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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 advancing 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 modeling, 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

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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 analytics to evaluate and prioritize candidate systems and approaches. In an environment of uncertain budgets and a changing military, political, and economic world landscape, our ability to understand and analyze CBRNE 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
- Modeling and simulation and algorithm development to identify or predict CBRNE threats
- 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 and/or advanced analytics to enhance CBRNE defense capabilities, decisions, and outcomes are of particular interest.
The subject of Working Group 3, IAP&R, has a natural connection to the theme of the 87th MORS, “advancing analytics to support national security.” The major thrust of this working group is the examination of critical infrastructure, particularly in relation to planning and preparing for failures, managing loss of function, restoring functionality, and adapting systems to natural and man-made disruptive events. Analytics that support these activities benefit national security by describing, predicting, and prescribing infrastructure functions and failures.

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 for 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 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. Analytics support these activities by identifying dependencies within or between the physical, informational, cognitive, and social networks that comprise infrastructure and offering decision makers new knowledge across these domains prior to disaster.
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. This year, we are particularly interested in research in the following areas:

Analytic Techniques for Infrastructure Operations and Resilience:

- Modeling, analytical techniques, and decision support tools to determine vulnerabilities in critical infrastructure and/or inform planning and investment;
- 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;

Infrastructure in Emerging Physical and Cyber 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, 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!
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 “Advancing Analytics to Support 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 can lead to improvement of interaction and response for all agencies involved in National Security.
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 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.

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, 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, electronic warfare, 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 cyberspace 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.

Our National Defense Strategy highlights the importance of winning the “competition” that precedes and follows conflict. Accordingly, the WG should also seek to know and understand how the Military Services are working together to better integrate and operationalize the emerging Multi-Domain Operations (MDO) doctrine across the Joint, interagency, and international landscape.

The WG encourages submission of presentations relevant to the information and cyberspace 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 cyberspace 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;
- Analyses of historical examples of successful and unsuccessful information and cyber operations;
- Analyses of the overall Operating Environment (OE) to help commanders build a tailored Intelligence Preparation of the Battle space (IPB) package for that OE in support of a particular tactical mission; and
• Studies or Use Cases for how Russia has developed the dual concept for detection and targeting of high-value targets using their revamped Reconnaissance Strike Complex doctrine.

Presentations that describe development of information and cyberspace 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!
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.” 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. 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 the 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 capabilities envisioned 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 87 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 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.
WG 7 – Intelligence, Surveillance, and Reconnaissance

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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 87th Symposium is “Advancing Analytics to Support 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 obfuscant 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 help our nation “secure the high ground” in space, even in a contested operating environment. Symposium presentations to the WG should highlight analytically sound OR techniques that help our nation acquire, test, and/or operate space capabilities/systems. The acquisition, testing, and operations processes are typically enabled by assessing real or projected space capabilities/systems’ strategic, operational, or tactical contributions. Presentations reflecting recent or ongoing efforts to provide candid, rigorous assessments of existing or prospective space capabilities/systems fits perfectly into this year’s MORSS theme: “Advancing Analytics to Support National Security.”

Today, more than ever, space is the true “high ground”, given that more nations around the world have increasing access to the space domain through organic or commercial space capabilities. The U.S. leverages 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. As other nations around the world continue to acquire space capabilities and create an increasingly congested, contested, and competitive space environment, it becomes even more important for the U.S. to maintain space superiority across the broad range of 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/or 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 interesting 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 (combatting WMD to denial of services), and support both material development and operational planning. A holistic 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 87th 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 87th MORS Symposium theme – “Advancing Analytics to Support 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.
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 87th MORSS theme, “Advancing Analytics to Support National Security,” 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.
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 87th Symposium’s theme of “Advancing Analytics to Support 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 87th MORS Symposium theme, this working group focuses on the use of new analytical tools, processes, applications, methodologies, and metrics. 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 87th 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.
The 87th MORS Symposium theme, “Advancing Analytics to Support National Security,” emphasizes the critical role that operations research and analytics play in national security. A robust medical support system is a vital component of a capable military force. The Casualty Estimation and Force Health Protection working group welcomes participants who are interested in applying operations research to protect and support those put in harm’s way in pursuit of the nation’s security.

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. In addition to estimating casualties, this working group is interested in research to determine the medical resources needed to manage casualties in the health service support system. These requirements include, but are not limited to: medical treatment facility capabilities and functions; patient movement and evacuation; staffing; replacement personnel; logistic support; and rehabilitation and reintegration.

Force Health Protection includes measures to promote, improve, or conserve the behavioral and physical well-being of service members. This will lead to a more healthy and fit force, the prevention of injury and illness, and better protection from health hazards. Functions in this area include: casualty prevention; preventative medicine; health surveillance; combat stress control; suicide prevention; and risk assessment.

Working Group 15 welcomes presentations in concepts and research that are still under development, as well as proven applications. 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, 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 Deployment and Distribution Working Group (WG 16) goal is to present and discuss analysis of readiness and capability in terms of the deployment and distribution required to support logistics and sustainment of the United States Military at the most affordable levels.

Abstracts should focus on 1) modeling and/or analysis examining improvements to deployment and distribution processes; 2) new/developing operations research (OR) techniques or modeling of mobility and transportation systems; 3) sharing new or changed doctrines, concepts of operation, missions, or assumptions regarding deployment, distribution, and sustainment processes; or 4) logistics distribution systems and processes that balance the risks (e.g., operational, costs, security) involved in an uncertain future. We encourage both completed presentations and works in progress.

Analyses presented should include operational effectiveness, cost, risk, capability, and/or metrics useful for senior level decision making and policy guidance affecting the wider mobility, distribution, and logistics community. Preference will be given to abstracts that discuss advances in analytic approaches and/or provide a holistic evaluation--2nd and 3rd order effects or system of systems considerations--of distribution capabilities is highly desired.
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 problems in other areas of logistics are valued, too.

With this year’s theme of “Advancing Analytics to Support National Security”, we are especially interested in how you are introducing new tools and techniques to look at long-standing problems in a different way. So, in addition to existing analytical techniques include mathematical modeling, statistical analyses, optimization, forecasting, and simulation, we would love to hear about your cloud computing, machine learning techniques, prescriptive analytics, or similar techniques. 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 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 87th MORSS, “Advancing Analytics To Support National Security” the Manpower and Personnel working group seeks to embrace analytical support to 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

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The latest National Security and National Defense Strategies place a renewed emphasis on force readiness and 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 is a broad topic covering several key questions, namely readiness for what, by whom, when, and for how long. 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.

This WG focuses on readiness capability assessments and tools across the span of relevant issues, particularly as these assessments aid in supporting a ready and resilient nation. 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.
Ensuring the national security of the United States in 2019 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 help leadership make sense of mountains of data and information while arming them 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 fore-most 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 87th 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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TOPICS: MORSS WG21 (Operational Energy) provides Energy Professionals and their associated disciplines, a forum for active discussion on a wide variety of topics, from the cutting-edge, state-of-the-art to critical foundational energy operations. These topics include, but are not limited to, Power grid security, Cyber and energy, Baseline metric development, Quantifiable improvements in energy performance, efficiency, innovations, Cost and risks, Benefits of alternative fuels, Renewable energy integration, Solving energy policy problems, etc..

WG21: 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 three-fold 2011 DoD Operational Energy Strategy (OES) approach continues to assure energy provision to the warfighter:

- More Fight, Less Fuel: Reduce Demand for Energy in Military Operations. Military missions have growing energy demands with supply lines that can be costly, vulnerable, and a burden on Warfighters. The DoD needs to improve its ability to manage overall operational energy as a system, reduce demand, and optimize conversion 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. DoD needs to diversify its energy sources, leverage novel, situation dependent 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 armed force energy requirements entail tactical, operational, and strategic risks, DoD institutions and processes for building future forces do not systematically consider such risks and costs. DoD needs to integrate operational energy considerations into a full range of planning and force development activities.

The 2016 Operational Energy Strategy further strengthens the mission with goals to:

- Increase future warfighting capability by including 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 improvements in training, exercises, and operations.
WG 22 – Experimentation

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The Experimentation Working Group 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 experimentation supporting the Department of Defense, industry, and other government departments and agencies. As we address the theme for this year’s symposium—Advancing Analytics to Support National Security—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 achieves consistency across government, industry, and academia.
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. This is reflected in the theme of this year’s symposium, “Advancing analytics to support 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.
Test and Evaluation (T&E) is a dynamic and challenging process that produces 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.

The T&E Working Group (WG 24) brings together government, academia, industry, and military operations research analysts and testers 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 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:

- 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
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 87th MORSS is “Advancing Analytics to Support 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 87th Military Operations Research Society Symposium is “Advancing Analytics to Support 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, procurement, and sustainment of today’s modern acquisition programs, and the on the effective resource decisions across the entire Department. 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. 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, 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

Presentations may be completed works or works-in-progress.
Decision Analysis 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. Decision analysis 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, in a variety of applications.

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
2) Incorporation of uncertainty about the outcomes and about 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 decision analysis. 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 Decision Analysis methods or models, and/or case studies in the application of Decision Analysis. In particular, WG27 seeks papers that align with the following 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.
A broad range of modeling and simulation (M&S) techniques are employed by the military operations research community to answer questions about strategy, doctrine, force structure, weapons, systems, and requirements. Our goal is to highlight unique and innovative approaches to M&S development, application, and verification and validation as well as unique applications of simulation tools. WG-28 will cover a variety of M&S techniques such as discrete event simulation, systems dynamics, agent based simulation, or any digital mechanism. WG-28 presentations should emphasize advances in M&S concepts, methodologies, and techniques, rather than on any specific study results.

To support this year's theme "Advancing Analytics to Support National Security," we seek papers that discuss advances in the application of sound M&S techniques from the joint strategic level down to system engineering level issues.
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 “Advancing Analytics to Support 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
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), humans (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). 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 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 to the analytic capability of the nation in understanding underlying operational environment factors that are relevant to complex decisions.
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.
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, 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.

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; 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
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 prerequisites 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 87th 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 rapid pace of technology changes, with emphasis on autonomy, calls for more recognition of man-machine interface issues.
• Equally, the future role of artificial (often called super) intelligence calls for intense analyses of human decision making, particularly on the complex battlefield. For example how will command and control be affected? How will the Services' view of "mission command" be affected by the technologies?

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!
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. Additionally, military applications are driving technological development of unmanned systems to achieve new and unique missions, to supplement manned operations, and to increase force structure.

Today, a wide variety of unmanned systems are operated by state and non-state actors to perform missions in the air, land, surface and undersea domains. Tomorrow will surely see new and innovative unmanned systems pushing the art of the possible. The theme of the 87th MORSS is: “Advancing Analytics to Support National Security.” Unmanned systems will undoubtedly play an increasingly important part in achieving this vision in the years to come as challenges are overcome and opportunities are realized.

The 87th MORS Symposium’s Unmanned Systems Distributed Working Group (DWG-2) invites you to share your work and insight on topics such as:

- Analysis of current unmanned systems, their applications, and their successes.
- Analysis of the planning and management of unmanned system operations including scheduling, system allocation, maintenance, communication and data link requirements, control stations, human operator, attached payloads, etc. across diverse mission scenarios.
- Evaluation of unmanned system operational effectiveness for specific missions via the analysis of system metrics such as speed, range, persistence, etc.
- Modeling and simulation of unmanned systems’ reliability, availability, and maintainability.
- Determination of the optimal mix of tactical unmanned aerial vehicles (UAVs) for a given operational scenario. For example, development and analysis of concepts of operation that utilize cross-domain mixtures of unmanned systems (unmanned land/sea/air platforms operating in conjunction with each other).
- Power (fuel) availability and its impact on mission range, flight duration, tactical planning and communication requirements.
- Cost and operational effectiveness analysis of the employment of unmanned systems over manned systems.
- Cooperation between manned and unmanned vehicles (i.e., manned/unmanned teaming).
- Solutions for safely managing the operational coordination of unmanned and manned systems within the same airspace/water space. For example, UAV and manned aircraft “sense and avoid” capabilities needed to safely integrate UAVs into the national airspace.

- Properly managing the endurance of the human operators of UAVs in order to maintain a high level of mental sharpness and operational awareness as well as avoiding “burnout” when flying an aircraft from a remote location.

- Techniques for on-board and off-board exploitation of collected data, such as full motion video, for intelligence purposes.

- Novel system deployment concepts such as the deployment of unmanned systems from manned system platforms and unmanned systems from unmanned system platforms.

- Translation of commercial unmanned system applications or law enforcement applications to military roles.

- Feasibility of the tactical employment of novel ground-based unmanned systems such as legged systems (e.g. Legged Squad Support System) and micro UAV platforms using biomimetic flight methods.

- Analysis of the use of unmanned systems for logistics purposes and for casualty evacuation.

- Analysis of the use of undersea gliders for naval applications.

- Effectiveness of unmanned surface vehicles (USVs) and unmanned underwater vehicles (UUVs) in undersea warfare and as mine countermeasure tools.

- The application of high altitude/near-space (>60K ft.) unmanned aircraft systems including airships to persistent surveillance roles.

- 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.

- Quantifying the relative threat posed by unmanned systems when used for nefarious purposes and the ability to neutralize that threat. How do we protect friendly unmanned systems from being electronically hijacked by adversaries? How do we neutralize adversary unmanned systems while maintaining the ability of friendly vehicles to operate in the same space?

DWG-2 Leadership is cooperating with other Working Groups to discuss these topics by developing joint sessions. In keeping with the dynamic nature of the unmanned system, DWG-2 welcomes papers describing ongoing analyses, data collection, problem formulation, metric definition, operational experience, and cost and mission effectiveness analyses. The submission may be finished work, work in progress, or ideas and concepts.
Focus Session 1 – AI and Autonomous Systems

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Artificial intelligence and autonomy are a current hot-bed of activity in the RDT&E communities and together make up a sub-set of what has become known as military autonomous complex adaptive systems.

There has been a steady trend in AI and autonomy related topics presented in various established MORS working groups over the past few years, such as the following from last year at the 86th MORSS:

37849 - Future Navy SUW Unmanned Surface Vessel Concept of Employment
37960 - Breaking Bad - Autonomy: Modelling Emergent Red Behavior
38000 - Decision-Making and Artificial Intelligence for Battle Management
38108 - Evaluating Artificial Intelligence in a Competitive Challenge (AI "Superbowl")
38290 - FY17 Automation in Integrated Fires Battle Management C2
38369 - Applying Machine Learning to Predict Barge Inspection Deficiencies
38456 - Mission Command in Human-Machine Teams
38505 - Tracking Vehicles in Satellite Imagery with Deep Learning
38592 - Tracking Vehicles in Satellite Imagery with Deep Learning
38603 - Training Convolutional Neural Networks to Detect Intelligence Objects
38861 - The Imminent Threat of Weaponized Artificial Intelligence to Cyber
38868 - An Application of Deep Learning in Military - Unmanned Drone Evaluation
39044 - Automatous Platform Decision Making in Complex, Dynamic Environments

AI and Autonomy have become a significant center of attention at many levels of government, industry and academia - with concomitant increases in research and development funding - the domain deserves its own, separate working group.

The AI/Autonomy problem is rich in profound analytic questions presenting us with opportunities in such diverse operations research topics as: developing new concepts of operations; methodologies to assess unique tactics, techniques and procedures; evaluate comparative systems design; designs to conduct field trials, demonstrations and experiments; evaluate emergent behaviors, explore new challenges in V&V, optimize man-machine interactions and the conduct operations at the “edge of chaos,” metric development and modeling and simulation to name just a few.
Not only is AI/Autonomy the subject of considerable importance to the MORS departmental sponsors and the MORS partners, in general, there is also growing evidence to suggest that MORS can provide significant contributions to this body of knowledge to overall US national security at this critical time in many unique and novel ways.

The purpose of the AI/Autonomy Focus Session will be to explore these issues in more detail through presentations and seminar-like discussion.
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 nest 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 advancing analytics to support national security.