



AALBORG UNIVERSITY
DENMARK

Aalborg Universitet

CLIMA 2016 - proceedings of the 12th REHVA World Congress

volume 5

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Publication date:
2016

Document Version
Publisher's PDF, also known as Version of record

[Link to publication from Aalborg University](#)

Citation for published version (APA):
Heiselberg, P. K. (Ed.) (2016). *CLIMA 2016 - proceedings of the 12th REHVA World Congress: volume 5*.
Department of Civil Engineering, Aalborg University.

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PROPOSAL of the DRAIN in PIPELINE of AIR CONDITIONING PIPE of COMMERCIAL AIRCRAFT with UNDER FLOOR AIR DIFFUSER and PERSONAL VENTILATION

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Abstract

The air quality in commercial aircraft cabins requires thermally comfortable and healthy environment. The circulation of air flow depends on the geometry of the cabin and the air conditioning ducts. This article is concerned with the provision of furniture and proposes a new methodology for the use of efficient and personalized way of the under floor air diffuser to airplane design. In this research will be checked the flow of air and its space used in jet aircraft E170 model with capacity for 70 people manufacturing Embraer, in order to determine through analysis of literature, how to improve the comfort conditions in the cabins, in order to attract passengers and achieve security, energy savings and thermal comfort throughout the flight.

Keywords - air conditioning; aircraft; UFAD; PV

1. Introduction

The main purpose of the air conditioning system is to maintain a comfortable cabin temperature in the all flight conditions, so that the system should have the ability to heat and cool the airflow (Lombardo, 1993). Another major concern is the control of moisture, because long-term exposure to low levels of humidity accelerate skin aging, dehydration and possible kidney disease.

Research conducted by Nilsen, P.V; Damsgaard, C .;L. Liu, Jesen, R.L.; 2013 on the distribution of ventilation in large aircraft find that the top-down displacement ventilation distribution leads to increased protection against the risks of cross infection among the passengers when compared with the mixed ventilation system, and this displacement ventilation leads to increased protection against cross infection, but reduces the vertical temperature gradient and reducing the thermal comfort for the passengers.

Currently most commercial aircraft use the mixing ventilation (MV), which has low temperature stratification, but by mixing the return air to the cabin, infectious diseases are easily spread throughout the aircraft.

Recent studies indicate improvements in the use of under floor air diffuser (UFAD) because air enters cleaner in the occupied zone, and by means of natural convection, there is better effectiveness of the ventilation, in other words, the ability to remove contaminants from the environment becomes comparatively higher compared to MV, because the air passes by the occupants and carries contaminants to exhaustion through the roof. Another advantage is to allow the UFAD temperatures higher insufflation, since the air is blown close to the occupant, providing lower energy expenditure (Marè, 2012).

There are many concerns when choosing UFAD even in new projects implementation depends on the type of occupation, stratification of temperature, greater sense of airflow for having the need to install diffusers, greater control in the air dehumidification, special care in location of the diffusers installation to be avoided the feeling of cold feet, among others.

1.1 Current situation of the aircraft E170

Through market research, airlines, companies and passengers, it is known that the E170 aircraft is one of the most sold by the manufacturer, because it is the most sought for domestic flights in Brazil and abroad, and also the most undergoes maintenance on Embraer, its industry of origin, both which are in Brazil as those sold abroad.

During the Brazilian high season, where the number of domestic flights increased in the same direction walks dissatisfaction and complaints from passengers during the flight, among them are the proximity of the seats "pitch" and thermal discomfort. A special feature of this aircraft are the noises, higher than the others. As the seats are very close to each other, long trips can harm the circulatory system causing tissue gangrene and cerebral hypoxia. Already in low season what prevails are commercial flights accompanied often by patients who require specialized care found only in hospitals in the Brazilian capital, so everyone's health is compromised since the MV renews the air, but returns mingling with the contaminated air of the cabin, favoring the spread of pathogens. Fig. 1 shows the importance of environmental quality inside the aircraft.

The physical model heat balance between man and the environment, through which the heat generated by the human body for the execution of activities must be dissipated in equal proportion to the environment, so that there is neither accumulation nor excessive loss heat inside the body (Moraes, 2009), a condition which passengers of commercial flights both need to

quietly focus and arrive at your destination with everything ready for business.

During market research it was found that in the air conditioning system reservoir is 35% of contaminated air and congested, not to mix with 65% of clean air, causing significant loss in return air to the system. This problem is identified in several planes in general.

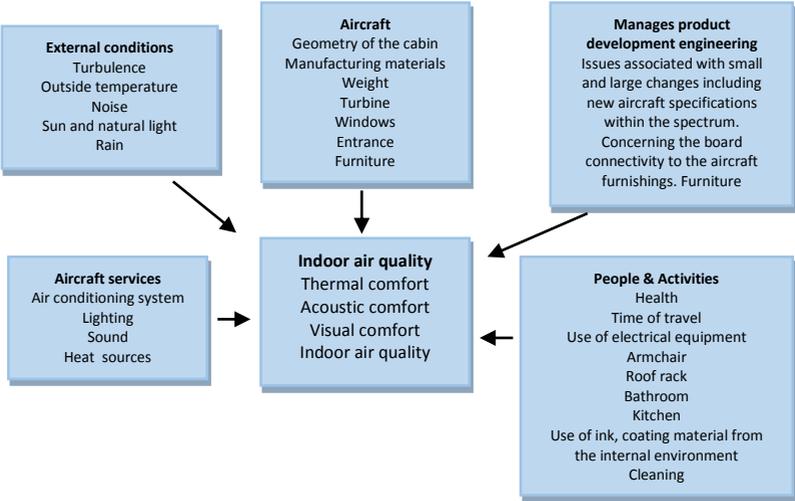


Fig. 1 Importance of environmental quality inside aircraft

2. Objective

This proposal is aimed at the E170 model manufactured by Embraer, but can easily be directed to all commercial aircraft.

3. Methodology

Applying several different ways in an attempt to improve by researchers and still fails it may be time to reverse logic, that is, to manipulate the aircraft design to further manipulate the parameters.

This project presents an innovation in the way of designing the plane starting from the remodeling of the internal environment to modify the parameters and try to keep the temperature and relative air velocity, mean radiant temperature, relative humidity, thermal resistance of clothing and metabolic rate at optimum levels to ensure thermal comfort and clean air to the passengers. The projects of the pressurization ducts and air conditioning will be refurbished avoiding folds and contours of pipelines that may impair air circulation and send oil to the air conditioning system.

Fig. 2 shows the typical pressurization and air conditioning system.

Most aircraft have the same problems in adapting between furniture, air conditioning system and passenger. Directing such problems E170 for the solution, can change the layout of the seats and in the air circuit, can provide high benefits to all occupants of the aircraft.

Passengers complain about dryness of the air into the cabin as the cause of dry eyes, nose, throat and skin, and people suffering from respiratory diseases are the most damaged during cruise.

On the heterogeneity of air in the air conditioning system reservoir, physical and chemical aspects need to be thoroughly studied and evaluated, because these are two areas of extreme complexity. In addition, part of the problem may be in determining the air ducts made during the design of the aircraft. Fig. 3 shows the purpose of this article.

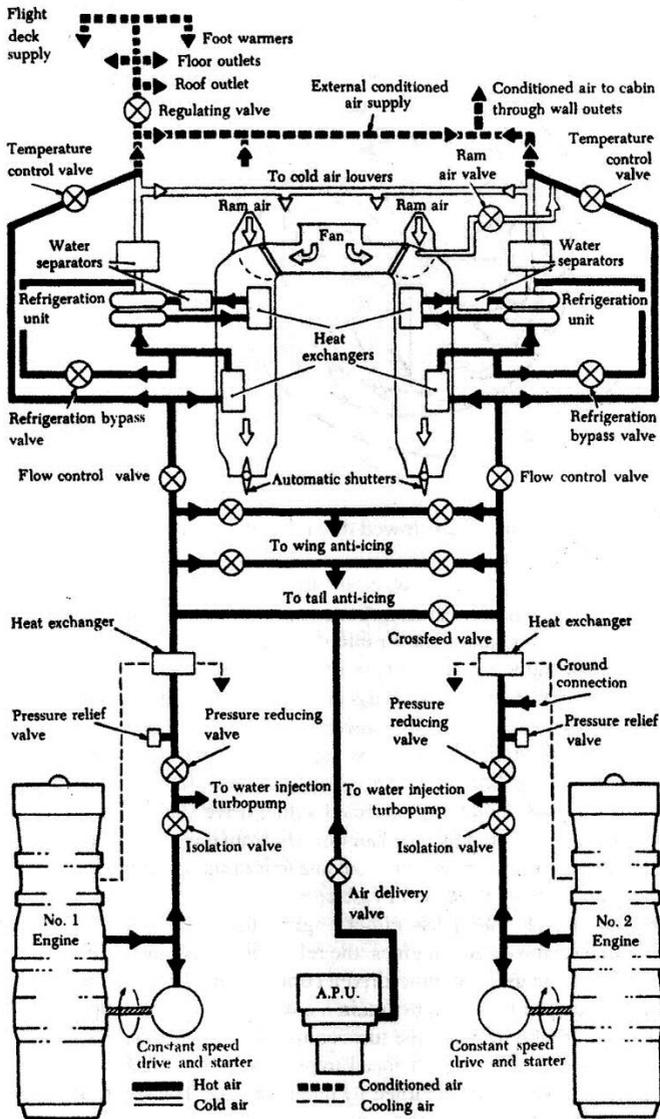


Fig. 2 Typical pressurization and air conditioning system (Font: Lombardo, 1993).

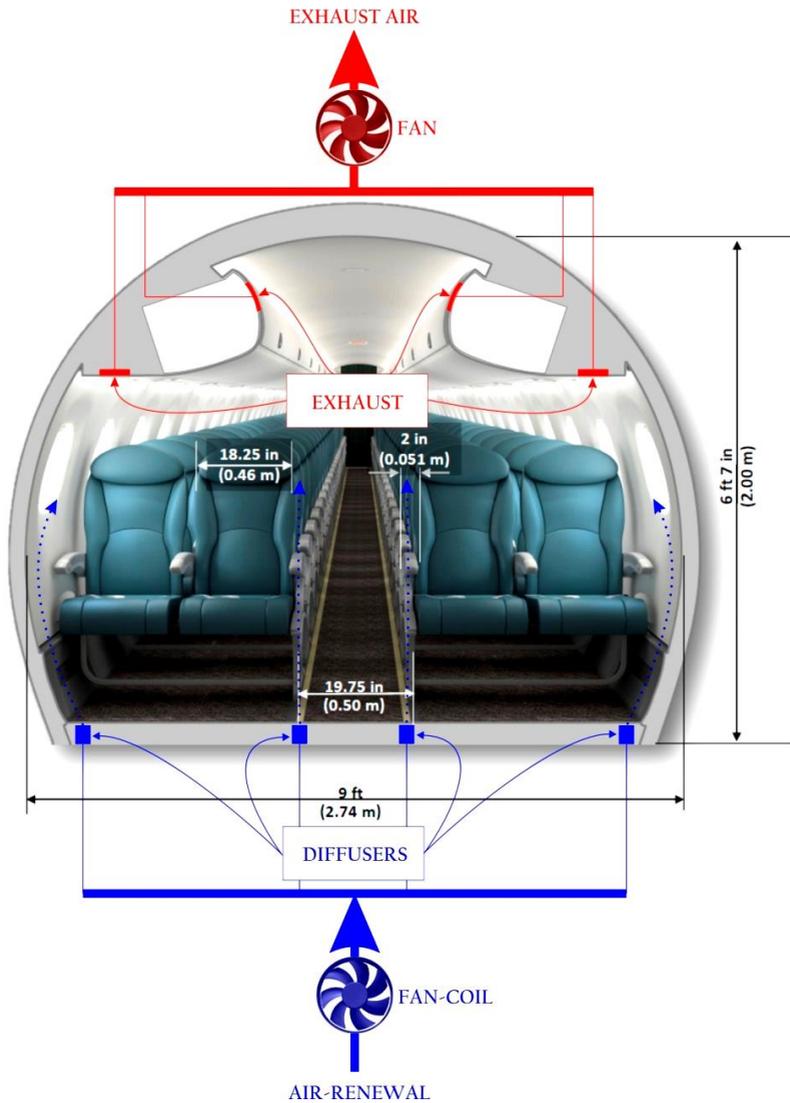


Fig. 3 Proposal of this article.

4. Analysis of the results

It is seen from Figure 3 that both hoods as diffusers take aspects of personal ventilation (PV), since the microclimate formation for each passenger is made possible because both the return as the air outlet is near the target occupant.

It was found that this proposal may help to increase the relative humidity at strategic points of the aircraft without injury to aircraft equipment and bringing well-being to the passenger.

5. Conclusion

Made the changes proposed by this article, along with market research that shows the importance of environmental quality inside the aircraft, the proposed circuit air UFAD and PV can provide personalized thermal comfort, a path to be solved existing problem in the mix of the air in the air conditioning system reservoir, reducing the spread of pathogens, increased humidity and finally begin to future changes beginning with the aircraft design, where all ideas can be tested beforehand in specific software like for example, CFD module within CATIA and then use the parameters Fanger, which are widely accepted and used by the current aircraft industry.

6. Future works

CFD analysis module within CATIA software and Fanger method for reshaping the internal layout of the aircraft and remodeling of the air conditioning duct system.

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