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# How 5G Clashed With an Aviation Device Invented in the 1920s

10-12 minutes

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## Correction: January 20, 2022

Because of an editing error, an earlier version of this article incorrectly described the fighter planes used in World War II. Most were not jets.

A technological innovation that helped pilots fly fighter planes during World War II is now at the heart of the dispute between airlines and AT&T and Verizon over 5G, an innovative service meant to speed up mobile devices.

The clash has been years in the making and came to a head in the last few weeks. [AT&T and Verizon](#) agreed on Tuesday to restrict 5G near airports after airlines warned that potential interference from it could cause a crucial device on planes to malfunction, and force them to cancel flights. Even with the airport restriction, a number of international airlines on Tuesday canceled flights to the United States, though some of those [flights were restored](#).

The instrument in question is a radio altimeter. It was first developed in the 1920s but still plays a crucial role in planes, helping pilots determine a jet's altitude and its distance from other objects. In some planes, altimeter readings are fed directly into automated systems that can act without input from pilots. As aviation experts describe it, [the 5G system used by AT&T and Verizon](#) works in similar frequencies to the ones used by altimeters.

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"You do not want to be on planes landing without the altimeter working," said Diana Furchtgott-Roth, a former deputy secretary at the Department of Transportation in charge of researching new technologies. She added that aviation regulators were correct in [raising concerns about 5G](#) and were taking appropriate steps to ensure safety.

But telecommunications experts say that there is little or no risk to altimeters from 5G and that the aviation business has had years to prepare for what little risk there is. "The science is pretty clear — it is

hard to repeal the laws of physics,” Tom Wheeler, a former chairman of the Federal Communications Commission, [wrote in a piece for the Brookings Institution](#) in November, in which he noted that F.C.C. engineers had found no real cause for concern.

### **What are aviation safety experts worried about?**

The altimeter was patented by [Lloyd Espenschied, a prolific inventor](#) who spent more than 40 years working for Bell Labs, the celebrated research arm of AT&T. The device functions by sending out radio waves to determine a plane’s location relative to the ground and other objects.

If an altimeter’s waves don’t bounce back because of 5G interference, or can’t be distinguished from other nearby waves, the altimeter could give the wrong reading or not function at all, said Peter Lemme, a former Boeing engineer who spent 16 years at the company designing safety systems that relied on altimeters.

A malfunctioning altimeter, for example, could prompt a plane’s computers to warn pilots about phantom obstacles or prevent systems from warning pilots of real threats.

The Helicopter Association International held a webinar last week for its members on 5G interference. One of the panelists was Seth Frick, a radar system engineer at Honeywell Aerospace, which makes altimeters for many aircraft, including its own military helicopters. Mr. Frick said Honeywell had found a range of errors, from altimeters “getting noisy” to providing no reading, in the company’s testing of 5G interference.

“I don’t know if there’s any cases where we can say there is absolutely no interference,” Mr. Frick said on the webinar.

Pilots tend to rely on altimeters when visibility is limited by, say, fog. But they are not used in most landings, which is why some wireless experts have dismissed the aviation industry’s concerns as hyperbolic. In addition, wireless experts have said most modern altimeters should be able to filter out interference.

“I see why it is a greater concern,” said Tim Farrar, a wireless industry consultant who has looked at the issue. “But I am still not convinced you will see any interference.”

### **Could a malfunctioning altimeter cause other problems?**

One of aviation safety experts’ biggest concerns is that an altimeter malfunctioning because of interference could set off a chain of mistakes by the automated systems and by pilots. Such errors

played an important role in the two fatal accidents involving the Boeing 737 Max that led regulators in 2019 to ground that plane for nearly two years.

“This is something that everyone will be more cautious about — the impact on aircraft with a high degree of automation — because of the problems automated systems caused on the 737 Max,” Mr. Farrar said.

Some experts said they were most worried about 5G interference with the Boeing 787, a larger plane that is typically used on long, international flights.

Altimeters are a key part of the 787’s landing system, turning on the reverse thrusters that slow the plane once it has landed. Mr. Lemme said a Boeing patent suggested that the function was totally automated, meaning that even a pilot landing a 787 manually would not be able to reverse the plane’s thrusters if the altimeter malfunctioned. The 787’s landing gear brakes, which are triggered by weight, would still function, as would its wing spoilers, which are only partly controlled by altimeter readings. But Mr. Lemme said a lack of reverse thrusters would make it difficult for pilots to stop planes before they reached the end of the runway.

“You absolutely could have some planes running through runways,” he said.

Boeing did not respond to a request for comment.

The F.A.A. on Friday issued a notification that it had detected “anomalies” that “regardless of weather or approach” could cause 5G interference to affect a number of the 787’s automated systems. “The presence of 5G C-band interference can result in degraded deceleration performance, increased landing distance and runway excursion,” the agency said. The notification covers 137 787s in the United States and more than 1,010 worldwide.

### **Why weren’t these concerns addressed earlier?**

AT&T and Verizon’s decision to temporarily limit their new 5G network within two miles of airports should address many of these safety concerns — [at least for now](#). But the start of 5G has been years in the making, raising questions about why airlines, the F.A.A., the wireless companies and the F.C.C. did not resolve them earlier.

Ms. Furchtgott-Roth said previous warnings from aviation experts had been ignored. She said that in December 2020, the Transportation Department [sent a letter](#) to the National Telecommunications and Information Administration warning that allowing 5G to operate in its proposed frequency band would

cause problems for flight safety systems. She said that letter was never passed along to the F.C.C. and to wireless companies.

Instead, the F.C.C., relying on its own research that cleared 5G of safety concerns, went ahead with a planned auction. In February, carriers bid more than \$80 billion to use that portion of the wireless spectrum for 5G.

“Wireless carriers have a right to expect a return on their investment,” Ms. Furchtgott-Roth said. “But you should be very happy that the F.A.A. is taking a strong stance to ensure people’s safety.”

Still, wireless experts, including some officials at the F.C.C. like Brendan Carr, a Republican member of the commission, dismiss the warnings from the F.A.A. and airlines, arguing that 5G interference does not pose a safety risk.

### **What happens now?**

Ms. Furchtgott-Roth, who teaches transportation economics at George Washington University, said that to fully resolve the issue each plane model had to be tested. “Can’t say the newer ones are going to work and the older ones are not going to work,” she said. “In some cases, it’s the opposite.” The F.A.A. says it has already [cleared 62 percent](#) of the commercial fleet in the United States.

The airline industry has been working on new standards for radio altimeters that would address the 5G interference and other issues. But those standards are not scheduled to be released until October and would apply only to new altimeters. The F.A.A. has approved five models of altimeters as 5G compliant in the past week, but the approvals are based on the combination of altimeter and plane model, and no altimeters have been approved for use in 787s.

“The most likely solution is swap out the altimeters,” said Mr. Lemme, the former Boeing engineer, adding that could take years.

Upgrading altimeters could cost billions of dollars. Airlines do not want to bear that burden, and neither do the wireless companies.

In his Brookings Institution piece, Mr. Wheeler, the former F.C.C. chair, outlined three sources of potential funding: The government could spend some of the \$82 billion it received from selling 5G frequencies to the wireless companies; the wireless industry could be forced to pay additional fees for use of those frequencies; or the aviation industry could be forced to pay for the upgrades because it has long known that 5G was coming.

A more immediate solution would be to make permanent the temporary limits that AT&T and Verizon have placed on their 5G networks near airports. Or the companies could reduce the strength of the 5G signals near airports, or redirect antennas in ways that limit or eliminate their impact on planes. These options would probably make 5G networks less useful in those areas, and potentially not available for those who live within the buffer zones of certain airports.

Any solution will have to be negotiated between the airlines and the F.A.A. on one side and wireless companies and the F.C.C. on the other. But the two camps view the problem so differently that reaching agreement could be difficult, said Harold Feld, a senior vice president at Public Knowledge, a research and advocacy group that has received funding from AT&T and Verizon.

“The assumptions for how altimeters and 5G towers are going to interact in the real world from each side are radically different,” he said.

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