



April 2008

AmbFridge



“All 81 frontline transport units and all 25 ready reserve ambulances would need a refrigerator...Bottom line, if City Council members can be persuaded that the procedure will significantly save/improve constituent's lives, then the refrigerators will probably be approved for a 'reasonable' cost.”
—Sr. Captain Don Gray, HFD EMS

Team Members:

Jon Allison, Tessa Kuykendall, Theresa Ring, Stacy Tsang

Bioengineering Design Challenge

A novel therapeutic hypothermia treatment is being introduced for use in victims of heart attacks or other traumas. The new treatment is believed to assist in recovery from these traumas as it will reduce reperfusion of blood to vital organs, thus increasing the survival rate by 14%. Cold saline solution is injected into the patient to cool the body to 92°C and slow metabolism. The immediate application of this treatment is critical for survival and also minimizes the likelihood of nerve and brain damage. Consequently, the Houston Fire Department (HFD) has approached us with the challenge of designing a refrigeration system for an ambulance that can keep the IV fluid at 33°C even while no power is available. Thus, our challenge was to design a compact refrigerator that will cool the medicines to within a precise temperature range, and be able to run independent of an operator.

Appropriate Solution

The Arctic Ambulance team, consisting of Jon Allison, Tessa Kuykendall, Theresa Ring, and Stacy Tsang collaborated on this interdisciplinary project through enrollment in BIOE 451/452 and MECH 407/408. With help from mentors at Rice University, Dr. Maria Oden and Dr. David McStravick, as well as collaborators at the Houston Fire Department, Dr. David Persse, Chief Thomas Dowdy, and Sr. Captain Don Gray, we developed a refrigeration device to meet the needs of HFD. The refrigerator operates from the power supplied directly from an ambulance's generator and utilizes an insulating container and thermoelectric module to cool and maintain the temperature within the refrigerator. The design also incorporates a phase-change material that allows the refrigerator to hold low temperatures without the use of an external power supply for a period of up to four hours. The refrigerator also includes a temperature controller to maintain the required temperature range without intervention from an operator.

Current Status

We have developed our completed prototype which successfully met all of the design criteria. The prototype was tested with an ambulance and found to be compatible with the ambulance's limited space and power. The group has submitted paperwork to file a patent on the design. The project will receive additional funding to produce more prototypes and improvements will be made on the design so that it is more cost-efficient. HFD has expressed interest in installing a refrigerator into each of their 106 ambulances. Should the therapeutic hypothermia treatment continue to be successful, the refrigerator can expand to other markets and may be installed in the 40,000 ambulances in the United States.

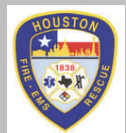


BIOENGINEERING DESIGN AT RICE



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