Compilation of

Thesis Abstracts

March 2008

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

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

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

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

The research program at NPS exists to support the primary mission of graduate education. Research at NPS:
- maintains upper-division course content and programs at cutting edge;
- challenges students with creative problem solving experiences on DoD-relevant issues;
- advances DoN/DoD technology;
- solves warfare problems; and
- attracts and retains quality faculty.

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

The Naval Postgraduate School has aligned its education and supporting research programs to achieve three major goals: 1) academic programs that are nationally recognized and support the current and future operations of the Navy and Marine Corps, our sister services, and our allies; 2) institutes that focus on the integration of teaching and research in direct support of the four pillars of Joint Visions 2010 and 2020 and their enabling technologies; and, 3) executive and continuing education programs that support continuous intellectual innovation and growth throughout an officer’s career.

*Integrated • Systems Oriented • Flexible • Partnered for Strength*

*Four Institutes*
- The Gelbrowski Institute for Information Innovation and Superiority
- The MOWES Institute (Modeling, virtual environments, and simulation)
- The Meyr Institute (National-security systems and technology)
- The National Security Institute (Partnership for security research and education)

*Four Schools*
- Graduate School of Engineering and Applied Science
- Graduate School of Operational and Information Sciences
- Graduate School of Business and Public Policy
- School of International Graduate Studies
INTRODUCTION

Programs of graduate studies at NPS are grouped as follows:

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

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

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

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

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

Figure 1: Resident Degrees/Subspecialty Student Population for March 2008
(1536 Concurrently Enrolled)

Academic Degrees

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

**Master of Arts Degrees**
- National Security Affairs
- Security Studies

**Master of Business Administration**

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

**Engineer Degrees**
- Astronautical Engineer
- Electrical Engineer
- Mechanical Engineer

**Doctor of Philosophy**
- Applied Mathematics
- Applied Physics
- Astronautical Engineering
- Computer Science
- Electrical Engineering
- Engineering Acoustics
- Information Sciences
- Mechanical Engineering
- Meteorology
- Modeling, Virtual Environments, and Simulation
- Operations Research
- Physical Oceanography
- Physics
- Security Studies
- Software Engineering
In March 2008, 167 degrees were conferred. Figure 2 indicates distribution by type, Figure 3 by degree area.

*Advanced degrees, Ph.D. Physical Oceanography (2), Mechanical Engineer (1), Electrical Engineer (1)
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.

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ADVANCED DEGREES

Doctor of Philosophy
Mechanical Engineer
A series of 10 to 20 kHz, frequency-sweeping signals synthesizing whistles of vocalizing odontocetes was transmitted from a J-9 sound projector suspended from the research vessel Pt. Sur while over the U.S. Navy Southern California Offshore Range (SCORE) Underwater Acoustic Range from 11 to 13 August 2004. The transmissions were recorded by a group of seven near-bottom hydrophones of the range. Using statistical analysis on ensembles of the repeated transmissions, the relationship between probability of detection \( p(D) \), probability of false alarm \( p(FA) \), signal-to-noise ratio (SNR) of the band-passed hydrophone data, and detection range were derived for both a correlator and energy detector. To extrapolate the detection range for a different SL, a ray propagation model was employed. Additionally, the feasibility of using the near-bottom hydrophones of the range for three-dimensional localization and for reconstructing the source signal waveform was assessed. While the experimental results show that accurate horizontal location estimates can be easily obtained through a minimization of the misfit between the observed and predicted differences in the signal arrival times at a cluster of hydrophones, a high-quality depth estimate is more difficult to accomplish. In order to choose a satisfactory depth estimator, simulated data were used to systematically quantify the sensitivity of the source depth estimates, produced by a set of commonly used frequency and time-domain processing methods to additive noise, sound-speed profile mismatch and hydrophone position errors. The simulation results suggest that a time-domain signal magnitude matching scheme consistently outperforms the other methods. The performance of this scheme was further demonstrated with experimental data. For source signal waveform reconstruction, the sensitivity of a frequency-uncorrelated, least-squares technique to the same errors was investigated.

**KEYWORDS:** Matched Field Processing, Odontocete, Magnitude Matching, Time Domain, Localization, Depth Estimation, Acoustic Model, Bottom Hydrophone, Least Squares Estimation
A component of the Office of Naval Research-funded Windy Islands Soliton Experiment was conducted from 13–15 April 2005 on the continental shelf in the northeast portion of the South China Sea to study the effects of nonlinear internal waves on the transmission of a 400-Hz signal. To capture the ocean variability along the acoustic path, a series of environmental moorings were deployed that sampled the water column. Significant variability in the sound-speed field was observed to be induced by nonlinear internal tides with a broad (~ 10 km) horizontal scale (referred to as the “long-wave pattern”) and narrow (< 1 km), high-frequency, nonlinear, internal depression and elevation waves superimposed on the internal tides. Through the use of an empirical sound speed field and a coupled, normal-mode, acoustic propagation model, the phenomenology of the nonlinear internal wave field upon the observed intensity pattern was examined. Analysis of the observed and modeled acoustic intensity time-series indicates that the long-wave pattern dictates, to a large degree, the temporal changes in the vertical structure of the sound intensity level.

Furthermore, both measurement and model results show that when the thermocline was rapidly displaced by the nonlinear internal waves, sound intensity fluctuations reached their maximum. Modeling results suggest that these maximums are due to the scattering of acoustic energy into both higher and lower acoustic modes along the edges of the elevation/depression waves where strong horizontal sound-speed gradients were present. An additional goal of this paper is to propose and validate an extended statistical theory that relates the observed statistics of the acoustic intensity to the number of resolvable arrivals. The number of resolvable arrivals depends on signal bandwidth and the criteria of “well separateness” and was found to vary significantly as the nonlinear internal waves evolve along the transmission path. The theory is found to be pertinent when the temporal length of the window for calculating statistics was expanded sufficiently in order to collect a sample population with the following characteristics: 1) the standard deviation of the estimated number of arrivals is small, and 2) sufficient internal wave events are captured to ensure the phase distribution of the arrivals in the sample population is uniform.

**KEYWORDS:** Intensity Fluctuations, Nonlinear Internal Waves, Shallow-Water Acoustics, South China Sea, Phase Random Distributions
The objective of this thesis is to analyze the hydrodynamic properties of a specialized, penta-hulled, air-entrapment, high-speed planing vessel. Due to the unique features of this hull, a multi-layered approach based on computational fluid dynamics is adopted. The first is a steady state model with no free surface effects. It determines the lift and drag on the hull at a fixed waterline. It does not capture any of the planing effects created by the air entrapment region between hulls, nor does it quantify, to any degree, the amount of air being ingested into the water jets. The second is a free surface model, which includes free surface effects and the generation of the wave train by including the mixed flow regions between hulls. This method also gives an idea of the amount of air that will be present at the water jet inlets. The difficulty with the free surface model is the extremely long computational times required by the program to converge on a solution; however, if it does generate a solution, it will be a much better approximation than the steady state model will produce. Conclusions from the applications of these methods and recommendations for further research are presented.

**KEYWORDS:** Steady State Model, Free Surface Model, Free Surface Effects, Air Entrapment Hull
MASTER
OF
BUSINESS ADMINISTRATION
MASTER OF BUSINESS ADMINISTRATION

A STRATEGIC APPROACH TO HUMANITARIAN MEDICAL-MANPOWER PLANNING
Kathleen K. Cooperman-Lieutenant, United States Navy
Master of Business Administration–March 2008
Linda J. Houde-Commander, United States Navy
Master of Business Administration–March 2008
Advisor: Anke Richter, Defense Resources Management Institute
Second Reader: Paula Konofige, Naval Health Research, San Diego

The demand for soft-power tools to positively influence stability and security has increased interest in humanitarian medical assistance. Current medical-maneuver determination processes for staffing medical missions are based on the required operational capabilities in the projected operational environment. These platforms are designed to support combat casualty, disaster relief, and readiness training. The current manpower process fails to capture country-centered healthcare requirements associated with peacetime missions. To develop a country-centered approach, a demand-driven manpower model is constructed using standard health statistical indicators. The model draws from the statistical indicators to align medical-maneuver workload to country health objectives for delivery at the community level. The model framework guides medical planners in identifying mission-essential medical programs and services. It shifts manpower planning from scenario- to country-based capability and needs assessment, which improves alignment to transformational doctrine. Finally, it creates clarity by using actual standard health statistics, thereby fostering prioritization of medical services and improved coordination with stakeholders, such as non-governmental organizations. It is recommended that a country-centered planning approach be adopted to optimize manpower resources and improve overall operational effectiveness.

KEYWORDS: Humanitarian Medical Manpower Planning, Humanitarian Assistance, Medical Staffing, Hospital Ship, Fleet Hospital, Manpower Requirements, Medical, Support Staff, Workload Intensity, Strategic Approach

SHOULD THE DEPARTMENT OF DEFENSE HEDGE OIL PRICES IN ORDER TO SAVE MONEY?
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Master of Business Administration–March 2008
Advisor: Bryan Hudgens, Graduate School of Business and Public Policy
Second Reader: Nicholas Dew, Graduate School of Business and Public Policy

This paper explores one possible solution to the Department of Defense (DoD) problem of increased expenditures due to rising jet fuel costs. This paper provides a brief overview of the futures market and of commercially accepted practices utilized by the airlines within the futures market. The goal of this paper is to explore the feasibility of the government entering the futures market in order to reduce current DoD jet fuel costs, and to analyze whether the potential savings would outweigh the associated risks and costs. This paper briefly discusses the current method of procurement and examines the commercial practices of futures trading, focusing on the airline industry, which offers the greatest affinity to the DoD.

KEYWORDS: Futures, Hedging, Oil Prices, DoD, Fossil Fuel, Alternative Energy
The purpose of this project is to determine if the Defense Travel System (DTS) reservation module is in compliance with the standards set by the Department of Defense (DoD). Examining flights given in DTS and comparing them to a commercial, online travel company (Expedia) will determine whether the implementation of ITA software in 2007 (as part of the renovation process) was effective and whether the reservation module currently meets standards. Another purpose of this research is to determine if the system has improved since the Government Accountability Office’s (GAO) audit report was issued in 2006. Ultimately, the study determines whether further improvements need to be made with the new procedures in place and what part of the system’s reservations module needs to be addressed. The scope includes a background of the Defense Travel System, GAO audits on the system’s inadequacy, an analysis of flight information found in the DTS reservation module compared to flight information found in one of the top commercial travel companies (Expedia), and an analysis of flights displayed in the DTS, including whether those flights are properly displayed in accordance with set standards.

**KEYWORDS:** Defense Travel System
MASTER OF SCIENCE

Applied Physics
Astronautical Engineering
Computer Science
Defense Analysis
Electrical Engineering
Electronic Warfare Systems Engineering
Engineering Acoustics
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
Software Engineering
Systems Technology
A FREE-ELECTRON LASER ANALYSIS FOR THE INNOVATIVE NAVY PROTOTYPE
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Master of Science in Applied Physics–March 2008
Advisors: William Colson, Department of Physics
Joseph Blau, Department of Physics

Free-electron lasers are the focus of a recently announced Innovative Navy Prototype to develop a directed energy weapon system for the self-defense of ships. Operating in a shipboard environment poses several challenges that must be overcome. Short Rayleigh-length systems offer solutions to some of these problems. Simulations are performed to examine the benefit of short Rayleigh-length designs in the face of electron beam misalignment. Additionally, simulations are performed to explore the effect of quadrupole misalignment on electron beam position and trajectory, and ultimately, on FEL performance.

KEYWORDS: Free-Electron Laser, FEL, Directed Energy, Quadrupole, Magnet Misalignment
Micro-satellites require a propulsion system that minimizes mass and size while maximizing performance. Ion propulsion engines may be the most scalable pending reductions in ionizer size. This work explores a new ionization chamber concept.

This thesis reports on the ionization of Argon, an alternative propellant to Xenon, which has been achieved at relatively low voltages with locally designed and manufactured micro-structured electrode (MSE) arrays. Testing is conducted with the gas flowing through the array holes, simulating the actual space environment as in an operating ion thruster. With argon flowing, breakdown is achieved at voltages between 230 and 350 volts depending on chamber pressure and array insulation thickness and hole size. The breakdown voltage in argon gas is higher (between 15 and 100 volts) with the flow than that without for the same wafer, and always higher for the smaller (0.127 mm vs. 0.381 mm) insulation thickness tested. No breakdown is observed when the cathode is located upstream.

**KEYWORDS:** Space Propulsion, Ion Thruster, Ionizer Chamber
UNIVERSITY COURSE TIMETABLEING WITH PROBABILITY COLLECTIVES
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Advisor: Kevin M. Squire, Department of Computer Science
Second Reader: Craig Martell, Department of Computer Science

The Naval Postgraduate School currently uses a time-consuming, manual process to generate course schedules for students and professors. Each quarter, the process of timetabling approximately two thousand students into nearly five hundred courses takes up to eight weeks. This thesis introduces an automated timetabling algorithm using probability collectives (PC) theory. PC theory is an agent-based approach that utilizes collective intelligence (COIN) to solve optimization problems by using a collection of agents attempting to achieve a single goal. The algorithm is tested on a set of data provided by the organizers of the 2007 International Timetabling Competition. The algorithm provides valid timetables for every problem instance and successfully schedules between 70% and 91.6% of all student course requests.

KEYWORDS: Time-tableing, Collective Intelligence, Probability Collective, Scheduling, Optimization

SOFTWARE REUSE IN THE NAVAL OPEN ARCHITECTURE
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Master of Science in Computer Science–March 2008
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Man-Tak Shing, Department of Computer Science

This thesis describes a web-based continuous-learning module (CLM) for use in introducing members of the Department of the Navy’s (DoN) acquisition community to software reuse in the context of Naval open architecture (OA). The CLM introduces the student to principles for effective software reuse, explains the unique challenges of software reuse, discusses software reuse within the context of the Naval Open Architecture under current Department of Defense and DoN policy and guidance, provides a strategy for successful software reuse, and introduces the student to the Software Hardware Asset Reuse Enterprise (SHARE) repository established by the Navy’s OA program.

KEYWORDS: Software Reuse, Naval Open Architecture, SHARE
The Department of Homeland Security (DHS) is deploying the transportation-worker identification credential (TWIC) to U.S. ports to help ensure that only authorized individuals who have undergone background checks have access to secure areas. Congress mandated that the TWIC have a biometric authenticator; DHS chose fingerprints.

This thesis argues that iris scanning is a better choice because of the nature of the maritime environment, and because iris scanning is a more accurate biometric. This thesis also argues that there are social factors affecting a biometric–enabled identification card that must be considered for the program to be successful.

To investigate the issue of biometrics and the TWIC, a field study of an iris scanner is performed; a survey of biometric attitudes is conducted; and interviews with members of the PMA and the ILWU are conducted. The iris study operates the scanner in an identification mode, experiencing no false acceptances and few false rejects; however, it is found that the scanner is sensitive to sun position with respect to the subject. The pilot study of attitudes finds subjects supportive of biometrics in scenarios currently requiring positive identification, but opposing them when it would create new requirements for identification. Both pilot studies are impacted by an inability to provide an incentive to study subjects.

KEYWORDS: Iris Scanning, Iris Recognition, Biometric Attitude Survey, Transportation Worker Identification Credential

Software debugging is a time consuming and important step in the development and evolution of software systems. Debugging is a practice that normally gets the least praise but requires the most attention and effort. The aim of debugging is to find and reduce the number of faults in a program, thereby making a program behave as expected. Even with the advances that have been made in computer speed, graphical user interfaces, networking abilities, and storage capabilities, the cost of debugging remains high. This thesis builds on the process of debugging using a statistical approach. Statistical debugging is not a new phenomenon, but a statistical debugging technique is developed to assist in addressing the difficulties of isolating faults in software. This debugging tool will save time and effort in finding faults, thereby saving money.

KEYWORDS: Statistical Debugging
TwiddleNet is a distributed architecture of personal servers that harnesses the power of mobile devices, enabling real-time information and file sharing of multiple data types from commercial, off-the-shelf platforms. This thesis involves research in mobile personal members, mobile social networks, and media sharing models; and develops a TwiddleNet portal running on a smart phone or a PDA so that the entire TwiddleNet system can be run on handheld devices for rapid deployment in emergencies.

**KEYWORDS:** Mobile Personal Server, Seamless Mobility, Social Networking Models, Media Sharing Services, Peer-to-Peer Architecture
FIRE SUPPORT FOR IRREGULAR WARFARE
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Master of Science in Defense Analysis–March 2008
Advisor: John Arquilla, Department of Defense Analysis
Second Reader: Col Brian Greenshields, USAF, Department of Defense Analysis

More than six years after the terrorist attacks on the United States and the initial invasion of Afghanistan, the U.S. military finds itself fully engaged in two large-scale combat operations and numerous smaller-scale operations around the globe. The U.S. military that went to war in 2001 was not optimally designed to fight against well-entrenched insurgent forces, often fighting in urban terrain. The enemy’s ability to adapt to our tactics has been impressive, and this, in turn, drives our need for innovation. Advances made in precision-guided munitions, satellite imagery available to the foot soldier, and networked fires have increased the lethality of indirect fires. At the same time, these advances have reduced the risk of collateral damage and improved safety margins for friendly troops. This thesis examines how artillery has been used in irregular conflicts over the past century and how current capabilities can be best utilized by applying the lessons learned from these previous conflicts. The combination of new technologies and applied lessons from previous irregular conflicts will help us develop the most appropriate application of artillery assets when conducting irregular warfare.

KEYWORDS: Irregular Warfare, Fire Support, Artillery, Mortars, Rocket Artillery, GMLRS

INNOVATIONS IN AIR INSERTION (INVOLVING PARACHUTES)
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Master of Science in Defense Analysis–March 2008
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Second Reader: David Tucker, Department of Defense Analysis

Numerous innovations in parachuting and related technologies have been developed in recent years; these innovations had their genesis in the military application of parachutes, which started early in the twentieth century. Although many of these new concepts have not been applied to military operations, they may have much to offer in the future. The innovations covered in this study involve concepts that could revolutionize the use of parachutes in warfare. This research focuses more on methods than materials; however, some of these related technologies are also examined.

The five systems covered are: 1) wing suit, 2) rigid wing, 3) high-glide ratio (HGR) parachute, 4) fixed-object parachuting (commonly known as BASE), and 5) tandem systems. These innovations provide many advantages and improvements to existing systems, such as greater offset for insertion for HAHO and HALO; a capability to conduct infiltration and exfiltration with the same compact equipment; greater capacity for inserting personnel and equipment; and the capacity for expanded use of the parachute in a constrained environment.

KEYWORDS: Parachuting, Innovation, Special Operations, SOF, Air Insertion, Wing Suit, Rigid Wing, Tandem, BASE, High Glide Ratio Parachute, Infiltration, Exfiltration
A PERFORMANCE ANALYSIS OF AN ALTERNATIVE LINK-16/JTIDS WAVEFORM
TRANSMITTED OVER A CHANNEL WITH PULSE-NOISE INTERFERENCE
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Master of Science in Electrical Engineering–March 2008
Advisor: R. Clark Robertson, Department of Electrical and Computer Engineering
Second Reader: Roberto Cristi, Department of Electrical and Computer Engineering

The Joint Tactical Information Distribution System (JTIDS) is a hybrid, frequency-hopped, direct-
sequence, spread-spectrum system that utilizes a (31,15) Reed–Solomon (RS) code and cyclical code-shift
keying modulation for the data packets, where each encoded symbol consists of five bits. The primary
drawback to JTIDS is the limited data rate. In this thesis, an alternative waveform consistent with the
existing JTIDS channel waveform (but with a twofold increase in data rate) is analyzed. The system
considered uses (31,15) RS encoding as in the original JTIDS, but each pair of five-bit symbols at the
output of the Reed–Solomon encoder undergoes serial-to-parallel conversion to two five-bit symbols,
which are then independently transmitted on the in-phase and quadrature components of the carrier using
32-ary bi-orthogonal keying with a diversity of two. The performance obtained with the alternative
waveform is compared with that obtained for the existing JTIDS waveform for the relatively
benign case where additive white Gaussian noise (AWGN) is the only noise present, as well as when pulse-noise
interference (PNI) is present. Errors-and-erasures decoding (EED) and errors-only decoding are considered.
Based on the analyses, it is seen that the proposed alternative JITDS/Link-16 waveform performs better in
AWGN, as well as when PNI is present. No significant advantage is obtained using EED for the alternative
waveform. There is a significant improvement in performance when perfect-side information is assumed.

KEYWORDS: JTIDS/Link-16, M-ary Bi-Orthogonal Keying, Reed-Solomon Coding, Pulse-Noise
Interference, Additive White Gaussian Noise, Error-and-Erasure Decoding

FIELD-PROGRAMMABLE GATE ARRAY CONTROL OF POWER SYSTEMS IN GRADUATE
STUDENT LABORATORIES
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Master of Science in Electrical Engineering–March 2008
Advisor: Alexander L. Julian, Department of Electrical and Computer Engineering
Second Reader: Roberto Cristi, Department of Electrical and Computer Engineering

The department of electrical and computer engineering at the Naval Postgraduate School (NPS)
continuously develops new design and education resources for students. One area of focus for students in
the power electronics curriculum is the development of a design center that explores field programmable
gate array (FPGA) control of power electronics. Utilizing Mathworks and XILINX software to interface the
FPGA with a voltage source converter (VSC), students gain experience with digital design, simulation, and
hardware testing. This thesis focuses on the design, implementation, and testing of a student design center
(SDC) employing an FPGA-based digital controller. This thesis concentrates on the hardware interface
between the FPGA and the power electronics and the development of laboratory procedures for students
utilizing the design center.

KEYWORDS: Field Programmable Gate Array, FPGA, Voltage Inverter, Graduate Student Laboratories
IMPLEMENTATION OF A CYCLOSTATIONARY SPECTRAL-ANALYSIS ALGORITHM ON AN SRC RECONFIGURABLE COMPUTER FOR REAL-TIME SIGNAL PROCESSING
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Master of Science in Electrical Engineering–March 2008
Advisors: Douglas J. Fouts, Department of Electrical and Computer Engineering
Phillip E. Pace, Department of Electrical and Computer Engineering

In this thesis, a near-real-time method of detecting low probability of intercept (LPI) emissions is presented. The cyclostationary spectral analysis implementation on the SRC-6 computer is based on the algorithms developed by the Center for Joint Services Electronic Warfare at the Naval Postgraduate School. Cyclostationary processing transforms a received signal into a frequency-cycle domain, which can have detection advantages over a time-frequency domain transformation. When performed at near-real-time processing speed, the algorithm could be used to detect and classify LPI emissions. The performance of the algorithm on the SRC-6 is compared to equivalent implementations in C and MATLAB. This thesis is part of a larger project investigating the use of the SRC-6 for electronic intelligence detection and processing.

KEYWORDS: Low Probability of Intercept, LPI, Cyclostationary Processing, Reconfigurable Computing, SRC, SRC-6, Electronic Intelligence, ELINT

ELECTRONIC-INTELLIGENCE SIGNAL PROCESSING USING THE CHOI–WILLIAMS DISTRIBUTION ON RECONFIGURABLE COMPUTERS FOR DETECTION AND CLASSIFICATION OF LOW-PROBABILITY-OF-INTERCEPT EMITTERS
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Phillip E. Pace, Department of Electrical and Computer Engineering

This thesis documents the use of the SRC-6 reconfigurable computer for use in analyzing low-probability-of-intercept (LPI) signals using the Choi–Williams distribution. The SRC-6 is a reconfigurable computer manufactured by SRC Computers, Inc. The SRC-6 allows the user to tailor both software and hardware to a specific task. This increases the speed at which the task can be accomplished. The Choi–Williams distribution is a mathematical technique that was first created using MATLAB and then converted to C code for use on the SRC-6. The purpose of this study is to investigate the feasibility of using a reconfigurable computer for the timely detection and classification of LPI signals. This thesis is part of a larger study to use reconfigurable computers for the autonomous detection and classification of LPI signals.

KEYWORDS: Choi-Williams Distribution, Reconfigurable Computer, Signal Processing, MATLAB Programming, C Programming, Low Probability of Intercept, LPI, Radar Detection, Radar Classification
MASTER OF SCIENCE
IN
ELECTRONIC WARFARE
SYSTEMS ENGINEERING

DISTRIBUTED BEAMFORMING IN A SWARM UNMANNED-AERIAL-VEHICLES NETWORK
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B.S., Turkish Air Force Academy, 2002
Master of Science in Electronic Warfare Systems Engineering–March 2008
Advisor: David C. Jenn, Department of Electrical and Computer Engineering
Second Reader: LtCol Terry Smith, USAF, Department of Information Sciences

The use of wireless communication techniques and network centric topologies with unmanned, aerial vehicles (UAVs) within modern warfare concepts makes it possible to utilize new distributed beamforming applications. The objective of this research is to combine the concept of wireless beamforming in opportunistic random arrays with the concept of swarm UAVs. A considerable amount of research has already been done on the feasibility and advantages of opportunistic arrays for a single platform. Distributed beamforming techniques are widely applied by many researchers. The use of swarm UAV concepts for a widely dispersed, wirelessly networked, opportunistic array may anticipate many advantages over single-platform-borne opportunistic arrays. Major challenges are synchronization and localization, which are caused by the mobile structure of the proposed network topology. Possible solutions to these problems are proposed.

In this thesis, the use of swarm UAVs for jamming is analyzed. Closed form expressions for jamming power versus the number of UAVs, ranges, degree of transmitter coherence, and quality of beamforming are derived. It is found that even for low-quality beamforming (large phase errors or poor synchronization), significant improvement in system performance is still achievable.

KEYWORDS: UAV, Beamforming, Opportunistic Arrays, Distributed Phased Arrays, Jamming

SELF-DEFENSE OF LARGE AIRCRAFT
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Master of Science in Electronic Warfare Systems Engineering–March 2008
Advisor: Michael Herrera, Department of Information Sciences
Second Reader: Nancy Haegel, Department of Physics

Large aircraft are important assets in both military and civilian aviation. Today, the threat is not only in the battlespace, but is also emerging and distributed throughout all places where large aircraft operate. The threat has expanded due to new developments in advancing missile technology. This study serves as both a comprehensive guide for non-technical aircrew and an introduction for technical personnel by defining threat technologies, detection systems, systems to counter today’s surface-to-air missile technologies, and possible future developments. Countermeasures are expressed both scientifically and operationally using examples from the current market. The emerging threats of man-portable, air-defense systems (MANPADs) and infrared technology are also reviewed. The hardness of flying platforms and survivability issues are explained, including the latest examples from operations in Iraq.

The goal of this study is to assist in the design or modernization of a large aircraft with equipment according to new demands both in the battlespace and in normal civilian operations.
KEYWORDS: SAM, Guidance, Detection of Threats, Countermeasures, Survivability, Large Aircraft, RWR, MAWS, LWR, Signature Reduction
Acoustic “windows” are used in SONAR applications to absorb structural loads associated with platform operation while allowing the passage of acoustic signals. The performance metric commonly used to gauge the acoustic window quality is insertion loss. This thesis provides a derivation of insertion loss for multi-layered materials as a function of frequency and angle of incidence. Derivations are modified to include attenuation of the signals in the material. The result is written into a MATLAB model. Measurements on single-layer plastic, polyurethane, and steel panels show good experimental agreement with the theoretical model. The model is then used to predict insertion loss of multi-layered materials as a tool for improving window-bending rigidity.

**KEYWORDS:** Insertion Loss, Acoustic Materials, Transmission Loss
VOICE-OVER-INTERNET PROTOCOL QUALITY MEASUREMENTS IN A MULTILEVEL, SECURE ENVIRONMENT
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B.S., Roger Williams University, 2000
Master of Science in Information Systems and Operations–March 2008
Advisors: Cynthia E. Irvine, Department of Computer Science
Nelson J. Irvine, Department of Information Sciences

Voice-over-Internet Protocol (VoIP) is growing in popularity in the civilian and military communities due to its low cost and the management advantages it offers over traditional public switched telephone networks (PSTNs) phone systems. Many military commands do not have the infrastructure or funding required to support the rapid expansion of multiple phone services at various locations throughout the world. VoIP offers a rapidly deployable alternative. A subjective study is designed to test the quality of VoIP signals in a controlled and isolated, multilevel secure network to which single-level networks are attached. The experiment provides useful insights regarding VoIP testing with human subjects. Its procedures can be repeated as the Monterey Security Architecture project moves forward with the implementation and deployment of VoIP services in its multilevel test bed.

KEYWORDS: VoIP, MYSEA, Multilevel Secure Network, MLS Network

INFORMATION OPERATIONS VERSUS CIVILIAN MARKETING AND ADVERTISING: A COMPARATIVE ANALYSIS TO IMPROVE INFORMATION-OPERATIONS PLANNING AND STRATEGY
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Advisor: Steven J. Iatrou, Department of Information Sciences
Second Reader: LtCol Karl Pfeiffer, USAF, Department of Information Sciences

In this thesis, the idea of utilizing civilian marketing and advertising planning, strategies, and tactics for information operations (IO) is presented. The objective of this work is to analyze and develop the concept of utilizing civilian advertising and marketing fundamentals for information operations planning and execution. This analysis focuses on the integration of traditional IO planning, tactics, and strategies with those known to be successful in American civilian marketing and advertising in order to create a more intuitive, efficient, and effective IO process.

Most networks, including those deployed in the Cooperative Operations and Applied Science and Technology Studies (COASTS) field-experimentation program, utilize an access point, wireless bridge, switch, and security gateway. Reducing equipment requirements in the field is most desirable to minimize the equipment footprint, cost, and power required. The COASTS research group, involved in developing a scalable, multi-mission, system-of-systems for coalition environments, relies heavily on commercial, off-the-shelf (COTS) network technology. Evaluating the performance of COTS technology, such as the Fortress secure wireless-access bridge (ES-520), directly supports the program’s objectives.

This thesis analyzes the performance of ES-520 versus traditional 802.11a/b/g wireless access points. Additionally, radio-frequency propagation performance is analyzed for distance, mobility, sustainability, and technical advantages/disadvantages with respect to varying antenna configurations and physical parameters, such as climate and terrain. Testing and evaluation is accomplished under the COASTS field experimentation program.

KEYWORDS: COASTS, C4ISR, IEEE 802.11 Technologies, Wi-Fi, Wireless Networks

Service-oriented architecture (SOA) software has revolutionized data interchange in the business world. An SOA software platform integrates independent, unrelated applications into a common architecture, thereby introducing data reuse, interoperability, and loose coupling between the services involved. The U.S. Navy is currently experimenting with an SOA-based research portal called TACFIRE, or Tactical Applications for Collaboration in FIRE (FORCEnet Innovation and Research Enterprise). TACFIRE provides a set of lightweight, XML-based, web services derived from the Oracle Collaboration Suite (OCS) 10g SOA. Such web services operating across multiple security domains would provide additional advantages, including improved intelligence aggregation and real-time collaboration between users in different security domains. However, current TACFIRE implementations provide no multi-domain functionality between different classification levels.

To date, the incorporation of an SOA software suite into a multilevel secure environment has been neither designed nor implemented. This project explores how an SOA software suite could be integrated into a multilevel environment. The OCS 10g is configured to run within the Monterey Security Architecture multilevel test bed. This thesis addresses Department of Defense requirements for building an enterprise-level computing architecture capable of providing a full range of information services at all major security classifications and information handling caveats.

KEYWORDS: Monterey Security Architecture, Service-Oriented Architecture, SOA, FORCEnet, TACFIRE, Oracle Collaboration Suite 10g
INFORMATION SYSTEMS AND OPERATIONS

A COMPARATIVE ANALYSIS OF FORTRESS (ES520) AND MESH DYNAMICS’ (4000 SERIES) NETWORKING CAPABILITIES DURING THE COOPERATIVE OPERATIONS AND APPLIED SCIENCE AND TECHNOLOGY STUDIES, 2007, FIELD EXPERIMENTS
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Tom Hoivik, Department of Operations Research

The Cooperative Operations and Applied Science and Technology Studies (COASTS) field experimentation program is a combined Indonesian–Malaysian–Singaporean–Thai-American research and development effort to test commercial, off-the-shelf command and control, communications, computers, intelligence, surveillance, and reconnaissance (C4ISR) technologies to provide real-time situational awareness for multi-national, tactical, and remote decision-makers in a cooperative environment.

This thesis evaluates the military suitability of Fortress 802.11 ES520 wireless technology and Mesh Dynamics’ 4000 series 802.11 wireless technology by conducting a comparative analysis of the technologies’ network performance while deployed in a tactical ground, maritime, and mobile configuration in support of COASTS 2007 field experiments. Several operational field tests were conducted in California and Thailand in order to evaluate both Mesh Modules’ and ES520s’ network performances. Specific military suitability areas evaluated include network availability, throughput, network security, graphical user interface, transportability, connectivity, environmental effects, peripheral support, encryption performance, AP-to-AP handoff capability, and antenna configuration.

KEYWORDS: IEEE 802.11 Technology, WiFi, COASTS, Fortress ES520 802.11 Access Bridge, Mesh Dynamics 802.11 4000 Series Access Bridge

MARITIME-DOMAIN AWARENESS DEVELOPMENT: BY DESIGN OR BY POLICY?
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Master of Science in Information Systems and Operations–March 2008
Advisor: Shelley P. Gallup, Department of Information Sciences
Second Reader: Douglas J. MacKinnon, Department of Information Sciences

Maritime-domain awareness (MDA) may require reach across federal, state, local, and private-agency maritime-security systems to create an accurate, timely, and reliable common operating view. The view will provide the user with an in-depth, multilayer linkage of situational awareness and threat assessment developed from many databases, to support different needs at different levels of the national maritime security system. Implementing new and emerging technologies into the U.S. Navy system may enhance the maritime commander’s ability to achieve situational awareness in a more timely, efficient, and accurate manner than what occurs now. Recognizing the advantage of new and emerging technologies, the Secretary of the Navy and the Chief of Naval Operations have tasked PEO C4I to develop a system that will aid the U.S. Navy in meeting the MDA mission; this system is known as MDA Spiral-1. This thesis examines the effects of placing new and emerging technologies developed in Spiral-1 onto legacy systems, and how the U.S. Navy as an organization will either absorb these technologies or make multidimensional changes to enhance the process of achieving MDA.

KEYWORDS: Maritime Domain Awareness, Spiral 1 Technologies, Homeland Defense, Maritime Security, Situation Awareness, Organizational Change, Process Engineering
AN ANALYSIS OF MIGRATION ALTERNATIVES OF THE "APPLY" PROCESS WITHIN THE UNITED STATES RESERVES
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B.S.M., Tulane University, 1997
Master of Science in Information Technology Management-September 2008
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Second Reader: CAPT Douglas Swanson, USN

As the Navy Reserve force continues to align with the active Navy to create a total force, initiatives are in place to migrate existing Navy manpower, personnel, and distribution systems into a single enterprise system. This migration will improve data integrity and provide the foundation for a position-based Navy, which is needed to support Sea Warrior. With this focus in mind, this thesis studies the feasibility of combining the current Navy reserve officer detailing and placement systems (APPLY/JOAPPLY) with other Navy systems with similar functionalities. The goal is to find a reasonable solution that will ultimately assist the Navy reserves’ transition toward the total-force enterprise system.

Currently, APPLY/JOAPPLY does not exist within the active Navy; however, both active and reserve Navy use Career Management System-Interactive Detailing (CMS-ID) as a personnel-management tool. Not only does CMS-ID manage enlisted records, it also has access to officer data (though not currently in use). Using a common system for both the active and reserve components could provide an economy of scales in systems management and maintenance, thus providing cost savings through the elimination of the management of two different information systems.

KEYWORDS: APPLY, JOAPPLY, CMS-ID, NMCMPS, Navy Reserves, Navy Reserve Detailing, Detailing, Personnel Management Systems, Manpower, RC Junior Officer, RC Senior Officer, RJOID, APPLY Board, Selection Board

AN AIRCRAFT-PILOT SITUATIONAL-AWARENESS INTERFACE FOR AIRBORNE OPERATION OF NETWORK-CONTROLLED, UNMANNED SYSTEMS
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B.S., Turkish Air Force Academy, 1999
Master of Science in Information Technology Management-March 2008
Advisors: Alex Bordetsky, Department of Information Sciences
Eugene Bourakov, Department of Information Sciences

This thesis research focuses on network centric operations with unmanned systems (US). It specifically focuses on the currently underdeveloped area of aircraft-pilot decision support for operating USs, including unmanned aerial vehicles (UAVs), unmanned ground vehicles (UGVs), and unmanned surface vehicles (USVs), over the network from the board of an aircraft.

Building on Landreth and Glass’s thesis on controlling a UAV over the network, including from another manned aircraft, this thesis aims to ease implementation and usage of the situational-awareness (SA) interface. The SA interface enables the operator to be aware of what is going on around the unmanned system while it is being operated from a remote location and to react in the best possible way within a
reasonable time. The Rascal UAV interface is reviewed, SA-related problems are identified, and solutions to those problems are proposed. Eight possible solutions are proposed; one of them is implemented and used. However, due to some problems, researchers are unable to test all solutions.

**KEYWORDS:** UAS, UAV, Network Control, Tactical UAS/UAV, Beyond Line of Sight, ISR, SA, Interface

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**A NOVEL PROJECT-MANAGEMENT THEORY AND ITS APPLICABILITY**

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Software project management is an emerging discipline. The software project manager’s job comprises every aspect of the project, from starting the project to closing out. Practitioners of the discipline use several project management tools in managing diverse aspects of software projects. However, there is no existing management theory that combines different aspects of a software project and results in a complete picture.

This study discusses a theory and modeling language that combine several management aspects of software projects into concrete models to aid the software project manager. The mathematical relations and graphical models derived from the theory comprise entire entities and activities of a project determined by the project team and depict any kind of relationships between the entities and activities, including stakeholders. The theory provides a mathematical model for software projects and the modeling language provides graphical models of software projects representing the mathematical model.

This study tests the applicability of the theory and the modeling in two case studies. The results indicate that the theory and the modeling language are applicable to real world projects and show promise as a valuable software project management tool.

**KEYWORDS:** Software Project Management, Stakeholders, Life Cycle Methodologies, Modeling Management

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**THE INTEGRATION OF DECISION-SUPPORT TECHNOLOGIES TO SUPPORT CONSISTENT GOVERNMENT EVALUATION OF CONTRACT PROPOSALS**

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Within federal government contracting, contracting officers are empowered to evaluate proposals and determine which contractor should be awarded the contract. With multiple variables to consider, managing tradeoffs is an important aspect of the evaluation process. As such, there is room for a large amount of subjectivity in the evaluation process. Since multiple contracting officers can arrive at different conclusions when evaluating the same proposals, there are instances when the wrong contractor is awarded a contract, as only one contractor can offer the true best value. Thus, the subjectivity in the process needs to be reduced so the contractor offering the best value is awarded the contract a higher percentage of the time.

This thesis examines how the application of existing decision-support technologies can assist contracting personnel in determining which proposal offers the best value to the government. The intent is to establish a model that, when implemented, will ensure that contracting officers evaluate proposals both consistently and fairly. The proposed system integrates several decision-support technologies. The overall concept is designed using a weight-based ranking model, enabled by a multi-criteria, decision-analysis software system. Supporting decision-support software packages include an expert system and a data warehouse.
Unmanned, aerial vehicles (UAVs) are an increasingly important element of many modern militaries. Their success on battlefields in Afghanistan, Iraq, and around the globe has driven demand for a variety of types of unmanned vehicles. Their proven value is their low risk and low cost, and their capabilities include persistent surveillance, tactical and combat reconnaissance, resilience, and dynamic re-tasking.

This research evaluates past, current, and possible future operating environments for several UAV platforms to survey the changing dynamics of combat-aviation tactics and makes recommendations regarding UAV employment scenarios to the Turkish military.

While UAVs have already established their importance in military operations, ongoing evaluations of UAV operating environments, capabilities, technologies, concepts, and organizational issues inform the development of future systems. To what extent will UAV capabilities increasingly define tomorrow’s missions, requirements, and results in surveillance and combat tactics?

Integrating UAVs and concepts of operations on future battlefields is an emergent science. Managing a transition from manned to unmanned and remotely piloted aviation platforms involves new technological complexity and new aviation personnel roles, especially for combat pilots. Managing a UAV military transformation involves cultural change, which can be measured in decades.

KEYWORDS: Unmanned Aerial Vehicle, Network Centric Warfare, Unmanned Aircraft System, UAV Missions, NCW, UAS, Turkish Armed Forces

This research utilizes the Joint Terminal Attack Controller (JTAC) mission and applies the Valued Information at the Right Time (VIRT) concept of smart-push information delivery. Current efforts within the Department of Defense (DoD) focus on achieving a virtual world where all information becomes available through the Global Information Grid (GiG). This smart-pull approach to information delivery does not adequately address the value of information and the absolute requirement to deliver it to the lowest levels when and where needed. The current DoD enterprise-wide mentality of information-technology (IT) implementation does not focus on where best to leverage IT in order to achieve an immediate increase in capability. VIRT, as demonstrated in this research, provides an excellent place to start and a great opportunity to utilize technology in an effective way without taking a decade for implementation.

KEYWORDS: VIRT, Model Based Communications Networks, Joint Terminal Attack Controller, JTAC, Reduced Bandwidth, Network Centric Warfare
DEVELOPING A CONCEPTUAL ARCHITECTURE FOR A GENERALIZED, AGENT-BASED MODELING ENVIRONMENT
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Agent-based technology is a relatively new but rapidly proliferating decision technology. The relative immaturity of agent-based modeling (ABM) software often requires significant programmer expertise in model representation and implementation. This limits potential users and their ability to utilize the software. A high-level conceptual architecture is developed for an agent-based modeling environment that overcomes this limitation. This thesis defines a taxonomy of agents based on commonly accepted agent characteristics, reviews six of the most popular software platforms for agent-based model development, and maps their relationship to the taxonomy. Past modeling advances in the operations research and management science (OR/MS) domains indicate that a more generalized environment is possible. A conceptual architecture for a generalized, agent-based modeling environment (GAME) based upon design principles from OR/MS systems is created to overcome some, if not all, of these obstacles. The GAME architecture incorporates higher-level model representations separate from solver code, a library of transformation procedures, reusable model libraries, and a robust language or equivalent interface for specifying experimental design procedures. Rapid technology development would allow for agent-based modeling software that subsequently benefits a much wider range of stakeholders than is currently the case. Finally, embedding GAME in an even higher-level, integrated, decision-technology environment (IDTE) would facilitate the integration of computational and analytical modeling.

KEYWORDS: Agent-Based Modeling and Simulation, Decision Technology, Modeling Environment, Model Representation, Solver, Model Reusability

MONITORING THE PERFORMANCE OF INTEGRATED WEAPONS SYSTEM PROCESSES IN AN OPEN ARCHITECTURE ENVIRONMENT
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This thesis focuses on a trial implementation of knowledge-value-added (KVA) software supporting the management of an open architecture (OA) process performance-monitoring analysis. During this research, maritime-domain awareness (MDA) business processes establish the baseline return on investment (ROI) analysis. Trial implementation of KVA software tools focuses on the assessing and monitoring performance of OA. Installation of KVA software tools is used to support ongoing assessment and performance monitoring for integrated weapons system (IWS) OA management. This work illustrates the capability to perform ongoing ROI analysis on OA processes for development and acquisition processes enabled through the use of the OA approach. Included in management reports derived from the GaussSoft KVA software, a crucial output of this thesis is the ability of the organization to extend the use of the method and toolset over time to meet the ongoing needs of Program Executive Office (PEO)--IWS from MDA into other programs/systems. All data gathered was conducted in the unclassified environment for use in this research.

KEYWORDS: KVA, ROI, Maritime Domain Awareness, MDA
EXTENDING OPEN ARCHITECTURE TO THE PHYSICAL LAYER
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The purpose of this thesis is to identify the key parameters and metrics associated with field-programmable gate array (FPGA) devices, which can be utilized in future integrated weapon systems (IWS) designs that will offset the costs of time-consuming maintenance and upkeep of the current IWS. The FPGA is a reconfigurable and programmable device, designed from commercial, off-the-shelf (COTS) materials, through the Navy’s open architecture (OA) procurement process that provides the IWS the necessary capabilities to continue to perform at the highest possible level.

KEYWORDS: Open Architecture, OA, FPGA, AEGIS, BMD, Return on Investment, ROI

FREQUENCY MAPPING FOR THE OPERATIONAL FREQUENCY MANAGER
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The Department of Defense (DoD) has placed great emphasis on the networking and connectivity of forces over the last several years. Programs include the Global Information Grid (GIG), FORCEnet, and net-centric warfare, to name a few. These programs emphasize and stress the warfighter’s need to stay connected to his appropriate operational command-and-control structure during operations. The value of this connectivity is crucial to both the individual warfighter and the command structure as a force multiplier in modern warfare. One solution to this problem of connectivity is giving operating forces the tools and knowledge of existing network infrastructure that details information regarding the location, frequency, and power-out of existing nodes and spectrum analysis. The knowledge and ability of a trained frequency manager will allow our forces to use the full electromagnetic spectrum to maintain connectivity with their command structure.

The goal of this research is to provide a systematic approach to detecting existing network and telecommunication frequencies and mapping their positions. This information can then be used by a frequency manager for planning operational test exercises and for operational forces that may operate in an area that is frequency saturated. In these situations, and with the knowledge of existing frequencies, these forces will be better able to manage, configure, and exploit existing network communications. This experimental study encompasses the collection, data processing, modeling, and mapping of existing networks and their electromagnetic effects in both a rural and urban environment using the TNT 802.16 OFDM test bed in the San Francisco Bay area and Camp Roberts.

KEYWORDS: Department of Defense, Global Information Grid, GIG, Force Net, Net Centric Warfare, Warfighter, Frequency Manager
AN ANALYSIS OF NAVAL OFFICER ACCESSION PROGRAMS
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This thesis conducts an extensive literature review of past studies on the three major commissioning programs for United States naval officers: the United States Naval Academy, Naval Reserve Officers Training Corps (ROTC), and Officer Candidate School (OCS). Three areas are covered: historical patterns in officer accessions and historical changes in Navy pre-commissioning training and education philosophy and policy; cost comparisons of the three major commissioning programs; and comparisons of job performance of junior and field grade officers from each program. The primary purpose of this research is to derive the implications for current Navy accession policies with respect to officer commissioning programs. The analysis finds that the Naval Academy has been and continues to be the primary source of officer accessions during periods of reduced officer requirements in the Navy. Additionally, it finds that while all naval officers perform superbly, U.S. Naval Academy graduates generally tend to have an advantage in performance during various points of their career. Due to this retention and performance differential, the larger initial cost of the education of Naval Academy graduates tends to yield a positive return to the Navy over an officer’s career. Recommendations include operating the Naval Academy at full capacity, while maintaining the necessary flow of ROTC and OCS graduates.

KEYWORDS: United States Naval Academy, Naval Reserve Officers Training Corps, Officer Candidate School, Education and Training, Officer Commissioning Programs, Naval Officer Accession Programs
MASTERS OF SCIENCE
IN
MANAGEMENT

THE EFFECT OF NAVY INDIVIDUAL-AUGMENTEE DEPLOYMENT/S ON MENTAL HEALTH OUTCOMES
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Since the start of the global war on terrorism, the Navy has provided individual-augmentee (IA) sailors to support contingency operations in order for other services to effectively perform their missions. This study analyzes the effects of IA deployments on the mental health outcome among Navy sailors. Data for this study came from three different sources: PERS-4G3 (Active Duty Augmentation Branch), the Army Medical Surveillance Activity, and the Defense Manpower Data Center. A multivariate analysis using probit models is used to estimate the effects.

Analyses on the officer and enlisted models indicate that an IA deployment of itself does not appear to adversely affect mental and physiological health. However, an IA officer deployed to a hostile location substantially increases the probability of requiring a mental-health referral compared with a non-IA officer who is also deployed to a hostile region. In contrast, an enlisted service member on an IA tour to a hostile location has a lower probability of an adverse mental and physiological health outcome compared to a non-IA enlisted service member who is also assigned to a hostile region. Due to the long period of manifestation of mental-health problems, future study should follow up those soldiers one year after deployment.

KEYWORDS: Navy Individual Augmentee, IA, Mental Health Outcomes, Deployment, Hostile Deployment, PTSD

THE EFFECT OF PAYSCALE CAPS ON MARINE MUSTANG OFFICERS AND RETIREMENT
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This research analyzes prior-enlisted Marine officer retention and its relationship to military pay caps. An analysis of the data shows that retention behavior of prior-enlisted Marine officers differs from non-prior Marine officers. Prior-enlisted Marine officers are more likely to remain on active duty after their initial service obligation and serve a full career in the Marine Corps than Marine officers with no previous military experience. Prior-enlisted service has a positive effect on retention to twenty years of service (YOS). A Marine officer with sufficient time in service stops receiving longevity pay and experiences the phenomenon known as pay compression. The lack of a pay raise for six years or longer may be a disincentive to continued service, although prior-enlisted Marine officers have higher retention rates than non-priors at every stage of their careers. The results of this study suggest that Mustangs, or prior-enlisted Marine officers, with at least eight years of prior service retire at a higher rate than regular officers after twenty YOS.

KEYWORDS: Manpower/Supply, Retirement, Retention, Personnel/Attrition, Manpower Policy Issues, Leadership
ADDING A PERFORMANCE-BASED COMPONENT TO SURFACE-WARFARE OFFICER BONUSES: WILL IT AFFECT RETENTION?

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The surface-warfare officer (SWO) community has difficulty retaining mid-grade officers, as is evident by the considerable shortfall between officer programmed authorization and the current officer inventory beginning at nine years of commissioned service. The objective of this study is to analyze the thirteen-year retention effect of adding a performance-based component to the SWO critical-skills bonus (CSB). By analyzing pay and personnel records from officer cohorts entering the Navy between 1987 and 2006, this study divides the sample of 1,331 SWOs into three performance tiers based on promotion timing to Lieutenant Commander (O-4). Probit regressions show that top performers exhibit higher retention rates than lower-performing peers, though pay has a stronger retention effect among low performers. Additionally, the Commander (O-5) promotion rate for high performers is triple the promotion rate of lower performers. Expanding upon performance-tier differences, optimization models predict a more efficient SWO CSB allocation, while retaining the highest performers and remaining within budgetary constraints. Thus, research recommends adding a performance-based component to the SWO CSB, which will maximize retention of high-performing officers. Furthermore, the Navy can realize additional savings by adopting cafeteria-style bonus options, capitalizing on differences between the federal standard discount rate and personal discount rates.

KEYWORDS: Surface Warfare Officer, SWO, Performance-Based Compensation, Pay for Performance, Performance Management, Internal Labor Market, Pay Reform, Surface Warfare Officer Retention Bonuses, SWO Critical Skills Bonus, DHS, NSPS

THE EFFECT OF GRADUATE EDUCATION ON THE PROMOTION OF A U.S. ARMY FIELD GRADE OFFICER BY CAREER FIELD

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The purpose of this study is to estimate the effect of graduate education on the promotion of a U.S. Army field grade officer. In addition, this thesis investigates whether or not there are significant differences among career fields of the Officers Personnel Management System. To do so, a probit model and three correction models are built. The first correction model uses the Heckit method to correct for sample selection bias. The second model uses the instrumental variable-regression method to correct for endogeneity of graduate education. The third model uses the double selection approach, which combines the Heckit correction with two-stage least squares to correct for both sample selection bias and endogeneity. The probit estimations indicate that the effect of graduate education for a representative officer increases the promotion probabilities by 0.148 and 0.132 for the grades of lieutenant colonel and colonel, respectively. After correcting for sample selection bias, the effect of graduate education on the promotion to lieutenant colonel is reduced by 59.5%. After correction for endogeneity, this effect is increased by 70.9%. Finally, this effect increases by 61.5% after correction for both sample selection bias and endogeneity.

KEYWORDS: U.S. Army Officer, Field Grade Officer, Graduate Education, OPMS, OPMD, Human Capital, Promotion, Selection Bias, Endogeneity, Double Selection, Heckit Method, Instrumental Variables
USING A SECOND-PRICE AUCTION TO SET MILITARY RETENTION BONUS LEVELS: AN APPLICATION TO THE AUSTRALIAN ARMY

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The Australian Army is attempting to improve retention rates, announcing a number of retention bonuses in 2007. In a service that has rarely used retention bonuses, historical data on the effectiveness of previous bonuses is limited. This thesis evaluates both the effectiveness of retention bonuses in the U.S. military, as well as an alternative method of establishing retention bonus levels with no historical data. It analyzes an experiment where a sealed-bid, second-price auction is used to set salary levels in a generic labor market scenario.

The experimental results support the literature: a second-price auction is a cost effective method of setting a retention bonus level. Without historical data and prediction techniques, a second-price auction allows the service to obtain the exact level of manning necessary at a value that more accurately reflects the value of the soldier. This reduces resource wastage. Cost effectiveness is further improved by adding a second auction for a longer-term contract. While this analysis may be valuable to the Royal Australian Navy, Royal Australian Air Force, and other volunteer militaries around the world, this thesis focuses specifically on application to the Australian Army.

KEYWORDS: Auction, Second-Price, Retention Bonus, Australian Army

THE EFFECTS OF MORAL CONDUCT WAIVERS ON FIRST-TERM ATTRITION OF U.S. ARMY SOLDIERS

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This study evaluates the U.S. Army’s policy on granting moral-conduct waivers and the effects of moral conduct waivers on the quality of service. The analysis investigates the wartime levels of recruits who were approved for different categories of conduct waivers. Research conducted includes multivariate analysis in the form of ordinary, least-squares regression models and probit regression models. This study employs U.S. Army MEPCOM data obtained from the Defense Manpower Data Center (DMDC) for soldiers who enlisted between 2000 and 2006. First-term attrition is analyzed as a function of age, sex, race, AFQT, rank, bonus size, education, prior service, youth program participation (such as JROTC), contract length, and all sub-categories of conduct waivers. In addition, attrition is analyzed at 180 and 365 days for all cohorts. The study also includes a survival analysis to investigate whether conduct waivers affect the duration of survival during the first enlistment contract.

The analysis reveals that the comparison of attrition rates between soldiers with waivers and those without does not remain constant and depends on when attrition is measured. At the beginning of the term, conduct-waiver soldiers(attrite) at lower rates than non-waiver soldiers. However, at the end of the first term this pattern is reversed. Model results show that recruits in the global-war-on-terrorism sample did not have a large difference in attrition rates between the waiver and non-waiver groups by the end of the first term of service. By breaking down the conduct waivers into sub-categories of waivers (substance, serious, and traffic), it is found that there are significant differences between each group’s attrition rates. These findings raise the question of whether the conduct-waiver policy needs to be revised to better suit current wartime needs and demographic changes in the recruit population.

KEYWORDS: Conduct, Moral, Waivers, Attrition, Recruiting, Manpower, First-Term Attrition, Waiver, Felony Waivers
AN ANALYSIS OF THE EFFECT OF THE GLOBAL WAR ON TERROR ON THE RETENTION OF UNITED STATES MILITARY ACADEMY GRADUATES
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This thesis analyzes whether the frequency and length of military deployments, due to the global war on terrorism, had an effect on separation at the end of the initial service obligation for United States Military Academy graduates between 1994 and 2001. Two types of cohorts, those eligible to make the stay/leave decision before March 2003 and those eligible after March 2003, are compared using difference-in-difference estimation techniques.

The general deployment model indicates that deployment had an adverse effect on retention. Results indicate that retention was 14.5% points lower for the period after Gulf War II (post-GWOT period). It also finds that as Army officers experience more deployments, their probability of leaving increases. An officer who deployed once is 7.3% points more likely to leave, while one with two or more deployments is 10.7% points more likely to leave the Army, compared to an officer with no deployment.

Models comparing hostile and non-hostile deployments indicate that both types of deployment negatively affect the decision to leave. However, non-hostile deployments had greater effects on the decision to leave than hostile deployments. In the post-GWOT period, the effects of non-hostile deployments were even greater compared to officers in pre-GWOT period. Specifically, an officer with more than fifteen months experience in a non-hostile area is 23% points more likely to leave relative to his peer in the pre-GWOT period.

KEYWORDS: United States Military Academy, Retention, Deployment, Global War on Terror, Probit Estimation, Army Officers, Army

SIGNIFICANT FACTORS IN PREDICTING PROMOTION TO MAJOR, LIEUTENANT COLONEL, AND COLONEL IN THE UNITED STATES MARINE CORPS
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Multiple factors influence a Marine officer’s probability of promotion. Currently, MMOA-4 counselors are not able to provide career advice based on statistical analysis of the multitude of variables that could be significant in an officer’s potential to advance to the next grade. Development of a statistical counseling model provides MMOA-4 the ability to examine an officer’s current predicted probability of promotion, as well as his future potential for advancement, given a set of possible career choices. Such a model may increase the effectiveness of the career-counseling process and potentially impact U.S. Marine Corps officer retention and performance.

Additionally, this study makes recommendations to improve the performance-evaluation system (PES). An analysis of eight years of fitness report data indicates that current procedures (which use raw numbers to evaluate the effects of the reviewing officer’s (RO) assessment) should be changed to a percentile system. The current system only provides a generalized output that has limited value in fitness-report analysis. The raw numbers of the comparative assessment limit the possibility of comparing officers across a grade for each RO. The exact value of the percentile system allows for officers to be differentiated and compared across grade. This is similar to the relative value system used for reporting senior (RS) markings. This new system will allow officers to be shown as average, above average, or below average for each RO, similar to what is currently being recorded by each RS. Ultimately, this would increase the effectiveness of retention, promotion, command, and resident school selections by empowering board members with the ability to screen officers with the RO percentile system.

KEYWORDS: Marine Corps, Officer Promotions, Officer Career, Human Resource Management
This research examines the effects of moral waivers with respect to unsatisfactory service separation in the Marine Corps. The analysis concludes that accessions who receive a moral waiver of any kind are more likely to experience unsatisfactory service; and those who receive a substance waiver are more likely to separate for drug-related reasons. The primary research question is to determine whether accessions that require one or more moral waivers significantly cause higher attrition rates in the Marine Corps. Secondary research questions are what combinations of demographics and moral waivers pose the highest attrition rate, and are individuals who are granted moral waivers more likely to separate for misconduct. In addition, are there differences in attrition rates by demographics (gender, race, marital status, dependents)? This thesis uses Total Force Data Warehouse cohort files from fiscal years 1997 to 2005. Cross-tabular comparison and logistic regression models are used to analyze the effects of moral waivers on unsatisfactory-service separations.

**KEYWORDS:** TERMS Attrition, Moral Waivers, Marine Corps, Misconduct, Discharge, Unsatisfactory Service Separations, Drug Use

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This study explores the need for incentives for Navy Chaplain Corps recruiting and recommends changes in the existing incentive program and a potential change to the way the Navy accesses chaplains. Using data from three surveys conducted with seminarians, junior chaplains, and senior chaplains, information on the efficacy of various programs is gathered and changes are recommended where deemed appropriate. Additionally, recruiting incentives and programs from the Army and Air Force are explored for possible inclusion in the Navy recruiting program.

Findings indicate that changes in the recruiting incentive program may be warranted. While recruiting bonuses may seem attractive, they are not currently required, although they may become instrumental in the future. A promising alternative to current recruiting is restructuring the way chaplain qualification is determined and the grade at which chaplains are accessed. Repayment of student loans as a recruitment option is only an incentive for those having incurred student loans. Other incentives for chaplains who engage in recruiting activities and provide viable candidates are also explored.

**KEYWORDS:** Bonuses, Incentives, Chaplain, Recruiting
THE EFFECTS OF THE GLOBAL WAR ON TERROR AND DEPLOYMENT INTENSITY ON THE PROPENSITY TO DEVELOP POST-TRAUMATIC STRESS DISORDER AMONG NAVY PERSONNEL

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This thesis addresses the effects of deployment characteristics and demographic data on propensity rates for developing post-traumatic stress disorder (PTSD). The results serve to identify the current trends of PTSD among sailors based on quantitative analysis of medical data provided by AMSA and DMDC. Potential policy recommendations to the Department of Defense are provided. Factors having positive impacts on the propensity to develop PTSD include deployment characteristics, such as hostile deployments, deployment duration lengths, and repeated deployments for enlisted sailors. Officers are not affected by deployment lengths or repeated deployments. Demographic factors that are significant include gender in both data sets and race for enlisted sailors.

KEYWORDS: Post-Traumatic Stress Disorder, PTSD, Probit Regression, Global War on Terror
THE NATIONAL SECURITY PERSONNEL SYSTEM: A HISTORY OF THE CREATION AND ENACTMENT OF THE LEGISLATION AUTHORIZING ITS ESTABLISHMENT

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The Department of Defense (DoD) National Security Personnel System (NSPS) was enacted through the fiscal year 2004 National Defense Authorization Act (NDAA), and signed into public law by President George W. Bush on 24 November 2003. NSPS enactment served as a key pillar of the DoD’s ongoing transformation effort and was an historically significant example of modern U.S. civil service reform. It also serves as a valuable case study for other government agencies interested in enacting their own civil service reform in the future.

The overall objective of this thesis is to construct an analytical history of the creation and enactment of the legislation that authorized NSPS. The two primary research questions are: 1) how was the original NSPS legislative proposal, Section 101 of “The Defense Transformation for the 21st Century Act,” created, and 2) how did Section 1101 of the fiscal year 2004 NDAA, which authorized the establishment of NSPS, become law? The thesis also explores how NSPS was created and enacted through the lens of relevant policy process frameworks.


AN ANALYSIS OF THE MARINE CORPS’ ENLISTMENT BONUS PROGRAM

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The Marine Corps has been very successful at meeting its yearly recruiting goal. However, the Marine Corps does struggle to recruit the correct number of applicants into each enlistment program. Enlistment bonuses are used to attract highly qualified applicants into critically short enlistment programs, and the enlistment bonus budget has increased significantly in the past three years. The Marine Corps has the ability to determine what enlistment programs are considered “difficult to fill” and the capability to increase the number of allocations and the dollar amount of enlistment bonuses. However, the Marine Corps does not have the ability to determine the optimal dollar amount for an enlistment bonus. This research begins by analyzing methods used in previous studies to estimate the optimal enlistment incentive. The research finds that choice-based surveys administered to recruits could be used to determine optimal enlistment incentives. Eight years of recruiting data obtained from the Total Force Data Warehouse and the Marine Corps Recruiting Command are analyzed. Results show that the enlistment bonus program (EBP) was unchanged for several years, and other factors identified could be decreasing the effectiveness of the EBP. With the information provided by this thesis, the Marine Corps can increase the effectiveness of the EBP.

KEYWORDS: Marine Corps, Enlistment Bonus, Recruiting
AN ANALYSIS OF THE NAVY’S SELECTIVE-REENLISTMENT BONUS MANAGEMENT SYSTEM AND ROGER MODEL

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The Navy’s Selective-reenlistment Bonus (SRB) Management System uses a model known as ROGER, which was developed as a Windows-based application in the mid 1990s to assist the Navy enlisted bonus manager in developing and analyzing SRB plans during the execution year. Substantial changes in the structure of the SRB program have led to increasing levels of predictive error in the model. Under-prediction of SRB program costs by the model leads to over-execution of the SRB budget and necessitates the reprogramming of funds from other enlisted programs.

The objective of this thesis is to assess the performance of the Navy’s ROGER model, which is used to forecast the reenlistment behavior of sailors in zones A, B, and C, and estimate the budget costs of the SRB program. The thesis assesses the accuracy of the reenlistment forecasting model and identifies factors that lead to prediction errors. In addition, the thesis analyzes the role of ROGER in the SRB planning process, which involves Naval Personnel Command, Enlisted Community Management Branch, as well as the Office of the Chief of Naval Operations. Finally, the thesis outlines methods to improve the identification of the population of SRB-eligible sailors in all zones and the predictive accuracy of the ROGER model.

KEYWORDS: SRB, Reenlistment, ACOL, Enlisted Retention, ROGER

A MARINE CORPS CONTRACT-SUPPLY MODEL FOR HIGH-QUALITY, MALE ENLISTMENT CONTRACTS AT THE RECRUITING SUBSTATION LEVEL

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The goal of this study is to provide Marine Corps manpower planners with a more reliable tool for forecasting enlistment supply at the local market level. This research develops contract production models at the recruiting substation level to estimate the effects of local economic conditions, demographics, and recruiting resources on new, high-quality, male-contract production. Focusing the analysis on the substation level allows the impact of recruiting resources to be more accurately predicted and more efficient allocation of resources. The supply models use pooled time series cross-sectional data from fiscal years 2003 to 2007, which provides 10,702 observations for estimation. The contract supply model is specified as a log-log functional form. The results find that Marine recruiters are the most significant predictor of new contract production. Additionally, other Department of Defense recruiters are estimated to be positively related to Marine Corps new contract production, suggesting complementary recruitment efforts. Finally, both the local unemployment rate and the military–civilian pay ratio are positively associated with contract production, but the estimated effects are not always statistically significant.

KEYWORDS: Recruiting, Enlisted Recruiting, Enlisted Supply, Manpower Supply, Fixed Effects
AN ANALYSIS OF PERFORMANCE AT THE BASIC SCHOOL AS A PREDICTOR OF OFFICER PERFORMANCE IN THE OPERATING FORCES

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The purpose of this thesis is to identify and assess factors that predict the performance of junior officers in the operating forces of the U.S. Marine Corps. In this analysis, fitness-report scores are used as indicators of performance. This research concentrates on the effect of performance at The Basic School (TBS) and other demographic characteristics on fitness-report scores. The data used in this analysis includes information on all officers who were newly commissioned between 1998 and 2005, TBS performance data for these same cohorts, and fitness report data for TBS graduates.

The results of this analysis find that several factors predict officer performance, as indicated by fitness report scores. All aspects of TBS performance are important in predicting future success. However, it is found that leadership scores at TBS have the strongest impact on performance in the operating forces. Also, officers who are prior-enlisted, married, or female have higher fitness-report scores, whereas blacks have lower scores. It is also found that officers who finish TBS in the top third of their TBS company receive higher average fitness-report scores than officers who finish in the middle third; conversely, officers in the bottom third of their TBS class receive lower fitness report scores than those in the middle third. Lastly, it is found that whether officers receive their preferred MOS assignment has little effect on their performance as a junior officer.

KEYWORDS: Marine Corps, Officer Career, Performance Evaluation System, The Basic School, Leadership, Quality Spread, MOS Assignment
MASTER OF SCIENCE
IN
MECHANICAL ENGINEERING

AUTONOMOUS UNDERWAY REPLENISHMENT AT SEA FOR RIVERINE OPERATIONS
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Currently the United States Navy is making a small footprint in the world’s littoral regions with the help of the United States Marine Corps. In Iraq, the Marine Corps is actively conducting riverine operations, however, they are overtaxed and in need of permanent replacement by the United States Navy. In order to alleviate the Marine Corps, the Naval Expeditionary Combat Command, with its riverine squadrons, will soon take over these riverine operational commitments in order to reestablish supremacy throughout the riverine environment. With this in mind, the Chief of Naval Operations, Center for Naval Analyses requirements, Systems Engineering Analysis class of 2007 developed a concept of operations that was used by the Total Ships Systems Engineering class of 2007 to develop a prototype platform, which met all initial design requirements. In order to take full advantage of this prototype platform, every effort was made to minimize the number of crewmembers on-station at any given time. The purpose of this thesis is to demonstrate the use of the direct method, which will allow the specialized command-and-control craft to conduct a fully autonomous underway replenishment at sea (UNREP) with a standard supply vessel. The direct method approach allows for a smooth path is created instead of using waypoint navigation. Additionally, this method allows for real-time updates at 1Hz.

KEYWORDS: AUV, UUV, Robotics, Trajectory Planning, Path Planning, Rendezvous, Real-time, Direct Methods

A COMPUTATIONAL FLUID DYNAMICS ANALYSIS OF A PENTA-HULLED, AIR-ENTRAPMENT, HIGH-SPEED PLANING VESSEL
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The objective of this thesis is to analyze the hydrodynamic properties of a specialized, penta-hulled, air-entrapment, high-speed planing vessel. Due to the unique features of this hull, a multi-layered approach based on computational fluid dynamics is adopted. The first is a steady state model with no free surface effects. It determines the lift and drag on the hull at a fixed waterline. It does not capture any of the planing effects created by the air entrapment region between hulls, nor does it quantify, to any degree, the amount of air being ingested into the water jets. The second is a free surface model, which includes free surface effects and the generation of the wave train by including the mixed flow regions between hulls. This method also gives an idea of the amount of air that will be present at the water jet inlets. The difficulty with the free surface model is the extremely long computational times required by the program to converge on a solution; however, if it does generate a solution, it will be a much better approximation than the steady state model will produce. Conclusions from the applications of these methods and recommendations for further research are presented.

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KEYWORDS: Steady State Model, Free Surface Model, Free Surface Effects, Air Entrapment Hull

A SEAKEEPING STUDY ON THE AUTONOMOUS SUSTAINMENT CARGO CONTAINER DELIVERY SYSTEM
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An increasing emphasis has recently been placed with fighting non-national and irregular forces. Single entity attacks on shipping and transportation units have replaced attacks on fortified or established military positions. The supply chain from sea-to-shore has become a target of opportunity to disrupt the Global War on Terrorism and put further lives in danger. Autonomous containers will play an essential role to deliver logistical supplies to waterborne littoral vessels in order to maintain station and complete military operations, all while eliminating the threat to human life as the containers will be programmed to deliver supplies to a specified locale in a reasonable timetable; vessels such as riverine warfare patrol craft, special operations craft, and Coast Guard search and rescue boats and their crews. This research focuses on the seakeeping characteristics of an autonomous sustainment cargo container and the feasibility of its deployment. Established geometric data is used, along with changing loading characteristics and ride effects. The in-depth analysis focuses on the responses of the container in varying sea conditions and at varying loads to determine whether further refinement of the design or policies concerning loading and deployment are required.

KEYWORDS: Autonomous, Cargo Container, Pitch, Slam, Seakeeping, Stability, Mast Submergence

MODELING AND SIMULATION OF SURVIVABLE ARMOR DESIGN STUDIES FOR IMPROVISED EXPLOSIVE DEVICE THREATS
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An improvised explosive device (IED) is used as a strategic weapon of choice and continues to be a threat both globally and domestically. One of the deadly devices in this arsenal is the explosively formed projectile (EPF). This study develops a methodology for modeling and simulation of armor plates to survive EFP threats. The EFP effects are modeled as a pressure or blast wave using compressible, isentropic conservation equations to get pressure loadings. The thermal effects are modeled as temperature intensities and resulting transient heat transfer analysis is conducted to obtain temperature distribution. The kinetic loads are modeled as high initial velocities applied to the plate. The combined mechanical and thermal loading is analyzed. The design space is generated for varying materials properties and thicknesses as parameters. Laminated composite and orthotropic composites are also used, in addition to special high-strength and high-stiffness generic alloys. The analysis is done using two-dimensional plate theories, as well as three-dimensional transient dynamic analysis. The results are presented showing maximum stresses and deformations for different combinations of materials and thicknesses. The results also indicate the need to use three-dimensional analysis for designing survivable armor. Recommendations are made for further studies.

KEYWORDS: Improvised Explosive Device Armor, Explosively Formed Projectile, Model and Simulation
A simple, test hail-growth model is created in order to compare hailstone sizes from model vertical velocities and calculated updrafts from a simple cloud model using forecasted soundings. The models use MM5 model data coinciding with severe hail events collected from the central and southern plains from March to May 2006 and 2007. In the test model, four different starting embryo sizes are interjected into four separate hail growth modes: dry growth and wet growth using model vertical velocities and dry and wet growths using calculated updrafts. These embryos are placed at four different beginning vertical levels, resulting in 64 possible ending hailstone sizes. Examination of the 804 hail events reveals the potential usefulness of model vertical velocities in generating severe hailstones. In particular, using dry growth, the model vertical velocities produce 727 severe hailstones compared to 661 produced by dry growth using the thermodynamically calculated updraft. Model vertical velocities also prove more accurate than updrafts, resulting in an average error of 0.417 compared to 0.788 under dry growth conditions. Calculated updrafts are still required to generate the large, severe hail that model vertical velocities could not produce.

KEYWORDS: Hail, Hail Forecasting, Model Vertical Velocities, Dry Hail Growth, Wet Hail Growth, HAILCAST

This thesis study focuses on the evaluation of the boundary layer height (BLH) diagnosed from a mesoscale model in comparison to wind profiler/Radio Acoustic Sounding System (RASS) measurements from the profiler site at Miramar Marine Corps Station (MMR). This objective is met through validation of the observed BLH and evaluations of the model BLH using the observed BLHs. In particular, two methods, one using signal-to-noise-ratio (SNR) from the profiler and the other using the vertical gradient of virtual potential temperature from RASS, are developed to detect BLH from the profiler/RASS systems. The detected BLH is validated against BLH from rawinsonde measurements. The SNR method gives a better mean BLH in the clear, convective, unstable BLs, while the gradient method shows better correlation with the rawinsonde BLH. The Weather Research and Forecasting (WRF) model for the inland location (MMR) is compared to these profiler BLH estimates. Although WRF reasonably predicts the general BL behavior, it underestimates the BLH by several hundred meters. The WRF diagnosed BLH using the bulk Richardson number is inconsistent with the WRF predicted BL thermodynamics structure. An alternative BLH detection scheme using a gradient method of BLH detection is proposed and tested for WRF, showing better results.
GLOBAL MODEL FORECASTS OF 2005 ATLANTIC TROPICAL-CYCLONE FORMATIONS AFTER POST-PROCESSING TO ACCOUNT FOR INITIAL INTENSITY

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The objective of this thesis is to test the impact on Atlantic tropical-cyclone formation forecasts during 2005 by three global models via a post-processing technique of adjusting the initial conditions to match the National Hurricane Center initial intensity information contained in the Combined Automated Response to Query (CARQ). Histograms of model analyses of the 850 – 500 mb relative vorticity and the 700 – 500 mb warm core, which are derived from the VORTRACK files, are created for CARQ intensities of 20 kt, 25 kt, 30 kt, and 35 kt, and are then used to derive Lower Tercile Values (LTVs). These LTVs of relative vorticity and warm core for each model are used to adjust the initial conditions to agree with the CARQ intensity, and the LTV35 is considered to be the threshold intensity value for formation. These adjusted model forecasts are all superior to the unadjusted forecasts because many of the false alarms are eliminated. The adjusted model forecasts of relative vorticity and warm core are also converted into equivalent intensity forecasts, and a consensus of these intensities provides a useful indication of the evolution of an incipient tropical disturbance toward the tropical storm stage.

KEYWORDS: Tropical Cyclone Formation, Numerical Model Cyclone Forecasts, Post-Processing Numerical Models

THE ROLE OF SUBTROPICAL INTRUSION IN THE DEVELOPMENT OF TYphoon USAGI (5W) 2007

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During July 2007, fields from both the NCEP GFS final analyses and ECMWF model of OW and SF analyses suggest the development of two distinct areas with sub-tropical intrusion from remnants of a decaying baroclinic system in the WNP.

This analysis of the formation of Usagi points to the sub-tropical intrusion of a strong, lower-tropospheric, baroclinic system undergoing decay as a potential seedling for typhoon formation in areas of high sea-surface temperatures; weak, low-level, vertical wind shear; and persistent convection. As the PV anomaly is stretched and detached from the baroclinic source region, it is wrapped around a strong tropospheric anticyclone in the subtropics. This constitutes a different type of baroclinic initiation process than has been previously identified in Atlantic cyclone formation events associated with TT, which are induced by upper-level troughs.

The area of high values of OW at the tip of a PV streamer favors sustained deep convection, which will enhance the low-level vorticity and moisten the mid-level, thereby producing high values of SF. The area of strong vorticity at the tip of the second PV streamer possessed both high OW and SF, favoring deep convection and cyclonic vortex tube stretching that appeared to culminate in an enhancement of lower tropospheric cyclonic vorticity.

Although this analysis was originally motivated by initial analyses suggesting that ex-hurricane Cosme underwent a direct vorticity interaction with the second PV streamer, a revised hypothesis on the role of Cosme is that it may have enlarged the wave pouch and helped preserve the mid-tropospheric circulation from hostile outside influences. In this sense, the Cosme wave may have played an important, indirect role in the formation of Usagi. This hypothesis requires further investigation.
This study examines the phase relationship (liquid versus ice) in Arctic clouds. Although it is recognized that clouds are fundamental components of the surface energy balance, the nature of an Arctic cloud phase is poorly understood and may have important implications for feedbacks associated with the rapid disappearance of sea ice. This study uses the annual cycle of cloud, radiation, and meteorological measurements made as part of the Surface Heat Budget of the Arctic Ocean field program to derive empirical relationships for cloud liquid fraction as a function of observed variables. Relative to each other, single-layer liquid, ice, and mixed-phase clouds occurred 17.6%, 39.4%, and 42.9% of the time, respectively. The dominant role that mixed-phase clouds play in the surface energy balance of the Arctic is confirmed, emphasizing the need for their correct parameterization in models at all scales. A linear fit of liquid fraction to cloud base temperature between -36°C and +2°C predicts 35% of the fraction variance. Including the observed variables of cloud base height and surface wind speed as predictors predicts another 10%.

KEYWORDS: SHEBA, Polar Meteorology, Sea Ice, Mixed-Phase Clouds, Arctic Surface Energy Balance, Cloud Parameterization

This research evaluates the production of three-dimensional (3D) clouds for geospatial viewing programs, such as Google Earth, NASA World Wind, and X3D Earth. This thesis takes advantage of iso-standard X3D graphics and X3D Edit, in conjunction with manually produced image textures, to represent 3D clouds. While a 3D geospatial viewing might never completely characterize the current state of the atmosphere, a sufficiently realistic, virtual, 3D rendering can be created to present current sky coverage given adequate satellite and model data. Various visualization demonstration results are presented that can be rendered and navigated in real time. Further research and development is needed to match a cloud typing model output with a particular method of 3D cloud production. Data-driven adaptation and production of cloud models for web-based delivery is an achievable capability given continued research and development.

KEYWORDS: X3D, Cloud, GIS
VERIFICATION OF THE AIR FORCE WEATHER AGENCY’S 3-ELEMENT SEVERE WEATHER FORECAST ALGORITHM
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Accurate severe-thunderstorm forecasts are critical to providing sufficient lead-time to protect lives and property. The Air Force Weather Agency has developed a 3-Element Severe Weather Forecast Algorithm that, when applied to model forecasts, gives an outlook region for severe thunderstorms. Improvements are made in this study to enhance the algorithm’s forecast skill and reduce its “false alarm” rate, thereby increasing the amount of lead-time for installation commanders to take decisive action to protect personnel and resources. This paper discusses the performance of the 3-Element Algorithm in its original form and the adjustments made to overcome some of its limitations.

The 3-Element Algorithm techniques and results of a performance evaluation are presented. Based on the amount of forecast improvement, eight configurations are retained for analysis across the entire dataset containing six severe weather cases. A new stability proxy, the Elevated Total-Totals Index, is developed and integrated into the algorithm to improve severe weather forecasts over high-elevation regions where some traditional severe weather indices cannot be accurately computed. Additionally, the horizontal gradient of convective, available, potential energy is studied as a new indicator to the presence of dynamic forcing. It is hoped that improvements discussed in this paper will make the 3-Element Algorithm an effective tool in the early forecasting of severe weather, increasing lead-time to safeguard lives and resources.

KEYWORDS: Severe Local Storms, Thunderstorms, Tornadoes, Hail, Mesoscale, Convective Systems, Midlatitude Cyclones, Numerical Weather Prediction, Algorithm

VERIFICATION OF AEROSOL OPTICAL DEPTH RETRIEVALS FROM CLOUD SHADOWS USING SATELLITE IMAGERY
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A technique for deriving aerosol optical depths by measuring the radiance inside and outside of shaded regions is expanded to include shadows from clouds. Previous research focused on utilizing QuickBird satellite imagery. The 2.4 meter resolution of QuickBird allowed for sampling to focus on building-generated shadows. Research was done on several different surface types, including dirt, grass, sand, and pavement. The research presented in this thesis focuses on the challenges presented by attempting this technique with three other types of imagery—Moderate Resolution Imaging Spectrometer (MODIS), IKONOS, and Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER). The lower resolution of MODIS and ASTER does not lend itself to focusing on building shadows, but rather cloud shadows. Results from sampling cloud-generated shadows show that this method has promise, much like previous studies, and opens up aerosol optical depth-determination using this technique to a wide variety of imagery, as well as additional sensor platforms.

KEYWORDS: Aerosol, Shadow Method, QuickBird, ASTER, MODIS, IKONOS, Aerosol Optical Depth Retrieval, Cloud Shadows
COMMUNICATING OPTIMIZED DECISION INPUT FROM STOCHASTIC TURBULENCE FORECASTS
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The uncertainty of weather forecasts contributes to mission risk. Ensemble data can improve combat capability by incorporating forecast uncertainty into the warfighter decision process. The study transforms raw ensemble data into optimized decision inputs for upper-level turbulence using ORM principles and decision science. It demonstrates the methodology and importance of incorporating ambiguity, the uncertainty in forecast uncertainty, into the decision-making process using the Taijitu method to estimate ambiguity. Comparing ambiguity and risk-tolerance uncertainty intervals produces a more appropriate decision input compared to currently existing methods. Significant differences between the current and research-derived, decision-input products demonstrate potential value added to decision making by incorporating ambiguity information. An effective visualization is devised for varying levels of risk tolerance and mission thresholds that is educational and practical for users. Research procedures and results can serve as an example to further education and development of stochastic methods in the Air Force and the Department of Defense.


LONG-RANGE STATISTICAL FORECASTING OF KOREAN SUMMER PRECIPITATION
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Col David Smarsh, USAF, Chief of Staff
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Long-range, statistical forecasting methods for Korean summer precipitation (KSP) are examined. Existing literature on the East Asian summer monsoon is reviewed to develop a background on current KSP research and on the relationship of KSP to climate variations. Second, the interannual variability of KSP is explored using composite and correlation analyses. It is found that circulation anomalies in the spring prior to the monsoon in the tropical northwest Pacific alter sea-surface temperatures (SST). These SST anomalies then persist into the following summer, leading to summer circulation anomalies that alter the flow into Korea and precipitation on the seasonal scale. From this relationship, a seasonal forecasting index is developed. Third, KSP is evaluated on the intraseasonal scale, to develop statistical forecast methods with five- to thirty-day lead times. It is found that the Korean summer monsoon onset, break, and withdrawal are positively correlated to the El Niño/La Niña state. It is also found that the Madden-Julian Oscillation (MJO), when conditioned with the seasonal index, shows skill in forecasting with lead times out to twenty days. Last, it is found that tropical cyclone activity in Korea is impacted by ENSO on the interannual scale, and by MJO on the intraseasonal scale.

KEYWORDS: Climate, Climate Variations, Korea, Monsoon, Precipitation, El Niño, La Niña, Teleconnections, Index Development, Smart Climatology, Flooding, Drought, Statistical Forecasting, Long-Range Forecasting
A DESCRIPTION OF THE CURRENTS ON THE CONTINENTAL SHELF NEAR EEL POINT,
SAN CLEMENTE ISLAND, CALIFORNIA, FROM 10 JULY 2006 TO 23 JULY 2007
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Master of Science in Meteorology and Physical Oceanography–March 2008
Advisors: Curtis A. Collins, Department of Oceanography
Fred Bahr, Department of Oceanography

This thesis investigates the current patterns around San Clemente Island, California. The data are from a mooring located at Eel Point, during the period 10 July 2006 to 23 July 2007. The currents were dominated by strong poleward flow along isobaths. Semi-diurnal and diurnal tides dominated the kinetic energy and rotary spectra. Clockwise rotation dominated the rotary spectra, with inertial peaks in both the near-surface and near-bottom depths. There were, on average, two to three current reversals every three months that appear to be unrelated to the wind stress curl. The stratification was described for the year, with one upwelling event occurring in late spring. Using wavelet analysis, it is shown that inertial/diurnal and semi-diurnal energy was present intermittently throughout the water column. The strongest modes of energy were associated with the near-bottom depths. Wind stress was poorly related to the currents.

Oscillations with a two to three day period were observed in the alongshore flow. These lasted for approximately ten days in April 2007, and are referred to as the April event. This event was observed from mid-water to the bottom. The event had maximum velocities of 30 cm/s at mid-water and upward phase speed of 0.12 cm/s. These oscillations were rectilinear at mid-water and became counter-clockwise with depth. It is speculated that this event may have been a coastally trapped wave, but, with these data, it cannot be determined as such.

SCI/SCORE is owned and operated by the Navy and supports training for the largest concentration of naval forces in the world. This thesis provides information on ocean currents and stratification on the continental shelf at SCI for SCORE and military participants to use with military exercises, regional climatologies, ocean engineering design studies, and marine mammal studies.

KEYWORDS: SCORE, San Clemente Island, Tidal, Wavelet, Spectra, Eel Point, Mooring, Currents, Southern California, Inertial, Diurnal, Semi-Diurnal, Coastally Trapped Wave

MODELING ATMOSPHERIC EFFECTS ON WIRELESS NETWORKS
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Second Reader: Ken Davidson, Department of Meteorology

Wireless communications infrastructures can extend command-and-control rapidly across the battle space. This study analyzes signal propagation measurements from an 802.16 link in comparison to effects-based model output. The atmospheric data include in situ measurements, numerical weather model data, and standard profiles routinely used by operators. The network studied is located in a region of highly variable terrain and vegetation in northern Thailand during the Cooperative Operations and Applied Science and Technology Studies (COASTS) 2007 field experiments.
METEOROLOGY AND PHYSICAL OCEANOGRAPHY

Received signal data show a weak correlation with predicted values using the Advanced Refractive Effects Prediction System (AREPS) with in situ and model weather data. Additional comparisons with Interactive Scenario Builder (Builder) do not show similar performance as a tactical decision aid using variable propagation conditions.

KEYWORDS: Wireless Networks, Propagation, Radiosondes, AREPS, Builder, COASTS, 802.16, WiMax, Models, COAMPS

MOMENTUM EXCHANGE NEAR ICE KEELS IN THE UNDER-ICE OCEAN BOUNDARY LAYER
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Second Reader: William J. Shaw, Department of Oceanography

This thesis describes momentum exchange in the under-ice ocean boundary layer near ice keels. Understanding ice-ocean momentum exchange is important for accurate predictive ice modeling. Due to climate change, increased naval presence in the Arctic region is anticipated and ice models will become necessary for tactical and safety reasons. Measurements took place in March 2007 in the Beaufort Sea at the Applied Physics Laboratory Ice Station sponsored by the U.S. Navy.

Turbulence measurements were made at a single point behind a large, multi-year ice ridge in the upper ocean boundary layer. The keel was found to be at least 12.5m deep and much broader than expected. Ocean profiles showed the pycnocline between 13-18m deep, and thus, a unique situation of measuring the flow around a large ice structure in a shallow boundary layer presented itself.

Results indicate that estimates of turbulence intensity depend on ice speed, direction, and measurement depth. Velocity spectra indicate periods of low inertial subrange levels likely resulting from close proximity to the pycnocline. Low frequency variance in the velocity spectra was also observed and is thought to be a wake effect resulting from an under-ice structure upstream of the flow.

KEYWORDS: Arctic, Momentum Exchange, Under-Ice, Ice Keels, Reynolds Stress, Turbulence

MICROSTRUCTURE SIGNATURE OF EQUILIBRIUM DOUBLE-DIFFUSIVE CONVECTION
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Second Reader: Jeffrey Haferman, Information Technology–High Performance Computing

Currently, analyses and interpretation of most microstructure measurements, and salt fingers in particular, are based upon the fundamental assumption that the microstructure is isotropic. While it generally accepted that the isotropic assumption may lead to underestimates of the dissipation rates of thermal and velocity fluctuations by factors of two to four, no significant attempt has yet been made to take the anisotropy of microstructure into account. This thesis represents an attempt to use direct numerical simulation in two- and three-dimensions to examine the validity of the isotropic assumption for fully developed, double-diffusive convection over a range of density ratios. Calculations are performed and the aspect ratio of the salt fingers is shown to be considerably different from unity. The anisotropy is particularly evident at higher density ratios. Based on the performed simulations, a simple method is formulated to take the anisotropy into account. The proposed technique is readily applicable to the oceanic data from free-falling and towed profilers. It is expected that the reanalysis of microstructure with high-density ratios would yield considerably different estimates of the diapycnal diffusivities and fluxes of heat and salt.

KEYWORDS: Double Diffusive Convection, Salt Fingers, Numerical Simulation, Isotropic, Anisotropy, Density Ratio
The two-dimensional (2D) spectral properties, including the degree of isotropy, of under-ice roughness in the Beaufort Gyre are investigated. Under-ice roughness plays an important role in turbulent ocean heat, salt, and momentum fluxes, which determine the delicate balance between surface forcing and the ocean interior that sustains or reduces the perennial ice cover. Accurate characterization of this roughness is important for numerical modeling and prediction of the Arctic air-ice-ocean system, which will play a significant role as the U.S. Navy increases its strategic presence in the ice-diminished Arctic Ocean. Ice draft data from moored, upward-looking echosounders of the Beaufort Gyre Exploration Project and ice motion derived from trajectories of International Arctic Buoy Program buoys are combined to create directional sections of ice draft. Autocorrelation functions are created for each segment, which are then combined to make a 2D autocorrelation function. The 2D FFT is taken of this in order to yield a 2D spectrum, from which isotropy and other spectral properties could be determined. The processing routine is tested on several synthetic test datasets and in each case produces the correct output. Two years of data from three moorings in the Beaufort all provide 2D spectra, which shows weak anisotropy of the under-ice roughness. Error estimates are determined by Monte Carlo simulations. For each dataset, most of the variance of the underside morphology is contained in a wavenumber band between 0.001 and 0.01 m\(^{-1}\) (100-1000m). There are no distinct, preferred wavelengths. Spectral levels range from 1.2 - 4.2 x 10^4 m\(^2\) for Mooring C (2004-2005) to 0.2 - 1.6 x 10^4 m\(^2\) for Mooring A (2004-2005).

**KEYWORDS:** Isotropy, Sea Ice, Pressure Ridges, Ice Keels, Ice Roughness, Beaufort Gyre, Arctic Ocean
MASTER OF SCIENCE
IN
MODELING, VIRTUAL ENVIRONMENTS, AND
SIMULATION

THE USE OF CONCEPT MAPS FOR THE DIFFUSION OF THE DISTRIBUTED OPERATIONS
CONCEPT AND THE DISSEMINATION OF EXISTING VIRTUAL TRAINING SIMULATIONS

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The U.S. Marine Corps (USMC) finds itself increasingly fighting an elusive, adaptive, and decentralized
effort. Facing this type of decentralized enemy suggests that the Marine Corps embrace a more
decentralized approach to conventional military operations. One of the strategies that the USMC has been
introducing is distributed operations (DO), which will enable commanders to fight a highly decentralized
engagement. Distributed operations require that the Marine Corps add to its conventional skills the additive
ability to decentralize decision making and an ability to distribute the force when it is tactically
advantageous to do so. Lessons learned from the Hunter Warrior series of experiments suggest that
technology can only be effectively applied once assigned tasks have been mastered. In order for the Marine
Corps to enable DO capability throughout the Marine Corps, a proactive information campaign must be
conducted. This thesis develops a web-based collaboration tool that will link critical DO-
specific and
conventional skills to the current simulations that train them. This will increase all Marines’ understanding
of the requisite knowledge and introduce novel training opportunities that exist as the concept of DO is
concurrently developed.

KEYWORDS: Distributed Operations, Maneuver Warfare, Concept Map

MODELING AIRPORT GROUND OPERATIONS USING DISCRETE EVENT SIMULATION
AND EXTENSIBLE 3D VISUALIZATION

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Almost all flight simulators are centered on the problems that can occur during flight, whereas airport
ground traffic problems are seldom addressed and are growing considerably. A number of precautions have
been directed by the U.S. Federal Aviation Administration (FAA) to overcome these challenges, such as
pilot training and adding taxiway indicator signals to help pilots follow specific paths when taxiing. Further
work is needed. This thesis simulates the problem of ground traffic incursions. Discrete event simulation
(DES) and the Viskit tool are used to build two scenarios that describe takeoff and landing maneuvers,
including potential ground incidents. It also presents the different techniques used to build three-
dimensional graphics models for the airplanes and the airport environment using Extensible 3D graphics.
After running the simulation a number of times with different parameters, collected data support basic
analysis and potential conclusions. This approach demonstrates a proof-of-concept capability worthy of
future work.
USING A COMPETITIVE APPROACH TO IMPROVE MILITARY SIMULATION ARTIFICIAL INTELLIGENCE DESIGN
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The research presented in this thesis attempts to show how using a competitive approach to artificial intelligence (AI) design can lead to improvement of the AI solutions used in military simulations. To demonstrate the potential of the competitive approach, ORTS, a real-time strategy game engine, and its competition setup are used. To justify the thesis statement, exploratory experiments are conducted. The experiments represent a tournament of virtual battles between base-case AIs and test-case AIs. The existing ORTS clients are used as base cases, and the test cases are evolved using the competitive approach to AI design described in this work. The analysis of the results from the tournament proves the advantages of the competitive approach. Some conclusions and recommendations for future work are made at the end of the thesis.

KEYWORDS: Real-time Strategy Games, Artificial Intelligence Designs, Military Simulations
MASTER OF SCIENCE
IN
OPERATIONS RESEARCH

LITTORAL COMBAT SHIP MISSION PACKAGES: DETERMINING THE BEST MIX
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B.S., United States Naval Academy, 2001
Master of Science in Operations Research–March 2008
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CAPT Jeffrey E. Kline, USN (Ret.), Department of Operations Research
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The threat of a large fleet engagement in the open ocean is currently overshadowed by the asymmetric challenges presented by state and non-state actors using the littorals for illicit purposes. Unlike traditional multi-mission combatants, the littoral combat ship (LCS) is a focused-mission platform significantly less capable of handling simultaneous missions, whether they are planned or not. However, when deploying LCS as a squadron, a combatant commander may select to equip multiple LCS platforms with a mix of focused-mission packages to ensure operational success across the broad range of challenges associated with littoral warfare. Through the use of simulation, design of experiments, and data analysis, this thesis simulates 41,195 littoral operations to address how many LCSs should comprise an employed squadron, what the composition of a squadron should be, and how sensors and weapon systems contribute to the effectiveness of an employed squadron. The results indicate that a squadron size of six to ten LCSs produces the best results, and that a compositional rule of thumb of five LCSs for the primary threat and two LCSs for the secondary threat applies to each warfare area. Lastly, the number of casualties suffered in each warfare area reinforces the danger associated with littoral combat and serves as a reminder that close engagement, while necessary, carries a cost.

KEYWORDS: Littoral Combat Ship, LCS, Mission Packages, Unmanned Vehicles, Remotely Manned Vehicles, Data Farming, Agent-Based Model, MANA, Simulation Experiments and Efficient Designs Center, Surface Warfare, Quantitative Analysis

A LOGISTICAL ANALYSIS OF THE LITTORAL COMBAT SHIP OPERATING INDEPENDENTLY IN THE PACIFIC
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The littoral combat ship (LCS) will be a small combatant designed to address many of the challenges facing the Navy in the 2002 Defense Planning Guidance (DPG). It will rely on newly developing mission-modular technology that will allow the core component of LCS, the seaframe, to change out warfare mission packages to adapt it for different warfighting scenarios. Unlike the current combatants of the Navy, the LCS will be a single-mission focused ship that will rely on still-developing technology to conduct operations in one of three main areas: antisubmarine warfare, mine warfare, and surface warfare. Through models developed in Microsoft Excel, this thesis evaluates how speed and different fuel reserve levels impact LCS fuel consumption and endurance based off the two approved versions of LCS; analyzes the implication of these findings and other possible mission-limiting factors on littoral combat ship logistics; and analyzes how the current Combat Logistics Force (CLF) force structure in the Pacific will affect overall mission capability of LCS.
ROUTING A HIGH VALUE UNIT FOR OPTIMIZED MISSILE DEFENSE IN COASTAL WATERS

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This thesis addresses the problem of routing a navy Carrier Strike Group (CSG), or other groups of ships, through a maritime chokepoint that presents one or more shore-based missile threats. The goal is to identify a path that minimizes risk to the CSG’s high value unit (HVU) (i.e., the CSG’s aircraft carrier). The HVU’s escort ships are assigned optimal positions relative to the HVU during the transit to maximize the overall probability of avoiding and/or defeating attacks. The problem is formulated and solved as a maximum-reliability path problem in a network: the operating environment is discretized into a grid of nodes that represents potential waypoints, escort formations, and travel directions; arcs define allowable transitions between nodes. An arc parameter represents the probability of successfully transiting between two adjacent nodes, computed as a function of formation, direction of travel, threat, and line-of-sight visibility between any threats and the CSG. A test scenario, with a node spacing of 2.5 nautical miles, approximates the Strait of Hormuz. The model solves in a fraction of a second on a personal computer. Results show that the CSG typically places escorts ahead of the HVU, and always between the HVU and the closest threat.

KEYWORDS: Optimization, Ship Routing, Carrier Strike Group, High Value Unit, Maritime Chokepoint, Shortest Path, Maximum Reliability Path, Missile Defense

OPTIMIZING SYSTEMS OF THRESHOLD DETECTION SENSORS

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

In any system of sensors, a threshold is established to judge whether a signal is deemed to be a detection. Beyond this threshold, all signals must be investigated to determine whether a true “event of interest” has occurred or whether the signal is a false alarm. Below the threshold the signals are ignored.

A mathematical optimization methodology is described for setting individual sensor thresholds to obtain optimal system performance. The goal is to maximize the system-wide probability of detecting an event, in the form of an increase in the mean incidence level of some statistic somewhere in the system, subject to a constraint on the expected number of false signals.

A large number of false signals can consume an excessive amount of resources and could undermine confidence in the system’s credibility. One motivation for this problem is that it allows decision-makers to explicitly optimize system detection performance while ensuring it meets organizational resource constraints.

Simulations demonstrate the methodology’s performance for various sizes of sensor networks, from ten up to thousands of sensors. Such systems apply to a wide variety of homeland security and national defense problems, from bio-surveillance to more classical military sensor applications.

KEYWORDS: Threshold Detection, Shewhart Chart, Statistical Process Control, Epidemiologic Surveillance, Syndromic Surveillance
AN ATTACKER-DEFENDER MODEL FOR INTERNET PROTOCOL-BASED NETWORKS
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The Internet Protocol (IP) has emerged as the dominant technology for determining how data is routed across the Internet. Because IP flows are defined essentially in terms of origin-destination (O-D) pairs, the authors represent IP traffic engineering as a multi-commodity flow problem in which each O-D pair is treated as a separate commodity. The authors account for the diversity in IP routing by modeling opposite extremes of traffic engineering: “naive” traffic engineering, where the IP routes data between any two users using only the shortest path between them; and “best case” traffic engineering, where the IP has the flexibility to route data using multiple paths in the network regardless of their length. The authors develop linear programming formulations that identify the maximum data flow for an IP network that satisfies proportionality constraints for traffic demand for each case of traffic engineering, and also determine the optimal interdiction of those flows that reduces that maximum flow in the worst possible way.

KEYWORDS: Internet Service Provider, Internet Protocol, Traffic Engineering, Linear Programming, Networks, Multi-Commodity Max Flow, Interdiction

ADAPTING THE DYNAMIC ALLOCATION OF FIRES AND SENSORS MODEL FOR USE IN MARITIME COMBAT ANALYSIS
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The U.S. Navy employs several models of maritime combat to provide analytical rigor to force structure and weapon system procurement policies. All of the models currently used are high-resolution and deterministic, providing very detailed results, but without any measurement of variance or any statistical manner of evaluating risk. This thesis provides the initial groundwork for a low-resolution, stochastic, maritime combat model that may provide an initial evaluation and shape future detailed studies. The framework for the model is a discrete event simulation (DES) model fed by Extensible Mark-up Language (XML) input and output modules. The simulation loads scenario inputs from XML files forming the baseline values of entities, the rules employed for movement and combat, and the general concept of the scenario. During simulation run, the model makes intermittent calls to an optimization package to allocate weapons based on a multi-dimensional knapsack problem simulating a networked force. Upon completion of the simulation run, the model generates an XML output that can later be read for statistical analysis and data mining. Because of the stochastic nature of the model, it provides an increased level of analytical quality to its results, as well as the ability to calculate the risk involved with the force structure and units employed.

This thesis focuses on interdiction of vehicle-borne improvised explosive devices (VBIEDs) on a major city by using “transparent” and “deceptive” assets. Transparent assets (e.g., road blocks) are those for which it is assumed positions are known by both attackers and interdictors. “Decoys” and “traps” are deceptive assets. Decoys are meant to be perceived as effective interdiction assets by attackers, while traps are not perceived. A mathematical optimization model is used to allocate interdiction assets maximizing expected interdicted “value.” Then, agent-based simulation is used to assess the effectiveness of those interdiction plans against a variety of attacker’s behaviors: perceptive (as assumed by the optimization), naïve, communicative, route blocker (static), route blocker (dynamic), and clairvoyant. Two test networks and seven scenarios, consisting of different combinations of interdiction assets, are used. From this analysis, it is noted that: a) if the network incorporates deception, any behavior other than perceptive may be advantageous to the attacker; b) a communicative behavior proves effective for the attackers against scenarios containing traps; c) decoys are most effective if used in defense against perceptive-like behaviors; and d) if the defender expects perceptive-like behavior, then adding transparent assets to traps and decoys may be of little value.

KEYWORDS: Deception, Network Interdiction, Agent Based Simulation, Shape File to Arcs

Within the past 50 years, containerization and globalization have driven a change from small container terminals to large container terminals that need efficient logistic models to keep up with the significant growth in container traffic. Efficient management of rubber-tired gantry cranes and planning container placement within the terminal are two ways to increase the overall efficiency of a terminal. In this thesis, these strategies are combined in a real-time dispatching tool using an approximate dynamic programming heuristic. The heuristic re-optimizes at the rate the quay crane handles containers, incorporating endogenous and exogenous information in each solution. An integer linear program (ILP) is formulated and solved to estimate the heuristic’s solution quality. The heuristic finds solutions within seconds and the absolute gap between the heuristic solutions and the ILP solutions remains essentially constant as the size of the problem increases.

KEYWORDS: Approximate Dynamic Programming, Optimization, Container Terminal, Yard Management Strategies, Crane Deployment, Rubber Tired Gantry Cranes, Container Grounding Strategies, Crane Dispatching
PASSIVE AND ACTIVE SONAR PROSECUTION OF DIESEL SUBMARINES BY NUCLEAR SUBMARINES
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This study analyzes the trend for initial detection times using both passive and active sonar during submarine-on-submarine operations. Specifically, it simulates a nuclear power submarine (SSN) searching for a diesel submarine in an environment where the SSN has a speed advantage and active sonar detection ranges exceed passive sonar detection ranges. The simulation uses a mover-sensor discrete event application of SIMKIT, developed by Professor Arnold Buss.

The simulation results show that initial detection times of a search follow an exponential distribution as a function of SSN speed, diesel submarine speed, detection ranges, ping interval, and detection probability. As a result, as detection ranges continue to decrease due to increases in sound quieting technology, initial detection times during a submarine search will increase exponentially. This can render a passive sonar prosecution ineffective when combating a modern diesel submarine. Should an SSN use active sonar, initial detection times can be significantly reduced, especially if combined with an effective search path. The threat to the SSN of using active sonar can be mitigated by judicious consideration of ping interval and search speed with detection probability and active detection ranges. All values used to arrive at the conclusions stated are notional and no classified information sources were consulted as part of this work.

KEYWORDS: Active, Passive, Submarine, Sonar, Simulation, Discrete Event, Undersea Warfare, Diesel, Detection Ranges, Search Speed, Ping Interval, Search Path

THE EFFECTS OF INDIVIDUAL AUGMENTATION ON NAVY JUNIOR OFFICER RETENTION
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The Navy started the individual augmentation (IA) deployment program in 2000. IA deployment provides a tool for military leaders to designate and assign specific individuals, not forces, to fill temporary duty jobs outlined by combatant commanders in support of National Command Authorities-directed operations. IA is one of the Navy’s means of contributing to the Global War on Terror and Operation Iraqi Freedom.

This thesis uses standard statistical-modeling techniques to quantify the effects of IA deployments on Navy junior officer retention. Using these models, it is found that the odds of retention for junior officers who went on IA deployments are statistically significantly higher than for those officers who did not. This is an important result because Navy leaders have said that IA deployments will continue in the future. Officers are the foundation of the Navy command and leadership structure; therefore, it is important to understand the effects these deployments have on their retention.

KEYWORDS: Individual Augmentation, IA, Junior Officer Retention
The U.S. Navy recently designated humanitarian assistance (HA) and disaster relief (DR) as core capabilities, recognizing the importance of delivering a potent strategic communications message directly to foreign populations. The ship-to-shore transportation problem (SSTP) refers to the daily need to determine transportation asset (embarked helicopters, watercraft, and ground vehicles) routing and loading to effect the movement of personnel and patients between hospital ship (T-AH) and ashore mission sites during HA/DR operations. The SSTP significantly impacts overall mission performance. The SSTP is formulated as a mixed-integer, mathematical optimization model, minimizing cost in a multi-objective merit function reflecting mission performance, personnel strength, and transportation asset utilization, while reflecting constraints unique to T-AH HA (flight deck limitations, restricted embarkation, and debarkation by watercraft). Optimized schedules improve average duration of ashore mission site operations by between 9% and 13% compared to a set of optimistic, pseudo-manually generated schedules, and decrease average time spent by personnel in transit by between 16% and 43%. USNS *COMFORT* (T-AH 20) treated nearly 95,000 patients in 2007 during an HA deployment; operational efficiencies can translate into thousands more benefiting from HA. This thesis also helps allocate helicopter flight hours, a monthly constraint, over a set of daily SSTP scenarios.

**KEYWORDS:** Humanitarian Assistance, Hospital Ship, Optimization, Scheduling, Disaster Relief, Medical Operations, Vehicle Routing
A QUANTITATIVE APPROACH TO DETERMINE ANALOGOUS AREAS USING ENVIRONMENTAL PARAMETERS

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Master of Science in Physical Oceanography—March 2008

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The backbone of the success of United States Navy (USN) forces has been their ability to train for future events. By conducting successful training operations, the Navy has prepared for real-world operations. The principle, “fight like you train, train like you fight,” has no less significance today than it did in the past. The purpose of this thesis is to develop a new, robust analogous area determination tool for the USN fleet. This thesis builds upon previous approaches by expanding the potential analogous areas to the entire globe and including more environmental parameters in the analogous area determination process. In addition, a different approach is used in determining the analogous areas. Instead of a MATLAB-based fuzzy logic approach, this method uses ArcMap software as a tool for performing analogous area searches and display of results. This method is more efficient and user-friendly than the fuzzy logic approach, and allows users to easily tailor the process to meet any requirement. The focus of this thesis is primarily on acoustic features within the water column, but other important environmental features are analyzed. The end result is an effective and accurate analogous area tool ready for immediate use in the fleet.

KEYWORDS: USW Area Analogs, Sound Speed Profile, Analogous Areas, ArcMap query, SSP Characterization
A FRAMEWORK FOR SOFTWARE REUSE IN SAFETY-CRITICAL SYSTEM-OF-SYSTEMS
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This thesis concerns effective and safe software reuse in safety-critical system-of-systems. Software reuse offers many un-utilized benefits, such as achieving rapid system development, saving resources and time, and keeping up technologically in an increasingly advancing global environment. System software needs to be designed for both reuse and safety and available information needs to be shared effectively. A process neutral framework for software reuse in safety-critical system-of-systems is introduced. That framework consists of four elements: organizational factors, component attributes, component specification, and safety analysis. A model (C5RA) is developed to capture the relevant component information and assist in specification matching. A survey of software safety metrics is conducted, metrics are created, and a ranking is developed. The framework is applied utilizing the reuse of a generic avionics software component. Key findings are that congruence between all elements is required; software should possess certain attributes with metrics that support a safe design; software component information can be specified using C5RA; and a process is identified for a system-of-systems hazard analysis for software reuse. The framework outlined provides a solution that enables effective software reuse in safety-critical system-of-systems.

KEYWORDS: Software Reuse, System of Systems, Safety-Critical, Software Certification, System Safety, Hazard Analysis
This research study evaluates the ability of the Naval Simulation System (NSS) to model how changes in communication architecture for a given scenario contribute to combat effectiveness. The scenario used for this study models communication capability associated with the Marine Corps Warfighting Lab, Sea Viking 06 distributed operations scenario using the NSS. In addition, an evaluation of alternative system configurations in the communication structure is obtained in order to determine how bandwidth constraints on specific systems limit mission effectiveness. The NSS is a multi-warfare mission area tool designed to support operational commanders in developing and analyzing operational courses of action at the group/force level. Recent evolutionary changes now provide the NSS with the ability to perform communication analysis of routed- and circuit-switched systems, in addition to course of action analysis of modifiable assets in a programmed scenario. This capability makes the NSS unique among modeling and simulation tools. The simulation model experiment contains seven communication architectures with progressively reduced bandwidth capacity. Each architecture excursion has the same scenario timeline and measurement parameters. The results of each excursion are graphically compared and statistically analyzed to identify communication performance impacts at critical events throughout the scenario. A correlation is made with communication performance and combat effectiveness when the enemy force attrition is compared over each excursion to identify if a decrease in combat effectiveness can be seen as a result of reduced communication capability. The results show that the NSS can be used appropriately and accurately to represent communication system effectiveness within a distributed operation scenario supported by the Expeditionary Strike Group. The objective of this study directly supports the Network Centric Operations framework at the information domain by demonstrating the ability of the NSS to measure the quality of a communication plan and its value within a command-and-control system architecture as applied to force effectiveness.

**KEYWORDS:** Expeditionary Strike Group, Distributed Operations, Naval Simulation System, C4I System Modeling, Communication Systems Modeling, Expeditionary Tactical Communication System, ETCS, ESG, NSS
AEGIS PLATFORMS: USING KVA ANALYSIS TO ASSESS OPEN ARCHITECTURE IN SUSTAINING ENGINEERING

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The purpose of this thesis is to estimate the potential performance improvement in sustaining engineering (SE) when an Open Architecture (OA) approach to system development is used. Its basis is that in Integrated Warfare Systems (IWS) acquisition, eighty percent of total life-cycle costs occur during the Operation and Support phase. This statistic demonstrates the necessity of measuring how the OA approach will affect software upgrade and maintenance processes for the AEGIS IWS Life Cycle. Using the OA approach, advances in distance support and monitoring, and maintenance free operating periods are possible, and this is significant in supporting the need to reduce costs and manpower while improving performance. To estimate the potential (Return on Investment) ROI that an OA approach might enable for SE in the form of software maintenance and upgrade, this thesis will apply the Knowledge Value Added (KVA) methodology to establish the baseline, "As Is," configuration of the current solutions in AEGIS. The KVA analysis will yield the ROIs and the current models for the approach to software maintenance and upgrade. Based on the assumptions of OA design for original system development, new approaches to distance and maintenance and monitoring will be explored in "To Be" solutions, and the ROIs will be estimated. The "To Be" solutions are rooted in the assumptions of MFOP and ARCI, and the results indicate that these solutions yield a potential improvement of 720% and a cost saving of $365,104.63 over the current methodology for just one ship. For all ships using AEGIS, ROI improves by 71,967% with a cost savings of $26,543,824.56.

The conclusion is that OA enables extension of these best practice approaches to AEGIS maintenance and upgrade solutions.

KEYWORDS: AEGIS Platforms, KVA, KVA+RO, Sustaining Engineering, Distance Support

MASTER OF ARTS

National Security Affairs
Security Studies
This thesis focuses on analyzing the challenges of the Albanian intelligence services during the implementation of security sector reform. What is the progress made in addressing these challenges and what are the problems still remaining? Which are the challenges that these services should face during the second phase, the consolidation of the SSR reform in the process of integration into the European Union (EU) and NATO?

Albania, as a new democratic society, should not wait for better conditions to vigorously consolidate the reform of the intelligence services and the system for controlling, directing, and coordinating these services. The intelligence structure reform would reflect NATO’s and the EU’s norms, the western standards of transparency and accountability in a modern democracy, but also the efforts of the intelligence and security domain for combating new threats. The reform will improve the mechanisms of accountability and control, as well as legislative and judicial oversight over intelligence and security services working under the rule of law, and will accelerate the process of integration into NATO and the EU. In this difficult work and without a clear scheme as how to do it, the experience of other states that have achieved this objective is useful.

**KEYWORDS:** Intelligence Reform, Intelligence Service, Security Services, Civil–Military Relation, Security Sector Reform, Democratic Control, NATO, EU

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This study examines the transatlantic security divide through the strategic culture lens, taking a comparative case study approach. It analyzes the emergent European Union (EU) strategic culture by looking at the European security strategy, European security elite speeches, and ESDP operations. It examines the same evidence to determine the predominant trends in American strategic culture during Operation Iraqi Freedom and finds the greatest divide in the ideational foundation of operations, particularly as concerns perceptions of legitimacy. In the area of multilateralism, there is a greater similarity than is usually argued as concerns ad hoc coalitions of the willing: the EU forms coalitions with non-EU partners; allows individual members to decide whether or not to contribute troops and thus carry financial obligations; and now opens up the possibility for “structured enhanced cooperation” in ESDP, despite the legitimacy derived from the institutionalized cooperation stressed in public. The use of force only as a last resort is upheld by both in public diplomacy; however, in reality, both keep all options open regarding when to act, even though the EU does stress less use of force and more crisis prevention and non-military tools, while the U.S. intervention in Iraq was instrumentally declared as a last resort.
DEFENDING U.S. NATIONAL INTERESTS IN THE PERSIAN GULF: GOING LIGHT
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Is it possible to defend U.S. interests in the Persian Gulf through the use of primarily special operations forces (SOF)/light forces? How might implementing this type of force structure affect the perception of U.S. involvement in the region and its ability to project power on a scale commensurate with its interests? This thesis examines two ways that the U.S. might be able to secure its interests in the Gulf using a minimalist approach. The two methods evaluated are using sea bases in the Gulf and land bases in Djibouti in the Horn of Africa as forward staging bases for SOF operations in the Persian Gulf. The study looks at these two options in terms of costs and benefits, both fiscally and physically, in terms of the impact that these bases would have on the populations in the Gulf.

KEYWORDS: Seabasing, Interests, Terrorism, Energy, Maritime, Security, Counter-Proliferation, SOF, Special Operations, Persian Gulf, Middle East, Joint, Counterterrorism, Djibouti, Horn of Africa

SERBIA AND THE NATO PARTNERSHIP FOR PEACE PROGRAM
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This thesis explores Serbia's relationship with NATO, focusing on two questions: how can Serbia and NATO benefit from the Partnership for Peace program (PFP)? How can Serbia identify its needs for assistance as a consumer of security and also actively contribute to regional security under the overarching PFP program? Serbia's main problems include: 1) weak civilian control of the military and intelligence services, 2) inadequate legal basis and appropriate legislation for effective leadership to transform the military and intelligence services, and 3) a deeply troubled heritage stemming from the period when Milosevic was in power.

Serbia's PFP membership can most directly benefit state authorities by providing expert support for solving the first two problems. These problems can be resolved with a clearly defined security policy and effective mechanisms for implementing such a policy. Serbian participation in the NATO PFP program cannot solve the third security issue, because NATO's role in regard to war criminals and Kosovo's final status is to support the UN. However, PFP membership provides an additional forum for governments to openly discuss, as equals, issues like the territorial integrity of Serbia and war crime convictions.

KEYWORDS: Serbia, NATO, Partnership for Peace Program, Euro-Atlantic Integration, State Security Policy
PROSPECTS FOR AN INDEPENDENT KURDISTAN?
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The last ninety years of Kurdish history demonstrate a political progression towards statehood. Examination of this history and U.S. policy during this period allows us to analyze the circumstances that prevented Kurdish statehood. The three levels of analysis utilized allow analysis of Kurdish history with regards to the individual, the state, and the international system. Such analysis assists in determining the prospect for independence of the Iraqi Kurds today.

An Iraqi Kurdish declaration of independence would directly influence U.S. foreign policy for the Middle East. American policy decisions would depend upon the effects of other foreign policy objectives for the region. Recognition of Kurdish sovereignty is a policy decision that requires analysis of Kurdish history within the context of U.S. foreign policy objectives.

KEYWORDS: Iraqi Kurdistan, Kurdish Nationalism, International Relations Levels-of-Analysis

DETERRING SPOILERS: PEACE ENFORCEMENT OPERATIONS AND POLITICAL SETTLEMENTS TO CONFLICT
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This thesis demonstrates that the ability of a peace enforcement operation to deter spoilers determines the progress of a political settlement to a conflict. The method of difference is used to examine how two case studies with similar security environments obtained divergent results in political settlements to their respective conflicts. In Somalia, Operation Restore Hope provided a strong peace-enforcement operation, but ultimately failed to deter spoilers to United Nations negotiations for a political settlement to the conflict. In the Democratic Republic of Congo, Operation Artemis succeeded in deterring spoilers to the implementation of a political settlement to that country’s civil war. Peace enforcement operations like Artemis, which offer highly credible military capabilities in direct support of the political negotiating process, prove to be effective in deterring spoilers and thus ensuring forward momentum for a political settlement to the conflict.

KEYWORDS: Spoilers, Conflict Resolution, Peace Enforcement Operations, Somalia, Democratic Republic of Congo

U.S. COLLABORATIVE ENGAGEMENT WITH CHINA: USING STRATEGIC TECHNOLOGICAL, COLLABORATIVE LEADERSHIP
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Master of Arts in National Security Affairs–March 2008
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China and the United States have taken different paths to arrive at their respective stages of technological development. The United States obtained leadership in technological innovation through its competitive bid to remain technologically superior to the Soviet Union during the Cold War. China developed late, taking a leapfrog approach to play catch-up to the West. This is now changing, as Cold War priorities end and globalization provides incentives for off-shoring of U.S. technology companies to China. The shift to rely more on commercial, off-the-shelf (COTS) for military technology means that keeping the United States a
leader in innovative, civilian technologies is a security issue complicating this economic interdependence. Since technological interdependence with China is a given, how can the United States compete with China economically, politically, and militarily in East Asia? Export controls, which kept technology out of the hands of the Soviet Union during the Cold War, do not work in a global political economy where commercial competitiveness is so vital and technology rapidly innovates and has global availability. A new, comprehensive approach is needed to solve the inadequate, dual-use technology export control structure. This new approach is required to meet current and future U.S. security and economic demands.

The United States should use strategic, technological, collaborative leadership (STCL) to lead the region in finding new technological solutions for the region’s environmental and energy demands. STCL would then lend itself to a collaborative-engagement policy that would have political, security, economic, and social benefits for the United States and the entire East Asian region. The collaborative structure set up in the United States to support this policy will also provide a comprehensive means to ensure an efficient and effective technology control process. This process would ensure that critical, dual-use technology innovations stay within the United States and would thus preserve the U.S. innovative technology base, while minimally affecting commercial trade with China. These policy attributes will be especially important, as nanotechnology, which is inherently interdisciplinary and collaborative, brings innovations with the promise of further enhancing this collaborative effort in a positive direction. There is an opportunity to find the maximum utility for this new technology through collaborative-engagement. If this opportunity is not taken, China and the United States, and the world for that matter, could enter a very dangerous period of an arms race based on this potentially deadly new technology.

KEYWORDS: Globalization, Strategic Technological Collaborative Leadership, Social Construction of Technology, Foreign Direct Investment, Multinational Corporations, Social Constructivist, Global Political Economy, Economic Interdependence, Collaborative Sphere of Influence

SINO-JAPANESE RELATIONS: COOPERATION, COMPETITION, OR STATUS QUO?
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Over the course of their history, bilateral Sino-Japanese relations have experienced a paradoxical relationship of autonomy and interdependence, mutual respect and suspicion, and admiration and condescension. The approach these regional powers take towards their bilateral relations—whether it is competition, cooperation, or the status quo—will circumscribe the framework for regional stability in the coming decades. To the casual observer, the cultural animosities stemming from World War II atrocities might indicate that diplomatic relations will be forever troubled. However, mutually beneficial economic ties have always existed between these two compatible economies.

This thesis unravels this complex relationship by examining salient diplomatic, economic, and security issues. It finds that the doomsayers who cite virulent anti-Japanese nationalism in China are too pessimistic and the liberally inclined advocates of economic interdependence are too optimistic. It also finds that security concerns in the Taiwan Straits and the East China Sea have generally been quelled by pragmatic political elites on both sides, who have managed to diffuse any potential escalation into armed conflict. Thus, the future for Sino-Japanese relations portends a continuation of the status quo, with bounded fluctuations between the optimists and the doomsayers.

The literature on U.S. policy towards Cuba during the post Cold War period has focused around the idea that a small domestic group has dominated policy making because of their electoral influence in Florida and have left the executive at their mercy. Critics have often argued that the Cuban American National Foundation (CANF) has been able to capture policy during non-crisis interludes and left poor policy options available to the executive powerless to respond effectively during critical periods and thus poor policies are implemented, not in tune with executive goals.

This thesis aims to disprove the widespread consensus that U.S. policy towards Cuba has been dominated by Cuban-Americans since the end of the Cold War. Instead, the executive has been able to maneuver and adapt policy throughout the changing and complex political environment and seize control of the two-level negotiations in order to achieve their own policy goals. Understanding the factors that shape U.S. policy toward Cuba is essential as Cuba approaches another important transition period with the ascendance of Raul Castro to the presidency. If policymakers continue to believe in the myth of CANF dominance, they are less likely to explore creative options for U.S. policy toward Cuba that might risk the ire of the group. Understanding the room for maneuver provided by the multiple interest groups with an interest in Cuba and public opinion is no guarantee of effective policy towards Cuba, but it would seem to be a necessary condition.

**KEYWORDS:** Cuba, U.S. Policy, Two Level Game Theory, Executive Discretion, Cuban American National Foundation, CANF, Domestic Politics
THE ROLE OF FRAMING IN COUNTERINSURGENCY/COUNTERTERRORISM OPERATIONS: THE STATUS OF HEARTS AND MINDS
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Second Reader: James A. Russell, Department of National Security Affairs

Public diplomacy – winning hearts and minds – is increasingly being recognized as integral to the fight against terrorism. Yet little is known about terrorist framing of their operations and its appeal. Is there a pattern in terrorist narratives that can be identified and countered? This thesis examines how terrorist movements frame their actions, delineating how these groups communicate with their public. Framing offers insights into insurgent and terrorist operations that are only recently being addressed, but are still not widely capitalized on by current U.S. Army operations in Iraq. The focus of this research is the role of framing in the U.S. counterterrorism effort. The authors demonstrate how insurgent and terrorist messages shape the information operations (IO) battlefield against U.S. and coalition forces in the Middle East. The thesis shows that the terrorist’s message is just as important as the act of terrorism itself, and these messages provide a window into understanding their operations, their ties to constituencies, and possibly, their direction for future attacks. The concept of framing can serve as an aid to U.S. military leaders in addressing problems that conventional forces face when tasked to fight an unconventional but highly organized enemy.

KEYWORDS: Framing, Information Operations, al Anbar Province, Counterinsurgency Operations

FACTORS THAT EFFECT INTERAGENCY COLLABORATION: LESSONS DURING AND FOLLOWING THE 2002 WINTER OLYMPICS
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Collaboration is a critical component of homeland security. During the 2002 Winter Olympics in Salt Lake City, Utah, 11,000 public safety officers came together from federal, state, and local agencies and successfully protected the Games. This collaboration ensured the safety of more than 3.5 million visitors to the state, including athletes and foreign dignitaries. However, six years after the Games and the 9/11 terror attacks, law enforcement agencies at every level have, at times, struggled to successfully implement collaborations on a continuing and consistent basis.

Creating collaborations that endure is an important issue for public safety organizations. What are the key factors or enablers that foster an environment in which collaborations can be sustained? Based on interviews with law enforcement leaders involved in the 2002 Winter Olympics, several factors are identified that impact the effectiveness and endurance of collaborations. These include motivation, felt need, leadership, trust and social capital, and a formalized system of roles and procedures. Leaders are an important part of a collaborative effort as well. By implementing a strategic plan, for example, leaders can increase the level of motivation for collaboration even if there is no immediate need for a collaborative
effort. This study finds that enablers for continued collaborations after the 2002 Winter Olympics included leadership, trust, social capital, and felt need. The major explanations for the discontinuation of other Olympic collaborations are lack of motivation or need, lack of leadership, lack of strategic planning, and no mandated system.

**KEYWORDS:** Collaboration, Multi-Organizations, Inter-Agency Cooperation, 2002 Winter Olympics, Collaborative, Enablers, Barriers

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**INTRODUCING THE FUTURE NOW: USING MEMETICS AND POPULAR CULTURE TO IDENTIFY THE POST-9/11 HOMELAND SECURITY ZEITGEIST**

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What effect did the terrorist attacks on September 11, 2001, have on American culture? One outcome was the emergence of “homeland security” as a new institution, concept, and method. But what does this mean as part of a broader historical narrative of cultural change following 9/11? This thesis uses a combination of both classic and contemporary theories to gain perspective on how the public perceives homeland security — Zeitgeist theory and memetics. By examining small clues found within American popular culture, called memes, the reader is able to see how ideas related to homeland security have been transmitted, varied, or faded away. What may appear to be random events found in American popular culture can be considered part of a larger dynamic at work, called the “Zeitgeist,” and may provide the first glimpse into a future that “currently exists, but is just not widely distributed yet.” The themes found within the homeland security Zeitgeist — patriotism, victimization, fear, and absurdity — provide insight into how Americans perceive homeland security and awareness of emerging cultural patterns that affect their lives. Opportunities for further research are suggested related to cultural evolution, memetics, popular culture analysis, strategic communications, and homeland security.


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**MITIGATING INFORMATION OVERLOAD: THE IMPACT OF A “CONTEXT-BASED APPROACH” TO THE DESIGN OF TOOLS FOR INTELLIGENCE ANALYSTS**

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With the explosion of available data from a variety of sources, it has become increasingly difficult to keep pace with the amount of arriving data, extract actionable information, and integrate it with prior knowledge. Add to that the pressures of today’s fusion center climate and it becomes clear that analysts, police officers, and executives’ ability to make rapid, sound decisions is severely compromised.

The combination of circular reporting and the complexity of data sources are contributing to information overload. Law enforcement agencies realize that this cannot be resolved by continuing to hire more intelligence analysts. Instead, they must begin leveraging technology. Illinois State Police are utilizing a technology artifact in their Statewide Terrorism and Intelligence Center (STIC) that incorporates technology built from the context of these users. This thesis uses a survey instrument to evaluate the effectiveness of this technology in reducing circular reporting and handling complex data sources.
The findings conclude that intelligence analysts within the STIC perceive that information overload exists, and both the complexity of data sources and circular reporting minimize their effectiveness and efficiency. Furthermore, this technology effectively improves these negative effects and increases the STIC’s ability to better serve communities.

**KEYWORDS:** Information Overload, Context-Based Technology, Circular Reporting, Complex Data Sources

**WHAT IS GOING TO MOVE THE NEEDLE ON CITIZEN PREPAREDNESS? CAN AMERICA CREATE A CULTURE OF PREPAREDNESS?**

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The federal government has called for the creation of a culture of preparedness. A literature review confirms that a variety of studies have found that citizens are woefully unprepared for disasters. Citizens are no more prepared now than prior to Hurricane Katrina. This thesis identifies two major hurdles for a culture of preparedness: 1) changing government itself to embrace citizen preparedness as a forward deployment of assets and to provide the necessary leadership and funding for preparedness efforts, and 2) changing the behavior of the American people to embrace and act upon the message of preparedness.

This thesis reviews numerous federal documents highlighting the importance of citizen preparedness and juxtaposes stated policy to actual federal budget numbers. Lack of formal policy by state and local government is identified as a concern.

Defining and measuring citizen preparedness have yet to be accomplished. A persuasive campaign to change human behavior has yet to be created that incorporates social marketing, cause marketing, psychology, and sociology. Case studies, including seatbelt usage and breast cancer awareness, are identified as models. Israel is discussed as a culture of preparedness.

Several recommendations and suggestions for developing a culture of preparedness are provided. Areas of further study are identified.

**KEYWORDS:** Citizen Preparedness, Citizen Corps, Culture of Preparedness, FEMA, Ready Campaign, Psychological Preparedness for Terrorism, Resiliency, Israel, Social Marketing, Cause Marketing, Psychology and Disaster Preparedness, Marketing and Disaster Preparedness, Federal Budget/Citizen Preparedness, Defining/Measuring Citizen Preparedness, Citizen Preparedness and Forward Deployment of Assets

**THE CRIMEAN TATARS AND THEIR INFLUENCE ON THE “TRIANGLE OF CONFLICT”—RUSSIA-CRIMEA-UKRAINE**

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The dissolution of the Soviet Union brought about multidimensional problems to the former republics of the Union of Soviet Socialist Republics (USSR) and their inhabitants. In 1990s Ukraine, Crimea became a center of conflict between Ukraine and Russia over the former Soviet Black Sea Fleet and Crimea itself, perceived as historically their own by both sides of the conflict. Local Crimean authorities took advantage of the specificity of a demographic situation in Crimea, where Ukrainians (the titular nation) are in the
minority and considerably Russified, to claim autonomy. Later, they attempted to secede from Ukraine. At the same time, the Crimean Tatars, returning from the exile orchestrated by the Stalinist regime in 1944, further exacerbated the “triangle of conflict” between the dyads Russia-Ukraine and Crimea-Ukraine. The Crimean Tatars, currently 12% of the Crimean population, proclaimed Crimea the national territory of the Crimean Tatar people, on which they alone possess the right to self-government; they claimed greater rights for themselves as allegedly the most indigenous people in Crimea, while the rest are colonizers.

This thesis explains the historical developments in Crimea and attempts to draw implications to the Ukrainian government in dealing with Crimean Tatar nationalism, which seems to be overcoming the problems within the “triangle of conflict” that was so sharp in the 1990s.

**KEYWORDS:** Ukraine, Autonomous Republic of Crimea, Crimea, Crimean Tatars, Black Sea Fleet, Autonomy, Indigenous Peoples

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**A UNIFORM APPROACH TO NATIONAL SUICIDE-BOMBER INCIDENT RESPONSE AND RECOVERY**

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First responders in the United States are not adequately prepared to respond to a suicide-bomber attack. Police, fire, and EMS are using protocols that do not anticipate the unique needs of a suicide-bomber response. There is an urgent need to develop and implement a consistent approach for responding to suicide bombers.

This thesis develops a Suicide Bomber Response Framework using International Association of Chiefs of Police training documents as the primary source, along with Technical Support Working Group training materials, and recommendations from relevant national training institutions. A full-scale Homeland Security Exercise and Evaluation Program (HSEEP) exercise is conducted for this thesis. The exercise is based on the newly written framework; the goal is to identify gaps between current standard operating procedures and operating procedures recommended by the Suicide Bomber Response Framework.

Exercise evaluators identify a significant gap between standard operating procedures of first responders and the recommended response procedures in the Suicide Bomber Response Framework. The thesis argues that a unified, suicide-bomber response approach should be instituted nationwide. The Suicide Bomber Response Framework would serve as the tool for responding agencies to develop consistent response plans necessary for this critical public-safety concern.

**KEYWORDS:** Suicide, Bomber, Response, Recovery, Homeland, Security, Exercise, Evaluation, Homegrown, Terrorist, Jihad, Weapons of Mass Destruction, IED, Critical Infrastructure, Plans, Operating Procedures, First Responders, Shoot to Kill, Incident Command

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**FIREFIGHTERS’ ABILITY AND WILLINGNESS TO PARTICIPATE IN A PANDEMIC**

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Second Reader: Christopher J. Bellavita, DoD Contractor

Current estimates predict that 30-40% of the population will be infected with the flu virus during a pandemic. Fire departments should anticipate a higher attack rate for their personnel because of increased exposure risk. Additionally, many variables will negatively influence firefighter participation rates over and above these attack rates.
This thesis analyzes firefighters’ ability and willingness to participate in a pandemic through a comprehensive survey of firefighters within the twelve National Capital Region fire departments. Issues that may influence firefighters’ ability and willingness to work include childcare, concern of family, adequate personal protective equipment, worker’s compensation coverage, and availability of vaccines and antivirals. Collectively, these variables determine a workforce participation percentage—the share of firefighters who will be able and willing to participate in a response during a pandemic. Results indicate that between 30-70% of the firefighters will not be able or willing to work during a pandemic. Although a firefighter’s participation is situationally dependent, fire departments should take urgent steps to address five core areas. These are included in a set of recommendations. Ultimately, the priority recommendation is for fire officials and regional public policymakers to rise to the challenge of the complexity of these issues. Leadership in the face of this recognized pandemic threat, however, remains an elusive solution.

**KEYWORDS:** Fire Fighter, Paramedic, Emergency Medical Technician, Pandemic, Participation, Bird-Flu, H5N1, Preparedness, Ability, Willingness, Worker’s Compensation, Personal Protective Equipment, SARS, Antivirals, Vaccines

**COERCIVE DISARMAMENT, DEMOBILIZATION, AND REINTEGRATION: CAN IT BE SUCCESSFUL?**

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In a post-conflict situation, a strategy of disarmament, demobilization, and reintegration (DDR) is critical to achieving sustainable peace. There are three main DDR approaches: the cooperative, successful against macro-insecurities; the integrated, emphasizes micro-insecurities; and the coercive, commonly a failure. Today, coercive DDR programs are increasingly common, which creates a need to understand why many think they always fail and how the programs can be improved. This thesis conducts a comparative study of three coercive DDR programs, comparing within and across the programs to ascertain conditions that lead to both success and failure. Haiti 1994–2004 is an example of coercive DDR with short-term success but long-term failure. Haiti 2004–2007 is an example of the unique challenges implementers confront when targeting criminal gangs. Albania 1997–1999 is an example of how coercive DDR achieves long-term success by using a community-based approach. The study finds that short-term success is sustainable when the terms of DDR are acceptable to the target group. Security, economic guarantees, and community involvement are critical to the success of coercive DDR. Contrary to expectations, coercive DDR programs can succeed, but require careful integration of local actors and local situations, a condition that is often absent.

**KEYWORDS:** Haiti, Albania, Disarmament, Demobilization and Reintegration, DDR, Macro-Insecurities, Micro-Insecurities, Cooperative Approach, Coercive Approach, Integrated Approach, Community-Based Approach
SECURITY STUDIES

FROM VICTORY IN EUROPE DAY TO THE FULDA GAP AND NEW EUROPE: THE POLICY OF U.S. FORCES IN GERMANY—IMPLICATIONS FOR TWENTY-FIRST CENTURY CONFLICT
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This thesis examines the sources and character of the U.S. policy that has maintained U.S. military forces in Germany from 1944 to the present, despite multiform changes in the international political environment and consistent global restructuring of U.S. troops in these decades. From the moment the decision was made to transform the occupying forces in West Germany into stationed forces in the late 1940s and until 2003, the presence of such forces has consistently been the subject of debate about policy and strategy. Despite outward appearances of continuity in U.S. garrisons on the Rhine and in the Palatine Forest, U.S. force reductions in Germany have been discussed and attempted in varying degrees by numerous administrations since the end of the Second World War. This record is less evident to a new generation of men and women charged with thinking about the posture of U.S. forces deployed across the face of the globe, especially in the wake of the upheaval connected with the present decade. The specific aim of this thesis is to explore the balance between international and domestic pressures; bureaucratic infighting and politics; and the general conditions within what was long West Germany and later, a united Germany, that makers of foreign and military policy struggled with and that have led to the maintenance of a U.S. presence in the region. The ability of policymakers to successfully balance these factors in any given time period accounts for the presence of American troops in Germany for more than 60 years.

KEYWORDS: Germany, West Germany, U.S. Force Posture, Post World War II, Constabulary Force, JCS 1067, RMA

JUSTICE SECURED: IMPLEMENTING A RISK-BASED APPROACH TO COURT SECURITY
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A significant challenge to reducing pervasive security risks in judiciary operations is the lack of an objective method to evaluate and compare existing levels of risk in court facilities. This is particularly problematic when security-funding enhancements are not supported by a standardized risk-assessment methodology. This thesis proposes a risk-based approach to identify and reduce risk to court security operations. The primary thrust of this research effort is the development and testing of a risk-assessment tool. Threat, vulnerability, and consequence elements of the risk-assessment tool are identified and quantified. The tool is beta-tested using data from four California courts. The end result is a risk-assessment tool that can serve as an integral part of a decision support system to help court security managers identify and reduce pervasive security risks.

REDUCING THE THREAT OF TERRORISM THROUGH KNOWLEDGE SHARING IN A VIRTUAL ENVIRONMENT BETWEEN LAW ENFORCEMENT AND THE PRIVATE SECURITY INDUSTRY

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Despite the private security industry being tasked with providing the first line of defense at a critical infrastructure, the Kansas City, Missouri, Police Department currently has no mechanism or protocol in place to facilitate a timely exchange of threat information with this potential counterterrorism resource. This thesis examines the feasibility of developing a web-based, virtual, knowledge-sharing initiative as a solution to provide “one stop shopping” for consumers of homeland security-related needs from the private security industry.

The factors measured in this study indicate that private security leaders perceive significant value in the proposed initiative, and that the current environment is one that would favor success. One factor that supports this finding is the strong positive bias displayed to the “trust” factor, which is identified in this research as the lubricant of exchange relationships. While leaders do not demonstrate a high level of concern regarding the threat of a local terrorist act occurring in the next five years, the sharing of threat information does indicate that complacency could be reduced and the level of interest/value of participating be increased through the sharing of threat knowledge. Industry leaders also clearly indicate a universal belief that private security should have a role in the mission of countering terrorism, including at critical infrastructures.

KEYWORDS: Private Security, Communities of Practice, Counter-Terrorism, Information-Sharing, Critical Infrastructure Protection, Public/Private Partnership, Virtual Network

TARGETING CIVILIANS WITH INDISCRIMINATE VIOLENCE

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Terrorist violence against innocent people in Iraq continues despite the determination of coalition and Iraqi forces to stop it. This thesis examines the relationship between a terrorist organization’s strategy of using indiscriminate violence to attack the civilian population and its operational success. Specifically, the tactic examined is that of al Qaeda in Iraq, which has attacked civilians with indiscriminate violence (in the context of the insurgency) since the formal termination of hostilities in Iraq in May 2003. Using the historical example of the 1992-1999 insurgency in Algeria, this thesis hopes to find the answer as to whether, and under what conditions, terrorist tactics of attacking civilians with indiscriminate violence, as applied by Iraqi Islamist insurgents, may be effective in reaching their political aims; or, if this manipulation of violence can turn the population against the protagonists, rather than mobilizing it in favor of one of them. The thesis answers the question of why Islamist insurgents from al Qaeda in Iraq kill civilians in unjustifiable ways: slaughtering, decapitating, bombing, and shooting hundreds of men, women, and children.

KEYWORDS: Armed Islamic Group, al Qaeda in Iraq, Terrorism, Islamism, Fundamentalism, Violence, Insurgency, Civil War
CHINESE INVOLVEMENT IN “MARITIME AGREEMENTS” WITHIN THE ASIA-PACIFIC REGION: REDUCING RISKS AND PROVIDING REASSURANCE
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This thesis examines the state of maritime operations in the Asia-Pacific region conducted by the People’s Republic of China (PRC) since Beijing’s admission to the United Nations in 1971. The goals are to develop an historical understanding of Chinese militarized incidents at sea; and to assess the ability of current Chinese maritime agreements and international institutions to reduce such incidents in the future. The data compiled in this paper can help facilitate future United States and PRC maritime agreements and, more generally, cooperation. Understanding the current nature of Chinese engagement can help recalibrate our measurement standards and our goals for future talks.

To foster successful maritime cooperation between the United States and China, adherence to several principles will greatly increase the chances of that relationship’s success: building on common interests, utilization of confidence building measures, basing cooperation on domestic (i.e., national) laws, building mechanisms for predictability, and, finally, ensuring an operating environment with both tactical and “political” space.

KEYWORDS: China, Maritime Agreements, International Agreements, Naval Incidents

HOMELAND SECURITY PLANNING FOR URBAN AREA SCHOOLS
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Schools in the United States are at risk of a terrorist attack and the country is unprepared. The recent history of terrorist attacks illustrates that the methodology and audacity of terrorists is evolving and increasing. Terrorists no longer differentiate between civilians and military personnel, nor do they discriminate amid gender and age. While the thought of deliberately focusing an attack on children might seem unconventional, or even taboo, terrorism and terrorist tactics have fundamentally changed, and terrorists are no longer fearful of taking such drastic action.

This research indicates that we are unprepared and major improvements need to be made. Until serious and significant changes are made, schools remain vulnerable, unprotected targets of terrorist attacks. The consequences of inaction are enormous, being measured in the loss of the lives of children. While a terrorist attack cannot always be prevented, there are actions that schools can take to enhance the safety and security of staff and students. This research culminates in specific recommendations for Maine School District 207 and highlights the strategic methodologies and practices that all schools can utilize and employ to become better prepared. A key recommendation is the inclusion of local response agencies, starting with the emergency planning process.

REVISING THE NATIONAL EXERCISE PROGRAM
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The National Exercise Program (NEP) serves as the primary means for training national leaders and department and agency staff members. Additionally, it serves in promoting collaboration among stakeholders and partners at all levels of government with homeland security missions. Although the National Strategy for Homeland Security directs a National Exercise Program, and the Department of Homeland Security (DHS) codifies this program in doctrine, it is continually a work in progress. This paper identifies and discusses four key areas which must be addressed in order to improve the National Exercise Program. These four key areas are interagency participation, stability and predictability, funding, and corrective action process. These four areas are inter-related in that actions occurring in one area can have an impact in any one or the other three areas. Although DHS has established a framework for administering the NEP, many challenges remain before the NEP is fully integrated and institutionalized.

KEYWORDS: National Exercise Program, National Exercises, National Preparedness, Readiness, Interagency Coordination

AN ANALYSIS OF THE REQUIREMENTS AND POTENTIAL OPPORTUNITIES FOR THE FUTURE EDUCATION OF LAW ENFORCEMENT INTELLIGENCE ANALYSTS
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The absence of law enforcement intelligence analysis programs in academia has created a serious gap in the nation’s ability to effectively protect itself from the terrorist threat. Academic institutions that teach analysis are primarily focused on foreign or national intelligence. Academia must begin addressing the need to educate law enforcement intelligence analysts.

Through an examination of current intelligence analyst programs, surveys of law enforcement intelligence analysts, and research on U.S. and foreign law enforcement intelligence analyst programs, this thesis explores how law enforcement analyst organizations and academia should provide law enforcement analyst instruction. Each chapter addresses a different component of the challenge in the education and training of law enforcement analysts. This thesis also provides recommendations for future law enforcement analyst instruction.

KEYWORDS: Academia, Law Enforcement, Intelligence Analyst Instruction

ARMY TRANSFORMATION AND THE FUTURE COMBAT SYSTEM
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Second Reader: James Wirtz, Department of National Security Affairs

This thesis examines current efforts to transform the U.S. Army to face new challenges. The Army’s transformation is based on the development of the Future Combat System (FCS), initiated in 1999. The FCS consists of eight new manned vehicles, various unmanned sensors, robotic vehicles, and remote-
controlled missiles, all connected by a common network. Critics of the Army’s transformation contend that this equipment and associated doctrine is based on traditional Cold War scenarios rather than the types of challenges the Army is likely to face. This thesis examines whether the FCS is influenced by traditional preferences for certain types of doctrine, equipment, and capabilities. To do this, the development of the Army’s current capabilities, through past reforms, is first described. Second, the influence of tradition on the development of future capabilities is examined. Third, the potential for FCS to achieve its design goals is measured in both technical and strategic terms. Fourth, the manner in which FCS capabilities relate to irregular warfare is examined from the perspective of the Army’s combat arms branches. Finally, considering the significance of institutional culture and past reforms, this thesis determines if outdated traditional considerations influence current Army transformation efforts.

KEYWORDS: Army Transformation, Future Combat System, Revolution in Military Affairs, Modularity, Brigade Combat Team, Counterinsurgency, Irregular Warfare, Traditional Warfare, Military Reform, Army Doctrine

THE ARAB CITIZENS OF ISRAEL: MOTIVATIONS FOR COLLECTIVE ACTION
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Advisor: Anne Marie Baylouny, Department of National Security Affairs
Second Reader: Abbas K. Kadhim, Department of National Security Affairs

Israeli Arabs are torn between their Palestinian identity and their Israeli citizenship. Discrimination against Arabs is evident in numerous aspects of Israeli society, such as the declaration of the country as a Jewish state, unequal state funding of Arab and Jewish programs, and the expropriation of Arab lands. Most studies of collective action and social mobilization would predict that repressed groups eventually mobilize if inclusion in the political process is denied. This has not been the case among Israeli Arabs because they are allowed to vote, but there are still many rights that are reserved for the Jewish majority. Discriminatory policies against Israeli Arabs may serve as short-term solutions for the Jewish majority, but they will also create long-term problems for the state.

This research uses social movement theory to analyze the situation of Israeli Arabs in order to determine the probability for their collective action against the state. The conclusion states that, among Arab citizens, a regional Palestinian identity is beginning to overshadow the Israeli identity. A new generation of educated and disgruntled Israeli Arabs is rising up to take ownership of the new identity, which could lead to future collective action against the state.

KEYWORDS: Israeli Arabs, Palestinian Citizens of Israel, Social Movement Theory, Arab Minority in Israel, Intifada, Collective Action, Mobilizing Structures, Frames, Political Opportunity

THE OLIVE BRANCH AND THE HAMMER: A STRATEGIC ANALYSIS OF HAWALA IN THE FINANCIAL WAR ON TERRORISM
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Since September 11, 2001, U.S. counterterrorism efforts to disrupt al Qaeda’s finances have been imprecise at best; at worst, they have had profound negative effects. The question of why hawala poses such a great threat and why there is a need for strict regulation or elimination of hawala has been the subject of great deliberation among policymakers and financial scholars since al Qaeda’s attacks on New York and Washington, D.C.

The purpose of this thesis is to understand the complexities of the hawala informal financial transfer system prevalent in the Middle East and to assess its complicity with terrorist financing. To that end, this
thesis examines whether the hawala system itself poses a significant terrorist threat to the United States as a medium for financial transactions for terrorist organizations.

By conducting a detailed analysis of hawala in Afghanistan from 2001-2006, this thesis provides a framework to assess whether the hawala system poses a strategic threat in the U.S.-led “war on terror.” Furthermore, by studying regulation attempts in Afghanistan, this thesis examines the cultural and economic effects of U.S. efforts on Muslims.

KEYWORDS: Hawala, Terrorism, al Qaeda, War on Terror, Hawaladar, Afghanistan, Informal Finance, Informal Value Transfer, Financial Action Task Force

FIRST RESPONDER PROBLEM-SOLVING AND DECISION-MAKING IN TODAY’S ASYMMETRICAL ENVIRONMENT
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Today’s first responders confront a common challenge, namely, the lack of exposure to and experience with asymmetric threats (i.e., terrorism and natural disasters). This thesis compares and contrasts the following decision-making subject matters in an endeavor to assist in this challenge. Included in this discussion are the different problem-solving strategies currently employed by today’s first responders; situation awareness and how to best leverage first responder experience; expert versus novice decision-making; and scenario-based learning and experimental research. Through scenario-based exercises, the thesis attempts to discover whether the decision-making skills of an experienced fire officer (expert) can be learned by a newly promoted officer (novice). Results from this experiment provide insight and plausible remedies regarding the thesis’ hypothesis in the form of recommendations for enhancing the first responder’s ability to develop good situational awareness and decision-making skills.

The goal now is to use research results and recommendations as a springboard to develop training that helps a novice to learn like an expert. Experiment results prove that, by combining scenarios designed to expose novices to situations they may not experience during routine operations with timely expert feedback, an individual’s decision-making skills and situation awareness can be fine-tuned.

KEYWORDS: Preparedness, First Responders, FDNY, Asymmetric Environment, Recognition Primed Decision Making, Naturalistic Decision Making, Rational Decision Making, Situation Awareness, Scenario Based Training

WIRELESS ROBOTIC COMMUNICATIONS IN URBAN ENVIRONMENTS: ISSUES FOR THE FIRE SERVICE
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Firefighters are tasked with conducting search and rescue operations at incidents ranging from minor smoke conditions to multi-agency disasters. In each instance, a rapid risk assessment must be conducted based on preliminary dispatch information. Small, lightweight, “man portable” robots are a natural fit for gaining improved situational awareness, yet few have been employed for this application. The problems encountered in using wireless robots in urban environments are among the primary reasons. This thesis focuses on the wireless link between the robot and the firefighter employing the robot. The work presented is useful for policymakers in allocating public safety spectrum, for firefighters in pre-planning responses,
and for engineers designing relevant control systems. While the arguments rest on a technical footing of test data and models, the paper is written primarily for a non-technical audience.

A technology acceptance model is developed for wirelessly employing robots. Test data is presented showing the debilitating effects of interference from employing multiple robots concurrently. Models are applied to predict signal loss in tunnels and urban environments; results indicate that an optimal frequency range exists between 500 MHz and 1 GHz. A case is presented to allocate spectrum in this range using a priority access protocol.

**KEYWORDS:** Wireless, Robot, Communications, Fire, Search, Rescue, Urban Environment

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**BADAL: A CULTURE OF REVENGE—THE IMPACT OF COLLATERAL DAMAGE ON THE TALIBAN INSURGENCY**

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This thesis examines the impact of collateral damage on the Taliban insurgency. It reveals the relationship between the death of innocent civilians and the tribal concept of *badal* (revenge). This research also analyzes Taliban propaganda leaflets to illustrate the compromise of popular support caused by collateral damage stemming from the coalition’s tactics. This research evaluates the historical Anglo-Afghan wars and the 1979 Soviet invasion and draws parallels to the current insurgency. In doing so, it highlights the rising role of religion and FATA, Pakistan. FATA is analyzed to show the effects of intrusions by outside actors, as well as historical and recent events that have shaped the populace and structure of these tribal regions. The research concludes by offering non-kinetic solutions to curbing the Taliban insurgency. The solutions focus on FATA and offer socioeconomic and political remedies to hinder Taliban recruitment efforts and cross-border incursions. The thesis recognizes FATA and reduction in collateral damage as pivotal factors to fostering stability in the region.

**KEYWORDS:** Taliban Insurgency, Collateral Damage, Badal, Pashtunwali, Nang, FATA Pakistan, Anglo-Afghan Wars, Soviet Invasion of Afghanistan, Taliban Propaganda, Information Operations

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**CHINA’S SOFT POWER AND GROWING INFLUENCE IN SOUTHEAST ASIA**

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The term “soft power” was coined by Joseph S. Nye, Jr., of Harvard. The definition of soft power has expanded over the years and continues to grow. In most contexts, the United States is the focus of debate over its use of or lack of soft power and the appropriateness and positive or negative effects generated. In more recent times, China has undergone a diplomatic makeover and has begun utilizing its soft power capabilities. By no means is China able to surpass the United States’ soft power capabilities. As China’s economy and influence in the region continue to grow, however, China as an alternative to the United States can become a reality.

This thesis focuses on China’s soft power in its relations with its southeastern neighbors (Myanmar, Cambodia, Vietnam, Thailand, and Laos) and considers, as a case study, its impact on China’s development plans for the Lacang-Mekong River. The author determines how the utilization of soft power tools allows China to pursue its development plans with minimal interference from the other five riparian countries. The thesis is divided into four sections. These sections assess: a) what soft power is and what its tools are; b) how China applies its soft power on its southeastern neighbors; c) how this affects China’s efforts to participate in development of the Lacang-Mekong River; and d) the implications for the United States.
TAINWAN’S DILEMMA: CHINA, THE UNITED STATES, AND REUNIFICATION

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The Taiwan issue is a source of possible conflict between Taiwan, the People’s Republic of China, and the United States. While relations have strengthened between China and Taiwan, the prospect of reunification remains uncertain. Although China promotes peaceful unification of all of its claimed territory, the military’s focus is on Taiwan. Conversely, Taiwan authorities rebuke unification, relying on the United States for arms and support.

The United States has played a pivotal role throughout this dilemma. Its policy of strategic ambiguity created an adverse effect. U.S. military sales to Taiwan formed dependency, requiring China to modernize its military to maintain legitimacy. Proving its commitment to reclaiming Taiwan, Beijing positioned significant weaponry across from Taiwan, ensuring that tensions remain. As arms sales continue, the odds of conflict grow. Resolution, whether obtained through peace or violence, generates significantly different strategic policy for all parties. Dialogue between Beijing and Taipei may alter the outcome. As talks progress, the United States must encourage peace, thereby avoiding a miscommunication leading to war.

This thesis focuses on two central questions. First, how do U.S. arms sales to Taiwan affect Taipei’s perception towards reunification? Second, do U.S. arms sales compel China to accelerate its military modernization? The answers may help to develop policies that normalize the relationship between China and Taiwan and minimize the role of the United States.

KEYWORDS: Arm Sales, China, People’s Liberation Army, Reunification, Taiwan, Taiwan Relations Act

THE STRATEGIC VALUE OF HUMANITARIAN IMMIGRATION POLICY TOWARD HOMELAND SECURITY

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The United States faces a terrorist threat provoked by an extremist ideology. A greater, more strategic contribution to the global good would reduce anger toward the United States and enhance constructive alliances. After the events of September 11, 2001, homeland security leaders identified the U.S. immigration system as a vulnerability exploited by terrorists. Consequently, much effort was expended to shore-up immigration processes. That same system should also be used as a mechanism to mitigate some of the causes of terrorism. Within U.S. immigration priorities is a commitment to humanitarian protection. Benefits such as resettlement of refugees, grants of asylum, and temporary protected status for victims of armed conflict or natural disasters do more than uphold the moral fabric of the United States. They also provide strategic value toward winning the war against violent extremism. Designing a strategy for humanitarian immigration policy, with the proper risk management principles in place, will promote long-term security for the United States.

KEYWORDS: Immigration, Humanitarian Immigration Policy, Refugee, Asylum, Temporary Protected Status
AN EXAMINATION OF FOUR SUCCESSES IN THE COAST GUARD’S INNOVATION PROGRAM AND IMPLICATIONS FOR INNOVATION WITHIN HOMELAND SECURITY
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Second Reader: Christopher J. Bellavita, DoD Contractor

Government bureaucracies designed to maintain a stable, fair, and open society are increasingly being outpaced by changing technologies, emerging threats, and shifting priorities. Innovation offers homeland security leaders an effective mechanism to sense emerging patterns, determine positive directions, and rapidly drive process improvements. This thesis examines literature related to leadership, strategic planning, collaboration, and government innovation. It highlights the importance of leadership and collaboration and illustrates how a relatively small number of people can drive significant change. A review of the U.S. Coast Guard’s innovation program, and four successful projects generated by that program, is provided to demonstrate how the literature applies to homeland security agencies. An analysis of the projects identifies how leaders can act in concert to enable government innovation and drive significant capability enhancements and process improvements. Recommendations and conclusions stress the importance of integrating innovation programs with education and process improvement programs and ensuring that efforts are aligned with overall agency direction. The thesis also offers recommendations for how the Department of Homeland Security can improve innovation within homeland security by supporting greater collaboration and information-sharing between innovators across all homeland security fields.

KEYWORDS: Innovation, Collaboration, Change Management, Leadership, Process Improvement

THE ROLE OF THE STRATEGIC DEFENSE INITIATIVE IN THE END OF THE COLD WAR
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The end of the Cold War was sudden and unpredicted, and stands as the seminal event of the latter half of the twentieth century. Since the disintegration of the Union of Soviet Socialist Republics (USSR), debate has centered on whom or what was responsible for the end of the conflict. Perhaps no issue is as controversial as the role the U.S. Strategic Defense Initiative (SDI) played in ending the Cold War.

Today, there are three main schools of thought concerning the SDI’s impact on the end of the Cold War. The first sees the Strategic Defense Initiative as a primary factor in ending the conflict. Another argues that the initiative extended the Cold War by creating one more hurdle to negotiations between the two superpowers. A third school holds that while SDI had a positive impact on ending the Cold War, it was one of many contributing factors. The third school’s position is best supported by the available evidence.

KEYWORDS: Strategic Defense, SDI, Star Wars, INF Treaty, Geneva Summit, Reykjavik Summit, End of the Cold War
This research focuses on fusion centers, particularly the expectations of state and local fusion centers and their role. How will fusion centers add to the national effort to protect the homeland, while also providing a benefit to their local communities? This effort seeks to determine what role state and local fusion centers should be concerned with and how they might add local value.

With the increasing prevalence of fusion centers, it will be important to determine how those fusion centers will be used and how they will collect the information that they will fuse, or analyze, and turn into an intelligence product. There are several questions before fusion centers: who are your customers, what is your product, how do you collect and analyze your data, and how do you get information from emergency responders and actionable intelligence back to them?

If the fusion centers can produce a timely, locally actionable, and relevant product to their customers in the form of strategic analysis to policymakers, tactical analysis to counter terrorism, tactical analysis to major criminal investigations, and situational awareness and reporting mechanisms to the emergency responder community, then they will have established their value.

KEYWORDS: Fusion Centers, Intelligence, Data Collection, Emergency Responders, Terrorism Liaison Officers

THE ROLE OF CULTURE IN CONFLICT RESOLUTION
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On any given day, news sources are packed with information on the various negotiations going on throughout the world in an attempt to resolve an ongoing dispute. Typically, nation-states enter into negotiations as a final attempt to resolve their differences in a diplomatic forum, rather than resorting to combative retaliation. These negotiations can be protracted and tenuous, especially when the disputing parties come from different cultures. This thesis asserts that all too often, culture is a neglected aspect of conflict resolution. Cultural mismatch and misunderstanding are additional confounding factors that complicate communication and create misperceptions that sometimes hinder finding a mutually acceptable compromise. This is especially true when an external third party, often from another cultural background, is added to mediate between the conflicting parties. When all parties approach negotiations with a clear understanding of the impact of cross-cultural understanding and communication on the conflict resolution process, the parties might find that negotiations are smoother and resolution comes easier.

This thesis attempts to merge two fields of study that, until now, have been left largely separate in the academic community and largely understudied: conflict resolution and cross-cultural communication. The overall question addressed in this thesis is: what is the role of culture in the conflict resolution process, specifically, in international negotiations? The thesis begins by laying out the conceptual foundation of both conflict resolution and culture/cross-cultural communication. The authors then build on existing theory from conflict resolution and culture and attempt to merge and expand on them in order to draw up a model with indicators of cultural match/mismatch in international negotiation scenarios. This model is applied to U.S.-China relations, first assessing the amount of mismatch and then examining two cases, the 1999 bombing of the Chinese Embassy in Belgrade and the negotiations surrounding the EP3 incident in 2001. They confirm that negotiations are greatly complicated by a large amount of cultural mismatch, even though further, more rigorous studies are warranted to refine the model.
Army special forces units are trained to conduct sensitive special operations, including unconventional warfare, counterterrorism, direct action, and strategic reconnaissance missions. Many of the unique skills and capabilities found in special forces units have potential applications to homeland security operations. Despite an absence of doctrine for domestic operations, special forces — especially Army National Guard special forces — are likely to be employed in future homeland security operations. This thesis examines potential homeland security missions for special forces. Additionally, given the unique first-responder role of the National Guard, this thesis analyzes potential policy changes needed to enhance National Guard special forces contributions to homeland security. The absence of doctrine for domestic, special forces operations potentially adversely impacts Army National Guard special forces. Given the unique, constitutionally-mandated nature of the National Guard, state governors have the ability to activate their forces, including Army National Guard special forces, for homeland security operations. The absence of doctrine for domestic special forces operations could potentially lead to the misuse, overuse, or illegal use of these strategic assets. Enhancing the National Guard’s capacity to correctly use special forces in domestic operations will enhance the country’s overall security posture.

KEYWORDS: Special Forces, Special Operations, Special Operations Forces, Homeland Security, Homeland Defense, National Guard, Army National Guard

AFGHANISTAN RECONSTRUCTION: A QUANTITATIVE ANALYSIS OF THE INTERNATIONAL EFFORT
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Since the start of Operation Enduring Freedom nearly seven years ago, Afghanistan has made very limited progress towards reconstruction. While they have experienced limited political progress under the framework agreed to in the Bonn Agreement, the development, reform, and progress in other sectors of the society have predominantly fallen short of expectations. After several years of relative calm, the Taliban reemerged in 2004, significantly increasing their operations and territorial control each year. The influence of the Taliban was accelerated, in part, by the dissatisfaction of the population due to the lack of progress in post-conflict development. In response, the international community and the United States are increasing the money and manpower dedicated to the reconstruction effort. This thesis quantitatively analyzes the number, type, and location of reconstruction projects; the localized Taliban risk level; and the number, type, and location of Taliban attacks from January 2004 to June 2007. The goal of the analysis is to assess the effectiveness of the reconstruction effort in decreasing Taliban attacks and to uncover which sectors have the greatest impact and act as the key leverage points. Through statistical calculations, it is determined that reconstruction projects targeting rural development, agricultural development, and natural resources development had the greatest effect on decreasing the Taliban presence. Local, small-scale security projects, rather than decreasing attacks, actually increased Taliban attacks, in some cases accounting for an amazing 76% of the increase. Additionally, the $10.3 billion in strategic-level security and infrastructure
improvements had no measurable impact on decreasing the level of Taliban attacks. These trends—that
direct aid to the livelihood of the population decreased attacks and aid aimed at direct military
confrontation with the Taliban actually increased attacks—reflect a classic counterinsurgency pattern. This
supports the position that the struggle against the Taliban in Afghanistan will not be won kinetically, and a
more counter-insurgency-focused approach is required.

KEYWORDS: Afghanistan, Post-Conflict Reconstruction, Aid, Bonn Agreement, Afghanistan National
Tracking System, ISAF, Taliban, Failed States, State Building, Quantitative Analysis, Counter-Insurgency

CREATING AN EFFECTIVE, MULTI-DOMAIN, WIDE-AREA SURVEILLANCE PLATFORM
TO ENHANCE BORDER SECURITY
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The North American Aerospace Defense Command (NORAD) and the United States Northern Command
(USNORTHCOM) lack persistent, multi-domain, wide-area surveillance (WAS) to conduct their assigned
homeland defense and homeland security missions. Wide-area surveillance allows military operators to see
vast expanses of the homeland. For example, it is the difference between a view of Texas and a view of the
broad, U.S. southern border—from Texas to California. With WAS, the Department of Defense (DoD)
would be able to see the big picture. Without WAS, gaps in radar coverage could allow potential
terrorists—or people transporting drugs into the United States—to cross the border undetected. DoD or
Customs would never see them.

This thesis examines how NORAD-USNORTHCOM could and must achieve consistent, wide-area
surveillance for the U.S. borders, both southern and northern. This can be achieved by combining the
existing manned and unmanned radars with over-the-horizon radar capabilities. By combining all three
systems to form a family of radar surveillance systems, working as one consistent radar surveillance
system, NORAD-USNORTHCOM will be more effective in homeland defense and homeland security
missions.

KEYWORDS: Over the Horizon Radar

THE SURVIVAL OF THE COMPANY MAN IN IRAQ
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Second Reader: James A. Russell, Department of National Security Affairs

This thesis describes the decision-making processes for company-grade officers operating in combat roles
in Iraq and seeks to determine if innovation largely originates among lower ranking officers. It analyzes the
incentives structure and the command climate of the U.S. Army in Iraq and how officers operate within this
environment. Interviews with officers who served in Iraq illuminate motivations for innovation. The thesis
identifies the many obstacles that officers encounter in attempting to “innovate from below.”

KEYWORDS: Army, Iraq, Company Commander, Platoon Leader, Decision-Making, Bureaucratic
Organizational Theory, Counterinsurgency Doctrine, Low Intensity Conflict
Malawi is one of the few African countries that has experienced neither a military coup nor a civil war and has remained peaceful since independence, despite being under a dictatorial regime for three decades. Its military has earned international recognition for being professional; however, the country faces significant institutional challenges to democratic civil–military relations where there is legislative oversight, checks and balances between the executive and the legislature.

This thesis identifies and analyzes civil–military relations challenges currently facing Malawi, and suggests solutions that can contribute to healthy civil–military relations. Specifically, it focuses on civilian control of the armed forces and the relationship between the executive and the legislature in military oversight. The power relations between these two arms of government, as provided in the republican constitution, is described and assessed as a contributing factor to various challenges in democratic civil–military relations. It is argued that the presidential powers remain the dominating factor in the country’s civil–military relations and go unchecked despite embracing democratic principles.

**KEYWORDS:** Civil–Military Relations, Legislative Oversight, Control, Ministry of Defense

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National leaders, federal legislation, and the Department of Homeland Security all endorse the adoption of a risk-management framework as an application for homeland security decision-makers. Risk-management frameworks developed by the Department of Homeland Security (DHS), the Government Accountability Office (GAO), and the International Risk Governance Council (IRGC) contain the elements for building a robust, risk-management framework for homeland security decision-making. Yet no single framework is perfect or perfectly applicable to homeland security, mainly because of the uncertainty and complexity of terrorism. This leaves the decision-maker with a series of challenges, the most pressing of which is to manage risk in the ever-evolving arena of homeland security.

This paper analyzes the principles of decision-making and links them with the risk-management processes illustrated in each of the frameworks. The final product is an integrative risk-management/governance framework and an evaluation of its utility in a sample context: the nation’s passenger rail system. This study narrows the focus even further by conducting a threat analysis on the passenger rail system for the New York and New Jersey region and applying the integrative risk-management/governance framework against a hypothetical terrorist threat on that system.

**KEYWORDS:** Risk Management Framework, Risk Assessment, Decision Making, Risk Management/Governance, Homeland Security Problem Space, Uncertainty, Complexity, Passenger Rail Risk
THE SIGNIFICANCE OF CONSEQUENCE ASSESSMENT APPLIED TO THE RISK-BASED APPROACH OF HOMELAND SECURITY

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The purpose of this thesis is to challenge the risk-based approach of homeland security practice to elevate the significance of consequence during the homeland security risk-assessment process. The consequence variable must be afforded an equal to or greater value similar to threat and vulnerability. In doing so, local homeland security policies can be focused towards consequence mitigation when planning and determining how to reduce risk within a designated jurisdiction.

Today’s emergency-preparedness risk environment has become increasingly more severe and complex, especially at the local level. The management of that risk is a fundamental requirement of local government, which is expected to identify and anticipate areas of vulnerability and set in place a cohesive strategy across all disciplines to mitigate, reduce, and eliminate these risks. The problem with this expectation is that federal guidance documents have a deliberate bias toward short-term objectives, which undermines a local government’s long-term commitment to the people it serves. Local agencies must be able to respond to emergencies in a way that minimizes the number of casualties or injuries during an incident that threatens members of their community and maintains services until the situation returns to normal.

KEYWORDS: Consequences, Consequence Assessment, Culture of Preparedness, Preparedness, Resilience, Risk, Risk Management, Threat, Vulnerability

SUB-SAHARAN AFRICA AND THE MARKET ECONOMY: A WAY FORWARD

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Jessica Piombo, Department of National Security Affairs

The thesis examines what economic policies are most suited for African countries in light of poor economic performances over the years. Policy prescriptions have varied from the state getting actively involved in the economy by shaping and directing to allowing the economy to shape itself. The regional framework, New Partnership for African Development, accords recognition to the efficacy of the market shaping itself. However, differences remain on the involvement of the state and the role of the market. This study aims to provide answers to this problem through a comparative examination of successful and unsuccessful economic cases.

In the case studies, none of the arguments are sufficient alone to improve economic growth and development. While the market facilitated growth in some sectors, it was state involvement that exploited and facilitated growth in others. The growth in instances in which the state intervened was sustained by market-friendly policies and short-term interventions. It is also obvious that growth is dependent on the nature, competence, and independence of a state’s bureaucracy.

Overall, the paper concludes that a blend of improved planning and opening of the market guarantees economic growth and development.

KEYWORDS: Sub-Saharan Africa, Liberalization, Structural Adjustment
THE PRESENCE OF AMERICAN TROOPS IN ROMANIA: CIVIL–MILITARY CHALLENGES BEYOND A “MILITARY RELATIONSHIP”

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This thesis analyzes the civil–military relations of the growing U.S. military presence in Romania and the implications of this development for bi-lateral relations beyond the barracks and the maneuver field. By the implementation of the “Agreement between Romania and the United States of America Regarding the Activities of United States Forces Located on the Territory of Romania,” the presence of the American troops on Romanian territory will have both positive and negative civil–military consequences. The history of U.S. and other foreign bases on European soil and other parts of the world in the 20th century sustains this conclusion and provides an area for inquiry. The areas of policy, economy, and society raise critical issues because of the social, cultural, legal, administrative, and other differences and dissimilar ways of perception and understanding of the requirements of strategy and policy.

The overall goal of this thesis is for those officials responsible for the issues of policy associated with guest forces in the host nation to approach their task so as to best avoid or minimize the political and operational negatives, and hence, avoid the bi-lateral problems that have affected host countries elsewhere in Europe, as well as the wider world; while at the same time emphasizing the positives and lessons learned from previous experiences. Such is in the U.S. national interest as well, and this latter concern is no less present in the author’s mind as a guest of the U.S. in the authorship of the present study.

This thesis has the potential to be a small but vital piece in solidifying U.S.-Romania relations in both civil and military affairs as such has unfolded since the 1990s.


U.S. POST-CONFLICT INTEGRATION POLICY OF MILITIAS IN IRAQ

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This thesis aims to examine what effect the United States policy towards militias in Iraq has on security, stability, and troop levels. Conventional wisdom regarding the imperative to eliminate militias in Iraq rests upon the correct observation that the state is locked in a struggle over the legitimate use of force, and therefore, over power and authority with the militias, but fails to appreciate that the militias may have more popular legitimacy than the state. Recognizing this calls for a reconsideration of policy responses to the militia phenomenon. This thesis argues that while military defeat is tactically feasible, it is unlikely to lead to strategic success because the militias have established popular legitimacy and military attacks by an occupying power are only likely to increase it. For similar reasons, engagement of the militia is likely to be more efficacious. The thesis uses two case studies to investigate which policy might work best for security, stability, transition, and reconstruction operations in Iraq. A comparison is adopted to evaluate the strengths and weaknesses of defeat and engagement as alternative military strategies employed by an occupying power vis-à-vis indigenous militia forces in the Middle East. The first case study is the United States occupation of Iraq from 2003 to 2007. The second case study is the British occupation of Palestine from 1920 to 1948. This thesis concludes with an analysis of the similarities between each case, a potential policy prescription for the U.S., avenues for future research, and some comments on the semantics of words.
THE TERRORIST THREAT: IMPLICATIONS FOR HOMELAND SECURITY
Thomas J. Sobocinski-Supervisory Special Agent, Federal Bureau of Investigation
B.A., Purdue University, 1991
Advisor: Christopher J. Bellavita, DoD Contractor
Second Reader: John Rollins, DoD Contractor

Since 9/11, the United States has implemented radical changes to its counterterrorism strategy and capabilities. Recently, critics have called into question the current strategy for fighting a war on terror. This thesis provides a summary of the two most common, competing criticisms of the U.S. counterterrorism strategy. On the one hand, critics argue that the threat has been exaggerated. On the opposite side of the spectrum, critics argue that we are engaged in a war between Islam and the West. An examination of the evidence used by these competing criticisms, combined with a review of existing U.S. strategies, provides a foundation for the construction of an appropriate response to terrorism.

This review reveals evidence that the threat should be evaluated differently for domestic and international counterterrorist threats. Internationally, the U.S. is engaged in a battle with a radical Islamic insurgency. Domestically, the terrorist threat is made up of terrorist operators who are engaged in a wide variety of criminal activity. Although the U.S. is unprepared for the external threat posed by radical Islamic insurgents, the post–9/11 enhancements to homeland security are appropriate to meet the current domestic threat.


ENHANCING THE EFFECTIVENESS OF NATIONAL GUARD SUPPORT OF CIVIL AUTHORITIES BY IMPROVING INTERAGENCY COORDINATION
William H. Stevenson-Lieutenant Colonel, Ft. Meade, Maryland
B.S., University of South Florida, 1988
M.S., Wilmington College, 1998
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Second Reader: COL Patrick J. Tennis, Army National Guard

Preparedness for response to a catastrophic event in the United States, natural disaster or terrorist attack, is a priority mission for the National Guard. Interagency coordination and collaboration are key to the success of this preparedness. Because state and regional responses are independent of federal deployment, the National Guard requires interagency relationships specific to their operations. This thesis evaluates the interagency coordination processes between the Department of Defense, the National Guard Bureau, and the Department of Homeland Security. The thesis explores what additional procedural, policy, and structural mechanisms can be implemented to enhance interagency cooperation and collaboration between the National Guard Bureau and other homeland security agencies for domestic operations. Four recommendations are provided: establish an operationally focused Joint Interagency Coordinating Group at the National Guard Bureau, organize National Guard homeland-security-oriented liaison officers under a Homeland Security Liaison Element, focus National Guard interagency coordination within the Federal Emergency Management Agency regional construct, and examine the U.S. Northern Command for opportunities to fully integrate civilian agencies and the National Guard into a civil–military command model.

KEYWORDS: National Guard, NGB, Interagency, Liaison, JIACG
MOLDOVA QUO VADIS: NEUTRALITY AND EUROPEAN INTEGRATION?  
PROBLEMS OF POLICY  
Igor Talcan-Major, Republic of Moldovian National Army  
B.A., Political Studies and International Relations Institute-Chisinau, 2006  
Master of Arts in Security Studies (Civil–Military Relations)–March 2008  
Advisors: Jeffrey W. Knopf, Department of National Security Affairs  
Donald J. Abenheim, Department of National Security Affairs

When the Republic of Moldova gained independence after the dissolution of the Union of Soviet Socialist Republics (USSR), the new country adopted a position of neutrality in world politics. Since then, Moldova’s leaders have become interested in joining the European Union (EU), but there is internal debate about how best to gain admission to this important European institution. Some political leaders state that Moldova could achieve EU membership while maintaining its neutral strategic status. Other politicians, however, call for abolishing neutrality, and advocate Moldova’s EU integration through NATO membership.

While states that chose a status of permanent neutrality were traditionally seen as entirely separate from multinational, institutional, security processes, the post-Cold War EU enlargement process included admission of permanent neutral countries, such as Austria. Additionally, over the years, the EU has also accepted states that had previously been granted NATO membership, such as Latvia.

This study analyzes Austria’s neutral and Latvia’s aligned EU integration processes and tests them against Moldova’s realities in order to determine how Moldova can integrate into the EU in the fastest time and at the least possible cost. The thesis concludes that though the Moldovan status of permanent neutrality seems fairly irrelevant, this strategy should be maintained for the time being in order to reduce anticipated Russian objections, and thus facilitate the Republic of Moldova’s integration into the European Union.

KEYWORDS: European Union, NATO, Moldova, Austria, Latvia, Russia, Neutrality, EU Integration, Security, Strategy

THE AWAKENING TIGER: INDIA’S QUEST FOR EXPANDED INFLUENCE IN THE WORLD
Robin J. Walker-DoD Civilian  
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Master of Arts in Security Studies (South Asia)–March 2008  
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This thesis examines India as a rising Asian and world power and asks whether that rise will be successful and compatible with U.S. interests. It explores the history of Indian foreign policy as it transformed from an inward-looking, non-aligned movement through the end of the Cold War, economic liberalization, the development of nuclear weapons, improved relations with the West, and an outward focus based on increasing India’s power. The three case studies examine the tools India is using to expand its influence in three key regions: soft power in Southeast Asia, hard power (including military bases) in Central Asia, and diplomatic efforts with the Middle East, especially Iran.

The main argument is that India’s foreign policy is primarily based on its interests in any given situation, in compliance with classic realist theory. The United States should not assume that India will be a reliable ally, as India will continue to act based on its own interests. India is on the rise toward becoming a great power, and has or is developing all the tools needed to achieve that status. However, Indian policymakers have not yet developed a comprehensive, grand strategy that will allow India to truly achieve its potential.

KEYWORDS: India, U.S. Foreign Policy, U.S.-India Civilian Nuclear Deal, 123 Deal, International Atomic Energy Agency, IAEA, United Nations Security Council, Non-Aligned Movement, Soft Power, Ayani Air Base, Iran, IPI Pipeline, India Lobby, Central Asia, Southeast Asia
American decision-makers all agree that China’s economic, military, and diplomatic rise will shape the geopolitical landscape and affect U.S. interests for decades to come. Beyond that broad consensus, visions of China’s rise range from optimistic to alarmist. With so much at stake, the U.S. government needs the expertise, organization, focus, and tools to better understand China and the impact of its rise on U.S. national interests. A broad survey of China’s economic, military, and diplomatic rise over the past decades shows that none of these areas stands in isolation, and that their complex interplay drives China’s intentions and capabilities. Assessing China from the intelligence community’s (IC) perspective of stove-piped and isolated military, economic, or political niches provides an incomplete, if not misleading, picture. This calls for an IC focus quite different from the one that evolved during the Cold War, legacies of which still haunt today’s reform efforts. Viewing current IC reform through the prisms of organization, doctrine, and technology, this thesis shows which steps are headed in the right direction and where there remains room for improvement.

KEYWORDS: China, Intelligence Reform, Intelligence Community, IC, Director of National Intelligence, DNI

The current homeland security (HLS) workforce is aging and the future need is growing. Academia plays a significant role in the development future HLS leaders; this thesis uses a meta-analysis to define what that role should include. The meta-analysis utilizes a template of a common HLS rubric, then uses systematic study of existing core curriculum, topics in frequently used HLS texts, opinions of HLS leaders, opinions of emergency managers, and opinions of community college students. The study of existing curriculum reflects the topical choices of current academic program directors, from which one could draw conclusions based on popular adoption. The topics in commonly used texts are categorized with the rubric template and then scored by frequency. The three surveys consist of a prioritization of the rubric template topics from very important to very unimportant. HLS leaders were queried to capture the leader’s future view of workforce educational needs. Emergency managers were queried to capture what the current practitioners view as important. Community college students were queried to identify what future students may view as important in further education. The net result of the meta-analysis is a recommendation of nine specific topical areas of interest to current or potential HLS undergraduate programs.

KEYWORDS: Homeland Security Curriculum, Undergraduate Curriculum
A COMPSTAT COUNTERTERRORISM STRATEGY TO PROTECT TRAIN AND SUBWAY SYSTEMS
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Advisor: David Brannan, DoD Contractor
Second Reader: Lauren F. Wollman, DoD Contractor

Several successful terrorist attacks have occurred on train and subway systems around the world, and past attempts have been made to attack the New York City Subway System. It is clear that train and subway systems within the United States remain a highly probable target of terrorist groups. Most systems are too porous and vast to protect every entrance and exit; even if this were possible, the physical screening of every passenger is just not feasible due to the volume of the passengers and the fluid nature of the systems.

This thesis recommends applying a CompStat counterterrorism strategy to this threat. It applies those same techniques that were successful in reducing crime in New York, as well as many other major cities, and adjusts them to counteract the threat of a terrorist attack on train and subway systems across the nation. This strategy takes a proven, realistic, and sustainable approach to the current threat, while allowing the systems to operate normally. This thesis does not portend to ensure absolute security, but applies the same successful, crime-reducing strategy to the current threat of terrorist attacks on trains and subway systems.

KEYWORDS: CompStat, Protect, Train, Subway, New York City, Terrorist, Attack

“SOMEONE TO WATCH OVER ME?” PRIVACY AND GOVERNANCE STRATEGIES FOR CLOSED-CIRCUIT TELEVISION AND EMERGING SURVEILLANCE TECHNOLOGIES
Donald R. Zoufal-Colonel, United States Army
Advisor: Christopher J. Bellavita, DoD Contractor
Second Reader: Hon. Diane J. Larsen, Circuit Court of Cook County

Responding to concerns of terror around the world, law enforcement agencies are rapidly moving to utilize a range of surveillance technologies to address the threat. While the lead technology in this area is closed circuit television (CCTV), other technologies, like radio frequency identification (RFID), global positioning satellite (GPS) technology, and biometrics, are also being expanded for use in monitoring human activity. These systems share common features and can be interrelated and controlled with developing computer technologies. They can also be used by governments for a range of other purposes. However, use of these technologies has implications for individual privacy.

This research examines the nature of privacy and existing legal protections. It also investigates a range of approaches to govern the use of these developing technologies. It is a critical governmental function to administer the use of these technologies to ensure that it is related to appropriate government purposes and that individual civil rights are protected. To be successful, that governance scheme will have to address key privacy concerns, while remaining flexible enough to adapt to changing technology. Informed by this research, policymakers will be better able to develop effective governance strategies.

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