

EVALUATING THE USE OF **NON-LETHAL WEAPONS** IN OPERATIONAL ENVIRONMENTS



The U.S. Department of Defense (DoD) is employing or developing various non-lethal weapons (NLWs) including acoustic hailers, eye-safe laser dazzlers, flash-bang grenades, blunt-impact munitions (e.g., rubber bullets), tasers, pepper balls, an active denial system that emits millimeter-wave energy to cause a temporary heating sensation, microwave-emitting technologies that disable vehicles and vessels, and systems that entangle vessels' propellers.

NLWs are used to minimize harm to civilians, to manage confrontations short of full-scale conflict (referred to as the *gray zone*), and for a variety of other purposes.¹ These weapons serve as intermediate force capabilities, a bridge between “shouting and shooting” that can influence behavior or temporarily incapacitate potential threats without inflicting permanent harm.² With increasing competition in the gray zone, the importance of these capabilities may expand because they can help demonstrate resolve while mitigating some of the risks of unwanted escalation.

Evaluating the tactical, operational, and strategic impact of NLWs is a challenge. Many DoD systems are assessed by the magnitude of the damage they inflict. But a different approach is needed to evaluate the impact of systems that deliberately aim to limit the harm that they cause. This brief summarizes a RAND-developed methodology to evaluate the impact of NLWs in a way that better informs DoD decisions about their development, acquisition, integration into military forces, and use in diverse contexts.

A Logic Model to Characterize Non-Lethal Weapons

The RAND team used a structure called a logic model to characterize the impact of NLWs. Although many styles of logic models exist, the version used in this analysis describes how the *inputs* that enable the use of NLWs are employed to conduct *activities* that contribute directly to *outputs*, then to higher-level *outcomes*, and, ultimately, to departmental-level *strategic goals* (see Figure 1). The team characterized the strength of the connections between adjacent elements of the logic model, which helped illuminate which logic model elements are most relevant to DoD strategic goals.

Turning to a deeper examination of this model, the inputs listed in the leftmost column consist of tangible and intangible inputs required to employ NLWs effectively and appropriately in a given situation. Most obviously, NLW employment requires the physical systems and the means to sustain their use. In addition, DoD must determine how and when personnel can and should use NLWs, and personnel must understand the operation of the physical systems and the broader guidelines for their use and be trained to employ them.

The second column of the logic model contains the activities that NLWs perform, such as hailing people to get their attention and communicate, distracting people to reduce their ability to act on possible malevolent intent, temporarily incapacitating them for the same reason, or affecting their mobility in ways that induce them to withdraw or disperse. Some NLWs may perform multiple activities even within a given context: a laser dazzler may, for example, distract a vehicle's driver while also affecting that person's ability to approach a particular location.

In the middle column are the outputs or direct results of NLW employment. Outputs include reducing various forms of risk of harm to U.S. personnel and civilians; increasing timelines, available information, and tactical options; affecting U.S. and other parties' costs; and enabling effective action in various situations despite constraints, such as restrictive rules of engagement.

The next column contains the outcomes. Outcomes are higher-level effects influencing how and where the United States can operate, the broadly defined costs incurred by U.S. operations, and the perceptions that they create. For example, a key outcome is avoiding alienation of authorities and people in a host nation.

Finally, strategic goals, listed in the rightmost column, are broad, department-wide goals set out by DoD leadership—specifically, the goals from the

LOGIC MODEL FOR NON-LETHAL WEAPONS



NOTES

CONOPS = concept of operations
 LOW = Laws of War
 ROE = rules of engagement
 TTP = tactics, techniques, and procedures

National Defense Strategy that NLWs can help fulfill.³ Although NLWs are obviously not wholly responsible for fulfillment of these goals, they can play a contributing role.

Using the Logic Model to Assess the Utility of Non-Lethal Weapons

The structure of the logic model, which connects inputs to the department's strategic goals, provides a framework by which to assess the impact of these capabilities. To conduct such assessments, the RAND team identified 97 metrics that can be used to help

evaluate how effective NLWs are regarding different columns of the logic model—that is, how effective they can be when employed in operational environments.

To relate the logic model and its metrics to real-life events and to evaluate the utility of those metrics in specific contexts, the research team developed and analyzed 13 vignettes in which NLWs might be used. These vignettes were also used to corroborate the hypothesis that NLWs are potentially useful in a wider range of tactical situations than those in which they are primarily used today.

Vignettes, which were based partly on past real-world experience, covered a variety of operational conditions, such as whether the adversary sought to escalate the situation, whether U.S. forces could feasibly withdraw, and whether

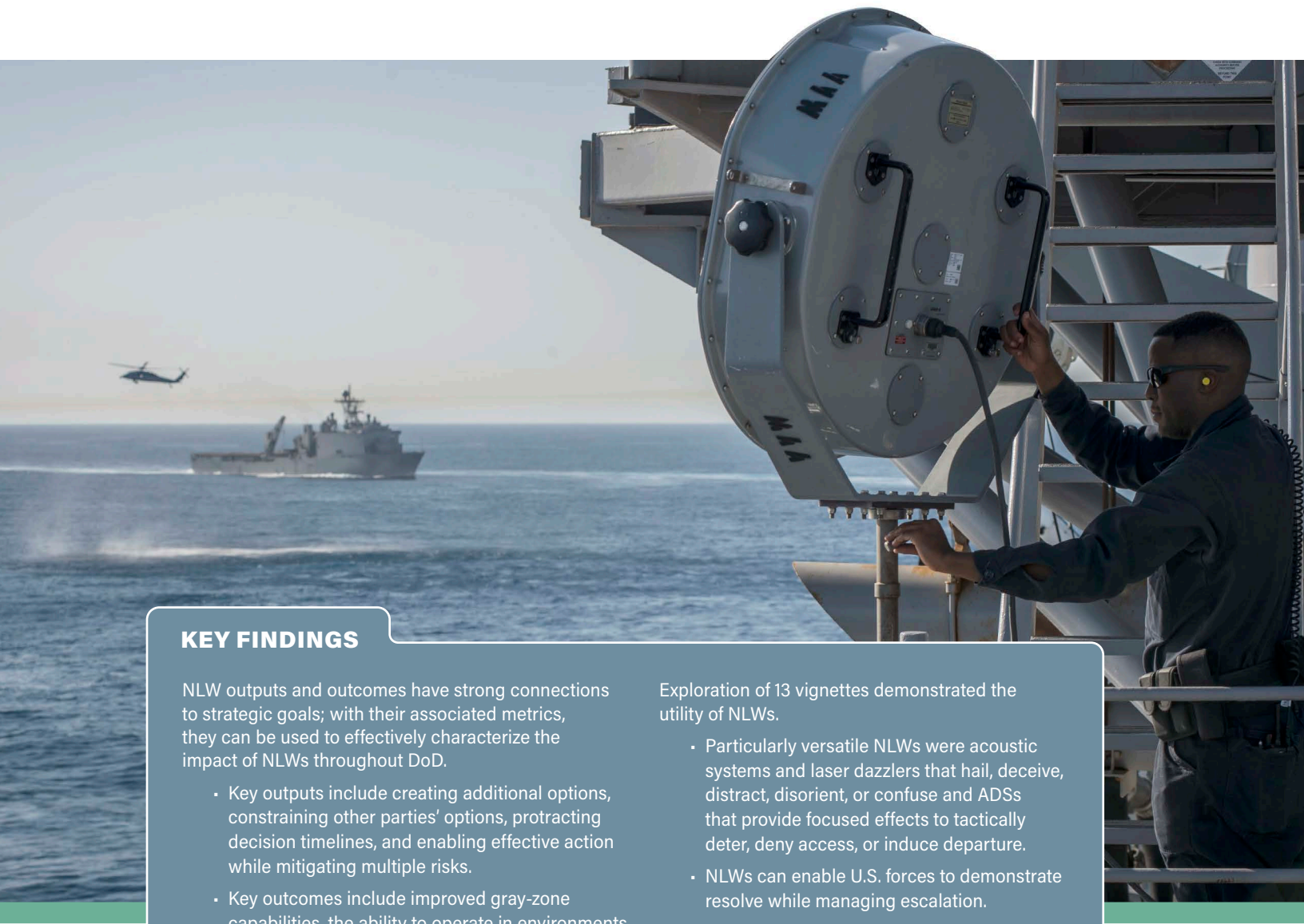


narrative surrounding the incident was stable. Examples included a motorized confrontation with Russian military contractors in Syria, countering aggressive behavior by Chinese ships or aircraft, and rescuing hostages in Somalia.

Applying the logic model and metrics to the vignettes illuminated *how* NLWs made a contribution to the operation, *which* NLWs were most applicable in certain contexts, and the *effects* on adversary actions and tactical risk, among other insights.

Despite their utility, negative perceptions about NLWs from some DoD stakeholders could inhibit their expanded use. The most likely barriers, which interact with and reinforce each other, include the following:

- Cultural and resource issues are the greatest challenge to NLW adoption, given the department's focus on lethal capabilities.
- Logistical concerns and constraints in the use of NLWs are often perceived as burdensome to the point that they are not carried into operational engagements.
- Opportunities for additional NLW usage are not widely recognized.
- Limited availability of NLWs and competing training demands often force units to de-emphasize the employment of NLWs, even when they might be useful.



KEY FINDINGS

NLW outputs and outcomes have strong connections to strategic goals; with their associated metrics, they can be used to effectively characterize the impact of NLWs throughout DoD.

- Key outputs include creating additional options, constraining other parties' options, protracting decision timelines, and enabling effective action while mitigating multiple risks.
- Key outcomes include improved gray-zone capabilities, the ability to operate in environments that would otherwise have been too risky, and enhanced perceptions of U.S. forces.

Exploration of 13 vignettes demonstrated the utility of NLWs.

- Particularly versatile NLWs were acoustic systems and laser dazzlers that hail, deceive, distract, disorient, or confuse and ADSs that provide focused effects to tactically deter, deny access, or induce departure.
- NLWs can enable U.S. forces to demonstrate resolve while managing escalation.
- Strategic impacts include improving capabilities below the level of armed conflict and proactively expanding the competitive space.



NLWs can make a valuable contribution to DoD capabilities in many contexts ranging from escalation management during encounters with other nations' forces to avoiding civilian casualties while transiting an urban environment. This research, centered around a logic model and associated metrics, offers a framework with which to evaluate the tactical, operational, and strategic impact of NLWs. It provides concrete descriptions of activities and relationships that illustrate how NLWs contribute to DoD strategic goals—contributions that have often been misunderstood or overlooked.

A clearer understanding of the capabilities and value of these weapons can help overcome negative perceptions of NLWs and inform future usage and development of these assets—with the aim of mainstream integration into overall DoD capabilities.

¹ According to a previous RAND report on the topic, “The gray zone is an operational space between peace and war, involving coercive actions to change the status quo below a threshold that, in most cases, would prompt a conventional military response, often by blurring the line between military and nonmilitary actions and the attribution for events” (see Lyle J. Morris, Michael J. Mazarr, Jeffrey W. Hornung, Stephanie Pezard, Anika Binnendijk, and Marta Kepe, *Gaining Competitive Advantage in the Gray Zone: Response Operations for Coercive Aggression Below the Threshold of Major War*, Santa Monica, Calif.: RAND Corporation, RR-2942-OSD, 2019, p. 8.

² See Susan Levine, “Beyond Bean Bags and Rubber Bullets: Intermediate Force Capabilities Across the Competition Continuum,” *Joint Forces Quarterly*, No. 100, First Quarter 2021, pp. 19–24.

³ James Mattis, *Summary of the 2018 National Defense Strategy: Sharpening the American Military's Competitive Edge*, Washington, D.C.: U.S. Department of Defense, 2018.

This brief describes work done in the RAND National Security Research Division and documented in *How to Effectively Assess the Impact of Non-Lethal Weapons as Intermediate Force Capabilities*, by Krista Romita Grocholski, Scott Savitz, Jonathan P. Wong, Sydney Litterer, Raza Khan, and Monika Cooper, RR-A654-1, 2022 (available at www.rand.org/t/RR-A654-1). To view this brief online, visit www.rand.org/t/RBA654-1. The RAND Corporation is a research organization that develops solutions to public policy challenges to help make communities throughout the world safer and more secure, healthier and more prosperous. RAND is nonprofit, nonpartisan, and committed to the public interest. RAND's publications do not necessarily reflect the opinions of its research clients and sponsors. **RAND**® is a registered trademark.

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