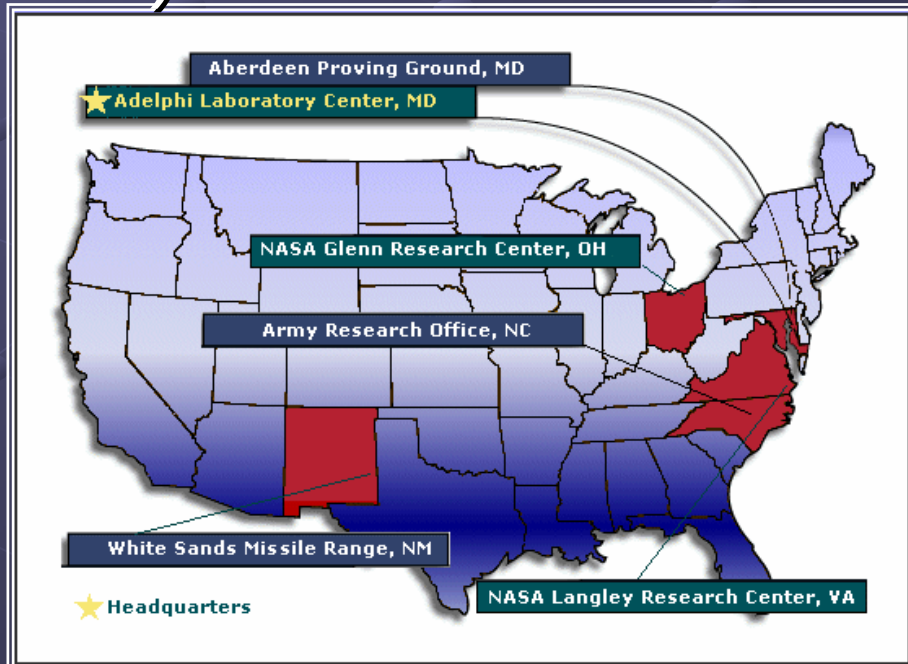
AIAD

SiC Device Characterization

Cadet Paul Bishop
Class of 2005

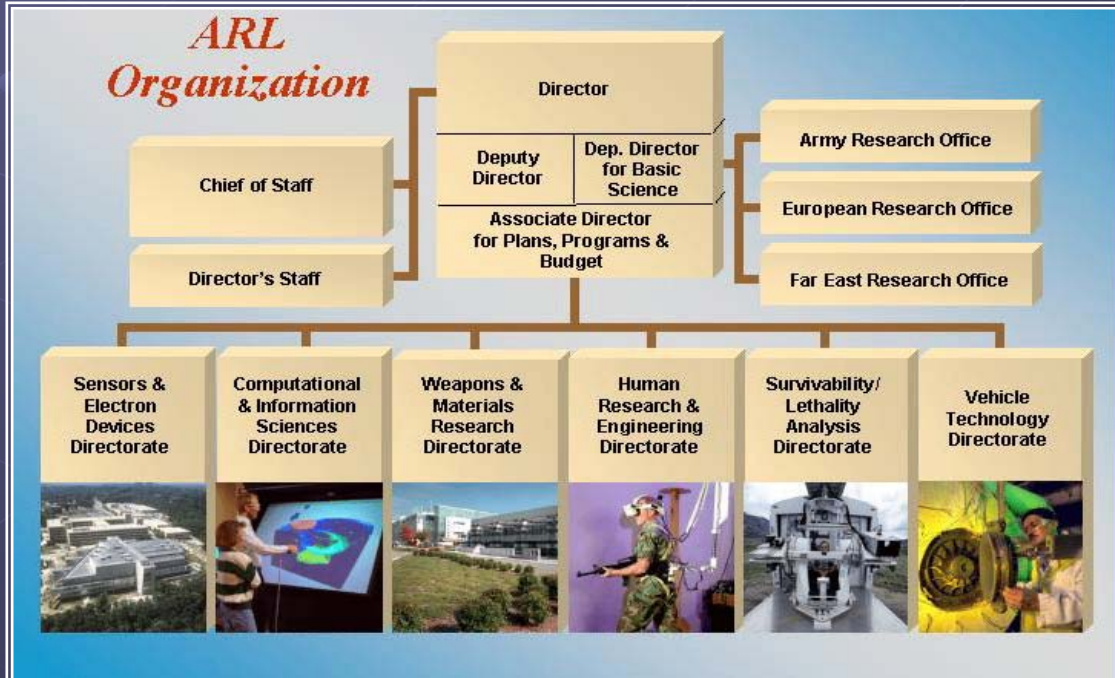
Agenda:

- Background
- Technology in progress
- Project
- After Action Review (AAR)
- Questions



Background

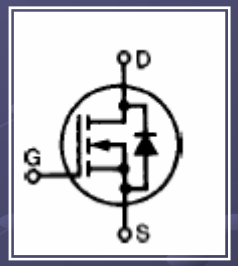
- Power Components Branch
- Power Switches Team
- Part of the Sensor, Electronic Device Division (SEDD)



Background Cont.

- Power
  - Components
  - Device Characterization
  - Circuits
  - Packaging
- Branch Goals
  - Pushing Power Density
  - Pushing Temperature
  - Testing Silicon Carbide (SiC) at higher temps and voltages
  - Devices with smaller footprints and lighter to improve logistics
  - To provide Protection, Mobility, Serviceability

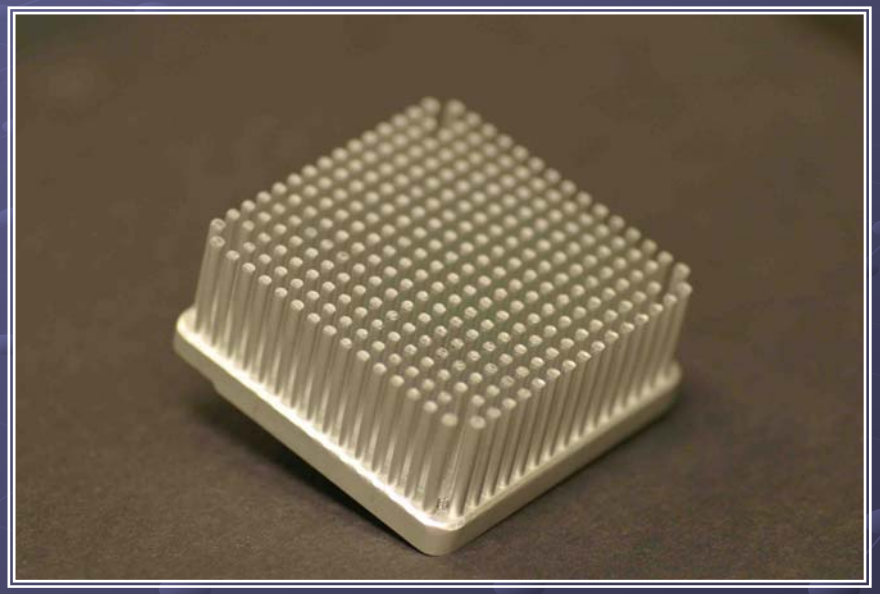
Current Research Areas



- Converters
- Inverters
- Switches
- New Packaging techniques for heat dissipation
- SiC diodes
- SiC Metal-Oxide Semiconductor Field-Effect Transistors (MOSFETs)
- SiC Junction Field-Effect Transistor (JFETs)
- SiC Bipolar Junction Transistors (BJTs)

Project

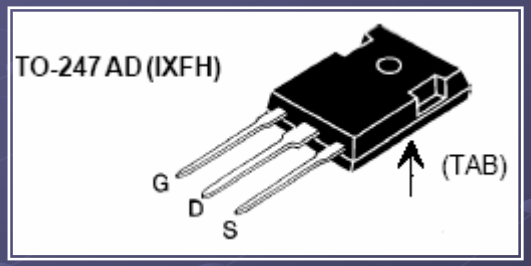
- Sponsor: Dr. Stephen Bayne
- Partnered with Dr. Tom Salem
- Experiment:
  - Testing the ability of a Thermshield pole-arrayed heat sink in drawing heat away from an IGBT or MOSFET at extreme operating ranges.

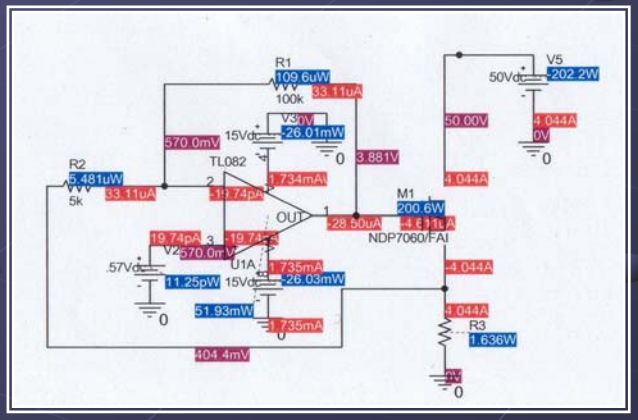


Thermshield TS-541123-HF

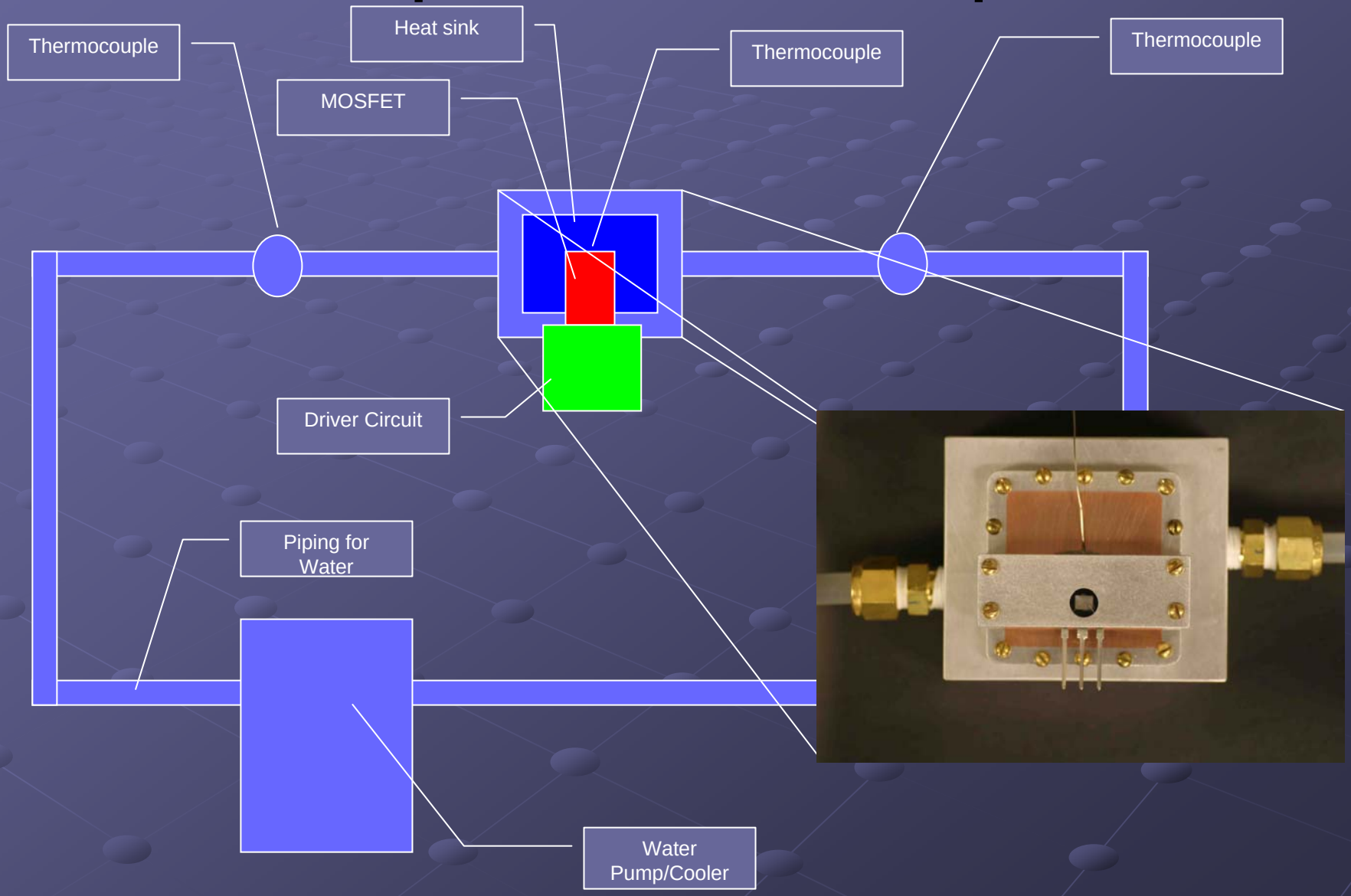
Project Cont.

- My tasks
  - Build Driver Circuits
  - Assisting in Experiment setup
  - Assist in testing the setup
- Skills and Knowledge Utilized
  - Fundamental EE
  - Excel
  - PSpice
  - Circuit Design
  - Circuit Building
  - EE302 Introduction to Electrical Engineering
  - EE362 Introduction to Electronics



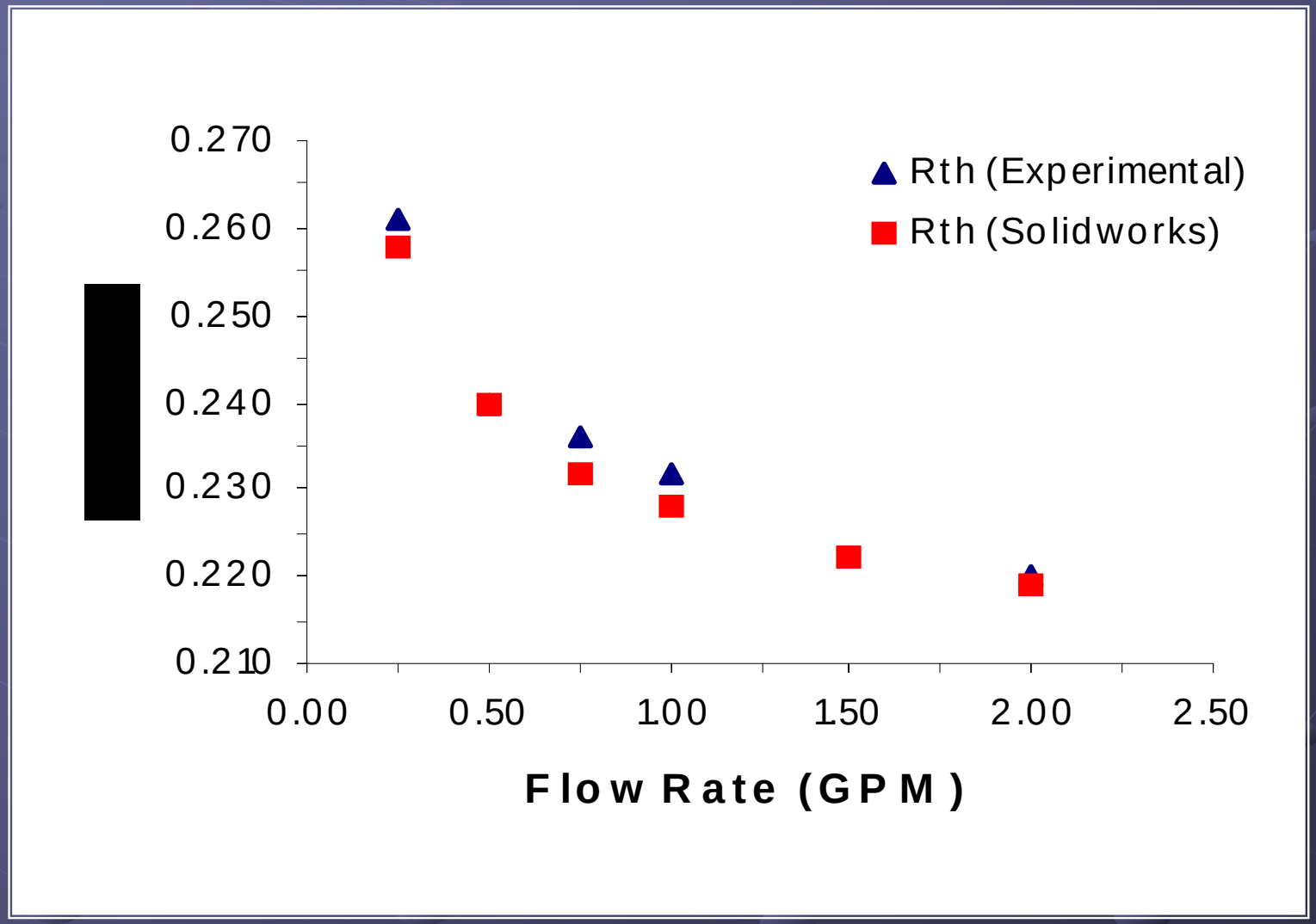


Experiment Setup



Data Plot

Thermal Resistance as a Function of Flow Rate



Experiment Outcome

- Gathered data will be used to further analyze the performance of the heat sink and compare it for use in specific system applications
- Heat sink may have possible applications for cooling MOSFETs or IGBTs in power converters or high power motor systems.

Lessons Learned

- Testing procedures
- Applicability of knowledge learned
- ARL’s mission
- ARL’s relationship with the ARMY

Gained Insight

- A better concept of what will be possible as the Army changes.
- Senior Design Project
- Army Officer

Special Thanks

- Dr. Ed Schaffer
- Dr. Stephan Bayne
- Dr. Tom Salem
- Dr. Wesley Tipton
- The Power Switches Team
- ARL

Sources

- Dr. Tom Salem
- ARL Homepage
- IXYS Corporation Website

Questions