

# Window Testing Apparatus

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## Purpose

- The purpose of this project was to design a testing apparatus that could measure the heat transfer across a polymer window insert.

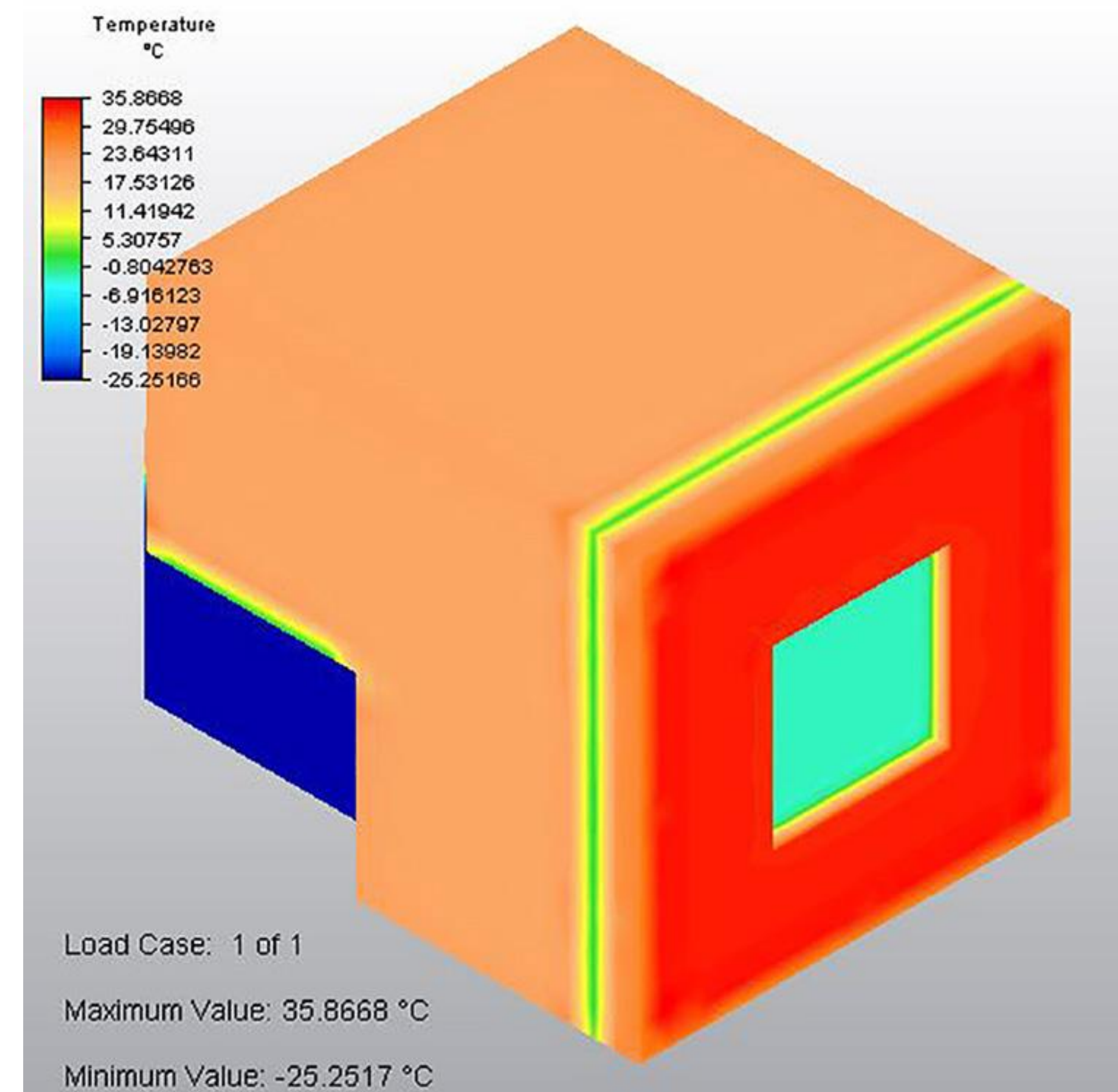
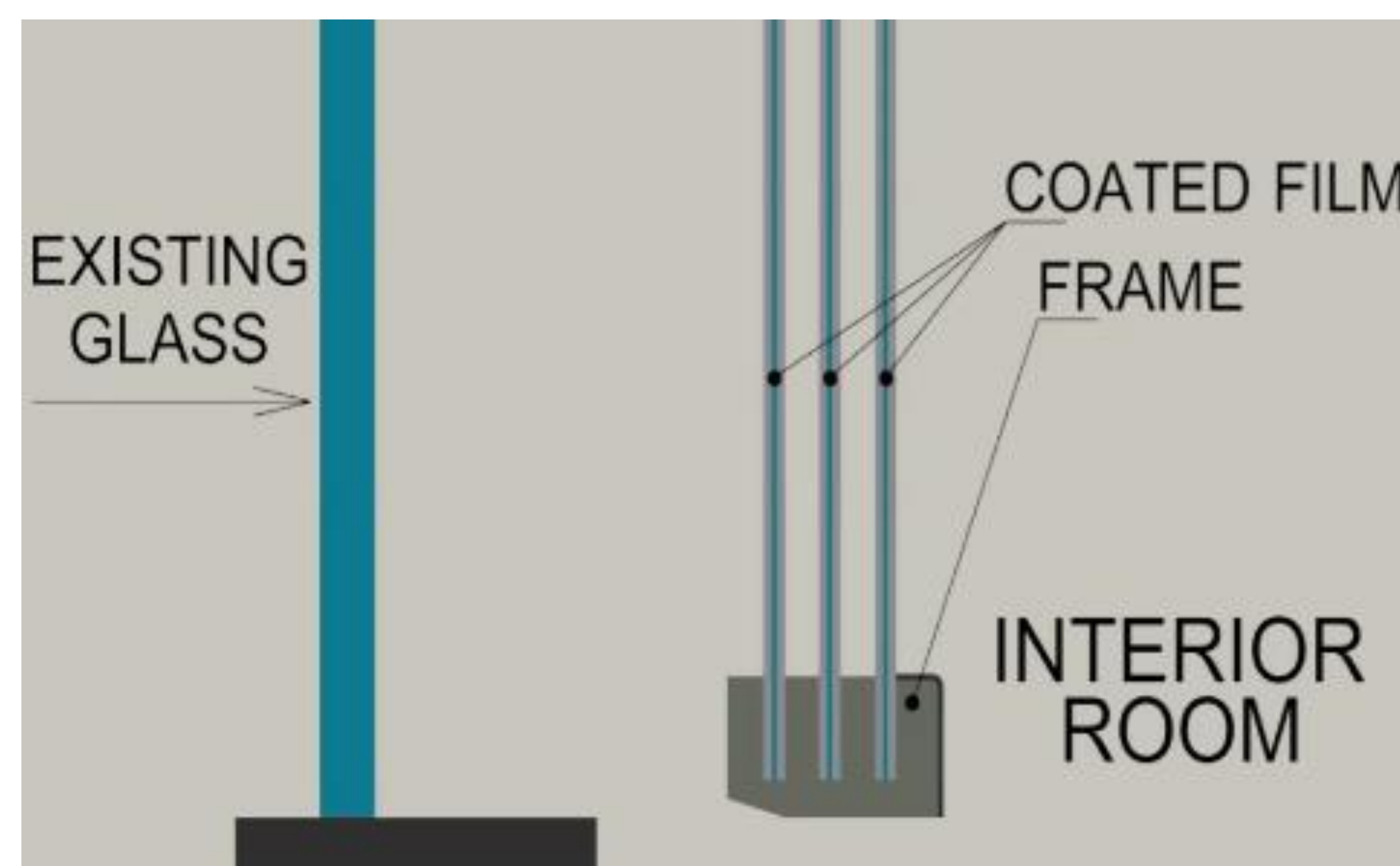
## Background

- In the 1970's it was thought that nuclear power would make electricity very inexpensive. As a result, little consideration was given to heating and cooling costs in large industrial buildings. Today, there is a great need for an inexpensive fix to these inefficient industrial windows. We believe that these window inserts will be both inexpensive and effective.

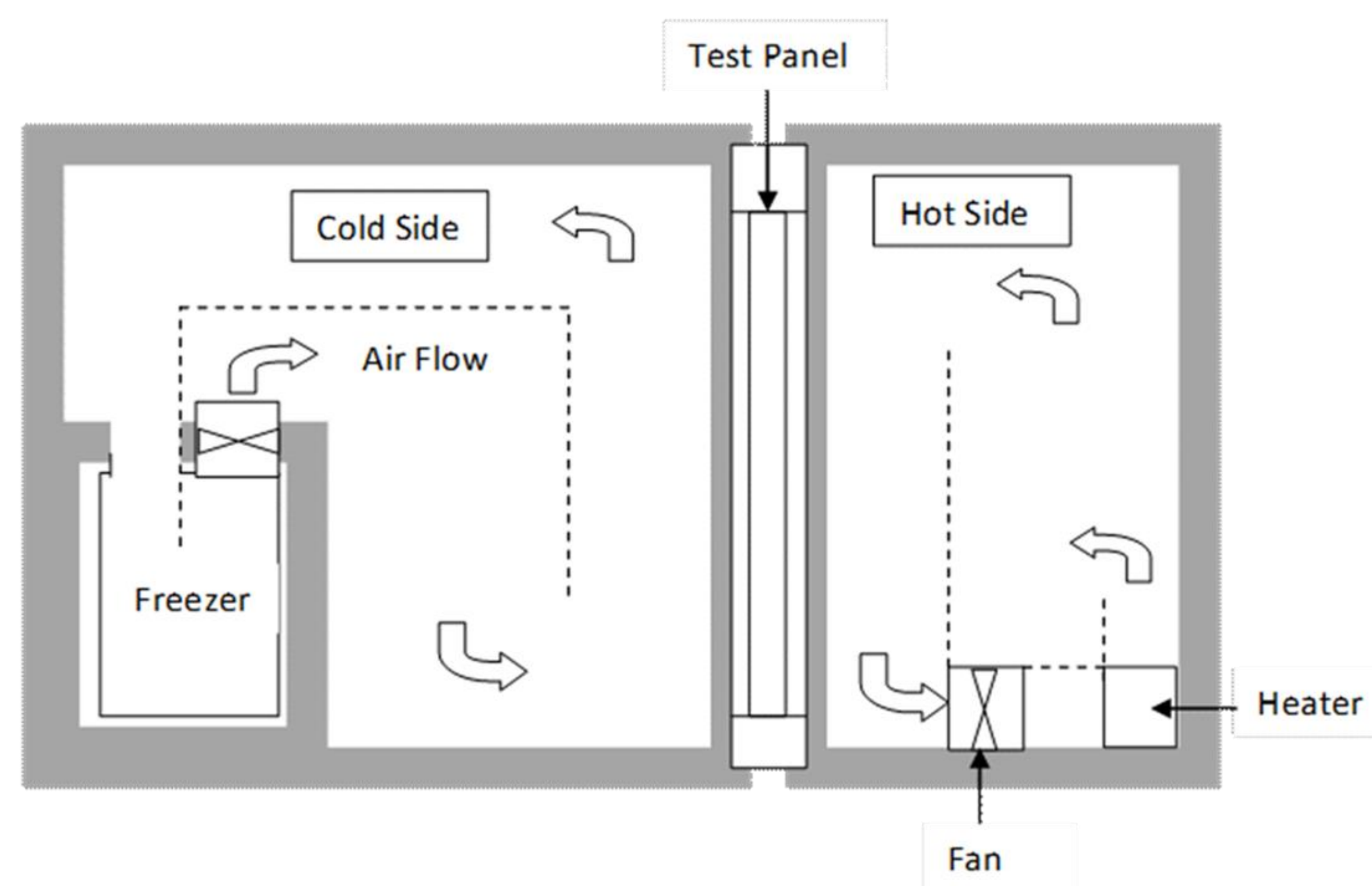
## Project Overview

- We renovated existing cold and hot boxes which were designed by former Calvin engineering students.
- We had to find a way to get the cold side to zero degrees Fahrenheit.
- We had to develop a repeatable process for heating the hot side to exactly the right temperature.

The Image below is a depiction of how the window insert (coated film frame) will work. Several specially coated layers of thin plastic held together by a small frame will fit on the inside of the window and impede heat loss.

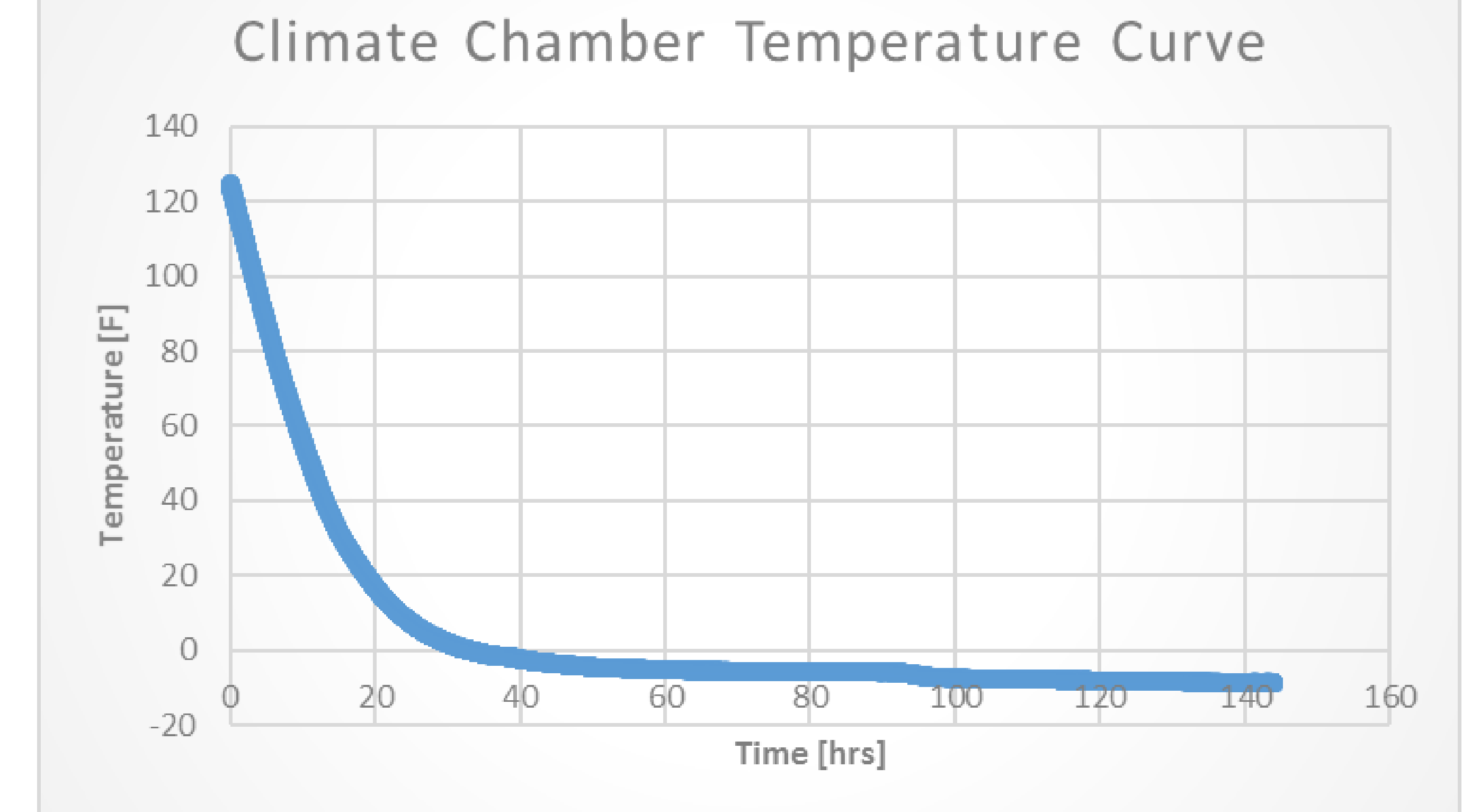


- The image above is thermal model that estimates the temperature of the cold box based on the geometry and conductivity of the materials. It was generated using Autodesk Simulation Mechanical, which uses FEA to compute heat transfer.



- The image above is a side view of the window testing apparatus. It shows how air currents flow within the box. Controlling wind speeds is necessary to simulate outdoor conditions on cold, windy days.

## Time to Cool



- The graph above shows the time it takes to cool the climate chamber (cold box) to 0 [F]. As seen, it takes about 36 hours. However, the coldest temperature isn't reached until around 100 hours.

## Meet the Team



From left to right: Jonathan Sager, Daniel Wharton, Rich De Jong, Ren Tubergen.