Unmanned Aerial Vehicles (UAVs) for Emergency and Reconstruction

A Resilient Future: Science and Technology for Disaster Risk Reduction

Interview with Andrew Shroeder, co-director of the Humanitarian UAV network UAViators and co-founder of WeRobotics

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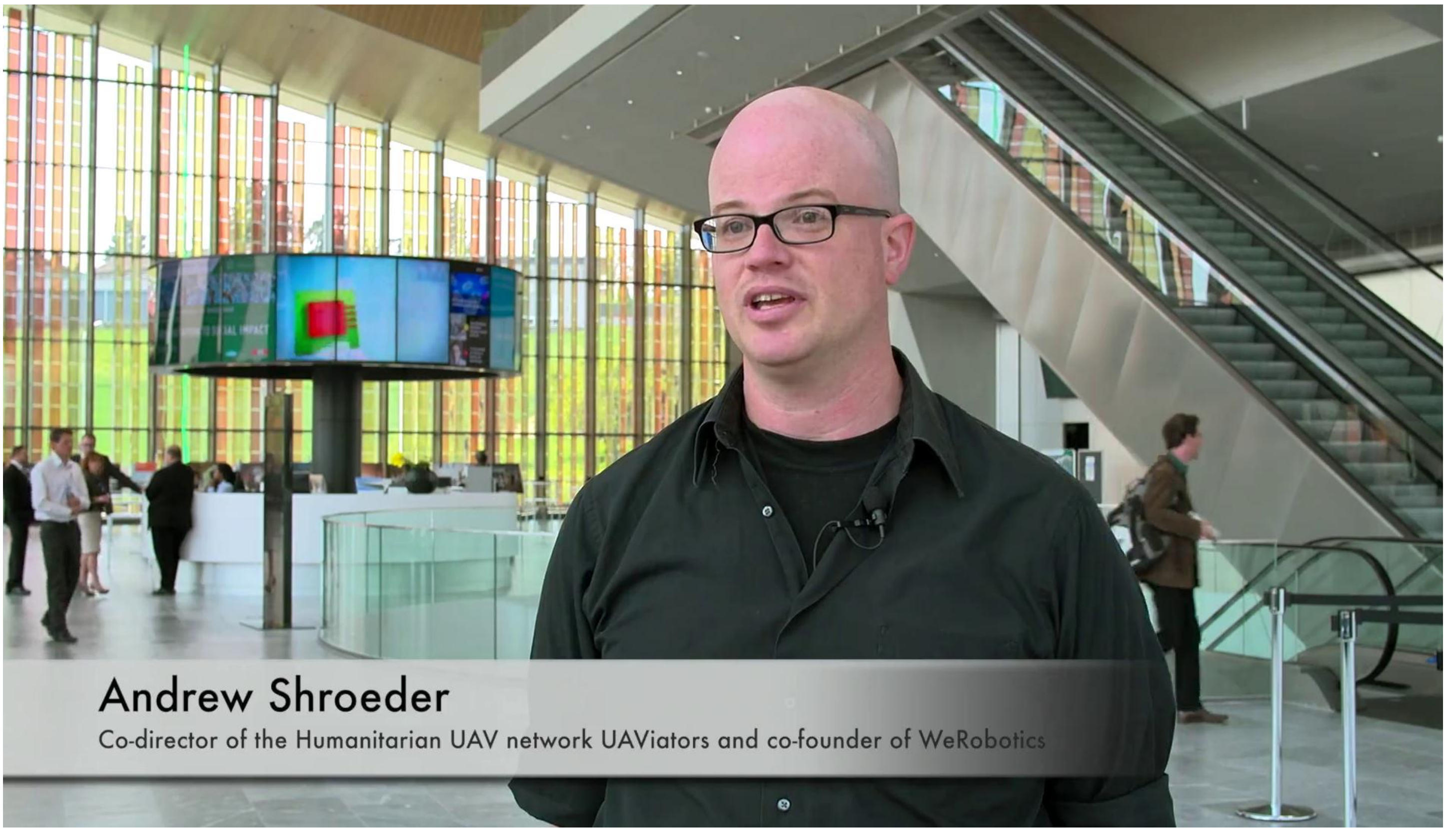

Hi. Andrew Shroeder is the Co-Director of the humanitarian UAV network, *UAViators*, which is a global network of UAV pilots, professionals, disaster response agencies, and NGOs participating in humanitarian activity. He is also the Co-Founder of *WeRobotics*, which is a new social organization devoted to applications of robotics for the social good throughout the Global South. In this video he will talk about the use of UAVs for emergency and reconstruction. Well, *UAVs* are unmanned aerial vehicles.

Notes

Summary

0m 05s

A UAV is a robot that can be programmed to fly around a defined area, and to do that for a variety of different purposes. So they're a way to take pictures of an area, they're a way to collect sensor information about a particular area of various kinds. They're a way to deliver a payload. UAVs can be used in the pre-disaster phase through what's commonly understood as *"remote sensing"* or the taking of pictures to produce models or baseline data to understand change. So, to give you one example-- Many areas of the world are subject to intense flooding on a regular basis. To understand the behavior of a flood requires an understanding of the underlying structure of the ground-- what's called a *digital elevation model*-- as well as the inundation of that ground. UAVs can take those pictures in extremely high resolution, down to one to two centimeters, so that the behavior of water on that surface can be understood very precisely. That helps people understand where to allocate resources, what's likely to happen in the wake of a flood, and where communities are likely to be most adversely affected. During response, UAVs can be used for a variety of applications ranging from surveillance...

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0m 44s

Just being able to look around in a remote setting is often extremely important. When you are faced with, say, roads that have been damaged, infrastructure that may be not functional in other ways, UAVs can provide a simple and very cheap way to just look at that environment and understand what ought to be done. You can also use them to create three-dimensional models. So when you take a UAV and you fly it around a three-dimensional structure, the data about that structure can be compiled into a model that lets you look at how a structure may be damaged, what's required to rebuild it, and other things that are important in the recovery from a disaster. They can also be used to deliver goods. This is an early stage application in disaster response, but one of the most provocative potential use cases involves being able to move small amounts of extremely important supplies like vaccines out into areas which are otherwise cut off from normal ground-based means of getting supplies to them. So UAVs can be effective in filling gaps in the logistics system. In the recovery process, UAVs are primarily-- again, you're going back to the pre-almost-- used to understand change because you can fly them repeatedly.

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2m 29s

In the same areas it's possible-- and much cheaper than using satellites-- to understand how an area is being rebuilt. So you can monitor, say, settlements. As a settlement is being rebuilt, you can image it and re-image it, and image it again, and understand how those settlements are growing, where the gaps are in promises to rebuild an area, and actual rebuilding of the area. They can be used in recovery of agriculture systems to measure the health of vegetation as that vegetation comes back online. And, again, in creation of better baseline imagery in preparation for future events. One of the really interesting examples we saw recently was in the Nepal earthquake response. Many organizations came into Nepal following the earthquake with intent to use UAVs. They were working in search and rescue capabilities. People that had been buried under rubble or potentially were in more remote areas and may have been lost, and a number of UAVs were equipped with thermal imaging that allows for detection of the heat signature of a person. And so, in search and rescue, those were really important. One of the things we discovered was that there were real challenges with the regulatory environment in Nepal that made it very hard to operate consistently.

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4m 14s

So after the earthquake was over, we decided to really lean more into building the capacity of Nepalese to do this work. There are a lot of people there that have capabilities to use UAVs, and to use the imagery, and to play a productive role in disaster response if they had the capacity in advance. So we went to Panga, Nepal with *DJI*, the drone company from China, and *Pix4D*, and worked on training engineers to do 3D modeling and imaging, and to build the capacity of the people on the ground and got a great response, and extremely enthusiastic, and they have played a role already in the six months since we were there in filling in gaps in the imagery and creating a much more robust baseline picture of Nepal, so it's been really great to see. One of the examples that my colleague, Patrick Meier, was really closely involved in was in Vanuatu following the cyclone, Cyclone Pam, which struck the island of Vanuatu. The problem in that case was widespread destruction of housing. Vanuatu has very fragile housing infrastructure and the cyclone was extremely powerful. Many of the islands are very hard to get to, they're far away from each other or are only accessible by water.

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So Patrick was contracted by *The World Bank* to help create rapid models of the damaged housing infrastructure throughout Vanuatu. One of the things that was really learned through that process was how to deploy rapidly. We were using a variety of different vehicles, and the vehicles, in that case, that proved to be most effective were those that were most easily transported-- lightweight, small vehicles that could get the job done to produce digital models of damaged infrastructure, damaged housing throughout the area. And the need to create oblique imagery. So, *oblique imagery* is imagery taken at an angle on a structure. The reason why that's important in disaster recovery is that you don't really understand how a structure has been damaged if you're only looking at it from the top down. *Satellite imagery* only looks from the top down because the satellite is directly overhead. That lets you see the roof, and you can tell a lot from the condition of the roof, but it doesn't tell you whether that roof is sitting on top of a collapsed building, or whether it's on top of an intact building.

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7m 26s

It doesn't tell you the condition of the walls, it doesn't tell you a lot of information that's needed to really determine priority areas for rebuilding housing. So I think the testing that was done around oblique imagery and rapid identification of, and classification of, damage to the structures, was one of the more important parts in Patrick's work in Vanuatu. The context for using UAV technology is a little bit different for each disaster, and that can mean the context for how you fly, what sensors are required, and the kind of data that you're collecting and using in that disaster. I talked about floods already, where digital elevation modeling becomes extremely important. Earthquakes are-- which I also talked about a little bit-- tend to be more concerned with damage assessments, particularly physical damage done to buildings, bridges, and roads. Some of that overlaps with floods, but you're looking for different signs. So in terms of differences in application context, I think one of the differences that I forgot to mention earlier, but which is quite important to bear in mind, is that there are many different kinds of UAVs in terms of how UAVs fly.

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8m 48s

The main difference is between UAVS that fly based on rotors and UAVs that fly with fixed wings, that fly like airplanes. The main difference there is that a *rotor-based aircraft* you have more control over, so it's more variable in its flight path, and it can be used to fly around a structure or some local area much more easily, but it burns energy at a much higher rate so if you're going to use it to cover a very large area, then it's an inappropriate technology. *Fixed-wing aircraft* that fly like airplanes are much more appropriate to cover a large territory. The main difference so far in the use of UAVs in countries in the Global North versus countries in the Global South has really been the much greater restriction in countries within the Global North around the use of the technology. Greater access exists because there are more people that can afford the technology. There are more examples of the technology in use, but the rules have been quite restrictive around areas that you are not allowed to fly.

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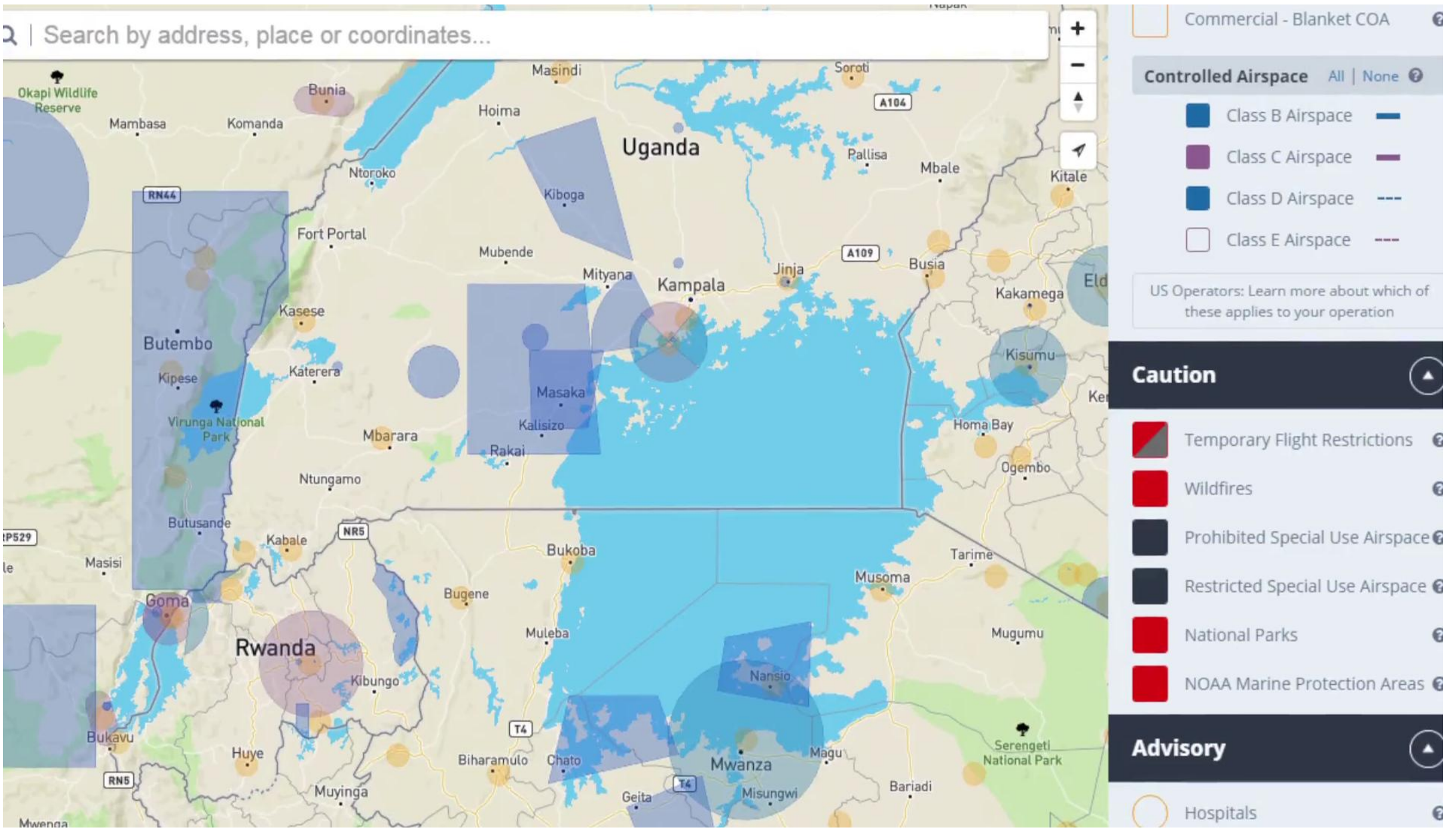
10m 16s



For instance, there was a famous incident in the United States where a security guard at the White House lost control of his drone and it landed on the lawn of the White House and created a kind of panic around the possible implications of technology landing in places that you don't want it to that could multiply as more examples of the technology get out there. What has been put in place is a series of *"no-fly zones"* in the Global North that are enforced by, in many cases, something called *"geo-fencing technology."* Geo-fencing is a piece of software that the drone or the UAV has onboard that can tell where it is in space, and whether it's inside or outside of a no-fly zone, and that can ground it, if it finds itself inside of a no-fly zone.

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11m 43s

That's been something which is used to protect airports, sports stadiums, and other areas. The entire city of Washington, D.C. is now a no-fly zone, for better or worse. The same restrictions can be applied in the Global South, but have been slower to be adopted. The likelihood of encountering geo-fenced areas is much smaller, even though you are *supposed to*. Best practice says that you need to consult *all* of the various relevant authorities in order to gain permission. Often, these are not followed and the application of the consequences of the rules has been uneven, at best, throughout countries in the Global South. So it's been unclear, often, as to what some of those dos and don'ts are for people that are actually using the technology, and governments may not have resources to be able to track all of that down. UAVs are changing very fast. The development lifecycle in the commercial sector for UAVs is down to about six months. That means, every six months a new model is released, and this is very hard for international agencies to keep up with. It's a lifecycle that's changing the conditions around how safe they are, it's changing the conditions around the kind of data that can be collected, the length of time they can fly-- the applications are very dynamic.

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12m 41s

So it's really important to think in much more rapid terms about technology adoption and to really forecast more than we've been used to in the international humanitarian community about the *potential* changes that are coming. Just as one example, UAVs are not the only automation technology that's about to be introduced in significant ways throughout the world. We're starting to see the introduction of autonomous cars. We're starting to see the introduction of autonomous marine vehicles. We're starting to see an increasing number of jobs that can be done through a form of social automation-- software bots, things like this-- that can do medical diagnosis and can follow through information. This kind of social automation also proceeds extremely rapidly, and I think it's important to have a dialogue *now* about the implications of social automation for humanitarian, development, global health systems in general and not wait for the world to be full of autonomous cars, or we will have a repeat of many of the most-challenging aspects of things like the introduction of UAVs. We can see this coming, and we should take steps now to really think it through.

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14m 22s

I think the model by which *UAViators*, in particular, has been able to create a conversation around this introduction of automation technology-- in this case, UAVs-- is something we should think very seriously about for the whole range of automation technologies that are about to be introduced into the world.

Notes

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15m 54s

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16m 12s