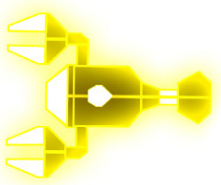
Military robots

Science background: Robo-Lobster



What's the issue?

Should we design robots that can go to war instead of humans?

Scientists are developing robots to do dangerous jobs such as bomb disposal, aerial surveillance and mapping territory, so we can put fewer human lives at risk.

But how much independence are we prepared to give robots? Will we be able to trust them as they get more intelligent and powerful? Will using robots on the battlefield detach us from the gory reality of war, turning it into a video game? Or will they make the world a safer place?

Military technology often spills over into other areas, so robots being developed now may one day help improve our lives. But is this benefit worth the risks?

Key terms

Biomimetic robots are inspired by nature. Engineers look at how organisms have evolved in an environment and recreate those adaptations in a robot's design.

AUVs (autonomous underwater vehicles) such as Robo-Lobster can operate alone for weeks following their programming.

UAVs (unmanned aerial vehicles, sometimes called drones) are pilotless flying robots. They can be any size from hand-held to large aeroplanes, and are controlled by a person on the ground.

UGVs (unmanned ground vehicles) are being used both by the military and for scientific research (like the Mars rovers). They can operate without human input for several weeks.

Use your Robo-Lobsters to keep the harbour safe from incoming mines.

What's all the fuss about?

Robo-Lobster is a biomimetic AUV robot that can scurry along the seabed because it's designed like a real lobster, which is stable underwater thanks to its eight legs, heavy claws and strong muscular tail. Today's robotic lobsters are designed to **chemically sniff out hidden mines in the water**.

In other words, Robo-Lobster will be doing dangerous jobs so human beings don't have to, keeping the seas safe whilst taking the risks instead of people. They might serve the military now, but robots like these may soon help improve our everyday lives too.

But what if the next step is to design robots for frontline fighting – or for laying mines instead of disposing of them? Although it sounds ideal to keep people as safe as possible, will this change the way we wage wars? Will governments be more likely to involve themselves in conflict if none of their people are at risk, and battles are fought with robot armies?

Investment in military technology has driven major innovation, which, time has shown, can have very real impacts beyond the battlefield.

Key facts

- The cost of producing and laying mines can be as low as 1% of the cost of removing them,[1] and thousands of mines are still being laid today as countries prepare to control their seas in case of conflict.[2]
- In 2010 the worldwide market for military robots was worth around $6 billion, and is only set to grow in the future.[3]
- The UK spent about £38 billion on defence in 2010.[4] Can we afford to develop military robots on top of that?
- Many technologies were first developed for military use – including the internet, duct tape, lasers, digital photography, radar, GPS and nuclear energy.[5] With potential spin-offs like these, can we afford not to spend money on research, even if it's initially for military use?

Image: General Atomics Aeronautical Systems Inc. All rights reserved.

An unmanned aerial vehicle (UAV) on a mission. This flying robot gets its orders from a person on the ground, and is equipped for surveillance as well as attacking targets.

What other animals are they using to help with the design of robots?

Tiny biomimetic robots known as **MAST** (micro autonomous systems and technology) will look like flies or spiders, perfectly camouflaged for surveillance. They will be able to communicate and work together without human input. Robo-tuna, a pollution-tracking 'bot', can swim the oceans much like the fish that inspired it. Robotics companies have also designed robots to move like dogs, carrying heavy loads across treacherous terrain, or climb walls like lizards. Invertebrates are a popular choice for designs because their bodies can wriggle through small gaps for surveillance tasks. Future designs could make robots even move like birds, with flapping wings.

What's so special about biomimetic robots?

Animals have evolved over millions of years to work perfectly in their environment. By mimicking nature, engineers can find good design solutions for the job. However, they don't just copy animals. Some military 'bots' are designed with sharp angles to make them more streamlined and invisible to radar.

Why use robots instead of humans?

Some jobs are incredibly dull or extremely dangerous. Because the unmanned vehicles don't need to carry a crew they can be any shape best suited to their environment. They can also move in ways that would be impossible with a pilot on board, such as extremely rapid accelerations, making the craft much more manoeuvrable.

How do robots get their orders?

UAVs depend on satellite communication and some missions need constant input. Sometimes this means a delay in the orders. AUVs need to surface to receive further instructions. In stealth situations this could mean jeopardising the mission. Therefore, some experts are looking at giving robots enough intelligence to operate independently.

Will these robots have non-military uses?

Any robot that can find a military purpose could also be used in an emergency, for example in an earthquake, fire or flood. Robots could also be used for scientific research when sending humans would be difficult or too dangerous, such as exploring space, inside volcanoes or the bottom of the ocean. For example, Robo-Lobster could be repurposed for marine research and conservation.

Image: US Navy by John F Williams

Robo-Lobster is a biomimetic underwater autonomous robot designed to move in shallow water just like a real lobster. It uses an electronic nervous system which is programmed to behave the way a lobster does as it searches its environment.

You could discuss...

- Who will benefit most from military robots?
- What would you trust a robot to do? Would you trust a robot to clean your room? What about look after you when you are ill?
- Who is responsible for a robot's actions? What if a robot hurts people?
- Will robots make us lazy? What will we do if robots do everything for us?
- Should we make robots look like us? How could you tell who is a robot and who is human?
- How much independence or intelligence should we give robots?
- Would you take orders from a robot?

Links to the Science Museum

The *Antenna* gallery (all about science in the news) currently has a pollution-tracking robotic fish on show. The story, together with images and opinions, is on our website.
http://antenna.sciencemuseum.org.uk/?page_id=1463

Brought to Life is packed with photos and stories on objects in the collection, such as land mines.
www.sciencemuseum.org.uk/broughttolife/techniques/landmines.aspx

Wars have driven the development of medicine. Some medical technologies that we use today were developed to save injured fighters.
www.sciencemuseum.org.uk/broughttolife/themes/war/innovations.aspx

Further information

Why use lobsters to sniff out sea mines?
www.wired.com/science/discoveries/news/2002/01/48892

Some biomimetic robots currently in development:
www.bostondynamics.com

This *Economist* article contains a comprehensive overview of UAVs and also looks at the legal and ethical problems of using them:
www.economist.com/node/21531433

This website looks at current US military research:
www.arl.army.mil/www/default.cfm?page=550

Sources

1 'Landmines factsheet', UN Cyberschoolbus, www.un.org/cyberschoolbus/banmines/facts.asp, data from United Nations Mine Clearance and Policy Unit, Department of Humanitarian Affairs, September 1997

2 '21st century U.S. Navy mine warfare – ensuring global access and commerce', US Navy (2009), http://www.navy.mil/n85/miw_primer-june2009.pdf

3 'Defense robotics – UAVs, UGVs, UUVs, and task robots for military applications', ABI Research (2011), www.abiresearch.com/research/1006109-Defense_Robotics

4 SIPRI Military Expenditure Database, www.sipri.org/databases/milex

5 Merritt Roe Smith, *Military Enterprise and Technological Change: Perspectives on the American Experience* (MIT Press, 1987)