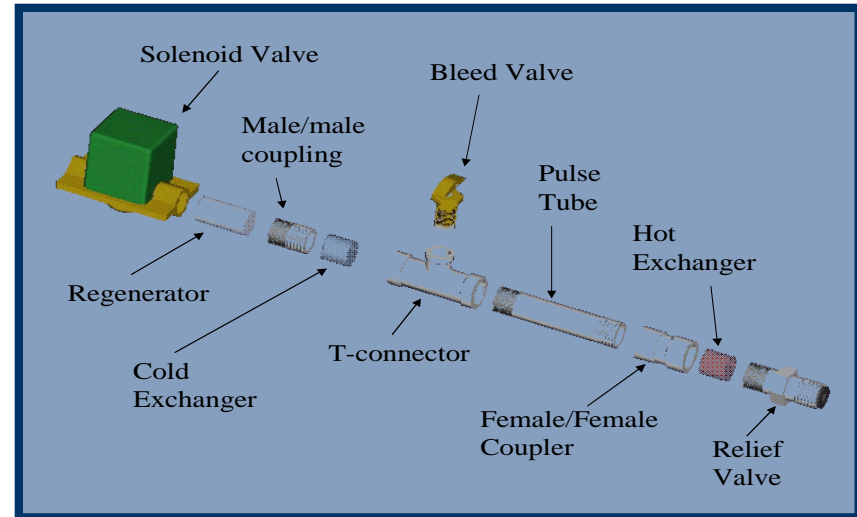
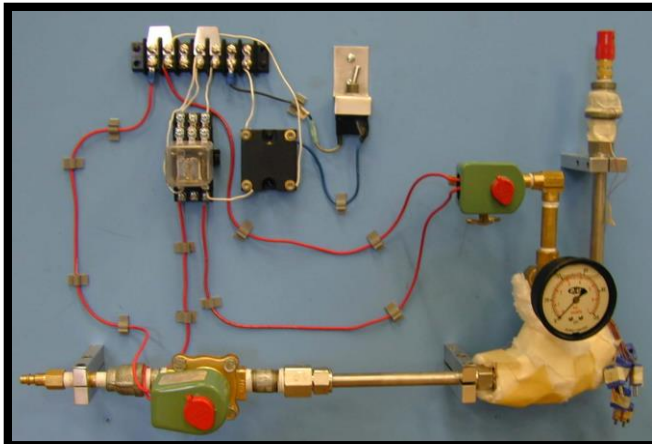


Pulse Tube Cooler

Team (L to R): Doug Schwab, Mark Eidelman, Adam Niblick, Nathan Landsiedel, and Atef Thabet



Simple Pulse Tube Design



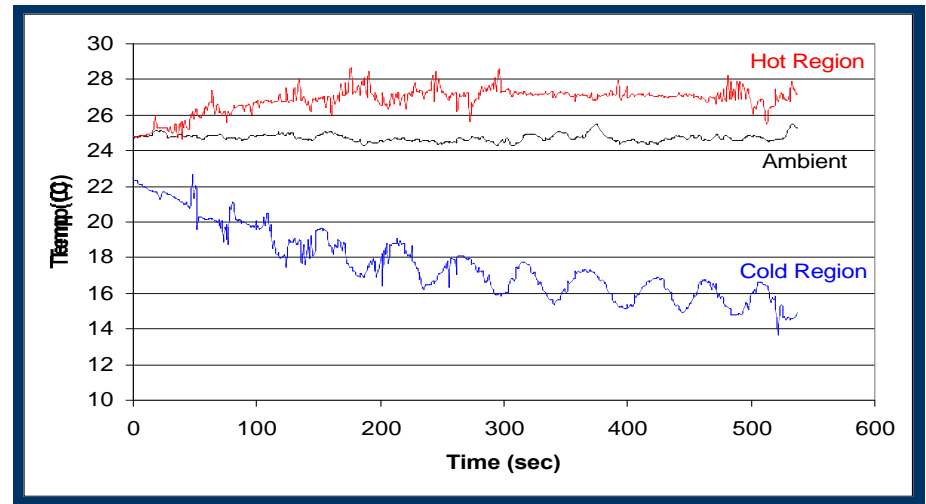
Prototype

Objectives

- ◆ Design thermal imager cooling system
- ◆ Prove viability of Pulse Tube Refrigeration
- ◆ Build pulse tube refrigerator at minimum cost and maximum efficiency

Pulse Tube Operation

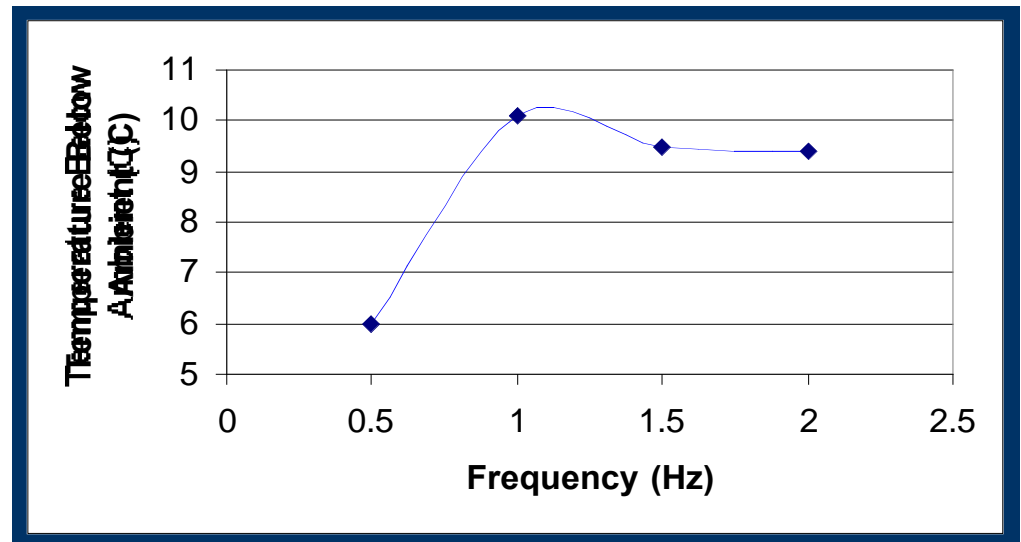
- ◆ Nitrogen at 100 psi supplied into primary solenoid valve
- ◆ Pressure allowed to build up while second solenoid valve is closed (gas compression)
- ◆ Pressure relief valve cracks open when pressure exceeds 100 psi
- ◆ Second solenoid valve opens and releases pressure (gas expansion)



Results for pulse tube with two solenoid valves operating out of phase at 1 Hz and 110 psi input pressure

Conclusions

- ◆ Total incurred cost: ~ \$110.
- ◆ Attained a 10 °C gradient below ambient temperature
- ◆ Maximum temperature occurs at a pulse frequency of 1 Hz.
- ◆ Larger supply pressure enhances cooling performance
- ◆ Adding second solenoid valve is key to achieving high cooling performance



Cold region temperature versus pulse frequency