

# DOE/SNL Accurate Time-Linked Acquisition System (ATLAS III) and Instrumentation

**Jonathan R. White, Ph.D.**

Testing Lead

Wind and Water Power Technologies

Sandia National Laboratories

[jonwhit@sandia.gov](mailto:jonwhit@sandia.gov)

(505) 284-5400

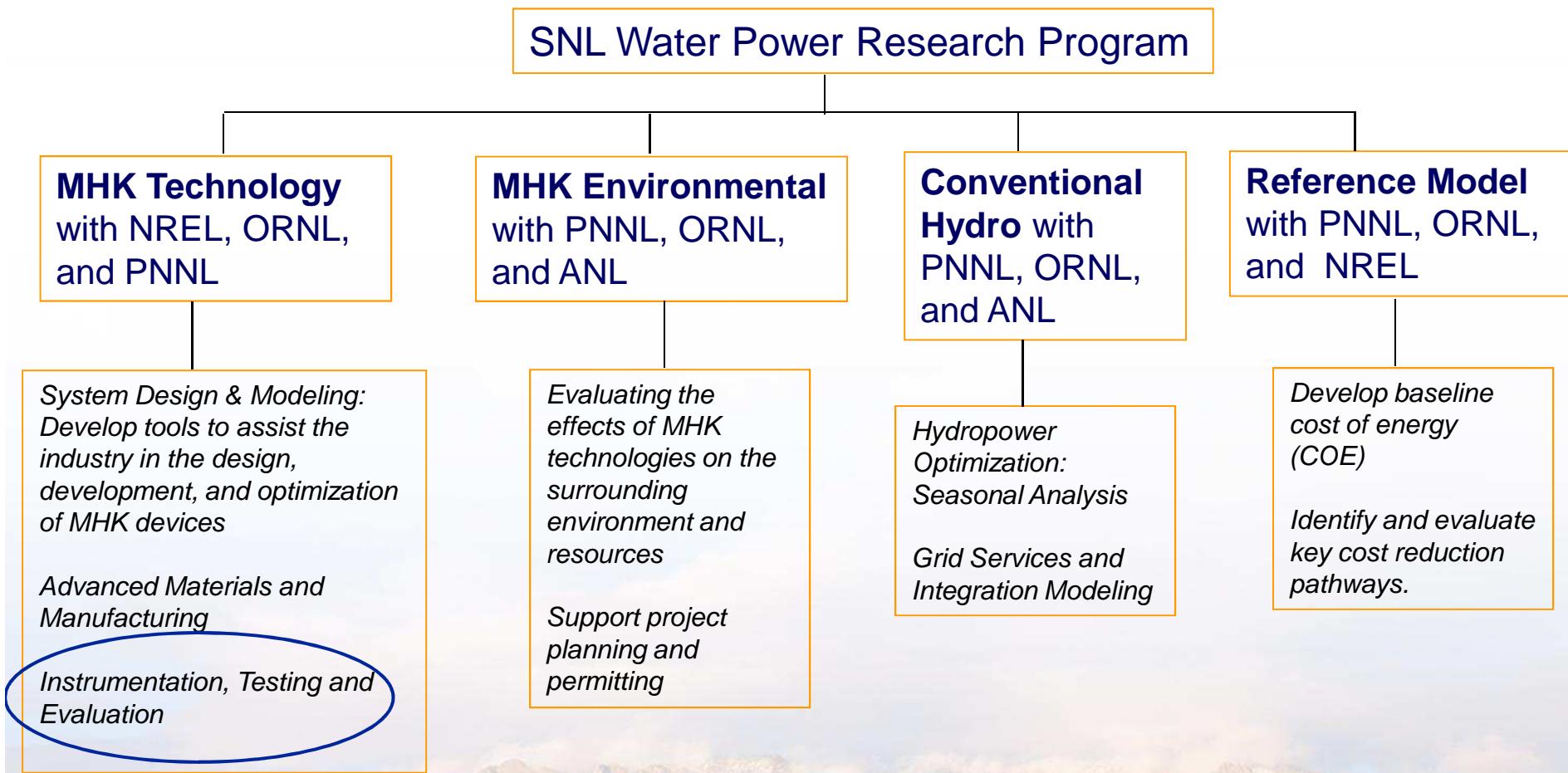


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# Sandia's Water Power Research



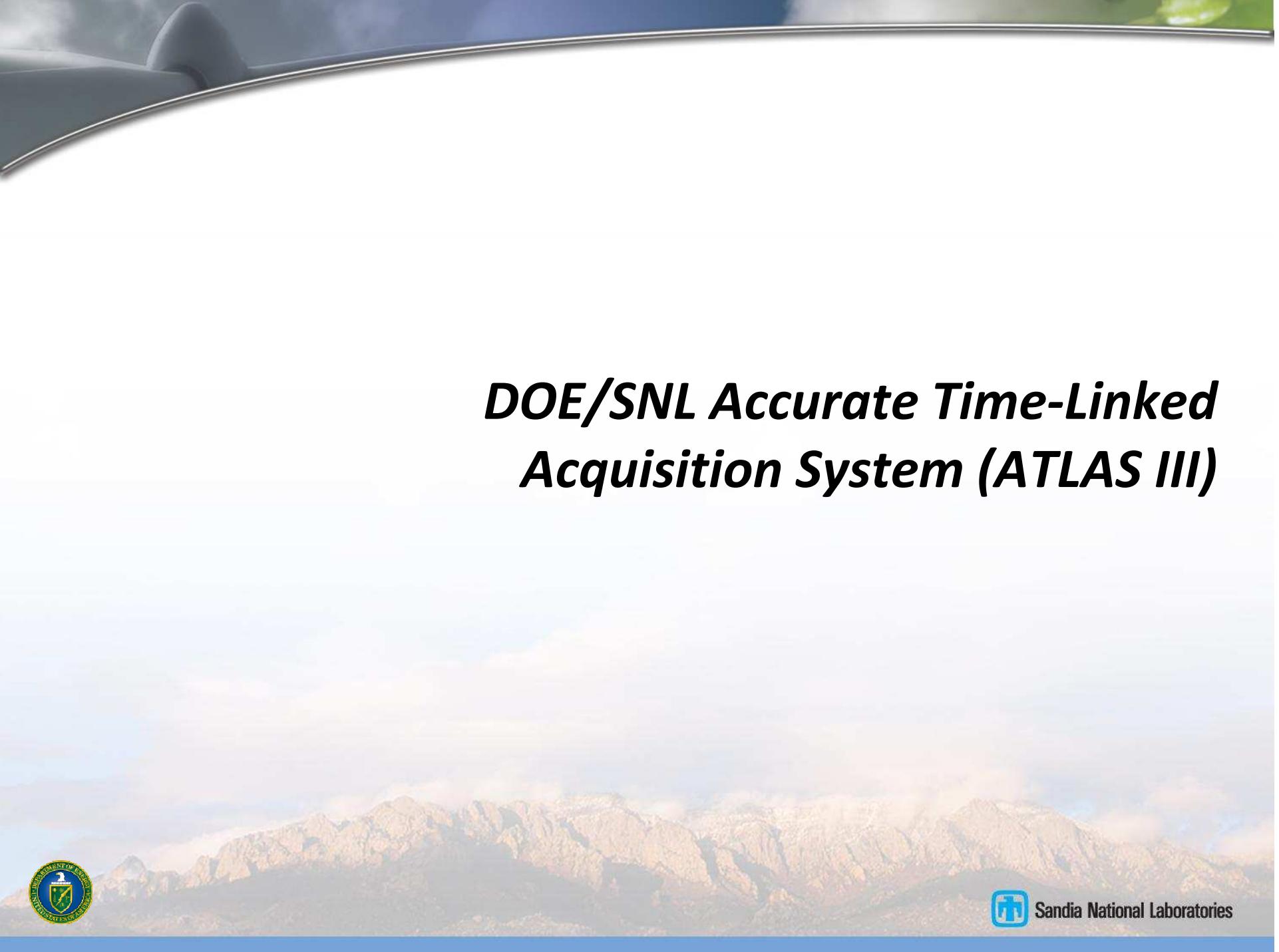
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# Outline

- DOE/SNL Accurate Time-Linked Acquisition System (ATLAS III)
- SNL Embedded Life-cycle Instrumentation
- Survivability and Packaging of Instrumentation



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# ***DOE/SNL Accurate Time-Linked Acquisition System (ATLAS III)***



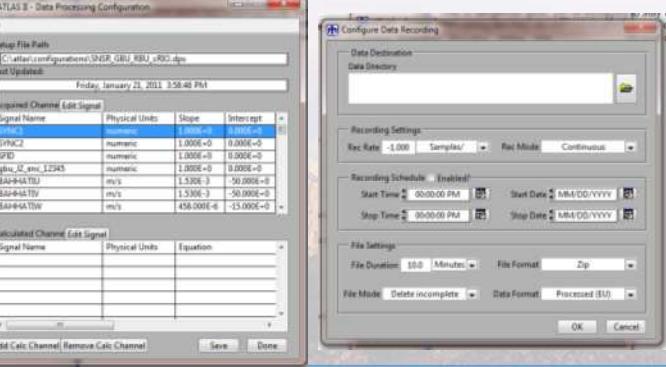
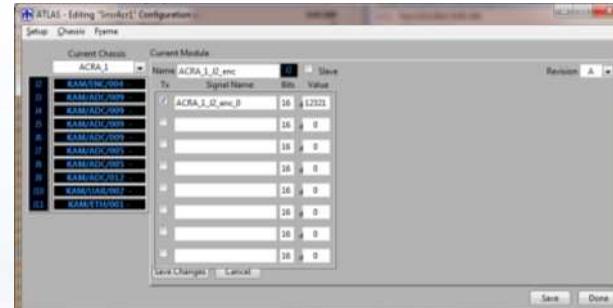
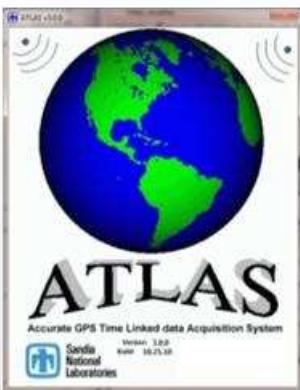
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# Accurate Time-Linked Acquisition System

- ATLAS 3.0 designed for acquisition of a variety of analog, optical, aerodynamic, and Ethernet based data sources from ACRA and NI devices.
- GPS time synchronized with Ethernet based master-slave control.
- Robust acquisition and file management / storage to meet IEC certification.
- **Software to be hosted by National Instruments and free to industry.**

## Hardware and Acquisition Setup

### ATLAS 3.0



## Recording



# Data Acquisition Systems

## ■ Hardware

- Acra Control
  - Modules: networking, communication, GPS, analog input, strain input, data backup, analog output, CAN output
  - Robust and commercialized product intended for industrial application.



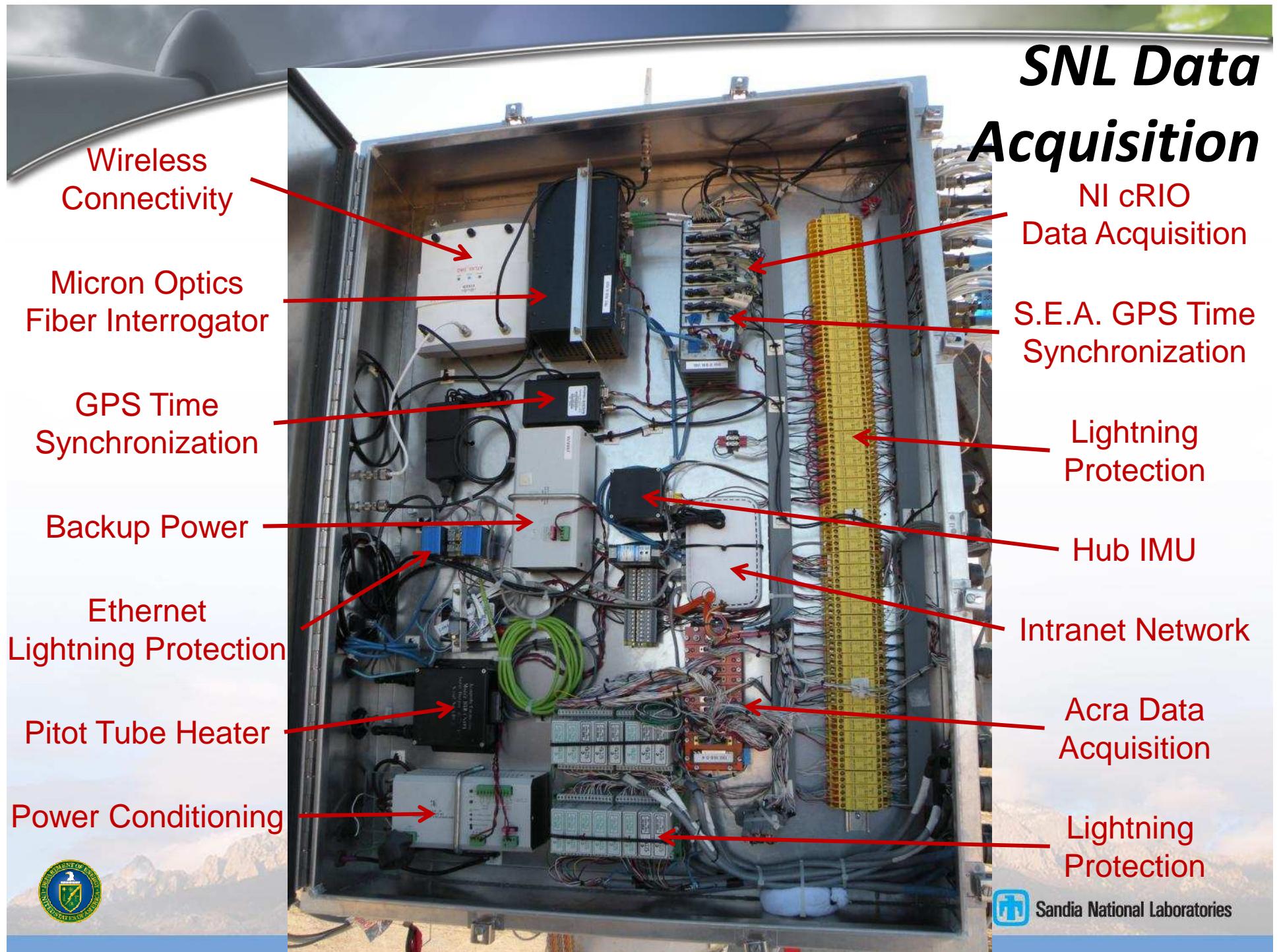
- National Instruments
  - Modules: networking, communication, GPS, analog input, strain input, data backup, analog output, CAN output
  - Robust and commercialized product intended for research applications.



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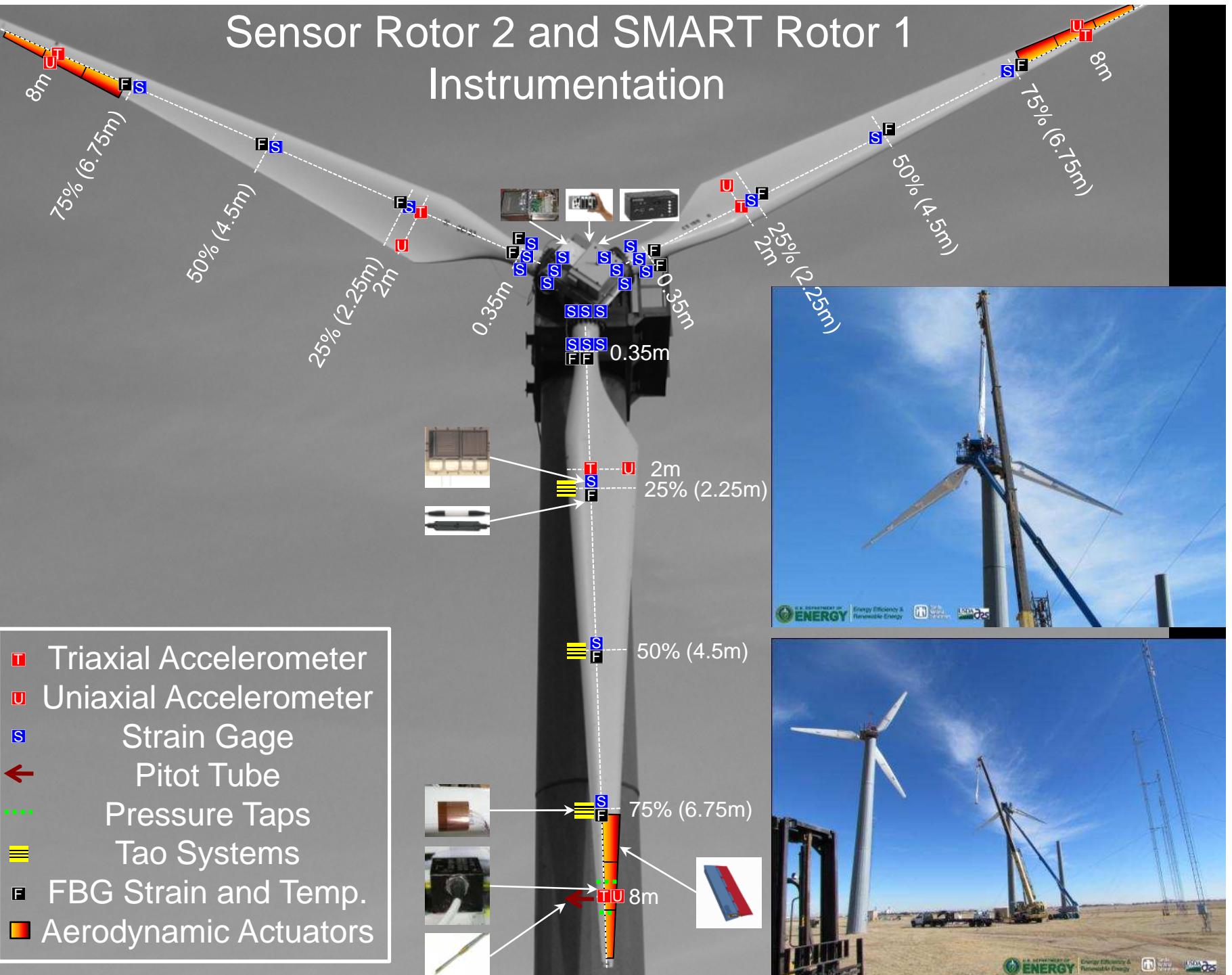


# SNL Data Acquisition



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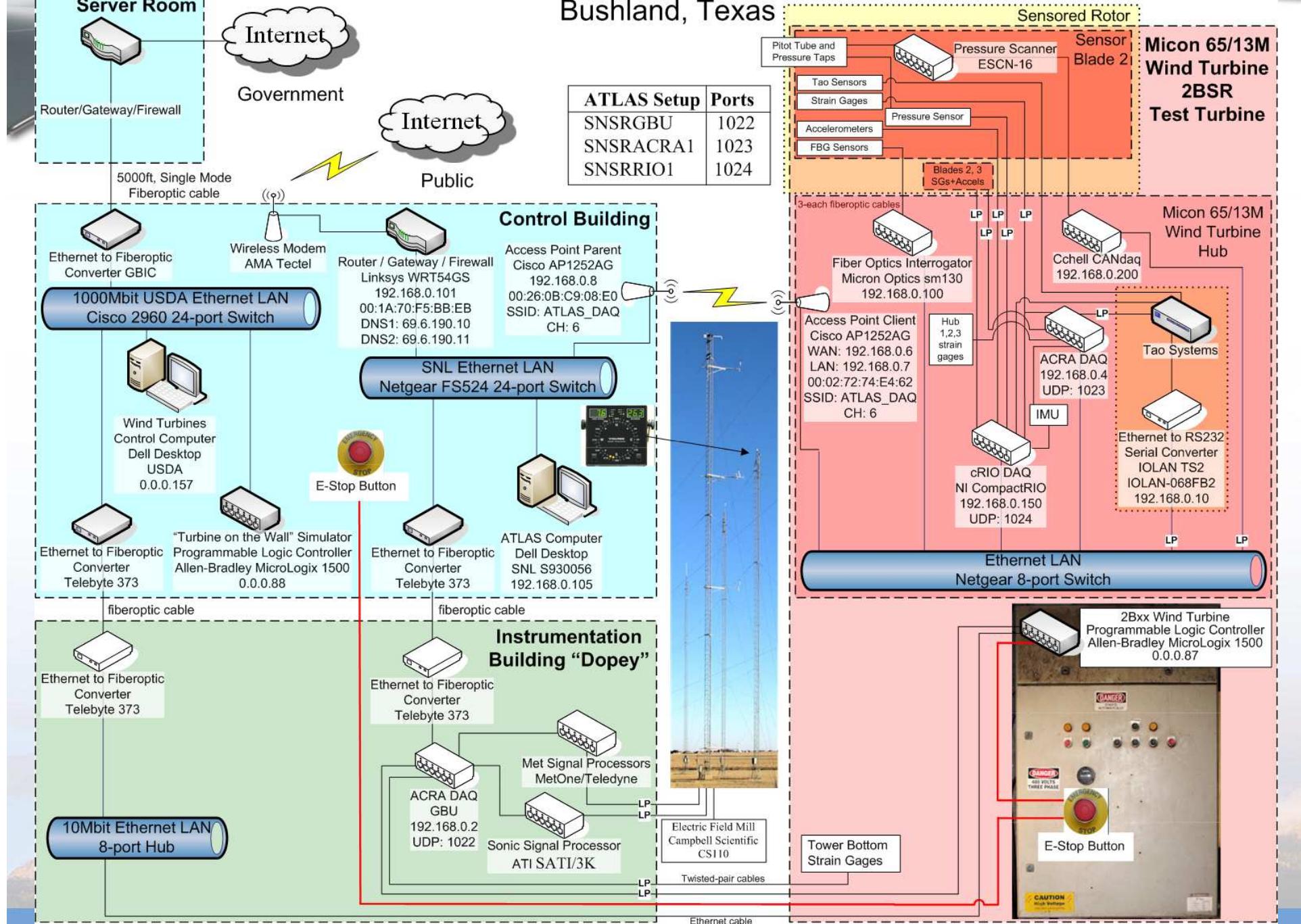
# Sensor Rotor 2 and SMART Rotor 1 Instrumentation



# USDA-ARS and SNL Field Test Site Data Networks

## Bushland, Texas

February 14, 2011





# ***SNL Embedded Life-cycle Instrumentation***



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# Sensor Blade 1 – Monitoring over life-cycle

2007

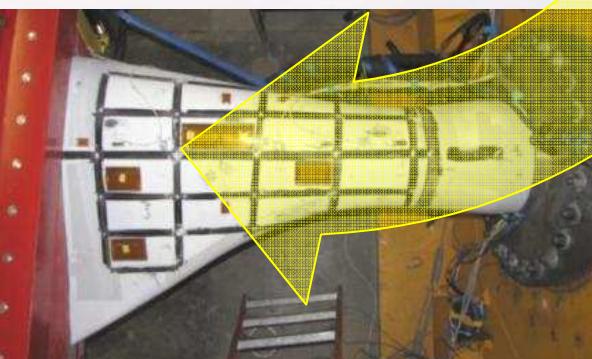
## 1 - Blade Fabrication (TPI Composites)



## 2 - Field Testing (USDA-ARS)



## 3 – Lab Testing (NREL - NWTC)



DOE, National labs, Industry,  
Universities, and non-wind companies  
“win-win-win-win”



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# Structural Measurements

- Accelerometer

- Uses: acceleration measurement, modal analysis, CHM, SHM, prognostics
- Partners: PCB Piezotronics, Silicon Designs
- Examples:



- Acoustic Emission

- Uses: high-frequency vibration measurement, damage detection
- Partners: Physical Acoustics
- Examples:



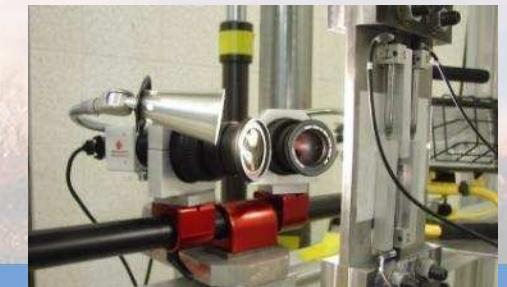
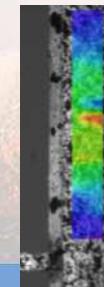
- Active Piezoelectrics

- Uses: strain measurement and creation, damage detection, SHM, operational monitoring
- Partners: Los Alamos Labs, NASA-KSC
- Examples:



- Digital Image Correlation

- Uses: displacement and strain measurement, model validation, modal analysis
- Partners: SNL, Univ. Mass. – Lowell



# Structural Measurements (cont.)

- Strain Gage
  - Uses: strain measurement, model validation, damage equivalent loading, modal analysis
  - Partners: Vishay
- Fiber Optic
  - Uses: strain measurement, model validation, damage equivalent loading, modal analysis
  - Partners: Aither Engineering, Intelligent Fiber Optic, Luna Innovations, Micron Optics, Inc.
- Examples:



# Aerodynamic Measurements

- Pitot Tube

- Uses: angle of attack measurement, controls, model validation
- Partners: Aeroprobe, PSI
- Examples:



- Pressure Sensor

- Uses: pressure measurement, CFD model validation
- Partners: Measurement Specialties
- Examples:



- Pressure Taps

- Uses: differential pressure measurement, CFD model validation
- Partners: Aeroprobe, PSI
- Examples:



- Stagnation Point

- Uses: angle of attack measurement, model validation
- Partners: SNL, Univ. Mass. – Lowell



Energy

# Aerodynamic Measurements (cont.)

- Cup Anemometer

- Uses: wind speed, inflow estimation
- Partners: Teledyne, MetOne, NRG
- Examples:



- Wind Vane

- Uses: wind direction
- Partners: MetOne, NRG
- Examples:



- Sonic Anemometer

- Uses: 3D wind speed, wind vector
- Partners: Applied Technologies
- Examples:

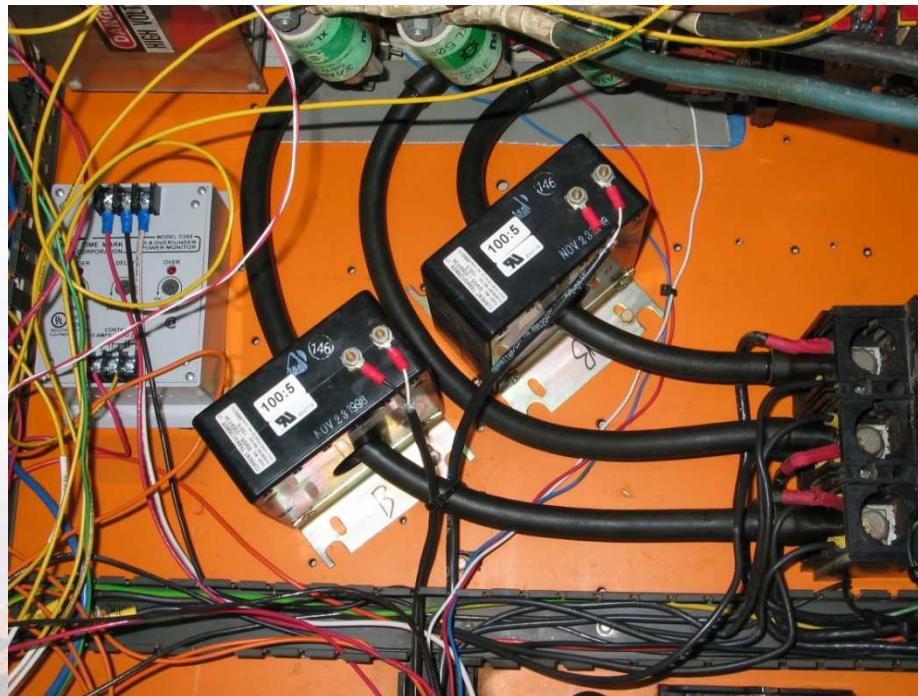


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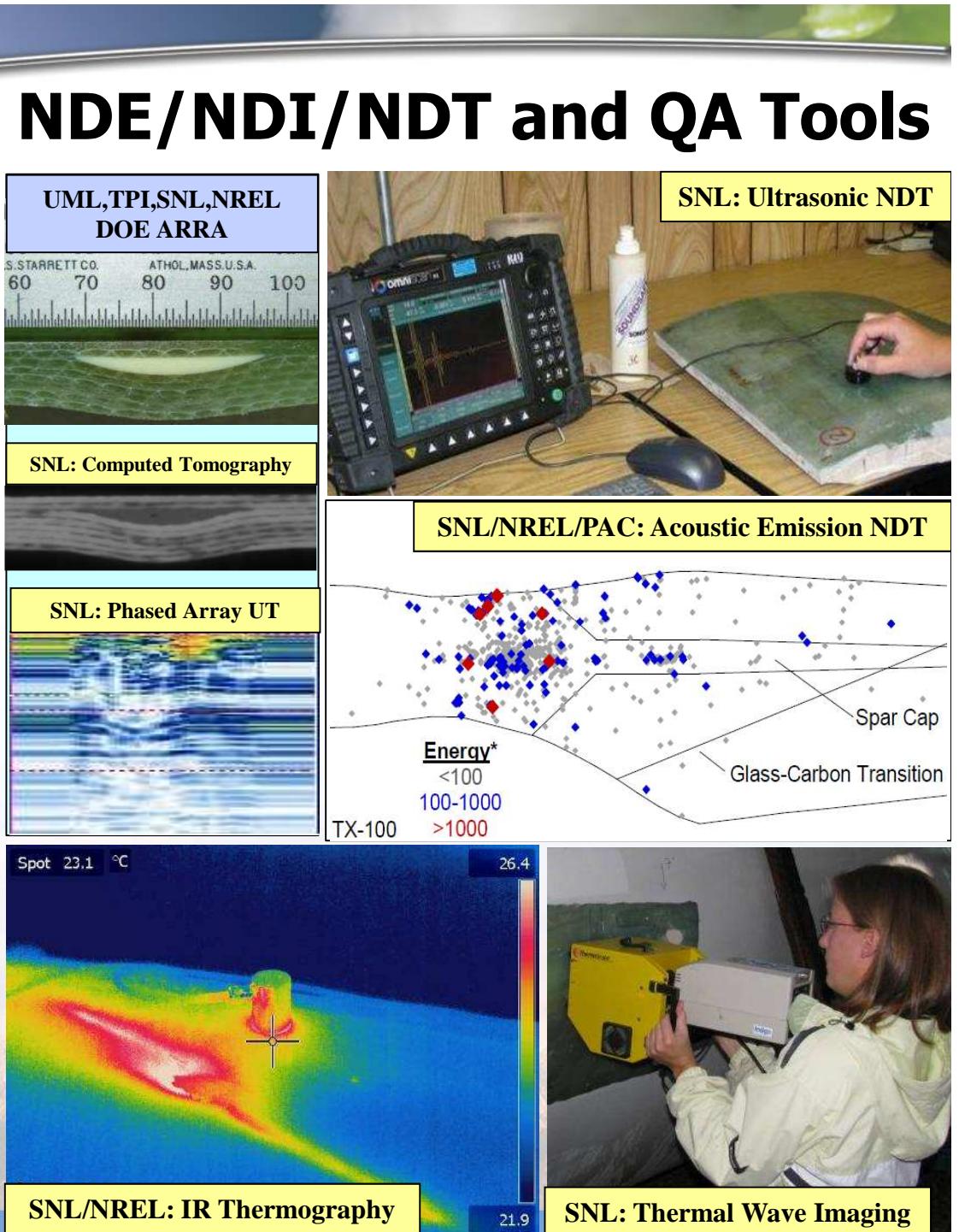
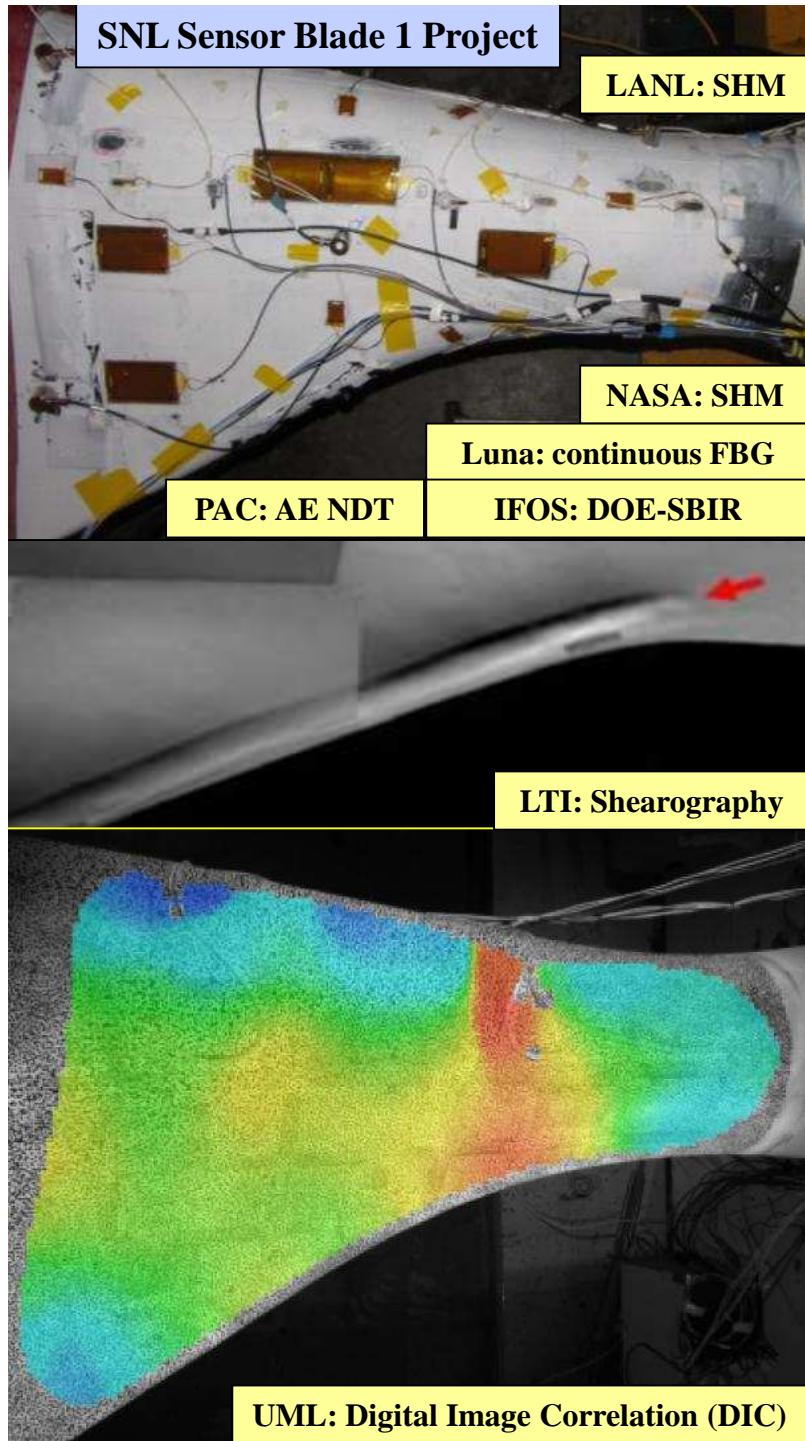
# Electrical Measurements

- Power

- Uses: three-phase voltage, current, total power, VAR
- Partners: Ohio Semitronics
- Examples:



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# *Survivability and Packaging of Instrumentation*



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# Instrumentation Packaging

Unmanned Operation  
and Connectivity



Reliable and Rugged Connectorizing



Rugged Packaging



Transportation Monitoring



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# *Instrumentation Survivability*

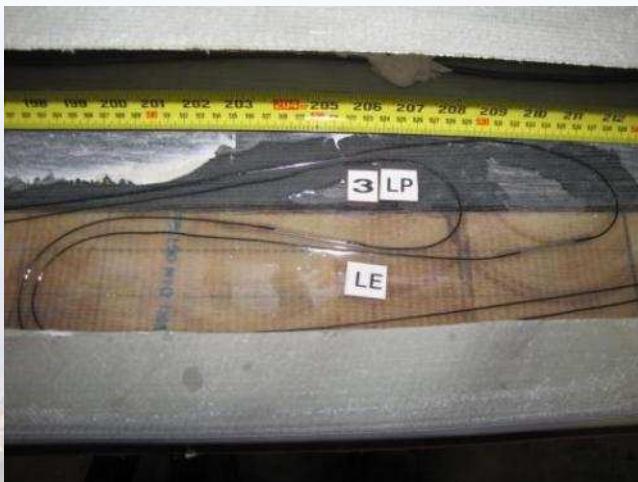
Waterproof Enclosure Testing



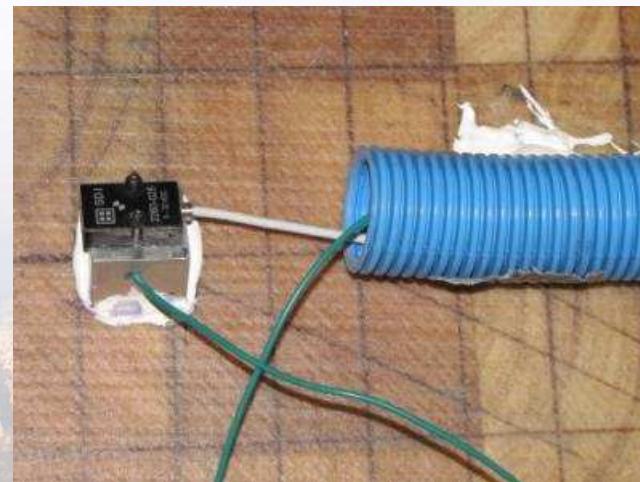
Robust Instrumentation Mounting



Robust Cabling Installation



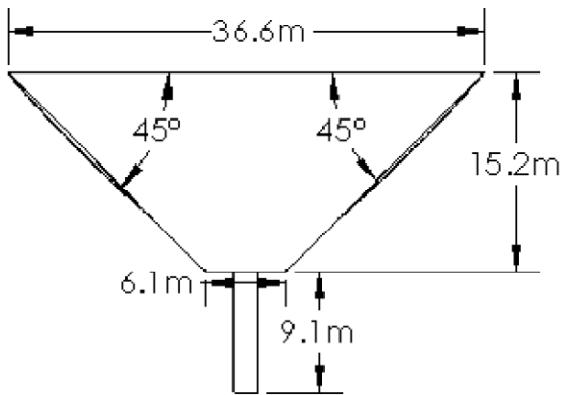
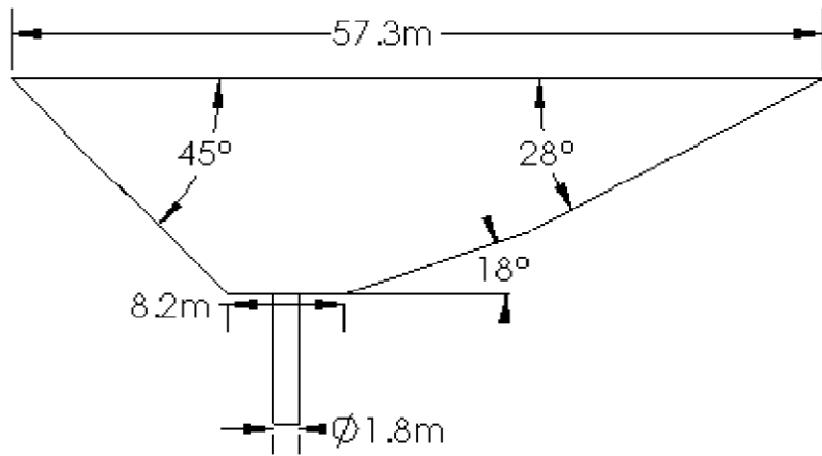
Sensor Survivability and Installability



Laboratories



# *SNL Testing Facility*



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*Thank You*



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