

Dangerous Goods: The Bad Ones

OPSGROUP Team

25 May, 2021



IATA recently 'urged action' over rogue lithium-battery shippers. Folk are apparently sneaking them onboard without proper notification or packaging, and this could turn into one big, hot mess for airlines.

So, here is a closer look at Lithium Ion batteries, what they are, what they can do, and how to better deal with them onboard.

What are they?

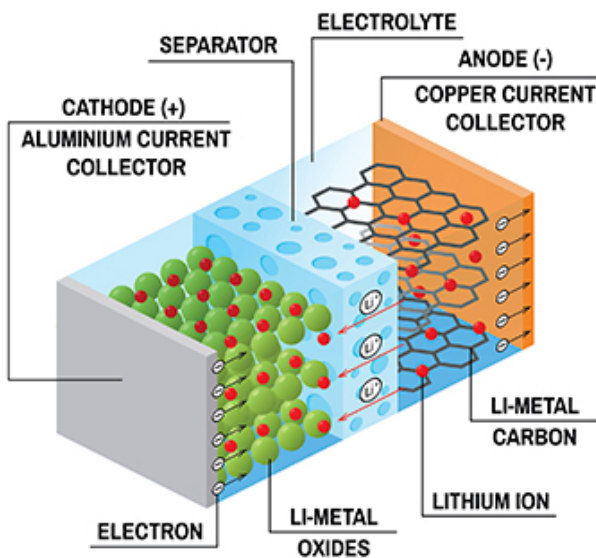
In big terms they are things that **power a lot of our airplanes**. In smaller terms, they are the **batteries in our phones** and portable electronics.

And in **super simple terms** (and with some creative licence thrown in) they are a cell that contains an electrolyte liquid. **Lithium Ions** get all charged up, and when they are feeling particularly positive, they dive into the electrolyte and swim through it. The movement of them gets the **electrons all excited too**, and they go zooming along from the current collector, through the device (your phone, laptop, airplane) which sucks out their charge, and then they get collected up by the negative current collector.

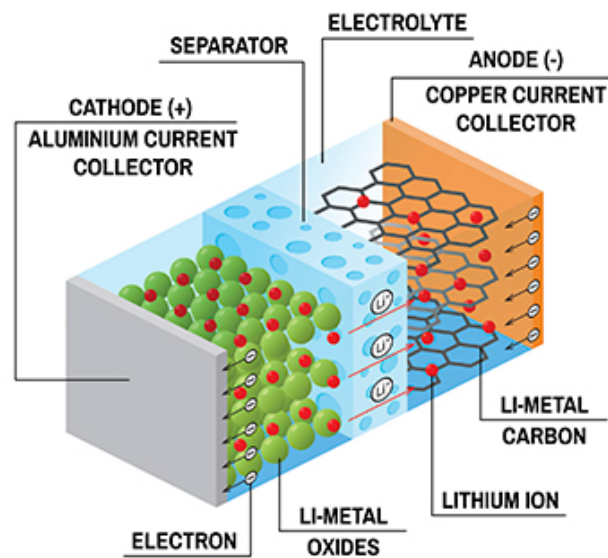
They are different to regular Lithium (without the ion) batteries because **they are rechargeable**. They also have no memory effect (they don't get lazy when repeatedly recharged) and they have good energy-to-weight ratios.

LITHIUM-ION BATTERY

DISCHARGE



CHARGE



A diagram because my explanation was not good

What is the risk?

They sometimes go into **thermal runaway**, usually when charging, but also if you bash them about (think iPhone stuck under business class seat, getting repeatedly run over by the chair mechanism as the passenger tries to pull it out again).

Thermal runaway, as the name suggests, involves them getting really hot – so hot it reaches the melting point of the metallic lithium and causes a **pretty horrid reaction** when it just keeps getting hotter and hotter until **flame, fire, explosion...**

You might think a small phone would not be much of a hazard but there are a lot of **very flammable things in your airplane cabin**. And there are a lot of things with lithium ion batteries in them that people bring onboard.

Then there are airplane batteries themselves. Boeing had an issue early on with their 787 Lithium Ion batteries leading to an **All Nippon Airways 787** having a pretty serious incident with one before the problem was resolved.

The biggest risk though comes from those in the cargo bay. Particularly the ones that you don't know are there, should not be there, and which you cannot monitor. A UPS 747 crashed in Dubai after LI batteries in the cargo hold caught fire. The report suggested the heat and smoke from the fire disabled the crew oxygen system and **entirely obscured their view within 3 minutes** of the initial warning.



Big flames. Not good.

What can we do about them?

Most airlines will have a procedure written into their manuals, but it is worth a quick recap because there are some important bits to note.

- If it has **flames, use Halon**. If you are using halon (in the cockpit) make sure at least one of you puts a smoke hood on – the stuff is very bad for you.
- If there are no flames and it is just smoking hot, then **cool it down** by pouring water or a non-alcoholic liquid on it. If it is a laptop or something fixed in the cockpit then have a little think before you go slugging water on it though, because there are other electrics around which might not like it that much.
- **Don't try to pick it up** (without gloves on). **Don't cover it with ice** thinking this will help cool it better, because it actually just insulates it more making it hotter. Don't put it in fire resistant bags for the same reason.
- Once it is safe to move, use fire gloves and **put it in a receptacle** – things like waste bins are good. Fill with water and store it somewhere safe where you can keep monitoring it.

Getting your crew to be vigilant for phones under seats (and passengers not moving said seat until phone is retrieved) is a good plan too.

The Cargo Concern

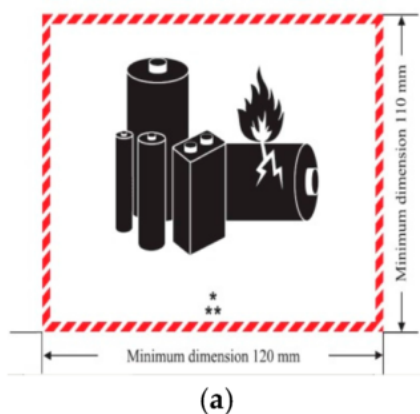
Lithium Ion batteries in the cargo hold are a different matter. If you have **Dangerous Goods approval** then you will have manuals and info on this. If you don't have DG approval then any mention of Lithium Ion batteries on a NOTOC should be concerning you.

Lithium Ion batteries are a **Class 9 Dangerous Good**. The ones to look out for are the **UN3480** and **UN3090** numbers:

- **UN 3090**, Lithium metal batteries (shipped by themselves). These are not rechargeable and are designed to be chucked out after their initial use. They are actually Lithium Metal batteries. These are prohibited for carriage on passenger aircraft.
- **UN 3480**, Lithium ion batteries (shipped by themselves). These are the rechargeable ones found in your phones and things.
- **UN 3091**, Lithium metal batteries contained in equipment or packed with equipment
- **UN 3481**, Lithium ion batteries contained in equipment or packed with equipment

Lithium Ion batteries are allowed to be **carried on cargo aircraft** so long as they have been handled properly. The proper handling, packing, labelling and loading (what they need to be separated from) is all covered by **IATA in their massive DG Manual**. You can get that here, and find some handy online while you're at it.

Again, if your operator doesn't have DG Approval then this is just for info. If you're wondering whether they do have approval then they don't – crew have to undergo a yearly Dangerous Goods refresher course and you would remember this (because it is generally quite boring).



The DG Labels you'll want to see on any Lithium Ion filled boxes

So, the simplest thing is to not carry them...

That would be great, but unfortunately it is not that simple. **Lithium ion batteries are in everything nowadays**. They come in all shapes and sizes. So the first step is ensuring your passengers know what they are in, and are aware that they shouldn't be putting these in their checked baggage.

Here is a handy info brochure to give to passengers.

This is a general 'heads up' list of some of the things an LI battery might be lurking within:

- **First up, those luggage bags** which have them installed in them – if the battery can't be removed and is more than 0.3g or 2.7Wh it probably shouldn't be carried. If the battery is under those limits, or if it is removable then it can come onboard but only in the cabin, not in checked baggage.
- **Any lithium ion battery** that is under 2g or 100Wh can generally be brought into the cabin. There is often a limit here (20 per person) but this varies with different operators.
- **Mobility aids** – electric wheelchairs – often cause problems because folk don't always know what their battery details are, and it is the airport staff who have to deal with this. The battery on these has to be in an enclosed container to prevent short circuits, and it must be attached as per the manufacturer instructions, or removed if it can be. If it is removed then it must not exceed 300 Wh or 160Wh if there are two of them on the device.
- **Hidden batteries** – A lot of devices contain batteries. eBikes. Drones. Things that passengers don't always think about.

The Captain probably needs to know about the location of these, so if you see stuff being loaded on and haven't been informed about it, ask.

Finally, **rogue shippers**. Because of the restrictions, people are **sneaking them onboard hidden in incorrect packaging**, and without declaring them. The key to stopping this is going to lie with the airlines, operators and ground staff who need to be vigilant. The crew cannot do much more than mitigate the situation if some are onboard, and do cause issues.

Here is the full note from the US Department of Transport and IATA

What to do if you have an incident

If you have a Dangerous Goods Incident, you need to report it, and usually quite quickly. The FAA info page is here to help.

Lithium Ion battery **fires are extremely hot and burn incredibly fast**. If you think you have LI onboard that might be compromised, get that airplane on the ground as quickly as possible, and get your passengers off.



They burn fast and hot

Want to read some more?

- EASA have a video you can watch
- The NBAA have some good guidance about it too

PBN, RNP and what it all means

OPSGROUP Team
25 May, 2021



All across Europe, 'Airspace Improvement Events' are occurring. It sounds huge. We were expecting new regions, routes, maybe some special-filtered cleaner air being puffed out into it...

Alas, we read through all the Airspace Improvement Event notices, and from what we gather, it is part of a big, ongoing project to implement things like **Free Route Airspace**, more **PBN routes**, and to basically **tidy up the airspace** a little. This is not limited to just Europe though – the world is going PBN.

So, less an 'Event' and more a 'Something'?

Everything is moving to Performance Based Navigation. It has something to do with being compliant with EC Regulation 2018/1048, but really just comes down to more efficient, better, safer, increased capacity airspace and approach benefits for everyone.

As simply as possible – **VORs are out, Waypoints are in.**

In a bit more detail – fixed ATS routes will continue to be implemented for better flow management and lateral separation, you'll hear more about Free Route Space, and you'll start seeing more RNP approaches popping up at airports.

So it is actually quite a big change, but one that will be slow to get implemented. Actually, most countries brought in things like **RNAV5 routes** and **SIDs/STARs that use RNAV1 and GNSS** instead of old-fashioned, Navaid-based manoeuvres quite some time ago, so this isn't something pilots will necessarily notice and there is no Big Date to look out for.

Except for one – **December 1 2022** (but we will get to that later).

Why don't we like conventional Navaids anymore?

Well, old Navaids need a lot of maintenance and they break a lot. Ok, not a lot, but they do potentially **double the chance of some sort of issue** for an airplane relying on them. Take your bog standard ILS for example – it has ground transmitters and aircraft receivers (and all the bits around them and in between then) and if any one of these conks out then you can't fly the ILS (quite so well) anymore.

Your **GPS approach** on the other hand relies on the aircraft system only, which means less to go wrong.*

*Actually satellites can have issues too – GPS Jamming is a big problem and the plan to decommission

NavAids is being delayed because of this.

So, what does this all actually mean, practically?

For operators, it doesn't mean a whole lot. Most aircraft will have been operating to RNAV5 for a fair old while now, so the only noticeable change will probably be some **newly named waypoints**, and some **slightly more efficient routings**.

You might need to **pay a little more attention to any MELs** that affect your performance capabilities, and be aware that approaches might no longer have conventional NavAids as backups in the future because a bunch of these are getting decommissioned.

But overall, it really means keeping an eye on them charts to see what's happening where, and to make sure you pull the right plate out for your arrival.

PBN, Say Again?

So, PBN, again. And December 1 2022. What happens then?

ICAO has ordered **all approach charts** to reflect the new specifications **by December 1, 2022**.

What is changing?

All charts will say **RNP APCH** on them (or **RNP AR APCH**) instead of *RNAV*, *RNP (GNSS)* or whatever other random title they currently have. The chart should have the three lines of minima on it which you will need to know – your **LNAV**, **LNAV/VNAV** or your **LPV**.

Which country is winning the chart race?

ICAO post updates on the implementation which you can follow [here](#), although they last updated it in 2017 so let's hope it is looking a little better now.

All the R's

In case you are still lost at RNP instead of RNAV, here is a quick recap on some terms for you:

- **GNSS** is your Global Navigation Satellite System and it is a generic term for all satellite navigation systems including GPS, Galileo, GLONASS, and ones augmented by ABAS, SBAS, GBAS... all the BASEs.
- **LNAV, VNAV, LPV, LP** are your different minima given on an RNP approach chart.
- **PBN** is Performance Based Navigation based on performance requirements of the aircraft on a route or approach or in designated airspace.
- **RNP** is required navigation performance which basically means the onboard monitoring and alerting system your aircraft has.
- **RNP Approach** is a generic term for any approach which uses GNSS to enable it and an RNP system to fly it.
- **RNAV Approach** is what RNP approaches used to be called.
- **RNP APCH** is the name of the navigation specification in the ICAO PBN manual for the 4 types of approach:
 - LNAV (GPS NPA)

- LP (SBAS-based NPA)
 - LNAV/VNAV (APV Baro-VNAV)
 - LPV (APV SBAS or SBAS Cat I)
- **RNP AR APCH** is an approach that requires a specific aircraft qualification and operational approval. Usually because it takes place in an environment “rich in obstacles”. The AR stands for ‘approval required’. So you might be allowed to fly an RNP (RNAV) but not an RNP AR and your OpSpec (and training) are going to make this pretty clear.

What is Free Route Airspace?

FRA is a specified volume of airspace in which users can freely plan a route between defined entry and exit points. It makes the sector much more efficient.

And because we mentioned it earlier, what about RNAV?

Way back in the olden days (not as far back as when airplanes just had a compass and a map to use, but before GPS came in), there used to be Nav aids. Ancient relics called VORs and NDBs which helped pilots work out where they were.

But then GPS came along and brought with it a way more effective and accurate way to navigate. How accurate is defined by ICAO under their four main navigation specifications – **RNAV10, RNAV5, RNAV2 and RNAV1**

RNAV5 is actually fairly basic. It has been around in Europe since 1998 and is mandated in pretty much all high level airspace there.

The 5 bit refers to the requirement for aircraft to operate to a **minimum navigational accuracy of +/-5nm for 95%** of the time.

RNAV1 is your precision RNAV (1 being +/-1nm). **RNAV10** is generally what you find over the oceans, and **RNAV2** is generally used in en-route areas of the US.

Fun fact: The UAE and Bahrain FIRs implemented RNAV1 a while back, which means you need GPS Primary to route into here. If you’ve encountered GPS jamming en-route, (common in Turkey, Iran, Iraq etc, read all about that here), then this might cause problems for you.

What do you need for RNAV5 operations?

You need some sort of FMS, 1 IRS, 1 GPS or VOR/DME receiver and 2 nav displays.

What about RNP?

If it is an RNP navigation specification then there is also a requirement for on-board performance monitoring and alerting. RNAV refers to ‘area navigation’ and it is slightly different to an RNP system (the monitoring and alerting requirements). PBN requires an RNAV or RNP system, while an RNP APCH specifically requires an RNP system.

What else?

Actually, that’s about it. Except for the poor old UK that will no longer support LPV approaches from June.

Need to know more?

Here is ICAO EUR Doc 025 which contains all the EUR RNP APCH Guidance Material.

Bomb Onboard: Do you know your procedures?

OPSGROUP Team

25 May, 2021



Airport security means the threat of a bomb onboard is greatly reduced. But if you do receive a bomb threat, or find a suspicious package onboard, what procedure does your operator have in place for you to follow?

How much risk is there?

You have probably all heard the Shoe Bomber attempt from 2001. This was thwarted by some brave passengers and crew, and also the fact the bomber had sweaty feet – his swamp foot dampened the trigger preventing it from igniting.

In 2016, an aircraft made an **emergency at HCMM/Mogadishu airport** after a bomb exploded onboard. The bomb was likely brought on concealed within a laptop. This flight was lucky though – the impact of the bomb was minimal, limited because the bomb exploded while the aircraft was at a lower altitude (11,000ft).

In 2020 a European airline found a 'bomb note' onboard. The flight was escorted to a safe landing and passengers disembarked without incident.

So bomb threats, and attempted bombings, do occur, and while **security is getting better and better**, unfortunately terrorists are getting more creative in finding ways to bring items on board. The attempts are not always aimed at causing destruction either – threats alone cause a huge amount of **disruption to**

operations. So understanding how to assess the risk and credibility of a threat is as important as knowing how to deal with a possible explosive device if one is found onboard.

Is the threat credible?

Threats received regarding an aircraft need to be assessed, and the **credibility determined**. The threat classification will generally be based around how specific the threat is. Most operators will have a procedure in place for determining this, and probably take into account something along the following lines:

If a threat mentions a **specific target**, or is made by a **known terrorist organization** and is **deemed credible** then this is going to be considered more serious. Often these are referred to as a **red** threat.

On the other hand, a threat which is **vague, general, and doesn't specify targets** might be considered less credible. A hand scribbled note in the toilet for example. This would be categorized as a **green** threat.

However, regardless of the assessed credibility, a bomb threat has to be taken seriously and treated as a genuine situation.

If you are on the ground

The simplest and safest option if you are on the ground is to **disembark and carry out a full search** of the aircraft. It might be a hassle and result in some big delays, but the possible alternative is much worse.

A serious threat may require a **precautionary disembarkation** – which will result in offloading the passengers as quickly and as safely as possible. This creates a risk to safety in itself, and generally the credibility of the threat will be communicated to the crew so that they can judge the risk of waiting (for steps) versus disembarking immediately to clear the aircraft (but have passengers hurling themselves towards the tarmac).

If you are in flight

If a threat is received against your aircraft while in flight, carry out a search checking those places which are often overlooked during security checks on the ground, but **where an article might easily be concealed** – toilets, galleys, jump seats, stowage areas, closets etc. Try and do it **discreetly to avoid unnecessary worry** for passengers.

If an article is found, **do not move it or touch it**. Move passengers away from the immediate area, and remove any flammable items and have fire extinguishers ready in case. A PA asking for anyone onboard with **'BD or EOD experience'** might help – these are terms which experts will recognize without saying "Hey, passengers, is there a **bomb** expert onboard?"

Not terrifying your passengers is probably a good call, but ensuring they are following your crew's orders, and that they are prepared for the situation on the ground, is also necessary. This means providing them with clear information, but **without dramatizing the situation**.

"Ladies and Gentlemen, we have received a message that a threat has been made against one of our aircraft/an aircraft in this airspace. These threats do happen, however, until we can establish how credible it is, we will take all possible precautions and therefore intend to land at... in..."

If you find a suspicious article

Most manufacturers provide **checklists for bomb-on-board** situations. Know where this is, and understand what it says.

There are a few measures you might want to consider:

- **Talk to ATC** so they know exactly what is going on and what you need. They all assist with locating an airport with services needed, and coordinating with military if necessary.
- Try to **avoid routes over heavily populated areas**.
- Consider carefully the choice between **flying fast** to minimize airborne time **versus flying slow** to minimize air-loads and damage (in the event of fuselage rupture).
- Request **remote parking** on the ground if there isn't a **designated bomb location**.
- **Brief your crew** for a possible emergency landing, and in any event, brief them to ensure passengers are disembarked quickly and moved to at least 200m upwind from the aircraft.
- **Avoid large and rapid changes to pressure altitude** – consider using manual cabin altitude controls to minimize rapid pressure changes while still lowering the cabin altitude to reduce the differential pressure.

Aircraft are designed to not 'explode' if there is a rupture in the fuselage – that's why they tend to have a lot of smaller sections attached together. It makes the overall structure more resilient to the effects of an explosive decompression, aiming to keep it "localized".

Reducing the differential pressure to around 1 PSI will also reduce the damage if an explosion does occur. Maintaining a slight differential will ensure the blast moves outwards, but the lower differential limits the force of air from the cabin outwards.

1psi is the equivalent of about 2,500 feet difference, but flying at an altitude that allows you to manually reduce the differential will probably mean a much lower level and much higher fuel burn.

Where is your aircraft's LRBL?

A **Least Risk Bomb Location** is an area where the least damage will occur should a bomb explode. This should be specified in your aircraft manual. These are often near aft doors or in washroom stowage areas. The area provides the least risk, in the event of an explosion, to flight critical structures and systems.

If the article is deemed unsafe to move, **cover it in plastic** to prevent any liquids getting in, and then **pile blankets and pillows, seat cushions and soft clothing** around it. We're talking as big a pile as you can, and once done, **saturate in water** to minimize fire risk in case an explosion does occur. Don't forget the plastic sheets first though – liquid damage to electrical components is also a big risk.

If you can move it, and only if it is deemed essential to do so, then check that LRBL. Once in place, build up the barricade.

Always minimize movement to any article as much as possible, and don't put anything directly on top of it. An igloo of saturated cushions around it and the gaps stuffed with blankets etc is good. This 'cushioning' will help minimize the force if an explosion does occur. Never put inside an oven or trolley though as a sealed container will amplify the pressure and explosive force of a bomb.

Where to go

You will likely be accompanied by fighter jets to an airport with a **designated bomb area** – usually a remote apron away from buildings, fuel supplies and other aircraft.

What next?

Getting your aircraft safely on the ground is **Step One**. Getting your aircraft to a safe point to disembark/evacuate your passengers and crew is **Step Two** and coordinating this with ATC and airport services is important. Knowing in advance where you will taxi to will get you there more quickly and safely. Landing, slamming on brakes and bursting tires will get you nowhere fast, so plan ahead and be prepared.

A bomb threat or bomb onboard situation is difficult to plan for because the ‘where you are and what will happen’ is not something we can prepare for, other than **being ready to follow our procedures** and **remaining calm**. Chances are this is not a situation many of us will (thankfully) find ourselves in, but understanding the resources you have to assist, and knowing the onboard procedures so you can coordinate passengers and crew will no doubt help if it ever does occur.

UK: No more LPV approaches after June

OPSGROUP Team

25 May, 2021



On June 25 the UK's current EGNOS working agreement comes to an end, and they are not renewing it. This means their access to EGNOS will stop – which means **LPV approaches at UK airports will no longer be possible**.

So let's talk LPVs. What exactly are they? What on earth is EGNOS? And what has Brexit got to do with all of this?

What is an LPV approach?

If you read this and are thinking “That isn't something I've ever flown” then you can probably stop reading (unless you're interested in a bit of aviation geekery), because this probably won't have much of an impact on you. If you do fly these, and fly them in the UK, then read on.

LPV means **localizer performance with vertical guidance**. It is a GPS based approach sort of like

LNAV/VNAV but also, confusingly, sort of like an ILS.

More confused? Us to. Let's dig deeper.

An LPV has vertical guidance but is not a precision approach (which your standard ILS of course is). Instead, it is classified as an 'approach with vertical guidance', or APV for short.

So an LPV is an APV? Yes, and the point of this distinction is that it's a lot cheaper, quicker and easier to implement than an ILS because there is a lot less paperwork involved, but it still offers "nearly" the same precision as an ILS – meaning you get down low if you need to.

You might also see the term SBAS used in the same breath. SBAS stands for **satellite-based augmentation system**, and is a generic term for the use of geostationary satellites which broadcast augmenting information.

That's the basics, but how does it actually work?

They provide lateral and guidance down to a DA, just like an ILS. And just like an ILS, they get more sensitive the closer to the runway you get, which is what allows you to operate down to lower minimas than, say, your **less sensitive LNAV option**.

There are a few things you also need to know – first up, **you need a special receiver** on your plane for it (which is probably why a lot of folk are scratching their chins and wondering what on earth as LPV is).

Secondly, if you're planning on using an airport without an ILS or some sort of ground based navaid as your alternate, then the FAA wants you to plan on LNAV minimas.

Why do we like them?

Well, because they get us nice and low so we can see the runway in not so nice weather.

They also use GPS, so the equipment you need is on your plane. An ILS needs a whole bunch of ground and plane equipment meaning there is a lot more that can fail on us. **RNP and SBAS approaches are the future.**

Okay, so what is EGNOS?

Not to be confused with the delicious Christmassy drink, EGNOS stands for 'European Geostationary Navigation Overlay Service'. It is basically a bunch of European satellites, (actually just 3 out of the Galileo GNSS system, and a network of 30 referencing stations), that improves positioning measurements and gives much better accuracy than GPS alone.

In fact, it has **95% accuracy**, which translates into the locating of a position to 1-3 meters horizontal accuracy, and between 2-4 meters vertical accuracy.

So EGNOS is what gives LPVs their precision.

Brexit...

Yep, we're pretty bored of it now too. Brexit means the leaving of the UK from the EU. Not to be confused with Europe the continent – the UK is still part of that. But leave the EU it has, which means leaving all EU related programs including EGNOS (even though the UK's NATS was one of the founders of EGNOS...)

Anyway, the EGNOS working agreements are not going to be renewed, so as of **25 June 2021, the UK will not longer participate in the EGNOS program** and their LPV approaches will no longer have the accuracy assurance that EGNOS provided.

How many airports are affected?

The UK has 125 licensed aerodromes and out of these 69 have at least one instrument approach (surprisingly low given how miserable the weather often is in the UK.)

Anyway, **ILS is still the most popular in the UK** with 81 runways having an ILS approach available on them. **Only 45 runways use LPVs** and 20 of those have an ILS as well anyway, but that does leave a few airports where the other option is your old school, much higher minima non-precision approach.

Like poor old **EGPL/Benbecula** for example, which only has a VOR. A very old VOR which they are really hoping to retire. Or **EGHE/St Mary's** which has a timed NDB...

The first LPV approach in the UK only went operational in 2014 at EGTE/Exeter airport, with Flyer magazine saying the country no longer needed to "hang its head in shame" because they had finally caught up with the rest of the modern aviation world...

The Impact

It isn't huge – most airports have alternative approaches. However, there are a few points to think about:

- Where there is an ILS, the minima will be the same, but the redundancy for approaches is now reduced.
- Where this is only an LNAV, or non-precision approach, the minima will be higher so watch out for that poor weather.

The official word on it all

Here are the official FAQs on the UK leaving the EGNOS program.

The FAQs have the following statement in them –

If EGNOS or an alternative SBAS SoL service becomes available before 31st December 2021, the LPV may be notified subject to the following:

- An impact assessment to confirm nothing has changed since the time of approval before implementation.
- IFPs shall be safeguarded against the latest obstacle data to ensure the procedures are obstacle clear.

Alas, unless the UK renegotiate the EGNOS Working Agreements (EWAs), or are able to find a replacement solution, then from **25 June 2021 the LPV approaches in the UK will stop.**

Up for some further reading?

- **AOPA UK** put out a great article explaining LPVs which you can find [here](#).
- To find out which space programs the UK is still involved in, you can find the government website on it [here](#).
- The **UK CAA Skywise site** promises to keep you up to date with all this UK aviation (although

are yet to update their info on LPVs).

- **The FAA** probably explain all this better with their info on Wide Area Augmentation System (WAAS).