Computational fluid dynamics (CFD) models of a Boeing 737 aircraft cabin and an indoor commercial space (ICS) were created to characterize the spread and lifetime of aerosols generated via coughing or breathing. The system designs and airflow patterns that reduce their concentration over time were also examined for each space. The results show that the aircraft cabin environment is well suited to address and respond to infectious agents, such as COVID-19. For a single cough, 80% of airborne particles released were removed within 1-2.5 minutes depending on conditions, this was five to twelve times more rapidly than the ICS.

The rapid removal of airborne particles in the aircraft cabin was due in large part to the airflow patterns and design of the airplane cabin environment. Air is delivered to the cabin in a top-down airflow approach without significant forward or aft flow. The cabin geometry works to preserve this airflow pattern with seatbacks acting as barriers. After the airflow leaves the cabin, it is either evacuated through the airplane's outflow valve and replaced with outside airflow, or it is passed through a HEPA filter which removes essentially all particles. The result is a clean supply flow that is delivered in such an approach to help isolate an infected occupant from their fellow cabin occupants.

The CFD analysis results were compared to empirical data from a U.S. Transportation Command (US TRANSCOM) study that tracked particles introduced by simulated infectious individuals in an airplane cabin environment. The results show excellent correlation between the 180 million particle releases undertaken in the US TRANSCOM study which reported a median max inhaled concentration of 0.0009% and a maximum of 0.46% the 106 million particle releases undertaken in the Boeing CFD study which reported a median particle inhalation mass of 0.075% and maximum of 0.47% respectively. In both cases, the inhaled mass from adjacent passengers was vastly higher from a single cough than for breathing cases.

The data demonstrates the requirement of utilizing an advection-dispersion model with a large dynamic set of data points to accurately model the airplane cabin environment. A well-mixed model, such as those utilized in Wells Riley, will result in an overestimate the inhaled mass at far distances, and severely underestimate the inhaled mass concentration at short distances. When proper methods are utilized, the simulations show that inhaled mass on an airplane is low compared to an indoor commercial space.