SAND2008-3048C

Blade Workshop

Initial National Reliability Database (NRD) Results

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Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company, for the United States Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.

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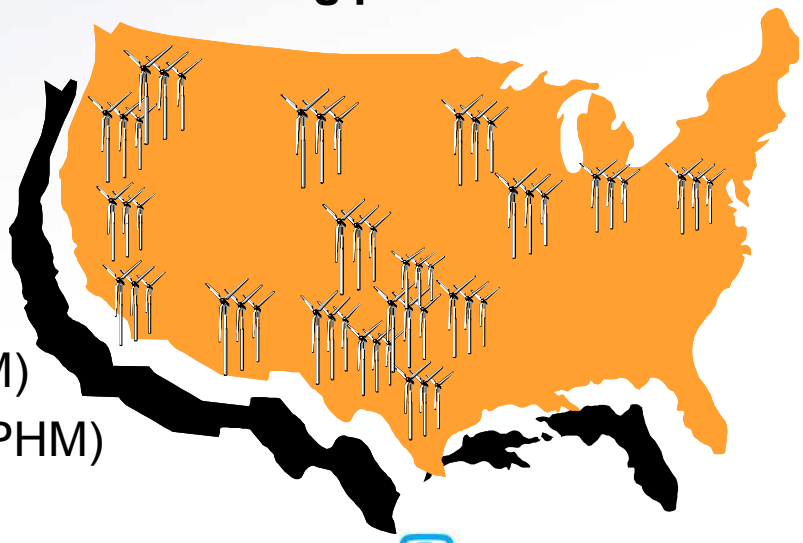
Program Goals and Objectives

Working through industry partnerships to:

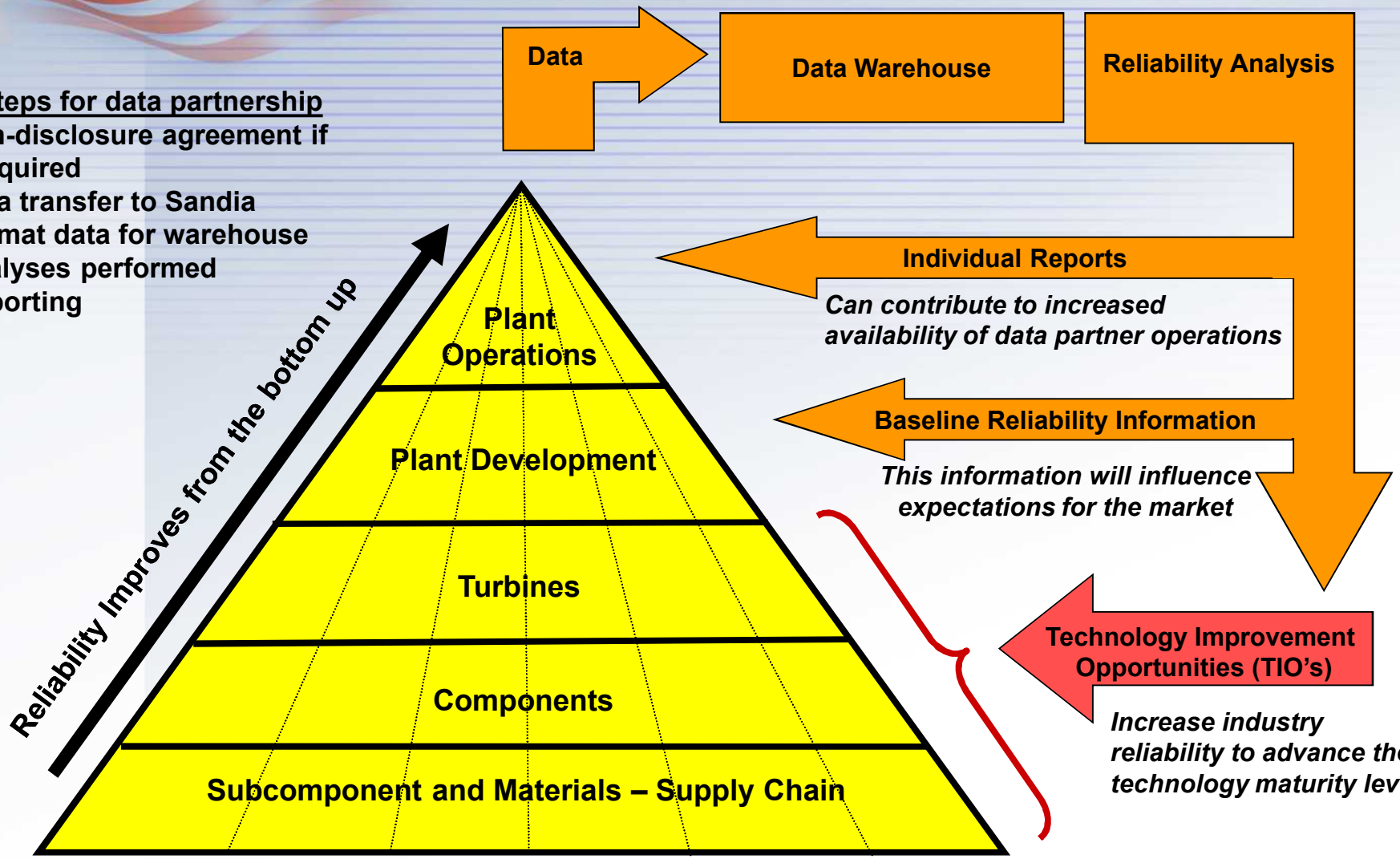
- **Develop National reliability baseline statistics for the US wind energy industry**
  - **Turbine component failure rates are higher than expected by some**
  - **This is the first long-term, data based, national effort to quantify and track these failures**
- **Guide efforts to address important component reliability problems**
- **Provide feedback for improving design and manufacturing practices**
- **Help wind plants:**
  - **Improve asset management for**
  - **Optimize O&M practices**
    - Preventive maintenance
    - Parts inventory optimization
    - Condition-Based Maintenance (CBM)
    - Prognostic & Health Management (PHM)



Data Driven Analysis Improves Reliability

Five Steps for data partnership

1. Non-disclosure agreement if required
2. Data transfer to Sandia
3. Format data for warehouse
4. Analyses performed
5. Reporting



Working through industry partnerships….

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Wind Farm A

- 0-5 years of operation
- 100+ turbines
- Two blade replacements due to lighting
- Lots of strikes

Wind Farm B

- 5-10 years of operation
- 100+ turbines
- Manufacturing related issues-laminations, voids
- Leading edge erosion
- Trailing edge splits
- Every blade struck by lightning at least once
- Grounding
- $100k spent on blade repairs
- 3 blades replaced due to lightning over life
- 6 blades/year replaced - 1/time
- Tune blades with lead shot

Wind Farm C

- 0-5 years of operation
- 0-50 turbines
- Bonding/laminations - delaminations, voids
- No onsite inventory
- Clean every year
- Replace in sets– around 5 since start of ops

Wind Farm D

- 5-10 years operation
- 100+ turbines
- Issues are QC
- Bug fouling, leading edge erosion
- Repairs, not replacements for lighting damage
- Clean when gearboxes are changed (rotor down)
- Around 40 blades replaced

Wind Farm E

- 0-5 years of operations
- 50-100 turbines
- No problems

Database Observations

- Multiple Work Orders
- Inspection takes minimal time
- Repairs take longer
- Replacements may take weeks

Conclusions

- Non standardization of data
- O&M may not be standardized either
- Around 18 years MTBF
- Crane required for replacements
- Availability requirements in contracts typical