



Executive Summary

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AUTONOMOUS WEAPON SYSTEMS A BRIEF SURVEY OF DEVELOPMENTAL, OPERATIONAL, LEGAL, AND ETHICAL ISSUES

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The use of autonomous weapon systems (AWS) in warfare is not a new concept. One could argue that the development and integration of such systems have evolved over the last century and accelerated significantly after the September 11, 2001, attacks on the U.S. homeland. AWS will likely continue to grow in both capabilities and numbers. This growth of unmanned systems is not limited to the U.S. military or even the United States; it is an international phenomena that includes government and commercial applications in all domains—air, land, and sea. Commercial endeavors for unmanned systems are at the forefront of many technologies and their proliferation will likely outnumber military use in the future.

What does the Department of Defense hope to gain from the use of AWS? This Letort Paper explores a diverse set of complex issues related to the developmental, operational, legal, and ethical aspects of AWS. It will briefly explore the recent history of the development and integration of autonomous and semi-autonomous systems into traditional military operations. It will examine anticipated expansion of these roles in the near future as well as outline international efforts to provide a context for U.S. use of the systems. These topics are well-documented in many sources, thus this Paper serves as a primer for current and future AWS operations to provide senior policymakers, decision-makers, military leaders, and their respective staffs an overall appreciation for existing capabilities and the challenges, opportunities, and risks associated with AWS across the range of military operations. Emphasis is added to missions and systems that include the use of deadly force.

Discussion is limited to unclassified and open source information; any classified discussion must occur at another venue. Despite the goal of using precise

language, the following terms may be used somewhat interchangeably due largely to the variety of source material cited in this Paper: autonomous weapon system; robot; drone; unmanned system; unmanned vehicle; unmanned platform.

After providing background information on the meaning of autonomy and its contemporary applications, the Paper establishes a dialogue in four main sections:

1. Developmental Issues Related to Autonomous Systems. This section explores two questions: How should the United States develop autonomy-related applications for use across the range of military operations? What technologies are imperative to the development of AWS? It addresses these questions first by describing the current state-of-the-art for Army unmanned ground vehicle systems, then by examining technology issues across the scope of application of autonomy, and ends with a brief analysis of the federal budget trends for AWS development.

2. Operational Issues Related to Use of Autonomous Systems. This section addresses two questions related to a vision of fully integrated AWS operations: What can be achieved via autonomy within the range of military operations? What missions can be enhanced by incorporating AWS? The resulting discussion considers the role of mission parameters, efforts toward AWS integration into force structure, doctrinal requirements, international efforts, and strategic geopolitical challenges.

3. Legal Issues Related to Use of Autonomous Systems. This section examines the legally acceptable uses of autonomous weapon systems within the range of military operations. It first looks at existing international legal conventions including the Law of Armed Conflict, then reviews recent assessments by the

United Nations, next it focuses on the concept of human control and judgement as it applies to AWS. Finally, it reviews current vignettes as well as consider potential trends for the future.

4. Ethical Issues Related to Use of Autonomous Systems. What should be the ethically acceptable and advisable uses of AWS within the range of military operations? What moral principles should form the foundation of AWS development and operation? This section explores these questions by first reviewing the ongoing work for developing ethical frameworks for AWS, then considering the varying cultural views that AWS applications may evoke, as well as analyze the potential reduction or proliferation in warfare that widespread use of AWS may introduce. Finally, it looks toward the future and contemplates potential long-term effects on national security.

After the discussion in these four areas, this Paper offers recommendations to facilitate the best evolutionary path for key issues affecting the use of AWS to enhance U.S. national security in the areas of policy, maintaining humanity, strategic implications, and areas for further research.

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