Constellations Podcast

Episode 119 – HAPs - Terrestrial, Satellite, and now Stratospheric Communications

Speaker: Walt Anderson, CEO and Founder, Avealto, Ltd.– 30 minutes

John Gilroy: Welcome to Constellations, the podcast from Kratos. My name is John Gilroy, and I'll be your moderator. Today, we welcome Walt Anderson, founder and CEO of Avealto. We are going to talk about high altitude platforms and learn what they are, how they might complement satellite communications, and how they might alter the current business model of satellite operators. Our guest, as I said, Walt Anderson, CEO of Avealto, a UK based company formed to design build and operate a fleet of high altitude platforms or HAP vehicles, which Avealto claims will be able to transparently replace point-to-point satellite services at a lower cost with higher quality service. But Walt, science fiction aficionados know all about HAL, H-A-L, but very few of who know about HAP, H-A-P. So maybe you can start off by defining HAP for our audience.

Walt Anderson: Well, basically the IQ has defined a HAP as a vehicle that operates at around 60,000 feet, maybe 20,000 meters. And that's pretty much it. Now, my company plans to operate a HAP designed for telecom purposes within that same altitude range.

John Gilroy: Good. Doing a little research here. I think there's maybe two or three types of HAPS, balloons, airships, and maybe aircraft.

Walt Anderson: Yes.

John Gilroy: So maybe help our audience understand how they're different, and what is your approach?

Walt Anderson: Okay. Well, first of all, balloons. A company called Loon, that was funded by Google, operated, or attempted to operate, some telecom balloons. The problem, was they had a theory that you could change the altitude of the balloons and control where the balloons went. And that works some of the time, but only some of the time. It never worked all the time. So they really had a bunch of fairly expensive telecommunications devices floating up in the stratosphere, going in places that they were of no value. It apparently took the Loon managers eight years to figure out that this wouldn't work. Maybe they just like their cushy salaries and benefits, because it's odd that it took them that long. Many other experienced aeronautic professionals said from the beginning that that won't work. You can't consistently control where a balloon goes by changing altitude. So, that didn't work. But balloons are still useful for momentary missions, like where you need to put something up just temporarily

to get a look at something or to overfly an area. It's not a good long term telecom strategy, though.

Walt Anderson: Then you've got airship... Sorry, airplane type HAPS, which are just very lightweight airplanes that can operate in this same 20,000 meter, 60,000 foot altitude. They tend to be of interest. The one operating vehicle now is called the Zephyr, and it's owned by the UK military, developed by Airbus. And it really is good for sort of strategic missions. It has a limited payload, limited power, but you can strap on some kind of detection device and fly around for maybe 30 days if you need to with the Zephyr. And it's useful. It's not that useful for telecom because my belief, is you need a vehicle that can remain in a stationary position so you can get the maximum reuse of the very limited frequencies.

Walt Anderson: And now, we get to an airship. An airship vehicle uses lifting gas, helium or hydrogen. Our vehicles uses helium, which is stable and non-flammable. And because the winds at 18 to 22,000 meters are fairly benign, the vehicle can maintain a stationary position by pointing the nose into the wind and moving just as fast as the wind. So effectively, it cancels out the movement. The vehicle is in a stationary position and it can stay there for months at a time, that allows focused antennas, the same kind of antennas that are used in the satellite industry. And that's the strategy we prefer for a telecommunication type HAP vehicle.

John Gilroy: Good, good, good. When I think of an airplane, I got an idea of what an airplane looks like. But an air ship, I think something bigger and hard for me to get the idea of what size things are. So-

Walt Anderson: Well, think of-

John Gilroy: How big are these guys?

Walt Anderson: Think of the Goodyear blimp magnified, many, many times.

John Gilroy: Whoa.

Walt Anderson: We've started out looking at the best way to optimize a telecommunication service, so we sized our vehicle the size needed to carry a certain size payload. Our payload, 55 kilograms maximum. So our vehicle is about 100 meters long, 330 feet long. Which sounds large, but mostly very lightweight. There's a lot of just gases inside. The biggest thing on board is of course, the batteries, which have to power it through the night, charges up by solar cells that are on the roof of the vehicle. There are some people talking about building HAPS that are much, much bigger than this 100 meter, but we don't think that's practical for beginning operation in telecom area. We've tried to get the minimum size that'll do the job.

John Gilroy: Well in America, we'd say, "100 meters, that's a football field." That's pretty big. So how do they get airborne and what powers them to get to the desired altitude?

Walt Anderson: Well, helium is a lifting gas. So the lifting gas tends to push the vehicle up into the stratosphere. We will have motors on board that can guide the vehicle, and that's how the vehicle's controlled. So we can accelerate its lift by pointing the nose up and turning up the power. The vehicle is shaped much like any other aircraft or aerodynamic structure. It's a long, cigar shaped vehicle and two propellers on each side. And so the lifting gas slowly leaks out, because helium is a tiny molecule. So we have to bring the vehicle back down every three to six months to top it up with helium.

John Gilroy: Walt, I think you're in the Washington DC area. I am, too. And in the summer, I'd always see teenage kids with NASA t-shirts, really popular. And I'm sure they know all the terms and they all know about LEO, GEO, and MEO satellites. So where does HAPS fit in this LEO, GEO, MEO ecosystem?

Walt Anderson: Well, I guess you could call us a GAP, geosynchronous airborne platform. We're not in orbit, but we emulate. From the ground standpoint, if you have a ground station pointed to a geosynchronous satellite, you have a parabolic dish that's highly focused on that geostationary satellite, 36,000 kilometers or 24,000 miles away. We're in a stationary position, so that exact same terminal can potentially work to link to a HAP, just pointed in a different direction so it doesn't interfere with the frequencies of the geostationary. Because we're hundreds of times closer to the earth, the power levels needed to deliver the same service are hundreds of times less too due to the power law. So we're able to take that 55 kilogram payload and do what a satellite might need, a three or 400 kilogram payload, to do because we don't need very large transmitters on a HAP.

John Gilroy: 15 years ago, everyone talked about VoIP and the term latency got real popular in the tech community. I would imagine because you're close to the earth, that reduces latency, is that right?

Walt Anderson: Latency is one of the factors that makes us a much better quality. Not just because if you're talking on a satellite line, you notice the delay, but when you're doing communication or network stuff, forward air correction is a disaster when there's a half second delay over a geosynchronous satellite. So it really screws things up and causes problems if there are errors. Whereas with a few milliseconds delay, like a HAP, it's just in routine, same type of problem you have with fiber and dealing with air correction.

John Gilroy: I spent a lot of time in classrooms and whiteboards, and I always draw big line and do the pros and cons or A and B. And so let's say Walt... A classroom here,

Walt and then we get a board up there and we go, "So here's a HAP on one side, and here's a satellite on the other." So what are the basic differences?

Walt Anderson: Right. The major difference is since they can both do telecom services through a parabolic dish terminal, main difference is a HAP serves a smaller area. Each HAP covers a circle of about 150 miles, or 240 kilometers in diameter. So that's a fairly small area when compared to what a high-throughput satellite Ku-band can cover the whole United States or large territories in Europe. So we're not going to replace satellites. We're simply a market niche where in some instances, some parts of the world, some locations, we can do a better job than satellites. And the better job means lower cost, higher quality. Now, in many regions of the world, there's not enough density. We are operating in a fairly low density population. But where the density drops off completely, that's where satellites shine. They can cover vast areas. So anyone in that territory can link to that satellite.

Walt Anderson: Whereas, we're going to focus on areas where there's a concentration of low density users, remote areas. For example, I mentioned Indonesia. Well, they're a lot of population. Arizona has 15 people per square mile, that's a fairly low density area. But when you add up 150 kilometer circle, we get a lot of square miles in that area and a lot of potential users. So we're simply a market niche. For example, people use fiber when it's most optimal, microwave when it's most optimal, coax cables when it's most optimal.

Walt Anderson: And we're going to be an instance where we're going to be optimal in some percentage of the markets. We're going to compliment satellite services though, because the satellite operator, much of the talent and skills that they have in their employees, we duplicate that. We're using the same terminals, we're using the same transmission, we're using the same issues, we're solving the same exact problems. So we're actually just another type of transmission wireless infrastructure, we call it wireless infrastructure, that satellites do simply with a different technology. So a satellite operator could use HAPS to cover their most high concentrations of users freeing up their expenses satellite capacity to cover all the rest of the territory.

John Gilroy: It's not just Indonesia, I'm thinking. A couple years ago, Claude Jennings and I drove from the airport up to Logan, Utah. There's a lot of empty between Logan, Utah and Salt Lake City. And so it's a lot of empty in Utah and Wyoming. And so it seems unnecessary to have to cover all those big empty... You talked about Arizona, but there's plenty of places in the United States like it, aren't there?

Walt Anderson: Oh yeah. And satellites would cover them, but they're expensive. For a mobile operator, who's doing mobile phone service and they have a fixed plan that they charge you a certain amount all you can eat, a mobile operator cannot afford to use satellites to connect mobile towers. But our service is low cost enough that in these remote areas in the United States where you're driving down the road

for 50 miles and don't see anything, you still want cell service. So we could cover cell towers in those areas, in the remote areas of Arizona, in West Virginia, and many, many places. 50 miles from London, there are areas that don't have service.

John Gilroy: Wow.

Walt Anderson: So we can fill those holes in developed countries areas. And in undeveloped areas, we can just cover vast... Put multiple HAPS and cover a fairly large part of the area that doesn't have service. So we're not going to solve the problem with 80% of satellites do TV. One to many, we're not going to compete in that area. Satellites are still the very best to send a signal to many, many people. But on the point-to-point communication, like what we're doing now, talking over a link, we could be better lower cost, higher quality than a satellite.

John Gilroy: I'm just looking from a big perspective here. So HAPS it's going to provide data and telecom services, and satellites have been doing this for quite some time. But your argument is, that you can do it more efficiently and lower the cost. Is that your basic argument?

Walt Anderson: Yeah, we are actually using... Satellite has made amazing technical developments. They've taken this basic idea and the efficiency, ability, and capability of satellite terminals and hubs is really amazing now. So we're not trying to reinvent the wheel. We're using those same technologies, the same power levels that have been shown not to interfere with terrestrial communication, really adopting those technologies so that our HAP can instantly be usable by the marketplace.

John Gilroy: Terrestrial, satellite, and now stratospheric technologies are all suited to different parts of the globe in different use cases. We mentioned a few of them. So what role does stratospheric technologies like HAPS play in this? Is it small, unique areas that can't be reached or larger areas? Or does price... So where do you think they should be?

Walt Anderson: Well, here's the thing. Usually, they say about 15... About 80% of the users of satellites are concentrated in about 15% of the physical land territory of the world. So we've eliminated two thirds of the ocean. And so there's really a small amount of square miles, square kilometers in which you find this concentration of users. So if we put two or three HAPS in, it won't make a difference. But if we start putting hundreds of HAP vehicles in the strategic locations, we will begin to have an effect on the satellite industries revenue, if they've chosen not to work with or partner with us. Or develop their own HAP technology, if they want to spend the time to do that. So we're potentially a great partner for a satellite company to have, because instead of disrupting their business, we can put them ahead of other competitors by lowering cost, greater flexibility.

Walt Anderson: Some countries in the world are so poor, they just can't afford satellite technology as their primary means of communication. But if we could put a couple of HAPS in place and cover 80% of their telecom services with HAPS and then the other 20% with satellites, they would be able to do 100% coverage of their country and reduce their cost. And the satellite operator would be doing the same job as before. We're going to enhance this overall industry that I call wireless infrastructure. Satellites are wireless infrastructure, we're wireless infrastructure. But when you lower the cost by 30, 40%, the business will double. That'll increase. That means the people who work in the satellite industry now will be fine and happy, it just means that some of the companies they work for may not have been clever enough to adopt technologies.

John Gilroy: Walt, thousands of people from all over the world have listened to this podcast. Go to Google and type in “Constellations Podcast” to get to our show notes page. Here, you can get transcripts for all 100 plus interviews. Also, you can sign up for free email notifications for future episodes. I was taking notes earlier and you carefully said 240 kilometers or 150 miles for your diameter. And that's a whole lot smaller than some small sats. And so I guess that's a big enough footprint to make it profitable and there must be some other benefits, like redundancy or capacity that's also part of that value formula. Is there?

Walt Anderson: Well, each HAP has the capacity... We think each HAP, maybe I have 20 gigs of throughput, not as much as some of these super satellite that do 160 to 300 gigs. But the cost of the HAPS is substantially lower, and we could put multiple hats in different positions. The big advantage is that we can select where to put a HAP. We're never going to put a HAP in a location that doesn't have enough business to make it profitable the first day. We don't have to, there's a big world out there. So we can select the low hanging fruit, the best areas to grab the most profitable revenue and put those HAPS there. And we can see that the first couple hundred HAPS...

Walt Anderson: We're not going to be building HAPS that quickly. Maybe two a month for the first year, four or five a month for the second year. So it's going to take a while to even put a couple hundred HAPS out there. But each of those vehicles will be profitable the first day it goes in service. Because we're not putting them in speculatively, we're putting them in where we have customers waiting. And we think there's $26 billion of revenue out there that we can eventually try to get. We certainly won't get all of it, but we certainly get some percentage of that $26 billion annual revenue.

John Gilroy: Walt, you sure sound like a nuts and bolts businessman more than anything in this interview. There's nothing in this space about you, except your equipment. When I did some research on this topic, you mentioned Loon earlier. So these technologies are not new, they've been around for a while. And so why now? Here, it's 2022. All of a sudden, we have the magic formula. Did something

happen technically or maybe from a [inaudible 00:17:47] basis or... So what... Why now?

Walt Anderson: Well, what happened, was the electric car manufacturers began to really push harder to get more efficiencies. And this is sort of... Batteries are a deep tech thing. Billions and billions of dollars have been spent by universities, large corporations to improve the efficiency of batteries. That money's been spent. And they succeeded, they did a great job. Now, it'll continue. We believe that the efficiency gains of batteries will continue. But they got efficient enough so that HAPS are possible. Solar cells didn't fill solar, also went through the same dip, deep tech cycle. And now, the solar panels are efficient. So the HAP has to operate for many months at a time on batteries and solar cells. Every day, the solar cells charge the batteries. Every night, the batteries are run down to almost zero capacity through the running the propellers and the radio system all night.

Walt Anderson: So when I first looked at HAPS more than 20 years ago, we studied it. We could build it, but it just wouldn't have been commercially viable, wouldn't have been useful. Now, it is and all the activity you see is based on that reality that it is now possible to create a commercially viable HAP vehicle. It is now possible to create an airship type HAP vehicle that's useful for strategic purposes, doing military overview or maybe flying around looking for carbon emissions, et cetera. So it's possible, wasn't possible 20 years ago.

John Gilroy: So the two innovations have been batteries and it's got to be solar, too. There's got to be innovation-

Walt Anderson: So yeah, solar panels. But there's other innovations. Another deep tech area is motors. Rare earth metals have made motors much more efficient, and powerful, and lighter weight. And so that very deep tech investment has paid off because we can buy motors off the shelf. We don't have to develop anything special.

John Gilroy: Now, some people look at this HAPS technology and they look at it as being deployed, as like a middle layer between the ground and satellite networks. Would this benefit the LEO operator or the end user any way?

Walt Anderson: I don't see how. I've had people ask me that. Satellites can transmit back to earth directly, putting another component... And HAPS are not... They're lower cost than satellites, but they still have a cost. So why add another cost to your transmission system unnecessarily? Satellites are perfectly capable of sending a signal back to earth. I don't see how having HAPS in the middle would be very valuable. Now, there are some space related things we've talked about. We potentially can carry secondary payloads. Now, telecom's going to pay the bills. But if we have some extra weight on board, we can do other things. We can put

infrared detectors to be early detectors of fires. And being closer to the earth, our detector will be more efficient in the areas we're looking than a satellite detector just by nature of the energy propagation.

Walt Anderson: But also one guy wants to put optical devices on board that will observe space debris, to try to track space debris from a higher altitude. If you get above the clouds and get above a lot of the atmosphere, you have a much clear vision of space and may be better able to track smaller objects. So a lot of, a lot of ideas about secondary payloads on HAPS, none of them will... I don't think any of them will justify building a HAP all by itself. But if they're riding on other HAP vehicles as a secondary, that would be very useful for everyone.

John Gilroy: Let's take a look at different angle here. Let's talk about maybe mobile network operators. Would it be possible for HAPS to maybe eliminate the need for more expensive devices like satellite phones or VSATs? Is that a possible application?

Walt Anderson: Well, the thing is, HAPS are only going to cover a certain area. I like the idea that wherever I go on the earth, I could be in communication with LEO sats and with the existing global telecommunications system. I can carry a handset anywhere on the earth and iridium will put me in, let me talk and send very low level of data. That's very useful. And the fact is, that's a business that we aren't going to disrupt because people are going to go to remote places where there is no telecom service and use satellite services. So I think we're certainly... I'm happy to have that, to know that's out there. Even though we don't really compete with that specialized need.

John Gilroy: Earlier in the interview, we mentioned isolated areas, everywhere from Indonesia to rural Utah, and the need to bring telecoms to those large swatches of territory that have no telecom services. But I think companies like SpaceX with Starlink, they're trying to close this gap, too. Is there a role for HAPS in there? Is that your competitor?

Walt Anderson: Well, I don't how SpaceX, Cooper, Oneweb, and Telesat all are very aggressively pursuing a constellation type service. I just... But their strategy is different. SpaceX wants to provide a service to the end user and right now, their pricing is around $99 a month for the US, equivalent prices around the world. The users that I want to provide service to are telecom operators in these developing areas. And the telecom operator needs to be able to sell service to its customers at a much lower price than $99 a month. So my pricing, my cost, is low enough that I can deliver service wholesale to a mobile operator, wireless service operator, or VSAT operator that will allow them to provide service so much lower cost than Starlink that they have no real opportunity in the markets that we're going to serve. Where we serve in the markets we choose to serve, we will be the lowest cost provider by far. But again, Starlink everywhere else in the world. If it's not an area we serve, hey, they may be the best option. And that's great to have that option.

John Gilroy: Good, good, good. Now, I did some research for this interview and I learned that HAPS currently is kind of a nascent industry, but there's many opportunities floating around this general area. There's satellites as a service, transportation as a service, wireless routing as a service, which one of these do you think you have more opportunities?

Walt Anderson: Well, since we're serving... Our plan is to serve existing telecom operators on a wholesale basis. We're never going to sell to the end user on the ground. So we're going to try to enhance the ability of those telecom operators to bring the cloud and enhance services into areas that it didn't exist before. So all these types of services are... We're more the context, the basic infrastructure, in the same way that somebody would buy capacity on a fiber to get from point A to point B. We can support all those technologies, but those aren't our concern. Whatever technologies our operators want to use, they can implement them over our network. We have enough capacity to do it. We can support multiple 4G and 5G sites on the ground. Each HAP vehicle can support many, many mobile systems in the territory we serve on the ground.

John Gilroy: Yeah. With 55 kilograms, I imagine you could. That's kind of big. When... Do Google search on HAPS, you find out there's maybe 30 or 40 HAPS programs at various stages of development all over the world. And each one is targeting a unique market, maybe geographically or maybe unique application. So what is Avealto's secret sauce and what's going to make them be the winner in the future? You're very confident about your pricing model.

Walt Anderson: Yeah, there's an awful lot of people. If you search the websites, you see beautiful graphical pictures of vehicles that have never been built and may never be built. One prime example is a company called Alenia Thales, a huge Kiltech corporate organization in Europe, cost plus contractor. In 2014, they started a HAPS program. And the first thing they did, they had their graphics department make a beautiful picture of a HAP vehicle. Every couple years after that, their graphics department puts out a different picture with a slightly different design. And yet, they've never really tested hardware or done anything. And why is that? They're waiting for some government to pay them to do it. And the French government gave them 20 million euros a few years ago. And what the French government got from that, was a new picture, a new graphic picture, and a request for a lot more money to actually build something. So-

John Gilroy: I want to get in that business. I want to set up that thing. Yeah, man.

Walt Anderson: I know. And we'll just become a government contractor.

John Gilroy: It's great.

Walt Anderson: I live in Washington. These people, they're all around. So there are a lot of people with pictures on their website of vehicles, there are only... I think there are three or four genuine companies that are generally putting the money and time into building HAP type vehicles. One of them is HAPSmobile owned by SoftBank. They've invested quite a bit of money. And the odd thing though, is that the HAPS Alliance conference, which was held in October, they announced that they didn't think they'd be ready for commercial operation until 2027. Well, that's a long time from now. And we hope Avealto is in the final fundraising to build our factory in the UK.

Walt Anderson: And when we build that factory, we will begin producing vehicles and we're maybe a year to 15 months away from producing commercial vehicles. So the secret sauce for us, is for some reason, unknown to me, we appear to be years ahead of every other company. And we have a product design that is very focused on the telecom market, to where I think that we could be the first operator, first mover, in that marketplace. Now, HAPSmobile's building an airplane type HAP, which I also think may be not the best option for telecom, but maybe they know something. I don't know. I know I'm ahead right now, and I hope to stay ahead.

John Gilroy: Walt, I've watched interviews of you and I thought you were some kind of a theoretical guy. No, you're a businessman. You're a dollars and cents businessman, telecommunications and "show me the money". It's really great. So from your perspective, from this business perspective, what's going to happen in five years to this whole HAPS market?

Walt Anderson: Well, in my dreams, we have 200 vehicles flying, my company's a billion dollar enterprise, and the next step... No, then we take a next step. I'm a businessman, but I also try... I'm talking to you as a businessman now, but I have some vision for making the world a better place. And one thing, I'm a telecom guy also. So if I'm running HAP vehicles in a developing country in areas that never had telecom before, except for satellite, I'm going to be the first person to know where we need to put terrestrial services. I'm going to know not only where we need telecom terrestrial services, like connecting villages or towns where we need the microwave and fiber, but I'm also going to know where the roads and electrical lines need to go. So I'm going to be in a unique position to either do that, or participate in doing that, or help do that.

Walt Anderson: And that's another business opportunity. I'd love to start out with HAPS and then connect these remote areas, the major cities, with fiber and microwave. To even further lower their cost, I'll find a place for the HAP network to go. And I really believe that lowering the cost of telecom will create more peace and prosperity in the world. I founded a university, co-founded a university called International Space University with this very idea, that development of space resources would create more peace and prosperity in the world. And we're hoping that continues to be true.

John Gilroy: Oh, that's great. Walt, thanks for shedding light on new approaches to lowering the cost of communications. I think it's a great insight you have here. I'd like to thank our guest, Walt Anderson, founder and CEO of Avealto. Thanks, Walt.

Walt Anderson: Thank you very much.