

Celestial Circuits

Design Considerations for NanoRacks NanoLab Experiments

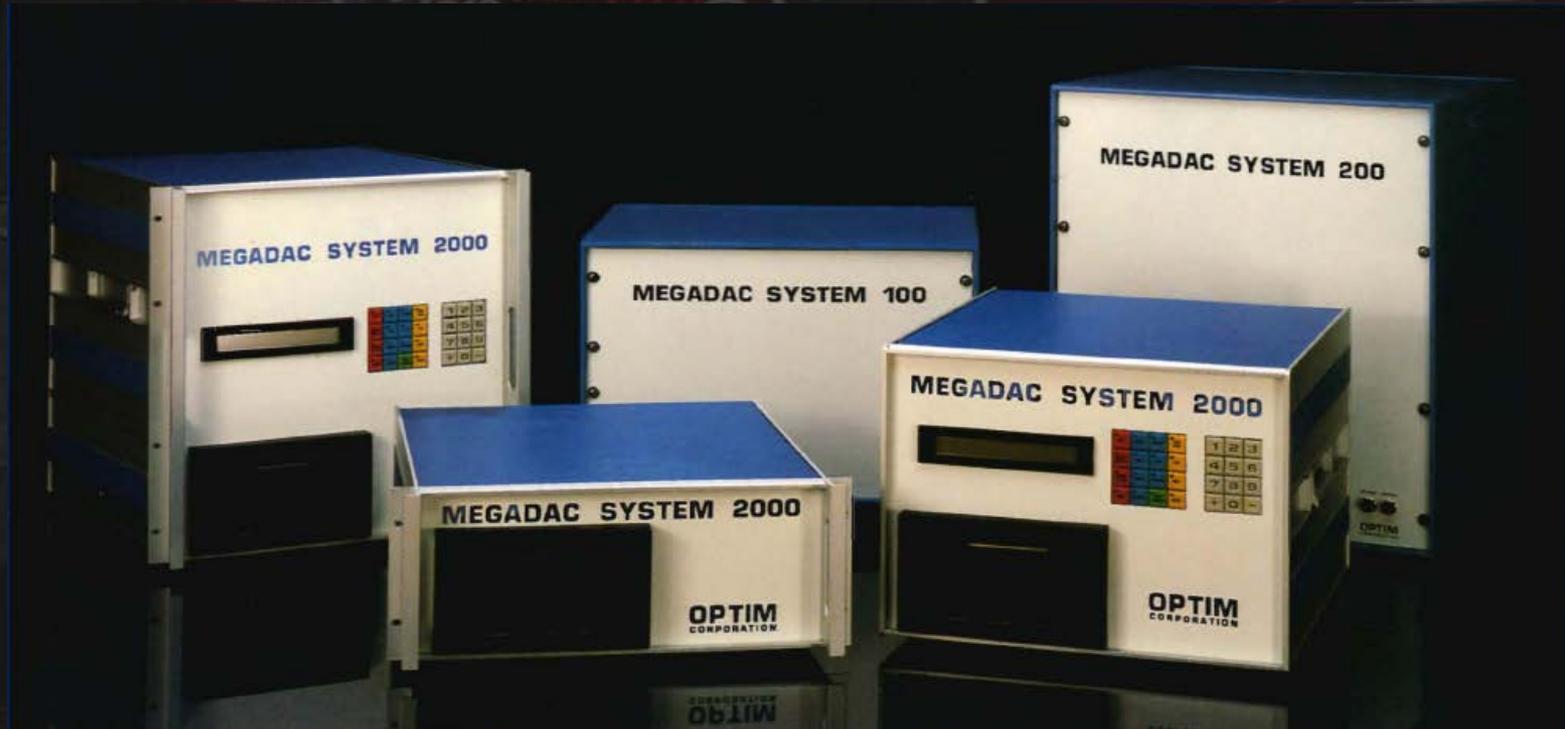
Steve Bress



October 5, 2012

Cape Canaveral

“Small”, High Speed Data Acquisition Systems



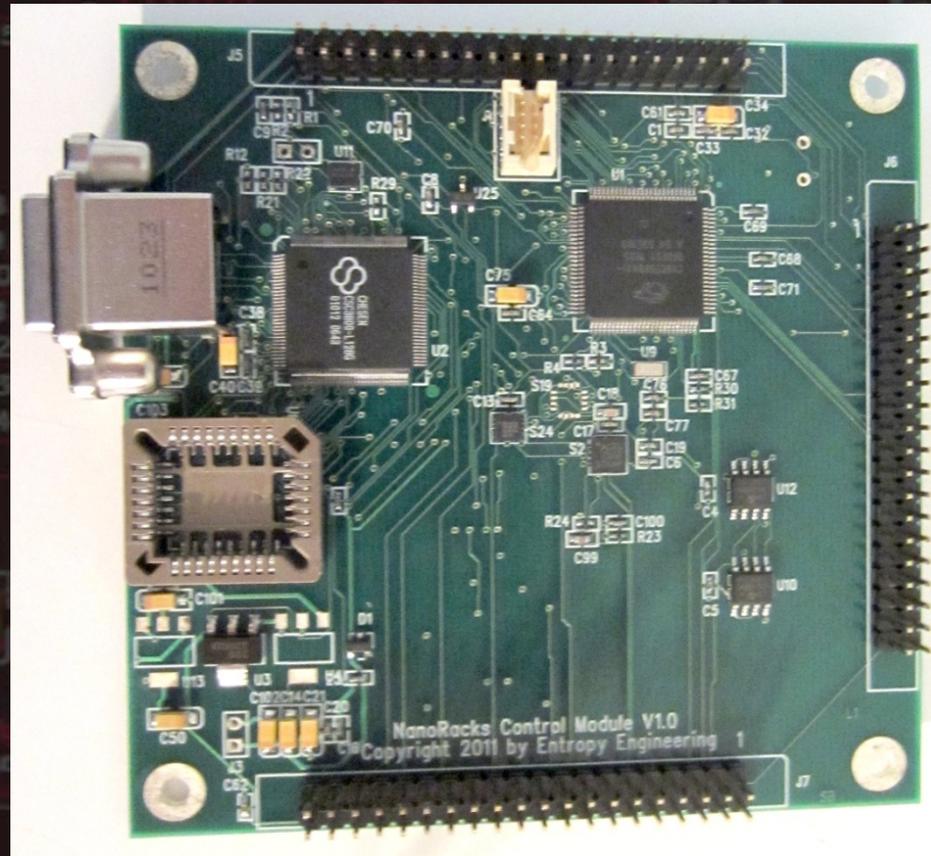
Buildin' it Old School



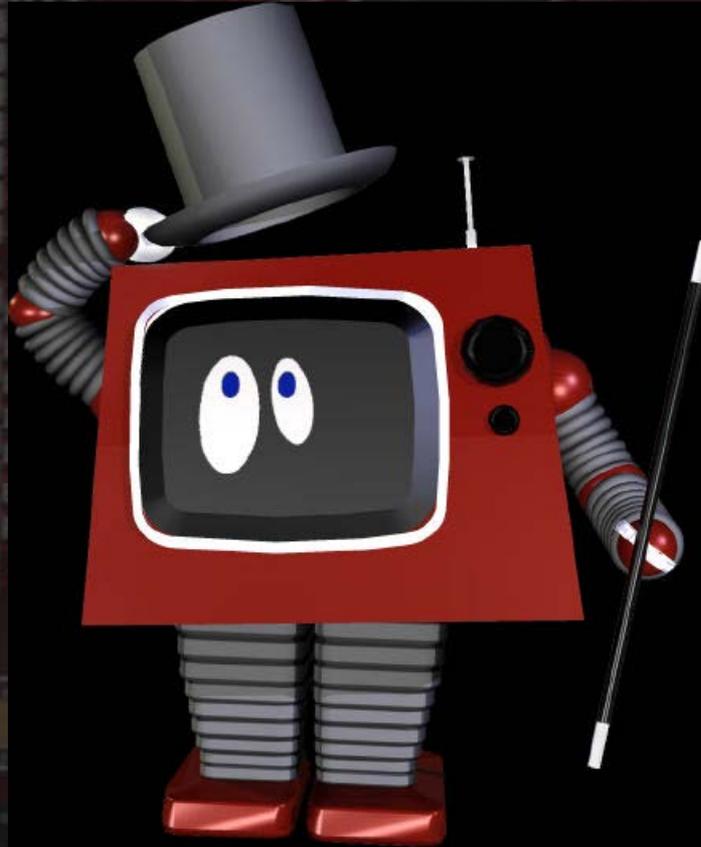
NASA Approved, Flight Qual Wiring



Celestial Circuits NanoRacks Control Module (CC_NCM)



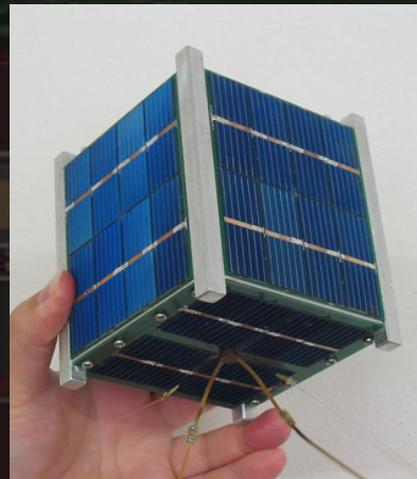
Welcome!



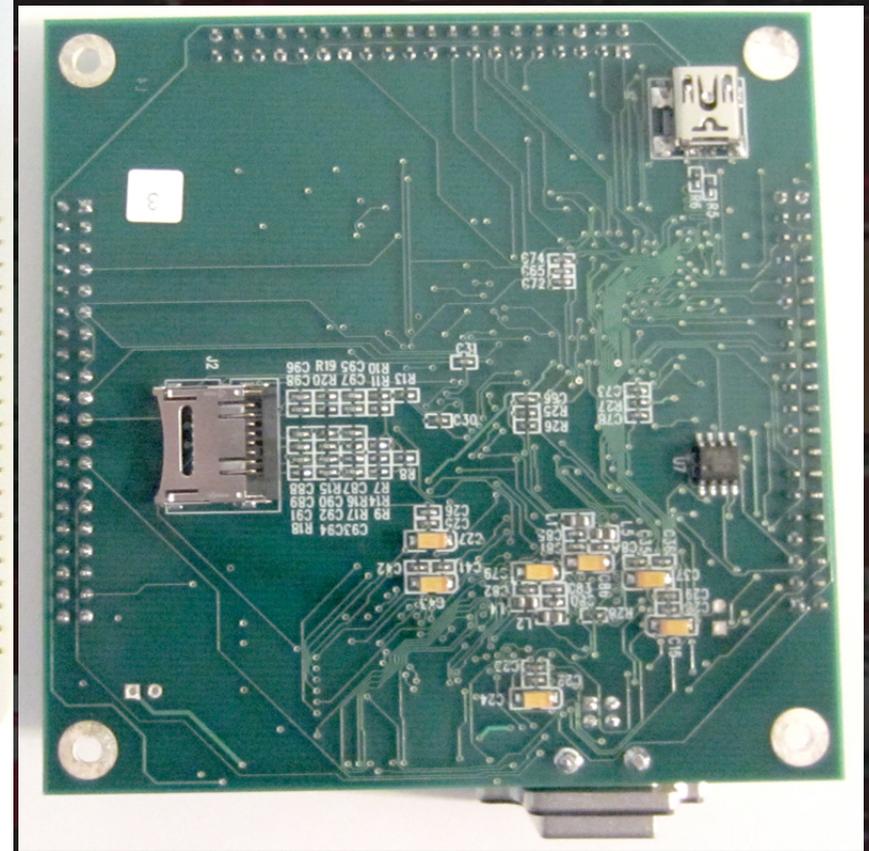
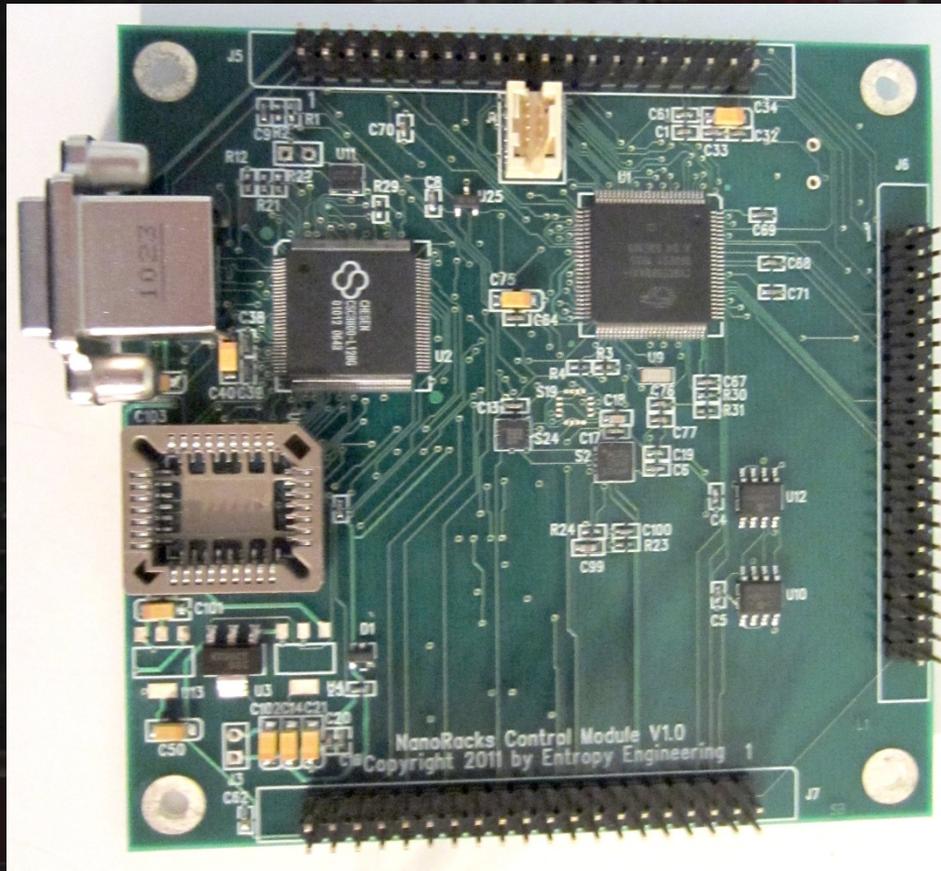
If I want to conduct a chemistry experiment, the first thing I DON'T do is invent the Bunsen Burner.

Mission Statement:

Celestial Circuits will standardize and drive down the cost of data acquisition hardware for the NanoRacks NanoLab form factor.



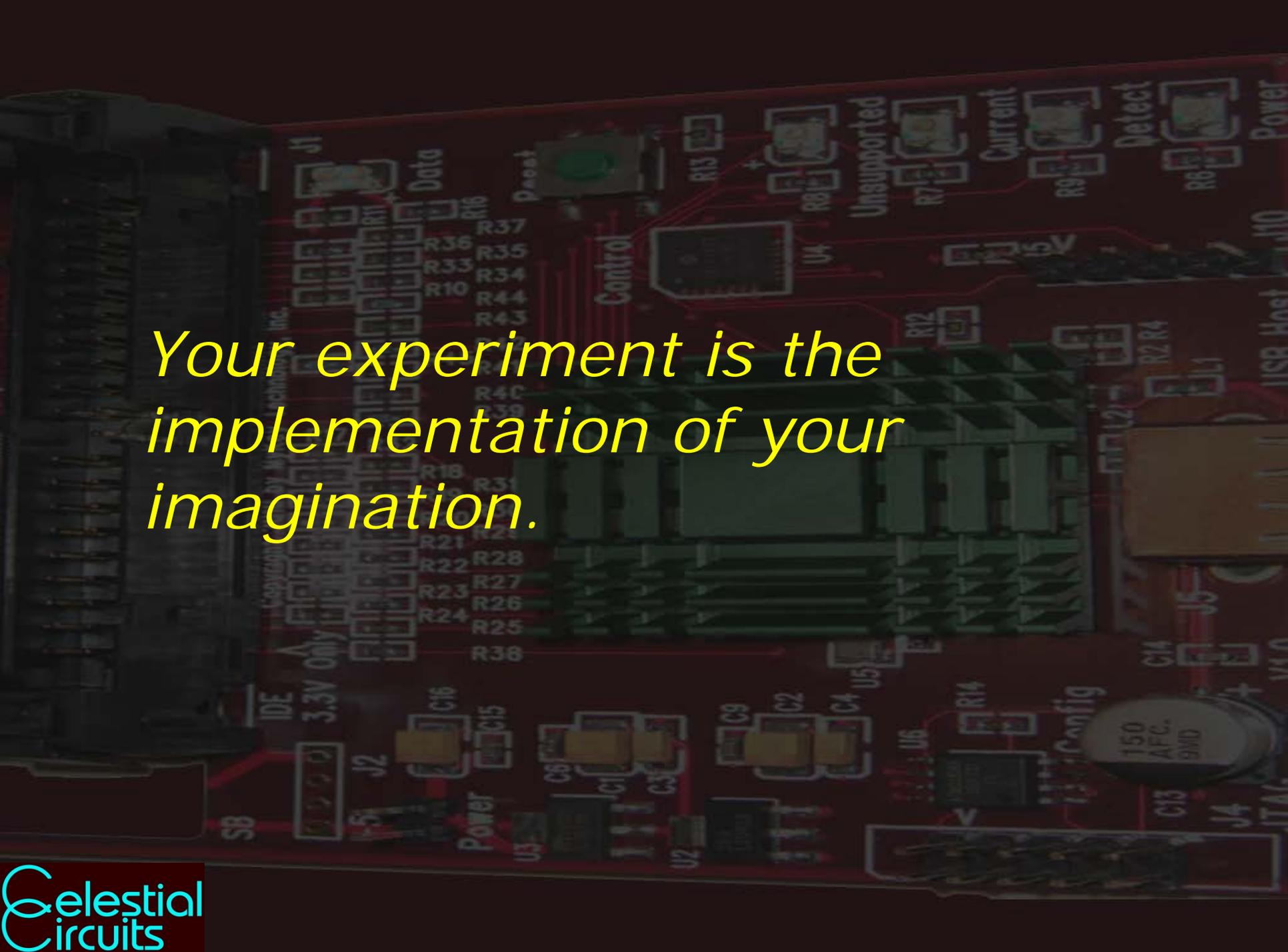
NanoRacks Control Module



NanoRacks Fan Controller



Currently developing curriculum based on state mandated learning standards.



Your experiment is the implementation of your imagination.

Sometimes real world restrictions can intrude on your imagination.

The NanoLab format has a number of unique requirements as does experimenting in space.

NanoLab

*Size: 100 x 100 x 100mm.
(or about a 4 inch cube)*

NanoLab

Power: 5V @ 500mA.

2.5 watts provided through a USB connector.

The same power available to a standard USB 2 peripheral.

NanoLab

Communication: USB 2 High Speed.

The NanoLab must appear to be a USB device following the Mass Storage specification.

Space

Safety: The NanoLab will be flying in two different spacecraft. The launch vehicle and ISS.

It must meet safety requirements for both.

General Issues

Things will go wrong. Proper planning can soften the effect.

General Issues

Random crashes and resets.

A watchdog timer can reboot automatically, but extra care must be taken to avoid data corruption.

General Issues

Experiments with liquids require a double containment system.

General Issues

3D printers create great parts on demand, but they are not necessarily watertight.

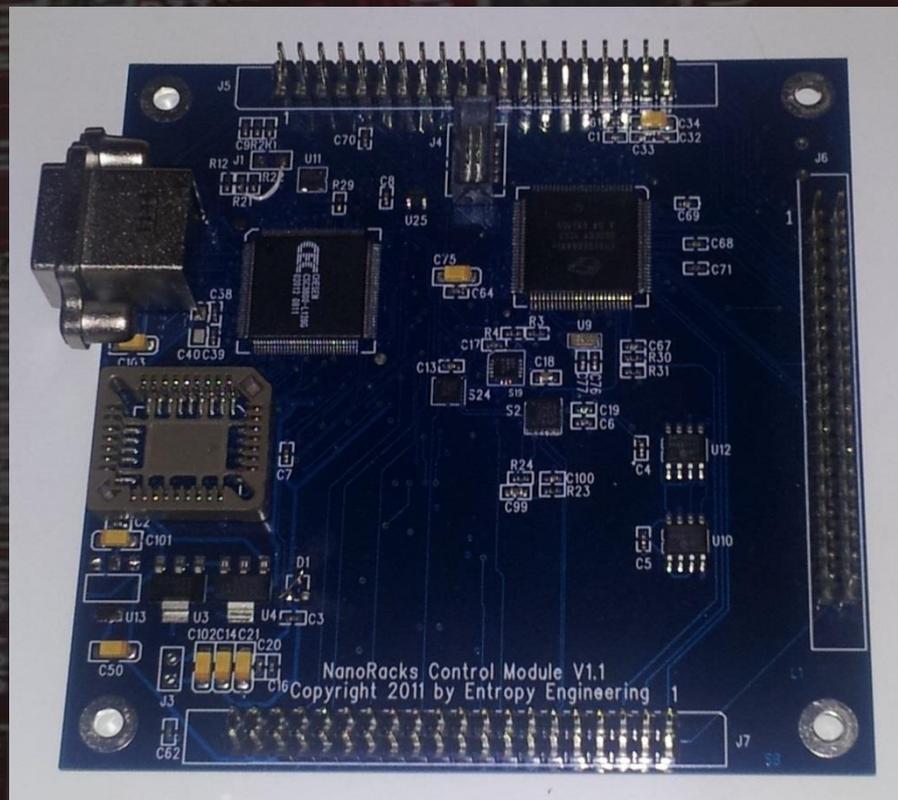
General Issues

Shipping – Time and Temperature

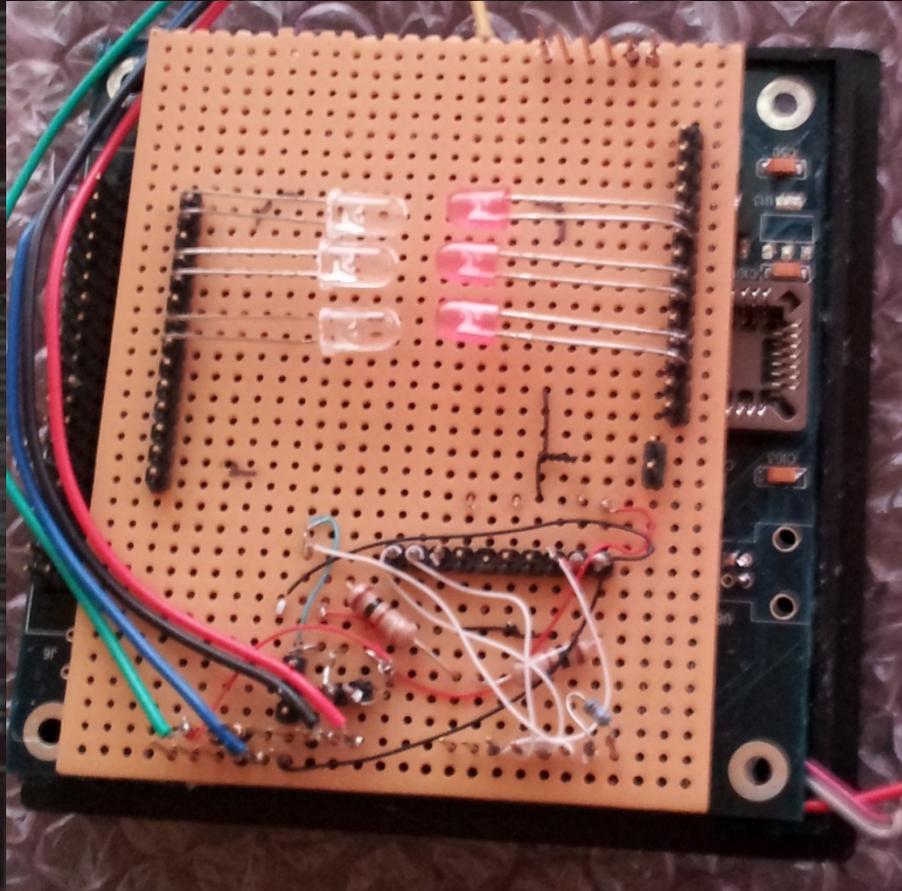
General Issues

Launch!

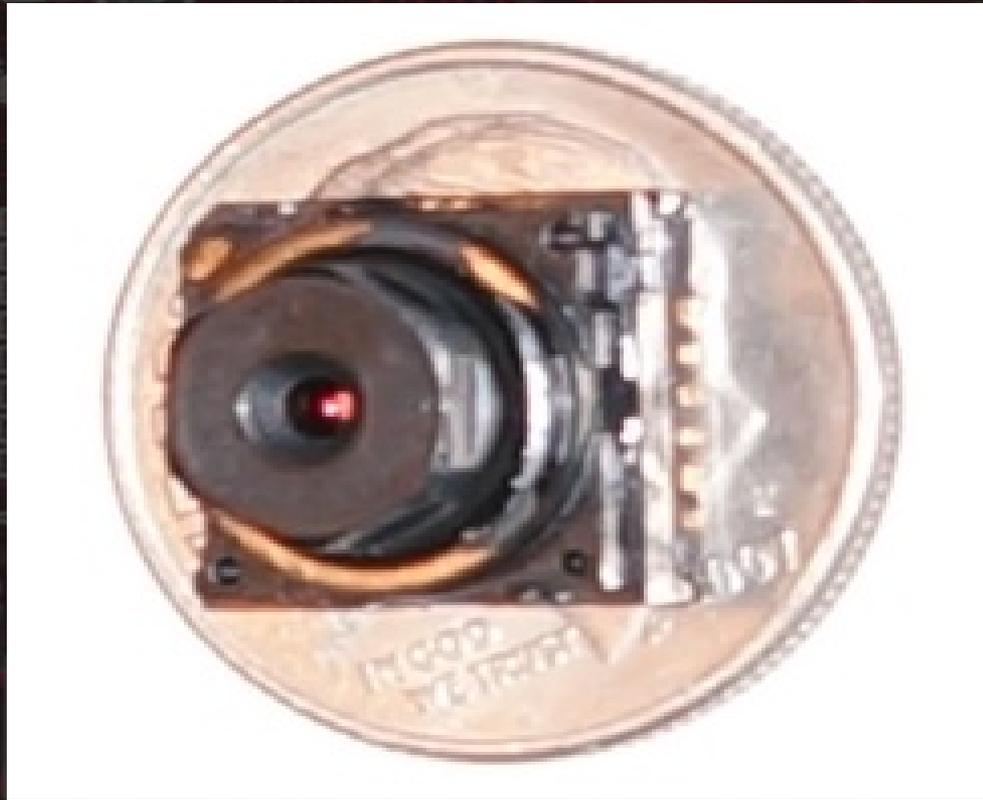
NanoRacks Control Module



NCM Custom Board



Celestial Circuits Micro Camera Module (CC-MCAM)



Celestial Circuits

It's Time to Experiment!™

Contact:

Steve Bress (sbress@celestialcircuits.com)

Jim Dunstan (jdunstan@celestialcircuits.com)

www.CelestialCircuits.com