

ME 1.01 – Quiet Cooling System for Semi-Open Air Sport Simulator Bays

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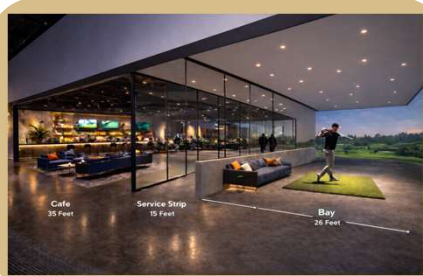
Product Description and Objective

Challenge: Combat elevated temperatures in semi-open sports simulator bays that negatively impact customer comfort.

Objective: Engineer a system that maintains a comfortable temperature (76-80°F) during peak outdoor temperatures.

Product: The Quiet Cooling System (QCS) is an unobtrusive, hybrid climate-controlled system specifically designed for semi-open recreational environments.

Application Environment



Stakeholders & Key Customer Needs

Through communication with stakeholders, 28 distinct needs were identified. Stakeholders and key customer needs are highlighted below:

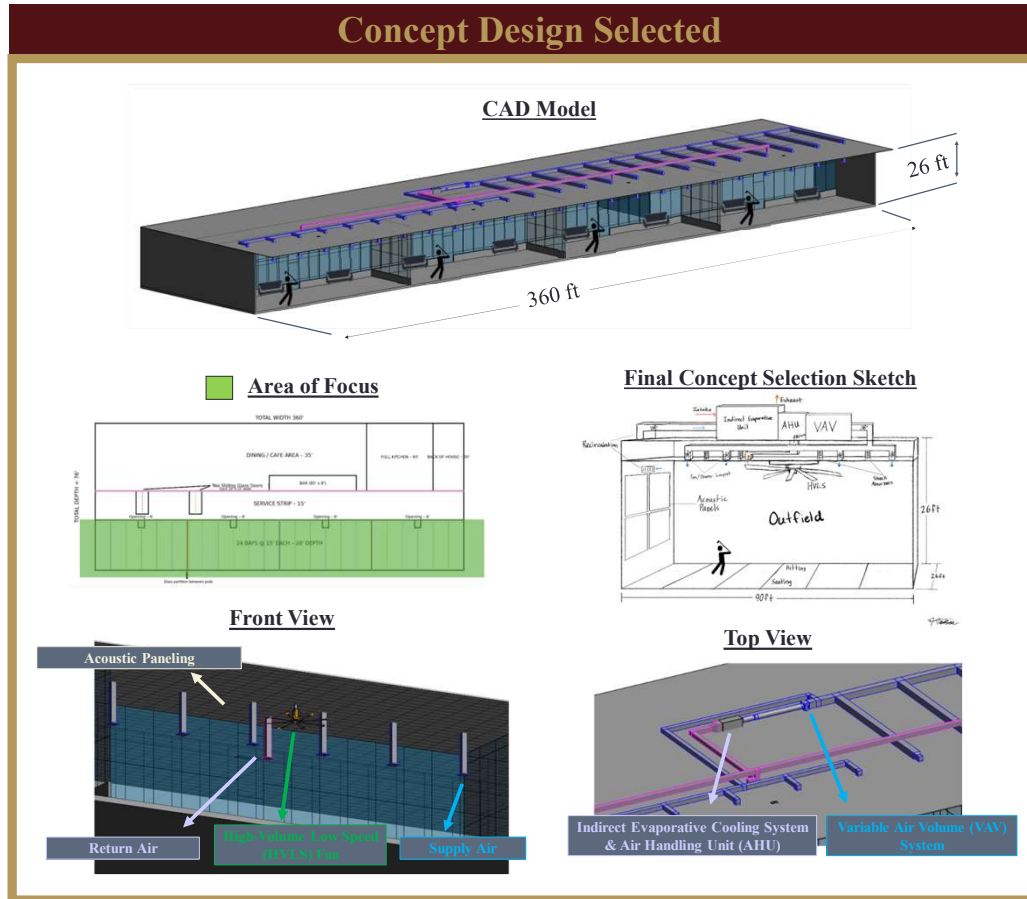
Stakeholders

- The Business
- Clients of The Business
- Investors
- Service Technicians
- HVAC Equipment Manufacturers
- Regulatory Bodies (Cities/Municipalities)

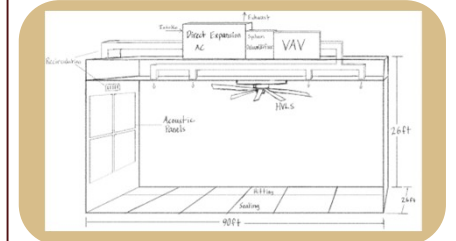
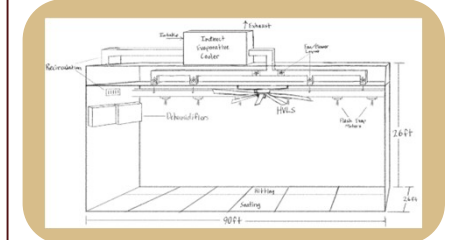
Key Customer Needs

- Provides a comfortable, controlled climate
- Aesthetically pleasing and unobtrusive
- Reliable and requires minimal maintenance
- Easy to operate
- Economically viable and efficient

Concept Design Selected



Other Concepts Considered



Key Benefits

- **Indirect Evaporative Unit:** An indirect evaporative unit provides superior cooling without adding moisture into the space
- **Air Handler Unit:** An AHU is used to manage the humidity in the space
- **Variable Air Volume Unit:** A VAV ensures that air is delivered to specific locations where cooling is needed
- **High-Volume Low Speed Fan (HVLS):** HVLS fans distribute air evenly across the bay and provide an enhanced "perceived cooling" effect
- **Acoustic Paneling:** Acoustic paneling helps to reduce noise within the bays
- **Shock Absorbers:** Duct shock absorbers reduce noise caused by vibration within the ducts
- **Recirculation System:** A recirculation system reuses cooler exhaust air from the space to improve energy efficiency within the system
- **Advanced Fan/Blower Layout:** An advanced layout of blowers within the ducts helps to reduce aerodynamic noise entering the space

Next Steps

- **Component Selection & Sourcing:** Select commercial components, including specific HVLS fans, AHUs, and indirect evaporative coolers
- **System Level CAD:** Update our current CAD model with the exact dimensions based on the selected commercial components
- **CFD Simulation:** Validate airflow distribution and cooling capacity using Computational Fluid Dynamics (CFD)

Critical Subproblems

Controlling the Temperature of an Open-Air Environment



Managing Mechanical and Aerodynamic Noise



Effective Air Distribution



Managing Humidity and Condensation Buildup



Minimize Energy Consumption

