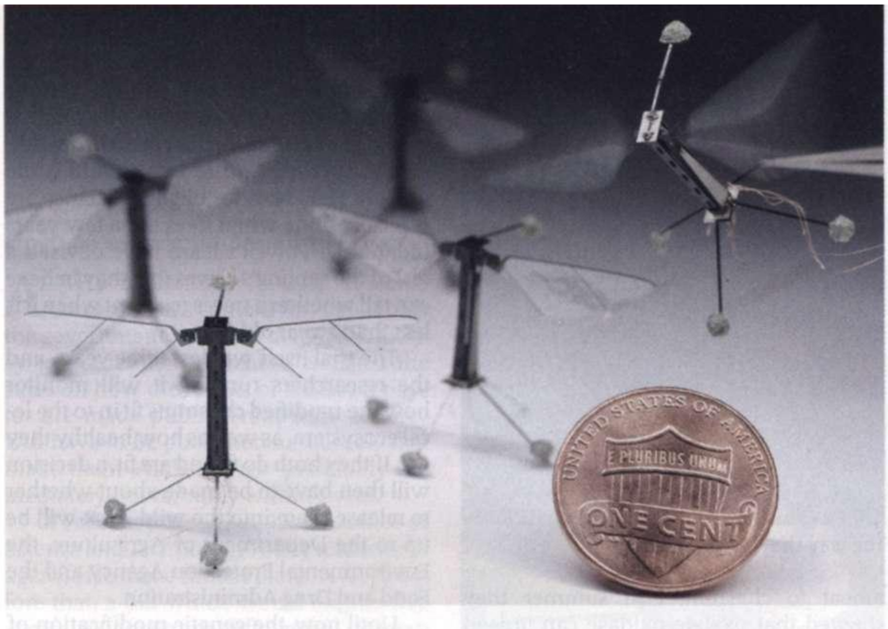

Also in this section

Miniature flying robots

Robodiptera

An insect-like robot, no bigger than a fly, takes to the air

SOME people are convinced they are already out there: swarms of tiny flying drones discreetly surveying the world on behalf of their shadowy masters. In 2007 anti-war protesters in America claimed they were being watched by small hovering craft that looked like dragonflies. Officials maintained they really were dragonflies. Whatever the truth, robotic flies actually are now getting airborne.

This week the successful flight of what are probably the smallest hovering robots yet was reported in Science by Robert Wood and his colleagues at the Wyss Institute for Biologically Inspired Engineering at Harvard. These robots (pictured above) are the size of crane flies. Most small flying robots are helicopters-kept aloft by one or more rotating wings. These, though, are ornithopters, meaning their wings flap. Wingtip to wingtip they measure 3cm and they weigh just 80 milligrams. Like true flies (those known to entomologists as Diptera), and unlike dragonflies or butterflies, they have but a single pair of wings.

Dr Wood, as he is quick to point out, is not trying to build a military drone. Rather, it is the basic science behind flying insects that he and his team are interested in. No doubt the armed forces are taking a keen interest in this sort of work. But civilian applications such as search and rescue, he thinks, are likely to be as important as military and security ones. Indeed, the idea that inspired the study was that of using swarms of robotic flies to pollinate crops.

Flies, as anyone who has tried to swat one knows, are the most agile of flying creatures. Dr Wood and his colleagues considered it impossible, even with the best miniaturised mechanical and electrical parts currently available, to build an artificial version of one that would show anything like that level of aerial prowess. They therefore had to come up with a new form of manufacturing, which they call smart composite microstructures (SCM), to do the job. SCM employs lasers to cut shapes from extremely tbin sheets of material and then bonds them together and folds them to make components. The materials' properties come from their layered structures.

Getting into a flap

The robot's wings, for example, are powered by artificial muscles. These are made from layers of a piezoelectric material-one that deforms when an electric current is applied to it. Correct alignment of these layers creates a structure analogous to an insect's flight muscles, which it contracts and relaxes in order to flap its wings.

Dr Wood's robots are modelled on a hoverfly called Eristalis. They have a long way to go before they can mimic the precision of such a creature's flight. They can, nevertheless, hover. They can also carry out simple manoeuvres. These include turning by flapping one wing harder than the other.

These acrobatics are possible because of the flight-control system Dr Wood has designed. Like jet fighters, flying insects are inherently unstable. And so are Dr Wood's robots. Insects have nervous systems to deal with this. Fighters have computers. Dr Wood's flies are similarly computer-controlled—and this, for the moment, is where the illusion breaks down, because the computer is on a desktop and is connected to the robot by a thin copper wire.

That could be fixed with a suitable chip. But the wire also carries electric power: 19 milliwatts, which is equivalent to the power consumed by a flying insect of the same size. Batteries light enough to fly with do exist. But they would keep the robot going for only a few minutes.

Dr Wood's robot is not the only experimental tiny flying machine around. The others, though, are bigger and heavier than most insects. Some, such as the DelFly Micro, a robot with a 10cm wingspan build by Delft University of Technology in the Netherlands, are also ornithopters. Others are helicopters. Researchers at the University of Pennsylvania have demonstrated how a swarm of palm-sized devices with a rotor on each corner can fly together in formation. And Seiko Epson, a Japanese firm, has built an 8cm-tall robot that uses contra-rotating blades mounted on the same shaft to achieve stability.

What is really needed is a breakthrough in battery technology. In the meantime, though, Dr Wood says there is plenty of research to get on with, in order to improve the flying abilities of his new robots and the way they are made. And eventually, like real insects, they will have to fly outdoors. Buzzing around a cosy laboratory is one thing. Coping with rain, gusts of wind and even predators that cannot tell the difference between a robot and the real thing is quite another. •

Fonte: The Economist, London, v. 407, n. 8834, p. 77, 4 a 10 May 2013.