

How HOT Is Rethinking Drone Mapping

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****Host:**** Hi, welcome to another episode of the Mapscaping Podcast. My name is Daniel, and this is a podcast for the geospatial community. My guest on the show today is Rebecca Firth. Rebecca is the executive director of the Humanitarian OpenStreetMap Team, also known as HOT. They are a global NGO and a community of around 750,000 people making free and open-source maps in the places that need them most.

In this conversation, we get into the drone tasking manager HOT has built, which lets local people using low-cost consumer drones capture professional-quality aerial imagery of their own communities. We talk about how it works, what it took to build it, the assumptions they got wrong along the way, and what it actually looks like on the ground in places like Freetown, where the same drone imagery is now being used for everything from waste collection planning to disability access to flood mitigation, and perhaps soon thermal mapping during heat waves. If you care about mapping drones, open data, or just the idea that local people with local tools can solve problems faster than anyone flying in from outside, you're going to enjoy this one. But before we get into it, a quick word from today's sponsor.

This episode is brought to you by GeoBusiness, which is back at Excel London on the 3rd and 4th of June. Now, the good people at GeoBusiness could have sponsored any episode, but they decided to give the stage to the Humanitarian OpenStreetMap Team to help spread this story, and I really appreciate that.

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So, thank you very much, GeoBusiness, for sponsoring this episode. I really appreciate it.

Anyway, here's my conversation with Rebecca from the Humanitarian OpenStreetMap Team.

****Host:**** Hey, Rebecca, welcome to the podcast. It's always funny saying that to people like yourself when we've just been chatting for the last five minutes, but welcome to Mapscaping. You're the executive director of something called the Humanitarian OpenStreetMap. Now, if somebody listening to this has never heard of that before, how would you describe that to them and what your role is there?

****Rebecca:**** Hey, it's so nice to be with you today. The Humanitarian OpenStreetMap Team, also known as HOT, is a global NGO and community of about 750,000 people around the world who are making free and open-source maps. But why do they need to do that? They need to make maps because without maps, people are left out of services. They're left out of things like disaster response, government service delivery, water and sanitation, and upgrading the communities they live in.

This is a huge problem because the majority of growth that happens in the world occurs in

informal settlements. It happens in an unplanned way, which means it is not recorded when it happens. It's not planned, drawn on a map, or built to a certain kind of specification. It springs up, people move around, and they need to make changes in the environment. The environment adapts, and that has to be documented in order for services to be delivered to people that live there, which would upgrade the quality of life that they're experiencing.

Our mission is to ensure that missing maps and missing data are not a cause for human suffering or loss of life, and they currently are. If you're not visible in a dataset, it's difficult for the people trying to support that location—whether that's government, international NGOs, the UN, or local community organizers—to know that their intervention is addressing the right problem and to measure if it's having any effect. We exist to solve that problem.

It's a big problem, and it keeps evolving every time there's a disaster, internal displacement, or migration. The map changes, and we need to ensure that we have the community of mappers and people set up to adapt the map as that happens.

****Host:**** Just one question. When we're talking about the map and documentation, are we in fact talking about OpenStreetMap?

****Rebecca:**** Yes. A lot of the data that we create is in OpenStreetMap. Think of it as anything you can see with the eye would go into OpenStreetMap—physical infrastructure and visible features are great things to put in OpenStreetMap. We also have some projects that collect data about individuals, which is more sensitive and shouldn't be in OpenStreetMap. That data is stored privately and is accessible to the people that need it.

For the most part, anything physical would be in OpenStreetMap, and anything above that would be stored privately. We have a tool called OpenAerialMap, which is a place where imagery gets stored that people can then map from. It's sort of a precursor to OpenStreetMap, but you can also use imagery directly for other things; it doesn't have to be mapping. We have about nine tools that work in sequence to enable you to create data that could go into OpenStreetMap, but also use that data separately if you wish.

Mapping is obviously a fundamental part of quality datasets in low and middle-income countries because geo-referenced data is much more usable, interoperable, and helpful than data without a geospatial component. The OpenStreetMap grounding is critical to us because we're not a direct humanitarian provider or a direct development actor; our work is to enable those who are direct humanitarian and development actors to do their work better. They can do that work better when all their data uses a common base, allowing them to compare between different organizations and add historical or current data to that backbone.

It sort of solves a problem that is niche in a way but very cross-cutting. It's a good example of a problem where, if you can solve that, it's like one piece of the puzzle. We are working on complex, intractable problems that persist despite years of effort to fix them, and a map is not the only thing that will fix that. But I think of it as a central puzzle piece that, once you get it in, everything else makes sense, and you can see what you're trying to build in that puzzle.

The data we produce, and the data that the communities that are part of HOT produce, are critical for making a situation known, making it seen, and making the complexities of the human experience visible. In the development sector, we've picked a lot of the low-hanging fruit already—like the \$1 vaccines and simple maps that help with routing or understanding where populations are for vaccines. What's coming next are really complex intersectional problems where you're dealing with compounded crises, such as health, conflict, and climate, all affecting people who are also very intersectional themselves—they might be parents, women, or have a disability.

To reach that higher-hanging fruit in the development sector, excellent data is needed to enable that. Communities are the only ones who have the means and interest to collect that. There's no

business model for an international company to go out and do that. But individuals, if equipped and resourced, can gather that information. Local people with local tools can create local knowledge that will massively transform how development and humanitarian aid work, and that's what we're hoping to create.

****Host:**** I realize that this was not at all a sales pitch, but you have to know I'm in. It sounds like a great thing to be doing and really important work. You mentioned a couple of different numbers—750,000 people, I believe, volunteers, and something about nine tools that work together. What is your main focus? Is your main focus on coordinating these volunteers, building software, or a bit of both?

****Rebecca:**** Historically, HOT has had three main pillars. I would say community is the first pillar—developing the number of mappers and the experience for mappers. Ideally, we want to ensure we have repeat mappers, so just ticking that number up isn't the only goal; making sure that it's the same people coming back is critical.

Partnerships is the second pillar. Data is not impactful unless it's used, and we need to ensure that there is a strong relationship between the people making data and the people using it.

****Host:**** The first pillar is partnerships. Data is not impactful unless it's used, and we need to ensure that there is a strong relationship between the people creating data and those using it. Sometimes they are the same person, but often they are different individuals. For us, impact means being able to generate data in one place and then inviting multiple partners to use it. This way, we can continue to have an impact without doing additional work. So, getting as many partners as possible to become more data-informed is a positive step.

The second pillar is technology. A key focus for us is developing free and open-source software that lowers the barriers for mappers, enabling more people to create and use data. This is part of our vision statement, though we haven't fully achieved it yet. One of our goals is for anyone, anywhere, to be a mapper. There are obvious limitations, such as the need for a device to map. We will never be able to lower the barrier of our technology so much that people without devices can map, but we still want to make it as accessible as possible.

One of our biggest goals is to create apps that require minimal training so that people can use them right away. We are currently working on a promising product called ChatMap, which pulls data from chat apps like WhatsApp or Signal to create maps. This means that the person mapping doesn't have to download a new tool or undergo training; they simply send a photo using a tool they already have, and in the background, we collate that into a map.

It's important to note that not all elements of our tool suite are perfect, as some have more technical limitations. However, we are committed to pushing down the barriers as far as we can. This has been an interesting challenge and has taken a lot of debate, consideration, and discussion within the community. When I first joined the community in 2014 as a digital consultant, I found it very difficult to use tools that were claimed to be accessible. The ongoing debate about what it means to be accessible and who our core stakeholders are for the future is critical. It's been a long journey, but I am proud of the progress we've made. I feel confident that our tool suite is getting closer to our goal of enabling anyone, anywhere, to be a mapper.

****Host:**** During this conversation, I'd like to focus on one particular tool. I believe it's a drone tasking manager. Is that correct?

****Guest:**** Yes, I'm very excited about it!

****Host:**** Could you tell me a little bit about what it is and what it does? I'd also like to understand more about the development side of this.

****Guest:**** The drone community, the OpenStreetMap community, and the HOT community have been capturing drone imagery for many years. Many individuals and enthusiasts have been capturing drone imagery in middle-income countries for a long time, often using our tool,

OpenAerialMap, to store that imagery. OpenAerialMap was initially created to store both drone and satellite imagery, allowing users to compare different imagery of the same place and serve as an open-source repository.

However, we faced a tricky moment in the OSM community when Maxar, formerly known as DigitalGlobe and now Vantor, decided to pull their imagery from the OpenMapping community. This imagery used to be a permanent layer available to us, and its removal highlighted the vulnerability of our ecosystem around imagery. This led us to consider how we could address that vulnerability, and the idea of the drone tasking manager was born.

Much of the satellite imagery we were working with was either outdated, unavailable, or not high-resolution enough for our use cases. For example, while satellite imagery can show roads and waterways, drone imagery allows us to identify smaller details like residential buildings, drainage systems, footways, and electrical systems. As HOT evolved and our ambition for data increased, we recognized the need for multiple imagery options to reduce our dependency on satellite imagery. We believed that higher quality imagery could be incredibly powerful for the community.

Thus, we developed the drone tasking manager (drone TM) as a way to tap into the drone sector, which we felt had high-end potential but also opportunities for growth at the lower end. In the countries we work in—63 low and middle-income countries over the past few years—there is often access to drone imagery, but it tends to be proprietary, created with large, expensive, highly regulated drones costing between \$4,000 and \$40,000. These drones require costly equipment, extensive training, and certification for pilots, and they often raise security and safety concerns due to their potential military applications.

We saw a significant gap in the market for non-weaponizable, low-cost drones that could scale the availability of drone imagery for mapping. More importantly, we wanted to empower local people to become drone operators. The drone TM emphasizes the idea of community members using low-cost, lightweight drones to create professional-quality data. Instead of relying on one foreign contractor or a couple of local drone operators charging international prices, we aim to enable 20, 30, or even 40 residents of a local community to generate high-quality imagery, fostering permanent capacity, skills, and ownership within that community.

A lot of what the drone TM does is coordinate those local pilots to map an area without overlapping their efforts, ensuring full coverage and quality data.

****Host:**** That sounds amazing! Could you give me an example of how this works in the field? What do I need to do? Do I need to download it? Set it up on a server? Does everyone need an app? Are there limitations to the drones that can be used? What does the data look like when it comes out the other end?

****Guest:**** Those are all great questions! A project creator—someone who wants to generate drone imagery in a specific area—can create a project in the drone TM with the parameters they need. They can specify the area, the desired resolution, and the amount of overlap they want. The drone TM will then split that area into smaller individual tasks, each about 500 square meters.

The drone operator can log in with their laptop or phone, select one of those tasks, and download it. They then upload that task to the drone's remote control unit and simply press go. The drone will automatically carry out the flight plan. The operator typically doesn't need to intervene unless something goes wrong, such as needing to manually land the drone if it encounters an obstacle.

We often refer to this as the "flip phone drone" because it's designed to be very basic and easy to use. A motivated drone operator could potentially complete about 12 flights in a day, with each flight lasting around 15 to 20 minutes. In that time, they could cover about three square

kilometers at a five-centimeter resolution.

Once the flight is complete, the operator uploads the photos to the drone TM, which processes the imagery. So, to recap: first, someone creates a project; second, a drone operator selects a task and executes the flight; and finally, the imagery is processed and made available for use.

****Host:**** So, you've had that first step where someone's created a project, and then a drone operator comes in, selects a task, presses go, and has their drone fly. After that, they need to get those photos from the drone to the drone tasking manager. So, they'll upload them, and they're processed using the OpenDroneMap software suite. OpenDroneMap.org is an amazing partner for us; they've created a core technological component for what communities need to make great imagery.

****Guest:**** Exactly. It produces an orthophoto mosaic of the original images from the drone across the whole area, along with a kind of 3D mesh. This is pretty similar to what you'd see in a 3D video game, but it enables a bunch of extra exciting mapping opportunities. From the operator's point of view, they don't need extensive prior training or knowledge. They just need basic operation skills for a consumer drone.

****Host:**** What kind of drones are you currently using?

****Guest:**** The drones we're currently using cost about \$1,000, but we're looking to integrate many more models. Our goal is to create a BYO (Bring Your Own) option, allowing people to bring their own drones without needing any specific equipment or prior experience. We're also innovating a community drone, an actual piece of hardware designed for community mapping.

****Host:**** That sounds interesting! I heard you've experimented with a build-your-own drone concept.

****Guest:**** Yes! We have an IKEA-style manual that guides users to find materials like polystyrene and bamboo sticks. We can send propellers around the world to help people build drones, which is amazing because if a drone crashes, it's quite easy to rebuild. Our long-term goal is for people to use any model, even homemade drones, to capture professional-quality imagery on this platform with very minimal training.

****Host:**** Just one question to clarify. When the tasking manager creates a project and sets parameters, like a five-centimeter resolution, do you need to know everything about that drone, or are you making assumptions about the flight plan to achieve that resolution?

****Guest:**** At the moment, we use the DJI Mini 4 Pro, which is a consumer model available for about \$1,000. We're integrating four new models this year, and our goal is to make this interoperable with any drone. Initially, we focused on making it work with one widely available, affordable drone, and we plan to expand this year, hopefully reaching the BYO drone concept next year.

****Host:**** That makes sense. What happens to the output of the imagery, the mosaic that's created? Where does that live?

****Guest:**** The drone imagery we collect lives in Open Aerial Map. It's free and accessible for anyone to use. You can go into Open Aerial Map yourself to view the imagery, download it, or create projects in OpenStreetMap with it. There are also various tools available to store the 3D elements of this imagery. One fun option is 3D Street View, where you can fly around the imagery yourself to see how the environment looks. This has been particularly helpful for our stakeholders in local government, as they can visualize their designs in the environment.

****Host:**** That's really cool! So, Open Aerial Map allows people to export and utilize the mosaic in the future. Have you heard of a project called Mapillary?

****Guest:**** Yes, I have. Do they accept drone imagery? I'm not sure about that. I think they focus on street view imagery, but there could be an interesting intersection between drone imagery, which captures aerial images, and the angled images that show building sides and shop names.

****Host:**** It seems like there could be some overlap there. When designing this, you mentioned the flip phone drone concept. What were some challenges in building that, especially with integrating different drones, resolutions, and flight planning?

****Guest:**** The development of this product has been based on decades of experience working with local communities to create technology that functions at the local level. Our co-developer for the drone tasking manager, Naxa, a Nepalese organization, has been a fantastic partner. They understand the challenges and constraints of local setups in a way that engineers from wealthier countries might not.

****Host:**** That's a valuable partnership.

****Guest:**** Absolutely. There have been many challenges in trying to bring high-end technology to low-resource settings. We made some assumptions based on how our technology had worked before, which didn't always play out in this context.

****Host:**** Can you give an example of one of those assumptions?

****Guest:**** One clear example is the credential system we built. It allowed only someone who locked a task to access a flight plan. This was based on our flagship tool, the tasking manager, which enables remote mappers to coordinate without overlapping. However, we missed the fact that there's a huge difference between virtual mapping and real-life drone flying.

****Host:**** That makes sense.

****Guest:**** People were enthusiastically coordinating in the field, swapping tasks and shifting focus due to rain or traffic. Locking a task didn't mean someone was committed to it. We spent a lot of time and resources building that credential system, which ultimately didn't work as intended. We mostly scrapped it, allowing users to mark a task as locked, but it doesn't prevent others from accessing it. This way, they can communicate and coordinate without technological barriers.

****Host:**** That's a great example of adapting to real-world needs. Were there any other challenges you faced?

****Guest:**** Yes, another challenge was related to charging. Before our pilots, we thought that charging would be a significant issue because drone batteries need to be recharged relatively frequently.

****Host:**** Prior to our pilots for this, we thought that charging would be a really significant issue because the drone batteries need to be recharged relatively frequently. That's kind of the case, obviously, when you're using a consumer-grade drone rather than a professional drone. We thought that charging was going to be a big challenge and had come up with all these plans around charging from car batteries and alternatives to de-risk this.

****Guest:**** Then we actually found that local people had no issue getting their drone batteries charged locally. They could just stop for lunch, ask to charge their battery, and easily find pathways through that. It was a good example of something we thought would be a problem, but local people didn't need us to solve it for them. They were able to access charging easily, and it turned out to be way cheaper and easier to give everyone an extra dollar to pay for charging than to try to solve that problem ourselves.

****Host:**** That's interesting! It sounds like you had some assumptions that were proven wrong.

****Guest:**** Exactly. There were a bunch of things like that where we had made assumptions about how this was going to work out, and then we realized we didn't need to worry about those aspects. Instead, we had to focus on other things. It's the magic of field testing, right?

****Host:**** People listening to this will be thinking, "Great! Sounds amazing." But what about accuracy? This is a geospatial podcast, and there are listeners who will want to know about precision and survey-grade accuracy.

****Guest:**** Right. We mentioned the five-centimeter resolution, which is one aspect. Is the entire

mosaic georeferenced accurately, or is it relative to each image?

****Host:**** Yes, that's a key question.

****Guest:**** There are probably two pieces to this question. The first is about coordination. How do you ensure that if you coordinate all those different operators flying different drones over the same area, you end up with one seamless mosaic as an output? That's the heart of the tasking manager part of the DroneTM. It creates flight plans that overlap along the edges so that each drone's flight functions as though it was one portion of a much larger continuous flight. The overlap helps ensure that any inaccuracies or issues with georeferencing from one drone or flight to another are corrected by aligning the overlapping areas. This means you have a seamless final product that merges all those tasks in the overall project area.

****Host:**** And what about the georeferencing itself?

****Guest:**** Consumer drones don't have high-precision GPS receivers like professional drones do. So, the georeferencing is not as good as what a professional mapping drone would provide. A professional mapping drone might achieve five-centimeter accuracy, while a consumer drone would get two to three meters, which is a bit better than your phone.

****Host:**** So, how do you mitigate that?

****Guest:**** We use ground control points. If one of the team members uses a ground-based GNSS device, like an ArduSimple, they can create five-centimeter precise points on multiple features visible in the imagery. Then, OpenDroneMap processes that so that your georeferencing is as good as what you would get from a professional drone.

****Host:**** That sounds like it adds some time and complexity.

****Guest:**** It does, but it's still way cheaper and faster with a big team than using a single professional drone. The interesting thing for us is that, in our experience with the use cases and partners we serve—local governments, organizations like the World Bank in lower-middle-income countries—they don't actually need or want high absolute positional accuracy. They need high relative accuracy.

****Host:**** So, as long as the imagery shows the right things at the right distance from each other, the exact placement on a geodesic model of the Earth isn't critical?

****Guest:**** Exactly. Most people are already accustomed to using tools that don't have high absolute accuracy, like Google satellite imagery, which has substantial positional inaccuracies and complex distortions. What we find our users need is often a view to work from or a view to detect change from. They're interested in seeing what is different in the imagery compared to previous imagery from six years ago.

****Host:**** So, it's about making something flexible enough to meet their needs?

****Guest:**** Yes, our goal is usable data. It's not about providing a perfect map of the Earth to five centimeters. For example, a local council person in Freetown looking for drone imagery to plan and upgrade an informal settlement doesn't need that level of precision. They need to know the relative changes compared to an older image, which might have a third of the buildings.

****Host:**** It sounds like a question of inputs as well. If I had better inputs, I would get a better output, right?

****Guest:**** Yes, that's correct. The system can adjust to the input you have. This tool can work with expensive professional drones, but there are already other software solutions that coordinate them, which isn't the market segment we're targeting. However, you could use DroneTM for that, and it would work well. Our goal is to ensure that you can create professional-quality imagery from low-cost drones and pilots who don't have extensive prior experience or training.

****Host:**** One of the challenges you face in the environments you work in must be connectivity. Will this also work offline?

****Guest:**** Yes, you're correct that internet connectivity is a challenge. It doesn't work offline perfectly, but it does if someone downloads all their flight plans before heading out for the day. If you know you're going to do these ten flights, you can download them all beforehand, and then you won't need internet during the day. However, if you need to change something during the day, that would be problematic.

****Host:**** So, you're currently implementing more offline features?

****Guest:**** Yes, our goal is to get this as offline as possible and to remove any dependency on a laptop. Ideally, you could do everything just with an Android phone and your consumer drone without needing internet during the day. One of our current priorities is building the ability to regenerate a flight plan, including terrain, on a phone without a network connection.

****Host:**** That sounds like a significant development.

****Guest:**** It is! One of the challenges will always be dealing with task locking offline. If two people lock a task offline without prior coordination, there could be some duplication of effort. But we believe the benefits of offline access outweigh that risk. It's a trade-off between a couple of duplicated efforts and the efficiency of being able to collect drone imagery in an area without needing constant internet access.

****Host:**** There's a trade-off there. You trade off a couple of duplicated efforts for the efficiency of everyone collecting drone imagery in an area being able to access it offline if they need to. Wow, man, if you guys figure that out, that'll be pretty impressive. Who pays for this? My guess is it costs money to run these servers. If you've got OpenDroneMap running on a server somewhere, in theory, you could be processing an incredible amount of imagery and different projects around the world running at the same time. Who pays for this?

****Guest:**** Yeah, for sure. Improving the efficiency of the processing and the upload is one of our current priorities, and OpenDroneMap is doing an amazing job working on that to make it cheaper and quicker. One of the critical things they're building right now is the ability to, if it pauses for some reason during the upload, to just pick up right back up at that same moment, which would reduce cost and time.

So, the World Bank funded the initial creation of the DroneTM software, partly because it aligned with their values. The World Bank often pays for moment-in-time drone imagery captures across the world. Every few years, they'll pay for drone imagery capture for most major cities in Africa, and they would much rather procure that imagery from local people. They experience challenges in bringing consulting drone operators into areas where they need data, whether that's cost or the complexity of importing drones into different countries. They also believe strongly in directing the economic benefit of their activities to the local population. They funded the first proof of concept for this tool, which was a huge undertaking. It's a complicated tool, and the first proof of concept involved a lot of work. Right now, we're sustaining it with some philanthropic funds targeted at innovation. We're focused on making this a more scalable, usable tool by taking it more offline, removing the need for a laptop, and bringing in different models of drones. These are all really important for the scalability of this solution, and that's being funded philanthropically.

In the long run, we believe we and others will be able to generate income from this. Drone imagery currently has a very high price tag. One of our goals is to build out a marketplace where communities, who are trained and accredited in our approach, can provide local data and drone services to clients, such as governments, NGOs, local partners, and potentially local businesses. There are many socially aligned local businesses that I think the communities we work with would love to provide more business to. Our intention is to build a marketplace that enables communities trained in gathering drone imagery to market their services to local organizations that could pay for that.

This is why we believe our approach is so important. We aren't just flying in someone from outside the community to gather data and then leave, even if their home is in the same country. We're enabling someone within that community, who is permanently equipped with the skills and experience to fly a drone, to keep doing that. We've seen this work repeatedly. One of the flagship places we innovated this concept was in Freetown, Sierra Leone.

Freetown has a very innovative local government that makes projects like this a complete delight to execute. We worked with Slum Dwellers International, a local organization, plus the Freetown City Council and the local OpenStreetMap communities. We trained 14 pilots, a mix of local residents and local government officials. It was fascinating to see local government and residents gathering data together. They flew drone imagery, which has now been used for seven different use cases by the Freetown City Council across various departments.

For example, it has been used to determine the width of roads in slums to understand where waste removal trucks can pass. The government wanted to build waste removal services but needed to know where the rubbish trucks could actually go. If they can't pass down a certain road, they need to consider other solutions, like designating a drop-off point or finding another form of collection.

It's also been used for improving disability access in slums and for flood mitigation. The next big thing we're doing is incorporating a thermal component into the drone mapping so that they can understand heat sensitivity at the building level. Our hope is to build the capacity to fly these drones during a heat wave. This is a critical example of a use case where local people using local tools is essential. You cannot fly in an international person during an extreme heat event to assess what is happening on the ground.

There are known issues with current methods of gathering extreme heat data; the sensors people use are not reflective of true indoor temperatures. This technology allows us to deploy on the day of an extreme heat event, saying, "Okay, we know we're going to have a heat event tomorrow. Let's get set up to fly and capture that imagery during the event itself."

It's an amazing use case that showcases the potential of this idea and the power of a local community being trained, equipped, and ready to respond. We actually just saw the first thermal imagery coming out of Freetown last week, and it was incredible to see the variation from building to building based on different roof types and the impact of trees on shading roadside businesses.

****Host:**** I can really see the value of that compounding as well. You just mentioned, "Oh, look at that. That is a hotspot here." Then being able to remove that layer and look at the high-resolution RGB imagery underneath it. Ah, okay, right. It's made out of that. That makes a lot of sense. Then, being able to apply some advanced machine learning on top of that and say, "Show me all the rooftops that look like they are made of tin, for example. And what is the heat?"

****Guest:**** Exactly! One of the aspects of that project I'm most excited about is that it's funded by a really innovative funder, the Howden Foundation. They want to enable local action, so they allowed a small section of the grant to be available for local people to make adaptations themselves. Most climate adaptation around the world involves a government mandating a climate action plan, implementing it, and then waiting for results.

What's often missing is that local people can make many of these adaptations themselves at a very low cost. For instance, how much would it cost to paint a tin roof white if someone could do it themselves rather than waiting for the government to set up a project for the whole city? If you know there's an extreme heat event next week and you have a few dollars for some white paint, you're going to paint your roof white.

One of the most amazing things we have in that grant is the ability to connect the technology.

Yes, the drone task manager is cool. Yes, we want to ensure it can do thermal imagery. Yes, we want to make sure local people are equipped to gather that same-day data. And also, how can we make a couple of dollars available for residents who are aware of the project, participating in it, and given knowledge by that project to self-lead an adaptation?

I'm super excited to see the impact of this, to observe what adaptations people make, and to see how long it takes. My guess is it will be a lot quicker than waiting for the government to execute a city-wide project when there are 52 informal settlements housing 450,000 people. It will be fascinating to see.

****Host:**** Now, you've done that project in Freetown, which has been used for these seven or eight different applications. I'm sure they're going to build on top of that. What are they going to do in the coming years? Are they going to take imagery as the season changes? I don't know if it changes very much there, but if it does, are they going to update that on a quarterly basis, maybe? What will that mean looking back at that archive over the next five years? That is going to be fascinating, I think. Plus, adding on those...

****Host:**** Quarterly basis, maybe? What is that going to mean? Looking back at that archive over the next, I don't know, five years or something. That is going to be fascinating, I think. Plus, adding on those projects that you're talking about. What impact are we actually having when we start compounding this kind of stuff? That's going to be really interesting.

So, people will be listening to this and just think, "Yes, we're in! This is amazing." For those kinds of people, what do they do? How can they become an operator, a developer, a funder—someone who thinks this matters and wants to help? What are the pathways into this?

****Guest:**** It's an amazing question. So, I think the DroneTM is a tool that, you know, that first proof of concept is out there. This has been field tested in about 10 different locations, and we're ready for partners. We're ready to stretch who it can serve and what it can do.

What we're looking for is people to tell us what you need, and we'll tell you if DroneTM can or will support it. We're looking for people with aerial imagery needs. So, if you want to be a customer of the imagery, partner with us, and a local community will help get going and create data for you, and be available to keep doing that.

If you want to fly drones yourself, you can go to the website. You can have a go and get in touch with us. We have a number of webinars online and training materials available. If you are a local drone operator or you are working with a local drone operator, then get in touch and partner with us because we really want to build the relationships and the business that can support those local drone operators.

So, I guess it's a very open stage right now with DroneTM, where I think the concept is great. It's working, and there are some really excited and innovative people behind it who want to build it further.

****Host:**** Well, I guess from my side, I just want to say thanks. I've really enjoyed the conversation. I think it's amazing what you're doing, and I appreciate the work that you do. So, thanks very much for showing up and teaching us a little bit about it today.

****Guest:**** Cheers. Thanks for giving us the time. I appreciate it.

****Host:**** Before you go, a quick thank you to today's sponsor, GeoBusiness. They're back at Excel London on the 3rd and 4th of June. It's where the Geo community comes together—live demos, expert talks, real-world location intelligence in action. Registration is free. The link is in the show notes.

Thanks very much for listening. I'll see you again soon. Bye!

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