



By Dr Salim Parker  
President-elect - SASTM



# TRAVEL MEDICINE

## The air we breathe in an aircraft: How safe is it?

"The microbe that felled one child in a distant continent yesterday can reach yours today, and seed a global pandemic tomorrow." These words, by Nobel laureate Joshua Lederberg, ring true when we consider the speed at which aircrafts travel presently. This fear has led to the common misconception among the travelling public that if just one person on board an aircraft has an infection, all the others are at high risk of acquiring it as well. In March 2007, a 16-year-old girl on board a Continental Airlines flight from Newark to Hawaii began coughing uncontrollably prior to take off. The pilot-in-command instructed the girl to be offloaded, as he feared she may have contracted an infectious disease. He indicated that he acted in the best interest of all the passengers. A day prior to that event, 272 passengers on board a Continental Airlines flight from Hong Kong were detained at Newark Liberty International Airport amid fears of avian influenza as some passengers displayed flu-like symptoms. Bird flu has a 50% mortality rate. It was later reported that they were suffering from ordinary seasonal flu.

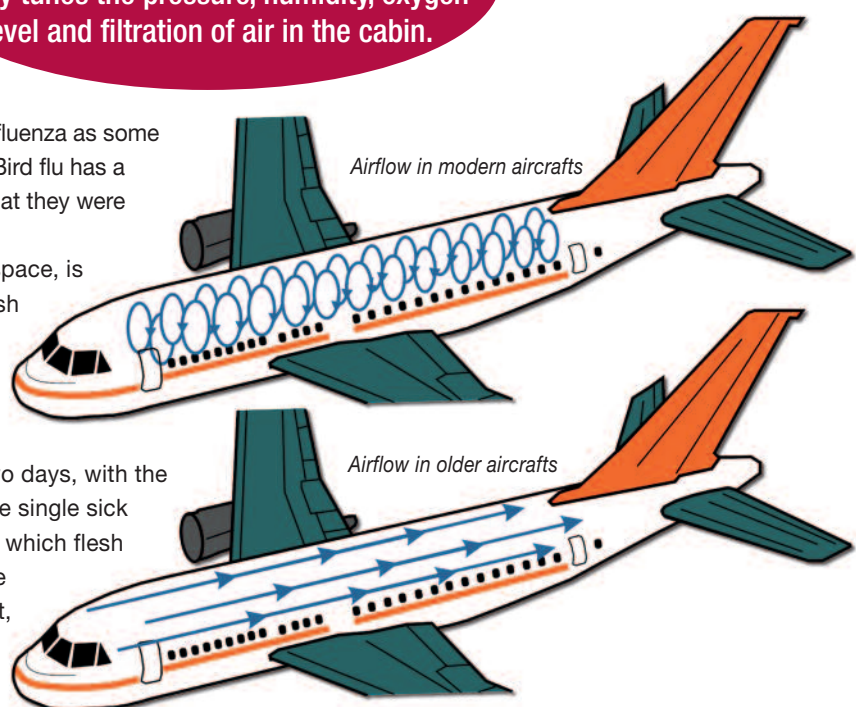
The aircraft itself, a closed confined space, is often perceived as the proverbial petri dish for the multiplication and spread of contagious diseases. This can indeed happen, as was the case when 72 percent of 54 passengers on a particular flight came down with influenza within two days, with the strain of that particular virus traced to one single sick passenger. But before we all panic about which flesh eating menace lurks in the crevices of the overhead compartments of our next flight, bear in mind that the abovementioned aircraft was grounded for three hours.

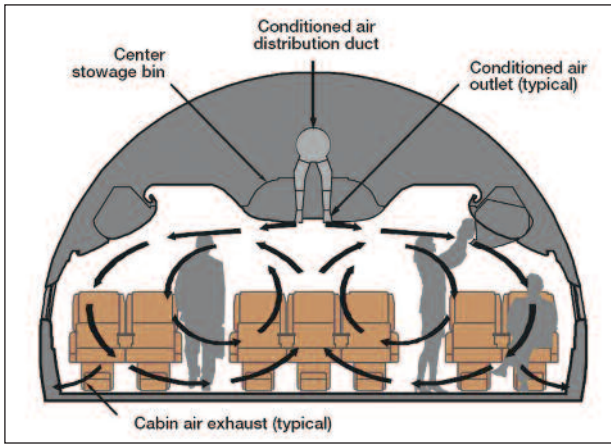
And that its ventilation system was not switched on. And that presently the airflow in aircrafts is a perpetually developing science that delivers highly filtered air inside the cabin.

Modern passenger aircrafts have environmental control systems in place that finely tunes the pressure, humidity, oxygen level and filtration of air in the cabin. Conditions are vastly different a few kilometres into the stratosphere; there is hypobaric hypoxia due to the low partial pressure of oxygen, relatively low humidity and close proximity to fellow passengers as a response to the

technical and economical requirements of flying. Fresh air is usually supplied to the cabin during a flight from the outside by the engines of the

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Cabin air circulation

aircraft. This outside air is for all practical purposes sterile, so the only potential pathogens in the cabin would have been brought on board by passengers and the crew, or would be found in prepared food for in-flight consumption. The outside air is heated by the aircraft engines to over 250 degrees Celsius.

Most modern aircrafts recirculate about 50% of the cabin air back into it, with the other 50% discarded. Modern buildings recirculate from 65% to 95% of the air. The cabin recirculated air first passes through high-efficiency particular filter systems (HEPA) and is then blended with the outside sterile air. This reduces the airborne pathogen load in the initial extracted air by about 63%. HEPA filters nearly all particles between 0.1-0.3  $\mu\text{m}$ , with bacteria and fungi being larger than that and being effectively removed from the circulating air. Viruses tend to be smaller, but because they have a tendency to clump together into larger aggregates, are effectively also filtered. A study comparing aircrafts using only fresh air (which is energy and cost intensive) to those using filtered recirculated air found no difference in the incidence of respiratory infections.

The air is supplied and exhausted continuously from the cabin and in effect is completely replaced after about

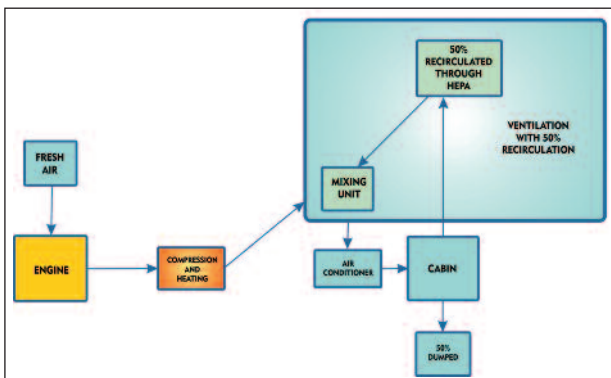
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4-5 minutes. American built aircrafts undergo 15-20 air changes/hour, whilst European start off at about 10 changes/hour. This has to be compared to offices having rates of 12/hour and private homes having five air changes/hour. Several studies, admittedly conducted in the late 1990s, found that levels of bacteria and fungi on aircrafts were lower than those found in public buildings. If an aircraft has to be delayed on the ground for more than thirty minutes and the ventilation system needs to be switched off, regulation requires that either a ground based preconditioned air source or pneumatic source is connected to the ventilation system, and that energy be supplied by an auxiliary power source.

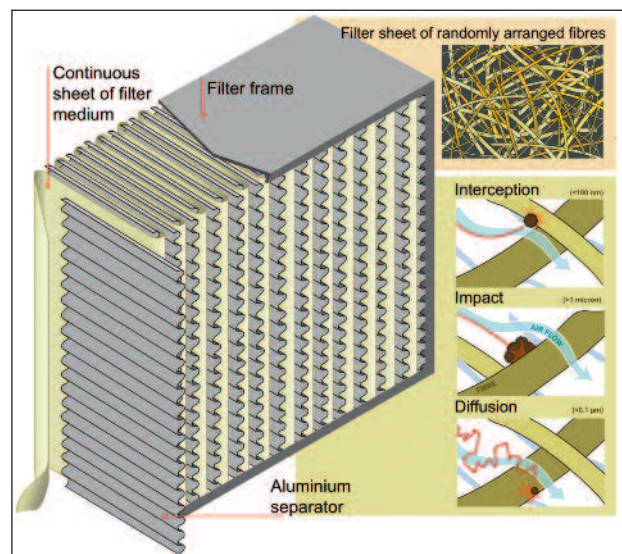
In older aircrafts, the flow of air was from the front to the back of the cabin, and this created a possible wind tunnel effect. Modern aeroplanes use the concept of laminar flow, where the air flows from the top through outlets throughout the entire cabin, downwards towards the floor where outlet valves vent it to the hold below.

From here the air is either exhausted or recirculated. The ventilation system is designed in a manner where air entering above a given seat is usually extracted from the floor in the same row. The airflow towards the front and the back of the aircraft is hence limited.

One of the drawbacks of the cabin air is its low humidity, which can lead to irritation and dryness of the eyes and respiratory tract. There is some evidence pointing to this leading to easier colonisation by pathogens. However, taking into consideration the effectiveness of the filtration of the circulating cabin air, it is safe to say that the air, miles high up in the sky, is indeed safe.



Ventilation in modern aircrafts



HEPA filter