Statistics Without Information

Valerie Peters
Sandia National Laboratories
vapeter@sandia.gov

Tammy Brown
Sandia Staffing Alliance
tambrow@sandia.gov

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.

SAND Number: 2008-7386C

Sandia National Laboratories

Agenda

- **Analysis Focus & Customers**
- **Information Scenarios**
  - **Existing systems**
    - Lots of data, but sometimes minimal information
  - **Prototype systems**
    - Available, but limited, data & information
  - **Future systems**
    - Almost no traditional data or information
- **Tips & Tricks**

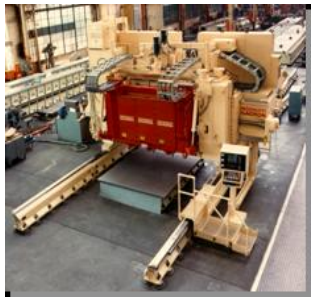
Sandia National Laboratories

Analysis Focuses & Customers

- Design for Reliability/Maintainability
- Acquisitions Programs
- Optimization Algorithms
- Prognostics & Health Management
- Modeling & Simulation
- Integrated Logistics
- Risk Assessment/Management
- Sensitivity/Uncertainty Quantification

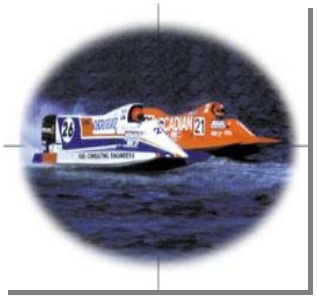
Technologies Support Broad Customer Base

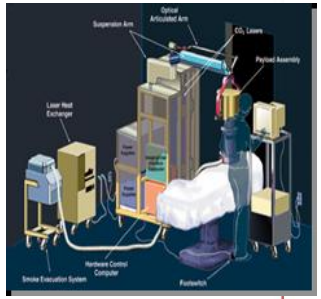

Defense


Machine Tool


Wind Energy

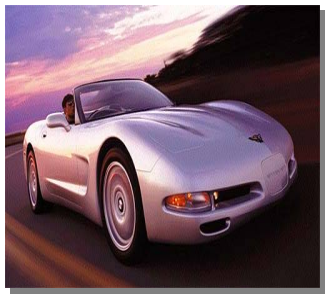

Semiconductors


Boating


Health Care

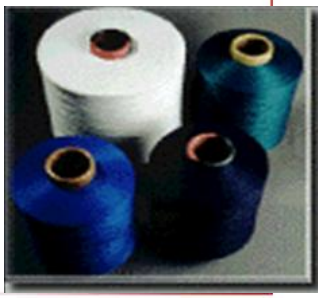

Petroleum


Aviation


Automotive


Nuclear Power


Coal-Fired Power

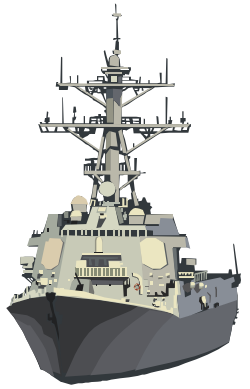

Textile

Sandia National Laboratories

Scenario 1: Existing Systems

- **Existing systems typically have a large amount of data, but that doesn't guarantee information**

- **Examples**
  - **Automobiles (especially after warranty period)**
  - **Legacy military systems**



Sandia National Laboratories

Scenario 1: Existing Systems

- **Examples of data which don't create information**
  - **Each piece of data makes sense, but the whole is illogical**

Problem Discovered	Problem Resolved
2/14/2007	1/15/2007

  - **Key linking information is missing**

Broken Part
ABCDE

    - Part Cost Table has no record for "ABCDE"

  - **Narratives and free text fields used where database keys and numbers are needed**

Broken Part
Widgit behind left tire

Sandia National Laboratories

Scenario 2: Prototype Systems

- **Prototype systems typically have some data, but it's limited**

- **Examples**
  - **Newly fielded electronics**
  - **Cutting edge technologies**

Sandia National Laboratories

Scenario 2: Prototype Systems

- **Examples of data which do not contain enough information**
  - **Cost data not available for the one-of-a-kind parts used in the fielded prototype**
    - Costs available for off-the-shelf parts does not tell the whole story
  - **Incomplete assessment of failure modes**
    - Predictions have been made for the failures that were seen or anticipated during testing, but this is optimistic at best
  - **Field test data that is not based on realistic conditions**
    - Assuming same or similar missions/scenarios will be used on actual systems
  - **Assuming a next-generation system is exactly like its predecessor**
  - **Assuming a system has the same weaknesses and strengths alone or in a system of systems**

Scenario 3: Future Systems

- **Future systems have almost no traditional data**
  - **Or, at least, no data accessible**

- **Examples**
  - **Early stage R&D ideas**
  - **Next Generation Classified systems**

Sandia National Laboratories

Tips & Tricks

- **Sensitivity Analysis**
  - How much does it matter what values are?
- **Gut Feel**
  - Are the input (or output) values more optimistic or conservative? Is this a best-case or worst-case prediction?
- **Clarify the impact of the assumptions you're making**
  - The right people with the right information can magically "come out of the woodwork" when the need is clear

Thank you!

Comments?

Questions?

Sandia National Laboratories