



85th Symposium

Group Prospectus

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WG 1 – National Security Strategic Operations

Chris Latham- Chair: (505) 853-7080; christopher.latham.2@us.af.mil

Richard Paulsen- Advisor: (505) 853-3041; richard.paulsen@us.af.mil

WG 1 Strategic Operations National Security Analysis fosters the use of operations research approaches, techniques, and methodologies to create a better understanding of the strategic dimensions of national security, security cooperation, stability, deterrence and assurance. Our primary focus is on strategic planning and operations (to include nuclear, cyber, and space) where instruments of national power are tasked to protect national security interests, enhance strategic stability, deter conflict, assure allies and set conditions for future contingency operations. Areas of interest include strategic force structure alternatives and their impacts, treaty implications, changes in roles and missions, WMD proliferation, expansion of cyber capabilities and domain, and other related topics. This Working Group also investigates the status and future prospects for regional stabilities, military capabilities, and the arms control process. This analysis will provide ways to conceptualize and analyze the sufficiency of forces and strategies in support of deterrence, assurance, counter proliferation and stability operations across the spectrum of conflict for US military planners, policy analysts, or anyone involved in formulating warfighter, service, and agency policy and planning.

To address this issue from a global perspective, we solicit analytically rigorous papers on the full spectrum of current and future issues to include: Non-Proliferation; Threat Assessment and Threat Reduction; Deterrence, Causes and Prevention of War; Conflict and Peacekeeping; Emerging, Catastrophic, and Disruptive Events; Regional Security Forces and Strategy; Theater Security Cooperation; Arms Control; Proliferation Maintenance, Monitoring, Prevention and Mitigation; Stability and Escalation Dynamics; Diplomatic and Military Approaches; Delivery and Defenses; Alternative/Potential Futures; Sustainment; Development; and Changing Environments.

Papers employing modeling, simulation, game theory, optimization, decision analysis, management science, assessment across PMESII and other quantitative/analytical techniques are especially welcomed. Both completed tasks and works in progress are encouraged.

WG 2 – Chemical, Biological, Radiological, Nuclear and Advanced Explosives (CBRNE) Defense

Eric Lowenstein- Chair: eric.j.lowenstein.civ@mail.mil

William T. Greer- Co-chair: 937-255-2436; william.greer.5@us.af.mil

Alana M. Moczydlowski- Co-chair: 434-995-3206; alana.m.moczydlowski.civ@mail.mil

Michael O. Kierzewski- Advisor: 410-436-5408; michael.o.kierzewski.civ@mail.mil

Chemical, Biological, Radiological, Nuclear and Advanced Explosive (CBRNE) threats pose serious challenges to US military operations. In the contexts of force protection, major and irregular combat operations, homeland defense and other missions, the proliferation of technical expertise and the availability of once scarce resources (such as computational capabilities, biomedical engineering equipment, and radiological industrial sources, etc.) necessitates that future military capabilities to effectively detect, respond, deter, and maintain mission performance be strengthened against an increasingly wide set of possible scenarios. In an environment of uncertain budgets, ensuring that CBRNE risks and hazards to military operations are well-understood is a fundamental challenge to national military, political, intelligence, and homeland security defense efforts.

This MORS working group seeks presentations on quantitative or qualitative CBRNE analysis efforts attempting to tackle difficult real-world problems despite inherent data shortfalls and other limitations.

WG 3 – Infrastructure Analysis, Protection and Recovery (IAP&R)

David L. Alderson- Chair; Naval Postgraduate School; (831) 656-1814; dlalders@nps.edu

Michael T. Lewis- Chair; Air Force A9AA; (571) 256-7686; michael.t.lewis88.civ@mail.mil

Scott Backhaus- Co-Chair; Los Alamos National Laboratory (505) 667-7545; backhaus@lanl.gov

Theresa Brown- Co-Chair; Sandia National Laboratories; (505) 844-5247; tjbrown@sandia.gov

Rob Edsall- Co-Chair; Idaho National Laboratory; (208) 526-0684; robert.edsall@inl.gov

Sarah Harrop- Co-Chair; Center for Army Analysis; (703) 693-2959; sarah.e.harrop.civ@mail.mil

Igor Linkov- Co-Chair; Army Corps Engineering R&D Center; (617) 233-9869;
igor.linkov@usace.army.mil

Micheal Pannell- Co-Chair; Center for Army Analysis; (703) 806-5129;
micheal.v.pannell.civ@mail.mil

Leah Talaber- Co-Chair; Argonne National Laboratory; (630) 252-4398; ltalaber@anl.gov

Gerald Brown- Advisor; (831) 656-2140; gbrown@nps.edu

Anthony O'Connor- Advisor; (703) 859-6471; tonyoconnor1234@aol.com

The subject of Working Group 3, IAP&R, has a natural rhetorical connection to the theme of the 85th MORSS, “Pivoting on a Strong Foundation to a Bright Future.” The major thrust of this working group is the examination of critical infrastructure, particularly as it pertains to the loss of function and the requirements for restoration in the event of a natural or man-made disruptive event.

The term *critical infrastructure* was defined by the USA PATRIOT Act of 2001 as “systems and assets, whether physical or virtual, so vital to the United States that the incapacity or destruction of such systems and assets would have a debilitating impact on security, national economic security, national public health or safety, or any combination of those matters.”

Critical infrastructure systems can be military or civilian. Critical infrastructure systems in the United States consist of a diversity of interdependent networks and more complex systems, varied operating and ownership models, systems in both the physical world and cyberspace, and stakeholders from multi-jurisdictional levels.

Presidential Policy Directive 21 (PPD21) summarizes the government's objective with regard to critical infrastructure: “The Federal Government also has a responsibility to strengthen the security and resilience of its own critical infrastructure, for the continuity of national essential functions, and to organize itself to partner effectively with and add value to the security and resilience efforts of critical infrastructure owners and operators.” In PPD21, the term resilience is defined explicitly to mean “the ability to prepare for and adapt to changing conditions and withstand and recover rapidly from disruptions.” These statements make clear that resilience is distinct from risk management in two respects: whereas risk management aims to reduce losses, resilience seeks to maintain the capabilities and functionality of a system, and where risk

management takes place before and during an event, resilience should be further-reaching, considering also how the system will recover and adapt.

Because of their interconnected nature, infrastructure systems face the potential for large-scale disruption resulting from both deliberate threats (e.g., attacks, sabotage) and non-deliberate hazards (e.g., accidents, failures, natural disasters). Large-scale disasters have revealed that decision makers often struggle to identify or determine key components and interdependency relationships in infrastructure systems, optimal resource allocation to increase resilience or reduce risk, and optimal response plans. These dependencies can occur within or between the physical, informational, cognitive, and social networks of the system, requiring decision makers to have knowledge and understanding of across these domains.

Working Group 3 (WG 3) welcomes papers in concepts under development and research as well as proven applications and techniques from all disciplines that highlight the use of operations research methods in the following subject areas:

- Metrics for measuring the resilience of critical infrastructure systems; Contrasts across infrastructure sectors; Perspectives from owner-operators, state, local, and federal agencies; Perspectives from military commanders;
- Modeling, analytical techniques, and decision support tools to determine vulnerabilities in critical infrastructure, assess resilience, and/or inform planning and investment;
- Modeling and analysis in support of assessing interdependencies across critical infrastructure systems and estimation of consequences of failure across infrastructures, with emphasis on defense and homeland security applications; Case studies and examinations of cascading impacts of infrastructure failures;
- Cyber-physical interdependencies in critical infrastructure analysis;
- Dependency of critical infrastructure resilience on the organization and performance of data collection, decision makers, and system users.
- Strategic guidance, development and implementation of national policies for military and/or civilian infrastructure systems;
- Best practices or case studies for critical infrastructure prior to, during, and after an event or incident; restoration of critical infrastructure systems following large scale disasters; and
- Methods, policies, techniques and programs for working across organizational or jurisdictional lines to assess and assure resilient critical infrastructure.

Presenters can include operations research analysts, statisticians, behavioral scientists, clinical providers, medical planners, logisticians, and other scientists. Papers that describe development of IAP&R analysis tools, techniques, and methodologies are welcome. Note that all presentations and discussions must be kept at the Secret level or lower. We look forward to hearing from you!

WG 4 – Homeland Security, Homeland Defense, and Civil Support

Geoffrey Berlin- Chair: (202) 254-8675; geoffrey.berlin@hq.dhs.gov

Robert Brigantic- Co-Chair: (509) 375-3675; robert.brigantic@pnnl.gov

Cherie Gott- Co-Chair: (719) 671-2399; cherie.d.gott.civ@mail.mil

Julie Seton- Co-Chair: (575) 639-3158; julie@indentus.com

Blair Sweigart- Co-Chair: (757) 398-6517; daniel.b.sweigart@uscg.mil

Ross Snare- Advisor: (202) 254-7080; ross.snare@noblis.org

National Security analysts have new challenges accurately characterizing future terrorist attacks. New problems are created by agile adversaries affecting how to address public safety. What are the appropriate issues that should be analyzed to support immigration control and illegal trafficking across our borders? Given limited security assets, how is risk calculated and how to use constrained resources to minimize this risk?

Working Group 4 (WG4) supports this year's MORS Symposium theme "Pivoting on a Strong Foundation to a Bright Future" by encouraging analysts in the Homeland Security (HLS) and Homeland Defense (HLD) communities to share best practices and new methodologies. Best practices emerge from the bedrock principles of military operations research that have evolved over the past 50 years. New methodologies are being tested to support HLS and HLD missions. WG4 provides the collaborative forum to share information and build upon the collective knowledge to strengthen HLS and HLD efforts. WG4 is home to an analytic cadre from DHS, its Components, and USNORTHCOM.

DHS was established to provide a unifying core for the vast national network of organizations and institutions involved in efforts to secure the United States of America. DHS's mission is to prevent and deter terrorist attacks and protect against and respond to threats and hazards to the nation. DHS works to ensure safe and secure borders, welcome lawful immigrants and visitors, and promote the free-flow of commerce.

USNORTHCOM is teamed with the bi-national North American Aerospace Defense Command (NORAD) with their complementary missions to collaborate with homeland defense, security, and law enforcement partners, to prevent air attacks against North America, to safeguard the sovereign spaces of the United States and Canada by responding to unknown, unwanted, and unauthorized air activity approaching and operating within these airspaces, and to provide aerospace and maritime warning for North America.

Many of the goals from last year will remain our areas of emphasis: (a) identifying and working through obstacles and differing priorities in the homeland security and homeland defense continuum, (b) assessing the issues, authorities, and associated policies of DHS and DoD's support to civil authorities, (c) evaluating information sharing within and across US and global partners, (d) sharing or exchanging information among national and international partners, and

(e) highlighting technical or methodological advances that improve HLS and HLD efforts.

WG4 intends to work throughout the year to address some of these analytic areas and will be active in MORS events to demonstrate our commitment to conducting analyses that can lead to improvement of interaction and response for all agencies involved in National Security.

WG 5 – Information and Cyber Operations

David Silvermail- Chair: (256) 955-1355; david.l.silvermail.civ@mail.mil

Brian Wisniewski- Co-Chair: (440) 235-0723; brian.d.wisniewski.mil@mail.mil

Dr. Steven Chaney- Co-Chair: 706-224-8065; Stephen.chaney@geeksandnerds.com

Paul Works- Co-Chair: (913) 684-5233; paul.w.works.civ@mail.mil

Paul Gellerman Co-Chair: (703) 806-5318; paul.c.gellerman.civ@mail.mil

David J. Myers- Co-Chair: (315) 330-2988; david.djm.myers@gmail.com

Lyman Moquin- Advisor: (703) 614-0640; lyman.moquin@navy.mil

Joint Publication 3-13, Information Operations (IO), dated 27 November 2012; incorporating change 1, dated 20 November 2014, defines IO as the “Integrated employment, during military operations, of information-related capabilities (IRC) in concert with other lines of operation to influence, disrupt, corrupt, or usurp the decision- making of adversaries and potential adversaries while protecting our own.” The newest revision of Joint Publication 3-13, introduces new models of information-influence relationships and environments; as well as, clarifies staff roles and desired effects upon target audiences (TA). There are many military capabilities that contribute to IO and should be taken into consideration during the planning process. These include: strategic communication, joint interagency coordination group, public affairs, civil-military operations, cyberspace operations (CO), information assurance, space operations, military information support operations (MISO), intelligence, military deception, operations security, special technical operations, joint electromagnetic spectrum operations, and key leader engagement.

JP 3-12, dated 5 February 2013 defines Cyberspace as “A global domain within the information environment consisting of the interdependent networks of information technology infrastructure, including the internet, telecommunications networks, computer systems, and embedded processors and controllers” and for cyberspace operations (CO), Joint Publication 3-0, “the employment of cyberspace capabilities, where the primary purpose is to achieve military objectives or effects in or through cyberspace.” The WG recognizes that information and cyber operations efforts must also be globally integrated with actions taken by other instruments of national power, and as such must consider Interagency, non-government, and Coalition partners, as well as potential opponents and neutrals across the full spectrum of conflict. Moreover, the heavy reliance upon information technologies and ensuing global integration has increased the importance of information and information superiority to the point that information technologies and information are becoming critical objectives for future conflicts. The WG encourages submission of presentations relevant to the information and cyber operations areas outlined below; especially as they identify, clarify and relate IO and CO. The submission may be finished work, work-in-progress, or ideas and concepts. There is a rising demand for IO/Cyber professionals across the Interagency, Department and Service communities. Professional development and continuing education to grow the workforce to meet this demand cannot be of higher priority.

The WG encourages submission of presentations relevant to the information and cyber operations areas outlined below; especially as they identify, clarify and relate IO and CO. The submission may be finished work, work-in-progress, or ideas and concepts. There is a rising demand for IO/Cyber professionals across the Interagency, Department and Service communities. Professional development and continuing education to grow the workforce to meet this demand cannot be of higher priority.

- Studies, activities and analyses illustrating the development and evaluation of IO/Cyber learning, instruction tools, hands-on or virtual learning, or exercises
- Multidisciplinary approaches to defining and solving information and cyber operations problems leading to new tactics, techniques and procedures
- Activities and analyses that demonstrate the integration of capabilities at the strategic, operational, and tactical levels of war to produce effective US Government responses
- Real-world applications of IO/CO tools, techniques, and simulations for IO/cyber workforce skill acquisition and sustainment-
- Training analyses of network operations that demonstrate the impact of information attack, defense, exploitation and assurance as well as on attack detection, and/or restoration across the spectrum of conflict
- Studies using tools applied to any of the core competencies described above
- Studies that examine the effects of attack, defense, and influence operations on friendly, adversarial, and/or neutral organizations
- Symposia, games, exercises, experiments or acquisition testing that involved information and cyber operations, emphasizing the vulnerabilities of information- dependent organizations
- Development of IO and CO modeling and simulation-based analysis tools, and
- Analyses of historical examples of successful and unsuccessful information and cyber operations.

Presentations that describe development of information and cyber operations analysis tools, techniques, measures of effectiveness, damage indicators and damage assessment methods—or the refinement of existing ones—are welcome. We look forward to hearing from you!

WG 6 – Battle Management Command and Control (BMC2)

Chris Moore- Chair: (571) 256-2114; christopher.m.moore141.civ@mail.mil

Scott Fischer- Co-Chair: (937) 781-2815; fischer_scott@bah.com

Eun-Joo Ketcham- Advisor: (760) 939-426; 1eun-joo.ketcham@navy.mil

Battle Management Command and Control (BMC2) is one of the six joint functions that enable the conduct of joint, interagency, intergovernmental and multinational tasks across the range of military operations. Joint Publication 3-0 states that command and control is “the authority and responsibility to effectively plan for, organize, coordinate, control, employ, and protect” the forces. For more than two decades, the United States has been increasingly relied upon to command and control joint, interagency, intergovernmental and multinational forces during offensive, defensive and stability operations in locations around the world. From these operations, analysts have been involved in not only helping plan and support these operations, but are responsible for identifying and providing solutions to real-time battlefield issues.

The size, diversity and age of the networks and systems comprising BMC2 represent a critical concern for national security, making it crucial for our National Security Analysts to have the skills necessary to understand, monitor and influence our BMC2 systems and systems-of-systems. Current and future operations will require the development and implementation of structures, systems, and procedures, defined, in part, by asymmetric threats; operations in urban environments; collaboration with joint, interagency, intergovernmental and multinational entities; and planning, employing, organizing, directing, coordinating, controlling, and protecting military forces. In addition, in order to achieve the capabilities envisioned by Net-centric Warfare - to expand the ability of the military commander to plan operations, assess their progress and quickly effect changes that appropriately respond to developments on the battlefield - analysts at every level will be vital in developing and evaluating the necessary and sufficient BMC2 solutions.

For the 85 MORSS, WG 6 will provide an opportunity for military, government, and civilian operations research analysts to examine topics, methodologies, analyses, and innovations pertinent to the challenges of C2, especially within the context of national security. WG 6 invites papers and discussions regarding the current and future analysis of BMC2 issues, systems, architectures, investment strategies and processes as well as educational programs, training programs and tools that support the continued growth and development of BMC2 capabilities. Presentations may include completed studies or work-in-progress.

WG 7 – ISR and Intelligence

Elizabeth Jones- Chair: (410) 278-6366; elizabeth.a.jones252.civ@mail.mil

William Harclerode- Co-Chair: (410) 278-6446; william.k.harclerode.civ@mail.mil

Richard Heine- Co-Chair: (410) 278-6360; richard.w.heine.civ@mail.mil

Chen Lai- Co-Chair: (410) 278-2320; chen.k.lai.civ@mail.mil

James Richards- Co-Chair: (603) 646-4703; james.e.richards@usace.army.mil

Timothy Elder- Advisor: (858) 925-9321; tim.elder@lmco.com

Scott Schoeb- Advisor: (410) 278-6606; scott.g.schoeb.civ@mail.mil

Robust and efficient analysis and operations research methods provide critical support to our Intelligence, Surveillance, and Reconnaissance (ISR) capabilities as our Nation continues to deal with uncertain global asymmetric and strategic threats. The purpose of the ISR Working Group is to promote the exchange of analytical techniques, permit the peer review of methods and results, and provide a means for continued growth of military operations research and related disciplines as applied to ISR analysis across the spectrum of peace, crisis, Stability and Support Operations (SASO), and Major Combat Operations (MCO). The theme of the 85th Symposium is "Building a Strong Foundation." Intelligence, Surveillance and Reconnaissance is a critical function of the US Military and an essential building block of our nation's security.

For the foreseeable future, the United States will maintain the technological edge in "battlefield awareness" and precision-guided weaponry. However, in the decades to come, we will face three types of threats: Asymmetric threats in which state and non-state adversaries avoid direct engagements with the US military but devise strategies, tactics, and weapons to minimize US strengths and exploit perceived weaknesses; Strategic threats, including mobile missile and submarine threats where a few countries will have the capability to strike the United States or its allies; and regional military threats, in which a few countries maintain large military forces with a mix of Cold War and post-Cold War concepts and technologies. Many of these potential adversaries are undertaking increasingly sophisticated Cover, Concealment, Camouflage, Denial and Deception (C3D2). These efforts are designed to hide key activities, facilities, and capabilities (e.g., mobilization or attack preparations, WMD programs, advanced weapons systems developments, treaty noncompliance) from US intelligence; to manipulate US perceptions and assessments of those programs; and to protect key capabilities from US precision strike platforms. With the increase in dynamic targeting, smaller yield weapons, a desire for reduced collateral damage and a large and growing inventory of coordinate-seeking weapons, special emphasis will be placed on the ability of intelligence assets to provide accurate target location accuracy. Foreign knowledge of U.S. intelligence and military operations capabilities is essential to effective C3D2. Advances in indications and warning capabilities; the growing availability of camouflage, concealment, deception, and obscurant materials; advanced technology for, and experience with, building underground facilities; and the growing use of fiber optics and encryption will increase the C3D2 challenge.

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The ISR Working Group seeks to provide a forum for ISR analysts to present their work across all intelligence disciplines (GEOINT, SIGINT, MASINT, HUMINT, etc.). The work may be focused on optimizing ISR assets, ISR modeling and simulation techniques and case studies, providing actionable intelligence to commanders and decision makers, the use of operations research techniques in support of ISR planning or execution, or the organized use of multidisciplinary teams combining less mathematical areas such as psychology, political science, cultural specialists, etc., to solve hard problems, including those in the intelligence arena.

In addition, the ISR Working Group provides a forum for information sharing within the ISR community. This includes information on ISR system's algorithms, data structures, and fusion capabilities in order to improve the knowledge base on which analysts perform assessments. The goal of the working group is to provide information to improve and grow ISR analysis to best support the community in current and future operations.

WG 8 – Space Acquisition, Testing and Operations

Joseph Hoecherl- Chair: (240) 612-4062; joseph.c.hoecherl.mil@mail.mil

Leisha Schiess- Co-Chair: (240) 612-4055; leisha.m.schiess.mil@mail.mil

Steven Toler- Co-Chair: (256) 955-1521; steven.g.toler.civ@mail.mil

Mike Tomlinson- Advisor: (256) 864-8355; tomlinsonw@saic.com

Working Group (WG) 8 focuses on Operations Research (OR) efforts that help our nation “secure the high ground” in space. The presentations will demonstrate analytically sound OR techniques that help our nation acquire and operate space capabilities/systems by assessing their strategic, tactical, and operational contributions (real or projected). Presentations will further our understanding of space capabilities incorporating this year’s theme: “Pivoting on a Strong Foundation to a Bright Future.”

Today, more than ever, space is the true “high ground” given that more nations around the world have access to the space domain through organic or commercial space capabilities. Leveraging space provides the most global perspective possible allowing for enhanced global security, protection of lives and assets, movement of information, and augmentation of the Warfighter’s operational environment. As nations around the world continue to leverage and acquire space capabilities, it becomes increasingly critical for the U.S. to maintain Space Superiority across the broad range of space operations in an increasingly congested, contested, and competitive space environment. This WG discusses the analysis of technological challenges and solutions that bring about unrestricted use of space and space-enabled cyber, enabling our military and intelligence communities to effectively decide, detect, and deliver on a global scale.

We are seeking presentations on strategic, tactical, and operational contributions from space capabilities/systems, space families of systems, or space architectures whether in the concept, R&D, acquisition, or operational phase. Presentations may also address innovative analytical processes, methodologies, utilization of models and simulations, or techniques as they are applied to space capabilities/systems operations and/or acquisition. Submissions should demonstrate operations research techniques, whether innovative, unique, or traditional, and may be completed works or works in progress. It is the intent of this WG to obtain a variety of topics to ensure an interesting exchange of approaches, interests, and ideas among the space-focused OR community.

WG 9 – Air and Missile Defense

Ronald Cappellini- Chair: (703) 614-2156; ronald.cappellini@navy.mil

Richard Austin- Co-Chair: (334) 953-7601; richard.austin.6@us.af.mil

David Halloran- Co-Chair: (719) 721-7257; david.halloran@torchtechnologies.com

Steve Toler- Co-Chair: (256) 955-1521; steven.g.toler.civ@mail.mil

Jonathan Francis- Advisor: (256) 955-2256; jon.francis@torchtechnologies.com

Richard Goodwin- Advisor: (402) 980-5459; rich.goodwin@mda.mil

The theme “Pivoting on a strong foundation to a bright future” recognizes the enduring legacy of the Joint Integrated Air and Missile Defense (IAMD) community and sets the benchmark for the Joint force to respond to evolving global security challenges over the next 50 years. Nils Bohr, Nobel laureate in Physics, said “Prediction is very difficult, especially if it’s about the future.” However, it is certain that the quantity of threats will increase and also become exceedingly complex with improvements in range, accuracy, mobility, speed, stealth, and targeting. Additionally, the battlespace will expand requiring plans and operations to range across Regional, Trans-Regional, and Homeland domains. These advances necessitate corresponding technological advances in IAMD weapons systems, both kinetic and non-kinetic, command and control architectures and decision support tools. The joint conceptual framework - *Capstone Concept for Joint Operations: Joint Force 2020, Countering Air and Missile Threats (JP 3-01); Command and Control for Joint Air Operations (JP 3-30); and the Integrated Air and Missile Defense Joint Integrating Concepts* provides the approach the IAMD community will take to prevent an adversary from effectively employing any of its offensive air and missile weapons and the operations research (OR) community must be positioned with the appropriate analytic tools to guide decisions on Joint force capabilities, capacity and readiness to counter the full spectrum of air and missile threats. The analyst must be able to effectively communicate the following: what we need, how much we need, how we measure it, and how we ensure effective and efficient integration is accomplished.

While the manned aircraft threat endures, the proliferation of unmanned air vehicles, cruise/ballistic missiles and rockets continues to increase. Missiles are perceived as a cost-effective force multiplier to many nations as they can be used effectively against an adversary with formidable air defense systems. It is in the consideration of a combined threat environment we are challenged to develop and build an integrated air and missile defense system expanding from independent architectures to a fully integrated, networked force. We must leverage retaining use of the electromagnetic spectrum, computer networks, and space systems within the conceptual framework. Consequence management must also be part of our OR tool kit for both material development and operational planning.

Key issues that Working Group 9 addresses for “Pivoting on a strong foundation to a bright future” include advances in computational capabilities that enable advances in OR techniques. During the last three years Working Group 9 has focused on developing the next generation of

national security analysts and methodologies to derive requirements for future systems and the supporting command relationships (Joint and Coalition). The future IAMD environment will be characterized by a full spectrum of threats (including cyber and space threats) utilizing a range of advanced capabilities (networked weapons, electronic attack, stealth, maneuvering reentry vehicles, decoys and advanced seekers). How does the analyst assess the effectiveness of operational concepts, tactics, techniques, and procedures (TTPs) that will allow Warfighters to be better equipped to defeat tomorrow's threat? Are there emergent threats to our capabilities that potential adversaries have gleaned from our employment of unmanned systems and other leading-edge technologies? A holistic approach of integrating air and missile defense is required to address this challenge. Exploiting the capabilities of joint interoperability, multi-role, multi-mission defense systems may provide the leverage needed to accomplish our goals. The need for operations research analysis is greater than ever to inform capability and capacity delivery to the warfighting needed to combat the evolving threat environment.

Supporting the 85th MORSS theme coupled with the diverse Warfighter needs, Working Group 9 will focus on current and future studies and analyses that address the full range of opportunities to deter and if necessary defeat adversary offensive air and missile weapons, both left and right of enemy launch, fully integrated with our coalition partners. We will explore the balance between the demand for increased capacity and enhanced warfighting capability and affordability. The vision for integrated air and missile defense is a versatile, responsive and decisive Joint Force enabled by a military operations research community that fosters continuing education, promotes critical thinking and creative thought, and enhanced collaboration.

WG 10 – Joint Campaign Analysis

David Knudson- Chair: (703) 806-5317; david.b.knudson.civ@mail.mil

Paul Bross- Co-Chair: (757) 935-9504; paul.bross@lmco.com

Cory Culver- Co-Chair: cory.l.culver.mil@mail.mil

William Woodson- Co-Chair: (703) 784-6017; william.woodson@usmc.mil

LTC Michael Landin- Co-Chair: DSN (315) 723-7205; michael.a.landin.mil@mail.mil

Robert J. Stevenson- Co-Chair: (703)-784-5480; robert.stevenson1@usmc.mil

Douglas Boerman- Advisor: (703) 693-3352; douglas.a.boerman.civ@mail.mil

Miles Edwards- Advisor: (703) 806-5615; miles.douglas.edwards@gmail.com

The Joint Campaign Analysis Working Group (WG 10) concentrates on the integration of land, sea, air, space, cyberspace, special operations and interagency concerns related to all phases of campaign operations. The primary goal of WG 10 is improving the quality of all aspects of campaign analysis and thereby supporting better-informed decision making at all levels.

WG 10 provides a forum for presentations and discussions that primarily relate to joint campaigns. Of special interest to WG 10 are models, analytical simulations, and automated tools supporting decision making based upon joint campaign analysis. Results of analysis will be presented and measures of effectiveness will be discussed. Peer review of the analysis techniques and results will be an important element of the working group activity.

The 85th MORS Symposium provides WG 10 the opportunity to review recent work that has a proximate influence on campaign analysis and share with the operations research community possible directions, cautions, and other benefits of its experience. Prime candidates of interest to WG 10 include:

- Studies related to joint campaigns (all phases)
- Analysis, research techniques, methodologies and models/simulations related to joint campaigns
- Emerging or innovative warfighting analysis methodologies and techniques
- Results of recently completed warfighting analysis (or ongoing works-in-progress)
- Analysis in support of programming and policy decisions
- Analysis informing the direction and scope of transforming forces
- Analysis of deliberate and crisis action decision-making
- Innovative or improved automated decision support tools

WG 10 solicits thought-provoking papers in these areas which relate to the 85th MORS Symposium theme – “Pivoting on a strong foundation to a bright future”. Based on previous symposia, presenters should be prepared to deliver their briefings in 30 minute periods to include questions.

WG 11 – Land and Expeditionary Warfare

Laurie Hable- Chair: (913) 684-9161; laurie.k.hable.civ@mail.mil
Robert Horton- Co-Chair: (913) 684-9211; robert.e.horton28.civ@mail.mil
Michael Landin- Co-Chair: (575) 678-7872; michael.a.landin.mil@mail.mil
Joseph Smith – Co-Chair: 520-545-9657; joseph.g2.smith@raytheon.com
Sharon Wagner- Co-Chair: (913) 773-8494; sharon.s.wagner.civ@mail.mil
Robert Steele- Advisor: (913) 684-9263; robert.h.steele8.civ@mail.mil

In order for the military operations research community to continue to build on a strong foundation, we as analysts need to share our knowledge and experience with the larger community. MORSS provides the opportunity to discuss lessons learned and evolving challenges in analysis. We face a dynamic and uncertain environment with threats ranging from Middle East terrorist networks, to Russian aggression in Eastern Europe, to China's military buildup and an increasingly threatening North Korea. The application of land and expeditionary warfare is essential in achieving strategic success, advancing national interests, deterring future conflict and building partners. The restrictions placed on the military due to budget constraints and downsizing means that there is even more value placed on the ability of the operations research community to inform decisions about concept development, acquisition, force design, force mix, and tactics, techniques, and procedures development.

We are seeking presentations from the land and expeditionary warfare domain that enhance analysts' professional development in military operations, operations research techniques, methodologies and models in the following areas:

- Operations against peer and near-peer threats.
- Operations in complex and urban environments.
- Operations against non-state actors.
- Interoperability between conventional and special operations forces.
- Influence of social, cultural, political, and historical knowledge on land operations.
- Combat and stability operations involving nonmilitary and multinational partners.
- Future concepts in the analytical field as they relate to land and expeditionary warfare.

Working Group 11 invites all analytical agencies, services and centers of excellence to submit presentations that can increase our professional development and educate our community on current studies and the future direction of land and expeditionary warfare. Efforts of interest include, but are not limited to, historical, current, and future force analysis, innovative applications of modeling and simulation, and studies that underpin the development of future warfighting concepts, and analytic efforts supporting critical resource allocation decisions.

WG 12 – Maritime Operations

Kimberly Ten Broeck- Chair: (850) 636-6040; kimberly.tenbroeck@navy.mil

Amy Bednar- Co-Chair: (601) 634-3559; amy.e.bednar@usace.army.mil

Jonathan Millhollon- Co-Chair: (850) 636-6492; jonathan.millhollon@navy.mil

Stephen Morris- Co-Chair: (850) 230-7364; stephen.n.morris@navy.mil

Kristin Gooch- Advisor: (850) 235-5620; kristin.gooch@navy.mil

The littoral regions of the world are where American influence and power have the greatest impact and are needed most often. Naval Forces will be focused on defeating anti-access capabilities — such as small, fast surface combatants, quiet diesel submarines, and sea mines — in order to enable control of the seas near land and assure freedom of maneuver of joint forces from the sea base to the objective.

Dominating the littorals allows Naval Forces to project power ashore and influence the land campaign. Continuing this domination in the near- and long-term future requires innovative and perhaps radical concepts for systems, tactics, support, maritime domain awareness, and force structure. Our evolving, integrated naval capability must be built wisely, with limited resources and assured effectiveness. Fresh ideas and bold new concepts, bolstered by sound analytic thought, are essential to foster the creativity and critical thinking needed.

The objective of the Maritime Operations Working Group is to promote the exchange of analytical techniques and encourage peer review of methodologies and results from research performed. This provides a means for continued growth of military operations research and related disciplines with respect to maritime operations and with specific emphasis on the littoral warfare and regional sea control missions.

The principle focus of WG-12 will be to examine maritime operations, littoral warfare, and regional sea control in contingency operations. This examination will be analyzed within the framework of interagency warfare. Our objective, in keeping with the 85th MORSS theme, “Pivoting on a Strong Foundation to a Bright Future,” will be to enhance Naval Operations Research in this area by calling for papers that link their analytical conclusions to practical recommendations. We seek innovative presentations displaying original and focused analysis that stimulates thought, commentary, and perhaps, even controversy. Analysis presented can be work that is complete or still in progress.

WG 13 – Power Projection and Strike Warfare

Laura Guay- Chair: (470) 694-0192; laura.d.guay.civ@mail.mil

Michael Alcantara- Co-Chair: (301) 342-8284; michael.alcantara@navy.mil

Thomas Fariss- Co-Chair: (603) 885-9012; thomas.l.fariss@baesystems.com

David Lyle- Co-Chair: (407) 356-9687; david.lyle@lmco.com

Robert Mount- Co-Chair: (760) 939-8386; robert.mount@navy.mil

Kathryn Sprouse- Co-Chair: kathryn.d.sprouse@raytheon.com

Todd Van Woerkom- Co-Chair: (937) 255-8581; tvanwoerkom@infoscitex.com

Kenneth Amster- Advisor: (760) 446-2124; kenneth.amster@navy.mil

The U.S. capability for global projection of power continues to be a crown jewel for the nation. This capability requires our military programs and analysts to discover new ways to apply precision force in support of national security objectives. It also requires us to examine the constraints that our adversaries invent to prevent strike weapons concepts from succeeding. Both of these areas challenge us in the uncertainty within both the operational and the programmatic arenas. We welcome contributors that have ideas on maximizing harm to our true adversaries while minimizing the costs (in non-combatant lives, property, and cost to the tax payer). WG-13 seeks presentations (either completed or work in progress) that focus on the development and evaluation of concepts of operation; tactics, techniques, and procedures; systems engineering; and new technologies that support warfare derived from the following:

- Studies and analysis
- Test and evaluation
- Experimentation / Advanced Concept Technology Demonstrations
- Modeling and simulation
- Training exercises
- Real world operations

WG-13 encourages submission on a wide range of topics including:

- Command, control, and communication for strike operations
- Intelligence, surveillance, and reconnaissance in support of strike targeting
- Electronic Warfare / Countermeasures in support of strike survivability
- Asymmetric threats to U.S. power projection assets and doctrine
- Methods to overcome adversary-imposed constraints on strike missions
- Modeling, mission planning, execution and assessment
- Joint fire support / Deep fires
- Manned and unmanned system concepts to execute strike warfare missions
- Strategic attack
- Land/Sea-based strike
- Distributed strike weapons concepts
- Precision weapon employment

WG 14 – Air Warfare

Kristi Brendlinger- Chair: (937) 713-7177; kristi.brendlinger.ctr@us.af.mil

Margret Martin- Co-Chair: (937) 257-1373; margret.martin@us.af.mil

Todd Paciencia- Co-Chair: (571) 256-2147; todd.j.paciencia.mil@mail.mil

John (Shoo) Schumacher- Co-Chair: (571) 256-2176; john.j.schumacher.civ@mail.mil

David Panson- Advisor: david.panson@wpafb.af.mil

Military power is most effective when it is integrated, combined, joint, and interagency. The Air Warfare Working Group is focused on one of several components of integrated military power: the employment of combat air power. Our focus includes the effective utilization of relevant sub-systems, operational employment concepts, and the integration of air assets during the conduct of joint and combined military operations that support national strategic and theater operational objectives.

Combat air power is intended to achieve specific desired effects that contribute directly to the achievement of military and political outcomes and objectives. Therefore, the primary focus of this working group is on conventional combat missions intended to destroy, degrade, defeat, or disrupt enemy forces. These missions include Counter-Air (Offensive and Defensive), Counter-Land (Close Air Support and Interdiction), Counter-Sea, and Strategic Attack.

The entire air warfare domain is rapidly changing and increasingly challenging as the environment and employment concepts evolve. Specifically, some of the toughest challenges we have faced in the combat arena, providing the most fertile ground for analysis, are the following: synergistic airborne force mixes to achieve desired capabilities, advanced technologies and technology requirements, rules of engagement, target identification, prevention of fratricide, effects-based operations, tactical battle management, autonomous air combat operations, command and control, electronic warfare, tactical control of air assets, integration of unmanned aerial systems, manned/unmanned teaming, time-critical targeting, employment of air-delivered munitions in a net-centric environment, hard targets, moving targets, preventing collateral damage, urban targets, as well as interoperability in the joint, combined, and interagency arena. Therefore, the emphasis of WG 14 presentations is on applications, analyses, tools, concepts, and methodologies that improve our understanding of the dynamic phenomena of air warfare and the myriad of factors that impact success. These factors include air vehicle performance, capabilities of air-delivered munitions, emerging technologies, countermeasures, concepts of employment, doctrine, tactics, techniques, procedures, rules of engagement, combat identification, threats, operating environments, proficiency, interoperability, and air operations planning.

WG 14 strives to assist in developing capabilities to cope with emerging threats, new environments, and technological breakthroughs. In keeping with the 85th MORS Symposium theme of “Pivoting on a Strong Foundation to a Bright Future”, this working group focuses on the use of new analytical tools, processes, applications, methodologies, and metrics. Thus, we

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provide a forum for discussions and presentations relating to the unique challenges faced when attempting to conceptualize, model, simulate, analyze, and experiment with the employment of combat air power and the many factors that affect success in the combat arena and improve our understanding of air warfare.

WG 14 encourages presentations on both completed work and work in progress. Final presentation selection will be based on both the 85th MORS Symposium theme and the focus of this working group. Presentations will be made in individual working group, combined working group, or composite group sessions. Presenters should be prepared to deliver their briefings in 30-minute periods including questions.

WG 15 – Casualty Estimation and Force Health Protection

Trevor Elkins-Chair: (619) 767-4559; trevor.a.elkins.ctr@mail.mil

Nathaniel Bastian- Co-Chair: (570) 809-3619; nathaniel.d.bastian.mil@mail.mil

James Young- Co-Chair: (256) 726-2456; james.young@teledyne.com

Edwin D’Souza- Advisor: (760) 822-4329; edwin.w.dsouza.ctr@mail.mil

The 85th MORS Symposium theme, “Pivoting on a Strong Foundation to a Bright Future,” honors past achievements that have laid the groundwork for the operations research community while highlighting the innovative advances of today. The symposium brings together researchers and military analysts who are passionate in the pursuit of knowledge and the application of their craft in defense of the nation. The Casualty Estimation and Force Health Protection working group welcomes participants interested in the application of operations research to protect those whose life and health are at risk in that endeavor.

The major thrust of this working group is the development and application of quantitative methods for estimating casualties and determining the medical planning requirements to manage the casualties in the health service support system. Casualty estimation encompasses personnel losses, such as the incidence of wounded-in-action, killed-in-action, disease and non-battle-injured, psychiatric casualties, and fratricide. Health service support includes, but is not limited to, the theater level medical treatment facility capabilities/functions; patient movement; forward resuscitative surgery; evacuations, admissions/occurrences, staffing, return-to-duty, preventive medicine, combat and operational stress control; and logistic support and estimation.

The range of military operations has created a tremendous challenge in providing the needed medical care and support of our military forces. The operational environments of interest range from stability, security, humanitarian, disaster relief, reconstruction operations and finally to major combat operations with always the threat of chemical, biological, radiological, and nuclear weapons.

Working Group 15 welcomes presentations in concepts under development and research as well as proven applications and techniques from all disciplines that highlight the use of operations research methods in the subject areas listed. Past presenters have included operations research analysts, statisticians, behavioral scientists, clinical providers, medical planners, logisticians, and other scientists.

WG 16 – Strategic Deployment & Distribution

Lee Rutledge- Chair: lee.rutledge@us.af.mil (937) 904-6523

Vince Raska- Co-Chair: vincent.raska@us.af.mil (937) 904-6569

Bryan Sparkman- Co-Chair: (703) 693-8757; bryan.t.sparkman.mil@mail.mil

Ronald Carl- Advisor: (618) 220-5175; ronald.g.carl.civ@mail.mil

The overall goal of the Strategic Deployment and Distribution Working Group (WG 16) is to present and discuss applied analysis to evaluate capabilities to meet the deployment and distribution requirements of the United States Military at the most affordable levels.

Abstracts submitted to this working group should focus on 1) examining state-of-the-art improvements to deployment and distribution processes through modeling and/or analysis, 2) developing new operations research techniques or modeling objects, families, and classes that represent mobility and transportation systems, 3) sharing new or changed doctrines, concepts of operation, missions, or fundamental assumptions regarding deployment and distribution processes, or 4) describing how defense distribution systems and processes are balancing the risks (e.g., operational, costs, security) involved in facing an uncertain future. We encourage presentations of works in progress as well as completed papers. The most critical component in any abstract is a clear statement regarding how the analysis yields insights into how different approaches are likely to yield differences in the most relevant outcomes, and at what cost and risk.

Analyses presented at this year's MORSS in WG 16 should cover some, but preferably multiple aspects, of operations research analysis to include operational effectiveness, cost, risk, capability, and/or metrics useful for senior level decision making and policy guidance and of interest to the wider mobility and distribution community. Preference will be given to those abstracts that not only discuss the analytic approach and findings, but provide a live demonstration of the supporting models. Additionally, preference will be given to those abstracts that provide outcomes as uncertainty distributions, or as a minimum, confidence bands. Lastly, analysis that demonstrates a flexible framework that supports interactive sensitivity analysis is highly desired; as well as analysis that provides a more holistic evaluation across a portfolio of distribution capabilities. For example, are there second- and third-order effects of the phenomena and, from a system-of-systems view, what is the impact?

WG 17 – Logistics, Reliability, and Maintainability

Thomas Collipi- Chair: (321) 951-6528; tom.collipi@ngc.com
Liz Comar- Co-Chair: (937) 257-6920; elizabeth.comar@us.af.mil
Carol DeZwarte- Co-Chair: (703) 300-6808; nygala@yahoo.com
David Sax- Co-Chair: (215) 697-2307; dave.sax@navy.mil
Huntley Bodden- Co-Chair: (229) 639-7307; huntley.bodden@usmc.mil
Joseph Boyett- Advisor: (334) 313-3361; jody.boyett@usa.net
David Fulk- Advisor: (757) 225-7672; dfulk@lmi.org
Bob McCormick- Advisor: (937) 904-1388; bobby.mccormick.1@us.af.mil

The nature of warfare constantly evolves, and challenges analysts to develop new problem-solving approaches and use existing techniques and models in new applications. Logistics, reliability, and maintainability are key aspects for supporting our warfighters and our allies around the globe. Technological improvements increase the information available to logisticians and the need for advancements in methods of organizing, mining, and presenting that information to decision makers in a manner which supports effective actions.

Working Group 17 provides a forum for discussing a wide variety of logistics analyses, including support to deployed forces, logistics impact on readiness, supply chain management, system reliability, designing for improved system maintainability, life cycle cost and operational effectiveness, product support management, support for joint and coalition operations, inter-agency support, and reverse logistics. This list is far from exhaustive; papers that seek to solve important problems in other areas of logistics are valued as well.

Especially of interest are new analytical approaches and tools for handling amorphous, hard-to-define, or long-standing problems, or applying existing techniques in areas that are usually considered to be more qualitative. Existing analytical techniques include mathematical modeling, statistical analyses, stochastic or deterministic optimization, forecasting, and simulation. We welcome analyses or analytical tools that are completed work, particularly those with demonstrated impact, as well as work in progress—often the best aspect of the sessions is discussion, questions and feedback from your peers.

WG 18 – Manpower and Personnel

Charles Weko- Chair: (814) 207-2808; charles.w.weko.mil@mail.mil

Bart Bennett- Co-Chair: (805) 499-6249; bart_bennett@rand.org

Phillip Compean- Co-Chair: (703) 601-6736; phillip.t.compean.mil@mail.mil

Todd Minners- Co-Chair: (703) 545-1154; toddboar@yahoo.com

Jerry Diaz- Advisor: (571) 344-8481

Kevin Loy- Advisor: (703) 298-2242; theloys@sbcglobal.net

The individual and collective talents, skills, and capabilities of the total force of active duty, reserve, civilian, contractor and interagency personnel are required to accomplish the mission and goals of our national security strategy. Success in this complex environment requires decision makers to depend upon a sophisticated human resource management system to access, recruit, train, assign, distribute, motivate, care for, evaluate, retain, and separate personnel. Integral to this success is the analytical support the manpower and personnel research community brings to bear on the toughest personnel challenges facing civilian and military leaders.

Keeping with the theme of the 85th MORSS, “Pivoting on a strong foundation to a bright future” the Manpower and Personnel working group seeks to embrace new technologies and research ideas, from both traditional and non-traditional sources of manpower and personnel analysis. We encourage the involvement of new communities in this important analytical area to boost the existing analytical power of the field. We seek individuals who innovatively addressed these challenges to share high quality presentations that describe their work or work-in-progress. Presentations should be rigorous in content and address one or more of the following: requirements determination, manpower planning, recruiting, screening and personnel selection, measurement of personnel readiness, attrition, retention, compensation, compensation reform, assignments and distribution, performance evaluation, and other manpower and personnel issues. To generate discussion and share ideas, presenters seeking input on work-in-progress, techniques currently under development, and completed analyses/papers are encouraged to submit abstracts to the working group chair/co-chairs or to the MORS office.

WG 19 – Readiness

Carlton Hill- Chair: (703) 695-8436; carlton.hill@navy.mil

Terry Dudley- Co-Chair: (513) 748-0104

Ryan Squires- Co-Chair: ryan.r.squires.mil@mail.mil

Joseph Adams- Advisor: (202) 957-1283; jadams@ida.org

David Hudak- Advisor: (703) 614-9805; david.hudak.mil@mail.mil

The Department of Defense will continue its transformation during the coming years to meet global challenges which confront the nation during the 21st Century while simultaneously operating with limited resources. As a result, analysis of readiness must address the complexities of considering the capabilities of interagency and coalition partners, private and non-governmental organizations, and state and local authorities.

Traditional readiness constructs must be rethought to provide efficient, cost effective, agile and dynamic organizations with expanded mission capabilities, including traditional and non-traditional roles both at home and abroad. Terminology such as rotational readiness, expeditionary forces, language and cultural capabilities, multiple service/component solutions, mission capability assessments, full spectrum operations, irregular warfare, and Stability, Security, Transition, and Reconstruction Operations (SSTRO), will dominate Department discussions for the foreseeable future. Therefore, what tools can be used to assess and manage organizations and individuals for the missions we face? Can we involve and assess interagency and coalition partner capabilities? How do we engage all of these diverse entities in order to synergistically leverage collective readiness capabilities? What type of readiness analysis needs to be developed for the 21st Century?

This Working Group focuses on readiness capability assessment tools. This includes organizations/force management/force generation, and all relevant material, training, and personnel readiness issues. We consider analytic techniques and tools that allow for real improvements in how we plan, manage, and assess the readiness of our organizations to meet real world missions. Presentations on a wide range of subjects are welcome.

WG 20 – Analytical Support to Training and Education

Britt Bray- Chair: (937) 422-7383; britt.bray@mnallc.com

John Nelson- Advisor: (913) 828-5968; john.nelson@engilitycorp.com

As the Armed Forces of the United States continue to transform to meet the challenges of the 21st Century, they work toward a common frame of reference for joint force concepts, capabilities, and requirements. For more than a decade our forces have been continually challenged in an uncertain and unpredictable strategic environment. The expansion of our national security boundaries requires individuals, units and their staffs be trained and educated to meet the needs of the Combatant Commanders for all operations as well as emerging capabilities for future operations. Evolving trends within the military environment highlight the importance of continuing to evolve training and education programs to meet our security challenges and to develop, sustain, and assess this challenge from a joint perspective in order to meet operational readiness requirements to respond to the security challenges faced in the long war. Department of Defense (DOD) Directive 1322.18, Subject: Military Training provides policy and guidance for the training of DOD personnel and the DOD components to support the operational needs of the combatant commanders.

Training and education are key elements of readiness and national security. Readiness is “the ability of U.S. military forces to fight and meet the demands of the national military strategy.” Readiness is the synthesis of unit readiness, derived from the ability of a unit to deliver the outputs for which it was designed, and joint readiness, the combatant commander’s ability to integrate and synchronize ready combat and support forces to execute the assigned mission. Budgetary pressures demand we use the most effective and cost efficient methods of training and education to attain the necessary readiness to support Combatant Commanders’ mission requirements and capabilities. Our ability to develop and use new analytical processes, frameworks, metrics, and tools, as well as new ways to use the old methodologies, to help solve the problems facing commanders and the training communities, is an important aspect to improving force readiness and contributing to our national security analyst needs. We must ensure we develop methodologies to measure, quantify, and assess improvements in training and education to meet the commanders’ needs and our national security goals.

The 85th MORS Symposium offers an opportunity to review recent work, training concepts, and new training and education developments that address national security issues. We seek analytical presentations addressing any of the mission priorities and concerns outlined above. Both completed work and works-in-progress are welcome.

WG 21 – Operational Energy

Nadine Miner- Chair: (505) 844-9990; neminer@sandia.gov

Gail Vaucher- Co-Chair: (575) 678-3237; gail.t.vaucher.civ@mail.mil

Mark Earnesty- Co-Chair: mark.earnesty@usmc.mil

Dr. Vikram Mittal- Co-Chair: (845)938-4473, vikram.mittal@usma.edu

John Hummel- Advisor: (630) 252-7189; jhummel@anl.gov

Alan Nanco- Advisor: (505) 845-9147; asnanco@sandia.gov

The nation's military faces a strategic environment that is increasingly complex and unpredictable. Analysts must enhance analytic skills and improve knowledge-sharing procedures. The DOD published an Operational Energy Strategy (OES) Implementation Plan in March 2012 to guide the nation through an uncertain energy environment, and enhance both research and development and information sharing using a three-fold approach:

- **More Fight, Less Fuel: Reduce Demand for Energy in Military Operations.** Today's military missions require large and growing amounts of energy with supply lines that can be costly, vulnerable to disruption, and a burden on Warfighters. The Department needs to improve its ability to measure operational energy consumption, reduce demand, and increase the efficiency of energy use to enhance combat effectiveness.
- **More Options, Less Risk: Expand and Secure Energy Supplies for Military Operations.** Reliance on a single energy source – petroleum – has economic, strategic, and environmental drawbacks. In addition, the security of energy supply infrastructure for critical missions at fixed installations is not always robust. The Department needs to diversify its energy sources and protect access to energy supplies to have a more assured supply of energy for military missions.
- **More Capability, Less Cost: Build Energy Security into the Future Force.** While the force's energy requirements entail tactical, operational, and strategic risks, the Department's institutions and processes for building future military forces do not systematically consider such risks and costs. The Department needs to integrate operational energy considerations into the full range of planning and force development activities.

The Operational Energy Working Group provides a forum for discussing a wide variety of energy analyses, including development of baseline metrics, quantifiable improvements in energy performance and efficiency, innovation, costs, risks, and benefits of both alternative fuels and energy security concerns. This list is far from exhaustive; papers that seek to solve important problems in other areas of energy policy are valued as well.

Especially of interest are new analytical approaches and tools for handling amorphous, hard-to-define, or long-standing problems, or applying existing techniques in areas that are usually considered more qualitative. Also of special interest are improved methods for collecting and sharing data, analytical methods, and analysis tools. Existing analytical techniques include mathematical modeling, statistical analyses, stochastic or deterministic optimization,

forecasting, and simulation. We welcome analyses or analytical tools that are completed work, particularly those with demonstrated impact, as well as work in progress—often the best aspect of the sessions is discussion, questions and feedback from your peers.

WG 22 – Experimentation

Jason Williams- Chair: (703) 693-8757; jason.williams.7@us.af.mil

David Smalenberger- Co-Chair: (937) 760-5137; david.smalenberger@us.af.mil

Frank Mindrup- Advisor: francis.mindrup@usafa.edu

The Experimentation Working Group provides an opportunity for military, government and civilian operations research analysts to examine topics, methodologies, analyses, and innovations pertinent to all aspects of designing, planning, executing, analyzing and reporting the results of experimentation supporting the Department of Defense and other government departments and agencies such as the Department of Homeland Security. As we address the theme for this year's symposium— Pivoting on a Strong Foundation to a Bright Future — Working Group 22 emphasizes rigor in analytical processes and experimentation efforts that drive innovation in this important area. We welcome all completed or in-progress studies and topics that affect any facet of experimentation, such as:

- Designing credible experiments with limited resources
- Developing coherent strategies for campaigns of experimentation
- Developing meaningful measures of merit / measures of effectiveness
- Accounting for small sample sizes
- Conducting experiments in training exercises or field tests
- Addressing challenges with participants
- Integrating modeling into experiments
- Reconciling data collection and player participation
- Analyzing results in a timely manner
- Addressing continually evolving experimental objectives
- Effectively sharing results and lessons learned
- Transitioning results into tangible action
- Assessing return on investment
- Analyzing qualitative data with rigor

Working Group 22 also sponsors the MORS Experimentation Community of Practice, a group that meets throughout the year to continue discussing experimentation issues and achieve consistency across government, industry and academia.

WG 23 – Measures of Merit

Michelle Meier- Chair: (913) 684 – 9248; michelle.m.meier.civ@mail.mil

Nick Arnold- Co-Chair: (913) 684 – 8064; nicholas.l.arnold.civ@mail.mil

Samar Guharay- Co-Chair: (703) 983-1787; sguharay@mitre.org

Kay LaFate- Co-Chair: (703) 432-5607; kurtrease.lafate@usmc.mil

Melissa Stafford- Co-Chair: (913) 684 -9134; melissa.a.stafford7.civ@mail.mil

Paul Theobald- Co-Chair: (913) 684-9260; paul.c.theobald.civ@mail.mil

Paul Thompson- Co-Chair: (703) 966-9567; pthompso@ida.org

Cody Quick- Co-Chair: (804)765-1836; cody.j.quick.civ@mail.mil

Our nation is confronted with global enemies who adapt to strike at U.S. military forces and our Homeland where and when we least expect, jeopardizing our existence and our way of life. To mitigate this ongoing and ever-changing threat, our military forces continue to transform to best defeat these enemies in the modern operational environments. This adaptive military stance challenges the ability of traditional measures of merit (MOMs) to measure success. New MOMs are necessary to quantitatively assess the effectiveness of the adaptive combat plan for countering dynamic threats.

While the U.S. continues to transform its forces to meet current and future needs within a fiscally constrained environment, the analytic challenge is to develop appropriate measures that will assist decision makers and reduce the risks that our nation faces.

Operations research is a field that includes various tested and well-established methods for conducting analyses, as well as methods that are still being explored and discovered. One feature common to all analyses is their reliance on quantifiable measures to gauge outcomes. This characteristic provides a strong foundation, which can be leveraged to meet the challenge of developing appropriate MOMs for increasingly complex analyses.

WG 23 solicits papers that successfully use MOMs to facilitate decision analysis; to assess changes in capability or operational effectiveness; to monitor system performance or reliability; to reduce the risks faced by our military and national security forces; to improve transformation or modernization; or to enable U.S. shaping of the international environment. Papers should focus on, but are not limited to, the associated measures used to support analyses and studies within these focus areas:

- Joint acquisition, force effectiveness, force allocation processes, force readiness and training.
- Conducting operations in urban and restrictive environments.
- Human Factors / social sciences/ civil affairs.
- Protecting and sustaining coalition forces.
- Intelligence, Surveillance, Reconnaissance, and Situational Awareness.
- Homeland Security

WG 24 – Test and Evaluation

Ricketa Clifton- Chair: ricketa.n.clifton.civ@mail.mil

Lynn Coles- Co-Chair: (707) 767-3376; lynn.coles@us.army.mil

Luis Cortes- Co-Chair: (951) 284-9994; lcortes@mitre.org

Chen Lai- Advisor: (410) 278-2320; chen.k.lai.civ@mail.mil

Test and Evaluation (T&E) is a dynamic and challenging field. Made up of military, government, and civilian organizations, T&E provides the information necessary for decision makers to make complex decisions with regard to military systems.

The T&E Working Group provides a forum for operations research analysts to examine topics, methodologies, analyses, and innovations pertinent to all aspects of planning, designing, executing, and reporting formal T&E in the Department of Defense and other government departments and agencies, as well as industry and key international allies.

The T&E Working Group will bring together Service, government, academic, and industry testers to share lessons learned in order to improve experimentation strategies and methods. Some recurring T&E issues to be addressed are:

- Implementation of design of experiments in T&E
- Designing credible tests with limited resources
- Developing meaningful measures of effectiveness
- Use of small sample sizes
- Advantages of different test designs
- Use of inexact technology surrogates
- Impact of data collection on player participation
- Communicating results effectively
- Timeliness of analysis
- Implementation and sharing of results/lessons learned

The T&E Working Group solicits input and discussion from analysts who are involved in all aspects of planning, designing and executing tests and the subsequent evaluation of the data. To understand and improve the entire process, participants from throughout the entire T&E community will be included. This community includes the organization leaders who develop and approve test and evaluation plans, combat developers who write testable requirements and provide concepts of employment and mission scenarios, developmental and operational testers, and operational forces who support T&E as participants.

We provide a forum for discussions and presentations relating to the unique challenges faced when attempting to plan, design, execute, and analyze experiments. WG-24 encourages presentations on both completed work and work in progress.

WG 25 – Analysis of Alternatives (AoA)

Jennifer Lizzol- Chair (719)554-3999; jennifer.lizzol@us.af.mil
Karen Merritt- Co-Chair (505)853-7174; karen.merritt@us.af.mil
Joseph Auletta- Co-Chair (703)614-5011; joseph.f.auletta.civ@mail.mil
Harry Conley- Co-Chair (937)656-4311; harry.conley.1@us.af.mil
Bruce Riggins- Co-Chair: (714) 896-4527; bruce.riggins@boeing.com
Jeffrey Erikson- Advisor: (505) 846-8326; jeff.erikson@kirtland.af.mil

An Analysis of Alternatives (AoA) is the analytic bridge between the Joint Capabilities Integration and Development System (JCIDS) and the DoD acquisition process. AoAs provide key insight and critical data to decision-makers responsible for the expenditure of billions of US tax dollars. The primary focus of an AoA is to evaluate the life cycle cost, operational effectiveness, and risks of the alternatives as they relate to identified defense capability shortfalls and gaps. An AoA is expected to illuminate capability advantages and disadvantages of each alternative; examine sufficient feasible alternatives; document and analyze key assumptions, variables and sensitivities; consider joint operational plans; and assess technology risk and maturity. Risk analysis and affordability constraints have become increasingly important AoA considerations as well. During execution, AoAs serve as an educational forum for complex and often unique issues as they demand communication and understanding amongst decision makers, stakeholders, and study staff members at all levels.

WG-25 strives to examine the intricacies of the AoA process, to analyze both materiel and non-materiel approaches to filling gaps and shortfalls, and to accurately identify capability gaps for producing decision quality analysis. WG-25 is also focused on AoA preparatory work (including Capability Based Assessments (CBA) and pre-Materiel Development Decisions (MDD) analyses).

Priority will be given to presentations on analytical methods to assess operational impact of alternatives and approaches to evaluate trades between cost, schedule, performance, and/or risk. Presentations focused on the effective use of qualitative analysis to reduce study time and cost while maintaining analytical rigor will also be given priority.

WG 26 – Cost Analysis

John Moskowitz- Chair: (703) 604-3482; john.moskowitz@navy.mil
Megan Connelly- Co-Chair: (703) 235-1961; megan.l.connelly@hq.dhs.gov
Sarah Harrop- Co-Chair: (703) 806-5689; sarah.e.harrop.civ@mail.mil
Nicholas Lanham- Co-Chair: (703) 604-1525; nicholas.lanham@navy.mil
Praful Patel- Co-Chair: (703) 604-3510; praful.patel@navy.mil
Scott Willette- Co-Chair: (703) 614-8712; scott.e.willette2.ctr@mail.mil
Michael You- Co-Chair: (310) 653-1824; michael.j.you.civ@mail.mil
Randi VanNyhuis- Advisor: (703) 692-5386; randi.vannyhuis@gmail.com

The theme for the 85th Military Operations Research Society Symposium is “Pivoting on a Strong Foundation to a Bright Future.”

Operations Research (OR) helps lay the foundation for the security of the nation. The projection of military, economic, diplomatic, and political power involves extensive research and well-informed analysis. National security is an expensive endeavor; one challenged by fiscal constraints. As such, sound, credible, and defensible cost analyses are essential more than ever. Strengthened with a foundation of the latest tools, practices, and techniques, analysts can build and document the most accurate cost estimates and assessments.

Detailed cost, affordability, risk and uncertainty, and capability analyses are mandatory requirements to inform decision makers. Such analyses have far-reaching impacts on decisions made during the development, procurement, and sustainment of acquisition programs. In addition, providing realistic life cycle and total ownership cost estimates for all phases of proposed systems, early enough in the design process to support trade-off decisions, presents a significant OR challenge.

Working Group (WG) 26 seeks to strengthen the community’s knowledge base by focusing on today’s “cutting edge” topics in cost analysis. Submissions or proposals relating to military cost analysis, economic analysis, risk and uncertainty analysis, and related disciplines are welcome. Preference will be given to study results that incorporate creative uses of OR tools to develop improved cost estimates and analysis to support better decisions. Effective methods for presenting the results of complex operational analysis in a clear, concise manner are always of interest. WG 26 also solicits topics suitable for a panel discussion format, and recommendations of subject matter experts willing to participate in such discussions.

Specific topics of interest include those that highlight OR contributions to expanding cost analysis scope and accuracy, such as:

- Affordability analysis in support of OSD, DoD, and Congressional mandates
- Cost and capability impact of technology insertion
- Projecting and managing costs for evolving threats, including terrorism
- Optimizing the management and replacement of aging infrastructure

- Costs of implementing cybersecurity and information assurance measures
- Portfolio analysis and decision support frameworks
- Costs and benefits of developing open standards and open architectures
- Costs and benefits associated with interagency operations, systems of systems, and network-centric operations
- Advances in cost, schedule, and performance risk and uncertainty analysis

Presentations may be completed works or works-in-progress.

WG 27 – Decision Analysis

Launa Jennings- Chair: (540) 226-0408; launa.jennings@usmc.mil

Bob Liebe- Co-Chair: (540) 272-7529; rmliebe@innovatedecisions.com

Samantha Oleson- Co-Chair: (508) 259-5615; soleson@innovatedecisions.com

Amy Bednar- Co-Chair: (601) 634-3559; amy.e.bednar@usace.army.mil

Kirstin Smead- Co-Chair: (575) 678-5966; kirstin.d.smead.civ@mail.mil

Scott Willette- Advisor: (703) 424-3439; sewillette@innovatedecisions.com

Decision Analysis as a discipline provides operations researchers with the philosophies, theories, and methodologies to address challenging, complex decision situations in a formal manner. It encompasses many procedures, methods, and tools that enable the analyst to model and evaluate the important aspects of a decision, with the goal of aiding the decision maker in making the best-informed decision possible in the allotted time.

Within WG27, emphasis is placed on two general categories of practice:

1. The assessment of decision maker's preferences in the evaluation of alternatives; and
2. The incorporation of uncertainty about the outcomes and about the information used in the decision.

One of the objectives of WG27 is to grow the capabilities of the current decision analysis practitioners continuously while building on the foundations set by our predecessors. This ties in perfectly with this year's MORS symposium, "Pivoting on a Strong Foundation to a Bright Future." We view the WG27 forum as a place to not only share the results of our work, but also to grow and learn from each other and continue to build on the legacy of military decision analysis.

Decision analysis methods are incorporated as components of multi-disciplined approaches, combining techniques such as mathematical programming, simulation, Bayesian Networks, Markov Decision Processes and Machine Learning, in a variety of applications.

WG 27 invites papers describing completed work or work in progress that describe innovative methods, models, and case studies in the use of Decision. In particular WG 27 seeks papers that align with the following agenda of topics:

- Innovations in Decision Analysis Practice and Theory
- Application of Soft Skills within Decision Analysis
- Modeling Risk and Uncertainty in Decisions
- Acquisition Applications of Decision Analysis and Risk Management
- Portfolio Analysis
- Modeling Human Decision Processes
- Large Data, Business Analytics, and Decision Analysis

To ensure a fair evaluation of abstracts and to help authors distinguish themselves, we encourage authors to emphasize the decision analysis aspects of their work, provide at least one published reference in their abstract submission, and link their submission to at least one of the agenda topics.

We look forward to hearing from you!

WG 28 – Modeling and Simulation

Drew Jensen- Chair: (703) 432-8231; andrew.jensen@usmc.mil

Matt Aylward- Co-Chair: (703) 784-6015; matthew.aylward@usmc.mil

Curtis Blais- Co-Chair: (575) 652-3354; clblais@nps.navy.mil

Brittlea Brown- Co-Chair: (703) 968-1137; brittlea.brown@gmail.com

Dave Miller- Co-Chair: (703) 432-8342; david.m.miller7@usmc.mil

Paul Nicholas- Advisor: (703) 784-0433; paul.nicholas@usmc.mil

Modeling and Simulation encompasses a broad range of techniques employed by the military operations research community to answer questions about strategy, doctrine, force structure, and systems. WG-28 is well suited to support this year's theme "Pivoting on a Strong Foundation to a Bright Future." WG-28 presentations should highlight unique and innovative approaches to modeling and simulation development, application, and verification and validation as well as unique applications of simulation tools and techniques such as discrete event simulation, systems dynamics, agent based simulation, or any digital mechanism. Special emphasis should be placed on applications of modeling and simulation to new or unique aspects of national security problems, and providing quantitative results to decision-makers. Our goal is to present a diverse mix of interesting analyses that cover a variety of operational issues and analytic techniques across the full spectrum of simulation. We seek papers that discuss the application of sound OR techniques from the joint strategic level down to system engineering level issues.

WG 29 – Computational Advances in Operations Research

J. Charles Domercant- Chair: charles.domercant@gtri.gatech.edu

Mitchell Kerman- Co-Chair: (201) 618-4453; mitchell.kerman@gmail.com

Carl Parson- Co-Chair: carlparson@gmail.com

Jonah Sonnenshein- Co-Chair: (858) 794-3508; sonnen@ca.metsci.com

Andrew Turner- Advisor; ajturner@mitre.org

As analysts, we are challenged to develop solutions to the most critical issues facing the defense of our nation. The complexity of these challenges requires innovative problem solving approaches and techniques to address the multiple domains represented by the well-known DIME/PMESII (Diplomatic, Informational, Military, and Economic / Political, Military, Economic, Social, Infrastructure, and Information) framework.

Working Group 29, the Advanced Mathematical, Statistical and Computational Methods Working Group, is focused on improving the ability of analysts to develop solutions to these critical issues and equipping decision-makers with new ways to handle complex decision-making. WG 29 seeks to continue building on a strong foundation of previous advancements in this topic area. This can be accomplished by providing a forum for OR analysts to examine and gain insight into the analytical and operational uses of existing and emerging mathematical and statistical techniques. This includes computational technologies and their associated methodologies. WG 29 solicits presentations that delve into the creation and application of innovative algorithms or computational advances to address challenging problems in the OR domain. We welcome presentations on work currently under development or fully completed. The following is an incomplete list that is illustrative of advancements in this topic area:

- high-dimensional data mining and analysis;
- big data and data analytics;
- advancements in complex adaptive systems, artificial intelligence, or machine learning techniques;
- advancements in campaign analysis or social network analysis;
- advances in distributed interactive simulations, federations, and architectures;
- rapid scenario generation techniques to support broad exploratory analysis;
- support to Enterprise-level information analysis in an operational sense;
- advanced modeling of the environment and environmental parameters, such as terrain and weather
- addressing computationally challenging problems in OR (e.g. NP-hardness)
- design space exploration using advanced heuristic, clustering or classification algorithms
- uncertainty quantification

WG 30 – Wargaming

Christian Teutsch- Chair: (703) 695-2020; christian.g.teutsch.mil@mail.mil

Chad Hinsch- Co-Chair: (540) 653-3859; chinsch@jwac.mil

Michael Kierzewski- Co-Chair: (410) 436-5408; michael.o.kierzewski.civ@mail.mil

Michael Ottenberg- Co-Chair: (703) 476-0132; Michael.a.ottenberg.ctr@mail.mil

Adam Szymanski- Co-Chair: (630) 252-2928; szymanski@anl.gov

Scott Simpkins- Advisor: (240) 228-3718; scott.simpkins@jhuapl.edu

Michael Garrazone- Advisor: (937) 233-3255; mgarrazone@aol.com

Wargames support all levels of government by presenting consequential, turn-based scenario adjudication to problems centered on human decision-making. The practice is found in training curricula in military schools, businesses, and university courses. Most wargames are structured to address specific issues, such as current or future national security challenges, but, in general, wargames provide a low-cost evaluation of alternatives. Outcomes tend to be qualitative in nature, but still of substantial interest to key decision-makers. Wargames are attractive to decision-makers because of the human interaction between experts and those with a vested interest in the issues. Operations research applies quantitative methods to games.

Although the narratives derived from a game are sometimes more important than the raw data, relating narratives to quantitative analysis is the value added by operations research.

The emphasis of Working Group (WG) 30 presentations is metric determination, game design, statistical analysis, game verification, tools to present information to players, models and simulations for game play, and best practices. Enduring special interests of the working group include considerations of interdisciplinary games, applications of game theory, complexity theory, and chaotic behaviors. In accordance with this year's theme of "Pivoting on a Strong Foundation to a Bright Future," our WG invites presentations on historical and educational aspects of wargaming. WG 30 encourages presentations on theory, completed projects, and work in progress.

WG 31 – Operational Environments

John Hummel, FS - Chair: (630) 252-7189; jhummel@anl.gov

Glenda Brandon- Co-Chair: (601) 634-2123; Glenda.M.Brandon@erdc.dren.mil

John Hummel- Co-Chair: (630) 252-7189; jhummel@anl.gov

David McInnis- Co-Chair: david.p.mcinnis@erdc.dren.mil

Joyce Mechling- Co-Chair: (603) 646-4161; Joyce.A.Mechling@usace.army.mil

Adam Szymanski- Co-Chair: (630) 252-2928; szymanski@anl.gov

Victoria Moore- Advisor: (601) 634-4636; victoria.d.moore@us.army.mil

Working Group (WG) 31 – Operational Environments provides a forum for discussions of the operational environment's role in the full spectrum of military and national security operations from warfighting to non-adversarial crisis prediction and response (e.g., humanitarian assistance, disaster relief, or emergency response). The operational environment consists of four major classes – natural environment (terrain, ocean, atmosphere, and space), human-constructs (infrastructure, hardware, and software), humans (civilian and military), and abstract factors (political, social, cultural, and economic) – and their synergistic interactions as they impact present and future operations. WG 31 focuses on two vital aspects of operational environments: 1) design and development of operational environments, including dynamic changes, and 2) identification and incorporation of appropriate operational environment subsets into various applications for military and homeland security operations.

The operational environment is dynamic, even volatile, as demonstrated by recent world events, including new and emerging threats. Technological advances in hardware and software affect the capabilities of both allies and foes as well as the US military and civilian communities. Such advances affect both human behaviors and abstract factors (political, social, cultural, and economic). WG 31 is interested in soliciting innovative approaches to assessing increased remote surveillance capabilities, improved socio-cultural and economic analysis, political and social shifts forecasting, advances in data analysis and visualization tools, improved natural environment data, and other technological advances that alter the operational environment.

WG 31 solicits thought-provoking presentations of studies, research and development, and experiments that describe in broad terms the human talent and operational capabilities that will be required for the joint force to succeed across a full range of operational environments. WG 31 invites presentations that offer insights into the challenges and opportunities that will confront national security analysts from the operational environmental perspective. WG31 encourages presentations concerning on-going and successfully completed research that would improve the analytic capability of the nation with complex issues by aiding decision-makers in understanding underlying operational environment factors.

WG 32 – Special Operations and Irregular Warfare

Vincent Boncich- Chair: vincent.j.boncich.mil@mail.mil

Loren Eggen- Co-Chair: (703) 432-8556; loren.eggen@usmc.mil

Steven Heinlein- Co-Chair: (703) 806-5359; steven.e.heinlein.civ@mail.mil

Renee Carlucci- Advisor: (703) 806-5617; renee.g.carlucci.civ@mail.mil

William Inserra- Advisor: (703) 432-8182; william.inserra@usmc.mil

Vernon Bahm- Advisor: (703) 806-6642; vernon.j.bahm.civ@mail.mil

The challenges posed by transnational terrorists and the focus on irregular threats from defense strategy create an irregular warfare (IW) environment that highlights the importance of joint special operations mission areas. The days of fighting known conventional threats in known parts of the world, while still a possibility and very dangerous, appear to have taken a back seat to the increasingly common IW threat. Groups like Al-Qaeda and the Islamic State have grown and continue to attract fighters from around the world, posing a significant challenge to the U.S. and our partner nations. These irregular threats create instability and challenge nation states around the world.

IW is a warfighting philosophy which seeks to achieve strategic objectives primarily by nontraditional, indirect, or asymmetric means and is characterized by the following operations: military information support operations (formerly psychological operations), information operations, counter proliferation of WMD, counterterrorism, counterinsurgency, intelligence activities, computer network operations, foreign internal defense, and stability operations.

Although IW continues to be a core competency of joint special operations forces, many organizations in the Department of Defense (DoD) as well as other governmental agencies contribute unique capabilities to IW operations. Just as we have provided exceptional analytical support to the DoD community for conventional fights in the past, the operations analysis community must continue looking for ways to support the IW fight. Organizations and stakeholders with interests in the IW arena will benefit from the analytical community in the areas of strategic decision making and policy determination using mission planning tools and analytical aids, simulations and analysis, and by systemic collection and dissemination of data and lessons learned from previous IW operations and interagency activities. These analytical capabilities include contributions from the social science disciplines, as well as from traditional national security operations research.

The conduct of operations such as peacekeeping and peace enforcement missions, disaster relief, and humanitarian assistance are also characterized by small scale operations very focused on specific missions and a lack of conventional mission effectiveness criteria. Working Group (WG) 32 includes these communities because they share many of the unique characteristics and analytical challenges as IW operations.

The WG seeks the participation of analysts who inform decision making related to special operations and IW at the strategic, operational, and tactical levels. General examples of WG 32 interests include (but are not limited to) dealing with the risk and uncertainty of diverse missions and functions, allocation of critical resources, and formulation and evaluation of policy and strategy decisions that affect current and future obligations of special operations forces. WG 32 is especially interested in serving as a venue for interagency analysis topics that are more transnational in nature and not usually viewed through the national defense prism.

WG 33 – Social Science Methods and Applications

Brandon A. Shapiro- Chair: (703) 845-6869; bshapiro@ida.org

L. Paul Lewis- Co-Chair: (630) 252-7797; plewis@anl.gov

Elizabeth Bartels- Co-Chair: ebartels@prgs.edu

John Hummel- Advisor: (630) 252-7189; jhummel@anl.gov

Deborah Duong- Advisor: (571) 276-8270; dduong@agentbasedlearningsystems.com

Working Group (WG) 33 explores methodologies for the human, social, cultural, and behavioral sciences, and their applications supporting the needs of the national security analysis community. Applicable methodologies may be derived from a number of social science disciplines, including: anthropology, cultural studies, demography, economics, geography, political science and political economy, psychology, and sociology; to name just a few. The representations of these theories take a variety of forms, including etic and emic methodologies particular to the social science disciplines at both the micro and macro levels of resolution, as well as statistical, mathematical (e.g., graph theory, social network analysis, game theory and differential equation) and computational social science (i.e., simulation) representations and analyses. Papers are welcome in both basic research on and in the application of these methodologies. Applications of these methodologies should reflect the scientific method (i.e. reflect an understanding of the testing of hypotheses with the use of evidence to accumulate knowledge) as the basis for the social scientific approaches undertaken by researchers in this area, and research should be focused on closing the gaps in scientific validity that exist in all of these methodologies, as is required for national security analysis. Additionally, inductive and adductive studies are also of interest and welcome.

Social science encompasses a wealth of knowledge that could be utilized by the national security analysis community to understand, detect, forecast and mitigate social phenomena at the strategic, operational, and tactical levels.

Application areas include, but are not limited to, understanding of regimes and regime change, the evolution and adaptation of terrorist networks, the complex multi-faceted challenge posed by Transnational Criminal Organizations (TCO), the dispersion of ideas through social media and other new mechanisms of communication, epidemiological insights, evacuations following a man-made or natural disaster and direct and indirect effects of kinetic and non-kinetic interventions, including Civil Military Operations and Military Information Support Operations on host nation populations. Application papers should clearly identify how social science methodological research and technologies have been or are being applied to these national security domains or operations, or propose how emerging methodological research and technologies can fit current or emerging national security challenges.

This WG solicits papers that detail contributions to the cumulative knowledge and methodologies of social science, in support of national security. In particular, papers should

contribute to the body of knowledge in one or more of the following areas:

- Provide a framework for understanding how social science methods, models, and techniques can anticipate, foster understanding of, and support decision making for emerging security challenges.
- Support efforts to promote data discovery, collection, rationalization, and integration methods that can further social science in the national security community.
- Detail approaches to incorporate proven social science methodologies into national security analyses.
- Provide insights and lessons learned from prior analyses and from the experiences of the social science communities.
- Draw on experts in the social sciences to create an institutionalized knowledge base for the Department.
- Integrate hybrid Computational Social Science (CSS) approaches for cultural understanding and/or modeling based on varying data quantity, fidelity, and confidence levels;
- Address data and data processing tools to support CSS data collection, processing, and modeling to include model validation and verification;
- Analyze social networks, their inter- and intra-network relationships, and their integration with other types of networks to include logistic, financial, physical processes;
- Visualize data, tool, and model output;
- Develop course of action and decision analytics that incorporate human socio-cultural and/or behavioral factors;
- Forecast human terrain such as sentiment or affinity analysis, geophysical analysis based on human socio-cultural behaviors, and assessment of micro- and macro-level conditions that support or inhibit behaviors;
- Use social media or other open source data to support socio-cultural analysis and automated model coding;
- Train using CSS models and tools; and mission rehearsal using human socio-cultural factors and models.
- Further develop the scientific underpinnings of social science methodologies including emic, statistical, mathematical, and computational methodologies.
- Describe and discuss the validity of computational representations of social theory.
- Conduct meta studies of social science and CSS that look across groups of prior studies of particular types, including from cross-disciplinary perspectives.

DWG 1 – Human Behavior and Performance

Laura Guay- Chair: (407) 694-0192; laura.guay@us.army.mil

Tom Hughes- Co-Chair; thughes@infoscitex.com

Eugene Visco- Advisor: (239) 464-1441; evisco@att.net

Traditionally, operations research has used conventional techniques from all the sciences, mathematics and engineering; and has developed methodologies of its own. Sometimes the most important part of a system is the human operator so it is crucial that today's analysts place more emphasis of the human factor on their analyses than ever before. Regardless of technological advances, the weapon systems developer and implementer are navigating through uncertain times and should work together. Cognitive demands for weapon system operators are increasing despite requirements to the contrary. Training and aptitude pre-requisites are increasing in recruitment. Individuals must perform the primary tasks of maneuver, target acquisition, engagement, and communication with decision making occurring at much lower levels on the modern battlefield. Technology will confuse as often as it will support the warrior. Transformation in how the services operate will force everybody – even the most junior – to think. We need to avoid the adverse impact technology insertion and mission change can have on humans and their performance. For that reason, enhanced human behavior and performance are part of the integrated solution to the mission problem. Representing and incorporating these factors adequately into models, simulations, and studies are sizeable challenges. Because of the extreme variability of the individual's behavior and performance on the modern battlefield, engineers and analysts may not be able to perform standard parametric or non-parametric analyses of the available data and must develop new tools to assist them.

For the 85th MORSS, the Human Behavior & Performance (HB&P) Distributed Working Group is soliciting papers covering the following topics:

- What are the second and third-order effects of designing systems with high cognitive requirements for servicemen and women? How do we recruit/train/retain such individuals?
- Can training systems be developed that detect student-specific deficits so instructors may target training to individual needs?
- What are the individual differences in human performance? What about training effectiveness and human behavior?
- How do we effectively develop human-in-the-loop experiments, tests and war games while capturing the human element appropriately?
- What are the best data gathering techniques for capturing human performance as a variable of interest?
- How does the analyst observe and measure human performance without interfering

with that performance?

- How do we design surveys?
- How can these data be better correlated with the more traditional “hard” data points we tend to collect (time to kill, time to detect, etc)?
- How do we incorporate fatigue, fear, exuberance, morale, anger, esprit de corps, and other factors affecting humans in combat?
- There is a growing disparity between warriors engaged in direct battle, face-to-face with the enemy, and those who fight from thousands of miles away from the battlefield (operating standoff weapons via satellite data link). Is that disparity leading to conflict within the military community?
- What set of incentives influence decision making behavior and how might it be potentially shaped to the benefit of the strategy or operational objective?
- What are the social components that affect decisions and communication and “stickiness” of those decisions?
- How does cognitive psychology fit in decision analysis?
- Are there models and simulations to analyze human abilities (cognitive and behavior), human decisions, and human group decisions to help servicemen and women perform better? If so, how have they been used in practice?
- How do we create a human-centered approach in the design, acquisition, testing, and operation of human-machine interfaces? What about human considerations as the top priority in systems design/acquisition to reduce life cycle costs and optimize system performance?

The HB&P Distributed Working Group Leadership is working with other Working Groups to discuss these topics by developing potential joint sessions with Manpower & Personnel (WG 18), Analytical Support to Training (WG 20), Experimentation (WG 22), Decision Analysis (WG 27), Modeling and Simulation (WG 28), and Wargaming (WG 30).

The Human Behavior and Performance Distributed Working Group Leadership encourages the submission of presentations and relevant to the areas outlined above and other areas not mentioned. The submission may be finished work, work in progress, or ideas and concepts. We look forward to hearing from you!

DWG 2 – Unmanned Systems

Eric Rose- Chair: (240) 228-9434; eric.rose@jhuapl.edu

Thomas Athanasas- Co-Chair: thomas.athanasas@jhuapl.edu

Larry Bulanda- Co-Chair: (240) 228-8705; larry.bulanda@jhuapl.edu

Tom Karnezos- Co-Chair: (814) 867-3287; tck143@arl.psu.edu

Thomas Wettergren- Co-Chair: (401) 832-1559; thomas.wettergren@navy.mil

Scott Swinsick- Advisor: (480) 891-8429; scott.swinsick@boeing.com

In recent years, unmanned systems have become an increasingly common and integral part of many military, law enforcement and border security operations. Commercial unmanned systems are more widely available, technologically advanced and affordable than ever before enabling their use in legitimate agricultural and commercial operations as well as for nefarious purposes. Today, a wide variety of unmanned systems are operated by state and non-state actors to perform missions in the air, land and/or sea domains. Tomorrow will surely see new and innovative unmanned systems pushing the art of the possible.

When considering unmanned systems, many people think of the vehicle only, but an unmanned system often includes additional subsystems such as a data link, control station, human operator, attached payloads, maintenance capability and more. Each subsystem must function effectively as part of the total system in order to successfully execute an assigned mission such as neutralizing undersea mines, conducting airborne intelligence, surveillance, and reconnaissance (ISR) or inspecting power lines.

The safe and effective sharing of operational space by unmanned and manned systems has become a significant issue. For example, with the increased number of unmanned aerial systems (UAS) have come airspace integration issues. How do we maintain the safety of manned vehicles and their passengers while allowing unmanned aircraft to operate in the same airspace? Automated “sense and avoid” systems are one method used to maintain safety in the air, but what other solutions might we utilize?

The potential for using unmanned systems for nefarious purposes has increased as unmanned systems have become more widely available on the open market. What is the extent of this threat and how does it compare to other threats? How do we protect friendly unmanned systems from being electronically hijacked by adversaries? How do we employ electronic techniques to neutralize adversary unmanned systems while maintaining the ability of friendly vehicles to operate in the same space?

There are many challenges and opportunities related to unmanned systems. The theme of the 85th MORSS is: “Pivoting on a Strong Foundation to a Bright Future.” Unmanned systems are now an integral part of the strong foundation upon which our nation’s security is built. DWG-2 is seeking papers for MORSS 85 as they relate to these and other unmanned systems topics, such as:

- Power (fuel) availability and its impact on mission range, flight duration, tactical planning and communication requirements.
- A fairly recent concern is the burn-out that human operators of unmanned aerial vehicles (UAVs) flying an aircraft half a world away have been subject to.
- Hours upon hours of video that is successfully collected in theater must be evaluated for intelligence value on the ground. How do we perform that task quickly and efficiently?
- Analysis of current unmanned systems, their application, and their successes
- Determination of the optimal mix of tactical UAVs to fit combat scenarios
- Evaluation of platforms for specific missions through the metrics of speed, range and persistence
- Modeling and analysis of unmanned systems reliability, availability, and maintainability
- Cost and operational effectiveness analysis of the employment of unmanned systems over manned systems
- Translation of commercial unmanned system applications or law enforcement applications to military roles
- Using undersea gliders for naval applications
- Effectiveness of unmanned surface vehicles (USVs) and unmanned undersea vehicles (UUVs) in undersea warfare and as mine countermeasure tools
- New and novel ground-based unmanned systems such as serpentine or legged vehicles (Legged Squad Support System). Novel micro UAS platforms such as those using biomimetic methods for flight. Feasibility of these platforms in tactical roles
- Cooperation between manned and unmanned vehicles, including concepts such as the Army's Manned to Unmanned Teaming (MUM-T) concept
- Deployment concepts such as the deployment of unmanned systems from manned system platforms and unmanned systems from unmanned system platforms
- Development and analysis of concepts of operations that utilize cross-domain mixtures of unmanned systems (unmanned land/sea/air platforms operating in conjunction with each other)
- Using unmanned systems for logistics purposes and for casualty evacuation.
- Defining and solving scheduling and allocation problems that arise during operations involving unmanned systems.
- The application of high Altitude/Near Space UASs (>60K ft.) including airships to persistent surveillance roles
- Elements of integrating unmanned air vehicles in national airspace, including "sense and avoid" capabilities for recognizing and avoiding other air traffic
- Evaluation of levels of autonomy from expense, complexity and capability standpoints
- "Swarm" control of unmanned vehicles: controlling a group as a single unit or giving the group a general task with individual vehicles autonomously determining how to cooperate. Swarming to include land sea and air applications

Focus Session 1 – Analysis Status and Gaps for Military Autonomous Complex Adaptive Systems

Eugene Visco- Chair: (239) 464-1441; evisco@att.net

George Waltensperger- Chair: (407) 356-2528; george.waltensperger@lmco.com

The purpose of the Focus Group is to identify, in broad terms, the state of knowledge about Autonomous Complex Adaptive Systems (ACAS), the gaps in knowledge, the state of research and analyses underway, and the folks active in the problem area. The ultimate purpose is to lay the ground work for a special meeting and a possible new working group. The objective of the working group is to identify on-going and completed analyses related to ACAS systems throughout the operations analysis community; determine needed areas of analyses not yet undertaken (analytic gaps); and to produce guidance for further investment by MORS. Possible next steps include a provisional working group for under Composite Group C: Joint Warfare for 85th MORS and a near-term special meeting (either a mini-symposium or workshop, depending on the nature of the perceived analytic gaps). The structure of the Focus Group would be invited short papers and open discussion. The discussion will result in a report, including the presentations, to the MORS leadership, with a recommendation for a provisional working group for next year, with the objective of designing a special meeting plan.