



Pilots in the cockpit: *"Either I stop, or someday they carry me dead from the cockpit."*

Stench of old socks

How harmful is the cabin air in aircraft? Pilots and flight crews are complaining about hazardous fumes which can come in from the air conditioning. They contain the neurotoxin TCP. Lufthansa are getting their flight crews tested.

Andreas Tittelbach clearly remembers the day when his dream job turned into a nightmare. The captain, now 48, was with his co-pilot in an Avroliner of Lufthansa subsidiary CityLine.

A foul stench accompanied them the whole day. On the flight back from Katowice to Frankfurt, "the dreadful smell was unbearable", recalls the stubble-headed man. His head was pounding and the co-pilot was overcome by choking.

In desperation they put on their oxygen masks. "What happened next shocked us both", said Tittelbach. "It was as if a veil had been pulled away from us." Only then the pilots noticed how much their cognitive functioning had been affected by the gases in the air.

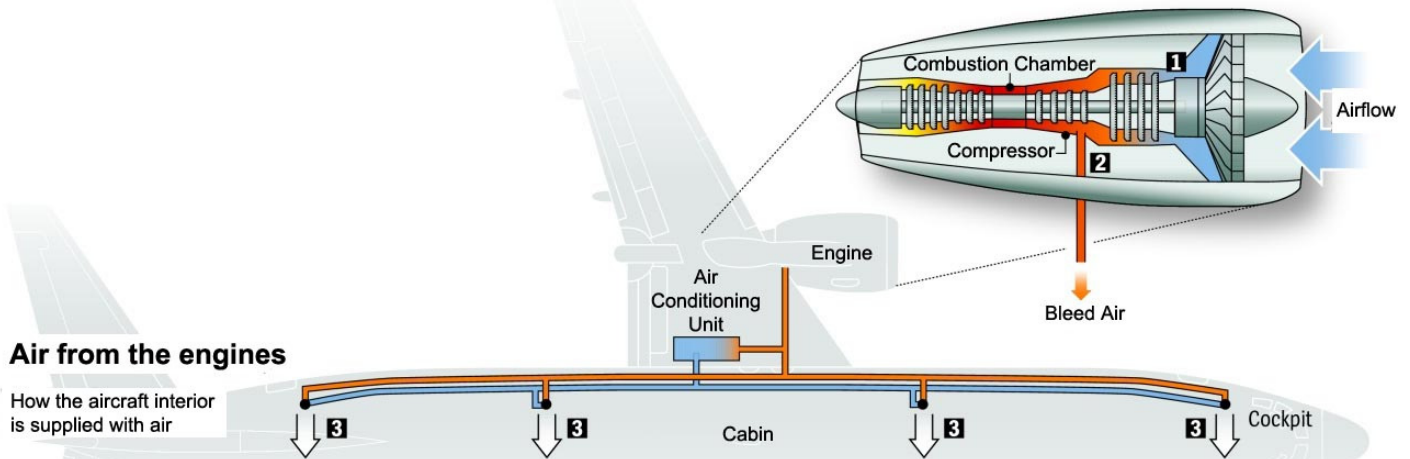
The two pilots got the foul-smelling aircraft safely on the ground and handed it over to the engineers. But since that fateful day on 18th January 2002, Tittelbach noticed strange things happening to his body; he was always sick, and constantly tired. Once he had hiccups for three days.

Then he suddenly started getting heart palpitations.

On the advice of psychotherapists, he was signed off sick. However, he was soon at the controls again, but only for a few months. And this would be for the last time; the symptoms and the smell kept returning. "I was finished", said Tittelbach. "I thought, either I stop, or someday they carry me dead from the cockpit." A psychiatrist eventually signed him off with a diagnosis of "generalized anxiety disorder." But was the cause of his suffering really in his mind?

Tittelbach is now convinced of the true cause - a contaminant with the unwieldy name tricresyl phosphate (TCP). The neurotoxin is an engine oil constituent. It is suspected to have made several pilots and flight attendants ill all over the world.

Some affected people have set up organisations specifically to convince authorities, airlines and manufacturers of the dangers of the oil fumes. They call the illness "Aerotoxic syndrome" and are fighting to have it recognised as an occupational illness and are seeking compensation. Andreas Tittelbach is also in the courts.



Air from the engines

How the aircraft interior is supplied with air

- 1** Cold air flows into the engine. In the compressor it is compressed and thereby heated.
- 2** The hot air is bled off from the compressor and fed into the air conditioning system.
- 3** There the bleed air is mixed with cooler air from the air conditioning and directed into the cockpit and cabin.

But the aircraft manufacturers don't want to stop putting TCP in turbine oil. The organophosphate was long regarded a marvel of the petrochemical industry. It is stable at high temperatures - an ideal lubricant for engine shafts - onto which compressor blades are attached that compress the airflow into the combustion chamber.

But what hardly any passengers would guess is that between the TCP-containing oil and the air they breathe in the cabin, there is only a seal which separates the compressor bearings and a component that distributes a portion of the compressed air to the cabin. The so-called bleed air supplies passengers on board with vital oxygen in every one of the 14,000 or so modern jet aircraft all over the world (see diagram).

The extraction of bleed air from the engines carries a risk. The seals may leak, particularly during take off and landing, whereby hot oil vapour is released into the air. "You get a really nasty stench of old socks, as I so often had to breathe in", explains ex-captain Tittelbach.

But how dangerous is it really? If you believe the protestations of the aviation industry, then the odours are barely worse than what fellow travellers give off. The aircraft manufacturer Airbus maintains that the debate is as unimportant as discussion about the dangers of cosmic radiation.

Critics argue that TCP is not only dangerous to the health of passengers and crew. "Pilots' cognitive function can be affected without them realising and it could lead to accidents", warns Jörg Handweg from the pilot union "Cockpit". He is calling for an independent scientific study on the health effects of oil fumes. Doctors share his concern. "It has been known for a long time that TCP is an extremely toxic chemical", says Dietrich Henschler. The retired pharmacologist from Würzburg is amazed that the aerospace industry has so persistently ignored the problem.

Henschler is not just anyone. It was his studies in the 1950s that first identified the neurotoxic potential of TCP. Henschler says, "The human body is particularly sensitive to it. Even in small amounts it destroys certain neural pathways."

Clement Furlong, a biochemist at the University of Washington in Seattle has developed a new method for detection of TCP in the blood. He also warns of potential adverse health effects. He says, "It's crazy that airplanes still use bleed air."

Manufacturers, airlines and authorities point out that scientific proof of a link between symptoms and the toxin has so far not been established. But it can hardly be disputed that oil vapour gets into the cabin. Some aircraft such as the Avroliner and Boeing 757 are particularly susceptible. However, Airbus aircraft are also affected by the design flaws.

In summer 2009, a German Wings A319 had oil smells coming out of the air conditioning. A witness said that one of the flight attendants almost collapsed against his car after work. German Wings states that the short-range jet was inspected immediately and that no defects were found. Pilots contradict this and say the plane was still flying two weeks later and still stinking.

Last year it even affected the prestigious Airbus aircraft, the enormous A380. On a Lufthansa flight from Frankfurt to Tokyo on 14 September 2010, the unpleasant smell was coming from the air conditioning. Methodically the pilots switched off the bleed air supply from each of the four engines, one by one. They identified the faulty unit. "We have since replaced the engine", confirmed Lufthansa spokesman Michael Lamberty.

There were dramatic scenes in January last year in the USA on a U.S. Airways Boeing 767. After landing in Charlotte (North Carolina), the two pilots and 13 passengers and crew members had to be carried off the aircraft on stretchers.

According to new unpublished findings, oil fumes in the cabin are more common than previously thought. At any rate this is what figures from the German Air Accidents Investigation Branch (BFU) show. These events have been very carefully analysed since last year. According to the figures, 60 oil fume events were reported in 2010 by just one German airline. "However, the estimated number of unreported cases could be higher", says BFU spokesman Karsten Severin.

Some airlines reported remarkably few incidents. But Severin often gets the message directly from pilots that they “obviously distrust their employer.” The BFU in Brunswick therefore assumes one incident per day.

The aviation industry doesn't have much interest in researching the TCP problem. There are a number of clues that give rise to caution. Back in 1930 the potential TCP has as a nerve poison was proved. During the Prohibition more than 20,000 Americans suffered paralysis after they drank an alcohol mixture contaminated with TCP.

Early on toxicologists had deciphered the effects of this substance. Processes in the body can transform chemicals into compounds that interfere with nerve cell communication and can lead to cell death. Biochemist Furlong explains that because the TCP derivatives interfere in such basic cellular processes, symptoms are also initially very scattered: headache, nausea and even vomiting, difficulty concentrating, dizziness. In the course of a TCP poisoning, the central nervous system is seriously affected.

It is striking how different people react to the neurotoxin. “Genetic differences can be responsible”, says Furlong, “but it can also be a question of how long a person has already been in contact with the substance.”

Therefore Furlong is hardly surprised that only some pilots and flight attendants are complaining of medical problems, while others are not. The industry sees it as an indication that Aerotoxic syndrome belongs in the realm of imaginary diseases.

Airbus says that TCP is made up of different isomers. However, the most toxic ones, known as ortho isomers are present in TCP at a maximum quantity of 0.2 percent. “In our opinion, the risk of being poisoned with TCP in the cabin poses no realistic danger”, says Andreas Bezold, expert on cabin air at Airbus. “This analysis is shown by scientific publications.”

Other experts are less confident. Toxicologist Henschler's verdict is “There is no meaningful health safety limit that we can offer for this substance.”

The Canadian biochemist Christiaan van Netten has compared symptoms from hundreds of oil fume event reports by cabin staff from the 90s. His study which was recently published in the USA by the National Academy of Science establishes at least an epidemiological link. “The substance is in the air, and it is harmful. We can not ignore it”, warned van Netten.

Only real measurements can determine what level of toxins are actually in cabin fume events. Until now, the airlines have only made measurements during normal operations, with no findings. But what levels of contaminants are present during a fume event? “The industry has not yet made the effort to find out”, criticised van Netten.

Aircraft manufacturers contest this. They say it would be too costly and say they can't have aircraft flying around non-stop with measuring equipment on board waiting for such an incident. Nevertheless, Lufthansa is planning a simulation. In a test aircraft, the technicians want to put hot oil in the bleed air system.

Recently Lufthansa have been urging their flight personnel to get a urine sample taken from an aviation doctor following a fume event. The samples go to the Institute for Prevention and Occupational Medicine at

the University of Bochum. There toxicologists analyse the frozen samples for TCP decomposition by-products.

The results from Bochum will be eagerly awaited as there is a lot at stake for the industry. In the worst case it could lead to a withdrawal of an operator certificate. In the aviation regulations it states that in normal operations the cabin air must contain no dangerous concentrations of contaminants. So the crucial is, are the oil fumes the rule rather than the exception?

Airlines and manufacturers argue that it is always caused by a technical failure. However, technicians admit that despite meticulous maintenance, they cannot prevent the oil seals from occasionally leaking.



Fume event: Out of the cockpit on a stretcher. Evacuation of a U.S. Airways Boeing 767 crew member in January 2010 in Charlotte, North Carolina.

An aircraft maintenance engineer who worked for many years on the susceptible Avroliner tells SPIEGEL, “The seals are still far from worn out, completely within limits - and yet they do not always hold tight.” The engineer explains that there is no procedure to detect a wearing seal. “The manufacturers accept that there are oil fume incidents.”

Technically, the TCP danger could be averted in two ways: either the neurotoxin is taken out of the oil, or the cabin air is no longer bled off the engines.

According to the French lubricant manufacturer Nycos, it has found a safer substitute for TCP. But so far it seems it has not found any airlines or manufacturers to test the product.

Meanwhile Boeing has equipped its new aircraft model, the 787 with an air conditioning system that supplies air to the cabin using separate electric compressors. Officially, doing away with bleed air will save fuel.

In a statement to the British House of Lords, Boeing accounts for the new air conditioning architecture quite differently. It says, it “eliminates the risk of engine oil decomposition products from being introduced in the cabin supply air.”

GERALD TRAUFFETTER