

Test Plans

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What are test plans?

- Necessary assessment & verification of your design
 - Customer requirements
 - Performance specifications
 - Validate any design claims
 - Safety
- Not just a to-do list
- Due after PDR, on Apr. 17

Types of Tests

- Performance tests
 - speed, time, speed, voltage, depth, etc.
 - From specifications or feasibility criteria
- Quality Assurance tests
 - (will resistor take the design load?)
- Product life , endurance, safety tests
- Human acceptance tests
- Environmental tests

Test Plans: Logic for each test

- Why are the specific tests necessary?
 - What are you trying to find/verify?
- How are the tests to be run?
- What design/build is needed to do the test?
 - Whole device
 - Part of a device

Test plan content

- Provide sufficient information so that someone else can do the test without you being there.

Test Content Format

- Test name and type
- Objective of test
- Success criteria
- Equipment required
- Procedure: **including sample size**
- Time required to complete (estimate)
- Location(s) of test
- Personnel: who will perform test
- **Results:**
 - **Presented in graphs, table**
 - **Statistics**
- **Analyze & Interpret meaning of results in terms of objective and success criteria**

Performance Tests Results

- Does the design meet the performance specification?
- e.g.,
 - Complete a task in specified time
 - Weight within specification
 - Not melt at Temperature
 - Not break under Forces

QA Tests

- Verify materials where data not available, or not certain.
 - Welds
 - New materials
- Verify purchased components work as design requires
 - Limits of duty cycles, frequency, voltage, energy

Life, endurance, safety testing

- How long will device last?
- How safe is the device?
 - At what load will it fail, not fail?
(hopefully you have a spare if it fails)
- Validate any condition you could not sufficiently model.

Human Acceptance Tests

- Is the device ergonomically acceptable?
 - User interfaces
 - Physically acceptable
 - Weight
 - Dimension
 - Range of motion
 - Visually acceptable
 - Displays: easy to read, right height
 - Colors: Pleasing, focuses attention when desired
- **Statistically significant** number of surveys after use by test subjects.

Environmental test

- Is the device affected by varying environments?
 - Sunlight (UV), temperature
 - Wind, rain, static electricity
 - Electro-magnetic noise effects
- Does the device affect the environment?
 - Oil leaks
 - Pollution , run-off
 - Recycle disposables?

Data

- Record appropriate data.
 - Have enough samples
 - Confidence interval, statistical significance of data
 - Do appropriate statistics
 - Use Student-T test if $n < 30$
- Display Data for interpretation
 - Mean, standard deviation, etc.
 - Plot data
 - X-Y plots, histograms, parametric curves, etc.

Interpret Data

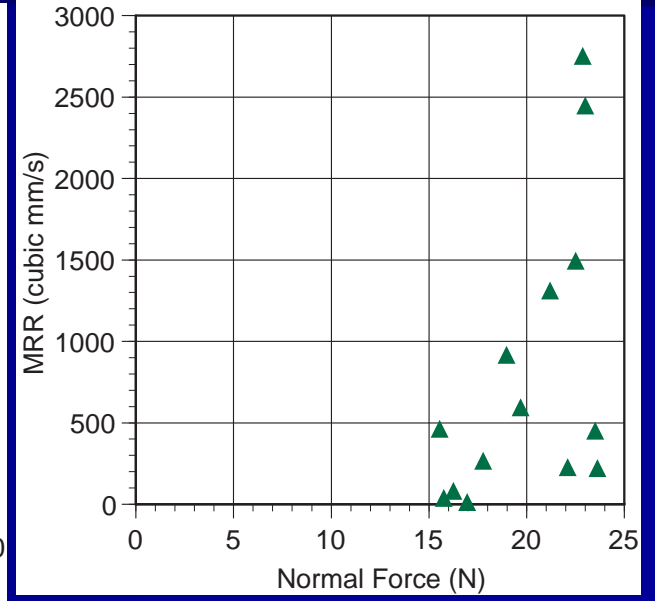
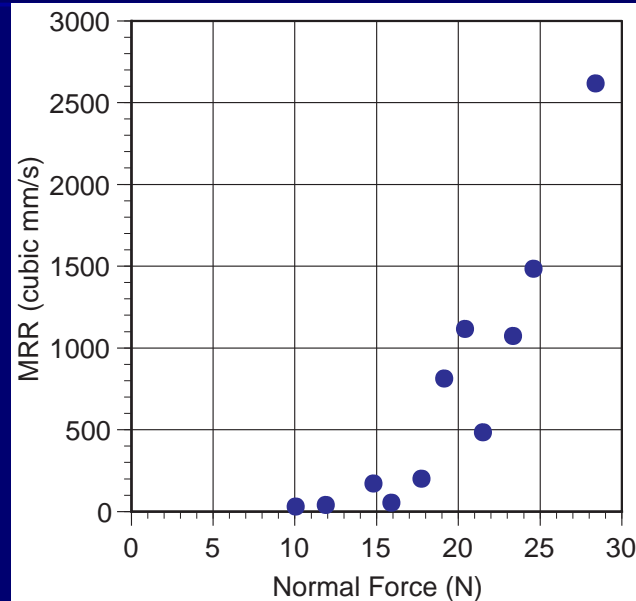
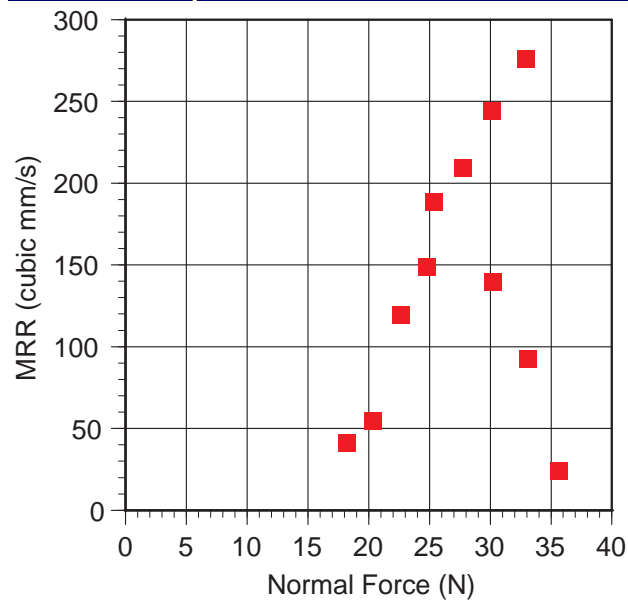
- Is there any correlations?
- Are there any trends?
- What does the mean and standard deviation indicate to the distribution?
- Does anything stand out?
- How does the data support your design performance, quality, etc?

Data analysis, with statistics

Table 1. Position Step Plunge Identified Model Parameter.

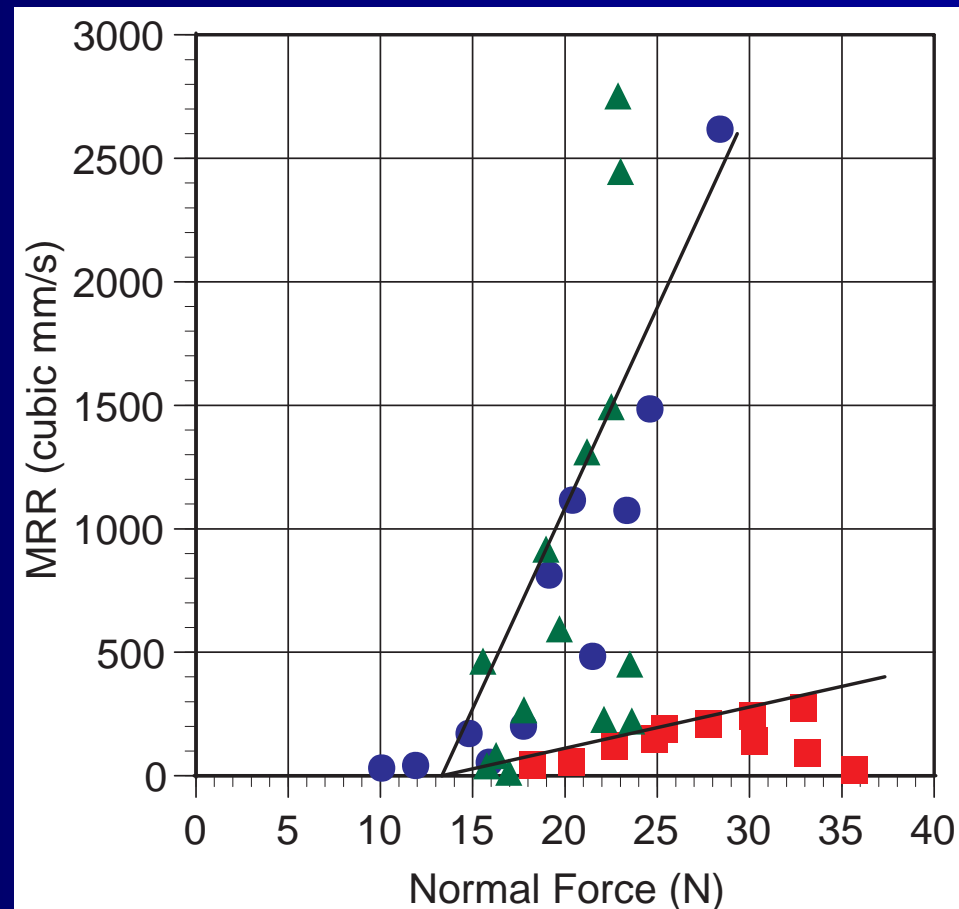
Material	Mean Model Coefficient K_P (10^{-6} mm²/N)	Std. Dev. Model Coefficient K_P (10^{-6} mm²/N)	Mean Threshold Force, F_{TH} (N) normalized to 36-mm² area	Std. Dev. Threshold Force F_{TH} (N)
AISI 8119	6.3	3.5	11.3	2.1
Inconel 718	3.4	1.8	11.3	2.8
AISI 4142	8.0	4.4	13.1	2.7
AISI A-2	8.3	3.9	12.4	2.8
AISI O-1	10.7	2.7	12.5	4.7
AISI 1020	44.3	10.7	12.7	1.3

Organize plots to visualize conclusion of data



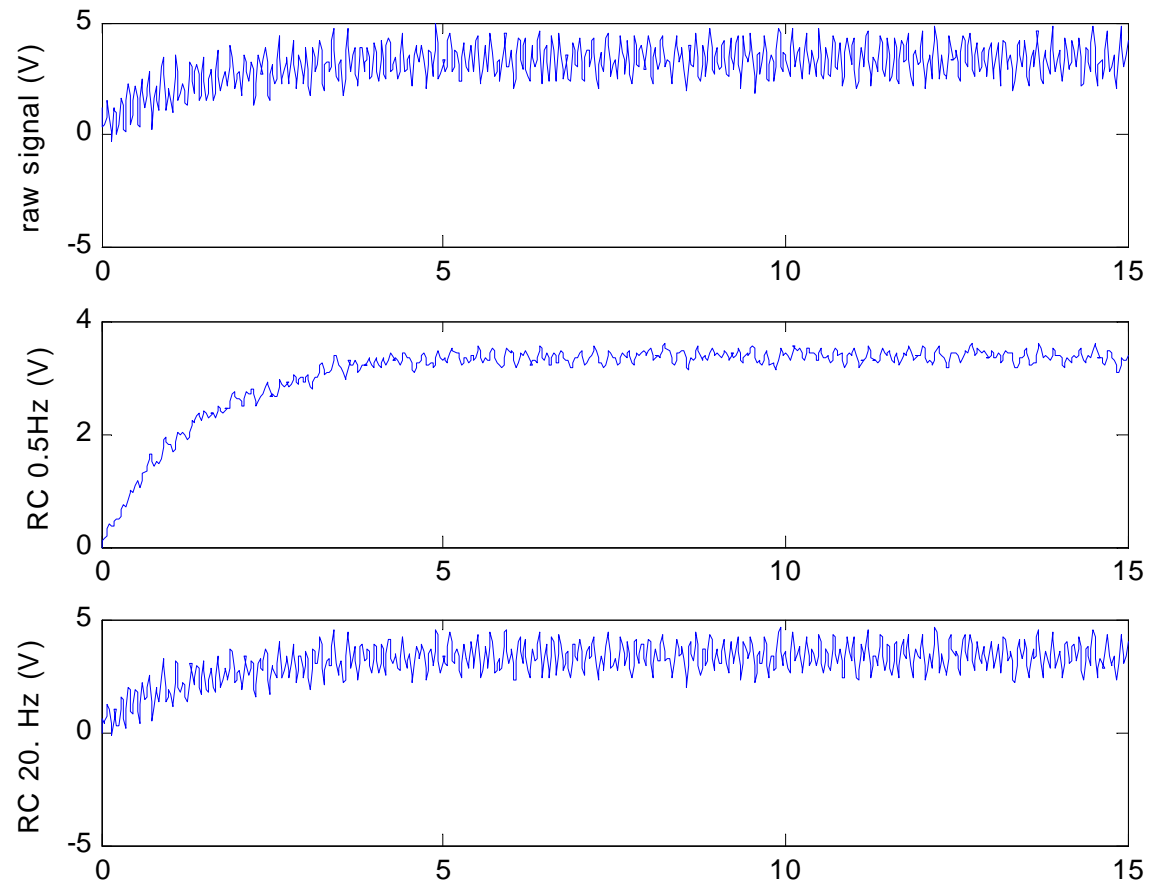
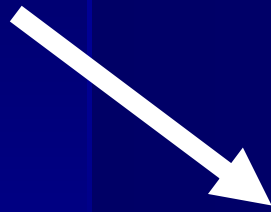
Organize plots to visualize conclusion of data

Threshold force has minimum value before $MRR > 0$.



Plot and process data

Low pass filter
reveals first
order system



Results & Conclusions

- Results will discuss the meaning of your data; you may have addition tables and plots to demonstrate your hypothesis
- Summarize in your conclusions how the interpreted results of your data support your design (met or exceeded specification).