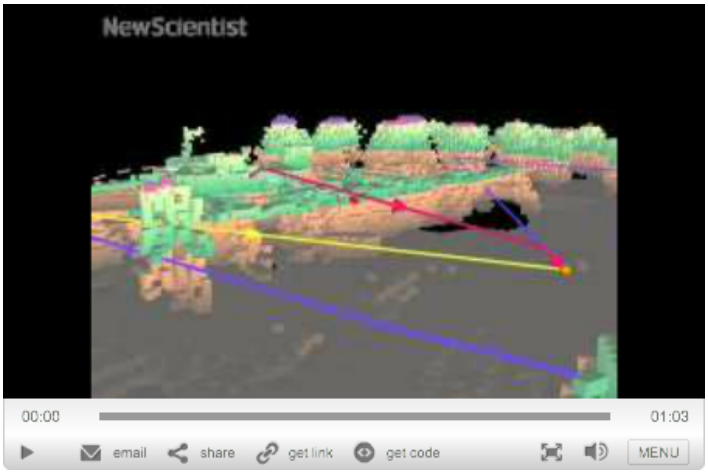
Robot helicopter takes flight navigation to a new low

› 07:00 10 November 2008 by **Kurt Kleiner**



Video: A laser scanner enables this uncrewed helicopter to fly low and dodge obstacles in its path

Flying low to the ground is a pilot's nightmare: buildings, trees, and power cables all threaten to put an early end to the flight. But now the first large robotic aircraft able to fly at low levels and weave around such obstacles has been developed by US engineers.

Giving uncrewed aerial vehicles (UAVs) this ability could aid military operations in urban areas, or help search-and-rescue efforts after disasters.

Most UAVs do not have the capacity to sense and avoid obstacles at all - a significant barrier to their being allowed to fly in civilian airspace.

But now engineers at Carnegie Mellon University, Pittsburgh, have modified a commercial civilian UAV helicopter made by Yamaha to be able to see obstacles it encounters.

The helicopter's "eye" is a custom-built 3D laser scanner, which sweeps an oval path ahead of the 3.5-metre long craft. The scanner can detect objects as hard to see as power lines from 150 metres away.

Twin strategy

The helicopter uses two navigation strategies. First, a long-range planning algorithm uses an existing 3D map to work out a general course that avoids large obstacles like buildings and trees. That map can be preloaded, or built up by the helicopter as it explores a new area.

When the aircraft flies a route, its scanner looks out for other obstacles. As these appear, a local planning system takes over and plots a detour. The UAV

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can fly between two obstacles with only around 3 metres clearance on each side.

The same two-part navigation strategy has been used successfully on wheeled robots in the past, developing the laser scanner made it possible on aircraft too.

The helicopter was put through its paces at a fake urban environment in Fort Benning, Georgia, including buildings and wires only 6 millimetres thick. Over 700 missions, the system successfully navigated at speeds up to 36 kilometres per hour and altitudes of between 5 to 11 meters.

Jean-Christophe Zufferey, an engineer at Swiss Federal Institute of Technology in Lausanne, Switzerland, says that the Carnegie Mellon aircraft is the only large UAV in existence capable of flying so low and planning its way around obstacles.

Robotic rescuer

"If you look at UAVs in general, they are not able to fly at low altitude around obstacles. Most are flying above in the free sky," Zufferey says.

"So trying to get closer to obstacles, to an urban environment, and to people in general is something that is very useful for a range of applications," he says.

Sanjiv Singh, the Carnegie Mellon roboticist leading the project, told **New Scientist** it was developed for a now-defunct initiative from DARPA, the US defence research agency tasked with protecting the country from "technological surprise" (see *Fifty years of DARPA: A surprising history*).

The research group also has a smaller version, a 1.5-kg "quadrotor" with its own, smaller, laser scanner.

They hope to eventually equip a full-size helicopter with their technology, to perform as a robotic air ambulance to retrieve wounded soldiers from combat zones.

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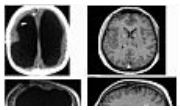
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