# Team 512: Temperature-Sensitive Medication Storage for Natural Disasters

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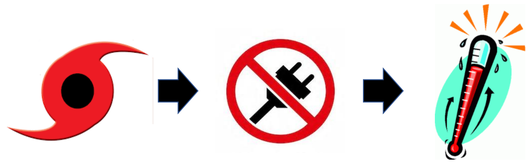
#ENGINEERING SERVES

## Problem



- Following a hurricane event, loss of grid power results in an inability to keep temperature-sensitive medications cool by conventional methods.
- Spikes in medical mortality rates from such events have been recorded in recent storms.

## Theory

- Analyze heat transfer rate via surfaces by adding resistances from walls and convection

$$\dot{Q} = \frac{T_{\infty,1} - T_{\infty,2}}{R_{total}}$$

$$R_{total} = R_{conv,1} + R_{wall,1} + R_{wall,2} + R_{wall,3} + R_{conv,2}$$

- Gather data from TEC to determine cooling rate
- Determine heat transfer rate from TEC via fins

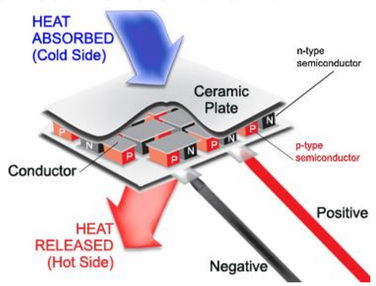
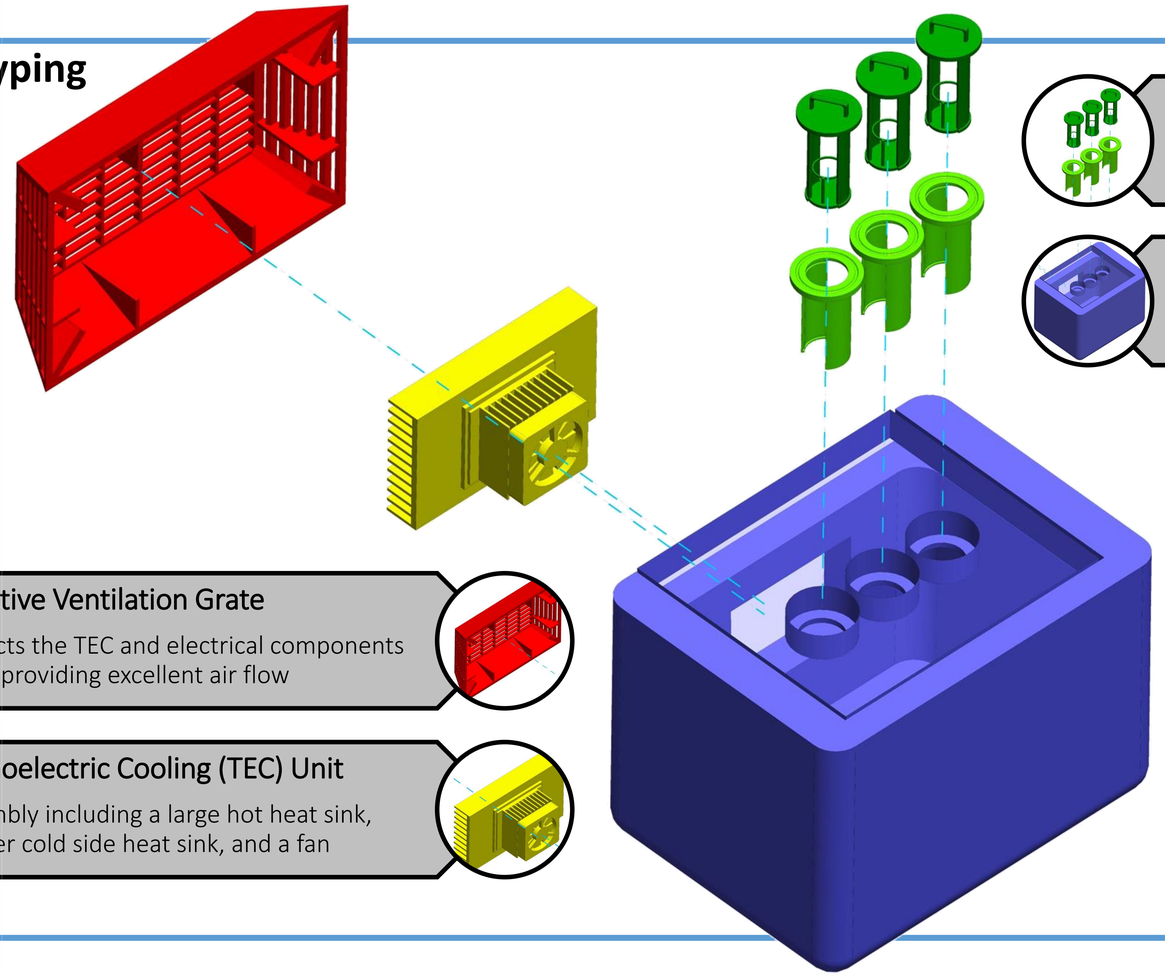



Diagram of Thermal Module Function

## Prototyping



**Locking Cylinders**

- Protects medication while an air tight seal prevents cold air from escaping

**Cooler**

- Store-bought cooler with added insulation to improve performance

**Protective Ventilation Grate**

- Protects the TEC and electrical components while providing excellent air flow

**Thermoelectric Cooling (TEC) Unit**

- Assembly including a large hot heat sink, smaller cold side heat sink, and a fan

**Operating Temperature Range:**

3.5 - 6°C

**Container Cooling Time:**

<= 15 minutes

## Testing

- The initial tests, shown in the figures to the right, represent the heat transfer rate due to free convection for the TEC system. The first plot shows the heat transfer rate as a function of the number of batteries (or current), while the second is a function of the number of modules.
- The next step is to analyze the heat transfer rate due to forced convection from a DC fan, and compare the energy required.