

EPISODE 261

[EPISODE]

[0:00:08] IP: Hello, and welcome to episode 261 of AvTalk. I am Ian Petchenik, here, as always with –

[0:00:16] JR: Jason Rabinowitz. How's it going, Ian?

[0:00:19] IP: It's going well, Jason. How are you, sir?

[0:00:21] JR: I'm good. It's just an ordinary week for me of work, but I hear it's spring break in your household.

[0:00:28] IP: It is indeed spring break. I've got three fine young interns this week. I should say that I was sitting, looking at something on the site this morning and I had a zoomed in map of a portion of Africa and I'm just bragging about my daughter at this point. She pointed at the map. She goes, "That's an airplane in Africa."

[0:00:48] JR: That's true.

[0:00:50] IP: Apparently, they're actually learning things at school.

[0:00:55] JR: That's good. All you can hope for, really.

[0:00:58] IP: I mean, that's really all I can hope for. But, yeah. They're home this week, so that's been a fun one. But it's been a good week. It's been a good week and we've got a great, great show. Last week, we talked about some new features we brought to the website, including the new GPS jamming map that we released that shows where aircraft are experiencing GPS interference, whether it's jamming, or spoofing, or just a solar flare. That map is available now. But what we wanted to get more into was what are pilots, what are airlines and what are manufacturers doing to mitigate spoofing, jamming, general interference and how are they reacting in the absence of new technology thus far.

This week, we've got Matt Thurber, who is AIN Media Group's Editor-in-Chief, to explain exactly what's happening me of the interesting technologies that are on the horizon. We'll chat with him a little bit later in the show. Looking forward to that conversation.

First, hey, I told people who listened last week, and if you listened for the first-time last week, they're going to think I'm a liar now, but we normally don't talk about FlightRadar24 specifically all that much on –

[0:02:14] JR: It's true. It's in our contract. We're not allowed to.

[0:02:17] IP: But we've got a brand-new feature on the web now that's long, long, long been requested. I'm so thrilled that it's finally there. You can now choose airline logos as an option for labeling on the website. For the longest time, we've had that as an option in the app. Now, it has come to the web. We've also redesigned the airport pins and how the labels work and how they look on the web. Some of those changes will come back to the app, including the airport pins and things like that, so everything proceeds a pace, so there's a eventually seamless connection between how you interact with FlightRadar24 in the app and how you interact with it on the web. I'm excited about that one. Go check it out. You don't need to do anything special. There's no special URL. It's just the main flihradar24.com page, and then you can go into settings and choose logos. Everybody, go check that out.

[0:03:17] JR: Yeah. Developers hard at work. Look at them go.

[0:03:20] IP: You know who might have more time on his hands to check that out?

[0:03:23] JR: Oh, man. I can name a few people.

[0:03:26] IP: Well, let's start with a small list of folks who this week are, well, we can use their words, retiring.

[0:03:36] JR: Or, not seeking reelection.

[0:03:38] IP: Not seeking reelection.

[0:03:41] JR: Or ending unemployment, let's say.

[0:03:43] IP: There you go. We're referring to the slate of leadership changes announced by Boeing this week, couched in terms of retirement and not seeking reelection and stepping down to retire. Basically, this is a shuffling of Boeing's top leadership that, I mean, I don't think it's a great mystery, was in no way voluntary by any of the participants.

[0:04:14] JR: No. This has been called for by, I think, much of the general public. Not too often the general public calls for such turnover at a large corporation like this, but also, crucially, Boeing's customers, some of their largest airlines, obviously we're not too happy with Boeing's performance, namely, Alaska Airlines, probably not all too happy. We know for a fact, Ryanair was one of those airlines that actually commented on the changes. We'll get to that in a moment after we summarized the changes, but some big changes long overdue should have happened weeks and weeks and weeks ago.

At this point, I was getting to that feeling that maybe there wasn't going to be any changes, but dad, you are right, it was coming all along. They just needed to be prodded hard enough and long enough for it to happen. We have Boeing President and CEO, David Calhoun, will step down at the end of 2024. However, no replacement has yet been named and I don't know, maybe they'll turn it into a TV show on Fox where you can – there's going to be some competition to get the next Boeing CEO. We don't know who that is at this point.

What we do know is that Stan Deal, Boeing Commercial Airplanes President and CEO was out effective immediately at the time of announcement to be replaced by Stephanie Pope, who was already the chief commercial officer, I believe, who will now be in a dual role as Boeing commercial –

[0:05:42] IP: Chief operating officer.

[0:05:43] JR: Chief operating officer. Thank you. COO. Will retain COO title, but also, be the new Boeing commercial airplanes president and CEO, which is an interesting move as many

pegged her to be the next Boeing CEO when Calhoun was ready to retire, be fired, or move on, or whatever. Very interesting, I guess, at this point that Stan Deal out immediately couched as retirement, though nobody retires like that. That's not what happened. He was fired outright.

Also, one of the, I think the chairman of the board will not be seeking reelection. Boeing will need a new board chairperson. All I can say is I hope, whoever Boeing brings in to be the new CEO is someone external from the company, someone with engineering background, and I don't think anyone's really disagreeing with that at this point.

[0:06:36] IP: I mean, yeah. Independent board chair. The independent board chair is the person who is not a member of the executive committee. It's not Boeing chair and CEO, or yeah. That person is not seeking reelection. Steve Mollenkopf has been appointed the new chair and Steve Mollenkopf is the person who is going to lead the selection process for Boeing's next CEO. He's the person that you have to convince you want the job, Jason.

[0:07:00] JR: Oh, I don't want it.

[0:07:02] IP: Oh, okay. Well, that was easy.

[0:07:03] JR: Yeah. It's good. In the letter that Boeing published, the CEO message to employees, David Calhoun opened by saying, "As you all know, the Alaska Airlines flight 1282 accident was a watershed moment for Boeing. We must continue to respond to this accident with humility and complete transparency." I think that's a good opening. It's probably six weeks too late, but I do like that this, this moment was the watershed moment for Boeing. Not all the other 737 incidents, not the crashes, not the issues with the 787. This was the watershed moment.

I don't really see it as the watershed moment. I see it as the straw that broke the camel's back. Enough is enough. Their customers are not willing to accept any more screw ups. But I do like that they just outright said, this is the time where something has to change. We cannot keep doing what we are doing now. Time to find a replacement.

[0:07:58] IP: Yeah. I think, that's absolutely correct. They'll have the balance of the year as Calhoun intends to step down at the end of the year. I would be interested to see how long he actually stays onboard, whether or not he stays until the end of the year, or if this is just a timeframe that they've chosen to announce. I will put in a plug for Jon Ostrower's piece over at

The Air Current about how these changes came about. It's a very interesting, as Jason alluded to with airline CEOs basically getting together and seeking to meet with Boeing's board without Dave Calhoun present in order to bypass the filter that they felt Calhoun and Stan Deal were giving the board to their comments. I thought that was a fascinating bit of how they wanted this change. But I want to go back to what Jason mentioned a few moments ago. That was Ryanair Group Chair's Michael O'Leary's comments.

[0:09:03] JR: Ah, yeah. I'll summarize the statement in a 45-second video posted to various social media channels. Summarize, where he goes on to say, "Stan Deal, he's not the person to turn around the operation in Seattle." That's a pretty big indictment. It's not too often you have the CEO of probably one of their largest, if not their largest customers in the world, come out right on social media to say, the guy that was in charge is not the guy who's going to get the job done. We applaud replacing him. That would show you really just how badly airlines and the executives were trying to affect change.

They were trying to do, I think what the FAA was trying to do, but can't come outright and say and do. Yeah, this is the most outright we're ever going to see a major customer CEO say, this guy sucks. He's out of here. We look forward to working with Dave Calhoun before he's also –

[0:09:57] IP: There was no confidence. It's as simple as that. It was very clear that no one who was buying airplanes from Boeing had confidence that the leadership was going to do anything about the problems that the company was facing. You mentioned this at the very beginning, the general public was onboard for this. How many corporations, how many companies, how many industries can you have just random people taking an interest in the CEO?

[0:10:28] JR: I wasn't going to mention this, but the amount of Boeing memes being sent to me by just ordinary friends who aren't followers of aviation and don't even fly all that often, the frequency which I'm getting Boeing memes and things related to everything Boeing right now is

just I never would have imagined like, not only people knowing what Boeing is and being able to identify a 737, but sending me memes about the Boeing CEO turnover, like this is not good. This is not something that should be happening. But at least it is happening now. It's out there. It's going on.

What I did think was interesting, what Ryanair put out was they framed it as, "We look forward to working with David Calhoun and Stephanie Pope to eliminate delivery delays." Not about product quality, or product safety, or anything about that, but specifically, to eliminate delivery delays. I think that's another thing that's been talked about a lot is that Boeing, not only were they not putting out quality aircraft. The people in charge, your David Calhouns and everyone else at the top rungs of Boeing, you could not trust anything they said. They put out these rosy delivery timelines that will be able to make 52 737s this summer and then they delivered 22.

Then every summer, seemingly for the last four years, they have said, "Oh, this year, we're going to be able to deliver all these aircraft," and then something happens, or some quality issue. Then they deliver half the aircraft required. At some point, airlines, they just cannot properly plan their fleets and their schedules around this and they're going to want someone at the top of the food chain that maybe can't fix everything, but we'll stop lying to them about it. Maybe not actively lying, but painting the situation as it actually is and not what they think it might be.

[0:12:20] IP: Well, I mean, I think it goes back to the family unfriendly comments that I used a few episodes ago. If my leg's getting wet, don't tell me it's raining if it's not in fact raining. I mean, and I think that's what they were saying.

[0:12:31] JR: Could be snow.

[0:12:33] IP: Could be snow. There you go. We'll continue to follow this and see the race to be Boeing's next CEO is already heating up. I can only imagine that it is going to be a thoroughly interesting race. Why anyone would want that job? I do not know. Good luck to the person who does it, right? Headquarters are in Chicago –

[0:12:56] JR: It's not even in Chicago anymore.

[0:12:57] IP: They're gone.

[0:12:59] JR: Never mind. They moved to the Pentagon, basically. That's right.

[0:13:02] IP: Basically. Okay. Let's move on.

[0:13:06] JR: As far away from that as possible.

[0:13:09] IP: To Russia we go. In Moscow, today, on the 27th of March, an Emirates A380 was damaged in a ground collision with a potable water truck. The driver of the truck reportedly suffered a stroke and drove under the aircraft. Photos from Moscow show fairly substantial damage to the underbelly of the A380. Certainly, nothing that isn't fixable, but because this is Moscow and getting parts, material and Airbus AOG team, perhaps, into Russia, that makes things a bit trickier. Certainly, Emirates has fixed a 777 there in the last year or so, so it's possible. I think, Jason, you mentioned an Air India aircraft.

[0:13:56] JR: Yeah. The US-bound diversion that went to Russia.

[0:13:59] IP: Right.

[0:14:00] JR: We know they can fix things that end up in Russia that are maybe not ideally placed to be fixed there. But this is probably the most significant damage we've seen.

[0:14:12] IP: This was a straight replacement.

[0:14:14] JR: Right. You're not just taking an engine off wing and placing another one on. This looks like, there's significant, at least external damage. We have no idea what internal damage. I think this was towards the rear of the aircraft. Was there any damage to the rear pressure bulkhead, or anything like that?

[0:14:29] IP: No. It seems like, it's under – I mean, who knows at this point, but it seems like it was –

[0:14:34] JR: Exactly. We don't know.

[0:14:35] IP: - forward enough that that was damaged. There could be structural damage, there could not be, we don't know.

[0:14:40] JR: Yeah. We'll keep a close eye on this aircraft. It's almost certainly the most extensive repair of a foreign-owned aircraft currently in Russia, because we know Russian Airlines are sending their aircraft to like, Iran for overhaul. I assume –

[0:14:55] IP: We forgot to mention that that aircraft is back in service.

[0:14:58] JR: It is.

[0:14:59] IP: We'll come back to that in just a second. This particular aircraft is Airbus A380 registration A6EDM. If you want to set an alert for that particular aircraft. Then, yeah. The Aeroflot A330 that was in Iran for a very long time, that was RA73700.

[0:15:23] JR: All right. We will keep an eye on it.

[0:15:25] IP: Back in service. We'll see how long it takes for the Emirates one to come back. This incident took place a few days ago in New York, and it hasn't quite gotten the traction I thought it would, given the incident happening in New York and also the hyper-focus that we talked about –

[0:15:47] JR: Recently happening at all is enough to make major headlines. Somehow this one didn't.

[0:15:53] IP: This one's interesting. There was poor weather in New York.

[0:15:57] JR: That's an understatement. It was disgusting that day.

[0:16:03] IP: There was disgusting weather in New York on the 23rd of March, when Southwest Flight 147 from Nashville was attempting to land at LaGuardia. The aircraft encountered turbulence, wind shear, and low visibility. On its first approach, performed a go around, began the go around and shifted to the right of the runway, came back around for a second approach, and shifted right of the runway again. This time, shifting well to the right of the runway, and flying close enough to the tower that the air traffic controller in the tower began to earnestly encourage the flight to climb.

[0:16:50] JR: Yeah. If you're familiar with LaGuardia, they were shooting the ILS runway for approach, which if there happen to be any pilots listening who are familiar with that approach, you know that you can't land using autopilot using the ILS4 at LaGuardia, because of signal reflections and buildings and all sorts of stuff. I think trucks passing by the ILS antennas. It's a very weird approach, but there's not much they could do since LaGuardia is fenced in with so much building. You would probably know if you were a little bit misaligned off to the right of the runway for approach, you're going to find yourself staring down the rather large new air traffic control tower and eventually, the terminal building, which is not where you want to be at all.

The air traffic controllers, I don't think it was actually the controller handling the flight. Somebody else on frequency, I think jumped on and said, "Go away, go away, go away. If you keep doing this, something really bad is going to happen." The pilots were very calm on the Southwest flight and they went around and they eventually diverted away to Baltimore, I think it was.

[0:17:57] IP: Baltimore. Yup.

[0:17:58] JR: Baltimore. Yeah. A lot of flights diverting that day. It was truly a horrendous day of weather. Yeah, not great, but it is good. It is great that the air traffic controllers were aware of the situation. They knew it was happening, because they probably couldn't see the aircraft in those conditions. But using their instruments and alerting systems and all that good stuff, they alerted the crew on radio and disaster, potential disaster was never going to happen.

[0:18:25] IP: Always good to avert potential disaster.

[0:18:28] JR: It is. It is.

[0:18:31] IP: In an effort to possibly avert potential disaster, or perhaps to just be seen like they're doing something, the FAA has paused, or said it will pause certain certification efforts related to United Airlines during an increasing period of overview and oversight for the airline. This comes after a string of incidents, seemingly unrelated incidents; a wheel fell off, a panel fell. Stuff was falling off United planes. But they were all different types of aircraft, Boeing aircraft, United aircraft.

In response, United sent a letter to all of its customers that said, "We're trying to make sure nothing falls off the plane again. We're sorry. We're going to do better." The FAA says, "Hey, we're going to be around more often." That seems like a good idea, I think.

[0:19:31] JR: Sure. Generally, just everywhere be around more often would be good for them.

[0:19:36] IP: United says, it will expect to know more soon about "variety of certification activities that the FAA could pause."

[0:19:46] JR: I don't like this at all. The focus on United was not really all that warranted. There was, of course, that one incident where the tire fell off the 777, but that's the only thing, only reason it became news, because it was caught on video and it looks dramatic. Then there was the panel that fell off. That is, again, not unique to United. That happens sometimes. You don't want it to happen, but it happens sometimes and all the other nonsense that we covered, I think, last week of like, oh, no, the flight to Osaka returned to gate and it was four hours late. That happens to literally every airline at every airport every day. It's a thing. It happens.

United was just under a lot of scrutiny. I don't think the FAA pausing certification activities, including some rumored to be not being able to launch any new routes, or put any new aircraft into service, that's nonsense. That's not going to accomplish literally anything, other than prevent United from launching new routes, or putting new aircraft into service. That doesn't do anything to enhance safety. That's a punitive punishment for things that were blown, in my opinion, way out of proportion. I hope those rumors are not true that they're going to take such a draconian action against United, because it's not something that's really – there's no precedent for doing something like that.

As far as I'm aware, this is something that the FAA would do and we saw with Mexico where, oh, the processes in safety culture, or things going on at the Mexican aviation authorities aren't up to our standard, so we're not going to let Mexican airlines launch new routes to the US, or do this, or do that. It feels like that. It's just not nearly on the same level and I don't like it. Like you said, Ian, I think this is because, just because the FAA wants to be seen like it's doing something, even though that something doesn't really seem like it's going to do anything.

[0:21:43] IP: Yeah. I mean, I'm all for having more FAA inspectors at United facilities. I'm all for having them walk through policies and procedures and things together. That seems to make all good sense. Why not do that on a regular basis for all airlines? I mean, obviously, you only have so many inspectors and technical folks to go around. Unless, the FAA is seeing things that we are not, which, I mean, is possible.

[0:22:11] JR: Maybe, but I don't know what that would have to do with new routes. That's a purely punitive action. I don't understand. Again, that's not something that has actually happened yet that we know of, but it has been rumored to possibly be a thing. I hope it isn't, because it just doesn't make sense to me. But if the FAA wants to go in, look at United's certification processes, its maintenance procedures, by all means, do it for all the airlines.

[0:22:41] IP: There you go. Let's talk about a thing that actually happened. This was another one where the NTSB report came out and we said, "Huh?"

[0:22:49] JR: Hadn't heard of that one before. They're getting better at this.

[0:22:52] IP: They're getting better at this. This occurred at the beginning of February, on the 10th of February, an American Airlines 737-800 touched down at DFW and didn't stop the 737's auto break system.

[0:23:13] JR: It had stopped at some point. It is not continuing down the runway up to this day.

[0:23:18] IP: It's still going through Texas as we speak. The auto break system failed. The pilots had to apply manual braking. That –

[0:23:29] JR: Didn't work.

[0:23:30] IP: Well, the timing of that, by the time they were like, "Oh, this isn't working. We need to put the thrust reversers back in. We need to slam on the brakes ourselves." The aircraft is moving fast enough that it exited the, we'll call it usable portion of the runway. It did not leave the pavement. It went over the runway threshold into the overrun area, but it did not in fact leave a paved surface. Nobody on board was hurt, which is very good news.

[0:24:02] JR: Looks like a couple of lights were hurt. We'll keep those lights –

[0:24:05] IP: A couple of lights that were hurt in the process. The NTSB report, the preliminary report that was released end of last week after we recorded, of course, the brake lines were reconnected incorrectly.

[0:24:21] JR: Not great. Apparently, American was converting the brakes on this aircraft from steel to carbon, which is apparently, something Boeing had recommended its airlines do quite a while ago. I guess, things in this industry take a long time. This was announced back in 2016 in a Boeing service bulletin. I guess, it was this aircraft's moment to get that work done. Unfortunately, and I'm summarizing from a Flight Global article, the job involved installing four flow limiters within hydraulic lines, two limiters for the left, two main in landing gear and two for the right. Unfortunately, the brake, the hydraulic hoses, and we have some pictures to show this were crossed and they were not hooked up to where they should have been.

When this aircraft landed and the crew presumably would have had auto braking turned on, it didn't work at all, because of this new system that they installed and the crossed-hydraulic hoses. Apparently, the left main landing gear also had a problem involving an incorrectly installed wiring harness. It says, the electrical connector for the left outboard and the left inboard wheel speed transducers were swapped. A lot went wrong here. American is lucky that this aircraft happened to be on a longer runway with a nice runway overrun area, where it didn't end up an EMS, didn't end up in the grass, or in a ravine, or anything. No harm, no foul. But sure seems like, I don't know, maybe American could use some enhanced FAA scrutiny, because this

is an actual legitimate bad screw up by whoever did this work. We're lucky that this was – the end result was pretty innocuous.

[0:26:04] IP: Yes. Yes. It ended about as well as it could have, given the issues with the aircraft.

[0:26:12] JR: Yes. We have pictures. We love pictures.

[0:26:15] IP: We do. Link in the show notes, but of course. Let's take a quick break and then we'll come back with Matt Thurber, the Editor-in-Chief for AIN Media Group who's going to talk with us about GPS jamming, spoofing, and all things knowing where you are while you're flying a plane. Stay with us. We'll be right back.

[CONVERSATION WITH MATT]

[0:26:40] IP: Welcome back. We're now joined by Matt Thurber, who is the Editor-in-Chief of AIN Media Group and aviation trade publication. Matt has been writing and researching about GPS jamming and spoofing for a while now. After last week where we talked about the new map that we've come out with showing where there's GPS interference and how that affects flight tracking in FlightRadar24, we wanted to dig deeper and Matt has graciously joined us to talk about what's happening on the flight deck and what manufacturers and other systems producers are doing to mitigate these things. Matt, thank you so much for joining us.

[0:27:23] MT: Thank you, Ian. I appreciate being here.

[0:27:25] JR: Thanks for joining, Matt.

[0:27:27] IP: Last week, we talked about how we are measuring GPS interference and the types of things that we're seeing, whether it's jamming, where we just lose the GPS signal from the aircraft coming out with the ADS-B, or whether we're seeing aircraft spoofed and moving to places, like aircraft that are flying into Tel Aviv, all of a sudden appearing over Beirut, or aircraft in the Egyptian airspace appearing over Israel and things like that. In your reporting, what are you seeing? What are some of the hotspots where we're seeing GPS jamming and spoofing?

[0:28:01] MT: Well, definitely over areas where there's a conflict activity that's happening basically all the time, as far as we can see from some of the information that FlightRadar24 is putting out and others such as gpsjam.org. There's quite a few companies looking at this now that it's become a hot topic. Also, the Baltic area for some reason, seems to be getting a lot of attention. It should be noted that these techniques of jamming and spoofing aren't necessarily something that the so-called bad actors might use, but it could be something that the good guys use to compromise the signals of the bad guys.

[0:28:49] IP: What we're talking about is really everyone getting in on the act. It seems that commercial aviation is just collateral damage in conflict activity.

[0:29:01] MT: Exactly. It might even be that nobody's trying to mess up commercial traffic, but as you said, collateral damage. Part of the problem also is that the technology needed to do spoofing, essentially, you can buy a fairly simple piece of hardware and download some software from the internet and off you go.

[0:29:28] JR: Let's go over some of the basics here. What is GPS, or GNSS jamming and how is it different than spoofing? Which of the two are we seeing more of these days?

[0:29:39] MT: Right. There is a big difference, because jamming requires that you overpower the GPS signal and that just requires basically, overwhelming it and making it unusable. A lot of these entities that are showing the maps, it's easy to show the results of jamming, because it just shows that the signal itself is not reliable.

[0:30:11] JR: GPS jamming, again, isn't exactly a new thing. I think we're seeing it more widespread now, but I think I remember stories from years ago that aircraft, or pilots reporting issues with GPS at Newark Airport, because truck drivers driving by on the New Jersey turnpike were using GPS denial systems to prevent the companies from tracking them and that impacted aircraft at Newark. This is years ago. But how is GPS jamming different now than it was 10 years ago when something like that may have happened?

[0:30:45] MT: It's probably because the equipment is easier to get, but also we should take note that jamming is often done, for example, in the United States, the military does it as a means of

testing their own capabilities. They're not shy about causing GPS outages for hundreds of miles that affect commercial operators. Luckily, there's a pretty good warning system in place and we get NOTAMs to let us know where it is and what altitudes will be affected. You're right. It does seem to be more widespread.

[0:31:25] IP: How is spoofing different than jamming?

[0:31:28] MT: Spoofing actually is easier according to experts, because you only have to have a signal that's the same magnitude as the authentic signal. You don't need to overwhelm it by having a much more powerful signal. What spoofing does is sends a signal that basically fakes the navigation equipment on the aircraft into thinking the aircraft is in a different position than it actually is. The problem is, is that this has the effect of screwing up systems on the aircraft that rely on knowing the position of the aircraft, and it could result in the aircraft actually being flown off course by following that spoof signal.

[0:32:26] JR: Spoofing sounds like it is a much more, let's say, dangerous phenomenon right now than jamming for sure. It sounds like, jamming, suddenly the aircraft just doesn't have its position and the pilots have to deal with that. But spoofing, how does that present to pilots? Do they know there's GPS spoofing, or can they mitigate it, or what happens when spoofing might be ongoing?

[0:32:48] MT: Yeah. That's one of the problems that a lot of companies are dealing with right now and trying to figure out the best way to detect what's going on. One of the ways a lot of people are recommending, well, first of all, pilots need to have a mechanism to be aware of areas where jamming and spoofing is happening. That's one thing that the FlightRadar24 jamming map can help with and gpsjam.org. There's other companies working on that as well, like APG just came out with its free Naviguard app that uses not only some geofencing to warn people about these areas, but also gives active alerts in-flight and monitors the position of the aircraft in relation to known good ground navigation aids, so that in the recent history, there's at least some record of a good known position.

In the air, this is where it gets confusing, but there's a few things that pilots can watch for if their equipment in the cockpit displays this information. Just modern jets, for example, will show you

estimated position uncertain, or EPU on the cockpit displays. If you see that this is increasing, some reports will say, wow, it just suddenly jumped to 99 nautical miles, then you know there's a problem. Another clue is change in the aircraft clock's time. Some reports have said that suddenly, it changed from a few hours to as much as 12 hours. One of the first mitigations when this happens, if your airplane allows it is to deselect GPS inputs to your flight management system, so that you don't keep getting the same bad information.

[0:34:57] IP: Then, so what happens after you've – we're relying on GPS to navigate the aircraft. We're experiencing either a significant jamming, or spoofing and we've deselected the GPS inputs. Now what?

[0:35:13] MT: It depends on the aircraft again, but basically, what you need is you need a last known good position and you need help to navigate from that point. If your aircraft is capable, most flight management systems are, they can use other navigation inputs to provide a solution. One of the first solutions is from the inertial reference system, which basically, can give you fairly accurate navigation for some period of time. Depends on how accurate the whole system is to start with. But you could navigate on the IRS after that for a while. Then hopefully, you'll get your GPS back to retain a good position.

Most FMSs also can use ground navigation aids like VORs, VOR-DME, or DME-DME to establish a good position and navigate. A problem with that is that many countries, including the US, are decommissioning VORs.

[0:36:29] IP: I was going to say.

[0:36:31] MT: Because they're trying to save money and they figure, well, GPS is great. Let's just go with that.

[0:36:37] IP: There was the big push to area navigation and GPS and all of this. Now we're saying, "Wait, wait, wait. We need those on the ground, because GPS might not be available all the time."

[0:36:46] MT: Exactly. The other fallback is if you're in an area with good radar coverage and in contact with air traffic control, you can simply ask the controllers for vectors. That's what's happening in a lot of these actual cases.

[0:37:02] IP: We recently filmed a series of videos with Widerøe up in Northern Norway and on a lot of their flights to **[inaudible 0:37:08 Name of place]**, which is, I think, 30 kilometers from the Russian border. Those flights are often experiencing GPS jamming. They've had to basically, develop a new system where they just start flying and then when it happens, it's not really if anymore, it's when it happens, they just let ATC know, "Okay, we lost GPS," and then ATC starts providing vectors from there. It's not even an if situation anymore. It's become so prevalent. It's interesting to see that it's become as simple as just ask ATC. There are some technical mitigations in the works from avionics manufacturers, are there not?

[0:37:48] MT: Oh, sure. Absolutely. In fact, some of them are way ahead of this game. This is nothing new. People have been warning us about it for years. Todd Humphrey's GNSS expert at the University of Texas at Austin's Cockrell School of Engineering did a TED Talk about this 10 years ago, and it's happening. Let's give an example. Universal Avionics, one of the pioneers in development of flight management systems, I don't know if they did this with the plan for GPS jamming and spoofing, but they designed their FMS with Coleman filtering that first favors GPS. When the GPS signals are compromised, it automatically goes to DME scanning, or triangulation.

The FAA technical standard order for that, they got that in 1991. They've been working on it for a while. In response to customer concerns about this, they issued a service letter to their customers, explaining what it does and how the FMS is getting its good position. Now with the latest software update to their FMS, it shows a banner message if GNSS is not reliable and if it's switched to DME-DME. That's a good example of a really proactive manufacturer.

[0:39:28] JR: That almost sounds like reverse MLAT, where sites like FlightRadar24 would use MLAT, which is basically, triangulation of the aircraft using multiple ADS-B stations to figure out where is the airplane. In this case, are you saying that the airplane is using multiple ground-based stations to figure out where it is and then sends that back out over ADS-B?

[0:39:50] MT: Well, no. It's not sending it back out. It's using that for its own flight management system. It's not sharing it outside the aircraft.

[0:39:59] IP: Sadly, it's not sharing it out. I mean, we've actually had to fall back. I mean, one of the things that we're doing is falling back on MLAT, because it doesn't matter where the signal is coming from, as long as we're getting the signal to enough receivers, we can calculate the position of the aircraft. It would be great if the aircraft shared that signal back out with us.

[0:40:18] MT: Well, that's a really good point. Nobody I've talked to suggested that. That's something interesting. I checked with Collins Aerospace, Talas, Safran, Honeywell, and they're all well aware of this. If they don't have a solution right now, some of them do. Some of them are working for with other solutions. Another interesting factor is that most avionics manufacturers will allow the air framer to modify the avionics for their particular platform. An example of this is that Dassault set up the Honeywell avionics in its easy equipped business jets, so that when they're using the inertial reference system inputs, it's not combined in a hybrid fashion with the GPS. The IRS is not impacted by GPS spoofing, which is also a good example of looking ahead and dealing with this issue.

There's other more advanced technologies coming around. There's one company called Advanced Navigation and developing artificial neural network processing for their filtering to detect and mitigate false GNSS signals. There's another company called Sandbox AQ, which is developing a whole new position, navigation and timing solution using artificial intelligence, quantum sensors, and the Earth's magnetic field, believe it or not.

[0:42:08] JR: Wow.

[0:42:08] IP: Okay.

[0:42:10] MT: One other interesting area of development, and I think this is going to be big, especially with UAVs and advanced air mobility, is image-based navigation where –

[0:42:22] IP: I was going to ask about this.

[0:42:24] MT: Yup, it's coming and there's been a lot of testing and it's definitely something that I think we'll see more. In fact, universal avionics has done a lot of research in this as well.

[0:42:36] IP: Basically, what we're talking about is using Google Earth to reference check your position. I think I'm here. Does this look the same to me with my cameras as it does on Google Earth?

[0:42:51] MT: Exactly. Big challenge is what sensors can you use to look through fog, or rain, or clouds, or whatever, because it's not always a clear day out there.

[0:43:02] JR: I'd be real interested to hear how that works at night at 42,000 feet.

[0:43:08] MT: Right, exactly. I think it has a lot of potential. Then another interesting idea is last week, I got a demo of SpaceX's Starlink Aviation Satcom, which works pretty well, by the way. I asked the SpaceX guys on the flight. I said, "Well, couldn't you use a low Earth satellite network, like Starlink for position navigation and timing?" They said, "Sure. Absolutely." I guarantee you, they're doing some research on it.

[0:43:43] JR: Interesting. I think that goes back to the point where something like Starlink, or other Leo networks would probably have a much stronger, harder to, let's say, override signal than GPS, which if you've ever done some research into GPS, you'd be shocked at how low gain the signal is. It's barely there. It's a miracle that it actually works at all, but it doesn't take much to interfere with the GPS signal, whereas, something like the frequencies that Starlink, or other Leo networks would use is a lot harder to override. Is that basically the thought there?

[0:44:18] MT: Yeah. Leo is a lot closer to the Earth. I don't know what the signal strength is, but I'm pretty sure it's a lot more than GPS, which is thousands and thousands of miles up.

[0:44:30] JR: It sounds like, right now, while the industry figures out, it's next high-tech, artificial intelligence, synthetic vision solution to this problem. The solution right now in here and now is let's fall back to the tried and true, possibly analog, VOR, DME, and even the old IRS systems, which the last time I think I even looked at something like that was back in the day, American 767s were famous for appearing all over the map in places they shouldn't have been, because

they didn't have GPS. They had IRS systems, and those definitely did stray quite a bit from where the aircraft actually was over time. It's unbelievable that something like that is making its way back in. It's not a GPS replacement, but certainly an augmentation now.

[0:45:20] MT: Yeah, absolutely. I think it's incumbent on pilots, especially, to be educated about what's going on, what the risks are, how to mitigate them. Also, a lot of the time, you're not flying in the clouds, especially if you're up in the higher altitudes. You can see a lot of geographic features, and maybe it's time to take a little more interest in what's outside the window, because you can see if you're off course in a lot of cases. Obviously, it's a gross measurement, but I think that it's just one part of the picture of keeping informed about your situation.

[0:46:03] IP: Yeah. It's a very interesting thing to be dealing with after such promise of how GPS was going to revolutionize navigation and did. But because of how it's built, we end up with some very interesting problems that seem to be spreading as we look at where jamming and spoofing are taking place. Matt Thurber is the Editor-in-Chief of AIN Media Group, an aviation industry publication. His excellent article, which we'll put in the show notes about GPS jamming and spoofing and how different organizations are working to mitigate that is on AIN online. Matt, thank you so much for taking the time to join us.

[0:46:44] MT: Absolutely. I really appreciate being invited, and if I can close with one small piece of advice, this was from one of the engineers I spoke to at one of the major business jet OEMs. He said, "Look, there's one place you can fall back, and that is, buy yourself a portable multi-constellation receiver that connects to your tablet computer. Even though it's completely advisory, you're not allowed to use it for navigation, use it to monitor your position." Because if one network is being spoofed, or jammed, sometimes another constellation will continue working, and that might help you keep track of where you are.

[0:47:32] IP: Absolutely. It's funny to me, because I had a chat with a pilot not too long ago, and he pulled out his little – I mean, they are little now, GPS receiver and stuck it on the dash, and plugged it into his iPad and said, "Look, this is where we are, versus where the aircraft is saying we are, and now they match, and that could be different later on." I was like, okay, this is an interesting way to mitigate the situation. It's fascinating to see how this continues to develop. Matt, thanks again so much for joining us. Really appreciate it.

[0:48:04] JR: Thanks, Matt.

[0:48:06] MT: Thank you. Take care.

[END OF CONVERSATION WITH MATT]

[0:48:13] IP: Welcome back. We now know what's going on with jamming, what's going on with spoofing, and how they're going to fix it. But in the meantime, I guess, just use the old school stuff, because it works for now.

[0:48:27] JR: Yeah, I don't like any of what we just talked about. All of that is scary. I don't like it. If you're doing it, stop it. I don't think anyone listening to this podcast is doing that, but it's scary stuff.

[0:48:38] IP: That would be something.

[0:48:40] JR: I mean, everything is.

[0:48:40] IP: It is. It is.

[0:48:41] JR: We talk about it very calmly, but it's a real-world problem that has no real world answer just yet, at least one that doesn't involve 70-year-old NAVAIDs and stuff like that.

[0:48:54] IP: Exactly. All right, back third of the show, we're going to get through as quickly as we possibly can, because there's still some things to get through in. Here we go. Last week, we talked about a Korean Air order that was in the offing. It has been confirmed along with the same day, Japan Airlines. Korean is going to take 33 A350s, a mix of 27 A350-1000s and six 900s. Japan Airlines will go for 21 A350-900s and pick up some A321neos, 11 of those. Why not just 12? I don't know. But they do go for the nice round number. Boeing gets something too here. They get the nice round number of 10 787-9s.

[0:49:44] JR: Good for them. We do know that they are taking 21 A350-900s, specifically, because they only wanted 20 for international, but they need one to replace the A350-900 they lost at Haneda on January 2nd, it was of this year. Pretty interesting to see how quickly they're trying to backfill the fleet loss for that one, and that they would just outright say that. Nice of them to do that.

[0:50:13] IP: Yeah. I mean, I think if you order one domestically configured A350, they're going to be like, "I think we can figure out where that was."

[0:50:18] JR: Well, they could have just said, we're ordering 21 A350-900s and not mention that.

[0:50:22] IP: Not say anything. That's true.

[0:50:23] JR: One of these is to replace one of the aircraft that melted on the runway at Haneda.

[0:50:27] IP: That's fair. That's fair.

[0:50:31] JR: It being Japan, they specific details, so they mentioned it. Sticking in Japan, remember the MRJ? I'm sorry, the SpaceJet?

[0:50:38] IP: Wistfully so, yes.

[0:50:40] JR: Yeah. We all know that did not go well. Mitsubishi Heavy Industries and the government of Japan wasted a lot of money, something like 50 billion yen initially, but they halted spending and all development on the MRJ/SpaceJet/ whatever in 2023. Japan has said, "You know what? We want to do it again." Apparently, the Ministry of Economy, Trade and Industry unveiled plans last Wednesday, I guess, that they want to try again, and the public and private sectors will invest 5 trillion yen, which is about 33 billion US dollars. Maybe, hey, they'll debut a new airliner by 2035, because sure, why not?

[0:51:25] IP: Well, I look forward to them disassembling all of the prototypes in the United States desert 10 years from now.

[0:51:32] JR: No. They say, it is their mission to utilize public and private knowledge and experience learned from the SpaceJet. Look, if they learn from their mistakes –

[0:51:42] IP: It gave them lessons. Great, great.

[0:51:45] JR: There were many. Maybe they got something here, because they probably don't want to be in a position where the US and possibly, China and also, Brazil dominate commercial aircraft manufacturing. I don't know. Give it another shot. But good luck.

[0:52:00] IP: I don't want to leave Airbus out of the equation on that one.

[0:52:04] JR: There is that little company. Yeah, I slip my mind –

[0:52:07] IP: They start kicking around.

[0:52:08] JR: Yeah. I think they're still making airplanes, but of the size that this would compete with, it's really just Embraer, the 220 and whatever, whoever would be bold enough to buy a Comac aircraft at this point.

[0:52:22] IP: Jason, we talk about potential stow aways in a variety of forms, people try and get on airplanes without tickets, people who climb inside aircraft and things like that. This recent case of a stow away is a bit different.

[0:52:37] JR: We almost cut this, but I feel like, we needed to talk about it, because we always talk about the unsuccessful ones, or the successful ones where they do get to their destination and get caught. But this one's interesting, because of how sneaky it was. I don't even like talking about it, because it's so easily reproducible that someone else can easily do this. Apparently, this guy was flying on a buddy pass for, I think, Southwest, or some other airline, and that didn't work out.

[0:53:00] IP: They're not buddies anymore.

[0:53:02] JR: No, they are not buddies. This is why you don't give out buddy passes. It never works out well for anyone. This person really wanted to get where they were going. They had the cover idea of sneaking around the gate area for another flight going to their destination. Found someone with a boarding pass either on their screen, or in their wallet or whatever on their phone, took a picture of the QR code and boarded using that.

I don't know how they ended up getting around the fact that the same boarding pass would have been scanned twice. Thankfully, the aircraft was sold out. The flight was sold out. There were no empty seats. The stow away intentionally went to a different seat. One that wasn't on that boarding pass since you know that person is going to be boarding the flight. They hung out in the lavatory, until departure was imminent where they would go find an empty seat, except there weren't no empty seats. That's sneaky. That's really sneaky. Don't do that. Please don't do that. I'm interested to know how the same boarding pass was scanned twice and someone got onboard. Some process wasn't followed. But that's just sneaky.

[0:54:08] IP: Yeah. Let's see. What else do we have left? We've got, so this is interesting, new screens for the American A320 family.

[0:54:16] JR: Yeah. Airbus, you might remember them, we talked about them moments ago, they are still a thing.

[0:54:21] IP: We've fact checked that in the past 30 seconds. They are still in fact, making airplanes.

[0:54:26] JR: Airbus is still a thing. They're just quiet these days. They don't like talking much, because no news is good news right now. American Airlines, who we talked about earlier, has some of the oldest A320 family aircraft in existence out there. Many of the A319s and A320s were originally owned by America West. Those ended up at US Airways, and they are now at American and they are getting old. A problem with old aircraft is they have old components onboard. One of those components are actually the flight displays in the flight deck. They are based off of CRT technology, which you really don't see anywhere anymore.

They're not making new CRTs. You can't refurbish them in any meaningful way. The only way there has been to prolong the life of them is to turn the brightness down, which isn't great because you really need to see them and they need to be bright in order to see them. American will be, apparently, the first airline in the world on its Airbus aircraft to upgrade the CRTs to LCD, which is pretty cool. They say the new system will save nearly 100 pounds per aircraft, which is not nothing over the life of an aircraft. They will do a few of them over the next few years, so this isn't something that's just going to be a quick rip and replace. It's going to take a while. I just thought this was pretty cool.

There's a lot of antiquated technology on aircraft like this from floppy drives to CRTs. It's very 90s up there still. That's an interesting way for American to get some more life out of its rather elderly Airbus fleet.

[0:56:00] IP: Yeah. I think one thing to mention is that this is the first – I think what American means to say is that they're the first passenger airline to retrofit these. Because UPS has done these with their A300s.

[0:56:13] JR: At least the 320 family, I believe.

[0:56:15] IP: Oh, okay, okay.

[0:56:17] JR: Yeah, the 320 family. We know if you're a UPS, or a FedEx, you're basically buying a spaceship compared to the passenger variants of the aircraft. Like the 767s, they've got night vision and all these fancy things you just won't find in the passenger variants of the aircraft. Apparently, yeah, this is the first time –

[0:56:34] IP: Because they're keeping them not forever.

[0:56:36] JR: - an A320 family series has been upgraded from CRT, which some of you listening to this podcast have probably never seen before.

[0:56:43] IP: Have no idea what –

[0:56:45] JR: That just made me really sad.

[0:56:47] IP: Yeah. We've just dated ourselves.

[0:56:50] JR: Oh, boy. All right, let's move on. I'm sad now.

[0:56:53] IP: All right. Hey, let's go to Philadelphia.

[0:56:55] JR: That's not going to make me happy, unless I'm a passenger flying out of Newark. Part of the FAA's, let's say, make the New York airspace less terrible plan was to move control of EWR Newark's airspace from N90, which is New York terminal radar approach, the TRACON Center from the New York to Philadelphia TRACON. Since New York is chronically understaffed, if you have been a passenger flying out of Newark during any adverse weather conditions, which is pretty much every day from late May to October, you probably took a delay, because there just weren't enough employees working the consoles at N90 to control your flight.

Thankfully, the FAA has come to an agreement with the National Air Traffic Controller Association, basically, the Union for air traffic controllers, where that sector will be moved to Philly. Thanks, Philly. We owe you one, I guess. This will happen by the end of June 2024. Several controllers are expected to voluntarily transfer. I hope somebody in the TRACON welcomes them with some cheesesteaks, or whatever else you have in Philly to celebrate moving to town.

[0:58:12] IP: Excellent. Okay, last two things. First thing, the Boom XB1 flew for the first time and made a 12-minute circle over Mohave. That happened.

[0:58:22] JR: Cool. Next story. Air France. This is what I wanted to talk about. I needed to make sure we talked about this, because it was –

[0:58:30] IP: We needed to close to show with this one.

[0:58:31] JR: We need to close –

[0:58:31] IP: This is the perfect story to close the show with.

[0:58:34] JR: Yes. For the first time ever on a commercial aircraft, a heart destined for a heart transplant was moved across the Atlantic Ocean on an Air France 777. It was preserved for 12 hours and six minutes onboard this aircraft, which went from the, where was it? From the French West Indies, I think, all the way to Paris in January 2024. We don't have the exact date of this aircraft, but a man in the French West Indies, 48-years-old, was declared brain dead three days after an intercerebral hemorrhage.

Normally, what happens in this situation is, thankfully, this person was an organ donor. Thank you to that person. This is the ultimate gift someone can give. They would have to find somebody locally who needs this heart and presumably, the other organs. At no point in the past had a heart for a heart transplant been transported so far. This comes to us from the Lancet published, also publicized widely by Air France. This was the longest time, any time over 10 hours, or had been a transport time for a heart. What did you have to think about this one? Because I know you – did you actually read the full case study here?

[0:59:53] IP: I didn't understand most of the case study. But, what's really interesting to me about all of this is when we talked in episode 198 about what goes into transporting an organ, we talked about it in the context of eyes, a kidney, and we talked about how those were, I guess, more transportable, because of how those organs operate and how they're able to be transported. But this was a heart. The interesting thing about this is it not only, this has nothing to do with how long – the flight has everything to do with how long the heart was outside of a body. The fact that they came up with a new way to basically pump cooled liquid through the heart in order to keep it viable for so long. That was just fascinating.

[1:00:49] JR: That was out there in the last row of an Air France 777. They say, the success achieved in this instance in which distance and transport time are no longer a limiting factor and has the potential to redefine the landscape of heart transplantation with unlimited geographic procurement and lowered time constraints. They say, the heart traveled a distance of 6,750 kilometers and survived some severe turbulence, apparently. I don't know how a medical journal

defines severe turbulence. It might be different than what air traffic control, or a flight crew defines it as, but it is the first time this has happened on a commercial aircraft.

I don't know if what they're saying here exactly means that there has been cases where this has happened across the Atlantic on private jets before, but I don't quite think that's my read on it. The first time for a heart transplant has just flown coach class in a commercial aircraft. They specifically mentioned coach class. If you're on the upgrade list, don't worry. It didn't need a business class. It needed two economy seats in the rear of the aircraft.

[1:01:58] IP: There's a guy sitting next to it as people are going to the bathroom and people are like, "Hey, what's this?" He's like, "Don't touch it."

[1:02:02] JR: Don't touch it. It's really important. It is unknown if the heart accrued any flying blue points, or if those will be awarded to the heart recipient. I hope so. That would be a good gift. Not just the literally the gift of continued life for the recipient. What was it? 6,750 flying blue points.

[1:02:24] IP: Flying blue. Silver. There you go.

[1:02:26] JR: Unless, it book basic economy, then they get nothing.

[1:02:28] IP: Ooh, ouch. All right. Before we go any further down that rabbit hole, I think we should call it an episode. This has been episode 261 of AvTalk. I am Ian Petchenik, here, as always with –

[1:02:44] JR: Jason Rabinowitz. Thanks for listening.

[END]