High Heat Flux Test Bed

AFRL & UCI Collaboration

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UCI Samueli School of Engineering

Background

- Current technological advances in electronic components will continue to produce higher power densities up to $1400 W/cm^2$ by 2020
- This power production requires a corresponding power dissipation in the form of various thermal management systems
- Paramount to the development of these thermal management systems is the creation of adequate and dedicated testbeds
- The testbeds will act as agents of efficiency maximization and allow for appropriate progression in the desired directions

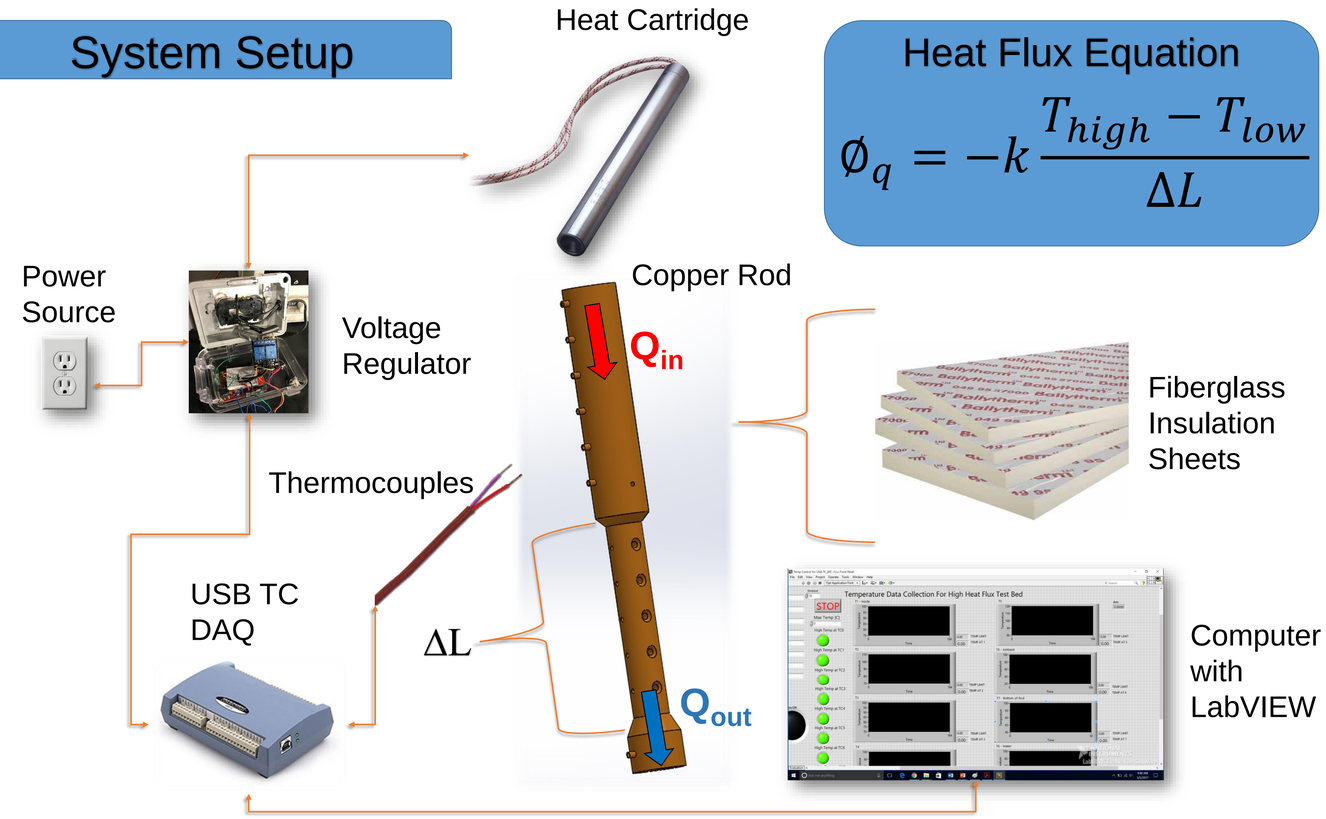
Goal & Objective

The primary goal of this project is to describe, develop and construct a test bed capable of providing an environment that can sufficiently withstand high heat loads and dense heat fluxes.

Team Structure

Name	Role
Matthew Hastings	Team Leader
Bao Tran	Power & Control
Lisheng Wang	Safety System & Control
David Baltazar	Thermal Modeler
Anthony Nguyen	Testing & Data

System Setup



Heat Flux Equation

$$\emptyset_q = -k\frac{T_{high} - T_{low}}{\Delta L}$$

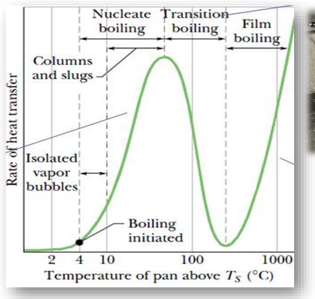
System Requirements

AFRL Requirements	UCI Design Compliance	Winter 2017
Thermal Source	Yes	Cartridge Heater
Thermal Sink	Yes	"Direct Vaporization" system
Heat Load: 500-2000W	Targeted for 100W	Up to ≈ 800W
Heat Flux: 500-2000W/cm^2	Targeted for 50-100W/cm^2	Up to ≈ 110W/cm^2
Safety System with shutdown power feature	Safety shutoff controlled by electronics	Voltage shutoff with relay
Data Acquisition Device	NI DAQ device with LabVIEW integration	USB-TC DAQ device
Mounting Frame	Yes	80/20 Structural Frame

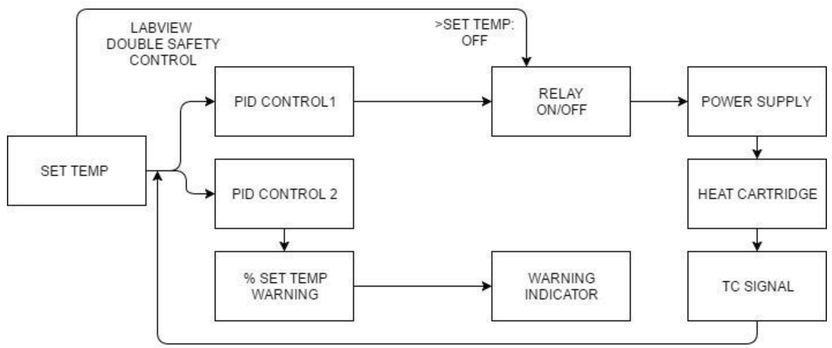
Current Thermal Sink

Direct Vaporization System

- Achieve nucleate boiling
- Trying to reach & maintain critical heat flux



Control System and Safety



Budget