

Final Report: Aircraft Air Quality and Bleed Air Contamination Detection: Phase 2, Volume 2: [Supporting Dataset]

Dataset metadata at: <https://doi.org/10.21949/rb92-6j61>

This dataset supports research report: **Aircraft Air Quality and Bleed Air Contamination Detection: Phase 2, Volume 2**, available at this link: <https://doi.org/10.21949/v5p6-j307>

Dataset Metadata

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Report Description: The purpose of this project was to provide a data driven process to identify sensor technologies with the potential for detecting and identifying low levels of contaminants that may occasionally be present in aircraft engine bleed air supplies. Bleed air from a ground-based aircraft propulsion engine and an auxiliary power unit (APU) were used to supply air through an ozone/volatile organic compound (VOC) converter to the environmental control system on a Boeing 747, while injecting controlled amounts of fluid contaminants (i.e., aircraft engine oil, hydraulic fluid, and deicing fluid). Measurements of contaminants were performed at the ozone/VOC converter inlet and exit, and at the air conditioning pack exit. Ultrafine particles (UFP) were found to be a sensitive marker for engine oil contamination with measurements at all three locations showing similar, highly elevated UFP concentrations with a mean diameter near 40nm and smaller when the sample stream was cooled to near room temperature. In situ measurements showed that UFPs are generated by condensation and high UFP concentrations were not detected in uncooled bleed air. Oil contamination VOC levels were very low upstream of the ozone/VOC converter at bleed air temperatures up to 220°C and increased at bleed temperatures of around 315°C; however, oil contamination VOC levels remained at sub-ppmv levels. Fine particle concentrations also increased with oil contamination at lower bleed air temperatures, but not with temperatures around 315 °C. Secondary contaminants including pentanoic acid, heptanoic acid, acetic acid, formaldehyde, and acetaldehyde formed in the ozone/VOC converter as the oil aerosol oxidized. Consideration must be given to contaminant deposition within the bleed air system and sample lines as this deposition may lead to delayed responses and contaminant release during temperature transients. Of the sensor technologies assessed, spectrometers provided the best opportunity to detect and identify contaminants. Carbon monoxide (CO) measurements confirmed that CO is not generated in sufficient quantities to be of value as a marker for engine oil or hydraulic fluid contamination of bleed air. CO may be useful as a marker for ingestion of engine exhaust in some cases. However, carbon dioxide (CO₂) is a much better marker for engine exhaust ingestion.

Supporting data for this report can be accessed with the following link:
<https://doi.org/10.21949/rb92-6j61>.

About the data: The total size of the data package is around 86.9 MB. The zip file can be

unzipped using any zip compression/decompression software. Data files in the zip folder include: .txt files, accessible via any text editor; .docx files, accessible via Microsoft Word or open document programs; .xlsx spreadsheets, accessible via Microsoft Excel or other open spreadsheet programs; and .PDF files, accessible Adobe PDF readers or other PDF reading programs. Open Access forms of the data files have been included. Consult the README below for more information.

National Transportation Library (NTL) Curation Note:

This data has been curated to CoreTrustSeal's curation level "A. Active P reservation." To find out more information on CoreTrustSeal's curation levels, please consult their "Curation & Preservation Levels" CoreTrustSeal Discussion Paper" (<https://doi.org/10.5281/zenodo.11476980>). NTL staff last accessed this dataset on 2025-02-14. If, in the future, you have trouble accessing this dataset, please email NTLDataCurator@dot.gov describing your problem. NTL staff will do its best to assist you at that time.