

# **Polar Technology Conference**

## **4/26/2007**

### **Iridium Remote Data Transmission System**

Andrew Young  
SRI International



# Purpose

- “Constraints on the physiology and growth of trees at the latitudinal treeline: integration of experimental and gradient approaches.”

Dr. Patrick Sullivan,  
University of Alaska

- Hourly Measurements
  - MET Data
  - Soil Moisture Sensor Line
  - Soil Temperature Sensors
- Daily Reporting
  - Is the system still working?
  - Real-time data (daily versus yearly)



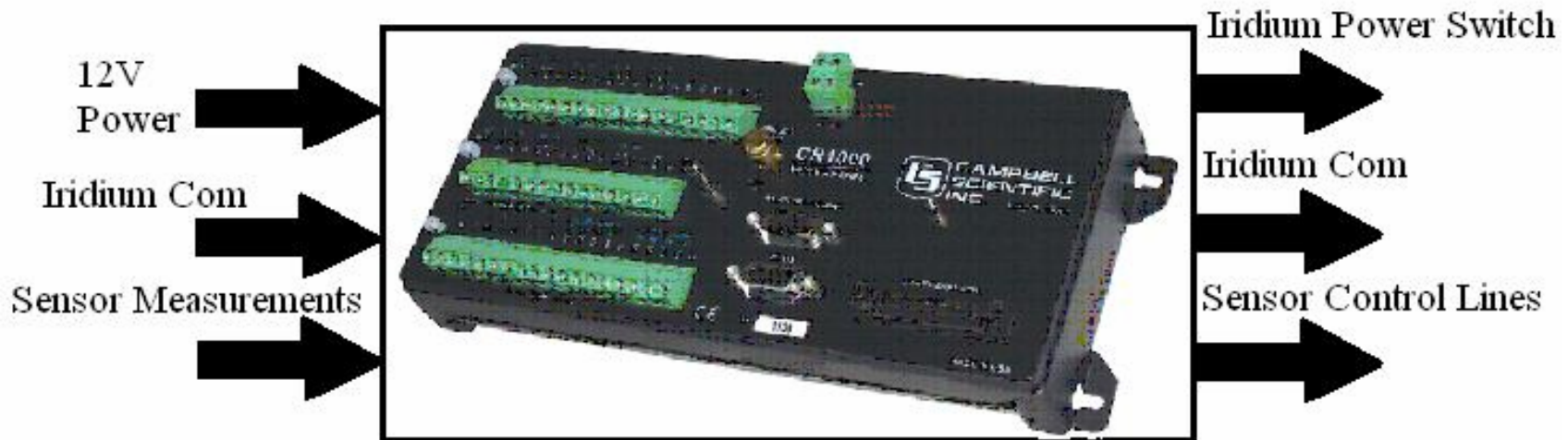
# Design Team

- Worcester Polytechnic Institute – Senior Qualifying Project
  - Eric Hall
  - Peter Kanieg
  - Amanda Quigley
  - Eric Young
- VECO Polar Resources
  - Tracy Dahl
  - Andrew Young



# CR1000 Datalogger Features

- H8S Hitachi Microcontroller
- CRBasic Programming Language
- RS232 Port
- 8 Control Ports
- 13 A/D Ports
- 2 Mbytes SRAM



# Specifications

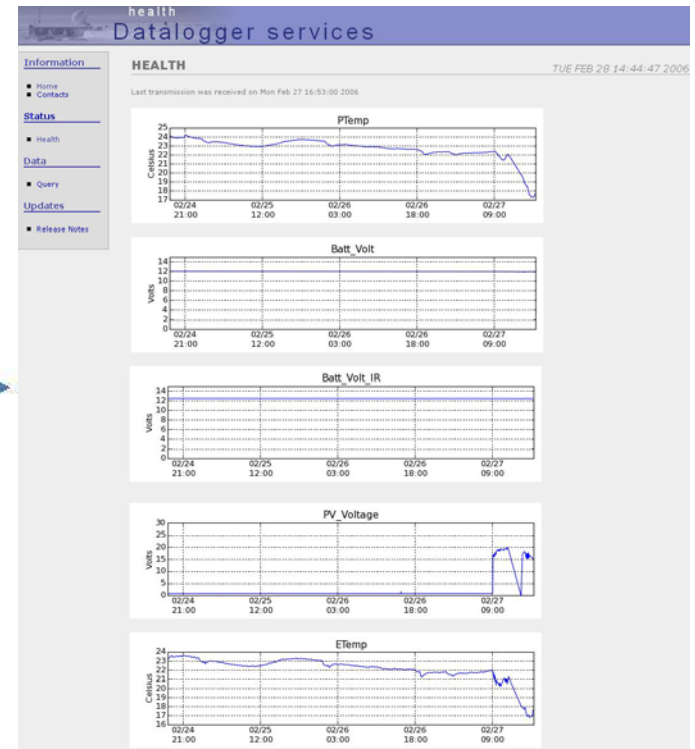
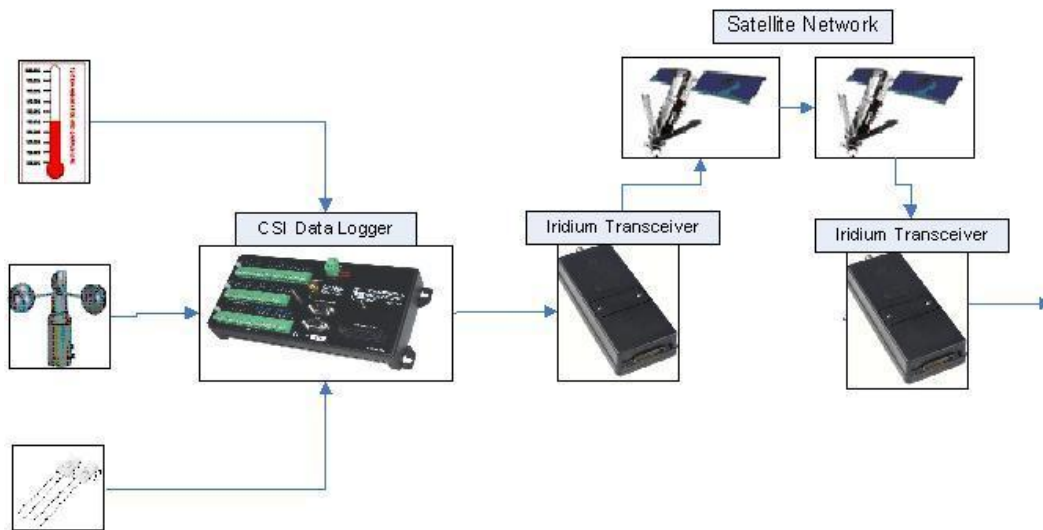
- Autonomous
  - Agashashok River 95 km Northeast of Kotzebue, AK.
  - Low Power, 20W PV
  - Operate in Polar Climates
    - -40° C, Ice and Snow
- Daily Transmissions
  - Data from each Sensor
  - System Health Check
    - Battery Voltages
    - Enclosure Temperatures
    - Solar Panel Voltage
- Insure datalogger runs



# System Design Factors

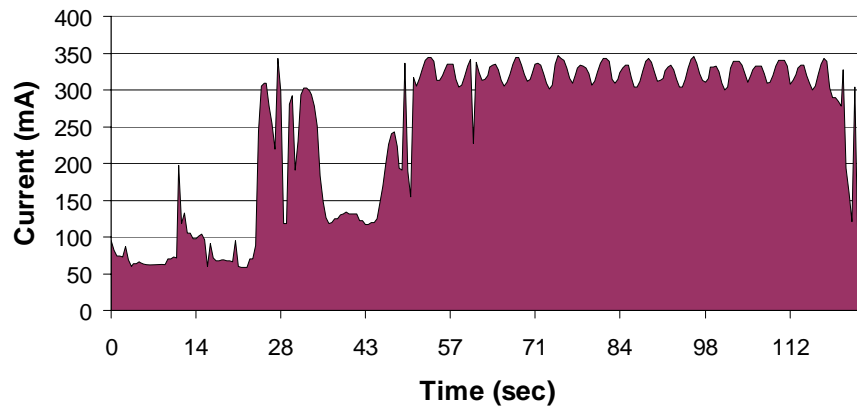
- Commercial Service only
  - Airtime budget limited to \$200/month
- ISU-to-ISU chosen over SBD or ISU-to-PSTN
  - Airtime costs significantly less for our amount of data
    - 5760 B/day (30 samples/hr)
  - Less Programming Complexity
    - Receiving emails versus handshaking
    - SBD message size limit and ordering
- Remote site pushes data chosen over Loggernet pulling data
  - No transceiver standby power needed
  - No time synchronization issues
  - No Loggernet or MS Windows
- Reliable Data Transfers
  - End to End Data Acknowledgement

# System Design

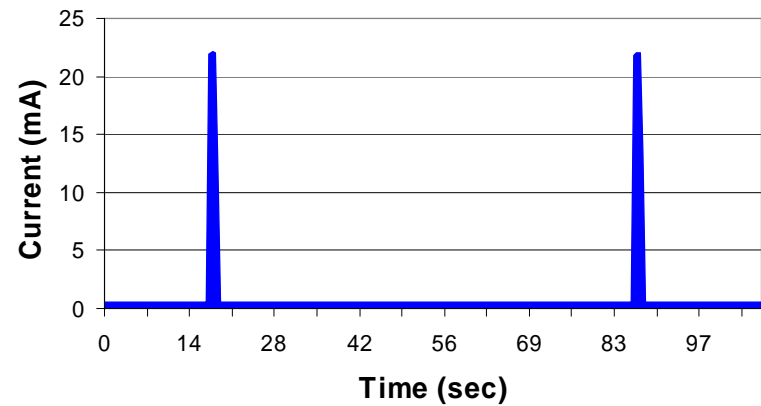


# System Power Profile

Iridium Transceiver Current Profile

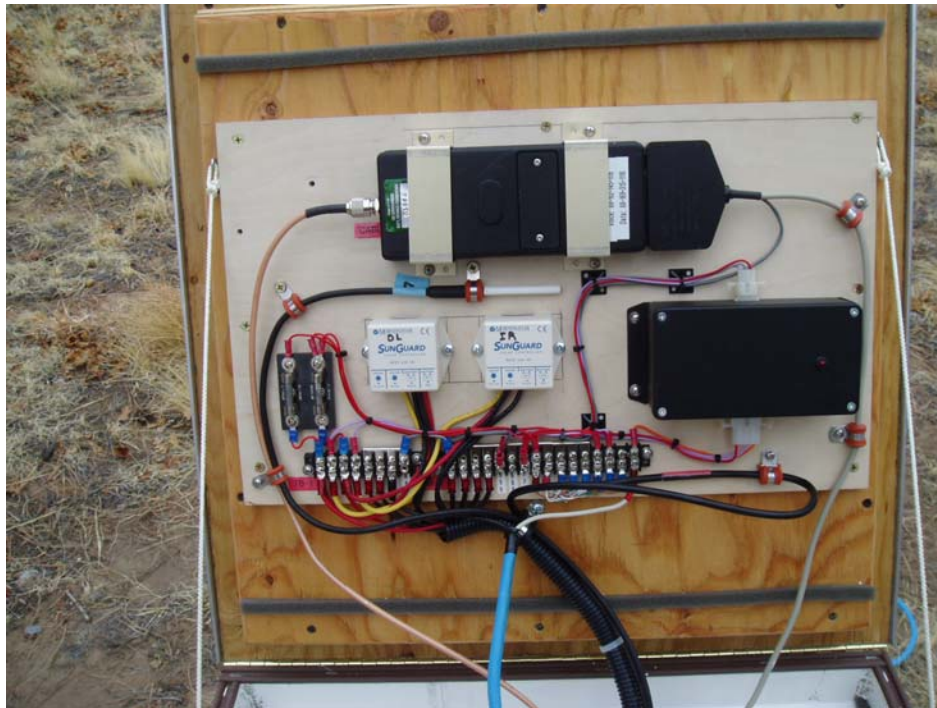


Datalogger Current Profile

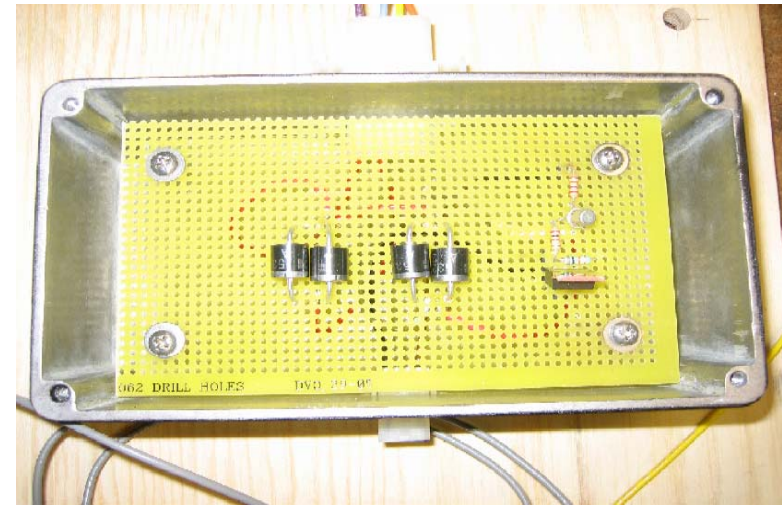
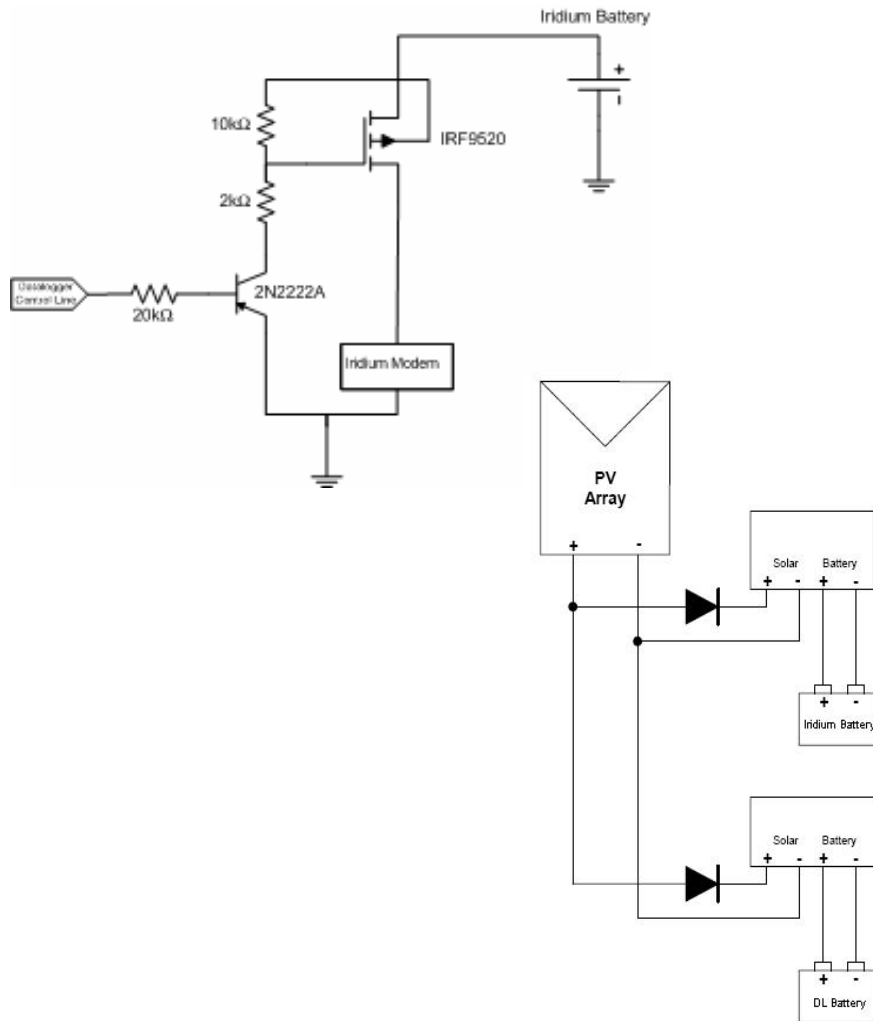


	Energy/Day (Ah)	Energy/Year (Ah)
Communications:	0.0132	4.8161
Datalogger:	0.0147	5.3778
<b>System Total:</b>	<b>0.0279</b>	<b>10.1939</b>

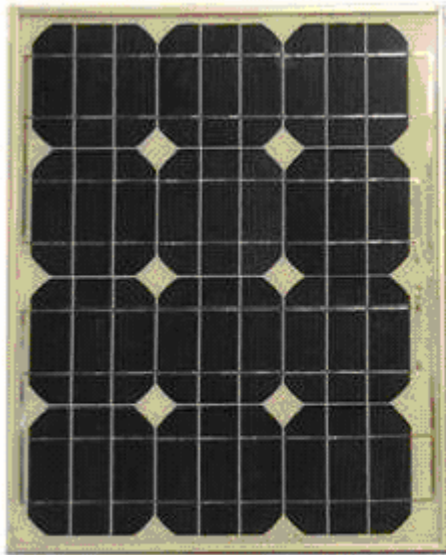
# Deployed System



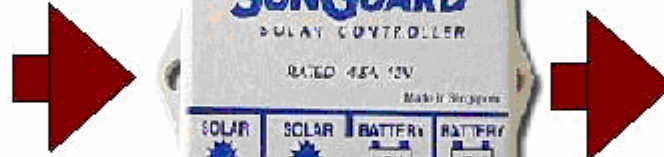
# Control circuitry



# Power System Design



**INDIA PV20 Solar Array**



**MorningStar SunGuard  
Charge Controller**



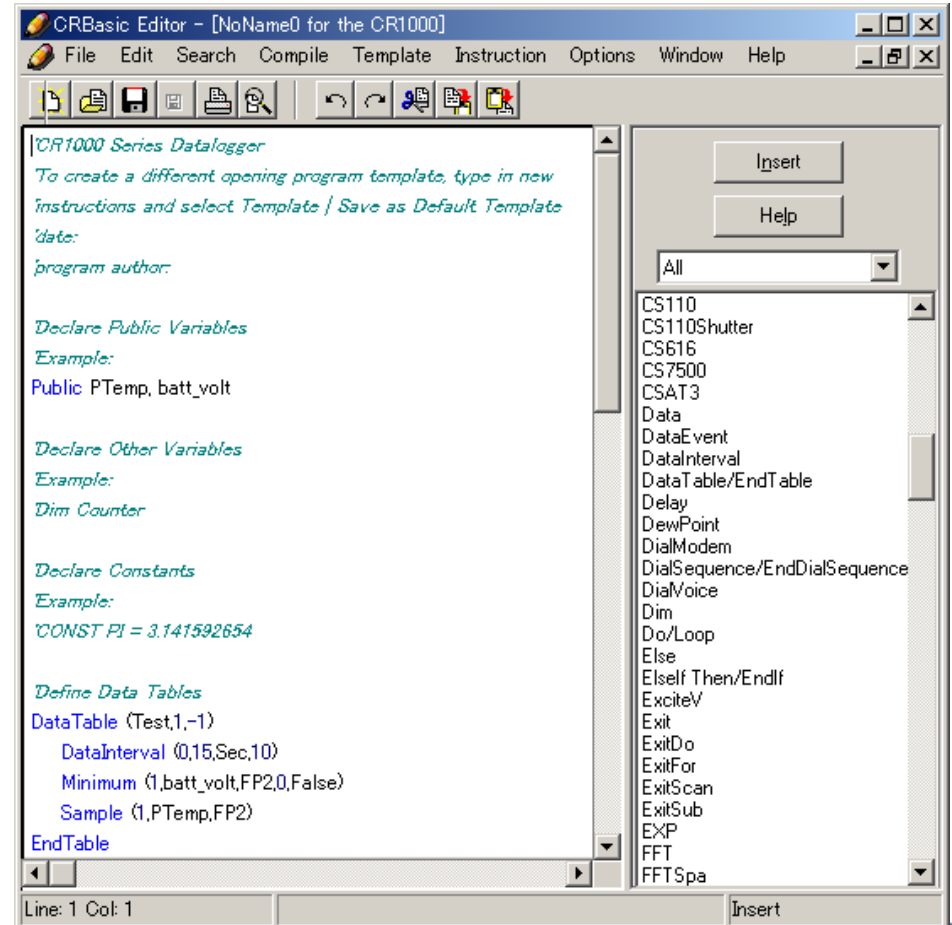
**Two Deka 8G31  
Batteries**

- Solar Array Mounted Vertically
- Separate Batteries for Communications and Datalogger
- Switching Circuit to turn on Iridium Transceiver

# CRBasic Software

## Tasks:

- Measure and Store Data
- Switch on Transceiver
- Control Communications
- Schedule Transmission



# Data Management System

- Dell PowerEdge 720
  - Fedora Core Linux
  - Apache Web Server
  - TurboGears Application Server
  - Postgres Database
  - MATPLOTT lib plotting library
  - Python Programming Language

