



# AmbFridge Ambulance Refrigeration System

## Arctic Ambulance Team

Tessa Kuykendall<sup>1</sup>, Theresa Ring<sup>2</sup>, Stacy Tsang<sup>2</sup>, Jon Allison<sup>2</sup>

tessa@rice.edu, tring@rice.edu, stsang@rice.edu, jallison@rice.edu

<sup>1</sup>Department of Bioengineering, <sup>2</sup>Department of Mechanical Engineering, Rice University, Houston, Texas



## Mission Statement

Develop a low-power refrigeration device to be used in emergency response vehicles.

The AmbFridge refrigeration system is designed to hold up to 2 liters of saline solution intended for the administration of therapeutic hypothermia. Therapeutic hypothermia is the intentional cooling of the core body temperature in order to slow the body's metabolism. The most common recipients of this treatment, in which the cold saline is injected into the body, are victims of heart attack and brain trauma. Once administered, therapeutic hypothermia increases the chance of surviving a heart attack by 14% and decreases the likelihood of brain trauma by 16%. **Early administration is critical for success of this treatment.** Therefore, once installed in the ambulance, the AmbFridge allows emergency medical technicians (EMTs) to have cold saline available for immediate injection into the patient.

Research has continued to show that early treatment is critical for success. The Houston Fire Department (HFD), as well as emergency medical services around the United States, are looking to implement this procedure and need a simple refrigeration system in which they can keep the saline solutions cool. **With 106 ambulances in HFD and 40,000 in the US, there is a large demand for the AmbFridge Ambulance Refrigeration System.**

## Requirements

The AmbFridge Ambulance Refrigeration System must:

- Sustain the temperature of 2L of saline between 0°C-1.1°C
- Be a compact size no larger than 9"L x 10"W x 30"H
- Maintain the cold saline temperature without power sources for 4 hours during emergency medical services training
- Be compatible with 12V DC or 240V AC power source and no more than 15 amps
- Meet ambulance safety requirements, including no toxic substances or sharp objects (a fan guard is required)
- Be operator independent
- Be rugged enough to sustain daily ambulance activity

## AmbFridge Design

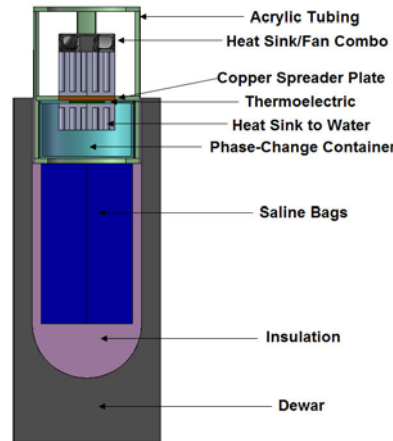


Fig. 3. A cross section view of the AmbFridge showing the components of the whole device.

### How it works

- Thermoelectric cooler (TEC) uses the Peltier effect to cool one side while heating the other
- "Cold sink" facilitates heat transfer from water to TEC
- Copper spreader plate and heat sink/fan assembly dissipate heat from water and generated from TEC
- Temperature controller regulates power supply to maintain proper temperature of refrigerator

### How it is used

- Saline bags are placed inside dewar (a large vacuum insulated thermos)
- Acrylic assembly holds all components of cooling system
  - Allows for easy removal and quick access to saline bags

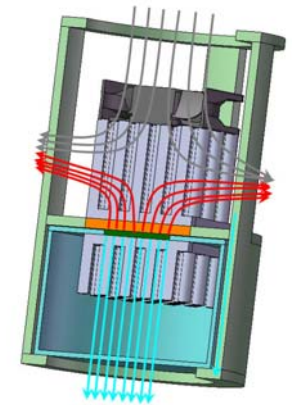


Fig. 4. Heat flow diagram for the cooling system. The cooling system of the device is supported inside an acrylic tube.

## Results of TEC Cooling System

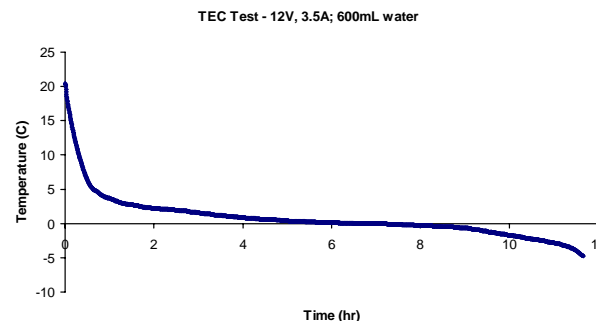


Fig.1. A cooling test was conducted to measure the time required to freeze 600 mL of water using the AmbFridge. **Data shows that the water froze after 7.5 hours.**

## Conclusion

- Current design meets all requirements set by HFD however it may be modified to be implemented in any emergency response vehicle
- Next phase is to test the design in an ambulance setting
- Future work may be done to develop a cheaper alternative by selecting a smaller, more efficient insulating container

### Acknowledgements

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