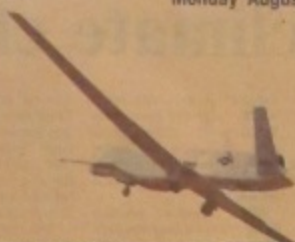




**Nortel's John Roth**  
An engineer who pays attention to the market  
**Profile, Page 11**



**The new weapon**  
The day of the robot dawns in warfare  
**Page 17**



**Stand-off in Japan**  
Central bank defies government on interest rates  
**Page 16**

## Let slip the drones of war

The helicopter picked its way through the disaster scene. It located the injured and dead while avoiding 40-foot flames, jets of water and wrecked trucks spilling hazardous waste. And all without a human at the controls.

This was a disaster designed by Robert Michelson, research engineer at Georgia Institute of Technology, who organises aerial robotics competitions. The latest contest, in June, won by a 4½-hour helicopter from Technische Universität Berlin, Germany, was closely watched by the Pentagon as well as the French defence ministry.

Plotless vehicles are not new in warfare. In the Vietnam war, the US Air Force sent "Lightning Bugs", remote-controlled jet aircraft, on 3,500 reconnaissance missions. In Northern Ireland, the British Army has used the Wheebox robot for bomb disposal since the 1970s.

But the day of the unmanned system may be dawning in earnest. At last month's Farnborough Air Show, pride of place went to a mock-up of a new aircraft bearing US Air Force insignia, the Global Hawk. Instead of a cockpit, it has a bulbous, windowless nose. It can do 24 hours of reconnaissance from 65,000 feet, 2,500 miles from home base. Humans provide it with a mission, but after that it is on its own.

Three factors are combining to encourage renewed interest in unmanned warfare. First, technology has advanced - not as fast as advanced - but as fast as advanced - of "artificial intelligence" had hoped, but enough to put robotic equipment all around us. Aircraft have "autonomous pilot" cars have cruise control, robots make cars. Sony's \$2,500 Aibo dog is an "entertainment robot" with "emotion" and "instincts" that "learn by living and interacting with you, developing its own unique personality unlike that of any other Aibo". James Lyons, British inventor of the hapless vacuum cleaner, is bringing out a \$2,000 robot that will vacuum without human help. Second, there is increasing

improvements in robotics and the desire to limit casualties have combined to rekindle military interest in unmanned vehicles, writes **Alexander Nicoll**



emphasis in modern warfare on preventing casualties to maintain public support. NATO's avoidance of the loss of a single pilot in last year's Kosovo campaign set a standard that politicians ordering future operations will want generals to match. Spurred by the use of unmanned aerial vehicles such as the US Predator drone in Kosovo, Senator John Warner, chairman of the Senate Armed Services Committee, has proposed "aggressive" development of unmanned control systems. He says one-third of deep-strike aircraft could be unmanned in 10 years and one-third of ground combat vehicles in 15 years. Finally removing human involvement is cheaper.



### THE NEW NEW WEAPON

There is no need to spend millions of dollars on each aircraft or submarine to make it safe for the crew. These "micro" systems have begun to overcome the "white scarf syndrome" in so far as they are unwilling to give up their role. "We know the air force is not embracing them," says Mack Day of Lockheed, the US defence manufacturer of the earlier days of unmanned aircraft. The market is already big. Shepherd's Unmanned

Vehicle Handbook lists 42 types in production and plenty more air, ground and sea, including six-inch "micro" aircraft. The wide "micro" aircraft has most interesting area for attention is the degree to which robots can operate "intelligently" and autonomously, learning from experience and - in particular - bumping into things. Public policy considerations have so far led more factories to manufacture that humans are still involved, operating aircraft remotely with a joystick or similar

device without risking human lives. If an aircraft is shot down, "there will be no pilot to be shown on television, to be interrogated and humiliated," says Mr Keret. Robots could also be used in Chernobyl-type disasters involving nuclear, chemical or biological dangers - as in Mr Michelson's simulation.

Pentagon scientists dream of "network-centric" dominance of the battlefield through information obtained by autonomous robots communicating with each other and with vehicles - manned or unmanned - that could deliver weapons. But in the real world, the way forward is more likely to be in specific robots that meet a clear need and can therefore win funding. For example, researchers at DERA's Robotics Facility at Portland Harbour in southern England are developing safe, unmanned ways to detect and destroy underwater mines. The mere threat of a minefield is a potent deterrent to an amphibious attack - such as the landing of a Royal Navy taskforce could have been asked to make recently in Sierra Leone. Remotely operated vehicles are used to detect mines, but manned ships still "sweep" for them and divers are also deployed. To hand over these tasks to robots, new sensors - acoustic, magnetic and electro-optic - have to be developed, as well as ways to communicate and synthesise information.

Will defence research into robots have civil uses? Defence experts use applications such as surveillance of oil and gas pipelines, anti-drug coastguard patrols, environmental testing, mapping and communications ping and they are also aware of extensive civil work being done on robots, which could well equip military development.

Companies such as RoboCup, a robot soccer competition to be held in Melbourne, Australia, this month, and seem trivial but require sophisticated scientific know-how. The aim is that by the mid-21st century a team of autonomous robots will defeat the human winner of the World Cup. Perhaps the Pentagon will then try to sign them up.

What will robots do? The most obvious one is to carry out dangerous reconnaissance