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A Software Copilot Can Learn To Fly A Damaged Plane

Crippled combat aircraft should soon stand a better chance of making it back to base, thanks to a novel neural network that has just passed its first major test.

When the control surfaces of an aeroplane, such as the rudder or ailerons, are damaged or malfunctioning there is often very little a pilot can do to avert a disaster. But in a series of tests that finished last week, NASA engineers have shown that smart software can keep aircraft flying even if some of their control surfaces are disabled.

The tests, at NASA's Dryden Flight Research Center in Edwards, California, used a modified F-15 aircraft similar to those flying combat missions against Serbia. The software was tested in high performance manoeuvres, such as tracking a target or performing a 360 degree roll. The neural net managed to keep disabled planes under control even at supersonic speeds. This is the first time such a system has helped control a piloted aircraft.

The software was developed at NASA's Ames Research Center in Moffett Field, California. It is designed to kick in when the flight control system detects a mismatch between data on the plane's airspeed, bearing and the forces on its wings, tail and fuselage, and a computer model showing what data should be received if the plane were flying normally.

Neural networks are programs that learn to perform a certain task by trial and error, rather like the human brain. The Ames team trained theirs to control an F-15 on a flight simulator, before letting it loose on the real thing. In an emergency, the network reassesses flight data six times every second to work out the best way of using the available control surfaces and the plane's engines to maintain normal flight.

The pilot would be warned of any failures, such as the loss of his ailerons. But in most cases, he shouldn't notice that the plane is handling differently from normal. "The computer would determine that the ailerons aren't available and would have another scheme in mind," says Mike Thomson, the engineer at Dryden who supervised the tests. "It would learn to use another control surface instead."

Thomson believes commercial airliners could also benefit from the system, although it would be restricted to modern fly-by-wire planes. When an airliner loses its control surfaces, the results can be horrific: at Sioux City, Iowa, in 1989, a full hydraulic failure left an aircrew trying to land a DC-10 using only the throttles of its two remaining engines. It crash-landed, killing 110 passengers.

However, civil authorities may be less willing than the military to embrace the system. They will demand standardised tests of the system's performance, says Tom Anderson, an expert on software reliability at Newcastle University. But such tests will be hard to devise, as the performance of neural networks is inherently difficult to predict.

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