



## Aerospace

### Unmanned aerial vehicles

# Mercy missions

Drones are not just for surveillance and warfare – they have a more positive side, with engineers developing them for applications such as delivering aid.

**Rachel Boagey** reports

More than one billion people live in remote communities without reliable access to medicines. Transporting medical supplies to these areas is difficult and unreliable, and the result is 10 million preventable deaths per year.

However, there is a technology with potential to bring such communities what they need. Mention drones or unmanned aerial vehicles (UAVs), and most people think surveillance and warfare. But this affordable technology is increasingly being used for good – to support

conservation, save lives and give more people access to realtime information about the world around them.

While today the focus of drones is mainly on the technology's applicability to commercial operations, there is a clear carryover for its ability to provide aid. The UN recently published a policy brief on the topic of drones for good, noting that UAVs are increasingly performing civilian tasks as the technology becomes more common, and that in 2013 UAVs were being made in 57 countries by 270 companies.

By 2020, it is predicted that UAVs will replace \$127 billion worth of services, and they are already being used to promote humanitarian purposes all over the world. An unprecedented number of small and lightweight UAVs were launched in the Philippines after Typhoon Haiyan in 2013; they were used in Haiti following Hurricane Sandy in 2012; and, more recently, they were flown in response to massive flooding in the Balkans and after the earthquake in China.

#### Disaster relief

Several UN groups, including the Office for the Coordination of Humanitarian Affairs, are exploring the use of UAVs for disaster response. These organisations have also joined the Humanitarian UAV Network (UAViators) to promote the safe and responsible use of drones in humanitarian settings.

One of the biggest opportunities for drones in any application is to reach remote, complex and dangerous locations, says Kyle Landry, research associate in the autonomous systems 2.0 team at Lux Research, which advises on emerging technologies. "This could be for megapipeline monitoring or last-mile postal delivery, or for monitoring/emergency response and aid delivery," he says.





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"Tasks such as these are carried out by personnel on foot, which is dangerous; personnel in vehicles, which requires a road of some sort to really be useful; or personnel in aircraft, which is expensive and limited near wooded areas. Drones offer the opportunity to take people out of the equation."

#### Blood deliveries

One company that is active in this field is UAVAid, which uses fixed-wing drones to map areas vulnerable to natural disaster, and to deliver packages of emergency aid or medical supplies – including temperature-sensitive vaccines – of up to 10kg to people in hard-to-reach areas, with a 150km radius (60,000km<sup>2</sup> area) range.

It is also setting up a "last 100-mile

research group", involving universities, to establish a research base/proof of concept for its project.

The company's Hansard V platform, which is being developed in the UK, has been specifically designed to address the healthcare development and emergency humanitarian response needs of the developing world. This low-infrastructure environment presents key challenges, such as a requirement for a platform that can operate with limited back-up, over extended ranges.

Drones provide several benefits compared with other forms of aircraft, says UAVAid co-founder Daniel Ronen. The first factor is cost. While satellite imagery has played a pivotal role in relief operations for almost two decades, this technology has limitations, including cost, data-sharing restrictions, cloud cover, and the time needed to acquire images.

In contrast, UAVs can capture aerial imagery at a far higher resolution, more quickly and at much lower cost. And,

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unlike satellites, members of the public can actually own UAVs. This means that disaster-affected communities can launch their own drones in response to a crisis. "Drones are much cheaper to purchase and operate than conventional methods," says Ronen. "An entire flight of UAVAid drones can be purchased and operated for less than the cost of just training a single conventional helicopter pilot."

Secondly, he says, UAVs provide availability in post-disaster situations where there are never enough helicopters and pilots, for example, and where it takes time for the support infrastructure to be established. "Drones, however, can be transported in the back of jeeps or vans, and are operable with short set-up times from just a small clearing or scrubland. In these situations, UAVs are a capacity multiplier – releasing other platforms for bulk transport or logistics – by providing either a camera in the sky or point delivery of critical aid to remote areas, which may not necessitate a bulk delivery."

#### Medical supplies

Medical deliveries to remote and difficult-to-reach areas are also expensive and in many cases impractical, because of the need to maintain the cold-chain. By flying the medicines directly to the point of use by UAV, says Ronen, "countless lives can be given access to basic medical healthcare, with enormous cost savings achieved through supply chain and logistics efficiencies".

However, there is no one-size-fits-all drone, says Landry. "A lot of people recognise the quadcopter-style drone, but that isn't the only one available. A drone strategy needs to be developed, building up a fleet of drones for the variety of tasks they could encounter and taking into consideration drone type, size, flight time,

#### DID YOU KNOW? FROM POLICING TO DRONE RACING

**Compared to manned aircraft, UAVs are often preferred for missions that are "dull, dirty or dangerous". They originated mostly in military applications, although their use is expanding in commercial, scientific, recreational, agricultural and other applications, such as policing and surveillance, aerial photography, and drone racing. Civilian drones now vastly outnumber military drones**



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and sensor payload," he says.

A fixed-wing drone of significant size, for example, could fly for up to four hours on battery power and up to eight hours on fuel, but would not fly in close proximity to objects, or undertake 'stationary flights'. "A quadcopter drone is capable of stable flight to go near infrastructure, but for the most part is limited to 30 minutes of flight time, so it won't be going on long-distance missions," says Landry. "Consumer drones may have built the foundation for the market today, but now industrial-grade drones are coming out that are designed to operate in harsh conditions such as inclement weather, high winds and extreme temperatures."

#### Scouts report back

These latest drones would be able to help emergency responders by acting as scouts. Drones could be sent out to gather information and report back, detailing the extent of damage because of wild-fires, gas leaks, oil spills, and so on. They could also be used as couriers to handle last-mile deliveries – after emergency responders drive near a remote location to set up operations, they could then use drones to access difficult and dangerous locations to deliver medical supplies, food and equipment.

However, for drones to

continue to develop as aid for hard-to-reach places, one of the first things that needs to be addressed is the state of regulations.

"Looking at the US, for a country to conduct commercial operations, companies needed to pursue a section 333 exemption," says Landry. "This was time-intensive, as the Federal Aviation Administration (FAA) needed to approve the exemptions on a case-by-case basis. The FAA just recently released its part 107 rules, which add clarity to US drone regulations that were not there before. Unfortunately, it came with restrictions that stand to stall some of the high-value applications for drones."

According to the most recent rules, drones require a 'pilot' to be in command at all times, removing the option for automated flights or parts of flights; they can't operate beyond visual line of sight, putting operators near potentially dangerous environments in the case of emergency responders; and they can operate only during daylight hours, whereas disaster response is a 24/7 job.

Therefore, says Landry, "the next step for drones is to develop reliable obstacle detection and avoidance capabilities, to convince the FAA to ease up on its restrictive rules".



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Paradoxically, says Ronen, areas of the world where the regulatory framework is less established and privacy concerns are not so prominent – such as Africa and parts of Asia – will be the first to see the mass adoption of UAV technology.

"This will include disaster response such as initial aerial surveillance for scoping the disaster, mapping and delivery of initial critical aid," he says. "This will see the establishment of a permanent logistics platform for medical deliveries to remote and difficult-to-reach areas which could have an impact on hundreds of millions of lives. It will also see non-line-of-sight operations, where UAVs will be operated within relatively short range of the 'pilot', and will be used for applications such as the mapping of agricultural land."

Despite the challenges that remain to be overcome, eventually unmanned aerial vehicles will fundamentally change the way an emergency response takes place. Information gathering will no longer depend on expensive supply chains or be at the mercy of weather, as with satellite images.

Drones will allow a more rapid and complete initial assessment, as well as a more effective follow-up in getting critical aid to dispersed communities. ■

#### SPOTLIGHT

#### DRONES AS WEAPONS OF WAR

UAVs can provide the attack capability for high-risk missions as they originated mostly in military applications. They are able to fly into zones where it would be dangerous for pilots, and are capable of flying

for long periods. However, unmanned aerial vehicles have made a negative name for themselves recently. Civilian opinions are typically negative, since they can be viewed as representing an invasion force.



The mere presence of drones has been known to convert civilians into combatants. And, when drones cause collateral damage, such as killing civilians, they are seen in a worse light.