

MECHANICAL SOLDIERS ON THE FRONT LINES



ROBOTICS CALLS TRADITIONAL MILITARY STRATEGY INTO QUESTION

Military and security applications are the single biggest driver of R&D funding in robotics. Indeed, a number of global military figures have predicted that robots will be the primary fighters of wars within a generation. Already, a rapidly increasing number of semi-autonomous robots is being deployed by military and police organizations around the world. We face a future in which our frontline soldiers will increasingly be mechanical, perhaps insulating decision makers from some of the consequences of their choices. This trend raises questions about the direction of both robotics as a field and humanity as a whole.

UNDERSTANDING HUMANS: The Mechanics of Conflict

Sociologist Marshall McLuhan notes that new technologies simultaneously extend and amputate natural human traits. Military robotics will be a critical laboratory for understanding this process; on the one hand, programmers and operators can move out of the range of danger, but on the other, they are distanced from experiencing the consequences of conflict. A Brookings Institution study, for example, suggests that remotely piloted drone strikes may trade greater pilot safety for reduced targeting accuracy. In many cases those pilots are thousands of miles from any danger and return home to their families in the evening. Military and security robotics have opened new questions about mediated experience and the line, if there is one, between video games and real-world human struggles.



Source: http://www.brookings.edu/opinions/2009/0714_targeted_killings_byman.aspx

Questioning targeted killings

A senior fellow at the Brookings Institution points out that the way unmanned systems are being deployed in combat may have unintended consequences, such as higher civilian casualty rates, that further complicate already messy situation.



Source: <http://gtresearchnews.gatech.edu/deceptive-robots/>

Robot Deception

Georgia Tech researchers have developed early versions of robots capable of applying algorithms to determine when deception is appropriate. For example, the system deceiving an enemy soldier by creating a false trail and hiding so that it will not be caught.



AUGMENTING HUMANS: Stronger, Faster, Better

The resilience of any military force depends on the resilience of individual soldiers. Traditionally, this has involved physical and vocational training regimens. Now, however, a new generation of robotic systems is interfacing with soldiers to increase their reach, strength, and effectiveness. These range from remote-controlled robotic systems to body suits that literally amplify individual soldiers' strength and endurance.



<http://www.lockheedmartin.com/products/hulc/index.html>

The HULC exoskeletal suit

Lockheed-Martin has designed and prototyped an exoskeletal suit intended to increase the load-carrying ability of soldiers in the field.



<http://www.foster-miller.com/products-talon.html>

TALON military robots

TALON military robots from QinetiQ are designed for multiple military applications, including reconnaissance and combat. More than 3,000 are currently deployed by the U.S. military.



AUTOMATING TASKS: What If They Had a War and Only Robots Showed Up?

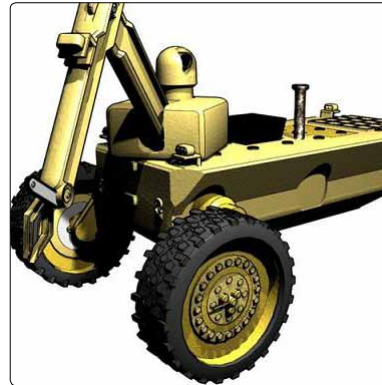
Initial robotic deployments are likely to be one-sided engagements. But what happens when robots are deployed to fight other robots? By definition, robotic deployment in military and security contexts is an arms race. As increasingly sophisticated systems take on more capabilities, questions are raised about the nature of war. Will war become a matter of detached robot chess, or will martial combat be replaced with new ways of expressing conflict?



Source: <http://www.globalsecurity.org/military/systems/ground/cram.htm>

Automated missile defense

The U.S. Army is working to develop a counter rocket, artillery, and mortar (C-RAM) capability that will use radar to detect incoming rockets and mortar rounds and automatically direct fire against them.



Source: <http://www.popsci.com/military-aviation-amp-space/article/2009-07/biomass-engine-coupled-hungry-hungry-robot>

Military reconnaissance robot fueled by biomass

The DARPA-funded Energetically Autonomous Tactical Robot (EATR) is a prototype military reconnaissance robot designed to use a waste heat engine to continually fuel itself on plants and other biomass, including dead bodies.

FORECAST

Over the next decade, military applications will be the single biggest driver of continuing advances in robotic technologies. In some cases, these developments will be logical extensions of previous trends in automation. Expect this area to be the leading forum for debate around the role of robotics in general.

(1) redefining the rules of war

Military robotics do not fit cleanly into any of our current protocols around the rules of engagement. Within the next decade we will need to assess not only the ethics of automated armed combat but also the allocation of accountability. Who, for example, will be responsible for system malfunctions or oversights that have human costs?

(2) robot ramp-up

In the next ten years we will see increasing levels of autonomous military activity. Where drones are currently flown at a ratio of one pilot per plane, we will begin to see systems that rely on one pilot per cluster or swarm.

(3) Spread of robotic augmentation

Expect military application of robotic augmentation to lead to civilian systems. Suits that multiply physical strength and endurance, for example, will have additional applications in agriculture and the treatment of disabilities.

(4) Security robots

Robotic systems will increasingly be used not only to insulate humans from potential harm but also to flag potentially suspicious activities and individuals. For example, systems could soon be deployed that flag unusual movement patterns or individuals carrying metal.



WHY IS THIS IMPORTANT?



Robotics is bringing the current logic of war into question. While simple automated systems were deployed as early as World War II and many military roboticists insist that humans “must remain in the loop,” a new generation of war-fighting technologies promises to redefine the nature and scope of that loop. Within a generation, it will become relatively rare for combat air missions from industrialized states to be manned, and a majority of on-the-ground military personnel will be trained to interact with robots on a daily basis.

RESOURCES

- *Wired for War: The Robotics Revolution and Conflict in the 21st Century* by Peter W. Singer (Penguin Press, 2009) explores the current deployment of battlefield robots and argues that military robotics is the most important military development since the advent of the atomic bomb. <http://wiredforwar.pwsinger.com/>
- *The Department of Mad Scientists: How DARPA Is Remaking Our World, from the Internet to Artificial Limbs* by Michael Belfiore (Smithsonian, 2009) takes a broad look at the Defense Advanced Research Projects Agency and its role in the development of new military technologies, including robotic brain-machine interfaces and telesurgery robotics for the battlefield. <http://michaelbelfiore.com/darpa>
- *War Bots: How U.S. Military Robots Are Transforming War In Iraq, Afghanistan, And The Future* by David Axe and Steve Olexa (Nimble Press, 2008) Examines robots currently being used in the U.S. military and makes the case that these will lead to significant moral questions.
- “A Soldier, Taking Orders From Its Ethical Judgment Center” by Cornelia Dean (*New York Times*, November 24, 2008) profiles computer scientists who believes that robots can be programmed to act more ethically in combat than human soldiers would. http://www.nytimes.com/2008/11/25/science/25robots.html?_r=1



INSTITUTE FOR THE FUTURE

Technology Horizons Program
124 University Avenue
2nd Floor
Palo Alto, CA 94301
t 650.854.6322
f 650.854.7850
www.iff.org