CREW

(Continuous Reliability Enhancement for Wind)
Database and Analysis Program
Sandia Blade Workshop
July 22, 2010

CREW Database Project **Team**

Bridget McKenney, Wind Reliability Lead

Alistair Ogilvie, Data Lead

Valerie Peters, Reliability Analyst

Wind & Water Power Technologies
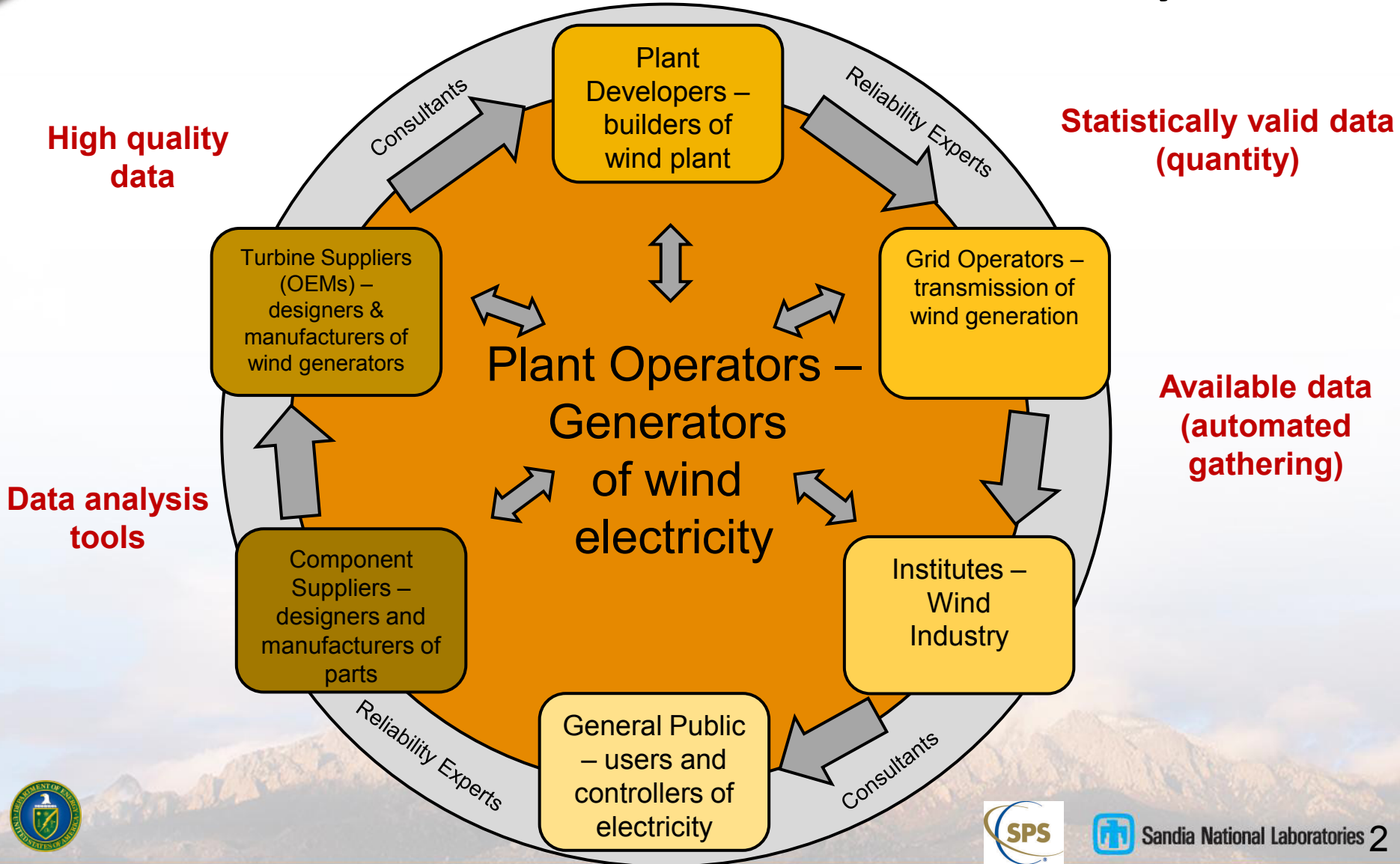Sandia National Laboratories

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Operators are at the hub of all reliability activities

High quality data

Statistically valid data (quantity)

Available data (automated gathering)

Data analysis tools

Plant Operators – Generators of wind electricity

Plant Developers – builders of wind plant

Grid Operators – transmission of wind generation

Institutes – Wind Industry

General Public – users and controllers of electricity

Component Suppliers – designers and manufacturers of parts

Turbine Suppliers (OEMs) – designers & manufacturers of wind generators

Consultants

Reliability Experts

A Comprehensive Data Model for Reliability

Challenge:
Size of database –
Dozens of operators,
Thousands of turbines,
Millions of data records

Data → Data Warehouse | Reliability Analysis

Reliability Improves from the bottom up

Federal role spans across industry

Plant Operations

Plant Development

Turbines

Components

Subcomponent and Materials – Supply Chain

Individual Reports

Contributes to increased availability of data partner operations

Baseline Reliability Information

This information will influence expectations for the market: provide confidence for 20% by 2030

Technology Improvement Opportunities (TIO's)

Value: Increase industry reliability and advance the technology maturity level

Data Driven Analysis Improves Reliability

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A Feasible Future Scenario

Industry Aggregated Data / Benchmarks for US Fleet

Company-Wide Wind Plant Data: Single Owner/Operator

Wind Plant Data: Single Owner/Operator

Turbine Level
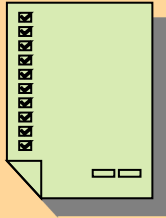
Improving Reliability

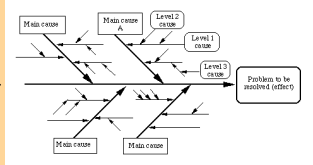Improvements

Actions & Operations

Failure Event

Power Production

Tag/Fault (symptom)

Work Order (resolution)

Root Cause Analysis

CREW: Continuous Reliability Enhancement database for Wind

- Create national reliability database of wind plant operating data to enable reliability analysis
  - System, component, and part levels – identify root cause of failures
  - Identify issues and technology improvement opportunities
  - O&M cost reduction
  - Industry RAM benchmarks
- Protect proprietary information
- Increase confidence: financial sector and policy makers

Industry Challenges

Three types of data needed:

- **SCADA Data (time series and events)**
  - Lack of data consistency and completeness across SCADA systems

- **Maintenance Data**
  - Paper work orders not scalable to high volume data analysis; low deployment of CMMS systems and data historians
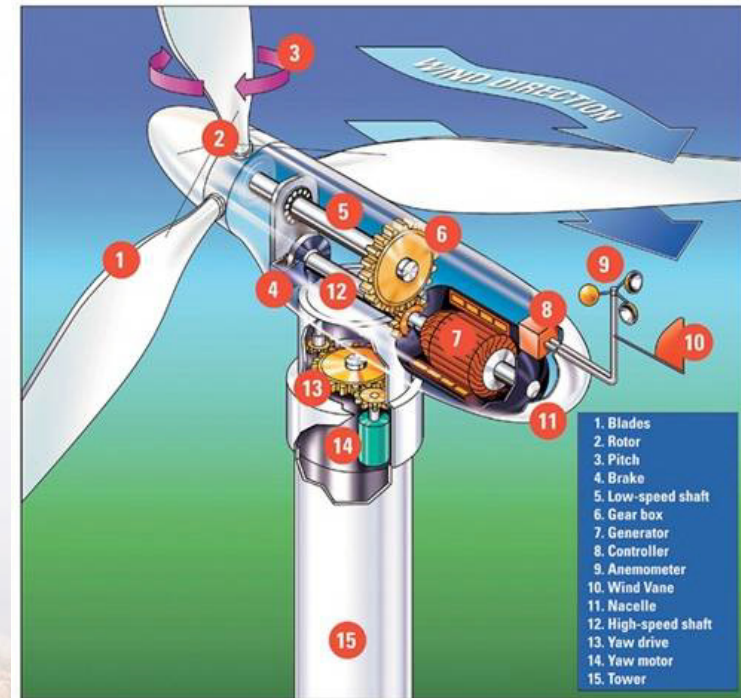
Operational support and business growth

- Data support requires bandwidth from sparse internal resources
- Cultural: "just fix it" attitude
- Concern regarding sharing of proprietary data

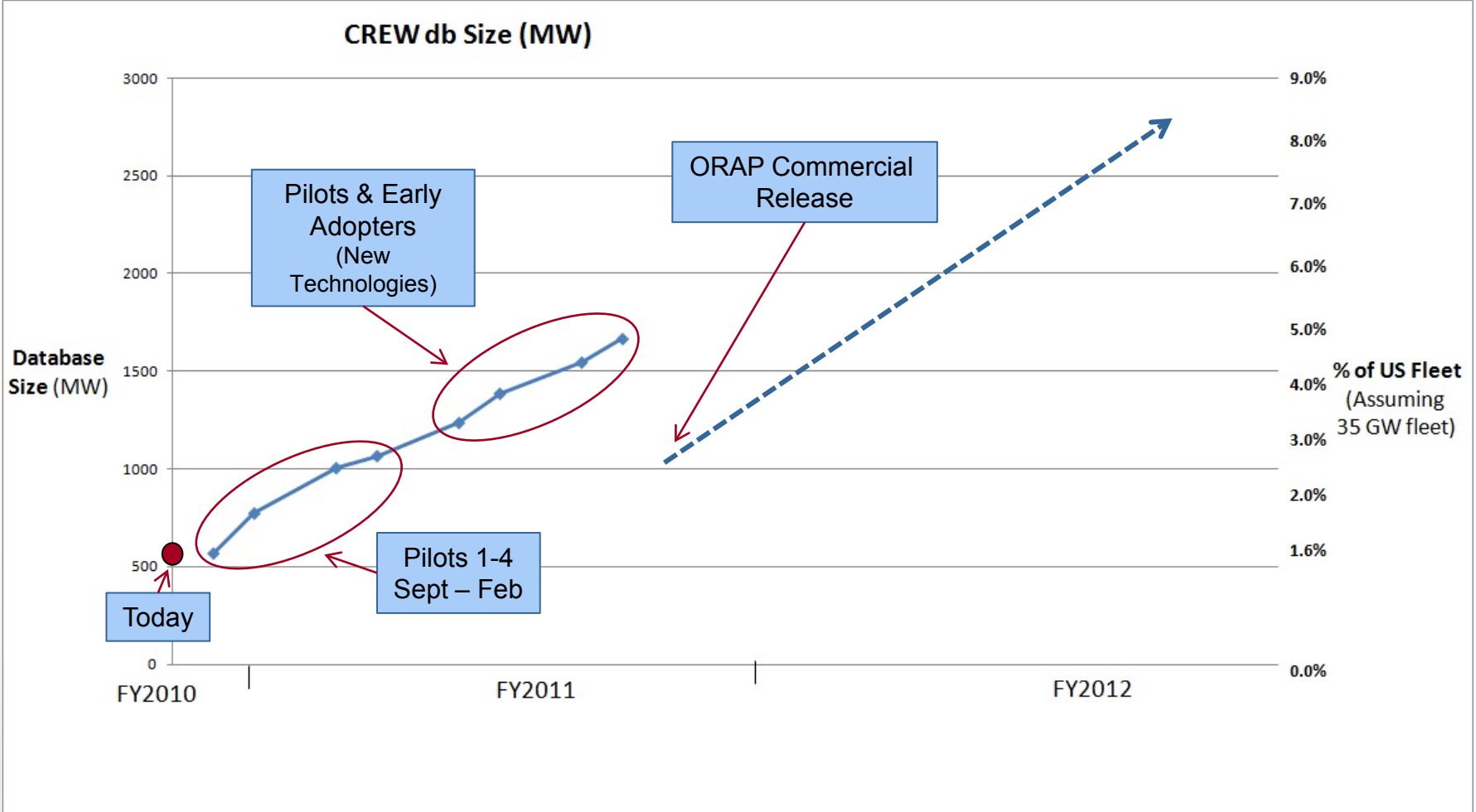Sandia National Laboratories

FY10: Partnership - Sandia & Strategic Power Systems (SPS)

- **SPS: a reliability engineering and information technology company**
- **Operational Reliability Analysis Program (ORAP)**
  - Over 20 years experience in reliability tracking and benchmarking
  - Gas and steam combustion turbine operations
- **ORAP for Wind**
  - Capture RAM data at component level
  - Close relationship with OEMs and operators
  - Customer-specific data treated as proprietary
  - Minimize human input
  - Internet-enabled reporting and feedback
- **Industry-driven methodology**
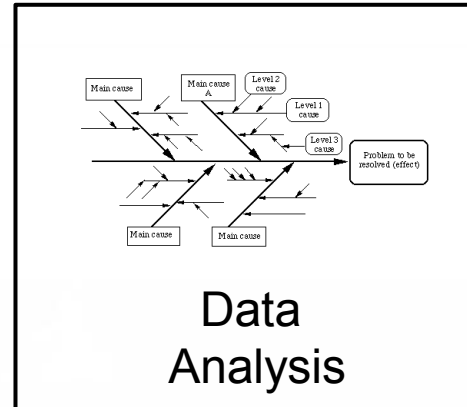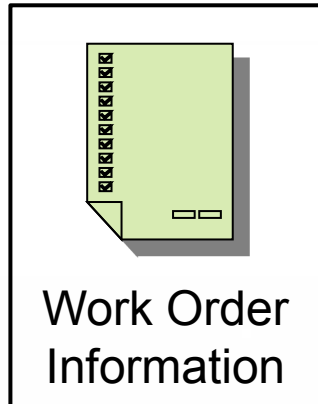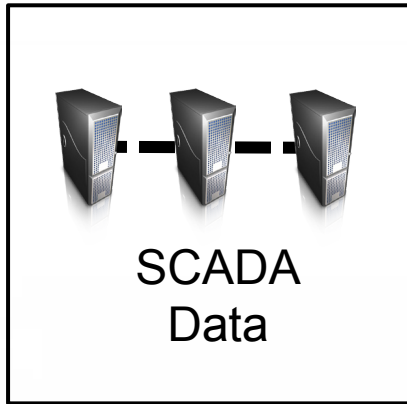 - IEEE, IEC and ISO standards
  - NERC compliant

WIND DIRECTION

1. Blades
2. Rotor
3. Pitch
4. Brake
5. Low-speed shaft
6. Gear box
7. Generator
8. Controller
9. Anemometer
10. Wind Vane
11. Nacelle
12. High-speed shaft
13. Yaw drive
14. Yaw motor
15. Tower

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CREW Database Growth

1 plant, 1 year = 138 Gigabytes of CREW data

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SCADA Data **+** Work Order Information **+** Data Analysis **=**

NOW: Owner/Operator

| Reduced Downtime |
| Effective Maintenance |
| Improved Performance |
| Better $ Decisions |
| Lower Costs |

LONG-TERM: US Fleet

Improved Quality of Next-Generation System and Components

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Development Phase

- **Critical Roles:**
  - Sandia National Labs: manage project and develop CREW database
  - Strategic Power Systems (SPS): develop a wind plant version of ORAP
  - Pilot Partners: demonstrate high-volume data flow
  - Advisory Board: provide input and influence industry adoption
  - Early Adopters: demonstrate scalability of ORAP