2015-12

Compilation of Abstracts, December 2015

Monterey, California; Naval Postgraduate School

NPS-04-16-001

COMPILATION OF ABSTRACTS

Unrestricted Dissertations, Theses, and Final Projects

NPS Class of December 2015

Office of the Vice President and Dean of Research
NAVAL POSTGRADUATE SCHOOL
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PREFACE

This publication, *Compilation of Abstracts*, contains abstracts of unrestricted dissertations, theses, and capstone project reports submitted for the doctor of philosophy, master of arts, master of business administration, and master of science degrees for the Naval Postgraduate School's December 2015 graduating class. A digital copy of this publication can be found at http://hdl.handle.net/10945/48283 while the corresponding metadata for December 2015 abstracts can be found at https://calhoun.nps.edu/handle/10945/47988.

This compilation is published to acquaint those interested in the fields represented with the nature and substance of Naval Postgraduate School student research, which covers a wide range of defense-related topics. An online copy of this and previous editions can be found at https://calhoun.nps.edu/handle/10945/27474. Calhoun, the institutional archive of NPS, provides a convenient way to search the content of unrestricted theses. Search for specific full-text theses and dissertations by author, advisor, branch of service, date issued, degree, department, or type at http://calhoun.nps.edu/handle/10945/16.

Guidelines for obtaining printed copies of unrestricted dissertations, theses, and capstone project reports are outlined on the last page of this volume. Restricted theses are available for viewing on the NPS SIPRNet and through the Defense Technical Information Center at http://www.dtic.mil/dtic/.

Additional Information on NPS Research and Academic Programs

Summary of Research, an annual compilation of research projects and publications, is also available online at https://calhoun.nps.edu/handle/10945/13736. "Research News," a monthly newsletter highlighting some of the newest developments in NPS research, can be found at https://calhoun.nps.edu/handle/10945/7839.

For other inquiries about student and faculty research at NPS, please contact the Dean of Research, Jeffrey Paduan:

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For details on degree programs at NPS, please contact the director of admissions at (831) 656-3093 or grad-ed@nps.edu. The NPS academic catalog is available at http://www.nps.edu/Academics/GeneralCatalog/Layout.html. The admissions website is at http://www.nps.edu/Academics/Admissions/Index.html.

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ADVANCED DEGREES

Doctor of Philosophy

MASTER OF ARTS

Master of Arts in Security Studies

Master of Business Administration

MASTER OF SCIENCE

INTRODUCTION

The Naval Postgraduate School is pleased to present the dissertation, thesis, and capstone project report abstracts (hereafter thesis or terminal project) for unrestricted research completed in December 2015 by the graduating class.

MISSION

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

To increase the combat effectiveness of commissioned officers of the naval service to enhance the security of the United States. In support of the foregoing, and to sustain academic excellence, fosters and encourages a program of relevant and meritorious research which both supports the needs of the Navy and Department of Defense (DOD) while building the intellectual capital of the Naval Postgraduate School faculty.

To fulfill its mission, the Naval Postgraduate School strives to advance innovation in the Navy and prepare officers for introducing and employing future technologies. The research program at NPS supports the mission of graduate education. Research at NPS

- advances knowledge in a wide range of disciplines relevant to DON/DOD;
- maintains upper-division course content and programs at the cutting edge;
- provides the opportunity for students to demonstrate independent graduate-level scholarship in their areas of study;
- challenges students with creative problem solving experiences on DOD-relevant issues;
- solves warfare problems; and
- attracts and retains quality faculty with state-of-the-art expertise.

To meet its educational requirements, the Navy has developed a unique academic institution at NPS and via distance learning (DL) through specially tailored academic programs and a distinctive educational experience tying academic disciplines to naval and joint warfighting applications. NPS has aligned its education and research programs to achieve three major goals:

1. nationally recognized academic programs that support the operations of the Navy and Marine Corps, our sister services, and our allies;
2. research programs that focus on the integration of education and research in support of current and emerging national security technologies and operations; and
3. executive and continuing education programs that support sustained intellectual innovation and growth throughout an officer's career.

ACADEMIC PROGRAMS

School of International Graduate Studies (SIGS)

The unique programs and faculty expertise within SIGS seek to identify and address current and emerging security challenges and strengthen multilateral and bilateral defense cooperation between the United States and other nations. Areas of expertise range from nuclear nonproliferation to counterterrorism; from the history of war to emerging biological and cyber threats; and from the security aspects of political economy to international law.

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

Graduate School of Business and Public Policy (GSBPP)

GSBPP reflects the management side of national defense in support of operational requirements, with programs open to the U.S. uniformed services, DOD employees and contractors, federal employees, and international military and government employees. An integrated civilian and military faculty focuses on defense organizations, system applications, and instruction supported by extensive defense-oriented research.

- Acquisition and Contract Management
- Advanced Acquisition Program
- Contract Management (DL)
- Defense Business Management
- Defense Systems Analysis
- Defense Systems Management
- Executive MBA (DL)
- Financial Management
- Information Systems Management
- Material Logistics Support
- Manpower Systems Analysis
- Program Management (DL)
- Supply-Chain Management
- Systems Acquisition Management
- Transportation Management

Graduate School of Engineering and Applied Sciences (GSEAS)

GSEAS provides advanced education in engineering and applied sciences while developing technological advances with strict application to DOD needs, thus setting it apart from civilian graduate schools of engineering. It is focused on preparing the next generation of U.S. and international leaders, military and civilian alike, for the uncertainties and challenges of a rapidly changing technological world.

- Applied Mathematics
- Combat Systems Sciences and Technology
- Electronic Systems Engineering (residential and DL)
- Mechanical Engineering for Nuclear-trained Officers (DL)
- Meteorology and Oceanography
- Meteorology
- Naval/Mechanical Engineering
- Oceanography
- Operational Oceanography
- Reactors–Mechanical/Electrical Engineering (DL)
- Space Systems Engineering
- Space Systems Operations (residential and DL)
- Systems Engineering (residential and DL)
- Systems Engineering Management (DL)
- Undersea Warfare
- Underwater Acoustic Systems (DL)

Graduate School of Operational and Information Sciences (GSOIS)

GSOIS delivers graduate-level education and conducts cutting-edge research in four non-traditional knowledge domains responsive to U.S. military needs: information science and technology, military computer science, military operations analysis and research, and special operations and related defense analysis.

- Applied Cyber Operations
- Computer Science (residential and DL)
- Computing Technology (DL)
- Cyber Systems and Operations
- Cost Estimating and Analysis (DL)
- Electronic Warfare Systems (International)
- Human Systems Integration
- Identity Management and Cyber Security (residential and DL)
- Information Sciences
- Information Systems and Operations
- Information Systems and Technology
- Information Warfare
- Joint C4I Systems
- Joint Information Operations
- Joint Operational Logistics
- Modeling, Virtual Environments, and Simulation
- Operations Analysis
- Remote Sensing
- Software Engineering (residential and DL)
- Special Operations
- Systems Analysis (DL)

Office of the Provost

The Office of the Provost provides oversight to a specialized degree program that leads to a master of science in systems engineering analysis. Students benefit from cross-disciplinary course offerings and research opportunities found in GSEAS systems engineering and GSOIS systems and operational analysis curricula.

- Systems Engineering Analysis

STUDENT POPULATION

The student body consists of U.S. officers from all branches of the uniformed services, civilian employees of the federal government, and international military officers and government civilians. The student population distribution for December 2015 is shown in Figure 1.

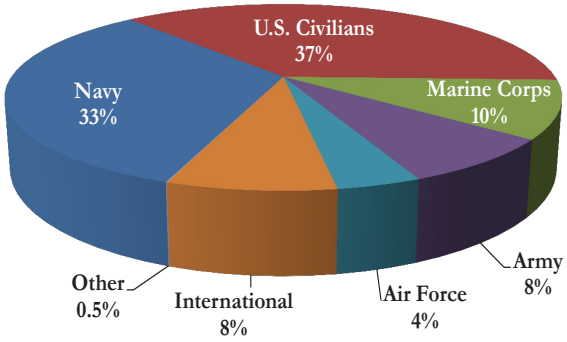

Figure 1: Total enrollment by student type for the first quarter of 2016 (2,725 total). Source: After NPS Academic Affairs Quarterly Enrollment Report, AY2016/Quarter 1.

STUDENT RESEARCH

Independent scholarly work in the form of a dissertation (PhD), thesis (Master's/Engineer), or capstone project is required for most academic programs. Student research projects address issues ranging from the current needs of the fleet and joint forces to the science and technology required to sustain long-term superiority of the Navy and DOD. Guided by faculty advisors, NPS students represent a vital resource within the DOD for addressing war-fighting problems and maintaining cutting-edge expertise, particularly in a time when technology and information operations are changing rapidly. Naval Postgraduate School alumni think innovatively and possess the knowledge and skills to apply nascent technologies in the commercial and military sectors. Their firsthand grasp of operations, when combined with challenging projects that require them to apply their focused graduate coursework, is one of the most effective elements in solving fleet, joint-force, and regional problems. NPS graduate education encourages a lifelong capacity for applying basic principles and creative solutions to complex problems. NPS is also unique in its ability to conduct classified research. Classified theses are available on the NPS SIPRNet.

Source: Naval Postgraduate School Public Affairs Office

DEGREES OFFERED

Curricula meet defense requirements within the traditional degree framework through residential or distance-learning status. All curricula lead to a master of science or art or a master of business administration; additional study may yield an engineer or doctoral degree. Below is a listing of degrees offered at the Naval Postgraduate School.

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
- Systems Engineering
- Systems Engineering Analysis

Engineer

- Astronautical
- Electrical
- Mechanical

Master of Arts

- Identity Management and Cyber Security
- Security Studies

Master of Business Administration

Source: NPS Public Affairs Office

Master of Science

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

DECEMBER 2015 DEGREES CONFERRED

The December 2015 graduating class produced 186 unrestricted dissertations, theses, and capstone project reports as part of the graduation requirement. Figure 2 indicates the distribution of degrees awarded by academic school.

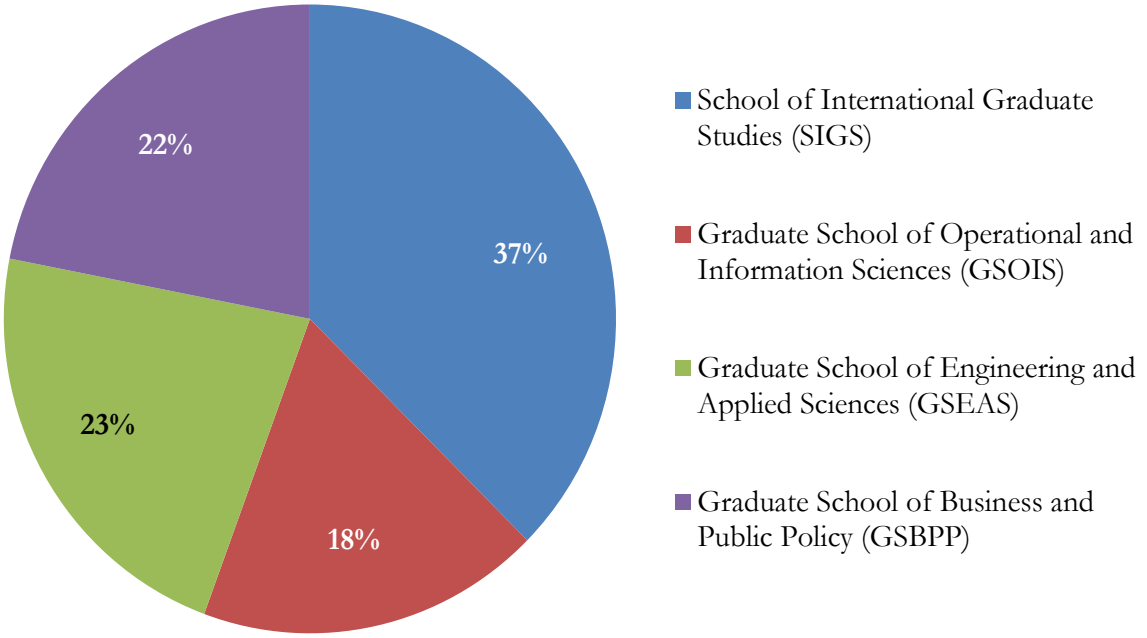

Figure 2. Distribution of degrees conferred by academic school, December 2015 (unrestricted theses)

Source: NPS Public Affairs Office

ACADEMIC AWARDS ANNOUNCED DECEMBER 2015

Many departments honor graduating students for the quality and contributions made by their dissertations, theses, or capstone reports. The following listing recognizes students selected by NPS faculty and military associations for superior academic achievement and outstanding theses.

Campus-wide Awards

- Association of the United States Army, General Joseph W. Stilwell Chapter, Award for Outstanding Army Student: Major Rustin Jessup, USA—Outstanding Thesis: *The Cost of Commonality: Assessing Value in Joint Programs* (second author listed in outstanding thesis section)
- Monterey Council Navy League Award for Highest Academic Achievement: Lieutenant Forrest N. Bush, USN
- Monterey Kiwanis Club Outstanding International Student Award: Lieutenant Commander Darren Benfield, Royal Bahamas Defence Force
- Naval Postgraduate School Outstanding Academic Achievement Award for International Students: Lieutenant Commander Oscar García, Chilean Navy

Graduate School of Business and Public Policy (GSBPP)

- The Army Acquisition Corps Award for Scholastic Achievement: Major Rustin Jessup, USA and Captain Brandon A. Pye, USA
- The Assistant Secretary of the Air Force (Acquisition) Award for Academic Excellence: Master Sergeant John Menanno, USAF, and Captain Clinton Walls, USAF
- Commander Philip A. Murphy-Sweet Memorial Award for Excellence in Acquisition: Lieutenant Commander Christopher Burt, USN
- Conrad Scholar Award for Distinguished Academic Achievement in Financial Management: Lieutenant Commander Theodore Vermeychuk, USN
- Department of the Navy Award for Academic Excellence in Financial Management: Captain Jason Wood, USMC
- The Graduate School of Business and Public Policy Faculty Outstanding International Student Award: Captain Sadik Dogan, Turkish Army, and Ms. Wan Ying Wong, Singapore
- The Louis D. Liskin Award for Excellence in Business and Public Policy: Captain Jason Wood, USMC, and Major Brian Turner, USMC—Outstanding Thesis: *An Analysis of the Impact of Financial Factors on the Well-Being of Military Officers*
- Naval Supply Systems Command Award for Academic Excellence in Management: Lieutenant Craig Dziewiatkowski, USN, and Lieutenant Michael Key, USN—Outstanding Thesis: *Developing a Universal Navy Uniform Adoption Model for Use in Forecasting* (second author listed in outstanding thesis section)
- Rear Admiral Donald R. Eaton Logistics Award for Outstanding Achievement: Capt Todd Hoyt, USMC, and Major Joshua A. Gregory, USMC—Outstanding Thesis: *Inventory Management of Cholera Vaccinations in the Event of Complex Natural Disasters* (second author listed in outstanding thesis section)
- Rear Admiral Thomas R. McClellan Award for Academic Excellence in the Graduate School of Business and Public Policy: Lieutenant Commander Theodore Vermeychuk, USN

Graduate School of Engineering and Applied Sciences (GSEAS)

- Astronaut Captain Michael J. Smith, USN, and Astronaut Commander William C. McCool, USN, Astronautics Award: Lieutenant Brian C. Fields, USN
- Meyer Award for Outstanding Student in Systems Engineering (Distance Learning): Paul A. Bourgeois and Alyson E. Ledder
- Naval Sea Systems Command Award for Excellence in Combat Systems: Lieutenant Michael Price, USN
- Naval Sea Systems Command Award in Naval/Mechanical Engineering: Lieutenant Timothy Ponshock, USN—Outstanding Thesis: *Design and Analysis of an Experimental Setup for Determining the Burst Strength and Material Properties of Hollow Cylinders*

- Space and Naval Warfare Systems Command Award in Electronic Systems Engineering: Lieutenant Owen Brooks, USN
- The Surface Navy Association's Award for Excellence in Surface Warfare Research: Lieutenant Loney Cason III, USN

Graduate School of Operational and Information Sciences (GSOIS)

- AAFCEA John McReynolds Wozencraft Electrical and Computer Engineering Academic Honor Award: Lieutenant Joel Cincotta, USN
- The Hans Jones Award for Excellence in Thesis Research in Special Operations and Irregular Warfare or Security, Stabilization, Transition and Reconstruction (SSTR): CW4 Stephen Dayspring, USA
- The Space Systems Engineering Award for Academic Excellence: Lieutenant Commander Ernesto Villalba, USN

School of International Graduate Studies (SIGS)

- The Curtis H. "Butch" Straub Achievement Award: Mr. Steven Polunsky, Texas A&M Transportation Institute
- Foreign Area Officer Association Award for Excellence in International Affairs: Captain Seth Neville, USAF
- The International Student Award for Excellence in Regional or Security Studies: Lieutenant Colonel Wah Kheng Dean Tan, Republic of Singapore Air Force—Outstanding Thesis: *Fueled by Wealth, Funneled by Politics: The Dominance of Domestic Drivers of Arms Procurement in Southeast Asia*
- The Louis D. Liskin Award for Excellence in Regional Security Studies: Lieutenant Kyle Kendall, USN
- The Outstanding United States Air Force Graduate Award, Department of National Security Affairs: Captain Jeffrey Paquette, USAF, and Captain Seth Neville, USAF
- The Philip Zimbardo Award: Lieutenant Patrice Hubbard, St Petersburg Police Department, Florida

Outstanding Thesis Recognition

- Major James P. Allen, USA; Major Scott A. Bailey, USA; and Captain Brandon A. Pye, USA: *Economic Value of Army Foreign Military Sales*
- Major Mark D. Chang, USAF: *Trolling New Media: Violent Extremist Groups Recruiting through Social Media*
- Lieutenant Robert T. Fauci III, USN: *Power Management System Design for Solar-Powered UAS*
- Major Joshua A. Gregory, USMC, and Captain Christine Taranto, USMC*: Inventory Management of Cholera Vaccinations in the Event of Complex Natural Disasters*
- Major Rustin Jessup, USA, and Major Jamal Williams, USA: *The Cost of Commonality: Assessing Value in Joint Programs*
- Lawrence Keener, Civilian, Vista Research: *Evaluating the Generality and Limits of Blind Return-oriented Programming Attacks*
- Lieutenant Michael Key, USN, and Lieutenant Jeff Legg, USN: *Developing a Universal Navy Uniform Adoption Model for Use in Forecasting*
- Major Donald M. Lee, USA, and Lieutenant Lupei Chou, USN: *The Navy's Superior Supplier Incentive Program: Analysis of Supplier Proposed Benefits*
- Lieutenant-Colonel GS Grégoire O. Monnet, Swiss Armed Forces: *The Evolution of Strategic Thought since September 11, 2001: A Swiss Perspective on Clausewitz, Classical, and Contemporary Theories*
- Lieutenant Keith R. Robison, USN: *A Human Systems Integration Approach to Energy Efficiency in Ground Transportation*
- Captain Simon Sanchez, USA: *Mesh Networking in the Tactical Environment Using White Space Technology*
- Captain Eric Saylors, Sacramento City Fire Department: *Quantifying a Negative: How Homeland Security Adds Value*
- Lieutenant Colonel Chaudhry Saeed Ullah, Pakistan Army: *China's Soft Power: Changing the World Perception*

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ADVANCED DEGREES

Doctor of Philosophy

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DOCTOR OF PHILOSOPHY

DEVELOPMENT OF A LOW-COST METHOD FOR WHOLE-SPACECRAFT ISOLATION OF SMALL SATELLITES

Wenschel Lan–Civilian, Department of the Navy
Doctor of Philosophy in Astronautical Engineering
Advisor: James Newman, Space Systems Academic Group

Force-limited vibration testing (FLVT) is effective in reducing the low-frequency vibration test environment for CubeSats on the Naval Postgraduate School CubeSat Launcher (NPSCuL); however, the CubeSats are still subjected to high-frequency amplifications above 500 Hz from the NPSCuL structure. The excessive, high-frequency vibration has caused test failures and forces CubeSat developers to focus more on surviving environmental testing instead of developing state-of-the-art technology. Whole-spacecraft isolation systems are often used to reduce these amplifications, but they currently exist only for large spacecraft and are too expensive to adapt for small satellites. These limitations motivated the combined use of FLVT and commercial-off-the-shelf (COTS) isolators on NPSCuL as a novel, practical, and low-cost method to reduce vibration levels for small satellites. This method significantly reduces the high-frequency amplification by up to 97%; the root-mean-square acceleration over the entire test frequency range drops by up to 78%. These results should allow more sensitive and complex payloads to gain access to space on future NPSCuL missions and demonstrate how a worst-case environment on a small satellite can be improved. Implementing low-cost, COTS isolators on other small satellites and CubeSat launch applications could be useful as well. Full Text

Keywords: force limited vibration testing, whole spacecraft isolation, CubeSat, ESPA, small satellites

IMPROVED CONCEPTUAL MODELS METHODOLOGY (ICOMM) FOR VALIDATION OF NON-OBSERVABLE SYSTEMS

Sang Sok–Lieutenant Colonel, United States Army
Doctor of Philosophy in Modeling, Virtual Environments and Simulation
Advisor: Eugene Paulo, Department of Systems Engineering

This dissertation expands the current view of development and validation of conceptual models (CoMs) of non-observable systems (NOSes) by using systems engineering (SE) and systems architecture (SA) methods during the model development process (MDP). A MDP is used to ensure that the models are validated and represent the real world as accurately as possible. There are several varieties of MDPs presented in literature, but all share the importance of the CoM. The improved conceptual model methodology (ICoMM) is developed in support of improving the structure of the CoM for both face and traces validation. The utility of ICoMM is demonstrated through the building of functional, physical, and allocated architecture products that improve the structure of the CoM for traces validation. ICoMM also incorporates a value model to ensure subject matter experts' (SMEs') values are documented early in the MDP for face validation. A well-constructed CoM supports model exploration of NOS when operational validation is not feasible. This dissertation uses a humanitarian assistance/disaster relief (HA/DR) scenario to demonstrate ICoMM's ability to ensure docu-

mentation of SMEs' values and that the structure of the COM links SMEs' values to the fundamental objective. Full Text

Keywords: modeling and simulation, conceptual models, systems engineering, systems architecture, non-observable systems, model validation, model development process, humanitarian assistance, disaster relief

DIAPYCNAL TRANSPORT AND PATTERN FORMATION IN DOUBLE-DIFFUSIVE CONVECTION

Erick Edwards–Lieutenant Commander, United States Navy
Doctor of Philosophy in Physical Oceanography
Advisor: Timour Radko, Department of Oceanography

This work analyzes the role of double-diffusive convection in constraining diapycnal velocity in the mid-latitude thermocline and in the initiation and maintenance of the deep convection associated with polynya and sea ice thinning events. Previously, no comprehensive high-resolution modeling studies of the possible role of double-diffusion in these areas have been conducted. A series of simulations using a numerical, multi-scale, MPI-based general circulation model is presented to remedy this dearth of knowledge. The effects of turbulent-dominated and purely double-diffusive regimes are compared to dual turbulent/double-diffusive systems and results are used to assess the likely roles of double-diffusion in constraining diapycnal velocity and delaying convection onset in high-latitude regions of marginal water column stability. High-resolution numerical modeling indicates that when both double-diffusion and turbulence are present, the constraints on diapycnal velocity loosen (tighten) with the increase of the fraction of the overall mixing attributed to turbulence (double-diffusion). The results of this study also indicate that double-diffusion could play an important role in delaying the onset of deep convection in the vicinity of Maud Rise in the eastern Weddell Sea, and may contribute to polynya formation and the persistence of interannual sea ice thinning. Full Text

Keywords: double-diffusion, diffusive convection, salt fingering, diffusive flux, diapycnal velocity, Weddell Sea polynya

WAR ON THE CHEAP: U.S. MILITARY ADVISORS IN GREECE, KOREA, THE PHILIPPINES, AND VIETNAM

Brian O'Lavin–Commander, United States Navy
Doctor of Philosophy in Security Studies
Advisor: Daniel Moran, Department of National Security Affairs

Following the Second World War, the United States assumed the mantle of world leadership from Great Britain and faced two concurrent pressures on the world order: communism and anti-colonialism. Confronted with the responsibility of containing the global menace, President Harry Truman promised U.S. military advice and assistance to free nations fighting against oppression. An analysis of the U.S. advisory missions in Greece, Korea, and the Philippines shows a pattern of perceived success that overshadowed the operational and strategic environments in which these missions took place. This pattern contributed to a misguided belief that advisors would be sufficient to fix South Vietnam's fundamental flaws. Unable to persuade South Vietnam to implement changes that would make it more effective, but unwilling to walk away, Washington stayed the advisory course in Vietnam when all signs were pointing toward its inability to affect the internal situation's most critical elements. In Vietnam, the United States discovered that the model it had previously tested—and perhaps thought perfected—failed in the face of the most motivated anti-colonialist communist

foe it faced during the Cold War. This paper challenges the contemporary mythology of America's early advisory efforts and the true efficacy of advisors in general. Full Text

Keywords: advice, assistance, foreign internal defense, security force assistance, Vietnam War, Greek Civil War, Huk Rebellion, Korean War, KMAG, JUSMAGP, JUSMAPG, MAAGV, military advisors, James Van Fleet, Edward Lansdale, Ngo Dinh Diem, Ramon Magsaysay, Samuel T. Williams, Lionel McGarr

UN-BUILDING BLOCKS: A MODEL OF REVERSE ENGINEERING AND APPLICABLE HEURISTICS

Jorge Garcia–Commander, United States Navy
Doctor of Philosophy in Systems Engineering
Advisor: Robert Harney, Department of Systems Engineering

Reverse engineering is the problem-solving activity that ensues when one takes a human-made system, whole or in part, and attempts—through systematic analysis of its physical characteristics and other available evidence—to answer one or more of the following questions: What is this for? What does it do? How does it do it? What is inside it? How was it made? A model developed from a synthesis of the technical literature is used to infer modes of failure in the process of reverse engineering and identify and catalog applicable experience-based techniques known as heuristics. The model is then cast in an executable formal language in order to further test its assumptions, and explore its implications. Hands-on, historic, and virtual case studies are used to validate and refine the model. The modes of failure, heuristics, and the model itself in its original and formal language expressions, introduce a new descriptive terminology of reverse engineering and provide a new framework to interpret real world reverse engineering activity. Full Text

Keywords: systems engineering, reverse engineering, heuristics, process modeling

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MASTER OF ARTS

Security Studies

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MASTER OF ARTS
IN
SECURITY STUDIES

UNGOVERNED SPACES AND THE SURVIVAL OF TERRORIST GROUPS IN AFRICA: A CASE STUDY OF THE LORD'S RESISTANCE ARMY

Africano Abasa–Major, Ugandan Army
Master of Arts in Security Studies (Combating Terrorism: Policy & Strategy)
Advisor: Carolyn Halladay, Center for Civil-Military Relations
Second Reader: Cristiana Matei, Center for Civil-Military Relations

Uganda's location in a region plagued by armed conflict entails ongoing security challenges. The situation becomes even more complicated when the various armed groups/insurgencies enjoy the breakdown of security, limited governance, and lack of control of vast territories where they operate. This thesis examines the role of ungoverned spaces and how they facilitate the survival of terrorist groups in Africa. It further seeks to evaluate policy prescriptions available to ameliorate the problem of ungoverned spaces. To answer these questions, this thesis uses the Lord's Resistance Army as a case study and analyzes other violent extremist groups—Al-Shabaab, Al Qaeda in the Maghreb, and Boko Haram—in relation to ungoverned spaces. The study reveals that instability emanating from ungoverned spaces is contagious and can recur even when it appears to have been contained. Although interventions through bilateral, regional, and multilateral mechanisms may offer some orderliness in ungoverned spaces, the real solution may lie in addressing the latent causes of violence and instability. These measures include embracing democratic practices and economic empowerment, and strengthening government institutions so that states are functional—and spaces are governed. Full Text

Keywords: ungoverned spaces, Uganda, LRA, terrorism, counterterrorism, Al-Shabaab, AQIM, Boko Haram, governance, intervention, Great Lakes region, international community

ENERGY CRISIS IN PAKISTAN

Malik Abbas–Lieutenant Colonel, Pakistan Army
Master of Arts in Security Studies (Combating Terrorism: Policy & Strategy)
Advisor: Robert Looney, Department of National Security Affairs
Co-Advisor: Siamak Naficy, Department of Defense Analysis

It is a universal phenomenon that the socio-economic progress of a state is significantly dependent upon the performance of the energy sector, as the energy sector drives the engine of growth and development in agricultural, industrial, and defense sectors, in addition to impacting domestic users. In Pakistan, the increasing gap between the demand for, and the supply of, energy has brought economic progress to a standstill. A number of industries have been closed due to this increasing gap, which is expected to grow even further. Despite huge indigenous potential and its geographical significance as a potential energy corridor between the Middle East and Central Asia, Pakistan's energy sector fails to secure its energy needs. The goal of this thesis is to evaluate why Pakistan's energy crisis is worsening day by day, and how the country can best secure its energy needs. Full Text

Keywords: energy crisis, energy security, gas pipelines, governance, coal, economy, resources, policies, oil and gas, renewable energy, tariffs, regional security

SAUDI ARABIA'S IMPLEMENTATION OF SOFT POWER POLICY TO CONFRONT IRAN'S OBVIOUS THREATS

Abdullah Khuliyf Alanazi–Colonel, Saudi Arabia National Guard
Master of Arts in Security Studies (Strategic Studies)
Advisor: James Russell, Department of National Security Affairs
Second Reader: Robert Looney, Department of National Security Affairs

The American scholar Joseph Nye was the first to coin the term "soft power." The soft power of a country is based on three resources: the culture, the value of internal policy, and the strength of the foreign policy. In international politics, soft power is among the ways in which success can be achieved without hard power. The concept of soft power has become an integral part of today's language for Saudi Arabia's political leaders, who use soft power to confront challenges with Iran. Such a concept has to be maintained for Iran to stop increasing its influence in the region. This thesis explores Saudi Arabian soft power aimed at counteracting challenges presented by Iran's hegemonic ambitions in the Middle East. Accordingly, the thesis explores the tools at Saudi Arabia's disposal that could enable it to counter Iran's ambition of dominating the Middle East and the rest of the Arab world. Full Text

Keywords: Saudi Arabia, Iran, soft power, challenges

THE ASEAN POLITICAL-SECURITY COMMUNITY: ENHANCING DEFENSE COOPERATION

Aminuddin Albek–Lieutenant Commander, Indonesian Navy
Master of Arts in Security Studies (Strategic Studies)
Advisor: Michael Malley, Department of National Security Affairs
Second Reader: Daniel Moran, Department of National Security Affairs

For more than three decades after its inception in 1967, the Association of Southeast Asian Nations (ASEAN) was reluctant to institutionalize multilateral defense cooperation because it wanted to avoid becoming a military alliance or a defense pact. Instead, its members limited themselves to bilateral forms of defense cooperation with each other. However, at its 2003 Summit, ASEAN established the ASEAN Security Community (later changed to the ASEAN Political-Security Community), with a goal to enhance its defense cooperation to a multilateral scope. Why did the member states agree to this change? This thesis finds three reasons that ASEAN agreed to pursue multilateral defense cooperation. First, the main security challenges faced by ASEAN members had changed from traditional to non-traditional forms. These non-traditional threats are transnational in nature and difficult for a single state to solve. Second, in comparison to these threats, ASEAN members' defense capabilities were large enough to make a difference. And third, mutual suspicions among these countries had declined over time, so they were more willing to cooperate with each other. Therefore, ASEAN established the ASEAN Defence Ministers' Meeting (ADMM) for intramural interaction and the ASEAN Defence Ministers' Meeting-Plus (ADMM-Plus) for external engagement. Through these arrangements, the members work together to achieve the ASEAN Political-Security Community. However, their cooperation remains limited to exercises against non-traditional security threats, and it seems unlikely that this new commitment to multilateral defense cooperation can be used in response to potential traditional security threats in the South China Sea or elsewhere in the region. Full Text

Keywords: ASEAN, Southeast Asia, security challenges, traditional security threats, non-traditional security threats, bilateral, multilateral, defense cooperation, ASEAN Political-Security Community, ASPC, ADMM, ADMM-Plus

WHAT CAN HISTORY TEACH US? A COMPARATIVE HISTORICAL ANALYSIS ON THE RESERVE OFFICER TRAINING CORPS AND THE DEPARTMENT OF HOMELAND SECURITY

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Second Reader: Meredith Kleykamp, University of Maryland

This thesis examines an institution that has been educating, providing leadership training, and commissioning the vast majority of U.S. military officers for nearly 100 years: the Reserve Officer Training Corps (ROTC). This program was formed and shaped over nearly a century through conflict, military necessity, and political maneuvering. Through the incorporation of a historical comparative lens, this program's mechanistic and temporal conditions are captured to provide lessons learned for other entities searching for an educational identity. One such organization that is struggling to establish a preparatory program and identity is the Department of Homeland Security (DHS). When looking at the two case studies side by side, it is easy to see that they do indeed share commonalities in organizational structure, need, and mission. The findings from this thesis offer evidence that the DHS is growing in educational parallel to ROTC, while suffering from many of the same growing pains the Department of Defense did while trying to establish its educational roots. This thesis tracks conditions that shaped the ROTC we know today, while simultaneously highlighting the deficiencies the DHS is facing. It also lays the path for future work that could call for a similar analog as the ROTC for the DHS. Full Text

Keywords: homeland security undergraduate education, DHS retention, DHS training, historical method, HS undergraduate debate, Reserve Officer Training Corps, ROTC, Junior Reserve Officer Training Corps, JROTC, Air Force Reserve Officer Training Corps, AFROTC, Army Air Forces

U.S. MILITARY AVIATION MISHAPS IN JAPAN AND OKINAWAN POLITICAL CONTROVERSY

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This thesis investigates the significance of U.S. military aviation mishaps in Japan. Such accidents routinely create political controversy in Okinawa, but some incidents draw more attention or ridicule than others. This study evaluates the conditions that shape the variation in how damaging aviation mishaps are to the maintenance of American bases, which are crucial to American regional strategy. Using qualitative methods, this research analyzes five U.S. military crashes in Okinawa: the 2004 CH-53 crash at Okinawa International University, the 2013 HH-60 Air Force crash near Camp Hansen, the 1988 CH-46 crash in Kunigami, the 1992 CH-46 crash at Marine Corps Air Station (MCAS) Futenma, and the 1959 F-100D crash at Miyamori Primary School. This study concludes that the four most significant crash factors in Okinawa are whether a crash occurred in a township, whether civilian fatalities/injuries were involved, whether there was a cluster of recent U.S. military accidents, and whether American post-crash public relations was poor. An accident involving MCAS Futenma or the U.S. Marines will be more highly politicized. Thus, a Futenma-based aircraft crashing into the township and killing civilians represents a worst-case scenario. Three crash factors that the U.S. military has the ability to influence are post-crash public relations, crash-site management, and local interagency cooperation. Full Text

Keywords: U.S. military aviation accidents, American basing presence, U.S.-Japan relations, Okinawan public opinion, political protests, Marine Corps Air Station Futenma, public relations, interagency cooperation, Japanese compensation politics

LUCK IS NOT A STRATEGY: INEFFICIENT COERCION IN OPERATION ALLIED FORCE

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Operation Allied Force, the bombing of Yugoslavia in 1999 over ethnic cleansing in Kosovo, has been used as evidence for many arguments including the value of independent airpower and the use of limited force to achieve coercion. This thesis examines the bases of airpower doctrine and coercion theory, and examines Allied Force as a case of coercion. The North Atlantic Treaty Organization (NATO), dominated by the United States, entered Allied Force without a coherent or complete strategy. Over the course of the air campaign, strategy eventually evolved to achieve the alliance's goals, but this was only possible because of the incredible mismatch between the superlatively capable NATO air forces and the largely obsolete Yugoslav defenses. Allied Force conclusively proved that airpower alone can be used to coerce a target state to concede to diplomatic demands, but it also showed that the United States' military and political leadership had little idea how to execute coercion. To improve the outcomes of future military interventions, it is essential that the United States' military and political leadership devotes far more resources to strategic planning and analysis instead of hoping that operationally proficient military personnel will unknowingly arrive at an effective strategy. Full Text

Keywords: Operation Allied Force, coercion, strategy, airpower, strategic bombing, NATO, U.S. Air Force, Yugoslavia, Serbia and Montenegro, Kosovo, Slobodan Milosevic

WINNING WITHOUT FIGHTING: MILITARY/NGO INTERACTION DEVELOPMENT

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The evolving nature of conflict will require the U.S. military to conduct humanitarian operations more frequently and on a larger scale than ever before. Humanitarian operations require extensive civil-military interaction, and this thesis suggests that the U.S. military is not currently postured and prepared to handle the increasing humanitarian requirement. This thesis analyzes the interactions that took place between the military, the Department of State, and non-governmental organizations throughout three case studies: Operation Unified Assistance (Indonesia, 2004), Operation Unified Response (Haiti, 2010), and Operation United Assistance (West Africa, 2014). Each case study is presented as an independent operation with its own observations and recommendations. The conclusion then identifies four significant generalized items—joint training, militaristic tendencies, integrated communications, and structural systems for collaboration—that challenged civil-military interaction at some point throughout each case. This thesis concludes that a dedicated unit designed to immediately respond and lead the United States government's humanitarian effort should be created including manpower and representation from each U.S. agency that plays a part in humanitarian operations. Legislation similar to the Goldwater-Nichols Act should pave the way for increased interagency interaction and cooperation to prepare the United States for the increasing demand for humanitarian response capabilities. Full Text

Keywords: humanitarian operation, humanitarian response, military, non-governmental organization, civil-military coordination

SOCIAL MEDIA: NEW SPACES FOR CONTENTION IN AUTHORITARIAN SYSTEMS

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What role has social media played in Bahraini political movements since 2011? Does it facilitate and encourage a space for free expressions of ideas, or do the dominant groups utilize social media to promote their agendas and shape social unrest outcomes? This thesis examines how the use of social media altered the course of protests in Bahrain on the heels of the regional Arab Spring movement. Historical protest activities incorporated the free space social media offered to offset the effects of government control and intimidation. This change resulted in a level of prolonged protests and violence never before seen in the country, where the momentum for change hung in the balance between protesters and an authoritarian regime. Social media played a role not only in organization and mobilization of the protests but also in the shaping of international opinion of the growing conflict. In the end, government and protesters alike used social media to further their agendas and minimize the effects of the others. Full Text

Keywords: social media, Bahrain, Arab Spring, social mobilization, Twitter, Facebook

LEVERAGING POISON CENTERS' CAPABILITIES FOR HOMELAND SECURITY

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Despite a nationwide presence, the daily provision of toxicologic emergency care and collaboration within the public health and emergency management arena, the nation's poison centers are underutilized as a resource and as a partner for homeland security. The lack of utilization has clinical and monetary implications across the healthcare and public health enterprise. This thesis investigated the question: do poison centers improve outcomes during public health emergencies? If so, how can they be better leveraged? This thesis's research includes a case study analysis evaluating five functions that poison centers provide: disaster response, situational awareness around emerging threats, communication of these threats to the general public and to health care responders, clinical expertise and reducing the burden on health care facilities by preventing unnecessary emergency department visits, and reducing hospitalized patients' length of stay. The findings of this research demonstrate that poison centers do positively impact outcomes during a disaster. They save lives, reduce health care costs, and provide a unique and valuable resource to the public and professional community. In order to better leverage these capabilities' recommendations based on this research, collaboration should be increased with the Department of Homeland Security, Health Resources and Service Administration, and the Center for Disease Control, as well as with local and state agencies engaged in emergency response efforts. Full Text

Keywords: poison, poisonings, poison centers, toxicology, American Association of Poison Control Centers, toxicosurveillance, disaster response, Upstate New York Poison Center

EL SALVADOR'S CRIME PREVENTION POLICIES—FROM MANO DURA TO EL SALVADOR SEGURO

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This thesis examines Salvadoran policies that addressed the rise in violent crime by gangs. These gangs have posed the biggest security risk to El Salvador since the end of the civil war in 1992. The two biggest gangs are the Mara Salvatrucha (MS-13) and 18th Street, both originating in Los Angeles, CA, and which have proliferated throughout the Americas since the 1990s. Salvadoran administrations have tried to solve the issue in different manners. The Nationalist Republican Alliance administration (1997–2009) created the Mano Dura (Iron Hand) policies in 2003 and Super Mano Dura in 2004 in an attempt to decrease violent crime through repressive police tactics and incarcerations. The result was higher homicide rates. The National Farabundo Martí Liberation administrations (2009–present) negotiated a Gang Truce between MS-13 and 18th Street to move past Mano Dura, leading to a modest decrease in homicides in 2012 and 2013. The results, however, were mixed in the levels of violent crime other than homicides. The truce was broken and replaced by a comprehensive social outreach strategy called Plan El Salvador Seguro. The argument is that after Plan El Salvador Seguro is implemented, the results should reverse the trend of rising violent crime, but it is going to take time—and money. Full Text

Keywords: El Salvador, Mano Dura, Super Mano Dura, anticrime policies, El Salvador Seguro, gangs, gang truce, violent crime, homicide rate

TROLLING NEW MEDIA: VIOLENT EXTREMIST GROUPS RECRUITING THROUGH SOCIAL MEDIA

This paper has been recognized as outstanding by its department

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Second Reader: Mohammed Hafez, Department of National Security Affairs

With the advent and subsequent growth of several new media technologies, violent extremist groups have incorporated social media into recruiting strategies. How are violent extremist groups using social media for recruiting? This thesis explores several new media technologies—websites, blogs, social media, mobile phones, and online gaming—to determine if violent extremist groups rely on social media for recruiting. By comparing the communication of al Qaeda and ISIS, this thesis concludes that violent extremist groups rely on social media, and they employ a wide range of new media technologies to attract and recruit new members. In some instances, virtual interaction still requires face-to-face communication to adequately recruit someone into a violent extremist group. Full Text

Keywords: violent extremist groups, terrorism, al Qaeda, Islamic State of Iraq and Syria, ISIS, recruiting, Internet, new media, social media, communication, narrowcast, broadcast, and propaganda

INTELLIGENCE-DRIVEN BORDER SECURITY: A PROMETHEAN VIEW OF U.S. BORDER PATROL INTELLIGENCE OPERATIONS

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Transnational criminal networks will continue to evolve. The United States Border Patrol's (USBP) intelligence-driven planning, resourcing, and operations need to be responsive to the constant evolution in adversary tactics, techniques, and procedures. To successfully standardize and institutionalize intelligence processes, a comprehensive evaluation was conducted on the current USBP intelligence architecture and intelligence processes. The research compared and contrasted the current Border Patrol intelligence mission with best practices, lessons learned, shared missions, and constraints within the Intelligence Community. The research focused on the synthesis of an intelligence-driven, law enforcement culture, one that will increase situational awareness and understanding of the homeland security ecosystem through efficient planning, collections, exploitation, processing, analysis, production, and dissemination of intelligence-related information to all components of the Department of Homeland Security (DHS). This study examines literature from the DHS strategic documents, Department of Defense intelligence doctrine, Government Accountability Office reports, internal USBP intelligence documents, and subject-matter expert perspectives. This research leads USBP to consider instituting an effective organizational architecture that supports the evolutionary development of its intelligence-driven, border security operations and intelligence-driven, decision-making process. The thesis concludes that the synergy between law enforcement culture and intelligence-driven operations is difficult to achieve, yet once established, it is very powerful, irreplaceable, highly effective, and self-sustainable. Evidence demonstrates that in order to institute a culture of an intelligence-driven border security agency, a more robust approach needs to be standardized to sustain the flexibility and adaptability the USBP requires to address future threats in the twenty-first century. Full Text

Keywords: United States Border Patrol, USBP, intelligence enterprise, USBP agent, intelligence, BPA-I, information sharing, capability gap analysis process, CGAP, Tucson Sector Red Team

COMBATING PARAMILITARY TERRORISM ON THE HOMEFRONT: AN EXAMINATION OF CAPABILITIES AND LIMITATIONS OF U.S. RESPONSE FORCES

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After the September 11 attacks, it was expected that terrorists would continue their innovations in tactics to eventually use high-tech weapons of mass destruction (WMD). Such a WMD attack has not occurred. During the past decade, however, law enforcement and military authorities in the United States and in other countries have faced a number of terrorist attacks carried out using more conventional paramilitary methods with devastating results. This thesis examines the paramilitary terrorist attacks that occurred in Beslan in 2004 and in Mumbai in 2008 in an attempt to understand the threat and to establish the criteria for an effective U.S. response to paramilitary terrorism. It is important to understand that a drastic difference exists between requirements for response to paramilitary terrorism and the more common active shooter protocols. This thesis examines the capabilities and limitations of law enforcement, the National Guard, and the active component (AC) of the military to recommend a response that could be uniformly achieved across the United States. It was determined that the AC of the military is the only capable response force. It requires additional planning,

coordination, and cross-training with regional civilian counterparts for an effective response to a paramilitary attack to be established. Full Text

Keywords: paramilitary terrorism, North Hollywood shootout, Mumbai attack, Beslan school attack, posse comitatus, counterterrorism, domestic terrorism

BEATING THE RED GOLD RUSH: COPPER THEFT AND HOMELAND SECURITY

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This thesis is a comparative case study comparing and contrasting the efforts of three countries (United Kingdom, France, Italy) in their fight to reduce copper wire theft incidents within their nations. The ultimate goal of the research is to highlight the significant threat posed to critical infrastructure from copper thieves and to offer best practice recommendations to policymakers within the United States in response, based on the experiences of the three targeted nations. An analysis of the data reveals that the United Kingdom has had the most success in the reduction of reported copper wire theft incidents primarily due to its multi-faceted approach to the problem, which includes heavy regulation of the scrap recycling industry, centralized law enforcement operations, and enhanced criminal statutes. Full Text

Keywords: copper theft, critical infrastructure, United States, United Kingdom, Italy, France, Amtrak Police Department

INCREASING EFFECTIVENESS AND EFFICIENCY THROUGH RISK-BASED DEPLOYMENTS

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Over the past several years, the Transportation Security Administration (TSA) has begun shifting away from a one-size-fits-all approach to security and toward one predicated upon risk-based security principles. The TSA has also been called upon by the Government Accountability Office and U.S. Department of Homeland Security Office of Inspector General to make risk-based decisions regarding the allocation and deployment of its resources. This thesis established an initial strategic framework with which to evaluate possible options and applied this framework to explore three possible paths forward. The first path was maintaining the current approach to resource deployments. The second path was the collection and analysis of various data points in order to understand the risk environment. The third path was the use of Bayesian game-theory to model adversarial actions. With the framework applied, the use of Bayesian game-theory was identified as the most beneficial to TSA in comparison to the other two assessed options. Strategic recommendations are also provided based upon research into the experiences of other entities with risk-based deployment methodologies. Full Text

Keywords: aviation security, Transportation Security Administration, risk-based security, resource deployment, game theory, big data

THE USE OF AUTONOMOUS SYSTEMS IN EMERGENCY MEDICAL SERVICES: BRIDGING HUMAN INTELLIGENCE AND TECHNOLOGY

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The rapid development of autonomous systems (AS), which are technological systems or processes that either support or replace human decision making, will have a significant impact on emergency medical services (EMS). EMS provider organizations must be prepared to not only interact with AS by having response protocols in place that provide responders with guidance in dealing with these systems during an emergency, but they must also be able to leverage this technology to improve the quality of public safety services. Effective leveraging of AS technologies will enable emergency medical responders to improve efficiency, reduce cost, and provide greater service to those in need. The strengths, weaknesses, opportunities, and threats evaluation of the impact of not embracing AS reveals that weakness in efficiency and safety and threats from the emerging technology-based markets and the users of EMS will be high, that the number of opportunities to improve required emergency response and deliver expedient medical care will be diminished, and that strengths may be nonexistent. The thesis focuses on the analysis of what AS are, how they are used in the provision of EMS today, how they may be leveraged in EMS systems in the future, and which concerns are related to the use of these systems with regard to homeland security. Full Text

Keywords: EMS, emergency medical services, autonomous vehicles, connected vehicle technology, Internet of things, car-to-car technology, car-to-infrastructure technology, autonomous vehicles

AUTONOMOUS AND CONNECTED VEHICLES: A LAW ENFORCEMENT PRIMER

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Co-Advisor: Kathleen Kiernan, Center for Homeland Defense and Security

The introduction of autonomous and connected vehicle technologies will have a significant impact on ground transportation systems in the United States. Law enforcement agencies, legislative bodies, judiciary members, and regulatory bodies across the country will have to make changes in their operational, legislative, and regulatory processes to respond to incidents or events involving these technologies to ensure public safety mandates are satisfied. This thesis examined both technologies to gain an understanding of how they function and to identify by predictive analysis the emerging issues that will impact homeland security, as these systems could potentially be used for nefarious purposes. Securing the technology from cyber intrusion will be of paramount concern to manufacturers and consumers. An examination of a cyber security project to protect police vehicle fleets, undertaken by the Virginia State Police and University of Virginia, will highlight vulnerabilities and offer relevant recommendations to safeguard those assets. This thesis is intended to serve as a primer for law enforcement managers to develop a baseline understanding of autonomous and connected vehicle technology, while stimulating a re-examination of law enforcement roles and responsibilities that will require change as these technologies emerge. Full Text

Keywords: autonomous vehicle, connected vehicle, cyber/cybersecurity, law enforcement

APPLYING SYSTEMS THINKING TO LAW ENFORCEMENT SAFETY: RECOMMENDATION FOR A COMPREHENSIVE SAFETY MANAGEMENT FRAMEWORK

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Co-Advisor: Patrick Miller, Center for Homeland Defense and Security

Each year, approximately 100,000 police officers experience work-related occupational injuries, and more than 100 are killed on the job, in training accidents, routine operations, and emergency response. Many of these injuries and deaths are considered preventable. Although the law enforcement profession has recently begun to place an emphasis on safety, with the goal of reducing injuries and fatalities, no systematic or comprehensive approach to safety management exists to oversee and coordinate safety throughout organizations. This thesis uses best-practice research to examine the safety protocols, practices, and safety management systems implemented in other high-risk professions, such as the fire service, military, and private industry, to determine common components and effective strategies that may be applied to the law enforcement profession. Numerous issues were identified to include the lack of a systemic approach to safety management, lack of a national reporting system for accidents and injuries, lack of safety management training for officers and leadership, lack of safety regulations and standards in the profession, and a failure to dedicate personnel to managing safety in organizations. A recommendation is then offered for a model law-enforcement safety management framework that can be applied to agencies of any size, with the goal of reducing accidents, injuries, and fatalities in the profession. Full Text

Keywords: safety management, police safety, law enforcement safety, safety officer, police safety officer, safety culture, police culture, line-of-duty-deaths, systems thinking, safety management systems, risk management, fire safety officer, after-action review, firefighter culture, OSHA, occupational health and wellness

IMPROVING ACCESS TO MILITARY AIRCRAFT DURING CIVILIAN WILDFIRES

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Second Reader: Giannina Rikoski, City of Colorado Springs, Colorado (Retired)

Wildfires are a growing problem in the United States, and military aircraft are increasingly mobilized in support of civilian wildfire suppression efforts. The photogenic qualities of aircraft distributing a trail of red slurry over a wildfire increase the public's expectation of fire suppression from the air. The problem is that Department of Defense (DOD) aircraft are not dispatched to civilian wildfires in a timely manner, resulting in lives lost, property destroyed, and critical infrastructure damaged. The research question considered by this thesis is, What improvements can be implemented to existing local, state, and federal protocols to provide a more timely response to civilian wildfires by DOD aircraft? The current system is complicated and confusing, involving federal laws, such as the Economy and Stafford acts; DOD doctrine and instruction, such as Defense Support to (of) Civil Authorities and Immediate Response Authority; and civilian agencies, such as the National Interagency Fire Center with its *Military Use Handbook* in the existing process to dispatch military aircraft to civilian wildfires. The results of the study recommend that (1) DOD aircraft be more closely coordinated with civilian aircraft via the IRA for responding to civilian wildfires, and that (2) the Economy and Stafford acts be modified to improve the efficiency with which military aircraft respond to civilian wildfires. Full Text

Keywords: wildfire, aircraft, the Economy Act, the Stafford Act, Department of Defense, National Interagency Fire Center, homeland security, natural disaster

CHINESE CYBER ESPIONAGE: A COMPLEMENTARY METHOD TO AID PLA MODERNIZATION

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In 2013, Mandiant published a report linking one People's Liberation Army (PLA) unit to the virtual exploitation of 11 modern U.S. military platforms. In the last two decades, Chinese cyber espionage has cultivated a significant reputation in cyberspace for its high-volume, illicit exploitation of defense technology. At the same time, the PLA has also rapidly modernized its naval, fighter jet, and air defense technologies. This thesis examines trends in Chinese cyber espionage, PLA modernization, and PLA acquisitions methods to determine—from only open-source information—if the categories are related and, if so, the nature of the relationship. Defense reports suggest there is a strong correlation between China's virtual exfiltration of modern U.S. technology and the PLA's rapid advancement; cyber espionage is the principal driver for PLA modernization. This thesis asks: Does cyber espionage really play a central role in PLA modernization, or does it simply complement alternate procurement methods? This thesis draws from case studies of China's overt acquisitions, indigenous research, and physical espionage operations to demonstrate that the majority of the PLA's modernized military platforms were developed from non-cyber acquisition methods. These studies support this thesis's conclusion that cyber espionage is not the critical component driving forward PLA modernization. Full Text

Keywords: China, Chinese, technology, cyber, espionage, military, modernization, Navy, Air Force, defense, PLA

DOES THE DEPARTMENT OF DEFENSE POSSESS SOLUTIONS FOR THE DEPARTMENT OF HOMELAND SECURITY'S PERSONNEL MANAGEMENT ISSUES?

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Second Reader: Erik Dahl, Department of National Security Affairs

Personnel and management problems are hindering the Department of Homeland Security in its ability to accomplish its mission. Leadership weaknesses, insufficient education and training for employees, and retention problems divide the workforce across many agencies and threaten to undermine the Department's ability to carry out its objective of protecting the United States. Department of Defense (DOD) practices, however, can serve as a model for change. The DOD has demonstrated a finely tuned system of addressing personnel and management concerns, as developed through the creation of the all-volunteer force and the Goldwater-Nichols Act, which restructured the military chain of command. This research explores how the DOD might offer solutions to DHS through lessons learned from 1973 through the early 1990s—some 20 years of hard-earned experience dealing with issues that are very similar to what the DHS is facing in its infancy. Full Text

Keywords: Department of Homeland Security, DHS, leadership, management, personnel issues, Department of Defense, DOD, Goldwater-Nichols, all-volunteer force

COMPARATIVE ANALYSIS OF FUSION CENTER OUTREACH TO FIRE AND EMS AGENCIES

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Second Reader: John Donnelly Sr., District of Columbia Fire and EMS Department

Fire and EMS responders have had little involvement with fusion center operations, and this directly impacts the country's safety. Only a handful of fusion centers have integrated the fire and emergency medical services (EMS) responders into the collection, analysis, and sharing of information on homeland security activities. This thesis analyzes the predominant practices of five fusion centers that have integrated fire and EMS responders into their reporting process. The highlighted practices from the study of these fusion centers can be utilized to expand the integration at fusion centers across the country and to further expand the role of the fire and EMS responders in homeland security. Implementing these practices involves the fusion centers' commitment to integration, to cooperation, and to preparedness. Having basic terrorism behavior training, along with suspicious-activity indicator awareness, sets the baseline for fire and EMS agencies to select key decision makers who become the liaison with the fusion center. Sufficient quantities of fusion center liaisons are needed to support the size and number of agencies in the fusion centers' areas of responsibility. Having uniformed senior fire and EMS line officers staffing the liaison positions will expand the trust of the fusion centers' processes while providing more channels for outreach and interaction between first responders and fusion centers. Full Text

Keywords: fire service, fire/rescue, emergency medical service (EMS), fusion center, intelligence liaison officer (ILO), fusion liaison officer (FLO), terrorism liaison officer (TLO), suspicious activity report (SAR), integration, outreach

CASE STUDIES OF PREDICTIVE ANALYSIS APPLICATIONS IN LAW ENFORCEMENT

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Law enforcement executives and policy makers continuously seek out effective strategies to reduce crime. Reducing crime reduces social harm, improves community resilience, and therefore improves homeland security. Before investing in a crime control strategy, police leaders must know if the effectiveness of that strategy has been validated. Predictive policing is one such strategy in use that relies on mathematical algorithms to forecast probable future crime locations and the application of interventions to interdict or prevent crime in those locations. In this thesis, theories and methodologies behind predictive policing are described, and the case study method is used to review current predictive policing practices. The research finds that despite the conventional wisdom that a correlation exists between the implementation of a predictive policing program and a reduction in crime, no evidence indicates that a direct cause and effect relationship exists. This thesis provides law enforcement executives and policy makers with objective research on the effectiveness of predictive analysis in reducing crime and provides recommendations for those evaluating whether to invest time and resources into a predictive policing program. Full Text

Keywords: crime control, predictive analysis, predictive policing, homeland security, community resilience, crime prevention, data mining, criminal justice, police, law enforcement, community policing

MAKING THE NATIONAL SECURITY COUNCIL "BETTER IN THE BAHAMAS" TO RESOLVE ILLEGAL MIGRATION

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The Bahamas' economy depends primarily on tourism. Unchecked crime and cross-border threats jeopardize the country's economic viability. The Bahamian government must find the solution for safeguarding the country's relatively high standard of living. Nonetheless, no national security policy has been forthcoming for the yet-developing small island state just fifty miles off the Florida coast. Central to a secure Bahamas is instituting a comprehensive national security strategy aimed at mitigating threats to national security. More direct involvement of the National Security Council (NSC) with improved civilian control and leadership will better coordinate national security. Such an outcome will bring focus to the unrelenting Haitian problem that results from illegal Haitian immigration to The Bahamas. This thesis examines how the NSC and its processes might optimally engage to realize strategic-level resolutions to the country's challenges. Both strategic and operational recommendations are offered to mitigate the Haitian problem. It is concluded that while The Bahamas has strong institutions, its hesitancy in developing a comprehensive and coherent national security strategy will prove detrimental if not remediated. Bahamian authorities will then be less reflexive and more assertive in seeking to reduce national security threats to the island nation. Full Text

Keywords: The Bahamas, national security council, civil-military relations, tourism, opportunistic maritime criminality, national security strategy, national insecurity, U.S.–Bahamian relations, Haitian migration, transnational and domestic crime

THE PURSUIT OF A FAILED U.S. DRUG POLICY IN LATIN AMERICA

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This thesis examines why U.S. counterdrug policy in Latin America focuses primarily on the supply side of the drug trade despite the policy's showing minimal effectiveness and in most cases making the region more volatile. To accomplish this objective congressional testimonies pertaining to U.S. drug policy in Latin America were reviewed in an attempt to find what factors influence politicians' policy recommendations. The findings from the congressional testimony reviews revealed that politicians were more inclined to align or disagree with the political party that held the presidency based on their own party affiliation. Additionally, SOUTHCOM posture statements and the QDR's were examined to see how the military leadership viewed and or argued for funding to stop the supply side of the drug trade in Latin America. Military leaders placed increased importance on the counterdrug mission as it pertained to terrorism and during times of financial uncertainty. To break the cycle of supply-side counterdrug policies in Latin America, politicians and military leadership should focus on domestic demand-side counterdrug policies. Demand-side counterdrug policies have proven effective both in the U.S. and abroad. Overall, they are less costly, both financially and in terms of human lives. Full Text

Keywords: Plan Colombia, drug policy, FARC, QDR, congressional testimony, narco-terrorist

IMPLEMENTATION OF POLICIES TO BRIDGE THE GAP BETWEEN POLICE OFFICER LINE OF DUTY DEATHS AND AGENCY RESILIENCY

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Law enforcement agencies in the United States experience line of duty deaths on a regular basis, but unfortunately, too many agencies do not have a line of duty death policy. This thesis focuses on locating agencies with viable and effective line of duty death policies to assist other agencies in policy implementation. The research found agencies with proactive policies to help guide leadership and subordinate personnel through the many aspects of such tragic events. For comparative analysis, five law enforcement agencies and three fire departments with varying degrees of line of duty death experience were selected. This research examined formal and informal, as well as written and unwritten, line of duty death policies in use by law enforcement agencies and fire departments across the United States and identified viable examples of policies and procedures. This thesis recommends that the St. Petersburg Police Department and other law enforcement agencies without a line of duty death policy take steps to create and implement a policy to enhance resiliency, readiness, and effectiveness. Full Text

Keywords: line of duty death, police, law enforcement, policy, resiliency, grief support, St. Petersburg Police Department

PIVOTS—A BOTTOM-UP APPROACH TO ENHANCE RESILIENCE

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Homeland security is evolving. Past and current linear approaches to preparedness do not focus on improving the resilience of an area post-recovery. Most preparation efforts do not address or consider the high number of small business owners failing due to lack of planning, even though small businesses are sometimes as much as half of the economic life of any given area. To address these challenges, a holistic approach establishes multiple sectors of preparedness. This thesis explores the advantages of a wrap-around services model (similar to a business incubator) to provide entrepreneurs with tools and resources to withstand disaster. Case studies and best practices identify and inform models of preparedness, including community asset mapping, scenario planning, and social network analysis for capacity building within Anytown, USA, when facing natural or man-made disasters. This approach engages entrepreneurs and coordinates already existing models and resources into a cost-effective community asset, since every dollar spent on mitigation saves four dollars in the event of a disaster. Successful response models mobilize support for a more resilient nation, community by community. Full Text

Keywords: PPD-8, whole community approach, resilience, game theory, community asset mapping, scenario planning, social network analysis, preparedness, mitigation, recovery, small business entrepreneurs, incubator, holistic, startup, economic recovery, contingency planning, wrap around services, hybrid

THE DILEMMA OF POROUS BORDERS: UGANDA'S EXPERIENCE IN COMBATING TERRORISM

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This thesis explores how porous borders have exacerbated terrorism in Uganda. Since the last terrorist attack in 2010 by Al Shabaab, Uganda has not experienced a significant terrorist incident. Still, the threat remains real and constant because of the situations on Uganda's porous borders. For example, the Allied Democratic Front (ADF) terrorists still operate cells in the country, and the Lord's Resistance Army (LRA) poses a threat from across the South Sudan–DRC–Uganda border. This thesis looks at how Uganda's law enforcement agencies secure the country without undermining legitimate economic and social activities conducted through the borders. Because porous borders are, by definition, an international concern, this study also explores the regional cooperation and coordination mechanisms in place between Uganda and its regional partners on the one hand, and between Uganda and the international community on the other hand. Ultimately, the study finds that, given Uganda's geopolitical location as a land-locked country, the borders will remain more or less porous. The way forward is to evolve systems that will manage this porosity to the benefit of law and order in Uganda. Full Text

Keywords: porous borders, terrorism, counterterrorism, Al Shabaab, ADF, LRA, ADF, geopolitical location, regional cooperation

WHAT'S IN A NAME: A COMPARATIVE ANALYSIS OF THE UNITED STATES' REAL ID ACT AND THE UNITED KINGDOM'S NATIONAL IDENTITY SCHEME

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Since September 11, 2001, many governments have considered developing national identity management systems. Beyond identification, politicians and proponents of these systems have touted such system benefits as combating terrorism, preventing identity theft, facilitating travel, and combating illegal work and benefit fraud. For these reasons, the United States and United Kingdom both considered variations of these systems. While the United Kingdom passed the Identity Cards Act of 2006 and spent several years developing a national identity management system before ultimately scrapping the scheme in 2010, the United States sought to secure further the existing means of identification—driver's licenses and identity cards—through the passage of the REAL ID Act. Both measures met with widespread resistance. What does an examination of resistance to nationwide identity management schemes in the United States and United Kingdom reveal about the nature of national identity management systems and identity cards, and what does this resistance tell policymakers and security officials who promote such schemes? Through a comparative analysis of the REAL ID Act implementation and the National Identity Scheme, this thesis shows that Anglophone, common-law nations experience the same inhibiting factors, whether or not they attempt to implement a national identity management system or an identity card on a national scale. Full Text

Keywords: personal identity management, national identity management system, national identity card, identity card, nationwide identity system, driver's license, REAL ID Act, national identity scheme, United Kingdom, national identity system, public policy, privacy, civil rights, civil liberties, public acceptance, terrorism, security

A STUDY ON THE DECISION FACTORS IN THE DELAY OF THE ROK–U.S. WARTIME OPCON TRANSFER: FOCUSING ON THE DOMESTIC DETERMINANTS

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This thesis begins by asking why the wartime OPCON transfer period between the ROK and the United States has continuously been delayed. To answer this question, the author studies how domestic politics have affected the continuous delay. To investigate the influence of domestic politics, this thesis first applied Graham Allison's Rational Actor Model (security); second, it applied domestic politics from Allison's bureaucratic politics model; and third, to fill a gap between security (RAM) and domestic politics, this thesis used Robert Putnam's Two-Level Game theory to clarify interconnectivity of international and domestic levels. The result of this study indicates that the security environment is critical and could affect the continuous delay of the wartime OPCON transfer; however, the key actors of those decisions are policy decision makers. Unless the security environment changes drastically, the ROK conservatives and progressives, and the U.S. neoconservatives and pragmatists, will remain key members. The ROK, with its strong ally—the United States—should meticulously prepare the process of the wartime OPCON transfer to maintain the peace of the Korean Peninsula under unexpected political and economic situations, mainly focusing on the future-oriented combined ROK–U.S. military structure. Full Text

Keywords: wartime OPCON transfer, condition-based wartime OPCON transition, ROK–U.S. alliance

USING THEIR OWN PEOPLE AGAINST THEM: RUSSIA'S EXPLOITATION OF ETHNICITY IN GEORGIA AND UKRAINE

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Russia consistently exploits ethnic divides in its foreign policy strategy, specifically against states in its near abroad. Georgia and Ukraine have been on the receiving end of this strategy for most of their post-Soviet history. As a result, the sovereignty of both has been systematically and repeatedly violated by Russia. A comparative study of Georgia and Ukraine, two countries that share a unique historical relationship with Russia but are now ideologically moving outside its orbit, permits a more nuanced view into two distinctive aspects of Russia's exploitation of ethnic divisions: Georgia as an ancient and unique nation located in the crossroads of three continents, and Ukraine as a fellow Slavic country with a shared Russian history fighting to create its own identity. Russia's efforts to exploit ethnic divides fall into six categories: exporting propaganda, manipulating identity, arming insurgents, supplying fighters, exploiting presence, and freezing conflicts. Though Russia has successfully weakened Georgia and Ukraine through these six strategic methods, Russia has struggled to achieve its long-term goals of limiting Western influence, creating a Russian hegemony, and restoring Russia to great-power status. In pursuing these goals, Russia not only irreparably damaged ethnic relationships in Georgia and Ukraine, but also severely tarnished its international reputation. Full Text

Keywords: Russian Federation, Georgia, Ukraine, South Ossetia, Abkhazia, Crimea, The Donbas, ethnicity, ethnic conflict, Ethnonationalism Foreign Policy, strategy, NATO, EU, hybrid war, propaganda, identity, insurgency, frozen conflicts, Ukraine Crisis, 2008 Russo-Georgian War, Vladimir Putin, Viktor Yanukovych

UNSC'S EXPANSION: PROSPECTS FOR CHANGE AND IMPLICATIONS FOR THE REGIONS AND THE WORLD

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The United Nations was formed in 1945 in San Francisco; its founding aim was to avert catastrophes like World War II. The U.N. Security Council (UNSC) is the most powerful organ of the U.N., which is responsible for maintenance of international peace. The five permanent members of the UNSC, collectively referred to as P5, possess veto power. The composition and power distribution among members of the UNSC has remained controversial ever since its existence, and therefore, demand has been raised for changing the council's composition and structure. Since the inception of the U.N., various reform efforts, especially to expand the UNSC, have been attempted from time to time. So far, all have failed. Since 2004, the reform process has gained renewed momentum, thanks to the interest of various influential countries that are seeking a seat at the UNSC for themselves. This thesis examines how expanding the UNSC would affect global security. Which likely effects would current reform proposals, if approved, have in the regions and the world? Finally, the thesis examines the implications for Pakistan and the South Asian region, in case India becomes a permanent member of the UNSC. Full Text

Keywords: UNSC expansion, UNSC reform, enlargement of the UNSC

THE DEPARTMENT OF HOMELAND SECURITY'S PURSUIT OF DATA-DRIVEN DECISION MAKING

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Lack of management integration is hindering the Department of Homeland Security's ability to conduct oversight and perform accurate assessments of its mission support functions. The DHS Under Secretary of Management and the Department's Management Directorate have been tasked with creating a unity of effort aimed at integrating the department's management functions via technology strategies that capture data and use it to make informed decisions. This thesis explores these strategies as the Department makes strides towards removing itself from the GAO's classification of DHS as high-risk—a categorization due in part to DHS's inability to integrate the disparate management information systems in existence during its creation in 2001. The author conducted interviews with past and present senior executives in an effort to comprehensively explore the various strategies used to accomplish the goal of implementing true data-driven decision-making. The result is identification of impediments and facilitators associated with the ability to drive enterprise-wide change. These findings are then applied against a change management analytical framework, Leavitt's Diamond. Recognizing that change cannot happen in a vacuum, the findings are analyzed across the dimensions of Leavitt's Diamond to determine which strategies are most consistently aligned. Ultimately, the results of this thesis are considerations for how the Management Directorate can position and mature its technology strategies in accordance with other organizational dynamics. Full Text

Keywords: organizational change, management integration, DHS Management Directorate, Leavitt's Diamond, systems modernization, data consolidation, data warehousing, business intelligence, systems modernization

UNIFICATION COSTS FOR KOREA AND THE KOREAN PENINSULA

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This research begins with two questions: Can the government of South Korea (SK) overcome the economic burden of Korean unification, and what will the effects of reunification be on the United States and China? This thesis focuses on manufacturing, the food industry, and infrastructure, since these three sectors will be the most important expenditures of a unified Korean government. To develop North Korea's (NK's) economy, the development of these three elements is essential; however, private capital and foreign investment will not come easily, because NK is certain to face political and economic instability in the early stages of unification. By combining SK's technology and NK's cheap labor, Korean unification might start a positive ripple effect throughout the global economy. In addition, the elimination of NK's weapons of mass destruction and nuclear programs will contribute to world peace. In consideration of these effects of Korean unification, this thesis explores the benefits of unification for the two most influential countries in the process: the United States and China. The Koreas must persuade powerful countries that have an interest in Korea by conveying the positive effects of unification. Full Text

Keywords: Korean unification, Korean peninsula, North Korean economy

WHAT ARE WE MISSING? A CALL FOR RED TEAMING WITHIN THE DOMESTIC MARITIME DOMAIN FOR ANTI-TERRORISM PROGRAMS

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As a component of the Department of Homeland Security and the department's lead for maritime security, the Coast Guard is charged with executing the United States domestic maritime anti-terrorism program. It is critical that Coast Guard policy, plans, and tactics maintain pace with the ever-changing risks associated with terrorism. This thesis examines alternative analysis red teaming and its potential value to the Coast Guard. Specifically, it seeks to answer how red teaming can be leveraged to enhance the value of domestic maritime anti-terrorism activities. The research reviews elements of the maritime domain and principles of red teaming, and proposes and provides implementation recommendations for a terrorism red teaming program for the domestic maritime domain. The study revealed that a red team program would be value added to the Coast Guard for domestic maritime anti-terrorism programs. Leveraging the concept of a minimal viable program, the thesis proposes a red team program and strategy to implement the program within the U.S. Coast Guard. The suggested program would be comprised of three elements: physical red teaming, identification of future attack scenarios, and policy red teaming. The thesis further provides insight into the implementation of these programs and suggests a minimal viable program approach to establishing a terrorism red teaming program for the domestic maritime domain. Full Text

Keywords: alternative analysis, red teaming, homeland security risk, domestic maritime domain, maritime terrorism, minimal viable program, social identity theory, port security, Coast Guard

WHAT EXPLAINS ECONOMIC UNDERDEVELOPMENT IN SUB-SAHARAN AFRICA?

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This thesis examines the causes of slow economic growth in Sub-Saharan Africa. In particular, it attempts to identify the links between economic growth and the dual-economic system that exists in most African countries. In doing so, the thesis argues that, without inclusive efforts to lift national or regional economies as one package, the problem with slow growth will persist. In the past, much effort has been oriented toward developing African capitalist economies by focusing on the modern sector while the indigenous or traditional economy that has sustained Africans for generations has been ignored. The main finding of the thesis is that the traditional sector appears to be rejecting any attempts to be conquered by a foreign capitalist system; at the same time, however, traditional economies have not had a good track record for attracting economic growth. In order to grow economies in Africa, the gap between the formal and informal economies will have to be reduced. Full Text

Keywords: inclusive economic growth and development, food security, division of labor, market capitalism, trade and investments

A EUROPEAN IDENTITY: TOO MUCH TO HOPE FOR?

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Right-wing political parties are nothing new to Europe. However, there has been a rise and revitalization among far-right populist parties across Europe over the past two decades. This development does not appear to be a flash in the political pan but a manifestation of deeper trends. Contributing factors include perceived and actual economic hardships, anti-immigrant sentiments, and perceived loss of autonomy under the European Union's umbrella. This thesis analyzes Europe's flirtations with populist parties and the current state of extreme right-wing parties in politics today. Specifically, it analyzes the United Kingdom Independence Party (UKIP) and the Alternative for Germany (AfD) party to determine what the implications are for the success of a European identity becoming the normal status quo—and the consequences if it fails. The thesis concludes that should the extreme right parties continue in their successes, the EU would change radically or even disintegrate, with security implications for the United States. Specifically, if UKIP and AfD are influential in having Britain or Germany exit the EU, the European project of forging a common European identity among EU citizens would be a catastrophic failure and a notable problem for U.S. security, which relies on a stable, prosperous, and unified Europe. Full Text

Keywords: far right, extreme right, UKIP, AfD, European Union, national identity, transnationalism, Eurosceptic, populism, euro

PUTTING THE CRITICAL BACK IN CRITICAL INFRASTRUCTURE

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In the context of national critical infrastructure security and resilience doctrine and deference to our federalist system and the sovereignty it demands, each of the sovereign states and their subdivisions have unilaterally interpreted their roles and priorities while still remaining true to the law of the land and national supremacy as demanded by the supremacy clause in Article VI of the United States Constitution. Each has independently structured, developed, and resourced its own critical infrastructure security and resilience program. Due to this subjective and evolving nature of the critical infrastructure security and resilience mission nationally, a qualitative research method was best suited and used for the foundational nature of this work. A formative program evaluation was conducted through an anonymous online survey to capture the perceptions and views of critical infrastructure professionals across the nation. The survey included an evaluation on the perceptions and views of the business process, program maturity and implementation, as well as the current state of outcomes. This thesis concludes with several key findings and recommendations based on the respondent survey data and analysis. Full Text

Keywords: critical infrastructure, critical infrastructure protection, critical infrastructure security and resilience, homeland security, emergency management, lifeline sectors, resilience, tragedy of the commons, self-organized criticality, defense industrial base

CONSIDERATIONS FOR DOMESTIC LAW ENFORCEMENT IMPLEMENTATION OF A UAS PROGRAM IN THE PROPOSED FAA REGULATORY ENVIRONMENT OF INTEGRATION INTO THE NATIONAL AIRSPACE SYSTEM

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This thesis identifies the potential future mission profile of an unmanned aircraft system (UAS) program within a domestic law enforcement agency after implementation of UAS regulations, a task currently in progress by the Federal Aviation Administration (FAA). First, the author reviews current academic literature and provides analysis on key policy issues of safety, the transfer of risk, and constitutional rights. Then, the author consults the knowledge and experience of individuals responsible for the integration architecture of UAS through an IRB-approved online survey. The survey of these subject matter experts using the Delphi method resulted in the following recommendations: early public engagement and transparency for intended UAS use by law enforcement a policy framework that addresses safe operation and privacy further investment in sense and avoid technology the development of a comprehensive UAS training program This academically rigorous consultation provides law enforcement executives and elected officials the policy implications of initiating a new UAS program and the groundwork to assess existing UAS programs. Full Text

Keywords: unmanned aircraft systems, UAS, law enforcement policy, public safety, airborne law enforcement, drones, civil liberties

ADVANCE OF THE BLACK FLAGS: SYMBOLISM, SOCIAL IDENTITY, AND PSYCHOLOGICAL OPERATIONS IN VIOLENT CONFLICT

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The United States is in an ideological war with violent extremists in the realm of mass communication, but the nature of this conflict is not well understood. This thesis reviewed literature concerning communication principles and the psychology of symbolism, then used qualitative analysis to investigate strategic communication samples to understand how media was used to construct group identity, influence attitudes, and challenge adversaries. Themes critical to narrative construction were identified, as were communication techniques that place emphasis on key ideas in music and film. The roles of symbolism, rituals, and music in human behavior were further researched. This research was then applied to the Islamic State's use of media to influence attitudes and inspire behavior. The ultimate recommendation suggests that the United States approach this conflict as a true war by asserting a communication strategy designed to disrupt violent, exclusionary ideologies. Full Text

Keywords: countering violent extremism, homegrown violent extremism, communication, strategic communication, psychological operations, PSYOP, Islamic State, ISIS, ISIL, Daesh, symbols, symbolism, ritual, music, ideological war, Jungian psychology, Joseph Campbell, Hero's Journey, masks, social control, propaganda, archetypal image, symbolic interactionism theory, social identity theory, assumed identity, impression management theory, virtual state, hybrid threat, morale operations, black ops, identity construction, camera angle, camera position, counter-propaganda, gangsta rap, nasheed, Al-Hayat Media Center, storytelling, narrative, religious music, jazz, blues, internet jihad, jihad, social media, imagery, media richness theory, symbolic terrorism, symbolic warfare, flags, key symbols, deindividuation, beheading, jihadist beheading, hermeneutics, hadith, mujahideen, mujahidin, black flags, black standard, information operations, public affairs, public diplomacy, disrupting insurgency

EFFECTIVENESS OF UNITED STATES–LED ECONOMIC SANCTIONS AS A COUNTERPROLIFERATION TOOL AGAINST IRAN'S NUCLEAR WEAPONS PROGRAM

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Co-Advisor: Zachary Davis, Department of National Security Affairs

The use of financial interdiction to disrupt the development of weapons of mass destruction (WMDs) and their components is an option in the so-called counterproliferation toolkit. The effectiveness of economic counterproliferation interdiction operations is frequently debated; however, counterproliferation operations have successfully stopped some global WMD illicit trade. What is unknown is the degree to which counterproliferation has inhibited further proliferation of WMD. Understanding the effectiveness of U.S.-led financial interdiction efforts against Iran's nuclear weapons program has significant policy implications. U.S. policy makers need to know whether their current financial interdiction operations are effective at stopping or delaying Iran's nuclear weapon program. Evidence from the International Atomic Energy Agency indicates that the current U.S. economic counterproliferation strategy against Iran's nuclear weapons program failed to slow down Iran's nuclear program as uranium enrichment increased despite implementation of further economic sanctions; however, evidence indicates the overall counterproliferation strategy eventually brought Iran to the negotiation table, thus temporarily halting further nuclear weapons development. The final result of U.S.-led

economic counterproliferation policy, along with the use of other counterproliferation tools, ultimately has been effective at disrupting and temporarily halting Iran's nuclear weapons program. Full Text

Keywords: financial interdiction, Iran, counterproliferation, weapons of mass destruction

ASSESSING GRANT ALLOCATION METHODS FOR FEDERAL HOMELAND SECURITY URBAN AREA ASSISTANCE FUNDING

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Federal grant assistance from the Department of Homeland Security (DHS) is critical for building and sustaining preparedness in urban areas. According to the 9/11 Commission Report nothing has been harder for government officials—executive or legislative—than to set priorities, making hard choices in allocating limited resources. The purpose of this thesis is to explore other viable options for allocating grant assistance to urban areas to reduce risk. A case study of the United Kingdom's grant allocation approach provides a comparative analysis for DHS funding. Components of the UK's allocation model, such as directly funding public safety and assessing relative need, could be applied in the United States as a pilot study. Similar to the Department of Justice's direct-funded, community-oriented policing program, DHS funding could be allocated to metropolitan statistical areas to address specific national threat priorities, thereby aligning funding with risk, enhancing regional collaboration, and leveraging limited resources. Full Text

Keywords: Urban Area Strategic Initiative, UASI, Department of Homeland Security grant funding, federal grant assistance for urban areas, homeland security grant program, HSGP, grant allocation factors, risk-based grants, relative risk rankings

THE EVOLUTION OF STRATEGIC THOUGHT SINCE SEPTEMBER 11, 2001: A SWISS PERSPECTIVE ON CLAUSEWITZ, CLASSICAL, AND CONTEMPORARY THEORIES

This paper has been recognized as outstanding by its department

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Since 1991, a long list of scholars has sought to write off Clausewitz as outdated and no longer worth study. In light of the past fifteen years and the absence of a strategic victory in the wars in Iraq and Afghanistan, however, Clausewitz's early retirement is misguided, to say the least. Are the classical theories of Clausewitz on the nature of war—particularly concerning small wars and insurgencies—relevant to contemporary conflicts since September 11, 2001? This study is chiefly based on secondary sources, including books and scholarly articles originating from the work of scholars, political researchers, and think tanks. The research method is qualitative, and it compares, contrasts, summarizes, and critically assesses the adaptations of, and effects on, counterinsurgency policy, strategy, and doctrine in English-speaking nations and Europe. The study shows that the content of Clausewitz's *On War* must be understood in the political and strategic context of the 21st century and not that of the 19th century. Now is the time to put aside visceral reactions against Clausewitz and start to study his work with closer attention, especially at the junction of the military and the political. Full Text

Keywords: Clausewitz, Jomini, Iraq, Afghanistan, COIN, NATO

ASSESSING THE PERFORMANCE MANAGEMENT OF NATIONAL PREPAREDNESS—A CONCEPTUAL MODEL

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Since its creation in 2003, the U.S. Department of Homeland Security (DHS) has allocated more than $40 billion in preparedness and homeland security grant funds to state, local, tribal, and territorial jurisdictions. The primary objectives of these funds are to develop and sustain the essential capabilities necessary to prevent, respond to, and recover from natural and man-caused disasters. Notwithstanding DHS's numerous efforts and initiatives, the ability to quantify and report on the effectiveness of these funds in meeting these objectives falls short of current federal requirements. This thesis examines statutory requirements for assessing and reporting on national preparedness, reviews the history of systems and programs developed by DHS to meet federal performance assessment and reporting requirements, reviews the fundamental principles of performance management, and assesses current elements of the homeland security enterprise. These reviews and assessments formulate a basis to remedy the longstanding shortfalls in preparedness performance management. This inquiry resulted in five overarching findings and twelve recommendations. Full Text

Keywords: national preparedness, Government Performance and Results Act-Modernization Act, GPRA, accountability, performance management, process analysis, performance improvement, performance measurement, performance reporting, strategic planning, strategic alignment, decision-making, data analysis, metrics, program evaluation, transparency, benchmarking, assessment, emergency management, alignment, standards

RUSSIA AND HYBRID WARFARE: IDENTIFYING CRITICAL ELEMENTS IN SUCCESSFUL APPLICATIONS OF HYBRID TACTICS

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With the Russian annexation of Crimea in 2014, hybrid war became a buzzword within political and academic circles. This thesis examines hybrid warfare applications using contemporary and historical examples. The analysis seeks to determine why a country was or was not successful in its execution of hybrid war, and it assesses the geo-political context of cost, benefit, and risk for an aggressor state contributing to its decision to engage in hybrid warfare. The case studies selected include the 1923 German Communist Revolution, Germany's 1938 annexation of Austria, the 2008 Russia-Georgia War, and the ongoing conflict in Ukraine. In each case study, a state went on the offensive, deliberately choosing hybrid tactics to obtain an objective. Ultimately, the thesis objective strives to deepen our understanding of hybrid war, and to extrapolate how one seemingly minor hybrid event can be tied into a broader goal of an aggressor state in its interactions with a defender state. The analysis of the case studies suggests that the length of the conflict, local support, consolidated leadership, and the power balance between the two states involved have contributed to the success of state-sponsored hybrid war. Full Text

Keywords: Russia, Nazi Germany, Austria, Soviet Union, Georgia, Ukraine, hybrid war, non-linear war, hybrid tactics, state-sponsored hybrid war, annexation

CHINESE INFRASTRUCTURE IN SOUTH ASIA: A REALIST AND LIBERAL PERSPECTIVE

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Since 2000, and with increased focus after the announcement of the One Belt, One Road initiative in 2015, China has led the development of a robust infrastructure program in South Asia. Despite being promoted by China as the creation of a win-win environment throughout the Indian Ocean region, realist scholars argue that China's motivations are to utilize this infrastructure to create overseas bases, threaten India's perceived sphere of influence, and increase Chinese influence by challenging the regional order. When viewed through a liberal lens, the initiative creates opportunities for common development, encourages multilateral growth, and addresses failures that current global and regional institutions have been unable to overcome. This thesis assesses both arguments and answers the question: Do China's motivations seem more consistent with a realist or liberal lens? The research found that when assessed under a four-aspect framework that addresses the potential economic, geopolitical, and security related effects of the initiative on South Asia, the liberal argument provided stronger evidence and produced a narrative more aligned with China's economic needs. By deciding through which lens to view China's motivations, great powers in the region can best assess how to address these programs and either challenge or support China. Full Text

Keywords: China, One Belt One Road initiative, South Asia, Indian Ocean region

APPROACHING CAREER CRIMINALS WITH AN INTELLIGENCE CYCLE

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Career criminals have been responsible for a high number of crimes out of proportion to their small numbers. Efforts to reduce the recidivism rate through intervention programs have not been effective. American law enforcement could be more effective if career criminals were targeted for special attention. Many law enforcement formats, such as community policing, problem-oriented policing and intelligence-led policing, are currently in use by American state, local, and tribal law enforcement agencies, and applying the use of intelligence practices to crime in these communities has become a focus of its law enforcement agencies. Can American law enforcement agencies use an intelligence community tool—the intelligence cycle—to deal with career criminals effectively? This thesis studies serious-offender programs and the use of the intelligence cycle by American intelligence agencies in order to create a model merging serious offender programs and intelligence cycles. It investigates serious-offender programs and finds that a lack of focus limited the use of the intelligence cycle within the American criminal justice system. This thesis concludes that the use of the intelligence cycle—specifically the FBI's intelligence cycle's six steps of requirements, planning and direction, collection, processing and exploitation, analysis and production, and dissemination—can assist a law enforcement agency in focusing its efforts on career criminals. Full Text

Keywords: career criminal, habitual offender, habitual serious and violent juvenile offender programs, repeat offender programs, intelligence, intelligence cycle, recidivism

WOULD THE U.S. BENEFIT FROM A UNIFIED NATIONAL STRATEGY TO COMBAT VIOLENT SALAFI JIHADISM?

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Violent Salafi jihadism, or VSJ, motivated the September 11 hijackers, but it is poorly understood by homeland security practitioners and not addressed in U.S. national strategies. This thesis argues that using precise language to define this threat is necessary to achieve a common understanding of the VSJ movement and posits that, based on the resources focused on this threat for the past 14 years, a unified national strategy is warranted. The use of the generic term terrorism has resulted in a vast array of counterterrorism experts, many of whom have little or no understanding of VSJ. An unintended consequence of conflating VSJ with motivation behind other Muslim groups using terrorist tactics is that it feeds the false narrative that VSJ represents Islam. Muslims in Asia and Africa are by far more often victimized by VSJ than is the far enemy in Europe and the United States. This thesis argues that imprecise language referencing the threat from VSJ has led to diluted and sometimes counterproductive, counterterrorism strategies. It also argues that the United States should disaggregate terrorist groups that do not directly threaten the United States and, instead, focus on VSJ with unity of effort across the federal government. Full Text

Keywords: violent Salafi jihadism, VSJ, Salafi jihad, counterterrorism, Wahhabi, countering violent extremism, CVE, radicalization, Islam, Muslim, antiterrorism, terrorism

FROM ROWING BETWEEN TWO REEFS TO SAILING IN TWO OCEANS: THE END OF A THOUSAND FRIENDS, ZERO ENEMIES?

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Under the presidency of Susilo Bambang Yudhoyono (SBY), Indonesia made positive strides in improving its international image, and the country's global stature is on the ascent. These outcomes were largely attributed to SBY's internationalist foreign policy, which adopted a principle of a thousand friends, zero enemies and preferred a multilateral approach to problem solving. Despite the successes gained from SBY's all directions foreign policy, Indonesia's foreign policy has turned nationalistic under Jokowi. In comparison with SBY's preference for cooperation and conflict avoidance, Jokowi's foreign policy decisions have shown a willingness to take unilateral actions and to be less conciliatory toward other countries. What set of factors informed Indonesia's foreign policy during SBY's drive for multilateralism and cooperation among countries and how much of the nationalist turn in Indonesia's foreign policy under Jokowi can be explained by changes in these factors? This thesis examines three domestic factors that have shaped Indonesia's foreign policy under both presidents: the state of Indonesia's economy, public opinion during each president's administration, and the strength of the president's political coalition. This thesis argues that changes in these three domestic factors took place during the period of transition between the two presidents, and Jokowi's interpretation of and response to the changes, subjected to the constraints imposed on a democratic system, caused the nationalist turn in Indonesia's foreign policy. Full Text

Keywords: Indonesia, foreign policy, domestic politics, nationalism, illegal fishing, two-level game, populist

"SENSING DISASTER": THE USE OF WEARABLE SENSOR TECHNOLOGY TO DECREASE FIREFIGHTER LINE-OF-DUTY DEATHS

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After more than 30 years of the American fire service averaging over 100 line-of-duty deaths annually, the technology now exists that can reduce the number of firefighter line-of-duty deaths of cardiac origin. Despite the creation of programs designed to improve firefighters' cardiac health and fitness, no reduction has occurred in the number of firefighters suffering fatal cardiac events. While firefighters can suffer heart attacks or cardiac emergencies anywhere, it has been well documented that firefighters working on the fire ground are exposed to significantly increased risk-factors for the development of coronary heart disease, as well as the exacerbation of underlying cardiac problems. As a result, more firefighters experience signs and symptoms of cardiac complications while on the fire ground than anywhere else while on duty. The development of wearable sensor technology now allows for incident commanders or their assigned designees to monitor the real-time physiologic health and wellness of each and every firefighter operating on the fire scene. Through the use of wearable sensor technology, firefighters can not only have their vital signs and EKG monitored, but this technology will also allow for real-time tracking of their location within a structure and their body motion, speed, and direction of travel. The use of wearable sensor technology in the fire service will have a significant impact on improving not only firefighter health and safety, but when fully developed, will improve other aspects of the firefighting profession, such as search and rescue and fire attack. Full Text

Keywords: firefighter line-of-duty-death, wearable sensor technology, Georgia tech wearable motherboard, ProeTEX, VTAMN, MagIC, firefighter cardiac health

BURMA/MYANMAR'S NONVIOLENT MOVEMENT FAILURES: WHY RESILIENCE AND LEVERAGE MATTER

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Co-Advisor: Anshu Chatterjee, Department of National Security Affairs

Empirical research shows that nonviolent movements tend to be more effective than armed rebellion in influencing regime change, but in Burma (renamed Myanmar in 1989), the people failed twice in overthrowing the military-controlled government. The 1988 student-led movement had nationwide support and incapacitated the government but fell short of severing the military's control of the state. In 2007, the monk-led Saffron Revolution attracted greater international attention but had less domestic participation and crumbled under violent suppression. Using Kurt Schock's analytical framework for explaining the outcome of unarmed uprisings, which he describes in the 2005 *Unarmed Insurrections: People Power Movements in Nondemocracies,* this thesis analyzes both movements in Burma/Myanmar in terms of their resilience and leverage. The comparative case studies of these failed movements show that they were unsuccessful because they lacked resilience due to fragmentation and a lack of leadership, and they lacked leverage due to the regime's unity and its capacity to pursue an effective repressive strategy against the opposition. This study concludes that the regime's unshakable solidarity was the main reason for the movements' failure. Resilience is important for an unarmed uprising to amass support and build strength, but without leverage, its chance of succeeding is low. Full Text

Keywords: Burma, Myanmar, nonviolent movement, pro-democracy movement, failure, resilience and leverage, student activists, civil society, military regime, repressive strategy, Saffron Revolution, monks, sangha, international community, Ne Win, Than Shwe, Aung San Suu Kyi

TEXAS SHOULD REQUIRE HOMELAND SECURITY STANDARDS FOR HIGH-SPEED RAIL

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A private corporation is proposing a high-speed intercity passenger train system to operate between Dallas and Houston using Japanese technology and methods. This project brings with it an array of unique and unprecedented homeland security issues. Train bombings in Madrid and London and attacks on high-speed trains elsewhere raise questions about the security of such transportation. A modern high-speed rail system is a network of potential vulnerabilities, and terrorist groups have identified public transportation as desirable targets. Should the State of Texas require homeland security standards for high-speed rail? A review of the literature reveals the number and consequences of terrorist actions against passenger rail in general and intercity high-speed trains in particular. In addition, it suggests that this writing is the first in its specific application. This thesis places the project in historical and geographical context and reviews potential vulnerabilities using a framework developed by the Argonne National Laboratory. Furthermore, it includes a fault tree analysis and an options analysis through which possible approaches are identified and analyzed. Finally, this thesis finds that the state of Texas should require homeland security standards and provides recommendations for action in the areas of law enforcement, cybersecurity, intelligence, privacy, screening, psychological and mental health effects, and community involvement. Full Text

Keywords: homeland security, high-speed rail, passenger trains, transit, Texas, transportation, terrorism, railroad, trains, intel, intelligence, cyber, energy, Japan, Texas A&M Transportation Institute

IMPACT OF CHANGING EXTERNAL CONDITIONS ON COUNTERINSURGENCY: THE SRI LANKAN EXPERIENCE

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After thirty years of protracted war against the Liberation Tigers of Tamil Eelam (LTTE), Sri Lanka defeated its long-lasting terrorist insurgency in May 2009. Sri Lanka's victory surprised the world. This thesis examines why Sri Lanka's counterterrorism strategy succeeded in 2009 when it had previously failed. Discriminatory government policies, the economic liberalization in the 1980s, and external support fueled Tamil insurgency and terrorism on the island. International settings in the 1990s enabled the Tamil diaspora to consolidate support in the Western world, and LTTE evolved as a hybrid terrorist organization. The behavior of the LTTE and its sympathizers overseas explains how the changing external conditions affected insurgency and terrorism in Sri Lanka. Though globalization and the end of the Cold War created new patterns of transnational terrorism, the aftermath of the 9/11 terrorist attack and the U.S.-led war on terror changed the world's opinion about terrorism. Therefore, this thesis argues that the change in international opinion on accommodating insurgency and terrorism after December 2001 strengthened the cooperation among countries combatting terrorism and had an impact on counterterrorism in Sri Lanka. The Sri Lankan victory proved that counterinsurgency and counterterrorism efforts succeeded after the external conditions changed. Full Text

Keywords: counterinsurgency, counterterrorism, external conditions, ethnic conflict, economic liberalization, external support, fundraising, front organizations, foreign collaboration, globalization, India, LTTE, NGOs, Sri Lanka, suicide terrorism, Tamil diaspora, Tamil Nadu

THE ADVANCED SURFACE FORCE FLEET: A PROPOSAL FOR AN ALTERNATE SURFACE FORCE STRUCTURE AND ITS IMPACT IN THE ASIAN PACIFIC THEATER

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This thesis addresses how an alternate surface fleet composed of aircraft carriers (CVNs), guided missile destroyers (DDGs), and enhanced San Antonio class amphibious transport dock ships (eLPD 17s) of an equal replacement procurement cost compare in 14 measures of capabilities to the planned 2040 U.S. fleet, and how the two fleets compare in Asian Pacific Theater operations. The estimated procurement costs for the proposed eLPD 17 class ship and for the Navy's planned 2040 fleet, and the composition of the equal procurement cost alternate fleet, the Advanced Surface Force Fleet, are determined. The two fleets are then compared using three different matrices: 14 measures of capabilities, the capability to conduct humanitarian assistance and disaster relief operations, and the capability to defeat an adversary in a maritime conflict. The Advanced Surface Force Fleet has more offensive capability than the Navy's planned 2040 fleet. Furthermore, the eLPD 17 provides the Navy with an amphibious ship that can act autonomously in contested environments, with more surface ships that have offensive capability, and with a warship that can perform conventional surface combatant roles while maintaining the ability to perform traditional amphibious lift capabilities. Full Text

Keywords: force structure analysis, sea shield, sea strike, naval expeditionary maneuver warfare, ground and sea vehicle, power projection and integrated defense, expeditionary and irregular warfare, bilateral and multilateral security building, modeling future conflicts, U.S. and allied security policies, planning and strategy

CORRECTING BLINDNESS IN THE NERVE CENTER: HOW TO IMPROVE SITUATIONAL AWARENESS

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Even though success or failure depends on it, situational awareness in emergency operations centers is often poorly prioritized. These centers depend on situational awareness to manage information, coordinate resources, and support executive-level decision making. Having limited or poor situational awareness forces emergency responders to act without all the information needed to make good decisions, leading to poor coordination and ineffective response. In order to identify opportunities for improving situational awareness, this thesis used a qualitative case study approach to examine the level of importance situational awareness plays in the emergency operations center during disasters, and to identify both good and poor practices. Examining four case studies through an organizational-change analytic framework revealed that situational awareness is a system of interconnected elements that include task, structure, people, and technology. This thesis concludes that situational awareness in the emergency operations center can be improved by employing an emergency operations center situational awareness organizational model. Investments must be made in improving all elements of the organization. The research determined that the intelligence process is an ideal model for defining how situational awareness can be established, maintained, and shared. Full Text

Keywords: situational awareness, common operating picture, emergency management, emergency operations center, intelligence process, fusion center, information sharing, decision making, public safety, homeland security, interagency coordination

IDEAL POLICE OVERSIGHT AND REVIEW: THE NEXT PIECE OF THE COMMUNITY POLICING PUZZLE

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There has been independent oversight of law enforcement complaints for over a hundred years in the United States, but recent cases of perceived excessive use of force by law enforcement officers have thrust independent oversight into the national forefront. This thesis set out to discover frameworks, operation methods, and responsibilities of independent oversight of cases involving police excessive use of force by researching the current structures and practices of oversight bodies across America—how they differ from each other, how they are successful—and determining whether there should be a national standard. This research includes oversight boards from small, medium, and large American municipalities with law enforcement agencies whose ethnic diversity is not reflective of their communities. Through the use of a request for information, 12 independent oversight boards were examined. The research suggests there is no consistency across independent oversight boards, no standard for independent oversight board frameworks, and no tracking of their efficiency toward organizational or academically suggested goals. Nor is there a central repository where lessons learned and best practices can be catalogued and distributed. This thesis provides recommendations for future research on independent oversight boards. Full Text

Keywords: police, law enforcement, citizen, independent oversight, review, board, committee, complaint, framework, excessive use of force, Stockton Police Department

QUANTIFYING A NEGATIVE: HOW HOMELAND SECURITY ADDS VALUE

This paper has been recognized as outstanding by its department

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Currently, fire department performance is measured in terms of tangible loss reduction, meaning lower dollar losses of tangible structures and contents equate with greater performance. This metric is flawed because it ignores the unmeasured performance of a fire department that saves nearby at-risk properties and businesses. Therefore, this thesis proposes a new metric: the saved ratio metric. It includes damages and business losses that may have occurred but did not, thanks to the suppression actions of an effective fire department. The saved ratio is defined as the ratio of the value that was saved at an incident versus the value of what was at risk. The total value of what was saved is defined as the total amount of what was at risk minus the total amount of what was lost, and total at risk is quantified using a new network model of at-risk property. Adjacent at-risk property is cast into a network model whereby structures are nodes and adjacency or direct contact is represented by links. Three major conclusions can be drawn from this study. First, the methodology of the real estate and economic industries can be used to quantify tangible and intangible value for structure fires. Second, network theory can be used to map the potential spread of a fire, allowing the user to identify which structures were saved or lost. Third, it is possible to estimate the return on investment added to the community from a fire suppression response model. Full Text

Keywords: fire, public safety, fire loss, fire saves, fire value, value added, quantifying the negative, return on investment, save ratio, Sacramento Fire Department

THE CRIME–TERROR NEXUS AND THE THREAT TO U.S. HOMELAND SECURITY

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Since 2001, violent sub-national groups with disparate ideologies and motivations have been working together to further their objectives. They are collaborating, sharing each other's tactics, and learning from one another's successes and failures. What is the background or historical context of the crime–terror nexus, and what challenge does it present to U.S. homeland security practitioners? This thesis uses a case study approach to examine the history of the nexus between transnational criminal organizations and foreign terrorist organizations. The three case studies are then used as the data for the analysis chapter, which shows the historical and emerging relationships between states and the three violent sub-national groups. The three case studies suggest the activities of these violent sub-national groups are protean in nature; they are best described by analysts as falling into the gray area phenomenon. The three case studies, the analysis, and conclusion of this thesis support the recommendation that more effort needs to be placed on intelligence collection, especially at the domestic and local levels. Full Text

Keywords: crime, terrorism, nexus, convergence, Hezbollah, FARC, cartels, communism, lumpenproletariat, Soviet Union, Cuba, Lebanon, Columbia, Latin America, Middle East, state sponsorship of terrorism, homeland security, intelligence

TEAM COMMUNICATION: THE SOCIAL IDENTITY APPROACH TO COLLABORATION

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This research applies the social identity approach to organizations and the public sector leaders who are instrumental in building the collaborative capacity of their respective groups. Collaboration at all levels of government and with the agencies within those levels of government has been elusive. Traditional studies on collaborative public management have focused on the need for collaboration and failures that occur without collaboration. Past studies in leadership communication have largely ignored the role of social identity in individual behavior. This research blends the social identity approach, collaborative public management, and leadership communication in order to alleviate these issues. The analysis of this research proposes that the social identity approach to organizational behavior gives insight into individual member behavior and thus the behavior of groups and the organization itself. Communication techniques are filtered through the social identity approach in order to identify those techniques that have the greatest chance of creating an identity that is more open to collaboration. Full Text

Keywords: social identity, collaboration, communication, emergency management, interagency response, unity of effort

AN EVALUATION OF THE IMPACT OF THE U.S. REBALANCING POLICY ON THE STABILITY OF NORTHEAST ASIA

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Focusing on potential economic development in Asia and acknowledging the stake of U.S. interests in the region, the United States has tried to foster secure international circumstances and promote cooperation among Asian countries. These U.S. efforts have been manifested most recently in the Pivot to Asia or Asia rebalancing policy. But, contrary to the intention of the rebalancing policy, the security environment of Northeast Asia has become unstable while all actors pursue their respective security and national interests. Given this current situation, this thesis focuses on the following question: Is the U.S. rebalancing policy toward Asia contributing to Northeast Asia stability? To address this question, this thesis tests a hypothesis: The Asia rebalancing policy affects Northeast Asia's instability through the Northeast Asian countries' various reactions to U.S. rebalancing. Using the analyses of the reactions of regional powers in the subcategories of diplomacy, military, and nuclear, this research assesses how Northeast Asian countries interact with the U.S. approach and whether the process of interaction contributes to the rebalancing goals of the United States. Full Text

Keywords: rebalancing, rebalance, Northeast Asia, security, diplomatic, military, nuclear, stability, instability

ENERGY SECURITY IN JORDAN

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This thesis explores if the energy strategy of the Hashemite Kingdom of Jordan, as formulated and executed by the Ministry of Energy and Mineral Resources, will help the country achieve greater energy security. This work qualitatively analyzes the progress in each energy subsector—hydrocarbons, nuclear power, and renewables—on goals presented in the country's strategy and provides further analysis to determine each subsector's potential to play a greater role in future energy development. The primary conclusion is that the goals within Jordan's overarching energy strategy have not been realized, and, consequently, the strategy is not on track to provide energy security. This conclusion is based on three main findings. First, Jordan failed in meeting targets to diversify and exploit domestic hydrocarbon resources—being forced to rely on foreign heavy fuels and running a deficit to meet basic energy needs. Second, the kingdom's nuclear program has not kept up with development milestones and further nuclear progress is hampered by significant political and resource constraints. Third, the administration in Amman has been unsuccessful in fully capitalizing on the abundance of renewable energy resources readily available within Jordan's borders. Full Text

Keywords: Hashemite Kingdom of Jordan, Jordan, energy security, energy strategy, hydrocarbons, nuclear energy, renewable energy

"THE BUCK STOPS WHERE?" ALIGNING AUTHORITY TO STRATEGY IN HOMELAND SECURITY

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This thesis examines how having authority to make decisions in different levels of an organization affects performance. The homeland security implications of this study are that the agencies responsible for homeland security are commonly structured along a rigid hierarchy with authorities accumulated at the top. This slow-moving structure is compared to more decentralized and flexible organizations found in private industry and in some foreign governments. Organizational performance can be predicted by examining how the level of operating environment instability is matched to an organization's decision-making authorities. Using case study analysis, coupled with an extensive literature review, this thesis concludes that the more turbulent the potential environment, such as in the case of a terrorist threat or natural disaster, the more decentralized the organizations should be. The conclusion recognizes the political reality that Congress and executive leaders are not going to easily devolve authority to lower levels in organizations. Therefore, the study concludes with recommendations that agencies dealing in uncertain and changing environments be more loosely coupled at lower levels, allowing more decision-making authority to street-level operators while maintaining ultimate authority at upper levels. Finally, the thesis also recommends additional study of decentralizing strategies specific to homeland security agencies. Full Text

Keywords: decision-making authority, decision making, decentralization, centralized, homeland security organization, prospector-analyzer-defender-reactor, P-A-D-R, National Performance Review, NPR, strategic business unit, (SBU), adaptive cycle, strategic typology

FUELED BY WEALTH, FUNNELED BY POLITICS: THE DOMINANCE OF DOMESTIC DRIVERS OF ARMS PROCUREMENT IN SOUTHEAST ASIA

This paper has been recognized as outstanding by its department

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What drives economically buoyant Southeast Asian nations, enjoying post–Cold War peace, to procure arms in a manner that has observers concerned about a regional arms race? Are these acquisitions driven by threats from within the region or from potential hegemons like China? Alternatively, are the purchases actually driven by domestic factors? This thesis investigates the following four factors to determine which are most powerful in driving arms procurements in Malaysia, Indonesia, and Singapore: availability of resources, domestic politics, external threats, and force modernization. By comparing these three countries, selected for their track record of being the largest defense spenders in Southeast Asia, this research finds that domestic factors (the availability of resources and domestic politics) were the strongest drivers. Consequently, the paucity of externally triggered instances of arms procurements undermines existing assertions of a regional arms race. As such, using Barry Buzan and Eric Herring's arms dynamics model, the situation among the three countries is best characterized as being arms maintenance, with occasional excursions to arms competitions for prestige reasons. Looking toward the future, the worrying trajectories of domestic politics in these countries could supply the conditions that could incite more frequent excursions toward competitive arms dynamics. Full Text

Keywords: Malaysia, Indonesia, Singapore, Southeast Asia, arms procurement, arms modernization, military expenditure, arms dynamic, arms race

COMBINING FACIAL RECOGNITION, AUTOMATIC LICENSE PLATE READERS, AND CLOSED-CIRCUIT TELEVISION TO CREATE AN INTERSTATE IDENTIFICATION SYSTEM FOR WANTED SUBJECTS

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Advancing technology in the field of facial recognition systems (FRSes), closed-circuit television (CCTV), and automatic license plate readers (ALPRs) could make it possible to create a system capable of identifying suspected terrorists, current terrorist watch list suspects, other wanted criminals, and missing persons. This research examines the convergence of these technologies to design an efficient system and improve the speed and accuracy of potential suspect identification. To do so, the thesis examines all systems' basic capabilities, privacy issues or concerns, best practices, possible areas for improvement, and policy considerations. Since the tragedies of September 11, 2001, a large volume of literature related to FRS, ALPR, and CCTV systems has been created. The intent of this thesis is to serve as catalyst for a new security system designed to locate, identify, and apprehend known terrorist watch list suspects and other wanted persons who are traversing the interstate systems in the United States. The goal is to provide another layer of protection and create a deterrent to both criminal and terrorist activity, providing a safer environment for all U.S. citizens. Furthermore, this capability can help locate Amber Alert and Silver Alert subjects. Full Text

Keywords: facial recognition, automatic license plate readers, closed-circuit television, technology, watch list, databases, combined technologist, terrorist identification, Amber Alert, Silver Alert, interstate identification system, London City, OCR reader, photographic database, license plate database, Patriot Act, REAL ID

BUILDING AUTOMATION SYSTEM CYBER NETWORKS: AN UNMITIGATED RISK TO FEDERAL FACILITIES

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Co-Advisor: John Rollins, Center for Homeland Defense and Security

The General Services Administration accesses building-automation system technology that runs federal facility processes such as HVAC, lighting, elevators, and access control via active Internet connections. Currently, these networks are not secure, despite legislation requiring them to be. This thesis investigated whether the Department of Homeland Security (DHS) could leverage existing federal laws, presidential directives, executive orders, government frameworks, and its current cyber and investigative capabilities to establish a strategy to secure federal facility building-automation system cyber networks, or if additional resources are needed. The research uncovered significant vulnerabilities and threats to federal facility building-automation system networks, which, if exploited, could cause a significant impact on the American people, who are dependent on services offered by federal agencies such as the Department of Veterans Affairs and the Social Security Administration. A qualitative research method was used to interpret and analyze government and nongovernment institutional studies and reports, existing cybersecurity frameworks, and scholarly journals to determine which of the policy options offered would provide the best strategy for the DHS moving forward. The thesis concluded that utilizing a combination of private contractors and existing DHS assets would provide the best option. Full Text

Keywords: industrial control systems, building automation systems, cybersecurity, Federal Protective Service (FPS), United States Secret Service (USSS), Industrial Control Systems Cyber Emergency Response Team (ICS-CERT), General Services Administration (GSA), Shodan, EINSTEIN, CSET, DHS, Department of Homeland Security

CHINA'S SOFT POWER: CHANGING THE WORLD PERCEPTION

This paper has been recognized as outstanding by its department

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China has focused on improving its image in the world by relying more on its soft power by investing billions of dollars simply to convince the world to accept its rise in the international system. This paper uses both quantitative and qualitative methods in order to grade and assess China's success with these efforts. While I could not find any significant relationship between China's tools of soft power and its positive perception building in the international community, I could also not find any significant effect of China's rise on its negative perception building among the international community. This may, in and of itself, be a significant result. More specifically, the research reveals that many of the ideals held by China significantly clash with existing international norms—that China lacks credibility in the exercise of its public diplomacy, and that China relies too heavily on the attractiveness of its culture. Full Text

Keywords: China, soft power, Asia, Africa, Latin America, China threat, culture, public diplomacy, foreign policy, peaceful rise, win-win strategy, peaceful development, energy, oil, great power, noninterference policy, resources, Beijing Consensus

CIVIL–MILITARY RELATIONS IN POST-CONFLICT SRI LANKA: SUCCESSFUL CIVILIAN CONSOLIDATION IN THE FACE OF POLITICAL COMPETITION

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Advisor: Anshu Chatterjee, Department of National Security Affairs
Second Reader: Cristiana Matei, Center for Civil-Military Relations

The Liberation Tigers of Tamil Eelam (LTTE) insurgency seeking a separate Tamil state in Sri Lanka was successfully eliminated by the Sri Lankan military in 2009. Toward the end of the conflict, Sri Lanka's armed forces' strength rose to approximately 375,000. The use of the military in nation-building projects was misunderstood by many as militarization of the country. Therefore, this thesis asks these questions: How are the civil authorities maintaining control and effectiveness of the country's armed forces? And how does the civilian government constructively utilize the military and continue to assert civilian rule? These questions were examined as a comparative single case study because in recent history, no civilian government has concluded terrorism through military means. A combination of Samuel Huntington's subjective and objective civilian control theory, Muthiah Alagappa's state coercion theory, and Matei and Thomas Bruneau's CMR dimensions was used. This thesis finds that the civilians used heavy subjective-control mechanisms to ascertain the subordination of military due to political competition. However, the divided political setting prevented the military from entering into party politics, increasing professionalism and antithesis of subjective control, which is objective control. In this situation, Huntington's subjective control did not happen, as the divided political setting and conflict positively contributed to ascertaining civilian control. Full Text

Keywords: civil–military relations, subjective and objective civilian control, state coercion, new conceptualization framework, Ministry of Defense, Sri Lanka military, post-conflict, nation-building, reconstruction, rehabilitation, and reconstruction; roles and missions

COMBATTING COMMERCIAL TERRORISTS: THE PKK CASE

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Money is vital for all terrorist organizations. For some organizations, it is a tool to achieve their goals; for others, it is the objective itself. Terrorists participate in organized crime activities at various levels. Organized crime expert Tamara Makarenko describes the nexus between organized crime groups and terrorist groups. This study expanded her continuum into understanding the Kurdistan Workers' Party (PKK) and its evolution through the organization's financial sources. Using this continuum, this study characterizes the PKK as a commercial terrorist group with strong financial motivations. Its financial motivations are stronger than its political ones. It originated as a pure terrorist organization sheltered by sponsoring states; meanwhile, it continuously improved its capabilities in criminal fields. To more easily conduct its criminal operations, its members maintain their deceptive political rhetoric. By UN standards, the organization can also be identified as a transnational organized crime group by considering the severity of its crimes and its criminal network across the Middle East, Turkey, and Europe. Full Text

Keywords: terror, hybrid, transnational crime, organized crime, financing, sponsoring, Greece, Syria, Armenia, Russia, Makarenko, PKK, Kurdistan Workers' Party, drug trafficking, human trafficking, cigarette smuggling, prostitution, extortion, money laundering, Turkey

NPS
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MASTER OF BUSINESS ADMINISTRATION

ANALYSIS OF THE CAPABILITIES SUPPORTING HUMANITARIAN ASSISTANCE AND DISASTER RELIEF OPERATIONS OF THE INDONESIAN NAVY AND THE UNITED STATES MARINE CORPS MARINE EXPEDITIONARY UNIT

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The 2014 Quadrennial Defense Review emphasized the importance of the Humanitarian Assistance/Disaster Relief (HA/DR) mission in rebalancing the Asia-Pacific region. The coupling of the U.S. pivot to the Pacific and the frequency of natural disasters in the vicinity of Sumatra, Indonesia, focused this research project on the disaster response capabilities of the Indonesian Navy (Tentara Nasional Indonesia Angkatan Laut [TNI AL]) and the United States Marine Corps–Marine Expeditionary Unit (USMC MEU). To examine the gaps between demand and supply, we derived potential demand through the analysis of historical HA/DR scenarios while garnering potential supply through a study of the TNI AL and USMC MEU organic assets. Through this analysis, we created a capabilities matrix to capture and present both the quantitative and qualitative aspects of HA/DR demand and available responder supply. This matrix encompasses the general categories of personnel, material, logistics, and communication, and how these categories affect the availability of medical support, sustenance, habitat, and infrastructure. The completed matrix identified regional capability shortfalls that can be addressed to increase future HA/DR responsiveness. These include the procurement of additional vertical lift, the pre-positioning of critical supplies, and the building of population resiliency. Full Text

Keywords: humanitarian assistance, disaster relief, disaster preparedness, capabilities and competencies, collaboration and coordination, military to military partnerships, military capabilities

ECONOMIC VALUE OF ARMY FOREIGN MILITARY SALES

This paper has been recognized as outstanding by its department

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Co-Advisor: John Dillard, Graduate School of Business and Public Policy

This project identifies current sources of cost savings and cost avoidance generated through Army foreign military sales (FMS). Using a comparative high-low case-study approach, a high-demand volume case and a low-demand volume case were selected in major weapons categories. The cases were analyzed on an internal basis to determine cost savings, cost avoidance, and public value. Once the cases were analyzed and compared against each other, advantages or trends in cost savings, cost avoidance, and public value became apparent. Upon completion of our analysis, we determined that cost savings were usually gained from reduced system unit costs due to higher economic order quantities, reduced overhead costs per unit, and reduced unit costs

resulting from manufacturing learning curves. Additional costs were avoided by reducing gaps in production lines. Furthermore, we determined that the Army's FMS strategy needs improvement in order to take full advantage of these sources of cost savings and cost avoidance. Full Text

Keywords: foreign military sales, learning curve, economic order quantity, cost avoidance

NAVY ADVERTISING: TARGETING GENERATION Z

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This study recommends improvements for Navy advertising efficiency by examining characteristics of recruits defined as Generation Z. Data gathered from five waves of the New Recruit Survey, covering September 2012 to April 2015, were separated into two groups by age, with ages 17–21 representing Generation Z recruits and those over 21 as the Other generation. Four main analysis questions centered on parental influences, social media habits, and advertisements received or viewed by the recruits. Our research found that Generation Z places a high value on parental input, suggesting that advertising directly to parents may be a viable option. The research also showed that recruits recall seeing Navy advertisements on television and on the Internet far more than on any other medium; all new recruits, on average, consume advertising media the same way across different formats; print readership (mediums such as newspapers, magazines, and books) seems to be declining over time. Further research should continue to use the New Recruit Survey and link responses to the Navy's 3C1L Recruiting and Advertising budget. Full Text

Keywords: Generation Z, advertising, Navy recruiting, New Recruit Survey

ARMY INITIAL ACQUISITION TRAINING: AN ANALYSIS OF COSTS AND BENEFITS

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Master of Business Administration
Advisor: Jesse Cunha, Graduate School of Business and Public Policy
Co-Advisor: Nicholas Dew, Graduate School of Business and Public Policy

This research estimates the costs of training and educating Army Acquisition officers using three different courses of action. We analyze the most cost effective means for an officer to earn a graduate degree, complete military education level four and satisfy technical training requirements of the Defense Acquisition Workforce Improvement Act. The most cost-effective alternative is to accomplish these concurrently while attending the Naval Postgraduate School (NPS). We also informally assess that, relative to the alternative courses of action, the NPS alternative has more benefits due to the defense focus of the degree and because all of the educational requirements are completed in the shortest amount of time, which benefits the Army. Our research provides senior leaders's recommendations for the least costly way of developing a highly trained Acquisition Corps. Full Text

Keywords: cost benefit analysis, Army acquisition, acquisition education, CBA, DAWIA

ANALYSIS OF SOURCE SELECTION METHODS AND PERFORMANCE OUTCOMES: LOWEST PRICE TECHNICALLY ACCEPTABLE VS. TRADEOFF IN AIR FORCE ACQUISITIONS

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Brett Barnes–Captain, United States Air Force
Matthew Comer–Captain, United States Air Force
Master of Business Administration
Advisor: Karen Landale, Graduate School of Business and Public Policy
Co-Advisor: Rene Rendon, Graduate School of Business and Public Policy

As part of procurement planning, government acquisition teams must select a method by which proposals will be evaluated. The two most common methodologies are lowest price technically acceptable (LPTA) and tradeoff. There is a commonly held anecdotal belief that an LPTA approach results in a shorter procurement administration lead time (PALT) but also tends to provide the government with an inferior product or level of service. Conversely, it is believed that a tradeoff approach will yield a better outcome but will also have a longer PALT and demand additional resources. The objective of this research is to analyze whether a relationship exists between source selection methods (LPTA or tradeoff) and the level of resulting contract performance outcomes. Performance outcomes include Contractor Performance Assessment Reporting System (CPARS) ratings, Earned Value Management (EVM) outcomes, and PALT. Multivariate and univariate analysis of covariance (MANCOVA and ANCOVA) techniques were used to determine whether there are differences in resulting performance outcomes based on source selection methodology. Findings indicate that a tradeoff approach may result in more positive performance outcomes. There is also evidence that suggests that PALT is not significantly affected by the methodology. Full Text

Keywords: LPTA, Lowest Price Technically Acceptable, tradeoff, best value, source selection

AN INQUIRY INTO THE RESILIENCE OF U.S. NAVY RECRUITS

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Master of Business Administration
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Co-Advisor: Frank Barrett, Graduate School of Business and Public Policy

The purpose of this study is to develop a better understanding of resilience in U.S. Navy recruits as they go through basic training. We seek to examine factors that contribute to higher or lower levels of resiliency. This study surveyed 299 U.S. Navy recruits to measure resilience and its constructs at four time intervals to examine relationships, trends, and any significant changes. This project used quantitative analysis techniques to surface factors relevant to increasing resiliency. Our results provide insight to increases in resilience trends and a path model, which investigates causation. Resilience trends demonstrate the possibility to increase resilience capacity through external factors. The important takeaway is we believe results further affirm that resilience may be learned and is not entirely a personality trait. Additionally, a path model found leadership moderated through cohesion and identification can positively impact division resilience. Our results also provide insight for recommended interventions that will focus on leadership, cohesion, and positive framing to increase the resilience capacity of new recruits. We feel that building resilience is essential to producing Sailors that are always ready to execute the Navy's mission. Full Text

Keywords: naval training command, recruits, basic training, resilience, leadership, cohesion, identification

POTENTIAL COST SAVINGS AND COST AVOIDANCES ASSOCIATED WITH SECURITY COOPERATION TRAINING PROGRAMS

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In this project, I examine the current security cooperation and assistance efforts in the U.S. Africa Command area of responsibility with a particular focus on training of foreign military forces under 10 U.S. Code § 2282. Specifically, I analyze whether the cost of such training programs is cheaper using contracted personnel versus uniformed military personnel. The costs of contractor-provided training come from the Defense Security Cooperation Agency. Using the Department of Defense's Financial Management Regulation, I priced the contractor provided training as if uniformed personnel had performed it to estimate the cost of provision using military personnel. Comparing the two estimates, I found that, in all cases, the contractor-provided price was significantly higher than the cost of uniformed personnel. While this study suggests that contracted services are not always cheaper than using military personnel, future research should incorporate better estimates of the opportunity cost of using uniformed personnel that may change the cost calculations. Full Text

Keywords: foreign military sales, FMS, international military education and training, cost savings, contracting

COST ANALYSIS OF A TRANSITION TO GREEN VEHICLE TECHNOLOGY FOR LIGHT DUTY FLEET VEHICLES IN PUBLIC WORKS DEPARTMENT–NAVAL SUPPORT ACTIVITY MONTEREY

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Co-Advisor: Daniel Nussbaum, Department of Operations Research

The MBA Project is a detailed cost analysis of various mature green vehicle technologies that can be implemented by Public Works Department–Naval Support Activity Monterey (PWD Monterey) and its subordinate entities, with the intent of reducing both overall life-cycle vehicle costs and carbon emissions. The focus is on light-duty, non-tactical vehicles in use in the region. The cost analysis explores Plug-In Hybrid Electric Vehicles (PHEV), the infrastructure required to operate them, and the social cost of carbon emissions (SCC). Our model indicates that it is not economically beneficial to implement green vehicle technologies on a fleet-wide level for PWD Monterey. Although there are SCC benefits, and right-sizing fleet vehicles to suitable alternatives leads to savings, the increased cost of PHEVs and relatively large required infrastructure cost outpace the total benefits. Full Text

Keywords: plug-in, hybrid, electric, public works, energy, green vehicle, cost estimation, cost-benefit analysis, net present value

MEASURING AIR FORCE CONTRACTING CUSTOMER SATISFACTION

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Co-Advisor: Thomas Albright, Graduate School of Business and Public Policy

This research gathers background information to identify which customer satisfaction elements should be included in a standardized tool that measures the level of customer satisfaction for AF Contracting's external and internal customers. This research conducts a comprehensive literature review of the prominent customer satisfaction trends, while exploring the idiosyncrasies of customer satisfaction that are unique to AF Contracting. For this research, two customer-specific questionnaires were used to interview AF Contracting's external and internal customers, in order to better understand their experiences. Based on the results of the interviews, it is apparent that AF Contracting's customers believe customer satisfaction is a critical component in enabling effective communication and strengthening customer relations. Although AF Contracting does not currently use a standardized approach for collecting customer satisfaction information, this paper recommends the development of a customer satisfaction mechanism as an essential tool to fully capitalize on the benefits of improved communication and enhanced customer relations. This paper also proposes a six-step system for developing a customer satisfaction system and specifically focuses on incorporating the customer satisfaction elements as identified by the customers who participated in this research. Finally, this research concludes with suggestions for areas of further study. Full Text

Keywords: customer satisfaction, air force contracting

DUPLICATE CLASS IV (LUMBER) ORDERING WITHIN DEFENSE LOGISTICS AGENCY AND ITS IMPACT IN EACH COMBATANT COMMAND

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The Department of Defense must give great emphasis to the supply chain of Class IV (lumber) resources to sustain successful operations worldwide because this is critical to the success of forward units. The rapid buildup of resources and capabilities in a forward location is dependent upon the timely arrival and accumulation of forces. Lumber is the medium that allows for this transition, from arrival to prolonged sustainment. Missions come in many shapes and forms; however, the one sustainable item that links them all together is lumber. Through a statistical sampling and data analytics, this research has identified that there is a duplicate ordering problem prevalent within the Defense Logistics Agency's ordering system. The problem becomes more prevalent given variables such as unit ordering, time of order, quantity of orders, and days between each order. These duplicates can lead to congestion through the supply chain management system. Furthermore, this duplicate ordering problem can lead to unnecessary costs associated with holding and shipping lumber as well as the lumber itself. Due to lumber's unique dimensions and weight, the cost with shipping it are much larger than other traditional DLA products. Identifying the frequent occurrence of duplicate orders can, in turn, provide the next step in finding a solution to the problem. Full Text

Keywords: customer interface, root cause analysis, operations process, supply chain management, Class IV, lumber, contingency operations, logistics, inventory management, process analysis

STRATEGIC ASSESSMENT OF LEAN SIX SIGMA PRACTICALITY IN THE TURKISH ARMY

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Lean Six Sigma (LSS) has proven to be a very effective method of continuous process and quality improvement in the private sector for the last several decades. The achievement acknowledged by top companies like General Electric, Toyota, Motorola, and Raytheon Corporation has also propelled the utilization of LSS in the U.S. Department of Defense (DOD). The DOD has obtained successful results from LSS implementation in selected Army depots and arsenal facilities, Navy maintenance, and Air Force Material Command. There has also been growing interest in the Lean Six Sigma concept in Turkish private industry since the 1990s. However, the Turkish military has not yet become acquainted with LSS. In this respect, the primary goal of this study is to introduce the LSS method, deliver examples of LSS implementation, and inquire into the practicality of LSS in the Turkish army. We conducted a survey to measure the organizational readiness to change and continuous improvement for Lean Six Sigma implementation with Turkish and U.S. students at the Naval Postgraduate School. The survey results indicate that there is no significant cultural difference between the U.S. and Turkish military organizations that likely would hinder the successful implementation of LSS. This report discusses the findings of the survey and concludes with recommendations and managerial guidelines for an effective practice of LSS in the Turkish army. Full Text

Keywords: Lean Six Sigma, Turkish army, cultural difference, continuous quality improvement, organizational readiness for change

INVENTORY MANAGEMENT OF CHOLERA VACCINATIONS IN THE EVENT OF COMPLEX NATURAL DISASTERS

This paper has been recognized as outstanding by its department

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Advisor: Aruna Apte, Graduate School of Business and Public Policy
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This MBA Project explores the considerations and recommendations for mass vaccination campaigns in response to natural disasters and their secondary effects, specifically cholera epidemics and the vaccine stockpile necessary to effectively treat the disease. Cholera is a significant post disaster risk to an already affected population. As a first responder to these disasters, the Marine Air Ground Task Force (MAGTF) must consider an epidemic cholera outbreak as a threat to mitigate and be considered in the planning process for Humanitarian Aid/Disaster Relief (HA/DR) scenarios. This project considers these factors based on former HA/DR events as well as an inventory management model, which determines optimized stockpile of vaccinations necessary in a given year in order to reduce the number of lives lost to cholera. Full Text

Keywords: HA/DR, inventory management, cholera, vaccinations, natural disasters

FACTORS THAT FACILITATE OR HINDER FUEL-SAVING INITIATIVES AND TECHNOLOGY

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This report presents a case study analysis into the factors that facilitate or hinder the implementation of fuel-saving initiatives and technology implementation in commercial vehicle fleets. Recognizing the enduring success of FedEx Express in an industry that must utilize a fleet of vehicles to accomplish its mission, an exploration was conducted into how the company has pursued savings in fuel costs through best practices and new technologies. Encouraged by opportunities to optimize both new and existing company assets, FedEx sought both qualitative solutions in routing tactics and opportunities provided by new technology. FedEx leveraged the power of their people to make responsible energy use a corporate professional standard without compromising the core mission of on-time delivery. The ability to ingrain constructive changes into an everyday activity fostered belief in the changes and promoted the acceptance of technical solutions that supported organizational initiatives. This case study offers insight into how organizations can extract value by combining technology and existing corporate social elements. A key concept for success that was observed in this FedEx case study was maintaining a keen awareness of corporate objectives while exerting control over the pace of any changes introduced. Full Text

Keywords: telematics, fleet fuel use, technology implementation, change management

AN ANALYSIS OF INTERNAL CONTROLS FOR DOD CONTRACT MANAGEMENT

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Master of Business Administration
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Co-Advisor: Rene Rendon, Graduate School of Business and Public Policy

According to a 2010 report, the Department of Defense (DOD) spends over $300 billion each year on contracts to sustain the organization as an operational military force. Since 1992, the Government Accountability Office (GAO) has identified contract management within the DOD as an area for high risk in fraud, waste, abuse, and mismanagement, and the DOD has not provided enough assurance that they are using sound practices in procurement. Failures to meet objectives in cost, schedule, and performance have led to cost overruns, reduced buying power, and a reduction in capabilities throughout contract administration processes. The purpose of this research was to assess internal controls within the DOD contract management processes. This assessment was conducted by analyzing reports from the DOD Inspector General, which noted deficiencies in the contract management processes and weaknesses in the internal control framework. The results of this analysis indicate that, overall, the highest numbers of deficiencies in the DOD were found in Procurement Planning, Solicitation Planning, and Contract Administration. In addition, overall, the highest numbers of weaknesses were found in Contract Environment, Contract Activities, and Risk Assessment. This research may help the DOD address identified problems within internal controls and contract management processes. Full Text

Keywords: procurement, contracting, auditability, internal controls, contract management processes

THE COST OF COMMONALITY: ASSESSING VALUE IN JOINT PROGRAMS

This paper has been recognized as outstanding by its department

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Master of Business Administration
Advisor: Jesse Cunha, Graduate School of Business and Public Policy
Co-Advisor: John Dillard, Graduate School of Business and Public Policy

In the 21st century, Major Defense Acquisition Programs (MDAPs) have become increasingly joint efforts. This trend has led to expanding program complexities and interdependencies. The resulting cost, schedule, and performance risks often counterbalance, and potentially outweigh, the efficiencies gained through inter-service program designs. We define these risks as the cost of commonality. Such costs are often unquantified in cost-benefit analyses in the defense acquisitions process. In this project, we first review the results of three joint MDAPs to evaluate ex-post indications of programmatic shortfalls resulting from commonality costs. We then propose a unique cost-effectiveness model to assess value in joint programs from a broader portfolio perspective. Finally, we apply our Joint Value Model to the Joint Light Tactical Vehicle program as a case study to validate the concept. The Joint Value Model provides a means for managers to evaluate cost-effectiveness in the portfolio context and compare meaningful differences among program alternatives. We recommend use of this model as a tool for program analysis at all stages of system development. Full Text

Keywords: commonality, cost, benefit, cost-benefit analysis, cost-effectiveness, joint, value, JLTV, JSF, JTRS, TFX, MDAP

COMPARISON BETWEEN NAVY AND ARMY IMPLEMENTATION OF SIOH AND RECOMMENDATIONS FOR NAVY IMPLEMENTATION

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Master of Business Administration
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This report compares the Naval Facilities Command (NAVFAC) implementation and financial management of supervision, inspection and overhead with the implementation and financial management of Supervision and Administration by the U.S. Army Corps of Engineers based on available documentation and instructions. This analysis finds no major differences in implementation that would benefit the Navy. Based on this analysis, the authors recommend updating and revising the NAVSO P-1570 *Military Construction Financial Management Handbook*. Full Text

Keywords: SIOH, S&A, financial management, NAVFAC, USACE

DEVELOPING A UNIVERSAL NAVY UNIFORM ADOPTION MODEL FOR USE IN FORECASTING

This paper has been recognized as outstanding by its department

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Jeff Legg–Lieutenant, United States Navy
Master of Business Administration
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The Navy Exchange Command (NEXCOM) Uniform Program Management Office (UPMO) is responsible for providing initial sales estimates to the Defense Logistics Agency (DLA) for new uniform programs, as a part of a Supply Request Package (SRP). The SRP contains a fielding plan that projects sale quantities through the Navy exchange (NEX) outlets, Recruit Training Command Great Lakes, and the Reserve Component. UPMO also provides annual revisions to DLA that reflect changes to expected sales, due to policy changes. As the item manager for most uniform programs, the DLA relies on these sales' forecasts provided by the UPMO. In turn, the NEXCOM sources these uniforms from the DLA for commercial sales through the NEXs. This project endeavors to develop an accurate sales forecasting model for use by the NEXCOM to support SRP development. Data analysis software will be used to identify relationships between uniform sales, time, manpower, and allowance data in order to build the model. Once chosen, the best candidate model will be validated against alternate sales data from a comparable uniform program. By using this model, the NEXCOM can provide more accurate procurement estimates to DLA, thereby reducing the risk of inventory shortage or excess inventory holding costs caused by overestimation. Full Text

Keywords: demand management, demand forecasting, Defense Logistics Agency, Navy Exchange Service Command

RELATIONSHIP OF SOURCE SELECTION METHODS TO CONTRACT OUTCOMES: AN ANALYSIS OF AIR FORCE SOURCE SELECTION

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Michael Murrow–Captain, United States Air Force
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Master of Business Administration
Advisor: Karen Landale, Graduate School of Business and Public Policy
Co-Advisor: Rene Rendon, Graduate School of Business and Public Policy

Budgetary concerns over the last decade have put increased pressure on federal agencies to improve efficiency and create cost savings. Accordingly, the Government Accountability Office (GAO) and other watchdog groups have increasingly scrutinized government source selections; GAO reports and procurement experts alike indicate opportunities for improvement in this area. To aid in this improvement initiative, our research focuses on the contract management process, with special emphasis on the source selection methods of tradeoff and lowest price technically acceptable (LPTA). Specifically, our data analysis explores the relationship of source selection methods to the contract outcomes of procurement administrative lead time (PALT) and contractor performance assessment reporting system (CPARS) ratings. The results of our analysis showed no statistically significant relationship between source selection method and contract outcomes. However, other variables, namely the number of evaluation factors and number of offers received, were shown to have a significant effect on PALT. At the conclusion of this MBA Professional Report, we present suggestions for further research to build upon these findings. Full Text

Keywords: LPTA, lowest price technically acceptable, tradeoff, source selection, evaluation, federal acquisition regulation, contract management, best value, Department of Defense

THE NAVY'S SUPERIOR SUPPLIER INCENTIVE PROGRAM: ANALYSIS OF SUPPLIER PROPOSED BENEFITS

This paper has been recognized as outstanding by its department

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Master of Business Administration
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Co-Advisor: Karen Landale, Graduate School of Business and Public Policy

The Department of Defense (DOD) launched the Superior Supplier Incentive Program in 2013 to adopt industry best practices on supply and supplier management and to explore opportunities to provide the high-performing defense contractors with benefits or reliefs that would reduce administrative burdens and streamline processes. The Department of the Navy provided an opportunity for its 2014 Superior Suppliers to submit white papers suggesting possible reliefs or benefits that would improve efficiency. This paper analyzes the 55 proposed benefits using three frameworks—Federal Acquisition Regulation (FAR) policy analysis, contract management process analysis, and risk-benefit analysis—to identify patterns or consistencies. The research reveals that FAR Part 42, Contract Management and Audit Services, and the contract management phase represent the most frustration for the Superior Suppliers. The results of the analysis can be used as a surrogate measure to identify potential improvements in the DOD's current acquisition practices. Full Text

Keywords: Better Buying Power (BBP), Contractor Performance Assessment Reporting System (CPARS), Superior Supplier Incentive Program (SSIP), Preferred Supplier, Supply Management, Supplier Management, Past Performance Information (PPI), Contract Management Process, Federal Acquisition Regulation (FAR), risk-benefit analysis.

EVALUATING THE MODERNIZATION OF MILITARY RETIREMENT

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Second Reader: Douglas Brinkley, Graduate School of Business and Public Policy

The purpose of this MBA Project is to examine the Final Report of the Department of Defense's Military Compensation and Retirement Modernization Commission that was released January 2015 and submitted to Congress and the President of the United States. We will evaluate the recommendation for implementing a modernized retirement system, consisting of a blended Defined Benefit and Defined Contribution Plan. The primary tool used to accomplish this goal was applying a Net Present Value (NPV) analysis based on the proposed recommendation, followed by comparing and contrasting the results of various scenarios to the current military retirement plan available to service members. Full Text

Keywords: military retirement, Net Present Value

A BUSINESS PROCESS ANALYSIS OF THE SURFACE NAVY'S DEPOT MAINTENANCE PROGRAM

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Second Reader: Matthew Kremer, Graduate School of Business and Public Policy

To maintain the Surface Fleet, the Navy spent approximately $7.2 billion in FY2015 and requested $7.8 billion for FY2016. In response to years of costs overruns and missed deadlines, the Navy wants to make better use of these funds by shifting from executing Multi-Ship Multi-Option Contracts with cost-plus fee types to Multi-Award contracts with fixed-price fees. The new contract choice will increase competition and shift risk to the contractor. This thesis conducts an in-depth analysis of the contract change process during execution of depot maintenance availabilities using five ships as case studies. It uses lean principles and lessons from buyer-supplier relationship studies to recommend improvements and to answer two questions. Is the Navy's current construct prepared to execute a new contract strategy? Is this the best decision to reduce cost and meet schedule requirements? The thesis concludes that process improvement is required before shifting to a new contract strategy, and that improving the working relationship with the contractor is paramount to process improvement. Full Text

Keywords: depot maintenance, naval surface forces maintenance, MSMO, MAC-MO, lean six sigma, Japanese supplier partnerships

ADDITIVE MANUFACTURING: AN ANALYSIS OF INTELLECTUAL PROPERTY RIGHTS ON NAVY ACQUISITION

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Wendell Stephens Sr.–Lieutenant Commander, United States Navy
Master of Business Administration
Advisor: Douglas Brinkley, Graduate School of Business and Public Policy
Co-Advisor: Matthew Kremer, Graduate School of Business and Public Policy

The intent of this project was to advance previous research into the benefits and challenges of implementing additive manufacturing (AM) in the Navy. Specifically, this project focused on intellectual property (IP) rights, government rights, and the potential impact current laws and regulations may have on AM implementation into the Navy. Research was conducted in a three phases. First, statutory and regulatory laws relating to IP were reviewed to provide a foundation for research analysis. Next, Department of Defense and Navy regulations and policies and government AM and IP reports were reviewed to understand government data-rights standards. Finally, a multi-case study analysis was conducted to determine private and public sector best practices in the management of IP associated with AM. This report concludes with recommendations for Navy management of IP and data rights related to AM. Full Text

Keywords: additive manufacturing, intellectual property, 3D

U.S. COAST GUARD CUTTER PROCUREMENT LESSONS' IMPACTS ON THE OFFSHORE PATROL CUTTER PROGRAM AFFORDABILITY

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Matthew Weber–Lieutenant Commander, United States Coast Guard
Master of Business Administration
Advisor: Fotis Papoulias, Department of Systems Engineering
Co-Advisor: John Dillard, Graduate School of Business and Public Policy

The U.S. Coast Guard's upcoming acquisition of the Offshore Patrol Cutter (OPC) offers many opportunities to leverage recent procurement lessons to achieve the program's affordability requirement of $310 million per hull. We explore the question of how lessons learned from the National Security Cutter (NSC) and Fast Response Cutter (FRC) procurement programs were applied to the OPC acquisition strategy to achieve affordability. We examine procurement lessons addressing management reforms, best practices in competition, contract structure, multiyear procurement, requirements generation, and test and evaluation. We employ a cost estimation model developed by Jeffrey Lineberry and first advanced in his 2012 work "Estimating Production Costs While Linking Combat Systems and Ship Design." We validate the Coast Guard's OPC cost requirement of $310 million per hull using notional design data. We further illustrate the impact that varying specific design characteristics (speed, personnel, and length/beam) have on ship production cost. Finally, we conclude that the U.S. Coast Guard has successfully incorporated lessons from the NSC and FRC procurement programs into the OPC acquisition strategy, and we present a trade-off analysis that program managers may use in future source selection processes. Full Text

Keywords: acquisition management, affordability, Coast Guard, contract management, contract structure, homeland security, offshore patrol cutter, lessons learned, procurement, program manager, requirement, ship production, source selection, strategy, ship procurement, cutter procurement

ANALYSIS OF NAVAL AMMUNITION STOCK POSITIONING

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Eric Rossmanith–Captain, United States Marine Corps
Master of Business Administration
Advisor: Geraldo Ferrer, Graduate School of Business and Public Policy
Co-Advisor: Kenneth Doerr, Graduate School of Business and Public Policy

Naval Supply Systems Command Global Logistics Support Ammunition (NAVSUP GLS AMMO) is considering an alteration of the current Navy ammunition stock positioning system. The purpose of this project is to analyze the cost and delivery performance risk associated with either centralizing the Navy's ammunition stockpiles and positioning them at an inland Army depot, or decentralizing the ammunition stockpiles and positioning them at coastal Navy facilities. A Monte Carlo simulation model was developed to simulate expected cost and delivery performance risk using historical demand data and rates provided by NAVSUP GLS AMMO. These measures of risk enable NAVSUP GLS AMMO to determine the probability that the centralized or decentralized system will outperform the status quo system with regard to cost and delivery performance. Full Text

Keywords: supply chain management, Monte-Carlo simulation, risk, delivery performance, stock positioning

APPLYING RISK AND RESILIENCE METRICS TO ENERGY INVESTMENTS

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Mark Weiss–Lieutenant, United States Navy
Master of Business Administration
Advisor: Daniel Nussbaum, Department of Operations Research
Co-Advisor: Alan Howard, Energy Academic Group

The purpose of this research is to develop a more comprehensive energy investment decision model that includes intangible factors related to risk and resiliency. Additionally, this project evaluates the current Department of the Navy energy investment model and pinpoints how gaps and shortfalls lead to increased exposure to avoidable energy risk. The project selects the relevant risk and resiliency factors for inclusion, and then quantifies them as inputs for a new decision making model. The model developed for this project includes cost metrics and policy mandates that the current model considers and adds the intangible factors related to risk and resiliency. To validate the model, the Bloom Box Energy Server is evaluated under the status quo and then again under the new model, with risk and resiliency playing a larger role in the outcome. The results show that under the status quo, the Bloom Box is a poor energy investment; however, when evaluated under the new model, the Bloom Box is a more attractive investment due to the energy security and independence it provides. The different outcomes show that energy risk and resiliency factors affect energy decisions. This project then recommends follow-on research options to further develop and validate the model. Full Text

Keywords: energy risk factors, energy resilience, renewable energy, energy security, energy independence, energy investment, energy model

LOCATION OPTIMIZATION OF MOBILE COLD-FORMED STEEL SYSTEMS TO PROVIDE HUMANITARIAN RELIEF AFTER NATURAL DISASTERS

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Master of Business Administration
Advisor: Tali Freed, Graduate School of Business and Public Policy
Co-Advisor: Brian Steckler, Department of Information Sciences

A cold-formed steel mobile factory (CFSMF) is a rapid self-contained system that produces members from rolled steel. The unit essentially provides a mobile framing construction system that can be used for construction of temporary, recyclable structures. These structures can be used for humanitarian assistance, disaster relief, and military contingency operations scenarios. CFSMFs also provide benefits by reducing reliance on local economies' resources in natural disaster affected areas and areas that have internally displaced or emigrating persons for various reasons. This project discusses the benefits and potential uses of CFSMFs and recommends global locations to base these units. The 10 countries discussed in the case study have the highest need of such systems based on United Nations natural disaster data. The level of diplomatic relations of the 10 countries with the United States is gauged by the cumulative economic aid they received from the United States Agency for International Development (USAID) over a 10-year period. The recommended locations are determined by an integer programming optimization model. The model solution proposes an allocation method for CFSMF systems. The model can also be used for similar types of aid. The case study in this report uses a small number of countries in order to simplify the mathematical model. It can be scaled up to reflect a larger set of countries, as well as additional types of constraints. Full Text

Keywords: cold-formed steel, humanitarian assistance and disaster relief (HA/DR), integer programming, optimization, natural disasters, persons affected

ANALYSIS OF THE 918TH CONTRACTING BATTALION AND 410TH CONTRACTING SUPPORT BRIGADE UTILIZING THE CONTRACT MANAGEMENT MATURITY MODEL

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Gary Croston–Captain, United States Army
Master of Business Administration
Advisor: Rene Rendon, Graduate School of Business and Public Policy
Co-Advisor: Matthew Kremer, Acquisition and Contracting

The purpose of this research is to determine the contract management process maturity level of the 918th Contracting Battalion and 410th Contracting Support Brigade utilizing the Contract Management Maturity Model. The Mission and Installation Contracting Command (MICC) is undergoing a significant change in structure known as MICC 2025. In order to gauge the effectiveness of this plan, this report analyzes those proposed changes. The 918th Contracting Battalion is part of the MICC, while the 410th Contracting Support Brigade is part of the Expeditionary Contracting Command (ECC) and not undergoing the same changes. Full Text

Keywords: Contract Management Maturity Model, CMMM, Army contracting, contract management, 918th Contracting Battalion, 410th Contracting Support Brigade, Expeditionary Contracting Command, ECC, Mission and Installation Contracting Command, MICC

DOWNSTREAM BENEFITS OF ENERGY MANAGEMENT SYSTEMS

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Co-Advisor: Eva Regnier, Defense Resources Management Institute

This report examines the downstream benefits of energy management systems (EMSes) at Department of Defense (DOD) installations. The DOD has mandated thorough energy metering at shore installations, but EMSes are not widespread within the DOD. Four DOD installations with EMSes serve as individual case studies in a multiple-case study analysis. This report identifies three categories of downstream benefits associated with EMSes: addressing errors that cause energy waste, identifying wasteful buildings on an installation, and identifying valuable follow-on investments. Much of the value associated with EMSes is in analyzing the data provided, and future improvements in EMS data analysis will likely yield additional benefits. Full Text

Keywords: energy management systems, energy intensity, installation, downstream benefits, return on investment

MASTER OF SCIENCE

Applied Physics
Astronautical Engineering
Computer Science
Defense Analysis
Electrical Engineering
Information Strategy and Political Warfare
Management
Mechanical Engineering
Meteorology and Physical Oceanography
Operations Research
Physical Oceanography
Program Management
Systems Engineering
Systems Technology

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MASTER OF SCIENCE IN APPLIED PHYSICS

THE DESIGN AND IMPLEMENTATION OF A PROTOTYPE SURF-ZONE ROBOT FOR WATERBORNE OPERATIONS

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Master of Science in Applied Physics
Advisor: Richard Harkins, Department of Physics
Second Reader: Fabio Alves, Department of Physics

Three dimensional (3D) simulation, Fused Deposition Modeling (FDM) technology and Computer Numerical Control (CNC) milling are used to design and implement a waterborne surf-zone robot prototype. This robot is an autonomous platform meant to be a test-bed for sensors and algorithms for future developments; a key enabler is its modular design. It combines the capabilities of an untethered Remotely Operated Vehicle (ROV) and an Unmanned Ground Vehicle (UGV), being able to transition between the maritime and ground environments. Components for the robot are modeled using Solidworks and later 3D printed or CNC milled in aluminum. A five-spoke Wheg variant is used for mobility on land, and three thrusters in a typical ROV configuration (one vertical, two lateral) provide water mobility. Channels to direct water flow around the waterproof cylinder are implemented as a novel way to avoid a through hole for the vertical thruster. Modular design enables platform design modifications and sensors to be changed or added for different missions. All sensible actuators, sensors, cabling and parts are waterproofed to withstand the difficult conditions of the surf zone. Full Text

Keywords: surf-zone, robot, vehicle, unmanned, autonomous, platform, 3D printing, CAD, robotics, FDM technology, Solidworks, CNC milling, waterproof

SENSORS AND ALGORITHMS FOR AN UNMANNED SURF-ZONE ROBOT

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Second Reader: Peter Crooker, Department of Physics

The design, construction, integration and implementation of electronics, sensors, actuators and power supplies for a surf-zone autonomous vehicle are presented. Physical models and lab-test characterizations are used to address limitations and achieve improved performance through signal-processing techniques. A deterministic centralized pooling-communication protocol is designed and implemented for use over a network of microcomputers and microprocessors with limited computational resources. A series of algorithms are developed to achieve autonomy over land and at sea. Autonomy functions include waypoint navigation, obstacle avoidance, sea-to-land transition, operation environment detection, depth maintenance and wireless communications—all of which support basic autonomous intelligence, surveillance and reconnaissance missions for missions over a beach front. Full Text

Keywords: robotics, unmanned systems, virtual potential filed, inertial measurement unit, pressure sensors, motor control, microprocessors, Kalman filter

CHARACTERIZATION OF PIEZOELECTRIC ENERGY HARVESTING MEMS

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Advisor: Dragoslav Grbovic, Department of Physics
Co-Advisor: Fabio Alves, Department of Physics

Energy conservation and increased efficiency lie at the forefront of defense missions, capabilities, and costs. Expeditionary forces require energy efficient devices embarkable on naval, ground, and air assault vessels. Piezoelectric microelectromechanical system (MEMS) devices can be used to convert energy— usually lost to mechanical vibrations—into usable electrical energy without adding significant weight or size to existing equipment. Previous work has analyzed materials and processes, and designed a piezoelectric energy harvesting device leading to its fabrication and characterization. This thesis experimentally tests the piezoelectric MEMS device and integrates the results into a refined model. The effects of Rayleigh damping and squeeze film damping are introduced to improve the connection between experimental data and a finite element model using COMSOL Multiphysics. This model exhibits good agreement with experimental results for resonant frequencies and output potential. From this model, the design can be optimized to resonate at 60 Hz. Full Text

Keywords: MEMS, piezoelectric energy harvester

SILICON CONTROLLED SWITCH FOR DETECTION OF IONIZING RADIATION

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Co-Advisor: Fabio Alves, Department of Physics

The purpose of this thesis is to utilize the developed knowledge of key semiconductor components at the Naval Postgraduate School (NPS) and build a circuit design toward the specific goal of detecting CS-137 sources. A Silicon-Controlled Switch (SCS), under the presence of a direct current (DC) voltage bias (VBIAS), was connected in series to a resistor and capacitor (RC) load. Additionally, a photodiode (PD) was connected to the anode gate (AG) of the SCS. The PD produced a triggering current that allowed the SCS-based circuit to create self-terminating pulses by operating in the SCS intermediate state. VBIAS and PD produced current on the AG of the SCS where the methods for triggering self-terminating pulses. Various circuit elements such as a Zener (Zn) diode connected to the AG, feedback resistor (RF), and RC load were varied to achieve diverse pulsation results. The final circuit design produced a circuit that had ten times the resolution and five times the sensitivity of previous NPS silicon controlled rectifier (SCR) based circuits. Additionally, the circuit in this thesis was able to detect AM-241 and CS-137 sources for the first time at NPS. Future NPS thesis research is proposed to further understand and fine-tune semi-conductor– based radiation detectors. It is proposed that future naval feasibility assessments be centered on the signal amplification and processing techniques from SCS-based circuits. Full Text

Keywords: Silicon-Controlled Switch, Pulse Generation Circuit, semiconductors, Solid-State Radiation Detectors, radiation detection, amplifier, signal processing

DESIGN AND ANALYSIS OF MEGAWATT CLASS FREE ELECTRON LASER WEAPONS

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Master of Science in Applied Physics
Advisor: Joseph Blau, Department of Physics
Co-Advisor: Keith Cohn, Department of Physics

Free Electron Lasers (FELs) are desirable for defense against a spectrum of threats, especially in the maritime domain, due to their all-electric nature, their wavelength tunability to atmospheric propagation sweet-spots, and their scalability to megawatt class lasers. In this thesis, we exploit these characteristics to design, simulate, and analyze both amplifier and oscillator FELs using the FEL 4-D code developed by the Physics Directed Energy (DE) Group at the Naval Postgraduate School (NPS). Propagation analysis is performed on the designs using the Atmospheric NPS Code for High Energy Laser Optical Propagation (ANCHOR), also developed by the NPS Physics DE Group, to arrive at various lethality estimates that allow us to quantify the weapon's effectiveness in its operating domain. We conclude that megawatt class FELs, while lacking in technological maturity, would provide an effective defense, especially against hardened, time-critical threats such as sub-sonic and super-sonic anti-ship missiles. Full Text

Keywords: directed energy weapons, high energy lasers, Free Electron Laser, FEL oscillator, FEL amplifier, FEL modeling, atmospheric propagation modeling

ROBOTIC ARM MANIPULATION LABORATORY WITH A SIX DEGREE OF FREEDOM JACO ARM

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Master of Science in Applied Physics
Advisor: Richard Harkins, Department of Physics
Second Reader: Peter Crooker, Department of Physics

The JACO six degree of freedom robotic arm and associated software is characterized for use by students in a Robotic Manipulation Laboratory. The lab was implemented to help students understand tele-operation techniques with a sophisticated Kinova JACO robotic arm. The purpose of the research was to follow up on Jacinto's work and expose students to forward kinematics via Denavit-Hartenberg (DH) parameters for robotic arm manipulation in a lab environment for various experiments. Jacinto demonstrated the viability of resistive glove control via simulation through the Robot Operating System (ROS) interface. He was not able to demonstrate real-time glove control. Here, we take an intermediate approach and introduce a virtual joystick. Manipulation experiments with various effector loads and Cartesian trajectories indicate a 1.0 kg load limit in the fully extended mode and 1.5 kg limit in a midrange mode. This verifies vendor specifications for the arm and is acceptable for light-load daily mobility requirements. Full Text

Keywords: robotic arm, lagrangian dynamics, kinematics, inverse kinematics, DH parameters

DESIGN OF HIGH POWER FELS AND THE EFFECTS OF DIFFRACTION ON DE-TUNING IN AN FEL OSCILLATOR

Michael Price–Lieutenant, United States Navy
Master of Science in Applied Physics
Advisor: Joseph Blau, Department of Physics
Second Reader: Keith Cohn, Department of Physics

In experiments going back to the first free electron laser (FEL) oscillator at Stanford, the measured width of the desynchronism curve is often significantly greater than predicted by theory and two-dimensional (2D) simulations in (z; t). The results of new four-dimensional (4D) simulations in (x; y; z; t) show that this dif-

ference can be explained by the effects of diffraction. When the light is artificially constrained to remain in the cavity fundamental mode, 2D and 4D simulations give similar results, but when the light is allowed to self-consistently develop higher-order modes, the 4D simulations give different results that agree better with experiments. The results of new 4D simulations also show the effects of emittance versus electron beam energy and mirror shift versus mirror tilt on extraction. Analysis of these results examine the robustness of FEL designs. Full Text

Keywords: FEL, emittance, energy spread, mirror tilt, mirror shift

METAMATERIAL RESONANT ABSORBERS FOR TERAHERTZ SENSING

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Master of Science in Applied Physics
Advisor: Gamani Karunasiri, Department of Physics
Co-Advisor: Fabio Alves, Department of Physics

The aim of this work is to develop a metamaterial absorber that can be incorporated into a terahertz (THz) imaging system with a 4.7 THz quantum cascade laser (QCL) illumination source. Finite element (FE) simulations were utilized to design metamaterials, and a Fourier transform infrared spectrometer (FTIR) was employed to characterize the absorption spectrum of each metamaterial configuration. Process parameters for future work with the microfabrication devices have been established for the Naval Postgraduate School clean room. Analysis of experimental data provided insight in determining the refractive index of the metamaterial dielectric, SiOx, from 3–8 THz and confirmed the Lorentzian shape for the absorption spectrum as theoretically proposed by another group. Future work will incorporate the metamaterial absorber design of this research into a more efficient, cost effective, bi-material THz sensor that can be employed in a variety of naval applications. Full Text

Keywords: terahertz sensors, metamaterials, uncooled detectors

MASTER OF SCIENCE IN ASTRONAUTICAL ENGINEERING

DEVELOPMENT OF A HARDWARE-IN-THE-LOOP SIMULATOR FOR CONTROL MOMENT GYROSCOPE-BASED ATTITUDE CONTROL SYSTEMS

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Master of Science in Astronautical Engineering
Advisor: Mark Karpenko, Department of Mechanical and Aerospace Engineering
Second Reader: I. Michael Ross, Mechanical and Aerospace Engineering

In this thesis, an open-architecture control moment gyroscope (CMG) system is developed for hardware-in-the-loop (HIL) simulation of spacecraft attitude control. This effort included construction of four single-gimbal CMGs, implementation of an attitude dynamics model, a quaternion error feedback control system, and a pseudoinverse CMG steering law on a real-time controller. The modular design of the embedded flight computer software allows for various parameters (such as the spacecraft inertia tensor, CMG rate limits, and control system gains) to be rapidly iterated and deployed for testing on physical hardware. Real-time communication with the CMG hardware is achieved via a Controller Area Network (CAN) bus; CMG commanding and telemetry sampling (including position, velocity, and current) can be performed at different sampling frequencies. The impact of sampling frequency on control law determinism and the CMG gimbal rest position (referred to as gimbal drift) is demonstrated. The HIL simulation testbed developed in this thesis allows future researchers to evaluate novel attitude control and CMG steering algorithms as well as optimal attitude guidance in a real-time, laboratory environment. Full Text

Keywords: control moment gyroscopes, spacecraft attitude controls, hardware-in-the-loop simulation, real-time attitude control, quaternion feedback control, pseudoinverse steering, gimbal drift

OPTICAL JITTER EFFECTS ON TARGET DETECTION AND TRACKING OF OVERHEAD PERSISTENT INFRARED SYSTEMS

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Master of Science in Astronautical Engineering
Advisor: Jae Jun Kim, Department of Mechanical and Aerospace Engineering
Co-Advisor: Brij Agrawal, Department of Mechanical and Aerospace Engineering

The purpose of this thesis is to provide a system level performance analysis for an imaging spacecraft. In an imaging spacecraft, an attitude control subsystem's function is to orient the spacecraft's body to acquire a target through the use of an actuator. In practice, reaction wheels commonly perform this function by producing a reactive torque on the spacecraft. Consequently, due to the static and dynamic imbalances in individual reaction wheels, an undesired vibration, called jitter, is generated during operation and causes variations in the spacecraft's attitude. Focusing on missions and payloads operating in the infrared band, optical jitter effects on target detection and tracking performance need to be investigated. Using a quaternion error feedback design, jitter produced by the reaction wheels was recorded while performing a standard spacecraft maneuver. Simulating a low earth orbiting satellite, the vibrations generated a significant optical jitter blur due to a line-of-sight motion. After implementing the optical jitter blur in a baseline high resolution image, the simulation considerably reduced the frame's spatial resolution and intensity. The simulation demonstrated the jitter blur's

effects on spatial resolution and intensity, which significantly decreased the system's ability to detect and track objects-of-interest. Full Text

Keywords: infrared detection and tracking, centroid, jitter, reaction wheel, blur, Kalman filter

REDUCING THE SURFACE PERFORMANCE REQUIREMENTS OF A PRIMARY MIRROR BY ADDING A DEFORMABLE MIRROR IN ITS OPTICAL PATH

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Master of Science in Astronautical Engineering
Advisor: Brij Agrawal, Department of Mechanical and Aerospace Engineering
Co-Advisor: Jae Jun Kim, Department of Mechanical and Aerospace Engineering

In recent years, carbon fiber reinforced polymer (CFRP) mirrors been proposed for use in future imaging satellites. Compared to traditional glass-based mirrors, CFRP mirrors offer reduced manufacturing times, lower coefficients of thermal expansion, lower areal density, and higher strength-to-weight ratios. Shorter manufacturing times promise to reduce program schedule requirements and cost. These advantages come at the expense of surface quality, which results in wavefront errors that are outside of the diffraction limit for optical imaging. To compensate for the reduced surface quality of CFRP mirrors, a deformable mirror (DM) is required in the optical path. During this research, the surface quality of a CFRP mirror was evaluated to establish a root-mean-square (RMS) error threshold for the DM corrections. An integral DM control law that employed a constrained least-squares solution was utilized to reduce the overall system wavefront error to below the specified CFRP error threshold. The application of this control law yielded a 38% reduction in RMS wavefront error (as compared to the CFRP error threshold), thus reducing the CFRP's RMS surface performance requirements by the same amount. Reducing the surface performance requirements of CFRP mirrors is a critical step toward employing these mirrors in future imaging satellites. Full Text

Keywords: carbon fiber reinforced polymer mirror, adaptive optics, deformable mirror, surface figure error

MASTER OF SCIENCE IN COMPUTER SCIENCE

EVALUATING THE GENERALITY AND LIMITS OF BLIND RETURN-ORIENTED PROGRAMMING ATTACKS

This paper has been recognized as outstanding by its department

Lawrence Keener–Civilian, Vista Research
Master of Science in Computer Science
Advisor: Mark Gondree, Department of Computer Science
Second Reader: Chris Eagle, Department of Computer Science

We consider a recently proposed information disclosure vulnerability called blind return-oriented programming (BROP). Under certain conditions, this attack allows a return-oriented programming attack against previously unknown binaries. We precisely enumerate the assumptions for a successful BROP attack to take place. We analyze prerequisite knowledge to perform a BROP attack, including the need to exploit a stack-based buffer overflow. In particular, we examine the types of buffer-handling functions and canaries that may render these functions useless for exploitation purposes. We survey network service binaries, to examine how often different BROP requirements are satisfied in real software, including the presence of certain gadgets and the behavior on crashes. We find if an optimized attack fails, a first principles BROP attack is unlikely to succeed. Our survey shows that certain required gadgets are rare, limiting a first principles attack. We show the presence of required gadgets fluctuates with binary version number and build conditions. The majority of the services we survey do not appear vulnerable to BROP due to missing gadgets or re-randomization on crash. We suggest some ameliorations that may further limit the applicability of this attack. Full Text

Keywords: BROP, return-oriented programming, ROP, return-to-libc, implementation disclosure attacks

WIRELESS SENSOR BUOYS FOR PERIMETER SECURITY OF MILITARY VESSELS AND SEABASES

Stephen Kent–Captain, United States Marine Corps
Master of Science in Computer Science
Advisor: Gurminder Singh, Department of Computer Science
Co-Advisor: John Gibson, Department of Computer Science

Naval vessels at anchor and seabases are vulnerable to attack by small surface crafts. The past two decades have demonstrated that attacks of this type are indeed possible, and that current security measures may not be sufficient to mitigate such a threat. As technology matures, it should be implemented into providing security for these valuable naval assets. An example of technology to be incorporated is wireless sensor networks. These wireless sensor networks have been utilized in recent conflicts, in the form of unattended ground sensors, with a high degree of success. By incorporating these ground sensors in an open ocean environment, attacks by small surface crafts toward naval vessels and seabases may be precluded. The innovation of attaching wireless sensor nodes to buoys and positioning them around naval vessels to provide the necessary standoff against attack was investigated. Wireless sensor buoys were created using commercial-off-the-shelf products and existing prototype wireless sensor nodes. The tests that were conducted during this thesis determined that the current sensor nodes are suitable, and could be implemented in creating an ad hoc network on an open

ocean environment. Future work to include the addition of alternate sensor modalities and longer ranging networks should be investigated. Full Text

Keywords: Ad-Hoc Network, Adaptable sensor system, Expeditionary Force 21, Light Detection And Ranging, Passive Infrared, Scheduler and Asynchronous/Synchronous, seabase, Shared Information Space, Unattended Ground Sensors, Wireless Sensor Buoys, Wireless Sensor Network

FINDING EFFECTIVE RESPONSES AGAINST CYBER ATTACKS FOR DIVIDED NATIONS

Ji Min Park–Captain, Republic of Korea Air Force
Master of Science in Computer Science
Advisor: Neil Rowe, Department of Computer Science
Second Reader: Wade Huntley, Department of National Security Affairs

There can be hostile relations between nations that are divided politically or ideologically, and there are threats in cyberspace as well as physical space. Although every cyber threat, like a physical threat, has countermeasures, this can be hard because of the complexity of cyberspace and the ethics in cyberspace. This study tries to find effective countermeasures for South Korea in cyberspace against North Korea's continuing cyber attacks in light of the Korean peninsula's situation, a typical example of divided nations in the world. To find good solutions, South and North Korea's cyber capabilities are compared in terms of infrastructure, organization, defensive capabilities, offensive capabilities, and vulnerabilities. Characteristics and features of North Korea's cyber attacks are inferred by analyses of past attacks. Based on these analyses, this study recommends defensive and offensive countermeasures to mitigate these cyber threats and prevent escalation. Each countermeasure is assessed using considerations such as prevention of escalation, efficient use of limited resources, international laws and ethics, and bargaining power in the real world. Full Text

Keywords: cyberwarfare, South Korea, North Korea, cyber attacks

MESH NETWORKING IN THE TACTICAL ENVIRONMENT USING WHITE SPACE TECHNOLOGY

This paper has been recognized as outstanding by its department

Simon Sanchez–Captain, United States Army
Master of Science in Computer Science
Advisor: Geoffrey Xie, Department of Computer Science
Second Reader: John Gibson, Department of Computer Science

The transition of the military from wars within two known and established theaters to a focus on a dynamic and hastily occupied combat environment necessitates the need for a similarly dynamic and adaptable communications backbone. Traditionally, Army units have relied on either FM communications over short distances or expensive radios to communicate over long distances. FM communications often require retransmission to extend their reach while expensive radio systems often rely on other resources such as satellites. The analog-to-digital television conversion saw the birth of white space spectral technology, which dynamically allocates unutilized spectral space within the television broadcast range to transmit data. This research explores the use of white space spectral technology in the creation of a dynamically established communications infrastructure for the purpose of repeating communications originating from numerous existing platforms in the tactical environment. A comparative analysis was conducted between an implementation of this technology, the Carlson Rural Connect, and similar solutions, specifically, a variant of the Harris 117G, currently available within the military in order to explore the merit of this technology for use as a communications relay in the tactical environment. The results obtained in these experiments demonstrate the potential use of white space technology as a repeater in the tactical environment. Though this potential exists, this technology requires time, a

dedicated development effort, and additional testing and experimentation before it is refined enough for use in military operations. Full Text

Keywords: tactical communications, white space, relay, television

METHODS TO SECURE DATABASES AGAINST VULNERABILITIES

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Advisor: Thomas Otani, Department of Computer Science
Second Reader: Mark Gondree, Department of Computer Science

Many commercial and government organizations utilize some form of proprietary or open source database management system. Recent history shows security incidents involving database management system vulnerabilities resulting in the compromise of personal information for millions of people. This thesis identifies common vulnerabilities affecting database management systems: injection, misconfigured databases, HTTP interfaces, encryption, and authentication and authorization. This thesis also examines three open source database management systems: MySQL, MongoDB, and Cassandra. We test each against the aforementioned vulnerabilities and provide recommendations to mitigate the vulnerabilities. Full Text

Keywords: database, security, injection, encryption, authentication, authorization, MySQL, MongoDB, Cassandra

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MASTER OF SCIENCE IN DEFENSE ANALYSIS

UNDERSTANDING ALLIANCE FORMATION PATTERNS

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Zoltan Schneider–Captain, Hungarian Defense Forces
Master of Science in Defense Analysis
Advisor: William Fox, Department of Defense Analysis
Second Reader: Heather Gregg, Department of Defense Analysis

In international relations literature, there seems to be some confusion caused by the many contradictory theories on alliance formation patterns. For this reason, this thesis surveys why there is not just one theory that explains most of the alliance formations throughout history. Using logistic regression models and statistical analysis for different historical periods from 1816 to 2012, the thesis explores the effects of four state-level variables—regime type, national material capabilities, geographical proximity, and trade exchange—on alliance formation behaviors. The results show that the four state-level variables have different levels of significance in the different periods. The thesis concludes that alliance formation behaviors differ depending on the prevailing system-level conditions in the different historical periods, especially under conditions of war and peace and based on the polarity of the international system. The approach presented in the thesis provides a new perspective to analyze alliance formation patterns for a better understanding of future alliances. Full Text

Keywords: alliance formation, historical periods, geographical proximity, trade exchange, regime type, national material capability, system-level conditions

THE DEVELOPMENT OF INDONESIA'S DOCTRINE FOR SPECIAL HOSTAGE-RESCUE OPERATIONS

Amrul Adriansyah–Major, Indonesian Navy
Edy Suntoro–Lieutenant Commander, Indonesian Navy
Master of Science in Defense Analysis
Advisor: Douglas Borer, Department of Defense Analysis
Second Reader: Robert Burks, Department of Defense Analysis

This thesis offers guidance for hostage-rescue operations by the Indonesian Armed Forces Special Forces. It analyzes three hostage situation case studies: two involving the United States and one involving Indonesia. These case studies are analyzed using the principles of special operations applicable to a rescue operation. These principles, derived from the theory of special operations, are simplicity, security, repetition, surprise, speed, purpose, operators' skills, and deception. Along with the theory of special operations, several guiding principles are also considered to both enhance the analysis and upgrade Indonesian doctrine for these particular rescue operations. These guiding principles are drawn from U.S. doctrine regarding military development in countries around the globe. Both the current Indonesian doctrine and manual need to be adjusted to reflect the dynamics of the current shifting nature of threats. A sound and systematic doctrine offering applicable guidance maximizes the chances of a successful operation. Furthermore, this thesis highlights the distinct phases and characteristics within a special operation. It provides a thorough understanding of the need for

clear Indonesian doctrine and guidance for operators and planners in preparing a special rescue operation. Full Text

Keywords: Operation Red and White, hostage rescue, rescue of Captain Phillips, the Sy Quest yacht hijacking, special operation concept, Somalia waters, SOF, CQB, rescue operations doctrinal concept

THE INDONESIAN COIN STRATEGY: FAILURES AND ALTERNATIVE APPROACHES IN OVERCOMING THE PAPUAN INSURGENCY

Djon Afriandi–Lieutenant Colonel, Indonesian Army
Master of Science in Defense Analysis
Advisor: Douglas Borer, Department of Defense Analysis
Second Reader: George Lober, Department of Defense Analysis

This thesis examines some failures of the current Indonesian counterinsurgency (COIN) strategy in the Indonesian government's efforts to eliminate the separatist insurgency in Papua. In doing so, this thesis uses the McCormick Diamond COIN model to measure and determine the mistakes of the Indonesian approaches from 1965 to 2014. This thesis finds that the Indonesian COIN strategy has no balancing concept in applying its approaches toward the conflict. This thesis proposes alternative options for the Indonesian COIN strategy to completely destroy the insurgents in Papua in the future. In exploring the alternative methods, this thesis also practices the theory of the Diamond COIN model as a framework that leads to the conclusion that the Indonesian government must keep using limited coercive and smart political actions in dealing with the Papuan insurgency. Full Text

Keywords: insurgency, counterinsurgency, and strategy

MULTINATIONAL COUNTER-PIRACY OPERATIONS: HOW STRATEGICALLY SIGNIFICANT IS THE GULF OF GUINEA TO THE MAJOR MARITIME POWERS?

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Piracy in the Gulf of Guinea regularly exceeded that of the Gulf of Aden between 2000 and 2007. But the major maritime powers established counter-piracy operations in the Gulf of Aden without replicating the same in the Gulf of Guinea. Since 2004, the United States has closely monitored counter-piracy operations in the Malacca Strait after a failed earlier attempt to materially provide such services. Why are the United States and other maritime powers interested in the Gulf of Aden and Malacca Strait? If the Gulf of Guinea states would allow these powers to establish a counter-piracy task force, does the region have the strategic heft to attract these powers? The search for answers to these questions informs this study. The study, which is essentially comparative, synthesizes and analyzes existing quantitative and qualitative data. It reveals that the strategic importance of the Gulf of Guinea is minor compared to the Malacca Strait and the Gulf of Aden. Therefore, the thesis urges the Gulf of Guinea states to search for regional solutions that would materialize improvements in maritime regime governance, security, and development. Full Text

Keywords: piracy, Gulf of Guinea, Gulf of Aden, maritime powers, Malacca Strait, multinational counter-piracy operations, regional maritime security solutions, cost of piracy, maritime strategic significance

INNOVATIVE PRACTICES FOR SPECIAL WARFARE

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Special Warfare forces are tasked with conducting operations in uncertain environments defined by rapidly changing environmental elements (instability) and the interaction of many diverse external factors (complexity). In order to succeed, organizations operating in uncertain environments should decentralize decision-making to the appropriate level and emphasize an organic approach that focuses on the importance of people, adaptation, and innovation. The current USASOC bureaucracy, mirroring the conventional Army, is built to maximize internal efficiency and specialize in previously predicted scenarios. Due to persistently high operational tempo, personnel downsizing, and fiscal constraints, redesigning USASOC is not feasible at this time. However, the improvement of processes and incremental enhancement to align better with the operational environment within the existing design is possible. This study explores best practices from innovative and adaptive organizations that ARSOF can draw upon to increase its capability to conduct special warfare. Through the examination of these best practices, the study identified four key factors that lead to innovation: collaboration, organizational structure, incentives, and acceptance. This study recommends that Special Warfare forces apply these factors by increasing career flexibility, internal and external linkages through broadening opportunities and liaisons, and the collective intelligence of the organization through the use of cross-functional teams and increased communication measures. Adopting these enhancements may promote innovation and adaptation and increase Special Warfare forces' contributions to national defense. Full Text

Keywords: Army Special Operations Forces, U.S. Army Special Operations Command, innovation, adaptation, organizational design, incentives, collaboration, acceptance

SOWING THE SEEDS OF SOFT POWER: THE UNITED STATES AND INDIA IN THE NEXT GREAT GAME

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In both the 2010 and 2015 National Security Strategy, the White House published President Barack Obama's remarks emphasizing that the United States must integrate all the tools of national power to further U.S. strategic interests. This is especially true in a dynamic and increasingly multipolar world. In what this thesis calls the Next Great Game, the future key players in this emerging geopolitical scenario are Iran, Russia, China, and India. This thesis focuses on India. Using Joseph Nye's concept of hard power and soft power, this thesis explores what bonds can and do serve to align the United States and India. In doing so, this thesis makes it clear that the United States and India share several soft power bonds as a result of their respective historic connections to British colonialism, which to a certain degree has already set the conditions for the integration of all the tools of U.S. national power with India. Though historic disagreements and complex regional relations stymie the process, the United States must be cognizant of the type of relationship that is presenting itself and understand that the tools of government may be less important than the form of power being exercised. Full Text

Keywords: India, China, Russia, Iran, soft power, hard power, U.S.-Indo foreign policy, Next Great Game, strategic interests

NEW CHALLENGES TO AUTHORITARIAN STATE STABILITY: THE PROLIFERATION OF MODERN INFORMATION COMMUNICATIONS TECHNOLOGY

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Numerous political commentators have proclaimed the rapid proliferation of information and communications technology (ICT) as the harbinger of instability to undemocratic governments. But does the spread of ICT necessarily destabilize authoritarian regimes, and does it impact different types of autocracies to the same degree? To determine the effect of ICT on governments, this study adopts a quantitative approach. The relationship between state stability and ICT penetration in countries from 1990 to 2013 is examined using logistic regression techniques. The results of the analysis indicate a statistically significant negative relationship between the onset of violence and ICT presence. Authoritarian regimes, specifically those with institutionalized succession regimes, such as monarchies and one-party states, appear to experience less violence as ICT levels increase, whereas stability changes only marginally in democratic countries. Governments and individuals may utilize ICT in disparate manners in pursuit of opposing objectives, but the spread of ICT to authoritarian regimes seems to favor existing institutions rather than the populace. To better understand the relationship between the stability of authoritarian regimes and ICT penetration, it is recommended that future research blend qualitative analysis with an examination of more specific elements of ICT. Full Text

Keywords: information and communications technology (ICT); authoritarian; autocratic; state stability; violence; civil war; civil conflict; conflict onset; social media index (SMI)

MEDIATION WITH MUSCLE: UNDERSTANDING WHEN MEDIATORS COMMIT RESOURCES TO CIVIL WAR NEGOTIATIONS

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Second Reader: Scott Gartner, School of International Affairs, Pennsylvania State University

Practitioners and scholars have sought to enhance their understanding of how to end civil wars through negotiations, as these conflicts have become increasingly common since WWII. This study argues that mediators might use their resources or influence to incentivize or coerce the warring sides to consider negotiated resolution. The concept of an incentive-based mediation strategy suggests mediators can put skin in the game to facilitate negotiation or settlement. Statistical analysis demonstrates that inter-governmental organizations, such as the United Nations, are more likely to use these incentive strategies and that mediators use these strategies in countries considered neither democracies nor autocracies. These findings can inform policymakers how to leverage power and capability to facilitate negotiations in seemingly intractable civil war conflicts. Full Text

Keywords: mediation, incentive strategies, directive strategies, Afghanistan, civil war, data, armed conflict

NAVY SEALS GONE WILD: PUBLICITY, FAME, AND THE LOSS OF THE QUIET PROFESSIONAL

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Over the past decade, Naval Special Warfare (NSW) has built up significant symbolic capital due to a string of highly politicized and romanticized military operations. The publicity, and the ensuing fame, helped set the conditions for the emergence of a SEAL counterculture characterized by an increasingly commodified and public persona. There has been a shift away from the traditional SEAL Ethos of quiet professionalism to a Market Ethos of commercialization and self-promotion, especially among former SEALs. At the same time, government officials, special interest groups, Hollywood, the publishing industry, and the media writ large have seen the profitability of associating their agendas with the SEAL identity. They are likewise tapping into SEAL fame and offering SEALs an outlet for the commodification of their SEAL affiliation. Such a promotional construct contravenes the dual requirements of security and surprise necessary for the success of SEAL missions. This paper analyzes these trends, and argues that the cultivation of celebrity status has incentivized narcissistic and profit-focused behavior within the SEAL community, which in turn has eroded organizational effectiveness, damaged national security, and undermined healthy civil-military relations. To redress this, all parties must work to reestablish an environment that refrains from promoting special operations for entertainment value, for profit, or for political gain. Full Text

Keywords: Navy SEALs, Naval Special Warfare, special operations, civil-military relations, organizational culture, commodification, social capital, military ethics, professionalism

TOWARD A THEORY OF HYBRID WARFARE: THE RUSSIAN CONDUCT OF WAR DURING PEACE

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With the Russian annexation of Crimea and the undeclared conflict in eastern Ukraine, Western policy analysts have asked if Russia's actions represent a new, more covert approach to warfare. Understanding Russia's perspective on international relations is imperative to supporting potential targets of future Russian action, and specifically, to updating NATO's defensive protocols that are predicated on response to clear military violations of sovereignty. This study uses an existing model for the weaponization of all instruments of state power to examine three case studies that exemplify hybrid political and military forms of war: the 2008 Russian War with Georgia, the 2014 Russian annexation of Crimea, and the 2014–2015 war in eastern Ukraine. This analysis reveals that the concept of hybrid warfare is often too narrowly focused on a conflict's kinetic aspects. In practice, hybrid warfare begins by establishing strategic objectives and employing means that violate another state's sovereignty during a time of peace. Findings further point to successful outcomes when coercive violence is timed to minimize the chances of international military response. Hybrid warfare also holds promise for other malign actors who wish to pursue objectives without directly confronting Western military strength. Full Text

Keywords: Hybrid warfare, inter-state conflict, Russia, political warfare, non-linear warfare, active measures

ASSESSING THE THREAT OF ISLAMICALLY MOTIVATED TERRORISM IN BULGARIA

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Second Reader: George Lober, Department of Defense Analysis

The purpose of this thesis is to create a simple model, called the Religious Extremism Manifestation Model (REMM), that will help identify whether specific conditions in Bulgaria are favorable for the emergence of Islamic extremism and terrorism. Building on fundamentalist theory, and Heather Gregg's insights into the causes of religious violence, the REMM model focuses on four variables—groups and leaders, intentions, capabilities, and targets—as necessary conditions for religiously motivated terrorism. Using the REMM model to analyze the potential for the growth of Islamically motivated terrorism in Bulgaria, the thesis argues that the Bulgarian government needs to increase the following: funding and cooperation between security services; a better understanding of its Muslim minority in order to decrease their sense of alienation; resources and services for minorities that can compete with Islamic non-governmental organizations (NGOs); cooperation with the EU to devise a strategy for managing immigrants; and monitoring of the presence of foreign influence, including Islamic NGOs, Bulgarians studying in Islamic schools abroad, and influential materials that could promote religiously motivated terrorism. Full Text

Keywords: fundamentalism, religious violence, religious extremism manifestation model, terrorism, Bulgaria

DIM NETWORKS: THE UTILITY OF SOCIAL NETWORK ANALYSIS FOR ILLUMINATING PARTNER SECURITY FORCE NETWORKS

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As the security landscape changes, the importance of strong and influential partnerships for security cooperation (SC) increases. The process of selecting the best possible partners should not be neglected; tools to accomplish this task may already exist. Recently, the use of social network analysis (SNA) has allowed the military to map dark networks of terrorist organizations and selectively target key elements. SNA data collection and analysis efforts remain focused on these terrorist networks, whereas friendly or light networks have been relatively neglected. This thesis highlights the importance of analyzing light networks for SC and introduces the concept of dim networks. These are networks that consist of friendly actors whose connections to external organizations may not be public. This thesis has potential to improve partner security force engagement selection through the use of SNA principles, methods, and software, yielding several dividends. First, it provides a commander with a detailed understanding of the foreign units involved in SC, which allows for development of a more focused engagement strategy. Second, it allows SC planners to invest time and resources on the partner security forces that most effectively advance the commander's engagement priorities. Third, it reinforces the collection of network-related data on organizations the U.S. military cooperates with and the importance of analyzing that empirical data to improve SC. Full Text

Keywords: social network analysis, dark networks, light networks, dim networks, security cooperation, Southeast Asia, network, Special Operations, Philippines

CYBER-ENABLED UNCONVENTIONAL WARFARE: THE CONVERGENCE OF CYBERSPACE, SOCIAL MOBILIZATION, AND SPECIAL WARFARE

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Master of Science in Information Strategy and Political Warfare
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Second Reader: Dorothy Denning, Department of Defense Analysis

The United States currently faces an environment of constrained resources and increasing threats where new foreign policy options need to be considered. An area that holds the potential for low-profile campaigns to confront enemies of the United States is cyber-enabled unconventional warfare (UW). Conducting military operations through cyber-enabled UW is less expensive, and inherently, it involves less physical risk than a conventional deployment of U.S. military personnel abroad. This research indicates that seven conditions exist in the cyberspace environment that can enhance the conduct of UW. Since no organization in the U.S. military with the requisite capabilities to exploit these conditions in the cyber domain exists, one should be created. Cyber-enabled UW can provide scalable military options to U.S. policymakers that are currently not available. Full Text

Keywords: attack, collective action, computer networks, conflict, cyber-attacks, cyber militia, cyber operations, cyber space, cyber warfare, cyber terrorism, DDoS attacks, department of defense, hackers, hacktivists, hybrid warfare, information warfare, insurgency, Internet, irregular warfare, military capabilities, military doctrine, military strategy, non-state actors, social movement theory, social network analysis, Special Forces, Special Operations Command, Special Operations Forces, strategic implications, technology, troll army, unconventional warfare, warfare

TRANSITIONS FROM VIOLENCE TO POLITICS: CONDITIONS FOR THE POLITICIZATION OF VIOLENT NON-STATE ACTORS

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Advisor: Glenn Robinson, Department of Defense Analysis
Co-Advisor: Robert Burks, Department of Defense Analysis

It is imperative for a nation to understand the most effective way to combat threats to its national security, and at times the best reaction to a violent atrocity could be diplomatic. This thesis examines the politicization process of violent non-state actors and the five statistical factors that contribute to the likelihood of a successful transition from violence to politics. These five salient factors include the occurrence of negotiations, the ideology of the organization, the motivations of the organization, the types of targets it selects to attack, and the longevity of the group. These factors are identified through a statistical analysis, and tested in successive chapters examining case studies of violent actors that have successfully politicized, are currently transitioning, or have failed. The objective of this thesis is to determine if the factors examined can be used to predict the likelihood of other violent non-state actors successfully transitioning to politics. Additionally, the case is made that politicization significantly reduces violence. The conclusion suggests how legitimate state actors that are combating violent non-state actors can gauge ripeness for politicization and suggests how to focus a state's efforts in order to support either a political transition or facilitate a group's collapse. Full Text

Keywords: politicization, politicize, political transition, transition to politics, factors for politicization, factors for transition

PHASES OF VIOLENT EXTREMISM: TARGETING THE EVOLUTION OF AL-SHABAAB

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Second Reader: Anna Simons, Department of Defense Analysis

The events of September 11, 2001, and the reactions that followed sparked a surge in international terrorist organizations, resulting in increased threat to U.S. national security. Although military operations have had some short-term successes against violent, extremist organizations (VEOs), they are an insufficient long-term counter-extremism strategy. It is apparent that a new approach and new way of analysis are necessary. We examine the problem by focusing on Al-Shabaab, a VEO in Somalia, with attention to its stages of development. Using unclassified sources, we apply three theoretical frameworks to determine whether deterrence might be effective as a countervailing strategy at each stage. For Phase One, beginning before the organization's establishment, we look at historical and cultural context. Phase Two analyzes formation and growth from the perspective of social movement theory, and Phase Three employs a structural perspective, using organizational design theory, to the VEO in its mature form. Conclusions are drawn, based on deterrence theory, for each stage in the VEO's evolution. This research provides a foundation by which policy and strategy makers may gain insight into the seams, gaps, strengths, and weakness of VEOs as they change over time, and where deterrent strategies may be applied to advantage. Full Text

Keywords: violent extremist organization, Al-Shabaab, culture, social movement theory, Somalia, organizational design theory, deterrence theory, terrorism

JOINT COMBINED EXCHANGE TRAINING EVALUATION FRAMEWORK: A CRUCIAL TOOL IN SECURITY COOPERATION ASSESSMENT

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Second Reader: Ian Rice, Department of Defense Analysis

A focal point of American security readiness is proactive security interaction with cooperative states and allies abroad to deter threats, protect the homeland, and advance national interests. As a component in this effort, the militaries of the United States and the Republic of the Philippines (PH) have been conducting recurring bilateral engagements since 1991. Among these Security Cooperation programs, Joint Combined Exchange Training (JCET) produces a high return on training investment through the enhancement of U.S. Special Operations Forces (SOF) in mentor, instructor and advisor roles, as well as increasing cultural understanding and trust between American and Filipino counterparts, U.S.–PH interoperability, and both militaries' tactical skills. Despite several decades of conducting JCETs, no objective assessment of these events has been done. Thus, this study develops the JCET Evaluation Framework (JEF)—a tool based on the Eight-Step and ADDIE training models to examine the effectiveness of JCETs. Uniquely, this study compares the post-training reports from both the PH and U.S. SOF units to validate the evaluation design, and provides recommendations for the improvement of future JCETs: improving after-action report formats, developing an overall engagement strategy, improving resource sustainment and the human rights vetting processes, and conducting and bilaterally sharing post-engagement surveys. Full Text

Keywords: joint combined exchange training (JCET), security cooperation (SC), security assistance (SA), security force assistance (SFA), Republic of the Philippines (PH), JCET evaluation framework (JEF), 8-step training model, analyze, design, develop, implement, and evaluate (ADDIE)

A CAUSE FOR CONCERN? THE SPREAD OF MILITANT ISLAM IN EAST AFRICA

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This thesis examines the spread of militant Islam in Kenya and Tanzania. We argue that Islamist militants who have gained a foothold in Kenya and are attempting to expand into Tanzania are behind an increasing number of attacks. We contend that spillover effects from the failed state of Somalia, along with influence from other external actors, are as important—if not more important—than other factors that receive the bulk of the attention, such as socioeconomic disparities and the perceived lack of political representation of Muslims. A third under-recognized but critical factor is the burgeoning population of Muslim youth. Ultimately, this thesis seeks to draw attention to the importance of these three factors. It concludes by offering options to counteract the spread of militant Islam in the region. Full Text

Keywords: East Africa, Kenya, Tanzania, Somalia, militant Islam, youth bulge, external actor, terrorism, counterterrorism, radicalization

DEATH, TAXES, AND DISASTERS: AFSOF'S UTILITY IN DISASTER RESPONSE

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Second Reader: Brian Greenshields, Department of Defense Analysis
Second Reader: Brian Steckler, Department of Information Sciences

The United States has participated in overseas humanitarian assistance and disaster relief (HADR) efforts since its inception. Today, the principal government agent responsible for HADR responses is the U.S. Agency for International Development (USAID), which works closely with the U.S. Department of Defense, including Marine, Navy, Air Force, and special operations forces to provide logistical support. Air Force special operations forces (AFSOF) are an especially useful HADR asset, given their speed, organic command and control, and unique mission sets. Despite this, AFSOF is often overlooked as a rapid responder in HADR operations. This thesis investigates the use of AFSOF as a rapid responder through two case studies: the 2004 HADR operation following the earthquake and tsunami in Southeast Asia and the HADR operation following the 2013 super typhoon in the central Philippines. In both cases, AFSOF provided critical support in the hours and days after these disasters and helped pave the way for more sustained efforts undertaken by other U.S. and international responders over time. To improve AFSOF's capabilities as a HADR force, this thesis recommends creating one set of HADR definitions for the U.S. government, improving AFSOF's and USAID's relationship, and implementing an AFSOF Disaster Response Concept of Operations. Full Text

Keywords: humanitarian assistance and disaster relief, Air Force special operations forces, special operations forces, rapid-onset natural disaster, organic command and control, speed, unique mission sets, interoperability, MC-130

COUNTERING THE HIDDEN HAND: A STUDY OF IRANIAN INFLUENCE IN IRAQ

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The purpose of this thesis is to illuminate the pathways of Iranian influence in Iraq in order to provide U.S. decision makers with a possible strategy to counter Iran's malignant influence there. By using a combination of social network analysis and social movement theory, this study illuminates the network of actors fighting Daesh in Iraq by first analyzing the network to map Iran's influence channels and identify macro- and micro-level brokerage within the network. Using a social-movement focused approach, this study then identifies a candidate group for mobilization. Study of the network reveals that Iranian influence is exerted via its sponsored Shi'a militias and by conducting bloc recruitment of tribal militias. To counter this, the Jubouri tribal confederation located in Salahuddin Province offers high potential for mobilization under U.S. sponsorship that could be used to combat Iranian influence. Full Text

Keywords: Daesh, Islamic State in Iraq and Syria, ISIS, Islamic State, IS, Islamic State in Iraq and the Levant ISIL, social movement theory, SMT, Social network analysis, SNA, unconventional warfare, UW, irregular warfare, IW, human domain mapping, influence, Iran, Iraq, brokerage, politics, political

TECHNOLOGY STRATEGY IN IRREGULAR WARFARE: HIGH-TECH VERSUS RIGHT-TECH

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When faced with any type of irregular warfare, technology integration has proved to be problematic for developed countries with technologically advanced militaries. Developed countries train and equip their militaries and develop military doctrines that tend to focus on protection from other developed countries. Thus, these military agencies are well prepared for conventional warfare and assume they can use the same operational concepts against irregular adversaries as well. Unfortunately, this theory has proved incorrect. History suggests that developed countries rely on the most advanced technologies to provide an advantage in all operations; however, high-tech does not always equate to right-tech. Through three related case studies, this thesis analyzes how strong actors use varying levels of technology to engage weak actors in irregular warfare, and how the misuse of technology can lead to defeat rather than victory for the strong actors. I suggest that advanced militaries should develop technology strategies for irregular warfare that are based on tailored capabilities. Additionally, these agencies need processes that promote tactical and technological innovation to fill operational gaps in their capabilities for waging irregular warfare. Full Text

Keywords: technology strategy, irregular warfare, unconventional warfare, high-tech, low-tech, special operations, Afghanistan, Britain, Soviet Union, United States, aircraft, artillery

INSURGENT DESIGN: THE RE-EMERGENCE OF AL-QA'IDA FROM 9/11 TO THE PRESENT

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Analysts disagree on how to characterize al-Qa'ida's evolution. One perspective regards jihadi-Islamism in general to be self-marginalizing. A second perspective describes the merging of discrete jihadist grand strategies that is considered symptomatic of the decline of al-Qa'ida and its allies. A third finds that al-Qa'ida is gathering strength. This study expands upon the gathering strength perspective, contending that al-Qa'ida's successes are derived from its design orientation and competence. Al-Qa'ida agents have vigorously redesigned their transnational system to adapt to a profoundly hostile and unpredictable environment. For al-Qa'ida and its brethren, the highest rate of adaptation is occurring on the battlefield, as they experiment with varied technologies of warfare, rather than in debate over grand strategic ideas. Where before there were fleeting, desultory actions by terroristic cells, now maturing organizations vie for territorial control, establishing jihadi emirates and proto-states. To respond effectively to the situation, Western understanding of al-Qa'ida and the wider system of jihadi-Islamist insurgency must evolve apace. Full Text

Keywords: al-Qa'ida, complex adaptive systems, design theory, insurgency, Islamism, jihadism, organization change, organization design, state formation, terrorism

ENTERING THE MATRIX: THE CHALLENGE OF REGULATING RADICAL LEVELING TECHNOLOGIES

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Radical Leveling Technologies (RLTs) constitute a new class of technologies that have exponential disruptive effects across a diverse set of societal processes resulting in radical change. This emerging class has profound leveling effects. Users can leverage RLTs to produce national or international impacts without the need for significant technological expertise. These effects may occur via digital diffusion and without the need for extensive infrastructure. RLTs are being driven by the power and expertise of online Open Source Communities. The ability of existing policy and enforcement methods to regulate this class of technology successfully, particularly within the counterproliferation space, suggests that a paradigm change is necessary. A spectrum of potential solutions is considered which advocates for collaborative efforts vice hard policing measures to engage online communities while also providing options to build additional security capacity within the government and law enforcement communities. Capacity can be gained via unconventional means including the use of cyber bounties, cyber privateering, hybrid fusion centers, and decentralized autonomous technology teams to improve support to existing special operations efforts, particularly within the counterproliferation mission set. Full Text

Keywords: Radical Leveling Technologies, additive manufacturing, synthetic biology, biohacking, 3D printing, emerging disruptive technology, technology regulation, technology policy, technology convergence, counterproliferation, counterterrorism, interagency collaboration

DECISION MAKING IN CHAOS

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Second Reader: Frank Barrett, Graduate School of Business and Public Policy

How do military special operations officers make quick decisions in complex, fast-moving combat environments where the quality and speed of a decision could mean the difference between life and death? This qualitative study of Army and Navy special operations officers explores the factors that contribute to each individual's decision-making process. The findings reveal that chaos is a function of enemy sensebreaking efforts, and to overcome this, leaders must first internalize the gravity of their current circumstances, a process referred to as sense conversion. After this point they are able to begin the sensemaking process that allows them to make an informed decision. This study led to a model of rapid decision making that revealed both the individual process as well as external factors, such as cohesion, that played critical roles in their ability to make decisions in chaos. Full Text

Keywords: sensebreaking, sense conversion, sensemaking, decision making, cohesion, chaos

CHINA'S SOFT POWER: CHANGING THE WORLD PERCEPTION

This paper has been recognized as outstanding by its department

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Second Reader: Feroz Khan, Department of National Security Affairs

China has focused on improving its image in the world by relying more on its soft power by investing billions of dollars simply to convince the world to accept its rise in the international system. This paper uses both quantitative and qualitative methods in order to grade and assess China's success with these efforts. While I could not find any significant relationship between China's tools of soft power and its positive perception building in the international community, I could also not find any significant effect of China's rise on its negative perception building among the international community. This may, in and of itself, be a significant result. More specifically, the research reveals that many of the ideals held by China significantly clash with existing international norms—that China lacks credibility in the exercise of its public diplomacy, and that China relies too heavily on the attractiveness of its culture. Full Text

Keywords: China, soft power, Asia, Africa, Latin America, China threat, culture, public diplomacy, foreign policy, peaceful rise, win-win strategy, peaceful development, energy, oil, great power, noninterference policy, resources, Beijing Consensus

MASTER OF SCIENCE
IN
ELECTRICAL ENGINEERING

RANGE SIDELOBE RESPONSE FROM THE USE OF POLYPHASE SIGNALS IN SPOTLIGHT SYNTHETIC APERTURE RADAR

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Co-Advisor: Phillip Pace, Department of Electrical and Computer Engineering

This thesis investigated five specific phase-shift keyed (PSK) modulated signals for usage in Spotlight Synthetic Aperture Radar (SAR) and the effects each of the individual PSK signals sidelobe structures has on SAR imagery. The specific PSK codes studied were the Frank code, P1 code, P2 code, P3 code and P4 code. A mathematical approach was used to define SAR limitations from signal parameters, and simulations were used to investigate an individual signal parameter's effects on the sidelobe structure in SAR images. Simulations were used to generate spatially diverse targets, collect each target's unique echo and apply cross-correlation match filtering and pulse integration to detect each returned echo from the targeted area. Results show the P1 and Frank codes to be the most promising based on the selected parameter presented in this thesis. The P4 code may be better given additional processing to remove range ambiguities, enhancing its unambiguous range. Full Text

Keywords: synthetic aperture radar, peak side lobe level, phase shift key, polyphase, range sidelobes

GENERALIZED HOUGH TRANSFORM FOR OBJECT CLASSIFICATION IN THE MARITIME DOMAIN

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Advisor: Murali Tummala, Department of Electrical and Computer Engineering
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A generalized Hough transform (GHT)-based classification scheme for an object-of-interest in maritime-domain images is proposed in this thesis. First, the object edge points are extracted and used to generate a representation of the object as a Hough coordinate table by using the GHT algorithm. The table is then reformatted to a contour map called a Hough features map. The coordinates of dominant peaks, or Hough features, on the map are extracted and fed into a feed-forward, back-propagation neural network for classification. In this research, the scheme is tested using perfect shapes of triangles, squares, circles, and stars and maritime-domain images of ships, aircraft, and clouds, and the classification results obtained are reported. Full Text

Keywords: generalized Hough transform, object detection, object classification, discrete cosine transform

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MASTER OF SCIENCE IN INFORMATION STRATEGY AND POLITICAL WARFARE

IDENTIFICATION OF BEHAVIORAL INDICATORS IN POLITICAL PROTEST MUSIC

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Advisor: Sean Everton, Department of Defense Analysis
Second Reader: Daniel Cunningham, Department of Defense Analysis

Planning and preparing to influence the behavior of foreign target audiences (TAs) is an immense and complex task. Current military information support operations (MISO) rely on content-based understandings of standard source material, such as traditional news sources. This approach is limited because each TA has cultural traits that may not be revealed by standard sources. Unconventional sources may supplement current practices and assist in identifying the motivations behind a TA's behavior, which can lead to ways to influence that behavior. Political protest songs are one such source. Protest music is goal-oriented, and lyrics often parallel movement goals of potential TAs. This thesis examines how political protest music can help identify conditions and vulnerabilities that may explain TA behavior. It takes the first step forward in exploring the value of political protest music to the MISO process by employing network text analysis to illuminate symbols, buzzwords, stereotypes, and factoids that reveal behavioral indicators. What is challenging for practitioners is that there is no single method that best identifies all behavioral indicators with political protest music. It remains that results may simply identify behavioral indicators, and that any full explanation of behavior must be developed as part of the whole MISO process. Full Text

Keywords: military information support operations, MISO, psychological operations, PSYOP, information warfare, target audience analysis, political protest music, protest music, network text analysis, NTA, behavioral indicators, behavioral vulnerabilities, behavioral conditions, information strategy, political warfare, social network analysis, network analysis, content analysis

MAPPING LIBYAN JIHADIST NETWORKS FOR UW

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Advisor: Doowan Lee, Department of Defense Analysis
Second Reader: Sean Everton, Department of Defense Analysis

The post-Gaddafi Libyan war continues along fractured lines of allegiance. Various militia networks are in open armed conflict with each other and pitted against other jihadist networks. The central government is split in two, and the United Nations is working to broker a unity government that can offer at least a partial solution. One of the contributing factors to this conflict and the pervasiveness of jihadist networks in Libya is a Libyan history of conflict stretching back to World War I. These jihadist networks arose both before and during the civil war. The latest jihadist organization to entrench itself in the civil war is the Daesh. In this thesis, Daesh's expansion in Libya is explored through the lens of a political process model. Then, jihadist networks in Libya are mapped. Social ties between each other and other non-jihadist elements of Libyan civil society are illuminated in a search of candidate brokers. The most influential jihadist brokers are identified and ranked in

terms of their relative influence. Finally, these insights are used to help define new strategies for contending with jihadists in Libya. Full Text

Keywords: Libya, Daesh, Islamic State in Iraq and Syria, ISIS, Islamic State, IS, social movement theory, SMT, social network analysis, SNA, unconventional warfare, UW, irregular warfare, IW, information operations, IO, information warfare, Army Operating Concept, AOC, human domain mapping, insurgency, organizational strength, political process model

PRECIPITATING THE DECLINE OF AL-SHABAAB: A CASE STUDY IN LEADERSHIP DECAPITATION

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Master of Science in Information Strategy and Political Warfare
Advisor: Bradley Strawser, Department of Defense Analysis
Second Reader: Anna Simons, Department of Defense Analysis

The tactic of leadership decapitation, using military action to capture or kill terrorist leadership, is a key component of United States counterterrorism strategy. Policymakers argue that eliminating terrorist leadership is an effective way to disrupt, and, ultimately, destroy terrorist organizations. Since 2001, hundreds of terrorist leaders have been captured or killed by U.S. counterterrorism operations. In spite of this, the spread of violent, radical jihadist groups like Al-Shabaab has expanded and grown in strength. This thesis analyzes the United States' approach of leadership targeting toward Al-Shabaab in Somalia, and asks the research question: Under what conditions are leadership decapitations effective in degrading the terrorist group Al-Shabaab? This thesis finds that leadership decapitation operations have a limited effect in disrupting and preventing future acts of terrorism. It argues for a more analytical approach to leadership decapitation in order to improve its effectiveness. This thesis argues for leadership targeting principles that are likely to be effective counterterrorism strategies and lead to the long-term decline of the group, including basing targeting decisions on understanding the group's internal dynamics, integrating decapitation operations into comprehensive counterterrorism strategies, and capitalizing on existing leadership divisions, which can be as effective as lethal military action. Full Text

Keywords: leadership targeting, leadership decapitation, counterterrorism, Somalia, Al-Qaeda, Al-Shabaab

CYBER-ENABLED UNCONVENTIONAL WARFARE: THE CONVERGENCE OF CYBERSPACE, SOCIAL MOBILIZATION, AND SPECIAL WARFARE

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Master of Science in Defense Analysis and
Master of Science in Information Strategy and Political Warfare
Advisor: Hy Rothstein, Department of Defense Analysis
Second Reader: Dorothy Denning, Department of Defense Analysis

The United States currently faces an environment of constrained resources and increasing threats where new foreign policy options need to be considered. An area that holds the potential for low-profile campaigns to confront enemies of the United States is cyber-enabled unconventional warfare (UW). Conducting military operations through cyber-enabled UW is less expensive, and inherently, it involves less physical risk than a conventional deployment of U.S. military personnel abroad. This research indicates that seven conditions exist in the cyberspace environment that can enhance the conduct of UW. Since no organization in the U.S. military with the requisite capabilities to exploit these conditions in the cyber domain exists, one should be

created. Cyber-enabled UW can provide scalable military options to U.S. policymakers that are currently not available. Full Text

Keywords: attack, collective action, computer networks, conflict, cyber-attacks, cyber militia, cyber operations, cyber space, cyber warfare, cyber terrorism, DDoS attacks, department of defense, hackers, hacktivists, hybrid warfare, information warfare, insurgency, Internet, irregular warfare, military capabilities, military doctrine, military strategy, non-state actors, social movement theory, social network analysis, Special Forces, Special Operations Command, Special Operations Forces, strategic implications, technology, troll army, unconventional warfare, warfare

CULTIVATING THE GRAPEVINE: AN ANALYSIS OF RUMOR PRINCIPLES AND CONCEPTS

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Jacob Sweatland–Major, United States Army
Master of Science in Information Strategy and Political Warfare
Advisor: Heather Gregg, Department of Defense Analysis
Second Reader: Dayne Nix, Naval War College

Rumors can be a perfect tool to subvert, deceive, or suggest what truth is to a population. However, despite the demonstrated ability of rumors to influence a population, current U.S. military doctrine does not address how to recognize, craft, or counter them effectively. The purpose of this study is to analyze the principles and concepts governing the spread of rumors for their future integration into Psychological Operations (PSYOP) forces doctrine and training. Specifically, this study draws from a review of current and historical literature on rumor theory to distill a set of principles to guide the successful employment of rumors, as well as a set of principles for defending against the employment of rumors by an adversary. These principles are then tested by the case study analysis of three examples of successful rumor generation, as well as two successful examples and one unsuccessful case of rumor defense. From its investigation, this study proposes two new models to assist the influence practitioner in the employment of and defense against rumors. Full Text

Keywords: PSYOP, rumors, doctrine, influence

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MASTER OF SCIENCE IN MANAGEMENT

THE IMPACTS OF HUMANITARIAN ASSISTANCE/DISASTER RELIEF OPERATIONS ON THE MENTAL HEALTH OF MARINES

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Master of Science in Management
Advisor: Yu-Chu Shen, Graduate School of Business and Public Policy
Co-Advisor: Donald Summers, Graduate School of Business and Public Policy

In this thesis, I analyze the role of participation in a Humanitarian Assistance/Disaster Relief (HA/DR) operation on the mental health of Marines serving between 2001 and 2011 by examining the hazard of being diagnosed with four mental health disorders during and after the mission while controlling for relevant demographic and service-specific variables. The four mental health illnesses examined are depression, post-traumatic stress disorder, substance abuse and self-inflicted injuries. The statistical model used in the thesis is the Cox proportional hazard model, a standard nonparametric method of survival analysis. I found that during the year HA/DR participation occurred, Marines were at less risk of being diagnosed with each of the four mental illnesses relative to those never deployed. In the years following participation in a HA/DR operation, Marines have comparable risk of being diagnosed with each of the four mental health illnesses relative to those that were never deployed. In contrast, Marines who returned from OEF/OIF deployments have elevated risks of all four mental health illnesses compared to those never deployed. Additional analysis showed that the effect of HA/DR deployments are similar across segments of Marines, but the elevated risks following OEF/OIF deployments are larger for male Marines relative to female Marines and for enlisted Marines relative to officers. Full Text

Keywords: humanitarian assistance, disaster relief, mental health, post-traumatic stress, depression, substance abuse

THE EFFECT OF USMC ENLISTED AVIATION MAINTENANCE QUALIFICATIONS ON AVIATION READINESS

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Scott Steele–Captain, United States Marine Corps
Master of Science in Management
Advisor: Simona Tick, Graduate School of Business and Public Policy
Co-Advisor: Mark Eitelberg, Graduate School of Business and Public Policy

In an environment where U.S. military readiness is increasingly critical, this thesis investigates the effects of Marine Corps aviation maintenance qualifications on Marine aircraft readiness. The sample population used in this thesis includes flightline, avionics, and airframe mechanics from heavy, light/attack, and tiltrotor Marine squadrons. The study focuses on three specific qualifications believed to have the most impact on readiness. The methods used to analyze these relationships include descriptive statistics, multivariate linear regression, and Monte Carlo simulations, using two independent databases (a time-series file containing readiness and basic qualification information from 2012–2015, and a cross-sectional file containing a snapshot of qualifications and other human characteristics, from 2015). The time-series linear regression models suggest a positive effect of qualifications on readiness. The cross-sectional linear regression models suggest a positive effect of individual characteristics such as rank, years of service, and marital status. The Monte Carlo simula-

tions extended the regression model's findings by injecting controlled variability from the distribution types. The Monte Carlo simulations are also used to formulate a recommended number of qualifications a squadron would need when provided with a target readiness score. Full Text

Keywords: aviation, readiness, qualification, maintenance

A VALIDATION OF THE PROPOSED ROYAL AUSTRALIAN NAVY STANDARD WORK WEEK AND NAVAL MANAGEMENT DIARY USING A SIMULATED CREW OF AN ARMIDALE CLASS PATROL BOAT

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Master of Science in Management
Advisor: Nita Shattuck, Department of Operations Research
Second Reader: Michael Smith, Graduate School of Business and Public Policy

This thesis investigated the validity of the Royal Australian Navy's proposed Navy Standard Work Week (NSWW) model and the Navy Management Diary (NMD) with its accompanying fatigue measurement tool. A simulated 21-member Armidale Class Patrol Boat (ACPB) crew was constructed in the NMD to assess the NSWW. The NMD fatigue measurement tool and the Sleep, Activity, Fatigue and Task Effectiveness (SAFTE) model, and its software instantiation, the Fatigue Avoidance Scheduling Tool (FAST), were used to estimate risk for the periods of activity across the three weeks, resulting in comparison of the associated risk levels identified by the NMD fatigue tool and corresponding FAST scores. In the proposed RAN NSWW model, the category of maintenance most often exceeded its allocated hours, leading to the recommendation that further research on a larger sample might address whether the proposed NSWW should be customized to be platform and occupation specific. The NMD and FAST software tool comparisons resulted in statistically significant differences in predicted risk. The discussion speculates on why these discrepancies exist between the two software tools. The thesis recommends that this methodology be replicated using a larger sample and include empirical observations of performance in actual operations before comparing to FAST-generated predicted effectiveness levels. Full Text

Keywords: actigraphy, crew endurance, crew performance, fatigue management, fatigue mitigation, sleep, FAST, SAFTE, Navy Management Diary, Royal Australian Navy, simulation

MOVEMENT OF FUEL ASHORE: STORAGE, CAPACITY, THROUGHPUT, AND DISTRIBUTION ANALYSIS

Michael Herendeen–Captain, United States Marine Corps
Master of Science in Management
Advisor: Chad Seagren, Department of Operations Research
Second Reader: Kenneth Doerr, Graduate School of Business and Public Policy

The Marine Corps' recent reemphasis on amphibious operations has identified a potential operational reach gap in the sustainment window of the Marine Expeditionary Brigade (MEB) in an undeveloped theater. This problem is defined by a limited capacity to move fuel ashore from tactical and seabased assets, coupled with increasing rates of end-user consumption. In the absence of host-nation support, sustaining the MEB during operations ashore requires joint interoperability of several fuel distribution systems and methods of resupply. The success of the seabased logistics network will depend on the use of a modern planning and forecasting approach. It is the aim of this study to understand the connection between the GCE's operational behavior and its fuel demand. This is accomplished through the use of the MAGTF Power and Energy Model to create a fuel usage data set. Subsequent regression analysis reveals key trends and provides insight into how opera-

tional decisions can result in marginal changes to fuel demand. Finally, this study examines the feasibility of fuel movement ashore using only the ship-to- shore connectors available to the MEB. Full Text

Keywords: Marine Corps, fuel, energy, logistics, expeditionary, amphibious, operational reach

SIGNIFICANT PRE-ACCESSION FACTORS PREDICTING SUCCESS OR FAILURE DURING A MARINE CORPS OFFICER'S INITIAL SERVICE OBLIGATION

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Master of Science in Management
Advisor: Marigee Bacolod, Graduate School of Business and Public Policy
Second Reader: Noah Myung, Graduate School of Business and Public Policy

Increasing diversity and equal opportunity in the military is a congressional and executive priority. At the same time, improving recruiting practices is a priority of the commandant of the Marine Corps. In an effort to provide information to the Marine Corps that may improve recruiting practice and enable retention of a higher quality and more diverse officer corps, probit econometric models are estimated to identify significant factors an officer candidate possesses prior to accession in predicting the probability of career success, as determined by career designation, and the probability of career failure, as determined by separation under unfavorable conditions and receiving a legal action while commissioned. Results showed demographic characteristics, such as race and marital status, significantly predict career success and career failure. In addition, officers with reenrollment waivers for withdrawal or dismissal from OCS, USNA, and NROTC proved less likely to be selected for career designation and more likely to be separated under unfavorable conditions. Based on the findings, the Marine Corps should reevaluate whether to grant reenrollment waivers to officer candidates, improve data collection, and strongly consider using non-cognitive assessment during the officer candidate screening process. The researcher also recommends ways to improve the models used in this study. Full Text

Keywords: Marine, officer, candidate, accession, success, failure, separation, career designation, probit, regression, predict, probability

THE EFFECT OF PERSONNEL STABILITY ON MARINE CORPS READINESS: ARE INFANTRY BATTALIONS READY TO RESPOND TO FUTURE CONFLICTS?

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Master of Science in Management
Advisor: Marigee Bacolod, Graduate School of Business and Public Policy
Co-Advisor: William Hatch, Graduate School of Business and Public Policy

The next man up slogan may be acceptable for competitive sports, but it seems more likely to characterize negligence when placed in the context of the potential life-and-death outcomes facing the members of a military organization. This research questions whether the Marine Corps' manning and staffing policies are adequately setting the conditions for infantry battalions to achieve optimal readiness prior to deployment. The clearest snapshot of an infantry battalion's readiness is displayed during the unit's mission rehearsal exercise. According to this research, the Marine Corps manning and staffing policies accomplish the commandant's guidance, but the results from the models in this study identify weaknesses in current policy metrics. In fact, the Marine Corps manpower process is underperforming the task of stabilizing infantry battalions prior to deployment. The resulting effect is a negative contribution toward unit cohesion and readiness. This study recommends including a stability metric in the current readiness model, adjusting the staffing window, and prioritizing the staffing of the statistically significant unit groups identified in this study. The Marine Corps can improve the

readiness of infantry battalions by modifying the manning and staffing policy guidelines and enforcing the initiative known as the Deployed Unit Staffing Cohesion policy. Full Text

Keywords: United States Marine Corps, infantry battalion, manpower, stability, personnel, readiness, cohesion, force generation, human resource development process (HRDP), manning, requirements, pre-deployment training, combat effectiveness, mission essential tasks

A BETWEEN-SQUADRON ANALYSIS OF CANNIBALIZATION ON THE MV-22

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Master of Science in Management
Advisor: Kenneth Doerr, Graduate School of Business and Public Policy
Second Reader: Donald Summers, Graduate School of Business and Public Policy

The Naval Aviation Maintenance Program recognizes cannibalization as a viable management tool when properly used in aviation squadrons. Squadrons consequently practice cannibalization in an attempt to reduce gaps in their logistical and maintenance support systems. This thesis analyzed cannibalizations on the MV-22 aircraft platform to examine how the practice varied between squadrons in the community, which specific components drove cannibalizations, and how the practice of cannibalization affected aircraft availability. Using descriptive and inferential statistics, cannibalization data from 2010 to 2014 for 13 selected MV-22 squadrons were analyzed under six selected categories. All MV-22 components cannibalized during that period were also analyzed to examine the top cannibalization drivers and how those components changed over time. Lastly, statistical tests were performed to uncover how cannibalizations affected aircraft availability. The analysis revealed some squadrons as better performers at cannibalization than others, and that squadrons also varied under reasons for cannibalization, maintenance hour documentation, partial mission capable cannibalizations, and cannibalizations on deployment. The statistical test also revealed that cannibalizations had little to no effect on MV-22 aircraft availability. Recommendations for maintenance data system improvements were provided along with suggested MV-22 best cannibalization practices. Full Text

Keywords: NAMP, V-22, cannibalization, aircraft maintenance, aviation, readiness

AN ANALYSIS OF THE IMPACT OF FINANCIAL FACTORS ON THE WELL-BEING OF MILITARY OFFICERS

This paper has been recognized as outstanding by its department

Brian Turner–Major, United States Marine Corps
Master of Science in Management
Advisor: Juanita Rendon, Graduate School of Business and Public Policy
Co-Advisor: Steven Landry, Graduate School of Business and Public Policy

The purpose of this research study was to survey resident Naval Postgraduate School (NPS) students about various financial factors to determine which factors have the most significant impact on subjective well-being. An online voluntary and anonymous survey was deployed to students about various financial factors, nonfinancial factors, and constraints on resources. This research replicates a previous study conducted primarily with enlisted soldiers. Based on the analysis, having enough net worth to be set for retirement, having emergency savings of $1,000 to $2,000, and having financial knowledge are all statistically significant variables affecting an individual officer's subjective well-being. Additionally, having over $5,000 of vehicle debt, being separated from a spouse, and having any dependents (excluding a spouse) result in a marginally negative impact on an officer's subjective well-being. Neither rank nor age were found to have any statistical significance with regard to well-being. The analysis highlights some differences between the mostly enlisted population previously surveyed and the officers at NPS. One difference was that credit card debt has less impact on the

subjective well-being of officers at NPS than was found in the previous study. Finally, the analysis provides some recommendations for future personal financial education of military officers. Full Text

Keywords: personal financial management, subjective well-being, financial factors

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MASTER OF SCIENCE IN MECHANICAL ENGINEERING

REDUCTION EXPANSION SYNTHESIS FOR MAGNETIC ALLOY POWDERS

Samuel Lowell–First Lieutenant, United States Army
Master of Science in Mechanical Engineering
Advisor: Jonathan Phillips, Department of Physics
Co-Advisor: Claudia Luhrs, Department of Mechanical and Aerospace Engineering

In this work submicron scale ferromagnetic and magnetic rare-earth alloys were produced using reduction expansion synthesis (RES), a technique in which metal particles are the product of the rapid heating to approximately 800 degrees Celsius, in inert atmosphere, of physical mixtures of urea, or similar molecules, and metal oxide, hydroxide or nitrates. As shown by scanning electron microscopy and X-ray diffraction, RES produced submicron magnetic particles. Essential to both 3D printing and metal injection molding (MIM) is the availability of fine powders to manufacture small, complex, metal parts. There are technological limits to the minimum particle size, which is approximately 10 microns, that can be produced using available low-cost techniques. This minimum particle size, in turn, limits the size of features on MIM and 3D printed metal parts. The demonstrated ability of RES to produce sub-micron particle sizes indicates this technology could enable the manufacture of finer features using either 3D printing or MIM. Full Text

Keywords: reduction expansion synthesis, 3D printing, metal injection molding, additive manufacturing, permanent magnets, rare earth magnets, ultrafine powder

DESIGN AND ANALYSIS OF AN EXPERIMENTAL SETUP FOR DETERMINING THE BURST STRENGTH AND MATERIAL PROPERTIES OF HOLLOW CYLINDERS

This paper has been recognized as outstanding by its department

Timothy Ponshock–Lieutenant, United States Navy
Master of Science in Mechanical Engineering
Advisor: Young Kwon, Department of Mechanical and Aerospace Engineering
Co-Advisor: John Molitoris, LLNL

A mechanical device and associated testing procedure were developed to apply internal pressure to open-ended cylinders for determination of various properties, including burst pressure, elastic modulus, and Poisson's ratio. ANSYS finite element analysis software was used to model the operation of the device with aluminum cylinders. Analytic equations for thin and thick cylinders were used to validate the computer model results. Initial mechanical testing was performed with aluminum cylinders to verify results against the finite element model. Glass and carbon fiber composite cylinders were fabricated and tested to failure with the device and the aforementioned properties were found. Finally, carbon fiber composite tensile specimens of the dog-bone shape were tested to failure to compare material properties with those found from the cylinder tests. The test device and methods developed in this research support Lawrence Livermore National Laboratory and the Defense Threat Reduction Agency in the development of the Agent Defeat Penetrator, a next-generation agent defeat weapon. Full Text

Keywords: carbon fiber composite, glass fiber composite, pressure testing, composite cylinder

INITIAL TESTING FOR THE RECOMMENDATION OF IMPROVED GAS METAL ARC WELDING PROCEDURES FOR HY-80 STEEL PLATE BUTT JOINTS AT NORFOLK NAVAL SHIPYARD

Veronika Rice–Lieutenant, United States Navy
Master of Science in Mechanical Engineering
Advisor: Young Kwon, Department of Mechanical and Aerospace Engineering
Second Reader: Ryan McCrillis, U.S. Navy, NNSY

Hull cut welding proficiency is an essential skill maintained by personnel at naval shipyards. This thesis explores arc weld theory to develop ideal submarine hull butt joint designs and recommends preliminary testing to be used .to develop improved butt joint welding procedures at Norfolk Naval Shipyard. Pulsed gas metal arc welding (GMAW-P) is the ideal process for shipboard hull welding applications, theoretically. Butt joint samples were created using HY-80 steel plate so that the following comparisons could be made: 90%Ar-10%CO2 versus 95%Ar-5%CO2 shielding gases and their effect upon weld penetration, Miller brand versus Lincoln Electric brand power supply synergic GMAW-P algorithm performance, and Single-V versus Double-V butt joint design. Based upon the creation of butt joint samples, it was determined that 90%Ar-10%CO2 is a more ideal gas mixture for this application and that Lincoln Electric brand machines have preferred interface by Norfolk Naval Shipyard welders. Future research is still needed in a controlled environment to develop optimized GMAW-P procedures. Full Text

Keywords: gas metal arc welding, submarine, hull cut, butt joint, weld, shielding gas, HY-80 steel, plate

MASTER OF SCIENCE
IN
METEOROLOGY AND PHYSICAL OCEANOGRAPHY

A TEMPORAL AND SPATIAL ANALYSIS OF WAVE-GENERATED FOAM PATTERNS IN THE SURF ZONE

Charlotte Benbow–Lieutenant, United States Navy
Master of Science in Meteorology and Physical Oceanography
Advisor: Jamie MacMahan, Department of Oceanography
Second Reader: Edward Thornton, Department of Oceanography

Aerial videos of the surf zone at Sand City, Monterey Bay, California, were acquired using an unmanned aerial vehicle. Videos of 26 individual bores were converted to still images and were georectified, georeferenced, and post processed. The size, shape, and evolution of the wave generated foam patterns within the surf zone were analyzed. The results were tested against two existing hypotheses of foam pattern generation, obliquely descending eddies (ODEs) and self-organization due to bubble rise. Three foam regions within the surf zone were recognized. The largest region, the foam mat, encompasses nearly the entire surf zone and is described as a mat of foam that develops obvious foam holes. The areas of the holes grew in area and elongated with time. The results were inconsistent with the two theories of foam hole generation. The fringe region is the most seaward foam region and is marked with circular foam rings that become larger in area and more distinct with time. The fringe region data are contrary to observations of ODEs but is consistent with the theory of self-organization due to bubble rise. The gap region, located between the plunge point and the splash up created by the bore collapse, is marked by horizontal foam tubes oriented in the cross-shore direction. The foam tubes are likely created in the convergent region between two counter-rotating vortices. Full Text

Keywords: wave breaking, foam, obliquely descending eddies, aerial imagery, image processing

ANALYSIS OF DELAYED SEA BREEZE ONSET FOR FORT ORD PRESCRIBED BURNING OPERATIONS

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Master of Science in Meteorology and Physical Oceanography
Advisor: Wendell Nuss, Department of Meteorology
Second Reader: Qing Wang, Department of Meteorology

The U.S. Army conducts prescribed burns at Fort Ord, in Monterey County, California, and is reliant upon forecasting a delayed sea breeze for successful smoke management. This has been previously associated with opposing synoptic scale flow, static stability, and weakened thermal gradients. Evolution of the sea breeze in the complex coastline and topographic structure of the Monterey Bay area is the focus of this study. The CFSR and 12 km NAM combined with local observations in a multiquadric data assimilation system were used to characterize synoptic and mesoscale flow evolutions. Eight case studies were analyzed to better understand background synoptic flow and mesoscale response, characterize primary sensitivities, and develop rules of thumb. All case studies had delayed sea breeze onset until approximately 2000 UTC. A 5 knot delayed sea breeze is triggered by a 5° cross-sectional thermal gradient in the presence of a 2–3 knot offshore synoptic scale component over Fort Ord, regardless of synoptic flow strength or direction. A weaker 2 knot delayed sea breeze developed when strong static stability reduced vertical motion or in the absence of a background cross-

coast thermal gradient. These factors suggest key forecast parameters to anticipate sea breeze delay effectively lengthening a burn window. Full Text

Keywords: delayed sea breeze, Fort Ord, Fort Ord prescribed burn, sea breeze, sea breeze onset, static stability, synoptic scale flow, thermal gradient

EASTERN MEDITERRANEAN SEA SPATIAL AND TEMPORAL VARIABILITY OF THERMOHALINE STRUCTURE AND CIRCULATION IDENTIFIED FROM OBSERVATIONAL (T, S) PROFILES

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Master of Science in Meteorology and Physical Oceanography
Advisor: Peter Chu, Department of Oceanography
Co-Advisor: Chenwu Fan, Department of Oceanography

In this thesis, the optimal spectral decomposition (OSD) method was used to establish the synoptic monthly varying three-dimensional gridded temperature and salinity data for 54 years on a 0.25°x0.25° grid. The analysis included 164,906 temperature profiles and 53,606 salinity profiles. After the establishment of gridded data, the seasonal and inter-annual variability of thermohaline structure and circulation were investigated. Surface depth shows high seasonal temperature variability throughout the year. There is almost no seasonal salinity variability in winter and spring seasons, while the summer and fall seasons show slight seasonal variation in the surface depth. P-vector inverse method is used to obtain the sea surface absolute geostrophic velocity. In EOF analyses, intermediate layer heat content anomaly is larger than the surface layer. However, inter-annual variability of heat content anomaly in the deep layer is very weak. Deep layer and intermediate layer show similar freshwater content anomalies, and both of them are larger than the surface layer. Full Text

Keywords: thermohaline, seasonal variability, inter-annual variability, water mass, Levantine Sea, Eastern Mediterranean Sea, absolute geostrophic velocity, empirical orthogonal function, heat content, freshwater content, optimal spectral decomposition, P-vector inverse method

ONSHORE WIND STRESS AND BUOYANCY FLUX OBSERVED ON A DISSIPATIVE MEDITERRANEAN BEACH

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Master of Science in Meteorology and Physical Oceanography
Advisor: Jamie MacMahan, Department of Oceanography
Co-Advisor: Qing Wang, Department of Meteorology

A five-month study was performed on an energetic, dissipative beach on a climatologically Mediterranean coastline to explore the wind stress and buoyancy flux. An eddy covariance system was deployed in the intertidal zone resulting in 1088 hours of quality-controlled flux observations at elevations of 1, 3, and 6m on a sandy beach in Monterey, California. The wind stress angle relative to the mean wind direction varied as much as 31o, representing one standard deviation, with a range of ±151o. The variations were dependent on the wind angle relative to the swell direction and shoreline, which directed the stress vector to the left for winds approaching from 0o>0>-45o and to the right for winds approaching from -45o>0>-80o, where 0o is onshore. The stress angle was independent of stability, stress, and wind speed. Air-ocean temperature differences produced unstable conditions 88% of the time in contrast to the near neutral conditions that dominate the open ocean. Based on flux footprints, the surf zone was found to be a source of positive buoyancy and heat flux contributing to the unstable conditions. Minimum buoyancy fluxes were observed with the flux footprints that were farther offshore centered outside the surf zone, resulting in stable conditions. Full Text

Keywords: wind stress, stress angle, buoyancy flux, eddy covariance, nearshore, surf zone

TURBULENT STRUCTURE UNDER SHORT FETCH WIND WAVES

Michael Papa–Lieutenant Commander, United States Navy
Master of Science in Meteorology and Physical Oceanography
Advisor: Timothy Stanton, Department of Oceanography
Second Reader: Timour Radko, Department of Oceanography

Momentum transfer from wind forcing into the ocean is complicated by the presence of surface waves. Wind momentum and energy are partitioned into wave growth, wave breaking, and wave forcing of the ocean surface layer. The purpose of this study was to support the ONR Coupled Boundary Layers and Air-Sea Transfer program by making very high spatial resolution profile measurements of the 3-D velocity field into the crest-trough region of wind-forced surface gravity waves, and study the low-frequency turbulent motions below the waves. The overarching goal is to improve model parameterization of how momentum is imparted on the ocean via wind-driven processes. At the Salinas River in California the Bistatic Coherent Acoustic Doppler Velocity Profiler and Thies Clima Ultrasonic 3-D Anemometer were deployed to capture the above-surface and subsurface velocity fields simultaneously to explore three main objectives: 1) determine the wave energy decay with depth and confirm the wavenumber, 2) determine the observed wind stress and calculate the wind stress using a bulk formula to identify any variations as a result of this estuarine environment, and 3) determine the turbulent stresses in the water column below the waves, and confirm the presence of Langmuir circulations and determine their advection and scaling. Full Text

Keywords: Langmuir circulation, Bistatic Coherent Acoustic Doppler Velocity Profiler, surface gravity wave turbulence, Coupled Boundary Layers and Air-Sea Transfer, wind stress

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MASTER OF SCIENCE IN OPERATIONS RESEARCH

MANPOWER ANALYSIS USING DISCRETE SIMULATION

Gregory Bauer–Lieutenant, United States Navy
Master of Science in Operations Research
Advisor: Arnold Buss, MOVES Institute
Co-Advisor: Paul Sanchez, Department of Operations Research
Second Reader: Steven Pilnick, Department of Operations Research

Career management and progression of Supply Corps officers is performed by PERS-4412, considering such factors of interest as number of accessions to make and tour lengths. To study the effect of policy choices on the underlying system, this thesis focused on model building using discrete event simulation (DES) and experimentation using design of experiments (DOE). We derived five metamodels to identify the most important factors that describe the personnel system response (model outputs) as functions of the policy choices (simulation inputs). Multiple regressions and the resultant profiler allowed fine-tuning of the inputs to arrive at personnel policy recommendations in which all but one of the system objectives were met. Full Text

Keywords: manpower policy analysis, discrete event simulation, SimKit

AN EXPLORATORY ANALYSIS OF ECONOMIC FACTORS IN THE NAVY TOTAL FORCE STRENGTH MODEL

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Advisor: Thomas Lucas, Department of Operations Research
Second Reader: Samuel Buttrey, Department of Operations Research

Accurate forecasts of U.S. Navy enlisted end-strength are crucial for budgetary planning and the development of manpower policies. An improving economy and increased employment opportunities in the civilian sector could cause a significant problem for enlisted retention. The Navy Total Force Strength Model (NTFSM) is a new stochastic simulation that is intended to offer manpower analysts more accurate enlisted manpower projections than those projected with the current tool. NTFSM uses historical data and user-defined inputs for economic factors to project monthly retention losses. However, NTFSM is still in the testing phase and its overall behavior is largely unknown. In particular, the analysts that NTFSM was designed to help are unsure of the effects that the economic factors, which they need to enter themselves, have on NTFSM's output. This thesis investigates the behavior of NTFSM's output and the sensitivity of the user-entered economic factors. Using design of experiments and data mining, a variety of scenarios are simulated and then analyzed to better understand the behavior of the model and to determine the sensitivity of the user-defined economic factors. The results of the analysis unexpectedly show that NTFSM's economic factors have no significant impact on NTFSM's end-strength output; this warrants further investigation. Full Text

Keywords: manpower, end strength, design of experiments, simulation, Navy Total Force Strength Model (NTFSM)

USMC LOGISTICS RESOURCE ALLOCATION OPTIMIZATION TOOL

Thomas Walker–Lieutenant Commander, Supply Corps, United States Navy
Master of Science in Operations Research
Advisor: Moshe Kress, Department of Operations Research
Co-Advisor: Javier Salmeron, Department of Operations Research
Second Reader: Daniel Reber, Logistics Operations Analysis Division (LX) HQMC, Installations and Logistics

To support the U.S. administration's announced rebalancing, or pivot, to the Asia-Pacific region, the U.S. Marine Corps is pushing its footprint beyond established logistics support locations. Yet, the Corps' ability to rapidly respond to primary missions, such as international military cooperation, humanitarian assistance, and defense of U.S. interests, must be maintained. This Marine diaspora from Okinawa, its current concentration, must consider the logistical vagaries of time, space, and expense. This thesis develops an optimization-based tool by which item-specific details are combined with theater logistical constraints to analyze present logistical performance and what-if capability for future troop redeployments within the region. The mathematical model is applied to optimally allocate Class IX repair parts for the Marine Corps across the Pacific theater. In particular, the combined relationship of Defense Logistics Agency and the Marine's intermediate level supply units is analyzed. The optimization model minimizes a logistical system cost of multiple priority demands from disparate locations. The model is flexible enough to allow any number of stock items, additional user locations, and supply nodes at operational and strategic levels. While the focus is the force rebalancing in the Pacific, the intent is a general tool that can support other theaters. Full Text

Keywords: Marine Corps Inventory Management, logistics, supply chain management, modeling and optimization, linear program

MASTER OF SCIENCE IN PHYSICAL OCEANOGRAPHY

CONTINUOUS ACOUSTIC SENSING WITH AN UNMANNED AERIAL VEHICLE SYSTEM FOR ANTI-SUBMARINE WARFARE IN A HIGH-THREAT AREA

Loney Cason III–Lieutenant, United States Navy
Master of Science in Physical Oceanography
Advisor: Peter Chu, Department of Oceanography
Co-Advisor: Kevin Jones, Department of Mechanical and Aerospace Engineering

An unmanned aerial vehicle system called the Aqua-Quad, an ultra-long-endurance hybrid design, developed by researchers in the NPS Department of Mechanical and Aerospace Engineering, is utilized in this thesis. The Aqua-Quad has the capability of landing on the ocean surface and deploying passive acoustic sensors at depth. We investigated the employment of the Aqua-Quad in a general environment, determined sea-state survivability, and verified, using a self-contained acoustic sensor, that the Aqua-Quad can be utilized in undersea warfare. The experiments and data collected on the initial setup of the Aqua-Quad are compared against the Navy's current asset, passive sonobuoys. These comparisons will prove to be influential in the process of building, researching, and developing a new and improved sensor asset with unlimited potential to strive in multiple warfare areas. This research benefits not only the Navy, through enhancement of offensive warfighting by testing the next generation of sonobuoys, but also the oceanographic community with fast sampling and detection. Full Text

Keywords: Aqua-Quad, new and improved sonobuoy, unmanned aerial vehicle

EAST SEA SPATIAL AND TEMPORAL VARIABILITY OF THERMOHALINE STRUCTURE AND CIRCULATION IDENTIFIED FROM OBSERVATIONAL (T, S) PROFILES

Hyewon Choi–Lieutenant Commander, Republic of Korea Navy
Master of Science in Physical Oceanography
Advisor: Peter Chu, Department of Oceanography
Co-Advisor: Chenwu Fan, Department of Oceanography

Synoptic monthly varying 3-D gridded temperature and salinity data for the East Sea were established in this study (January 1960 to December 2013). From the gridded data, seasonal and inter-annual variability of thermohaline structure and circulation of the East Sea were analyzed. Found was a low salinity effect caused by the Amur River's discharge into the Tatar Strait, and a one-month delay after maximum discharge in September. The research discovered another low salinity effect through the Korea Strait in summer by the Changjiang River's discharge into the East China Sea, which identified with a matching strong inflow in the surface layer of the Korea Strait in an absolute geostrophic velocity distribution. The anticyclonic pattern of the Ulleung Warm Eddy in the intermediate layer and an opposite pattern in the deep layer were noticed. Inter-annual variability by EOF analysis shows that the difference in heat content according to area is more significant in the surface layer, while the freshwater content difference is more significant in the deep layer. By temporal

analysis, an increase of heat content in all areas and layers since 1990 and a decrease of the freshwater content in the deep layer since mid-1990s were identified. Full Text

Keywords: East Sea, Japan East Sea, seasonal variability, inter-annual variability, temperature distribution, salinity distribution, spatial variability, temporal variability, heat content, freshwater content, absolute geostrophic velocity, water mass

HORIZONTAL ANISOTROPY AND SEASONAL VARIATION OF ACOUSTIC FLUCTUATIONS OBSERVED DURING THE 2010–2011 PHILIPPINE SEA EXPERIMENT

Bambang Marwoto–Lieutenant Commander, Indonesian Navy
Master of Science in Physical Oceanography
Advisor: John Colosi, Department of Oceanography
Second Reader: John Joseph, Department of Oceanography

The anisotropic ocean environment will lead to variability of ocean acoustic travel time. The variability of travel times comes from several ocean dynamical processes, including eddies, internal tides, and stochastic internal waves. This study analyzes time series of travel time from the Philippine Sea 2010–2011 experiment conducted by the Scripps Institution of Oceanography. In this experiment, a pentagonal array of acoustic transceivers of radius 600-km transmitted 250 Hz pulses for the purpose of observing acoustic variability at multiple time and space scales. Using filtering methods, this study separates variability in travel time in bands associated with eddies, internal tides, and stochastic internal waves. The observed fluctuations in the internal wave band are compared to a simple theoretical model. The result of the research shows that over the year, eddies induce the largest amount of variability. Internal tides and internal waves show comparable fluctuations. There is some seasonal variability. Eddies and internal waves show fluctuations that are fairly isotropic across the array, while internal tides give highly anisotropic fluctuations. This anisotropy is related to the strong directionality of the internal tides that emanate from the Luzon Strait. Full Text

Keywords: internal waves, ocean acoustic propagation, travel time variance, Philippine Sea

MASTER OF SCIENCE IN PROGRAM MANAGEMENT

ANALYSIS OF RAPID ACQUISITION PROCESSES TO FULFILL FUTURE URGENT NEEDS

Robert Arellano–Civilian, Department of Army
Ryan Pringle–Civilian, Department of Army
Kelly Sowell–Civilian, Department of Army
Master of Science in Program Management
Advisor: Ray Jones, Graduate School of Business and Public Policy
Co-Advisor: Charles Pickar, Graduate School of Business and Public Policy
Co-Advisor: Brad Naegle, Graduate School of Business and Public Policy

The objective of this project is to analyze rapid acquisition processes in order to evaluate the current organization, structure and regulations within the Department of Defense (DOD). This analysis helps determine if the rapid acquisition process used for two programs is repeatable for future endeavors. Additional analysis of identified DOD regulations and organizations shows how the rapid acquisition process expedited these systems and how it benefited the warfighter. The project reviews statutory and regulatory requirements covering the rapid acquisition process in the DOD and compares current DOD processes and the effects of their implementation. The project also reviews the warfighters' actions when DOD entities do not address critical needs within reasonable timelines. The analysis results indicate that the current DOD organization and regulations do not provide an effective means for future rapid acquisition requirements, do not effectively promote the agility needed for rapid acquisition, and actually encumber the rapid acquisition process. Full Text

Keywords: rapid acquisition, urgent needs, rapid fielding of capabilities

TRANSITIONING SCIENCE AND TECHNOLOGY INTO ACQUISITION PROGRAMS: ASSESSING ONE GOVERNMENT LABORATORY'S PROCESSES

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Laura Magidson–Civilian, Department of the Army
Master of Science in Program Management
Advisor: Brad Naegle, Graduate School of Business and Public Policy
Co-Advisor: Vincent Matrisciano, Picatinny Arsenal, New Jersey

This paper examined the strengths and weaknesses of the overall technology transition process between Armament Research, Development and Engineering Center (ARDEC) and its partnered program offices in transitioning technology into established Programs of Record. This examination was a direct review and comparison of Department of Defense policies, U.S. Government Accountability Office reports and recommendations, and ARDEC and the program managers established processes. The research indicated that the following recommendations should be implemented by other research and development (R&D) organizations to foster proper technology transition: endorsement from future customers, collaboration early on with the soldier and developing organizations, alignment with soldier needs, leverage available capabilities, and introduction of technology transition agreements. Research also indicated that in order for ARDEC to continue to improve its technology transition process, it should focus on the transition and inclusion of industry, address all changes and decisions, and conduct affordability and tradeoff analysis. Additionally, ARDEC should fill all management positions with qualified individuals, assign managers for durations of program, stress impor-

tance of operations deployment, and use service acquisition organizations to review the process and R&D adaptability to PM expectations. Full Text

Keywords: Armament Research, Development and Engineering Center (ARDEC), transitioning technology into programs of record, Technology Readiness Levels (TRLs), DOD, GAO

INFORMATION ON ARMY PLANNED FUTURE STATE AGILE WORKFORCE TO MEET THE EVER-CHANGING NEEDS OF THE ARMY

Marc Jones–Civilian, Naval Postgraduate School
Richard Nease–Civilian, Naval Postgraduate School
Brandon Warren–Commander, United States Navy
Master of Science in Program Management
Advisor: Charles Pickar, Graduate School of Business and Public Policy
Co-Advisor: John Swart, PEO-EIS Technology Application Office

This publication addresses whether the conventional principle that the Table of Distribution and Allowances (TDA) is a one-size-fits-all tool to make human resource/human capital decisions based on the TDA's methodology. Our research found that this is an unsupported and perhaps costly assumption that will not support, or enhance, the Army's 2025 expressed goal, also known as Force 2025. The overarching goal of Force 2025 is the creation of a leaner force equal to, or more capable than, today's forces. Our research focused on the second- and third-order effects that decisions made to use a TDA could potentially have on an organization and the organization's ability to remain competitively relevant. This paper demonstrates why TDA is not the best, or even the preferred, method to make human capital decisions for research and development organizations that are primarily funded through the reimbursement mechanism. We believe these organizations focus on methodologies that make civilian workforces leaner and more efficient by using cross-knowledge transfers and a cross-utilization of resources and creating holistic synergies by the practice of working on multiple projects simultaneously. We believe our findings have broader applications to other reimbursable funded organizations; however, the extent and scope of our findings will be solely focused on the Army's R&D organizations. Full Text

Keywords: TDA, organizational change, organizational culture, cross-utilization

REFORMING THE U.S. SECURITY ASSISTANCE EXPORT PROCESS TO BUILD EXISTING CAPABILITIES

John Stokes Jr.–Civilian, Department of Army
Master of Science in Program Management
Advisor: Charles Pickar, Graduate School of Business and Public Policy
Co-Advisor: Gilbert Liptak, TACOM, Director, Security Assistance

Security assistance is a key element in the formulation of foreign policy in the United States. The Department of State, the Department of Defense, and other agencies are involved in planning and managing the programs. This paper aims at evaluating security assistance programs in the United States and the mechanisms the government can use to leverage the programs and build upon the existing capabilities. Consequently, this paper examines the roles of the agencies and departments involved in the programs to offer an understanding of the limitations and challenges experienced in the execution of the programs. While acknowledging the expanding role of the programs, the findings indicate a need for reforms in the export-control mechanisms since they have a direct effect on security assistance. Additionally, the findings highlight redundancies in the execution of the programs because of the involvement of many agencies and departments, which have duplicated roles.

The study recommends a governance framework in the management of the programs since the framework could help in the integration of the redundant roles. Full Text

Keywords: United States security assistance, export law reforms, excess defense articles, U.S. Army Security Assistance Command, Foreign Military Sales

AN ANALYSIS OF TEST AND EVALUATION IN RAPID ACQUISITION PROGRAMS

Timothy Tharp–Civilian, Department of the Army
Christopher Voinier–Civilian, Department of the Army
Master of Science in Program Management
Advisor: Brad Naegle, Graduate School of Business and Public Policy
Co-Advisor: Clyde Webster, Department of the Army
Co-Advisor: David Lee, Department of the Army

The last decade of conflict in Operation Enduring Freedom, Operation Iraqi Freedom, Operation New Dawn, and other contingency operations has brought about many technical advances for our Soldiers. In order to get new capabilities fielded quickly, the traditional Department of Defense acquisition cycle was modified to achieve rapid fieldlings. This paper examines how requirements are developed for programs of record (PORs) and rapid acquisitions (RAs), and then how test and evaluation (T&E) is administered to each. A materiel release is required for any equipment, regardless of how the requirement is generated. PORs that transition from RAs still must go through the Joint Capabilities Integration Development System process, but the path may be shortened if the gains from the RI are capitalized upon. After examination of two PORs that began as RAs, we found clear examples of how to capitalize on the testing that occurred during the fielding of an RA. We recommend that all RAs conduct T&E in a manner that provides usable data for decision makers and also to inform future PORs. We further recommend that T&E be included during R&D phases of acquisition to reduce T&E burden in later phases of the program. Full Text

Keywords: test and evaluation, Joint Capabilities Integration Development System, and programs of record

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MASTER OF SCIENCE IN SYSTEMS ENGINEERING

The following capstone project reports were produced by cohorts of residential or distance learning students in the systems-engineering curriculum. The degrees awarded include Masters of Science in Systems Engineering, Systems Engineering Management, and Engineering Systems.

AUTONOMOUS UNDERWATER VEHICLE ARCHITECTURE SYNTHESIS FOR SHIPWRECK INTERIOR EXPLORATION

Ross Eldred–Lieutenant, United States Navy
Master of Science in Systems Engineering
Advisor: Fotis Papoulias, Department of Systems Engineering
Co-Advisor: Noel Du Toit, Department of Mechanical and Aerospace Engineering

The objective of this thesis is to develop, using a systems engineering approach, the functional analysis, general requirements, key performance parameters, and high-level architectural tradeoff considerations that lead to an architecture synthesis for an autonomous underwater vehicle (AUV) capable of shipwreck interior exploration. A design reference mission is used as the basis for the development of a high-level analysis of alternatives, mission planning, high-level essential tasks and constraints analysis. An examination of the problem space leads to the development of effective stakeholder needs and scope, including context, definitions, the identification of key concerns and system objectives. A literature review of the most mission-pertinent AUVs, including DEPTHX, HAUV, ARROWS and ACQUAS, reveals five key capability gaps. A functional analysis, requirements generation, and architectural design tradeoff analysis lead to the development of a potential architectural solution—the wreck interior exploration vehicle (WIEVLE)—and eight recommendations for future architecture development. Full Text

Keywords: AUV, wreck interior exploration, architecture, DRM, SLAM, CAVR, REMUS, WIEVLE

POWER MANAGEMENT SYSTEM DESIGN FOR SOLAR-POWERED UAS

This paper has been recognized as outstanding by its department

Robert Fauci III–Lieutenant, United States Navy
Master of Science in Systems Engineering
Advisor: Alejandro Hernandez, Department of Systems Engineering
Co-Advisor: Kevin Jones, Department of Mechanical and Aerospace Engineering

Drone technology has catapulted to the forefront of military and private sector research. Of particular interest are unmanned aerial systems that are able to stay airborne for extended periods by absorbing energy from the environment. This requires extreme aerodynamic efficiency in order to minimize the power required to maintain flight, and a recognition that every sub-system in this system of systems must operate at optimal levels in order to achieve this nearly perpetual flight. A critical component of a drone is the electrical hardware that optimizes solar energy absorption and manages energy storage. In particular, weight-to-power consumption demands consideration as inefficiencies quickly equate to additional power requirements. While off-the-shelf components are available for many of the individual pieces, none of these parts is optimized with size and weight in mind. Therefore, the impetus of this thesis is to examine the power management system within a systems engineering framework. This study includes maximum power point tracking, battery management,

energy storage and flux tracking by the batteries, propulsion, avionics and payload components. The results drove the design and development of a compact single circuit that optimally integrates these sub-systems into a lightweight module for particular mission sets. Full Text

Keywords: solar efficiency, maximum power point tracker, solar array, unmanned aerial system, power management

A HUMAN SYSTEMS INTEGRATION APPROACH TO ENERGY EFFICIENCY IN GROUND TRANSPORTATION

This paper has been recognized as outstanding by its department

Keith Robison–Lieutenant, United States Navy
Master of Science in Systems Engineering
Advisor: Alejandro Hernandez, Department of Systems Engineering
Co-Advisor: Anita Salem, Graduate School of Business and Public Policy

This effort establishes the feasibility of implementing telematics systems into the United States Marine Corps' decision-making process in order to increase its operational reach and overall effectiveness. It is based around a qualitative case study evaluation of commercially implemented telematics. Telematics, as defined by Fleetmatics, is the integrated use of telecommunications combined with information and technology communication systems used to achieve improved operational capabilities while creating a more effective and efficient workforce. This research was done through numerous interviews with a variety of personnel who use telematics. The information is then partitioned and analyzed using a systems engineering framework utilizing a human systems integration methodology. This analysis acts as a framework to outline best practices in metering and monitoring. Once established, it is applied to the Marine Corps to determine a feasible way to implement similar technologies on its ground vehicles. This study prescribes policies for the successful use of telematics systems in the Marine Corps that will make it a more fuel-efficient fighting force. As a result, the Marine Corps extends its operational reach, improves its warfighting capability, and reduces the risk to the warfighter. Full Text

Keywords: systems engineering, human systems integration, telematics, operational energy usage

TECHNOLOGICAL EVOLUTION OF HIGH TEMPERATURE SUPERCONDUCTORS

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Master of Science in Systems Engineering
Advisor: Clifford Whitcomb, Department of Systems Engineering
Co-Advisor: Fotis Papoulias, Department of Systems Engineering

High temperature superconducting (HTS) cables are currently being used in the commercial energy industry primarily for demonstration purposes and to evaluate the feasibility of large-scale implementation into the electric grid. While still in the evaluation stage, the U.S. Navy is finding the test results promising and is investigating its potential use for future electric ships to supply power to electric propulsion motors and possible high-energy weapons such as rail guns and lasers. Moreover, the Navy successfully tested an HTS degaussing system on a modern U.S. destroyer in 2008. The day of full-scale HTS integration is quickly approaching. This thesis used the IHS Goldfire Cloud Connect software in an attempt to determine any current trends of HTS cable innovation and development based on published patents trends. Specific search criteria and filters were used to determine the applicable technology, and those patents categorized by year, were used to develop a regression model to predict future patent trends. Full Text

Keywords: electric ships, high temperature superconductor, HTS

OPERATIONAL RESILIENCY ASSESSMENT OF AN ARMY COMPANY TEAM

Systems Engineering Analysis, Army Operational Resiliency Team
Master of Science in Systems Engineering Analysis and Master of Science in Engineering Systems
Advisor: Eugene Paulo, Department of Systems Engineering
Co-Advisor: Paul Beery, Department of Systems Engineering

This capstone report provides a practical example of how to assess the operational resiliency of an Army company team. In this research, operational resiliency is the ability of a company team to preserve its warfighting capability when operating in different operational scenarios composed of distinct mission, enemy, and terrain requirements. This study evaluates three alternative configurations for their performance in three distinct scenarios (Mountain Attack, Urban Clear, and Desert Ambush) based on three measures of effectiveness (MOEs): force exchange ratio (FER), indirect-fire kill ratio (IDK), and intelligence time to detect 50% of enemy forces (INTEL). The systems engineering approach utilizes Model Based Systems Engineering (MBSE) techniques to produce nine agent-based simulation meta-models. The study performs a value-focused, multi-objective decision analysis of the three alternative configurations by developing MOE-specific value functions and scenario-specific swing-weight matrices. The results are compiled into an Operational Resiliency Decision Block that provides decision makers with a visual display tool to further analyze and assess performance. To ensure robustness of the results, the research analyzes the nine scenario–MOE weighted values for sensitivity. Full Text

Keywords: systems engineering, resiliency, and multi-objective decision analysis

A METHODOLOGY TO ASSESS THE BENEFIT OF OPERATIONAL OR TACTIC ADJUSTMENTS TO REDUCE MARINE CORPS FUEL CONSUMPTION

Systems Engineering, Team E20
Master of Science in Systems Engineering and Master of Science in Engineering Systems
Advisor: Eugene Paulo, Department of Systems Engineering
Co-Advisor: Brigitte Kwinn, Department of Systems Engineering
Co-Advisor: Paul Beery, Department of Systems Engineering

The United States Marine Corps is too dependent on fossil fuel, which leaves logistics fuel support and supply lines vulnerable to attack, potentially degrading Marine Corps capabilities and ultimately putting Marines at risk. A need exists to identify doctrine, organization, training, materiel, leadership and education, personnel, and facilities (DOTMLPF) changes that provide a positive impact on energy efficiency while maintaining or improving operational effectiveness, essentially improving operational reach. Using the systems engineering process, key capabilities were identified from the Expeditionary Energy Office (E2O) stakeholders and used to develop a methodology to assess potential improvements to operational reach in the context of a Marine Expeditionary Unit (MEU) operation. At the heart of the methodology was a discrete event model developed to simulate the conditions of a close air support (CAS) operation and ground combat support (GCS) operation. Using a specific ship-to-shore vignette, factors were identified and a design of experiments (DOE) analysis was conducted to assess changes to doctrine, aircraft materiel solution, and environmental conditions on operational reach. This report: a) demonstrates the methodology developed, b) identifies the effects of the factors on extending the operational reach of a CAS and GCS operation, and c) recommends future efforts to continue research. Full Text

Keywords: systems engineering, model based systems engineering, fuel consumption, close air support, ground combat support, operational effectiveness, DOTMLPF

TRANSPORTATION ANALYSIS EXPLORING ALTERNATIVE SHIPPING OF MARINE EXPEDITIONARY BRIGADE FORCES TO SEABASE IN CONTINGENCY RESPONSE SCENARIOS

Systems Engineering, Team MARFORPAC
Master of Science in Systems Engineering and Master of Science in Engineering Systems
Advisor: Eugene Paulo, Department of Systems Engineering
Co-Advisor: Brigitte Kwinn, Department of Systems Engineering
Co-Advisor: Paul Beery, Department of Systems Engineering

As the U.S. national security policy shifts focus toward the Pacific theater and limited availability of amphibious shipping, Marine Forces Pacific must consider the augmentation of alternative shipping to deploy forces to a seabase location to support military operations in the Pacific Command area of operations. Implementing a model-based systems engineering approach, this capstone project examines the effects of augmenting amphibious shipping with commercial, allied nation, and military sealift command ships to achieve force closure at a seabase and reduce fuel consumption. Multiple shipping alternatives supporting a Marine Expeditionary Brigade in anti-access/area denial (A2/AD) and humanitarian assistance/disaster relief (HA/DR) missions formed the basis for measuring the effects of augmenting amphibious shipping. A simulation was developed to model the operational scenarios, and statistical analysis was performed upon the results of each alternative to identify factors affecting force closure time and fuel consumption. Analysis indicated that the effects of augmenting amphibious shipping vary based upon the mission type. Significant statistical evidence suggests that augmentation of amphibious shipping reduces force closure time and fuel consumption for the A2/AD mission. Based on the research, further investigation into the effects of augmented shipping on the Assembly and Employ phases of seabasing operations is recommended. Full Text

Keywords: Model-Based Systems Engineering, MBSE, systems analysis, seabasing, Marine Forces Pacific, amphibious shipping

A DECISION SUPPORT SYSTEM FOR EVALUATING SYSTEMS OF UNDERSEA SENSORS AND WEAPONS

Systems Engineering, Team Mental Focus
Master of Science in Systems Engineering and Master of Science in Engineering Systems
Advisor: Bonnie Young, Department of Systems Engineering
Co-Advisor: Paul Shebalin, Department of Systems Engineering
Co-Advisor: Richard Williams, Expeditionary and Mine Warfare

This project developed and analyzed the requirements for a decision support system capable of simulating future naval mine warfare scenarios. As the U.S. Navy explores replacing legacy naval mines with new systems of undersea weapons, it requires the supporting tools to evaluate and predict the effectiveness of these system concepts. While current naval minefield modeling and simulation capabilities provide planners with the capability to design and evaluate the effectiveness of minefields using legacy naval mine capabilities, they are not adequate for the planning and performance modeling of new concepts under consideration. The project addressed gaps in the Navy's capability to simulate mine warfare scenarios involving arrays of distributed sensors linked with autonomous mobile weapons by reviewing the current innovations in naval mine warfare development, verifying the gap in current modeling and simulation capabilities, and using systems engineering processes to derive solution requirements. Analysis conducted using prototype simulation capabilities, developed as part of this project, indicates that these future systems will likely outperform legacy mine systems at a competitive cost. Full Text

Keywords: decision support, simulation system, COA development, COA analysis, capability development, counter mobility, USW, MIW, AUWS, UUV, underwater networks, unmanned systems, autonomous systems

SCENARIO-BASED SYSTEMS ENGINEERING APPLICATION TO MINE WARFARE

Systems Engineering, Team Mine Warfare 2015
Master of Science in Systems Engineering and Master of Science in Engineering Systems
Advisor: Eugene Paulo, Department of Systems Engineering
Co-Advisor: Brigitte Kwinn, Department of Systems Engineering
Co-Advisor: Paul Beery, Department of Systems Engineering

This report builds upon the Team MIW 2014 capstone report in comparing legacy and future mine countermeasures capabilities. The Mark 18 Modification 2 Unmanned Underwater Vehicle was compared to the planned Littoral Combat Ship MCM Mission Package Increment 1 Remote Mine Hunting System as well as the legacy MCM 1 and CH-53E. The Measures of Effectiveness (MOEs) utilized were Area Clearance Rate Sustained and minefield percent clearance. A tailored systems engineering approach based on a modified SE Vee model was utilized to identify stakeholder requirements, conduct analysis of functional and physical architectures, and use these resulting artifacts to modify an existing model. A design of experiments process was utilized to analyze input variables for relationships to the MOEs and compare resulting MOEs from the various configurations. A cost analysis was then performed and, with the performance data, was used to evaluate the relative value of the various configurations. Conclusions from the data are presented along with recommendations for future analysis. Full Text

Keywords: model based systems engineering, design of experiments, measures of effectiveness, mine warfare, mine countermeasures, littoral combat ship, area coverage rate sustained, percent clearance, unmanned underwater vehicle, MK18 Mod 2

SYSTEMS ENGINEERING OF UNMANNED DOD SYSTEMS: FOLLOWING THE JOINT CAPABILITIES INTEGRATION AND DEVELOPMENT SYSTEM/DEFENSE ACQUISITION SYSTEM PROCESS TO DEVELOP AN UNMANNED GROUND VEHICLE SYSTEM

Systems Engineering, Team TECHMAN
Master of Science in Systems Engineering and Master of Science in Engineering Systems
Advisor: Paul Shebalin, Department of Systems Engineering
Co-Advisor: Bonnie Young, Department of Systems Engineering

The objective of this capstone project was to build a simulated system using the Joint Capabilities Integration and Development System/Defense Acquisition System (JCIDS/DAS) process to gain insight into JCIDS/DAS as it relates to unmanned robotics systems. JCIDS and DAS are the Department of Defense's procedures and guidelines for acquiring military programs. Using JCIDS/DAS and system engineering (SE) methodology, the team developed a radiological clearance system (RCS) and an unmanned ground vehicle (UGV) using LEGO MINDSTORMS. The UGV was named the Threat Exposure and Clearing Hardware Manipulated Autonomously or Networked (TECHMAN). The team researched UGVs, software platforms and the JCIDS /DAS regulations to tailor an SE approach in designing and building the TECHMAN robot, starting with the mission needs and requirements followed by system architecture development. The team tested and evaluated two TECHMAN systems. One system was teleoperated and the other was autonomous. The team compared the test results and other system attributes of the two platforms. The knowledge gained from the project results was used to provide insight into the JCIDS/DAS process with regard to procurement of robotics systems. Full Text

Keywords: JCIDS, DAS, unmanned systems, unmanned ground vehicle, autonomous systems, teleoperated systems, UMS, UGV

ORGANIZATIONAL SELF-AWARENESS IS THE KEY TO KNOWLEDGE SUPERIORITY

Ricardo Rivera–Civilian, Department of the Navy
Master of Science in Systems Engineering Management
Advisor: Mark Nissen, Department of Information Sciences
Second Reader: Walter Owen, Department of Systems Engineering

This thesis proposes an integrated approach to develop and evaluate knowledge management systems and methodologies that deliver sustainable competitive advantages through knowledge superiority. Integration revolves around internal, structural factors that the organization can manipulate to achieve its strategic goals. The fundamental concept behind the research is that an organization's self-awareness allows leaders to select the best approaches to achieve knowledge superiority, leading to sustainable competitive advantages and market leadership. The research behind this thesis identifies four attributes of self-awareness that are critical contributors to knowledge superiority: success decomposition, targeted dissemination of knowledge, organizational design, and individual decision making. The three arguments of organizational needs that this thesis seeks to address are: (1) firms do not understand precisely why they succeed; (2) market leaders feel they must compromise either the power or uniqueness of their knowledge and competitive advantage, and (3) the design and goals of existing knowledge management systems do not fit the organization's design. The thesis examines the hierarchy of needs of the organization's stakeholders and proposes a knowledge management system that integrates the self-awareness attributes that contribute to knowledge superiority. It develops a theoretical architecture for the system, which prioritizes the needs and selection criteria for that system. Full Text

Keywords: knowledge superiority, innovation, organizational design, decision making

MASTER OF SCIENCE
IN
SYSTEMS TECHNOLOGY

MULTI-SENSOR IMAGE FUSION FOR TARGET RECOGNITION IN THE ENVIRONMENT OF NETWORK DECISION SUPPORT SYSTEMS

Michail Pothitos–Lieutenant Commander, Hellenic Navy
Master of Science in Systems Technology (Command, Control & Communications)
Advisor: Alex Bordetsky, Department of Information Sciences
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This thesis proposed a concept of distributed management of littoral operations at the tactical level, in which timeliness of information and reduced decision cycles are of critical importance. The use of mesh tactical networks augmented by sensor management, operational databases, and an appropriate level of automation of target recognition can turn the obstacles of land masses in littoral environments into a tactical advantage. Ultimately, this thesis concept aimed to enhance situational awareness by enabling the timely exploitation and dissemination of imagery data from small satellites and unmanned systems at the tactical level. Analyses of simulation and field experimentation results that focused on mobile ad-hoc networks (MANETs)—which connected dissimilar imaging sensors and enabled fusion of captured images—supported this concept. Mesh tactical radios provided an adequate range and quality of service (QoS) to enable networking of kinetic and non-kinetic assets equipped with imaging or data relaying capabilities and to support dissemination of imagery data. Additionally, multi-spectral image fusion of thermal and visual images for target recognition yielded the best classification performance after the use of speeded-up robust features (SURF) and artificial neural networks (ANNs). Full Text

Keywords: artificial neural networks, automatic target recognition, mobile ad-hoc networks, network decision support systems, speeded-up robust features, wireless mesh networks, image fusion

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