

Is the 5G rollout a new threat to aircraft safety?

OPSGROUP Team
9 December, 2021



The FAA issued a statement on Dec 7 regarding the expansion of 5G networks across the US, and its impact on aviation. It doesn't sound good - which is something folk have been saying for a while now...

What's the background?

5G is being rolled out across the US in the form of massive antennas. No issue so far. The problem comes in when they turn them on because they use frequencies which are part of **the 'slice' of radio spectrum usually reserved for GPS signals**. Which means they will probably interfere with those signals, and disrupt the equipment in the aircraft utilising those frequencies.

That equipment concerned are **Radio Altimeters** which, as we all know, are fairly critical to certain operations. Some big accidents have been attributed to malfunctioning Rad Alts like Turkish Airlines Flight 1951.

Radio Altimeters transmit on frequencies between **4.2GHz and 4.4GHz**, while the 5G network will use a C-Band range of **3.7GHz to 3.98GHz**.



A larger telecommunications base station.

Why the concern?

The big problem in all of this is the lack of information on **how much interference** will actually occur.

It is not clear which airports will be impacted or to what degree equipment might be disrupted because it depends on the location and the strength of signals. While the RTCA (Radio Technical Commission for Aeronautics) has conducted measurements and found that **high levels of inaccuracy and outright failure** of Radio Altimeters can be expected when operated near base stations – many of which are located near major airports – **until they are turned on it is hard to know...**

The FAA also suggested that while issues with RAs are the primary problem, it is **unknown what else may be impacted** so crew are going to have to be extra vigilant of their instruments, and of passengers potentially connecting to 5G networks while airborne because the impacts are just not known.

What has the FAA done?

The FAA has issued **two airworthiness directives**, one for aircraft and one for helicopters, in an attempt to enable *'the expansion of 5G and aviation'* to *'safely co-exist'*.

This is in addition to an earlier Special Airworthiness Information Bulletin issued in November 2021 highlighting the **Risk of Potential Adverse Effects on Radio Altimeters**.

Let's take a look at the new directive.

The FAA determined that – *"at this time, **no information has been presented that shows radio altimeters are not susceptible** to interference caused by C-Band emissions"* and because they don't know, they have to mitigate against the possibility that they will be.

So, **AD 2021-23-12** requires the *"revising of the limitations section of the exiting airplane/aircraft flight*

manual (AFM) to incorporate limitations prohibiting certain operations requiring radio altimeter data when in presence of 5G C-Band interference as identified by NOTAMs.”

In other words, you’re going to need to **amend your AFM** so it takes into account the possible impact of 5G.

The AFM revision will look something like this –

(Required by AD 2021-23-12)
Radio Altimeter Flight Restrictions When operating in U.S. airspace, the following operations requiring radio altimeter are prohibited in the presence of 5G C-Band wireless broadband interference as identified by NOTAM (NOTAMs will be issued to state the specific airports where the radio altimeter is unreliable due to the presence of 5G C-Band wireless broadband interference): <ul style="list-style-type: none">• Instrument Landing System (ILS) Instrument Approach Procedures (IAP) SA CAT I, SA CAT II, CAT II, and CAT III• Required Navigation Performance (RNP) Procedures with Authorization Required (AR), RNP AR IAP• Automatic Landing operations• Manual Flight Control Guidance System operations to landing/head-up display (HUD) to touchdown operation• Use of Enhanced Flight Vision System (EFVS) to touchdown under 14 CFR 91.176(a)

The AFM revision showing RA restrictions

What’s the impact?

In short – possibly a lot, possibly nothing, and **the only way to tell is to check NOTAMs**. Start checking them now, because operations **using the new spectrum started December 5**.

The key word in the revision is **‘interference’** because again, that won’t be entirely known until base stations are switched on and reports received. Which puts operators in a tough spot because those approaches that are prohibited (because of interference) are effectively all your **precision approaches and means of landing in reduced weather conditions**:

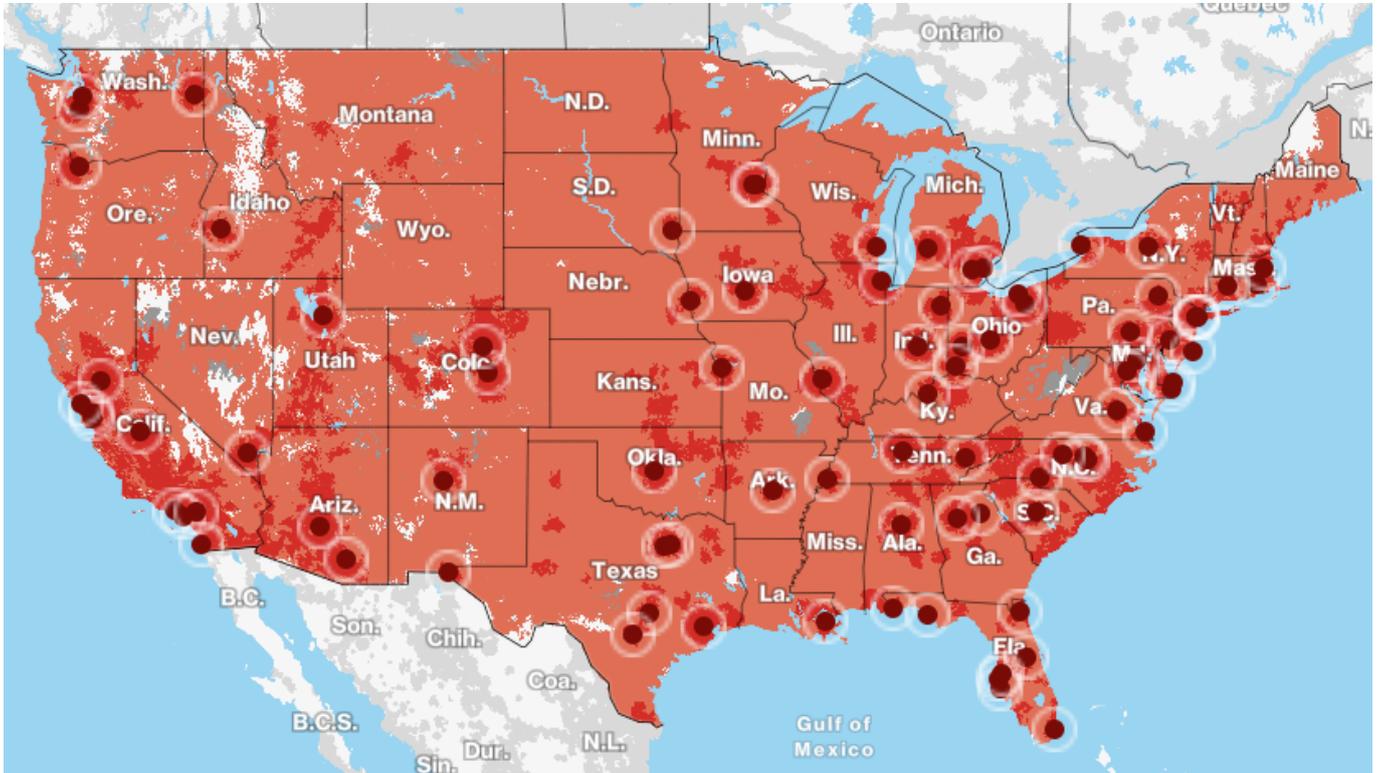
- ILS CAT I, II, III.
- RNP (AR) procedures.
- Automatic Landing.
- Manual flight control guidance system operations to landing/HUD to touchdown operations.
- Use of EFVS to touchdown.

Where is the impact?

The US currently has around **279 cities, across 46 states**, connected to the 5G network. Of course, it is

only the base stations in close proximity to airports which will be operating on the C-band at interfering levels that are a problem. The FAA are currently working with telecoms providers to **establish which airports will have C-Band base stations** near them.

This shows the anticipated coverage across the USA. The magenta is **5G Ultra Wideband**, the bright red is 5G Nationwide, and the pinkish/orange red is the current 4G LTE coverage.



Map of 5G coverage

It could be a worldwide problem

The issue is not necessarily restricted to the US. **5G is growing globally**, with China equally far ahead in their implementation of it, which raises concerns of where else this might pose a potential threat.

Thankfully some countries, like Canada, have opted to prevent or restrict services near major airports, at least until further data is received.

What you need to do.

- As an operator, you will need to ensure your aircraft are compliant with the new directive, so read **AD 2021-23-12** and ensure you update your AFM when required.
- Right now, the biggest thing to do is to **check NOTAMs**.
 - Base stations are still being activated, and the interference levels due variable power levels and locations means it is not clear where or what the impact will be. NOTAMs will therefore be **issued for specific airports** confirming the restrictions for them, as and when this is known. And this could change daily.
- Staying updated on the situation at airports you operate into, as well as encouraging crew to **review the weather and alternative approaches** in case they become required is critical.

- **Review the function of radio altimeters** on your aircraft and understand the implications to capability and performance of malfunctions.

What else can you do?

You can write in and express comments, written data, views and arguments on the directive to the FAA. Ensure you title the correspondence with this - *“Docket No. FAA-2021-0953 and Project Identifier AD-2021-01169-T”*

You can **Email** this feedback to operationalafety@faa.gov. Alternatively, you can send via Fax: 202-493-2251 or Post: U.S. Department of Transportation, Docket Operations, M-30, West Building Ground Floor, Room W12-140, 1200 New Jersey Avenue SE, Washington, DC 20590.

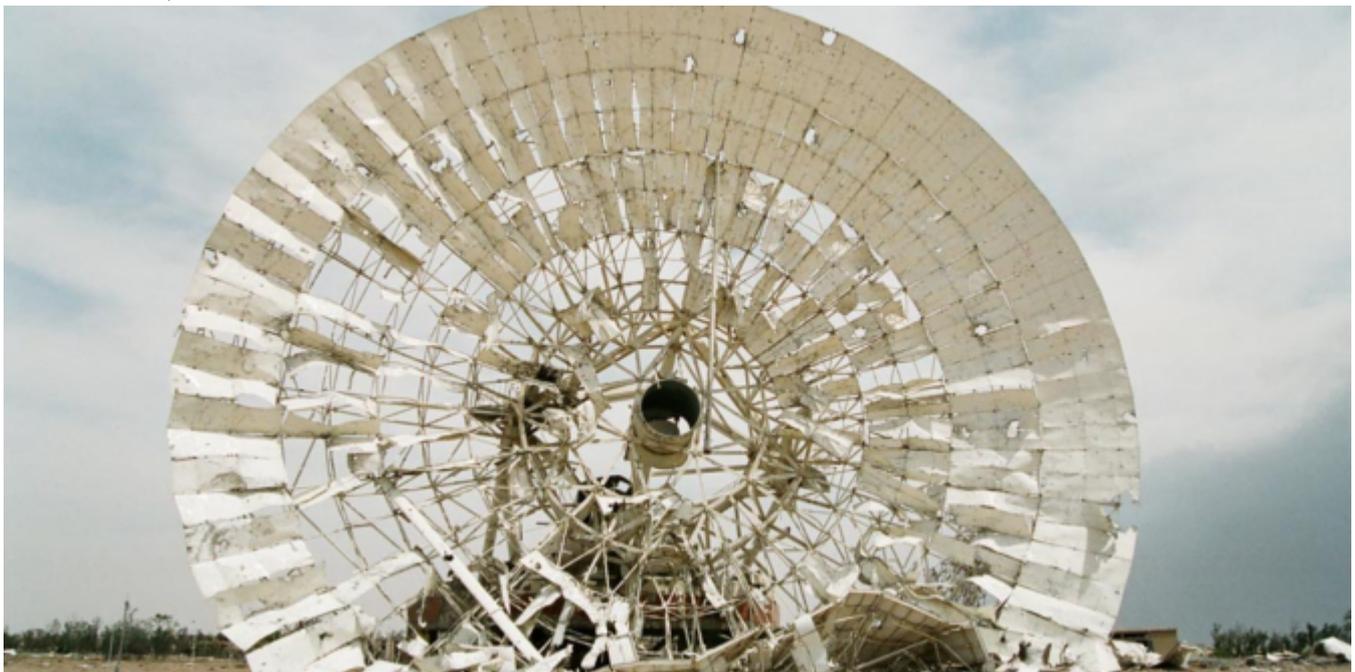
You can also **request further information** from Mr Brett Portwood, Continued Operational Safety Technical Advisor, COS Program Management Section, Operational Safety Branch, FAA, 3960 Paramount Boulevard, Lakewood, CA 90712-4137.

Any interference should be reported to the FAA to assist them in building up a better picture of the impact and safety concern.

You can also follow AOPA’s work on 5G as they continue to monitor and ask the FAA to address the situation urgently.

GPS U/S in the US

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We have written a fair amount on worldwide GPS Jamming issues. Here is what we said about it in ‘GPS Jamming: All the Wrong Signals’. But there is another GPS problem though which is a little closer to home (if your ‘aviation’ home is in the US anyway).

What's the deal?

Let's take a step back to 2017, when the NBAA and a bunch of other stakeholders took part in the 2017 RTCA tactical operation committee. That's the **Radio Technical Commission for Aeronautics** and they are great - they try and help find compromises amongst the competing interests on critical aviation modernization issues.

One of these very issues is with GPS.

The FAA's NextGen modernization program is using more and more GPS 'stuff'. Stuff that is critical for commercial flight operations safety and efficiency. The US Department of Defense on the other hand is sort of doing the opposite - they are running GPS Jamming tests which are critical for National Security and the **big problem** with this is that the jamming tests often interfere with the GPS signals civil aircraft are using.

What was the 2017 outcome?

After they talked about it in 2017, the compromise was that the DoD will notify the FAA at least **120 hours before any planned tests**. This should give the FAA time to put out Notams to warn crew and operators.

Problem solved?

Unfortunately not. The 120 hours notification is given, **but the information which filters down to the pilots and operators who need to know about it often not sufficient**. One of the difficulties is that the Notams have to provide information on different outage locations and this means **looooooong Notams** filled with lots of Lat and Longs and times and dates. And this means critical information can sometimes get buried inside and makes it difficult or confusing for the crew to find it, extrapolate it (or even be aware of it in the first place).

What's the plan now?

Well, the NBAA have reported on this, and say that the FAA are taking their concerns onboard. They plan to revisit the idea of producing **visual representations of the outage areas**. These will be much easier to digest than lines of lat and longs, and would hopefully enable crew to use them in conjunction with planning apps in the future.

There has also been a reminder issued to crew asking them to **report outages and issues**. If you find yourself in a jammy area, let ATC know. Tell them what you have lost so that they can warn other aircraft in the immediate area. The reminder has been sent to ATC as well because in the past, when aircraft have made these reports, the information has not always been shared out to other operators in the near vicinity.

What do you need to look out for?

What an outage means, practically, is interference to the GPS signals which your navigation system is using. The result can be a **degradation in accuracy, or a full loss of the system** (GPS primary).

If you are enroute, let ATC know your capability has been degraded so you can get the support you need to continue navigating safely.

Some aircraft are particularly sensitive to disruption in the GPS signals, and it can lead to you losing that system until it is reset on the ground. **This means RNAV/RNP approaches might not be flyable anymore**. Having an awareness of what this means for your aircraft is important. Think about your plan B for approaches in case you do lose GPS navigation capability.

Notams are out there and it might be frustrating picking out the areas which could impact you, but

knowing about the outage spots in advance will help.

Where can you look for info?

- The Navigation Center website is run by Homeland Security, and this is where you will find notices of GPS service interruptions and a link to their GPS Testing Notices. You can also file reports here if you encounter unexpected disruptions.
- This will take you to the Official government page on GPS.
- Your WAAS monitoring site is here. There are some good real time maps of current coverage
- The FAA also have a site where you can find Notams specific to GPS outages.

The 5G Update

We thought we'd throw in a little update in on this as well.

Last year we saw increasing concerns about possible **interference from 5G networks** because they operate on the same slice of radio spectrum usually reserved for Radio Altimeter signals (the 3.7-3.98 GHz band).

The big concern here is that interference could result in degradation of accuracy from spurious emissions, or outright failures in the radio altimeters. Not sure how much of a risk that means? Well, Turkish Airlines TK1951 crashed in EHAM/Amsterdam Schiphol in 2009 and one of the primary factors was attributed to a malfunctioning radio altimeter which sent an erroneous -8ft reading to the autothrottle system, commanding it to idle.

The NBAA are fronting a campaign here as well. Twenty organizations have joined forces to send the FAA a letter raising their concerns over this, in response to a report issued on March 3 that they don't feel addresses the threat with enough analysis.

You can read the letter here.

Military aircraft and UAVs are also at risk here. Their radio altimeters use the same C-band frequencies, but they tend to fly a lot nearer the ground a lot more often. A very good summary of the issue can be found here.