Air Distribution in Aircraft Cabins Using Free Convection Personalized Ventilation

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Free Convection Personalized Ventilation (FCPV)

The aim of the ventilation system is to control cross infection in an aircraft cabin if one or a number of the passengers are "source patients" (source of airborne disease). The Personalized Ventilation described in this text is of the type mentioned in "*Free Convection Personalized Ventilation*". The seven different types are shown in figure 1.

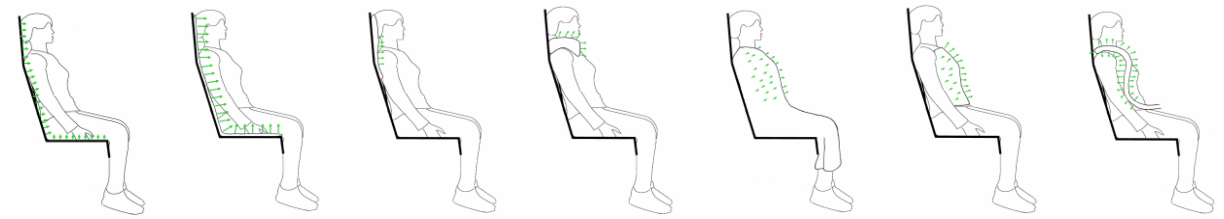
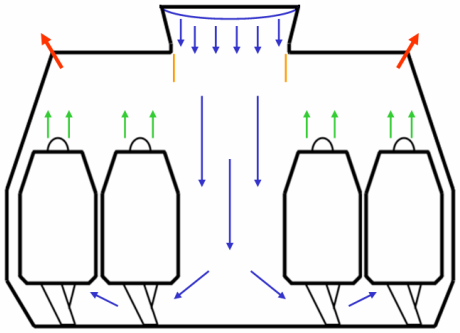


Figure1. Personalized Ventilation as a: seat, snap on blanket, pillow, headrest, blanket, waistcoat and flexible diffuser.

They can be used with any air distribution system, but some systems will support the effect of free convection ventilation around the person and one system will improve the conditions for people working in the cabin. The following two suggestions are both based on buoyancy driven flow, and this unusual for aircraft ventilation.

Active Displacement Ventilation system

The principle behind active displacement ventilation system with FCPV is illustrated in figure 2.



Figur2. Active displacement ventilation with FCPV. The downward vertical supply flow takes place in the aisle in the mean plane of the cabin.

The air is supplied in the top of the cabin, and it falls down due to gravity. The supply opening could be a textile terminal (at least in the full scale experiments). A wane or a curtain on both side of the aisle will improve the air quality in head height of the cabin attendants (orange colour in the figure). The supply air will fall to the floor and rise in the free convection boundary layer of the seated persons. Even in this situation, the air around most persons is protected from the source person. The FCPV system will add further clean air to the breathing zone, and protect against close located source persons. The supply air will protect the cabin attendants, but it is also necessary to supply extra cold air, because the supply to the FCPV should be personal adjusted to the users wish, and not necessary a part of the heat balance of the cabin. The crew is only breathing the clean air close to the supply when they are moving along the aisle, but this do also correspond to reality. The curtain above the passenger will support an exhaust reservoir with warm and perhaps contaminated air. The system will not generate movement in the length of the cabin, and this also an improvement compared to the situation with mixing ventilation.

Displacement Ventilation System

The principle behind displacement ventilation system with FCPV is illustrated in figure 3.

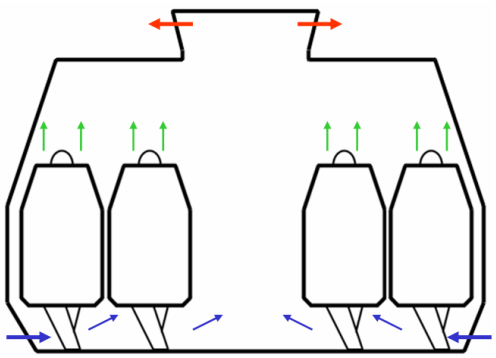


Figure3. Displacement ventilation with FCPV

Cold air is supplied along the floor below the passengers. The air is entrained into the free convection boundary layer and even in this situation, the air around most persons is protected from the source person. The FCPV system will add further clean air to the breathing zone, and protect against close located source persons. The air in the upper part of the cabin is contaminated, and moving cabin attendants will not be protected from that. But it should be remembered that the level of contaminant correspond to the level obtained in a cabin with mixing ventilation, which is the only known air distribution system to day in aircrafts.