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NPS NRP Executive Summary

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Report Date: 10 October 2018 IREF Project ID Number: NPS-18-M336-A

Naval Postgraduate School / School: (GSEAS/SE)



NAVAL RESEARCH PROGRAM

NAVAL POSTGRADUATE SCHOOL

MONTEREY, CALIFORNIA

ANALYSIS OF NON-LETHAL DIRECTED ENERGY WEAPON EMPLOYED IN AREA DENIAL MISSION SCENARIO

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Topic Sponsor: HQMC Plans, Policies and Operations

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EXECUTIVE SUMMARY

Project Summary

The operational threat environment is becoming more complex and uncertain as threat capabilities materialize and re-emerge from near-peer military competitors. A need for increased mission effectiveness, against a dynamic and technologically equal adversary, requires the development of new capabilities to defeat these emerging threats. Those uncertainties extend to the United States and regional security partners that may be susceptible to amphibious attack resulting in the need for an Operational Littoral Defense System (OLDS). Strategically significant amphibious operations will play an increasingly critical role in the projection of power and control in battle-space environments. OLDS attempts to deter, disrupt, and deny enemy forces from completing their amphibious operation. Non-lethal weapons (NLW) systems that are currently in service and/or under development by the Department of Defense (DoD) Joint Non-Lethal Weapons Program (JNLWP) are employed within OLDS and utilized in conjunction with lethal weapon systems to support defensive operations of an amphibious operating area by increasing lethality, reducing potential casualties, and increasing mission effectiveness. This study of NLW systems within OLDS addressed the impact of NLW systems in a traditional conflict scenario, provided insight to potential operational capabilities enhanced by NLW, and analyzed potential effects to lethality, survivability, and mission effectiveness.

Keywords: *non-lethal weapons, area denial, littoral operations*

Background

In recent years, the United States of America and their allies have shifted their military focus from the Middle East and United States Central Command (CENTCOM) area of responsibility (AOR) to focusing in regions dominated by near-peer military adversaries such as China and Russia as defined in the 2017 National Security Strategy. The consistent growth of their economic gains and political influence coupled with unprecedented gains in military capability present unique threats to national security that require dynamic solutions. In order to defeat these threats, the DoD and defense community has been charged to identify methods and ways of increasing lethality and the overall probability of mission success.

Based on the narrowing capability gaps between the DoD and our adversaries, there is a greater need to identify unique systems comprised of currently existing technologies combined with elements that are currently in development to meet those requirements. A potential also exists to reduce casualties associated with near future conflicts in order to reduce potential escalations in an increasingly unstable international security environment. This set of requirements has brought the focus of NLW into the forefront of winning potential future conflicts while being able to de-escalate hostilities to reduce collateral damages. This research project developed a concept to incorporate NLW systems with legacy, lethal weapons systems to provide increased lethality as required by the 2017 National Security Strategy.

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Findings and Conclusions

Increasing mission success through increased lethality and/or the provision for diplomatic de-escalatory off-ramps is critical to manage the security focus being placed on the South China Sea (SCS) due to growing Chinese territorial claims and expansion. The militarization of the SCS and illegal sovereign claims present a greater security risk to regional allies from the growing expansion and capabilities of the People's Liberation Army Navy (PLA(N)). These activities could potentially lead to an amphibious operation to advance Chinese security objectives in the SCS.

This research project developed an OLDS to defend against a potential enemy amphibious operation by a near-peer adversary. The study and culminating report identified a potential conflict scenario, order of battle, and subsequent analysis of conflict outcomes between an aggressive PLA(N) amphibious raid against an Armed Forces of the Philippines (AFP) defense of a targeted airfield. The OLDS was developed, modeled, and simulated as both a 'baseline' model comprised of only lethal weapon systems and an 'alternative' model comprised of current NLW and lethal weapon systems. The capabilities that are identified are assumed to be available with a potential deployment of 2025 and seek to deter, disrupt, and potentially deny an enemy amphibious operation. While NLW plays a key role in the implementation of OLDS, other system elements such as logistics support; sensors; command, control, communications, computer, intelligence, surveillance and reconnaissance (C4ISR); etc. must also be considered in the development of the OLDS.

The JP 3-02 *Joint Amphibious Operations* describes the processes and methods for conducting an amphibious demonstration/raid. We referenced the methodology used by the United States Navy (USN) and United States Marine Corps (USMC) to assume that near peer adversaries will conduct amphibious operations in a similar way. The major phases (Plan, Embark, Rehearse, Move, and Act) are the top-level functions of the enemy's amphibious demonstration/raid operations.

Each of these phases is further decomposed to lower level sub-functions and modeled with enhanced functional flow block diagrams (EFFBD). Once the red forces arrive in the operational area, NLW systems ashore will be utilized to disrupt their advance and deter a demonstration/raid operation from being conducted. NLWs utilized ashore would consist mainly of area denial systems and vehicle stoppers. These systems have parameters that are inputs for the model such as power level, range, and effectiveness. These determine the effectiveness of NLWs by modeling and simulating the distance the enemy travels to the objective area, rate of travel, time required to achieve success or to withdraw, and reduction of forces.

Our research team identified a specific order of battle for the OLDS, created architecture models and discrete event simulations, and then conducted statistical analysis between the OLDS baseline (only lethal weapons) and OLDS alternative model (includes lethal and NLW). The research identified that the OLDS alternative model was more effective against a potential enemy amphibious raid resulting in an increased mission effectiveness (defined as the percentage of enemy forces that fail to complete their mission and do not survive through all 5 phases) of 86.33% as compared to the baseline system that proved effective only 42.5% of scenarios. This shows that NLW systems can be integrated to deter, disrupt, and deny enemy

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amphibious operations potentially reducing friendly force casualties while increasing their lethality and mission success.

Recommendations for Further Research

Further analysis of existing and under-development NLW systems may provide commanders with new and undiscovered capabilities against near-peer adversaries in future projected operating environments. The greatest performance gap is situated in the early detection of the planning phase. NLW systems such as the Sairdrones and the Counter-electronics High-powered Advanced Missile Project (CHAMP) could increase the overall effectiveness providing early detection of enemy forces during the planning phase. Additionally, future modeling and simulation should include future NLW developments while working with warfare commanders and the JNLWP to model threats and a system of systems with integration of NLW systems into OLDS to support the defense of the littoral operating environment.

References

- Grooms, B E. 2001. *Joint Publication 3-02*. Washington, District of Columbia, September 19.
- MCWP-3-15.8. 2003. *MTTP for the Tactical Employment of Nonlethal Weapons*. Quantico: US Marine Corps Combat Development Command.
- NSC. 2017. *National Security Strategy*. Executive Office of the President of the United States.

Acronyms

AOR	Area of responsibility
AFP	Armed Forces of the Philippines
CHAMP	Counter-electronics High-powered Advanced Missile Project
C4ISR	Command, control, communications, computer, intelligence, surveillance and reconnaissance
DOD	Department of Defense
EFFBD	enhanced functional flow block diagrams
JNLWP	Joint Non-Lethal Weapons Program
NLW	Non-lethal weapons
OLDS	Operational Littoral Defense System
PLA(N)	People's Liberation Army Navy
SCS	South China Sea
CENTCOM	United States Central Command