

Research in Military Aircraft Emissions

- Collaborative effort among Air Force Research Lab, EPA, Industry, and ORNL (the program lead)
- Focus on high-payload aircraft
- Aircraft emissions play a significant role in atmospheric pollution
 - Large amounts of elemental carbon and sulfate are present in aircraft emitted particulate matter
 - Most of particulate matter is smaller than 300 nm in mobility diameter
- Extractive sampling at exhaust appears to be the only reliable means for quantitative determination of aircraft emissions at the present
- Far-field measurement (15-m behind the exhaust) would not provide useful emission indices as expected by regulatory agency. This is due to the nonlinear transformation in reactive plume chemistry and turbulent mixing



Photo of a B-52 bomber taking off (above) and landing (below)



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Military aircraft can produce significant particulate and gaseous emissions. The emissions are deposited directly into the atmosphere effectively contributing to the change in air composition, radiation balance, and possibly cloud life cycle (e.g., formation of contrail) from local to global scale. Most of the aircraft fuel consumed by the Air Force is in high-payload aircraft; e.g. cargo planes (C130H) and bomber aircraft (B-52). Current emissions measurement methodology is not suitable for ultrafine particles that are the dominant species in the aircraft exhaust. The fate and transport of the precursor gases and the ultrafine particles in the reactive plume of aircraft exhaust are not well understood at the present. Observations from the field measurements of a C130H cargo aircraft reveal that the particulate matter was dominated by soot and sulfate. Far-field measurements result in indiscernible emission indices that might not be useful for regulatory purpose. Extractive sampling by using dilution probe appears to effectively quench aerosol dynamics right at the probe tip yielding the only reliable means for quantitative determination of aircraft emissions at the present.

Contact: [Meng-Dawn Cheng](#)

Senior Scientist and Leader, Atmospheric and Aerosol Science Group

Phone: (865) 241-5918; Email: chengmd@ornl.gov