Sponsor: UCI MAE Dept. /Air Force Research Laboratory

Schedule: Fall 2016 to Spring 2017

UCI MAE Faculty: Prof. J. C LaRue and Dr Khalid Rafique
AFRL Project Liaison: Mike Wilson

Prof, LaRue and Dr Rafique acquired from AFRL a senior design project. The first phase of the design was completed during academic year fall 2015 to spring 2016. The second phase starts in fall 2016 and will be completed in spring 2017. A new team will be formed at the start of fall 2016 quarter. Phase II will start by testing single rod Phase I built hardware. Using Phase I test data more complex design features will be added and tested. Following is a summary of High Heat Flux Test Bed project:

Objective

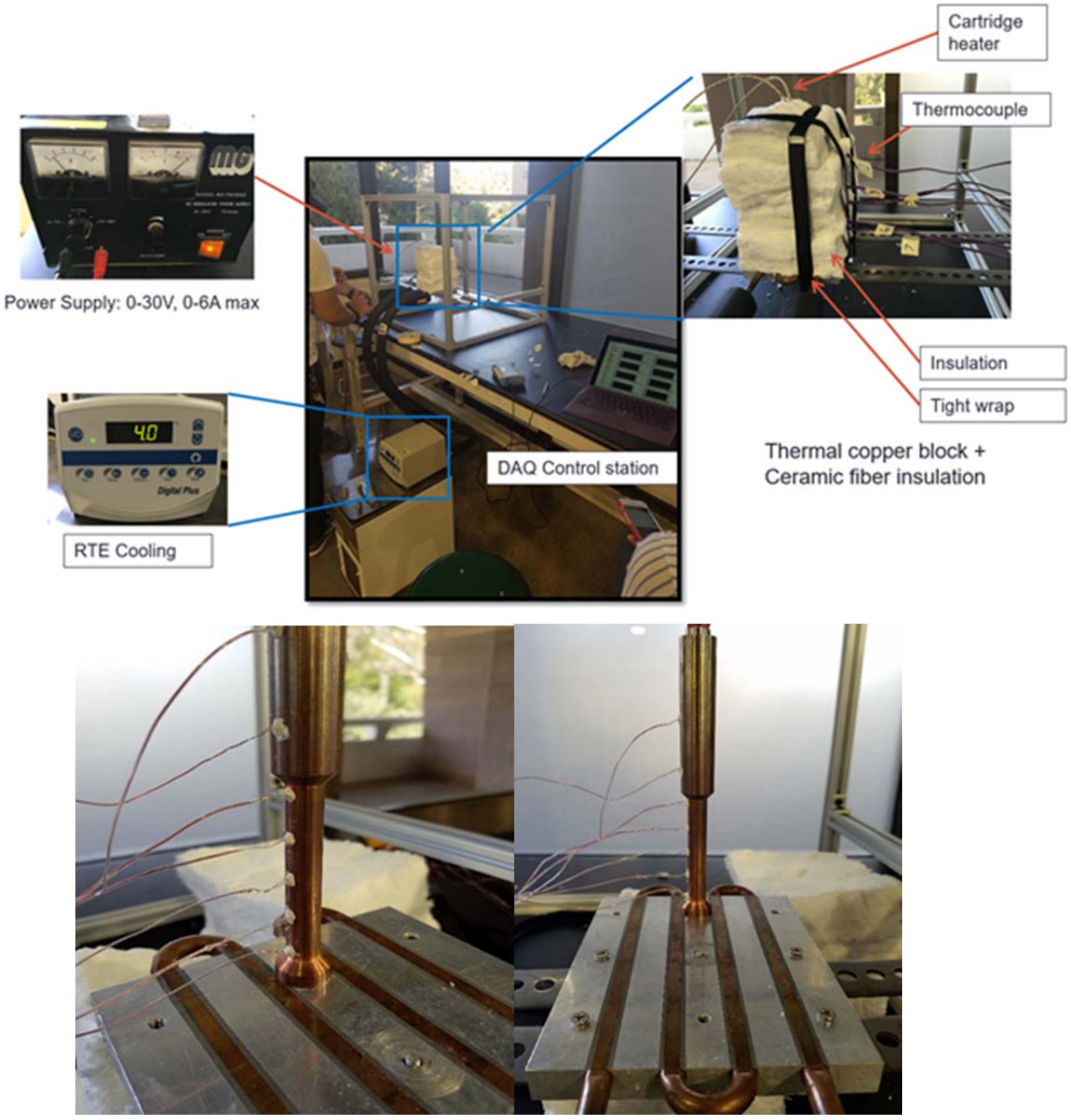
The primary objective of this project is to design, develop, and fabricate a testbed capable of producing and dissipating high heat fluxes/loads.

Description

This project includes the design, development, and fabrication of a high heat flux testbed for use in both ambient and vacuum environments. The testbed will be used for testing a wide-range of thermal control solutions

Safety System: Safety is of primary concern with this system. Thermal runaway conditions could lead to dangerous conditions. Because of this, a robust safety system consisting of multiple redundancies will be designed and developed.

- **Thermal source:** Heating units will be created to allow for large heat loads to be concentrated onto the small heating areas creating large heat fluxes. Heaters, powered by a DC power supply, will be sized and selected to provide these large heat loads/fluxes. Transient thermal modeling will be carried out to estimate the temperature rise in the case of failure so that the thermal response can be characterized.
- **Thermal sink:** Achieving low heat loads/fluxes can be achieved with commercial-off-the-shelf (COTS) products; however, these devices won't stand up to the cooling needs of next generation heat loads/fluxes. Because of this, state-of-the-art (SOTA) cooling technologies must be used
- **Data acquisition:** Heat loads and temperatures will be measured, monitored, and recorded using National Instruments CompactDAQ equipment.
- **Mounting Frame:** A modular and adjustable frame will be designed and developed to accommodate a wide-range of test scenarios (e.g. heating and cooling solutions). All materials will be vacuum compatible. 80/20 hardware (8020.net) provides a good option.
- **Interested students** should contact **Dr Khalid Rafique at krafique@uci.edu**



Current Single Rod Test Set-up

Requirements

	Designed	As-built Testbed
Environment:	Ambient and Vacuum	
Maximum Heat Load:	500 to 2,000 W	TBD (based on analysis)
Maximum Heat Flux:	2,000 W/cm^2	TBD (based on analysis)
Heating Area:	0.25 cm^2 to 1.00 cm^2	TBD (based on analysis)
Cooling Method:	SOTA	COTS
Safety Shutoff:	Provide multiple safety features (e.g. temperature dependent alarm and safety shutdown via GUI and thermal interlocks)	