Investigation of the Cooling Load of Airbus A330 for the Pre-Conditioned Air (PCA) Unit System Design

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Abstract:

Pre-Conditioned Air (PCA) units are specialized air conditioning systems designed to regulate the temperature and humidity inside an aircraft when its onboard air conditioning is inactive, typically while the aircraft is on the ground. These units are crucial for maintaining passenger comfort and protecting sensitive onboard electronics, particularly during boarding, disembarking, and other ground operations. PCA units supply fresh, conditioned air to the aircraft, ensuring optimal cabin conditions regardless of external weather.

This study focuses on the energy analysis of aircraft cabins to determine the necessary cooling demands required for maintaining optimal onboard conditions. By evaluating heat loads, passenger occupancy, external weather conditions, and heat transfer mechanisms, the research aims to establish precise cooling requirements for different aircraft types. These findings will form the basis for the design of an efficient Pre-Conditioned Air (PCA) unit system tailored to meet the specific cooling needs of various aircraft.

Future work will further analyze electric-driven PCA units to optimize their performance and cost-effectiveness. This study provides a structured methodology for cooling load analysis in aircraft cabins, ensuring energy-efficient and effective air conditioning solutions on the ground.

The findings will help decision-makers optimize the operation of PCA units, ensuring both energy efficiency and cost-effectiveness in maintaining aircraft cabin conditions.

Keywords:

PCA, Air Condition, Aircraft, Apron, Optimization, Thermal Analysis, Heat Analysis, Cooling.