Reserve Batteries

By CDT Nadig

Agenda

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- Types of Reserve Batteries
- Thermal
  - Test Setup
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- Liquid Reserve
  - Test Setup
  - Results
- Thanks
- Questions

What is a Reserve Battery?

- Battery designed to have a long shelf life usually around 20 years.
- Withstand extreme weather conditions
- Able to be “turned on” at a moment’s notice.
- Most common application is in Military Munitions. i.e. mortars, rockets, ect.
- One time use – not rechargeable.

Types of Reserve Batteries

- Thermal
- Liquid Reserve

Thermal

- Uses an internal heat source to melt solid electrolytes to a liquid form.
- Once in a liquid form, the electrolyte is able to mix with the cells to provide power.
- At ARL, we tested the battery used in the Excalibur rocket. (believed to not be meeting the minimum run times.)

Excalibur Reserve Battery Test

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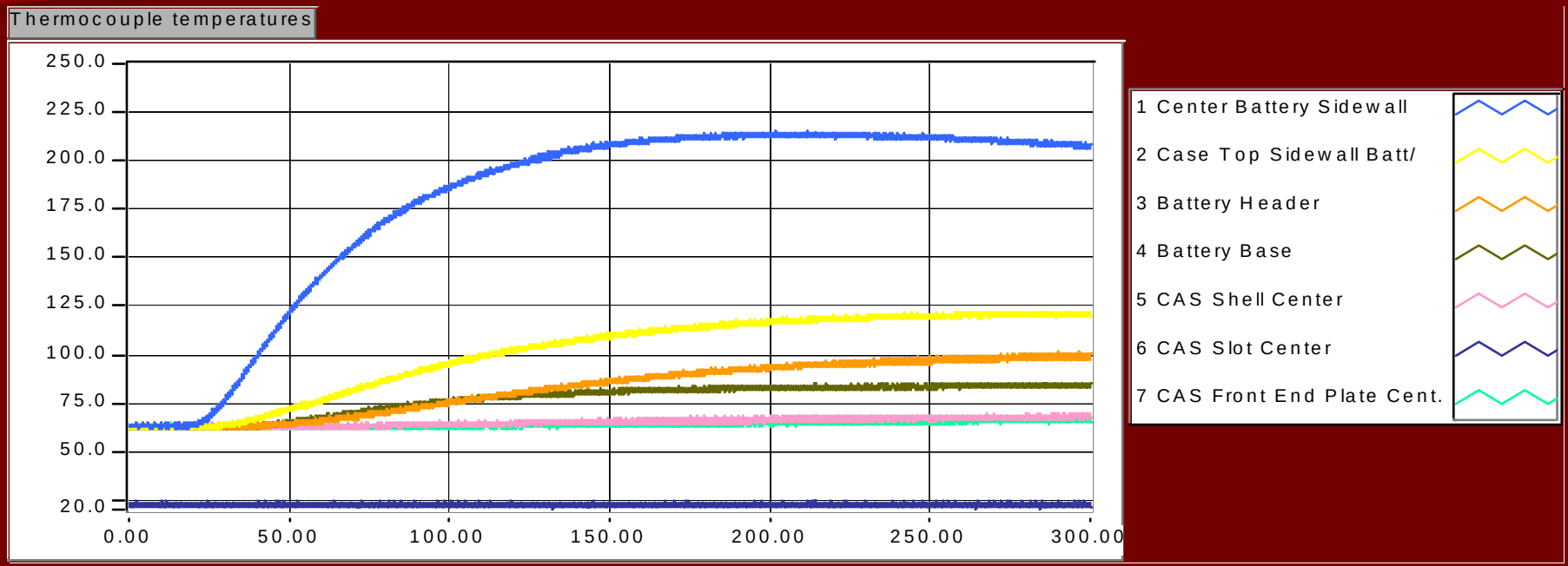
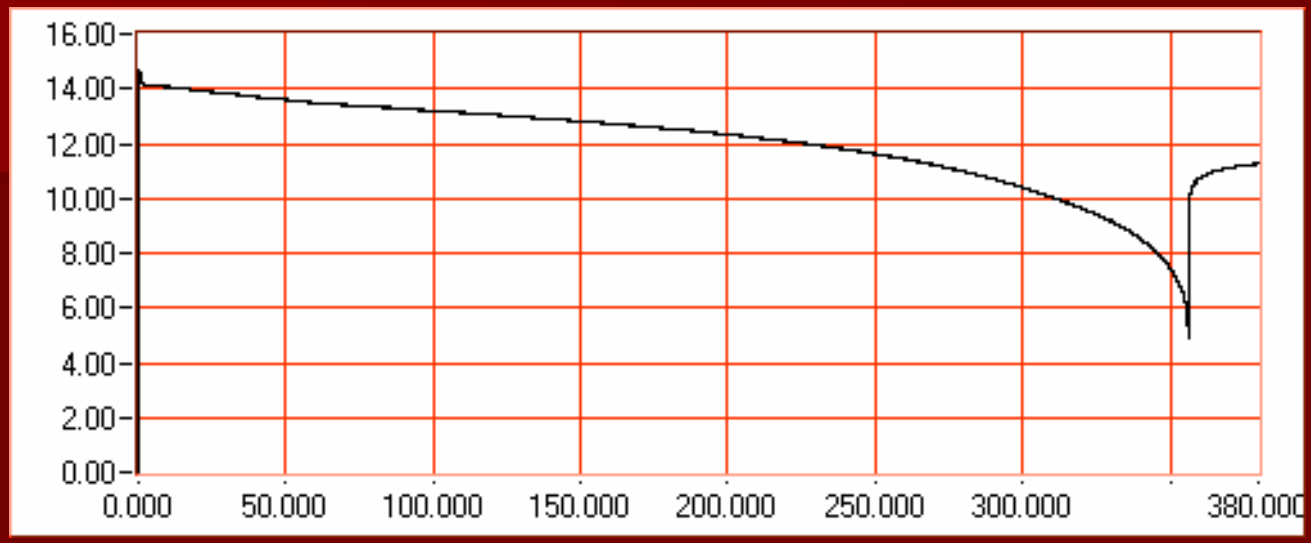
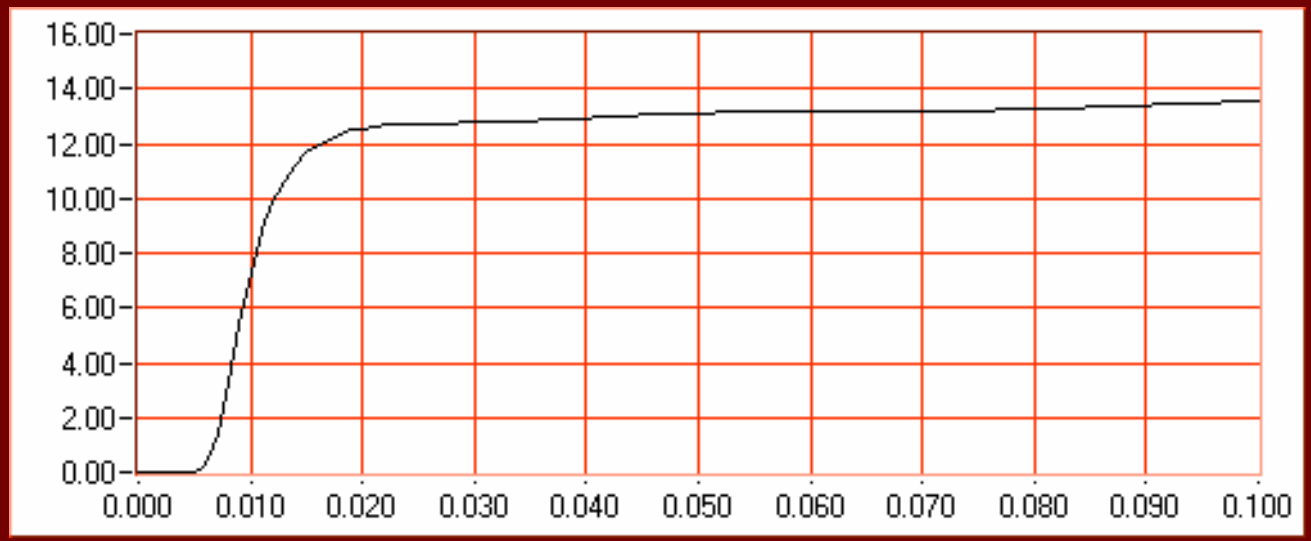


Excalibur Electronics Section Battery
Tested at 62.8 C under a 40.5 W Constant Power Load



Run time to 9.5 volts: 323 seconds



Activation Curve: T_zero is when squib was energized

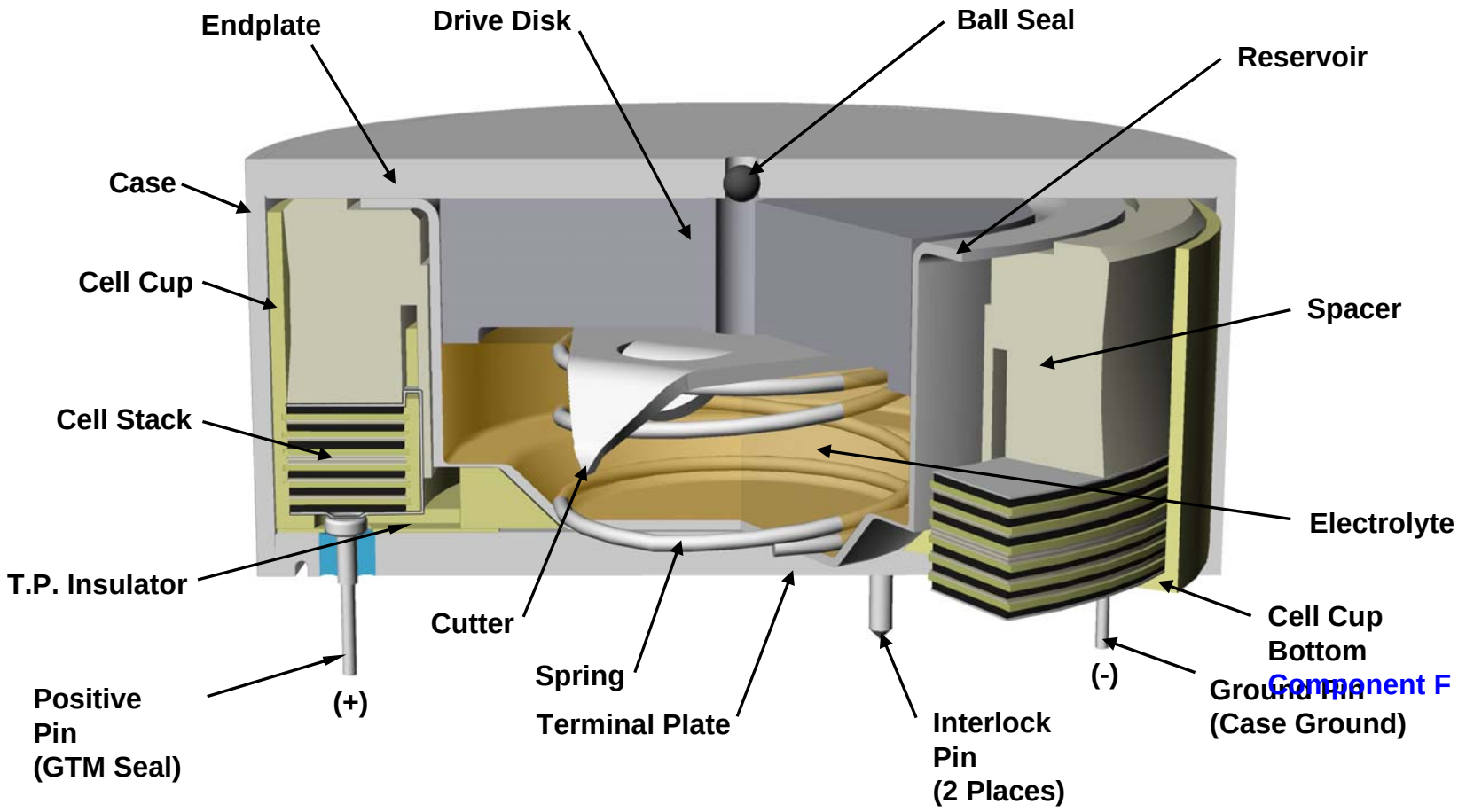
Liquid Reserve

- Electrolyte is kept in different “bladder” than the cells
- Uses G-force of fired weapon and centripetal rotational forces to release and mix the electrolyte.
- At ARL, we tested the MOFA battery (quality control).

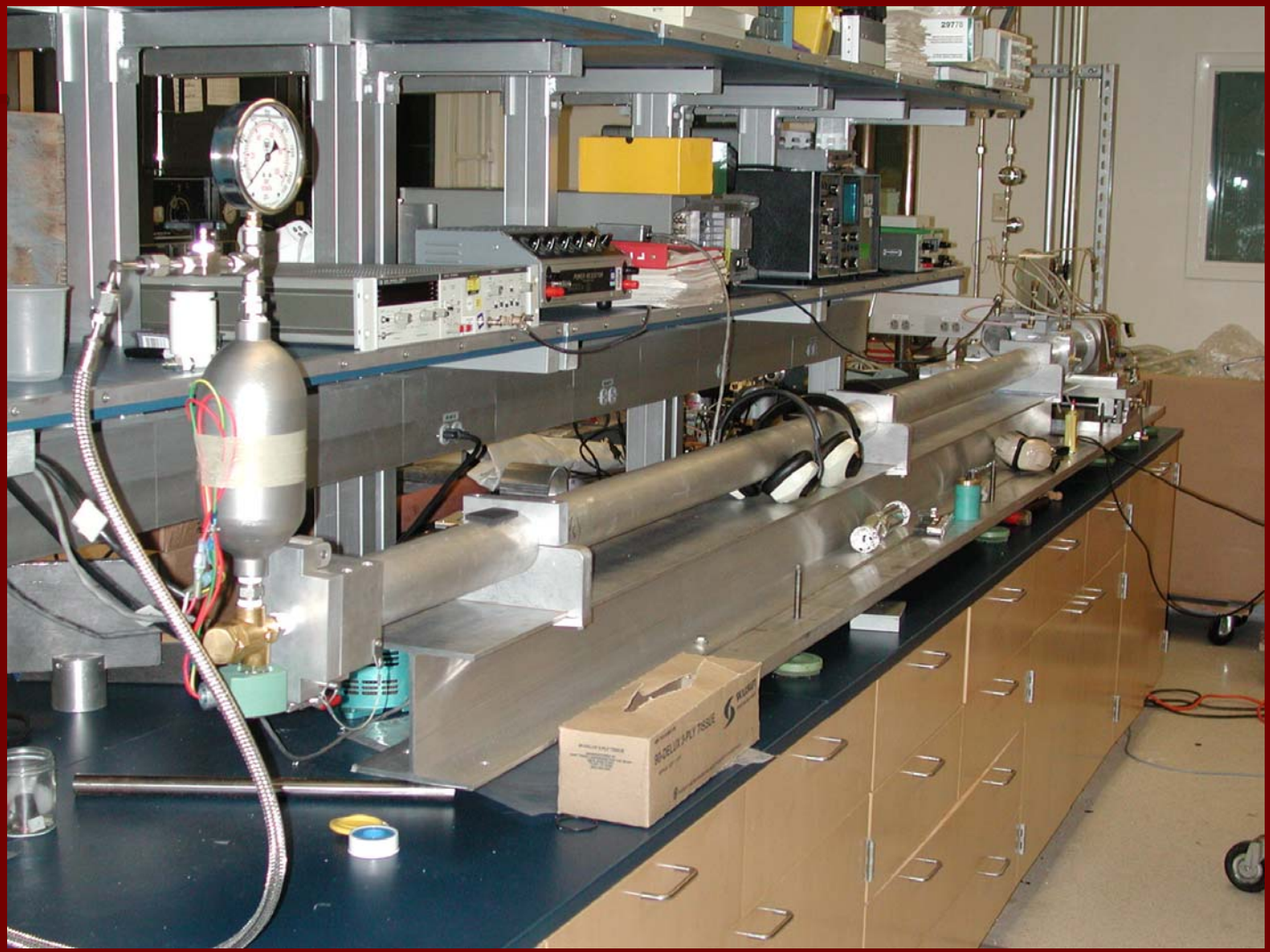
MOFA Battery Specs

- Voltage - 5.6 to 12 volts
- Activation acceleration (g's) - 2,200 to 30,000
- Setback duration (ms) - 4 to 16
- Spin (rpm) - 5,100 to 30,000
- Rise Time (ms) with 35 mA load - 50 +/- 50
- Operational Life in seconds - 200
- Current - 35 mA for 1st 10 seconds, then 325 mA for remainder of operational life to 5.6 v
- Capacity in milliamp-hours - 18.1
- Temperature (degrees Fahrenheit)
  - Storage -60 to +160 -- Operating -45 to +145
- Size - 1.50 inch diameter by 0.65 inch

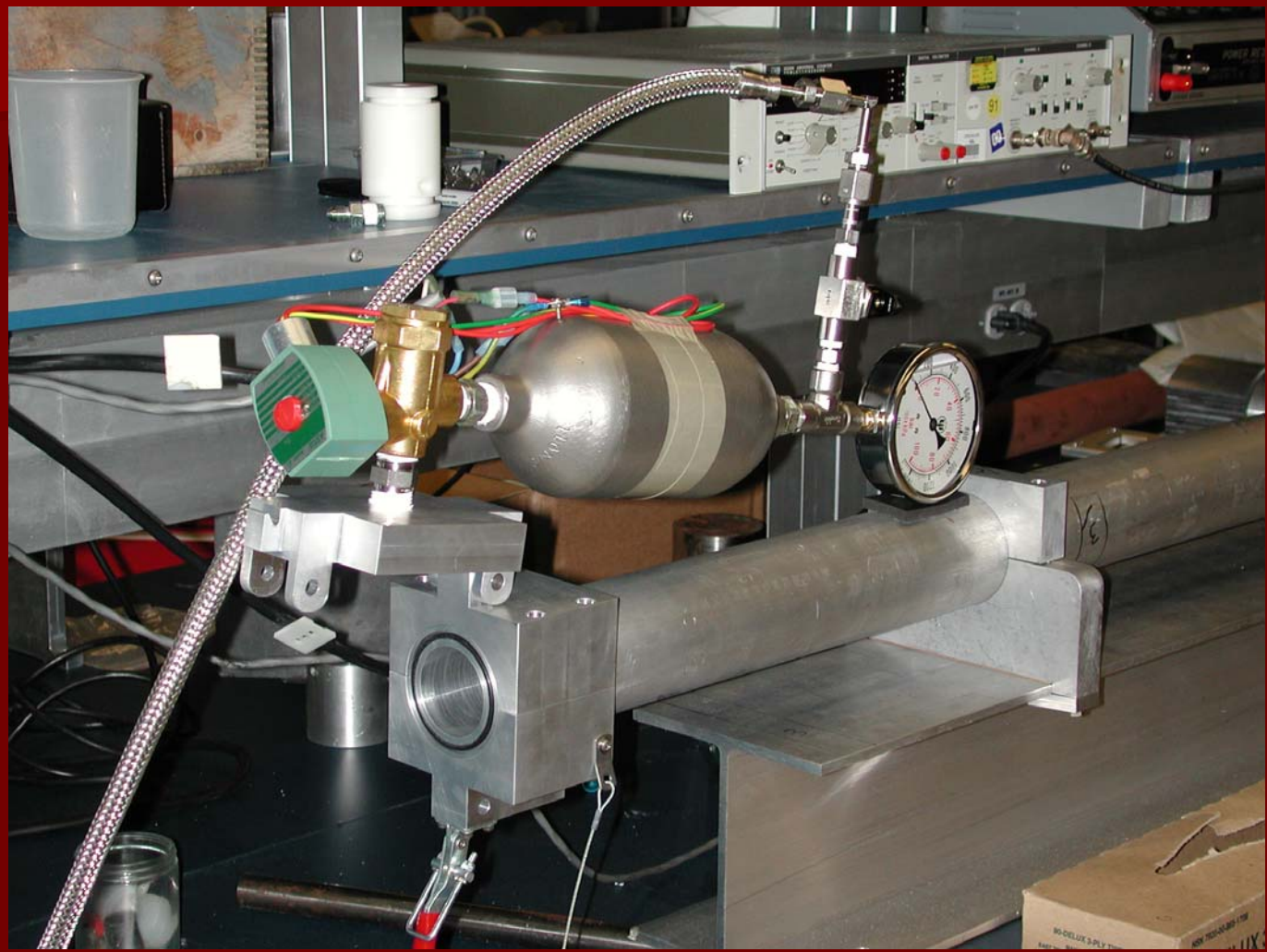
MOFA Battery



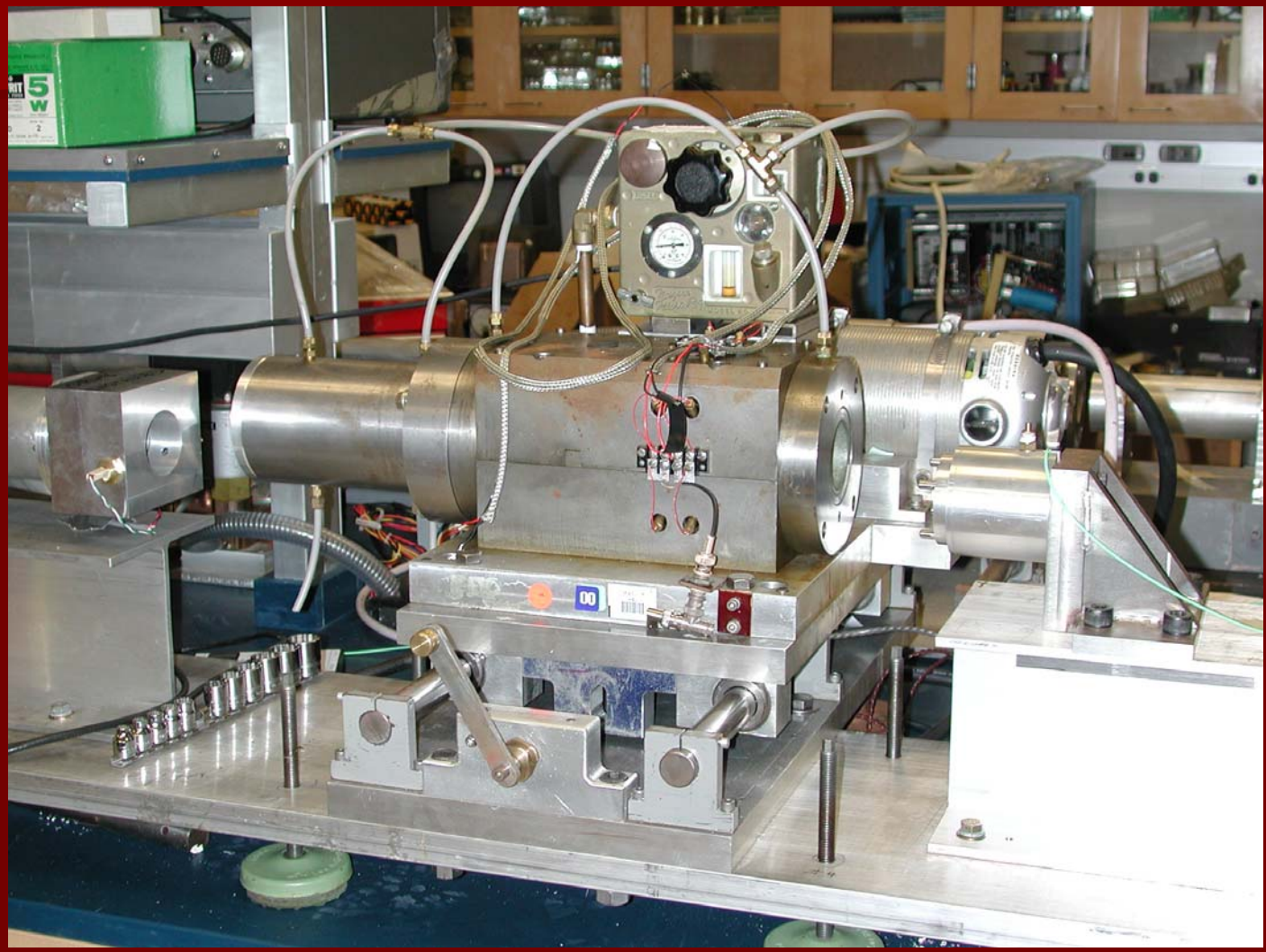
MOFA Battery Testing



MOFA Battery Testing



MOFA Battery Testing



Results

- The Rise time was acceptable
- Battery didn’t last as long as it was supposed to
- The lack of performance was believed to be a result of cell material physical properties.

Thanks

- I would like to thank Allan Goldberg and the rest of the Reserve Battery Crew for their help during my time at ARL.

Questions?