



# ***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  
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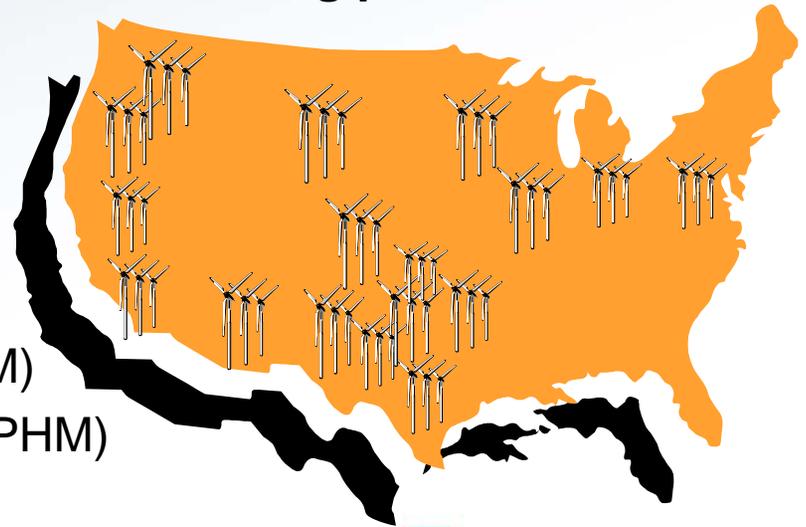


Sandia National Laboratories

# Program Goals and Objectives

## *Working through industry partnerships to:*

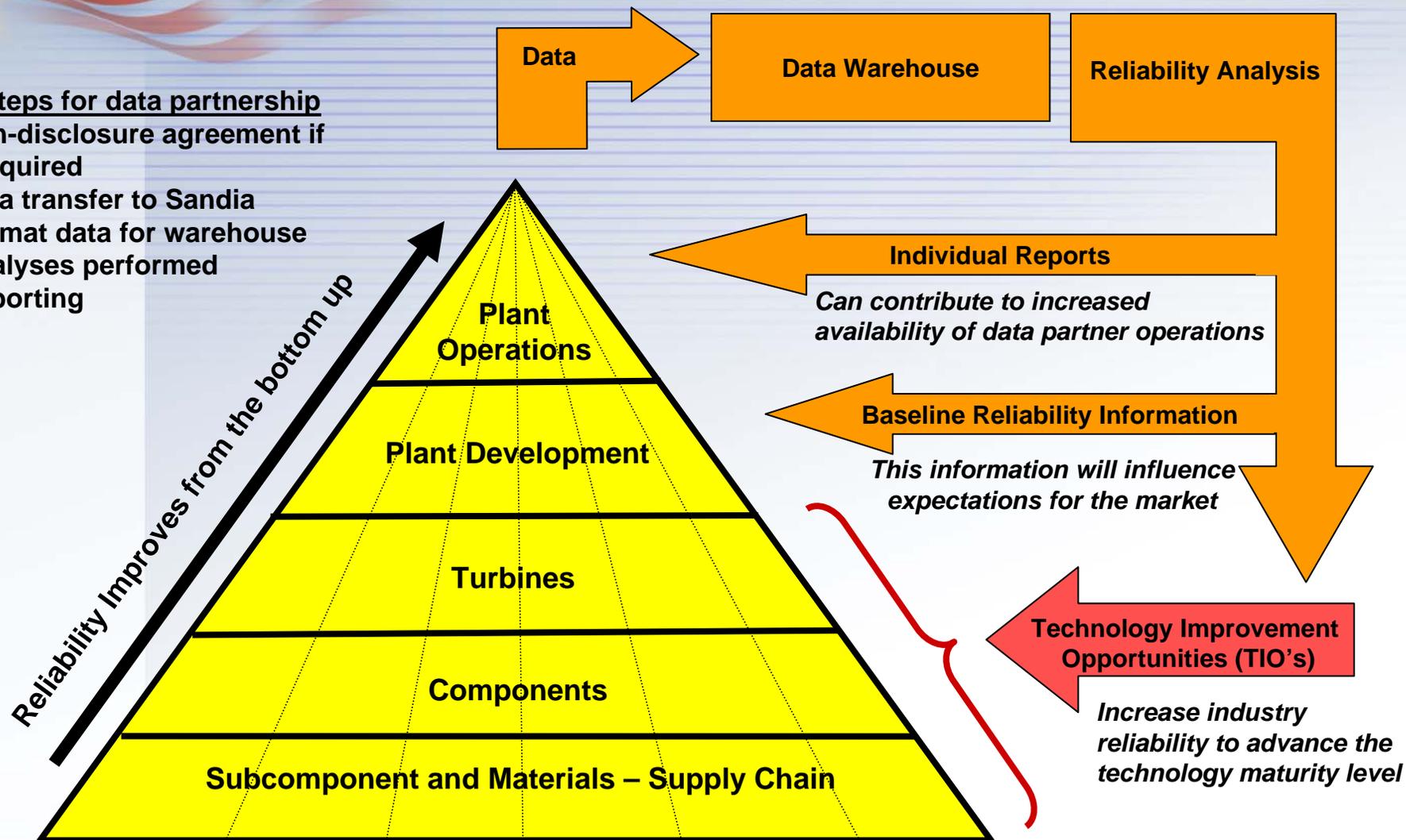
- **Develop National reliability baseline statistics for the US wind energy industry**
  - Turbine component failure rates are higher than expected by some
  - This is the first long-term, data based, national effort to quantify and track these failures
- **Guide efforts to address important component 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

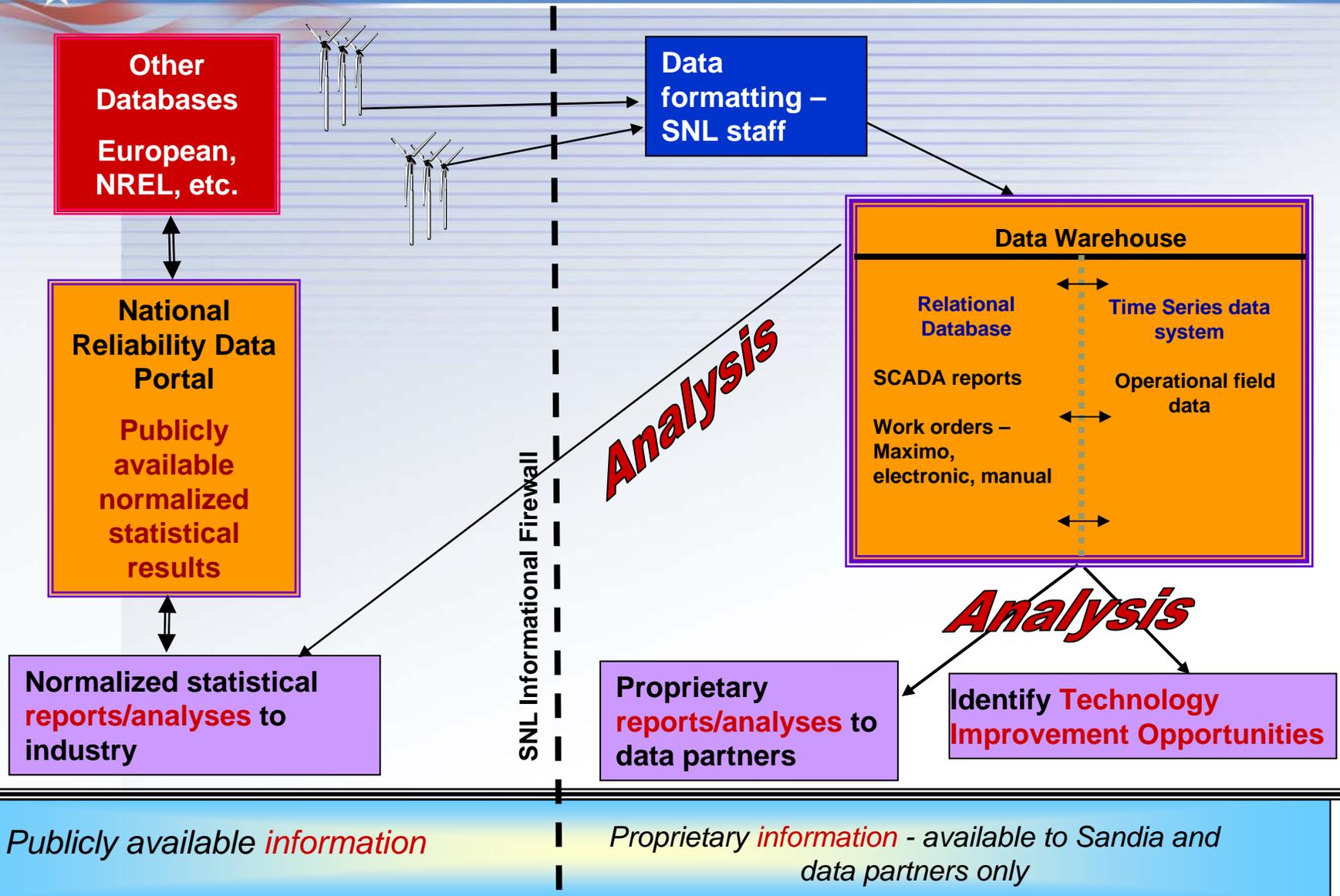
## Five Steps for data partnership

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....

# National Reliability Database



# *Wind Farm A*

- **0-5 years of operation**
- **100+ turbines**
- **Two blade replacements due to lightning**
- **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 lightning 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**

A graphic of the American flag, showing the stars and stripes, positioned in the upper left corner of the slide.

# *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**