

Naval Postgraduate School  
Monterey, California 93943-5138



NPS-09-08-007

---

# Compilation of Thesis Abstracts September 2008



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



## PREFACE

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

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

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

Director of Admissions  
Code 01B3

Naval Postgraduate School  
Monterey, CA 93943-5100  
Phone: (831) 656-3093  
Fax: (831) 656-3093

The World Wide Web edition of the school's catalog is at:  
<http://www.nps.edu/Admissions/index.html>

For further information about student and faculty research at the school, contact the associate provost and dean of research.

Vice President and Dean of Research  
Code 09

Naval Postgraduate School  
Monterey, CA 93943-5138  
Phone: (831) 656-2099  
Fax: (831) 656-2038  
Email: [research@nps.edu](mailto:research@nps.edu)

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

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



# INTRODUCTION

---

## Mission

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

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

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

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

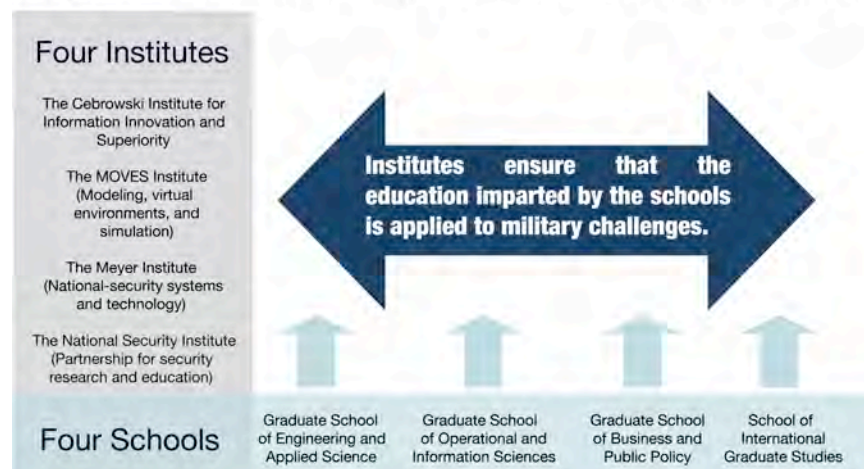
- maintains upper-division course content and programs at cutting edge;
- challenges students with creative problem solving experiences on DoD-relevant issues;
- advances DoN/DoD technology;
- solves warfare problems; and
- attracts and retains quality faculty.

## Academic Programs

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

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

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



---

# INTRODUCTION

---

Programs of graduate studies at NPS are grouped as follows:

## **Graduate School of Operational and Information Sciences**

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

## **Graduate School of Engineering and Applied Sciences**

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

## **Graduate School of Business and Public Policy**

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

## **School of International Graduate Studies**

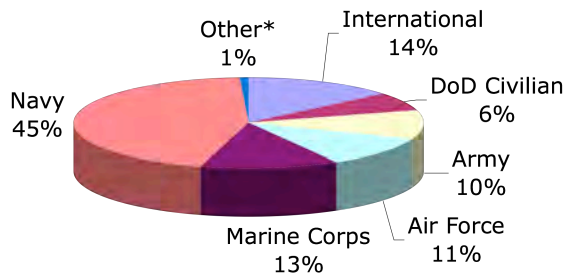
- Civil–Military Relations
- Combating Terrorism: Policy, Strategy
- Defense Decision Making and Planning
- Homeland Defense and Security
- Homeland Security and Defense
- Security Studies
- Stabilization and Reconstruction
- National Security and Intelligence:
  - Middle East, South Asia, Sub-Saharan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

## **Students**

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

# INTRODUCTION

---



\* Army National Guard, Army Reserve, Coast Guard, National Oceanic and Atmospheric Administration

**Figure 1: Resident Degrees/Subspecialty Student Population for September 2008  
1,592 Total**

## Academic Degrees

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

### Master of Arts 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

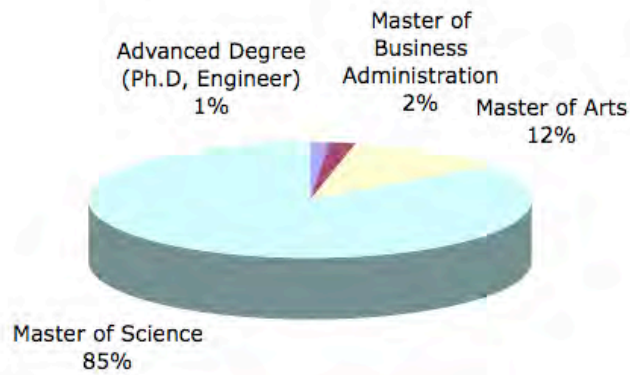
### Doctor of Philosophy

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

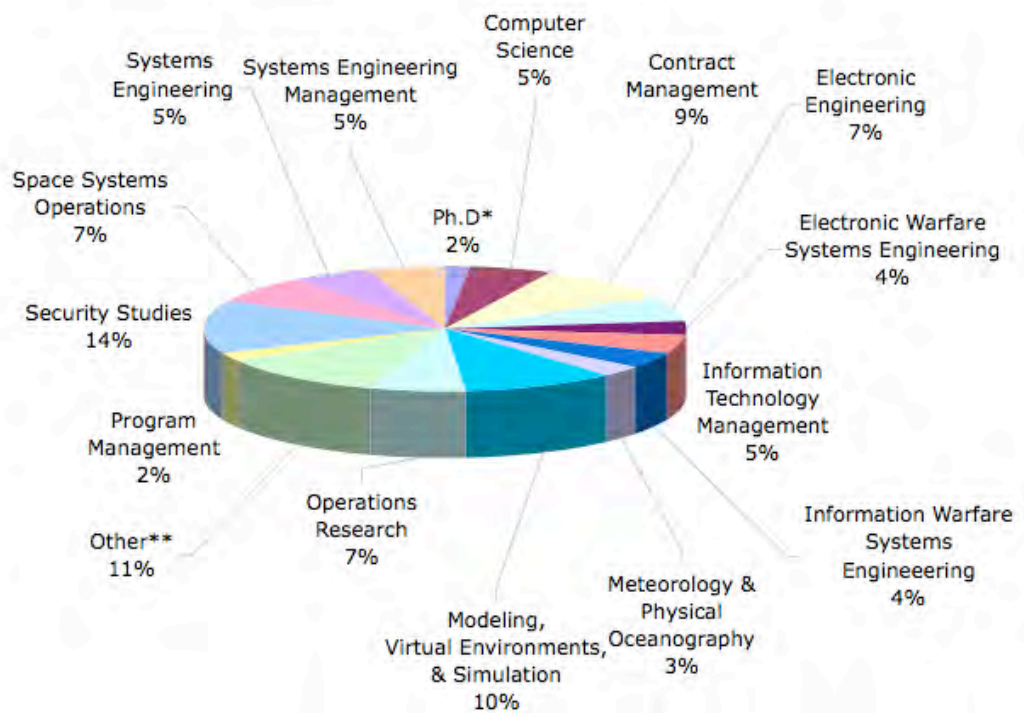
In September 2008, 214 degrees were conferred. Figure 2 indicates distribution by type, Figure 3 by degree area.

# INTRODUCTION

---



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



\* Ph.D: Applied Mathematics (1), Software Engineering (1), Operations Research (1)

\*\*Other master's degrees: Applied Math (1), Applied Physics (2), Astronautical Engineering (1), Business Administration (4), Defense Analysis (1), Information Systems and Operations (1), Management (1), Mechanical Engineering (4), Physical Oceanography (2), Software Engineering (1), Systems Technology (1)

**Figure 3. Degrees Conferred in September 2008**  
(214 Degrees Conferred)

---

# INTRODUCTION

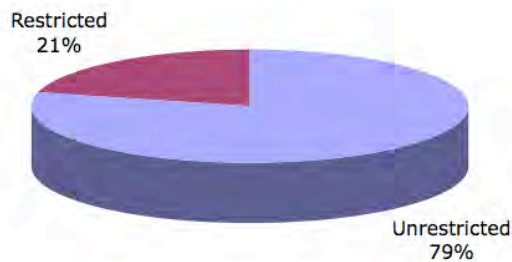
---

## Theses

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

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

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



**Figure 4. Classification of Theses**



---

# TABLE OF CONTENTS

---

## **ADVANCED DEGREES**

### **DOCTOR OF PHILOSOPHY**

High-Order, NonReflecting Boundary Conditions for the Linearized Euler Equations.....	3
An Engineering Context for Software Engineering .....	3
Path Optimization for Single and Multiple Searchers: Models and Algorithms .....	4

### **MASTER OF BUSINESS ADMINISTRATION**

Power and Leader Effectiveness in Organizations: A Literature Review .....	7
An Analysis of Leadership Behavior in Extreme Military Contexts.....	7
E-Bomb: The Key Element of the Contemporary Military–Technical Revolution.....	8
Exploitation of Free Markets and Globalization to Finance Terrorists .....	8

### **MASTER OF SCIENCE**

#### **APPLIED PHYSICS**

Assessing Accuracy in Varying LIDAR Data-Point Densities in Digital Elevation Maps .....	11
--	----

#### **ASTRONAUTICAL ENGINEERING**

LIDAR Design for Space Situational Awareness.....	13
---	----

#### **COMPUTER SCIENCE**

Smart Caching for Efficient Information Sharing in Distributed Information Systems.....	15
Conversation-Thread Extraction and Topic Detection in Text-Based Chat .....	15
An Automated Behavior Property Verification Tool .....	16
A Vision-Based Interest-Point Extraction Evaluation in Multiple Environments.....	16
Detection of Improvised, Explosive-Device Emplacement in Urban Environments .....	17
Clandestine Message Passing in Virtual Environments .....	17
An Approach for Developing and Validating Libraries of Temporal Formal Specifications .....	18
Detection and Tracking Based on a Dynamic, Hierarchical Occupancy Map in Agent-Based Simulations .....	18

#### **CONTRACT MANAGEMENT**

United States Army Contingency Contracting Operations: Emerging Roles, Procedures, and Challenges Facing Contracting Professionals .....	19
Army Corps of Engineers and Gulf-Region Division Contingency Contracting in Iraq/Afghanistan: Sustaining the Civilian Voluntary Workforce.....	19
An Army Medical Command Handbook for the Government-Purchase-Card Program.....	20
How to Do More with Less: Handling an Increased Workload while Maintaining Human Capital Levels.....	20
An Approach for Systematically Capturing Value-Added Knowledge as Applicable to Contracting .....	21
The Application of Lean-Six Sigma in the Pre-Award Procurement Process .....	21
An Organizational Analysis of the United States Army Contracting Command–Kuwait.....	22
Losing Human Capital in the U.S. Naval Civilian Workforce: Trends and Impacts at Naval Surface Warfare Center–Dahlgren, Contracts Division .....	22
The Next Step to Creating a More Efficient Form of Paperless Contracting .....	23

#### **DEFENSE ANALYSIS**

Private Military Companies: An Assessment.....	25
--	----

#### **ELECTRICAL ENGINEERING**

A Performance Analysis of Decode-and-Forward with Cooperative Diversity and Alamouti Cooperative Space-Time Coding in Clustered, Ad-Hoc Wireless Networks.....	27
Detection of Frequency-Hopped-Signals Timing Information Using the Temporal-Correlation Function .....	27

---

---

## TABLE OF CONTENTS

---

A Fault-Tolerant Microcontroller for the Configurable Fault-Tolerant Processor .....	28
A Photonic Front End and Comparator Processor for a Sigma-Delta Modulator .....	28
Digital Communications Over Fading and Non-Fading Channels .....	29
The Design and Implementation of a Motor Incremental Shaft Encoder .....	29
A Quantum Tunneling Model of a P-N Junction in Silvaco .....	29
A Performance Analysis of a Link-16/Joint Tactical Information Distribution System (JTIDS)- Compatible Waveform Transmitted Over a Channel with Pulse-Noise Interference .....	30
The Design and Implementation of an Active Calibration System for Weather Radars .....	30
Development of a 3D Pen Input Device .....	31
Modeling and Simulation of a Non-Coherent Frequency-Shift Keying Transceiver Using a Field- Programmable Gate Array .....	31
<b>ELECTRONIC WARFARE SYSTEMS ENGINEERING</b>	
The Development of a Distributed Digital-Array Radar .....	33
E-Bomb: The Key Element of the Contemporary Military-Technical Revolution .....	33
A Flexible Architecture System and Topology License-Plate Recognition (FAST LPR) and Concept of Operations in Thailand .....	34
A Performance Analysis of a Link-16/Joint Tactical Information-Distribution System (JTIDS)- Compatible Waveform Transmitted Over a Channel with Pulse-Noise Interference .....	34
The Design and Implementation of an Active Calibration System for Weather Radars .....	35
<b>INFORMATION SYSTEMS AND OPERATIONS</b>	
An Analysis of Satellite Communication as a Method to Meet Information-Exchange Requirements for the Enhanced-Company Concept .....	37
<b>INFORMATION TECHNOLOGY MANAGEMENT</b>	
A Performance-Management Analysis of an IPv6 Sensor on the Move Using Commercial Network- Management Software .....	39
Investigating the Effects of Higher Spatial Resolution on Benthic Classification Accuracy at the Midway Atoll .....	39
Missile Defense Certification: An Examination of the U.S. Navy Aegis Warship and the U.S. Army Patriot Crew Certification Process .....	40
An Ontological Approach to Developing Information Operations Applications for Use on the Semantic Web .....	40
A Conceptual Framework for Tactical Private Satellite Networks .....	41
Defense Travel System: Using Restricted Airfare in Conjunction with the GSA City Pair Program to Effectively Reduce TDY Travel Costs within the Department of Defense .....	42
Can Simple Network Management Protocol be Used to Create a Silent Subscriber Station in an 802.16 Implementation? .....	42
The Human Terrain System: Achieving a Competitive Advantage through Enhanced "Population-Centric" Knowledge Flows .....	43
<b>INFORMATION WARFARE SYSTEMS ENGINEERING</b>	
Enhanced Detection of Orthogonal Radar Waveforms Using Time-Frequency and Bi-Frequency Signal Processing Techniques .....	45
The Holistic Targeting Methodology as the Means to Improve Information Operations Target Development and Prioritization .....	45
Information Sharing for Computing Trust Metrics on Commercial, Off-the-Shelf Electronic Components .....	46
"ISM" Analysis: A Necessity for Effective Strategic Communication .....	46
A Revitalized Information Assurance Training Approach and Information Assurance Best-Practice Rule Set .....	47
Optimizing Navy Information Warfare: A Systems Engineering Approach .....	47
<b>MANAGEMENT</b>	
A Study of Navy Enlisted Attrition: Race, Ethnicity, and Type of Occupation .....	49

---

---

## TABLE OF CONTENTS

---

### MECHANICAL ENGINEERING

A Study of Composite Joint Strength with Carbon Nanotube Reinforcement .....	51
Experimental Study of Composite and Metal-Wire Joints .....	51
Physics-Based Modeling and Assessment of a Mobile Landing Platform System Design .....	52

### METEOROLOGY AND PHYSICAL OCEANOGRAPHY

The Pattern and Dynamics of the Meridional Overturning Circulation in the Upper Cell .....	53
The Development of a Kernel to Detect Ziphius Cavirostris Vocalizations and a Performance Assessment of an Automated Passive Acoustic Detection Scheme .....	53
Atmospheric Effects on Signal Propagation in Adverse Environmental Conditions: A Validation of the Advanced Refractive Effects Prediction System .....	54
Smart Climatology Applications for Undersea Warfare .....	54
A Probabilistic Approach to Tropical Cyclone Conditions of Readiness .....	55

### MODELING, VIRTUAL ENVIRONMENTS, AND SIMULATION

A Mission Assignment Model and Simulation Tool for Different Types of Unmanned Aerial Vehicles .....	57
Defining Stability, Security, Transition, and Reconstruction Operations Requirements for Future Department of the Navy Training and Analytical Models and Simulations .....	57
The Identification of Human Factors Concerns in Joint Strike Fighter and Training Recommendations .....	58
Prototype Development of a Low-Cost, Augmented-Reality Trainer for Crew Service Weapons .....	59
Framing Cultural Attributes for Human Representation in Military Training and Simulations .....	59
Improving Situational Awareness on Submarines Using Augmented Reality .....	60
The Development of a Long-Range, Gliding, Unmanned Underwater Vehicle Utilizing Java SunSpot Technology .....	60
Acquisition of a Static Human Target in Complex Terrain: A Study of Perceptual Learning Utilizing Virtual Environments .....	61
The Impact Analysis of a Mixed Squadron, Containing a Littoral Combat Ship and Multi-Mission Surface Platforms, on Blue Force Casualties and Mission Effectiveness .....	61
Using Motion Capture to Determine Marksmanship Shooting Profiles: Teaching Soldiers to Shoot Better Faster .....	62
Clandestine Message Passing in Virtual Environments .....	62
Single Operator Control of Multiple, Uninhabited Air Vehicles: A Situational Awareness Requirement .....	63
Swarm and Small-Boat Defense: A Gap Study .....	63

### OPERATIONS RESEARCH

The Development of a Human Performance Model as a Baseline for Automatic Change-Detection Software Capabilities in Mine Warfare .....	65
Adjusting to Random Demands of Patient Care: A Predictive Model for Nursing Staff Scheduling at Naval Medical Center San Diego .....	65
Littoral Combat Ships: Analysis and Comparison of Designs .....	66
Logistically-Constrained Asset Scheduling in Maritime Security Operations .....	66
A Heuristic Algorithm for U.S. Naval Mission Resource Allocation .....	67
Improving Life Cycle Management through Simulation and Efficient Design .....	67
The Applicability of COSMOS to the Development of the Submarine Radioman Career Model .....	68
Optimization of the Combat Logistics Force to Support Major Combat Operations .....	68
Tri-Level Optimization for Anti-Submarine Warfare Mission Planning .....	69
Surface Combatant Readiness to Confront a Sea Control Navy .....	69
An Optimal Scheduling and Operating Target Cost Model for Aircraft Carriers in the Fleet Response Plan .....	70

### PHYSICAL OCEANOGRAPHY

Validation of High-Frequency Radar Used in Ocean Surface Current Mapping via <i>In Situ</i> Drifting Buoys .....	71
---	----

### PROGRAM MANAGEMENT

The Challenges Associated with Accounting for the Army's Force Provider System when Deployed in Support of Military Operations .....	73
---	----

---

# TABLE OF CONTENTS

---

## SOFTWARE ENGINEERING

An Ontological Approach to Developing Information Operations Applications for Use on the Semantic Web .....	75
---	----

## SPACE SYSTEMS OPERATIONS

Assessing Accuracy in Varying LIDAR Data Point Densities in Digital Elevation Maps.....	77
Investigating the Effects of Higher Spatial Resolution on Benthic Classification Accuracy at the Midway Atoll .....	77
NPS-SCAT (Solar Cell Array Tester): The Construction of the Naval Postgraduate School's First Prototype CubeSat.....	78
Design, Build, and Test of a Handheld-GPS Interference Detector .....	78
A Cost-Effectiveness Analysis of Tactical Satellites, High-Altitude Long-Endurance Airships, and High- and Medium-Altitude Unmanned Aerial Systems for ISR and Communication Missions.....	79
Future Integrated Architecture: A Proposed Space Internetworking Architecture for Future Operations ....	79
An Analysis of Satellite Communication as a Method to Meet Information-Exchange Requirements for the Enhanced-Company Concept .....	80
The Uses of a Polarimetric Camera.....	80

## SYSTEMS ENGINEERING

A Model-Based Methodology for System-of-Systems Architecture Development with Application to the Recapitalization of the Future Towing and Salvage Platform.....	83
Technology Insertion Considerations for Complex System-of-Systems Development .....	83
An Improved Methodology for Developing Cost-Uncertainty Models for Naval Vessels .....	84
Spacelift Range Incremental Modernization: Moving from a Strategy of Backward Compatibility .....	84
Protection Against a Ship as a Weapon.....	85
Improving Test Throughput on a Navy Open-Air Test and Evaluation Range.....	85
A Computer-Aided Method for System Safety and Reliability Assessments .....	85
Architecting a Net-Centric Operations Systems of Systems for Multi-Domain Awareness .....	86
A Systems-Engineering Approach to Address Human-Capital Management Issues in the Shipbuilding Industry .....	87

## SYSTEMS ENGINEERING MANAGEMENT

An Evaluation of a Continuous-Process-Improvement Pilot Program to Reduce or Eliminate TRIDENT II D5-Launcher Processing-Authority Documentation at the Strategic Weapons Facility, Atlantic.....	89
An Analysis of Military Use of Commercial Satellite Communications .....	89
Integration and Interoperability: An Analysis to Identify the Attributes for Systems of Systems .....	90
Net-Centric Information Sharing: Supporting the 21st Century Maritime Strategy.....	90
Categorization and Representation of Functional Decomposition by Experts .....	91
A Dynamic Model of the Workforce at the Naval Air Weapons Station, China Lake.....	91
A Systems-Engineering Approach to Addressing Human-Capital Management Issues in the Shipbuilding Industry.....	92
Improving the U.S. Navy's Execution of Technical Authority through a Common-Risk Management and Technical-Assessment Process.....	92

## SYSTEMS TECHNOLOGY

Team Collaboration of the Northeast Air Defense Sector and the Federal Aviation Administration during the September 11, 2001, Attacks .....	93
---	----

## MASTER OF ARTS

### SECURITY STUDIES

Altering the Mission Statement: The Training of Firefighters as Intelligence Gatherers.....	97
The Chinese-Indian-Pakistani Water Crisis: Prospects for Interstate Conflict .....	97
Dynamic Personal Identity and the Dynamic Identity Grid: How Theory and Concept Can Transform Information into Knowledge and Secure the American Homeland.....	98

---

## TABLE OF CONTENTS

---

Leveraging Service-Oriented Architecture to Enhance Information Sharing for Surface-Transportation Security .....	98
Veiled Normalization: The Implications of Japanese Missile Defense .....	99
The Future Role of the Fire Service in Homeland Security .....	99
Implications of the Chinese Antisatellite Test for the United States Navy’s Surface Forces, Viewed through the Lens of Stephen Van Evera’s Offense, Defense, and the Causes of War Theory .....	100
How to Fund Homeland Security without Federal Dollars: State and Local Funding of Homeland-Security Initiatives in Light of Decreased Support by the Federal Government.....	100
EMS Response to Mass Casualty Incidents: The Critical Importance of Automatic Statewide Mutual Aid and MCI Training.....	101
A 21st Century National Public-Health System.....	101
A Flexible Architecture System and Topology License-Plate Recognition (FAST LPR) and Concept of Operations in Thailand.....	102
The Future of the Ballistic-Missile Submarine Force in the Russian Nuclear Triad.....	102
Do the Metrics Make the Mission? .....	103
Russian Anti-Americanism: Origins and Implications.....	103
Going the Distance: Measuring the Social Identity of Terrorists .....	103
Terrorism 101: Knowledge About the “What and Why” of Terrorism as a State and Local Law-Enforcement Competency.....	104
Improving the Current Department of Homeland Security Capabilities Framework.....	104
United States Northern Command Education in Action: Educating Critical Stakeholders at the Away Game .....	105
Building a New Storyline for Florida’s Domestic Security Strategy to Provide Future Resiliency for the State .....	105
The U.S.–Saudi Partnership: Is This Marriage Headed for Divorce? .....	106
The Republic of Macedonia: Implementing the Ohrid Framework Agreement and Reforming the State .....	106
Building School Resiliency in an Era of Multiple Threats.....	107
U.S. Democratization Strategy: Origins and Obstacles.....	107
STUDENT INDEX .....	109
ADVISOR INDEX.....	111
INFORMATION FOR OBTAINING A COPY OF A THESIS OR OTHER NPS REPORTS.....	113



**ADVANCED DEGREES**

**Doctor of Philosophy**



# DOCTOR OF PHILOSOPHY

---

## HIGH-ORDER, NONREFLECTING BOUNDARY CONDITIONS FOR THE LINEARIZED EULER EQUATIONS

**John R. Dea–Major, United States Air Force**

**B.S., Baylor University, 1993**

**M.S., Creighton University, 1998**

**Doctor of Philosophy in Applied Mathematics–September 2008**

**Advisors: Beny Neta, Department of Applied Mathematics**

**Francis X. Giraldo, Department of Applied Mathematics**

The goal is to solve fluid-flow problems in only a portion of a large or infinite domain. Restricting the area of interest effectively creates a boundary where none exists physically, dividing the computational domain from the rest of the physical domain. The challenge that must be overcome, then, is defining this boundary in such a way that it behaves computationally as if there were no physical boundary. Such a boundary definition is often called a nonreflecting boundary, as its primary function is to permit wave phenomena to pass through the open boundary without reflection. In this dissertation, several nonreflecting boundary conditions are developed for the linearized Euler equations of inviscid gas dynamics. These boundary conditions are derived from the Higdon, Givoli–Neta, and Hagstrom–Warburton boundary schemes for scalar equations, and they are adapted here for a system of first-order partial differential equations. Using finite difference methods, the various boundary schemes are applied to the gas dynamic equations in two dimensions, in an open domain with and without the influence of gravity or Coriolis forces. These new methods provide significantly greater accuracy than the classic Sommerfeld radiation condition, with only a modest increase to the computation time.

**KEYWORDS:** Open Boundary Conditions, Auxiliary Variables, Wave Propagation, Euler Equations, Gravity, Infinite Domains, Non-Reflecting, Finite Differences

## AN ENGINEERING CONTEXT FOR SOFTWARE ENGINEERING

**Richard D. Riehle–DoD Civilian**

**B.A., Brigham Young University, 1965**

**M.S., National University, 1990**

**Doctor of Philosophy in Software Engineering–September 2008**

**Advisor: James Bret Michael, Department of Computer Science**

New engineering disciplines are emerging in the late twentieth and early twenty-first centuries. One such emerging discipline is software engineering. The engineering community at large has long harbored a sense of skepticism about the validity of the term “software engineering.” During most of the fifty-plus years of software practice, that skepticism was probably justified. Professional education of software developers often fell short of the standard expected for conventional engineers; software practice seemed to be a “hit or miss” approach; and the available knowledge, tools, and language designs were not sufficiently mature to support an engineering model for software practice.

Much progress has occurred in recent years, due to improved tools and languages and better ways of reasoning about and designing software products. This progress has contributed to the increase in success in the way software is developed and managed. However, even with a growing number of software successes, there are still enough horror stories to reinforce the skepticism of the larger engineering community. Those skeptics continue to ask the reasonable question, “Where is the engineering in software engineering?” The primary contribution of this dissertation is to establish a foundation for answering this

---

# DOCTOR OF PHILOSOPHY

---

question. Another contribution is to establish a foundation for answering that same question for other emerging engineering disciplines. This foundation is called a context. The context is derived from a study of conventional engineering, a review of contemporary software practices, recent advances in software engineering and computer science, and analysis of the relationships between those four concerns. This engineering context for software engineering includes two chapters on the topic of engineering. It opens the door to a dialogue about both the philosophical and practical concerns of emerging engineering disciplines. It also includes chapters mapping the engineering context to both current and expected trends in software engineering practices. A collateral contribution is a model for aspiring engineering disciplines in the twenty-first century.

**KEYWORDS:** Software, Software Engineering, Engineering, Computer Science, Risk Management, Software Design Metrics, Designing to Tolerances, Software Architecture

## **PATH OPTIMIZATION FOR SINGLE AND MULTIPLE SEARCHERS: MODELS AND ALGORITHMS**

**Hiroyuki Sato- Japanese Ministry of Defense  
B.S., Kyusyu University, 1991**

**M.S., Naval Postgraduate School, 2005**

**Doctor of Philosophy in Operations Research–September 2008**

**Advisor: Johannes O. Royset, Department of Operation Research**

Models and solution methodologies are developed to solve the discrete-time, path-optimization problem where a single or multiple searchers look for a moving target in a finite set of cells. The single searcher is constrained by maximum limits on the consumption of several resources, such as time, fuel, and risk along any path. A specialized branch-and-bound algorithm is developed for this problem utilizing several new network reduction procedures, as well as a new bounding technique based on Lagrangian relaxation and network expansion. The resulting algorithm is quite efficient and promising. For multiple searchers, an optimal set of paths (search plan) is determined by taking advantage of the cooperative search effect. A new, exact algorithm and two new heuristics are presented to find an optimal or near-optimal search plan. One of the heuristics is based on the cross-entropy method and is found to perform well for a broad range of problem instances. The exact algorithm deals with the specific case of homogeneous searchers and is based on outer approximations by several new cutting planes. In addition, it is proven that under certain assumptions, the path-optimization problem becomes equivalent to a large-scale, linear, mixed-integer program.

**KEYWORDS:** Path Optimization, Branch-and-Bound, Cross-Entropy Method, Outer Approximation

**MASTER  
OF  
BUSINESS ADMINISTRATION**



# **MASTER OF BUSINESS ADMINISTRATION**

---

## **POWER AND LEADER EFFECTIVENESS IN ORGANIZATIONS: A LITERATURE REVIEW**

**Michael Barksdale–Lieutenant, United States Navy**

**Master of Business Administration–September 2008**

**Advisors: Cynthia L. King, Graduate School of Business and Public Policy**

**Lisa L. Massi Lindsey, Visiting Professor, Graduate School of Business and Public Policy**

This study examines the effects of power, interpersonal attraction, and perceived similarity on employee and organizational outcomes. The first purpose of this paper is to review the communication and organizational literature on power in order to illustrate how various uses and forms of power impact employee perceptions of leaders. Scholars from various disciplines have accepted the definition of power as “the capacity to produce intended effects, and in particular, the ability to influence the behavior of another person” (Burgoon and Dunbar, 2005, p. 208). This definition of power can be extended to describe a leader’s power in the workplace, as leaders are often characterized by their capacity to make effective decisions and their ability to influence their employees’ actions and perceptions. The results of this research on power might aid military leaders in better understanding how their communicative behaviors impact their subordinates. The second purpose of this paper is to review the literature on interpersonal attraction and investigate its impact on employee outcomes. Interpersonal attraction in a relationship is most often described as the attitude(s) that one person has toward another person. The nature of interpersonal attraction in relationships has been associated with individual mental health and physical well being (Orbuch and Sprecher, 2003), and perceived similarity is a factor that often explains why interpersonal attraction occurs in the workplace (Morry, 2007). The results of this research on interpersonal attraction and perceived similarity might aid military leaders in further understanding how interpersonal attraction in relationships might impact organizational outcomes.

**KEYWORDS:** Power, Leadership, Leadership Communication, Interpersonal Attraction, Perceived Similarity

## **AN ANALYSIS OF LEADERSHIP BEHAVIOR IN EXTREME MILITARY CONTEXTS**

**Robert Crosby–Lieutenant, United States Navy**

**Master of Business Administration–September 2008**

**Advisors: Edward H. Powley, Graduate School of Business and Public Policy**

**Cynthia L. King, Graduate School of Business and Public Policy**

The September 11 terrorist attacks, the Virginia Tech shootings, and Hurricane Katrina represent examples of intense circumstances that appear to be increasingly commonplace. This type of event seems to be occurring with much greater frequency than before. How city officials, military officers, and emergency responders lead in extreme situations is an important area of study. The central aim of this project is to uncover the key leadership behaviors and competencies necessary for managers and leaders dealing with major trauma and extreme events. The project identifies leader behaviors related to the competencies needed for effective leadership. Based on the level of violence and tragedy in society, it is vital to explore how competency-based leadership may help deal with this trend. A study of leadership in extreme circumstances is one avenue to help executives, managers, and subordinates bring healing and cohesiveness to their respective workplaces in times of crisis. The lessons learned from extreme cases provide new perspectives on how to manage and lead; as a result, there is great potential to inform managers and leaders everywhere.

**KEYWORDS:** Emotional Intelligence, Extreme Crisis, Crisis Management, Leadership Competencies

---

---

# MASTER OF BUSINESS ADMINISTRATION

---

## **E-BOMB: THE KEY ELEMENT OF THE CONTEMPORARY MILITARY–TECHNICAL REVOLUTION**

**Necati Ertekin–Lieutenant Junior Grade, Turkish Navy**

**Master of Science in Electronic Warfare Systems Engineering–September 2008**

**Master of Business Administration–September 2008**

**Advisors: Lt Col Terry Smith, USAF, Department of Information Sciences**

**James Airola, Defense Resources Management Institute**

**Second Readers: Phillip E. Pace, Department of Electrical and Computer Engineering**

**Raymond E. Franck, Graduate School of Business and Public Policy**

Contemporary military rivalry is driven mostly by the ongoing military-technical revolution. In particular, the weapons used on the future battlefield will play an important role in military affairs. Which weapons can play a key role in the future? Electromagnetic weapons seem to involve key elements for the future battlefield; they offer advantages over conventional weaponry by providing non-lethality, the advantage of attack at the speed of light, fast engagement of multiple targets, potentially low operational cost, and wide-area coverage for offensive and defensive purposes. This thesis proposes hypothetical electromagnetic bombs (e-bombs) and classifies e-bombs into three isocategories depending on power sources. It also assesses the potential lethality effects on different targets based on a simulation model developed in MATLAB. It provides an understanding of the principles of high-altitude, electromagnetic pulse (HEMP) and high-power microwave (HPM) weapons. In addition, a measure of effectiveness model is proposed to compare the hypothetical e-bomb, HEMP, and HPM weapons. The strategic effects on military affairs are assessed. Finally, this study will help the Turkish armed forces decide on investments in e-bomb research and development to improve combat capabilities on the future battlefield.

**KEYWORDS:** Electromagnetic-Bomb, High Power Microwave Weapons, High Altitude Electromagnetic Pulse, Electromagnetic Weapons, Electromagnetic Susceptibility, Soft Kill, Hard Kill, Potential Lethality, Multiple Objective Decision, Cost-Effectiveness Analysis, Measure of Effectiveness, Military Rivalry, Military Technical Revolution

## **EXPLOITATION OF FREE MARKETS AND GLOBALIZATION TO FINANCE TERRORISTS**

**Claudia P. Pena-Guzman–Major, United States Army**

**Master of Business Administration–September 2008**

**Advisors: Joseph G. San Miguel, Graduate School of Business and Public Policy**

**Michael Freeman, Department of Defense Analysis**

The international community has taken measures to monitor financial networks through anti– money-laundering acts. Since 9/11, these measures have been expanded to cover terrorist financing. However, the strides made to date in some parts of the world have been limited, and gaps still exist that terrorist organizations can infiltrate to thwart the international community’s efforts.

The purpose of this study is to investigate and provide an overview of current, international, counterterrorist financing efforts and to focus on how terrorists exploit them. This project is conducted as a study of three cases looking at globalization and free markets. Colombia is the primary case, while Peru and Great Britain are secondary cases. The goal of this project is to identify and document the trends in these countries in terms of existing, exploitable vulnerabilities. Specifically in Colombia, the study focuses on the FARC, ELN, and AUC, and how the Colombian government and financial institutions have responded. In Peru, the focus of the examination is Sendero Luminoso, and in Great Britain, the Irish Republican Army in Northern Ireland.

**KEYWORDS:** Colombia, Terrorism, Globalization, Marketization, Drug Trafficking, Drug Revenues, Coca Cultivation, Narco-Guerilla Groups, FARC, ELN, AUC, Plan Colombia, Second Order Effects, Financing

# **MASTER OF SCIENCE**

**Applied Physics**  
**Astronautical Engineering**  
**Computer Science**  
**Contract Management**  
**Defense Analysis**  
**Electrical Engineering**  
**Electronic Warfare Systems Engineering**  
**Information Systems and Operations**  
**Information Technology Management**  
**Information Warfare Systems Engineering**  
**Management**  
**Mechanical Engineering**  
**Meteorology and Physical Oceanography**  
**Modeling, Virtual Environments, and Simulation**  
**Operations Research**  
**Physical Oceanography**  
**Program Management**  
**Software Engineering**  
**Space Systems Operations**  
**Systems Engineering**  
**Systems Engineering Management**  
**Systems Technology**



# **MASTER OF SCIENCE IN APPLIED PHYSICS**

---

## **ASSESSING ACCURACY IN VARYING LIDAR DATA-POINT DENSITIES IN DIGITAL ELEVATION MAPS**

**Brian C. Anderson–Major, United States Marine Corps  
B.S., Boston University, 1995**

**Master of Science in Space Systems Operations–September 2008**

**Master of Science in Applied Physics–September 2008**

**Advisor: Richard C. Olsen, Department of Physics**

**Second Reader: James H. Newman, Space Systems Academic Group**

This thesis discusses the production of digital elevation maps (DEM) using a varying density of data points from a laser imaging, detection, and ranging (LIDAR) collection. Additionally, this thesis contains information on the multiple space missions that use laser altimetry or LIDAR to gather data about the earth, moon, asteroids, Mars, and Mercury. The thesis covers the accuracy of different amounts of data used when generating a DEM in the Quick Terrain Modeler software package and the ILAP Bare Earth Extraction plug-in; and discusses the error analysis when comparing the different DEMs built by randomly selecting 90%, 66%, 50%, 30%, 10%, 5%, 3%, 1%, 0.5%, 0.3%, 0.05%, 0.03%, and 0.01% of the data from an airborne Lidar collection from Honduras in 2008. Analyzing surface DEMs created in QTM, the results of the point reduction experiment indicate that a collection cloud-point density of 60,000 points per square kilometer is required for an accurate surface DEM in this environment.

**KEYWORDS:** Lidar, Ladar, Laser Radar, Laser Altimetry, Foliage Penetration, FOPEN, Poke-Through, Digital Elevation Map, DEM, Lidar Space Missions

---



# **MASTER OF SCIENCE IN ASTRONAUTICAL ENGINEERING**

---

## **LIDAR DESIGN FOR SPACE SITUATIONAL AWARENESS**

**David W. Gast—Lieutenant Commander, United States Navy**

**B.S., United States Naval Academy, 1996**

**Master of Science in Astronautical Engineering—September 2008**

**Advisor: Brij N. Agrawal, Department of Mechanical and Astronautical Engineering**

**Second Reader: Daniel C. Boger, Department of Information Sciences**

Space situational awareness (SSA) is a growing concern for national security. Among the many methods for increasing SSA is the use of space-based laser imaging, detection, and ranging (LIDAR) sensors to detect, track, classify, or image other spacecraft. This thesis explores the unique trade-spaces and design decisions faced by an engineer designing such a system. It provides an overview of the basic operational principles, the major components, the impact of one design choice on all other decisions, and guidelines for making design choices when designing a space-based LIDAR for space situational awareness applications. System operational constraints, demands on the host spacecraft, and potential impacts on other spacecraft are explored. Finally, an illustrative system design is presented, demonstrating the interaction between system requirements, system design, and component selection.

**KEYWORDS:** LIDAR, Laser Radar, LADAR, Space Situational Awareness, Satellite Payload Design, Active Optical Sensors, Satellite Detection and Tracking

---



# MASTER OF SCIENCE IN COMPUTER SCIENCE

---

## SMART CACHING FOR EFFICIENT INFORMATION SHARING IN DISTRIBUTED INFORMATION SYSTEMS

Dirk Ableiter—Lieutenant, German Navy

Master of Science in Computer Science—September 2008

Advisors: Gurminder Singh, Department of Computer Science

Thomas Otani, Department of Computer Science

Remarkable technical advances in cell phones and smart phones have resulted in a worldwide marketplace permeated by mobile devices. These capabilities, in combination with increasing consumer demand to share information, illustrate the need to utilize mobile devices more efficiently. However, within a distributed network of mobile devices like TwiddleNet, the two most limiting resources are still battery power and bandwidth. By distributing only small sets of data that represent the actual content, use of these resources can be reduced. The information tags can be sent throughout the network, reducing the amount of traffic to share the information. Once the content itself is shared, however, the workload on the mobile servers can quickly exceed the mobile device's ability to perform. This thesis offers an algorithm that will conserve battery power and bandwidth, depending on demand and device capabilities. Once a certain limit of bandwidth usage or a certain battery level is reached, the algorithm selects the content that most efficiently relieves these two resources and temporarily uploads it to a proxy server that serves the content on its behalf. This smart temporary caching lasts as long as the bandwidth or battery level limits are exceeded.

**KEYWORDS:** Mobile File Sharing, Caching, Distributed Networks, Mobile Devices, TwiddleNet

## CONVERSATION-THREAD EXTRACTION AND TOPIC DETECTION IN TEXT-BASED CHAT

Paige H. Adams—Lieutenant, United States Navy

B.A., Hawaii Pacific University, 2000

B.S., Hawaii Pacific University, 2000

Master of Science in Computer Science—September 2008

Advisor: Craig H. Martell, Department of Computer Science

Second Reader: Cynthia E. Irvine, Department of Computer Science

Text-based chat systems are widely used within the Department of Defense, but the standard systems available do not provide robust capabilities for search, information retrieval, or information assurance. The objective of this research is to explore methods for the extraction of conversation threads from text-based chat systems in order to enable such tasks. As part of the research, the author manually annotates over 20,000 internet relay chat posts with conversation thread information, and construct a probabilistic model for automatically classifying posts according to conversation thread. The author also provides an algorithm for extracting these conversation threads from the chat session in order to form discrete documents that may be used in a vector space model information retrieval system. The author elaborates on how this technique can be used to support search and data mining systems, as well as audit tasks and guard functions in a security system. Using the developed probabilistic models, the author achieves classification results on par with those of human annotators.

**KEYWORDS:** Natural Language Processing, Computer Mediated Communication, Internet Relay Chat, Conversation Analysis, Latent Dirichlet Allocation, Text Classification

---

---

# COMPUTER SCIENCE

---

## AN AUTOMATED BEHAVIOR PROPERTY VERIFICATION TOOL

John K. Leo—Lieutenant, United States Navy

B.S., Austin Peay State University, 2002

Master of Science in Computer Science—September 2008

Advisor: Mikhail Auguston, Department of Computer Science

Second Reader: Man-Tak Shing, Department of Computer Science

Computer-generated forces (CGF) simulations have entities as actors in their simulation. A type of CGF in which the entities have limited autonomy is semiautomated forces (SAF). The SAF system used in this research is OneSAF, a near real-time SAF that offers raw data collection of the entities in a particular simulation scenario. The data collection files vary in size from 500Kb to larger than four gigabytes. Entity behavior property verification (BPV) is an integral part of SAF simulation software testing. The purpose of this research is to provide immediate feedback to the system user/developer as to what an entity did in a scenario. From the simulation point of view, it provides answers to questions such as whether an entity routed the shortest distance to a destination. From the developer's point of interest, the BPV can provide insight to flaws in the model, such as a vehicle crossing a river where a bridge does not exist. Automated BPV (ABPV) goes one step further by minimizing "hard coding" of tools that process collection files. ABPV allows portability of the product of this thesis to other systems. ABPV Tools in this thesis is designed to run in Linux and Windows and will be included in future distributions of OneSAF as an intricate part of the testing suite.

**KEYWORDS:** Entity Behavior Verification, Computer Simulation Verification, Analysis of Real-Time Simulation, OneSAF

## A VISION-BASED INTEREST-POINT EXTRACTION EVALUATION IN MULTIPLE ENVIRONMENTS

Zachary Dean McKeehan—Lieutenant United States Navy

B.S., Chapman University, 1999

Master of Science in Computer Science—September 2008

Advisors: Mathias Kölsch, MOVES Institute (Modeling, Virtual Environments, and Simulation)

Kevin Squire, Department of Computer Science

Computer-based vision is becoming a primary sensor mechanism in many facets of real-world 2D and 3D applications, including autonomous robotics, augmented reality, object recognition, motion tracking, and biometrics. Vision's ability to utilize nonvolatile features to serve as permanent landmarks in motion tracking provides a superior basis for applications such as initial self-localization, future re-localization, and 3D scene reconstruction and mapping. Furthermore, the increased reliance of the American armed forces on the standoff warfighting capabilities of unmanned and autonomous vehicles (UXV) in, on, and above the sea necessitates better overall navigation capabilities for these platforms. Towards this end, existing technology is drawn upon to measure and compare current visual interest-point-extractor performance. An inventory of extractors is utilized to define and track interest points through physical transformations captured in images of various scene classifications. A preliminary determination is then performed of the best-suited extraction descriptor for each visual scene given multiframe interest-point persistence with maximum viewpoint invariance. This research contributes an important cornerstone towards the validation of precise, vision-based navigation, thereby increasing UXV performance and strengthening the security of the United States and its allies worldwide.

**KEYWORDS:** Simultaneous Localization and Mapping, SLAM, Epipolar Geometry, Fundamental Matrix, Camera Motion, Vision, Feature Extraction, Interest Point, Feature Detections, Feature Description, Scale Invariant Feature Transform, SIFT

---

# COMPUTER SCIENCE

---

## DETECTION OF IMPROVISED, EXPLOSIVE-DEVICE EMPLACEMENT IN URBAN ENVIRONMENTS

**Matthew O'Hara—Lieutenant, United States Navy  
B.S., United States Naval Academy, 2002**

**Master of Science in Computer Science—September 2008**

**Advisor: Gurminder Singh, Department of Computer Science**

**Second Reader: Arijit Das, Department of Computer Science**

This research focuses on discovering patterns of activity that lead to the emplacement of improvised, explosive devices (IEDs) by terrorists in urban environments. This research employs a network in a predictive mode by looking for suspicious activity patterns and raising alerts when a predetermined level of confidence is achieved in the prediction.

The scope of this thesis includes conducting various experiments using wireless-sensor network motes to detect the presence of magnetic material. Using various configurations of the motes, a pattern is established that best predicts the presence of IEDs in a busy urban environment. The configurations are designed and tested for reliability and coverage to support detection in various urban settings.

The results show that wireless-sensor networks, in conjunction with other anti-IED methods, prove useful in the detection of IED material in urban settings. A wireless-sensor network configured with proper equipment provides useful results for detecting IEDs and shows potential for correctly predicting behavior associated personnel carrying IED material.

**KEYWORDS:** IED, WSN, Mote, Magnetic

## CLANDESTINE MESSAGE PASSING IN VIRTUAL ENVIRONMENTS

**Ryan A. Rippeon—Lieutenant, United States Navy  
B.S., United States Naval Academy, 2004**

**Master of Science in Computer Science—September 2008**

**Master of Science in Modeling, Virtual Environments, and Simulation—September 2008**

**Advisors: Gurminder Singh, Department of Computer Science**

**CDR Joseph A. Sullivan, USN, MOVES Institute (Modeling, Virtual Environments, and Simulation)**

Virtual environments (VEs) present a new challenge for government officials attempting to monitor computer networks for terrorist communication. VEs bring new dimensions to online communication through visual appearance and state-maintaining servers. In this thesis, various VEs are explored to study what current abilities and usage patterns exist. Once characteristics of the VEs are established, clandestine methods for passing information are developed, along with proof of concepts. Visual cues, steganography, and autonomous bots are examined. Monitoring techniques are then discussed to attempt observation and analysis of this information at various levels. The expectation is that these results will improve awareness and solidify an understanding of the more surreptitious capabilities present in these networked environments.

**KEYWORDS:** Message Passing, Virtual Environments, Steganography, Second Life, Internet Terrorism, Honeyworld, Sun MPK20, Clandestine Messages, Virtual Worlds, Massive Multiplayer Online

---

# COMPUTER SCIENCE

---

## AN APPROACH FOR DEVELOPING AND VALIDATING LIBRARIES OF TEMPORAL FORMAL SPECIFICATIONS

**James J. Sordi, Jr.**—Lieutenant, United States Navy  
**B.S., State University of New York Maritime College**  
**Master of Science in Computer Science—September 2008**  
**Colleen A. Sybor**—Lieutenant, United States Navy  
**B.A., University of California, Los Angeles**  
**Master of Science in Computer Science—September 2008**  
**Advisors: James Bret Michael, Department of Computer Science**  
**Doron Drusinsky, Department of Computer Science**  
**Man-Tak Shing, Department of Computer Science**

This thesis examines the role of independent validation in the development of software systems. As software systems become larger and more complex, software validation becomes crucial. In particular, one must make sure that the specification of a software system is correct with respect to customer expectations. An approach for developing and validating reuse libraries of temporal formal specifications is introduced. These libraries include UML state chart-based assertions for formal specifications and their associated validation test scenarios. The validation test scenarios are built with the goal of ensuring that specifications within the libraries are indeed error free and consistent.

**KEYWORDS:** Validation, Reuse, Requirements, System Reference Model, Formal Specification, Assertions

## DETECTION AND TRACKING BASED ON A DYNAMIC, HIERARCHICAL OCCUPANCY MAP IN AGENT-BASED SIMULATIONS

**Dietmar Josef Teufel**—Lieutenant, German Navy  
**Graduate Engineer (FH), University of German Armed Forces-Munich, 1996**  
**Master of Science in Computer Science—September 2008**  
**Advisor: Christian Darken, Department of Computer Science**  
**Second Reader: Kevin Squire, Department of Computer Science**

Agent-based models in military simulation need a model for detection and tracking other agents. It has been suggested that statistical models, such as occupancy maps or particle filters, can be used for that purpose. An occupancy map is one possibility for this task. However, the more volume of space in a simulation, the more the computational demand of using occupancy maps grows, and the more benefit could be obtained by the ability to switch to a coarser granularity in at least some parts of the volume.

Using both possible benefits of an occupancy map, fine granularity in tracking and detection where needed and less computational demand by switching to low granularity where possible, parts of the volume will be transferred to a new occupancy map on a higher hierarchical level with coarser granularity. Only the most interesting areas in the simulation have fine granularity.

The main contribution of this research is to provide an improved algorithm and a prototype for using hierarchy occupancy maps in agent-based simulations involving large volumes of simulated space.

**KEYWORDS:** Tracking, Detection, Agents, Occupancy Map, Simulation, Probabilistic Target Tracking, Hierarchical Graph, Abstract Graph

# **MASTER OF SCIENCE IN CONTRACT MANAGEMENT**

---

## **UNITED STATES ARMY CONTINGENCY CONTRACTING OPERATIONS: EMERGING ROLES, PROCEDURES, AND CHALLENGES FACING CONTRACTING PROFESSIONALS**

**Roxanne Barbaris–DoD Civilian**

**B.S., Rowan University, 2002**

**Master of Science in Contract Management–September 2008**

**Christine Callanan–DoD Civilian**

**B.S., Monmouth University, 2004**

**M.B.A., Monmouth University, 2005**

**Master of Science in Contract Management–September 2008**

**Advisors: CDR Richard M. Nalwasky, USN, Graduate School of Business and Public Policy**

**Cary A. Simon, Graduate School of Business and Public Policy**

This joint applied project analyzes the extent to which Army leadership has acknowledged and is acting upon key improvement recommendations made by the Gansler Report (2007). This project explores roles, procedures, principles, and emerging issues facing contingency contracting professionals in respect to their responsibilities in expeditionary operations. Basic principles of contingency contracting and current literature relative to Army expeditionary operations are analyzed. Semi-structured interviews are conducted with both military and civilian acquisition professionals. Additionally, researcher-developed surveys are distributed amongst deployed contingency contracting officers/specialists in order to approach this topic with a “boots on the ground” perspective. Recommendations are provided that the Army can implement to improve modern wartime contingency contracting and to better prepare and train the contracting workforce to support future contingency operations.

**KEYWORDS:** Contingency Contracting, Army Training, Gansler Commission Report

## **ARMY CORPS OF ENGINEERS AND GULF-REGION DIVISION CONTINGENCY CONTRACTING IN IRAQ/AFGHANISTAN: SUSTAINING THE CIVILIAN VOLUNTARY WORKFORCE**

**Paige H. Brosch–DoD Civilian**

**Master of Science in Contract Management–September 2008**

**Travis Clemons–DoD Civilian**

**Master of Science in Contract Management–September 2008**

**Henry Wigfall–DoD Civilian**

**Master of Science in Contract Management–September 2008**

**Advisor: E. Cory Yoder, Graduate School of Business and Public Policy**

**Second Reader: Louis J. Moore, DoD Civilian**

The objective of this project is to describe, analyze, and recommend the strategy and process for using an Army, volunteer civilian, contracting, deployable workforce in Iraq and Afghanistan, particularly in terms of the U.S. Army Corps of Engineers (USACE)’s accomplishing the contingency contracting mission and completing the construction portion of reconstruction efforts. The Corps has been extensively involved in the nation-building effort in Iraq/Afghanistan, using civilian volunteers for deployment. To support this additional mission, the USACE has deployed civilian contingency contracting personnel to Iraq and Afghanistan. This project analyzes the extent to which the USACE strategies and structures are

---

---

## **CONTRACT MANAGEMENT**

---

accomplishing the mission, particularly in terms of new and emerging wartime needs and expectations. Subsidiary factors, such as an aging defense workforce and possible impacts on the Iraq/Afghanistan contracting mission, are also analyzed. Conclusions are drawn on the extent to which the current volunteer structure appears to be working and possible areas for improvement. Recommendations are offered on ways to encourage civilians to volunteer for assignments with the USACE Gulf Region Division (GRD) and as yet undefined future contingency operations.

**KEYWORDS:** Acquisition, Department of Defense Contracting, United States Army Corps of Engineers

### **AN ARMY MEDICAL COMMAND HANDBOOK FOR THE GOVERNMENT- PURCHASE-CARD PROGRAM**

**Angelene Decker–DoD Civilian**

**B.S., Hawaii Pacific University, 2003**

**Master of Science in Contract Management–September 2008**

**Advisors: CDR Richard M. Nalwasky, USN, Graduate School of Business and Public Policy**

**James Suchan, Graduate School of Business and Public Policy**

This project provides a “MEDCOM Supplemental” to the AR-715 to assist the government-purchase-card (GPC) program manager in doing his job. A supplemental is needed to interpret and clarify the current policy for the GPC program manager. This joint applied project is organized in a report and a project. The project provides an AR-715 supplemental handbook specific to the MEDCOM activity. This handbook will bridge the gap between the Department of the Army AR-715 and the installation level and will become an operational handbook for GPC program managers.

**KEYWORDS:** Army Medical Command, Government Purchase Card Program, Government-Wide Commercial Purchase Card

### **HOW TO DO MORE WITH LESS: HANDLING AN INCREASED WORKLOAD WHILE MAINTAINING HUMAN CAPITAL LEVELS**

**James Doerr, Jr.–DoD Civilian**

**B.S., Strayer University, 2000**

**Master of Science in Contract Management–September 2008**

**Emily Glazman–DoD Civilian**

**B.A., University of Virginia, 1997**

**J.D., University of Richmond School of Law, 2000**

**Master of Science in Contract Management–September 2008**

**Advisors: CDR Richard M. Nalwasky, USN, Graduate School of Business and Public Policy**

**Stephen G. Thomas, Naval Surface Warfare Center–Dahlgren Division**

**Second Reader: K.B. Hall, Naval Surface Warfare Center–Dahlgren Division**

The purpose of this project is to investigate and provide a comprehensive overview of the Department of Defense and local situation with regard to “human capital.” The DoD is particularly concerned with the issue of maintaining its knowledge base in the face of large numbers of retirees and with an ever-increasing and increasingly complex workload. This issue cannot be oversimplified, as several separate and key situational factors play into an agency’s ability to maintain a static level of human capital, despite fluctuations in staffing, type of work, amount of work, hiring, and training. The goal of this project is to identify the various issues that impact an organization’s (specifically, our organization’s) ability to maintain its knowledge base. This issue is evaluated using a five-pronged approach: environmental changes at all levels, workload, workforce changes, retention and training of existing personnel, and hiring strategies (this area includes the topic of professionalizing the acquisition workforce). The hope is to highlight the current state of affairs and provide some clarity with regard to where the DoD and the Naval Surface Warfare Center–Dahlgren Division are currently directed.

**KEYWORDS:** Human Capital, Workforce Changes, Workload Analysis, Retention of Personnel, Training of Personnel

---

## CONTRACT MANAGEMENT

---

### AN APPROACH FOR SYSTEMATICALLY CAPTURING VALUE-ADDED KNOWLEDGE AS APPLICABLE TO CONTRACTING

**Rachelle B. Eller–DoD Civilian**

**B.S., Bluefield College, 2004**

**Master of Science in Contract Management–September 2008**

**Sherry A. Moore–DoD Civilian**

**B.S., Strayer University, 2001**

**Master of Science in Contract Management–September 2008**

**Bonnie A. Impastato–DoD Civilian**

**B.S., Southern Christian University, 2005**

**Master of Science in Contract Management–September 2008**

**Advisors: Kenneth Doerr, Graduate School of Business and Public Policy**

**Richard Bergin, Department of Information Sciences**

**Ross E. Duncan, Naval Surface Warfare Center–Dahlgren Division**

Naval Surface Warfare Center–Dahlgren Division (NSWCDD) anticipates a substantial loss of contracting knowledge due to the retirement of senior leadership and contract specialists over the next seven years. This research examines the capabilities the NSWCDD will be losing and determines what valuable information will be lost due to this retirement surge. The research focuses on an approach for methodically capturing and analyzing knowledge gaps, and the best method to provide accessibility to all captured knowledge and knowledge that educates contracting personnel in the performance of contracting-related tasks. This report focuses on the contracting knowledge gaps that present the highest risk of loss and determines the key roles that are essential to meeting departmental needs. Through an analysis of organizational data repository systems and the determination of knowledge management gaps, this research reviews current content and processes of knowledge management and potential application of a knowledge management system.

Findings indicate that NSWCDD can anticipate critical gaps in knowledge upon a majority of contracting professionals retiring. A pilot test indicates that development of a knowledge management team and utilizing a knowledge management system are feasible methods for capturing and sharing knowledge at the NSWCDD.

**KEYWORDS:** Knowledge, Knowledge Management, KM, Knowledge Management Systems, MBA Professional Project

### THE APPLICATION OF LEAN-SIX SIGMA IN THE PRE-AWARD PROCUREMENT PROCESS

**Kristy M. Himes–DoD Civilian**

**B.A., George Mason University, 2003**

**Master of Science in Contract Management–September 2008**

**Constance M. Salisbury–DoD Civilian**

**B.L.S., University of Mary Washington, 2001**

**Master of Science in Contract Management–September 2008**

**Advisor: Kenneth Doerr, Graduate School of Business and Public Policy**

**Second Reader: Jeffrey R. Cuskey, Graduate School of Business and Public Policy**

**Third Reader: Robert E. Ashley, Naval Surface Warfare Center–Dahlgren Division**

This project outlines Lean Six Sigma principles, provides examples of Lean Six Sigma events, and analyzes principles that can be applied to Navy acquisition and contracting. The objectives of this project are to: 1) provide an overview of Lean Six Sigma principles in contracting and acquisition; 2) identify Navy contracting processes that have and can be analyzed using Lean Six Sigma principles; and 3) explore how Lean Six Sigma can be applied to interpret and implement regulations and instructions affecting the pre-award procurement process. The outcome of this project is an analysis of the applicability of using Lean Six Sigma processes to streamline the pre-award procurement process using Lean Six Sigma principles.

**KEYWORDS:** Lean, Six Sigma, Pre-Award Procurement Process, Procurement Action Lead Time, PALT, Acquisition, Contracting

---

# CONTRACT MANAGEMENT

---

## AN ORGANIZATIONAL ANALYSIS OF THE UNITED STATES ARMY CONTRACTING COMMAND–KUWAIT

**Kristine R. Orr–DoD Civilian**

**B.A., University of Alaska-Anchorage, 1993**

**Master of Science in Contract Management–September 2008**

**Advisors: E. Cory Yoder, Graduate School of Business and Public Policy**

**Cary A. Simon, Graduate School of Business and Public Policy**

**CDR Richard M. Nalwasky, USN, Graduate School of Business and Public Policy**

This study of the U.S. Army Contracting Command–Kuwait (USACC-KU) uses an organizational systems framework to analyze factors related to strategy structure, processes, and results experienced at USACC-KU during 2006-2008. The researcher's experience at the command, coupled with survey data from employees and middle and senior managers, is used to analyze the organization as a system. Conclusions and recommendations regarding the assessment include: 1) key variables appear to be incongruent, which may have contributed to documented organizational dysfunctions; 2) the command should initiate meaningful morale building events into the command's schedule and encourage use of existing morale, welfare, and recreation activities; and 3) the command should establish clear and compelling short- and long-range goals, involve personnel and communicate goals throughout the command, and establish metrics to ensure and track implementation of needed changes. Looking at an organization as a system through a comprehensive analysis provides leaders with a diagnostic tool to assess the health of the organization, identify weaknesses, and better align its direction with the needs of the organization.

**KEYWORDS:** Organizational Analysis, Organizational Systems Framework Model, Inputs, Throughputs, Outputs

## LOSING HUMAN CAPITAL IN THE U.S. NAVAL CIVILIAN WORKFORCE: TRENDS AND IMPACTS AT NAVAL SURFACE WARFARE CENTER–DAHLGREN, CONTRACTS DIVISION

**Jason R. Ostrander–DoD Civilian**

**B.S., University of Mary Washington, 1993**

**M.Ed., Marymount University, 1996**

**Master of Science in Contract Management–September 2008**

**Advisors: Philip P. Hayden, DoD Contractor**

**CDR Richard M. Nalwasky, USN, Graduate School of Business and Public Policy**

The purpose of this joint applied project is to investigate and provide a comprehensive overview of the importance of human capital to the Department of the Navy's civilian workforce. Causes for human capital loss in this arena are examined, and plans to prevent a shortage and loss of talent, knowledge, and experience are addressed. Human capital is defined by Derek Stockley as the knowledge and experience each individual brings to the workplace. Investing in human capital is as important as investing in tangible assets, such as buildings and equipment. The value of human capital can be difficult to measure and is often realized in its absence. The extent to which the Department of the Navy plans, programs, and actions are deemed sufficient for mitigating the potentially negative impacts of an aging and demographically changing defense civilian workforce is described. This includes substantial recruiting difficulties and challenges retaining crucial skill sets that are changing during wartime. Conclusions are drawn, recommendations are provided, and alternatives are discussed for alleviating the impacts of these factors and trends on Navy civilian workforce performance.

**KEYWORDS:** Civilian, Workforce, Navy, Retirement, Aging, Recruitment, Retention, Knowledge Management, Mentor

# CONTRACT MANAGEMENT

---

## THE NEXT STEP TO CREATING A MORE EFFICIENT FORM OF PAPERLESS CONTRACTING

**Gerald L. Sweet—DoD Civilian**

**Master of Science in Contract Management—September 2008**

**Advisors: E. Cory Yoder, Graduate School of Business and Public Policy**

**CDR Richard M. Nalwasky, USN, Graduate School of Business and Public Policy**

**Kenneth Doerr, Graduate School of Business and Public Policy**

The purpose of this project is to explore the early years of paper procurement and chart the progression to paperless contracting. This is followed by an analysis of the Department of Defense's next step for further improving procurement software and the user interface. This is contrasted against the Army's further refinement of their enterprise system, which only removes the paper from the otherwise archaic procurement system. The author, a contracting officer whose background includes programming, business administration, management information systems, geographic information systems, and systems design, explores the future of possible procurement solutions. This includes web-based enterprise architecture and the user interface.

**KEYWORDS:** Paper-Procurement, Paperless Contracting, Contracting, Procurement, Standard Procurement System, SPS, Procurement Automated Data and Document System, PADDs, Interactive Business Opportunities Page, IBOP, Army Single Face to Industry, ASFI, Federal Business Opportunities, FBO, Wholesale Logistics Modernization Program, WLMP, Logistics Modernization Program, LMP, Project Contract Folder, PCF, DoD Architecture Framework, DODAF, Solutions for Enterprise-Wide Procurement, SEWP



# MASTER OF SCIENCE IN DEFENSE ANALYSIS

---

## **PRIVATE MILITARY COMPANIES: AN ASSESSMENT**

**James M. O'Brien, II—Major, United States Army**

**B.S., United States Military Academy, 1996**

**Master of Science in Defense Analysis—September 2008**

**Advisor: Hy S. Rothstein, Department of Defense Analysis**

**Second Reader: John Arquilla, Department of Defense Analysis**

This thesis examines the controversies regarding the use of private military companies (PMCs) as defense contractors. The history of privatized security, consideration of ethical and legal issues, and an examination of three case studies allow for an assessment of PMCs in accordance with five criteria for success: competence, cost-benefit analysis, control, flexibility, and impact on state armed forces. After examining three case studies representing a variety of types of PMCs (Executive Outcomes in Angola and Sierra Leone, MPRI in Croatia, and Blackwater in Afghanistan and Iraq), it is found that although PMCs can be used legitimately and to good effect, expanded use of PMCs may pose serious risks to U.S. forces, national security objectives, and U.S. political legitimacy.

**KEYWORDS:** Private Military Company, Private Security, Outsourcing, Iraq, Afghanistan, Executive Outcomes, Military Professional Resources Incorporated, Blackwater

---



# MASTER OF SCIENCE IN ELECTRICAL ENGINEERING

---

## A PERFORMANCE ANALYSIS OF DECODE-AND-FORWARD WITH COOPERATIVE DIVERSITY AND ALAMOUTI COOPERATIVE SPACE-TIME CODING IN CLUSTERED, AD-HOC WIRELESS NETWORKS

**Konstantinos Alexopoulos—Lieutenant Junior Grade, Hellenic Navy  
B.S., Hellenic Naval Academy, 2001**

**Master of Science in Electrical Engineering—September 2008**

**Advisors: Murali Tummala, Department of Electrical and Computer Engineering  
John C. McEachen, Department of Electrical and Computer Engineering**

Space-time coding and spatial-diversity schemes enhance the performance of energy constrained, multihop, clustered relay networks. The purpose of this thesis is to evaluate the performance of techniques such as the decode-and-forward with cooperative diversity and the Alamouti space-time coding, which were primarily used in relay multiple-input/multiple-output communications, in distributed clustered two-hop and multihop relaying networks consisting of single-antenna terminals.

Simulation results for phase-shift keyed and quadrature amplitude-modulation signals in single carrier Rayleigh and Stanford University interim channels show that the use of the decode-and-forward with cooperative diversity and the Alamouti cooperative space-time coding schemes improve the error probability performance in a power constrained, clustered multihop relaying network operating in a multipath fading environment.

**KEYWORDS:** Cooperative Diversity, Spatial Diversity, Alamouti Cooperative Space-Time Coding, Decode-and-Forward, Cooperative Multiplexing, Amplify-and-Forward, Clustered Relay Network, Single-Antenna Terminal

## DETECTION OF FREQUENCY-HOPPED-SIGNALS TIMING INFORMATION USING THE TEMPORAL-CORRELATION FUNCTION

**Yuan-Pin Cheng—Captain, Republic of Chinese (Taiwanese) Army  
B.S., Chung Cheng Institute of Technology-Taiwan, 2000**

**Master of Science in Electrical Engineering—September 2008**

**Advisor: Monique P. Fargues, Department of Electrical and Computer Engineering  
Second Reader: Roberto Cristi, Department of Electrical and Computer Engineering**

This work extends earlier work derived by Overdyk and investigates the use of wavelet transform and image processing tools to estimate hopping times occurring in frequency hopping schemes. The detection algorithm identifies frequency hopping (FH) time locations found in FH schemes from the information provided by the two-dimensional, short-term, signal temporal correlation function (TCF). Hopping time locations are shown to be provided by identifying TCF phase discontinuities. The detection scheme has three main stages: 1) derive the analytic version of the FH signal and compute the resulting TCF function; 2) enhance discontinuities via the one-dimensional wavelet transform; and 3) apply morphological image processing operations and the Hough transform to estimate hopping time locations.

Results show that for FH signals imbedded in additive white Gaussian noise, reliable detection performance may be obtained for signal-to-noise (SNR) levels above three dB and good detection performance for SNR levels above six dB for 5% to 20% detection accuracy.

**KEYWORDS:** Frequency Hopping Signals, Wavelet Transforms, Temporal Correlation Function, Edge Detection, Hough Transform

---

---

# ELECTRICAL ENGINEERING

---

## A FAULT-TOLERANT MICROCONTROLLER FOR THE CONFIGURABLE FAULT-TOLERANT PROCESSOR

David E. Dwiggins, Jr.—Lieutenant, United States Navy  
B.S., Carnegie Mellon University, 1993

Master of Science in Electrical Engineering—September 2008

Advisors: Herschel H. Loomis, Jr., Department of Electrical and Computer Engineering  
Alan A. Ross, Space Systems Academic Group

In this thesis, the design of a fault-tolerant microcontroller for the configurable fault-tolerant processor is presented. The configurable fault-tolerant processor is a space-borne, field-programmable, gate-array (FPGA) experiment platform susceptible to single event upsets. Fault tolerance is needed to control the experiment in higher radiation orbits, and the microcontroller offers enhanced functionality for experiments. The 16-bit microcontroller is contained within the resources of a single FPGA. It includes RAM, microprocessor, FPGA configuration and configuration-scrubbing modules, PC/104 interface module, and fault detection and correction capabilities. Fault tolerance is implemented via triple modular redundancy and Hamming error-correction coding. Complete source code for the microcontroller and C-based compilation tools are included as appendices.

**KEYWORDS:** Fault Tolerance, Configurable Fault Tolerant Processor, Triple-Modular Redundancy, Single-Event Upset, Field Programmable Gate Array

## A PHOTONIC FRONT END AND COMPARATOR PROCESSOR FOR A SIGMA-DELTA MODULATOR

Kenny E. Escobar—DoD Civilian  
B.S., University of Florida, 2006

Master of Science in Electrical Engineering—September 2008

Advisor: Phillip E. Pace, Department of Electrical and Computer Engineering  
Second Reader: Douglas J. Fouts, Department of Electrical and Computer Engineering

This thesis examines the role of photonics and integrated optics (IO) for use in analog-to-digital conversion in electronic warfare (EW) intercept receivers. The IO approach uses a continuous wave (CW) distributed feedback (DFB) laser diode at a peak wavelength of 1550 nm to oversample two Mach-Zehnder interferometers (MZIs). The MZIs are part of the sigma-delta ( $\Sigma\Delta$ ) modulator-based analog-to-digital converter (ADC) oversampling architecture. A ring resonator accumulator is embedded within a feedback loop in the modulator to spectrally shape the quantization noise of the system. The experimental and simulation results are evaluated as a narrow-band proof-of-concept for the use of photonics technology in the sampling of wide-band radio frequency (RF) signals.

Taking the characteristics of the real components and the experimental results, a pulse-to-pulse computer simulation of an oversampled, first-order, single-bit  $\Sigma\Delta$  modulator is accomplished using RSoft OptSim. The performance characteristics of this subsystem are compared with the narrow-band results produced in the laboratory. In addition, a comparator processor circuit for the signal oversampling subsystem is designed and simulated in SIMUCAD SmartSpice. The analysis of the comparator processor circuit is evaluated. The lack of high-speed components limits the experimental and simulation results. With the system integrated with high-speed components, a wideband, direct, digital-antenna architecture can be demonstrated.

**KEYWORDS:** Integrated Optics, Electronic Warfare, Sigma-Delta Modulator, Mach-Zehnder Interferometer, Distributed Feedback Laser, Analog-to-Digital Converter

---

# ELECTRICAL ENGINEERING

---

## DIGITAL COMMUNICATIONS OVER FADING AND NON-FADING CHANNELS

**Jose H. Hernandez, Jr.—Captain, United States Marine Corps**

**B.S., Texas A&M University, 2001**

**Master of Science in Electrical Engineering—September 2008**

**Advisor: Ralph Clark Robertson, Department of Electrical and Computer Engineering**

**Second Reader: Frank Kragh, Department of Electrical and Computer Engineering**

The objective of this thesis is to enhance the ability of the Improved Many-on-Many (IMOM) software package to analyze modern digital-communication systems using available intelligence. Currently, IMOM can only be used to analyze analog communication systems, but modern systems are increasingly digital. In this thesis, the probability of bit-error expressions for many common digital-modulation techniques, both binary and non-binary, are inverted to obtain expressions for the required signal-to-noise ratio as a function of probability of channel bit error. Furthermore, results are obtained not only for a non-fading channel, but for channels modeled as either Rayleigh or Ricean. These equations can be implemented in IMOM to increase the accuracy of the link budget analysis when the specific modulation type being evaluated is known. This thesis takes the approach of determining probability of channel bit error rather than information bit error, which allows generic solutions independent of the specifics of the system under investigation as long as the particular modulation type is known. When even greater accuracy is desired, system specifics, such as the type of error control coding, must be taken into account. As an example of this, the Joint Tactical Distribution System (JTIDS) is considered.

**KEYWORDS:** Digital Modulation, IMOM, Multipath, Signal Fading, Ricean, Rayleigh

## THE DESIGN AND IMPLEMENTATION OF A MOTOR INCREMENTAL SHAFT ENCODER

**Andrew M. La Valley—Lieutenant, United States Navy**

**B.S., San Diego State University, 2001**

**Master of Science in Electrical Engineering—September 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 continuously develops new design applications and searches for new ways to provide students with the tools necessary to gain a greater understanding of advanced motor applications. One such tool is the Student Design Center (SDC). The SDC utilizes field-programmable gate-array (FPGA) technology for digital control of motor applications. One of the key factors in motor control is having the capability to measure the motor position. This thesis lays the groundwork for motor position control and also focuses on the design and implementation of an electrical interface for the MES20 (Type C) Position Encoder with the SDC via FPGA. More specifically, through the use of Mathworks and XILINX software, a digital algorithm is created specifically for the MES20 (Type C) position encoder interfaced with an FPGA in order to interpret the encoder's output signals into angular position, total degrees traveled, detection of clockwise and counter-clockwise rotation, and speed estimation.

**KEYWORDS:** Motor Control, Encoder, FPGA

## A QUANTUM TUNNELING MODEL OF A P-N JUNCTION IN SILVACO

**Jeffrey B. Lavery—Lieutenant, United States Navy**

**B.A., University of San Diego, 2003**

**B.S., University of San Diego, 2003**

**Master of Science in Electrical Engineering—September 2008**

**Advisor: Sherif Michael, Department of Electrical and Computer Engineering**

**Second Reader: Todd R. Weatherford, Department of Electrical and Computer Engineering**

In this thesis, the accurate development and implementation of a tunnel junction interconnect within a photovoltaic cell is investigated. A physically based, 2-D model is created in ATLAS to model the quantum tunneling effect that is realized within a multi-junction cell. The tunnel junction interconnect is a critical

---

# ELECTRICAL ENGINEERING

---

factor in the design of multi-junction photovoltaics, and the successful modeling of the junction will lead to increased efficiency and power density of a given cell. The quantum tunneling effect is based on the band-to-band and trap-assisted tunneling probability described by the Wentzel–Kramers–Brillouin method.

**KEYWORDS:** Tunnel Junction, Quantum Tunneling, ATLAS©, Photovoltaic Interconnect, Multi-Junction Photovoltaic, Wentzel-Kramers-Brillouin, Band-to-Band Tunneling

## **A PERFORMANCE ANALYSIS OF A LINK-16/JOINT TACTICAL INFORMATION DISTRIBUTION SYSTEM (JTIDS)-COMPATIBLE WAVEFORM TRANSMITTED OVER A CHANNEL WITH PULSE-NOISE INTERFERENCE**

**Dimitrios Lekkakos—Lieutenant, Hellenic Navy  
B.N.S., Hellenic Naval Academy, 1999**

**Master of Science in Electronic Warfare Systems Engineering—September 2008**

**Master of Science in Electrical Engineering—September 2008**

**Advisor: Ralph Clark Robertson, Department of Electrical and Computer Engineering**

**Second Reader: Tri T. Ha, 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 (CCSK) modulation for the data packets, where each encoded symbol consists of five bits. In this thesis, an alternative waveform consistent with the existing JTIDS channel waveform is analyzed. The system considered uses (31, 15) RS encoding as the original JTIDS, but each pair of five-bit symbols at the output of the RS encoder undergoes serial-to-parallel conversion to two five-bit symbols, which are then independently transmitted on the in-phase (I) and quadrature (Q) component of the carrier using 32-ary orthogonal signaling with 32-chip baseband waveforms, such as Walsh functions. This system is consistent with the direct sequence waveform generated by JTIDS. The performance obtained with the alternative waveform is compared with that obtained with 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 is also considered. Based on the analyses, it is concluded that the proposed alternative Link-16/JTIDS compatible waveform performs better than the existing Link-16/JTIDS waveform in AWGN as well as when PNI is present for both coherent and non-coherent demodulation. No significant advantage is obtained by using errors-and-erasures decoding (EED) for the alternative Link-16/JTIDS compatible waveform.

**KEYWORDS:** Link-16/JTIDS, 31,15, Reed-Solomon, RS, Coding, 32-Ary Orthogonal Signaling, Additive White Gaussian Noise, AWGN, Pulse-Noise Interference, PNI, Error-and-Erasures Decoding, EED

## **THE DESIGN AND IMPLEMENTATION OF AN ACTIVE CALIBRATION SYSTEM FOR WEATHER RADARS**

**Jason M. Phillips—DoD Civilian**

**B.S., University of Maryland-College Park, 2002**

**B.S., University of Maryland-College Park, 2002**

**Master of Science in Electrical Engineering—September 2008**

**Master of Science in Electronic Warfare Systems Engineering—September 2008**

**Advisors: Jeffrey B. Knorr, Department of Electrical and Computer Engineering**

**Lt Col Terry Smith, USAF, Department of Information Sciences**

Pulsed weather radars produce estimates of reflectivity, mean radial velocity, and velocity spread using echo signal samples from weather targets. From these radar products, other meteorological quantities, such as rainfall rate and wind fields, are derived. Estimates are derived from the parameters of the modified RF echo signal (amplitude, frequency/phase) scattered from the target. RF scattering and propagation effects are the mechanisms that modify echo signal parameters. Bias and variance in the weather signal parameter estimates naturally influence the accuracy of all subsequent quantities produced. For meteorological products to be as accurate as possible, the uncertainty of each estimate must be minimized. If radar system

---

## ELECTRICAL ENGINEERING

---

parameters are not accurately known, the reflectivity estimate will be biased. A well-controlled calibration process is therefore critical to reduce the bias of the reflectivity estimate. This thesis presents the design and implementation of a calibration system specifically for use with the Naval Postgraduate School's MWR-05XP X-band weather radar, although the general concept is applicable to all radars. The calibration system presented is an active, external calibrator intended to verify end-to-end radar system performance. Within this thesis, the background of the radar calibration problem and the research objectives for this specific project and related works are introduced and discussed. The theory behind the operation of weather radar (how the three principle quantities are measured and related to signal parameters) is also presented and explained. The density function for precipitation, relation between signal correlation and velocity spread, and fundamentals of weather radar signal parameter estimation are given. Conclusions on the success of the implementation and recommendations for future work are presented. The active calibrator design is described in explicit detail and experimental data are provided in appendices.

**KEYWORDS:** Active Calibration, Weather Radar, MWR-05XP, Radar Meteorology, Radar Calibration, Radar Theory, External Calibration

### DEVELOPMENT OF A 3D PEN INPUT DEVICE

**Deven A. Rhett—DoD Civilian**

**B.A., Gallaudet University, 2005**

**B.S., Gallaudet University, 2005**

**Master of Science in Electrical Engineering—September 2008**

**Advisor: Xiaoping Yun, Department of Electrical and Computer Engineering**

**Second Reader: Roberto Cristi, Department of Electrical and Computer Engineering**

The principal objective of this research is to demonstrate the capability of obtaining the acceleration in the navigation frame of a unistroke which can be written on any surface or in the air while correcting integration errors from the measurements of the inertial measurement unit (IMU) of pen-type input devices. With the core topic of obtaining the acceleration while correcting integration errors, there are four subsidiary research questions relating to the pen-type input devices. The first question is how to segment a stroke from the tip of the pen-type input device movement of the user. The second question is how to adjust the integration errors rapidly growing as time increases. The third question is how to reconstruct 2D trajectory from 3D trajectory in the air. The fourth question is how to project the trajectory onto the x-y plane.

**KEYWORDS:** IMU, Inertial Measurement Unit, Pen-Type Input Device, Unistroke, Integration Errors, 2D Trajectory, 3D Trajectory

### MODELING AND SIMULATION OF A NON-COHERENT FREQUENCY-SHIFT KEYING TRANSCIVER USING A FIELD-PROGRAMMABLE GATE ARRAY

**Konstantinos Voskakis—Lieutenant Junior Grade, Hellenic Navy**

**B.S., Hellenic Naval Academy, 1999**

**Master of Science in Electrical Engineering—September 2008**

**Advisors: Frank Kragh, Department of Electrical and Computer Engineering**

**Peter Ateshian, Department of Electrical and Computer Engineering**

**Second Reader: Roberto Cristi, Department of Electrical and Computer Engineering**

In this thesis, the principals of software-defined radio are demonstrated by implementing a binary frequency shift keying (BFSK) receiver-transmitter in a field-programmable gate array (FPGA). After introducing the theory behind the non-coherent BFSK demodulation implemented at the receiver, the design of the transmitter and receiver is illustrated. The design environment of choice is Mathworks' Simulink and Xilinx System Generator, a dedicated library for Mathworks' Simulink. The design is downloaded to a Virtex-4 FPGA.

The receiver is non-coherent in the sense that the receiver need not know the phase of the incoming signal. A feedback circuit is responsible for both packet and bit synchronization. Also, the receiver is implemented using non-coherent match filters instead of low pass filters, which would be easier but would

## ELECTRICAL ENGINEERING

---

degrade the performance. Finally, some interesting experiences gained during the learning process are discussed.

The different technological options in implementing communication modulating techniques and software-defined radio are evaluated. These options include digital signal processors, field programmable gate arrays, general purpose processors, and application specific integrated circuits. A comparison between these choices is presented.

**KEYWORDS:** Software Defined Radio, Field Programmable Gate Array, Digital Signal Processing Chip, Application Specific Integrated Circuit, Binary Frequency Shift Keying, Xilinx, System Generator

# **MASTER OF SCIENCE IN ELECTRONIC WARFARE SYSTEMS ENGINEERING**

---

## **THE DEVELOPMENT OF A DISTRIBUTED DIGITAL-ARRAY RADAR**

**Pontus R. Djerf-Commander, Swedish Armed Forces**

**B.S., Swedish National Defense College, 2005**

**Master of Science in Electronic Warfare Systems Engineering–September 2008**

**Ioannis Tornazakis–Captain, Hellenic Air Force**

**B.S., Hellenic Air Force Academy, 1996**

**Master of Science in Electronic Warfare Systems Engineering–September 2008**

**Advisor: David C. Jenn, Department of Electrical and Computer Engineering**

**Second Reader: Robert Broadston, Department of Electrical and Computer Engineering**

Distributed digital arrays have many potential applications in radar and communication systems. The objective of this thesis is to reexamine previous research on distributed digital-array radar (DDAR) and evaluate several critical aspects of a proposed wireless architecture. Self-standing transmit/receive (T/R) modules are synchronized wirelessly. An important issue is whether a simple low-cost synchronization circuit would perform adequately. To this end, two breadboard T/R modules are built to support test and evaluation. Both measurements and simulations are performed.

Other issues addressed in the research include a comprehensive investigation of the demodulator performance and the development of controller and processing software in LabVIEW.

**KEYWORDS:** Phased Array, Phase Synchronization, Aperature, Radar, Modulator, Demodulator, Transmit/Receive Module, Digital Beamforming, Demonstration Array

## **E-BOMB: THE KEY ELEMENT OF THE CONTEMPORARY MILITARY–TECHNICAL REVOLUTION**

**Necati Ertekin–Lieutenant Junior Grade, Turkish Navy**

**Master of Science in Electronic Warfare Systems Engineering–September 2008**

**Master of Business Administration–September 2008**

**Advisors: Lt Col Terry Smith, USAF, Department of Information Sciences**

**James Airola, Defense Resources Management Institute**

**Second Readers: Phillip E. Pace, Department of Electrical and Computer Engineering**

**Raymond E. Franck, Graduate School of Business and Public Policy**

Contemporary military rivalry is driven mostly by the ongoing military–technical revolution. In particular, the weapons used on the future battlefield will play an important role in military affairs. Which weapons can play a key role in the future? Electromagnetic weapons seem to involve key elements for the future battlefield; they offer advantages over conventional weaponry by providing non-lethality, the advantage of attack at the speed of light, fast engagement of multiple targets, potentially low operational cost, and wide-area coverage for offensive and defensive purposes. This thesis proposes hypothetical electromagnetic bombs (e-bombs) and classifies e-bombs into three isocategories depending on power sources. It also assesses the potential lethality effects on different targets based on a simulation model developed in MATLAB. It provides an understanding of the principles of high-altitude, electromagnetic pulse (HEMP) and high-power microwave (HPM) weapons. In addition, a measure of effectiveness model is proposed to compare the hypothetical e-bomb, HEMP, and HPM weapons. The strategic effects on military affairs are assessed. Finally, this study will help the Turkish armed forces decide on investments in e-bomb research and development to improve combat capabilities on the future battlefield.

---

---

# ELECTRONIC WARFARE SYSTEMS ENGINEERING

---

**KEYWORDS:** Electromagnetic-Bomb, High Power Microwave Weapons, High Altitude Electromagnetic Pulse, Electromagnetic Weapons, Electromagnetic Susceptibility, Soft Kill, Hard Kill, Potential Lethality, Multiple Objective Decision, Cost-Effectiveness Analysis, Measure of Effectiveness, Military Rivalry, Military Technical Revolution

## **A FLEXIBLE ARCHITECTURE SYSTEM AND TOPOLOGY LICENSE-PLATE RECOGNITION (FAST LPR) AND CONCEPT OF OPERATIONS IN THAILAND**

**Avraam Kazantzoglou–Major, Hellenic Air Force**

**B.S., Hellenic Air Force Academy, 1992**

**Master of Science in Electronic Warfare Systems Engineering–September 2008**

**Master of Arts in Security Studies –September 2008**

**Advisors: Pat Sankar, Department of Information Sciences**

**Robert McNab, Defense Resources Management Institute**

**Second Reader: James Ehlert, Department of Information Sciences**

This thesis examines the potential for technologically advanced systems to assist local law enforcement authorities in Thailand in continuing to effectively control drug trafficking, despite the advent of newly appeared “threats,” such as the spread of amphetamine-type stimulants (ATS). The pre-concept of operations (CONOPS) of such a system, funded by the Department of Defense/Counter–Narco-terrorism Technology Program Office (DoD/CNTPO), is provided. Even with opium seizures significantly reduced in the country, accompanied by a similar decline in heroin and morphine seizures, there is no room for complacency, especially given the fact that one of the neighboring countries, Myanmar, numbers among the top two opium producers around the globe.

Illicit drug trafficking is a phenomenon that cannot be addressed autonomously. Rather, evidence strongly relates illicit drug trafficking to terrorism activity, in a relation that is highly reciprocal. In the past decade this common front has been described by the term “narco-terrorism.” This term stresses the correlation of these two areas of illegal activity, which until recently were independent of one another. Clearly, the only response to sophisticated narco-terrorism networks must be based on advanced technological tools. The flexible architecture system and topology license-plate recognition (FAST LPR) are a promising solution to this problem.

**KEYWORDS:** Illicit Drug Trafficking, Drugs, Opium, Narcoterrorism, License Plate Recognition, Counter-Narcoterrorism

## **A PERFORMANCE ANALYSIS OF A LINK-16/JOINT TACTICAL INFORMATION-DISTRIBUTION SYSTEM (JTIDS)-COMPATIBLE WAVEFORM TRANSMITTED OVER A CHANNEL WITH PULSE-NOISE INTERFERENCE**

**Dimitrios Lekkakos–Lieutenant, Hellenic Navy**

**B.N.S., Hellenic Naval Academy, 1999**

**Master of Science in Electronic Warfare Systems Engineering–September 2008**

**Master of Science in Electrical Engineering–September 2008**

**Advisor: Ralph Clark Robertson, Department of Electrical and Computer Engineering**

**Second Reader: Tri T. Ha, 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 (CCSK) modulation for the data packets, where each encoded symbol consists of five bits. In this thesis, an alternative waveform consistent with the existing JTIDS channel waveform is analyzed. The system considered uses (31, 15) RS encoding as the original JTIDS, but each pair of five-bit symbols at the output of the RS encoder undergoes serial-to-parallel conversion to two five-bit symbols, which are then independently transmitted on the in-phase (I) and quadrature (Q) component of the carrier using 32-ary orthogonal signaling with 32-chip baseband waveforms, such as Walsh functions. This system is consistent with the direct sequence waveform generated by JTIDS. The performance obtained with the alternative waveform is compared with that obtained with 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

---

## **ELECTRONIC WARFARE SYSTEMS ENGINEERING**

---

interference (PNI) is present. Errors-and-erasures decoding (EED) and errors-only decoding is also considered. Based on the analyses, it is concluded that the proposed alternative Link-16/JTIDS compatible waveform performs better than the existing Link-16/JTIDS waveform in AWGN as well as when PNI is present for both coherent and non-coherent demodulation. No significant advantage is obtained by using errors-and-erasures decoding (EED) for the alternative Link-16/JTIDS compatible waveform.

**KEYWORDS:** Link-16/JTIDS, 31,15, Reed-Solomon, RS, Coding, 32-Ary Orthogonal Signaling, Additive White Gaussian Noise, AWGN, Pulse-Noise Interference, PNI, Error-and-Erasures Decoding, EED

### **THE DESIGN AND IMPLEMENTATION OF AN ACTIVE CALIBRATION SYSTEM FOR WEATHER RADARS**

**Jason M. Phillips–DoD Civilian**

**B.S., University of Maryland-College Park, 2002**

**B.S., University of Maryland-College Park, 2002**

**Master of Science in Electrical Engineering–September 2008**

**Master of Science in Electronic Warfare Systems Engineering–September 2008**

**Advisors: Jeffrey B. Knorr, Department of Electrical and Computer Engineering**

**Lt Col Terry Smith, USAF, Department of Information Sciences**

Pulsed weather radars produce estimates of reflectivity, mean radial velocity, and velocity spread using echo signal samples from weather targets. From these radar products, other meteorological quantities, such as rainfall rate and wind fields, are derived. Estimates are derived from the parameters of the modified RF echo signal (amplitude, frequency/phase) scattered from the target. RF scattering and propagation effects are the mechanisms that modify echo signal parameters. Bias and variance in the weather signal parameter estimates naturally influence the accuracy of all subsequent quantities produced. For meteorological products to be as accurate as possible, the uncertainty of each estimate must be minimized. If radar system parameters are not accurately known, the reflectivity estimate will be biased. A well-controlled calibration process is therefore critical to reduce the bias of the reflectivity estimate. This thesis presents the design and implementation of a calibration system specifically for use with the Naval Postgraduate School's MWR-05XP X-band weather radar, although the general concept is applicable to all radars. The calibration system presented is an active, external calibrator intended to verify end-to-end radar system performance. Within this thesis, the background of the radar calibration problem and the research objectives for this specific project and related works are introduced and discussed. The theory behind the operation of weather radar (how the three principle quantities are measured and related to signal parameters) is also presented and explained. The density function for precipitation, relation between signal correlation and velocity spread, and fundamentals of weather radar signal parameter estimation are given. Conclusions on the success of the implementation and recommendations for future work are presented. The active calibrator design is described in explicit detail and experimental data are provided in appendices.

**KEYWORDS:** Active Calibration, Weather Radar, MWR-05XP, Radar Meteorology, Radar Calibration, Radar Theory, External Calibration



# MASTER OF SCIENCE IN INFORMATION SYSTEMS AND OPERATIONS

---

## AN ANALYSIS OF SATELLITE COMMUNICATION AS A METHOD TO MEET INFORMATION-EXCHANGE REQUIREMENTS FOR THE ENHANCED- COMPANY CONCEPT

**Matthew A. Senn—Major, United States Marine Corps**

**B.S., United States Naval Academy, 1995**

**Master of Science in Space Systems Operations—September 2008**

**Master of Science in Information Systems and Operations—September 2008**

**James D. Turner—Major, United States Marine Corps**

**B.S., University of Florida, 1998**

**Master of Science in Space Systems Operations—September 2008**

**Advisors: Alexander Bordetsky, Department of Information Sciences**

**William J. Welch, Department of Information Sciences**

In the global war on terrorism and future irregular battlefields, the Marine Corps will not only fight in large-scale conventional wars against sizable military forces, it will also engage adversaries that utilize smaller units dispersed asymmetrically over vast geographical locations. To address this emerging threat, the Marine Corps is developing the enhanced-company (EC) concept, with the aim of providing the company commander with the tools necessary to make isolated decisions in an increasingly complex battlefield. In order to make timely, independent decisions and maintain information superiority, these widely dispersed units will require organic access to services normally provided by higher headquarters. The Marine Corps Warfighting Laboratory is working to enhance the decision-making capabilities of the infantry company through the development of the company-level intelligence center (CLIC) and the company-level operations center (CLOC).

Current Marine Corps communications capabilities cannot meet the data demands of widely dispersed lower-echelon units. The communications equipment organic to these units is mostly line-of-sight (LOS) technology. These systems limit the geographic dispersion of the units and are also limited in data throughput capability. To allow for wider dispersion on the battlefield while providing the connectivity required for isolated decision making, these units require communications assets that are capable of operating beyond line of sight (BLOS), such as satellite communications (SATCOM) equipment.

This thesis analyzes the use of SATCOM in support of the EC concept in an FOB environment. Using a limited-objective experiment, the authors test whether SATCOM technology is sufficient to support information-exchange requirements (IERS) developed in the laboratory and validated with experience. Based on the outcome of the experiments, the thesis provides recommendations regarding the use of such technology.

**KEYWORDS:** Distributed Operations, SATCOM, BLOS, OTH, Communications, Information Exchange Requirements, Enhanced Company, CLOC

---



# **MASTER OF SCIENCE IN INFORMATION TECHNOLOGY MANAGEMENT**

---

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

**Adrian S. Adame—Captain, United States Marine Corps  
B.A., University of New Mexico, 2001**

**Master of Science in Information Technology Management—September 2008**

**Bruce Kong—Lieutenant Commander, United States Navy  
B.A., University of Hawaii, 2001**

**Master of Science in Information Technology Management—June 2008**

**Advisor: Alexander Bordetsky, Department of Information Sciences**

**Second Reader: Michael Clement, Department of Information Sciences**

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

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

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

## **INVESTIGATING THE EFFECTS OF HIGHER SPATIAL RESOLUTION ON BENTHIC CLASSIFICATION ACCURACY AT THE MIDWAY ATOLL**

**Richard K. Arledge—Lieutenant, United States Navy  
B.A., Jacksonville State University, 2001**

**Master of Science in Space Systems Operations—September 2008**

**Ervin B. Hatcher—Lieutenant, United States Navy  
B.S., North Carolina State University, 2002**

**Master of Science in Space Systems Operations—September 2008**

**Master of Science in Information Technology Management—September 2008**

**Advisors: Daria Siciliano, National Research Council Associate**

**Richard C. Olsen, Department of Physics**

**Second Reader: Glenn R. Cook, Department of Information Sciences**

Effective monitoring of coral reefs is important for ecological and economic reasons, and satellite remote sensing has been shown to be useful for mapping and monitoring these ecosystems. This thesis compares two multispectral systems and investigates the effects of increased spatial resolution on benthic classifications in the highly heterogeneous coral reef environment of the Midway Atoll. It evaluates the utility of QuickBird's increased spatial resolution compared to IKONOS imagery in the same study area at

---

---

## INFORMATION TECHNOLOGY MANAGEMENT

---

multiple scales. Previous studies (e.g., Mumby and Edwards, 2002; Capolsini, et al., 2003; Wang, et al., 2004; Benefield, et al., 2007) comparing various satellite sensors suggest that greater spatial resolution should lead to more accurate classifications, but a direct comparison of QuickBird and IKONOS sensors has not been carried out in marine environments. Light interactions in marine environments are complex and add difficulty to spectral discrimination, producing more variable results in classification accuracy than in terrestrial environments. This research does not find any significant improvements in the thematic mapping accuracy of the benthic environment from QuickBird's higher spatial resolution satellite imagery. Additionally, a cost benefit analysis does not show a decisive advantage in choosing either imagery type for the application of monitoring the extent, biodiversity, and health of coral reef habitats.

**KEYWORDS:** Benthic Classification, Spatial Resolution, QuickBird, IKONOS, Cross-Scale, Remote Sensing, Multispectral, ENVI, ACORN, Satellite, Midway Atoll, Coral Reef, Cost Benefit Analysis

### **MISSILE DEFENSE CERTIFICATION: AN EXAMINATION OF THE U.S. NAVY AEGIS WARSHIP AND THE U.S. ARMY PATRIOT CREW CERTIFICATION PROCESS**

**Robert C. Biggs—Lieutenant, United States Navy  
B.A., Park University, 1999**

**Master of Science in Information Technology Management—September 2008**

**Advisor: Glenn R. Cook, Department of Information Sciences**

**Second Reader: James Bret Michael, Department of Computer Science**

The process employed by naval surface forces to capture information during warfare certification is enabled by a computer-based feedback mechanism. The surface force type commander employs two information management system models in the form of the Training and Operational Readiness Information Service (TORIS) and the Training Figure of Merit (TFOM) to report progress, capture data, compare trends, and achieve training and certification process efficiency. These systems have advantages that can be recognized and capitalized upon by other elements within the ballistic missile defense community. This thesis examines how two ballistic missile defense elements—Naval Aegis units and Army Patriot units—leverage technology to capture data as part of the certification timeline and the degree of alignment between the certification processes of the elements. It is recommended that an initiative be undertaken to record and retain data associated with certification events down to a granular (unit) level. It is further recommended that the Patriot community in particular consider an information technology solution for the issue of unit-level readiness management.

**KEYWORDS:** Ballistic Missile Defense, Crew Certification, Unit Certification, Organizational Memory, Corporate Memory, Readiness Management, Unit Readiness

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

**Timothy L. Clarke—Lieutenant Colonel, United States Marine Corps  
B.S., Truman State University, 1992**

**Master of Science in Information Technology Management—September 2008**

**Master of Science in Software Engineering—September 2008**

**Advisors: Man-Tak Shing, Department of Computer Science**

**Lt Col Karl D. Pfeiffer, USAF, Department of Information Sciences**

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

---

## INFORMATION TECHNOLOGY MANAGEMENT

---

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

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

### A CONCEPTUAL FRAMEWORK FOR TACTICAL PRIVATE SATELLITE NETWORKS

**Brian Conrad–Major, United States Marine Corps**

**B.A., University of Memphis, 1994**

**Master of Science in Information Technology Management–September 2008**

**Ioannis Tzanos–Lieutenant Commander, Hellenic Navy**

**B.S., Hellenic Naval Academy, 1993**

**Master of Science in Information Technology Management–March 2009**

**Advisor: Alexander Bordetsky, Department of Information Sciences**

**Second Reader: Rex Buddenberg, Department of Information Sciences**

The purpose of this research is three-fold. First is to examine the current state of military satellite communications (SATCOM) and analyze current trends in the commercial satellite communications market that support military command and control, as well as facilitate network operations. Second is the operational implementation of such private satellite networks within the context of net centric operations, as well as within the context of a coalition environment. Third, this work illustrates how the private satellite network could be managed, as well as understanding how the network could be used in the context of a network management control channel to exercise management of numerous, dispersed network devices and nodes.

The focus is to define, examine, and research the conceptual framework for a tactical private satellite network that facilitates command and control of geographically dispersed tactical units, as well as provides a mechanism for the management of tactical networks. After having acquired a clear picture of today's state and the future's capabilities in SATCOM, research is directed to how a tactical private satellite network would be implemented to support network centric operations and how this tactical private satellite network could be utilized as a tool for the management of tactical networks.

During the research, a number of secondary yet supportive topics are examined: how the tactical private satellite network could be implemented to facilitate collaboration between other government agencies, non-governmental organizations, and coalition partners from other countries; or how it would be managed to offer the desired service in terms of quantity (throughput) and overall quality to its subscribers.

To materialize the above, it is essential to thoroughly examine a commercial base station that is fully capable of managing this satellite network under any conditions. The whole concept of this tactical private satellite network is examined based on two innovative approaches. First, the establishment of two different logical channels inside the physical one; and second, the concept of a private satellite network and its implementation is examined as a method for direct delivery of data.

**KEYWORDS:** Remote Network Management, Satellite Communications, Tactical Network, Military Communications, Network Entry Point, Ground Control Station, Communication Gateway, Logical Channel, Direct Data Delivery

---

## INFORMATION TECHNOLOGY MANAGEMENT

---

### **DEFENSE TRAVEL SYSTEM: USING RESTRICTED AIRFARE IN CONJUNCTION WITH THE GSA CITY PAIR PROGRAM TO EFFECTIVELY REDUCE TDY TRAVEL COSTS WITHIN THE DEPARTMENT OF DEFENSE**

**Ashton F. Feehan, III—Lieutenant, United States Navy  
B.S., University of Mississippi, 1998**

**Master of Science in Information Technology Management—September 2008**

**Advisor: Glenn R. Cook, Department of Information Sciences**

**Second Reader: Daniel C. Boger, Department of Information Sciences**

This thesis discusses the Naval Postgraduate School's (NPS) use of the Defense Travel System (DTS) and examines a process of using the GSA City Pair Program in conjunction with restricted airfare as a means to effectively reduce travel costs in order to conserve Department of Defense (DoD) dollars. The thesis starts with a brief introduction of travel at NPS, followed by a section on the Defense Travel System, including NPS' history with electronic travel systems. The third chapter highlights NPS' current travel process, including the Commercial Travel Office and the GSA City Pair Program. The thesis reviews the process in which NPS could use a combination of the City Pair Program and restricted airfare to reduce travel expenditures. Specifically, this section discusses obstacles to effectively using restricted fares and how to overcome these obstacles, such as gaining approval from the Chief of Naval Operation's Office (OPNAV N431) to designate NPS as a test platform, using a decision matrix to help travelers decide if a restricted fare is right for their trip, implementing the process with assistance from the DTS program office, and reporting requirements and evaluation for determining if the process should be implemented throughout the DoD. A summary is provided, along with recommendations for improving DTS to increase stakeholder satisfaction.

**KEYWORDS:** Defense Travel System, Restricted Airfare, Business Process Improvement

### **CAN SIMPLE NETWORK MANAGEMENT PROTOCOL BE USED TO CREATE A SILENT SUBSCRIBER STATION IN AN 802.16 IMPLEMENTATION?**

**Joseph K. Harrison, II—DoD Civilian**

**B.S., California State University-Monterey Bay, 2001**

**Master of Science in Information Technology Management—September 2008**

**Advisor: Rex Buddenberg, Department of Information Sciences**

**Second Reader: Albert Barreto, Department of Information Sciences**

The IEEE 802.16 standard is a wireless communications standard that holds great potential for use by the U.S. military. As IEEE Std. 802.16 is a commercial standard, it can be used as a commercial, off-the-shelf solution for extending the reach of the internet down to the level of the individual soldier without incurring any development costs. Additionally, 802.16 "out of the box" supports end-to-end routing and is compatible/interoperable with other ubiquitous networking technologies, such as Ethernet and IP. Given the wireless nature of 802.16, every soldier within range of an 802.16 base station (BS) has the potential to benefit from the flow of information from the command and control network, as well as the ability to contribute back to the network, increasing the situational awareness of all who are connected.

While the default configuration of 802.16 has tremendous potential, it is at its base, a commercial standard. There is a potential for modification of the standard to increase the usefulness of 802.16 for the military. This thesis explores one such possibility by investigating the use of Simple Network Management Protocol to obviate the need for a subscriber station to transmit, eliminating the associated risk of detection through signal tracking.

**KEYWORDS:** 802.16, IEEE Std. 802.16, SNMP, Wireless

# INFORMATION TECHNOLOGY MANAGEMENT

---

## **THE HUMAN TERRAIN SYSTEM: ACHIEVING A COMPETITIVE ADVANTAGE THROUGH ENHANCED “POPULATION-CENTRIC” KNOWLEDGE FLOWS**

**Eric X. Schaner—Captain, United States Marine Corps**

**B.A., State University of New York at Buffalo, 1998**

**Master of Science in Information Technology Management—September 2008**

**Advisors: Mark E. Nissen, Department of Information Sciences**

**Heather S. Gregg, Department of Defense Analysis**

The United States military must fundamentally evolve its strategy and capabilities to better meet the unconventional challenges that define the post 9/11 era. Two principal requirements of this evolution are: 1) adopting a population-centric strategy for counterinsurgency and nation building, and 2) developing capabilities that better integrate U.S. forces and host nation civilians, leadership, and security forces. This thesis shows how a new Army initiative called the Human Terrain System (HTS) advances the U.S. Army toward achieving these requirements by embedding human terrain teams (HTTs) within U.S. Army units performing counterinsurgency and nation building in Iraq and Afghanistan.

The research uses the case study method to analyze a currently deployed human terrain team. The analysis leverages Knowledge Flow Theory to explain how the HTT creates, shares, and harnesses relevant cultural knowledge to improve the competitive performance of the host unit and advance the adoption of a population-centric strategy. The thesis concludes that the embedded HTT concept is valid and necessary in counterinsurgency and nation building contexts. The thesis recommends developing a large pool of career military social scientists to serve as future candidate participants; and integrating a knowledge management mechanism and policy into the HTS framework.

**KEYWORDS:** Knowledge Flow Theory, Human Terrain System, Human Terrain Team, Competitive Advantage, Counterinsurgency Warfare, Tacit Knowledge, Explicit Knowledge



# **MASTER OF SCIENCE IN INFORMATION WARFARE SYSTEMS ENGINEERING**

---

## **ENHANCED DETECTION OF ORTHOGONAL RADAR WAVEFORMS USING TIME-FREQUENCY AND BI-FREQUENCY SIGNAL PROCESSING TECHNIQUES**

**David M. Crescitelli—Lieutenant, United States Navy**

**B.S., United States Naval Academy, 2002**

**Master of Science in Information Warfare Systems Engineering—September 2008**

**Patrick B. Kistner—Lieutenant, United States Navy**

**B.S., New School for Social Research, 1994**

**Master of Science in Information Warfare Systems Engineering—September 2008**

**Advisor: Phillip E. Pace, Department of Electrical and Computer Engineering**

**Second Reader: Lt Col Terry Smith, USAF, Department of Information Sciences**

This thesis investigates the periodic autocorrelation function (PACF) and the periodic ambiguity function (PAF) for orthogonal continuous waveform (CW) modulations used in netted, low probability of intercept (LPI) radar. Three orthogonal polyphase sequences and one frequency coding sequence are examined and their PACF and PAF characteristics are quantified. The Wigner-Ville distribution (WVD) and quadrature mirror filter bank (QMFB) time-frequency signal processing techniques and the cyclostationary bi-frequency technique (often used in non-cooperative intercept receivers) are used to detect the orthogonal CW signals and extract their parameters. The results show that a combination of the techniques used are able to extract the basic signal parameters of bandwidth and code period from the polyphase waveforms and also the frequency hop slots and code length from the frequency coding sequence. The concept of using a swarm of unmanned aerial vehicles is examined from the viewpoint of a coordinated group of netted intercept receivers in search of an LPI radar network.

**KEYWORDS:** Polyphase, Orthogonal, Netted Radar, Simulated Annealing, Signal Design, LPI, UAV Swarm, Stigmergy, Gossip Network

## **THE HOLISTIC TARGETING METHODOLOGY AS THE MEANS TO IMPROVE INFORMATION OPERATIONS TARGET DEVELOPMENT AND PRIORITIZATION**

**Christopher S. Ieva—Major, United States Marine Corps**

**B.S., United States Naval Academy, 1996**

**M.A., Webster University, 2003**

**Master of Science in Information Warfare Systems Engineering—September 2008**

**Advisors: Steven Iatrou, Department of Information Sciences**

**Michael A. Herrera, Department of Information Sciences**

The Joint Publication 3-13 Information Operations (IO) states that both IO planning and targeting should be fully integrated with all joint planning and targeting efforts. However, this research with IO subject matter expertise on IO targeting and practice suggests the existence of a fracture in the integration process. The most challenging doctrinal, technical, and practical integration challenge stems from the second phase of the Joint Targeting Cycle: Target Development and Prioritization. In response to this challenge, this study proposes five recommendations to enhance IO integration into the Joint Targeting Cycle: the use of interim IO Joint Munitions Effectiveness Manual (JMEM) techniques to better forecast cognitive effects, the adoption of the Measure of Worth (MOW) Model to assess IO effects, the HOT methodology to develop and prioritize IO targets, the use of compendium software to facilitate targeting problem understanding and the network analysis tool, Palantir, as an efficient and tailored semi-automated means to holistically prioritize and develop targets.

---

---

## INFORMATION WARFARE SYSTEMS ENGINEERING

---

**KEYWORDS:** Information Operations, IO, Targeting, Non-Lethal, Joint Targeting Cycle, Target Development and Prioritization, Assessment, Social Network Analysis, Measure of Effectiveness

### INFORMATION SHARING FOR COMPUTING TRUST METRICS ON COMMERCIAL, OFF-THE-SHELF ELECTRONIC COMPONENTS

**William J. McMillon—Lieutenant, United States Navy  
B.S., University of Texas at Austin, 2001**

**Master of Science in Information Warfare Systems Engineering—September 2008**

**Advisors: James Bret Michael, Department of Computer Science  
Raymond R. Buettner, Department of Information Sciences**

The Department of Defense (DoD) has become highly reliant on commercial, off-the-shelf (COTS) technology in mission-critical, unclassified systems to reduce both the cost and time to acquire a system and to standardize support for deployed systems. It is challenging for the DoD to determine whether and how much to trust in COTS components, given uncertainty and incomplete information about the developers and suppliers of COTS components, as well as the capabilities provided by COTS components.

The purpose of this thesis is to explore the current landscape of DoD information assurance (IA) as it pertains to COTS components, show how Jøsang's trust model can be used to calculate trust based on opinions provided by multiple government and non-government services, and explore the need for cross-domain sharing of information to support populating, maintaining, and using the trust models.

**KEYWORDS:** Commercial Off the Shelf, COTS, Information Sharing, Information Assurance

### “ISM” ANALYSIS: A NECESSITY FOR EFFECTIVE STRATEGIC COMMUNICATION

**Joshua J. Norris—Captain, United States Marine Corps  
B.S., University of Evansville, 1999**

**Master of Science in Information Warfare Systems Engineering—September 2008**

**Advisor: Steven Iatrou, Department of Information Sciences  
Second Reader: Lt Col Karl D. Pfeiffer, USAF, Department of Information Sciences**

Ideas have consequences. This simple yet sufficient principle comes from a philosophical work of the same name by Richard M. Weaver, published in 1948. In this book, Weaver refers to the “channels of information and entertainment” as the “Great Stereopticon.” The purpose of this “machine” is to “project selected pictures of life in the hope that what is seen will be imitated.” According to Weaver, the audience is growing and so is their responsiveness to being “told the time to laugh and the time to cry.” The media understand this concept and look to wield choice words; in the information domain, in order to manage a certain perception; in the cognitive domain, through an active process called framing. This thesis postulates that a correlation exists between a given area’s system of belief and the framing of certain events by the local media. In order to determine if such a correlation actually exists, this thesis looks specifically at events in Iraq and the framing of these events by the media in and around Dearborn, Michigan, which has the highest density population of Muslims in the U.S. This study establishes a methodology for deciphering the layers of public information that inform and solidify these views.

**KEYWORDS:** Strategic Communications, Information Operation, Information Warfare, Influence Operations, Psychological Operations, Systems Analysis, Public Affairs, Media Frames Analysis, Worldview Analysis

---

# INFORMATION WARFARE SYSTEMS ENGINEERING

---

## A REVITALIZED INFORMATION ASSURANCE TRAINING APPROACH AND INFORMATION ASSURANCE BEST-PRACTICE RULE SET

**James A. Pappas—Lieutenant, United States Navy  
B.S., United States Naval Academy, 2000**

**Master of Science in Information Warfare Systems Engineering—September 2008**

**Advisor: Lt Col Terry Smith, USAF, Department of Information Sciences**

**Second Reader: Ray Elliott, Department of Information Sciences**

As the Information Age emerges to become the next great technological movement of modern civilization, the passion for information dominance will ultimately lead to the possession of information superiority, yet inferiority could prevail in the same breath if not carefully examined. Unlike wars of the past, the Department of Defense (DoD) faces a new dimension in modern warfare, against a novel adversary: the faceless foe. This faceless foe can come from abroad, domestically, and even within our own seemingly secure, yet vulnerable infrastructure. As modern society continues to move forward with the “latest high-tech gadget” or “cutting edge” technology, information still prevails. With increased wants and needs for information come the associated risks and vulnerabilities of information management, as people (and organizational procedure) can work against you and/or your information management and protection schemes.

The objective of this thesis is to assess the people and organizational (P-O) aspect of secure network environments with respect to the current standards and procedures that the DoD implements toward protecting network infrastructures. This thesis aims to revitalize information assurance training standards and implement best practice methods to address the people (as users) and organizational procedures (as operating environments) influences within the DoD structure on information security.

**KEYWORDS:** Information Assurance, Information Operations, Information Warfare, Infrastructure, Computer Security, OPSEC, Insider Attack, Internet, Computer Network Operations, Information, Network, Best Practice, Training, Security, Network

## OPTIMIZING NAVY INFORMATION WARFARE: A SYSTEMS ENGINEERING APPROACH

**Chad M. Smith—Lieutenant Commander, United States Navy  
B.S., Miami University, 1999**

**Master of Science in Information Warfare Systems Engineering—September 2008**

**Advisor: Ray Elliott, Department of Information Sciences**

**Second Reader: Lt Col Terry Smith, USAF, Department of Information Sciences**

In today’s information age, information warfare has gained prominence as an effective means of waging war. From a service perspective, the Naval Network Warfare Command, specifically the Navy information warfare community, has been tasked to lead in providing manning, training, and equipment to make this form of warfare a reality. While this relatively new requirement brings tremendous opportunity to the community, it also presents many challenges. Specifically, effective information operations integration and a well-defined career path that provides officers with experience, education, and skill sets in both signals intelligence and information operations have evaded the community.

This thesis proposes systems engineering combined with technical expertise as the solution to confront the information operations integration problem and provide an avenue to bridge the gap between the current expertise in signals intelligence and information operations.

**KEYWORDS:** Information Operations, Information Warfare, Systems Engineering, Career Path, Navy Information Warfare Community, Information Operations Integration, Training



# MASTER OF SCIENCE IN MANAGEMENT

---

## A STUDY OF NAVY ENLISTED ATTRITION: RACE, ETHNICITY, AND TYPE OF OCCUPATION

**James M. Carroll—Lieutenant, United States Navy  
B.S., Jacksonville University, 2000**

**Master of Science in Management—September 2008**

**Advisors: Mark J. Eitelberg, Graduate School of Business and Public Policy**

**Kathryn Kocher, Graduate School of Business and Public Policy**

The primary objective of this study is to gain a better understanding of Navy first-term enlisted attrition among racial/ethnic minorities by comparing attrition rates in technical and non-technical occupations. This study uses a special database developed by the Defense Manpower Data Center in Monterey, California, that contains the records of 186,938 male recruits who enlisted in the Navy during calendar years 1996 through 2000. These individuals are tracked over a four-year period to determine rates of failure to complete the initial enlistment contract. Cross-tabulation and frequency analysis are first used to examine attrition rates by race, racial/ethnic group, and ethnicity. The attrition behavior of these groups is then investigated using two factors shown to correlate with attrition, Armed Forces Qualification Test category and educational tier group. Finally, the attrition behavior of these groups is examined by assigned occupation, grouped by technical and non-technical categories. The study finds that occupational assignment is related to the attrition behavior of first-term enlisted personnel, and that the relationship is different between whites and most minorities. On average, non-Hispanic Asians and non-Hispanic whites are more likely to attrite when assigned to a non-technical job than to a technical one; in contrast, most minorities are far more likely to attrite when serving in a technical job. Further research is recommended to explore these results and to suggest approaches that might assist in lowering attrition rates among minorities, particularly those assigned to technical occupations.

**KEYWORDS:** Navy, First-Term Attrition, Racial/Ethnic, Technical Rating, Non-Technical Ratings

---



# MASTER OF SCIENCE IN MECHANICAL ENGINEERING

---

## A STUDY OF COMPOSITE JOINT STRENGTH WITH CARBON NANOTUBE REINFORCEMENT

**Susan D. Faulkner–Lieutenant, United States Navy  
B.S., United States Naval Academy, 2000**

**Master of Science in Mechanical Engineering–September 2008**

**Advisor: Young Kwon, Department of Mechanical and Astronautical Engineering**

**Second Reader: Scott Bartlett, Naval Surface Warfare Center-Carderock**

Strengthening of composite joints is a topic of recent research. The benefits of using locally applied carbon nanotubes to reinforce a carbon fiber composite joint are studied. The effect of carbon nanotubes on enhancing the fracture toughness and joint interface strength is investigated by performing Mode I, Mode II, and Mixed Mode I/Mode II fracture with and without carbon nanotubes applied locally at the joint interface. Furthermore, the effects of seawater absorption on Mode II fracture are investigated. Finally, an optimization of carbon nanotube concentration is performed. During the study, the image correlation technique is used to examine the fracture mechanisms altered by the introduction of carbon nanotubes. The experimental study shows that carbon nanotubes can increase the fracture toughness of the composite interface significantly, especially for Mode II, including a physical change in the fracture mechanism.

**KEYWORDS:** Carbon Nanotubes, CNT, Carbon Fiber Composite, Fracture Mechanics, Joint Strength Enhancement, Reinforcement, Mode I, Mode II, Mixed Mode I/Mode II

## EXPERIMENTAL STUDY OF COMPOSITE AND METAL-WIRE JOINTS

**William A. Schultz–Lieutenant Commander, United States Navy  
B.S., University of Kansas, 1996**

**Master of Science in Mechanical Engineering–September 2008**

**Advisor: Young Kwon, Department of Mechanical and Astronautical Engineering**

**Second Reader: Douglas C. Loup, Naval Surface Warfare Center-Carderock**

In order to join a composite structure to a metallic structure, the metal-wire layers are co-cured with composite layers using Vacuum Assisted Resin Transfer Molding (VARTM). Then, the interface fracture strength is measured for Mode II fracture for various lay-up and interface conditions. The study includes a metal-wire to composite interface, composite to composite interface, and metal-wire to metal-wire interface. In addition, the lay-up orientations of the metal-wires are varied between 0 and 90 degrees. The study also examines the crack propagation from a composite to a metal/composite interface. During the test, the Digital Image Correlation (DIC) technique is applied to capture the strain field around the crack tip. The results suggest that a metal-wire/composite laminate would be effective for connecting a composite structure to a metallic structure.

**KEYWORDS:** Vacuum Assisted Resin Transfer, VARTM, Digital Image Correlation, Composite, Fiberglass, Metal Wire, Metal Composite

---

# MECHANICAL ENGINEERING

---

## PHYSICS-BASED MODELING AND ASSESSMENT OF A MOBILE LANDING PLATFORM SYSTEM DESIGN

**Christopher G. Williams**—Lieutenant Commander, United States Navy  
B.S., United States Naval Academy, 1998

Master of Science in Mechanical Engineering—September 2008

**Advisors: Fotis Papoulias, Department of Mechanical and Astronautical Engineering**  
**Joshua Gordis, Department of Mechanical and Astronautical Engineering**

The overall throughput rate is examined from a container ship servicing the sea base to the objective ashore, with focus on the mobile landing platform (MLP) design. An initial study is conducted that considers the various technologies being developed for the sea base concept, a variety of air and surface connectors, and the use of a T-AKE class ship acting as a warehouse. A second study is conducted using a code that was developed using MATLAB to determine the maximum number of surface connectors that could be used with no wait time. The number of loading spots versus the amount of deck space available for stowage of cargo is calculated for the various cases. The surface connectors considered are the Landing Craft Air Cushioned (LCAC), the Next Generation Landing Craft Air Cushioned (LCAC(X)), and the Sea Base Connector Transformable Craft (T-Craft). A separate logistics simulation developed by Professor Gordis is used to compare the different connectors, increasing the available deck space on the mobile landing platform and the effects of technologies which would increase the connector load times.

**KEYWORDS:** Sea Base, Mobile Landing Platform, Logistical Connector, Fleet Force Sustainment

# MASTER OF SCIENCE IN METEOROLOGY AND PHYSICAL OCEANOGRAPHY

---

## THE PATTERN AND DYNAMICS OF THE MERIDIONAL OVERTURNING CIRCULATION IN THE UPPER CELL

Erick Lee Edwards—Lieutenant Commander, United States Navy  
B.S., United States Naval Academy, 1998

Master of Science in Meteorology and Physical Oceanography—September 2008

Advisor: Timour Radko, Department of Oceanography

Second Reader: Jeffrey L. Haferman, High-Performance Computing Center

The physics of the meridional overturning circulation (MOC) and inter-hemispheric heat transport is explored with an emphasis on the upper and central ocean. Sea surface temperature and wind stress are considered in the context of their ability to influence the MOC pattern, and their relative significance is quantified. Most calculations in this study use an idealized rectangular basin which makes it easier to identify the key dynamic processes and explain interaction. Volumetric and advective heat transport stream-functions are used to analyze inter-hemispheric exchanges of mass and energy.

Data concerning the effects of equatorially-asymmetric wind stress and surface heat flux forcing are used to construct expressions that explicitly define the relationships between wind stress, surface heat flux, inter-hemispheric volume flow, and heat transport. The relative importance of wind stress and surface heat flux to the overall values of transport is discussed in light of climatology.

The MOC in the upper ocean is found to be the dominant factor in inter-hemispheric heat transport and in the maintenance of the Earth's climate, despite its extremely small contribution to total meridional-vertical circulations in the entire ocean basin. This study suggests that the previous emphasis on deep overturning in the abyssal region and small-scale mixing as the dominant factors in the meridional overturning circulation should be reconsidered, and the role of wind stress and surface heat fluxes as determining factors of MOC strength and maintenance should be more thoroughly investigated.

This study explores possible mechanisms responsible for climate shift that could result in long-term changes to weather patterns and ocean conditions, altering important factors in the Navy's operating environment. Thus, long-term Navy planning must include an appreciation of possible changes in the forcing mechanisms responsible for the meridional overturning circulation.

**KEYWORDS:** Meridional Overturning Circulation, Thermohaline Circulation, Thermocline

## THE DEVELOPMENT OF A KERNEL TO DETECT ZIPHIUS CAVIROSTRIS VOCALIZATIONS AND A PERFORMANCE ASSESSMENT OF AN AUTOMATED PASSIVE ACOUSTIC DETECTION SCHEME

Jessica Rose Mohamed—Lieutenant, United States Navy  
B.S., United States Naval Academy, 2004

Master of Science in Meteorology and Physical Oceanography—September 2008

Advisors: Ching-Sang Chiu, Department of Oceanography

Christopher W. Miller, Department of Oceanography

An ensemble consisting of 150 Ziphius cavirostris vocalizations is compiled from acoustic data recorded at two High-Frequency Acoustic Recording Package (HARP) locations: the Naval Postgraduate School's (NPS) Point Sur HARP and the Scripps Institution of Oceanography's (SIO) site H HARP. The ensemble is analyzed via a principal component analysis (PCA). The results of the PCA verify the statistical robustness of the signal and yield one dominant mode which accounts for 73% of the variance. The

---

---

## METEOROLOGY AND PHYSICAL OCEANOGRAPHY

---

dominant mode is used to create a kernel for a matched filter detection scheme. The subsequent detector output is statistically evaluated against a ground truth. The ground truth identifies 28,434 Ziphius clicks by visually inspecting over 170 minutes of data recorded by NPS' Data Acquisition System (DAS) at the Southern California Offshore Range (SCORE). The inability to visually discriminate a signal embedded in noise creates a conservatively biased ground truth estimate, which increases the detector's false alarm rate. At an acceptable 0.1% false alarm rate, the detector has an overall 44% probability of detection. A further assessment of the detector's performance divides the data into two categories: cluttered and uncluttered. At a false alarm rate of 0.1%, the probability of detection is 26% and 61% respectively.

**KEYWORDS:** Ziphius Cavirostris, Cuvier's Beaked Whales, Principal Component Analysis, Matched Filter, SCORE, HARP, Hydrophone, Vocalizations, ROC Curves, Marine Mammal Acoustics

### **ATMOSPHERIC EFFECTS ON SIGNAL PROPAGATION IN ADVERSE ENVIRONMENTAL CONDITIONS: A VALIDATION OF THE ADVANCED REFRACTIVE EFFECTS PREDICTION SYSTEM**

**Erin E. O'Marr–Lieutenant, United States Navy  
B.S., United States Naval Academy, 2000**

**Master of Science in Meteorology and Physical Oceanography–September 2008**

**Advisors: Kenneth Davidson, Department of Meteorology**

**Lt Col Karl D. Pfeiffer, USAF, Department of Meteorology**

Signal propagation measurements from an 802.16 wireless communications network link are analyzed and compared with respect to effects-based model outputs influenced by atmosphere conditions. Atmospheric data collected includes in situ ground measurements, radiosonde upper air observations, and numerical weather model data. Extrapolated vertical atmospheric profiles, based on boundary layer constant flux theory and using the in situ ground measurements, are compared to the radiosonde upper air observations and high-resolution, numerical weather model data for consistency and accuracy. All three sources of data are input into the Advanced Refractive Effects Prediction System (AREPS), which uses the Advanced Propagation Model (APM) to predict radio frequency (RF) signal loss. AREPS output is compared with measured network signal data. The network studied was part of the COASTS 2007 field experiments in northern Thailand, a region of highly varied terrain and vegetation, as well as adverse environmental conditions. Results validate the extrapolated atmospheric profiles for use as input into tactical decision aids; provide a real-time assessment of the boundary layer and refractive layers overland; and compare high-resolution, numerical model data with radiosonde upper air profiles in the data sparse environment. Results validate AREPS as a tactical decision aid and tool for network administrators and operators for RF signal propagation; determine a negligible statistical significance of refractivity condition impact, even though in situ meteorological data captured non-standard refractivity gradients; show that the atmosphere is not a significant contributor to anomalous signal propagation at the operating wavelength and transmission distances; and conclude that the radiation heating of the network equipment remains as the likely factor to impact the transmission signal and equipment.

**KEYWORDS:** 802.16 Wireless Communications Network System, Advanced Refractive Effects Prediction System, Advanced Propagation Model, Boundary Layer Flux Theory, Atmospheric Refractivity, Signal Propagation, COASTS, COAMPS, Radiosonde Upper Air Observations

### **SMART CLIMATOLOGY APPLICATIONS FOR UNDERSEA WARFARE**

**Allon G. Turek–Lieutenant Commander, United States Navy  
B.S., Maine Maritime Academy, 1996**

**Master of Science in Meteorology and Physical Oceanography–September 2008**

**Advisor: James T. Murphree, Department of Meteorology**

**Second Reader: CDR Rebecca E. Stone, USN, Department of Meteorology**

Undersea warfare operations, particularly sound navigation and ranging (SONAR), are sensitive to small changes in the ocean environment. Therefore, variations in both atmospheric and oceanic characteristics on a monthly, seasonal, yearly, or even decadal scale have significant impacts on U.S. Navy operations in the

---

## METEOROLOGY AND PHYSICAL OCEANOGRAPHY

---

undersea environment. Long-term mean climatologies, by nature of their construction, are unable to represent trends or climate oscillations that occur on scales of months to years and consequently do not provide an adequate representation of the actual ocean environment. The Naval Postgraduate School smart climatology process, along with state-of-the-science atmospheric and oceanic re-analysis data, is used to create a smart ocean climatology. Comparison of the smart ocean climatology to the current Navy-utilized Generalized Digital Environmental Model (GDEM) climatology reveals a number of differences. These differences are highlighted when plots of tactically significant ocean parameters, such as sonic layer depth, are compared. The tactical significance of these differences is investigated by comparing data from the smart climatology with data from GDEM using current Navy TDAs. The results of this study indicate that smart ocean climatologies using state-of-the-science civilian data sets offer a significant tactical advantage over current Navy LTM climatologies.

**KEYWORDS:** Smart Climatology, Long-Term Mean Climatology, Ocean Climatology, Climatology, Climate, Simple Ocean Data Assimilation, SODA, Generalized Digital Environmental Model, GDEM, Re-Analysis, Ocean Re-Analysis, SONAR, Acoustic Performance, Propagation Loss, Convergence Zone, Upwelling, Downwelling, Wind Forcing, Ekman Transport, Ekman Pumping

### **A PROBABILISTIC APPROACH TO TROPICAL CYCLONE CONDITIONS OF READINESS**

**Kenneth A. Wallace–Lieutenant Commander, United States Navy**

**B.S., United States Naval Academy, 1998**

**Master of Science in Meteorology and Physical Oceanography–September 2008**

**Advisors: Patrick A. Harr, Department of Meteorology**

**James Hansen, Naval Research Laboratory**

Tropical Cyclone Conditions of Readiness (TCCOR) are set at Department of Defense installations in the western Pacific to convey the risk associated with the onset of destructive winds from approaching tropical cyclones. In this thesis, the methods by which TCCOR are set are analyzed to determine if objective and/or probabilistic guidance could improve the process. The Tropical Prediction Utility (TPU) was developed by forecasters in Yokosuka, Japan, and the Joint Typhoon Warning Center (JTWC) as a means of standardizing TCCOR forecasts using elements from JTWC official warnings. The TPU is used to recreate TCCOR timelines for 42 different cases affecting military bases at Guam, Kadena, Sasebo, and Yokosuka, Japan, during the 2002–2007 typhoon seasons. These timelines are then compared to historical TCCOR timelines and wind observations to identify any trends and biases in set time and duration for each TCCOR. A wind speed probability model is also used to compare the timelines to the wind observations and to categorize them based on consistent trends in probability at each predicted and historical TCCOR. The results suggest that potential biases exist in the TPU that tend to predict TCCOR earlier than they were set in practice. Although clear trends are identified between wind speed probabilities and elevated TCCOR, statistical uncertainties exist when using the probabilities to discern between “hits” and “false alarms.” While this thesis identifies basic traits in TCCOR settings, a larger sample of cases is needed for further study to determine factors that discriminate between hits and false alarms.

**KEYWORDS:** Tropical Cyclone Conditions of Readiness, Wind Speed Probability, Tropical Prediction Utility, Tropical Cyclone, Joint Typhoon Warning Center



# **MASTER OF SCIENCE IN MODELING, VIRTUAL ENVIRONMENTS, AND SIMULATION**

---

## **A MISSION ASSIGNMENT MODEL AND SIMULATION TOOL FOR DIFFERENT TYPES OF UNMANNED AERIAL VEHICLES**

**Yücel Alver—Captain, Turkish Air Force**

**B.S., Turkish Air Force Academy, 2000**

**Master of Science in Modeling, Virtual Environments, and Simulation—September 2008**

**Murat Ozdogan—First Lieutenant, Turkish Air Force**

**B.S., Turkish Air Force Academy, 2000**

**Master of Science in Modeling, Virtual Environments, and Simulation—September 2008**

**Advisor: Arnold Buss, MOVES Institute (Modeling, Virtual Environments, and Simulation)**

**Second Reader: Enver Yucesan, INSEAD Graduate Business School, France**

The use of unmanned aerial vehicles (UAVs) on the battlefield becomes more and more important every day. Parallel to this growing demand, there is a need for robust algorithms to solve the mission assignment problem in an optimum way. There are several tools for solving the assignment problem and testing the results to evaluate the robustness of the proposed algorithm. For most of the models, input factors are limited to the most important ones to make the process simpler. The aim of this thesis is to create an optimal solution for the assignment problem and test its robustness with a stochastic simulation tool. To accomplish the goals, more factors, such as ground abort rates of the UAVs and the area weather risk levels, which were typically excluded from previous studies, are incorporated to make the model more realistic. The analysis and results prove that the assignment algorithm works well and creates plausible results.

**KEYWORDS:** UAV, Model, Simulation, Assignment Problem, Simkit, Regression Analysis

## **DEFINING STABILITY, SECURITY, TRANSITION, AND RECONSTRUCTION OPERATIONS REQUIREMENTS FOR FUTURE DEPARTMENT OF THE NAVY TRAINING AND ANALYTICAL MODELS AND SIMULATIONS**

**Jonathan V. Beris—Lieutenant Commander, United States Navy**

**B.S., University of Miami, 1994**

**M.S., Florida International University, 2005**

**Master of Science in Modeling, Virtual Environments, and Simulation—September 2008**

**Eric S. Whittington—Major, United States Marine Corps**

**B.S., University of Memphis, 1994**

**Master of Science in Modeling, Virtual Environments, and Simulation—September 2008**

**Advisors: Curtis L. Blais, MOVES Institute (Modeling, Virtual Environments, and Simulation)**

**Arnold Buss, MOVES Institute (Modeling, Virtual Environments, and Simulation)**

**Christian Darken, Department of Computer Science**

The Department of Defense has elevated stability operations to be of equal importance as combat operations. With 75 percent of the world's population located in the littorals, the Navy-Marine Corps team is poised to be the country's instrument of choice for military support to stability operations. This has created a need for training and planning for these non-traditional missions. Furthermore, while simulations are force multipliers in both the training and planning arenas, no current simulation exists that adequately addresses stability operations. This thesis reviews how Navy-Marine Corps leaders plan and train for restoring a civilian population's essential services, via the guidance of the Department of Defense

---

---

## **MODELING, VIRTUAL ENVIRONMENTS, AND SIMULATION**

---

Directive 3000.05 and National Security Presidential Directive 44. The objective of this thesis is to create a documented methodology, define requirements, and provide metrics that will assist analysts and instructors during naval support to stability, security, transition, and reconstruction (SSTR) operations. In addition, the capability gaps in current simulations are evaluated. Lastly, a conceptual model is proposed using water as a proof-of-concept essential service, and a prototype framework simulation is presented. This work provides a working foundation to begin developing the next generation of simulations that will support our warfighters into the next era of warfare.

**KEYWORDS:** Shaping, Reconstruction, Essential Services, Stabilization Operations, Training and Education, National Military Strategy, Department of Defense Directive 3000.05, National Security Presidential Directive 44, Modeling, Simulations, Effects Based Operations, PMESII, DIME, SIMKIT, Military Scenario Definition Language, MSDL, Combat XXI, Pythagoras

### **THE IDENTIFICATION OF HUMAN FACTORS CONCERNS IN JOINT STRIKE FIGHTER AND TRAINING RECOMMENDATIONS**

**Arif B. Bitik—Captain, Turkish Air Force  
B.S., Turkish Air Force Academy, 1999**

**Master of Science in Modeling, Virtual Environments, and Simulation—September 2008**

**Bulent Kulunk—First Lieutenant, Turkish Air Force  
B.S., Turkish Air Force Academy, 2001**

**Master of Science in Modeling, Virtual Environments, and Simulation—September 2008**

**Advisors: CDR Joseph A. Sullivan, USN, MOVES Institute (Modeling, Virtual Environments, and Simulation)**

**Michael E. McCauley, Department of Operations Research**

**Second Reader: Anthony P. Ciavarelli, MOVES Institute (Modeling, Virtual Environments, and Simulation)**

Military aviation is at the frontier of implementing leading edge technology. The major objectives of advanced technology aircraft are to increase pilot safety and mission efficiency; the Joint Strike Fighter (JSF), the most modern fighter aircraft under development, has many technological innovations for just this purpose.

A common fact is that technology develops and is used faster than it can be thoroughly researched. This thesis seeks to identify and mitigate potential human factor concerns related to the JSF before it is used in the air forces of participating countries. The objective is neither to blame nor defend the design of the aircraft.

Two surveys and an interview yield the following findings: fighter pilots will use automation more in JSF than in their current types, the main LCD management will be key to mission efficiency and safety, the distributed aperture system (DAS) should be addressed very carefully to avoid disorientation issues, and tactical decision-making skills will be more important and demanding.

The major requirements of JSF pilot training include new approaches for better automation training, more focus on data filtering, display management, prioritization skills, establishing robust standard operating procedures for DAS, and addressing complex decision-making skills in more detail than in current training curriculums.

**KEYWORDS:** Human Factors, Cockpit Automation, Pilot Workload, Attentional Resources, Joint Strike Fighter, DAS, Glass Cockpit

---

# **MODELING, VIRTUAL ENVIRONMENTS, AND SIMULATION**

---

## **PROTOTYPE DEVELOPMENT OF A LOW-COST, AUGMENTED-REALITY TRAINER FOR CREW SERVICE WEAPONS**

**Nathan W. Conger—Lieutenant, United States Navy  
B.A., Texas A&M University, 1998**

**Master of Science in Modeling, Virtual Environments, and Simulation—September 2008**

**Advisors: Mathias Kölsch, MOVES Institute (Modeling, Virtual Environments, and Simulation)  
CDR Joseph A. Sullivan, USN, MOVES Institute (Modeling, Virtual Environments, and Simulation)**

A significant emerging threat to coalition forces in littoral regions is from small craft, such as jet skis, fast patrol boats, and speedboats. When armed, these craft are categorized as Fast Inshore Attack Craft (FIAC), and their arsenal can contain an array of weapons, including suicide bombs, crew-served weapons, anti-tank or ship missiles, and torpedoes. While these craft often have crude weapon technologies, they use an asymmetric tactic of large numbers of small, cheap, and poorly armed and armored units to overwhelm coalition defenses.

Training on crew-served weapons on coalition ships has not advanced to meet this new threat. The current training methods do not satisfactorily train the following skills: rules of engagement (ROE), marksmanship against highly maneuverable targets, threat prioritization, target designation, field of fire coordination, coordinated arms effects, or watch station to CIC communications.

The creation of a prototype Augmented Reality Virtual at Sea Trainer (AR-VAST) shows that emerging augmented reality technologies can overcome the limitations of traditional training methods. A fully developed AR-VAST system would be a deployable technology solution that uses in-place weapon systems as trainers in real-world environments with simulated enemy targets. While the AR-VAST architecture can be expanded to allow for training and coordination with multiple weapon operators, phone talkers, and bridge teams for maximum training effectiveness, the current prototype addresses the primary issue of identification and marksmanship.

**KEYWORDS:** Augmented Reality, Swarm Tactics, .50 Cal Trainer, Small Boat, Swarm Defense

## **FRAMING CULTURAL ATTRIBUTES FOR HUMAN REPRESENTATION IN MILITARY TRAINING AND SIMULATIONS**

**Tellis A. Fears—Lieutenant, United States Navy  
B.A., Savannah State University, 2001**

**Master of Science in Modeling, Virtual Environments, and Simulation—September 2008**

**Advisors: Deborah E. Gibbons, Graduate School of Business and Public Policy  
Curtis L. Blais, MOVES Institute (Modeling, Virtual Environments, and Simulation)**

This thesis provides insight to improve training of personnel that will support United States security, stability, transformation, and reconstruction (SSTR) operations in the social and cultural context of the Middle East. SSTR operations require competencies far beyond conventional fighting skills. Necessary skills include rounded knowledge about the history, culture, and language of the indigenous people in the operational area. Through personal interviews, social science research, and historical literature reviews, this thesis provides a framework for training military personnel on culture and social interactions using modeling and simulation. The author proposes the use of computer agents, bots or avatars with the cultural/social attributes explained within to be a solution to the lack of training in this field. These enhanced interaction skills will further support regional stability, increase cooperative engagements, and decrease insurgent activities.

**KEYWORDS:** Culture, Pre-Deployment Training, Stability Operations, Social Behavior, Modeling Culture

---

# MODELING, VIRTUAL ENVIRONMENTS, AND SIMULATION

---

## IMPROVING SITUATIONAL AWARENESS ON SUBMARINES USING AUGMENTED REALITY

Ronald V. Hatt—Lieutenant, United States Navy  
B.S., The Citadel, 2001

Master of Science in Modeling, Virtual Environments, and Simulation—September 2008  
Advisors: CDR Joseph A. Sullivan, USN, MOVES Institute (Modeling, Virtual Environments, and  
Simulation)

Mathias Kölsch, MOVES Institute (Modeling, Virtual Environments, and Simulation)

Modern submarines are complex machines operating in a harsh environment. Although technology has been rapidly introduced in the submarine fleet, submariners must process more information due to increases in sensor capability and information available for decision-making. Unfortunately, improvements in the human-systems interfaces have not kept up with the new technology. Incidents involving human error are still occurring at an unacceptable rate in the modern fleet. This thesis addresses the deficiency in display information that occurs for the key decision maker in control, the Officer of the Deck (OOD). The results from a cognitive task analysis (CTA) provide insights on the information flow and display uses for the critical periscope depth procedure. This thesis also identifies the level of SA associated with each step of the CTA. An analysis of the data from the CTA provides the deficiencies of the current system and suggests that the breakdown of SA occurs at level two. Through subject observations and personal experience, the author details the required information necessary for the OOD to make prompt decisions in control. This thesis attempts to provide an answer to the information display problem by introducing the emerging technology of augmented reality as a candidate solution.

**KEYWORDS:** Augmented Reality, Submarine, Human Systems Integration, Human Factors, Cognitive Task Analysis

## THE DEVELOPMENT OF A LONG-RANGE, GLIDING, UNMANNED UNDERWATER VEHICLE UTILIZING JAVA SUNSPOT TECHNOLOGY

Ronald J. Hemmelgarn—Lieutenant, United States Navy  
B.S., Old Dominion University, 2003

Master of Science in Modeling, Virtual Environments, and Simulation—September 2008  
Advisor: Donald P. Brutzman, Department of Information Sciences  
Second Reader: Jeff Weekley, MOVES Institute (Modeling, Virtual Environments, and Simulation)

The future of U.S. Naval operations can be described by a simple system of requirements and constraints. Increasing the diversity and scope of mission requirements, while being constrained by decreasing budget resources, requires some form of equalization to maintain a constant rate of successful mission fulfillment. The solution to this system can be found in unmanned vehicle development. The most recent revision of the Navy Unmanned Undersea Vehicle (UUV) Master Plan outlined the need to develop a cost-effective, flexible program by maximizing modularity and commonality of UUVs. This thesis investigates the convergence of three main areas of UUV development and introduces a potential solution to support those objectives.

Hardware-in-the-loop simulation and testing of embedded systems is a proven method for effectively testing complex systems, helping to reduce the risks of developing or deploying an ineffective, costly system. An innovative glider design by the University of Toulon, France, is the subject of this study. Unlike most rigid-hull gliders, the scalable free-flood volume of this vehicle holds the promise of carrying significant payload as long as overall buoyancy remains neutral. The research and development described in this thesis utilizes an existing planning and simulation tool, combined with an improved, low-cost, embedded-system robot controller, to test and evaluate a new, free-flood, long-range, gliding, underwater vehicle. This proposed solution utilizes all open-source hardware and software solutions to design a prototype gliding underwater vehicle. Further work is needed to demonstrate the efficiency and effectiveness of this design.

**KEYWORDS:** Java, UUV, AUVW, Sun SPOT, Glider

---

# MODELING, VIRTUAL ENVIRONMENTS, AND SIMULATION

---

## ACQUISITION OF A STATIC HUMAN TARGET IN COMPLEX TERRAIN: A STUDY OF PERCEPTUAL LEARNING UTILIZING VIRTUAL ENVIRONMENTS

Robert L. Kammerzell–Major, United States Army

B.S., Colorado State University, 1993

M.P.A., University of Oklahoma, 2006

Master of Science in Modeling, Virtual Environments, and Simulation–September 2008

Advisor: Michael E. McCauley, Department of Operations Research

Second Reader: CDR Joseph A. Sullivan, USN, MOVES Institute (Modeling, Virtual Environments, and Simulation)

Soldiers conducting ground operations must visually detect various dynamic and static threats. While enemy utilization of improvised explosive devices (IEDs) is a constant danger, there is also the requirement to detect the insurgent sniper threat. The U.S. Army has long identified enemy sniper activity as one of great importance to both the individual soldier's survivability and the unit's operational effectiveness. Specifically, the soldier's visual system and perceptual skills are immediately tasked with categorizing both the environment and any detected threat.

This study utilizes game engine technology to assess the ability to train subjects in visual target acquisition within a complex, virtual environment. The prevalence of computer games within the training realm requires study as to the game engine's ability to support current operations and soldier training.

The study's results determine that training improves a subject's target hit rate percentage 29% ( $p = .0001$ ), in comparison to the control group, when presented scenes of increased difficulty. Historically, military-themed computer games have succeeded in providing strategic training value. This study indicates that military-themed computer games also assist with individual soldier skills training.

**KEYWORDS:** Simulation and Training, Human Systems, Perceptual Learning, Vision

## THE IMPACT ANALYSIS OF A MIXED SQUADRON, CONTAINING A LITTORAL COMBAT SHIP AND MULTI-MISSION SURFACE PLATFORMS, ON BLUE FORCE CASUALTIES AND MISSION EFFECTIVENESS

Michael S. Milliken–Lieutenant Commander, United States Navy

B.S., University of Iowa, 1997

M.S., Central Michigan University, 2004

Master of Science in Modeling, Virtual Environments, and Simulation–September 2008

Advisor: Thomas W. Lucas, Department of Operations Research

Second Reader: Edward J. Lesnowicz, Jr., Department of Operations Research

In today's world, the United States is the dominant naval power. World powers are trading naval dominance in favor of naval defense, creating fleets of smaller ships to protect their littoral waters. As a result, the United States Navy will be called upon to engage enemy naval forces to ensure access against asymmetrical threats close to enemy coastlines.

The littoral combat ship (LCS) is a networked, focused-mission platform, designed to be swift, agile, stealthy, and capable of defeating asymmetric threats in the littorals. Although the LCS has limited capability to handle simultaneous missions, it will not be alone. The experimental guided missile destroyer DD(X) represents the U.S. Navy's next-generation. It is a multimission surface combatant tailored for land attack and littoral dominance, with capabilities designed to defeat current and projected threats.

Through simulation, data analysis, and design of experiment, this analysis simulates 15,420 littoral battles to determine if the addition of a multimission platform to an LCS squadron affects overall Blue Force casualties and mission effectiveness. The study examines squadron composition, size, and effects of sensors and weapon systems in both surface warfare (SUW) and anti-air warfare (AAW) scenarios. The data analysis reveals that a squadron composition of 5 to 11 LCSs with 1 to 2 DDGs in a stressing SUW scenario provides the best outcome, while destroyers and aircraft have the most impact for AAW missions.

**KEYWORDS:** LCS, DD(X), DDG-1000, Zumwalt, Littoral, MANA, Asymmetric, Coastlines, Squadron, DDG, Simulation, Design of Experiments, SUW, AAW

---

## **MODELING, VIRTUAL ENVIRONMENTS, AND SIMULATION**

---

### **USING MOTION CAPTURE TO DETERMINE MARKSMANSHIP SHOOTING PROFILES: TEACHING SOLDIERS TO SHOOT BETTER FASTER**

**William "Bill" L. Platte—Major, United States Army**

**B.S., North Georgia College, 1996**

**M.E., Troy State University, 2004**

**Master of Science in Modeling, Virtual Environments, and Simulation—September 2008**

**Johnny J. Powers—Major, United States Army**

**B.A., University of Arkansas at Little Rock, 1993**

**Master of Science in Modeling, Virtual Environments, and Simulation—September 2008**

**Advisor: Anthony P. Ciavarelli, MOVES Institute (Modeling, Virtual Environments, and Simulation)**

**Second Reader: CDR Joseph A. Sullivan, USN, MOVES Institute (Modeling, Virtual Environments, and Simulation)**

How can the U.S. Army teach soldiers marksmanship skills faster and sustain those skills between live fire training periods? Virtual marksmanship trainers are currently used to provide the means to teach basic and advanced marksmanship skills, monitor performance progress from novice to expert, and maintain marksmanship skills. This research focuses on the use of virtual marksmanship trainers to explore various training method enhancements based on recent studies of complex skill acquisition and expertise. The study of marksmanship skill and shooting characteristics benefits from the emergence of highly precise instrumentation for digital recording of the subject's performance. Motion capture technology is used to define and measure rifle-shooting postural profiles associated with different levels of marksmanship expertise. Motion capture data reveals significant ( $p < .008$ ) differences between beginner and expert profiles. Using this knowledge to develop a training system for the standardization of expert level marksmanship performance would result in higher levels of expertise and the reduction of variance during the instruction of rifle marksmanship.

**KEYWORDS:** EST 2000, Vicon Motion Capture, Training Transfer, Marksmanship, Skills Acquisition, Virtual Environment Trainer, Weapons, Simulation, Training

### **CLANDESTINE MESSAGE PASSING IN VIRTUAL ENVIRONMENTS**

**Ryan A. Rippeon—Lieutenant, United States Navy**

**B.S., United States Naval Academy, 2004**

**Master of Science in Computer Science—September 2008**

**Master of Science in Modeling, Virtual Environments, and Simulation—September 2008**

**Advisors: Gurminder Singh, Department of Computer Science**

**CDR Joseph A. Sullivan, USN, MOVES Institute (Modeling, Virtual Environments, and Simulation)**

Virtual environments (VEs) present a new challenge for government officials attempting to monitor computer networks for terrorist communication. VEs bring new dimensions to online communication through visual appearance and state maintaining servers. In this thesis, various VEs are explored to study what current abilities and usage patterns exist. Once characteristics of the VEs are established, clandestine methods for passing information are developed, along with proof-of-concepts. Visual cues, steganography and autonomous bots are examined. Monitoring techniques are then discussed to attempt observation and analysis of this information at various levels. The expectation is that these results will improve awareness and solidify an understanding of the more surreptitious capabilities present in these networked environments.

**KEYWORDS:** Message Passing, Virtual Environments, Steganography, Second Life, Internet Terrorism, Honeyworld, Sun MPK20, Clandestine Messages, Virtual Worlds, Massive Multiplayer Online

---

# MODELING, VIRTUAL ENVIRONMENTS, AND SIMULATION

---

## **SINGLE OPERATOR CONTROL OF MULTIPLE, UNINHABITED AIR VEHICLES: A SITUATIONAL AWARENESS REQUIREMENT**

**Derek M. Sebalj–Major, Canadian Forces  
B.A., Royal Military College of Canada, 1987  
M.S., University of North Dakota, 2002**

**Master of Science in Modeling, Virtual Environments, and Simulation–September 2008**

**Advisor: Michael E. McCauley, Department of Operations Research**

**Second Reader: Anthony P. Ciavarelli, MOVES Institute (Modeling, Virtual Environments, and Simulation)**

Militaries around the world, as well as other government agencies, are increasingly using uninhabited vehicles to perform dull, dirty, and dangerous work. In the United States, laws currently mandate their increasing use throughout the armed services, with set percentages of overall vehicle fleets. Currently, teams of people operate these vehicles, especially uninhabited air vehicles (UAVs). For example,  $n:1$ , where  $n$  is the number of operators and  $n > 1$ . The ultimate goal, and the object of much research, is the technology to lower, or even invert, the control ratio from many people to one vehicle to one operator of several vehicles, e.g.,  $1:m$ , where  $m$  is the number of vehicles and  $m \geq 1$ . While the technology to automate these vehicles continues to progress at a rapid pace, less attention has been paid to the human factors aspect. Theoretically, technology exists to enable single operator control of multiple UAVs; however, the human operator must interact with the vehicle, especially if the vehicle will be used to apply deadly force. What information does the operator readily need to make these critical decisions? How will the human operators be able maintain the situational awareness of all vehicles under their control and make informed decisions as to their employment in dynamic situations? One possible aid to maintaining situational awareness is an overall situational awareness display that gives an overview of the vehicle locations, both geographically and in relation to one another. The question to be answered is whether this display adds useful information to the operator without further straining the operator's limited attention resources.

Experiment participants are tasked to provide supervisory control of four simulated UAVs in a simulated environment, and to make tasking decisions for the UAVs based on static ground targets that require investigation. Accuracy of situational-awareness information is measured with and without the additional situation awareness display to determine the net benefit of adding an additional display to the operator's station. Results indicate that the situational awareness display helps the UAV pilot make more accurate decisions regarding the UAV in closest proximity to a target requiring reinvestigation. Contrary to expectations, the situational awareness display does not increase the speed of decision making for re-assigning the UAVs to a target of interest. The results support the conclusion that operators of multiple UAVs should have some form of situational awareness display to aid in determining the UAV's location geographically and in relation to other UAVs and search objects.

**KEYWORDS:** Uninhabited Air System, UAS, Uninhabited Air Vehicle, UAV, Uninhabited Military Vehicle, UMV, Unmanned Air Vehicle, Drones, Multiple Vehicle Control, Situational Awareness

## **SWARM AND SMALL-BOAT DEFENSE: A GAP STUDY**

**Andre N. Tiwari–Lieutenant, United States Navy  
B.S., Jacksonville University, 2002**

**Master of Science in Modeling, Virtual Environments, and Simulation–September 2008**

**Advisors: Michael E. McCauley, Department of Operations Research**

**Curtis L. Blais, MOVES Institute (Modeling, Virtual Environments, and Simulation)**

**Second Reader: Terry Norbraten, MOVES Institute (Modeling, Virtual Environments, and Simulation)**

United States naval forces conducting straits transits face a host of unique force-protection challenges. Traffic density is often high, with many ferries, fishing and pleasure boats, and large cargo ships maneuvering in a small area. Although the rules of engagement (ROE) will generally designate query and warning ranges, international law and freedom of navigation allow vessels to operate in very close proximity to warships. Small vessels are often difficult to regulate and many lack basic equipment, such as bridge-to-bridge radios. These conditions make the identification of and defense against hostile, small craft

## **MODELING, VIRTUAL ENVIRONMENTS, AND SIMULATION**

---

extremely difficult. Even after a craft is designated hostile, the timeline for mounting an effective defense is often very short.

This thesis shows that a gap in capability exists in the surface force to defend itself against small threat craft. It adds functionality to the Anti-Terrorism/Force Protection (AT/FP) Tool initially developed by Lieutenant James Harney (Harney, 2003) and significantly enhanced by Lieutenant Patrick Sullivan (Sullivan, 2006). It further expands the simulation's capabilities by adding the functionality to simulate small-boat and swarm attacks against ships conducting straits transits. The simulation does not reach full capability during the allotted period due to unidentified code errors. However, the framework for scenario generation is in place; after debugging, it will allow future researchers to evaluate the effectiveness of prototype sensors, weapons, and tactics visually or through output analysis in order to make more informed decisions regarding systems acquisition or doctrinal changes.

**KEYWORDS:** Force Protection, X3D, Savage Studios, Straits Transit, Swarm, FIAC, FAC, Simulation

# MASTER OF SCIENCE IN OPERATIONS RESEARCH

---

## **THE DEVELOPMENT OF A HUMAN PERFORMANCE MODEL AS A BASELINE FOR AUTOMATIC CHANGE-DETECTION SOFTWARE CAPABILITIES IN MINE WARFARE**

**Jason S. Barrett—Lieutenant, United States Navy**

**B.S., Georgia Institute of Technology, 2001**

**Master of Science in Operations Research—September 2008**

**Advisor: Lyn R. Whitaker, Department of Operations Research**

**Second Reader: Richard D. Williams, Wayne E. Meyer Institute of Systems Engineering**

This study focuses on the development of a human performance model as a baseline performance capability for automatic change detection software for use in mine warfare. Through a series of survey images, operator performance is observed under a variety of sonar image conditions, including increasing clutter levels and changes in image altitude and orientation. While a rough model is developed utilizing only the physical attributes of the images, to obtain a close fit between the model and actual observations, the variability of personal proficiency is included in the final model. The inclusion of this parameter greatly improves model accuracy and highlights the need to better understand differences between operator performances in mine warfare planning.

**KEYWORDS:** Mine Warfare, Change Detection, Automatic Change Detection Software, Clutter Density, Operator Variability

## **ADJUSTING TO RANDOM DEMANDS OF PATIENT CARE: A PREDICTIVE MODEL FOR NURSING STAFF SCHEDULING AT NAVAL MEDICAL CENTER SAN DIEGO**

**Joseph E. Chery—Lieutenant, United States Navy**

**B.A., Oakwood College, 2001**

**M.H.S.A., Florida International University, 2003**

**Master of Science in Operations Research—September 2008**

**Advisor: Ronald D. Fricker, Jr., Department of Operations Research**

**Second Reader: Lyn R. Whitaker, Department of Operations Research**

In this thesis, the Holt-Winters time series methods are used to forecast the monthly number of nursing full time equivalents (FTEs) required to meet patient care needs at the Naval Medical Center in San Diego, California. In order to capture both patient census and patient acuities, the monthly total required workload hours given by the Res-Q system is used. The monthly number of nursing FTEs is calculated by dividing the total monthly workload hours required by 168 hours (per DoD 6010.13-M). The Holt-Winters time series models are fit using both Excel and JMP software packages. Using three years of historical data to fit the models, the number of nursing FTEs that would be required every month for fiscal year 2008 for the entire hospital is forecasted with a mean absolute percentage error (MAPE) of 17.83. Fitting the model to data starting from December 2005 (to eliminate historical anomalies) further reduces the MAPE to 8.80. The overall model is subsequently partitioned into five sub-models, one for each of the five nursing units that reflect the hospital's patient and nursing staff mixes. Again, after adjusting for missing data points and outliers, the monthly number of nursing FTEs required for 4West, Adult ICU, Surgical, Medical, and Medical Oncology is forecasted with MAPE's of 20.77, 11.42, 13.63, 13.85, and 6.98, respectively.

**KEYWORDS:** Patient Acuity, Patient Census, Assigned FTE, Available FTE, Total Required Workload Hours, Staffing-to-Capacity, Nurse-to-Patient Ratio, MEPRS, CHCS, Length of Stay, DRG, R-Q Software System

---

---

# OPERATIONS RESEARCH

---

## LITTORAL COMBAT SHIPS: ANALYSIS AND COMPARISON OF DESIGNS

**Bryan J. Christiansen—Lieutenant, United States Navy**

**B.S., San Diego State University, 2002**

**Master of Science in Operations Research—September 2008**

**Advisor: Wayne P. Hughes, Department of Operations Research**

**Second Reader: Thomas W. Lucas, Department of Operations Research**

The introduction of new technologies forces navies to adapt; and the introduction of surface-to-surface, anti-ship cruise missiles from a large number of small coastal combatants created vulnerability in the Navy's force structure of large, expensive, nonexpendable warships. To counter this threat, it is recommended that the U.S. Navy adopt small, inexpensive, missile-bearing vessels. Four alternative candidate vessels are evaluated using a mathematical simulation. The candidates are a littoral combat ship with a surface warfare module, a national security cutter augmented with offensive and defensive weaponry, a "Sea Lance" inshore combat vessel, and a combat patrol craft, a variant of the Cyclone class patrol craft augmented with offensive and defensive weaponry. Equal-cost force structures for the four candidate vessels are developed, and these forces are "fought" in simulated battles against a missile-firing opponent force of variable strength. Additional roles, such as maritime interdiction and theater security cooperation, are considered, and the candidate vessels are qualitatively compared for their ability to perform in these missions. Sea Lance is demonstrated to be the most effective and lowest cost candidate vessel. The driving force behind this is the large number of vessels the equal-cost Sea Lance squadron makes possible by its low procurement and operating costs. This result was predicted by Lanchester and Hughes because in naval combat, numerical superiority is the single most important factor in determining the outcome of a battle.

**KEYWORDS:** Tree Littoral Combat Ship, National Security Cutter, Sea Lance, Combat Patrol Craft, Chinese Type 022 Houbei, Missile Combat, Salvo Model, Leakers

## LOGISTICALLY-CONSTRAINED ASSET SCHEDULING IN MARITIME SECURITY OPERATIONS

**Doyne Damian Clem—Lieutenant Commander, United States Navy**

**B.E., University of Mississippi, 1997**

**Master of Science in Operations Research—September 2008**

**Advisor: Johannes O. Royset, Department of Operations Research**

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

Operational commanders and planners are challenged with maintaining a fleet presence in many environments with limited resources. To add to this challenge, there are further constraints placed upon assets allocated to a given operational commander, such as replenishments at sea, multinational exercises, diplomatic port visits, and predetermined in-chop and out-chop dates. In the case of the Combined Maritime Force (CMF), which operates in the Fifth Fleet area of responsibility, these constraints are further magnified by the fact that ships under his or her operational command are from as many as ten different coalition nations at any given time. Furthermore, command of the CMF rotates between these coalition nations, increasing the propensity for inconsistent and sub-optimal resource allocation. This thesis develops a scheduling tool—Coalition Resource Allocation for Maritime Security (C-RAMS)—that is capable of quickly producing a schedule that optimizes a given measure of effectiveness for assets assigned to the CMF. This C-RAMS tool accounts for logistics requirements and allows a commander to set priorities within various sub-regions, types of assets, and specific time periods. Visual Basic with an Excel 2003 user interface is used to illustrate how C-RAMS provides such an optimal schedule and also provides insights into the interactions between different priorities and ship types, including those which may be interpolated for future force configurations.

**KEYWORDS:** Maritime Security Operations, Scheduling Tool, Optimization, Dynamic Programming, Time Expanded Network, Coalition, Combined Maritime Force, Logistics Constrained, UAV

---

# OPERATIONS RESEARCH

---

## A HEURISTIC ALGORITHM FOR U.S. NAVAL MISSION RESOURCE ALLOCATION

Derek T. Dwyer—Lieutenant Commander, United States Navy

B.S., Kansas State University, 1998

M.B.A., Webster University, 2002

Master of Science in Operations Research—September 2008

Advisor: Javier Salmeron, Department of Operations Research

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

Current military leadership is directing the U.S. Navy to engage in theater-security cooperation activities or missions to bolster confidence and build trust relationships with other national military forces. Using ships efficiently by maximizing the value of missions accomplished in any time period is important because these missions affect world security, as well as our own national security. In recent research, a mixed-integer programming optimization model called Central-West Africa Resource and Mission Allocation (CARMA) was developed. CARMA seeks to efficiently route a single naval vessel embarked with expeditionary partnership teams conducting theater-security cooperation missions, to maximize the total mission value. The two current algorithms for solving CARMA require commercial software to solve the associated optimization models. This thesis develops a custom-built, license-free, heuristic algorithm that provides decent solutions to CARMA in a fraction of the time of these algorithms. This heuristic uses limited enumeration to generate feasible routes and mission schedules for the ship. In the scenarios tested, the solution produced by the heuristic is not only generated in a fraction of the time of the current algorithms, but the total mission value collected is within 5% - 7% of those solution values.

**KEYWORDS:** Gulf of Guinea, Global Fleet Stations, Theater Security Cooperation, Vehicle Routing, Enumeration Heuristic, Mission Routing, Optimization

## IMPROVING LIFE CYCLE MANAGEMENT THROUGH SIMULATION AND EFFICIENT DESIGN

Alberto A. Garcia—Lieutenant Commander, United States Navy

B.S., Embry-Riddle Aeronautical University, 1996

Master of Science in Operations Research—September 2008

Advisor: Thomas W. Lucas, Department of Operations Research

Second Reader: Paul Sanchez, Department of Operations Research

Life Cycle Management (LCM) is defined as a decision-making process that takes into consideration the benefits, costs, and risks associated with each action over the full life cycle of a system. Effective LCM requires good forecasting to help determine future requirements for design and development, acquisition, in-service support and sustainment, modernization, and final disposal of a fleet of systems. It is in forecasting that simulation tools play a key role in LCM by helping program managers gain insights into their supported systems.

The Total Life Cycle Management Assessment Tool (TLCM-AT) is a probabilistic modeling and simulation analysis tool developed to support and improve the U.S. Marine Corps' LCM. This powerful tool is capable of performing "what-if" scenario analysis to compare the merits of multiple courses of action (COAs) or policies. Unfortunately, such analytical results are predicated on a set of conditions developed in the model that have little chance of occurring in real life.

This thesis introduces a Java-based application that combines the capabilities of TLCM-AT with the benefits of a sophisticated design of experiments (DOE) to perform in-depth sensitivity analysis of alternatives. A well-developed DOE can simulate real life by modeling a wide range of conditions under which the performance of each COA is measured. Data from this kind of experiment can be used to help in the development and selection of robust COAs and policies.

**KEYWORDS:** Life Cycle Management, Life-Cycle Costs, Availability, Data Farming, Design of Experiments, Nearly Orthogonal Latin Hypercube, TLCM-AT, Light Armored Vehicle, Clockwork Solutions, SEED Center, Modeling and Simulation, Partition Analysis

---

# OPERATIONS RESEARCH

---

## THE APPLICABILITY OF COSMOS TO THE DEVELOPMENT OF THE SUBMARINE RADIOMAN CAREER MODEL

Jose M. Lamberty–Lieutenant, United States Navy  
B.S., Jacksonville University, 2002

Master of Science in Operations Research–September 2008

Advisor: John Enns, Defense Resources Management Institute

Second Reader: Samuel E. Buttrey, Department of Operations Research

The thesis consists of two parts, a flow model and a data analysis section. The flow model is used to lay out the career path of an enlisted Navy radioman from accession (E-1) until the point he becomes a United States Navy Chief Petty Officer (E-7). This is the first time enlisted flows have been modeled.

Part two of this thesis is the analysis of enlisted radioman data from October 1998 to September 2007. The data set is compiled from the Proxy Perstempo file maintained by the Defense Manpower Data Center, which contains monthly information on all active component personnel in the Navy.

It is concluded that demographic variables are not good predictors for an individual's promotion to E-7. Nevertheless, according to the Clementine software, MAX.EDU seems to be the strongest non-demographic variable. This result is analogous to the promotion parameters used to calculate the final multiplication score (FMS). In the FMS computation, education can account for up to 2% of the total score. The use of this model will allow for the implementation in simulation software and the creation of the first enlisted career guide book.

**KEYWORDS:** COSMOS, Radioman, Career Model, Career Flow, Submarine, Enlisted

## OPTIMIZATION OF THE COMBAT LOGISTICS FORCE TO SUPPORT MAJOR COMBAT OPERATIONS

Troy C. Morse–Lieutenant Commander, United States Navy  
B.S., Virginia Tech, 1997

Master of Science in Operations Research–September 2008

Advisor: W. Matthew Carlyle, Department of Operations Research

Second Reader: Gerald G. Brown, Department of Operations Research

Military requirements development involves operational commanders conducting analyses of a variety of combat scenarios to assess force structure and material requirements to meet their military objectives. The naval component of each command determines the number of combat logistics force (CLF) ships necessary to keep combatant vessels on station. Without sufficient CLF ships, naval forces are unable to sustain continued presence in theater, hampering their ability to support combat operations. Current practice uses spreadsheet-based average consumption models to estimate the CLF requirement. However, these models do not adequately account for surges in demand or coordination of shuttle ships between multiple battle groups. This thesis demonstrates an optimization model coupled with a spreadsheet interface to identify CLF requirements for campaign level analysis through the use of a fictional 60-day combat scenario. It is determined that re-supply port location is a key determinant of shuttle ship quantity and employment. It is also demonstrated that an all-shuttle-ship concept that eliminates the need for station ships and further reduces the number of CLF ships necessary to support the mission.

**KEYWORDS:** Combat Logistics Force, CLF, Scenario Builder Interface, Spratly Islands

# OPERATIONS RESEARCH

---

## **TRI-LEVEL OPTIMIZATION FOR ANTI-SUBMARINE WARFARE MISSION PLANNING**

**Adam J. Thomas—Lieutenant, United States Navy**

**B.S.E., University of Michigan, 2002**

**Master of Science in Operations Research—September 2008**

**Advisors: Gerald G. Brown, Department of Operations Research**

**R. Kevin Wood, Department of Operations Research**

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

The Game-Theoretic ASW Mission Planner (G-TAMP), an operational-level planning aid for the tasking of anti-submarine warfare (ASW) platforms to protect a high-value unit (HVU) from attack by hostile submarines (SSKs), is developed. A defender-attacker optimization model is first presented, in which the defender tasks platforms to minimize the probability that the enemy can reach the HVU, while the enemy observes and reacts to these visible defenses by routing SSKs to maximize this probability. A defender-attacker/defender (D-A/D) model then extends the first model by adding a final “defender stage” to task potentially “secret” platforms. This model also prescribes the optimal sensor mode for platforms that can use passive sonar (for secrecy) or active sonar (for increased detection ranges), in effect, quantifying the value of secrecy for the defender. Five scenarios illustrate the D-A/D model’s ability to “shape” the battlespace to the defender’s advantage using visible platforms in the first stage, and then to exploit the secrecy of hidden platforms for maximum benefit. Model instances are mixed-integer programs with up to 14,000 constraints and 12,000 variables. In each case, an optimal or near-optimal search plan coordinates the actions of multiple, heterogeneous, ASW platforms to protect an HVU from an intelligent enemy.

**KEYWORDS:** Optimization, Mathematical Programming, Anti-Submarine Warfare, Search and Detection, Defender-Attacker Optimization, Tri-Level Optimization, Game Theory

## **SURFACE COMBATANT READINESS TO CONFRONT A SEA CONTROL NAVY**

**Nicholas E. Wissel—Lieutenant, United States Navy**

**B.A., McDaniel College, 2000**

**Master of Science in Operations Research—September 2008**

**Advisor: Wayne P. Hughes, Jr., Department of Operations Research**

**Second Reader: Thomas W. Lucas, Department of Operations Research**

This thesis proposes to correct the shortfalls in the U.S. surface combatants’ ability to counter a sea-control Navy. The concept counters this threat using unmanned aerial systems, decoys, and a layered defense. The performance is analyzed with a Filtering Model of Salvo Warfare that is an extension of the Hughes Salvo Equations. The model incorporates the diluting effect of decoys upon enemy salvos and accounts for the historical reality of leakers. It is concluded that in the absence of air support provided by U.S. carriers, the warships that will have to re-establish sea control will be Arleigh Burke destroyers based on current force composition. In summary, the thesis illustrates serious combat shortfalls in the surface warfare of DDGs against a numerically superior Chinese Surface Action Group and proposes a reasonable solution of three key upgrades. The first upgrade is a long-range TASM-like missile to correct the current DDG’s lack of long-range offensive missiles. The next two upgrades are both unmanned aerial systems. The Global Hawk maritime variant would provide offensive targeting data to surface combatants, allowing for a successful first strike. The Fire Scout would provide local airborne early warning, allowing for timely launches of decoys and defensive missiles.

**KEYWORDS:** Surface Warfare, Combat Models, Hughes Salvo Model, Campaign Analysis

# OPERATIONS RESEARCH

---

## AN OPTIMAL SCHEDULING AND OPERATING TARGET COST MODEL FOR AIRCRAFT CARRIERS IN THE FLEET RESPONSE PLAN

Michael A. York–Lieutenant Commander, United States Navy  
B.S., United States Naval Academy, 1996

Master of Science in Operations Research–September 2008

Advisor: Gerald G. Brown, Department of Operations Research

Second Reader: Daniel A. Nussbaum, Department of Operations Research

The Fleet Response Plan was developed to provide persistent readiness of the carrier fleet to respond to a variety of situations. This capability is developed through the Fleet Readiness Training Plan (FRTTP), where the Navy's carriers are scheduled in staggered 32-month cycles consisting of four phases of progressive readiness levels. Required operating target funds, or OPTAR, are budgeted to each carrier by Commander Naval Air Forces to achieve and maintain that readiness. Future OPTAR budgets, however, will be constrained by a 20-percent reduction in fiscal years 2009 through 2013. To compensate, funding priority is given to carriers in higher readiness phases at the expense of carriers conducting baseline training and maintenance, adversely impacting the fleet's ability to exercise the Fleet Response Plan as originally intended. This thesis optimizes scheduling synchronously across all carriers to meet established FRTTP readiness goals. Then, using a cost model based on recent historical spending and employment data, an estimate of funding required to operate all carriers is generated. Ultimately, this thesis provides a link between operational requirements and OPTAR budget requirements.

**KEYWORDS:** Fleet Response Plan, Aircraft Carriers, Fleet Readiness Training Plan, Operating Target, Optimization

# MASTER OF SCIENCE IN PHYSICAL OCEANOGRAPHY

---

## VALIDATION OF HIGH-FREQUENCY RADAR USED IN OCEAN SURFACE CURRENT MAPPING VIA *IN SITU* DRIFTING BUOYS

George C. Wright-Commander, United States Navy

B.A., University of North Carolina at Chapel Hill, 1992

Master of Science in Physical Oceanography–September 2008

Advisor: Jeffrey D. Paduan, Department of Oceanography

Second Reader: Mary L. Batteen, Department of Oceanography

High frequency (HF) radar and its application to mapping ocean surface currents is a relatively new field of study in oceanography. Nevertheless, this scientific field produces real, tangible, accurate, real-time results readily available to the military operational planner. The information gained through this process aids in the planning and execution of littoral operations via the development of the battle-space environment. Additionally, commercial use of this information can aide in the containment of coastal oil spills, efforts in search and rescue, and the execution of coastal engineering projects. Indeed, the utilization of high-frequency radar in the ocean environment has many beneficial qualities used by a wide variety of organizations. This study focuses on the validation aspects of high-frequency radar through the use of four drifters placed in situ from 23-27 January 2008 on the central California coast from Monterey to San Francisco. A second experiment was conducted from 1-10 April 2008 involving 32 drifters placed west of the San Francisco Bay. Various statistical comparisons between radial current velocity data from 12 Coastal Ocean Dynamics Application Radar (CODAR) stations and radial velocity data from each of the drifters are analyzed.

**KEYWORDS:** HF Radar, Ocean Surface Current, Validation, Drifter Buoys

---



# **MASTER OF SCIENCE IN PROGRAM MANAGEMENT**

---

## **THE CHALLENGES ASSOCIATED WITH ACCOUNTING FOR THE ARMY'S FORCE PROVIDER SYSTEM WHEN DEPLOYED IN SUPPORT OF MILITARY OPERATIONS**

**Carlos Correia–DoD Civilian**

**Master of Science in Program Management–September 2008**

**MAJ Allen Horner-USA, Product Manager Force Sustainment Systems, Natick, Massachusetts**

**Master of Science in Program Management–September 2008**

**James McLaughlin- DoD Civilian**

**Master of Science in Program Management–September 2008**

**Donald Stewardson- DoD Civilian**

**Master of Science in Program Management–September 2008**

**Advisors: Bradley R. Naegle, Graduate School of Business and Public Policy**

**Cary A. Simon, Graduate School of Business and Public Policy**

In this joint applied project, information relative to the challenges faced by the Army in accounting for the Force Provider (FP) system while deployed is presented. The process for FP property accountability used in current deployments is compared against established property accountability rules set forth by the Department of Defense. This comparison shows why there are inherent challenges to effectively accounting for the FP system (due to either design or employment strategy), and how these challenges are resulting in an increased cost burden to the Army. In addition, areas such as financial liability due to loss, determination on ownership of FP, and recurring expenses required to reset the system are also presented. Recommendations are made regarding clear and concise guidance that needs to be provided to the operational users; these recommendations are only a minor step in the effort to resolve the accountability issues identified in this project.

**KEYWORDS:** Force Provider, RESET, Accountability, Modules, LOGCAP, Logistics, City in a Box, Property Book, TAT, Technical Assistance Teams, ILSC, Natick, PM Force Sustainment Systems, PBUSE, AMC, G4

---



# MASTER OF SCIENCE IN SOFTWARE ENGINEERING

---

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

Timothy L. Clarke—Lieutenant Colonel, United States Marine Corps  
B.S., Truman State University, 1992

Master of Science in Information Technology Management—September 2008

Master of Science in Software Engineering—September 2008

Advisors: Man-Tak Shing, Department of Computer Science

Lt Col Karl D. Pfeiffer, USAF, Department of Information Sciences

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

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

---



# **MASTER OF SCIENCE IN SPACE SYSTEMS OPERATIONS**

---

## **ASSESSING ACCURACY IN VARYING LIDAR DATA POINT DENSITIES IN DIGITAL ELEVATION MAPS**

**Brian C. Anderson–Major, United States Marine Corps  
B.S., Boston University, 1995  
Master of Science in Space Systems Operations–September 2008  
Master of Science in Applied Physics–September 2008  
Advisor: Richard C. Olsen, Department of Physics  
Second Reader: James H. Newman, Space Systems Academic Group**

This thesis discusses the production of digital elevation maps (DEM) using a varying density of data points from a Lidar (laser or light detection and ranging) collection. Additionally, this thesis contains information on the multiple space missions that use laser altimetry or Lidar to gather data about planet Earth, the moon, asteroids, Mars, and Mercury. The thesis covers the accuracy of different amounts of data used when generating a DEM in the Quick Terrain Modeler software package and the ILAP Bare Earth Extraction Plug-In; and discusses the error analysis when comparing the different DEMs built by randomly selecting 90%, 66%, 50%, 30%, 10%, 5%, 3%, 1%, 0.5%, 0.3%, 0.05%, 0.03%, and 0.01% of the data from an airborne Lidar collection from Honduras in 2008. Analyzing surface DEMs created in QTM, the results of the point reduction experiment indicate that a collection cloud point density of 60,000 points per square kilometer is required for an accurate surface DEM in this environment.

**KEYWORDS:** Lidar, Ladar, Laser Radar, Laser Altimetry, Foliage Penetration, FOPEN, Poke-Through, Digital Elevation Map, DEM, Lidar Space Missions

## **INVESTIGATING THE EFFECTS OF HIGHER SPATIAL RESOLUTION ON BENTHIC CLASSIFICATION ACCURACY AT THE MIDWAY ATOLL**

**Richard K. Arledge–Lieutenant, United States Navy  
B.A., Jacksonville State University, 2001  
Master of Science in Space Systems Operations–September 2008  
Ervin B. Hatcher–Lieutenant, United States Navy  
B.S., North Carolina State University, 2002  
Master of Science in Space Systems Operations–September 2008  
Master of Science in Information Technology Management–September 2008  
Advisors: Daria Siciliano, National Research Council Associate  
Richard C. Olsen, Department of Physics  
Second Reader: Glenn R. Cook, Department of Information Sciences**

Effective monitoring of coral reefs is important for ecological and economic reasons, and satellite remote sensing has been shown to be useful for mapping and monitoring these ecosystems. This thesis compares two multispectral systems and investigates the effects of increased spatial resolution on benthic classifications in the highly heterogeneous coral reef environment of the Midway Atoll. It evaluates the utility of QuickBird's increased spatial resolution compared to IKONOS imagery in the same study area at multiple scales. Previous studies (e.g., Mumby and Edwards, 2002; Capolsini, et al., 2003; Wang, et al., 2004; Benefield, et al., 2007) comparing various satellite sensors suggest that greater spatial resolution should lead to more accurate classifications, but a direct comparison of QuickBird and IKONOS sensors has not been carried out in marine environments. Light interactions in marine environments are complex and add difficulty to spectral discrimination, producing more variable results in classification accuracy than in terrestrial environments. This research does not find any significant improvements in the thematic

---

---

## SPACE SYSTEMS OPERATIONS

---

mapping accuracy of the benthic environment from QuickBird's higher spatial resolution satellite imagery. Additionally, a cost benefit analysis does not show a decisive advantage in choosing either imagery type for the application of monitoring the extent, biodiversity, and health of coral reef habitats.

**KEYWORDS:** Benthic Classification, Spatial Resolution, QuickBird, IKONOS, Cross-Scale, Remote Sensing, Multispectral, ENVI, ACORN, Satellite, Midway Atoll, Coral Reef, Cost Benefit Analysis

### **NPS-SCAT (SOLAR CELL ARRAY TESTER): THE CONSTRUCTION OF THE NAVAL POSTGRADUATE SCHOOL'S FIRST PROTOTYPE CUBESAT**

**Alexander L. Bein—Lieutenant, United States Navy  
B.S., United States Naval Academy, 2001**

**Master of Science in Space Systems Operations—September 2008**

**Advisor: James H. Newman, Space Systems Academic Group**

**Second Reader: Daniel J. Sakoda, Space Systems Academic Group**

Large, expensive satellites have experienced failures or degraded missions due to solar cells that had not been tested in the space environment. In addition, the Space Systems Academic Group is interested in developing a CubeSat program. To address these issues, a solar cell testing CubeSat prototype was developed as part of the Space Systems Academic Group's CubeSat program. This prototype provides a dedicated and responsive solution to testing solar cells in space; as the first CubeSat built at the Naval Postgraduate School (NPS), it provides valuable experience that will encourage CubeSat projects at NPS in the future. In this research, the NPS-SCAT (solar cell array tester) project is described, including the author's experience as the program manager of the project, responsible for budget, schedule, and technical deliverables. The process used to develop the prototype is explained in detail and recommendations are provided for the flight unit. An important conclusion of this thesis is that CubeSats show great promise for hands-on education and as potential platforms for conducting focused research of national interest.

**KEYWORDS:** CubeSat, Naval Postgraduate School, NPS-SCAT, Solar Cell Tester, SMS, Solar Cell Measurement System, Photovoltaic, Satellite, Program Management

### **DESIGN, BUILD, AND TEST OF A HANDHELD-GPS INTERFERENCE DETECTOR**

**James E. Carson—Captain, United States Army  
B.S., DeVry University, 2002**

**Master of Science in Space Systems Operations—September 2008**

**John C. Rayburn—Major, United States Army  
B.S., University of Missouri-Rolla, 1992**

**Master of Science in Space Systems Operations—September 2008**

**Advisor: Alexander Bordetsky, Department of Information Sciences**

**Second Reader: Andrew A. Parker, Department of Electrical and Computer Engineering**

The global-positioning system (GPS) navigation signal is extremely vulnerable to intentional and unintentional interference. Increased dependence on GPS by military users has created a need to quickly detect and locate interference at its source. Current methods for detecting and locating GPS interference sources employ a network of multiple sensors to identify the interference. The data collected from sensors is then sent to a remote, centralized, processing station and analyzed to determine the location of the interference source. Although this method has demonstrated effectiveness in this endeavor, it introduces latency between the time of detection at the sensor and the location of the source. The intent of this thesis is to investigate whether a portable, handheld, interference-detection system can provide more timely detection and location information to provide the actionable intelligence to the disadvantaged GPS users.

**KEYWORDS:** GPS, Interference, Jamming, Correlator Output Power, Carrier to Noise Ratio

---

# SPACE SYSTEMS OPERATIONS

---

## **A COST-EFFECTIVENESS ANALYSIS OF TACTICAL SATELLITES, HIGH-ALTITUDE LONG-ENDURANCE AIRSHIPS, AND HIGH- AND MEDIUM-ALTITUDE UNMANNED AERIAL SYSTEMS FOR ISR AND COMMUNICATION MISSIONS**

**Corey M. Collier—Major, United States Marine Corps**

**B.S., The Citadel, 1996**

**Master of Science in Space Systems Operations—September 2008**

**Jeffrey C. Kacala—Major, United States Army**

**B.S., United States Military Academy, 1998**

**M.S., University of Maryland University College, 2004**

**Master of Science in Space Systems Operations—September 2008**

**Advisors: William J. Welch, Department of Information Sciences**

**Charles M. Racoosin, Space Systems Academic Group**

Before 1991, the United States military's demand for additional communications bandwidth and timely intelligence was rising rapidly. Since then, with the advent of the global war on terrorism, it has increased substantially. To address this growing need, the Department of Defense has focused its acquisition and procurement efforts on obtaining new communications and intelligence, surveillance, and reconnaissance (ISR) platforms that can help lessen shortfalls and possibly exploit new, untapped resources.

Recently, there has been an increasing focus on new technology, such as tactical satellites or high-altitude, long-endurance airships, as a way to increase communications and intelligence collection capacities. Likewise, advances in the capabilities of medium-altitude and high-altitude unmanned aerial systems have resulted in a more prominent role for them on today's battlefield. Each of these vehicles has a unique niche in today's military, but the increasing capabilities of each are beginning to create some overlap in their uses.

This study conducts a cost-effectiveness analysis on these systems for use as a persistent communications and ISR platform. In particular, it measures the effectiveness of each for comparison, and offers possibilities to increase the overall effective use of the three together in order to maximize performance and cost.

**KEYWORDS:** Unmanned Aerial Vehicle, Unmanned Aerial System, High Altitude Airship, Small Satellite, Tactical Satellite, Cost-Effectiveness, Analytical Hierarchy Process, High-Altitude Long-Endurance

## **FUTURE INTEGRATED ARCHITECTURE: A PROPOSED SPACE INTERNETWORKING ARCHITECTURE FOR FUTURE OPERATIONS**

**Jeffrey M. Nelson—Lieutenant Colonel, United States Marine Corps Reserve**

**B.A., Point Loma Nazarene University, 1988**

**Master of Science in Space Systems Operations—September 2008**

**Advisor: William J. Welch, Department of Information Sciences**

**Second Reader: Charles M. Racoosin, Space Systems Academic Group**

In order for the U.S. military to adjust to asymmetrical warfare and fight a global war on terrorism, military leaders have had to dramatically increase the quantity and quality of information flowing across the communications networks, which has strained limited network resources. Yet, increased information requirements only begin to describe the current issue. An elusive enemy and multiple theatres of conflict have increased the operational distances between front-line units and command structures, increasing the demand for satellite communications. However, deployed forces currently depend on multiple satellite systems that may not always support the interoperability, connectivity, and net-centricity required for enemy engagement.

This thesis begins with discussion of several current efforts attempting to address this issue, as well as several enabling technologies and concepts. Key capabilities extracted from these efforts form the basis for the initial evaluation of the proposed architecture, the Future Integrated Architecture, supported by the software-modeling tool OpNet. For operational applicability, recent Marine Corps operations, concepts, and lessons learned provide the basis for further evaluation. Findings support internetworking in space capabilities and a recommended modification of current architectural strategies and policies.

---

## SPACE SYSTEMS OPERATIONS

---

**KEYWORDS:** Satellite Communications, IRIS, Networking, Intersatellite Links, Marine Corps Distributed Operations, Transformational Communications, WGS, MUOS, Commercial Satellites

### AN ANALYSIS OF SATELLITE COMMUNICATION AS A METHOD TO MEET INFORMATION-EXCHANGE REQUIREMENTS FOR THE ENHANCED- COMPANY CONCEPT

**Matthew A. Senn—Major, United States Marine Corps  
B.S., United States Naval Academy, 1995**

**Master of Science in Space Systems Operations—September 2008**

**Master of Science in Information Systems Operations—September 2008**

**James D. Turner—Major, United States Marine Corps  
B.S., University of Florida, 1998**

**Master of Science in Space Systems Operations—September 2008**

**Advisors: Alexander Bordetsky, Department of Information Sciences  
William J. Welch, Department of Information Sciences**

In the global war on terrorism and future irregular battlefields, the Marine Corps will not only fight in large-scale conventional wars against sizable military forces, it will also engage adversaries that utilize smaller units dispersed asymmetrically over vast geographical locations. To address this emerging threat, the Marine Corps is developing the enhanced-company (EC) concept, with the aim of providing the company commander with the tools necessary to make isolated decisions in an increasingly complex battlefield. In order to make timely, independent decisions and maintain information superiority, these widely dispersed units will require organic access to services normally provided by higher headquarters. The Marine Corps Warfighting Laboratory is working to enhance the decision-making capabilities of the infantry company through the development of the company-level intelligence center (CLIC) and the company-level operations center (CLOC).

Current Marine Corps communications capabilities cannot meet the data demands of widely dispersed lower-echelon units. The communications equipment organic to these units is mostly line-of-sight (LOS) technology. These systems limit the geographic dispersion of the units and are also limited in data throughput capability. To allow for wider dispersion on the battlefield while providing the connectivity required for isolated decision making, these units require communications assets that are capable of operating beyond line of sight (BLOS), such as satellite communications (SATCOM) equipment.

This thesis analyzes the use of SATCOM in support of the EC concept in an FOB environment. Using a limited-objective experiment, the authors test whether SATCOM technology is sufficient to support information-exchange requirements (IERS) developed in the laboratory and validated with experience. Based on the outcome of the experiments, the thesis provides recommendations regarding the use of such technology.

**KEYWORDS:** Distributed Operations, SATCOM, BLOS, OTH, Communications, Information Exchange Requirements, Enhanced Company, CLOC

### THE USES OF A POLARIMETRIC CAMERA

**Phillip Sean Smith—Lieutenant, United States Navy  
B.A., University of Missouri at Kansas City, 1998**

**Master of Science in Space Systems Operations—September 2008**

**Advisor: Richard C. Olsen, Department of Physics**

**Second Reader: Richard Harkins, Department of Physics**

Using polarimetric imaging, what is the capability for the detection of disturbed surfaces (soil, asphalt, other)? In particular, what capabilities are provided by a compact video-imaging system currently being acquired by the Naval Postgraduate School (NPS) for various research uses? Polarimetric imaging is the final domain in optical systems, following panchromatic and spectral imaging. This technology is now viable to test for possible phenomenologies and applications of military interest. Since polarization is strongly affected by surface roughness, it is intrinsically sensitive to disturbed surfaces. As such, it should be good for the detection of improvised explosive devices and traffic by foot or vehicle. There are some

## SPACE SYSTEMS OPERATIONS

---

reasons to believe it may help discriminate good and bad landing zones for helicopter activities in desert environments, and may help helicopters avoid “brown outs.” In this thesis it is discovered that there are no significant changes in the area-of-degree of linear polarization over a fixed amount of time at a fixed target.

**KEYWORDS:** Polarimetric Imaging, Salsa Camera, Bossa Nova Technologies



# **MASTER OF SCIENCE IN SYSTEMS ENGINEERING**

---

## **A MODEL-BASED METHODOLOGY FOR SYSTEM-OF-SYSTEMS ARCHITECTURE DEVELOPMENT WITH APPLICATION TO THE RECAPITALIZATION OF THE FUTURE TOWING AND SALVAGE PLATFORM**

**Christopher D. Addington—Lieutenant, United States Navy  
B.S., University of Florida, 2000**

**Master of Science in Systems Engineering—September 2008**

**Advisor: Clifford Whitcomb, Department of Systems Engineering**

**Second Reader: Fotis Papoulias, Department of Mechanical and Astronautical Engineering**

The United States Navy owns four salvage ships and four towing ships that will reach the end of their 40-year life expectancy in 2019. The program manager for these vessels has a set of desirable performance requirements for a new ship class, T-ARS(X), which combines capabilities from both salvage and towing ship classes. The need to develop a recapitalization strategy based on either designing a new ship class based on these desirable requirements or purchasing commercial capabilities based on the salvage and towing community's needs is paramount. Meanwhile, the Department of Defense has shifted defense planning from the specific-service Requirements Generating System (RGS) acquisition to the Joint Capabilities Integration and Development System (JCIDS) approach, which focuses on requirements generation based on customer need. This thesis explores how to use systems architecting principles in the context of model-based systems engineering (MBSE) to incorporate the capabilities needed for towing and salvage recapitalization into a cohesive framework for developing the T-ARS(X) requirement specification. The CORE design tool is used to implement the MBSE architecting process using the Naval Architecture Elements Reference Guide (NAERG) and standardized operational tasks to create DODAF v1.5 products from system models. The requirements generated from the architecture model are compared with current, combined towing and salvage-capable commercial platforms for analysis. Based on the methodology presented, the towing and salvage community now has the basis to perform a capabilities-based analysis of alternatives for the T-ARS(X) recapitalization.

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

## **TECHNOLOGY INSERTION CONSIDERATIONS FOR COMPLEX SYSTEM-OF-SYSTEMS DEVELOPMENT**

**Lasumar (Mark) Aragon—Lieutenant, United States Navy  
B.S., Illinois Institute of Technology, 1999**

**Master of Science in Systems Engineering—September 2008**

**Advisor: Eugene Paulo, Department of Systems Engineering**

**Second Reader: Mark M. Rhoades, Department of Systems Engineering**

The Future Combat System (FCS) is a system of systems, comprising fourteen individual systems, all connected via a common network with the soldier as the centerpiece. The Army has recognized that evolutionary acquisition enables the rapid fielding of FCS technologies as they mature to meet warfighter requirements. It has implemented a spinout plan to leverage FCS research and development efforts to insert new capabilities into the current force. Complex system of systems development, however, requires more robust approaches to ensure effective and efficient delivery of new capabilities to the warfighter, such that he can immediately take advantage of the full capabilities the new system offers. Integrating a modular open systems approach (MOSA) to acquisition ensures the seamless insertion of newly acquired systems into existing systems and facilitates insertion of future envisioned systems. The system structure methodology provides a framework for engineering a system and is used to integrate the evolutionary

---

---

## SYSTEMS ENGINEERING

---

acquisition process and the modular open systems approach for a tailored framework that addresses the needs and requirements of the FCS program and contributes to Army modernization strategy overall. The integration of evolutionary acquisition and MOSA within a sound systems engineering framework results in an insertion strategy that is responsive and flexible, with the greatest benefit of the resulting products to the end user.

**KEYWORDS:** Technology Insertion, Complex System of Systems, Evolutionary Acquisition, Systems Engineering, Modular Open System Approach, MOSA, Future Combat Systems

### **AN IMPROVED METHODOLOGY FOR DEVELOPING COST-UNCERTAINTY MODELS FOR NAVAL VESSELS**

**Cinda L. Brown–Lieutenant Commander, United States Navy  
B.S., United States Naval Academy, 1998**

**Master of Science in Systems Engineering–September 2008**

**Advisor: Edouard Kujawski, Department of Systems Engineering**

**Second Reader: Diana Angelis, Defense Resources Management Institute**

The purpose of this thesis is to analyze the probabilistic cost model currently in use by NAVSEA 05C to predict cost uncertainty in naval vessel construction and to develop a method that better predicts the ultimate cost risk. The data used to develop the improved approach is collected from analysis of the CG(X) class ship by NAVSEA 05C. The NAVSEA 05C cost risk factors are reviewed and analyzed to determine if different factors are better cost predictors. The impact of data elicitation, the “money allocated is money spent (MAIMS) principle, and correlation effects are incorporated into the research and analysis of this thesis. Data quality is directly affected by data elicitation methods and influences the choice of probability distribution used to give the best predictor of cost risk. MAIMS and correlation effects are shown to have a significant impact on the overall cost model. Program managers and analysts can readily implement the enhanced models using commercial Excel add-ins, such as Crystal Ball or @Risk, and integrate them into their current cost risk analysis and management practices to better mitigate risk and control project cost.

**KEYWORDS:** Cost Uncertainty, Cost Model, Surface Ship Estimation, Naval Vessel

### **SPACELIFT RANGE INCREMENTAL MODERNIZATION: MOVING FROM A STRATEGY OF BACKWARD COMPATIBILITY**

**Paul T. Driessen–Lieutenant Colonel, United States Air Force  
M.S., New Mexico State University, 1994**

**Master of Science in Systems Engineering–September 2008**

**Advisors: John S. Osmundson, Department of Information Sciences**

**Thomas V. Huynh, Department of Systems Engineering**

The intent of this thesis is to gain insight into launch and test range requirements in order to determine transitional architectures by using a systems engineering methodology developed at the Naval Postgraduate School. The range is a weapon system that has many characteristics of an automated information system, with each function having its own timing and bandwidth requirements. The sensors considered are those left after the range begins using GPS metric tracking for all launch vehicles. This analysis focuses on comparing the use of current data formats to an Internet Protocol version 6 (IPv6) standard by considering data availability and timeliness as design parameters. Sensors should be compatible with the data network rather than with legacy formats since data is not transported in the legacy formats. Devices requiring a legacy format need a converter to consume data from the network. The analysis is an accounting of throughput required at various nodes on the data network and estimates of data latency along critical data links. The conclusion is that the current range architecture is able to support GPS metric tracking and that an IPv6 network is a viable option that moves the range toward compliance with the operational requirements document.

**KEYWORDS:** Spacelift Range, System of Systems Engineering, Systems Engineering

---

# SYSTEMS ENGINEERING

---

## **PROTECTION AGAINST A SHIP AS A WEAPON**

**Christopher D. Epp—Lieutenant, United States Navy**

**B.A., North Carolina State University**

**Master of Science in Systems Engineering—September 2008**

**Advisor: Thomas V. Huynh, Department of Systems Engineering**

**Second Reader: Boo C. Khoo, National University of Singapore**

Stopping a ship commandeered and used as a weapon to attack shore infrastructure in the Strait of Malacca is a challenging problem. The purpose of this thesis is to determine systems that constitute architectures of a system of systems to stop an oil tanker that is hijacked with the intention of running into the oil terminal on Jurong Island, Singapore. In addition, this research aims to establish a sound systems engineering foundation for addressing this problem. The approach primarily leverages the system-of-systems architecture-development process (SoSADP). Systems to stop hijacked merchant vessels or ships used as weapons (SAW) are investigated. This thesis shows that there are means to stop a SAW. These include existing and postulated systems that warrant further consideration and study for inclusion into Singapore's maritime-domain protection (MDP) architecture. The results of the research cited in this thesis have potential MDP applications around the world and can serve as tools for decision makers in future SAW and MDP analysis. All products in this thesis can be expanded in the future as part of the iterative systems engineering process.

**KEYWORDS:** System of Systems Engineering, Ship as a Weapon, Design Reference Mission, Technical Measures, Measures of Effectiveness, Measures of Performance, Maritime Domain Protection

## **IMPROVING TEST THROUGHPUT ON A NAVY OPEN-AIR**

**TEST AND EVALUATION RANGE**

**Robert B. Jensen—DoD Civilian**

**B.S., Brigham Young University, 1993**

**Master of Science in Systems Engineering—September 2008**

**Advisor: David H. Olwell, Department of Systems Engineering**

**Second Reader: Robert B. Rogers, Naval Air Warfare Center—Weapons Division**

This thesis suggests changes to processes to increase test throughput of a weapons test and evaluation range. Current processes are analyzed to find the interrelationships and identify constraints that could be limiting additional testing. Constraints are identified and suggestions are made for changes to some processes. The workload for a period of time in the past is submitted to the changed processes and a manual simulation of the scheduling process is repeated. The new processes allow a relaxation of constraints that yields up to 9% more time available for testing.

**KEYWORDS:** Process Improvement, Open-Air Ranges, Test and Evaluation

## **A COMPUTER-AIDED METHOD FOR SYSTEM SAFETY AND RELIABILITY ASSESSMENTS**

**Steven M. Roycroft—Captain, United States Air Force**

**B.S., North Carolina State University, 2000**

**Master of Science in Systems Engineering—September 2008**

**Advisors: Mark M. Rhoades, Department of Systems Engineering**

**Louis C. Huang, Space and Missile Systems Center, Los Angeles Air Force Base**

The objective of this study is to determine a methodology for implementing feedback loops into a logical, automated, computer-assisted, probability assessment tool. A tool exists called the GO program, which allows for systems to be modeled in a block diagram or schematic format and then analyzed in a structured manner to determine the probabilities of outcome events. The challenge is to incorporate a method for analyzing feedback loops. Given the difficulty involved with using computer code to analyze feedback loops, reliability engineers would normally create two separate models. To allow for a single model to be used and achieve consistent and repeatable results, a methodology for creating multiple layers of feedback loops in increasing complexity is analyzed for use with the GO program. Monte Carlo simulations for each

# SYSTEMS ENGINEERING

---

of these representative models are constructed and analyzed to validate the adequacy of the GO program to effectively create probabilities of event success and failure. With the demonstrated ability of the GO program to correctly model feedback loops, a path is cleared for the Department of Defense to investigate the benefits of adopting a standardized approach for the analyses of complex systems.

**KEYWORDS:** Systems Engineering, System Safety, Reliability Engineering, GO Program, Feedback Loops

## **ARCHITECTING A NET-CENTRIC OPERATIONS SYSTEMS OF SYSTEMS FOR MULTI-DOMAIN AWARENESS**

**Keith L. Ruegger—Lieutenant Commander, United States Navy**

**B.S., United States Naval Academy, 1991**

**M.S., Naval Postgraduate School, 1999**

**Master of Science in Systems Engineering—September 2008**

**Advisor: Thomas V. Huynh, Department of Systems Engineering**

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

Maritime domain awareness (MDA) entails knowing what is happening in the oceans and waterways that could affect the security or environment of the United States. With a focus on potential attack vessels (PAV) as threats in the maritime domain, a multi-domain SoS is needed to exploit and integrate information from multiple sources, including sensors, databases, and intelligence, to provide reconnaissance, surveillance, and information used in the formulation of a common operational picture (COP), a tool to effect maritime domain awareness. In this thesis the best architecture of net-centric operations (NCO) multi-domain system of systems (SoS) for MDA is determined, employing an integrated systems engineering methodology for analyzing and ranking systems of systems architectures.

This methodology involves the use of process modeling, modeling of an SoS with the systems modeling language (SysML), and subsequent conversion of the resulting SysML diagrams into an Extend<sup>TM</sup> executable simulation model, used in a simulative study carried out to evaluate three multi-domain awareness SoS architecture alternatives in terms of the time to establish a COP and the probability of COP accuracy.

Of the three architecture alternatives, a conceptual SoS whose constituting systems are connected in a distributed network with a high degree of connectivity is found to take the least amount of time to establish a COP and to have a high probability of COP accuracy. It can thus be considered to be the best of the three MDA SoS architecture alternatives.

The results indicate that, in a distributed network, which is the backbone of net-centric operations, direct links between the sensors and the coalition C2 center shorten the communications delay and hence reduce the time to establish a COP. The accuracy of the information to be combined at the coalition C2 center is necessary for having a high probability of COP accuracy. Furthermore, the integrated systems engineering methodology for analyzing SoS architectures provides an effective framework and tool for designing and analyzing complex SoS in general and NCO MDA SoS in particular.

**KEYWORDS:** System of Systems, SoS, Net-Centric Operations, NCO, Multi-Domain Awareness, Maritime Domain Awareness, MDA, SoSADP

# SYSTEMS ENGINEERING

---

## A SYSTEMS-ENGINEERING APPROACH TO ADDRESS HUMAN-CAPITAL MANAGEMENT ISSUES IN THE SHIPBUILDING INDUSTRY

Hal M. Todd–DoD Civilian

B.S., University of South Alabama, 1997

Master of Science in Systems Engineering–September 2008

Douglas S. Parten- DoD Civilian

B.S., Oregon State University, 1990

Master of Science in Systems Engineering Management–September 2008

Advisor: Gary O. Langford, Department of Systems Engineering

Second Reader: James A. Turso, DoD Contractor

Recent human capital trends within the Department of Defense and its contractors have shown a dramatic decrease in science and engineering skill levels due to retirement and attrition. This has caused major concern for leaders, especially regarding the engineering talent necessary for shipbuilding. This study investigates current DoD human-capital management (HCM) strategies for attracting, developing, retaining, and managing competencies and intellectual resources for science and engineering talent within the shipbuilding industry. The investigation consists of a survey of current DoD and industry HCM frameworks, an analysis of the needs of key stakeholders, and an examination of the gaps in the HCM strategies employed by these stakeholders. The result of the analysis is the development, via a functional analysis, of a notional HCM architecture for the shipbuilding industry that addresses stakeholder needs and closes the perceived gaps in current strategies. The notional HCM architecture is developed to provide a first iteration of an HCM architecture tailorable to a particular stakeholder's HCM needs. This study also develops a notional, overall measure of effectiveness (OMOE) model to suggest the means by which stakeholders can judge the effectiveness of their tailored version of the HCM architecture. This first-iterate OMOE is derived using weights and metrics based on insights gained from research performed in the course of this study and suggests that further refinement of the HCM architecture is required.

**KEYWORDS:** Systems Engineering, Human Capital, Human Capital Management, Shipbuilding, Stakeholder Analysis, Functional Analysis, Gap Analysis, Overall Measure of Effectiveness Model



# **MASTER OF SCIENCE IN SYSTEMS ENGINEERING MANAGEMENT**

---

## **AN EVALUATION OF A CONTINUOUS-PROCESS-IMPROVEMENT PILOT PROGRAM TO REDUCE OR ELIMINATE TRIDENT II D5-LAUNCHER PROCESSING-AUTHORITY DOCUMENTATION AT THE STRATEGIC WEAPONS FACILITY, ATLANTIC**

**Elizabeth A. Fields-Austin–DoD Civilian**

**B.A., Old Dominion University, 1979**

**B.S., Strayer University, 1993**

**Master of Science in Systems Engineering Management–September 2008**

**Advisor: John S. Osmundson, Department of Information Sciences**

**Second Reader: Cary A. Simon, Graduate School of Business and Public Policy**

In this thesis, the author evaluates the continuous-improvement pilot program initiated by the Strategic Systems Program in March 2008 to reduce or eliminate TRIDENT II D5 Launcher trouble–failure inspection/rejection reports (TFIRRs) processing-authority documentation and reduce third-level repair-cycle times for launcher components and shore-side support hardware at the Northrop Grumman Electronic Systems–Marine Systems (NGES–MS) facilities at Strategic Weapons Facility, Atlantic (SWFLANT). To continue to meet the high readiness and operational requirements for the TRIDENT II D5-launcher strategic weapon system and support equipment, the SWFLANT government and contractor team held a continuous improvement event and established a process to streamline third-level TFIRR documentation and reduce third-level repair-cycle time. The current process requires extensive TFIRR processing-authority documentation, which results in a loss of contractor manhours and third-level repair-cycle time while waiting for government approval to begin repairs, even though there are government-approved repair procedures in place. Reducing third-level repair-cycle time will free manpower and increase facility capacity to meet the increasing repair demands. The TFIRRs that are addressed in this thesis are the induction TFIRRs and the standard repair documentation TFIRRs.

The results of the pilot program data analysis indicate that both the government and contractor saved approximately eight man-days during the eight-week data-gathering portion of the program by demonstrating a more efficient workflow and a 20% reduction of third level cycle time. Projecting the data over one year, the government could potentially save forty-nine man-days and NGES-MS could save approximately fifty-three man-days, which would allow for an increase in repair capacity to accommodate increasing repair requirements.

**KEYWORDS:** Systems Engineering, Maintenance, Third Level Repair, TRIDENT II D5, Launcher

## **AN ANALYSIS OF MILITARY USE OF COMMERCIAL SATELLITE COMMUNICATIONS**

**Benjamin D. Forest–Major, United States Air Force**

**B.S., Park University, 1997**

**M.A., University of Oklahoma, 2000**

**Master of Science in Systems Engineering Management–September 2008**

**Advisors: William J. Welch, Department of Information Sciences**

**Mark M. Rhoades, Department of Systems Engineering**

**Second Reader: Lt Col Michael R. Gregg, Los Angeles Air Force Base, Space Missile and Systems Center**

This thesis analyzes the balance between Department of Defense use of commercial versus military satellite communications (SATCOM). It surveys historical and current military usage of DoD and commercial SATCOM, evaluates current predictions for military use of commercial SATCOM, and describes measures of effectiveness that can be used to evaluate the various SATCOM options. In culmination, this thesis defines what constitutes an appropriate balance of military and commercial SATCOM usage

---

---

## **SYSTEMS ENGINEERING MANAGEMENT**

---

using cost, technical, and policy compliance measures of effectiveness. The measures of effectiveness lead to a recommendation for a more deliberate, less ad hoc use of commercial SATCOM for the vast majority of military SATCOM needs.

**KEYWORDS:** Satellite Communications, SATCOM, MILSATCOM, Satellite Acquisition, Commercial Satellites

### **INTEGRATION AND INTEROPERABILITY: AN ANALYSIS TO IDENTIFY THE ATTRIBUTES FOR SYSTEMS OF SYSTEMS**

**John E. Gay–DoD Civilian**

**B.S., University of South Florida, 1988**

**Master of Science in Systems Engineering Management–September 2008**

**Denise L. Turso–DoD Civilian**

**B.S., Pennsylvania State University, 1989**

**M.Ed., Pennsylvania State University, 1995**

**Master of Science in Systems Engineering Management–September 2008**

**Advisor: John S. Osmundson, Department of Information Sciences**

**Second Readers: Scott Bey, United States Marine Corps, Marine Corps Systems Command**

**Henry Cook, DoD Contractor**

A system-of-systems design is the development of multiple systems whose various individual functions collectively support a holistic functional capability. With the evolution of today's increased demand for heterogeneous systems that integrate to form complex systems of systems, integration and interoperability are critical to cost, schedule, and performance during the lifecycle of a product. Enterprises must explore and discover the current and future techniques of building both human and technical systems that require a deep knowledge and understanding of integration and interoperability. In support of this goal, this thesis, through research and analysis, develops a descriptive and prescriptive approach to assist management in achieving integration and interoperability. This thesis discovers the key attributes that result in an integrated and interoperable system and determines new procedures and techniques that can be recommended to achieve the systems engineering required to support interoperability and ensure integration of system of systems.

**KEYWORDS:** System of Systems, Family of Systems, Enterprise, Integration, Interoperability, Framework, Statutory Laws, Regulatory Laws, Descriptive Model, Normative Model, Prescriptive Model, C4ISR, I2 Analysis, Learning Management System, Enterprise Resource Planning, ERP

### **NET-CENTRIC INFORMATION SHARING: SUPPORTING THE 21ST CENTURY MARITIME STRATEGY**

**Daniel M. Green–DoD Civilian**

**B.A., Villanova University, 1986**

**Master of Science in Systems Engineering Management–September 2008**

**Advisor: John S. Osmundson, Department of Information Sciences**

**Second Reader: Cary A. Simon, Graduate School of Business and Public Policy**

This thesis analyzes Joint Vision 2020 and DoD transformation technical concepts in the context of the "Cooperative Maritime Strategy for the 21st Century." It hypothesizes that decision superiority requires a renewed emphasis on the fundamentals of decision making. The thesis introduces the concept of ignorance management as a risk reduction concept to help focus decision makers, and the IT professionals who support them, on getting the right information, to the right people at the right time. The concept of information readiness levels is explored as a means to help operational forces more objectively gauge the ability of the information architecture to support decision making in the context of specific missions. One finding is that technical convergence has occurred and the promise of network-centric operations is becoming more fully realized as organizational and cultural evolution accelerates. Examples of organizational evolution are provided, including a survey of portfolio management and communities of interest policies. The thesis concludes with a case study of the Universal Core, an interagency information

---

# SYSTEMS ENGINEERING MANAGEMENT

---

sharing initiative that exemplifies enterprise behavior, including political, technical, and cultural progress in this area.

**KEYWORDS:** Net-Centric, UCore, Decision Superiority, SOA, XML, Maritime Strategy, Ignorance Management, Right Information, Information Sharing, Communities of Interest, Portfolio Management, Information Readiness Levels, FORCEnet, Change Management, Enterprise Management, Semantic Web, Web 2.0, Universal Core, Navy Data Strategy

## **CATEGORIZATION AND REPRESENTATION OF FUNCTIONAL DECOMPOSITION BY EXPERTS**

**Paul W. Melançon–DoD Civilian**

**B.S., University of Massachusetts-Dartmouth, 2001**

**Master of Science in Systems Engineering Management–September 2008**

**Advisor: Gary O. Langford, Department of Systems Engineering**

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

The objective of this thesis is to investigate different approaches to identifying system functions. The approaches described are the standard functional decomposition process, the Unified Modeling Language (UML), the System Modeling Language (SySML), and the Integration Definition for Function Modeling (IDEF0). A discussion is presented on advantages and limitations of describing and using functions by means of graphical formatting. Improving system functionality by effective decomposition is vital to robust system development. However, not one of these approaches presents the best method for complete functional identification. While each has benefits and should be considered during functional analysis, a good decomposition has proper interrogation of the functions by means of coupling and cohesion of the functionality, as well as identifying functional overlap and underlap. Standard functional decomposition works best as the first step in laying out system functionality. Rigor and completeness are improved when followed up by UML, SySML, or even IDEF0. Value and risk of each function can and should be identified as a way of posing a series of questions that measure and analyze the appropriateness of the functional decomposition. Combining these different approaches can help lead to a more complete functional decomposition and therefore reduce the risk to system development.

**KEYWORDS:** Functional Decomposition, Function, Function Coupling, Function Cohesion, Function Overlap, Function Underlap, Value of Function, Risk of Function, Complete Functional Decomposition

## **A DYNAMIC MODEL OF THE WORKFORCE AT THE NAVAL AIR WEAPONS STATION, CHINA LAKE**

**William H. Spearow–DoD Civilian**

**B.S., University of South Alabama, 1991**

**Master of Science in Systems Engineering Management–September 2008**

**Advisor: Mark M. Rhoades, Department of Systems Engineering**

**Second Reader: Mark A. Lambert, Naval Air Weapons Station, China Lake**

Outsourcing entered the lexicon during the 1980s and today is a standard practice in the Department of Defense. Contractors are now filling jobs that have traditionally been held by government employees. As yearly budgets change, the decision whether to outsource government jobs has placed a significant burden on project managers. This thesis focuses on the dynamic modeling of a workforce labor mix consisting of civilian and contractor workers. This study gives the government manager a systems-thinking tool to determine the optimum workforce numbers for a given workload demand. It is envisioned that local managers will be able to use this study to make a more balanced and informed decision when hiring civilian and contract workers.

**KEYWORDS:** Systems Thinking, Dynamic Modeling, Workforce Modeling, Causal Loop Diagram, NAWCWD, China Lake

---

# SYSTEMS ENGINEERING MANAGEMENT

---

## A SYSTEMS-ENGINEERING APPROACH TO ADDRESSING HUMAN-CAPITAL MANAGEMENT ISSUES IN THE SHIPBUILDING INDUSTRY

Hal M. Todd—DoD Civilian

B.S., University of South Alabama, 1997

Master of Science in Systems Engineering—September 2008

Douglas S. Parten- DoD Civilian

B.S., Oregon State University, 1990

Master of Science in Systems Engineering Management—September 2008

Advisor: Gary O. Langford, Department of Systems Engineering

Second Reader: James A. Turso, DoD Contractor

Recent human capital trends within the Department of Defense (DoD) and its contractors have shown a dramatic decrease in science and engineering skill levels due to retirement and attrition. This has caused major concern for leaders, especially regarding the engineering talent necessary for shipbuilding. This study investigates current DoD human-capital management (HCM) strategies for attracting, developing, retaining, and managing competencies and intellectual resources for science and engineering talent within the shipbuilding industry. The investigation consists of a survey of current DoD and industry HCM frameworks, an analysis of the needs of key stakeholders, and an examination of the gaps in the HCM strategies employed by these stakeholders. The result of the analysis is the development, via a functional analysis, of a notional HCM architecture for the shipbuilding industry that addresses stakeholder needs and closes the perceived gaps in current strategies. The notional HCM architecture is developed to provide a first iteration of an HCM architecture tailorable to a particular stakeholder's HCM needs. This study also develops a notional, overall measure of effectiveness (OMOE) model to suggest the means by which stakeholders can judge the effectiveness of their tailored version of the HCM architecture. This first-iterate OMOE is derived using weights and metrics based on insights gained from research performed in the course of this study and suggests that further refinement of the HCM architecture is required.

**KEYWORDS:** Systems Engineering, Human Capital, Human Capital Management, Shipbuilding, Stakeholder Analysis, Functional Analysis, Gap Analysis, Overall Measure of Effectiveness Model

## IMPROVING THE U.S. NAVY'S EXECUTION OF TECHNICAL AUTHORITY THROUGH A COMMON-RISK MANAGEMENT AND TECHNICAL-ASSESSMENT PROCESS

Thomas A. Tomaiko—Commander, United States Navy (Ret.)

B.S., United States Naval Academy, 1987

Master of Science in Systems Engineering Management—September 2008

Advisor: David F. Matthews, Graduate School of Business and Public Policy

Second Reader: Benjamin J. Roberts, Wayne E. Meyer Institute of Systems Engineering

The focus of this paper is upon improving the U.S. Navy's execution of technical authority: 1) technical authority targets compliance with technical criteria and standards; 2) this targeting must be done at the earliest stages of program development and addressed during development of the program acquisition strategy; 3) an executable acquisition strategy must take into consideration the Navy's technical authority responsibility; 4) a successful strategy needs to provide the industry sufficient time to fully develop plans and deliver products, especially in high-risk program areas, and incorporate a system engineering process where the technical authorities can perform their mission; and 5) history has shown that costs will increase if technical risks are not adequately addressed.

The purpose of this focus—improving execution of technical authority—is to reduce exposure to risks and costs. This thesis defines the relationship between program authority and technical authority, and improves the state of technical authority through common policy.

**KEYWORDS:** Technical Authority, Risk Management, Common Risk Management Process, Technical Assessment, Technical Assessment Process, Risk Analysis, Systems Engineering, Systems Engineering Management, Systems Engineering Process, Program Management

# **MASTER OF SCIENCE IN SYSTEMS TECHNOLOGY**

---

**TEAM COLLABORATION OF THE NORTHEAST AIR DEFENSE SECTOR AND THE  
FEDERAL AVIATION ADMINISTRATION DURING THE SEPTEMBER 11, 2001, ATTACKS**

**Luis Socias–Lieutenant, United States Navy  
B.A., Marquette University, 2001**

**Master of Science in Systems Technology–September 2008**

**Advisor: Susan Hutchins, Department of Information Sciences**

**Second Reader: Lt Col Karl D. Pfeiffer, USAF, Military Faculty, Department of Information  
Sciences**

The tragic events of September 11, 2001, brought about changes in the procedures for interagency collaboration. That day, air traffic controllers in New York, Boston, Washington, and Cleveland were scrambling due to the hijacking of four American commercial airliners. In their efforts to bring order to chaos, the Federal Aviation Administration (FAA), in communication with the Northeast Air Defense Sector (NEADS) and the North American Aerospace Defense Command (NORAD), scrambled fighter aircraft to escort the airliners. The collaborative teamwork that occurred during this response was recorded in the radio transcripts between NEADS and FAA air-traffic controllers. The goal of this thesis is to use the September 11, 2001, NEADS/FAA channel four transcripts to provide a real-world example of a team collaborating on a unique, one-of-a-kind problem, to contribute to the effort to validate the structural model of team collaboration developed under the collaboration and knowledge-integration program sponsored by the Office of Naval Research. The focus of the model is on individual cognitive processes used during agency or team collaboration with the goal of understanding how individuals and different agencies work together towards reaching a decision.

**KEYWORDS:** Team Collaboration, Model of Team Collaboration, Interagency Collaboration, Team Communications, Cognition, FAA, NORAD, NEADS

---



**MASTER OF ARTS**

**Security Studies**



# **MASTER OF ARTS IN SECURITY STUDIES**

---

## **ALTERING THE MISSION STATEMENT: THE TRAINING OF FIREFIGHTERS AS INTELLIGENCE GATHERERS**

**Richard J. Blatus—Fire Department of New York**

**B.S., State University of New York, 1993**

**Master of Arts in Security Studies—September 2008**

**Advisor: Robert Bach, DoD Contractor**

**Second Reader: Robert Simeral, Department of National Security Affairs**

The fire service is one of the premier emergency-response agencies in the United States. As our nation strives to expand and enhance its homeland-security efforts, firefighters have been recognized as an underutilized asset. The opportunity for firefighters to act as first preventers in the war on terrorism is unmatched by any other emergency-response agency. This, coupled with the warrantless-search provisions afforded firefighters by the Constitution, makes firefighters the logical choice for training and inclusion into an expanded terrorism-awareness initiative. Expansion of the intelligence-gathering capabilities of first responders, specifically firefighters, will not occur without difficulty. The lack of training and educational opportunities afforded firefighters in this area, the changes in firefighting culture, and the status of firefighters as an integral part of the community are all obstacles that must be addressed. Firefighters respond to homes and businesses with unprecedented frequency. A multifaceted approach involving training, community involvement, and operational awareness will streamline the utilization of firefighters in the area of threat recognition. Trained firefighters will help shoulder some of the burden placed on law enforcement, while the utilization of a current asset will put forth a new best practice for the safety of our communities.

**KEYWORDS:** Fire Service, First Responders, Intelligence, Firefighter Training, Awareness Training, Emergency Preparedness, Emergency Response

## **THE CHINESE-INDIAN-PAKISTANI WATER CRISIS: PROSPECTS FOR INTERSTATE CONFLICT**

**James F. Brennan—Lieutenant, United States Navy**

**B.A., Wabash College, 1997**

**Master of Arts in Security Studies—September 2008**

**Advisors: Alice L. Miller, Department of National Security Affairs**

**Feroz Khan, Department of National Security Affairs**

This thesis examines the prospects of conflict caused by water scarcity in China, India, and Pakistan. The thesis uses indicators of water tensions, including water quality, water quantity, management of water, state institutions, and national water philosophy. On its own, a water shortage is unlikely to be the only cause of regional conflict; however, the resource may be one catalyst towards conflict or instability in an already fragile region. The indicators studied throughout this thesis continue to deteriorate and are anticipated to reach unacceptable levels by the year 2025. The current water dilemma in Asia increases the likelihood for regional conflict if practical solutions are not obtained.

**KEYWORDS:** China, India, Pakistan, Water, Crisis, Interstate Conflict

---

---

## SECURITY STUDIES

---

### **DYNAMIC PERSONAL IDENTITY AND THE DYNAMIC IDENTITY GRID: HOW THEORY AND CONCEPT CAN TRANSFORM INFORMATION INTO KNOWLEDGE AND SECURE THE AMERICAN HOMELAND**

**Ryan Burchnell– Florida Highway Patrol  
B.S., Florida State University, 1994  
Master of Arts in Security Studies–September 2008  
Advisors: Anders Strindberg, DoD Contractor  
Richard Bergin, Department of Information Sciences**

Personal identification systems and processes, including those used for transliteration, travel visas, and driver's licenses, have failed to adequately adapt to the nation's new asymmetric threat. After September 11, personal identification information about the attackers began to emerge, and it became clear that this information could have been used to identify the attackers prior to their terrorist acts. This study uses qualitative research methods to construct meaning from previously uncorrelated issues and employs a three-stage analytical approach that grounded the research. The tertiary stage identifies themes that had theoretical relevance and, in turn, a direct impact on the proposed solutions. The study borrows concepts from a handful of formal qualitative methods, including grounded theory, content/document analysis, interviewing, triangulation, and conceptual modeling. It is found that ambiguity and ethnocentricity is inherent in American name-based identity collection practices, systems, and processes; that consistently collecting specific name-based characteristics could be highly beneficial to combating terrorism; and that by leveraging the knowledge created by consistent collection practices, systems, and processes, name-based identity can be transformed into a dynamic and leveragable commodity. To effectively do so, this project presents a substantive theory, the dynamic personal identity, and a conceptual technological system, the dynamic identity grid, as potential solutions.

**KEYWORDS:** Terrorism, Terrorist Travel, Kinship, Transliteration, Translation, Identity, Personal Identity, Arab Naming Conventions, Knowledge Flow, Intelligence and Security Informatics, ISI, Dynamic Personal Identity, DPI, Dynamic Identity Grid, DIG

### **LEVERAGING SERVICE-ORIENTED ARCHITECTURE TO ENHANCE INFORMATION SHARING FOR SURFACE-TRANSPORTATION SECURITY**

**Ash Chatterjee–DoD Civilian  
B.S., Indian Institute of Technology, 1978  
M.S.E., University of Michigan, 1979  
Master of Arts in Security Studies–September 2008  
Advisor: Richard Bergin, Department of Information Sciences  
Second Reader: Brian Steckler, Department of Information Sciences**

This thesis determines the technology and architecture best suited for sharing security information among mass-transit systems (MTS), their security partners, and the Transportation Security Administration. The architecture would enable the TSA to enhance the security of MTS and surface transportation. It incorporates existing security practices between MTS, their regional security partners, and the TSA. Existing practices are determined through interviews and case reviews of regional information sharing networks. These are analyzed to identify gaps in information sharing practices and technology. Requirements for the architecture are established to close the gaps, accounting for variability in size, capability, risk, and ownership characteristics of MTS. A scalable architecture, adaptable to evolving homeland security requirements and capable of exchanging information among disparate databases and formats, was needed.

Characteristics of service-oriented architecture (SOA) are analyzed and found to fulfill these requirements. Technologies underlying SOA, including XML and web services, are reviewed to develop the understanding needed to create the architecture. An architecture is created for the TSA that is consistent with its organization and business practices, and that of MTS and their stakeholders. Data exchange standards being developed by DHS are incorporated in the architecture. Collaboration and governance considerations for implementing SOA are briefly discussed.

**KEYWORDS:** TSA, Mass Transit Systems, Surface Transportation Security, Information Sharing, Service Oriented Architecture, SOA, Web Services, XML, NIEM, Suspicious Activities Reports, Data Exchange Standards

### **VEILED NORMALIZATION: THE IMPLICATIONS OF JAPANESE MISSILE DEFENSE**

**Timothy L. Clarke—Lieutenant Colonel, United States Marine Corps  
B.S., Truman State University, 1992**

**Master of Arts in Security Studies—September 2008**

**Advisor: Robert Weiner, Department of National Security Affairs**

**Second Reader: Alice L. Miller, Department of National Security Affairs**

Japan's development of a missile defense system has been accompanied by the acquisition of potentially offensive military assets, an increased command-and-control capability, significant restructuring of the collective defense establishment, and doctrinal changes that allow preemption should an attack be deemed imminent. Regardless of the longstanding Japanese debate on the constitutionality of the use of force, the introduction of missile defense has institutionalized key structural elements within the defense establishment, marking a clear milestone in an ongoing trend towards security normalization.

Under the broad rubric of missile defense, Japan has had to reevaluate its position on the military use of space, the export of weapons technology, collective security, command authority, and the conditions under which preemption may be warranted. These changes have manifested themselves in many ways, including statutory changes, restructuring and elevation of the former defense agency, an increased emphasis on joint-service interoperability, and the acquisition of a broad range of advanced technologies. It is undeniable that the trend towards security normalization began with the inception of the National Police Reserve in 1950, but it can also be asserted that missile defense has provided an umbrella under which the trend has significantly advanced.

**KEYWORDS:** Missile Defense, BMD, Normalization, Japanese Self Defense Forces, JSDF

### **THE FUTURE ROLE OF THE FIRE SERVICE IN HOMELAND SECURITY**

**Rosemary R. Cloud—Fire Department, City of East Point, Georgia  
B.A., National Lewis University, 1998**

**Master of Arts in Security Studies—September 2008**

**Advisors: Richard Bergin, Department of Information Sciences**

**Lauren F. Wollman, DoD Contractor**

As action-oriented organizations, fire departments have traditionally played a reactive role in public safety, responding to emergencies in progress to protect the lives and property of citizens. The problem is that the world has changed. Increasing terrorist threats against the U.S. homeland and the potential for pandemic or other natural disasters are shifting the mission and placing new, unconventional demands on the fire department. Meeting these challenges will require strategies to identify and address the future role of the fire service in homeland security. This thesis uses the Delphi method to explore what this future role might be. Information, responses, and recommendations from three groups of subject matter experts are examined, analyzed, and synthesized to determine key issues the fire service will face. The future role of the fire service in homeland security will demand the need for progressive leadership, effective collaboration, intelligence engagement, and the adoption of a shifting mission that supports preparedness, prevention, response, and recovery of terrorist attacks. Emerging issues and areas of responsibility to meet new asymmetrical threats require a response paradigm. This response paradigm in the fire department should include the ability to adjust service delivery to meet all hazard and homeland-security demands.

**KEYWORDS:** Fire Service Leaders, Fire Service Tradition, Collaboration, Firefighters as Collectors, Strategic Change in Fire Service, Adaptive Changes, First Responders, Future Role in Homeland Security, Reactive, Proactive, Intelligence

---

## SECURITY STUDIES

---

### **IMPLICATIONS OF THE CHINESE ANTISATELLITE TEST FOR THE UNITED STATES NAVY'S SURFACE FORCES, VIEWED THROUGH THE LENS OF STEPHEN VAN EVERA'S OFFENSE, DEFENSE, AND THE CAUSES OF WAR THEORY**

**Matthew John Dillon—Lieutenant, United States Navy**

**B.A., California State University—Sacramento, 1998**

**Master of Arts in Security Studies—September 2008**

**Advisor: Christopher Twomey, Department of National Security Affairs**

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

On January 11, 2007, China successfully tested an antisatellite (ASAT) weapon. This thesis seeks to view the test's implications with regard to the prospect of China holding a false impression of offense dominance by using its ASAT weapon to temporarily create a shift in the strategic balance between it and the United States. Although China announced to the world that its test was not directed at any one country, its military strategic observers have assumed to identify the strategic weakness of the United States military as its reliance on space assets. The United States Navy's surface force is the largest customer of space-based assets, and U.S. naval surface forces could be expected to deploy to the Taiwan Straits if tensions between Taipei and Beijing elevate. China may be tempted to use to use its newly tested capabilities in a potential contest concerning the future of Taiwan, and this could potentially expose U.S. naval forces to an environment of degraded space assets. This thesis seeks to view China's perception of these weapons in offense-defense terms and shows that China's leadership may overestimate the expected advantage of an ASAT weapon attack.

**KEYWORDS:** Anti-Satellite, ASAT, Offence Dominance, False Optimism, Chinese Military Modernization, Causes of War, Chinese Perceptions Concerning Anti-Satellite Weapons

### **HOW TO FUND HOMELAND SECURITY WITHOUT FEDERAL DOLLARS: STATE AND LOCAL FUNDING OF HOMELAND-SECURITY INITIATIVES IN LIGHT OF DECREASED SUPPORT BY THE FEDERAL GOVERNMENT**

**Jay Scott Emler— Kansas State Senator**

**B.A., Bethany College, 1971**

**J.D., University of Denver, College of Law, 1976**

**Master of Arts in Security Studies—September 2008**

**Advisor: Christopher J. Bellavita, DoD Contractor**

**Second Reader: Alan D. Conroy, Kansas Legislative Research Department**

States cannot depend on the federal government to fund homeland-security initiatives at the state and local levels. This thesis, therefore, examines alternatives that state and local units of government might use to fund homeland-security initiatives, ranging from conventional alternatives, such as asset forfeiture, sales taxes, congestion fees, and multi-year budgeting with the addition of a rainy-day fund; to less conventional options, such as public-private partnerships and innovative investment strategies, mirroring the Kansas Economic Growth Act for biosciences. The policy-options analysis reveals that while most of these options have some merit or suitability for some jurisdictions, none appear to be conclusively appropriate.

Therefore, the final recommendation of this thesis is that homeland-security professionals and emergency-management directors take the initiative and determine which programs are the most critical in their respective jurisdictions. They should then approach the state executive budget office and request budget consideration for those priorities.

The options discussed in this thesis should provide legislators and homeland-security and emergency-management professionals with innovative ideas and methods to develop innovative solutions to sustainability funding for state and local homeland-security initiatives.

**KEYWORDS:** State, Local, Funding

---

## SECURITY STUDIES

---

### **EMS RESPONSE TO MASS CASUALTY INCIDENTS: THE CRITICAL IMPORTANCE OF AUTOMATIC STATEWIDE MUTUAL AID AND MCI TRAINING**

**Cheryl L. Hill—Fire and Rescue Department, Toledo, Ohio**

**B.S., Western Michigan University, 1989**

**M.P.A., University of Toledo, 2004**

**Master of Arts in Security Studies—September 2008**

**Advisor: Nadav Morag, DoD Contractor**

**Second Reader: Michael G. Petrie, San Francisco Emergency Medical Services Agency**

Incidents of natural and manmade disasters are increasing and expanding in scope. While these events may cause mass injuries, the pre-hospital emergency medical services (EMS) community is left out of the preparedness equation, being underrepresented on planning committees, not privy to disaster training, nor on the receiving end of preparedness funding. Additionally, for many states, outside standard mutual aid agreements, a disaster declaration is required prior to other types of medical-aid-rendering assistance, creating a gap in response. This thesis answers the following research question: have or how have other states and jurisdictions incorporated their EMS communities in disaster planning and response, and what can be learned in order to create this process elsewhere? Two case studies are reviewed to ascertain lessons learned regarding how other states and communities have incorporated their EMS communities into the disaster planning and response framework. Adopting automatic statewide mutual aid, supported by EMS involvement in incident preplanning, training, and exercises, will allow responders to immediately deploy upon request, closing the gap in response and resulting in positive outcomes for victims of the incident.

**KEYWORDS:** Mutual Aid, Mutual Aid Box Alarm System, MABAS, Emergency Medical Service, EMS, Mass Casualty Incident Response, Medical Response Team, Mass Casualty Response Structures, Mass Casualty Response Case Study, Emergency Medical Service Response Training, Automatic Statewide Mutual Aid, Automatic Mutual Aid

### **A 21ST CENTURY NATIONAL PUBLIC-HEALTH SYSTEM**

**Mary J. Jones—Deputy Director and Division Director, Acute Disease Prevention and Emergency  
Response, Iowa Department of Public Health**

**B.S., Creighton University, 2005**

**Master of Arts in Security Studies—September 2008**

**Advisor: Christopher J. Bellavita, DoD Contractor**

**Second Reader: Mary Mincer Hansen, Des Moines University**

The attention that SARS created in 2003 has influenced public and political perceptions about the risks associated with infectious diseases and the role the public health system should play in national security. This comparative case study is conducted to examine the Canadian public health's system response to SARS in order to formulate recommendations for the U.S. public health system. This analysis demonstrates that the governmental, organizational structure of the U.S. public health system does not support its current mission or its new responsibilities for public health security.

A national public health system is needed to support dual missions: the traditional mission of tailoring public health programs specific to the social and demographic needs of the citizens; and the new mission of public health security. In order to transform the current U.S. public health system into a national public health system, two critical components must be addressed at the federal, state, and local levels: organizational capacity and service delivery. Recommendations are provided regarding the way forward at the federal level and the work that needs to be done at state and local levels towards building a national system capable of meeting the public health threats of the 21st century.

**KEYWORDS:** Public Health Preparedness, Infectious Disease, Severe Acute Respiratory Syndrome, SARS, Canada, Epidemic, National Security, Public Health System, Organizational Capacity, Service Delivery

---

## SECURITY STUDIES

---

### **A FLEXIBLE ARCHITECTURE SYSTEM AND TOPOLOGY LICENSE-PLATE RECOGNITION (FAST LPR) AND CONCEPT OF OPERATIONS IN THAILAND**

**Avraam Kazantzoglou—Major, Hellenic Air Force  
B.S., Hellenic Air Force Academy, 1992**

**Master of Science in Electronic Warfare Systems Engineering—September 2008**

**Master of Arts in Security Studies—September 2008**

**Advisors: Pat Sankar, Department of Information Sciences**

**Robert McNab, Defense Resources Management Institute**

**Second Reader: James Ehlert, Department of Information Sciences**

This thesis examines the potential for technologically advanced systems to assist local law enforcement authorities in Thailand in continuing to effectively control drug trafficking, despite the advent of newly appeared “threats,” such as the spread of amphetamine-type stimulants (ATS). The pre-concept of operations (CONOPS) of such a system, funded by the Department of Defense/Counter–Narcoterrorism Technology Program Office (DoD/CNTPO), is provided. Even with opium seizures significantly reduced in the country, accompanied by a similar decline in heroin and morphine seizures, there is no room for complacency, especially given the fact that one of the neighboring countries, Myanmar, numbers among the top two opium producers around the globe.

Illicit drug trafficking is a phenomenon that cannot be addressed autonomously. Rather, evidence strongly relates illicit drug trafficking to terrorism activity, in a relation that is highly reciprocal. In the past decade this common front has been described by the term “narcoterrorism.” This term stresses the correlation of these two areas of illegal activity, which until recently were independent of one another. Clearly, the only response to sophisticated narcoterrorism networks must be based on advanced technological tools. The Flexible Architecture System and the Topology License-Plate Recognition (FAST LPR) system is a promising solution to this problem.

**KEYWORDS:** Illicit Drug Trafficking, Drugs, Opium, Narcoterrorism, License Plate Recognition, Counter–Narcoterrorism

### **THE FUTURE OF THE BALLISTIC-MISSILE SUBMARINE FORCE IN THE RUSSIAN NUCLEAR TRIAD**

**Richard T. Lesiw—Lieutenant, United States Navy  
B.S., Eckerd College, 2000**

**Master of Arts in Security Studies—September 2008**

**Advisor: David S. Yost, Department of National Security Affairs**

**Second Reader: Mikhail Tsyarkin, Department of National Security Affairs**

This thesis analyzes the current status of the Russian Federation’s ballistic-missile submarine force. It reviews the history of the ballistic-missile submarine force, its current status, and the implementation of plans currently in progress, as well as the advantages and disadvantages of maintaining a ballistic-missile submarine force. This thesis also assesses the other two legs of the nuclear triad: the intercontinental ballistic missiles (ICBMs) and long-range bomber aircraft. The status of these two forces and their operational advantages and disadvantages are compared with those of the ballistic-missile submarine force. The financial and political factors that may affect the prospects of the ballistic-missile submarine force are also examined. This includes arms-control treaties that may affect the force structure. Current and prospective energy prices suggest that the economy of the Russian Federation will be able to provide long-term financing for the ballistic-missile submarine force and Moscow’s other strategic nuclear forces. This thesis concludes that the ballistic-missile submarine force is a vital part of the Russian Federation’s nuclear triad and will probably be maintained over the next fifteen years and beyond.

**KEYWORDS:** Ballistic Missile Submarine Force, Intercontinental Ballistic Missile, ICBM, Long Range Bomber Aircraft, Nuclear Deterrence, Nuclear Weapon, Russia, Russian Federation, SSBN, Strategic Nuclear Forces

---

## SECURITY STUDIES

---

### **DO THE METRICS MAKE THE MISSION?**

**Anthony W. Like—Lieutenant, United States Navy  
B.S., Old Dominion University, 2002**

**Master of Arts in Security Studies—September 2008**

**Advisors: Thomas C. Bruneau, Department of National Security Affairs  
Donald J. Stoker, Naval War College**

Since Saddam Hussein took power in 1979, Iraq has engaged in wars with Iran, Kuwait, and twice with the United States. The years between the wars with the United States, 1991–2003, were characterized by economic sanctions that destroyed the social fabric the wars had missed. In 2003, after major combat operations were complete, the United Nations created the United Nations Assist Mission for Iraq (UNAMI) to prop up the nation in hopes of returning it to a self-sustaining country capable of managing itself economically and politically.

This thesis assesses the success of the UNAMI based on two metrics relating to effectiveness and efficiency. The first metric hinges on stated objectives compared to goals achieved. The second examines the three primary human-development indicators; life expectancy at birth, adult literacy, and GDP per capita. The purpose is to determine if the method by which a project is measured determines its effectiveness and efficiency. After reviewing the UNAMI and applying two measures of effectiveness and efficiency, the assessment is that the mission is only partly effective and all aspects are inefficient.

**KEYWORDS:** United Nations Assist Mission Iraq, Measure, Effectiveness, Efficiency

### **RUSSIAN ANTI-AMERICANISM: ORIGINS AND IMPLICATIONS**

**Mark B. Leskoff—Lieutenant, United States Navy  
B.S., Norfolk State University, 2001**

**Master of Arts in Security Studies—September 2008**

**Advisor: James Clay Moltz, Department of National Security Affairs  
Second Reader: Mikhail Tsypkin, Department of National Security Affairs**

As 21<sup>st</sup> Century relations between the United States and Russia continue to deteriorate, post-Soviet relations with Washington have reached an all-time low. In principle, the foundations of these relations could be traced to Putin, Bush, U.S. policy, Russian nationalism, or Russia's struggle to strengthen its position in the international balance of power. The objective of this research is to identify the main causes of this anti-Americanism through the employment of Kenneth Waltz's three levels of analysis.

The overall questions that this thesis seeks to answer are: 1) what has caused an increase in Russian anti-Americanism in recent years?, and 2) what historical, political, and strategic significance can be attributed to this increased Russian dissatisfaction with the United States? The analysis considers possible root causes found at each of the three levels of analysis identified in Kenneth Waltz's framework for studying international relations. These three levels concern the individual, the state and society, and the international system. At each level, relevant factors are examined that may have contributed to Russian anti-Americanism.

**KEYWORDS:** Russia, Anti-Americanism, United States, Kenneth Waltz, Putin

### **GOING THE DISTANCE: MEASURING THE SOCIAL IDENTITY OF TERRORISTS**

**Keith W. Ludwick—Federal Bureau of Investigation  
B.S., California State University—Sacramento, 1990  
Master of Arts in Security Studies—September 2008**

**Advisor: Anders Strindberg, DoD Contractor  
Second Reader: David Brannan, DoD Contractor**

Studies of terrorism today focus on the psychological and behavioral aspects of individuals. Most research shows that using a single model in an attempt to profile terrorists psychologically is problematic, if not impossible. However, using two well-established theories from social psychology, social-identity theory

---

## SECURITY STUDIES

---

and social-distance theory, allows the development of a practical model to develop a social profile of a terrorist group. From that, it is further possible to use the resulting social profile to compare terrorist groups against each other in order to develop predictive models as to the propensity of violence of a particular group.

To test this, the research in this thesis uses open source interviews of the terrorist groups HAMAS and the Popular Front for the Liberation of Palestine (PFLP), taken from online magazines, online journals, on-line newspapers, and official websites, to serve as respondents to a survey instrument developed from other social-identity studies. The results of this research show that a social profile of a terrorist group can be developed from standard, social-identity measurement survey instruments and it is possible to develop practical methods for comparing groups, based on their social identities, to predict their propensity towards violence.

**KEYWORDS:** Social Identity Theory, Social Distance Theory, Social Identity, Measurement, Terrorism, HAMAS, PFLP

### **TERRORISM 101: KNOWLEDGE ABOUT THE “WHAT AND WHY” OF TERRORISM AS A STATE AND LOCAL LAW-ENFORCEMENT COMPETENCY**

**LD M. Maples– California Highway Patrol  
B.A., California State University–Bakersfield, 1999  
Master of Arts in Security Studies–September 2008  
Advisors: Anders Strindberg, DoD Contractor  
David Brannan, DoD Contractor**

In the wake of the September 11, 2001, terrorist attacks, state and local police agencies were thrust into new homeland-security-related roles. One area specifically identified in national strategies, and supported by expert opinion on enhancing the ability of law enforcement to prevent terrorism, is increased knowledge and education regarding terrorism. Terrorism has been the subject of academic work even prior to the 9/11 attacks. Some of this work has evaluated the underlying causes that compel people to threaten and use violence to achieve their individual or group objectives. This body of work is a resource for law enforcement to bridge gaps between national strategies and current practices.

The primary focus of this research is to assess the current state of terrorism training for state and local law-enforcement officials. This research evaluates whether the subject of terrorism is a core professional competency for law enforcement in every state and, specifically, whether state and local police are being exposed to knowledge about the causes and motivations associated with terrorism in order to better understand, and ultimately, prevent it. Surveys and interviews of state officials are conducted in order to gather data about the current state of terrorism-related training throughout the nation. A qualitative analysis is conducted in order to further assess the content of select course content and identify potential training and educational gaps.

**KEYWORDS:** State Law Enforcement, Local Law Enforcement, Certification, Terrorism Courses, Education, Peace Officers Standards and Training

### **IMPROVING THE CURRENT DEPARTMENT OF HOMELAND SECURITY CAPABILITIES FRAMEWORK**

**Dan W. McGowan– Montana Disaster and Emergency Services  
B.A., Carroll College, 1978  
Master of Arts in Security Studies–September 2008  
Advisors: Glen Woodbury, Department of National Security Affairs  
Ellen Gordon, DoD Contractor**

After the 9/11/2001 terrorist attack, the president signed Homeland Security Presidential Directive Eight (HSPD 8). The intent of the directive was to establish a mechanism for improving the ability to protect against, prevent, respond to, and recover from any occurrence. Interim guidance established complimentary initiatives toward a national system for developing capabilities: national preparedness goal, universal tasks

---

## SECURITY STUDIES

---

and target capabilities. The effectiveness of the guidance, however, is hampered by several incongruities and conflicting efforts with other similar federal initiatives. There is no one consistent approach, either in content or application, for identifying or developing jurisdictional capabilities.

The current capability initiative was developed over a short timeframe with a focus on the intent of presidential directives, congressional concerns, and mandated deadlines. The current initiative was developed through consultation, and not collaboration, with all involved stakeholders. The research and development of this thesis to improve the current DHS capabilities framework relies on stakeholder input, years of emergency management experience, and eighteen months dedicated to studying all the elements. The intent of this thesis is to enhance current efforts by proposing a framework that is reflective of the homeland-security and emergency-management community or jurisdictional needs.

**KEYWORDS:** Target Capabilities, Universal Task List, HSPD 8, Capability-Based-Planning, Effects-Based-Planning

### **UNITED STATES NORTHERN COMMAND EDUCATION IN ACTION: EDUCATING CRITICAL STAKEHOLDERS AT THE AWAY GAME**

**Steven Edward Osterholzer—Major, United States Army**

**M.P.A., City University of New York, 2003**

**M.P.R., University of Oregon School of Journalism, 2005**

**Master of Arts in Security Studies—September 2008**

**Advisor: Lauren F. Wollman, DoD Contractor**

**Second Reader: Stan Stupinski, DoD Contractor**

This thesis is a customizable strategy to educate United States Northern Command's (NORTHCOM) critical stakeholders utilizing a mobile education and training team to educate key stakeholder personnel at their location. After providing background on NORTHCOM and discussing why it is important for stakeholders to have an understanding of the unit's missions, organizations, capabilities, and limitations, the thesis poses the question, how can NORTHCOM change its outreach and education policies and practices to more effectively educate its key interagency stakeholders—at the stakeholder location—in order to improve response efforts during a crisis. Stakeholders are identified, a customizable education package is presented, several delivery options are discussed, and several courses of action are considered regarding educator options. A methodology called the military decision-making process (MDMP) is utilized to assist in identifying the most effective courses of action, developing evaluation criteria, ranking each course of action utilizing those criteria, and using a quantifiable system to determine the most effective courses of action. These chapters are augmented with a discussion on developing and implementing measures of effectiveness, along with recommended areas for future study.

**KEYWORDS:** United States Northern Command, NORTHCOM, Interagency Education, Education Strategy

### **BUILDING A NEW STORYLINE FOR FLORIDA'S DOMESTIC SECURITY STRATEGY TO PROVIDE FUTURE RESILIENCY FOR THE STATE**

**Dominick D. Pape—Florida Department of Law Enforcement**

**B.A., Kings College, 1980**

**M.S., Florida International University, 1995**

**Master of Arts in Security Studies—September 2008**

**Advisor: Robert Bach, DoD Contractor**

**Second Reader: David Kaufman, DoD Contractor**

Quickly after the 9/11 strike, the state of Florida drafted one of the nation's first comprehensive, counterterrorism strategies to aid in the protection of the state's visitors and citizens. This strategy was drafted early in the new paradigm of homeland security. The strategy has had several modifications over several years, but has not had a comprehensive review since its inception. Many things have changed in the arena of homeland security since that first step after 9/11. An analysis of interviews with Florida homeland-

---

## SECURITY STUDIES

---

security leaders and other states' homeland-security strategies, in combination with the Government Accountability Office (GAO)'s six desirable characteristics, demonstrates the need for Florida to develop the next iteration of its domestic-security strategy. This thesis recommends using the strengths of Florida's Regional Domestic Security Task Force, the Department of Homeland Security's target-capability list, and the GAO desirable characteristics, combined with traditional elements of strategic planning, as the pillars of this new iteration of the strategy. A new vision and mission statement based on a traditional strategic planning tool will be the first step in building a new storyline for Florida's domestic-security strategy.

**KEYWORDS:** Homeland Security Strategy, Capability-Based Planning, Target Capability List, TCL, Strategy Change Cycle, Florida, Counterterrorism

### **THE U.S.–SAUDI PARTNERSHIP: IS THIS MARRIAGE HEADED FOR DIVORCE?**

**Edward Sylvester–Lieutenant Commander, United States Navy**

**B.A., San Francisco State University, 1988**

**M.S., California State University–Long Beach, 1995**

**Master of Arts in Security Studies–September 2008**

**Advisor: James Russell, Department of National Security Affairs**

**Second Reader: Daniel Moran, Department of National Security Affairs**

This thesis seeks to determine whether the relationship between the United States and the Kingdom of Saudi Arabia can continue to survive in light of the unprecedented developments that have challenged this partnership within the last decade. This question is addressed through careful review of the history of the U.S.–Saudi partnership from 1931 to the present. The information is then analyzed to answer the question, asserting that the relationship is more robust than generally perceived. The analysis also supports the notion that, despite the numerous disagreements that have occurred throughout the U.S.–Saudi relationship, the two nations have always reverted back to a mutually beneficial strategic partnership, enduring most of the challenges that have presented themselves.

**KEYWORDS:** Saudi Arabia, Middle East, Oil Politics, 9/11, Intifada, Operation Defensive Shield, Racism, Xenophobia, Oil History, Ibn Saud

### **THE REPUBLIC OF MACEDONIA: IMPLEMENTING THE OHRID FRAMEWORK AGREEMENT AND REFORMING THE STATE**

**George A. Tsukatos–Lieutenant, United States Navy**

**B.S., Johnson and Wales University, 1998**

**Master of Arts in Security Studies–September 2008**

**Advisors: Thomas C. Bruneau, Center for Civil–Military Relations**

**Sophal Ear, Department of National Security Affairs**

The Republic of Macedonia (ROM) remained peaceful during the violent breakup of Yugoslavia. However, the 1999 Kosovan refugee crisis, combined with a large, disgruntled ethnic Albanian minority, triggered an ethnic conflict between the Macedonian security forces and Albanian rebels in February 2001. Hostilities ended with the signing of the Ohrid Framework Agreement in August 2001. It proposed a power-sharing system between the Macedonians and the minorities, along with greater cultural and educational rights. Since Ohrid, the republic has worked to implement the framework agreement and reform its institutions, all in hopes of joining the European Union (EU). This thesis examines the factors that led to the 2001 conflict, the status of the framework agreement implementation, and the political, economic, and security reforms the ROM promised to the EU. Factors supporting success in executing the reforms are examined, as well as factors impeding progress. Finally, this thesis discusses what roles the international community plays in the development of the ROM.

**KEYWORDS:** Republic of Macedonia, European Union

---

## SECURITY STUDIES

---

### **BUILDING SCHOOL RESILIENCY IN AN ERA OF MULTIPLE THREATS**

**Kenneth J. Van Sparrentak–Walled Lake Fire Department**

**B.S., Madonna University, 1998**

**Master of Arts in Security Studies–September 2008**

**Advisors: Glen Woodbury, Department of National Security Affairs**

**Nadav Morag, DoD Contractor**

There is a lack of attention towards the process of recovery in U.S. schools, despite their vulnerability to natural and intentional threats and the potential for creating mass casualties. By promoting resiliency as a component of recovery, as similarly modeled in Israel and the UK, the U.S. can empower children and the at-large community, enabling a quicker recovery. Case studies from mass-casualty incidents from a variety of threat mechanisms involving schools are analyzed to assess: 1) time criticality, 2) lack of information sharing, 3) family reunification, 4) lockdown considerations, and 5) first-responder considerations. Regardless of threat mechanism, most variables will factor in a school's ability to recover, including the reality that the longer the exposure to the trauma, the greater the psychosocial impact and the greater the difficulty in recovery.

School administrators and first responders, primarily from public health and law enforcement, should collaborate on efforts in the pre-event phase to mitigate both physical and psychological impacts from trauma. The success of fire-prevention education has promoted resiliency for decades. Similar strategies should focus on all hazards, and the term “resiliency” should become a natural term in the American lexicon.

**KEYWORDS:** Schools, Preparedness, Resilience, Recovery, Psychosocial, Mass Casualty Incidents, Public Health, School Resource Officers, Lockdowns, Crisis Response Teams

### **U.S. DEMOCRATIZATION STRATEGY: ORIGINS AND OBSTACLES**

**Chad G. Wahlin–Lieutenant Commander, United States Navy**

**B.S., United States Naval Academy, 1993**

**Master of Arts in Security Studies–September 2008**

**Advisors: David S. Yost, Department of National Security Affairs**

**Donald J. Abenheim, Department of National Security Affairs**

The George W. Bush administration offered two rationales for the U.S.-led invasion of Iraq in March 2003. First and foremost, the invasion would eliminate the threat that the Iraqi regime headed by Saddam Hussein might transfer weapons of mass destruction (WMD) to terrorist organizations. Second, the invasion would depose the brutal dictatorship in Baghdad and deliver the oppressed people of Iraq from tyranny. After the invasion, in the absence of any Iraqi WMD stockpiles, only one of these original justifications for war remained viable. As a result, the Bush administration realigned U.S. national-security strategy and set forth a vision of peace and security through the democratization of the Middle East and the world. This thesis examines the historical antecedents of this vision. It also analyzes the transition in the Bush administration's foreign policy from a position of pragmatic restraint and America-first principles to a Wilsonian vision of global pacification through the spread of democratic principles of governance. Finally, the thesis reviews the various obstacles that could prevent the fulfillment of this vision, which has met with significant resistance in both Afghanistan and Iraq.

**KEYWORDS:** Democratization, Democratic Peace Theory, Wilsonianism, Immanuel Kant, Bush Strategy



## STUDENT INDEX

---

### A

Ableiter, Dirk, 15  
Adame, Adrian S., 39  
Adams, Paige H., 15  
Addington, Christopher D., 83  
Alexopoulos, Konstantinos, 27  
Alver, Yücel, 57  
Anderson, Brian C., 11, 77  
Aragon, Lasumar, 83  
Arledge, Richard K., 39, 77

### B

Barbaris, Roxanne, 19  
Barksdale, Michael, 7  
Barrett, Jason S., 65  
Bein, Alexander L., 78  
Beris, Jonathan V., 57  
Biggs, Robert C., 40  
Bitik, Arif B., 58  
Blatus, Richard J., 97  
Brennan, James F., 97  
Brosch, Paige H., 19  
Brown, Cinda L., 84  
Burchnell, Ryan, 98

### C

Callanan, Christine, 19  
Carroll, James M., 49  
Carson, James E., 78  
Chatterjee, Ash, 98  
Cheng, Yuan-Pin, 27  
Chery, Joseph E., 65  
Christiansen, Bryan J., 66  
Clarke, Timothy L., 40, 75, 99  
Clem, Doyne Damian, 66  
Clemons, Travis, 19  
Cloud, Rosemary R., 99  
Collier, Corey M., 79  
Conger, Nathan W., 59  
Conrad, Brian, 41  
Correia, Carlos, 73  
Crescitelli, David M., 45  
Crosby, Robert, 7

### D

Dea, John R., 3  
Decker, Angelene, 20  
Dillon, Matthew John, 100  
Djerf, Pontus R., 33  
Doerr, James, Jr., 20  
Driessen, Paul T., 84  
Dwiggins, David E., Jr., 28  
Dwyer, Derek T., 67

### E

Edwards, Erick Lee, 53  
Eller, Rachelle B., 21  
Emler, Jay Scott, 100  
Epp, Christopher D., 85  
Ertekin, Necati, 8, 33  
Escobar, Kenny E., 28

### F

Faulkner, Susan D., 51  
Fears, Tellis A., 59  
Feehan, Ashton F., III, 42  
Fields-Austin, Elizabeth A., 89  
Forest, Benjamin D., 89

### G

Garcia, Alberto A., 67  
Gast, David W., 13  
Gay, John E., 90  
Glazman, Emily, 20  
Green, Daniel M., 90

### H

Harrison, Joseph K., II, 42  
Hatcher, Ervin B., 39, 77  
Hatt, Ronald V., 60  
Hemmelgarn, Ronald J., 60  
Hernandez, Jose H., Jr., 29  
Hill, Cheryl L., 101  
Himes, Kristy M., 21  
Horner, Allen, MAJ, USA, 73

### I

Ieva, Christopher S., 45  
Impastato, Bonnie A., 21

### J

Jensen, Robert B., 85  
Jones, Mary J., 101

### K

Kacala, Jeffrey C., 79  
Kammerzell, Robert L., 61  
Kazantzoglou, Avraam Avraam, 34, 102  
Kistner, Patrick B., 45  
Kong, Bruce, 39  
Kulunk, Bulent, 58

### L

La Valley, Andrew M., 29  
Lamberty, Jose M., 68  
Lavery, Jeffrey B., 29  
Lekakos, Dimitrios, 30, 34  
Leo, John K., 16

---

## STUDENT INDEX

---

Lesiw, Richard T., 102  
Leskoff, Mark B., 103  
Like, Anthony W., 103  
Ludwick, Keith W., 103

### M

Maples, LD M., 104  
McGowan, Dan W., 104  
McKeehan, Zachary Dean, 16  
McLaughlin, James, 73  
McMillon, William J., 46  
Melançon, Paul W., 91  
Milliken, Michael S., 61  
Mohamed, Jessica Rose, 53  
Moore, Sherry A., 21  
Morse, Troy C., 68

### N

Nelson, Jeffrey M., 79  
Norris, Joshua J., 46

### O

O'Brien, James M., II, 25  
O'Hara, Matthew, 17  
O'Marr, Erin E., 54  
Orr, Kristine R., 22  
Osterholzer, Steven Edward, 105  
Ostrander, Jason R., 22  
Ozdogan, Murat, 57

### P

Pape, Dominick D., 105  
Pappas, James A., 47  
Parten, Douglas S., 87, 92  
Pena, Claudia P., 8  
Phillips, Jason M., 30, 35  
Platte, William L., 62  
Powers, Johnny J., 62

### R

Rayburn, John C., 78  
Rhett, Deven A., 31  
Riehle, Richard D., 3  
Rippeon, Ryan A., 17, 62  
Roycroft, Steven M., 85  
Ruegger, Keith L., 86

### S

Salisbury, Constance M., 21  
Sato, Hiroyuki, 4  
Schaner, Eric X., 43  
Schultz, William A., 51  
Sebalj, Derek M., 63  
Senn, Matthew A., 37, 80  
Smith, Chad M., 47  
Smith, Phillip Sean, 80  
Socias, Luis, 93  
Sordi, James J., Jr., 18  
Spearow, William H., 91  
Stewardson, Donald, 73  
Sweet, Gerald L., 23  
Sybor, Colleen A., 18  
Sylvester, Edward, 106

### T

Teufel, Dietmar Josef, 18  
Thomas, Adam J., 69  
Tiwari, Andre N., 63  
Todd, Hal M., 87, 92  
Tomaiko, Thomas A., 92  
Tornazakis, Ioannis, 33  
Tsukatos, George A., 106  
Turek, Allon G., 54  
Turner, James D., 37, 80  
Turso, Denise L., 90  
Tzanos, Ioannis, 41

### V

Van Sparrentak, Kenneth J., 107  
Voskakis, Konstantinos, 31

### W

Wahlin, Chad G., 107  
Wallace, Kenneth A., 55  
Whittington, Eric S., 57  
Wigfall, Henry, 19  
Williams, Christopher G., 52  
Wissel, Nicholas E., 69  
Wright, George C., 71

### Y

York, Michael A., 70

## ADVISOR INDEX

---

### A

Abenheim, Donald J., 107  
Agrawal, Brij N., 13  
Airola, James, 8, 33  
Angelis, Diana, 84  
Arquilla, John, 25  
Ashley, Robert E., 21  
Ateshian, Peter, 31  
Auguston, Mikhail, 16

### B

Bach, Robert, 97, 105  
Barreto, Albert, 42  
Bartlett, Scott, 51  
Batteen, Mary L., 71  
Bellavita, Christopher J., 100, 101  
Bergin, Richard, 21, 98, 99  
Bey, Scott, 90  
Blais, Curtis L., 57, 59, 63  
Boger, Daniel C., 13, 42  
Bordetsky, Alexander, 37, 39, 41, 78, 80  
Brannan, David, 103, 104  
Broadston, Robert, 33  
Brown, Gerald G., 68, 69, 70  
Bruneau, Thomas C., 103, 106  
Brutzman, Donald P., 60  
Buddenberg, Rex, 41, 42  
Buettner, Raymond R., 46  
Buss, Arnold, 57  
Buttrey, Samuel E., 68

### C

Carlyle, W. Matthew, 66, 67, 68  
Chiu, Ching-Sang, 53  
Ciavarelli, Anthony P., 58, 62, 63  
Clement, Michael, 39  
Conroy, Alan D., 100  
Cook, Glenn R., 39, 40, 42, 77  
Cook, Henry, 90  
Cristi, Roberto, 27, 29, 31  
Cuskey, Jeffrey R., 21

### D

Darken, Christian, 18, 57  
Das, Arijit, 17  
Davidson, Kenneth, 54  
Doerr, Kenneth, 21, 23  
Drusinsky, Doron, 18  
Duncan, Ross E., 21

### E

Ear, Sophal, 106  
Ehlert, James, 34, 102  
Eitelberg, Mark J., 49  
Elliott, Ray, 47

Enns, John, 68

### F

Fargues, Monique P., 27  
Fouts, Douglas J., 28  
Franck, Raymond E., 8, 33  
Freeman, Michael, 8  
Fricker, Ronald D., Jr., 65

### G

Gibbons, Deborah E., 59  
Giraldo, Francis X., 3  
Gordis, Joshua, 52  
Gordon, Ellen, 104  
Gregg, Heather S., 43  
Gregg, Michael R., Lt Col, USAF, 89

### H

Ha, Tri T., 30, 34  
Haferman, Jeffrey L., 53  
Hall, K.B., 20  
Hansen, James, 55  
Hansen, Mary Mincer, 101  
Harkins, Richard, 80  
Harr, Patrick A., 55  
Hayden, Philip P., 22  
Herrera, Michael A., 45  
Huang, Louis C., 85  
Hughes, Wayne P., 66, 69  
Hutchins, Susan, 93  
Huynh, Thomas V., 84, 85, 86

### I

Iatrou, Steven, 45, 46  
Irvine, Cynthia E., 15

### J

Jenn, David C., 33  
Julian, Alexander L., 29

### K

Kaufman, David, 105  
Khan, Feroz, 97  
Khoo, Boo C., 85  
King, Cynthia L., 7  
Knorr, Jeffrey B., 30, 35  
Kocher, Kathryn, 49  
Kölsch, Mathias, 16, 59, 60  
Kragh, Frank, 29, 31  
Kujawski, Edouard, 84  
Kwon, Young, 51

### L

Lambert, Mark A., 91  
Langford, Gary O., 87, 91, 92

## ADVISOR INDEX

---

Lesnowicz, Edward J., Jr., 61  
Lindsey, Lisa L. Massi, 7  
Loomis, Herschel H., Jr., 28  
Loup, Douglas C., 51  
Lucas, Thomas W., 61, 66, 67, 69

### M

Martell, Craig H., 15  
Matthews, David F., 92  
McCauley, Michael E., 58, 61, 63  
McEachen, John C., 27  
McNab, Robert, 34, 102  
Michael, James Bret, 3, 18, 40, 46  
Michael, Sherif, 29  
Miller, Alice L., 97, 99  
Miller, Christopher W., 53  
Moltz, James Clay, 103  
Moore, Louis J., 19  
Morag, Nadav, 101, 107  
Moran, Daniel, 106  
Murphree, James T., 54

### N

Naegle, Bradley R., 73  
Nalwasky, Richard M., CDR, USN, 19,  
20, 22, 23  
Neta, Beny, 3  
Newman, James H., 11, 77, 78  
Nissen, Mark E., 43  
Norbraten, Terry, 63  
Nussbaum, Daniel A., 70

### O

Olsen, Richard C., 11, 39, 77, 80  
Olwell, David H., 85  
Osmundson, John S., 84, 86, 89, 90, 91  
Otani, Thomas, 15

### P

Pace, Phillip E., 8, 28, 33, 45  
Paduan, Jeffrey D., 71  
Papoulias, Fotis, 52, 83  
Parker, Andrew A., 78  
Paulo, Eugene, 83  
Petrie, Michael G., 101  
Pfeiffer, Karl D., Lt Col, USAF, 40, 46,  
54, 75, 93  
Powley, Edward H., 7

### R

Racoosin, Charles M., 79  
Radko, Timour, 53  
Rhoades, Mark M., 83, 85, 89, 91  
Roberts, Benjamin J., 92

Robertson, Ralph Clark, 29, 30, 34  
Rogers, Robert B., 85  
Ross, Alan A., 28  
Rothstein, Hy S., 25  
Royset, Johannes O., 4, 66  
Russell, James, 106

### S

Sakoda, Daniel J., 78  
Salmeron, Javier, 67  
San Miguel, Joseph G., 8  
Sanchez, Paul, 67  
Sankar, Pat, 34, 102  
Shing, Man-Tak, 16, 18, 40, 75  
Siciliano, Daria, 39, 77  
Simeral, Robert, 97  
Simon, Cary A., 19, 22, 73, 89, 90  
Singh, Gurminder, 15, 17, 62  
Smith, Terry, Lt Col, USAF, 8, 30, 33, 35, 45, 47  
Squire, Kevin, 16, 18  
Steckler, Brian, 98  
Stoker, Donald J., 103  
Stone, Rebecca E., CDR, USN, 54  
Strindberg, Anders, 98, 103, 104  
Stupinski, Stan, 105  
Suchan, James, 20  
Sullivan, Joseph A., CDR, USN, 17, 58, 59,  
60, 61, 62

### T

Thomas, Stephen G., 20  
Tsyarkin, Mikhail, 102, 103  
Tummala, Murali, 27  
Turso, James A., 87, 92  
Twomey, Christopher, 100

### W

Weatherford, Todd R., 29  
Weekley, Jeff, 60  
Weiner, Robert, 99  
Welch, William J., 37, 79, 80, 89  
Whitaker, Lyn R., 65  
Whitcomb, Clifford, 83  
Williams, Richard D., 65  
Wollman, Lauren F., 99, 105  
Wood, R. Kevin, 69  
Woodbury, Glen, 104, 107

### Y

Yoder, E. Cory, 19, 22, 23  
Yost, David S., 102, 107  
Yucesan, Enver, 57  
Yun, Xiaoping, 31

## INFORMATION FOR OBTAINING A COPY OF A THESIS OR OTHER NPS REPORTS

NPS' Dudley Knox Library catalogs all publicly releasable theses, technical reports, and MBA professional reports. A good source of information on the theses and reports that have been written by NPS faculty and students is the Library's general catalog, BOSUN, accessible at <http://www.nps.edu/Library/index.html>. An explanatory page facilitating access to NPS theses can be found at <http://www.nps.edu/Library/Services/Special%20Collections/NPSTheses.html>. The same information applies to many other NPS-produced reports.

Copies of the quarterly NPS publication, *Compilation of Theses Abstracts*, can be found at <http://www.nps.edu/Research/index.html>. The annual list of technical reports can be found at <http://www.nps.edu/Research/TechReports.html>.

Copies of unclassified theses or other reports that are publicly releasable may be purchased from either of the following agencies depending on the particular circumstances.

U.S. government employees, individuals affiliated with a research and development activity within the U.S. government, or its associated contractors, subcontractors, or grantees, under current U.S. government contract, can order from:

DEFENSE TECHNICAL INFORMATION CENTER  
8725 John J. Kingman Road, STE 0944  
Fort Belvoir, Virginia 22060-2218  
Phone: 1-800-225-3842  
Email: [msorders@dtic.mil](mailto:msorders@dtic.mil)  
URL: <http://www.dtic.mil/dtic/order.html>

Purchasing documents from DTIC requires registration with DTIC. However, many theses, particularly those completed recently, are available in electronic format for free at <http://stinet.dtic.mil>.

Private U.S. citizens without a U.S. government contract can purchase copies from:

NATIONAL TECHNICAL INFORMATION SERVICE  
U.S. Department of Commerce  
5285 Port Royal Road  
Springfield, Virginia 22161  
Phone: 1-800-553-6847  
Email: [orders@ntis.fedworld.gov](mailto:orders@ntis.fedworld.gov)  
URL: <http://www.ntis.gov/help/ordermethods.asp>

For those outside the U.S., Canada, or Mexico, please see the NTIS arrangements with international cooperating organizations at <http://www.ntis.gov/help/cooperate.asp?loc=7-0-0>.

Information that is needed to obtain a given document includes 1) author name, 2) title, 3) publication date, and 4) reference to the document as a Naval Postgraduate School thesis.

General inquiries concerning faculty and student research at the Naval Postgraduate School can be addressed to:

Vice President and Dean of Research  
Code 09  
Naval Postgraduate School  
Monterey, California 93943-5138  
Phone: (831) 656-2099  
Email: [research@nps.edu](mailto:research@nps.edu)