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Robots: The Future is Here

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On June 5, 2006, the Heritage Foundation held an event titled "Robots: the Future is Here." The discussion, part of the 2006 Competitive Technology for National Security Policy series, brought together representatives from industry, academia, and government to discuss the current state, and future direction, of robotics technology for national security.

Helen Greiner, the chairman and founder of iRobot, described robots as a disruptive technology, which has the possibility to change human life. Robots that are agile and autonomous are well-suited for jobs that are "dull, dirty, and dangerous" and will significantly change the way we live.

Current combat operations provide an example. The U.S. military used robots in cave-clearing operations in Afghanistan, and robots are used in Iraq to help clear improvised explosive devices (IEDs). The advantage of using robots in such situations, Ms. Greiner said, was that no human lives have to be risked. In fact, robots have saved dozens of soldiers' lives in both countries. Future uses for such robots include urban combat, sniper detection, explosive "sniffers," nuclear/biological/chemical sensing, mapping, and service as weapons platforms. Ms. Greiner explained that robots could provide innovative, flexible, and "persistent" solutions to evolving threats and problems.

Dr. John Leonard of the Massachusetts Institute of Technology (MIT) said that the six fundamental challenges in autonomous robot development are

locomotion, mapping and navigation, motion planning, object recognition, manipulation of objects, and cooperation between robots. Dr. Leonard's research focuses on Autonomous Underwater and Sea Surface Vehicles whose uses include undersea mapping and mine detection and mine-field mapping, as well as ship inspection. Groups of networked autonomous underwater vehicles could potentially provide position, mapping, communication, and surveillance capabilities to surface fleets or ships. Dr. Leonard has also built autonomous surface craft with off-the-shelf technology that could have applications in disaster-relief situations such as hurricanes, tsunamis, or floods, where they could rescue survivors, deliver food, water, and medical supplies, or even help establish an emergency communications network for emergency personnel.

Dr. Vladimir Lumelsky of NASA described the current state of robotic development, especially in relation to robot arm manipulators' interactions with humans. In the 1960s, many claims of the promises of robotics were going to be fulfilled "within a few years." Forty years later, while many

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earlier predictions have not been realized, there are now over one million robotic arm manipulators used in industry.

In the past 15 years, better electronics and computers have led to progress in robotics, according to Dr. Lumelsky. Robots have become very good at structured tasks—such as automobile body welding—but are still not good at unstructured interaction with humans. NASA is working on sensor-studded "skin" that can be used to cover robotic arms so that they can interact with their environment in an unstructured manner.

According to Mr. Stephen Welby of the Tactical Technology Office at the Defense Advanced Research Projects Agency (DARPA), robotics use in national security is trending towards more autonomy in increasingly complex environments. Robots have advantages over humans in areas such as strength, size, mobility, expendability, and the types of environments in which they can work. For example, the U.S. Air Force's aircraft with the single most combat hours is a RQ-4A Global Hawk robotic surveillance aircraft. This aircraft can operate for over 24 hours at an altitude of over 65,000 feet—something a human pilot cannot do.

In the next steps of robotics, according to Mr. Welby, robots will not simply mimic human actions, but use their unique abilities and advantages in ways that humans cannot duplicate. DARPA is currently investigating Unmanned Ground Combat Vehicles (UGCVs), surgical and medical-assistant robots, and robots that autonomously service and repair satellites. To encourage development in UGCVs, DARPA recently held a competition for robotic vehicles to complete a 132-mile course across the Nevada desert, the "Grand Challenge." This program will be repeated in 2007 in an urban environment.

While robotics is still in its "Wright Brothers" stage, where the first generation of these technologies is still being explored, the robotic technologies available today are being deployed dynamically for national security applications.

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