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14. ABSTRACT

The US government currently uses unmanned systems for a variety of combat missions and their use will only increase in the future. The use of machines to conduct actions traditionally completed by humans has resulted in a robust debate about the legality of using unmanned systems. Because most of the debate surrounds the US's use of Unmanned Aerial Vehicles (UAVs), there is a wealth of knowledge and analysis regarding whether the US's use of UAVs complies with the Law of Armed Conflict (LOAC). However, remotely operated Unmanned Ground Vehicles (UGVs) are closer in proximity to humans and they similarly conduct numerous missions on the battlefield, including improvised explosive devise clearing; intelligence, surveillance, and reconnaissance; and offensive engagement operations. Far less legal analysis exists on this important and growing area. Because UAVs and UGVs conduct different missions and operate in vastly different environments, the analysis conducted on UAVs does not directly apply to UGVs. The unique capabilities provided by UGVs increase battlespace awareness, improve strike accuracy, and mitigate against potentially harmful human factors. As a result, UGVs enhance DoD compliance with LOAC.

15. SUBJECT TERMS

Unmanned Ground Vehicle; Unmanned Aerial Vehicle; Law of Armed Conflict; Department of Defense; Accuracy; Battlefield Awareness; Human Factors; Remotely Operated

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MASTER OF MILITARY STUDIES

ON STABLE GROUND: REMOTELY OPERATED UNMANNED GROUND VEHICLES ENHANCING COMPLIANCE WITH THE LAW OF ARMED CONFLICT

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF MILITARY STUDIES

MAJOR HARLYE S.M. CARLTON, UNITED STATES MARINE CORPS

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EXECUTIVE SUMMARY

Title: On Stable Ground: Remotely Operated Unmanned Ground Vehicles Enhancing Department of Defense Compliance with the Law of Armed Conflict

Author: Major Harlye S.M. Carlton, United States Marine Corps

Thesis: Department of Defense (DoD) use of UGV capabilities enhances DoD compliance with LOAC because UGVs increase battlespace awareness, improve strike accuracy, and mitigate against potentially harmful human factors.

Discussion: The US government currently uses unmanned systems for a variety of combat missions and their use will only increase in the future. The use of machines to conduct actions traditionally completed by humans has resulted in a robust debate about the legality of using unmanned systems. Because most of the debate surrounds the US's use of Unmanned Aerial Vehicles (UAVs), there is a wealth of knowledge and analysis regarding whether the US's use of UAVs complies with the Law of Armed Conflict (LOAC). However, remotely operated Unmanned Ground Vehicles (UGVs) are closer in proximity to humans and they similarly conduct numerous missions on the battlefield, including improvised explosive devise clearing; intelligence, surveillance, and reconnaissance; and offensive engagement operations. Far less legal analysis exists on this important and growing area. Because UAVs and UGVs conduct different missions and operate in vastly different environments, the analysis conducted on UAVs does not directly apply to UGVs. The unique capabilities provided by UGVs increase battlespace awareness, improve strike accuracy, and mitigate against potentially harmful human factors. As a result, UGVs enhance DoD compliance with LOAC.

Conclusion: As unmanned systems develop, stakeholders should avoid a "one-size-fits-all" approach in analyzing their lawful use. An appropriate legal analysis requires studying the systems' capabilities and the environment in which they operate. Future warfare will possibly include unmanned systems with increased autonomy. This paper provides a base from which future analysis of how UGVs and other unmanned systems comply with LOAC may continue. Stakeholders should continue to study and debate these important issues to better understand unmanned systems and their capabilities. This understanding will help decisionmakers avoid over-regulation based on fear or unfamiliarity, which would put the US at an unjustified disadvantage against its enemies. For now, the use of UGVs keeps the US on stable ground by enhancing DoD compliance with LOAC.

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DISCLAIMER

THE OPINIONS AND CONCLUSIONS EXPRESSED HEREIN ARE THOSE OF THE INDIVIDUAL STUDENT AUTHOR AND DO NOT NECESSARILY REPRESENT THE VIEWS OF EITHER THE MARINE CORPS COMMAND AND STAFF COLLEGE OR ANY OTHER GOVERNMENT AGENCY. REFERENCES TO THIS STUDY SHOULD INCLUDE THE FOREGOING STATEMENT.

PREFACE

Unmanned systems have captured the attention of a wide-array of interested parties including governments, private companies, universities, and scholars. While the use of Unmanned Aerial Vehicles (UAVs) has traditionally dominated the unmanned system debate, another type of unmanned system has been instrumental across a wide range of mission sets: Unmanned Ground Vehicles (UGVs). This paper brings the conversation from the sky to earth, conducting an in-depth analysis of UGVs and the Law of Armed Conflict (LOAC). My intent is to provide a base upon which future research on UGVs and LOAC may build, to include analyses of UGVs containing varying levels of autonomy.

Numerous individuals helped me throughout the research and writing process for this paper. I would like to thank Dr. Jill Goldenziel for her guidance and mentorship. Her breadth of knowledge, expertise, and eye for detail encouraged me to explore new areas of operational law and directly contributed to the development of a unique analysis in the unmanned system universe. I would also like to thank Lieutenant Colonel Benjamin Pappas, U.S. Marine Corps, and Dr. Benjamin Jensen, Ph.D., for reviewing this paper and for their technical input. Their experiences and perspectives cannot be replicated, and I am grateful for their contribution to this paper. Last, I would like to thank my husband, Major Jeffrey Carlton, U.S. Marine Corps, for his assistance in developing this topic and for his constant support.

While the aforementioned individuals provided invaluable advice during the writing of this paper, the views, opinions, findings, and conclusions expressed in this paper are strictly my own. They are not responsible for any errors or omissions in this paper.

I'm telling you right now, 10 years from now if the first person through a breach isn't a friggin' robot, shame on us.
-Deputy Secretary of Defense Bob Work, Simi Valley, California, 2015

I. Introduction

From lightweight, throwable robots weighing a few pounds to forty-ton mine-clearing vehicles, the Department of Defense (DoD)[1] relies on Unmanned Ground Vehicles (UGVs) that are remotely operated to accomplish critical missions and save lives.[2] UGVs are a "powered physical system with (optionally) no human operator aboard the principal platform, which can act remotely to accomplish assigned tasks."[3] They are "remotely operated" because a human operator is controlling the UGVs' actions.[4] Like a rifle, the UGV is acting as an extension of that operator. Therefore, regardless of whether the UGV and operator are co-located, US forces' use of UGVs must comply with the Law of Armed Conflict (LOAC).

As the DoD increasingly develops and relies on remotely operated unmanned systems to complete missions previously performed in-person by humans,[5] the distance between the system operators and the dangers of the battlefield have created concerns that the use of unmanned systems will result in decreased compliance with LOAC. These concerns are often raised in the

[1] While other agencies of the United States government may also operate unmanned systems, this paper focuses on Department of Defense (DoD) use of unmanned systems. Sources use different terminology with respect to unmanned systems. This paper will use the phrases "Unmanned Ground Vehicles" (UGV) and "Unmanned Aerial Vehicles" (UAVs). The phrase "Unmanned Systems" encompasses both UAVs and UGVs.
[2] U.S. DEP'T OF DEF., OFFICE OF UNDER SEC'Y OF DEF. ACQUISITION, TECH. AND LOGISTICS, REPORT TO CONGRESS, DEVELOPMENT AND UTILIZATION OF ROBOTICS AND UNMANNED GROUND VEHICLES 11 (2006) [hereinafter 2006 REPORT].
[3] U.S. DEP'T OF DEF., UNMANNED SYSTEMS INTEGRATED ROADMAP FY2013–2038 6 (2013) [hereinafter USIR], *available at* https://www.defense.gov/Portals/1/Documents/pubs/DOD-USRM-2013.pdf. The DoD outlines its "vision and strategy for the continued development, production, test, training, operation, and sustainment of unmanned systems technology" in its *Unmanned Systems Integrated Roadmap*. *Id.* at 1.
[4] The Unmanned Ground Vehicles discussed in this paper are "remotely operated" by humans, as opposed to those that are "autonomous." *See infra* Section II.A ("Unmanned Ground Vehicles.").
[5] *See* Peter W. Singer, *Military Robots and the Laws of War*, 23 THE NEW ATLANTIS 25, 26 (Winter 2009), *available at* https://www.thenewatlantis.com/docLib/20090203_TNA23Singer.pdf ("When U.S. forces went into Iraq, the original invasion had no robotic systems on the ground. By the end of 2004, there were 150 robots on the ground in Iraq; a year later there were 2,400; by the end of 2008, there were about 12,000 robots of nearly two dozen varieties operating on the ground in Iraq.").

context of UGVs' aerial counterpart, the Unmanned Aerial Vehicle (UAV). For example, some analysts have expressed concern that lack of risk to US forces will cause system operators to lower the threshold of system use, or that a "video-game mentality" will desensitize operators.[6] However, UGVs provide capabilities distinct from both humans and UAVs that improve the ability of DoD personnel to conduct operations within the requirements of LOAC. DoD use of UGV capabilities enhances DoD compliance with LOAC because UGVs increase battlespace awareness, improve strike accuracy, and mitigate against potentially harmful human factors.

This paper contributes to debate over unmanned systems by drawing attention from the sky and aiming it at the ground. While the use of UAVs has been heavily analyzed and debated, UGVs have received comparatively little attention. While UGVs do not conduct aerial strikes, the lack of analysis regarding UGV use is surprising considering the wide range of UGV capabilities and how UGVs often operate closer in proximity to combatants and civilians than UAVs. Moreover, analysis that is applicable to UAVs is not always applicable to UGVs. The uses, environmental considerations, and LOAC-enhancing capabilities of UAVs and UGVs are quite different. Failure to articulate and consider these differences can prevent forces from maximizing the use of UGVs and may lead to regulations intended for UAVs applying to UGVs as well. These possible outcomes would not only put the US at a technological disadvantage, they may prevent the US from benefiting from this technology that enhances LOAC compliance.

To make this argument, this paper reviews the principles of LOAC as discussed in DoD reports and manuals and in scholarly writings and applies them to remotely operated UGV use. This paper begins by defining and describing UGVs, UAVs, LOAC, and outlining the debate

[6] U.N. Human Rights Council, *Report of the Special Rapporteur on Extrajudicial, Summary or Arbitrary Executions, Study on Targeted Killings, Addendum*, ¶ 84 U.N. Doc A/HRC/14/24/Add.6 (May 28, 2010) (*prepared by* Philip Alston) [hereinafter Alston Report], *available at* http://www2.ohchr.org/english/bodies/hrcouncil/docs/14session/ A.HRC.14.24.Add6.pdf.

surrounding the use of unmanned systems in combat. Next, this paper differentiates UGV capabilities from those of UAVs and humans and explains how UGVs provide the following benefits to US forces: increased awareness of the battlespace, improved strike accuracy, and mitigation against potentially harmful human factors. The paper then explains how those benefits enhance DoD compliance with LOAC. The subsequent section discusses and responds to concerns with potential LOAC violations involving UGV use. This paper concludes by looking ahead to DoD use of autonomous systems and cautioning against unnecessary regulations on their development and use.

II. Background

A. Unmanned Ground Vehicles

Terminology pertaining to unmanned systems is often misused.[7] Carefully distinguishing the concepts of "unmanned" and "autonomous" alleviates confusion.[8] The DoD's *Unmanned Systems Integrated Roadmap* (USIR) explains that whether the system is "manned" depends on whether it is carrying a human operator. This definition is distinguishable from an "autonomous" system, which refers to whether the system can make decisions and react "without human interaction."[9] Therefore, the USIR explains, when a system is controlled remotely by a human operator, it is not autonomous. Likewise, when a system is autonomous, it is not controlled remotely by a human.[10] Although current DoD use of UGVs may lack a human

[7] USIR, *supra* note 3, at 15.
[8] It is important to make this distinction, as authors have provided many definitions for unmanned systems. For example, in 2001, Congress stated for purposes of a particular section, "[a]n aircraft or ground combat vehicle has "unmanned advanced capability" if it is an autonomous, semi-autonomous, or remotely controlled system that can be deployed, re-tasked, recovered, and re-deployed." Floyd D. Spence National Defense Authorization Act for Fiscal Year 2001, Pub. L. No. 106-398, § 220, 114 Stat. 1654A-1, 1654A-38–1654A-40 (2000); Harlye Carlton, Unmanned Ground Vehicles: Offensive Use and the Security Dilemma 4 (Dec. 3, 2017) (unpublished manuscript, on file with Marine Corps University).
[9] USIR, *supra* note 3, at 15.
[10] *Id*.

operator physically co-located with the UGV, human oversight is inherent in their operation and programing. This paper analyses UGVs that are remotely operated by humans; autonomous vehicles are outside the scope of this paper.[11]

Using unmanned systems in war brings numerous benefits, to include enhanced warfighting capabilities and reduced troop casualties, operational costs, and environmental harm.[12] In a 2006 report to Congress entitled, *Development and Utilization of Robotics and Unmanned Ground Vehicles*, the DoD expressed the importance of unmanned systems when it said, "Today's battlefield environment unequivocally demonstrates the military utility of robotics applications in combat."[13] The report continued this discussion by stating robots are being destroyed rather than Servicemen being wounded, which is the "preferred outcome."[14] The USIR states UGV integration into new military domains will continue, partially because of the important and varied roles UGVs played in Iraq and Afghanistan.[15] UGVs provide capabilities that range across a broad range of mission sets to include intelligence, surveillance, and reconnaissance (ISR), command and control (C2),[16] logistics, transport, explosive ordinance disposal (EOD), force protection, and engineering.[17]

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[11] The DoD has increased the use of unmanned systems over the last decade; the majority are remotely operated and not autonomous. U.S. DEP'T OF DEF., DEFENSE SCIENCE BOARD SUMMER STUDY ON AUTONOMY 11 (Jun. 9, 2016), *available at* https://www.hsdl.org/?view&did=794641. Four levels of autonomy are (1) non-autonomous/teleoperated (operator controlling every movement), (2) supervisory autonomy (the operator specifies movements and the system completes the task), (3) task autonomy (operator specifies a task and the system processes and creates a course of action), and (4) full autonomy (system creates and completes its own tasks). JAI GALLIOTT, MILITARY ROBOTS: MAPPING THE MORAL LANDSCAPE 7 (Routledge 2015). The scope of this paper is limited to level 1.

[12] GALLIOTT, *supra* note 11, at 38–43.

[13] 2006 REPORT, *supra* note 2, at 9.

[14] *Id*.

[15] USIR, *supra* note 3, at 6.

[16] Command and Control is defined as: "The exercise of authority and direction by a properly designated commander over assigned and attached forces in the accomplishment of the mission. Command and control functions are performed through an arrangement of personnel, equipment, communications, facilities, and procedures employed by a commander in planning, directing, coordinating, and controlling forces and operations in the accomplishment of the mission." JOINT CHIEFS OF STAFF, JOINT PUB. 1, DOCTRINE FOR THE ARMED FORCES OF THE UNITED STATES, at GL-5 (12 July 2017), *available at* https://fas.org/irp/doddir/dod/jp1.pdf.

[17] USIR, *supra* note 3, at 7.

B. Unmanned Aerial Vehicles

The uses and capabilities of UAVs provide important context for the debate surrounding lawful UGV use and how UGVs enhance US force compliance with LOAC. A UAV is "[a]n aircraft that does not carry a human operator and is capable of flight with or without human remote control."[18] The missions performed by UAVs include offensive anti-air warfare, electronic attack, electronic warfare support, armed reconnaissance, air interdiction, strike coordination and reconnaissance, multisensory imagery reconnaissance, aviation support to tactical recovery of aircraft, personnel and air logistical support, and aerial escort.[19]

Examples of UAVs currently in use by US forces are the MQ-9 Reaper and RQ-11 Raven. The MQ-9 Reaper is a medium-altitude, armed, "long-endurance remotely piloted aircraft that is employed primarily against dynamic execution targets and secondarily as an intelligence collection asset."[20] It has a range of 1,150 miles, has a cruise speed is 230 miles per hour, and weighs 4,900 pounds. It may also carry up to four Air-to-Ground (AGM)-114 Hellfire missiles, which are laser guided and provide anti-armor and anti-personnel capabilities.[21] The RQ-11 Raven provides low-altitude ISR and targeting information in real time. It has a 10-kilometer range, has a cruise speed of 26 miles per hour, is hand launched, and weighs 4.8 pounds.[22] These assets provide the ability to locate, target, and directly engage enemies from a

[18] JOINT CHIEFS OF STAFF, JOINT PUB. 3-30, COMMAND AND CONTROL OF JOINT AIR OPERATIONS, at GL-7 (Feb. 2014), *available at* https://fas.org/irp/doddir/dod/jp3_30.pdf.
[19] U.S. MARINE CORPS, MARINE CORPS WARFIGHTING PUBLICATION 3-42.1, UNMANNED AIRCRAFT SYSTEMS OPERATIONS, 1-7–1-8 (2 May 2016), *available at* http://www.marines.mil/Portals/59/Publications/MCWP%203-20.5%20(Formerly%20MCWP%203-42.1).pdf?ver=2016-06-06-123323-993.
[20] U.S. Air Force, Fact Sheets, MQ-9 Reaper, http://www.af.mil/About-Us/Fact-Sheets/Display/Article/104470/mq-9-reaper/ (last visited Feb. 16, 2018).
[21] *Id.*
[22] U.S. Air Force, Fact Sheet, RQ-11B Raven, http://www.af.mil/About-Us/Fact-Sheets/Display/Article/104533/rq-11b-raven/ (last visited Feb. 16, 2018).

great distance. While some oppose the use of armed drones for killing enemies,[23] prominent sources have agreed that the use of armed drones is not per se prohibited by LOAC, and that no intrinsic drone features prevent their operators from complying with LOAC.[24]

While US use of both UAVs and UGVs must comply with LOAC,[25] their capabilities and the environments in which they operate differ. Thus, while literature and analysis conducted on UAVs provides helpful insight into UGV use, it is not always applicable. For example, while UAVs have the ability to provide sustained reconnaissance and over-watch without detection, UGVs' ability to provide these assets without detection are limited due to their location on the earth's surface. Additionally, while UAVs primarily provide observation and strike capabilities from the sky, UGVs provide observation and strike capabilities from the ground level or below and with smaller weapons systems. Another example are UGVs' abilities to provide precise and targeted Improvised Explosive Devise (IED) diffusion and carry-away assistance; a capability different from those of UAVs. As a result, of these and other differences, UGVs provide unique ways to enhance compliance with LOAC.

C. Law of Armed Conflict

LOAC "is that part of international law that regulates the resort to armed force; the conduct of hostilities and the protection of war victims in both international and non-international armed conflict; belligerent occupation; and the relationship between belligerent,

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[23] *See generally* Frederic Megret, *Symposium: The Legal and Ethical Limits of Technological Warfare: The Humanitarian Problem with Drones*, 2013 UTAH L. REV. 1283 (2013) (explaining that arguments against the use of armed drones include the one-sidedness of the risk of harm, risk to noncombatants, their clandestine nature, and concerns regarding oversite).

[24] International Committee of the Red Cross, Statement at the Human Rights Council, Panel Discussion on Ensuring use of Remotely Piloted Aircraft or Armed Drones in Counterterrorism and Military Operations in Accordance with International Law, including International Human Rights and Humanitarian Law: Ensuring the Use of Drones in Accordance with International Law, (Sept. 22, 2014), https://www.icrc.org/en/document/ensuring-use-remotely-piloted-aircraft-or-armed-drones-counterterrorism-and-military (concurring with the United National General Assembly).

[25] *See infra* Section II.C. ("Law of Armed Conflict.").

neutral, and non-belligerent states."[26] LOAC includes "treaties and customary international law applicable to the United States."[27] LOAC has been developed specifically accounting for the unique context of war, and therefore, receives priority over all other laws.[28] Additionally, any subsequently created laws must be consistent with LOAC.[29]

Codifying this vast array of treaty and customary international law, the *Department of Defense Law of War Manual* (DoD Manual) recognizes five LOAC principles: military necessity, humanity, proportionality, distinction, and honor.[30] These principles translate into "basic rules of conduct taught to soldiers from initial entry training" and throughout their careers.[31] These principles are binding on members of the DoD during all armed conflicts and military operations.[32] Additionally, the principles provide a baseline that US Servicemembers must follow in the absence of more specific guidance,[33] and work together as a system.[34]

The first principle, military necessity, "justifies those measures not forbidden by international law which are indispensable for securing the complete submission of the enemy as soon as possible."[35] Under the military necessity principle, the measure taken "must be leveraged to gaining a military advantage—in the circumstances ruling at the time—as a direct

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[26] U.S. DEP'T OF DEF., DOD LAW OF WAR MANUAL para. 1.3 (June 2015) (C1, May 2016) [hereinafter MANUAL], *available at* https://www.defense.gov/Portals/1/Documents/pubs/DoD%20Law%20of%20War%20Manual%20-%20June%202015%20Updated%20Dec%202016.pdf?ver=2016-12-13-172036-190. The Department of Defense Law of War Manual uses this definition to define Law of War, however, the Manual recognizes the terms Law of War and Law of Armed Conflict (LOAC) are often used interchangeably. *Id*. at para. 1.3.1.2. This paper will use the term LOAC.
[27] *Id*., at para. 1.3.
[28] *Id*., at para. 1.3.2.1.
[29] *Id*., at para. 1.3.2.2 (citing The Charming Betsy, 6 U.S. 64, 118 (1804)).
[30] MANUAL, *supra* note 26, at para. 2.1.
[31] GEOFFREY CORN ET AL., THE LAW OF ARMED CONFLICT: AN OPERATIONAL APPROACH 112 (Wolters Kluwer 2012).
[32] DOD DIRECTIVE 2311.01E, *DoD Law of War Program*, ¶4.1 (May 9, 2006, Certified Current as of Feb. 22, 2011).
[33] CORN ET AL., *supra* note 31, at 112.
[34] MANUAL, *supra* note 26, at para. 2.1.2.
[35] U.S. DEP'T OF ARMY, FIELD MANUAL 27-10, THE LAW OF LAND WARFARE, para. 3a, (18 July 1956) (C1, 15 July 1976).

result of their use."[36] Stated as a prohibition by the Hague Regulations, military necessity mandates a belligerent not "destroy or seize the enemy's property, unless such destruction or seizure be imperatively demanded by the necessity of war."[37] The second principle, humanity, "forbids the infliction of suffering, injury, or destruction unnecessary to accomplish a legitimate military purpose."[38] This principle applies to both combatants and noncombatants.[39] In addition to minimizing unnecessary suffering, it seeks to rid emotional hazards such as "personal interests, anger, animosity, or revenge" from the conduct of war.[40]

Third, the proportionality principle requires "that even where one is justified in acting, one must not act in a way that is unreasonable or excessive."[41] This requires balancing the justification for an action against the expected harm to determine whether the harm is disproportionate to the justification.[42] While the nature of war creates the near-certainty of incidental damage to civilians and civilian objects, the principle of proportionality limits damage as much as possible.[43]

The fourth principle, distinction, "obliges parties to a conflict to distinguish principally between the armed forces and the civilian population, and between unprotected and protected objects," when determining what is a lawful military target.[44] The principle of distinction ultimately aims to reduce the amount of suffering experienced during war. The fifth principle, honor, "demands a certain amount of fairness in offense and defense and a certain mutual respect

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[36] YORAM DINSTEIN, THE CONDUCT OF HOSTILITIES UNDER THE LAW OF INTERNATIONAL ARMED CONFLICT 8 (Cambridge University Press 3d ed. 2016).
[37] Convention Respecting the Laws and Customs of War on Land and its Annex: Regulations Respecting the Laws and Customs of War on Land, art. 23, Oct. 18, 1907, 36 Stat. 2277, 205 Consol. T.S. 277.
[38] MANUAL, *supra* note 26, at para. 2.3.
[39] CORN ET AL., *supra* note 31, at 118–19.
[40] CORN ET AL., *supra* note 31, at 119.
[41] MANUAL, *supra* note 26, at para. 2.4.
[42] *Id.*, at para. 2.4.1.2.
[43] *Id.*
[44] *Id.*, at para. 2.5.

between opposing military forces."[45] Honor is important because it assists in the implementation of LOAC. It is a type of good faith between combatants that the other side will abide by LOAC. Likewise, it is a breach of honor to take advantage of the other side's adherence to LOAC.

LOAC dictates the actions of the humans actively participating in hostilities regardless of the means and methods they use to achieve their military ends.[46] Thus, even as technologies evolve and develop, the actions of those humans using the technology must still comport with LOAC. Therefore, because this paper address UGVs remotely operated by US forces, the US use of UGVs must comply with LOAC. However, as shown herein, the capabilities provided by UGVs do more than just ensure compliance, they enhance the US ability to comply with LOAC.

D. The Unmanned Systems Debate

Scholars, academics, activists, members of the military, and other stakeholders have promulgated a robust debate about the use of unmanned systems—usually UAVs—in war. Their arguments include perceptions about entering war (the "threshold problem"), targeted killings outside of declared conflict zones,[47] targeted killings generally[48] and accountability (the "responsibility gap").[49]

George R. Lucas Jr.'s article *Industrial Challenges of Military Robotics* discusses the "threshold problem" theory in the larger context of technological innovations and applies it

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[45] *Id*., at para. 2.6.
[46] *See* Rain Liivoja, *Technological Change and the Evolution of the Law of War*, 97 INTERNATIONAL REVIEW OF THE RED CROSS 900, 1168 (Dec. 2015), *available at* https://www.icrc.org/en/download/file/30314/irc_97_900-10.pdf ("The law of war governs the conduct of hostilities and offers protection to persons not taking part in hostilities – all quite irrespective of the means and methods of warfare the belligerents adopt and other technology that they use.").
[47] *See generally*, Mary Ellen O'Connell, *Unlawful Killing with Combat Drones: A Case Study of Pakistan, 2004–2009* (Notre Dame Law Sch. Legal Studies Research Paper No. 09-43), *available at* https://papers.ssrn.com/sol3/Delivery.cfm/SSRN_ID1654055_code1212987.pdf?abstractid=1501144&mirid=1 (subsequently published in SHOOTING TO KILL: SOCIO-LEGAL PERSPECTIVES ON THE USE OF LETHAL FORCE (Simon Bronitt et al. eds., 2012)).
[48] *See generally*, Oren Gross, *The New Way of War: Is There a Duty to Use Drones?*, 67 FLA. L. REV. 1, 8–11 (Jan. 2016).
[49] GALLIOTT, *supra* note 11, at 212.

specifically to the use of unmanned systems.[50] This theory proposes that all the efforts aimed toward lowering risk to life and property may inadvertently also lower the threshold for decision-makers to enter that conflict. A byproduct is that unmanned systems—hiding the "true cost" of war—enable governments to participate in wars without the full consent of the public.[51] Thus, between lowering threshold for entering conflict and bypassing the full measures a government requires for entering into a conflict, unmanned systems may cause a state actor to engage in armed conflict when it is not militarily necessary.[52] Jai Galliot counters this argument by highlighting that improved technology associated with unmanned systems—such as high resolution photos and videos—bring the "horrors of war" directly to the public.[53] He argues these images of war will make it less likely "the public will underestimate the moral gravity of war,"[54] thereby countering the "threshold problem" theory. These opposing views demonstrate unmanned system capabilities may raise or lower the threshold for entering into a conflict.

Targeted killings raise numerous international law concerns regarding the use of force and the conduct of warfare.[55] Targeted killing is "the deliberate assassination of a known terrorist outside the country's territory (even in a friendly nation's territory), usually (but not exclusively) by an airstrike."[56] The unmanned systems conducting these strikes—UAVs—reach distant and remote areas, conduct the strike, and return to their starting point in a matter of hours, all without requiring the accompaniment of a human on the mission. Such operations have raised some of the most questions, especially because they often occur outside of declared

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[50] George R. Lucas, Jr., *Industrial Challenges of Military Robotics*, 10 J. MIL. ETHICS 274, 276 (2011).
[51] *Id.*
[52] *See id.*
[53] GALLIOTT, *supra* note 11, at 131.
[54] *Id.*, at 132.
[55] O'Connell, *supra* note 47, at 2.
[56] Gabriella Blum & Philip Heymann, Law and Policy of Targeted Killing, 1 HARV. NAT'L SEC. J. 145, 147 (2010). For additional definitions, *see* Gregory S. McNeal, *Targeted Killing and Accountability*, 102 GEO L.J. 681, 684 n.2 (2014).

conflict zones. One such question is whether the US may be unnecessarily bringing risk to civilians without reliable "on the ground" information due to the lack of forces present in the country. In such cases, remotely-located UAV operators must rely solely on cameras and sensors, items that can be affected by weather and terrain.[57] Other questions revolve around whether the country in which the UAV strikes are occurring provided consent,[58] and whether that consent is even necessary if the US is acting in self-defense.[59]

In addition to the concerns regarding targeted strikes outside of declared conflict zones, the debate includes concerns about UAV-conducted targeted strikes generally. Harold Koh, Legal Advisor at the Department of State during the Obama Administration, identified such concerns, including whether it is lawful to target enemy leaders, whether targeted killings "fails to provide adequate process," and whether they constitute "assassinations," which are unlawful under domestic law.[60] While Koh argues the US's acting in self-defense and the enemy's status as belligerents justifies the use of targeted killings, others, such as Professor Philip Alston, former United Nations Special Rapporteur on Extrajudicial, Summary or Arbitrary Executions (2004–2010), take a different view. According to Alston, the US's claim to self-defense is "expansive and open-ended," and threatens international rule of law. He further argues that targeted killings are legal only during armed conflict against those directly engaged in combat

[57] *Id*., at 6.
[58] *Id*., at 18 ("Without express, public consent of the kind the U.S. received from Afghanistan and Iraq, Pakistan is in a position to claim the U.S. is acting unlawfully, even bringing a future legal claim for compensation.").
[59] *See* Harold H. Koh, "The Obama Administration and International Law," Annual Meeting of the American Society of International Law, March 25, 2010, https://2009-2017.state.gov/s/l/releases/remarks/139119.htm ("as a matter of international law, the United States is in an armed conflict with al-Qaeda, as well as the Taliban and associated forces, in response to the horrific 9/11 attacks, and may use force consistent with its inherent right to self-defense under international law.").
[60] *Id*. Mr. Harold H. Koh's answers to these concerns were as follows: (1) leaders of an enemy force are belligerents and therefore lawful targets, (2) a stated engaged in self-defense or armed conflict—such as the US—is not required to provide due process to targets, and (3) a stated engaged in self-defense or armed conflict—such as the US—using precision weapons to target belligerent leaders is not considered an "assassination." *Id*.

and that any state that conducts "targeted killing must demonstrate that its actions comply with laws of war."[61] Therefore, Alston argues, the US should disclose when, where, and why certain individuals are killed along with the legal justification for said killings.[62]

Regarding accountability, should an alleged LOAC violation occur, US forces must investigate[63] and, where appropriate, hold individuals accountable. Holding individuals accountable where appropriate allows the US to demonstrate it takes LOAC seriously, serves as a deterent to the individuals and to others, and brings justice for the victims.[64] A challenge to accountability is the "responsibility gap," which is defined as "the inability to identify an appropriate locus of responsibility" for actions during armed conflict.[65] Michael Walzer, in his book *Just and Unjust Wars: A Moral Argument with Historical Illustrations*, asserts "assignment of responsibility is…critical" because "there can be no justice in war if there are not, ultimately, responsible men and women."[66] Galliott discusses how it is difficult to attribute responsibility in the context of technology in the military because many mishaps involve "multifaceted mistakes commonly involving a wide range of persons, not limited to end users, engineers, and technicians."[67] Thus, it is difficult to attribute a causal connection—and thereby,

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[61] Philip Alston, "Statement of U.N. Special Rapporteur on U.S. Targeted Killings without Due Process," August 3, 2010, https://www.aclu.org/statement-un-special-rapporteur-us-targeted-killings-without-due-process?redirect=national-security/statement-un-special-rapporteur-us-targeted-killings-without-due-process.
[62] *Id.*
[63] "Commanders have a duty to investigate reports of alleged law of war violations committed by persons under their command or against persons to whom they have a legal duty to protect." Manual, *supra* note 26, at para. 18.4.3.
[64] For example, the Uniform Code of Military Justice, as amended by the National Defense Authorization Act for Fiscal Year 2017, states courts-martial shall consider the impact of the crime on the victim and the need for the sentence to: (1) reflect the seriousness of the offense; (2) promote respect for the law; (3) provide just punishment for the offense; (4) promote adequate deterrence of misconduct; (5) protect others from further crimes by the accused; (6) rehabilitate the accused; and (7) provide, in appropriate cases, the opportunity for retraining and return to duty to meet the needs of the service. National Defense Authorization Act for Fiscal Year 2017, Pub. L. No. 114-328, § 5301, 114 Stat. 2000, 2919–20 (2016) (effective date to be determined by the President, but no later than 1 Jan. 2019.).
[65] GALLIOTT, *supra* note 11, at 211.
[66] *Id.* (quoting MICHAEL WALZER, JUST AND UNJUST WARS: A MORAL ARGUMENT WITH HISTORICAL ILLUSTRATIONS 287–8 (Basic Books, 4th ed. 2006)).
[67] *Id.*, at 215.

responsibility—to any one person or action.[68] Galliott also describes how the distance between the actor and the event further exacerbates the problem of assigning responsibility. This distance may affect the operator's ability to comprehend the range of consequences for their actions through no fault of their own, further mitigating responsibility.[69] The bureaucracy involved in the use of UAVs to conduct strikes also poses a challenge for assigning responsibility. As discussed by Gregory S. McNeal, many individuals involved in the decision-making process are "deep within the military or intelligence bureaucracies of the Executive Branch…far removed from public scrutiny…"[70] Between the technological aspects of UAV strikes and the number of people involved in the decision-making process, accountability may be difficult to achieve.

While important with respect to UAVs, these debates are not entirely applicable to UGVs because UAVs and UGVs operate in different environments and have different capabilities and mission sets. Regarding the "threshold problem," while UGVs provide distance between operators and the enemy—along with the accompanying relative safety for the operator—the distance is far less than the thousands of miles provided by UAVs. The degree of operator safety provided by UAVs when compared to UGVs is so different the current "lowering the threshold" arguments do not automatically apply to UGV use. Additionally, unlike with UAVs, the US does not generally use UGVs for targeted killing. Yet much of the literature on the debate involving unmanned systems centers around their use for targeted killings. Furthermore, UGVs may not face the same "accountability" issues as their aerial counterparts. While many individuals are likely involved in the programming and construction of both UAVs and UGVs, usually far fewer individuals are involved in the operation and use of UGVs than UAVs. This

[68] *Id*.
[69] *Id*., at 216 (citing Katinka Waelbers, *Technological Delegation: Responsibility for the Unintended*, 15 SCIENCE AND ENGINEERING ETHICS 51, 52 (2009)).
[70] McNeal, *supra* note 56, at 684.

differentiation voids the UAV accountability argument as applied to UGVs. The environment and capabilities provided by UGVs—as discussed in the following sections—demand separate analyses from those conducted on UAVs.

III. Discussion

A. Increased Awareness of the Battlespace

1. UGVs that Increase Battlespace Awareness

The increased awareness of the battlespace provided by UGVs permits US forces the ability to conduct a more in-depth assessment of how to proceed in various scenarios. The DoD defines battlespace awareness as: "Knowledge and understanding of the operational area's environment, factors, and conditions, to include the status of friendly and adversary forces, neutrals and noncombatants, weather and terrain, that enables timely, relevant, comprehensive, and accurate assessments, in order to successfully apply combat power, protect the force, and/or complete the mission."[71] Timely and accurate information about the battlespace allows US forces to accomplish the mission while preventing unnecessary harm to US forces and protected persons and objects. Numerous UGVs currently in use by the DoD provide increased awareness of the battlespace, largely through their ISR, C2, and EOD-specific reconnaissance capabilities.[72]

a. Intelligence, Surveillance, and Reconnaissance

The intelligence provided by ISR is essential for commanders because it provides a picture of the enemy's current and future activities and highlights the enemy's strengths and

[71] JOINT CHIEFS OF STAFF, JOINT PUB. 2-01, JOINT AND NATIONAL INTELLIGENCE SUPPORT TO MILITARY OPERATIONS, GL-10 (7 Oct. 2004), *available at* http://www.bits.de/NRANEU/others/jp-doctrine/jp2_01.pdf. This definition was removed from subsequent versions of this publication.

[72] While connectivity and mechanical issues may hinder the proper functioning of UGVs, this paper assumes the UGVs will operate as intended.

weaknesses, thereby facilitating the friendly force decision-making process.[73] The USIR lists the Ultra-Light Reconnaissance Robot (ULRR) as a UGV with ISR capabilities.[74] One such ULRR used by the DoD is the Dragon Runner 10 (DR10).[75] The DR10 provides visual reports to operators, positions counter IEDs, delivers remote sensors, gathers intelligence, and conducts surveillance.[76] It is also durable enough to be thrown or driven into the area of interest and can provide visual reports during the day or at night.[77] The DoD also uses the Throwbot and Toughbot to provide intelligence on the battlespace.[78] These small, throwable robots provide short-range reconnaissance and building-clearing abilities and can operate across a range of military environments to include austere, rugged terrain.[79] They are remotely operated and provide real-time feedback. They also provide the unique capability of displaying the situation behind walls, in different rooms, and in small spaces of a structure otherwise not visible to troops on the ground or from the air.

b. Command and Control

C2 provides the direction and authority required for mission accomplishment. Having clear lines of communication with subordinate commands and higher headquarters ensures the correct people have the information they need to oversee operations. A UGV that enhances C2 capabilities is the United States Air Force's Robo-Trencher, which the Engineering Installation

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[73] MARINE CORPS INTELLIGENCE, SURVEILLANCE, AND RECONNAISSANCE ENTERPRISE PLAN 8 (2015-2020), *available at* http://www.hqmc.marines.mil/Portals/133/Docs/MCISRE_Final_ Sept2014.pdf.
[74] USIR, *supra* note 3, at 7.
[75] Caroline Reese, *QinetiQ's Ultra Light Reconnaissance Robot Selected by RSJPO*, UNMANNED SYSTEMS TECHNOLOGY (June 18, 2012), http://www.unmannedsystemstechnology.com/2012/06/qinetiqs-ultra-light-reconnaissance-robot-selected-by-rsjpo/.
[76] *Id*.; Carlton, *supra* note 8, at 7.
[77] Carlton, *supra* note 8, at 7.
[78] 2006 REPORT, *supra* note 2, at 13.
[79] *Id*.; YouTube, Throwbot XT - ReconRobotics Tactical Micro Robot System for Army Swat Law Enforcement Security, https://www.youtube.com/watch?v=U9DR4OpSKvY (last visited Feb. 21, 2018); Omnitech Robotics, Toughbot Data Sheet, http://www.omnitech.com/pdf/TOUGHBOT_DATASHEET_ REV3_1.pdf (last visited Feb 21, 2018).

Squadrons use to install communications systems. This UGV performs excavation and trenching missions in hazardous areas while the operator is physically separated from the UGV.[80] UAVs do not provide similar excavation and trenching capabilities. The ability to create lines of communication without exposing troops to dangerous terrain expands the opportunity to provide C2 in terrain where a unit may have otherwise had limited communication.

c. Explosive Ordinance Device Missions

Numerous UGVs provide the ability to confirm and diffuse IEDs from a distance. Three examples of such UGVs are the Man Transportable Robot System (MTRS),[81] BomBot, and Remote Ordnance Neutralization System (RONS).[82] The MTRS provides "stand-off ability to locate, identify and clear landmines, unexploded ordnance and improvised explosive devises."[83] The BomBot is a small, lightweight, fast UGV that drops a C4 explosive charge near an IED, and, if practicable, drives away before remotely denotating the C4 charge and IED.[84] The RONS is used by EOD technicians for "reconnaissance, access, render safe, pick-up and carry away and disposal activities."[85] Many of these EOD-support UGVs have "sophisticated claw-like grippers, high-powered zoom cameras and nuclear, biological and chemical sensors."[86] These UGVs provide sensory and dismantling capabilities and imagery not available from the air and that humans could not provide without personally approaching the suspected IED.

2. Ways the UGVs Increase Battlespace Awareness

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[80] 2006 REPORT, *supra* note 2, at 14.
[81] USIR, *supra* note 3, at 7.
[82] 2006 REPORT, *supra* note 1, at 12–14.
[83] United States Army Acquisition Support Center, Man Transportable Root System (MTRS) Increment 2, http://asc.army.mil/web/portfolio-item/cs-css-man-transportable-robot-system-mtrs-increment-2/ (last visited Dec. 2, 2017).
[84] 2006 REPORT, *supra* note 2, at 12.
[85] *Id*., at 14.
[86] GALLIOTT, *supra* note 11, at 24.

The ISR-enhancing UGVs provide increased awareness of the battlespace in ways unique from the abilities of humans or UAVs. First, the UGVs' small size allows entry into areas such as tunnels or pipes that humans could not fit and that would be blocked from view from the sky.[87] This reconnaissance and surveillance is especially important in the urban environment the US has been operating within for the past decade because of the enemy's practice of planting IEDs below the earth's surface. Due to the concealed nature of such IEDs, a Servicemember may not know of its presence without stepping on or driving over the IED, likely resulting in injury or death. UGVs, however, provide the ability to see within these well-concealed areas from afar thereby painting an in-depth picture for the commander and for troops on the ground while reducing risk to Servicemembers. Second, ISR-oriented UGVs provide the ability to look within larger structures in real-time to better identify individuals or objects that may be in a building prior to US forces entering that structure. Confirming the presence of combatants or IEDs within a structure is critical to US forces deciding how to proceed on a mission across the range of military operations. Third, these UGVs—particularly the DR10, Throwbot, or Toughbot—provide the ability to gather intelligence without informing the enemy of the presence of US forces. This allows US forces to observe combatants conducting their activities uninterrupted. Undetected observation of the enemy enhances the ability to confirm whether the individuals are combatants, anticipate future enemy operations, and depending on the type of mission, gather evidence for possible follow-on criminal proceedings.

The C2-enhancing UGVs provide increased awareness of the battlespace for commanders in ways more unique and expansive than humans alone. More areas are available for laying

[87] Toughbots may be lowered on a string down wells, pipes, or mine shafts and driven inside air ducts. Omnitech Robotics, Toughbot Data Sheet, http://www.omnitech.com/pdf/TOUGHBOT_DATASHEET_ REV3_1.pdf (last visited Feb 21, 2018).

communications lines or other C2 requirements where a commander does not want to risk the lives of his or her forces or where the commander does not have many troops to spare. This is especially important in remote or hazardous areas where US forces require communications capabilities to conduct operations. Where a commander may have conducted an operation without enhanced communication capabilities, now the commander may decide to use the Robo-Trencher or a similar engineering UGV to install communication equipment and have better control over an operation. This additional C2 capability would allow a commander, through communications, to better understand the situation in the area, thereby decreasing the chance for accidental LOAC violations.

3. Increased Awareness of the Battlespace Enhances Compliance with LOAC

Increased awareness of the battlespace enhances DoD personnel compliance with the LOAC principles of military necessity, humanity, and distinction. Turning first to military necessity, an individual's determination of whether something is militarily necessary will be subjective and will depend on the specific facts and circumstances of a situation.[88] UGVs can enhance US forces' ability to ensure their actions comply with the military necessity principle because UGVs improve the ability to directly observe areas prior to entry or attack. Such observation allows forces to have the most up to date information on specific facts and circumstances, allowing them to make better-informed decisions. Without UGVs, based on otherwise available intelligence such as that provided by UAVs, US forces may justify destroying a building due to reports that the enemy is using it for unlawful purposes. However, the use of UGVs may provide timely information about the activities occurring or the people present within that building—not be visible from the sky—that no longer justifies the destruction

[88] MANUAL, *supra* note 26, at para. 2.2.3.

of that building. Conversely, these UGVs may confirm information about the activities occurring within a building that justifies destruction.

Like intelligence, increased C2 can also reduce the occurrences where a commander perceives it is militarily necessary to destroy property or take other similar actions to accomplish the mission. Without C2, commanders may be cut off from subordinate commands passing valuable information, which degrades the ability to successfully accomplish the mission. Commanders' enhance their ability to accurately perceive the situation and make a military necessity decision—thereby reducing the chance of an accidental LOAC violation—if they can lay more communications lines due to reduced risk to troops.

The humanity principle requires safeguarding injured or surrendering forces and protecting civilians, civilian objects, medical personnel, and buildings when such destruction serves no military purpose.[89] The principle of humanity also requires the elimination of unnecessary suffering. The increased battlespace awareness provided by UGVs allows US forces to better identify legally protected people and objects prior to continuing military engagement. For example, if an enemy combatant is incapacitated while US forces are clearing a building, the unique access and visibility within the building provided by UGVs may allow US forces to identify that the enemy combatant is injured and unable to continue hostilities. As a result, US forces may cease fire earlier and reduce unnecessary suffering and damage to the area. Commanders may also ensure increased battlespace awareness—and the resulting compliance with the humanity principle—without increasing risk to their troops because of the ability to remotely operate the UGV from a position of relative safety.

[89] *See id*., at para. 2.3.2.

Turning to the principle of distinction, increased awareness of the battlespace enables US forces to more rapidly and accurately determine whether individuals are combatants or engaging in hostile acts. UGVs provide the ability to observe the enemy at a closer distance and in areas that would not be observable by the human eye or from the sky. Additionally, closer, undetected observation of areas can allow US forces to determine whether individuals are enemy combatants before they can blend in with non-combatants. This ability to accurately determine the status of individuals is vital in the current environment where the enemy engages in asymmetric warfare, often seeking to blend in with the local population. This increased awareness of the battlespace will allow US forces to better distinguish protected from non-protected persons, thereby enhancing compliance with LOAC.

B. Improved Strike Accuracy

1. UGVs that Improve Strike Accuracy

The DoD defines a strike as, "An attack to damage or destroy an objective or a capability."[90] Accuracy refers to the ability of that strike to hit the intended target.[91] UGV capabilities improve strike accuracy when the DoD uses UGVs as weapons platforms; this increased strike accuracy enhances US forces' ability to comply with LOAC.

Two examples of UGVs that are also weapons systems are the Armed Robotic Vehicle (ARV) and the Tactical Unmanned Ground Vehicle (TUGV). The ARV was originally intended to support the force "with reconnaissance capabilities to target the enemy and weapon systems to

[90] JOINT CHIEFS OF STAFF, JOINT PUB. 3-0, JOINT OPERATIONS, xx (17 Jan. 2017), *available at* https://fas.org/irp/doddir/dod/jp3_0.pdf.

[91] *See* National Oceanic and Atmospheric Administration, Accuracy Versus Precision, https://celebrating200years.noaa.gov/magazine/tct/tct_side1.html (last visited Feb. 21, 2018) (speaking of accuracy in terms of measurements, the National Oceanic and Atmospheric Administration defines accuracy as "how closely a measurement or observation comes to measuring a 'true value'" and uses four cases of rifle shots to distinguish accuracy from precision.).

engage and destroy the enemy."[92] Weighing in at 9.3 tons, the ARV has two settings, one for reconnaissance and one for offensive weapons engagement. On the reconnaissance side, the ARV has the ability to detect and recognize targets with enough dependability to use line-of-sight, beyond line-of-sight (BLOS), and non-line-of-sight (NLOS) assets. The ARV is armed with a "medium caliber cannon, missile system and a machine gun system."[93] The TUGV, which is a United States Marine Corps program, has the ability to carry a range of cameras (such as Forward Looking Infrared (FLIR)), sensors, and weapons systems, to include the Shoulder-Launched Multi-Purpose Assault Weapon and M240 and M249 machine guns. It also carries non-lethal capabilities such as a smoke system and an anti-personnel breaching system. It can be operated up to 4 kilometers from the vehicle.[94] Additionally, UGVs with the primary function of combat support may be fitted with weapons ranging "from less-than-lethal rubber pellet shotguns to deadly machine guns and rocket launchers,"[95] providing more strike options for US forces.

2. Ways the UGVs Increase Strike Accuracy

These UGVs provide the ability to have improved strike accuracy from that provided by human or aerial capabilities alone by improving the range of visibility. When combined with cameras, scopes, and sensors, UGVs enable humans to see further and more clearly, particularly when the UGV uses BLOS and NLOS capabilities. The FLIR capabilities provided by the TUGV allow operators to "ensure targeting capability in all weather, under the widest range of battlefield conditions."[96] These capabilities provide the ability to have accurate strikes each time from distances and over terrain not possible with humans alone.

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[92] 2006 REPORT, *supra* note 2, at 16.
[93] *Id.*, at 17.
[94] *Id.*, at 18.
[95] GALLIOTT, *supra* note 11, at 82.
[96] UNITED STATES MARINE CORPS, CONCEPTS AND ISSUES 2000 153, *available at* http://www.hqmc.marines.mil/Portals/136/Docs/Concepts%20and%20Programs/2000/ci2000.pdf?ver=2012-09-08-173458-187.

UGVs provide improved strike accuracy when compared to their aerial counterparts because UGVs can fire from more angles and can employ smaller weapons systems than UAVs. Regarding the angles of employment, UAVs fire largely from the air to the ground, limiting their ability to provide fires on targets inside of buildings without destroying the entire building or surrounding structure. UGVs, however, may fire from the ground or from inside the building, leaving the structure intact. Additionally, UGVs are stationary and can attempt another strike right away if they miss their targets the first time. If a UAV misses its target, it must turn around to attempt another strike. These steps take time and provide an opportunity for the enemy to escape or seek additional cover. Concerning the employment of smaller weapons, while UAVs fire larger payloads—such as the 100-pound AGM-114 Hellfire missile[97]—UGVs can fire small arms. Two examples of small arms carried by the TUGV are the M249 and M240 machine guns,[98] which fire 5.56 mm and 7.62 mm rounds respectively. These small arms leave a smaller footprint and signature than their airborne counterparts, allowing for more accurate target acquisition with less opportunity for detection.

3. Improved Strike Accuracy Enhances Compliance with LOAC

Improved strike accuracy on the battlefield permits greater compliance with the LOAC principles of proportionality and distinction. Looking first at proportionality, this principle requires combatants to "refrain from attacks in which the expected harm incidental to such attacks would be excessive in relation to the concrete and direct military advantage anticipated to be gained."[99] Applying these concepts to armed UGVs, first, with increased accuracy from reconnaissance capabilities and direct fire weapons, combatants using UGVs reduce the risk for

[97] U.S. Army Acquisition Support Center, HELLFIRE Family of Missiles, http://asc.army.mil/web/portfolio-item/hellfire-family-of-missiles/ (last visited Jan. 12, 2018).
[98] 2006 REPORT, *supra* note 2, at 18.
[99] MANUAL, *supra* note 26, at 61.

collateral damage that would make the attack disproportionate to the gained military advantage. If there is a high value target in the window of a building, in some circumstances it may be worth damaging the entire building to acquire that target. However, the availability of UGVs with direct fire weapons would allow operators to view the target and fire small arms fire into the window without destroying the rest of the building. Depending on the circumstances, it may not be proportional to destroy the building to reach that target.

The proportionality principle also requires taking any feasible actions necessary to protect civilians and protected objects,[100] and the availability of small arms on UGVs helps meet this requirement. Using the same example of the high value target in the window, that building may be a hospital or civilians may be in the building. By using the direct fire small arms available on UGVs rather than a Hellfire missile from a MQ-9 Reaper, the entire building—and potentially civilian lives—could be saved. The capabilities provided by UGVs would permit a more proportionate attack in numerous circumstances while allowing US forces greater standoff, thereby ensuring greater compliance with LOAC and increased safety for US Servicemembers.

Turning to distinction, combatants have the duty and obligation to distinguish themselves from the civilian population and to refrain from using protected objects for prohibited purposes. However, under LOAC combatants still have the obligation to distinguish themselves from protected civilians and objects even where the combatants' enemies fail to distinguish themselves from the civilian population.[101] The UGVs' reconnaissance capabilities provided by FLIR and day camera technologies allow US forces the ability to carefully observe the enemy and distinguish them from the civilian population, even where the enemy attempts to blend in with protected persons. Once observed, the increased accuracy provided by the UGVs assists US

[100] *Id*., at 61.
[101] *Id*., at 64.

forces in maintaining compliance with distinction by reducing the chance of mistakenly striking a noncombatant and by reducing the potential for collateral damage.

C. Mitigating Against Potentially Harmful Human Factors

UGVs enhance the US Servicemembers' ability to comply with LOAC by reducing the likelihood of stress-related incidents caused by human factors. Human factors are "[t]he physical, cultural, psychological, and behavioral attributes of an individual or group that influence perceptions, understanding, and interactions."[102] According to a Marine Corps training manual, human factors may be internal and external.[103] Internal human factors include sleep loss, surprise, uncertainty, isolation, fear, stress, cohesion, comradeship, and will.[104] External human factors include weather, darkness, violence, "Soldier's Load," terrain, and environment.[105] The training manual then lists nine stress-causing elements common to the combat environment: (1) confusion and lack of information; (2) causalities; (3) violent, unnerving sights and sounds; (4) feelings of isolation; (5) communication breakdowns; (6) individual discomfort and fatigue; (7) fear, stress, and mental fatigue; (8) continuous operations; and (9) homesickness.[106] All of these factors impact the mental state of US forces.

The mental state of forces has a real and apparent impact on how those forces conduct themselves on the battlefield. The Mental Health Advisory Team (MHAT) IV, established at the request of the Commanding General, Multi-National Force- Iraq, found that Soldiers and Marines were more than twice as likely to engage in unethical behaviors on the battlefield when

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[102] JOINT CHIEFS OF STAFF, JOINT PUB. 2-0, JOINT INTELLIGENCE, GL-8 (22 Oct. 2013), *available at* http://www.jcs.mil/Portals/36/Documents/Doctrine/pubs/jp2_0.pdf.
[103] U.S. Marine Corps, Human Factors, The Basic School, United States Marine Corps, 5, *available at* http://www.trngcmd.marines.mil/Portals/207/Docs/TBS/B130916%20Human%20factors.pdf?ver=2015-03-26-091759-713.
[104] *Id*., at 5.
[105] *Id*.
[106] *Id*., at 6.

they were angry than when they had low levels of anger. These unethical behaviors included unnecessarily damaging Iraqi property or physically hitting or kicking noncombatants.[107] Similarly, the MHAT found that Soldiers who screened positively for other mental health issues, such as anxiety, depression, or acute stress, "were twice as likely to engage in unethical behavior compared to those Soldiers who did not screen positive."[108] Some of the experiences that led to these behaviors included having a member of one's unit become a casualty or handling the remains of deceased forces.[109] UGVs reduce combat-associated stressors by providing stand-off distance between US forces and danger.

By putting distance in between US forces and danger, UGVs provide a sense of security and prevent the deaths of US Servicemembers. This capability is highlighted through the Servicemembers' use of UGVs to identify, diffuse, and remove IEDs. IEDs have wounded and killed hundreds of Servicemembers over the course of the wars in Iraq and Afghanistan. The Pentagon's Joint IED Defeat Organization has estimated that between "half to two-thirds of Americans killed or wounded in combat in the Iraq and Afghanistan wars have been victims of IEDs planted in the ground, in vehicles or buildings…"[110] The injuries and deaths caused by IEDs are especially stressful for US forces because the IEDs often are not seen ahead of time, they can strike any time, and usually the perpetrator who laid the IED is not held accountable. The MTRs, BomBots, and RONS previously discussed are examples of UGVs that assist with IED disposal. Particularly, their ability to disarm an IED from a safe distance or carry it away

[107] OFFICE OF THE SURGEON MULTINATIONAL FORCE-IRAQ AND OFFICE OF THE SURGEON GENERAL, UNITED STATES ARMY MEDICAL COMMAND, MENTAL HEALTH ADVISORY TEAM (MHAT) IV, OPERATION IRAQI FREEDOM, FINAL REPORT, 38 (Nov. 17, 2006), *available at* http://www.combatreform.org/MHAT_IV_Report_17NOV06.pdf.
[108] *Id*.
[109] *Id*., at 39–40.
[110] Gregg Zoroya, *How the IED Changed the U.S. Military*, USA TODAY (Dec. 18, 2013), https://www.usatoday.com/story/news/nation/2013/12/18/ied-10-years-blast-wounds-amputations/3803017/ (citing statistics from the Pentagon's Joint Improved Explosive Devise Defeat Organization).

from an area provides mental assurances to US forces. Similarly, the Robo-Trencher permits distance between human operators and exposure to IEDs and enemy fire while the UGV digs trenches that are important for communications lines. These capabilities are distinct from those provided by UAVs, as UAVs lack the ability to disable and carry away IEDs. Additionally, while UAV camera systems can provide some early detection of IEDs, UGVs are specifically built for this capability and the information is readily accessible to their operators. The UGVs ability to provide standoff and early detection also reduces the number of US force casualties, thereby reducing the emotional stress of losing a companion on the battlefield.

While the humans operating the UGVs are still susceptible to human factors, the use of UGVs reduce the operators' direct exposure to danger, and possibly save the lives of members of their unit. The standoff and reduced casualties provided by UGVs may alleviate the stress of experiencing direct combat, saving the US forces from the emotional distress of being in danger, losing a member of their unit, or handling remains. This reduction in potentially harmful human factors could make a difference in the unit's compliance with LOAC.

IV. Arguments Against UGV Use

As previously discussed, a robust debate surrounds the US's use of unmanned systems. While most concerns apply uniquely to UAVs, two key arguments are also applicable to UGV use. One such argument is using unmanned systems to conduct war will reduce the risk to US forces, therefore policy makers, commanders, and troops will interpret who may be killed—and by what means—too expansively.[111] The notion underpinning this argument is the relative safety provided by unmanned systems would provide "psychological distance and disconnection."[112]

[111] Alston Report, *supra* note 6, at 24.
[112] Singer, *supra* note 5, at 42.

This distance and disconnection would result because the US operator would not "share with his foes even those brief minutes of danger that would give them a bond of mutual risk."[113]

While the use of UGVs would reduce the risk to US forces, there are specific reasons to expect this knowledge not will affect how US forces target their enemies. US forces are taught LOAC and targeting principles throughout their careers,[114] and they can face administrative or criminal consequences for violating those principles. Additionally, the US military already has weapons and technologies that provide the safety of standoff, such as sniper fires and artillery. It is unclear how the availability of UGVs would expand how US forces target their enemies or who they target to the point where they violate LOAC. Due to mandatory LOAC training, consequences for violations, and how the US already uses weapons that provide standoff, this argument fails to illustrate how the use of UGVs would contribute to LOAC violations.

The second argument promulgated by opponents is that removing humans from the battlefield will dehumanize war—providing a video-game mentality—making LOAC violations more likely.[115] The concern is that when consequence-free mentality of the virtual world[116] is transferred to the battlefield that the operators become "*too* calm, too unaffected by killing."[117] However, operators of remote weapons systems who are separated from the immediate vicinity of combat still experience the stressors of combat and take their jobs as seriously as those physically present. For example, even using the extreme-distance circumstance of UAV

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[113] *Id.*
[114] U.S. DEP'T OF DEF., DIR 2311.01E, DOD LAW OF WAR PROGRAM, para. 5.7 (May 9, 2006, Certified Current as of Feb. 22, 2011), *available at* http://www.esd.whs.mil/Portals/54/Documents/DD/issuances/dodd/231101e.pdf ("The Heads of the DoD Components shall…[i]nstitute and implement effective programs to prevent violations of the law of war, including law of war training and dissemination…").
[115] Alston Report, *supra* note 6, at 25.
[116] Singer, *supra* note 5, at 42. Singer also refers to Dave Grossman's book *On Killing*, saying "disconnecting a person, especial via distance, makes killing easier and abuses and atrocities more likely." *Id.* (citing DAVE GROSSMAN, ON KILLING: THE PSYCHOLOGICAL COST OF LEARNING TO KILL IN WAR AND SOCIETY (Back Bay Books, 1995).).
[117] Singer, *supra* note 5, at 42.

operators conducting and analyzing strikes on battlefields, most of these US operators do not experience de-sensitization. Airmen stationed at Langley Air Force Base in Hampton, VA, according to one commander, are "exposed to the most gruesome things…that could happen on a battlefield…[t]hey find mass graves; they witness executions."[118] According to a doctor overseeing the team of physicians and psychologists embedded with the unit, this exposure impacts these Airmen "as human beings."[119] The commander commented on the weight of the decisions the Airmen make, saying, "Their job is to decide who on that battlefield gets blown up, and who on that battlefield gets protected."[120] This has led to the Air Force treating the trauma associated with remote combat the same as those located at the site of the combat.[121]

This example demonstrates how even though individuals may be physically separated from combat and operating weapons and technologies remotely, they are not acquiring a video-game mentality where they are desensitized to the realities of war. They are heavily involved in the situation and may be held as accountable for their actions as those co-located with the weapons in combat. UGV operators would be closer to combat than the aforementioned UAV operators. They would be able to experience more sensations of combat than just sight to include hearing, scent, and touch. As such, this "video-game" mentality argument against the use of UGVs similarly fails when confronted with evidence to the contrary.

V. Conclusion

The US uses a wide array of remotely operated UGVs to conduct critical and life-saving missions across the range of military operations. The partnership between manned and

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[118] Sarah McCammon, *The Warfare May be Remote but the Trauma is Real*, NATIONAL PUBLIC RADIO, (Apr. 24, 2017), *available at* https://www.npr.org/2017/04/24/525413427/for-drone-pilots-warfare-may-be-remote-but-the-trauma-is-real.
[119] *Id*.
[120] *Id*.
[121] *Id*.

unmanned systems promises to grow as Congress continues to show interest and finance additional research, development, and procurement of unmanned systems, particularly UGVs.[122] Although some have raised concerns about the legality of using unmanned systems to accomplish missions previously completed by humans—particularly with respect to UAVs—the US is better equipped to comply with LOAC through its use of UGVs. UGVs provide capabilities unique from their aerial counterparts and beyond what may be accomplished by humans alone. Specifically, UGVs enhance the US ability to comply with LOAC by increasing awareness of the battlespace, improving strike accuracy, and mitigating against potentially harmful human factors on the battlefield.

While this paper has focused on the use of unmanned systems remotely operated by humans, future phases of warfare will likely involve the use of autonomous robots and weapons systems. The ability to use autonomous systems lawfully faces two significant challenges: the requirement for a subjective analysis of the facts and circumstances at the time of action and the ability to hold violators of LOAC accountable.[123] While human oversight mitigates these challenges for the UGVs discussed in this paper, future research should build on the concepts examined herein by analyzing the lawful use of UGVs with increasing levels of autonomy.

The ever-changing and increasingly complex nature of the US operational environment will require the DoD to continue its development and use of UGVs.[124] While UGVs allow for a

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[122] In 2000, Congress set a goal for the DoD that one-third of operational ground combat vehicles are unmanned by 2015. Floyd D. Spence National Defense Authorization Act for Fiscal Year 2001, Pub. L. No. 106-398, § 220, 114 Stat. 1654A-1, 1654A-38–1654A-40 (2000). In 2016, the House of Representatives requested the DoD provide an assessment of reaching this goal by 2021. H.R. REP. NO. 114-537, at 96 (2016). The National Defense Authorization Act for Fiscal Year 2017 authorized $39,282,000 for Tactical Unmanned Ground Vehicle system development and demonstration. National Defense Authorization Act for Fiscal Year 2017, Pub. L. No. 114-328, 114 Stat. 2000, 2832 (2016).

[123] *See* Singer, *supra* note 5, at 43–44.

[124] *See* GALLIOTT, *supra* note 11, at 15 (citing Yuri Balyko, *NATO's Unmanned Aerial Vehicles in Local Conflicts*, 1 MILITARY PARADE 36 (2008)) ("The US currently leads in the design, development and deployment of unmanned systems, but 55 other nations are proceeding in similar fashion and this number is steadily increasing.").

heightened ability to comply with LOAC, those capabilities require increased vigilance to ensure US personnel use UGVs responsibly and within legal limits. Throughout the development of UGV use, policy-makers, DoD leadership, scholars, lawyers, commanders, and small unit leaders must continue to analyze and discuss ethical and lawful ways to use UGVs. While an innovative technology or method often drives additional regulations and restrictions, it is important to allow the practices to develop within the current LOAC construct without unnecessary limitations. Additionally, stakeholders should differentiate between unmanned systems operating in the air, ground, and sea when conducting their analysis, accounting for the different environments in which they operate and the varying capabilities they provide. Increased restrictions on development or use based on a "one-size-fits-all" approach, fear, or unfamiliarity with UGVs could inadvertently give an advantage to an enemy that is not similarly restricted. US forces have the obligation to comply with LOAC, therefore, their use of UGVs must also comply with LOAC. Moreover, the use of remotely operated UGVs keeps the US on stable ground by enhancing DoD compliance with LOAC.

BIBLIOGRAPHY

Caroline Reese, *QinetiQ's Ultra Light Reconnaissance Robot Selected by RSJPO*, UNMANNED SYSTEMS TECHNOLOGY (June 18, 2012), http://www.unmannedsystemstechnology.com/2012/06/qinetiqs-ultra-light-reconnaissance-robot-selected-by-rsjpo/.

Convention Respecting the Laws and Customs of War on Land and its Annex: Regulations Respecting the Laws and Customs of War on Land, art. 23, Oct. 18, 1907, 36 Stat. 2277, 205 Consol. T.S. 277.

Floyd D. Spence National Defense Authorization Act for Fiscal Year 2001, Pub. L. No. 106-398, § 220, 114 Stat. 1654A-1, 1654A-38–1654A-40 (2000).

Frederic Megret, *Symposium: The Legal and Ethical Limits of Technological Warfare: The Humanitarian Problem with Drones*, 2013 UTAH L. REV. 1283 (2013).

Gabriella Blum & Philip Heymann, Law and Policy of Targeted Killing, 1 HARV. NAT'L SEC. J. 145 (2010).

GEOFFREY CORN ET AL., THE LAW OF ARMED CONFLICT: AN OPERATIONAL APPROACH (Wolters Kluwer 2012).

George R. Lucas, Jr., *Industrial Challenges of Military Robotics*, 10 J. MIL. ETHICS 274 (2011).

Gregg Zoroya, *How the IED Changed the U.S. Military*, USA TODAY (Dec. 18, 2013), https://www.usatoday.com/story/news/nation/2013/12/18/ied-10-years-blast-wounds-amputations/3803017/.

Gregory S. McNeal, *Targeted Killing and Accountability*, 102 GEO L.J. 681 (2014).

Harlye S.M. Carlton, Unmanned Ground Vehicles: Offensive Use and the Security Dilemma (Dec. 3, 2017) (unpublished manuscript, on file with Marine Corps University).

Harold H. Koh, "The Obama Administration and International Law," Annual Meeting of the American Society of International Law, March 25, 2010, https://2009-2017.state.gov/s/l/releases/remarks/139119.htm.

International Committee of the Red Cross, Statement at the Human Rights Council, Panel Discussion on Ensuring use of Remotely Piloted Aircraft or Armed Drones in Counterterrorism and Military Operations in Accordance with International Law, including International Human Rights and Humanitarian Law: Ensuring the Use of Drones in Accordance with International Law, (Sept. 22, 2014), https://www.icrc.org/en/document/ensuring-use-remotely-piloted-aircraft-or-armed-drones-counterterrorism-and-military.

JAI GALLIOTT, MILITARY ROBOTS: MAPPING THE MORAL LANDSCAPE (Routledge 2015).

JOINT CHIEFS OF STAFF, JOINT PUB. 1, DOCTRINE FOR THE ARMED FORCES OF THE UNITED STATES (12 July 2017), *available at* https://fas.org/irp/doddir/dod/jp1.pdf.

JOINT CHIEFS OF STAFF, JOINT PUB. 2-0, JOINT INTELLIGENCE (22 Oct. 2013), *available at* http://www.jcs.mil/Portals/36/Documents/Doctrine/pubs/jp2_0.pdf.

JOINT CHIEFS OF STAFF, JOINT PUB. 2-01, JOINT AND NATIONAL INTELLIGENCE SUPPORT TO MILITARY OPERATIONS (7 Oct. 2004) *available at* http://www.bits.de/NRANEU/ others/jp-doctrine/jp2_01.pdf.

JOINT CHIEFS OF STAFF, JOINT PUB. 3-0, JOINT OPERATIONS, xx (17 Jan. 2017), *available at* https://fas.org/irp/doddir/dod/jp3_0.pdf.

JOINT CHIEFS OF STAFF, JOINT PUB. 3-30, COMMAND AND CONTROL OF JOINT AIR OPERATIONS (Feb. 2014), *available at* https://fas.org/irp/doddir/dod/jp3_30.pdf.

MARINE CORPS INTELLIGENCE, SURVEILLANCE, AND RECONNAISSANCE ENTERPRISE PLAN (2015-2020), *available at* http://www.hqmc.marines.mil/Portals/133/Docs/MCISRE_Final_ Sept2014.pdf.

Mary Ellen O'Connell, *Unlawful Killing with Combat Drones: A Case Study of Pakistan, 2004–2009* (Notre Dame Law Sch. Legal Studies Research Paper No. 09-43), *available at* https://papers.ssrn.com/sol3/Delivery.cfm/SSRN_ID1654055_code1212987.pdf?abstractid=1501144&mirid=1 (subsequently published in SHOOTING TO KILL: SOCIO-LEGAL PERSPECTIVES ON THE USE OF LETHAL FORCE (Simon Bronitt et al. eds., 2012)).

National Defense Authorization Act for Fiscal Year 2017, Pub. L. No. 114-328, 114 Stat. 2000 (2016).

OFFICE OF THE SURGEON MULTINATIONAL FORCE-IRAQ AND OFFICE OF THE SURGEON GENERAL, UNITED STATES ARMY MEDICAL COMMAND, MENTAL HEALTH ADVISORY TEAM (MHAT) IV, OPERATION IRAQI FREEDOM, FINAL REPORT (Nov. 17, 2006), *available at* http://www.combatreform.org/MHAT_IV_Report_17NOV06.pdf.

Oren Gross, *The New Way of War: Is There a Duty to Use Drones?*, 67 FLA. L. REV. 1 (Jan. 2016).

Peter W. Singer, *Military Robots and the Laws of War*, 23 THE NEW ATLANTIS 25 (Winter 2009), *available at* https://www.thenewatlantis.com/docLib/20090203_ TNA23Singer.pdf.

Philip Alston, "Statement of U.N. Special Rapporteur on U.S. Targeted Killings without Due Process," August 3, 2010, https://www.aclu.org/statement-un-special-rapporteur-us-targeted-killings-without-due-process?redirect= national-security/statement-un-special-rapporteur-us-targeted-killings-without-due-process.

Rain Liivoja, *Technological Change and the Evolution of the Law of War*, 97 INTERNATIONAL REVIEW OF THE RED CROSS 900 (Dec. 2015) *available at* https://www.icrc.org/en/download/file/30314/irc_97_900-10.pdf.

Sarah McCammon, *The Warfare May be Remote but the Trauma is Real*, NATIONAL PUBLIC RADIO, (Apr. 24, 2017), *available at* https://www.npr.org/2017/04/24/525413427/for-drone-pilots-warfare-may-be-remote-but-the-trauma-is-real.

U.N. Human Rights Council, *Report of the Special Rapporteur on Extrajudicial, Summary or Arbitrary Executions, Study on Targeted Killings, Addendum*, ¶ 84 U.N. Doc A/HRC/14/24/Add.6 (May 28, 2010) (*prepared by* Philip Alston), *available at* http://www2.ohchr.org/english/bodies/hrcouncil/docs/14session/A.HRC.14.24.Add6.pdf.

U.S. DEP'T OF ARMY, FIELD MANUAL 27-10, THE LAW OF LAND WARFARE (18 July 1956) (C1, 15 July 1976).

U.S. DEP'T OF DEF., DEFENSE SCIENCE BOARD SUMMER STUDY ON AUTONOMY (Jun. 9, 2016), *available at* https://www.hsdl.org/?view&did=794641.

U.S. DEP'T OF DEF., DIR 2311.01E, DOD LAW OF WAR PROGRAM, para. 5.7 (May 9, 2006, Certified Current as of Feb. 22, 2011), *available at* http://www.esd.whs.mil/Portals/54/Documents/DD/issuances/dodd/231101e.pdf.

U.S. DEP'T OF DEF., DOD LAW OF WAR MANUAL (June 2015) (C1, May 2016), *available at* https://www.defense.gov/Portals/1/Documents/pubs/DoD%20Law%20of%20War%20Manual%20-%20June%202015%20Updated%20Dec%202016.pdf?ver=2016-12-13-172036-190.

U.S. DEP'T OF DEF., OFFICE OF UNDER SEC'Y OF DEF. ACQUISITION, TECH. AND LOGISTICS, REPORT TO CONGRESS, DEVELOPMENT AND UTILIZATION OF ROBOTICS AND UNMANNED GROUND VEHICLES (2006).

U.S. DEP'T OF DEF., UNMANNED SYSTEMS INTEGRATED ROADMAP FY2013–2038 (2013), *available at* https://www.defense.gov/Portals/1/Documents/pubs/DOD-USRM-2013.pdf.

U.S. Marine Corps, Human Factors, The Basic School, United States Marine Corps, *available at* http://www.trngcmd.marines.mil/Portals/207/Docs/TBS/B130916%20Human%20factors.pdf?ver=2015-03-26-091759-713.

U.S. MARINE CORPS, MARINE CORPS WARFIGHTING PUBLICATION 3-42.1, UNMANNED AIRCRAFT SYSTEMS OPERATIONS (2 May 2016), *available at* http://www.marines.mil/Portals/59/Publications/MCWP%203-20.5%20(Formerly%20MCWP%203-42.1).pdf?ver=2016-06-06-123323-993.

UNITED STATES MARINE CORPS, CONCEPTS AND ISSUES 2000 153, *available at* http://www.hqmc.marines.mil/Portals/136/Docs/Concepts%20and%20Programs/2000/ci2000.pdf?ver=2012-09-08-173458-187.

YORAM DINSTEIN, THE CONDUCT OF HOSTILITIES UNDER THE LAW OF INTERNATIONAL ARMED CONFLICT (Cambridge University Press 3d ed. 2016).