**ABSTRACT:**

# Impact of Environmental Conditions and Jet Blast Deflectors on the Dispersion of Ultrafine Particle Aircraft Emissions

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Particulate emissions from aviation engines consist primarily of ultrafine particles (UFPs) smaller than 100nm in size [1]. UFPs pose a health hazard to both flight and technical personnel as well as passengers. This study aims to model the fate of UFPs after they are emitted from various aircraft engine configurations.

We use ANSYS 2022 R2 and the flow field is validated with the available literature [2]. The computational domain is defined using the nozzle exit diameter (D) as a reference, extending downstream of the engine nozzle exit up to 100D. The nozzle exit is divided into a core jet exhaust region with a diameter of D/3 and an annular fan exhaust region extending to D. The standard k-ε turbulence model is employed, with calibrated coefficients [2] to increase accuracy. Local mesh refinement is achieved using a body of influence (BOI) to control element size in the flow region. Different BOI target mesh sizes are tested to ensure mesh independence.

We examine the motion of UFPs using a Lagrangian discrete phase model (DPM). The trajectories are obtained by integrating the force balance acting on each particle, including drag and Brownian forces, while thermophoretic effects are also taken into account due to the high temperature gradients in the exhaust plume. An effort will be made to include the effects of ambient conditions (temperature, humidity, dust and wind speed), bypass ratio, evaporation, and condensation as well as the influence of surrounding structural features (ground proximity and jet blast deflectors) on particle dispersion. At a later stage we intend to use the findings of this study as initial conditions on the fate and transport of aviation UFPs inside the human body. \

[1] B. Stacey, Atmos. Environ., 198, 463-477, (2019).
[2] A. Epikhin, D. Romanova, and S. Elistratov, Phys. Fluids, 37, 095189 (2025).\

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