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Army call-up for rats, robots and reptiles: The US government is ploughing money into unconventional projects to toughen its defences against terrorism, says Geoff Dyer:

By GEOFF DYER

A robot with legs that can climb walls; rats whose movements can be controlled down the internet via a computer; body-hugging suits that will carry the load of a 300lb rucksack.

These projects sound like the sort of wacky scientific experiments a frustrated inventor would conduct in the garage, mixing the science fiction of comic books with the thrall of the very latest James Bond gadget.

In fact, they are all desperately serious scientific projects that have become some of the most unlikely beneficiaries of the September 11 2001 attacks in the US.

The US government is trying to get approval from Congress for a Dollars 6bn (Pounds 3.6bn) 10-year research programme to improve its preparations for bioterrorist attacks.

The bulk of those funds would be pumped into research into obvious fields of study, such as vaccines and treatments for anthrax.

But outside the drug development labs, the government is also ploughing money into unconventional biological research that, with lateral thinking, might produce interesting products for the bioterrorism effort.

Much of the work is sponsored by Darpa, the Pentagon's central research organisation, or Defence Advanced Research Projects Agency, which prides itself on long-range and innovative work and now has an annual budget of about Dollars 2.5bn. It has a long record in information technology but recently it has turned more of its attention to biology.

Alan Rudolph, a programme manager at Darpa, says the agency has 23 programmes in the biomedical area, each with a budget of between Dollars 10m and Dollars 50m. "Our interest in life sciences has grown hugely," he says. The idea is to back interesting biomedical research that other

agencies, such as the National Institutes of Health, might not consider but which has potential for defence use. "There are a number of projects being pursued under the auspices of national security that have broad appeal," he says.

Rhex is one of the projects Darpa is pinning its hopes on. Most robots have wheels and tracks. Rhex is one of the first to have legs. Developed by the University of Michigan, McGill University in Canada and the University of California at Berkeley, it started as an investigation into why legs are important in mobility.

Now there is a prototype that can move quickly over very rough terrain, or even swim. The next stage will be to give Rhex a video camera or sensors to detect substances in the atmosphere.

Such a device could be used in search and rescue operations, after an earthquake, for instance. In defence, Rhex could detect biological agents. "It is designed for places where it is too dangerous for humans to go," says Dr Rudolph.

Another project is based on the gecko. Three years ago, researchers at Berkeley said they had worked out the mysterious suction mechanism that allows these reptiles to hang from ceilings. It comprises millions of tiny hairs; the combined efforts of all these foot hairs create an electrical force that allows them to stick to most surfaces.

If the principle can be replicated, it would have many industrial applications, such as adhesives. In defence, the prize would be attaching the "gecko" feet to a robot such as Rhex, which could then scale walls.

Robert Full, a biomechanist from the department of integrated biology at the University of California at Berkeley and leader of the gecko project, says unconventional research that brings together different disciplines deserves strong backing. "We have to support more curiosity-based research because often the great discoveries do not come from where you thought they would."

John Chapin, of the State University of New York, and Miguel Nicolelis at Duke University, have been working for years on ways to restore motor function to people after an accident by trying to record information from brain neurones. In one experiment, electrodes were implanted into the sections of a monkey brain where instructions for arm movements occur; they then monitored its brain signals as it performed tasks.

Next, they routed the monkey's brain signals through a computer and forwarded them to a robotic arm, so that the robot mimicked the monkey's

movements. The brain signals were even transmitted over the internet, allowing the monkey's neural commands to operate the robot from a distance. The hope is that this approach might eventually be used to restore movement to a paralysed patient.

Their work was noted by the defence department because of the potential for an animal such as a rat to be guided remotely into dangerous places to look for explosives or bio-weapons. "Rats can go places that humans and even robots cannot," says Dr Chapin.

Darpa is also backing research into "exoskeletons", body-hugging frames designed to carry the heavy load of a soldier's pack.

Biomedical research is not new for Darpa and many of the scientists have worked with the agency for years. But the September 11 attacks have given the field a much higher priority.

Susan Hardin, founder and chief executive of Visigen, which develops rapid DNA sequencing technology, says she spent months in 2001 trying to negotiate a Darpa grant. Then the contract was swiftly signed on September 15 - aSaturday. "That was when I realised how serious this was," she says.