

# THE FORGOTTEN POLLUTION: CABIN AIR QUALITY IN COMMERCIAL AIRCRAFT

R. A. Roos\*, A. van Wijk

RE(C)ENTRE RECHERCHE, 6 La Pichotière, 61340 Perche en Nocé, France.

\*Corresponding author: [rein.andre.roos@gmail.com](mailto:rein.andre.roos@gmail.com)

## INTRODUCTION

An interesting article concerning a type of forgotten pollution [1] appeared in a major Dutch journal De Telegraaf on the 9<sup>th</sup> February 2017. It concerns a stewardess who was initially summarily dismissed, but still loses her job at the KLM, the major Dutch airline company, because she suffers from a non recognized professional illness named “aerotoxic syndrome”, see Figure 1.



Figure 1 Screenshot of the article [2]

Looking a little closer to the information about this illness, one gets the impression that it skips a dimension: electrostatics. If this is the case it opens the possibility to take real measures to reduce its burden both to the aircraft crew but also to those passengers observing unexplained health and fitness problems after a flight.

## AEROTOXIC SYNDROME

Aerotoxic Syndrome [3] is the term given to an illness, see table 1, related to the exposure to contaminated air in jet and turbojet aircraft. It is thought to be caused partly by certain materials emitting hazardous ingredients. An other cause that has been pointed at, could be a lack of maintenance.

However in general it is assumed that it is caused by air that at altitude has been contaminated by engine oil or other aircraft fuels. This outside air is in general directly supplied by the turbine of the jet engine, and is called **bleed air**. It is mixed with the recirculated cabin air, and inhaled by crew and passengers.

## ATS SYMTOMES

Fatigue – feeling exhausted, even after sleep
Blurred or tunnel vision
Shaking and tremors
Loss of balance and vertigo
Seizures
Loss of consciousness
Memory impairment
Headache
Tinnitus
Light-headedness, dizziness
Confusion / cognitive problems
Feeling intoxicated
Nausea
Diarrhoea
Vomiting
Coughs
Breathing difficulties (shortness of breath)
Tightness in chest
Respiratory failure requiring oxygen
Increased heart rate and palpitations
Irritation of eyes, nose and upper airways.

Table 1, aerotoxic symptoms.

Any combination of the previous symptoms may be experienced by the patient.

## BLEED AIR ENVIRONMENT

Bleed air [4] comes from the compressor section of the jet or turbo engine, just before the combustion chamber as shows figure 2. A region dominated by the plasma that is produced by the finely dispersed hydro carbons of the aircraft fuel and the nitrogen, oxygen, carbon dioxide and water vapor containing ambient air at altitude. [5]

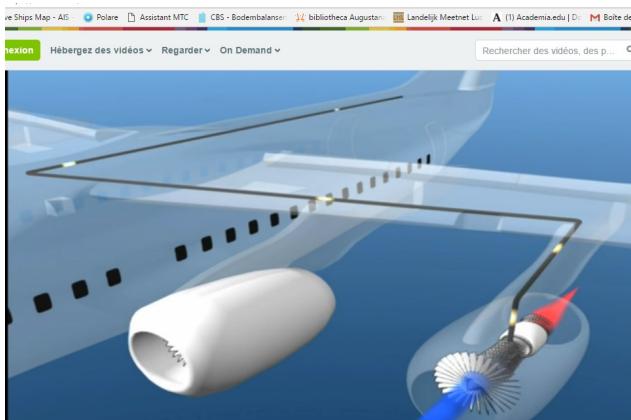
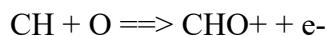


Figure 2, Screen shot of bleed air circuit

Ignition of this mixture produces the following reaction in the flame front



This means a mixture of large positive protons, and tiny negatively charged electrons. Such a small particle, like the electron has a very high mobility and clouds of them will leave rapidly the plasma (flame) region and are attracted to the metal parts in the vicinity like, as it is the case with large metal sphere of the Van de Graaff high voltage generator.

The consequences are well known to everybody dealing with aircraft because this charge buildup is everywhere: on the wings, the body and the tail. It forces the manufacturer to install there the characteristic static wicks, which through corona discharges are able to reduce the initial potential of the aircraft having values in the order of some 1,000,000 volts, to levels low enough that the remaining charge can rapidly be evacuated through the tires during the landing.



Figure 3. Static dischargers on the winglet and aileron of an EasyJet Airbus A319-100 [6]

## ST. ELM'S FIRE

Never the less there is a considerable potential difference between the negatively charged metallic parts of the aircraft and the plasma consisting of the larger, positively charged particles who with their reduced mobility remain in the center of the combustion chamber.

The reduced atmospheric pressure at altitude will under these circumstances produce easily a luminous discharge in the vicinity of the reactor of the faint St. Elm's fire type, as shown in figure 4. This phenomenon, probably also the Bible's burning bush, is well known for numerous centuries and considered to be quite inoffensive. The suction of bleed air is done in this environment.

However sucking "clean air" through this discharge of a gasous mixture containing:

- Nitrogen
- Oxygen
- Carbon
- Hydrogen
- Water vapor

is the right receipt to produce an important quantity of amino acids as has been shown numerous times since 1952 when the Urey – Miller experiment was carried out for the first time.

So let's take a look at the performances of this experiment before we examine more closely what the impact of these amino acids,

also called the building blocks of life, can have on the health and well being of crew and passengers.



Figure 4. Low pressure electric gas discharge

#### THE UREY-MILLER EXPERIMENT [7]

During the 20th century attempts have been made to explain the origin of life on Earth in a chemical way, leaving aside electrostatic dimensions like the presence of plasma's caused by solar wind.

When, almost by accident, electrostatics was taken into account, by using sparks as it was the case in the Urey – Miller experiment, the results were almost miraculous.

Under electrical stimulated conditions a wide range of amino acids, the building blocks of life were produced by the lifeless gases using a simple experiment of a high school student level.

#### AMINO ACIDS[8]

Amino acids are characterized by the fact that they are very small, less than 1 nm and contain nitrogen (N), whereas fats and carbohydrates do not.

More than 200 different amino acids exist only 10% are used in relation to medicine and sports. Nine of these form the backbone of orthomolecular medicine.

The importance of amino acids as the precursors of enzymes and neurotransmitters is often underestimated. As such, amino acids regulate almost all of the metabolic processes in the human body.

Careful supplementation of selected essential and semi essential amino acids is necessary when they are used as compliment to classical medical therapy.

However adverse effects may be expected when medicated and healthy persons are exposed for hours to a mix of unselected amino acids as it is likely the case in today's commercial aircraft.

#### CONCLUSIONS

Because the sensitivity to these "building blocks" of life depends strongly on the defense system of the person, could be the cause of the seemingly incoherent number of persons falling ill to this aerotoxic syndrome.

For this reason, further investigation into the electrostatic dimension of the aerotoxin syndrome could be a far better approach then trying to conceal the problem by firing the messengers.

#### REFERENCES

- [1] R. A. Roos, The Forgotten Pollution, Kluwer Academic Press, 1996  
<http://preview.tinyurl.com/raroos>
- [2] De Telegraaf, 9 Februari 2017, Stuardess KLM is baan toch kwijt.  
<http://preview.tinyurl.com/jj5z8jv>
- [3] C. Winder, J-C Balouet, Aerotoxic Syndrome: Adverse health effects following exposure to jet oil mist during commercial flights. 1999  
<http://preview.tinyurl.com/hxbqt4w>
- [4] <https://vimeo.com/59136226>
- [5] <https://eos.org/research-spotlights/the-forgotten-water-vapor-at-high-altitudes>
- [6] [https://en.wikipedia.org/wiki/Static\\_discharger](https://en.wikipedia.org/wiki/Static_discharger)
- [7] R. A. Roos, A. van Wijk, Revisiting methods related to respiration and fermentation of tumor cells, J. Electrostatic Reorientation Vol. 1, N° 1, F>V 2017.
- [8] <http://aminoacidstudies.org/>