Polar Technology Conference
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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

Diagram showing the flow of data from a CSI Data Logger to an Iridium Transceiver, connected to a Satellite Network.
### System Power Profile

#### Iridium Transceiver Current Profile

#### Datalogger Current Profile

<table>
<thead>
<tr>
<th></th>
<th>Energy/Day (Ah)</th>
<th>Energy/Year (Ah)</th>
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<tbody>
<tr>
<td>Communications</td>
<td>0.0132</td>
<td>4.8161</td>
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<tr>
<td>Datalogger</td>
<td>0.0147</td>
<td>5.3778</td>
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<tr>
<td><strong>System Total</strong></td>
<td><strong>0.0279</strong></td>
<td><strong>10.1939</strong></td>
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Deployed System
Control circuitry
Power System Design

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

INDIA PV20 Solar Array → MorningStar SunGuard Charge Controller → Two Deka 8G31 Batteries
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
  - MATPLOT lib plotting library
  - Python Programming Language