

## Munching machines

*Robotics: A vegetarian robot that forages for fuel and runs on steam power would have a range of military and civilian uses.*



*What's on the menu?*

A ROBOT with dietary requirements might sound a bit far fetched, but a team of American researchers is developing a machine that will fend for itself by gathering biomass (wood, leaves and grass) to be used as a biofuel to run its steam-driven engine. Who might want such a device? The American army.

The Energetically Autonomous Tactical Robot is known, of course, by its acronym: EATR. It is the brainchild of Robotic Technology of Washington, DC. So far it is only a concept, but a working prototype is in the works. The research, in part funded by America's Defence Advanced Research Projects Agency, is seen as a way to help soldiers reduce their dependence on fuel supplies. The robot could, for instance, forage for biofuel while a unit on a long-endurance mission rested. It could then be used to recharge their electrical devices, carry some of their equipment or even transport the soldiers.

The EATR uses a robotic arm to gather and prepare vegetation, which it feeds through a shredder into a centrifugal combustion chamber, where it is ignited and then heats a series of coils. The coils contain deionised water (to stop them from furring up like a kettle). As the water inside the coils is superheated the steam is piped to a radial steam engine, which consists of six pistons. The steam drives the pistons, turning a generator which produces electricity. This is stored in batteries that power the electric motors which drive the EATR along.

The steam engine is designed to be a "closed-loop" system, in which water escaping from the cylinders through the exhaust valves is captured and cooled in a condensing unit. This turns the steam back into water, which is then returned to the combustion chamber. As well as using biomass, EATR's engine could also run on petrol, diesel, kerosene, cooking oil or anything similar than could be scavenged. The ability to consume a wide range of fuels would be important if the vehicle found itself in areas like deserts, where vegetation may not be available and alternative fuel would be needed.

Image-recognition software linked to a laser and camera would allow EATR to recognise plants, leaves and wood. Robert Finkelstein, Robotic Technology's president, estimates that about 68 kilograms (150 pounds) of vegetation would provide enough electricity for the machine to travel around 160km (100 miles). The company recently received EATR's engine, which has been developed by Cyclone Power Technology of Florida. The next stage is to integrate the EATR technology into a military vehicle to prove that the idea works. The type of vehicle that will be used has not yet been decided, although it could be a High Mobility Multipurpose

Wheeled Vehicle, popularly known as a Humvee, modified to drive itself under robotic control. Dr Finkelstein thinks an EATR prototype could be scurrying around woodland by around 2013.

Such a machine would be extremely useful for the army. With no dependence on external fuel supplies, an EATR would be able to perform long reconnaissance missions in areas which might be deemed too dangerous for soldiers to venture. There are also civilian applications, such as a forestry patrol over large swathes of territory where traditional fuel may be hard to find, but where there is plenty of biomass to keep the EATR going. An agricultural version might navigate around farmland, checking for weed and insect infestations, and feeding itself as it went. It would be a return, in a way, to a time when old-fashioned steam engines once worked in the fields.

**Fonte: The Economist, June 10<sup>th</sup> 2010. Disponível em: <[www.economist.com](http://www.economist.com)>.**

**Acesso em: 16 jun. 2010.**

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