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 Nov. 25
- Submit electronically as an email attachment to your instructor

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

Quality Assurance (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 tests

- 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?

Use of the Test Plan

- Establish a rational approach to establish that your design meets requirements
- Test plan will be incorporated into your CDR document (along with test results)

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

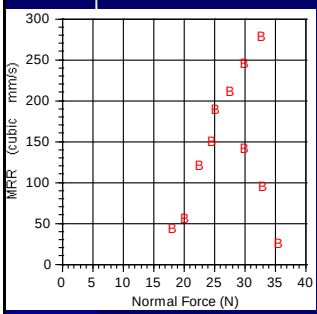
- Are there any correlations?
- Are there any trends?
- What does the mean and standard deviation indicate to the distribution?
- Does anything stand out?
- How does the data support your design performance, quality, etc?

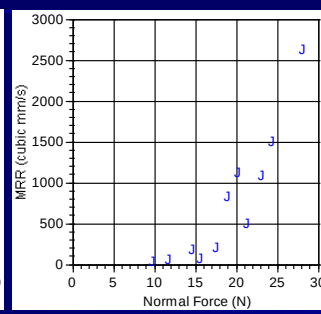
Data analysis, with statistics

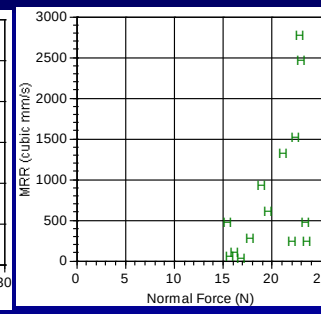
Table 1. Position Step Plunge Identified Model Parameter.

Material	Mean Model Coefficient K_P (10^{-6} mm^2/N)	Std. Dev. Model Coefficient K_P (10^{-6} mm^2/N)	Mean Threshold Force, F_{TH} (N) normalized to 36-mm^2 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

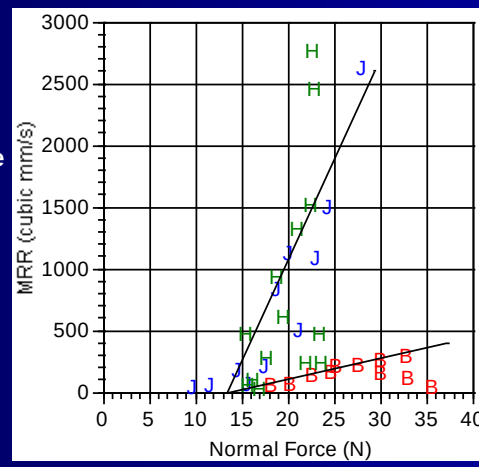






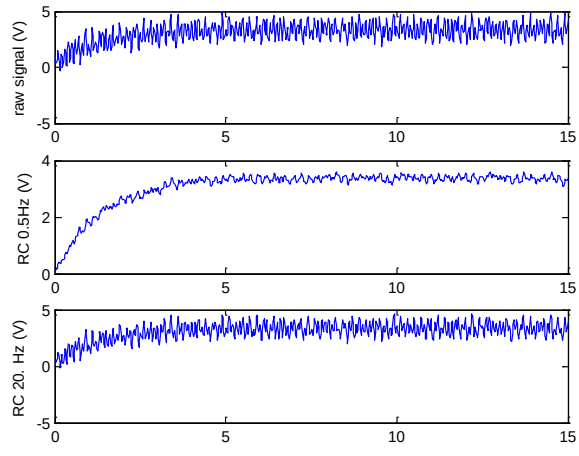
Organize plots to visualize conclusion of data

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).

Rest of the Semester

- Respond to PDR feedback from client, tech. advisors, instructor
  - Due on or before Dec. 4 team mtgs.
- Final class meeting Dec. 2 – mandatory peer evaluations
- Secure a project room if needed
- Start ordering parts