Transcript

Vigilant Aerospace - UAS Summit and Expo 2024 - Adapting a DAA System for Dual-Use

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I'm the CEO of Vigilant Aerospace, as Matt said, and we develop detect and avoid and airspace management systems.

We integrate with a wide variety of devices.

So I'm going to talk about that, give a little intro, and then I'm going to talk about our topic, which is taking commercial UAS technologies and turning them into dual use technologies that can also be used in a military setting.

And then bringing those improvements and updates back to the civilian world, which is what we're in the middle of right now.

So we do multi sensor detect and avoid systems.

So this is based on two NASA patents that we've licensed the parent patent and they can a continuation part and it's really focused on collusion avoidance and we really focus on standards compliance.

So that's a very important part of what we focus on so that we have the ability to provide a system that can meet technical standards and meet the regulatory requirements.

And this is designed to allow drones in in UAS to find beyond visual line of sight.

We've done projects with NASA, we've done projects with the FAA and now we're doing projects with the Air Force and work with several UAS test sites and several drone ports, including Skyway 36 in Tulsa.

And we've had a long-standing relationship with the Northern Plains UAS test site.

So this is a quick diagram just to give you an idea of how this technology works before I dive into how we turned it into a dual use product.

So we start out by integrating with the UAS.

We're very flexible about this.

We just pull a data feed either live as an observer over the radio feed or at the ground control station.

We do this quite commonly and we pull that into our software, which sits in the middle.

We then pull in usually a radar feed.

We work with a wide variety of radars from the small ones like these all the way up to very large radars.

We have a D tech 7360 on a trailer for example that we use now.

We've integrated with terminal radars and then we pull in ADSB feeds, so transponders on aircraft so that we can look at non cooperative aircraft with the radar and then cooperative aircraft with the ADSB.

And then we also pull in remote ID information so that we can see drones and our users can be aware of those drones.

We also pull in live FAA data, weather data, other things that allows to provide a complete picture of what's going on and all that comes into the system.

And that's really the heart of our software and where we do the detect and avoid work, which I'll show you a picture of that goes out into the display.

So here's a picture real quickly, I'll go through this.

So we show your aircraft in the center of our display.

That's the white aircraft.

We have these hockey pucks around the aircraft that represent the authorized safe distance that that aircraft is supposed to stay away from other aircraft.

We have detected aircraft that come in with a trajectory prediction to allow us to figure out where that aircraft is going to be and what you might need to do about it.

And in this case, there is a specific resolution advisory that's provided to give the pilot or the autopilot that information about what to do.

So that's the basic background of our system before I go into our dual use product.

So we started working with the Air Force.

We were approached by them through some of our contacts at NASA.

They've seen what we've been doing for several years in this industry and we're awarded a contract to develop a DA system for a new long range drone.

This is all information from that solicitation they needed to detect and avoid.

They needed the ability to fly this on a larger aircraft as Group 5.

They're flying mostly in visual flight rules, so you can sort of conclude what type of flight that might be.

And then they needed to improve situational awareness.

And because of the program, it's a silver phase two.

It's inherently a dual use product.

So we're looking to bring commercial industry leading products into the Air Force to solve a urgent pressing need.

So we were obviously very excited about this.

Some of the requirements they wanted to be standards compliance so they can fly safely and with quick authorization and civilian air airspace.

This is a universal need and they wanted to use with both piloted and potentially automatic DAA so that if the aircraft was out of range or needed to take the maneuver, it was able to do so.

And so DA integration work and testing and then flight testing were part of this project.

So as we approach this, we have one of our products, we have other products for ground based detect and avoid aerospace management.

But our Flight Horizon pilot product was the one that was targeted for this because it is an onboard system and it does use that onboard collision avoidance system.

So that's where we started with this.

We had proved in the past that we could do onboard DAA.

So this was a project that we did with FAA support with a quasi which is the test site at Fairbanks in Alaska and actually built our full system out and deployed it on a small UAS.

And so this was a scale up of that on the left hand side.

This is how we might deploy it in a portable fashion on the ground.

And then on the right hand side there you can see all the same systems installed on an aircraft.

So that's one of the reasons that we were excited about this project.

This is a common problem.

So as we begin to think about this as a dual use product, what does that mean in this case?

It's because there's a common problem between both civil, civil and civilian aviation and military aviation in which you have to do this detect track and avoid collisions with other aircraft.

It's really at the frontier now of safety to be able to do that with increasing autonomy, to be able to do with more sensors either on the ground that are fully integrated or on board and then to be able to comply with the regulatory requirements, meet the industry technical standards.

So there's a couple of standards I'll talk about a little bit.

We really want it to be easy to deploy and use.

This is really important.

You can engineer systems to do this, but when you want widespread adoption, you want to be able to do it in the commercial markets.
You really need to make it affordable and use the low swap, relatively inexpensive equipment to be able to bring it to the commercial market and widespread military market.

So there are some big differences and this is as we began to do this project, we were already very aware of this having worked with NASA and the FAA.

But as we began looking at this, some of the big differences you've seen between the civilian product need and the military product need are that the form factors are going to be different.

The autopilots that are in use may be different, for example, between what a civilian aircraft might use.

The ground control stations are different, communication systems are different, and the military has access to great communications.

Usually.

The available sensors may be different or they may be very similar, and then the military technical standards have to be met, which may be a little different.

Operating environment can be very different and then the testing process and then finally the authorization to operate that ultimate product that gets put onto the aircraft is a process that the military requires.

So we started out doing this and in doing so we pioneered a lot of new technologies and capabilities inside our existing FlightHorizon pilot products.

So we did extensive multi program field testing both with the support of AFRL and along the lines of some of the other projects we were already in the middle of.

We were doing a lot of multi sensor work.

So we already had the three sensors, the telemetry, radar and cooperative ADSB sensor.

But as we were scaling this up, we were adding additional sensors which all had to be thoroughly integrated and tested.

So we've done that over the last year and then huge amounts of data collection and that's really what we focus on all the time.

These are some photos from some of that testing flying some aircraft, in some case smaller aircraft with some of these radars on the ground that could also be installed on civilian or military aircraft to get all of that working.

And we continue doing that through this process.

So some milestones in in the development of this, this dual use product going from civilian to military and ultimately back to civilian use.

We license those patents from NASA.

We went through R&D with NASA and with Oklahoma State University with whom we've done a couple of projects.
We did our commercial product development based on that initial prototype from NASA.
So we started with a workstation that they had developed and turn that into our commercial ground-based product.

And then we did testing on board with a quasi in Fairbanks with an FAA contract.

We designed simulations for an advanced air mobility company.

So they're developing air taxis.

I needed a very similar system.

And in doing that we learned a huge amount about what the industry needed.

We did our ground-based system in which we began deploying the full system at drone ports.

And so that's kind of a separate product, but it uses all the same technologies, algorithms and sensor integrations and correlation that the onboard product uses.

And said that is a fantastic opportunity.

And that's really our bread and butter right now is drone ports are using this system.

We then were awarded this, this silver phase two.

We did intensive in, in improvements with ground-based testing and then ultimately moved to onboard multi radar testing.

And so that's kind of our path along here.

We've done a lot of other things, but to get to this product where we are today, that's the path that we took.

So finally we are in the midst of multi radar fully integrated system field testing, which we do a lot of through a variety of programs right now.

This is what this display looks like in the field where you've got that aircraft being tracked and you've got all those sensors sending that information.

This is a diagram to sort of explain the evolution.

So as we moved for our ground based system, this is what a little bit more of what the onboard system looks like.

A couple of things to keep in mind.

It is going, for example, onto onboard computers and it ultimately can feed out to ground control stations for the pilot and to airspace management systems, including the Flight Horizon commander display, which is the airspace management display.

All right, So talking a little bit about what this path has looked like and the concerns when adapting a civilian product for military use, we found that flexibility was key.

Understanding that we were able to reuse the algorithms, the correlation across the civilian to the military product was very useful as something we had to focus on early to be sure that we were doing that correctly and that everything we had been doing was going to work correctly.

It's highly configurable.

So our system is very modular and so we can add components and be able to just use the software that's needed or add a new piece of software for a new function that is unique to a particular aircraft, a particular set of sensors or a particular operating environment without changing the core that that's really fundamental.

And for any project like this where you are trying to adapt a civilian product for military use, having that architecture built in is key to success.

And then it's highly configurable as the hardware.

So we have a process where we can quickly integrate new pieces of hardware without changing the core.

So we can write the new parser at the edge, write a new data stream and send that into the overall system.

And then we can deploy the system in different ways.

So we can use small single board computers all the way up to cloud servers.

So we do that a lot.

We do a lot of our simulation in cloud servers or on dedicated servers, but we also have it in the field all the time on small single board computers and what's essentially a cut down version that's purpose specific to that aircraft, that set of sensors in that test.

So this is what we're doing overall with system like this to take our overall architecture and overall software product and make it available for military use.

So that's my presentation.
Thank you all very much.