Zipline delivery drone

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Celebrating 5 years of NT100

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DRONES DELIVERING MEDICAL SUPPLIES TO RURAL COMMUNITIES

By Zipline

Project URL: https://www.socialtech.org.uk/projects/zipline/
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Organisation URL: http://flyzipline.com/product/

To celebrate five years of NT100 we've revisited Zipline to understand what's helped the initiative grow, since it featured in our 2016 NT100.

"No one should die because of a lack of blood," Alfred Habumugisha told CNET News last year. A pastor from Rwanda, he experienced a parent's worst nightmare. In just one day, he lost both his grandchild and his daughter, Pacifique. After her baby didn't survive birth, Pacifique was bleeding heavily and urgently needed a blood transfusion. Her father spent five frantic hours waiting for the blood to arrive, but it came too late.

Unfortunately, Pacifique's case is far from unique. According to the World Health Organization, post-partum haemorrhaging (PPH) is responsible for 60% of maternal deaths in developing countries, causing more than 100,000 maternal deaths a year. The problem is particularly acute across Africa, because of the so-called 'last mile' problem, where delivering medical supplies from cities to rural areas is slow and difficult.

In Rwanda in East Africa, the problem is exacerbated by the country's mountainous terrain. Its network of dirt roads becomes impassable with rain and mud, making deliveries for emergency blood transfusions a challenge.

Thankfully, Rwanda has been working hard to modernise its healthcare system. The small, landlocked country, home to just under 12 million people, has a national public health service, and is heavily engaged in technological innovation. In 2016, it became the first country in the world to pave the way for a national medical drone network, through a partnership with US startup Zipline.

Zipline was founded by two Harvard grads, Keller Rinaudo and Will Hetzler, and a Stanford grad, Keenan Wyrobek. Each founder learned on separate trips to Tanzania that the challenges in getting emergency medical supplies to patients on time had deadly repercussions. They now had a mission – to create a fast, reliable transport system that bypassed poorly navigable roads to get doctors what they need, and fast.

The trio established Zipline in 2011, and spent the next five years experimenting with a range of unmanned aerial vehicles at their base in California. Following a few setbacks (the first prototype crashed after a year of development), the team eventually signed a contract with Rwanda, where Zipline's first fleet of vehicles started operating in 2016.

Rather than the classic quadcopter drone, the Zipline fleet is made up of custom-designed fixed-wing airplanes weighing just 10kg, racing along at 110kmph. Called 'Zips', the small planes can currently carry cargo up to 1.5kg in weight on a 150km round trip.

When a doctor needs an emergency blood supply, he sends an SMS or a WhatsApp message to the Zipline distribution centre, requesting a specific blood product by type and quantity. A Zipline flight technician then loads the cargo into a Zip, sets one of the pre-approved flight paths on their flight control iPad, and launches the Zip into the air.

The cargo is released above its selected destination, landing softly with the aid of a paper-thin parachute, and with an accuracy of two parking spaces. The Zip then returns to the distribution centre, where it is recharged for another delivery.

Zips have a number of advantages over quadcopter drones. Unlike drones, which are thwarted by wind and rain, Zips can operate in all weather conditions. They also don't need to land, which means no accidental or intentional tampering by people or animals on the ground.

Each site and flight path is surveyed prior to use, which takes the team about two days, and the recipient is updated via text or SMS on the delivery's status with an ETA and a request for a digital signature, built with Zipline's own secure encryption system. Zips themselves are outfitted with SIM cards and use peer-to-peer communication to remain in contact. The government is charged a fee per delivery.

To describe the service as life-changing is not a hyperbole. Etienne Ndekezi, a nurse at Kabgyi General Hospital in southern Rwanda, says: "Before, if we needed blood, we had to go to the city and that would take three or four hours. But now, with drone deliveries, when we need blood, it can be here in 20 to 30 minutes."

About half of the blood supply is used to treat postpartum haemorrhaging. Malaria-related blood loss is another issue that can easily be treated with a blood transfusion. About 30% of blood delivered goes to children under five with severe anaemia due to malaria, according to Wyrobek.

Zipline currently delivers blood to 21 transfusion facilities located in the western half of Rwanda, serving about 500,000 people. 4,100 units of blood have been delivered so far, and Zipline says that no blood has been wasted at any of its receiving facilities, thanks to the flexibility of requesting emergency blood on demand.

"The best option that medical providers have had in the past was to essentially 'guesstimate'," explains Zipline spokesperson Justin Hamilton. "What we're able to do is actually create just in time on-demand delivery so the end result is that hospitals can carry lower stocks of blood while at the same time increasing access," he explains.

Zipline is now planning to expand its services to the rest of Rwanda, which means that all 12 million inhabitants will be served by a hospital that can receive blood supplies quickly and reliably. Zipline is also retiring its current fleet and replacing it with new Zips that weigh just 2kg and reach a distance of 160km. The first are due to arrive in January.

The company recently announced it will launch its service in Tanzania next year, serving 10 million people via four distribution centres and over 1,000 health facilities, which would make it the largest drone delivery network in the world to date. Dr Mpoki Ulisubisya, Tanzania's Permanent Secretary of the Ministry of Health says that the country's vision is to "have a healthy society with improved social wellbeing that will contribute effectively to personal and national development; working with Zipline will help make that vision a reality."

While Rwanda – with its small size, receptiveness to innovation, single public healthcare system and one set of airspace regulations – provided the ideal conditions for Zipline to launch operations, the company has made no secret of its ambition to launch in the US. Hamilton says that "the US has the highest rate of maternal death due to post-partum hemorrhaging in the industrialised world. They can certainly benefit from a service like this." Recent devolution of authority by the US Federal Aviation Administration (FAA) to state and local level might just make that ambition a reality.

Rinaudo says that the US now needs to catch up, telling WIRED earlier this year that, "Countries like Rwanda can make decisions fast and can implement new technologies in concert with new regulations fast, so we're now in a position where the US is trying to follow Rwanda. They're not trying to catch up to US infrastructure. They're just leapfrogging roads and trucks and motorcycles and going to a new type of infrastructure."

Critics say that leapfrogging technologies are in fact counterproductive, and that the money used for Zipline would be better spent on more doctors and nurses, which are in short supply. And while a drone can get a blood product to a hospital, getting the patient there requires better transport infrastructure on the ground.

Hamilton says that Zipline is supportive of improvements in infrastructure overall. "Zipline is basically the combination of an aerospace company with a global logistics company. We focus on both," he explains, also pointing out that Zipline provides local jobs. "Our base in Rwanda is run by a Rwandan team,

they are helping to essentially create an entirely new field, and not just there, but globally," he says.

Zipline won't disclose its pricing, but Hamilton says "the costs are on par with the previous costs of delivery, we're just faster and more reliable." The company has raised $43 million in outside capital so far, and the team believes strongly in doing good by doing business. "I think a lot of people have the incorrect assumption that you have to be a philanthropist in order to do good work that's impactful. We believe that you can build a business that will help people and do it in a way that is sustainable," says Hamilton.

While focusing on perfecting and scaling their operations in Rwanda and Tanzania for now, the company's ultimate goal is to operate globally to deliver a wide range of medical cargo. "We're in conversation with ministries of health from around the world," says Hamilton. "If we can reduce waste, increase efficiency and help solve the global problem of medical stock out that would be an amazing contribution to global public health."

The idea of emergency drone delivery certainly has wings. Matternet, another medical drone operator based in California, has recently announced the rollout of a permanent autonomous drone network that transports lab tests and other diagnostics between hospitals in Switzerland. And a number of European countries are looking at relaxing drone regulation to enable humanitarian uses. For now, Zipline's pilot operations in Rwanda are helping many more patients, doctors and government officials rest in the knowledge that that crucial unit of blood is just a few minutes, rather than hours, away.

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