS, Context, Background, Technology Acceptance Model, TAM, Emergency Management, Public Health, Unclassified, Value, Quality, CBF, Fusion, NTR, Intelligence
PARTNERSHIPS: THE PATH TO IMPROVING CRISIS COMMUNICATION
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The global availability of 24-hour broadcast news has established the media as a critical link to communicating with the public in times of crisis. As a result, the broadcast-news media play a significant role in shaping how the public will react in a crisis. Since fire and police departments will likely be the media’s primary source for information in the initial stages of a disaster, preventing loss of life depends on how quickly information is delivered to the public. However, positive working relationships between public safety and the media are often hampered by differences in police and fire cultures, distrust, and lack of clear understanding of each other’s roles and responsibilities. The safety messages delivered by public-safety officials and the media in an emergency have the power to influence the way the public behaves and the protective actions they take. This report looks at how forming nontraditional partnerships between public-safety agencies and the media can be used effectively to give direction to the public before, during, and after a crisis. This report proposes a set of recommendations to help public-safety agencies avoid costly communication mistakes, utilizing best practices and lessons learned from recent high-profile incidents.

KEYWORDS: Public Safety, Broadcast Media, Public Safety and Media Partnerships, Crisis Communication

TERRORISM-INFORMATION MANAGEMENT WITHIN THE NEW YORK CITY FIRE DEPARTMENT: PAST, PRESENT, AND FUTURE
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The New York City Fire Department (FDNY), like the entire fire service, has been proven to be a primary stakeholder in homeland security. The mindset of firefighters is influenced by traditional and expected roles that are not fully considerate of the challenges accompanying the “new enemy” of terrorism. A fundamental deficiency is herein identified as the manner in which information is managed. The FDNY must adapt so as to recognize information as an entity that must be collected, saved, and utilized holistically for greater preventive and response capabilities. It must adopt lessons learned by others in the pursuit of better information management. These needs also exist, to a great extent, within the national fire service. This thesis uses a detailed analysis of existing FDNY information systems, a review of the criticality of information to past events, and perspectives of FDNY firefighters to identify common denominators of deficiency. It examines the manner in which others have confronted the issue of information management with an eye toward extracting salient lessons. The operational and psychological ramifications of poor information management are explored. Finally, concepts that hold promise for the underpinning of practical solutions to the information management problem are presented.

KEYWORDS: New York City Fire Department, FDNY, New York City Police Department, NYPD, Information, Intelligence, Terrorism, Prevention, Information Sharing, Information Management, JTTF, Situational Awareness, World Trade Center, 9/11, FEMA, Urban Search and Rescue, Terrorism Liaison Officer, TLO
In the process of international socialization, states are induced to adopt the constitutive norms and rules of the international community. This thesis examines the process of norm transfer by international organizations (IOs), specifically the European Union (EU) and NATO. Generally, international norms are diffused through IO enlargement or, as an alternative, through the partnership between the organization and non-member states.

The ultimate success of socialization depends on the strategies, mechanisms, and tools that are used by each socializing agent. The effectiveness of IOs’ norms diffusion in dealing with partners is greater when the organizations apply differentiated, multi-staged socialization strategies that imply various levels of conditionality and offer powerful incentives that encourage domestic transformation.

This study evaluates the effectiveness of the socialization strategies of the EU and NATO towards their East European neighbors, given the fact that a prospective membership is not on the table. The main argument of this thesis is that, despite all positive achievements and results to date, the European Neighborhood Policy (ENP) as a norm-diffusion mechanism is less effective than the Partnership for Peace (PfP) program, and could be improved by more actively applying the PfP’s experience.

KEYWORDS: Norm Diffusion, International Organizations, International Socialization, Socialization Strategies, European Neighborhood Policy, Partnership for Peace Program, Political Conditionality, European Union, NATO

This thesis analyzes civil–military relations in European security institutions by evaluating the organizational and institutional mechanisms needed to exercise democratic civilian control over the military elements that adapted to or emerged in response to the need to conduct peace operations. The goal is to assess the importance of civil–military relations in planning and conducting peace operations.

European security institutions have been involved in peacekeeping operations in the Balkans for more than ten years. Their effectiveness is measured by a dramatic decrease in violence. In Bosnia and Herzegovina, the number of troops decreased from 60,000 in 1996, when the NATO-led implementation force was deployed, to a planned 2,500 at the end of 2007. The number of military forces involved in providing security, a normal task for them, is even smaller.

The thesis argues that one of the factors that influenced the improvement of the effectiveness of the peace-keeping forces in the Balkans after NATO took over the mission in 1995 is that NATO and EU military forces received clear missions and comprehensive political guidance from their political decision-making bodies. Because civilian structures did not micromanage the conduct of operations, despite the complex environment in which they operated, their effectiveness increased.

KEYWORDS: European Security Institutions, Civil-Military Relations, European Union, CFSP, NATO, UN, Peace Keeping, Peace Operations, Bosnia and Herzegovina, Multi-Institutionality
REDUCING THE “GAP OF PAIN: ” A STRATEGY FOR OPTIMIZING FEDERAL RESOURCE AVAILABILITY IN RESPONSE TO MAJOR INCIDENTS

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In large-scale domestic disasters, a temporal gap frequently develops between the exhaustion of state and local resources and the arrival of federal resources. To date, strategies for reducing this so-called “gap of pain” have not been based upon scientific methodology. This thesis reviews four alternatives for ensuring continuous availability of critical commodities: pre-positioning, preemptive federal action, phased deployment, and surge transportation. For a given scenario, the optimum approach is likely to be some combination of these alternatives. Stochastic modeling using optimization techniques holds great promise for producing efficient and effective strategic solutions. This thesis evaluates one such model using two notional scenarios affecting the Washington, D.C. metropolitan area: a Category 4 hurricane and a one-kiloton nuclear explosion near the city center. The results reinforce the validity of using this method to generate viable strategic alternatives for consideration by senior decision makers. With additional development and testing, the model may be productively applied to a range of natural and manmade incidents in disparate locations.

KEYWORDS: Disaster Relief, Humanitarian Logistics, Stochastic Models, Pre-Positioning, Surge Transportation, Pre-Deployment

A THEORY OF STATE BEHAVIOR UNDER THREAT: THE TRAGEDY OF DOMESTIC REALISM

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This thesis introduces the theory of domestic realism to explain and predict state behavior under threat. The formulation of the theory relies on a dual-track approach. The first is eclectic and deductive; this track utilizes concepts from diverse fields, especially from international-relations theory, to build the theory. The second track is inductive and illustrates the theory by introducing four case studies.

Domestic realism holds that under perceived high threats, the behavior of states, their institutions, and those citizens responsible for security are marked by aberrations that starkly depart from their espoused norms, laws, and values. The prime concern for security and self-preservation trumps all other legal constraints and ethical considerations.

In spite of the tragic and unsettling nature of this concept, it behooves us to accept the domestic-realism notion that aberrations in behavior are inevitable in the face of looming threats. Only through increased awareness can leaders be inoculated and educated at different levels to account for the manifestations of domestic realism as they formulate and implement policies, prompting them to be proactive and to incorporate mechanisms for oversight and accountability in order to counter or at least mitigate potential excesses.

This thesis analyzes past, current, and proposed immigration policies that address illegal immigrants already living inside the United States. Although these policies were developed under different circumstances, they all shed light on future challenges regarding this issue. These policies are synthesized to show what components of each will be most effective for future policies. The overall objective is to promote a comprehensive strategy that both manages illegal immigrants already inside the United States and develops a legal path for future immigrants to follow.

**KEYWORDS:** Illegal Immigration, IRCA, CIRA, Amnesty, U.S.-VISIT, Immigration

Despite dire predictions from the federal government, academia, and private research institutions about the threat posed by nuclear and radiological terrorism, the federal government has yet to develop an overarching organizational framework to collectively plan and prepare for the horrendous consequences of such an attack. In addition, the federal government has yet to develop even a modest program to provide technical planning and preparedness assistance to those local officials charged with coordinating the response to nuclear or radiological terrorism—the local emergency managers. To reduce loss of life, social panic, and the direct and indirect economic costs caused by a nuclear- or radiological-terror attack, the federal government should pursue a suite of strategic national and regional organizational innovations designed explicitly to prepare the nation’s emergency-management community and other first responders for their critical roles during a large-scale radiological response. First among these innovations should be the promulgation of a new homeland-security presidential directive establishing a domestic nuclear-preparedness office. Such organizational improvements, coupled with an aggressive, field-level, technical-assistance planning, training, and exercise campaign, will enable the United States to build a sophisticated and coordinated nuclear- and radiological-terrorism preparedness-and-response system.

**KEYWORDS:** Radiological Dispersal Device, Improvised Nuclear Device, Emergency Managers, Federal Radiological Preparedness Coordinating Committee, Unified Command, Regional Radiological Assistance Committee, Domestic Nuclear Preparedness Office
MEASURING THE FOUNDATION OF HOMELAND SECURITY
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Advisor: Christopher J. Bellavita, DoD Contractor
Second Reader: Joseph V. Saiita, Virginia Department of Health

This thesis provides a self-assessment tool to compel discussion concerning homeland-security teamwork. Building on research focusing on collaboration and teamwork as essential for homeland security, it is asserted that teamwork is the foundation of homeland-security capability. Components of teamwork among local, multidisciplinary organizations with a common homeland security mission are defined, to provide statements for each of the components and enter them into a metric for measuring teamwork. Results of the research yield five components of teamwork, highlighting leadership as the key to implementation. Focus groups of local homeland-security professionals are used to authenticate research findings. Three statements are developed from research and focus groups to measure the five components of teamwork. A focus group from Seattle homeland security reviews and revises the final teamwork metric to assure its usefulness for homeland-security organizations. It is recommended that standard methodologies be used to establish actual validity and reliability of the teamwork metric. Finally, a discussion on the interrelation between teamwork, organizational change, and leadership is provided.

KEYWORDS: Teamwork, Collaboration, Multidiscipline Teams, Cross-Functional Teams, Metrics, Survey, Leadership, Organizational Change

THE DEVELOPMENT AND RECOGNITION OF HOMELAND-SECURITY LAW
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This thesis considers those laws created in direct response to the terrorist attack of since September 11, 2001, and intended to protect the American homeland from further attacks. The paper discusses whether a practice area of homeland-security law has arisen, commensurate with the growth of homeland security as a separate professional discipline. Just as Congress passed thousands of pages of legislation in response to the events of September 11, 2001, the Department of Homeland Security, created by one of those new laws, is churning out thousands of pages of federal regulations, and thousands of federal workers now seek to regulate and impose new legal standards on U.S. citizens and businesses. After reviewing the congressional, executive, and legal-profession responses to September 11, 2001, a survey is created and sent to those attorneys who hold themselves out as practicing or teaching “homeland-security law.” The intent is to determine whether the legal profession should now recognize homeland-security law as a separate practice area, and if not, what steps are necessary before a practice area is recognized. Interviews are also conducted with representative experts in private- and public practice and the academy.

A substantial majority in both the surveys and the interviews finds that anti-terrorism laws, emergency management, and critical-infrastructure resiliency and protection are included within the area of “homeland-security law.” A working definition of homeland-security law, then, is “those laws and regulations enacted or promulgated to ensure domestic security from manmade or natural attack or disaster.”

APPLYING GOLDWATER-NICHOLS REFORMS TO FOSTER INTERAGENCY COOPERATION BETWEEN PUBLIC-SAFETY AGENCIES IN NEW YORK CITY

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Interagency conflict between police and fire departments throughout the country has existed for many years and is generally attributable to competition for limited municipal dollars and overlapping areas of responsibility. New York City (NYC) is frequently cited as the most egregious example of this rivalry. The relationship between NYC’s emergency-response agencies, and the resultant lack of integrated strategic planning, has many parallels to the situation within the Department of Defense from the years after WWII until the passage the Goldwater–Nichols Act in 1986. That act is widely credited with changing the culture of the DoD from service parochialism to jointness, and allowing the military to seamlessly coordinate and integrate its war-fighting activities across service lines.

This thesis recommends that NYC adapt several provisions of the Goldwater–Nichols Act to change the underlying attitudes and cultures of its first-responder agencies. By encouraging personnel to focus their planning, training, and operational activities on what benefits the city as a whole, as opposed to the individual agency to which they belong, the city will profit from the improved coordination, communication, and cooperation necessary to prepare for and respond to emergencies of any magnitude.


STRATEGIES FOR THE INTEGRATION OF MEDICAL AND HEALTH REPRESENTATION WITHIN LAW-ENFORCEMENT INTELLIGENCE-FUSION CENTERS

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Terrorism-related intelligence gathering, analysis, and information dissemination would be improved and enhanced by including a medical and health element in law-enforcement intelligence-fusion centers. The lack of medical representation and participation in intelligence analysis and information dissemination has been an obstacle to effective terrorism prevention, preparedness, and response. Terrorist acts, including release of weapons of mass destruction, would have a significant and profound impact on the medical and health community, who should work more closely with intelligence and be privy to terrorism-related information and alerts. The three areas of implementation examined include the FBI’s Joint Terrorism Task Force, state-level fusion centers, and local (city, county, and regional) terrorism early-warning groups. The Terrorism Liaison-Officer Program is examined as an option for medical involvement in anti-terrorism efforts. Literature on the subject shows overwhelming support for the involvement of non–law-enforcement public-safety representation, including the medical and health communities, in intelligence-fusion centers.

KEYWORDS: Intelligence, Fusion Center, Law Enforcement, Terrorism, Medical, Health, Emergency Medical Services, Public Health, Weapons of Mass Destruction, Information Dissemination
To accommodate the nation’s escalating demand for natural gas, which is expected to increase 700% by 2030, the natural-gas industry will likely build several new liquefied-natural-gas (LNG)-import terminals. The location of these terminals is an important strategic decision that significantly impacts the resiliency of the nation’s natural-gas supply and distribution network. Due to public opposition in many communities and shortcomings in the current licensing process, any additional LNG-import terminals are apt to be concentrated along the Gulf Coast. Unfortunately, such an impending concentration will increase the vulnerability and diminish the resiliency of this critical infrastructure. This thesis uses network theory to forecast how the location of new terminals will impact the risk, vulnerability, and resiliency of the natural-gas supply and distribution network. To enhance the resiliency and reduce the vulnerability of the infrastructure, researchers argue that network-analysis methodology should be applied during the terminal-siting process. The federal government must act quickly to facilitate siting of terminals in locations that reduce vulnerability and improve resiliency. Failure to act will squander an unprecedented opportunity to shape and intelligently design this portion of the nation’s critical infrastructure.

KEYWORDS: Liquefied Natural Gas, LNG, Critical Infrastructure, Resiliency, Vulnerability, Network Analysis, FERC, Federal Energy Regulatory Commission, United States Coast Guard

BUILDING COLLABORATIVE CAPACITY FOR BIOSECURITY AT GEORGIA SEAPORTS
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When public-health interventions are incorporated into a comprehensive seaport-security strategy, they can effectively prevent and reduce morbidity and mortality resulting from natural- or manmade disasters. The challenge is to build collaborative capacities through new and renewed seaport-surveillance activities among government agencies and private companies to strengthen the role of public health to detect, intercept, and mitigate the potential effects of the intentional or unintentional introduction of disease. Currently, effective collaborative processes between public-health agencies and other local, state, and federal partners in seaport security are weak, primarily the result of informal activities. Although seaport security receives considerable policy attention in other areas of risk management, such as radiological detection, public-health investments are largely neglected. Effective, sustainable approaches to building interagency collaboration could prove to be an indispensable homeland-security initiative to prepare for a bioterrorism attack or infectious-disease incidents.

KEYWORDS: Biosecurity, Quarantine Stations, Health Screening at Border, Public Health Response, Collaborative Capacity, Syndromic Surveillance, Infectious Disease Response Protocol, Bioterrorism
The nation’s ability to respond to natural- or manmade disasters has remained relatively unchanged since the attacks of 9/11. Current response operations are characterized by the inability to efficiently produce a collaborative and effective response to incidents of national significance and to address the challenges of the information age. The military has adapted network-centric tenents and principles from business applications to effectively operate in the information age and increase mission effectiveness. These tenents and principles can be adapted by responders to address current deficiencies and increase mission effectiveness. Implementation of “network-centric response” is both technologically and organizationally feasible. Network-centric-response operations would allow responders to meet the challenges and leverage the opportunities of the information age, resulting in increased mission effectiveness.


After more than seven years of funding through the Centers for Disease Control and Prevention, local public-health agencies have made inconsistent progress in fulfilling their homeland-security objectives. Most progress has been made in those areas in which public health has previous experience. However, in those activities requiring integration with other responder agencies, public health has lagged in developing effective capabilities in prevention, preparedness, response, mitigation, and recovery. This thesis argues that several factors contribute to this lack of success, including funding structures and guidelines, the reluctance on the part of other responder agencies to include public health in emergency planning and response activities, and the organizational isolation in which public health has existed.

In order for local public-health agencies to meet their homeland-security objectives, funding structures and guidelines must support local public health, and public-health agencies must be better integrated with their homeland-security partners. Public-health agencies at all levels, and their leadership, have the opportunity to effect organizational changes designed to accelerate transformation, enhancing their homeland-security partnerships. Public-health agencies can be more effectively integrated into the larger homeland-security community by demonstrating commitment to these changes.

**KEYWORDS:** Public Health, Integration, Collaboration, Homeland Security
THE PUZZLE OF NATO–UKRAINE RELATIONS: THE IMPORTANCE OF IMAGE IN UKRAINE'S BID FOR NATO MEMBERSHIP

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This thesis examines the puzzle of NATO–Ukrainian relations and the uncertainty that characterizes the nation’s integration into NATO. Despite Ukraine's pluralistic reforms, considerable democratic advances, and President Victor Yushchenko's continuous assertion of the high priority given Euro-Atlantic integration in Ukrainian foreign policy, NATO does not perceive Ukraine as a potential ally. In addition, the majority of the Ukrainian population holds a distorted and negative image of NATO and objects to the idea that their nation will join the alliance.

The politico-psychological realm of international-relations theory offers a framework to demonstrate the importance of image in NATO–Ukrainian relations and thus explains the puzzling nature of Ukraine’s relationship with the alliance. Historically, NATO's perception of Ukraine focused on international behavior and foreign-policy motivations, and this perception affected the forms of cooperation the alliance proposed to Ukraine. Unless Ukraine is perceived as a stable ally, it will not be invited to be part of the NATO Membership Action Plan and the main priority of Ukraine's foreign policy—full integration into European and Euro-Atlantic institutions—will remain impossible. Being seen as a NATO ally, as well as reversing the Ukrainian public's negative view of the alliance, is a major responsibility of Ukrainian leadership. However, it is also crucially important that Western democracies keep the door open for Ukraine.

KEYWORDS: Ukraine, Euro-Atlantic Integration, NATO

MEDICAL RESERVE-CORPS VOLUNTEERS’ ABILITY AND WILLINGNESS TO REPORT TO WORK FOR THE DEPARTMENT OF HEALTH DURING CATASTROPHIC DISASTERS

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Local public-health systems must have the capacity to meet the surge requirements of a health emergency that requires an extraordinary increase in activity, including the rapid prophylaxis of an affected community. Forty percent of paid health professionals may be unable or unwilling to report to work during catastrophic disasters. The Medical Reserve Corps (MRC) are healthcare volunteers with a primary mission of providing support to the public-health system during disasters. This thesis surveys the members of a county health department MRC to identify ability and willingness to volunteer in a public-health emergency, barriers and enablers to response, and perceptions of community preparedness. Both significant differences in the responses of paid versus volunteer health professionals regarding their ability and willingness and striking similarities in their responses regarding barriers and enablers to report to work are identified. Volunteer motivation, cognitive dissonance, and the nature of self-selected volunteers are examined as they relate to these findings. Strategies to strengthen the ability and willingness of MRC units to respond with the public-health system are recommended.

KEYWORDS: Public Health Surge Capacity, Volunteer Motivation, Ability and Willingness, Cognitive Dissonance, Medical Reserve Corps, Public Health Disasters
TRANSFORMING LEADERSHIP IN THE FEDERAL BUREAU OF INVESTIGATION:  
A RECOMMENDATION FOR STRATEGIC CHANGE

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Second Reader: David Brannan, DoD Contractor

The Federal Bureau of Investigation has entered a critical point in its history. The new normalcy of the post-9/11 world has created seemingly insurmountable challenges that highlight the need to further examine the policies, practices, and procedures used to identify, select, professionally develop, evaluate, and place leaders in the FBI’s special-agent ranks. The FBI must identify its most capable leaders, set conditions for their success, and systematically place them in positions that will maximize their impact on the future of the organization. This research examines drivers and impediments that have led to the current methodologies used by the FBI to select and place its special-agent leaders. It also reviews current mechanisms for training and developing FBI special-agent midlevel and executive managers and explores an alternative strategy to identify, select, professionally develop, evaluate, and place ensuing generations of FBI special-agent leaders. Finally, this research recommends courses of action and a new strategic framework, moving from a system of individual career management to a system of organizational career development or a leadership pipeline, to transform the special-agent leaders into standard setters within the larger intelligence and law-enforcement communities they serve.

KEYWORDS: Federal Bureau of Investigation, Law Enforcement, National Security, Training and Education, Leadership, Organizational Change, Information Sharing, Intelligence Sharing

IN INVOLVING CORPORATIONS IN DISPENSING DURING MASS PROPHYLAXIS

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The purpose of mass prophylaxis following a bioterrorist attack is to reduce fear within the community and to reduce loss of life to the disease. Current guidance provided by the Department of Health and Human Services’ Centers for Disease Control and Prevention (CDC) for response to an anthrax attack states that the optimal period for distribution of prophylaxis to the community is two days. Yet, how can a state public-health agency dispense antibiotics to everyone in a metropolitan area within forty-eight hours of potential exposure?

A key to a successful mass prophylaxis campaign is in staffing the functions required to receive, stage, transport, deliver, and dispense antibiotics. Is there value in developing relationships with large corporations within the metropolitan area to support their active involvement as reliable, effective, and efficient volunteer entities for dispensing pharmaceuticals following a terrorist incident or natural disaster? This thesis evaluates the novel approach of inviting corporations to act as volunteer entities in and of themselves (rather than merely offering their facilities to support a government activity) as well as more traditional options such as utilizing the public-health force (supported by traditional volunteer recruitment) and the United States Postal Service to deliver medication to households. A fourth option, combining the first three options to meet the requirements of timely delivery, security, medical-personnel support, and client-information collection is also considered.

Any strategic option for distributing prophylaxis should address the following fundamental questions:

- Does the option encourage community ownership of the problem?
- Does the option provide for better response time to the problem?
- Does the option increase the number of people who can be served within a given timeframe?
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- Does the option increase the availability of medical-care providers to support screening and dispensing?
- Does the option reduce security-personnel requirements?
- Does the option support gathering needed information about those who receive the medication?
- Does the option provide redress for clients in the event of an adverse side effect to medication?
- Does the option require new legislation or changes to existing legislation?
- Does the option increase the availability of non-medical support personnel for dispensing activities?

This thesis compares the four primary strategic options on how well they answer these questions. The thesis provides informed consideration of policy options for community leaders who are addressing the need to rapidly dispense medicines, based on combining public and private resources to meet the needs of the community.


A MODEL FOR EFFECTIVE ORGANIZATION AND COMMUNICATION OF HOMELAND-SECURITY ACTIVITIES AT THE STATE LEVEL

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This thesis is concerned with the optimal state organizational structure needed to achieve homeland-security missions, particular in Wisconsin. It first reviews the relevant literature in order to identify a core set of critical homeland-security functions germane to states. Four organizational models, as represented by four case states, are examined to determine which meet those critical functions, to what degree, and with what demonstrable success. Wisconsin’s organizational structure for homeland security is evaluated in a gap analysis in that state’s capabilities, and finally, a set of policy and organizational recommendations are provided for Wisconsin—and indeed other states attempting to meet these core critical functions—to achieve an effective design for organizing and communicating state homeland-security activities within a structure that provides a comprehensive response and a stable and unambiguous communications flow pattern.

ROMANIA’S EXPERIENCES WITH DEFENSE REFORMS SINCE THE DECEMBER 1989 REVOLUTION AND THE DIMENSIONS OF CIVIL–MILITARY RELATIONS VIEWED AS A TRINITY
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The thesis addresses Romania’s experiences with defense reform and the development of democratic civil–military relations (CMR) since the collapse of communism in December 1989.

The purpose of the thesis is to identify relevant qualitative and quantitative indicators to measure the progress of the Romanian political and military authorities in implementing defense-reform initiatives, with a special focus on the CMR trinity (civilian, democratic control over the armed forces, defense efficiency, and military effectiveness).

The thesis argues that civilian, democratic control over the armed forces was the key priority during the early stages of defense reform, given the challenges posed by the transition to democracy. During this period, attention was focused on establishing and enforcing the democratic constitutional and legal framework, redefining the roles and missions of the armed forces, and restructuring of the military. Once these objectives were achieved, defense reform allowed for finding appropriate strategies and policies for improving defense efficiency and military effectiveness. Consistent progress has been made in these aspects of CMR, especially since the 2000s, when national efforts were more convincing and NATO assistance for further accession was more targeted.

The success of Romania’s experiences with defense reform is demonstrated by revisiting three areas of policy: defense planning, programming and budgeting; human-resource management; and modernization of military equipment.

**KEYWORDS:** Romania, Defense Reforms, Civil-Military Relations, Civilian Control Over the Armed Forces, Defense Efficiency, Military Effectiveness

ENHANCING REGIONAL COLLABORATION: TAKING THE NEXT STEP
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Several states throughout the nation have established regional councils, created regional taskforces or teams, and drafted legislation to meet the national priority of expanding regional collaboration. Expanding regional collaboration is not easily defined, nor does it have metrics by which to assess the effectiveness of efforts to implement regional collaboration. This thesis, by conducting a broad literature review and case study, highlights the benefits and impediments to regional collaboration. Specifically addressed are South Carolina’s efforts to expand collaboration and how methods used in other states can be applied to further expand regional collaboration throughout the state. Although South Carolina has taken steps to expand regional collaboration, several lessons from other states can ensure that efforts are both effective and efficient.

**KEYWORDS:** Expanding Regional Collaboration, Enhancing Regional Collaboration, Regionalism, Regional Planning, Leadership, Regionalization, Effective Collaboration, Coordination, Regional Structure, Regional Strategies, South Carolina
PRO PATRIA: LIMITS TO MILITARY OBEDIENCE AND SOLDIERLY HONOR IN MODERN CONTINENTAL EUROPE—CASE STUDIES FROM POLISH AND GERMAN MILITARY HISTORY

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The present study analyzes cases where officers considered themselves relieved of duty as soldiers in favor of adhering either to what they believed was a higher loyalty and professional purpose or to their own personal interpretation of such values as honor, obedience, responsibility, discipline, integrity, and political neutrality.

What are the limits of obedience for a military officer? The soldiers of Poland and Germany have served their nation and various regimes in modern history. The changes in those regimes have not been without effect on the professional self-images of those professional officers. How can the ideals of national loyalty and loyalty to individual conscience in the face of an unjust regime be reconciled with the dictates of democratic civil–military relations and with the need to anchor the soldier in a constitutional system? Can one, at the same time, from different political perspectives, be both a hero and a traitor? What are the similarities and differences between the moral and professional aspects of being an officer, from the narrow perspective of the early and mid-20th century?

Soldierly loyalty, military command and obedience, and the transition from totalitarian to democratic rule in central Europe in the 20th century are treated, as such affect soldiers, especially, in the state.

KEYWORDS: Poland, Germany, WWII, Cold War, Military Obedience and Loyalty

WHAT CAN MONGOLIA LEARN FROM THE EXPERIENCES OF OTHER DEMOCRATIC COUNTRIES THAT HAVE SET UP SYSTEMS FOR DEFENSE-POLICY PLANNING?

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Around the world, the defense policies and security priority of all countries require review and revision that reflect the changing political environment. The end of the Cold War and the initiation of the War on Terrorism are two examples of this. It is uncertain what future world event will precipitate necessary revision and review of defense policies. While such planning is difficult for established democracies, it is even more problematic for new democracies. Instead of adopting another country’s defense policy or structure directly, it is necessary for a new democracy to create a version that is appropriate for its individual defense needs and interests.

This thesis examines the defense-policy planning processes of selected democratic countries to ascertain common processes, characteristics, and experiences and identify contemporary debates and challenges. To that end, the United States serves as the model of an established democracy and Estonia and Mongolia are the newly democratic countries. Analyzing these cases comparatively will enable Mongolia to review its current policies and opt for improvements to its planning system. This thesis attempts to answer the question, “What lessons can Mongolia learn from the experiences of other democratic countries that have already set up systems for defense-policy planning?”

Since defense-policy planning is a broad area of study, this thesis focuses on the basic form of the process, the key actors and their responsibilities, and defense-policy documents at the national level, such as strategies for national security, national defense, and military strategy.

SECURITY STUDIES

BRIDGING THE GAP IN PORT SECURITY; NETWORK-CENTRIC THEORY APPLIED TO PUBLIC–PRIVATE COLLABORATION
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Application of network-centric warfare theory enables all port stakeholders to better prepare for a disaster through increased information sharing and collaboration. Currently, a significant gap in connectivity exists among the many of the entities responsible for securing the intermodal supply chain throughout the port complex. The research conducted in this thesis creates an architecture using network-centric warfare to perpetuate a cycle of preparedness in a seaport, thus enhancing situational awareness for improved security. The architecture is being applied in the Port of Los Angeles/Long Beach in the form of a public–private “virtual maritime fusion center” to fill the gap between stakeholders, thus improving overall maritime-domain awareness.

KEYWORDS: Maritime Security, Port Security, Network Centric Theory, Cycle of Preparedness, Public/Private Collaboration

U.S. IMMIGRATION AND CUSTOMS ENFORCEMENT: DYSFUNCTIONAL, NOT BY DESIGN
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Critical to the success of the homeland-security mission is a robust Department of Homeland Security, Immigration and Customs Enforcement (ICE). During a speech made while signing the Homeland Security Appropriations Act for 2006, President George W. Bush stressed that in order to defend the United States from terrorists and criminals, the borders and interior of the country must be secured and immigration laws enforced. ICE is uniquely responsible for carrying out this mission. ICE can only accomplish this mission as an integrated and focused agency. However, evidence exists that ICE, which was created by the merger of the Immigration and Naturalization Service and the Customs Service, has not integrated legacy workforces to produce an efficient and unified organization. The evidence suggests that a failed merger plan has left ICE with a segregated workforce that is dysfunctional in executing an enforcement strategy using the blended workforce. This thesis examines and assesses the result of the merger and seeks to identify the causes of inefficiency in the current organization. The thesis recommends a course of action that will mitigate the issues present and help ICE to become efficient and focused.

The pace of democratic political and economic reforms in Ukraine has been slower than that of some other democracies of post–communist Eastern and Central Europe. Ukraine is still uncertain of its future orientation. The reasons for this uncertainty involve internal factors, such as the historically diverse political, cultural, and ethnic affiliations of Ukraine’s population. At the same time, the impact of external factors, especially Russian and Western geo-strategic interests relating to the future of Ukraine, also contribute to the current crisis.

This thesis examines the historically based geopolitical and cultural attachments of the Ukrainian people in relation to the nation-formation process in independent Ukraine. The absence of a common national identity in Ukraine is one of the obstacles to successful national development. In the case of Ukraine, a sense of national identity cannot be based purely on ethno-cultural and regional bonds. On the contrary, the emphasis on the rise of civic consciousness among all strata of Ukrainian society seems crucial. The successful integration of major democratic values might afford a clear direction for the country’s future development, and help define its place in Europe in a way that would be acceptable to a majority of the Ukrainian people.

KEYWORDS: Ukraine, National Identity, National Consolidation, Civil Society
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