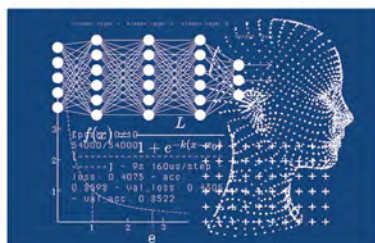
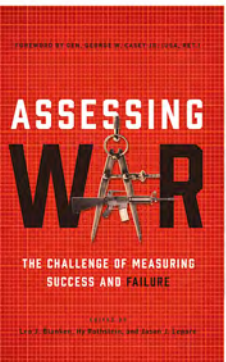
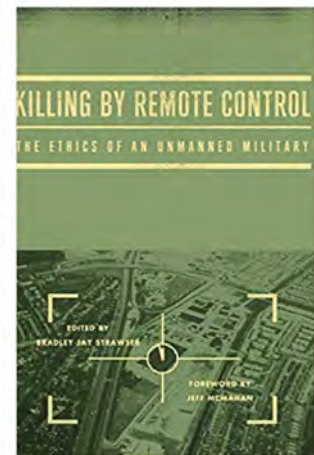
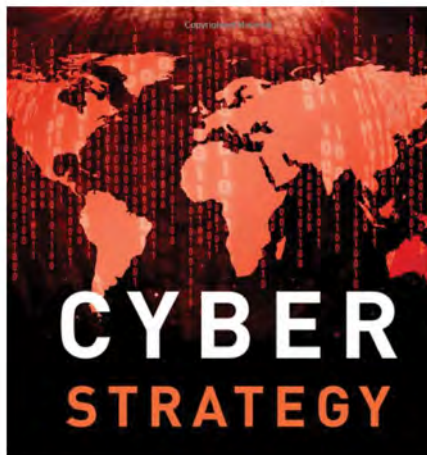


DEFENSE ANALYSIS



HIGHLIGHTS OF OPERATIONALLY IMPACTFUL NPS RESEARCH

Leveraging Education for Strategic Advantage

rev 5.12.2022



NPS MISSION

Provide defense-focused graduate education, including classified studies and interdisciplinary research, to advance the operational effectiveness, technological leadership and warfighting advantage of the Naval service.



DEFENSE ANALYSIS MISSION

The Defense Analysis Department of the Naval Postgraduate School (NPS) educates students in critical thinking and special operations. NPS maintains close integration between student/faculty research and the priorities of SOCOM, OSD, and SOF component commands.

HIGHLIGHTS OF OPERATIONALLY SIGNIFICANT NPS RESEARCH

NPS students and faculty of the Defense Analysis department have completed a broad range of research related to special operations and the Joint Force as a whole. Every student completes a thesis or capstone project to receive their 18-month Master of Science degree. Additionally, the faculty complete their own special operations—and defense—relevant research.

RESEARCH THEMES AND PROJECTS

Special Operations and Deterrence

In 2022, Dr. Tristan Volpe taught and researched the uses of deterrence. From studying the contribution of special operations to deterrence and how to measure it, he argues that the use of SOF for deterrence involves a tradeoff. On the one hand, low-signature operations do not clearly convey a willingness on the part of the United States to bear risk. On the other hand, low-signature operations allow an adversary to back down without feeling the pressure to respond to an overt military attack. In this way, special operations can help control escalation.

Special Operations and Space

In 2018, MAJ Phil Swintek (US Army) researched, created, and tested a satellite communications payload with the specific intent to support ground-force operations in signals-denied areas. A fellowship with SPAWAR enabled him to present his research on alternative solutions for providing new communications technology to SOF before an audience of more than 1,000 aerospace professionals, including directors of the National Reconnaissance Office.



In 2022, a student team of LT Austin Dumas, LT Jiles Maness, LTJG Chris Mears, and LCDR Hans Lauzen researched resilient communications architectures for standoff systems and intelligence, surveillance, reconnaissance, and targeting (ISRT) in an anti-access/area-denial environment. Their research found that proliferated lower Earth orbit (pLEO) satellite constellations via Starlink offer a resilient architecture for beyond-line-of-sight capabilities and for the command and control of unmanned systems.

Special Operations and Arctic Operations

In 2022, MAJ Barrett Martin, MAJ Mike Tovo, and MAJ Devin Kirkwood examined the question “How can the United States Army Special Operations Command influence Arctic policy, improve Arctic strategy, and optimize Arctic readiness?” They uncovered major gaps in equipping, doctrine, and training that need to be filled before the Joint Force can be combat effective in that region. In order for USASOC units to campaign in the Arctic and successfully partner with our High North allies in Arctic and sub-Arctic environments, they recommend that:

- ▶ SOCOM and USASOC publish Arctic guidance to ensure that tactical units clearly understand the desired end state for Arctic readiness.
- ▶ USASOC increase its footprint, training, and multi-domain operations in Alaska to improve readiness and increase homeland defense. This should include requisite permissions and authorities to operate in Alaska.
- ▶ SOCNORTH continue to develop clear C2 capabilities to allow units to work with PACOM soldiers in a NORTHCOM area with effects in the EUCOM area of responsibility.



Cyber and Information Strategy

In 2022, MAJ Kelley Jhong (US Army, winner of the Award for Outstanding Army Student) researched “Evaluating Artificial Intelligence for Operations in the Information Environment.” She finds that AI can assist practitioners in addressing four traditional challenges in OIE: analyzing the information environment, enabling in-house product development, enhancing the timeliness and scale of information dissemination, and improving the ability to measure effectiveness. To properly evaluate AI, model performance metrics—which have not been traditionally communicated to end users—should be accessible to and interpretable by practitioners. Jhong’s work was done in cooperation with DIUX.



In 2022, MSgt David Nass (USMC) completed his thesis on how to create “Cyber JTACS” that would coordinate cyber, information, and EW activities at the unit or team level. MSgt Nass received the Council of the Navy League Academic Achievement Award.

Dr. Shannon Houck and NPS graduate Maj Molly Dundon (USMC) wrote “Adversarial Propaganda: How Enemies Target the US to Fuel Division” in 2022. They stress that adversaries often portray America as systemically corrupt in order to influence Americans with preexisting grievances and to foster public discontent. Houck and Dundon advise that US military commands should both educate their ranks on how to recognize credible sources of information and instill a general skepticism of unknown sources of information.

Dr. Ryan Maness leads an ongoing project that involves students and professors at other universities to codify variables capturing state-initiated cyber and cyber-enabled information operations with the Dyadic Cyber Incident and Campaign Dataset (DCID). His analysis reveals that there is a tendency to exaggerate the use and impact of cyber operations as a coercive instrument, obscuring their role as an instrument of disruption, espionage, and sabotage. He also finds limited evidence of coordinated multidomain operations between military and cyber operators. For example, despite an increase in cyber operations during the Ukraine war, there remains little evidence that cyber capabilities are changing the course of war.

Unmanned Systems

MAJ Sean Redding (US Army) wrote “Creating Special Operation Force’s Organic Small Unmanned Aircraft System of the Future” in 2021, based on several field experiments conducted in partnership with private industries. His results suggest that integrating object recognition capabilities into a SOF team’s organic UAS can achieve the performance parameters necessary to fill the current gap in US SOF force protection and ISR requirements. His thesis is part of the semi-autonomous threat alert system (SATLAS) project, an ongoing effort by students at NPS to integrate object recognition software into autonomous operations.

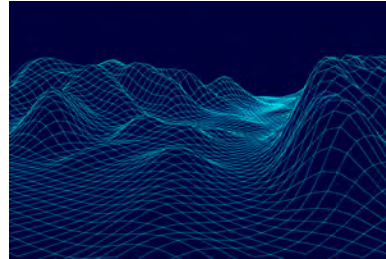


In his 2022 thesis, Capt Christian Thiessen (USMC) outlined the current technology used to counter unmanned autonomous systems (C-UAS) and proposes a defense-in-depth framework using air-

borne C-UAS patrols outfitted with cyber-attack capabilities. His main recommendation is the development of the Detachable Drone Hijacker—a small-size, low-weight, and low-power C-UAS device designed to deliver cyber-attacks over wireless communications against commercial UAVs.

Artificial Intelligence

In 2021, Maj John Bowman (USAF) examined the structure and capabilities of PRC smart cities. He found that such cities, with their integrated, government-controlled urban surveillance networks, could threaten AFSOC access. To overcome this obstacle, AFSOC could use cyber-attacks—such as distributed denial of service and software manipulation—to preserve access and placement.

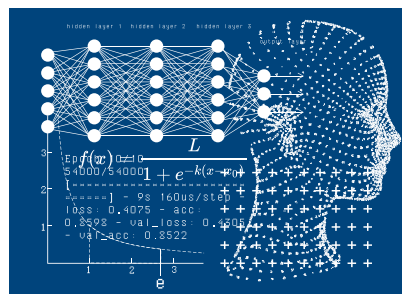


In 2021, Maj Randy Buckley (USAF) and Maj Jonathan Pryor (USAF) completed their thesis on “*Autonomous Maneuvering: An Advantage for AFSOC Aircraft*.” They worked with Merlin Labs on flight automation and how to incorporate a machine-trained system capable of performing defensive maneuvers into existing manned platforms to reduce reaction time. Two current students—Maj William Borges (USAF) and MSgt Daniel Christenson (USAF)—are now designing their thesis around the next steps to be taken in this research.

In 2022, MAJ LaMarke Patterson (USASOC) looked at how commercial imaging technology can better inform the targeting process for special operations forces. He created a prototype of a novel sensor, called Persistent Outward Reconnaissance System (POWRS), that is capable of conducting three-dimensional mapping and image recognition across different forms of terrain. He demonstrated that the sensor can collect geographic street-view imaging, conduct target-object identification, and increase force protection for the SOF and partner operator.”

Data Science

Over the past five years, Dr Camber Warren has conducted leading work on predictive sensing of adversary influence campaigns and future conflicts. His lab, the Coalition for Open-Source Defense Analysis (CODA), uses novel computational architectures and machine-learning algorithms based on a neural network to identify where radicalization and violence may occur globally. The system conducts a cross-lingual analysis of all available social media and mass media sources to generate spatio-temporal maps of communication patterns. Neural network algorithms then identify early-warning signs of radicalization on complex human landscapes and generate high-resolution predictions of the timing and location (down to a 5-km radius) of emergent threats.



CDR Milton Mendieta, Ecuadoran Navy, and a double major in Operations Research and Defense Analysis, wrote his thesis on “Predicting Collective Violence from Coordinated Hostile Information Campaigns in Social Media.” He wrote the code for training a deep neural network to identify linguistic patterns in social media associated with the outbreak of violence. The work represents a new level of technical sophistication in predicting what localities throughout the world are most at conflict risk. Milton’s thesis has been awarded the Chief of Naval Operations Award for Excellence in Operations Research.

Communications and Remote Advising

In 2015 and 2016, MAJ Eric Roles and a team of faculty and students conceptualized and tested software for remotely advising and assisting partner forces in combat by leveraging commercial satellites. The \$2 million capstone project became the RA/VAAK kit that was deployed to Iraq and Syria in the Counter-ISIS fight to communicate with and advise partner forces remotely. It directly affected the outcome of the 2016-17 battle for Mosul, Iraq.



MAJs Patrick Foley and Peter Harris completed their 2022 thesis on replacing unsecure commercial messaging platforms (such as WhatsApp and Signal) with secure digital tools for information-sharing with partner forces at the edge (Project ISHARE). MAJs Foley and Harris conducted field assessments in the Philippines and survey research with military officers representing over 25 allied and partnered nations, in addition to US military personnel, over the course of fourteen months. Results suggest that partner forces are open to adopting non-commercial secure messaging.

MAJ Scott Rowen wrote his 2022 thesis on the use of cryptocurrency and blockchain for clandestine communications, contract management, and improving data resiliency through peer-to-peer data security. He developed relationships with PayPal, MIT, and Stanford to carry out his research. Ultimately, he cautions, cryptocurrency is very difficult to use clandestinely.

Diversity, Inclusion, and Ethics

MAJ Megan Tucker (US Army) examined barriers to SOCOM’s diversity and inclusion implementation action plan in her 2022 thesis. Her assessment is that the main barriers are:

- ▶ The available talent pool is limited by who is qualified and who has propensity for broader service.
- ▶ A perspective gap between civilian oversight and SOCOM obscures whether diversity should be based on diversity proportional to American demographics (which is the benchmark in most policy documents) versus improved performance outcomes.
- ▶ Cultural paradigms within SOF of adherence to pre-existing standards at all costs and exclusivity/eliteness often goes hand-in-hand with sexism.



One of her foremost recommendations is a comprehensive civilian-military review to determine which standards are critical to meet the changing demands of the mission set in strategic competition and in remote and tech-enabled profiles. She cautions that SOCOM cannot and should not be expected to attain diversity proportional to American demographics.

In 2021, LT Paul Beauchamp (USN) conducted a systems analysis of strategies for integrating women into SOF. He highlighted that improving retention could be a cost-effective way to increase the number of women but the increase in total numbers would be modest.

Dr Bradley Strawser, who teaches ethics in the department, co-authored the groundbreaking book *Outsourcing Duty: The Moral Exploitation of the American Soldier*. It explores how America’s professional service members disproportionately carry the moral weight of America’s war-fighting decisions.

Irregular Warfare

Maj Josh “Bear” Dryden (USAF, winner of the outstanding Air Force student award) completed his 2022 thesis on the evolution of covert action across presidential administrations. He concludes with observations on covert action that may be relevant for strategic competition today:



- ▶ Broad objectives and urgency have led well-intentioned “bottom up” initiatives to diverge from national interests, undermining the desired ends.
- ▶ Attempting to replicate success by transferring methods from one region to another was a pitfall.
- ▶ Strategic evaluation is essential to ensure operations stay aligned with interests.

In their 2022 thesis, MAJ Ryan Ward and MAJ Leo Villalobos examined how special operations can use social movements against adversaries to achieve strategic objectives in irregular warfare. They conducted multiple linear regression tests of over 600 violent and non-violent events to determine what factors most prominently influenced the likelihood of a social movement achieving its goals. They found:

- ▶ Use of violent vs. non-violent tactics is a critical factor in a social movement’s success.
- ▶ Non-violent protest tactics have a statistically significant higher probability of success in democratic societies vs. autocratic societies.
- ▶ The objective of the movement, whether for regime change, independence, or merely increasing dissent, also makes a difference.
- ▶ Additional necessary conditions for an effective movement are collective identity, functional coordination with grassroots organizations that facilitate network development, and, above all, selection of leadership.

Their framework for evaluating a social movement’s utility is a tool analysts can use to determine whether devoting finite SOF resources to a social movement could yield success.

Social Network Analysis

For 15 years, NPS’s CORE Lab has led the field in social network analysis. Led by Dr Sean Everton, the lab has recently proved that social network analysis yields key insights when applied to strategic competition and the gray zone. Notable work includes:



- ▶ Mapping the relational, geo-spatial, and temporal structures of Russia’s information warfare network.
- ▶ Mapping the pro-Russian network embedded in the Ukrainian army and naval forces stationed in Crimea prior to the 2014 Russian occupation
- ▶ Assessing Russian attempts at extraterritorial assassination





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