

Fly without getting into a flap

A new breed of aircraft without conventional control surfaces will be stealthier, more reliable and cheaper, writes Roger Highfield

Three ... two ... one ...
A few days ago a new kind of aircraft was launched into the cloudy skies over Eccles. When it landed in a field of stubble near the river Mersey, the plane marked a return to the flap-free aircraft of the Wright brothers and a glimpse of the next generation of "fluidic" aircraft.

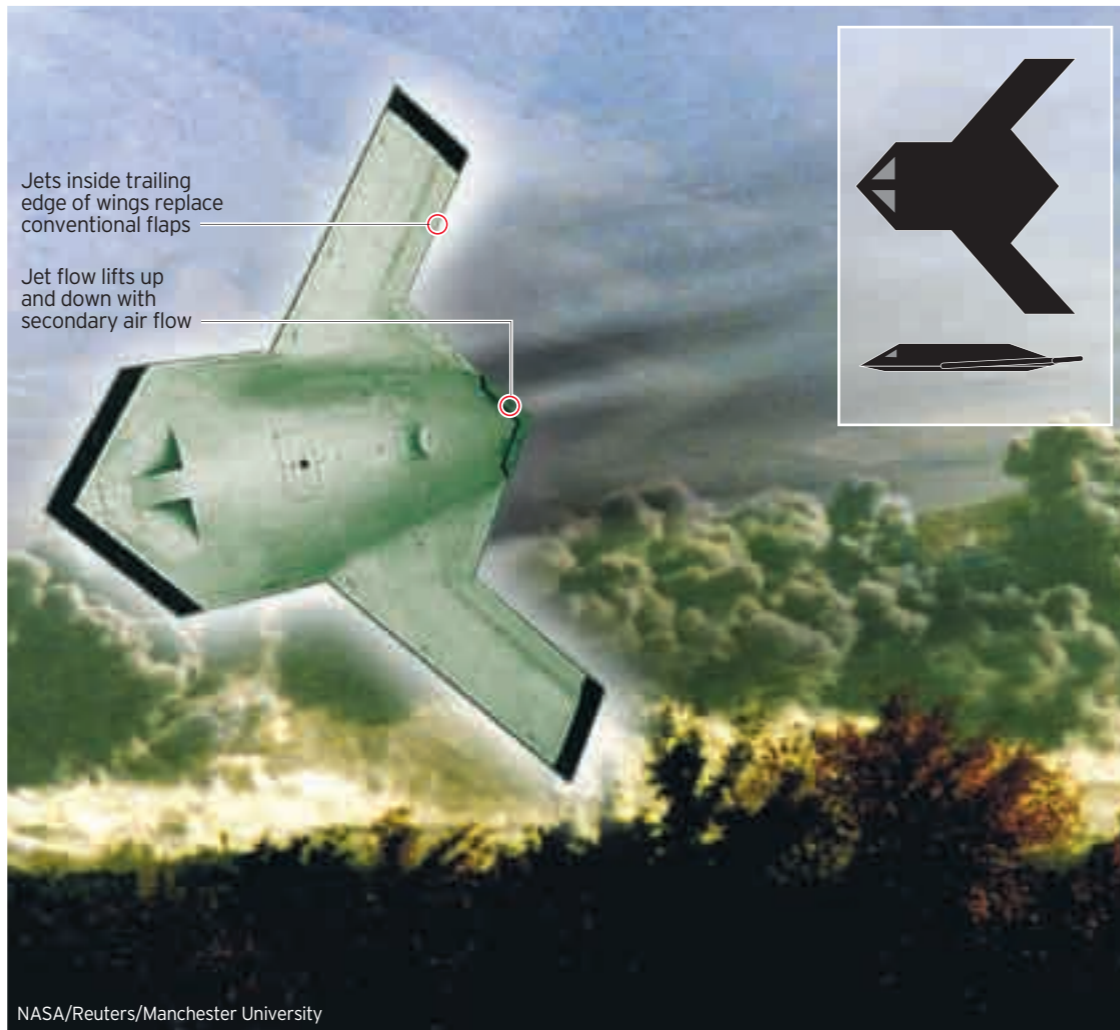
The plane is one of two revolutionary models that have successfully flown over a cornfield near Manchester in the past few months, marking the first test flights of fluidic planes, which can turn, pitch and yaw without the need for control surfaces, and the first look at the future of aviation.

The remote-controlled craft alter air flows – and performance – with gusts, sheets and jets of air instead of flaps and ailerons and have been developed as part of a five-year, £6.2 million programme, funded jointly by BAE Systems and the Engineering and Physical Sciences Research Council, called Flaviir (flapless air vehicle integrated industrial research).

The model flapless aircraft have been developed by a 10-strong team of doctoral students – many working as volunteers – at Manchester University's Goldstein Aeronautical Research Laboratory. The aim is to come up with the next generation of unmanned air vehicles, which are used by the air force for reconnaissance, spying and strikes on key targets such as radar installations.

Overall, the programme is being managed from Cranfield University by Professor Paul Ivey and includes teams in Leicester, Liverpool, Nottingham, Southampton, Swansea, Warwick, York and London. The team hopes to deliver a flying fluidic demonstrator with a wingspan of 2.5 metres in early 2009; the aircraft is likely to be a modified version of a delta-wing plane called an Eclipse.

For their effort, Eccles's answer to the Wright brothers try out their designs with radio-controlled model craft to avoid aviation authority bureaucracy and red tape. Size and weight constraints make modifying existing model aircraft "more challenging" than designing a full-size aircraft based on the new technologies, says Russell Sparks, 23, chief engineer of the Flaviir "seedcorn demonstrator" project. Although the initial



NASA/Reuters/Manchester University

‘No one has flown anything like this before’

aim is to make robot planes for reconnaissance and other uses, there is no reason fluidics could not move the largest of passenger jets, he says.

One fluidics approach developed at Manchester, called circulation control (CC), replaces conventional flaps by blowing air from the trailing edge of the wing. "This entrains the upper surface flow and so increases lift," says Stephen Michie, 22.

Although the model aircraft that flies with CC technology looks rather mundane, like a baby Cessna, it contains a modified turbocharger from a Peugeot 406 car and air ducting from the world's biggest aircraft, the Airbus A380, to help it to bank and turn by bleeding sheets of air from its wings. It was successfully tested in May.

The second method, called fluidic thrust vectoring (FTV), achieves what a Harrier jump jet does without moving parts: the direction of a jet can be changed with a secondary air flow, explains Ken Gill, 23. Graze the top of the main jet and the thrust moves up, graze the bottom and it shifts down.

In this case the demonstrator plane is a delta-wing electric ducted fan craft that is launched with a 30m bungee. The first test flight this month showed that the FTV concept worked; perhaps too well, since it



climbed so fast that it stalled.

Both prototypes can fly without flaps: one eliminated the need for elevators but still uses ailerons, while the second needs no ailerons but still uses elevators. They will pave the way to a test flight of the world's first truly flapless plane, which will be more reliable and stealthy than today's aircraft, while remaining just as manoeuvrable.

The plane, called the Integrated Demonstrator and based on the stealth X45 design developed by Boeing, will combine both kinds of fluidic flow control. Wind tunnel tests are already under way and the aircraft is due to fly at the end of the year, says Andrew Lytton, 25.

Other fluidic concepts under

development at Imperial College London are "synthetic jets", devices that mimic the movement of a loudspeaker or the way a smoker blows rings of smoke. By putting hundreds of tiny synthetic jets on control surfaces, the aerodynamic engineers hope to use them to influence air flows over the plane to change the lift, drag and other features of its performance.

When it comes to fluidic planes, "no one has flown anything like this before", says Phil Woods of BAE Systems' Advanced Technology Centre. Being able to fly and control aircraft without conventional control surfaces will bring benefits to both military and civil aircraft, he says. "BAE Systems is excited by the

The Flapless Technology Team: (left to right) Andy Lytton, Russell Sparks, Ken Gill and Stephen Michie

possibilities."

For military jets the stealth characteristics – their invisibility – will be enhanced by a reduction in edges and gaps that can increase the chances of detection by radar. These stealth characteristics give the aircraft greater ability to penetrate an enemy's most sophisticated defences and threaten its most valued and heavily defended targets.

Additionally, the number of moving parts, both hydraulic and electric, in flap-free aircraft will be reduced, which will in turn boost reliability and efficiency while cutting costs and maintenance. "We can make a lighter and more robust aircraft," says Woods. "We can leave an aircraft for a year, get it out, plug it in and off it will go."

Science howlers make BBC comedy a laughing stock

VIEW FROM THE LAB



Meanwhile, the heavens are exploding, says Steve Jones

Science is not funny and scientists are less so (and even the recent Ig Nobel Prize for plumbing the pressure within a pooing penguin was a bit, well, 20th century). The BBC disagrees. Tonight sees the first episode of *Supernova*, a six-part comedy about astronomers (who are even less amusing than the rest of us, given that they tend to spend all night at work) with a cast that includes Rob ("Little Smashers") Brydon and quite a lot of eccentric Australians in the outback in a place with a pub.

Some of it is comical (I liked the Stephen Hawking Action Man) and some less so. There is certainly a whole lot of science jargon, much of it Bang (geddit?) up to date, with talk of splitting isotopes around the event horizon of a black hole, and ekpyrotic wormholes with convex gullets (they have to do with the theory that our universe began when two smaller universes collided and quarrelled about how many dimensions the resulting wreck should contain).

And – can it be coincidence, or do the TV schedulers know something the Astronomer Royal does not? – just before BBC2's stellar entertainment is due to go out, *Nature* has news of a series of sudden and almost instantaneous pulses of enormous energy flashing towards the Earth. A feeble version of such explosions was noticed 30 years ago. They astonished the sky-watchers, for the heavenly eruptions burst into life as the brightest source of gamma rays in the sky but disappeared within a few seconds. They come from a long way away, and are due to the violent collapse of young stars, half way to the edge of the universe.

The newly discovered versions last for an even shorter instant. A satellite telescope identifies them as the result of sudden collisions of dense stars or black holes with each other, in galaxies not far from home. One blast arrived on July 9 and involved such immense energy that after the gamma-ray flash it left a visible glow lasting for more than a day.

So, well done the *Supernova* team for timing their Black Hole comedy to fit the intestinal explosions of the heavens. But how well does the rest of their science hold up? Of course, in the boring and literal way that scientists specialise in, it is easy to pick up faults. When probing the universe, *Size Does Matter* (the show's doubles entendres are catching), and the claim that

the Antipodeans can pick up an image of the effects of a distant black hole with a telescope a foot in diameter is optimistic indeed. To do so needs not just a small lens tended by a glamorous keeper, but virtual telescopes thousands of miles across, with an array of radio dishes linked together into a single unit.

The hapless (and sexually frustrated) Welsh gas man (gas in the interstellar clouds sense, rather than the hot air we Celts are famed for) smashes the observatory's radium lens as he tries to impress his colleagues. I'm not sure what that device might have been, although he gets caught when the broken bits glow through his lab coat, in a macabre echo of the fate of Marie Curie. There are other technical infelicities too, but what really made my teeth grate was the conversation between the luscious female physicist and her boyfriend in a spacecraft orbiting Mars while Rob Brydon hid, for comedic reasons, under the table. Their erotic (or selerotic) chat turned on the distant American's suspicions and her instant denials of any hint of infidelity (which, I suspect, will be a major feature of episodes 2, 3, 4, 5 and 6).

The difficulty is the immediacy of their chat: in fact it takes a lot of energy, and from 10 to 40 minutes, depending on where the Red Planet is in relation to the Earth at the time, for a radio message to travel back and forth between the two planets.

Nasa is aware of the problem and a couple of months ago launched the Mars Reconnaissance Orbiter as a first step in an InterPlanetary Internet. It uses "store-and-forward" technology to hold information in reserve and send it on when a channel opens up. The satellite will be the central node in the .Mars domain that is to serve the crowd of machines that may soon crawl the planet's surface. They will send their data back to the Orbiter to be forwarded when a channel becomes available, rather than direct to Earth itself.

That conserves their batteries, but their messages will never travel at more than the speed of light. Any real astronomical couple in Mars-Earth dialogue should hence have plenty of time to think up a few more sarcastic comments, or even some better jokes, for the next five *Supernova* episodes.

Steve Jones is professor of genetics at University College London