Drones on ice

The Antarctic isn't kind to drones – but it's not easy or cheap for people to work in either, so robots represent a huge scientific opportunity. Tom Marshall talked to researchers at NERC's British Antarctic Survey (BAS) about how they're using UAVs to map hard-to-reach areas and help ships steer clear of ice.

Off-the-shelf drones are built to stand up to hard landings and variable weather, but not to cope with temperatures way below 0°C. So in a way it's surprising BAS scientists have had as much success as they have in using them for research at the poles.

Even in summer it's often -10°C or lower, playing havoc with batteries. High winds can make flight impossible, and there's always the risk of losing a drone – even if one crashes on the ice a few hundred metres away, there's no guarantee the terrain will be safe enough to recover it. So while scientists have made some efforts to add insulation, they've mostly focused on less expensive quadcopters whose loss wouldn't be a financial disaster.

These are also much easier to launch and land than heavier fixed-wing drones would be, particularly in a tight space like a ship's deck. BAS's first foray into drones was launching quadcopters from its ships to help find a route through the sea ice. The vessels are designed to operate safely amid ice floes, but sailing through them is slow and uses a lot of fuel – fuel that's incredibly expensive by the time it's made it to the Antarctic. Knowing whether a stretch of ice ahead goes on for a couple of kilometres or for dozens lets the ship's captain make better decision about when to push through and when to go around.

Andrew Fleming works in the BAS mapping team, and recently returned from a spell which included flying drones from the polar research vessel RRS *Ernest Shackleton*. 'It's just giving us a much taller conning tower, really,' he says. 'Even at the highest point on the ship, you're still only a few metres up from the sea, so the horizon's just a few kilometres away. The drone's amazingly effective at extending our view; even if it only goes up 100 metres or so, we can see much, much further.'

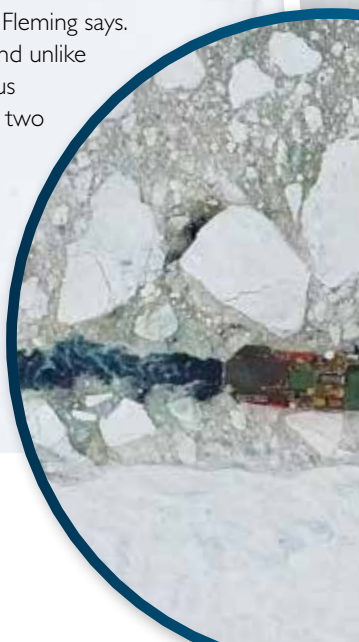
Information from shipborne drones now feeds into the information provided by the international PolarView consortium, complementing data from satellites to help ships navigate the frigid polar waters safely and efficiently.

BAS researchers are now starting to use drones more generally to work over the Antarctic ice. They're using them for everything from surveying penguin colonies to spotting algae growing on the surface. Sometimes the drones can gather data themselves; sometimes their value lies in helping plan research on the ground to make it faster and easier – for instance, they allowed more efficient route planning on a recent expedition to catalogue rocky outcrops, letting scientists get better data on the geological landscape beneath the ice than they could otherwise have done.

BAS is now investigating using heavier fixed-wing drones. These may include ones with petrol engines that will be able to range much further over the ice – some current models can travel up to 1000km – and carry heavier instrument loads.

He's also been looking at the possibility of producing 3D ice maps with drone data; if it turns out to work, it could provide a fast new way to map the surface of Antarctic ice sheets and monitor how they are changing.

'We rely a lot on satellite imagery, and that's great for the big picture but we also need more detail about local conditions,' Fleming says. 'Drones can provide that – and unlike satellites they don't only tell us what's going on every day or two when they come overhead – they can be deployed when required. The challenge for us is to work out the best way to use them to collect data, extract the required information, and make new observations that we couldn't have got before.'



Andrew Fleming is the remote sensing manager at the British Antarctic Survey. To find out more about the Polar View project, visit :

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