Thomas Furness and the Invention of Virtual Reality (https://mindmatters.ai/podcast/ep85/)

Robert J. Marks:

Why was virtual reality pioneered by the US military? That's the topic today on Mind Matters News.

Introduction:

Welcome to Mind Matters News, where artificial and natural intelligence meet head on. Here's your host, Robert J. Marks.

Robert J. Marks:

GPS and the internet were both founded by the United States military in their think tanks. The military also had a major role in the development of virtual reality. We are fortunate to have with us today the man that pioneered virtual reality during his military service to the United States. Our guest, Dr. Thomas Furness, has been dubbed the grandfather of virtual reality. I first met Dr. Furness at the University of Washington, where with our mutual friend, Dr. Tom Caudell, who was then at Boeing, we put together the first technically serious conference on virtual reality. This was a long time ago, back in 1993. Dr. Furness, of course, was the General Chair, but that was over 35 years ago. The conference got great reviews and was standing room only. It really was the launching pad for serious interest outside of science fiction, Comic-Con sort of type gatherings for interest in virtual reality and other human interface technology. Lots has happened since then and Dr. Furness has been right there in the development.

Robert J. Marks:

Dr. Thomas Furness is professor at the University of Washington in Seattle, where I used to hang my hat. He is a professor in the Department of Industrial and Systems Engineering, and the founder of the Human Interface Technology Lab at the University of Washington. He has sister labs, HIT labs, human interface technology labs, at the University of Canterbury and the University of Tasmania. His technology has started 27 companies. Two are currently traded on NASDAQ and are worth like $12 billion. And we're going to ask him if some of that stuck to him, hope so. I think, very prestigiously, he recently received the IEEE Virtual Reality Career Award for his lifetime contributions to virtual reality and augmented reality. And if you don't know IEEE, it's the largest professional society in the world. It's the Institute of Electrical and Electronic Engineers, and it has over, gosh, 400,000 members. And Dr. Furness is also a fellow of the IEEE. Okay. I'm out of breath, Tom. Welcome. It's good to talk to you.

Thomas Furness:

Oh, Bob. It's so good to hear your voice again after all these years. We've both been on some amazing journeys and I'm just happy that we can get together again after our conference together in 1993.

Robert J. Marks:

It was a long time ago. Hey, let's go to the beginning. This is way before we met. And you were with the Air Force. You were first a commissioned Officer with the Air Force, and there you had kind of a command from somebody to develop virtual reality in what sense? Walk us through the history of that.

Thomas Furness:

You bet. Well, it's interesting, the journey that I've taken. I graduated from Duke University in electrical engineering in 1966 and was, the day of my graduation, I was commissioned as a Second Lieutenant in the air force and assigned to Wright-Patterson Air Force Base in Ohio. And I didn't know what to expect. I knew that I had to spend four years there in the military. This is sort of the Vietnam War period. And I felt if I have to go to war, it'd be best to go in Air Force rather than any of the other services. And when I did show up to begin my duty assignment at Wright-Patterson, I was assigned to basically do whatever I wanted to do. Yeah, this was an amazing program. They call it the LEAP program, which is a Lieutenant's Education Application Program, which meant that I could go work anywhere I wanted to at Wright-Patterson Air Force Base. Now-

Robert J. Marks:

Such a deal. Wow.

Thomas Furness:

What a deal. Yeah. I mean, this was like hog heaven. I mean, for an engineer. I mean, there was all of these laboratories, this is where they developed the advanced aircraft. This was where they did flight testing and all of that. And of course, what I'd wanted to do before joining the Air Force is I wanted to be an astronaut because I wanted to go into space. I wanted to go to the moon, all those kinds of things. But it turns out my eyes kept me out of the doing that in the Air Force Academy. And so I ended up at Wright-Patterson. But then this thing happened.

Thomas Furness:

And so what I decided to do, with advice from the personnel office, is to pick maybe three jobs I'd work in for three months or four months at a time. And then at the end, pick a job that I wanted to do for the longer term. And so I did, I picked these jobs. One of which was in flight test, which was really fun because I was flying in the fighters, I was flying in the Phantoms, F-4s.

Robert J. Marks:

So you were a pilot then?

Thomas Furness:

I was a flight test engineer.

Robert J. Marks:

I see, okay.

Thomas Furness:

I was sitting in a back seat. I had to suit up. I was sitting in the ejection seat and parachutes and g-suits and all this kind of stuff, just like the pilots. But my job was actually running the test instrumentation. And while the pilot was flying the airplane, but half the time, the pilot said, "Ah, you take it." And so I was flying the airplane while he was eating bananas or something like that. So it was, yeah, we were boring holes through the sky. We're going near the Mach and beyond the Mach and testing this equipment, flying at low altitude, flying at high altitude, going straight up, going straight down. It was really fun.

Robert J. Marks:

I got to ask you, Tom, does anything special happen when you go faster than the speed of sound?

Thomas Furness:

Well, not really. When you're in this side, there may be a little bit of buffeting that you feel, but other than that, it's no big deal when you're on the inside. You don't really notice it that too much.

Robert J. Marks:

I see. Okay.

Thomas Furness:

So what happened in the process of doing this, I found out that to spend those few hours in the air, you had to spend a lot of time on the ground in preparation, as well as sitting on your hands a lot while the aircraft was being prepared and things like that. And I decided I would really rather be working on building these interfaces and these cockpits and things like that. Yeah, I'll fly too, but that's fun, but still, I'm an engineer, I want to build stuff. And so I decided to go back to one of the jobs I had during this first year period, which was basically developing Vance cockpits.

Thomas Furness:

And this, again, this is during the Vietnam War period. We had some really tough problems. We're trying to decide how we could fly at night without being seen and find the enemy on the ground using sensors. We had low light level television, forward looking infrared sensors that let us see at night. And there were just a whole bunch of problems in terms of also air to air combat and things like that. And it sort of boils down to, I guess, into three sets of problems. One was, and these were all the ones that I was dealing with as running this lab at my ... The lab that they set me up to do, I actually said, "Build a lab that works on this stuff." So I did, here's a brand new second Lieutenant just out of ... As an undergraduate.

Thomas Furness:

And so I started putting together these ways to develop interfaces, better interfaces, for cockpits. So one of the problems we're trying to solve is actually aiming things. As it turns out, the way that these aircraft were built, in order to aim the weapon systems of the aircraft or to aim sensors and things like that, you had to aim the whole airplane. And so you use these head up displays to do that, but it meant moving this amazing mass, this high energy mass, around to aim doing that. And it was difficult to do. And when, in fact, you could actually see what you wanted to do, you could actually see the targets, but in order to get those into the machine, you had to physically fly the machine to aim it. And I decided, "Well, why isn't just looking it a good enough? Because we could probably measure where you're looking." And so that's what I started working on, the idea of why don't we track the pilot's helmet, the helmet position? And what we do is project a infinity collimated reticle.

Robert J. Marks:

Okay. Okay. You have to back up a second. And infinite something something, what is that?

Thomas Furness:

Right. Okay. Well, what this is is like a gunsight piper, but it appears in the distance. It's not like it's in front of you, it's out in the distance. And that's what we call infinity collimation.

Robert J. Marks:

I see, yes.

Thomas Furness:

That means the light rays optically are fixed so they appear to be coming a long way away, at what we call optical infinity, which is sort of beyond 30 feet or 50 feet. That's when the light rays sort of are so far away they appear to be parallel. So we had this little, what is a little mirror system located on the front of the helmet that you'd look through and you'd see this little piper, what we call a piper or gunsight, projected out in space. And all you do is move it around with your head and put it over the target or designate something that you're interested in.

Thomas Furness:

And then what we would do is aligned with that piper in sort of the line of sight of the helmet, we had two photodiodes on each side of the helmet. And what we'd do is interrogate those photodiodes, they're infrared sensors, with this fanning light that would sweep through the cockpit. And every time the photodiode picked up a signal, we would take the timing of that signal, basically the timing of the sweeping of the fan, and we would basically triangulate on those four photodiodes on the helmet. And then we would draw a vector through those and resolve that vector into azimuth and elevation angles relative to aircraft. So wherever the line of sight of that piper was from the pilot was where the aircraft knew that line of sight. And then we'd use that to aim sensors, infrared trackers, or missiles, we could use it to designate something on the ground, to our navigation system and determine the coordinates of that. And we could also aim imaging sensors, low light level television and forward-looking bread, things like that.

Thomas Furness:

So we were able to solve the tracking problem. And it was sort of a necessity, invention comes from necessity. The mother of invention is necessity, right?

Robert J. Marks:

Yes.

Thomas Furness:

And so, it was trying to solve a problem of how do you aim the aircraft that we started doing this head tracking stuff. And then it was clear that, okay, so you've done that, but then you have this problem of how in the world do you communicate the images from the sensor, let's say an imaging sensor that's looking into darkness, how do you display that to the pilot when, in fact, you had no space in the cockpit to do that? So we were trying to figure out how would you cut a hole in this cockpit big enough to make a display that was big enough, that you could actually represent those pixels to the pilot so they could see the information?

Thomas Furness:

And this was very expensive and difficult to do because cockpits, fighter cockpits especially, the most expensive real estate on the earth per square inch. Because if you start moving things around, it costs a fortune to do that. And there just wasn't enough room. Already, we had 300 switches, 75 displays, 11 switches on the control stick, and nine switches on the throttle in this cockpit. And you're trying to manage all of that. I'll get to that a little bit later. But so we said, "Well, why don't we, instead of trying to create a real image display where you're actually looking at the face of a cathode ray tube or some kind of display device, why don't we make it a virtual image?" And the virtual image is something that you see in space that doesn't really exist there.

Thomas Furness:

For example, the simplest example of this is really the mirror in your bathroom. You're standing in front of your mirror in the bathroom, you see yourself. But that's not really you, you just appear to be there. You're not really there. And that is a virtual image of you. And if we could use some mirrors and some what we call combiners, beam combiners, we could actually take a really small picture, like from a miniature cathode ray tube, it may be the size of a quarter. We could draw a picture on that, then we can magnify and collimate it, meaning making it appear in the distance, and to project it into the eye so you get a huge screen, maybe a 30 inch screen that doesn't take up any cockpit space.

Robert J. Marks:

Well, the first thing that comes to my mind is that's going to block your views of other things.

Thomas Furness:

Well, you see through it. What you do is you see the outside world through this combiner and so that you can see the virtual world, the virtual scene, superimposed on top of the real scene, just like we're doing with Head Up displays.

Robert J. Marks:

I see. I always think of driving at night and I put something on my dashboard and it reflects in my windshield and it looks like it's just floating there. So that's the sort of thing you see.

Thomas Furness:

It is. And you see this all the time. We see these kinds of things, especially at night, reflections of our dashboard into our windows and things like that. So the beauty of this is that it really didn't have to take up any space in the cockpit. So there wasn't the major overhauling of the cockpit instruments and things like that. This was something that was just attached to the helmet. And it had the additional advantage is it moved around. So you had this big picture projected to you that moved wherever you moved your head, of course.

Thomas Furness:

Now, the exciting thing happened when we found that we could actually see those pixels that came from the infrared sensors and the low light level television sensors, we could actually see them now. But then we decided, well, wait a minute now. If we combine this head tracking thing with this head helmet mounted display thing, now we had basically an aperture or a big screen that we can move around and we always knew where it was. So what that meant is that we could take our head position and move those sensors around outside the cockpit, and then display a picture in that same angle. And it was just like cutting a hole in the whole airplane and being able to see at night, sort of like having a picture

window, being able to see through, see at night. And so this became really the first virtual reality system where we could basically take the place of the scene through the cockpit.

Thomas Furness:

Now, after that, we said, "Well, wait a minute. Why can't we put all the instruments up there? And not only that, we could stabilize them in space." In other words, we can have things that moved with the head, but things that seem to stay stabilized with the cockpit. Therefore, we could take the whole cockpit and project that as a virtual image in addition to what we were getting from our sensors. And so this became evolved over years. And I was working on this continuously from 1966. In the process of getting there, we were building better and better head tracking systems, better and better displays, we were using miniature cathode ray tubes to begin with. Nice thing about cathode ray tubes is electrons are really small. And you could scan a lot of these babies on a faceplate at high luminance. The only problem is that you have to have an accelerating potential in that, so you have 15 kilovolts sitting on the side of your head in order to get that image.

Thomas Furness:

So when liquid crystal displays came along and all OLEDs and things like that, that changed everything. But we're still using miniature cathode ray tubes at the beginning. So we were continue to develop the displays, the tracking systems, and the computers that would actually generate these cockpit instruments. And finally, I convinced the air force to give me enough money to build this so-called VCASS system.

Robert J. Marks:

Say again, a VCASS?

Thomas Furness:

VCASS. It's called VCASS, Visually Coupled Airborne System Simulator. Because what I wanted to do is simulate this idea of a virtual cockpit, the whole cockpit being a virtual image, three-dimensional virtual image, on the ground before we took it into the air to test it. And so the VCASS, we built this, started building it in 1977. And the whole idea is to create a panoramic display. We had an instantaneous field of view of 120 degrees by 80 degrees. And it was a stereo graphic. We had a 16 bit tracking system, electromagnetic tracking system, to measure where that was. We had speech input. We had eye tracking. And even, we're working on tactile displays.

Thomas Furness:

So we switched this on in 1981. We had, I think it was, eight VAX computers to run this thing. And two Evans & Sutherland Picture Systems, one to draw the left eye, one to draw the right eye. Okay? And this is the simulator on the ground. And we'd generate sort of the outside world, we'd generate other adversaries in that outside world, as well as our virtual cockpit. And this was all vectographic type stuff at the time, which meant there were lines. There wasn't a continuous picture, sort of a filled in raster picture. But it worked.

Thomas Furness:

And so this, we were working with this and found some amazing things about the power of virtual reality. And this launched another project that was what we call a super cockpit. And the super cockpit, I proposed this as part of an exercise we did at the Pentagon called Air Force Forecast Two. And this is

one of the two projects that got funded out of that. And this was to build basically a cockpit the pilot wears. And we started working on this in the mid-'80s based upon what I was doing in the earlier work. And it was to do all the things I mentioned before, but also have tactile displays and to have artificial intelligence built into it. You would have R2D2 in the cockpit to help you with things, they were organizing tray information. You had a circumambience of information with a panoramic scene, and you could see through it in the daytime. And at night, it sort of took the place of the outside world.

Robert J. Marks:

Let me ask you a couple of clarifying things. You say tactile display. Usually I associate that with kind of feeling and things of that sort. So what sort of tactile display did you use?

Thomas Furness:

Okay, well, of course, now that we have this virtual image, how do you interact with the virtual image? Now you could look at it. You could look at various symbols and give a verbal command, say select. And you'd look at a switch and just say select. But we also wanted to have a different way of interacting. And that was to be able to do this with your hands. So we figure out a way to track the hands, the hand position and finger position. And then as you would reach into a particular volume space in the cockpit, a switch panel would window in, right? It would appear in that location. And then the whole idea is to reach out and touch a switch to activate it. But you need to have feedback.

Thomas Furness:

And so, one of the feedbacks was really a sound. You'd hear that switch clicking with binaural sound. By this time, we're using three-dimensional sound, binaural sound. We're using individual ear prints of the pilot so that you're basically mapping the sounds so as true 3D sound and not just stereophonic sound, it's 3D sound. So you hear things in 360 degrees around you. And so you'd hear that switch click in that direction. And then you would have, in the gloves, you would have tactors that actually would stimulate the fingers. And so you'd feel a little pressure in your finger when you touched that display, even though it's not really there, but it appears to be there. So when you get this tactical feedback, you know that you'd activated that switch. You got the sound that it clicked and things like that. You take your hand away, the switch panel disappears because it's just getting into way otherwise.

Robert J. Marks:

Understood. Yeah.

Thomas Furness:

So this was the notion of this super cockpit. And the whole idea was we going to develop this and test it to be an airborne system. I mean, this was not a sim. We're using a simulator to engineer it, but it was eventually going to be a real cockpit in the airplane.

Robert J. Marks:

Now this was actually a cockpit that was worn by the pilot, you said.

Thomas Furness:

Basically, yeah. I mean, you're in a real cockpit, but you plug into this and now all what you see, you have standby instruments in the cockpit, what you see is this virtual projection in 3D and surrounds you.

Okay? We'd have it, we'd take information from the outside world and project it in there in terms of where you're located, the navigation information, where the friendly aircraft are, where the enemy aircraft are, where the ground surface, the air missile batteries are. All of this you'd see in this grand gestalt, this picture that surrounds you.

Robert J. Marks:

Now, I've seen flight simulations, Tom, where from the outside, it actually tumbles as you do things. Are you there yet? Or is that coming?

Thomas Furness:

Tumbles meaning physically moving?

Robert J. Marks:

Yeah. Yes, you're in this little ball and this ball kind of tips and does different things.

Thomas Furness:

Yeah. That's the Large Amplitude LAMARS there at the Applied Dynamics Lab at Wright-Patterson Air Force Base.

Robert J. Marks:

Okay.

Thomas Furness:

Yeah. That's one of them, certainly. But yes, we were actually testing some of these things in real aircraft. So it was happening. But let me tell you a little story that goes along with this. So here we were developing this kind of concept, the virtual cockpit, the super cockpit. We're using our Darth Vader simulator, this so-called VCASS. And we decided, now's the time for us to bring in the test pilots. And these are the Air Force finest pilots from Eglin's Air Force Base and other places. And we wanted them to take a look at it and see what they thought. And they knew that it was going to be something pretty far out that they'd never seen before, but they didn't realize how far out this was going to be.

Thomas Furness:

And so they came into my lab and over to the simulator, the cockpit simulator. And they saw this huge helmet hanging above the cockpit. I mean, this thing weighed about 10 pounds at the time, but it was just the simulator of these things. It had all kinds of bells and whistles built in.

Robert J. Marks:

So this was the equivalent of today's headset, virtual reality headset.

Thomas Furness:

Yes, it was. And it gave us the wide field of view. It had these miniature cathode ray tubes built in and all the tracking stuff and things like that. And we had this negator spring assembly that would actually support the weight of the helmet. It wouldn't change the momentum, the angular momentum of the head set when you're moving it around. But nevertheless, so the first reaction when these pilots came in and they saw this helmet, they pointed at the helmet and they pointed to me and said, "You got to be

kidding me." And I said, "Wait, guys, understand that this is just a simulator for us to test out what it should look like and how it should function. But here's what the airborne version is going to look like." And I showed them this new helmet that had actually been done. This was with a project we had with McDonnell Douglas and Kaiser Aerospace, and where the helmet was actually designed by Lucasfilms.

Robert J. Marks:

Really?

Thomas Furness:

We'd hired the industrial design guys from Lucasfilms after they did the first Star Wars. And we said, "We want you to make us a sexy looking helmet." And because it's back to pilots, they have to look good.

Robert J. Marks:

They're known for their big egos.

Thomas Furness:

That's right. I mean, they have big watches and things like that. So that was part of our ... There were some other requirements of this that we had to put into it. So they did, they came back with a bunch of different designs. And so some of them are really pretty cool. And so we had some of them built. And so I hand this to this flight pilot, I said, "Okay, this is what your airborne version is going to look like. This is what you're going to wear when you're flying the airplane." And it was blue sky and it had lightning bolts painting on the side of it. And so they looked at that said, "Wow, this is really cool." Now remember, these guys are engineers too. I mean, they're really good. They're really good flight test people, but they're also engineers. And they said, "Oh, this is so cool." And I said, "Okay, well, you're going to see what's inside this helmet when you go into my big helmet. So give it a go."

Thomas Furness:

And so they'd get in the cockpit, we'd suit them up, we'd log them into the speech recognition system and a boresight the system with a Head Up display kind of thing. And then we would switch on the display and this huge picture would open up to them. It's like sitting on the front row of an IMAX theater. And they would say, "Wow." And I said, "Well, look around a little bit." And they'd look around. And they said, "Wow, this is really cool." Then we started explaining how it works. Now, they'd never seen this before in their lives, but they knew how to fly airplanes. And we explained some of the things that they're going to see. For example, they could actually see the radar painting the sky. They could see the radar signals actually painting the sky. They'd see all where these other guys are located in the world in 3D. And they had a God's eye display where they could look down in their lap and they see this bubble, this hemisphere of the whole world, so to speak.

Thomas Furness:

So that's their outside in display. And then their head mounted display was their inside out display. So all of this was going on. And so we'd launch them on a mission and they would see this information being portrayed, they'd see their energy management curves in the aircraft and so forth. And that's when they said, "Wow, this is really cool." And that was our signal to send in the bad guys.

Robert J. Marks:

The bad guys being the guys with the money in the military?

Thomas Furness:

No, no, not those bad guys.

Robert J. Marks:

Oh, not those, other bad guys.

Thomas Furness:

No. These are the adversaries, the computer generated adversaries.

Robert J. Marks:

Oh, I see. I see. Okay.

Thomas Furness:

They're flying along in this world. They see the outside world, they're flying along. They're seeing all this information. And now they're in this proper, this simulation, this virtual simulation. And then what would happen is we send in the bad guys. The first thing they would do is they'd hear it in 3D sound behind them. They hear this guy radiating them from the behind, and then rear view mirrors would wind into the cockpit and they would see a representation of the guys coming in from behind. And then there'd be a few swear words that come out of the pilots. That happened. And then they would go into afterburner. They're go into afterburner and start climbing straight up. And then they were in the fur ball, what we call a fur ball, where they are in, they're working with this adversary in air to air combat. And they were in and out of afterburner, speed brakes, the whole deal. Just watch Top Gun and you'll see what they were doing. And they were swearing and all of this kind of stuff going on. And then about that time, what I did was I shut off the simulation and everything went dark. And I said to them over the microphone in their headset, I said, "Okay, guys, we need another quarter please."

Robert J. Marks:

Just like for Space Invaders or something, yes.

Thomas Furness:

That's right.

Robert J. Marks:

Okay. Gotcha. Gotcha.

Thomas Furness:

And they were so sucked in. They said, "Oh my goodness. I'm able to do things I've never been able to do before." I mean, it's the same airplane. They only thing is different is the way we're representing information in virtual space. And so, as a result of that, we got the funding for working on the super cockpit. And it was a substantial amount of money because there was a lot of going on, including the artificial intelligence people that would be sort of trying to infer the intent of the pilot, what we call a pilot intent inference engine. So we're trying to look at what's going on in all of the sensors, what the pilot was trying to do, and basically organizing this virtual world to help them do it.

Robert J. Marks:

Oh my goodness. Okay.

Thomas Furness:

Yeah. And we're also concerned about the pilots blacking out and things like that when they're pulling excessive Gs and-

Robert J. Marks:

Of course.

Thomas Furness:

And so that was another thing, the physiological state of the pilot was important.

Robert J. Marks:

Well, Tom, that's incredible. What year was this, by the way?

Thomas Furness:

Okay. This is about '86.

Robert J. Marks:

My goodness, okay.

Thomas Furness:

Yeah, '86. '85, '86, '87 time period. Now let me tell you what happened after that. So this is sort of a transition. This is what changed my life. So I got a phone call from a General in the Pentagon. And he said, "I know about your virtual cockpit stuff that you're doing. And we would like for you to hold a press release or write up a press release and have a news conference, hold a news conference on what you're doing on that virtual cockpit stuff." And I told him, "Well, it's classified. Some of the stuff we're doing is classified." And he said, "That's okay, just declassify it." And I said, "Okay." And he said, "We need some positive publicity." It had just come out in the news that the Navy was spending $800 for toilet seats, the army was spending $500 for hammers. I don't know if you remember this, but this was-

Robert J. Marks:

I do remember that, yeah.

Thomas Furness:

Yeah, this was the military industrial complex that was spending us into oblivion, you know?

Robert J. Marks:

$50 paperclips, stuff like that, yes. Okay.

Thomas Furness:

So they said, "We need some positive publicity. The defense appropriations bill is coming up and we're going to get hammered. And we don't have a black airplane to show this year, but we have your stuff."

And so I said, "Okay, I'll do it." And so I wrote up this press release and CBS Evening News comes into my lab. This is Dan Rather's crowd. And David Martin, the Pentagon correspondent, is there with a film crew. And they spend two days taping stuff. And I have tape over the top of instruments and things like that in the cockpit. But anyhow. And I end up, a few days later, on the CBS Evening News. Here I am a lab puke from Wright-Patterson Air Force Base and I'm on the evening news talking about virtual cockpits.

Thomas Furness:

Well, that was the event that opened Pandora's box because after that, then ABC had to come, and NBC, and CBC, and CNN, and BBC, and Australian television, New Zealand television, the science header of the New York Times came in and spent a whole day with me talking about the future of virtual reality. I was contacted by Popular Mechanics to write an article about this. We were on the front cover of US News and World Report. And after that, we didn't do in research anymore, we were into show business. And I started getting phone calls. I mean, and all these visiting. And we had, by the way, when the Generals came to visit, they'd heard about this, they wanted to see it, we had what we call the General switch. Whenever the generals sat in the cockpit to operate this, we had the switch that's a General switch. And when we switched that on, the Generals always hit their targets.

Robert J. Marks:

Tom, that's terrible. That's divisive. But it probably worked, right?

Thomas Furness:

It worked. No, we didn't have to throw the General switch for them, they get the idea of it. But nevertheless, what happened as a result of all this media exposure and all of these pilots, these test pilots, when they got out of the cockpit. They said, "Hey, Tom, this is fantastic. We have to have this." And so I was heading in that direction and then we had this news conference.

Thomas Furness:

And after that, I started getting phone calls. And one of the first phone calls I got, and I don't know how they tracked me down, but they called Wright-Patterson switchboard and they somehow vectored them to me. And this mother called, and she said, "I watched this program on television when you were talking about this virtual cockpit stuff and this virtual reality stuff." And she said, "My child has cerebral palsy. Is there anything you can do with this technology to help my child?" And then a surgeon called me, says, "I'm a thoracic surgeon. I'm trying to do a graft on aorta. I'm up to my elbows inside this patient, trying to feel my way around, and my map is actually a CT scan, which is on a light box on the wall on the side of the operating room. Is there any way that you can take that information and superimpose it into a patient?"

Robert J. Marks:

I really want to hear about this, but let's do this for a subsequent podcast. Could we? Because I think it's a great transition point, if that's okay. We've been talking to Dr. Tom Furness, he's at the University of Washington, and he's the grandfather of virtual reality, as we've been hearing. So until next time, be of good cheer.

Conclusion:

This has been Mind Matters News with your host, Robert J. Marks. Explore more at mindmatters.ai. That's mindmatters.ai. Mind Matters News is directed and edited by Austin Egbert. The opinions expressed on this program are solely those of the speakers.