Static Test Stand Water Bottle Rocket Thrust Performance Analysis Lab Report *due Wednesday/Thursday 4/19/17 – 4/20/17*

Use general guidelines from the earlier AIAA paper template.

This description is meant as a guide for what to include in your report – write it as clear and logical as you can, in the way you prefer. Do include the discussions here.

You will be graded on ***presentation*** *(neatness),* ***clarity, accuracy****, and* ***completeness****.*

Authors (don't forget to include your names! You will both/all three be given equal credit, so work together!)

Nomenclature
Acronyms and terms

Introduction and Theory
Why and how is rocket thrust measured? Provide a little background on the process of measuring thrust, calculating Isp and what this info means.

Isp is defined as…
Isp is determined by…
Isp is used to …

How many times does a test need to be run to establish the desired degree of confidence in the results? Standard Error of the Mean (SEM) is used to…

Materials and Methods
List and describe all aspects of the test setup, include a few key photos of test stand and VI console

Describe the thrust/time data collection process
Why does the baseline change before and after the water rocket is fired? How do we compensate for the sensor and test stand to improve our Isp calculation?
NOTE: do not include your detailed checklists here, just summarize the general flow

Summarize your analysis protocol (pseudo code) for determining Isp from the thrust/time data sets

Results
1. Show a representative force curve (*Newtons* vs. *time*)
2. Table of Isp for each data set (provide Isp in *seconds*)
3. Table of peak thrust for each data set – calculate average thrust and standard deviation
4. Table/Histogram ~~Plot~~ of total time of thrust for each data set – calculate average time and standard deviation

Make sure you have properly labeled axes/units and terms in all plots

5. SEM analysis – what is SEM? When is it useful? Why is it useful?
   See notes on D2L for SEM equations.
6. Plot of SEM vs. N (incremental) (as you add tests to the dataset, how does SEM change?)
7. Computed SEM for the full data set (N)
8. How many test firings (N) are needed in order to say that the sample mean value for the Isp is within 0.1 seconds of the real mean expected Isp value within a 95% confidence interval? 97.5%? 99%? How many test firings are needed for 95%, 97.5%, and 99% confidence for a precision of 0.01 seconds?

Conclusions

How many times would the static test need to be performed to establish 95% confidence interval (CI) in the thrust data? How does this relate to uncertainty in the rocket flight performance model?

References

Include at least one source that you looked up (NOT a website or the textbook) on rocket thrust (Isp) and one for statistical analysis (SEM)