

Dynamic Cabin Air Contamination Calculation Theory

Task for a project

Background

In recent years health concerns associated with contaminated cabin air in aircraft have gained public attention. These concerns were raised by crew and passengers about potential health effects causing neurotoxic symptoms. Engine oil got into focus with its additive called tricresyl phosphate (TCP), an organophosphate. TCP can enter already during normal operation in small quantities from the engine bearings through bearing seals via bleed air (taken from the engine's compressor) into the aircraft cabin. Problems are pronounced in failure cases leading to Cabin Air Contamination Events (CACE) – commonly known as fume events or smell events. Recently, also the dynamics of the contamination concentration in the cabin was discussed. If a certain amount of oil gets released at one point in time, the concentration of e.g. hydrocarbons in the cabin will initially increase and will subsequently quickly decrease again. Oil residue may also deposit in bleed ducts or cabin air ducts. Upon a trigger event these accumulated deposits could theoretically be released in a short time, which could substantially increase the concentration of various substances in the cabin.

Task

The dynamics of the concentration of cabin air contaminants should be explained with all equations well derived and with worked examples well visualized. These steps should be followed:

- Short review of the aircraft air conditioning system.
- Short review of possible air contamination sources and the types of contaminants.
- Short review of the means to reduce the contaminant concentration.
- Derivation of equations for the dynamics of the concentration of cabin air contaminants.
- Calculation of selected example scenarios.
- Discussion of results, conclusions and recommendations for further research.

The report has to be written in English based on German or international standards on report writing.