

How much radiation are we getting zapped with as crew?

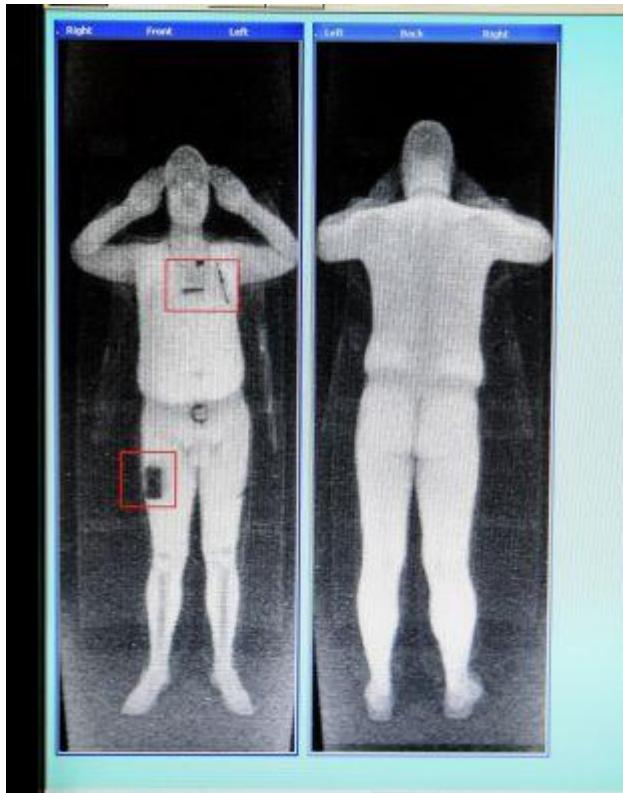
OPSGROUP Team
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How much radiation are we getting zapped with as crew, and what sort of levels should we be concerned about?

The Airport Security Scanner

Most pilots have probably experienced rather overzealous security scanners in an airport. You know the ones – when you go through, it beeps. You remove the watch you forgot to take off. It beeps again. You take your jacket, shoes, tie off. It still beeps. Now you’re wondering if you’ll need to strip down like this South African Airways pilot did...



More concerning than any radiation levels

Anyway, it is frustrating, but it is not really a big deal radiation-wise. One dose of the airport scanner is **100,000 times lower** than the average annual dose we get from **natural background radiation and medical sources**. It actually delivers around 0.1 microsieverts per scan which is 100th what a standard chest x-ray delivers.

For comparison, every banana you eat contains around **half a gram of potassium-40** (an ionising radiation source) which means eating it is the equivalent of 1000th of a chest X-ray in terms of the radiation dosage. The granite counter top you prepared your lunch on is also dosing you. While if you live in the UK you are getting about **2.7 millisieverts of radiation annually** just by being there because it is one giant granite counter top under your feet.



Bananas are a great source of (radioactive) energy

So, no, we shouldn't be worried about radiation from airport scanners. But given that every minute on an airplane is equivalent to one airport scan, should we be worried about that?

Flight Risk

When you fly you are exposed to low levels of radiation – from some of the onboard equipment, to the fact you are way nearer space and all the cosmic and UV rays swilling about up there.

UV radiation is what we protect ourselves against by not destroying our friend, **the Ozone Layer**, and with all the SPF suncream we slather upon ourselves. The ozone layer sits around 10-15 miles above the ground (so our airplanes stay below it), and it blocks out a good whack of UV-B, all of UV-C and some UV-A.

Now, that *some is the reason why we should be **slathering more sunblock on** ourselves when we fly, because the ozone layer and our windscreens help, but not enough. A study showed that the amount of UV radiation the pilot seat (and you in it, presumably) gets smacked with when **flying for under an hour at 30,000 feet is equivalent to a 20 minute tanning bed session.**

Studies also show the rates of skin cancer in pilots and cabin crew are significantly higher than the general population. So, you need to be careful. Plus it makes you wrinkle more.

- **Wear sunblock** (decent UV-A and UV-B ones)
- **Get decent sunglasses** with UV protection lenses because your eyeballs are damaged by it too! Polarized sunglasses help reduce glare, but don't necessarily provide more UV protection (and they mess with the screens).
- **Check them moles** (if you're a moley sort of person) – it isn't just areas exposed to direct sunlight which can be at risk.

In fact, going back to the sunglasses point, IFALPA have a very handy handout on the 'Ocular Hazards of UV Exposure'. It is basically 'scary stuff, bad stuff, scary stuff' and then a "get sunglasses that have a UV absorption up to 400nm/ 100% absorption'.



There is no evidence of people sunburning in airplanes

Cosmic Vibes

Cosmic radiation is high-energy charged particles – x-rays and gamma rays which come from stars, like our very own sun. It differs to UV radiation in that it is higher energy and ionising.

We don't like **ionising radiation** because it causes damage to our squidgy little insides.

The closer to space we get, the more cosmic radiation we are exposed to, and the **higher the latitude the more** we get as well, which means those high altitude, **Polar flights** are the ones to really monitor.

The Northern Lights displays we see, despite their “radioactive” green colour actually do not emit any radiation that reaches us. Although, if you were up there, in it, it probably wouldn't be great for you.

What are the numbers looking like?

The International Commission on Radiological Protection (ICRP) basically **classify aircrew as ‘Radiation Workers’** and recommend a **maximum of 20mSv a year averaged over 5 years**. So a maximum of 100 mSv in 5 years.

The average person in the US receives up to 3mSv, with a recommended dose of 1mSv per year. Anything between 3 and 20mSv is considered moderate.

So, how much are we getting?

Well, heading from the **east to the west coast of the USA you probably get about 0.035mSv**. Not a tremendous amount if you're a passenger, but what about if you are doing flights several times a week?

2 sectors a day, 3 times a week, plus or minus a few for holidays, and you could be heading towards something in the region of 10mSv which is higher than normal but still in the moderate (and acceptable) range.

If you are flying from **Athens to New York** – a flight likely to take you along a relatively northerly route and at a flight level of 41,000ft or higher, then the 9 to 10 hours airborne are going to dose you up another **0.063mSv - 0.63mSv per 100 block hours**.

A study carried out in 1998 suggested the average crew member flies around 673 block hours, getting an **average cosmic ray dose of 2.27mSv**, while the annual cosmic ray dose for a long haul Captain was calculated at around 2.19mSv.

Ok, that was back in 1998, but as far as we know the levels of cosmic rays haven't increased. Our block time might be a few hundred higher, but still well within limits on the radiation dose front.



Sunglasses always necessary

How can you monitor it?

Airlines and operators should monitor this for you, but if you want to keep an eye on it you can via various apps out there in the mobile phone world.

CRAYFIS is an app developed by scientists to help monitor the amount received via the pixels in your smartphone screen.

Apps like **TrackYourDose** have options to plug in a route and uses average flight paths to help you monitor your dose on specific flights and days.

Or you can work it all out yourself using this handy little formula.

$$E = \sum_T w_T H_T = \sum_T w_T \sum_R w_R D_{T,R}$$

where H_T is the equivalent dose in a tissue or organ T given by $\sum_R w_R D_{T,R}$; $D_{T,R}$ is the mean absorbed dose from radiation type R in a tissue or organ T , and w_R and w_T are the radiation and tissue weighting factors, respectively, defined by the ICRP. The SI unit for the effective dose is joule per kilogram ($J \text{ kg}^{-1}$) and its special name is sievert (Sv).

Maybe just use the app

So, should we be worried?

The figures suggest no.

A study of 10,211 pilots carried out in 2003 also supported this, with skin cancer showing slightly higher incidences.

So unless you are flying an excessive number of long haul Polar Flights, the overall the radiation dosage received by air crew is higher than the average ground dweller, but remains within acceptable limits.

That space weather is likely to have more of an impact on your HF than it is you.

Want to read some more (official) stuff?

The CDC offer some good guidance.

As do the FAA in this useful booklet for air crew.

Any Single Pilots Out There?

OPSGROUP Team

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The big talking point of the moment – Airbus and Cathay Pacific's project to have **only one pilot in the cockpit during cruise**.

So let's take a look at what this might mean for **safety, operations** and **pilots** worldwide.

The headlines are misleading

Cathay and Airbus have **not** designed a new A350 which no longer needs pilots operating it. There is **no** mega computer AI robot involved which is stealing our job.

The plan is to simply allow **one pilot to go and rest during “quiet cruise” phases**, while another pilot remains in the cockpit vigilantly monitoring (and probably with toothpicks propping their eyes open). This will allow them to potentially reduce the number of crew required on long haul flights, and while it means a change to procedures it is not really, as many are reporting, a leap towards pilotless flight decks.

Maybe just a small step

So, what are the considerations here that people are talking about?

GermanWings

The GermanWings accident resulted in a rule that there must be two persons in the cockpit at anytime. So if a pilot needed a bathroom break, a cabin crew member was required to come in. This was fairly contentious at the time because, as many pointed out, **what is a cabin crew member going to do** if a “situation” arises?

This **rule was eventually revoked**, in part because EASA and other authorities brought in new regulations relating to pilot psychometric testing. However, with only one pilot in the flight deck, this does raise various safety concerns – from events similar to the GermanWings accident, to the question of pilot incapacitation or even, what do they do if they need the loo?

What about the AF447 accident?

AF447 was, in part, **attributed to the experience levels of the two crew in the flight deck** – both First Officers while the Captain was out sleeping.

Using cruise relief pilots is not a new thing though, and in order to operate with a single pilot, that pilot will presumably need to meet a minimum experience level. Additionally, the Captain will maintain the decision as to when they leave the flight deck in their First Officer's hands.

The lonesome pilot can also recall their colleague to the flight deck should a situation require it. So the question really comes down to whether a situation is likely to arise where, by **having only a single pilot the result is more critical or catastrophic** than if two had been present and therein lies the problem – because years of aviation safety studies have shown time again that there is a reason we operate with two crew.

Safety in numbers

Modern aircraft, and the A350 in particular, have **many levels of safety and redundancy** to support the crew. They can automatically fly TCAS maneuvers. They can carry out an emergency descent at the push of a button. In addition, Airbus are working to demonstrate that their aircraft and systems are robust enough to basically not really fail. They are also designing them to be able to **autonomously handle any situation without pilot input for 15 minutes**.

This will be a big deal. It will mean, should something fail, and the single pilot be incapacitated, that there is time for the second pilot to wake up and make it to the flight deck to solve the situation. However, **recent aviation accidents involving malfunctioning systems** (designed to minimize pilot workload), and ongoing concerns about automation complacency highlight the potential downside of such advancements.

Can ETOPS can teach us something?

The A350 was certified for 370 minutes ETOPS. That's a long time. It is over 6 hours. 6 hours on one engine potentially. So what leads to this?

ETOPS is given to the operator, not the aircraft, and it is based on the operator's ability to demonstrate necessary airworthiness, maintenance and ops requirements. **It is really a statistical thing.** If an operator hasn't had an engine issue in a really long time then they are probably going to be able to get a better ETOPS approval.

So what does this have to do with only one pilot in the flight deck?

Well, it boils down to the same thing – statistics and procedures:

- How often does something go wrong in the cruise (which requires two pilots to handle it)?
- What procedures will be in place for ensuring safety and redundancy levels are maintained?

The answer to Question 1 might be “hardly ever”, but aviation safety improvements are built on the fairly simply idea that **if there is a risk, find a way to mitigate it.**

Even if that risk is minute, if it can be removed it should be. This is why astronauts have their appendix out before heading into space. This is why we have redundant systems onboard, or each pilot eats a different meal. Statistics might suggest an event occurring which a single pilot cannot deal with and which then results in a fatal accident or hull loss is tinier than a hair on a fleas back...

But if a risk exists that can be mitigates simply by retaining two pilots in the cockpit, then two pilots should remain.

A Disco onboard

They gave the A380 a bar and showers, now the plan is to have Discos...

DISCO actually stands for Disruptive Cockpit (I am not sure that sounds any better). This is the Airbus project looking at enhanced cockpit design to enable single-pilot operations on new aircraft.

The DISCO concept is looking to place core technologies into the flight deck in a 'multi modal' way. Things like pilot monitoring systems which track eye movement, voice recognition for commands, improved ground collision avoidance systems, new navigation sensors.

And of course pilot health monitoring systems.

An integral safety aspect of this concept lies in the monitoring of the sole pilot, and the availability of a system to detect if they become incapacitated, and to alert the remaining crew member.

It is only happening in 2025

The plan is to implement this in 2025. That is **3 and a bit years of procedure writing, regulation making, testing and trialling** before it is put into action, and there are a fair few obstacles that stand between now and that day :

- Regulators will be looking at their procedures with a fine tooth comb
- The pilot will probably need monitoring, particularly to ensure incapacitation does not occur (or if it does, the other pilot can quick-foot it back)
- There will need to be pilot training in place
- Airbus need to hit that 15 minutes of safe autonomy.
 - And these systems will also need to deal with situations where 'Black and White' failures do not occur. When you consider the multiple, varied and often "illogical" failures which can arise from a lightning strike, a bomb onboard, or multiple computer failures this does not look as simple as Airbus might say
- The approvals for this do not just sit with the Hong Kong authorities. Any state that the airline might overfly with only one pilot in the driving seat is going to have to be convinced as well
- Passengers will need convincing...

And they still need to answer the question of the toilet. We all want a little more information on how that 'specially designed unisex toilet' to be used 'in coordination with ATC' will work.

If this happens, they won't need pilots anymore

This is a contentious one to raise right now. Say 'single pilot' or 'autonomous systems' and a lot of pilots break out in a sweat, seeing themselves replaced by AI computers. But aviation has always been very innovative and those in it have always had to adapt to new technologies. Take a glance back to the 1980s and flight engineers were still a relatively common site in flight.

Ignoring the rather decimating impact of Covid though, **aviation was growing, and it was growing fast.**

Chances are it will again.

There are around 200,000 active pilots and forecasts suggested upwards of 500,000 would have to be trained over the next two decades to meet forecast growth demands. Even if every (long haul) flight deck sees the number of crew in it halved, it is still probably safe to say none of the current or new generation of pilots will be out of work anytime soon.

But we still are not convinced

There are unresolved questions here. **The main one being “Why?”**

You see, there is already this rather marvelous thing in an airplane – it can watch the pilot, it can monitor aircraft systems, and it can take over no matter what the failure or the complexity of that failure might be...

It is called “the other pilot”.

There is a good reason why aircraft are multi-crew machines. So why are Airbus and Cathay Pacific investing millions into developing systems which can do this?

It isn't for safety...

This is being driven, not by manufacturers looking to increase safety, but by **an operator looking to reduce costs**. And for many, that appears an unwise and arguably unethical reason. Even if the statistical impact on safety is a 0.0001% decrease, that is still an unacceptable decrease when it is made for business reasons. There are also a great many places within an airline or operation where costs can be cut, and when cuts are made these should never occur at the price of safety, even if that price does seem negligible.

The main photo is of a pair of VietJet co-pilots who got married - because we think that's nice, but also because we liked the play on 'single pilot' in the flight deck idea. Congrats to them both for their lovely day!

Going Viral: The non-Covid nasties to watch out for

OPSGROUP Team
26 July, 2021



With Covid running rampant across the globe, other risky diseases have been forgotten somewhat, but there are a fair few out there which can pose a threat to crew on layovers.

So here's a quick round up on **the regions where you might need to cover up, dose up, or just be extra cautious** during your international flight operations, split into sections based on the active travel health alerts that the CDC and other health authorities have out at the moment.

Red Warning Level 3: Avoid all non-essential travel

Guinea - Ebola

They had a serious outbreak earlier in 2021. Actually, cases have reduced significantly and the US has just removed their travel restriction which required travelers coming from Guinea to enter the US via 6 main airports only. Caution is still very much advised though if traveling in the country.

Venezuela - Infrastructure

Not a specific disease caution here, just a warning that their healthcare infrastructure is breaking down and if you are taken ill here you may not be able to access treatment. One to think about if you ever have crew on a layover here.

Amber Warning Level 2: Extra caution

Fiji - Leptospirosis

This is really prevalent in Fiji at the moment, particularly rural areas. It is caused by a bacteria spread around by animal pee, and can get into water and soil and live there for months. The main guidance is to avoid swimming or wading in water that could have had infected animals in it. Wear protective clothing and footwear and cover any cuts and scratches with waterproof bandages.

Haiti - Rabies

Haiti currently has a big problem with rabid dogs. The bigger issue is that there is an extremely limited supply of treatment drugs in Haiti, so the recommendation is to get vaccinated before you head there.

Avoid dogs, and cats for that matter - even the cute baby ones. You can catch it if you are bitten,

scratched or even licked, and treatment is only effective if administered early. Once symptoms present themselves it is often fatal. Plus, getting bitten by anything is never pleasant.

Polio - Africa and Asia

Everyone should be vaccinated against this. If you are not, get vaccinated (or don't travel) because this is continues to be very prevalent in African countries and there is always a risk.

Nigeria - Yellow Fever

Consider getting vaccinated if you head here regularly, and try to prevent mosquito bites (also, because they carry loads of horrid stuff).

International flight crew generally are required to have had Yellow Fever Vaccinations - if you have not then take care because some countries will not allow crew (anyone) to enter who does not have a vaccination booklet if they have traveled to a Yellow Fever region recently.

What else to watch out for

Malaria

Malaria is a parasite carried around by mosquitos. There are actually four types of it, and it is in a lot of places!

The big risk here is it can take a while for symptoms to show. They reckon you're most likely to have **symptoms between 10 days and 4 weeks** from being infected, but it could take as long as a year. The little beasties also like to loiter around in your liver, popping out at random times when you're run down, and so can cause recurring illness for as long as 4 years after infection.

Where?

According to the CDC it is **found in warmer regions**, which doesn't narrow it down an awful lot - basically anywhere hot and humid where there are places for mosquitoes to breed and grow. Just after rainy season is likely to be the worst, and rural areas will be more risky.

We have borrowed the CDC map because it is easier than trying to list everywhere to watch out.

How to prevent it

If you are going to a Malaria riddled area then you can take preventative medicine, but watch out! Not many are approved for operating pilots because they can have some nasty side effects. Malarone is the most commonly approved (and generally has the least side effects) but **we ain't no doctor so check with an AME** from your licensing state before taking.

The other option is to slather yourself in deet and wear long clothing to prevent the little nippers from getting at you in the first place.

The Symptoms

- Fever, sweats ad chills
- Muscle ache
- Nausea and sickness

So, basically generic symptoms of about a thousand other possible diseases.

If you have been to a malaria area and are thinking "**I got chills, they're multiplying**", don't write them off as a random cold - tell a doctor so you can get tested because it can get very serious!

Dengue Fever

Another one to blame on the pesky mosquito, Dengue is **common in over 100 countries**, and over 400 million people catch it every year, 100 million getting sick and 22,000 dying. Dengue Fever is **Malaria's bigger, badder brother**, and there is no specific treatment.

Like Malaria, there are also different strains of the virus meaning you can get different sorts, multiply times.

Where?

Outbreaks are coming across the Americas (including North America, although the mosquitoes aren't there, people just head in already infected), Africa, the Middle East and Asia, and the Pacific Islands. It is most prevalent in **tropical and sub-tropical areas**.

There is currently a growing outbreak in Reunion.

Brazil has the highest rate of Dengue fever in the world.

How to prevent it

Best plan, don't get bitten. Insect repellent is smelly, sticky stuff but it works. Here's what the CDC recommends:

- DEET
- Picaridin (known as KBR 3023 and icaridin outside the US)
- IR3535
- Oil of lemon eucalyptus (OLE)
- Para-menthane-diol (PMD)
- 2-undecanone

There is a vaccine but it is only given to people who have been infected before and have a risk of getting severe Dengue, and for kids between 9-16 who live in a Dengue area.

The Symptoms

The early, mild ones tend to get confused with other diseases so again, if you've been somewhere with Dengue, don't assume it is something else. **Go get tested.**

Initial symptoms usually appear within 4 to 10 days:

- Nausea and sickness
- Rash
- Aches and pains, especially behind the eyes and in bone joints and muscles

These last around a week, unless you develop serious Dengue fever, which 1 in 20 do:

- Belly pain
- Vomiting (a lot)
- Bleeding from nose and gums
- Lethargy

Zika

This one made the news a few years ago as it can cause serious birth defects. The symptoms for most tend to be fairly mild though.

It is also transmitted by our old friend the mosquito and there is no particular treatment so your preventative tricks are the best – don't get bitten!

Chikengunya

Transmitted by mosquitoes, this has very similar symptoms to Dengue Fever and Malaria, and is found in all the same spots.

There is no treatment for it and no vaccine to prevent it, so preventing bites is really important.

There are currently serious outbreaks in Brazil, and in Asia (Vietnam, Philippines)

Ebola

This is a nasty one, often deadly, and **causes lasting damage**. They don't really know where it comes from but it possibly started with monkeys and apes and was passed onto us human folk.

It is spread through direct contact with all the gory stuff that comes out of sick people.

Where?

Guinea had a major outbreak in 2021, but cases have fallen again. The US previously restricted travelers from here, and from the DRC, only allowing entry through 6 specific airports.

In 2020, the DRC (formerly Zaire) had a major outbreak.

It is most common in African countries, particularly the central African countries, and along the north west coast.

How to prevent it

It is spread through bodily fluids so avoiding contact with these is important. You also should avoid contact with animals that live in Ebola regions. Bats, primates, forest antelope all carry stains of the virus. **So don't eat them.**

There is a vaccine but it is only used in areas where an outbreak is occurring. There is medicine for treating it, and the do help survival rates. You also need medication to support blood pressure, to manage the fever etc, so this really is a serious disease which you do not want to catch

The symptoms

These can appear between **2 and 21 days of infection, usually around the 8 day mark**. The main symptoms are:

- Fever
- Severe aches and pains
- Sore throat
- Loss of appetite
- Gastrointestinal symptoms
- Unexplained hemorrhaging, bleeding and bruising

Yellow Fever

This is **pretty rare nowadays**, but still on to watch out for across Africa and South America. It gets its name from the fact it generally causes jaundice.

Insect repellent works well. It is transmitted by the mosquito (again)

There is also a vaccine. It has been used for 80 years and it pretty well tested, safe and effective, with 1 dose providing life long protection. In fact, many countries require travelers to have had the vaccine if they are entering from a country (or have visited one) where there are high incidences of Yellow Fever.

Meningitis

This is serious – it makes your brain and spinal cord membranes swell up which sounds horrid and painful. It can be **bacterial, viral, parasitic, fungal, amebic**... so there are a bunch of different sorts all with varying degrees of nastiness.

Good news though, there is treatment for most, and vaccines. You have likely had some already, it is another one that flight crew are often vaccinated for because this can be caught from all over the place. Bacterial in particular can be in food.

General travel recommendations

The CDC has good guidance for flight crew which you can read [here](#).

Many international airlines require their crew to have the following vaccinations, and they are often recommended in general for any traveller:

Cholera – Africa, Asia, Central America and the Caribbean

Diphtheria – Africa, south Asia, former Soviet Union. This protects you against Diphtheria, polio and tetanus

Hepatitis A – Africa, Asia, Middle East, Central and South America. This is common in places with poor sanitation and hygiene and can be picked up a lot of ways.

Hepatitis B – Africa, Asia, Middle East, Central and South America. This is spread by bodily contact generally.

Japanese Encephalitis – Common in rural areas of Asia with a tropical climate, after the rain season. It is also found in western Pacific island and near Pakistan, China and Australia. Actually, it is rarely found in Japan because they did a mass immunization program years ago. There is a tick borne version too. Also with a vaccine available.

Typhoid – the Indian sub continent, south and south east Asia, South and Central America, Middle East