SAND2014-17381PE

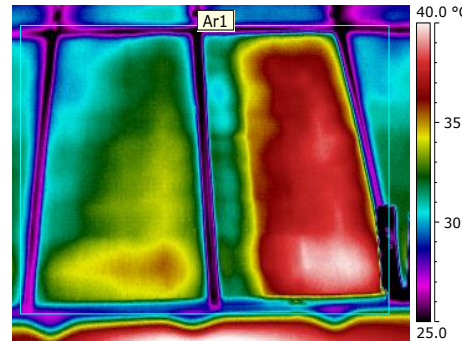**Sandia National Laboratories**

Standardizing PV O&M Best Practices - Presentation for PV-Insider

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September 10, 2014

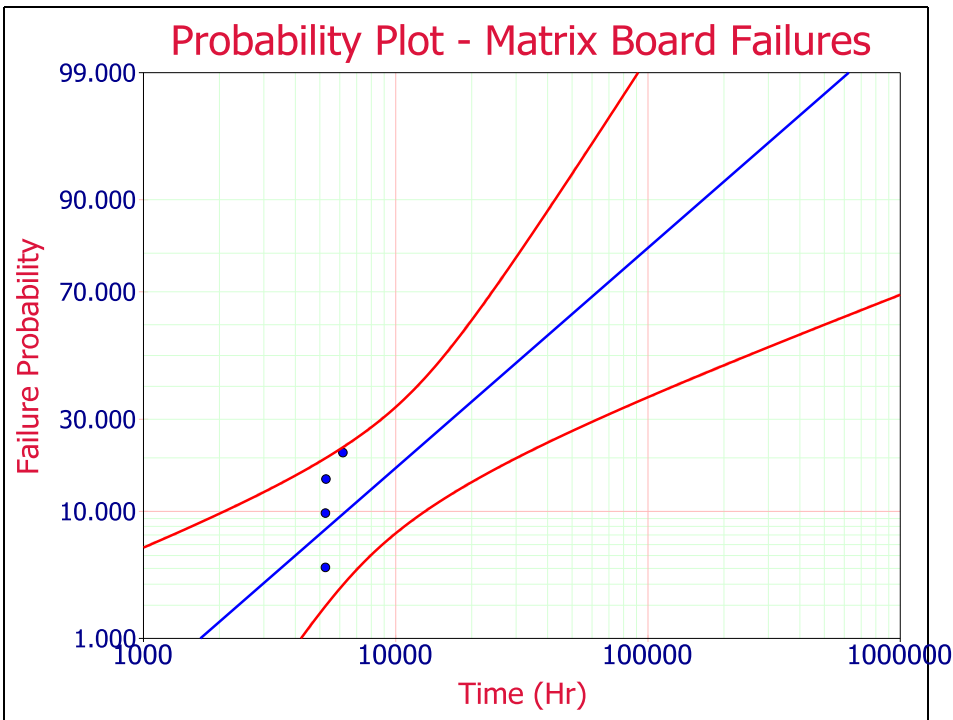# Research Efforts – Improve PV System Reliability, by:

Developing <u>PV Reliability Operations Maintenance</u> (PVROM) *process* into a Best Practice

- Failure Reporting, Analysis, and Corrective Action (FRACAS) methodology
- Reveals reliability improvement or decline over time
- Relies on industry participation (data) to demonstrate value

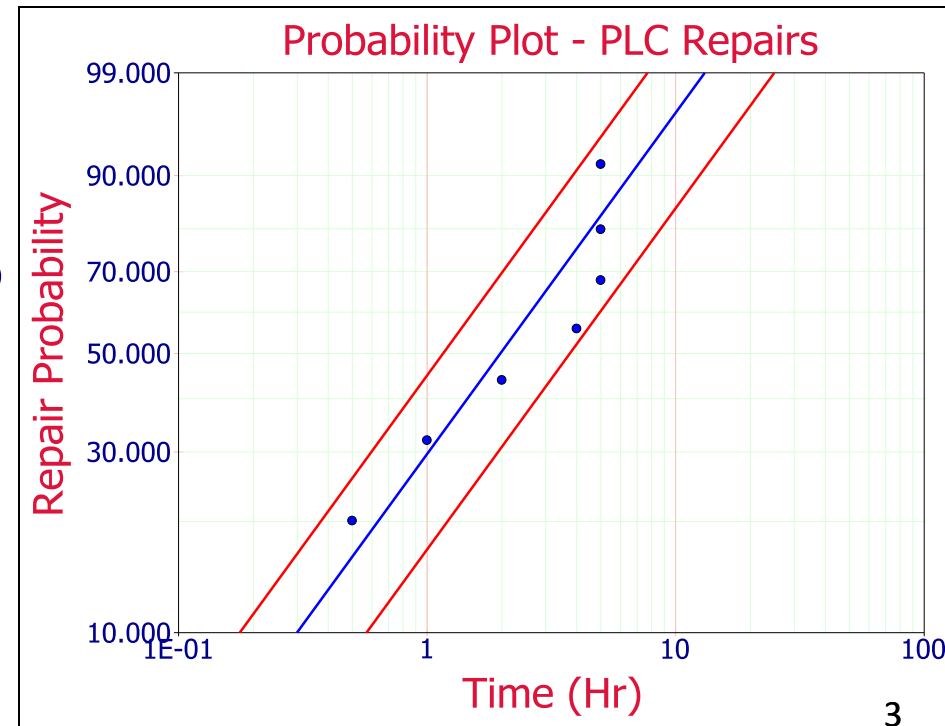**Facilitating working group to tackle topics on improving PV *system* reliability**

- O&M Practices and Standards – gaps analysis
- Key Performance Indicators – definitions and applications
- Availability states – Definitions and examples
- Preventative Maintenance
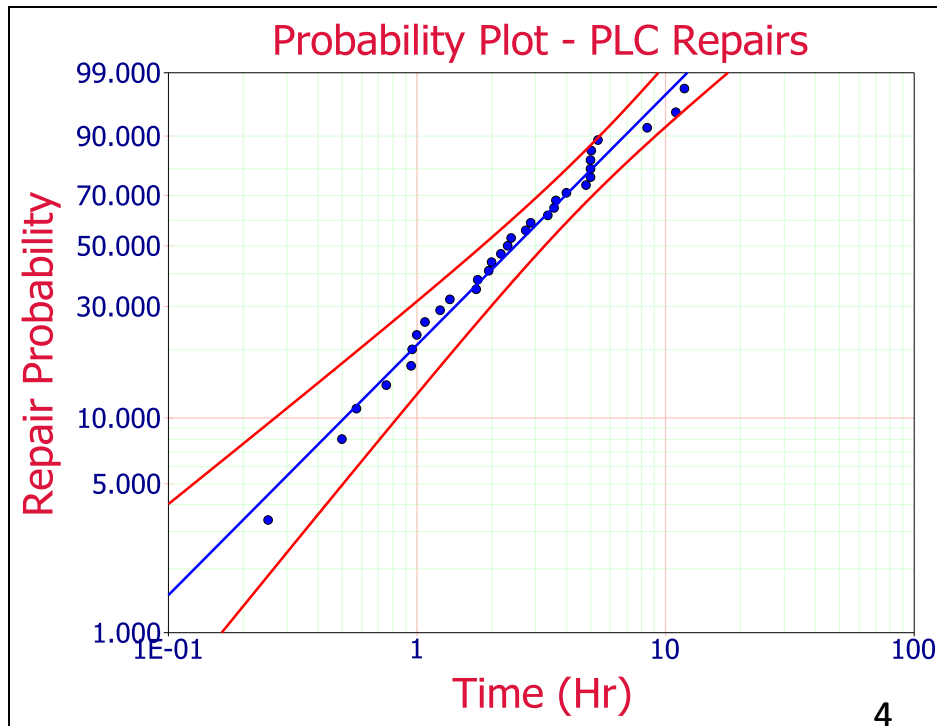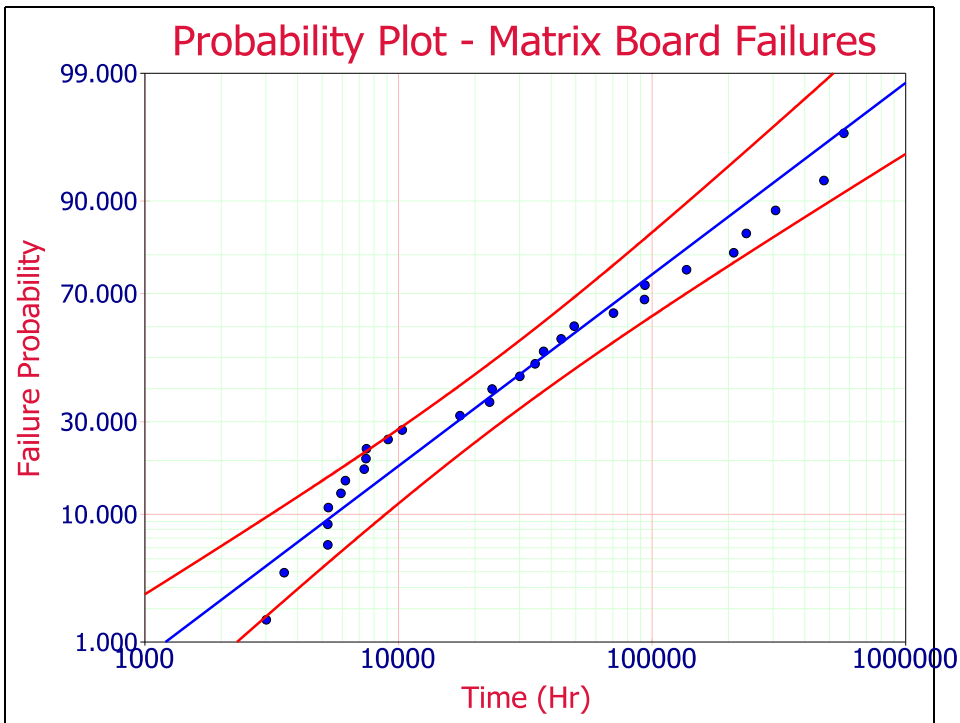
Prediction of O&M Performance

Probability Plot - Matrix Board Failures

- Using the data from PVROM we can "fit" statistical models

Probability Plot - PLC Repairs

90% double-sided confidence bounds shown by red curves

Prediction of O&M Performance

Probability Plot - Matrix Board Failures

With more data, model confidence increases

Probability Plot - PLC Repairs
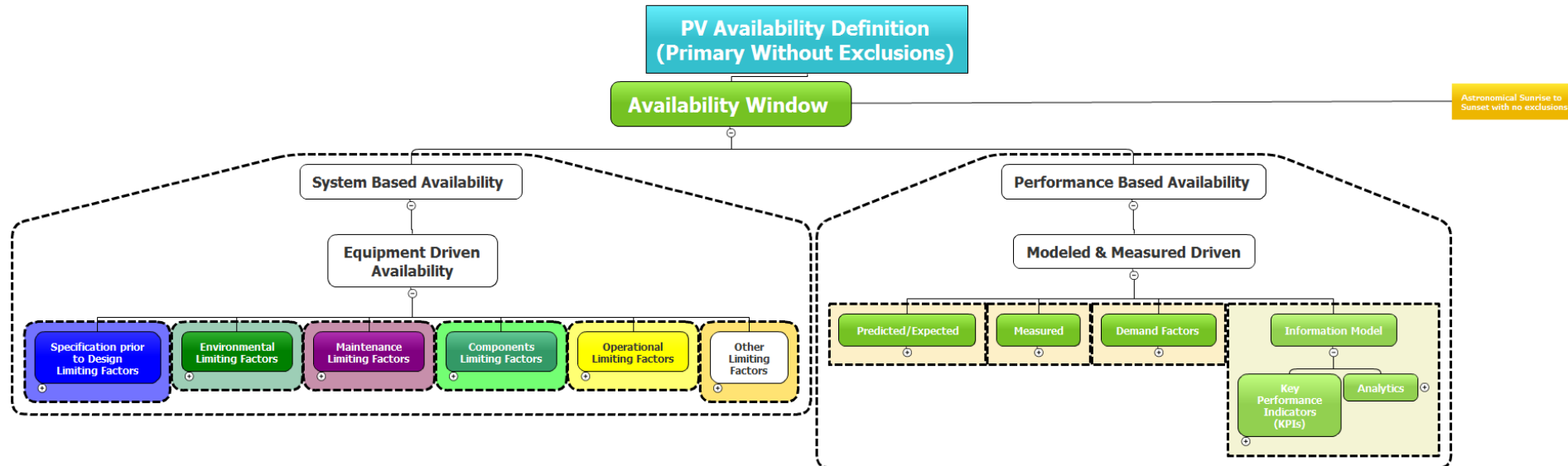
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Sparing Analysis

- How many spares do we need (on-site or at a depot) to ensure that we are likely not to run out?

- A risk management approach is employed

  - How many hydraulic cylinder spares should we buy to run less than a 10% risk of having no spares?

Year	Expected Number of Failures (in year)	Required Spares (for year)	Risk of Not Having a Spare
1	3.5	6	9.4%
2	18.7	23	9.4%
3	20.1	24	9.2%
4	18.4	22	9.1%
5	19.5	23	9.0%

Recommended spares will vary due to the wear-out failure mode of the component in question

Availability Flow Charting

- PV system "Availability" – where reliability engineering and PV system performance meet
- Goal is to simplify and standardize Availability definition
- Sub-group is working to define terms and relationships

For Additional Information:

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