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WG 1 – Strategic Operations National Security Analysis

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WG 1 Strategic Homeland and National Security Analysis fosters the use of operations research approaches, techniques, and methodologies to create a better understanding of the strategic dimensions of homeland and national security, security cooperation, stability, deterrence and assurance. Our primary focus is on strategic planning and operations including manmade threats (e.g., nuclear, cyber, space, international crime) or natural disasters (e.g., hurricanes, wild fires) 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 and homeland capabilities, and the arms control process. This analysis will provide insight that is particularly helpful to those involved in formulating warfighter, Service, Homeland, and Agency policy and planning.

To address this issue from a national and global perspective, we solicit analytically rigorous papers on multi-discipline analysis in support of National Security objectives. Analytics of current and future issues to include: strategic force structure alternatives and their impacts; treaty implications; changes in roles and missions; weapons of mass destruction proliferation; expansion of cyber capabilities and the cyber domain; guarding American borders and infrastructure from dangerous people and materials; and, the integration of Federal with State, Local, Territorial, and Tribal (SLTT) security strategies.

Papers employing any form of multi-discipline analysis modeling, game theory, optimization, decision analysis, management science, assessment across PMESI 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

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Chemical, Biological, Radiological, Nuclear, and Advanced Explosive (CBRNE) threats pose serious challenges to our national security, both at home and abroad. As we prepare for possible CBRNE events, work to prevent them from even happening, and design equipment/doctrine/tactics to protect ourselves, respond to attacks, and recover from them, we require advances in data collection and analytics to evaluate and prioritize candidate systems and approaches and to better inform decision-making. In an environment of uncertain budgets and a changing military, political, and economic world landscape, our ability to understand and analyze CBRNE threats, risks and hazards to our national security is a fundamental challenge.

Working Group 2 (WG 2) seeks presentations on quantitative or qualitative CBRNE analysis efforts that tackle difficult real-world analysis problems despite inherent data shortfalls and other limitations.

- Development and use of metrics to determine CBRNE defense program effectiveness
- Development and use of novel data visualization techniques to increase situational awareness or inform CBRNE defense decisions
- Development and use of novel and/or multi-disciplinary methodologies and techniques to enhance or inform CBRNE decision making
- Modeling and simulation and algorithm development to identify or predict CBRNE threats
- Modeling and Simulation and analytic methods to understand and enhance CBRN system contamination survivability
- Modeling and simulation and algorithm development to predict CBRNE-affected mission outcomes and inform DOTMLPF and real-world decisions, including portfolio optimization, optimal employment of CBRNE systems and personnel, and trade-space analyses
- Use of designed experiments and other approaches to efficiently conduct CBRNE research and tests

Presentations that demonstrate the use of novel, advanced, and/or multi-disciplinary analytical approaches to enhance CBRNE defense capabilities, decisions, and outcomes are of particular interest.
WG 3 – Infrastructure Analysis, Protection and Recovery (IAP&R)

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Working Group 3 (WG 3) has a natural connection to the theme of the MORS 88th Symposium, “Multi-Discipline Analysis in National Security.” The major thrust of this working group is to promote the analysis, protection, and recovery critical infrastructure systems in the US and Allied nations. These activities are fundamental to US national security, particularly with respect to planning and preparing for infrastructure failures, managing loss of critical functions, restoring functionality, and adapting systems to natural and man-made disruptive events. Moreover, the analysis, protection, and recovery of critical infrastructure systems are inherently multi-disciplinary activities and requires experts in engineering, applied mathematics, public policy, administration, and emergency management among others. Thus, WG 3 is a unique focal point for bringing these diverse experts together to support new research for national security.

The term critical infrastructure was first 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 and comprise 16 sectors defined by the Department of Homeland Security. These sectors include but are not limited to lifeline systems such as electricity, fuel, water, transportation, telecommunications, food, financial, and government services. These systems consist of a diversity of interdependent physical and social networks with varied operating and ownership models, in both physical space and cyberspace, and with stakeholders from multi-jurisdictional levels.

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). Recent disasters reveal 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. Analysis, protection, and recovery methods and techniques from broad technical disciplines can support these activities by identifying dependencies within or between infrastructure systems and supporting protection and recovery decisions prior to disaster.

Presidential Policy Directive 21 (PPD21) summarizes the government’s objective for critical infrastructure: “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.” Achieving secure and resilient critical infrastructure for the US and Allies captures the overall vision of WG 3.

Recently, the US Federal Government established in law the roles and responsibilities for critical infrastructure analysis, protection, and recovery by establishing the Cyber and Infrastructure Security Agency (CISA) within the US Department of Homeland Security (DHS). CISA’s national security mission is to reduce and eliminate threats to US physical and cyber infrastructures by partnering with industry and government to understand and manage risk. Broadly, the activities within CISA for analyzing and partnering to protect national critical infrastructure systems provide a framework for the kinds of work we hope to promote and advance in WG 3.

WG 3 welcomes conceptual, under development and research as well as proven applications and techniques from all disciplines that highlight the use of operations research methods for critical infrastructure. This year, we are particularly interested in research in the following areas:

Operations Research for Critical Infrastructure Resilience:

- Modeling, analytic techniques, and decision support tools to determine vulnerabilities in critical infrastructure and/or inform planning and investment to manage them;
- Theory, methods, and models studying the resilience of critical infrastructure systems;
- Modeling and analysis of interdependencies across critical infrastructure systems, estimation of failure consequences across infrastructures, case studies and examinations of cascading impacts of infrastructure failures, and comparison of modeling techniques across systems and sectors;
- Techniques to describe, predict, and prescribe infrastructure operations with emphasis on defense and homeland security applications;

Critical Infrastructure in Emerging Terrain:

- Methods and models studying the implications of rapidly changing and extreme physical environments on critical infrastructure operations, including but not limited to the Arctic, island territories, and dense urban systems;
- Methods and models studying the implications of cyber-physical interdependencies and/or cyber attack in critical infrastructure operations;

Human, Social, and Organizational Effects:

- Influence of critical infrastructure resilience on the organizations that use, own, operate, regulate, and govern them;
- Methods, policies, techniques and programs for working across organizational or jurisdictional lines to assess and assure resilient critical infrastructure.
- 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;

• Perspectives from owner-operators, state, local, and federal agencies; Perspectives from military commanders.

Presenters can include operations research analysts, statisticians, behavioral scientists, clinical providers, medical planners, logisticians, engineers, and other scientists. Papers that describe development of analysis tools, techniques, and methodologies are welcome. Note that all presentations and discussions must be kept at the Secret level or lower.
WG 4 - Homeland Security, Homeland Defense and Civil Support

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Homeland and National Security analysts have new challenges accurately charactering current and future threats, manmade or natural. New problems are created by agile adversaries as well as Mother Nature 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? The Homeland Security, Homeland Defense, and Civil Support Working Group promotes the discussion and analysis of the Homeland Security Enterprise issues. This working group recognizes that collaboration, cooperation, and communication among agencies with similar missions is essential to the effective protection, prevention, and if necessary, response and recovery from threats to the US Homeland. This working group has evolved to consider and analyze both DHS and DoD missions to foster better integration. As USG directs proactive interagency activity across organizations at every level, WG-4 stands poised to facilitate opportunities for sharing and developing interagency interaction, research, and conversation. Working Group 4 (WG4) supports this year’s MORS Symposium theme, "Multi-Discipline Analysis in National Security," by encouraging analysts in the Homeland Security and Homeland Defense 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 homeland security and defense missions. WG4 provides the collaborative forum to share information and build upon the collective knowledge to strengthen homeland security and defense efforts. WG4 is home to an analytic cadre from DHS 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
Joint Publication (JP) 3-13, Information Operations (IO) defines IO as the “Integrated employment, during military operations, of information-related capabilities (IRC) in concert with other lines of operation (LOE) to influence, disrupt, corrupt, or usurp the decision-making of adversaries and potential adversaries while protecting our own capabilities.” IRC includes the core capabilities of electronic warfare, cyberspace operations, psychological operations, military deception and operations security, in concert with other specified supporting and related capabilities.

JP 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, public affairs, civil-military operations, cyberspace operations (CO), information assurance, space operations, military information support
operations (MISO), intelligence, military deception, Operations Security (OPSEC), Special Technical Operations (STO), Electromagnetic Spectrum Operations (EMSO), Electronic Warfare (EW), Cyber Electromagnetic Activities (CEMA), and key leader engagement.

JP 3-12 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 cyberspace operations efforts must take a multi-discipline approach, 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 within the multi-disciplines of information operations 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 Joint Concept for Operating in the Information Environment (JCOIE) “…describes how the Joint Force will build information into operational art to design operations that deliberately leverage information and the informational aspects of military activities to achieve enduring strategic outcomes. The changing role of information has allowed state and non-state actors to influence global audiences, rapidly gain momentum, and advance their objectives. Adaptive state and non-state actors are proficient at using information to gain an advantage over the Joint Force. In order to compete in the information environment (IE), JCOIE aims to institutionalize and operationalize the Joint Force’s approach to information. This requires an understanding of information, the informational aspects of military activities, and informational power.” Multi-disciplined analytic methodologies coupled with competitive analytical viewpoints from Subject Matter Experts (SMEs) is critical for the Joint Force to achieve “Joint Information Advantage (JIA)” through the dominant application of information in Multi-Domain Operations (MDO) doctrine across the Joint, interagency, and international landscape.
Command and Control (C2) is one of the seven 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 C2 “encompasses the exercise of authority and direction by a commander over assigned and attached forces to accomplish the mission.” 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. Analysts have been involved in not only helping plan and support these operations but are responsible for identifying and providing solutions to C2 issues occurring anytime from planning to troops-in-contact situations. The size, diversity and age of the processes, networks and systems comprising C2 represent a critical concern for national security, making it crucial for our National Security Analysts to have the skills and data necessary to understand, monitor and influence our C2 procedures, systems and systems-of-systems. Current and future operations will require multi-discipline analysis, development, and implementation of changes to C2 capabilities allowing forces to respond dynamically to 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 order to achieve the envisioned capabilities necessary 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 C2 solutions. For the 88th 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 multi-discipline national security. WG 6 invites papers and discussions regarding the current and future analysis of C2 issues, systems, architectures, investment strategies and processes as well as educational programs, training programs and tools that support the continued growth and development of the nation’s C2 capabilities. Presentations may include completed studies or work-in-progress.
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 88th Symposium is "Multi-Discipline Analysis in National Security." 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.

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

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Working Group (WG) 8 focuses on Operations Research (OR) efforts that our nation warfighters require in space to Compete, Deter, & Win in a contested, degraded, and operationally-limited (CDO) warfighting domain. Symposium presentations to the WG should highlight analytically sound OR techniques that support our nation’s efforts to acquire, test, and operate space capabilities. The acquisition, testing, and operations processes are typically enabled by the assessment of realized or projected space capabilities’ strategic, operational, or tactical contributions. Presentations that reflect recent or ongoing efforts to provide multi-domain, impartial, evidence-based rigorous assessments of existing or prospective space capabilities and Systems of systems fit perfectly into this year’s MORSS theme: “Multi-Discipline Analysis in National Security.”

The debate is over; Space is now a contested domain. Our competitive advantages within this warfighting domain are rapidly eroding due to many nations increasing their access to space through the development and proliferation of their organic and commercially augmented capabilities. The U.S. values the necessity to leverage space to provide ourselves the most global perspective possible; which in turn enhances global security, protects lives and assets, facilitates the movement of information, and augments the warfighter’s operational environment. The United States’ ability to fight and win on future battlefields to preserve peace, assure our freedoms, and guarantee the sovereignty of the nation is intrinsically linked to our ability to maintain space superiority across the broad range of Multi-Discipline space operations. This WG advocates analysis of technological challenges and solutions that do (or could) help maintain our unrestricted use of space and space-enabled cyber. Our WG seeks to share OR techniques and analytical best practices to enable our military and intelligence communities to effectively acquire, test, and operate on a global scale.

Our speaker-friendly WG seeks presentations touching tactical, operational, and strategic contributions from space capabilities/systems, space families of systems, or space architectures, whether in the concept, R&D, acquisition, or operational phase(s). We welcome and encourage presentations that address innovative analytical processes, methodologies, use of models and simulations, or techniques as they are applied to space capabilities/systems acquisition, testing, or operations. Presentations on analysis/OR efforts, whether innovative, unique, or traditional, may reflect completed works or works in progress. Our WG is committed to showcasing a variety of topics and ensuring an engaging exchange of approaches, interests, and ideas among the space-focused OR community.
US National Security Policy defines the requirement to enhance Homeland and Regional Security through integration of new mission elements such as Cyber Defense/Attack, continued cooperation with Allied defense initiatives, and the ongoing need to deter/defeat the growing threat from weapons of mass destruction and their delivery means (US NSS, 2015). NATO Policy states: “Proliferation of ballistic missiles poses an increasing threat to Allied populations, territory and deployed forces. The proliferation of these capabilities does not necessarily mean there is an immediate intent to attack NATO, but it does mean that the Alliance has a responsibility to take this into account as part of its core task of collective defense (NATO, 2016). Both US and NATO doctrine emphasize “Integrated Air and Missile Defense (NIAMD) as an essential, continuous mission in peacetime, crisis and times of conflict, which safeguards and protects [US and] Alliance territory, populations and forces against any air and missile threat and attack. It contributes to deterrence and to indivisible security and freedom of action of the Alliance” (NATO, 2016).

An analyst in the complex world of Integrated Air and Missile Defense (IAMD) must deal with a multitude of complex factors to prevent an adversary from effectively employing any of its offensive capabilities. The proliferation of highly sophisticated long-range missile systems (hyper-sonic weapons, advanced countermeasures, and maneuvering re-entry vehicles come to mind) coupled with advance target capability enabled by robust adversarial ISR challenges our Force Projection and Assured Access. While the tenets of IAMD endure, the analyst must also weight non-kinetic and cyber effects which are becoming increasingly more sophisticated and available. Our working group seeks to prepare the IAMD analyst and Combatant Command staff with new analytic tools to guide decisions on Joint force capabilities, enhance capability and develop tactics to counter the full spectrum of air, missile, space, and cyber threats. While leveraging existing tools, we must also address consequence management (combating WMD to denial of services), and support both material development and operational planning. A multi-disciplinary approach of integrating air and missile defense is required and will only succeed if we leverage all of our operational and analytic capability. Exploiting the capabilities of joint interoperability, multi-role, multi- mission assets may provide the leverage needed to accomplish our goals. Thus, our focus is to share foundational and groundbreaking analytic techniques and research as they apply to the current and emergent IAMD threats and defensive systems allowing us to retain an operational advantage.
WG 10 – Joint Campaign Analysis

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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 88th 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, challenges, and benefits of its experience. Prime candidates of interest to WG 10 include:

- Studies related to joint campaigns (all phases)
- 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 globally integrated 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 88th MORS Symposium theme – “Multi-Discipline Analysis in National Security”. 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

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The application of land and expeditionary warfare is essential to achieving strategic success, advancing national interests, deterring future conflict, and building partners. We face a dynamic environment with ever-changing threats. We are reminded of this by our uncertain relationships with North Korea, Russia, Iran, and China. Middle Eastern terrorist networks also continue to pose a threat. It is crucial as ever to advance analytics to support national security by informing decisions about concept development, acquisition, force design, force mix, and tactics, techniques, and procedures.

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 non-military and multinational partners.
- Future concepts in the analytical field as they relate to land and expeditionary warfare.

Working Group 11 invites all 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, studies that underpin the development of future warfighting concepts, and analytic efforts supporting critical resource allocation decisions.
At the forefront of national security on our coasts and abroad are the Maritime Operations that ensure security, project power and provide support to our Nation and allies alike.

The goal of the Maritime Operations Working group is to support the 88th MORSS theme "Multi-Discipline Analysis in National Security". This will be achieved by calling on new and existing members of the working group to submit presentations of completed/works in progress which exemplify a variety of analytic methods, processes, and approaches. This includes but is not limited to Mission Level Assessment and Evaluation (MLA&E) methods utilizing modelling and simulation (M&S) tools, architecture products, kill chain assessments etc., to analyze and adjudicate capability and limitations of current and future maritime operations contributing to our national security focusing on Joint War at Sea (JWAS) and Long Range Surface Warfare (LRSuW).

In addition, the Maritime Operations working group proves to be an opportunity to reach across the engineering and operational communities to promote collaboration, sharing, and networking; supporting the larger goal national security in a maritime environment.
WG 13 – Power Projection and Strike Warfare

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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). In keeping with the 88th Symposium’s theme of “Multi-Discipline Analysis of National Security,” 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
- 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
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 air warfare domain is rapidly changing and increasingly challenging as the environment and employment concepts evolve. 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, prevention of collateral damage, urban targets, as well as interoperability in the joint, combined, and interagency arena. The emphasis of WG 14 presentations will be 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 88th MORS Symposium theme, “Multi-Discipline Analysis in National Security”, this working group focuses on the use of and sharing of new analytical tools, processes, applications, methodologies, and metrics to increase knowledge and exchange of ideas among members. Thus, we 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 works and works-in-progress. Final presentation selection will be based on both the 88th 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 – Health Service Support, Force Health Protection, and Casualty Estimation

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A robust medical support system is a vital component of a capable military force. In conjunction with the 88th MORS Symposium theme, “Multi-Discipline Analysis in National Security,” the Health Service Support, Force Health Protection, and Casualty Estimation working group welcomes participants from a wide range of disciplines whose research impacts healthcare in its broadest sense.

As defined in Joint Publication 4-02, Health Service Support consists of casualty care and other “support and services performed, provided, and arranged to promote, improve, conserve, or restore the behavioral and physical well-being of military personnel.” Force Health Protection includes casualty prevention, preventative medicine, and other measures to “promote, improve, or conserve the behavioral and physical well-being of Department of Defense personnel.” Taken together, these functions minimize the risk to the warfighter by ensuring the force is healthy, fit, and well supported medically.

Casualty estimation is the development and application of quantitative methods for estimating casualties due to combat or non-combat related causes. Casualties may be caused by conventional, natural, or irregular threats, including chemical, biological, radiological, and nuclear weapons. The ability to accurately estimate casualties of all types is an essential component of providing health service support and force health protection.

Working Group 15 welcomes presentations in concepts and research that are still under development, as well as proven applications. Relevant topics include, but are not limited to: casualty care; medical treatment facility capabilities and functions; patient movement and evacuation; medical staffing; replacement personnel requirements; medical logistics; medical planning; rehabilitation and reintegration; blood management; casualty prevention; preventative medicine; health surveillance; combat stress control; suicide prevention; risk assessment; conventional and CBRNE casualty estimation; and toxicity estimation.

Presentations are encouraged from all disciplines that use operations research methods in the subject areas listed above. Past presenters have included operations research analysts, statisticians, behavioral scientists, clinical providers, medical planners, logisticians, engineers, and other scientists. Submissions to WG-15 can include applications across the range of military operations, including major combat operations, crisis response, stability and security operations, humanitarian assistance, and disaster relief. Non-military applications with a relevance to national security are also welcome.
The strategic and efficient deployment of military cargo and personnel is paramount in assuring a successful military campaign. Beyond deployment, the optimal distribution or placement of critical assets while in theater can greatly improve the overall readiness and sustainment of United States military forces and their allies. Given the many factors that can complicate the timely transportation and optimal placement of military assets, problems of this nature pose a challenging military logistics problem that lends itself well to operations research and analysis.

The overall goal of the strategic deployment and distribution working group (WG-16) is to present and discuss analysis related to these complicated systems to determine efficient and effective movement, placement and transportation of military cargo and personnel. Abstracts should focus on: 1) modeling and/or analysis examining improvements to deployment and distribution planning and processes; 2) new/developing operations research techniques or modeling of mobility and transportation systems; 3) sharing new or changed doctrines, concepts of operations, missions, or assumptions regarding deployment, distribution, and sustainment processes; or 4) logistics distribution systems and processes that balance risks (e.g. operational, costs, security) involved in an uncertain future. Abstracts not highlighting one of these four focus areas but still concerned with operations research and analysis within the deployment and distribution realm or analysis that could be applied within this field will still be considered.

Given the theme of the 88th MORS symposium, “Multi-Discipline Analysis in National Security,” there is a particular interest in abstracts that focus on collaboration and cooperation across service branches, companies or other disciplines. We encourage both completed presentations and works in progress.
The nature of warfare constantly evolves, much like the nature of the analytics landscape. We are challenged to adapt both new and existing methods into advancing technology to enhance the logistics, reliability, and maintainability support we provide our warfighters and our allies. Despite being often viewed as behind-the-scenes components of system performance, we know logistics, reliability, and maintainability offer extremely challenging and rewarding technical challenges and measurable impacts on military operations.

Working Group 17 provides a forum for discussing a wide variety of logistics analyses, including but not limited to support to deployed forces, logistics impact on readiness, supply chain management, system reliability, designing for improved system maintainability, operational effectiveness, support for joint and coalition operations, inter-agency support, and reverse logistics. Important insights in solving problems in other areas of logistics are valued, too.

With this year’s theme of “Multi-Discipline Analysis in National Security”, we are especially interested in how you are employing a fully integrated approach that breaks down the traditional stovepipes and boundaries between disciplines. So, in addition to existing analytical techniques including mathematical modeling, statistical analyses, optimization, forecasting, and simulation, we want to hear about approaches that take full advantage of diverse analytical backgrounds and specialized skill sets to explore multi-disciplinary alternatives and analytical processes. We welcome both completed and incomplete work as long as it has demonstrated impact potential—often the best aspect of the sessions is discussion, questions, and feedback from your peers.
The individual and collective knowledge, skills, behaviors, and talents of the total force of active duty, reserve, civilian, contractor, and interagency personnel are critical to accomplishing the goals of our National Security Strategy. Success in a complex multi-domain environment requires decision makers to depend upon a sophisticated human resource management system to recruit, access, develop, employ, motivate, 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 human resource challenges facing civilian and military leaders.

Keeping with the theme of the 88th MORSS, “Multi-Discipline Analysis in National Security,” the Manpower and Personnel working group seeks to embrace multi-disciplinary analysis and research ideas, from both traditional and non-traditional sources of analysis. We encourage the involvement of new communities in this important area to boost our cognitive horsepower, and seek individuals who innovatively address these challenges. Presentations should be rigorous in content and address one or more of the following:

- Requirements determination and manpower planning
- Recruiting and personnel selection
- Assessment
- Measurement of readiness
- Attrition and/or continuation
- Retention
- Compensation and compensation reform
- Assignments and distribution
- Performance evaluation

To generate discussion and share ideas, presenters seeking input on work-in-progress, techniques under development, and completed analyses/papers are encouraged to submit abstracts to the working group chairs/co-chairs or to the MORS office.
The National Security and National Defense Strategies place a renewed emphasis on force readiness, generating the necessary capabilities to compete, deter and win in a complex security environment. Specifically, the National Defense Strategy includes a priority line of effort to rebuild military readiness as we build a more lethal Joint force. In support of these efforts, WG 19 looks to advance the body of knowledge associated with readiness analysis.

Readiness analysis is a challenging area, as readiness covers a vast area of potential subjects. Readiness includes wide-ranging topics from overall readiness for specific missions such as regional conflicts, hybrid warfare, defending against weapons of mass destruction, combating bio threats, and securing U.S. borders and territories, to focus areas of cyber readiness, medical readiness, and logistical readiness, among others. The questions of readiness can focus on the component parts – personnel, supply, and training – and the force management/force generation processes that combine those parts into ready forces. Readiness issues range from the individual all the way to the Service or Combatant Command level, and include both current capabilities as well as modernization and readiness for the future fight. There is a need for methodologies across disciplines to better understand the broad questions of readiness for what, by whom, when, and for how long.

This WG focuses on readiness methodologies and tools across the span of relevant issues. We consider analytic techniques and tools that allow for real improvements in how we plan, manage, and assess the readiness of our organizations and individuals to meet real world missions.

Presentations on a wide range of subjects are welcome.
Multidisciplinary analysis in support of national security in 2020 and the years following will present enormous challenges for our military and civilian leaders. Meeting those challenges calls for all oars in the water and that is especially true for the analytic community. We must be prepared to integrate various disciplines in order to make sense of mountains of data and information while arming leadership with analysis to guide and underpin national security decisions. The Training and Education Working Group should provide a forum to exchange ideas, lessons learned, and best practices in two key areas to advance analytics in support of national security.

First and foremost, we must develop and apply analytics to ensure our Armed Forces get the most out of every dollar spent on training and education so that our military and civilian workforce is prepared to achieve national security objectives in an ever-changing operational environment.

Secondly, we must ensure the analytic work force stays abreast of and proficient in the application of advancing analytic methods and tools.

Training and education play a vital role in growing our military’s capability to support national security. Our ability to develop and use new analytical processes, frameworks, metrics, and tools, and use them to help solve the problems facing commanders and assess training and education program effectiveness is vital.

The 88th MORS Symposium offers an opportunity to review recent work, training evaluation and assessment concepts, and new training and education developments that support national security priorities now and in future. 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

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WG21: MORSS WG21 (Operational Energy) recognizes that energy is a fundamental enabler for the US defense enterprise, that the US military faces a strategic environment that is increasingly complex and unpredictable, and that the nation’s security depends on the assured delivery of secure and resilient energy to permanent installations, contingency locations, and to the battlefield.

The most recent DoD Operational Energy Strategy (OES) addresses the challenge of assuring energy provision to installations, platforms, and equipment with the following threefold strategy:

- Increase future warfighting capability by considering energy throughout future force development.
- Identify and reduce logistics and operational risks from operational energy vulnerabilities.
- Enhance the mission effectiveness of the current force through updated equipment and facilities, increased resilience, and improvements in training, exercises, and operations.

Energy intersects with a wide variety of other topics in operations research, and as such offers a rich arena for multi-discipline analysis. MORSS WG21 provides energy practitioners a forum for active discussion ranging from cutting-edge new technologies and techniques to critical foundational issues in energy operations in support of the OES and in keeping with the theme of the 88th MORSS, “Multi-Discipline Analysis in National Security”. Possible topics include, but are not limited to:

- Energy security and resilience,
- Sustainment energy,
- Energy supportability of operations concepts,
- Delivery technologies and concepts (e.g. wireless energy transmission),
- Incorporating energy into wargames and exercises,
- Energy supply chain and power grid security (including kinetic and cybersecurity),
- Directed energy,
- Weaponization of energy systems (e.g. restricting natural gas flows to adversaries),
- Developing energy metrics,
- Quantifying and improving energy performance and efficiency,
- Innovations and capability development,
• Cost/benefit analyses and risk assessment,
• Modeling and simulation,
• Alternative fuels and other energy sources,
• Renewable energy integration,
• Energy and the environment,
• Energy policy,
• Training and best practices for energy operators.
# WG 22 – Military Assessments

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Military assessments determine if an organization is achieving its strategic objectives. Although very technical and detailed assessments are conducted across DoD, there is no training, no education, immature doctrine, and no designated career fields. Assessments is an area in need of constant collaboration between active practitioners and experienced members of the assessment community. Assessors of common strategic, operational and tactical levels collaborate at this venue, as well as discuss nesting between higher and lower levels.

This MORS focus group seeks presentations on assessment techniques, assessment examples of best practice, taxonomies for assessments, and recommendations for improving communications, doctrine, training, and education, with an emphasis on assessment topics relating to multi-discipline analysis in national security.
Our nation is confronted with peer and near peer adversaries who adapt to strike at U.S. military forces, our Homeland, and Allies and Partners 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 current and future 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 identifying and countering dynamic and emerging threats.

While the U.S. continues to transform its forces to meet current and future requirements within a fiscally constrained environment, the analytic challenge is to develop appropriate and informative measures that will assist decision makers and reduce the risks that our nation faces. This is reflected in the theme of this year’s symposium, “Multi-Discipline Analysis in National Security.”

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.
The Test, Experimentation and Evaluation Working Group (WG 24) provides an opportunity for military, government, international, 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 both test and experimentation supporting the Department of Defense, industry, and other government departments and agencies.

Both test and experimentation are dynamic and challenging processes that produce knowledge about the true capability of a system by comparing the analysis of empirical observations obtained from stimulating a system to requirements and standards. The goal is to transform knowledge gained from testing into “decision-quality information” to inform key acquisition and national security decisions.

As we address the theme for this year's symposium—Advancing Analytics to Support National Security, WG 24 brings together government, academia, industry, and military operations research analysts to share lessons learned and state-of-the-art methods and techniques that are key on advancing analytics to support national security. WG 24 examines the challenges faced in planning, designing, and executing experiments, tests and the subsequent analysis, assessment, and evaluation of the data.

WG 24 welcomes analytically rigorous papers from all aspects of T&E, particularly in the following subject areas:

- Advancing Test and Experimentation
- T&E policy and guidance updates relevant to the MORS community
- Statistical Engineering in T&E
- Design of experiments in T&E
- Reliability and reliability growth
- Cybersecurity T&E
- Interoperability T&E
- Modeling and Simulation (M&S) in T&E
- M&S Verification, Validation, and Accreditation (VV&A)
- Data analytics and data mining for T&E
- Predictive analytics
- Software T&E
- Modern data analysis techniques
- Designing credible tests with limited resources
• Developing meaningful measures of effectiveness
• Implementation and sharing of results/lessons learned

Additionally, WG 24 welcomes papers from all aspects of experimentation, particularly the following:

• 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
WG 25 – Analysis of Alternatives (AoA) and Capability Development

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Capability Development is the process used by the military Services to identify, evaluate, develop, field, and sustain capabilities in an environment of limited resources. Capability Development encompasses three major activities: 1) Capability gap identification, 2) Risk assessment, and 3) Solution development. A key reform tenet of the 2018 National Defense Strategy (NDS) is to “Streamline rapid, iterative approaches from development to fielding. A rapid, iterative approach to capability development will reduce costs, technological obsolescence, and acquisition risk. Prototyping and experimentation should be used prior to defining requirements...” “This approach, a major departure from previous practices and culture, will allow the Department to more quickly respond to changes in the security environment and make it harder for competitors to offset our systems.”

Capability Development is a critical part of thorough and robust Capabilities Based Assessments (CBAs) and Analyses of Alternatives (AoAs). WG 25 is open to examining any Capability Development approach utilized to achieve effective warfighting solutions. In addition to CBAs and AoAs, topics of particular interest include Development Planning, pre-Materiel Development Decisions (MDD) analyses, gap identification and prioritization, risk assessment, science and technology initiatives, experimentation and rapid prototyping, and other emerging technologies that aim to mitigate capability gaps.

The theme for the 88th MORSS is “Multi-Discipline Analysis in National Security.” WG 25 looks to address this theme by providing a wide-ranging selection of topic presentations that demonstrate how creative and dedicated analysts are working in the Capability Development arena to set the conditions for the ultimate delivery of operationally relevant and cost effective warfighting capabilities.
WG 26 – Cost Analysis

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The theme for the 88th Military Operations Research Society Symposium is “Multi-Discipline Analysis in National Security”.

Operations Research (OR) plays a vital role in defending the nation, securing its borders, and protecting its interests. The projection of military, economic, diplomatic, and political power involves extensive research and well-informed, data-driven analysis.

Detailed cost, affordability, risk, uncertainty, and capability analyses are mandatory requirements to inform decision makers. Such analyses have far-reaching impacts on decisions made during the development, testing, procurement, operations, validation and sustainment of today’s modern programs, and on the effective resource decisions across the entire Department. In addition, providing realistic life cycle and total ownership cost estimates for all stages of proposed systems, early enough in the design process to support trade-off decisions, presents a significant OR challenge. Armed with the latest tools, techniques, and best practices, analysts can generate the most accurate cost estimates and assessments to ensure the necessary resources are available to support the needs of the warfighter and the supporting establishment.

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, resource 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
• Cost estimating in a rapid acquisition environment
• Costs of implementing cybersecurity and information assurance measures
• Portfolio analysis and decision support frameworks
• Costs and benefits of employing open standards and open architectures
• Advances in cost, schedule, and performance risk/uncertainty analysis
• Analysis utilizing new technological tools such as Artificial Intelligence, machine learning, block chain, etc.

Presentations may be completed works or works-in-progress.
Decision Analysis (DA), as a discipline, provides researchers with the philosophies, theories, and methodologies needed to address challenging and complex decision situations in a formal manner. It encompasses the many procedures, methods, and tools leveraged by analysts to assist decision makers in making the best-informed decisions within the constraints of the problem space. To enhance analysis in national security applications, DA methods are incorporated as components of multi-disciplined approaches that combine techniques such as mathematical programming, simulation, Bayesian networks, Markov decision processes, and machine learning.

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

1) Assessment of the decision maker’s biases and preferences in the evaluation of alternatives, and
2) Incorporation of uncertainty associated with the outcomes and the information used in the decision.

One of the objectives of WG27 is to build on the legacy of military decision analysts by expanding the capabilities and standard practices of the current field of DA. We view WG27 as a forum in which both novice and seasoned decision analysts can share the results of their work and teach each other innovative methods for addressing the ever-changing modern decision space.

WG27 invites papers describing completed work or work in progress that makes use of DA methods or models, and/or case studies in the application of DA. In particular, WG27 seeks papers that align with the following topics:

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

To ensure a fair evaluation of abstracts and to help authors distinguish themselves, we encourage authors to emphasize the DA 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.
To support this year's theme of "Advancing Analytics to Support National Security," WG-28 is seeking papers that discuss advances in the application of sound modeling and simulation (M&S) techniques from systems engineering to the joint strategic level. WG-28's focus is to highlight unique and innovative approaches to M&S development through: application, verification, validation, and simulation tools.

A broad range of M&S techniques are developed and utilized by the military operations research community. These techniques endeavor to answer questions about: strategy, doctrine, force structure, weapons, various systems, and specific requirements. WG-28 is inclusive of a variety of M&S techniques such as discrete event simulation, systems dynamics, and agent-based simulation. Presentations for WG-28 should have an emphasis on advances in M&S concepts, methodologies and techniques, more so than specific study results.
WG 29 - Computational Advances in OR

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As analysts, we are challenged to develop solutions to the most critical issues that threaten our national security. Meeting this challenge requires innovative problem solving approaches and techniques to address the multiple problem domains facing today’s military analyst. To support this year’s theme “Multi-Discipline Analysis in National Security”, 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.

Working Group 29, the Computational Advances in Operations Research 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. 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

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A wargame is a dynamic representation of conflict or competition in which people make decisions and respond to the consequences of those decisions. Analytic wargames are wargames created to provide insights to assist senior leaders as they make difficult decisions. Analytic wargames are inherent in DoD’s planning process (as well as many of our allies and partners, including NATO, UK, Canada, Australia), and they are also used by many analytic organizations to explore future concepts and technologies and to develop the CONOPS necessary to instantiate into combat simulations. Additionally, testers and experimenters use wargames as a front-end screening tool to better understand where to leverage high-dollar tests and experiments to get the highest return on investment. This year, we are seeking analytic wargaming best practices from planners, analysts, testers, and experimenters. We are especially interested in hearing from planning wargamers at flag headquarters such as Combatant Commands to hear best practices and lessons learned while creating and conducting the wargames that inform our future plans. We are interested in hearing from those who use wargames and combat simulations together for analytic studies and for planning. We are also looking for new techniques that organizations have found for wargaming adjudication and analysis. We are interested in hearing from those who have adopted techniques and mechanics from hobby games for use in defense wargaming. We would like to hear from logistics wargamers, as this is a critical need and one often overlooked. WG 30 encourages presentations on best practices for the definition, design, execution, and analysis of wargames, methods from other disciplines that may be of use to DoD-oriented wargames, new or innovative wargaming techniques from educational or experiential wargames, and wargame results from national security domains.
WG 31 – Operational Environments

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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), human populations (civilian and military), and social science factors (political, social, cultural, informational, and economic) – and their synergistic interactions as they impact present and future operations. WG 31 focuses on identifying, describing, and incorporating appropriate operational environment subsets into various applications for military and homeland security operations.

The operational environment is dynamic. 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 also affect both human behaviors and social science factors (political, social, cultural, informational, and economic). In today’s world we also see ongoing changes in population sizes and movement patterns, regional climates, the nature of infectious disease outbreaks, and the physical layout of large urban areas. 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 analytic advances that alter either the operational environment itself or the ability to understand the operational environment.

WG 31 solicits thought-provoking presentations of studies, research and development, and experiments that describe in broad terms the 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 welcomes presentations of both on-going and completed research concerning improvements and new approaches in using multi-discipline tools and capabilities to help the national security community to better understand underlying operational environment factors that are relevant to complex decisions and to develop policy options that can mitigate the challenges created by certain operational environment factors.
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

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Working Group (WG) 33 explores multidisciplinary methodologies for the human, social, cultural, and behavioral sciences, and their applications supporting the needs of the national security analysis community. 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.

Applicable methodologies may be derived from a number of social science disciplines, including: anthropology, cultural studies, demography, economics, geography, political science, political economy, psychology, and sociology. 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 the application of these methodologies. Applications of these methodologies should reflect the scientific method (i.e., demonstrate 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.

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; the dispersion of ideas (including misinformation) through social media and other new mechanisms of communication; demographic and economic 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.

WG 33 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;
• 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; and
• Conduct meta studies of social science and CSS that look across groups of prior studies of particular types, including from cross-disciplinary perspectives.
Data science is a rapidly growing field within the operations research, computing, statistics and other analytics communities. Data science is generally defined as the application of machine learning/data mining, text analytics/natural language processing, and network science together to solve a wide variety of problems. As a data-focused discipline, data science generally enables descriptive, diagnostic and predictive analytics for decision-makers. Over the past several years, the field has been energized by technological advances that have led to new methods that are both highly available and low-cost. Furthermore, improvements in data management and architecture technologies continue to unlock data sets that can benefit from data science methods. This combination of improved, inexpensive tools and newly available data has sparked a growing data science community within the Department of Defense (DoD). Because these trends appear that they will continue for at least the next few years, there is a sustained need to establish forums and collaboration opportunities for data scientists.

In addition to tremendous opportunities, the rapid growth of data science will also create significant challenges for the community to address. There is no doubt that data science has been fully embraced by the commercial sector, but it is still common to find detractors within the DoD. Much of this derision likely stems from misunderstandings that are caused by a lack of knowledge and/or miscommunication from both customers and practitioners. The success of this field will hinge on the ability of practitioners to address these misunderstandings and stop the cycle of over-promising and under-delivering. An important first step in this process is to bring data scientists together to explore how to solve these problems collaboratively.

Establishing a working group within the MORS community presents a unique opportunity to band together data scientists throughout the DoD with a common goal of leveraging the unique tools of the discipline. Currently, this leverage is adversely affected by the separation (both geographic and bureaucratic) between data scientists throughout the DoD. Above all else, the goal of this working group is to remove barriers between practitioners, allowing them to benefit from the collaboration and cooperation that is necessary to sustain an effective community of practice.

We solicit presentations from experienced data scientists, operations research analysts, statisticians, and machine learning engineers who will shed light on several key issues, primarily in the form of applied results:
• Demonstration of emerging (or novel) technologies to include open source software, cloud environments, big data methods, parallel computing strategies, high-performance computing enabled analytics, streaming data, multi-media and multi-structured data, link and graph mining, semantic-based data mining, recommendation systems, social web-mining, and other data science approaches.

• Development or application of emerging (or novel) methods targeting any part of the data science pipeline (acquire/store data, munging, wrangling, modeling, visualization, human/computer interaction)

• Success stories: when data science methods were used to inform decisions
WG 35 – AI and Autonomous Systems

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WG 35 - Artificial Intelligence & Autonomous Systems – will explore the unique array of operational issues associated with AI-enabled autonomous systems in detail; to deconstruct the profound complexities presented by such systems; and, develop new OR methods and tools to analyze these problems to support national security.

As envisioned, autonomous systems will present extraordinary new issues and challenges for the military operations research community. WG 35 will significantly contribute to this body of knowledge to support the U.S. national security mission through presentations, seminars, discussions, and the development of a community of interest. We present the following topics as examples for discussion:

Developing New Concepts of Operations for Autonomous Systems
- What are the concepts of operation (CONOPS) and concepts of employment (CONEMPs) required to fully and appropriately leverage new autonomous behaviors?
- What is the level of improved operational effectiveness / military utility required to justify an AI/ML-enhanced change to current concepts and DOTMLPF solutions?

Maturing AI/Autonomy for the OR community
- What new tactics, techniques and procedures are made possible by AI and autonomous capabilities?
- Efficient algorithm and machine learning development and techniques
- What are the appropriate relationships between the federal government, commercial AI/ML developers, military AI/ML developers, and foreign countries?
• What data sources are currently available to train AI/ML models, and how can we anticipate future data requirements?
• V&V of the data and training techniques
• Will learning systems require novel experimental designs?
• What metrics are appropriate for autonomous systems?

Building Trust in AI/Autonomy
• How do we validate and verify AI and autonomous systems models to build confidence and trust?
• What levels of autonomy and what degree of human supervision are required for each intelligent or autonomous military system?
• What changes do we need to make to developmental and operational test & evaluation, including modeling & simulation, to accommodate AI/autonomy?
The most critical part of any system is the operator, so it is crucial that human performance issues are considered when assessing the overall performance of a system. The importance of this focus will only continue to grow as machines become more complex and new issues begin to emerge that will drive performance changes. Human Machine Teams, Autonomy, and Artificial Intelligence will all change the way operators interact with machines so new ways of thinking about system performance and safety must be addressed. Such human performance issues might leverage the domains of Psychology, Organizational Behavior, and Human Factors which often relate to topics found in 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). For example, operator cognitive demands or other system characteristics might interact with individual differences, decision making, and motivation to create implications for training and recruitment. Further, methodological issues such as psychometrics, data fusion, and modeling might need to ensure that current and future measurement and analysis techniques are appropriate, reliable, valid, and accurate. Any studies that relate to these topics, or related issues, are welcome.