

Non-Lethal Weapon Human Effects

Establishing a Process for DoD Program Managers

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A new class of weapons is proceeding through the acquisition process that will ultimately provide the warfighter in the field with a much needed capability to “fill the gap” between a military mission of presence (show of force) and lethal firepower. This new class of weapons—known collectively as non-lethal capabilities—is intended to provide our political and military leadership with additional options in missions ranging from peacekeeping to major theater war. Included are counter-personnel non-lethal capabilities, with wide-ranging applications typical of the following:

- Incapacitating personnel participating in a riot.
- Clearing volunteer human shields from a potential military target.
- Counter-material capabilities for neutralizing facilities or equipment, with minimal collateral damage to personnel and the environment.

The development of non-lethal capabilities has brought with it new challenges to the DoD acquisition community and the program managers who are tasked to develop weapons that are both effective and primarily non-lethal against the span of the human population. This article describes the complexity of the human effects challenge and the development and implementation of a pilot program, instituted by the DoD Joint Non-Lethal Weapons Program (JNLWP), to standardize a process for human effects characterization of non-lethal weapons.

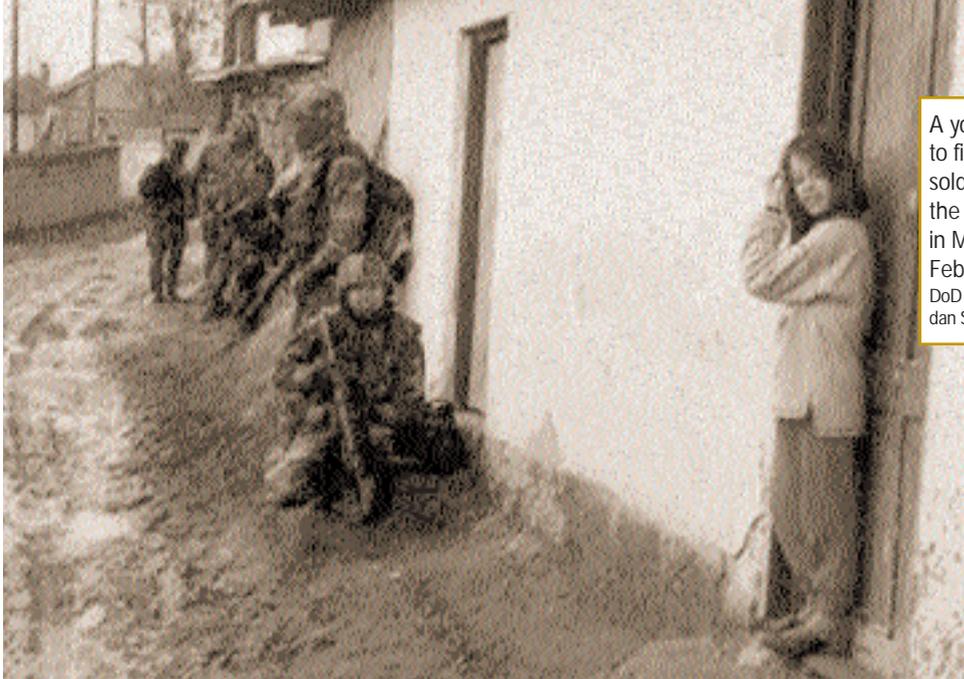


Soldiers of the 504th Parachute Infantry Regiment maintain crowd control as residents of Vitina, Kosovo, protest in the streets on Jan. 9, 2000. DoD photo by Army Spc. Sean A. Terry



Marine Gunnery Sgt. William Post (center) marches with the local children down the main street of Zegra, Kosovo, on June 28, 1999. DoD photo by Marine Sgt. Craig J. Shell

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A young girl is amused to find U.S. Army soldiers lined up against the walls of her house in Mitrovica, Kosovo, on Feb. 21, 2000. DoD photo by Army Sgt. Brendan Stephens

A Complex Challenge
Non-lethal weapons, as defined in DoD Policy Directive 3000.3., *Policy for Non-Lethal Weapons*, dated July 9, 1996, are:

“... weapons that are explicitly designed and primarily employed so as to incapacitate personnel or materiel, while minimizing fatalities, permanent injury to personnel, and undesired damage to property and the environment.”

While DoD policy makes it clear that the qualitative term “non-lethal” prescribes intent and is not meant to imply that non-lethal weapons will be non-

lethal 100 percent of the time against 100 percent of the human population, clearly, some type of quantitative definition or risk factor must be associated with non-lethal weapons so that the field commanders who order their employment will have an understanding of the risk associated with their use.



Air Force Brig Gen. Paul Nielsen, Air Force Research Laboratory, and Marine Col. G.P. Fenton, Director, Joint Non-Lethal Weapons Directorate, preside at the Human Effects Center of Excellence (HECOE) Ribbon Cutting and Memorandum of Agreement signing ceremony, June 7, 2001, at Quantico, Va. USAF photo by Dr. Michael Murphy

Additionally, program managers responsible for non-lethal weapon capabilities must have criteria thresholds to design and test against. Essentially, what does “non-lethal” really mean, and how do you test something to validate it as being “non-lethal”?

Many factors are associated with quantifying non-lethal weapons effects and effectiveness.



A Military Police squad from the 709th Military Police Battalion crosses a bridge in Sevc, Kosovo, where several hundred Kosovar Serbs were blocking the road on April 4, 2000. DoD photo by Army photographer Drew Lockwood

Diversity of Non-Lethal Weapons Technology
First, the types of technology associated with or proposed as non-lethal weapons are diverse, ranging from the relatively low-tech, ki-

“Safeguarding Peace—Safeguarding Life”



The JNLWP was formed to coordinate and integrate the development of all non-lethal weapon programs and activities in DoD. The JNLWP logo has a shield as a symbol of protection. A sword poised in a downward position representing non-lethal military protection of life and peace separates the four stars—one for each of the Services. The four stars are white, and the two halves of the shield are red and blue to represent the United States of America while the olive branches are symbols of peace. The insignia is presented over the earth, symbolic of our global commitments. The Latin motto, *Pax Custimus—Vita Custimus*, is loosely translated as “Safeguarding Peace—Safeguarding Life.”

netic, or blunt impact munitions, entanglements, and malodorants; to the more high-tech directed energy technologies such as millimeter wave electromagnetic energy and dazzling light.

Human Physiology

A second factor is the diversity of the human population and variations in physiology associated with age, gender, and even “average” individual health.

Uncertain Conflict Scenarios

Third is the number of varying situations in which non-lethal weapons may be employed. For example, troops protecting food stations may be faced with

more women and children than those in another scenario protecting a facility from a crowd of predominately male rioters.

All of these factors are relevant and contribute to the complexity of the problem. Accordingly, it is unrealistic to believe that a non-lethal weapon program manager will be able to build a weapon, test it, and determine with absolute certainty how well or poorly it will perform against its intended targets. The quandary is that this is exactly the type of information field commanders need to make educated decisions on its use.

Developing a Credible Process

The challenge is development of a process that will allow testing and validation of non-lethal effects and effectiveness that will give users and policy makers the confidence they need to employ these capabilities. This challenge is even more complicated by the fact that weapon system program managers in DoD historically have earned their degrees in engineering or physics, without any significant training in the medical sciences; and that traditionally, they have focused their work toward the goal of maximizing the probability of kill of a given weapon system.

Recognizing these challenges, in the summer of 1999 the Chair of the JNLWP Integrated Product Team (IPT) asked the Service Acquisition Executives and Service Surgeon Generals to provide representatives to form a Human Effects Process Action Team (HEPAT). The purpose of the HEPAT was to develop a process-based approach that non-lethal weapon program managers could use during the weapon development process.

The HEPAT met diligently for seven months, becoming familiar with the different non-lethal weapon programs and technologies, the various methods that existing non-lethal weapon program managers were using to assess non-lethality, and deliberating the common process that should be used by all DoD non-lethal weapon program managers.

From their deliberations, the HEPAT quickly recognized challenges in three distinct areas with respect to quantification of the human effects and effectiveness of non-lethal weapons.

No Assessment Process or Guidance

No published acquisition policy or guidance exists, in any DoD component, that requires program managers to characterize effects of non-lethal weapon systems on their targets. Program managers must rely on their own discretion to determine the approach for characterizing the effects and effectiveness of their non-lethal weapon systems.

State of the Science

The HEPAT reviewed ongoing non-lethal weapon acquisition programs (mostly blunt impact weapons) and the tools available for predicting their effects.

RUDIMENTARY EXISTING MODELS

At the time of the HEPAT's assessment, the only existing models for predicting blunt trauma injury were very rudimentary and based largely on data from the automotive industry. Models did not exist for the potential impact of bodily injury to major organs, nor were there mechanisms for coping with such injuries. In addition, models did not take into account the impacts of bodily injury on the young vs. the old.

EDUCATED ASSUMPTIONS

Models predicting blunt impact weapon effectiveness or human response were non-existent. Further, they were not validated for predicting injury caused by small, fast projectiles from non-lethal weapons. The first fielded weapons were assessed based on experience of law enforcement and educated assumptions on the part of the program managers.

DIFFICULTY IN DEVELOPING MODELS

Program managers of less mature weapon technologies (e.g., directed energy), because of their longer development timelines, have more lead time before fielding. But without expert help, they will also have difficulty assembling the data and developing the models needed to facilitate employment and acquisition decisions.

No Organization to Perform Assessments

The organizations that have developed some of the most promising injury prediction models are prohibited by their medical research mission and command policy from performing weapons effectiveness assessments for the non-lethal weapon developers. No organization within the Services or the DoD exists, with both the responsibility and expertise to provide technical research, analysis, or advice to the non-lethal weapon program managers for non-lethal weapon human effects characterization.

In addition, no single organization or agency reviews the data outputs of the characterization processes and ensures that they are adequate and that the data are presented in a manner useful to the Milestone Decision Authorities (MDAs) and weapon users.

Developing a Solution

The HEPAT identified three critical elements for establishment of a DoD non-lethal weapon Human Effects process. These include an independent review process, establishment of centralized human effects expertise, and use of a risk assessment approach for characterizing the effects and effectiveness of non-lethal weapons.

Independent Review

The HEPAT concluded that an independent review of the human effects characterization efforts for each non-lethal weapon program would be critical to its successful development and employment. Accordingly, the HEPAT examined several existing processes within the DoD for providing independent review of technical, health, or safety components of acquisition programs and decided to focus on the Navy's Weapons Systems Explosive Safety Review Board (WSESRB) process.

The WSESRB reviews testing and evaluation that has been conducted on explosives that will be stored and transported aboard Navy ships. As such, members of the board provide advice and guidance to program managers and MDAs who review the WSESRB assess-

ments during the milestone decision process. The HEPAT focused on this process because of two desirable characteristics: independence from the weapon developer and the credibility that the WSESRB has obtained within the Navy over the last 30 years (essentially no explosive goes on a Navy ship without a WSESRB review).

Analogously, the HEPAT recommended establishment of a Human Effects Review Board (HERB) for non-lethal weapons. The HERB would review the human effects data available on each non-lethal weapon system, assess and quantify the significant risks associated with the weapon system (including the risk that it will not be effective), and provide recommendations to the program manager and MDA that they can follow to adequately quantify and/or reduce the risk. The HERB's recommendations are intended to be considered as part of the milestone decision process for each weapon system.

Human Effects Support for Program Managers

Having determined an approach for independent review of human effects characterization, the HEPAT focused on the challenges that program managers face in analyzing and characterizing human effects. In the absence of any recognized DoD organization chartered with the human effects research mission and possessing the needed expertise, the HEPAT identified the need for a central focal point for non-lethal weapon human effects work. The HEPAT recommended the establishment of a DoD Human Effects Center of Excellence (HECOE) with the mission of aiding non-lethal weapon program managers in all facets of human effects planning, analysis, and testing.

The HECOE would serve as a repository of existing data and information, a resource to help program managers determine the appropriate research approach, and a resource to identify researchers from within DoD, academia, and the private sector. Further, the center would assist the program manager in research and data collection on human effects.

The HEPAT recommended the Air Force Research Laboratory Human Effectiveness (AFRL/HE) Directorate, Radiofrequency Radiation Branch, serve as the DoD non-lethal weapons HECOE. This organization was recommended due to its existing weapon development mission, biomedical expertise, and proven track record of non-lethal weapon development with the Active Denial Technology Program. Additionally, AFRL/HE is co-located with Army and Navy units as part of the Tri-Service Directed Energy Bioeffects Laboratory. The Army and Navy units have medical expertise to assist in a number of health protection areas and lend a critical multi-Service flavor to the organization.

Risk Assessment Approach

To address the challenge of adequately characterizing the effects and effectiveness of non-lethal capabilities against the span of the human population when it is not practical to collect complete test data, the HEPAT recommended that a risk assessment approach be used in describing the effects and effectiveness of non-lethal weapons. This is advantageous because military leaders make decisions based on risk; non-lethal weapons effects lend themselves to risk assessment since they are subject to physiological and psychological variability. A range of weapons, from lethal to non-lethal, can be compared using relative risk.

Implementing a Human Effects Pilot Program

The HEPAT's recommendations were unanimously endorsed by all Service Surgeon Generals and Service Acquisition Executives. After endorsement, implementation began almost immediately in September 2000, when the Joint Non-Lethal Weapons flag-level Integrated Product Team approved a two-year pilot program to evaluate the recommendations.

The HERB was formed with representatives from each Service's medical and biomedical research communities and chaired by the Joint Non-Lethal Weapons Directorate Health Effects Officer. The board began its work by first

reviewing near-term Joint Non-Lethal Weapon acquisition programs, including the Modular Crowd Control Munition, 40 mm Non-Lethal Crowd Dispersal Cartridge, 66mm Vehicle Launched Non-Lethal Grenade, and Portable Vehicle Arresting Barrier. Currently, the HERB is reviewing concept exploration efforts and will provide recommendations on pre-Milestone A programs as they approach that milestone decision.

On June 7, 2001, the HECOFE was formally established at a Ribbon Cutting and Memorandum of Agreement signing ceremony. Setting to work immediately, the center started by defining a specific human effects characterization process for non-lethal weapon program managers, assisting acquisition program managers with effects assessment, working with concept exploration program managers to incorporate human effects in the concept exploration process, developing a master non-lethal weapon

human effects database, and defining a risk assessment framework to describe non-lethal weapon effects.

A Solid Foundation and Continuing Effort

With the recommendations of the Human Effects Process Action Team and the successful implementation of these recommendations during the two-year human effects pilot program, the JNLWP has laid the foundation necessary to ensure that non-lethal weapons have appropriate human effects evaluations conducted, and that these evaluations are carefully reviewed through an independent process.

The Human Effects Center of Excellence has been established as a resource to 1) assist non-lethal weapon program managers in characterizing human effects, and 2) serve as a focal point for DoD in non-lethal weapon human effects data collection. The Human Effects Review Board will continue to provide valuable

advice and recommendations to non-lethal weapon program managers and MDAs that will assist them in reducing risk and ensuring that the soldier, sailor, airman, or Marine who uses a non-lethal weapon can do so with the utmost confidence as to the effect on target and overall weapon effectiveness.

Next Step

The next step is to formalize the non-lethal weapon human effects characterization process in DoD acquisition policy and regulations so they become a standard part of all non-lethal weapon acquisition programs. All of these measures will help put DoD non-lethal weapons on a firm footing for the 21st century and beyond.

Editor's Note: The authors welcome questions or comments on this article. Contact **LeVine** at levinesd@jnlwd.usmc.mil. Contact **Montgomery** at Noel.Montgomery@langley.af.mil.

EDLINK

Defense Electronic Business Program Office Launches New eBusiness Education Web Site

Fulfilling its mission to accelerate integration of eBusiness techniques into DoD's operations, the Defense Electronic Business Program Office has launched **edLINK** to provide easy access to DoD eBusiness information. The **edLINK** Web site, <http://www.interactionnet.com>, is designed specifically to provide DoD educators with information that can easily be incorporated into current and future courses. Prime candidates include courses related to program management, contracting, logistics, supply, and supervisor or manager development.

In addition, the Defense Electronic Business Program Office provides a LIST SERVE, which complements **edLINK** and is a useful communication network for the exchange of eBusiness curriculum-related information among DoD's education com-

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As a DoD instructor, your support in promoting these eBusiness resources is vital. DLA welcomes your participation and anticipates that these tools will become a valued part of your academic endeavors.

For further information on **edLINK**, contact Stan Dubowski at stanley_dubowski@hq.dla.mil; or call 703-767-0614, DSN 427-0614. Any technical questions or suggestions regarding **edLINK** should be directed to Allen Van Brunt, DoD eBusiness Education Program Analyst, LLD, Inc., at avanbrunt@corp.ild.com; or 703-925-0660, ext. 540.

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