

Wargaming at the Naval Postgraduate School

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INTRODUCTION: *The United States Department of Defense (DoD) and the military services have employed wargaming for well over a century to prepare for war and other operations. The Naval War College first employed naval wargames in the late 19th century at the tactical and strategic levels. During the period between world wars, Plan Orange wargaming at the Naval War College was a key contributor to the strategic plan that led to the defeat of the Japanese Empire in 1945. Since that conflict, wargaming techniques have become widespread within U.S. organizations and throughout the world.*

After a recent period of quiescence, there is a resurgence of interest in wargaming by DoD. The Naval Postgraduate School has a long history of teaching wargaming, starting with a partnership to share course materials and naval simulations with the Naval War College in the mid-1980s. NPS education and research wargaming activities on campus have resulted in the execution of over 50 wargames in the past five years. These wargames are conducted as part of resident wargaming courses and other on-campus workshops and events in direct support of DON, DoD, major command sponsors and allies and other international partners, as well as separate wargames to support technical research. Today, wargaming activities of all types can be found in many of the NPS curricula and outreach activities around the globe.

In 2014, a need to bring higher visibility and synergy to the myriad of wargaming activities at NPS resulted in the formation of the Wargaming Activity Hub. The Hub's mission is to leverage wargaming to conduct high quality education, analysis, and research in support of the Naval Postgraduate School's mission, to prepare future leaders, and help shape and form key decisions on the future of the Department of Defense (DoD). The Wargaming Activity Hub's purpose is to support and contribute to the Naval Postgraduate School's educational and research mission and provide a wargaming and simulation environment to assist DoD leaders in their mission to develop new strategies and concepts across all levels of warfare to counter emerging adversary capabilities and complement ongoing field experimentation activities for the rapid testing and fielding of new technologies.

While it would be impossible to detail all NPS wargaming activities, there are several that provide support to DoD and defense partner organizations by leveraging educational opportunities for NPS students and faculty and provide a flavor of the range of wargaming support at NPS.

NPS On-Campus Wargaming Activities

Warfare Innovation Workshops

Originally sponsored by the Navy Warfare Development Command and the Consortium for Robots and Unmanned Systems Education and Research (CRUSER), the Warfare Innovation Workshops have kicked off the NPS Warfare Innovation Continuum since 2010.

The NPS Warfare Innovation Workshop uses seminar wargaming techniques and design thinking for NPS officers and system command engineers to consider how they would design and/or employ new capabilities in hostile environments. How players employ forces and view risk are assessed with a programmed force and again with a force with new technologies included. Innovative employment of new technologies from the synergy between early- to mid-career officers and early career engineers have been the basis for Navy system design and concept development like the Advanced Undersea Warfare Systems (AUWS), undersea docking stations, air UAV swarms, and distributed fleet. The ideas generated from the Warfare Innovation Workshops are further developed in the year-long Warfare Innovation Continuum, a NPS federation of classes, capstone projects, theses, and research work usually involving 400 faculty, students and sponsors.

Global ECCO

Global ECCO's (Education Community Collaboration Online) mission is to build and strengthen the Combating Terrorism Fellowship Program's (CTFP) global alumni network of Combating Terrorism experts and practitioners through innovative and engaging technologies and techniques that both enable and encourage collaborative partnership between individuals, nations, organizations, and cultures. At NPS, Global ECCO has utilized computer and web-based technologies to develop engaging strategic games to educate players about counter-terrorism tactics. The strategic games teach the methods and mindsets of terrorist tactics as well as how to contend with them as opponents face off against each other in a virtual online environment. This strategic gaming environment facilitates thinking about terrorism and combating terrorism issues and provides an effective framework for discussing related concepts. Global

ECCO has developed multiple strategic games including concepts focused on Asymmetric Warfare, Terrorism Finance, Social Network Analysis, Cyber, Counter Insurgency, and Countering Terrorist Ideologies.

MMOWGLI

The MMOWGLI project was originally sponsored by the Office of Naval Research (ONR) for the United States Navy. The goal of the project is to explore the potential of a Massively Multiplayer Online War Game Leveraging the Internet (MMOWGLI), with a variety of themes, to expand engagement in military and non-military strategy development for complex geopolitical problems. The platform is designed to support large numbers of distributed global players working together on idea generation and action planning, with an eye towards surfacing innovative outlier strategies. Several dozen games, workshops and courses have used the MMOWGLI platform.

Red Teaming and Red Celling

The Assistant Secretary of the Navy for Research and Development, Department of Energy, the Commander Naval Surface Forces, and the State of California are four past sponsors of red teaming and red celling activities at the Naval

Postgraduate School. Leveraging the operational experience and technical education of NPS students, these classified efforts focus on technical red teaming future systems and or red celling emerging blue concept of operations. These activities employ wargaming techniques to frame the students' perspective of defeating blue systems and result in recommendations to increase blue system resiliency or modifications to Blue concepts.

"Facilitates thinking about terrorism and combating terrorism issues and provides an effective framework for discussing related concepts"



Warfare Innovation Workshop participants discuss technological solutions for employment.

Resident courses

For students taking degree programs at NPS, there are several wargaming courses to choose from. Within the Operations Research Department, there is a basic course on applications of wargaming as well as a follow-on advanced course. Within the Defense Analysis Department, there are courses that provide students with a deeper understanding of the analytical value of wargaming and historical wargaming. These NPS courses

stress the contribution of wargaming to decision making and problem solving. Students learn how wargames must be developed and analyzed to provide high quality material for evidence-based decision making, whether in dealing with current operations, in exploring and evaluating options for acquisition projects, or for developing new concepts and doctrine. Beyond the courses specifically on wargaming, there are numerous NPS courses on tools related to analytical wargaming, for example computer-based simulation, data collection and analysis, and statistics.

Wargaming Applications

The Naval Postgraduate School has taught the Wargaming Applications course in the Operations Research Department for well over three decades. This 11-week course for NPS resident students focuses on analytic wargaming, which is a wargame designed to collect and analyze information from wargame play, with results that either feed directly into a decision, or are used to develop other analytic products. The course is a mixture of lecture and hands-on practical exercises designed to develop student wargaming knowledge and skills. Since 2009, the course has integrated external DoD or defense partner organizations into the fabric of the course. By the third week of the course, the students have been introduced to their sponsor, and they partner with the sponsor to begin the design process of the wargame that the students will produce for the sponsor. After the completion of formal instruction and the Wargaming Apprentice Certification Exam during the sixth week, the student teams focus solely on designing, developing, executing, and analyzing their sponsor's wargame. This capstone wargaming project, conducted for the sponsor during NPS "Wargaming Week," serves as the students' final exam. While most of the wargaming sponsors have come from DoD organizations, several sponsors have been from allied or partner nations. Additionally, defense industry partners have also sponsored NPS wargames. The course is offered in the fall and spring quarters, and three to four sponsored wargames are designed, developed, executed and analyzed per student section, one section in the fall, two in spring.

Recent sponsors include the U.S. Navy's N-96 examining the Distributed Lethality concept, U.S. Special Operations Command J-3 (International) exploring the implications of a Russian hybrid threat in the Arctic, and U.S. Central Command seeking a better understanding of the implications of Shia Militia Groups employed against ISIS in Iraq.



Fred Cameron facilitates the Zefra seminar wargame with NPS resident students as part of the Wargaming Applications course.



The Russian Hybrid Threat wargaming players contemplate the first scenario in the Arctic during NPS "Wargaming Week"

Advanced Wargaming Applications

The Advanced Wargaming Applications course student teams create a military modeling application for an external Defense sponsor and/or an NPS Faculty advisor that will examine sponsor/advisor approved issues with more focus and depth than the initial Wargaming Applications course permitted. While that wargame was a complete, playable wargame, the time restrictions of the course didn't allow for the design

and development of advanced adjudication, data collection, or analysis tools and techniques, or the analysis of their output. The concept of this course is to start with a Wargaming Applications wargame or a suitable capstone project or thesis proposal that provides a functioning framework where these modeling techniques can be designed, developed, integrated and then used to generate output to be analyzed and documented for the sponsor/advisor as the final course project deliverables. For our defense sponsors, this provides an opportunity for student teams to continue to work on their wargame for a second, consecutive quarter.

This course was offered for the first time in the fall quarter of 2016 and has two student team successes including Remote Advise and Assist and High-Arctic thesis projects for the Defense Analysis curriculum.



Indonesian Navy students tackle a difficult South China Sea scenario in the Basic Analytic Wargaming MTT course

Mobile Training Team Courses

Since 2011, NPS faculty have gone on the road to deliver wargaming education. This is provided to organizations that want to establish an organic wargaming capability or that are expanding their existing wargaming capacity.

Basic Analytic Wargaming Mobile Training Team (MTT) Course

NPS offers a five-day Basic Analytic Wargaming Course to defense partners at their home station. The course provides hands-on experience with designing, developing, executing, and analyzing a wargame. This course is a compressed version of the 11-week resident course described above. The sponsoring organization provides the wargaming topic that will be the focus for the students. The course is then oriented on mentoring the students' development of a wargame that is then executed by the students themselves on the last day of the course. Like the resident course, this course is a mixture of lectures and practical exercises, with even more emphasis on practice. The course was first conducted for the Canadian Forces Aerospace Warfare Centre, and was followed by courses for U.S. Strategic Command, Indonesian Navy, U.S. Central Command, and the Australian government's Defence Science and Technology Group.

Non-standard MTT Courses and Workshops

A custom-designed course is created when a sponsor has a unique wargaming requirement. In 2011, a five day Peacegaming course was designed and conducted for the Kazakhstan Army in order to assess the Kazakh Army students' knowledge of U.N. Peacekeeping



Playing Risk spurs a lively debate on tactics among Counter-Terrorism students in Dushanbe, Tajikistan

Operations using the Peace Support Operations Model (PSOM) developed by the United Kingdom's Defence Science and Technology Laboratory. A wargaming research and development workshop was provided to Lockheed Martin Space Systems through a Cooperative Research and Development Agreement (CRADA) in 2012. A five day Wargaming and Combat Modeling for Counter-terrorism course was designed and delivered in 2014 for Tajikistan government and military students.

Way Ahead

The NPS resident Wargaming Applications course is currently working on four sponsored wargames this fall. Global SOF Force

Structure (SOCOM J-3I), Countering Transnational Organizations (SOCCENT), Iranian Threat Network (SOCCENT) and Theater Anti-Submarine Warfare (U.S. Navy) wargames are currently in development and will be completed and played for their sponsors in December 2016.

NPS is currently developing a classified wargaming workshop to support CENTCOM's newly formed Wargaming Cell with a delivery date in the winter of 2017. CENTCOM is currently pursuing a long-term relationship with NPS that will include recurring Basic Analytic Wargaming MTT courses, periodic Advanced Analytic Wargaming courses, and consulting on CENTCOM wargames as needed.

Several Basic Analytic Wargaming MTT courses may be delivered in 2017. Potential sponsors include NAVAIR (China Lake), Joint Experimentation (Australian Defence Force), U.S. European Command, and NATO. The New Zealand Defence Force is considering a course in the FY 18-19 timeframe.

Some sponsors of the NPS Basic Analytic Wargaming course have asked for a two or three-day course that focuses on advanced analytic techniques. NPS is developing a proposal for such a course in response to Australia's DST-Group's request.

Under an OSD Wargaming Education Initiative, NPS will develop an automated education and assessment system that will permit a lower-cost, time-saving delivery of wargaming skills to DoD, allied and partner organizations. The vision is to take the existing NPS Basic Analytic Wargaming MTT course and develop a two-phased wargaming course (Basic Analytic Wargaming Fundamentals (BAWF) Phases I and II) that will be less resource intensive yet still provide a high-quality wargaming course for DoD, allied and partner organizations. Basic Analytic Wargaming Fundamentals (BAWF) Phase I will provide the means to acquire and assess basic analytic wargaming fundamentals education that students learn on their own without live instruction through a web-based asynchronous education and assessment website. BAWF Phase II will be a three-day, hands-on, instructor-led practical exercise-based MTT course

for a group of 12-16 students who have demonstrated proficiency in the basic analytic wargaming fundamentals as assessed by BAWF Phase I. A prototype of the BAWF I system will be completed by September 2017.

Under sponsorship of CRUSER, the Warfare Innovation Workshops will continue to kick off the Warfare Innovation Continuum each September. The value to NPS students are an emersion in design thinking, conflict assessment, and being exposed to potential thesis research topics. CRUSER will continue to mine this activity to seed research funds into unmanned systems.

Global ECCO is currently working on updating several of its previously developed strategic games to better support specific sponsor requirements. In addition, future strategic games include efforts addressing the issues of boarder security and countering weapons of mass destruction proliferation.

The NPS MMOWGLI team is currently developing a game in support of the NPS Littoral Operations Center to better understand the dynamic interactions of the U.S. Navy with allies and partners in the South China Sea.

Conclusion

NPS continues to provide analytical wargaming education to its students and to DoD and defense partner organizations around the world. Wargaming sponsors continue to benefit from wargames created and analysis conducted by NPS student wargaming teams, and NPS continues to enhance its students' professional development by providing opportunities to work with joint and service sponsors on operational warfighter requirements and analyses worldwide. Our joint, service, and international defense partners benefit from NPS educational expertise and engagement through our MTT outreach, building stronger defense partnerships in a dynamic security environment. NPS stands ready to support DoD, its allies, and its partners through our operationally-experienced multiservice and multinational student body and our world-class faculty.

ABOUT THE AUTHORS

Dr. Jeff Appleget is a retired Army Colonel who served as an Artilleryman and Operations Research analyst in his 30-year Army career. He teaches the Wargaming Analysis, Combat Modeling, and Advanced Wargaming Applications courses at NPS. He also teaches week-long Basic Analytic Wargaming Mobile Training Team (MTT) courses, with the most recent offering conducted in Adelaide, Australia for DST-Group (the Australian Government's Defence Science and Technology organization). He is the Joint Warfare Analysis Center (JWAC) Chair of Applied Operations Research at NPS. His research interests include Irregular Warfare and Stability Operations modeling, Amphibious Operations modeling, Wargaming, Combat Modeling, and Integer Programming. He was a member of the NATO SAS-091 Specialist Team (2012 Research and Technology Organization Scientific Achievement Award winner) that developed metrics to support decisions for the transition of responsibilities from ISAF to the Afghanistan Government. His other major awards include the Richard W. Hamming Faculty Award for Interdisciplinary Achievement (2016), Army Modeling and Simulation Office Analysis Award (2011), Dr. Wilbur B. Payne Memorial Award for Excellence in Analysis (1991 and 2003), Simulation and Modeling for Acquisition, Requirements, and Training (SMART) Award (2001 and 2003), and 1990 Concepts Analysis Agency Director's Award for Excellence. He served on the Military Operations Research Society (MORS) Board of Directors from 2000-2004.

Mr. Fred Cameron joined the Canadian Department of National Defence in 1974 upon graduation in mathematics from Dalhousie University in Halifax, Nova Scotia. He recently retired after more than 35 years as an operational research analyst. He has since been appointed a scientist emeritus by the Centre for Operational Research and Analysis in Ottawa. During his career, Mr. Cameron provided operational research for all three Canadian military services. From 1976 to 1978 he supported NORAD in its North American air defence mission. He then spent three years in the Netherlands with NATO, with a focus on air operations in the European theatre. From 1983 to 1988 he led the OR team in Victoria, British Columbia supporting Canada's west-coast navy, and had close collaboration with analysts at US Third Fleet on naval operations in the northern Pacific. His introduction to army problems came in 1988 with assignment to the Directorate of Land Operational Research in Ottawa. From 1998 he led an OR team in Kingston, Ontario dealing with future concepts for the Canadian Army. Mr. Cameron deployed to Macedonia and Kosovo in 1999 to provide OR support to the Commander of the Canadian Contingent in KFOR. Mr. Cameron has been an advisory director of the Military Operations Research Society since 2009.

Dr. Robert E. Burks, Jr. is a Senior Lecturer in the Defense Analysis Department of the Naval Postgraduate School (NPS). He holds a Ph.D. in Operations Research from the Air Force Institute of Technology and a M.S. in Operations Research from the Florida Institute of Technology and a bachelor's degree in Aerospace Engineering from the United States Military Academy. He is a retired logistics Army Colonel with more than thirty years of military experience in leadership, advanced analytics management and logistics operations who served as an Army Operations Research analyst at the Naval Postgraduate School, TRADOC Analysis Center, United States Military Academy, and the United States Army Recruiting Command. He has led multiple analytical study teams responsible for Army Transformation (organizational change) issues and his work includes applying analytical methods to develop solutions for complex problems in support of the Combined Arms Support Command, the Army's sustainment think tank and premier sustainment learning institution. In addition, he has served as the technical expert on studies involving deployment, equipping, manning, training, and logistics operations of military forces in multiple theaters of operation. He currently teaches the Modeling for Decision Making and Statistics Courses at NPS. His research interests include Irregular Warfare and Stability Operations modeling, Information Operations modeling, Wargaming and Agent Based Modeling and Simulation. His recent major awards include the Military Leadership Award (2013), Joint Service Warfare Award (2013), Military Operations Research Journal Award (2011) for developing analytical methods for solving the Theater Distribution Problem, and the Omar Bradley Fellowship for the Study of Mathematical Sciences (2011).

CAPT Jeff Kline, USN (ret) is a retired naval officer with 26 years of service, two ship commands, and time as a naval analyst in the Office of the Secretary of Defense. Jeff is currently a Professor of Practice in the Operations Research department and holds the Naval Postgraduate School's Chair of Systems Engineering Analysis. He teaches Joint Campaign Analysis, executive risk assessment and coordinates maritime security education programs offered at NPS. Jeff supports applied analytical research in maritime operations and security, theater ballistic missile defense, and future force composition studies. He has served on several U.S. Naval Study Board Committees. His NPS faculty awards include the Superior Civilian Service Medal, 2011 Institute for Operations Research and Management Science (INFORMS) Award for Teaching of OR Practice, 2009 American Institute of Aeronautics and Astronautics Homeland Security Award, 2007 Hamming Award for interdisciplinary research, 2007 Wayne E. Meyers Award for Excellence in Systems Engineering Research, and the 2005 Northrop Grumman Award for Excellence in Systems Engineering. He is a member of the Military Operations Research Society and the Institute for Operations Research and Management Science.