

# THE ACTIVE DENIAL SYSTEM: OBSTACLES AND PROMISE

BENJAMIN BUCH AND KATHERINE MITCHELL

The Active Denial System (ADS) is a non-lethal weapons technology that uses millimeter-wave directed energy to arrest and deter potential adversaries. Developed by the Air Force Research Laboratory and the Department of Defense's Non-Lethal Weapons Program, ADS provides U.S. forces with a highly effective means of responding to potential threats while also preserving human life.

Despite its promise, ADS has confronted non-technological challenges in its deployment, most recently in Afghanistan. This brief analyzes the political, psychological, and sociological barriers to the use of non-lethal directed energy weapons. Specifically, it surveys the psychological and sociological biases against radiation-based and non-lethal technology and how these prejudices were overcome in the past. It also examines potential human rights concerns and political complications that might arise from the deployment of ADS in population protection operations. Given these obstacles, the report proposes a series of recommendations for the use of ADS moving forward.

## **The Changing Nature of Warfare**

The two decades following the conclusion of the Cold War have presented a new strategic and operational landscape for American military planners. The overwhelming conventional superiority of the United States has encouraged adversaries to adopt unconventional asymmetric strategies and tactics.

### Rise of Asymmetric Conflict

Given U.S. conventional military supremacy, American forces have increasingly encountered adversaries who seek to exploit asymmetries in vulnerability, logistics, and organization through the novel use of strategy, tactics, and technology. This asymmetric form of warfare avoids traditional force-on-force confrontations in which U.S. forces dominate. Instead, adversaries seek and use relatively low-cost means to increase U.S. military and civilian casualties and hinder operations. In addition, these adversaries have shown a growing tendency to harness information networks to affect the perceptions of decision-makers and populations in the United States, the host nation, and the international community.<sup>1</sup>

## Implications for Population Centric Warfare

Population centric warfare involves those conflicts in which the outcome depends on garnering and maintaining the support of local and domestic populations, normally associated with peacekeeping and counterinsurgency (COIN) operations.<sup>2</sup> Due to the rise of asymmetric strategies and tactics, U.S. forces can expect adversaries to increasingly take advantage of aversion to military and civilian casualties in order to weaken popular support for U.S. operations. Part of such an effort will be adopting strategies that bait U.S. forces into overusing their conventional superiority in an attempt to cause greater civilian casualties and collateral damage. This aversion reinforces the importance to operational planners of adopting alternative metrics of mission success in population centric warfare, such as:

- Number of civilian casualties;
- Collateral damage to civilian infrastructure; and
- Domestic and international public opinion.<sup>3</sup>

Moreover, population-centric warfare reinforces the need for U.S. forces to have a wide range of non-lethal force options in order to limit civilian casualties and collateral damage when engaged in peacekeeping and COIN operations.<sup>4</sup>

## **The Promise of ADS**

The use of conventional lethal and non-lethal weaponry by U.S. forces may cause civilian casualties and collateral damage, alienating local populations.<sup>5</sup> However, ADS is a revolutionary non-lethal weapon that could mitigate many of the problems U.S. troops face in population protection missions. ADS uses millimeter wave technology to heat moisture just below the skin's surface, creating an intense sensation of heat. This sensation prompts an immediate and reflexive flight response in the target.

ADS is a unique technology for four reasons:

1. *ADS is a single weapon that can provide a spectrum of deterrence options.*

Unlike lethal weapons and a variety of non-lethal weapons—such as the TASER, rubber bullets, pepper spray, and tear gas—ADS can operate along a wide spectrum of deterrence, as the frequency of its millimeter wave is adjustable. The device can also be used for a single warning or the repeated deterrence of human targets.

2. *ADS does not physically damage its targets.*

The intense sensation of heat caused by ADS allows troops or law enforcement to protect themselves and their assets without having to resort to lethal or even harmful force. When operated in the 94-95 GHz frequency range, ADS's millimeter wave has no long term adverse health effects. ADS's ability to leave its targets uninjured, painless, and fully functional post-use is a revolutionary feature in the realm of non-lethal weapons technology. A 2008 Human Effects Advisory Panel study showed that ADS repels its targets at a lower temperature than would cause first- or second-degree burns, and causes no pain, injury, or incapacitation as soon as targets step out of the millimeter wave beam. During the only incident in which ADS has been shown to produce injury, it was found that, because of a technical malfunction, ADS had been operated outside of its standard power and duration settings.<sup>6</sup>

3. *ADS acts on single human targets, minimizing collateral damage.*

Unlike other non-lethal weapons systems, like the Long Range Acoustic Device (LRAD) or chemical crowd control systems, ADS's energy beam can precisely target individuals.<sup>7</sup> This feature allows U.S. forces to selectively deter instigators or potential perpetrators of violence, while minimizing harm to innocent bystanders.

4. *ADS acts at a range and efficacy unprecedented in the realm of non-lethal technology.*

ADS exceeds the range of traditional non-lethal weapons allowing for effective use far beyond the effective range of small arms.<sup>8</sup> In addition, traditional forms of protection against non-lethal weapons, like thick clothing, do not counter ADS's millimeter wave.<sup>9</sup>

#### ADS: Technical Specifications

In response to its early promise, ADS was designated an Advanced Concept Technology Demonstration between 2002 and 2007.<sup>10</sup> Two ADS models were produced from this process:

- *System 1* is mounted on a modified High Mobility Multi-Purpose Wheeled Vehicle (HMMWV); and
- *System 2* is a self-contained, box-shaped model transportable via tactical vehicles larger than the HMMWV.

Both systems use a millimeter wave generator that operates in the 94-95 GHz range. In 2008, System 2 underwent a Capabilities and Liabilities review and was deemed ready for deployment.<sup>11</sup>

### Initial Deployment and Public Response

In 2010, ADS was introduced into two theaters—U.S. COIN operations in Afghanistan and the Los Angeles County prison system—and then withdrawn.<sup>12</sup>

ADS attracted wide coverage in the media during and after its initial deployment.<sup>13</sup> While most early coverage was neutral and focused on the technical development of ADS, later coverage emphasized both the positive and negative aspects of the technology.

- Positive media coverage centered on the ability of ADS to limit civilian deaths, its utility in dispersing mass demonstrations, and its technologically novel aspects, such as its range, economic value, and ability to limit collateral damage.<sup>14</sup>
- Meanwhile, negative media coverage focused on the "science fiction" nature of the technology (i.e., its ability to cause pain from a distance), the potential for a backlash among target populations in theaters of use, and possible unanticipated adverse health effects.<sup>15</sup>

### **Political Barriers to the Deployment of ADS**

Two characteristics of ADS's millimeter wave technology pose political problems for its successful deployment:

1. *ADS has the potential to cause severe pain without leaving a visible mark or physically harming its target.*
2. *ADS acts silently and invisibly.*

These two characteristics produce the following political obstacles to the use of ADS:

### Human Rights Concerns

Unethical regimes or personnel could easily deny abuses of ADS, as the device leaves no physical evidence of its use. In addition, because ADS is a new and radiation-based technology, there is fear that exposure could lead to long-term health effects. While few human rights organizations have explicitly commented on ADS, many have expressed deep concerns regarding the use of non-lethal weapons: An analysis of these concerns can help shed light on likely future objections to ADS deployment and use.<sup>16</sup>

- *Amnesty International*: Amnesty International has been the most outspoken critic of non-lethal weapons, particularly of conducted energy devices (CEDs).<sup>17</sup> It has recommended the recall of all non-lethal weapons on the grounds that their abuse

is easy to conceal, and that they are potentially deadly if used on targets with some medical conditions.<sup>18</sup>

- *Human Rights Watch*: Human Rights Watch does not oppose the use of non-lethal technology on principle; in fact, it has supported their use as an alternative to lethal force in places like New York City, Kazakhstan, Tibet, Yemen, and Uganda.<sup>19</sup> However, in a 2007 interview, Marc Garlasco, a former senior military expert for the organization, argued that, although ADS is preferred to lethal force, it has the potential to be used excessively due to its non-lethal nature. Law enforcement literature confirms Garlasco's fear that the availability of non-lethal force can prompt an "increase in the total incidence of force."<sup>20</sup> Garlasco also expressed concern about ADS's long-term health effects.<sup>21</sup>
- *United Nations*: In 2004, the UN's Special Rapporteur on Torture Theo van Boven released a report on the development and sale of technology specifically designed to inflict pain.<sup>22</sup> In Article 30 of the report, Van Boven concluded that non-lethal weapons could be used for "torture and ill-treatment" and recommended extensive testing, "stringent training [for their use], and restrictions on their transfer."<sup>23</sup>

All of these organizations speculate that states and non-state actors alike could easily abuse non-lethal weapons with impunity, given that they leave no physical trace. In a 1997 report, Amnesty International alleged that twelve states, including the United States, had abused CEDs.<sup>24</sup> Additionally, Human Rights Watch and United Nations officials worry that there has been insufficient testing of the long-term medical effects of non-lethal weapon use, especially testing that examines how non-lethal weapon exposure will interact with pre-existing medical conditions.

### Psychological and Sociological Biases

There is currently a low level of awareness of ADS among the general public. However, ADS is similar to other radiation-based technologies with which the public is familiar and researchers have documented an entrenched psychological bias against these technologies. This bias is likely to pose a significant obstacle to the use of ADS at home and abroad. For example:

- In a 2000 study, Lennart Sjoberg reported that radiation was one of the four most frightening phenomena according to approximately 700 participants who were surveyed about a variety of terrifying situations. Additionally, when asked about a Chernobyl-like nuclear disaster, participants indicated that they were more afraid of the mere presence of radiation than the actual catastrophic nature of the accident. The participants also said that they felt radiation technology was "tampering with nature."<sup>25</sup>

- A number of psychological studies have shown that radiation is one of the four main “modern health worries” that have resulted from the emergence of new technologies.<sup>26</sup> Individuals for whom radiation is a primary worry also reported experiencing increased physical sensitivity to the effects of radiation-based technologies.<sup>27</sup>
- Victims of nuclear accidents, such as those in Chernobyl in 1986 or Fukushima in 2011, suffer from more persistent psychological trauma than victims of natural disasters where the physical damage incurred was of a comparable scale.<sup>28</sup>

There are two characteristics of radiation technology that most worry the public and could cause it to view ADS as a particularly frightening weapon:

1. *Radiation has the potential to cause permanent damage.*

Unlike conventional weapons, radiation is known not only to cause immediate contamination but also long-term, irreversible biological damage.<sup>29</sup> The potential for permanent injury underlies the fear of and hostility towards radiation technologies. For example, there was a substantial public backlash to the use of depleted uranium ammunition in the Gulf War by U.S. forces in the early 1990s.<sup>30</sup> Despite medical testing that indicates the technology is safe, ADS’s use of radiation could also spark fears that it is carcinogenic.<sup>31</sup>

2. *Radiation invisibly penetrates the human body.*

Traditional weapons, like bullets, cause successive levels of pain as they visibly penetrate a target’s body. But like other radiation-based technologies, the effect of ADS is invisible. Its millimeter wave imperceptibly and inaudibly causes a sensation of burning under the surface of the skin and cornea while leaving the skin’s outer surface intact.

Radiation’s invisible penetration of the human body is problematic for the acceptance of ADS on two levels.

First, the ability of radiation to leave no trace while causing internal damage gives radiation technologies the stigma of “tampering with nature.”<sup>32</sup> As such, they are viewed as more frightening than new technologies that use more conventional delivery mechanisms.<sup>33</sup> Because ADS could be perceived as invisibly tampering with human biology, it is more likely to be met with public resistance than other forms of non-lethal weaponry.

Second, in cultures where folklore plays a significant role in group identities, ADS may be perceived as a magical or supernatural instrument of evil. Therefore,

ADS has the potential to be used as a tool to turn the population against U.S. military operations.

Insurgent and counterinsurgent leaders alike have manipulated local beliefs in superstition for strategic gain in asymmetric conflicts, such as those in the Philippines, the Congo, and India.<sup>34</sup> For example, the Filipino government scared away Han rebels from their strongholds in 1953 by convincing them that vampires resided there.

Consequently, ADS could be a powerful propaganda tool for insurgents in missions like Afghan COIN operations, where tribal populations hold superstitions against invisible “jinns” who cause misfortune or illness.<sup>35</sup> Because ADS acts with no visible cause-effect mechanism, U.S. forces will have difficulty proving to target populations that ADS is not the root cause of later misfortunes among them.<sup>36</sup> Furthermore, insurgent leaders may convince local populations that, even when they do not feel the burning sensation that accompanies ADS, they are continuously exposed to radiation because of the presence of ADS.

Acceptance of new technology occurs not only through spreading awareness of its benefits, but also through a long-term process of socialization.<sup>37</sup> Conducting a few successful and effective test missions will be crucial in helping domestic and foreign populations understand ADS’s safety and usefulness.

Further, ADS deployment must be accompanied by aggressive efforts to gain the support of tribal or traditional authorities for use of the weapon. Any information campaign addressing the fears of ADS within a population must take into account local norms, religions, and superstitions.

### Legal Challenges

The increase of non-lethal weapon use in combat has raised concerns regarding their compliance with the two principles of *in jus bello*, or the legal concept of “justice in war”.<sup>38</sup>

- *Discrimination: In jus bello* dictates that force must not be used against noncombatants. While the application of this concept within the framework of lethal force is straightforward, its application to the use of non-lethal weapons is contested, as non-lethal weapons are often used with the express knowledge that they may target civilians.<sup>39</sup>
- *Proportionality: In jus bello* dictates that “enemy combatants should not be subjected to unnecessary suffering and superfluous injury.”<sup>40</sup>

The potential legal obstacle to the use of non-lethal weapons is that they “reduce lethality by making force itself less lethal while also *increasing* the likelihood of civilian exposure

to that force.”<sup>41</sup> For ADS in particular, discrimination is a bigger concern than proportionality. The utility of ADS to the U.S. Armed Forces lies in its ability to determine the intent of approaching individuals; therefore, ADS’s mandate is, in part, to be used against non-combatants. As Human Rights Watch’s Marc Garlasco discussed, the use of ADS is ethically and legally problematic because it is likely to be employed more frequently against non-combatants than lethal weapons.

While ADS does not violate any explicit international statutes on weapon use in military operations, the 1997 Additional Protocol to the Geneva Conventions provides concrete legal guidelines that should shape future ADS deployments. Article 35.2 of the Additional Protocol reads: “it is prohibited to employ weapons, projectiles, and methods of warfare of a nature to cause superfluous injury or unnecessary suffering.” Therefore, when ADS is used, the group responsible for deployment must demonstrate that it does not cause superfluous injury or unnecessary suffering.<sup>42</sup>

## **Recommendations for Fielding and Improving ADS**

This brief presents a series of recommendations for combating the potential obstacles to the use of ADS. It is crucial that these political barriers are overcome if ADS is to be employed in conflicts where population support is a key metric for success.

### Human Rights Concerns

Human rights organizations are primarily concerned with three possibilities:

- *ADS will be abused without leaving physical evidence on its victims.*
- *Because ADS is non-lethal, operators will feel more comfortable using it either indiscriminately or more often.*
- *ADS may cause long-term health effects and be lethal to targets with prior medical conditions.*

To combat these concerns, this brief recommends the following:

- *Recommendation #1: Limit ADS ownership to U.S. forces or allies with strong human rights records.*

While the United States can enforce standard operating procedures for ADS among U.S. operators, it cannot control how ADS is used by other states. In light of the sensitive nature of ADS, we recommend that ADS or civilian-made equivalents (e.g., Raytheon’s “Silent Guardian”) should not be sold to foreign actors through Foreign Military Sales (FMS) or Direct Commercial Sale (DCS), except to close allies with strong human rights records.



At present, ADS has not been labeled by the DOD as a “program of record,” and, therefore, it does not qualify for transfer under the FMS program.<sup>43</sup> However, this does not preclude the sale of civilian-produced equivalents, such as the “Silent Guardian,” through the process of DCS.<sup>44</sup> Additionally, the DOD should take steps to ensure that ADS does not fall into the hands of irresponsible or unstable foreign actors through theft of the device.

Preventing unwanted foreign acquisition of ADS is particularly important as the technology has not yet been used in a large-scale deployment by U.S. forces. If abused by foreign governments, the technology will lose much of its strategic utility for U.S. forces. In addition to eliminating an existing technological superiority, foreign use will undermine U.S. efforts to encourage a positive public perception of the device. More specifically, the misuse of ADS technology by foreign governments likely will result in the weapon being labeled as a tool of oppression.

- *Recommendation #2:* Equip ADS units with video recording systems and establish a credible chain of command for the recordings of ADS use.

Every ADS unit should be equipped with a tamper-proof video recording mechanism that tracks the user, date, time, duration, and beam intensity of each instance when the millimeter wave is fired and sends this data to a central database. Similar recording mechanisms are found in the TASER’s AXON device, which exports video recordings of police TASER use to an external database via a camera attached to the officer’s head. This allows officers to show the precise situations they faced when using the TASER. A digital fingerprint on each file ensures that the video recordings in the central database cannot be tampered with.<sup>45</sup> Recordings of ADS uses should regularly be made available to the international media, human rights organizations, and senior commanders to demonstrate the appropriate use of the device.<sup>46</sup>

This modification will serve two important purposes:

First, keeping permanent records of ADS uses will protect U.S. troops from wrongful prosecution should hostile target populations make false allegations of abuse. Mitigating the potential for such accusations will not only assuage fears that U.S. troops may have about using this technology, but will also protect the reputation of the U.S. Armed Forces internationally and among populations where ADS is deployed.

Second, installing a permanent data recording and transmission capability will help the United States identify any ADS abuse by its forces. This capability will allow the United States to punish those operators who violate the established standard operating procedures.

- *Recommendation #3:* Outline clear operational and tactical doctrines.

ADS deployment and operational training should include a “Use of Force Continuum,” such as the one employed by many U.S. police departments, and should look to protocols for the use of CEDs, like the TASER, as models.<sup>47</sup> For example, by developing a new doctrine that linked specific suspect behaviors with appropriate responses, the Orlando Police Department doctrine substantially improved the public image of CEDs.<sup>48</sup> In the case of ADS, it will be important to tailor these tactical doctrines to the specific operational conditions in each theater where ADS is used.<sup>49</sup>

- *Recommendation #4:* When possible, publicize the punishment of any troops who abuse ADS.

It will be important to demonstrate to both the U.S. public and the international community that there will be tough oversight of ADS use. Police departments in the United States and abroad have sought to reassure a skeptical public by widely publicizing incidents in which officers were punished for CED-related infractions.<sup>50</sup> This practice would be particularly important when deploying a system in a delicate operational environment, such as COIN. Therefore, when military guidelines permit, any punishments following incidents of abuse should be publicized to demonstrate that the U.S. Armed Forces are committed to maintaining a positive relationship with populations among whom ADS is deployed.

- *Recommendation #5:* Fund independent medical research on health conditions that could make the use of ADS dangerous.

The U.S. government should fund further independent research on medical conditions that may amplify the severity of ADS’s effects. Additional research will increase public confidence in the findings of the 2008 Human Effects Advisory Panel study of ADS. CEDs faced similar concerns and, in response, studies were conducted to determine the effect of CED use on targets that had different levels of intoxication or preexisting heart conditions.<sup>51</sup>

### Psychological, Sociological, and Legal Concerns

The use of millimeter wave radiation by ADS raises four psychological, sociological, and legal obstacles to public acceptance of the device:

- *Even harmless irradiation is widely associated with permanent damage.*
- *Radiation is perceived as “tampering with nature.”*

- *Due to its invisible, inaudible operating mechanism, the use of ADS may be exploited by adversaries in theaters of use where local superstitions are rampant.*
- *ADS violates the discrimination principle of jus bello. In trying to use ADS to determine intent, operators will likely target innocents as well as belligerents.*

To combat these concerns, this brief recommends the following:

- *Recommendation #6:* Associate ADS with commonplace radiation technologies in public relations campaigns.

Associating ADS with a harmless device, such as the airport body scanner that uses similar millimeter wave radiation, will encourage a positive (or at least neutral) view of the technology. Not only will this association quell fears that ADS could cause permanently harmful health effects, but it will diminish ADS's current negative association with microwave oven technology and the corresponding fear of being 'cooked' when exposed to its beam.

- *Recommendation #7:* Rename ADS.

Operators should choose a name for ADS that is free of negative language like "denial." Renaming the device will help limit the association of ADS with negative terms like "pain ray" or "microwave" that are prevalent in media coverage, which reinforce stereotypes that all radiation technologies tamper with nature.

Additionally, ADS should be given a name that emphasizes its use as a tool of non-lethal engagement and cooperation with target populations. In the case of LRAD, the military focused on the loudspeaker aspect of the device to reinforce the perception that it is mainly a defensive system. LRAD was labeled an "acoustic hailing device," which emphasized that its purpose is to warn and communicate with civilians.<sup>52</sup> "Active denial" indicates that operators of the system are opposed to their targets, even if those targets are innocent or are approaching U.S.-manned posts to seek council or to express legitimate grievances. This notion is counterproductive to the goals of population-centric U.S. missions.

Any new name should emphasize the defensive aspects of the system or its role in determining target intent. For example: Area Defense System (ADS), Non-lethal Intent Determination System (NLIDS), or Millimeter Wave Deterrence System (MWDS).<sup>53</sup>

- *Recommendation #8*: Include optional warning mechanisms with ADS.

Introducing warning signals with ADS is an important step towards mitigating public fear of the device due to the invisibility of its beam. A warning signal would be a particularly useful addition to the device in theaters where the local population has superstitions against invisible, malevolent entities.

Most audio and visual warning systems have a shorter range than ADS and, therefore, would be ineffective. However, the laser dazzler, a non-lethal weapons technology that uses laser technology to cause temporary vision impairment and disorientation in subjects could be an effective warning system. Unlike traditional warning mechanisms, it has a range similar to that of ADS. Pairing ADS with a laser dazzler would allow operators to provide targets with early warning and allow for a greater spectrum of deterrence. For example, a laser dazzler could signal to an individual that he or she is being targeted by ADS. If the dazzler fails to deter a target, then ADS could be used to inflict increasing levels of pain, starting with a mild sensation of heat and progressing to an intense burning sensation, to alter the target's behavior.

Another option would be a warning system where potential targets could opt to receive cell phone messages announcing when the device is present or in use. This warning system would require cooperation with authorities with access to the local phone systems. But the primary advantage of a warning system would be that it allows direct interaction with a sizeable portion of the target population, further mitigating the negative political and psychological effects of ADS use.<sup>54</sup>

A warning system, combined with clear tactical doctrines and recording mechanisms, also demonstrates the desire to minimize its use on civilians. These steps will go a long way to mitigate concerns of ADS violating the discrimination principle of *jus bello* legal theory.

- *Recommendation #9*: Hold domestic public demonstrations coinciding with deployment.

When ADS is introduced in a theater, it should be frequently and publicly demonstrated to preempt misperceptions or rumors. A common tactic to promote CED acceptance has been public demonstrations on local police officers.<sup>55</sup>

The “media days” held to demonstrate ADS between 2007 and 2012 are examples of such outreach campaigns. Any future deployment should include further outreach efforts, not only in the United States, but also among target populations. Ideally, demonstrations will include local elites, as respected leaders will play a critical role in encouraging positive dialogue about the technology.

- *Recommendation #10*: Publicize the challenges necessitating the deployment of ADS.

Another important step to overcoming political barriers to ADS deployment is to convince the American public of the need for ADS to protect our soldiers in the field. Before deployment, the need for ADS should be explained to the U.S. population. This outreach effort should include short films chronicling life for soldiers manning checkpoints or tasked with base defense in Afghanistan.

These outreach efforts should be distributed through traditional media and online media distribution sources, including YouTube. Current ADS demonstration videos have already reached a wide audience, displaying the potential of online media for shaping public perception of ADS.

## Conclusion

ADS is a promising non-lethal technology for the U.S. Armed Forces, performing an important role in an era where U.S. military engagements are defined by population protection. To be deployed successfully, however, ADS must overcome political, sociological, and psychological barriers among the U.S. public and target populations. Public acceptance of ADS is crucial both to achieve domestic support for its deployment, as well as to facilitate the very purpose of ADS, which is to foster a positive relationship between the U.S. Armed Forces and the populations among which they operate. In this brief, we have identified the primary barriers to the successful use of ADS and have suggested steps that the U.S. military can take to address these concerns. Should these barriers be overcome, ADS has the potential to become the vanguard technology of an emerging class of weapons that fill a crucial gap in the current capabilities of the U.S. Armed Forces.

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<sup>1</sup> For more on the rise of asymmetric warfare, see: Col. T.X. Hammes, *The Sling and the Stone: On War in the 21st Century*, (St. Paul, MN: Zenith, 2004). Ivan Arreguin-Toft, "How the Weak Win Wars: A Theory of Asymmetric Conflict," *International Security* 26, no. 1 (2001). Tim Benbow, "Irresistible Force or Immoveable Object? The "Revolution in Military Affairs" and Asymmetric Warfare," *Defense and Security Analysis* 25, no. 1 (2009). John Galvin, "Uncomfortable Wars: Toward a New Paradigm," *Parameters* 16, no. 4 (1986). Ernest Evans, "El Salvador's Lessons for Future U.S. Interventions," *World Affairs* 160, no. 2 (1997). Andrew Mack, "Why Big Nations Lose Small Wars: The Politics of Asymmetric Conflict," *World Politics* 27, no. 2 (1975). Michael Evans, "The 21st Century Security Environment," *The RUSI Journal* 154, no. 2 (2009). Ehsan Ehrari, "Transformation of America's Military and Asymmetric War," *Comparative Strategy* 29, no. 3 (2010). Michael Moodie, "Conflict Trends in the 21st Century," *Joint Forces Quarterly* (2009); Ralph Peters, "The Culture of Future Conflict," *Parameters* 25, no. 2 (1995); Daniel P. Bolger, "The Ghosts of Omduran," *Parameters* 21, no. 3 (1991); Vincent J. Goulding Jr., "Back to the Future with Asymmetric Warfare," *Parameters* 30, no. 4 (2000); Robert M. Cassidy, "Why Great Powers Fight Small Wars Badly," *Military Review* 82, no. 5 (2002).

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<sup>2</sup> William B. Caldwell, IV, and Steven M. Leonard, "Field Manual 3-07. Stability Operations: Upshifting the Engine of Change," *Military Review*, 88 (July/August 2008). Department of the Army, Field Manual 3-24, *Counterinsurgency* (Washington, Headquarters Department of the Army, 2006), 10-1, 1-28, 5-18.

<sup>3</sup> For more on metrics for success in counterinsurgency see: David Galula, *Counterinsurgency Warfare: Theory and Practice* (Westport, CT: Praeger Security International, 2006). David Killcullen, "Twenty-Eight Articles: Fundamentals of Company-level Counterinsurgency," *IO Sphere* (2006). Heather S. Gregg, "Beyond Population Engagement: Understanding Counterinsurgency," *Parameters* 39, no. 3 (2009). Bruce Hoffman, "Insurgency and Counterinsurgency in Iraq," *RAND* (2004). Colin Kahl, "Review: COIN of the Realm," *Foreign Affairs* 86, no. 6 (2007). Col. T.X. Hammes, "Insurgency: Modern Warfare Evolves into a Fourth Generation," *Institute for National Strategic Studies* 214(2005). Gregg, "Beyond Population Engagement: Understanding Counterinsurgency." Hoffman, "Insurgency and Counterinsurgency in Iraq." Kahl, "Review: COIN of the Realm." Hammes, "Insurgency: Modern Warfare Evolves into a Fourth Generation." Jacob N. Shapiro Luke N. Condra, "Who Takes the Blame? The Strategic Effects of Collateral Damage," *American Journal of Political Science* 56, no. 1 (2012). Stuart E. Johnson David C. Gompert, Martin C. Libicki, David R. Frelinger, John Gordon, IV, Raymond Smith, Camille A. Sawak, "Underkill: Scalable Capabilities for Military Operations Among Populations," *RAND Corporation* (2009).

<sup>4</sup> David A. Koplow, "Tangled Up In Khaki and Blue: Lethal and Non-Lethal Weapons In Recent Confrontations," *Georgetown Journal of International Law* 36, no. 3 (2005). David B. Law, "The US DoD's Next-Generation Non-Lethal Escalation-of-Force Weapons.," *Military Technology* 33, no. 5 (2009); Massimo Annati, "Non-Lethal Weapons Revisited," *Military Technology* 31, no. 3 (2007). Jesse. Kang Galvan, Theo, "The Future of the Army Nonlethal Scalable Effects Center," *Military Police* (2006). For a full history of modern non-lethal weapons see: Neil Davison, "The Early History of "Non-Lethal" Weapons," *Bradford Non-Lethal Weapons Research Project (BNLWRP)*(2006), [http://www.bradford.ac.uk/acad/nlw/research\\_reports/docs/BNLWRP\\_OP1\\_Dec06.pdf](http://www.bradford.ac.uk/acad/nlw/research_reports/docs/BNLWRP_OP1_Dec06.pdf); Neil Davison, "The Development of "Non-Lethal" Weapons During the 1990's.," *Bradford Non-Lethal Weapons Research Project (BNLWRP)*(2007),

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<sup>5</sup> MAJ Joe Schrantz, "The Long Range Acoustic Device: Don't Call It a Weapon-Their's Fightin' Words," *The Army Lawyer*, August 2010.

<sup>6</sup> For the only large scale independent review of ADS's health effects, see: Human Effects Advisory Panel, *A Narrative Summary and Independent Assessment of the Active Denial System* Penn State Applied Research Laboratory: 2008.

<sup>7</sup> For more on the LRAD, see: MAJ Joe Schrantz, "The Long Range Acoustic Device: Don't Call It a Weapon-Their's Fightin' Words," *The Army Lawyer* (2010); "LRAD Deters Birds for Aircraft, Airport Safety," *Air Safety Week* 25, no. 26 (2011); Jeremy Boren, "Safety of Long Range Acoustic Device debated," (Pittsburgh Tribune Review (PA), 2009); James Kraska and Brian Wilson, "Piracy Repression, Partnering and the Law," *Journal of Maritime Law & Commerce* 40, no. 1 (2009).

<sup>8</sup> Defense Science Board, "Defense Science Board Task Force on Directed Energy Weapons," ed. Department of Defense (2007).

<sup>9</sup> ADS's millimeter wave can penetrate clothing and glass, but not wood or metal. However, in testing, metal shields proved ineffective because the system works on any amount of exposed skin, however small. Even hiding behind concrete traffic barriers was ineffective because the beam came through the space between the road and the barrier. David A. Fulghum, "Silent Launch; New directed-energy weapon balances strength, low cost and portability," *Aviation Week and Space Technology* 165, no. 4 (2006).

<sup>10</sup> ACTD is a Department of Defense program for quickly moving promising new technologies into the hands of warfighters for evaluation.

<sup>11</sup> LTG Amos David GEN. David Petraeus, and LTC John Nagl, "Introduction," in *The U.S. Army-Marine Corps Counterinsurgency Manual* (Chicago: University of Chicago Press, 2007). For more on the history of ADS, see: Randy Roughton, "The Fast Goodbye," *Airman* 54, no. 4 (2010); "Raytheon Delivers Non-lethal Sheriff Active Denial System," *Microwave Journal* 48, no. 11 (2005); Alec Wilkinson, "NON-LETHAL FORCE," *The New Yorker* 2008; David Hambling, "Pain-inducing microwave weapon to fire from the sky," *New Scientist* 203, no. 2718 (2009); Nathan Hodge, "US commanders seek Active Denial System for use in Iraq," *Jane's Defence Weekly* 44, no. 44 (2007); John McHale, "Raytheon delivers Active Denial System 2 to U.S. Air Force," *Military and Aerospace Electronics* 8, no. 12 (2007); Tim Ripley, "USAF receives its second Active Denial System," *Jane's Defence Weekly* 44, no. 38 (2007). Amy Butler Sharon Weinburger, "A Sea of Pain," *Aviation Week and Space*

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Technology 164, no. 14; John Dodge, "Military Beams over New Non-Lethal Weapon.," *Design News* 63, no. 7 (2008).

<sup>12</sup> For further media coverage on ADS' deployment and recall from Afghanistan, see: Ed Gunning, "The Weapon That's a Hot Topic," *The Daily Telegraph* 2010. Sean Hollister, "Raytheon's pain gun finally gets deployed in Afghanistan (update: recalled)," *Engadget*(2010). Noah Shachtman, "Pain Ray Recalled From Afghanistan," *Wired*(2010). David Hambling, "Army Orders Pain Ray Trucks; New Report Shows 'Potential for Death'," (2008). David Cairns, "US withdraws 'heat ray' gun from Afghanistan," *BBC*(2010). For more on the media reaction to the L.A. prison deployment see: Noah Shachtman, "Pain Ray, Rejected by the Military, Ready to Blast L.A. Prisoners," *Wired* (2010). Sharon Weinberger, "'Pain Beam' to Be Installed in LA Jail," *AOL News* (2010); Madalit Del Barco, "Zapping Inmates To Control Them: Harmless Or Torture?," *NPR*(2010). Thomas Watkins, "L.A. officials plan to use heat-beam ray in jail," *MSNBC* (2010). "An L.A. Jail's 'Excruciating' New Laser Weapon," *The Week*(2010). Torrance Stephens, "Los Angeles County Jail Uses Inmates as Test Rats for New Electronic Weapon," *Rolling Out*(2010). Ando Arike, "Rolling Back the Enlightenment: Pentagon "Pain Ray" to Debut in L.A.," *The Williamsburg Observer* (2010). Noah Shachtman "ACLU Blasts Jailhouse Pain Ray, Condemns 'Star Wars Tech'," *Wired*(2010). Clay Dillow, "L.A. Prison Using Experimental, Controversial 'Pain Ray' to Keep Inmates in Line" *PopSci*, August 24, 2010. "Prison to Use 'Excruciating' Pain Ray to Control Unruly Inmates," *The Daily Mail*, August 24, 2010.

<sup>13</sup> For more on general media coverage of the development of ADS, see: John Nolan, "Nonlethal heat-zapping weapon awaiting use," *The Journal-News* 2011. "US military unveils heat-ray gun ", *BBC*(2007). "US unveils ray beam as latest nonlethal weapon," *Korea Times* 2012. "State Of Active Denial," *Defense Technology International* 2007.

<sup>14</sup> For articles discussing ADS's ability to limit civilian deaths, see Dan Cairns, "US army heat ray gun in Afghanistan," *BBC*(2010). David Hambling, "Nervous Breakdown; Electromagnetic energy provides a way to harmlessly subdue troublemakers," *Defense Technology International* 2008. For articles discussing ADS use in crowd control, see Theunis Bates, "Shooting to Stun," *Time* 2007; Thomas Harding, "Non-lethal ray gun aims to quell rioters," *The Daily Telegraph* 2007. For articles discussing novel technical aspects of ADS, see Patrick Johnson, "How Hot is the Heat Ray Gun?," *BBC*(2007).

<sup>15</sup> For articles discussing the "science fiction" nature of ADS, see Ed Cumming, "The Active Denial System: the weapon that's a hot topic," *The Telegraph* 2010. Paul Koring, "Stranger than fiction: U.S. military unleashes its heat-ray weapon," *The Globe and the Mail* 341. and Philip Sherwell, "How I was zapped by US military's heat ray, that doesn't leave a mark Fiery blast is intended to show that weapon known as Silent Guardian is not dangerous," *The Sunday Telegraph* 2007. For articles concerned with foreign backlash, see "Active Denial System: Microwave Weapon Safe for Military Use? ," *International Business Times* 2012. Noah Shachtman, "U.S. Testing Pain Ray in Afghanistan ", *Wired*(2010). For articles concerned with the health effects of ADS, see Spencer Ackerman, "I Got Blasted by the Pentagon's Pain Ray — Twice," *Wired*(2012).

<sup>16</sup> In 2007, Human Rights Watch became one of the only organizations to do so when their Senior Military Analyst Marc Garlasco appeared on the *Democracy Now!* show to discuss the technology. He expressed support for the principle of non-lethal weapons, but highlighted a number of areas for concern. *Democracy Now*. "Pentagon Unveils Heat-Inducing Ray-Gun: Non-Lethal Crowd Control or Dangerous Weapon?" January 26, 2007. [http://www.democracynow.org/2007/1/26/pentagon\\_unveils\\_heat\\_inducing\\_ray\\_gun](http://www.democracynow.org/2007/1/26/pentagon_unveils_heat_inducing_ray_gun).

<sup>17</sup> CED is the name for a class of weapons that use electric currents to disrupt muscle function and subdue potential belligerents. The best-known version of this weapon is manufactured by Taser International.

<sup>18</sup> Amnesty International, "Arming the Torturers: Electro-shock Torture and the Spread of Stun Technology," (Washington, D.C.: Amnesty International Press, 1997): 6-16; "US Authorities Urged to Control Tasers," Amnesty International, Press Release (May 27, 2011).

<sup>19</sup> Hugh Williamson, "[Kazakhstan: Letter to the Prosecutor General regarding the December events in Zhanaozen and Shetpe](#)," Human Rights Watch: February 1, 2012; Human Rights Watch, "[China: Refrain From Using Excessive Force Against Protesters](#)," New York: January 25, 2012; Jamie Fellner, "[Letter to New York City Police Commissioner Raymond W. Kelly](#)," January 28, 2004; Ken Roth, "[Letter Regarding US Counterterrorism Assistance to Yemen](#)," November 9, 2010; Human Rights Watch, "[Uganda: Investigate Use of Lethal Force During Riots](#)," Kampala: October 1, 2009.

<sup>20</sup> Kenneth Adams and Victoria Jennison, "What we do not know about police use of Tasers," *Int'l J. Police Strat. & Mgmt.* 30, no. 3 (2007): 452-453.

<sup>21</sup> *Democracy Now*. "Pentagon Unveils Heat-Inducing Ray-Gun: Non-Lethal Crowd Control or Dangerous Weapon?" January 26, 2007. [http://www.democracynow.org/2007/1/26/pentagon\\_unveils\\_heat\\_inducing\\_ray\\_gun](http://www.democracynow.org/2007/1/26/pentagon_unveils_heat_inducing_ray_gun).

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- <sup>22</sup> The Special Rapporteur on the question of torture regularly releases interim reports, in accordance with the UN Commission on Human Rights' 1985 mandate for the position.
- <sup>23</sup> Theo van Boven, "Report of the Special Rapporteur on the Question of Torture on the Trade and Production of Equipment Specifically Designed to Inflict Torture," United Nations Economic and Social Council Commission on Human Rights (Geneva: United Nations, 2004).
- <sup>24</sup> This list included the United States on the basis that law enforcement officers had not used proper operating procedure when using conducted energy weapons. "Arming the Torturers: Electro-shock Torture and the Spread of Stun Technology," Amnesty International: (Washington, D.C.: Amnesty International Press, 1997): 6-16.
- <sup>25</sup> Lennart Sjolberg, "Specifying factors in radiation risk perception," *Scandinavian Journal of Psychology* 41 (2000): 169-174.
- <sup>26</sup> J. Bailer et al., "The relationship of worries about new technologies to environment related health complaints," *Zeitschrift Fur Klinische Psychologie Und Psychotherapie* 37, no. 1 (2008).
- <sup>27</sup> G. J. Rubin, A. J. Cleare, and S. Wessely, "Psychological factors associated with self-reported sensitivity to mobile phones," *Journal of Psychosomatic Research* 64, no. 1 (2008).
- <sup>28</sup> For further discussion of the psychological consequences of nuclear accidents, see F. N. von Hippel, "The radiological and psychological consequences of the Fukushima Daiichi accident," *Bulletin of the Atomic Scientists* 67, no. 5 (2011); N. V. Tarabrina, "Perception and Experiencing of "Invisible Stress" (in Relation to Radiation Incidents)," *Psychological Responses to the New Terrorism: A NATO-Russia Dialogue* 3, no. 1 (2005). E. J. Bromet and J. M. Havenaar, "Psychological and perceived health effects of the Chernobyl disaster: A 20-year review," *Health Physics* 93, no. 5 (2007). Kai Erikson, "Radiation's Lingering Dread," *Bulletin of the Atomic Scientists* (March 1991): 34-39.
- <sup>29</sup> Kai Erikson, "Radiation's Lingering Dread," *Bulletin of the Atomic Scientists* (March 1991): 34-39.
- <sup>30</sup> Depleted uranium (DU) was used by NATO forces in anti-tank weaponry during peacekeeping operations in the Balkans in the 1990's. NGOs, European scientific institutions, and the UN General Assembly all expressed fear that DU was harmful to local populations in the Balkans even after UN Environmental Programme studies showed that there was no health risk from DU. For further discussion of this topic, see Gustav Åkerblom, "Depleted Uranium—Experience of the United Nations Environmental Programme Missions," *AIP Conference Proceedings* 1034, no. 1 (2008).
- <sup>31</sup> Human Effects Advisory Panel, "A Narrative Summary and Independent Assessment of the Active Denial System," (Penn State Applied Research Laboratory: February 11, 2008): 5.
- <sup>32</sup> Lennart Sjolberg, "Specifying factors in radiation risk perception," *Scandinavian Journal of Psychology* 41 (2000): 173.
- <sup>33</sup> For further discussion of this topic, see P. Slovic, "Perception of risk," *Science* 236: 280-285 and L. Sjolberg and E. Winroth, "Risk, moral value of actions, and mood," *Scandinavian Journal of Psychology* 27: 191—208.
- <sup>34</sup> [awkward wording, redundant based on the body text] During the 1953 insurrection of Philippine Communists against the Philippine government, U.S. Air Force Colonel Edward Lansdale successfully frightened Huk guerrillas away from their strongholds by killing select insurgents as if *asuang*, or a local vampire, had murdered them near Huk territory. Superstition has also been used to unite local populations towards a common political cause. For example, insurgents against the European-educated Congolese political leadership in 1960 mobilized tribal populations against the government under the premise that the regime's attempts to ban witchcraft were themselves evil acts of sorcery. Similarly, since the 1980's, Maoist insurgents in the rural Indian province of Maharashtra have convinced local residents that the police ban on superstitious practices is to blame for misfortunes in towns like Bodalkasa, which suffers from an unusually high adolescent death rate. John J. Tierney Jr, "Can a Popular Insurgency Be Defeated?," *Military History* 24, no. 1 (2007). Price and James R. Price and Paul Jureidini, "Witchcraft, Sorcery, Magic, and other Psychological Phenomena and their Implications on Military and Paramilitary Operations in the Congo," (Washington, D.C. : Special Operations Research Office, 1964). 1964; and Amit Desai, "Anti-'anti-witchcraft' and the Maoist insurgency in rural Maharashtra, India," *Dialectical Anthropology* 33, no. 3/4 (2009).
- <sup>35</sup> Hafizullah Emadi, *Culture and Customs of Afghanistan* (Westport, CT: Greenwood Press, 2005): 63.
- <sup>36</sup> In 2008, The RAND Corporation hosted a discussion among experts on Arab and Muslim population about different aspects of a continuum of force. These experts indicated that "an unfamiliar effect from what may seem a mysterious device could cause great consternation, abundant rumors, and lasting suspicions that ailments are the result of that device." For more discussion of this topic, see Stuart E. Johnson David C. Gompert, et. al. , "Underkill: Scalable Capabilities for Military Operations among Populations," (Arlington, VA: RAND Corporation, 2009).



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- <sup>37</sup> Jerome D. Frank, "Nuclear Arms and Nuclear Leaders": Sociopsychological Aspects of the Nuclear Arms Race," *Political Psychology* 4, no. 2 (June 1983): 393-408.
- <sup>38</sup> Sjef Orbons, "Do Non-Lethal Capabilities License to 'Silence'?" *Journal of Military Ethics* 9, no. 1 (2010): 78-99.
- <sup>39</sup> Chris Mayer, "Nonlethal weapons and noncombatant immunity: is it permissible to target noncombatants?" *Journal of Military Ethics* 6, no. 3 (2007): 221-231; and P. Kaurin, *With Fear and Trembling: A Qualified Defense of 'Non-Lethal' Weapons* (Tacoma, Pacific Lutheran University: 2008).
- <sup>40</sup> Christian Enemark, "'Non-lethal' weapons and the occupation of Iraq: technology, ethics, and law," *Cambridge Review of International Affairs* 21, no. 2 (2008): 200.
- <sup>41</sup> Christian Enemark, "'Non-lethal' weapons and the occupation of Iraq: technology, ethics, and law," *Cambridge Review of International Affairs* 21, no. 2 (2008): 201.
- <sup>42</sup> David P. Fidler, "The Meaning of Moscow: 'Non-Lethal Weapons' and International Law in the 21st Century," *International Review of the Red Cross* 87, no. 859 (September 2005).
- <sup>43</sup> Defense Acquisition University. "Question and Answer Detail" Available online at: <https://dap.dau.mil/aap/pages/qdetails.aspx?cgiSubjectAreaID=38&cgiQuestionID=106517>
- <sup>44</sup> Hambling, David. "Pain Ray First Commercial Sale Looms", *Wired*, August 5, 2009. Defense Security Cooperation Agency "The FMS Advantage: Frequently Asked Questions About Foreign Military Sales"
- <sup>45</sup> <http://www.taser.com/products/on-officer-video/taser-axon>
- <sup>46</sup> In fact, some form of recording system is already in place on the prototypes of ADS available to the military, although the chain of command associated with these recordings and the measures put in place to prevent tampering are not publicly available.
- <sup>47</sup> For examples of successful TASER protocols in various police departments throughout the United States, refer to Robert J. Cramer, "Taser Weapons: Use of Tasers by Selected Law Enforcement Agencies: GAO-05-464," (U.S. Government Accountability Office, 2005).
- <sup>48</sup> Miller: 30-31, 143-146.
- <sup>49</sup> For example, operational and tactical doctrines will vary significantly depending on whether the deployment is domestic or international, controlled by police forces or by military units, and whether it is deployed on land or at sea.
- <sup>50</sup> Police officers are often fired when it has been confirmed that they used their TASER in an inappropriate manner, such as on a restrained target or on a target's neck. For examples of such incidents, see "Two Rockingham police officers were yesterday sacked for repeatedly misleading investigators during the inquiry into the misuse of Tasers on other officers at the station," (Y, 2010); Press The Associated [is that how you actually cite that?], "Evergreen, Ala. police officer fired," (The Associated Press, 2011); Matt McKinney, "Mpls. cop fired over Taser arrest wants his job back: The officer contends the department's probe into the incident had a predetermined outcome to silence criticism," (Star Tribune (Minneapolis, MN), 2010).
- <sup>51</sup> J. Strote and H. Range Hutson, "Taser use in restraint-related deaths," *Prehospital Emergency Care* 10, no. 4 (2006).
- <sup>52</sup> US Department of Defense Non-Lethal Weapons Program. *Non-Lethal Weapons for Today's Operations*. (Washington: DOD, 2010), 9.
- <sup>53</sup> While Area Defense System would allow ADS to keep the same acronym, there is already a technology in development called the High Energy Liquid Laser Area Defense System (HELLADS) which could potentially cause confusion.
- <sup>54</sup> David C. Gompert, "Underkill: Scalable Capabilities for Military Operations Among Populations."
- <sup>55</sup> John Bartus, "Tasers: Peaceful for Police, Safer for Subjects" *Keysweekly.com* 17 July 2009 <http://keysweekly.com/42/tasers-peaceful-for-police-safer-for-subjects/> (18 December, 2011) – The use of demonstrations by the Orlando Police Department was also discussed in Miller.