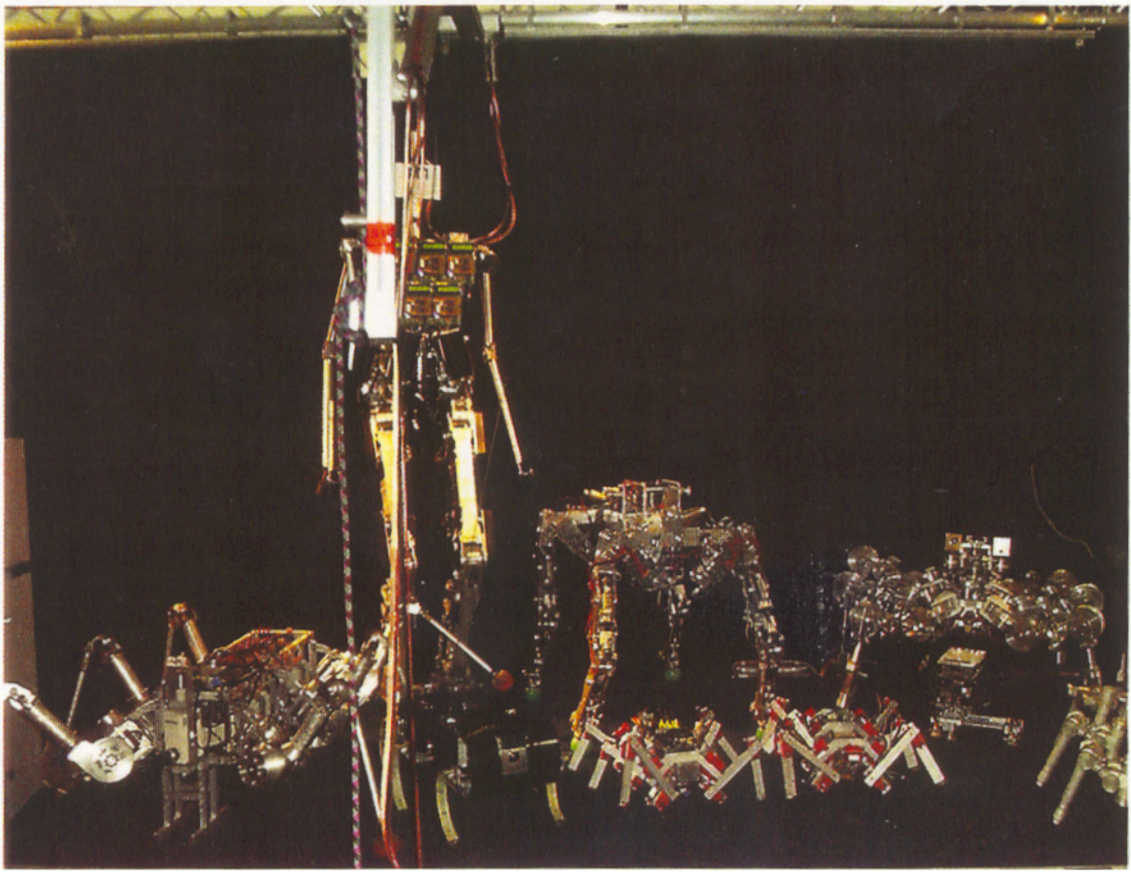
Eurobots

Robotic Niches In Europeans' Sights



European countries, as well as Canada, Israel, and Japan, are conducting innovative basic research on robotic systems. Much of this work is civilian in nature, but it has military applications, particularly in the areas of mobility and remote control. Among the most striking examples of these endeavors are the advances that Europeans and Canadians, in particular, have made in explosive-ordnance disposal and mine-clearing.

Despite the "visibility" of ground robotic systems, some 80 percent of robotic applications are in aerial systems. Naval systems account for more than 10 percent and land systems the remainder, according to Pierre Dumas, General Manager of the Western European Armaments Organization (WEAO) Research Cell.

European Cooperation for the Long Term In Defence (EUCLID) Common European Priority Area 15 covers missile unmanned aerial vehicle and robotic technology, involving Belgium, France, Italy, Turkey, and the UK. EUCLID accounts for three percent of European defense research. The fact that most European research and development spending is done by France and the UK is reflected in the two countries' work on robotics.

AUTONOMOUS MOBILITY

Paul Fisher of the University of Portsmouth, a center of excellence for robotics, said that walking and climbing robots are being developed in Europe. These include tracked robots that are designed to traverse any type of terrain, and anthropomorphic robots, "because we're well adapted to our environment." The latter can run and jog.

Another possibility is walking bicycles. Fisher recalled that the Japanese used bicycles in the Second World War. One project involves a multi-legged giant crab, Robug, that measures about 1.5 meters across.

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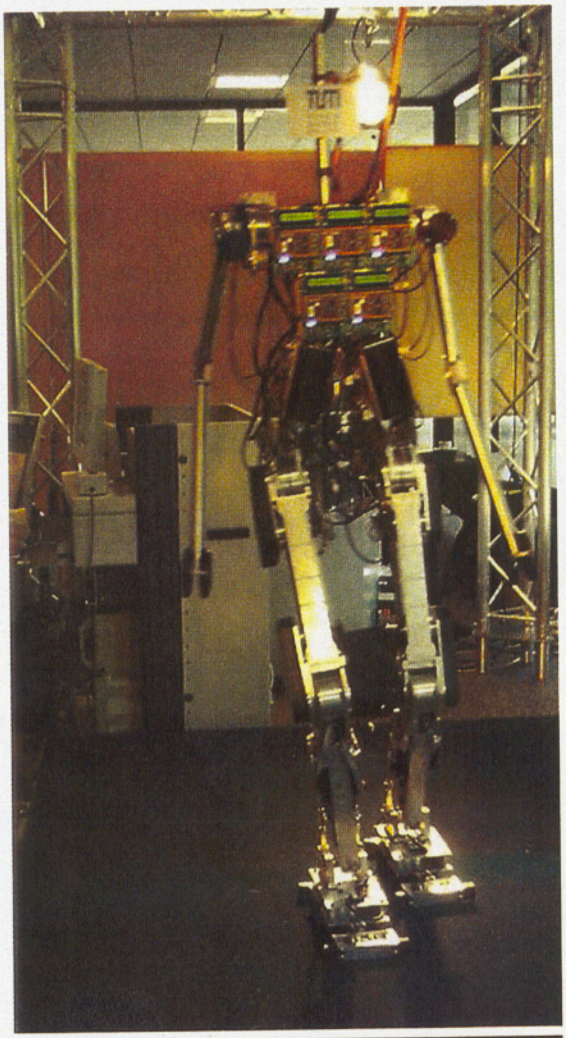

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For tracked and wheeled vehicles, Thales (the former Thomson-CSF) has been conducting trials with the Démonstrateur Autonome à Rapidité de Déplacement pour la Surveillance (Rapid Autonomous Surveillance Demonstrator, abbreviated DARDS). Some 10,000 kilometers of trials have been conducted in different semi-autonomous modes in all kinds of environments, reaching speeds up to 120 kilometers an hour. Platforms used have included four-wheel vehicles and the Wiesel tracked vehicle. Semi-autonomous operation allows DARDS to handle situations like a loss of communications with the command center, off-road movement, and moving in hazardous terrain.

DARDS technology is used in the Système Robotisé d'Acquisition pour la Neutralisation d'Objectifs (Robotic Acquisition System for Target Neutralization, abbreviated SYRANO) advanced technical demonstrator, a reconnaissance, surveillance, and target acquisition system. SYRANO was delivered to the Délégation Générale pour l'Armement (DGA), the French defense procurement agency, in 2000, and is undergoing operational evaluation.

The DGA has selected Thales as the prime contractor for robotics studies for ground force applications and to develop new functions such as convoy following, area surveillance, obstacle avoidance, and mine-clearing. Plans call for integrating all of these capabilities into a future tele-operation kit system.

MINE-CLEARING NICHE

European militaries are mine-clearing specialists. Slovakia has deployed an armored mine-clearing system using a T-55 chassis and a flail system in the Balkans. The next logical step is to make such a system remote controlled.

Norway has done just that with its Armored Mine Clearing Vehicle (AMCV), which is based on the Leopard 1 main battle tank. The AMCV is remotely operated and uses a flail system to clear mines.

Norway is cooperating with the US on the Viking Mine Clearing System (VMCS), which uses the same flail rotor, tool configuration, flail head, and rotor-drive system as the AMCV. Hägglunds Moelv, the Norwegian subsidiary of Alvis, and SUMMA Technology of the US began a feasibility study to integrate Norwegian flail technology with robotic control on a US platform. The US Army Aviation and Missile Command signed a contract in 2000 for prototyping, manufacturing, and installation; the first prototype was delivered in mid-November.

The concept involves mounting Hägglunds Moelv flail technology on a Liebherr Crawler Tractor 742 with a robotic control system for remote operations. The modular system includes a flail assembly and external power pack. The flail assembly consists of a rotor with 96 attachment points for clearing tools. During rotation, these clearing tools penetrate the ground surface and neutralize or detonate anti-personnel and anti-tank pressure-fuzed mines. The external power pack, which operates independently of the platform, consists of a diesel engine with support elements that run the hydraulic power pack to drive the flail assembly.

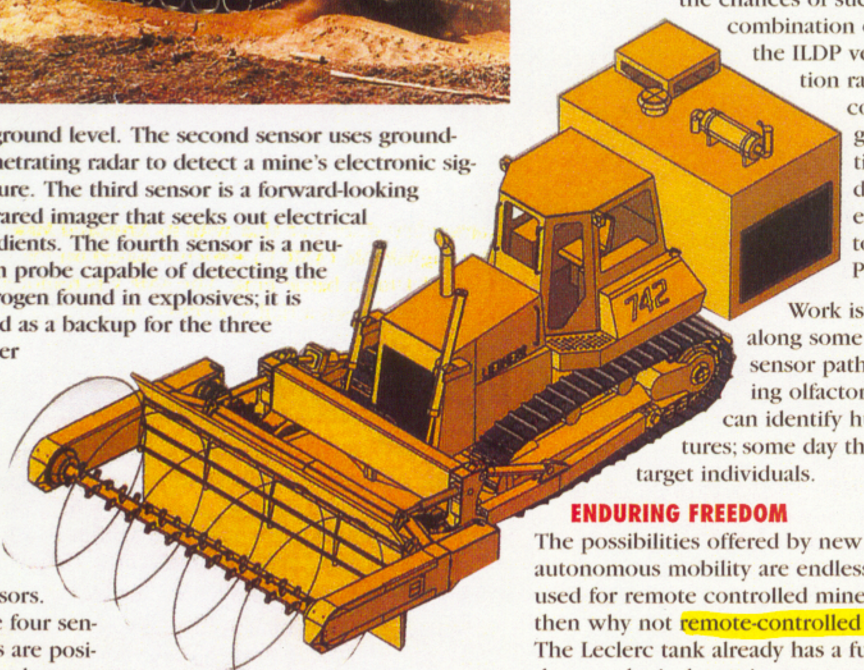
The robotic control system, which interfaces between the operator and the vehicle to allow for remote mine-clearing operations, consists of a flail assembly control system, vehicle control unit, and operator's control unit with command link, video link, and emergency radio link. While the VMCS uses a Liebherr tractor, it can be customized for various requirements and integrated into different platforms.

Canada, a driving force behind the movement to ban anti-personnel mines, took the concept a step further. The result of the Improved Landmine Detection Program (ILDP) is a multi-sensor robotic vehicle capable of detecting low-metal-content anti-vehicle mines on roads and tracks. The ILDP, conducted by Defence Research and Development Canada (CRDC), uses four different types of sensors.

The first sensor, which is placed at the front of the vehicle, is three meters wide and can "see" to a depth of 30 centimeters, detecting metal by gliding

Armored Mine Clearing Vehicle

at ground level. The second sensor uses ground-penetrating radar to detect a mine's electronic signature. The third sensor is a forward-looking infrared imager that seeks out electrical gradients. The fourth sensor is a neutron probe capable of detecting the nitrogen found in explosives; it is used as a backup for the three other sensors. The four sensors are positioned so as not to interfere with each other. The ILDP vehicle marks the location of mines, which are then defused by hand. It has a 95-percent detection rate.



Viking Mine Clearing System

Using ILDP technology, Computing Devices Canada (CDC), part of General Dynamics, is building the Improved Landmine Detection System (ILDS). ILDS, in fact, consists of three separate systems: a modified protection vehicle, a remote detection vehicle (RDV), and a control station installed in an armored personnel carrier.

The RDV, which is called Scorpion (and looks like one, too), uses a plow fitted with a device that can replicate magnetic signatures to simulate the presence of a vehicle in front of the plow, thereby neutralizing magnetic influence mines and clearing the way for the protection vehicle. Low ground pressure means further protection for the detection vehicle.

Both the RDV and the protection vehicle are equipped with an infrared camera, so that operators in the control center can see mines marked on the center of the track by the protection vehicle using biodegradable paint containing a fluorescent dye. There are three operators in the control center. One operates the detection vehicle, another controls the probes and data-analysis functions, and the third handles the protection vehicle.

The first ILDS was completed in August 2001. The company is also working on the Minder program to develop a detection system for the UK. It also has ambitions in the US.

IMPROVED DETECTION

CRDC plans even more advanced systems than the ILDP. It is considering improvements to the probes, integrating target recognition heads that operate digitally, using electronic neutron detection instead of thermal neutron activation, and better data fusion and telemetry.

In mine clearing, the more sensors used, the better the chances of success. The use of a combination of four sensors gives the ILDP vehicle its high detection rate. Another sensor combination—the single-chip ion-amplification package—detects very low levels of iron, according to the University of Portsmouth's Fisher.

Work is also progressing along some interesting single-sensor paths, Fisher said, including olfactory devices. These can identify human scent signatures; some day they might be used to target individuals.

ENDURING FREEDOM

The possibilities offered by new sensors and autonomous mobility are endless. If tank chassis are used for remote controlled mine-clearing vehicles, then why not remote-controlled artillery and tanks? The Leclerc tank already has a fully automatic loader; the next logical step is remote-control, a NATO official said. He also mentioned the possibility of remote-controlled artillery. Giat developed the first artillery piece with a fully automatic loading and firing system, the AUF1, back in the 1970s.

The main obstacle to making the most out of robots is cultural, the WEAO's Dumas pointed out. He criticized the US Congress' 10-year moratorium on armed robots that expired in the mid-1990s: "An armed robot is less dangerous than a madman with a Kalashnikov," he concluded. ■

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Landmine Detection System

Scorpion

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