PYROTECHNIC SHOCK SIMULATION

SPRING UPDATE PRESENTATION
1/19/16

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Instructors: Dr. Gupta & Dr. Shih

Team 12 Members: Tiffany Shaw, Max Mecabe, Justin Vigo, Luis Lopez, Sarah Wyper

PROJECT BACKGROUND

- Pyrotechnics are used for tasks such as rocket
  separation, pilot ejection, airbag inflation, and
  payload deployment
- Can be damaging to electronic hardware
- Not easy to simulate
  - High Frequency
  - High Acceleration
  - Short Duration
  - Transient Response
- Difficult to computationally model
- Actual pyrotechnics are not required to simulate similar shock responses

Figure 1: Rocket Separation

PROJECT SCOPE

What does Harris want?

o   Currently simulate pyrotechnic shock

o   Long, time consuming process

o   Not able to change a lot of variables

o   Want understanding of how different variables affect SRS

PROJECT SCOPE

➢ Two Year Project
- o Year 1 – Design and build test rig and data acquisition system.
- o Year 2 – Implement design changes to create repeatability and collect data for variable pyroshock simulation.

➢ Need Statement

The current methods for shock testing lack accurate and repeatable results, as well as repeatability and efficiency.

➢ Project Goals
- o Modify design to create repeatability in results
- o Systemize and correlate variables to specific SRS curve outputs
- o Possibly improve efficiency of data acquisition process

Team 12
Presenter: Max Mecabe

PROGRESS

Creating stability and repeatability:

- ❑ Anchor
- ❑ Pivot Improvement
- ❑ Decouple plate from frame
- ❑ Electromagnetic quick release

Collecting data:

- ❑ Acquire DAQ
- ❑ Install LabVIEW software
- ❑ Test run data collection with code from previous year
- ❑ Run pyrotechnic shock testing

PROGRESS - ANCHORING

- o Newport series optical table

- o 528lb

- o Aluminum two hole strap

- o Foam for equivalent force distribution.

Figure 10: Simulation Table and Mounts

PROGRESS - PIVOT

- o Previous pivot was a static pivot mount
  - o This caused wear and unwanted side to side motion.
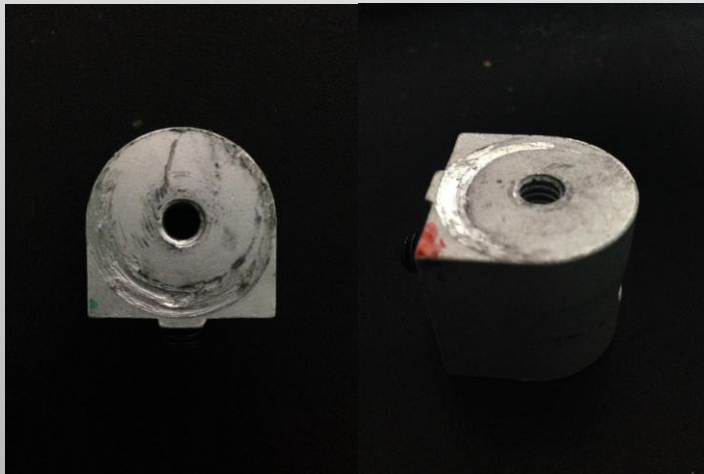- o New pivot is a dynamic pivot with lubricated bronze bushings

Figure 13: Static Pivot Wear

Figure 14: Dynamic Pivot

PROGRESS - DECOUPLING

o   Figure 15 shows the updated tethered plate design.

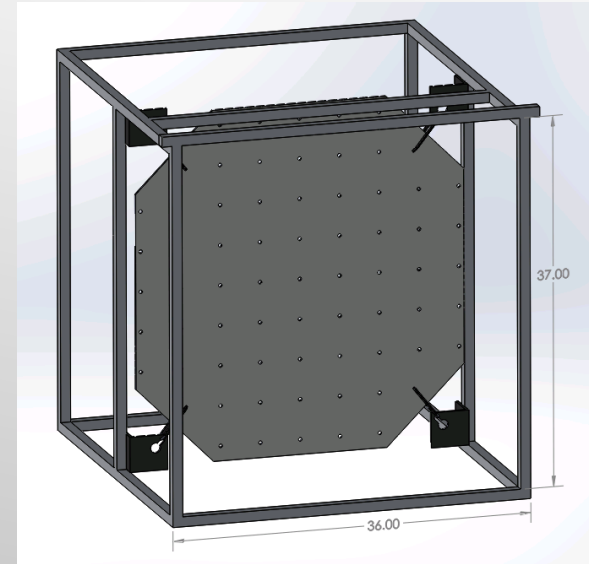o   The octogonal shape is a result of cutting the corners off the plate to make room for bungees.

Figure 15: Tethered Suspension Design

PROGRESS

Creating stability and repeatability:

- ☑ Anchor
- ☑ Pivot Improvement
- ☐ Decouple plate from frame
- ☒ Electromagnetic quick release

Collecting data:

- ☑ Acquire DAQ
- ☑ Install LabVIEW software
- ☑ Test run data collection with code from previous year
- ☐ Run pyrotechnic shock testing

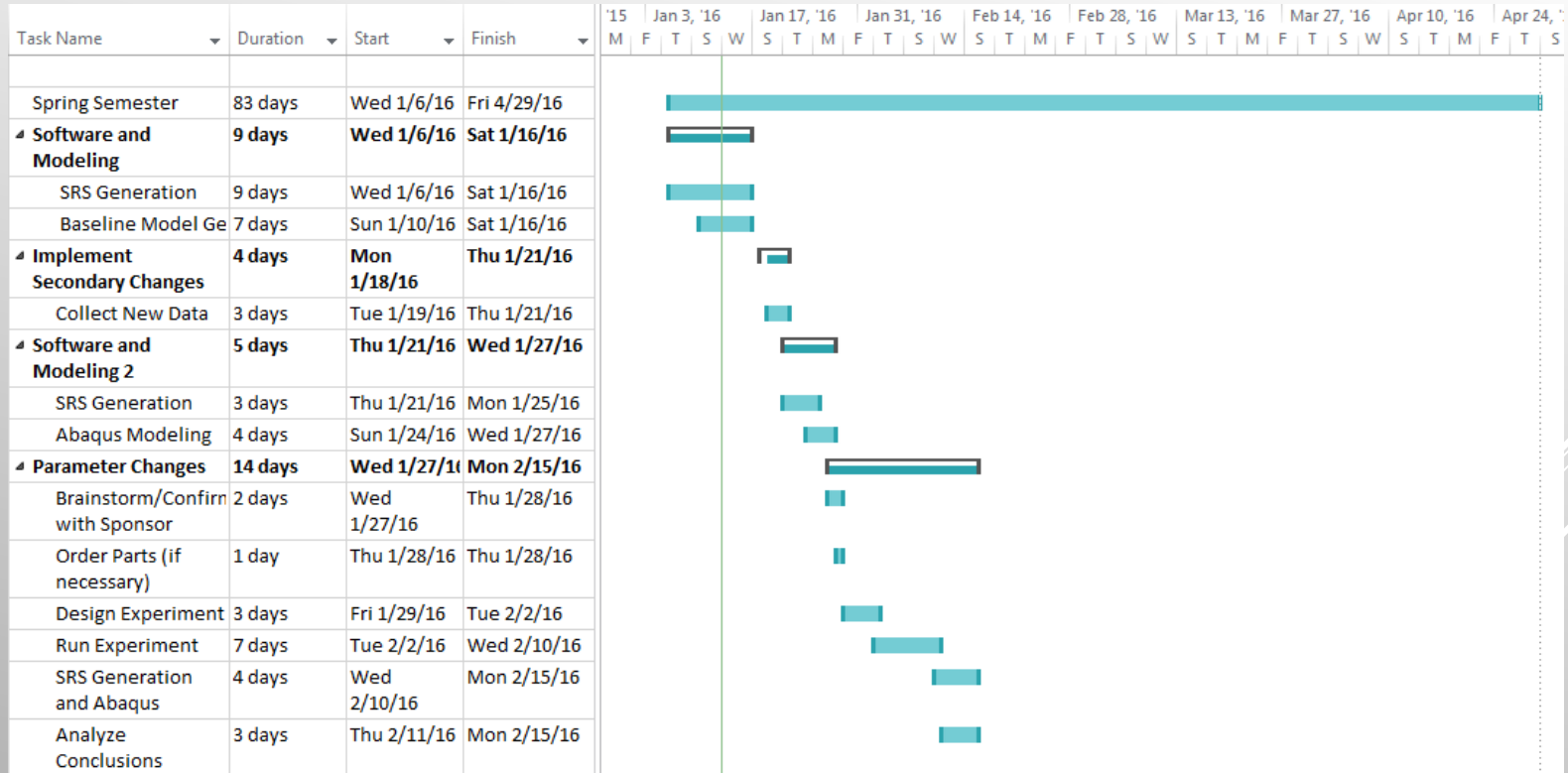# EQUIPMENT INFORMATION

o   Currently borrowing DAQ from Dr. Kumar, needs to be returned before Feb. 1st.

o   DAQ has been ordered on the 6th: NI USB 6211

      o   Very similar to what we are using

      o   Moves up 14 bit to 16 bit

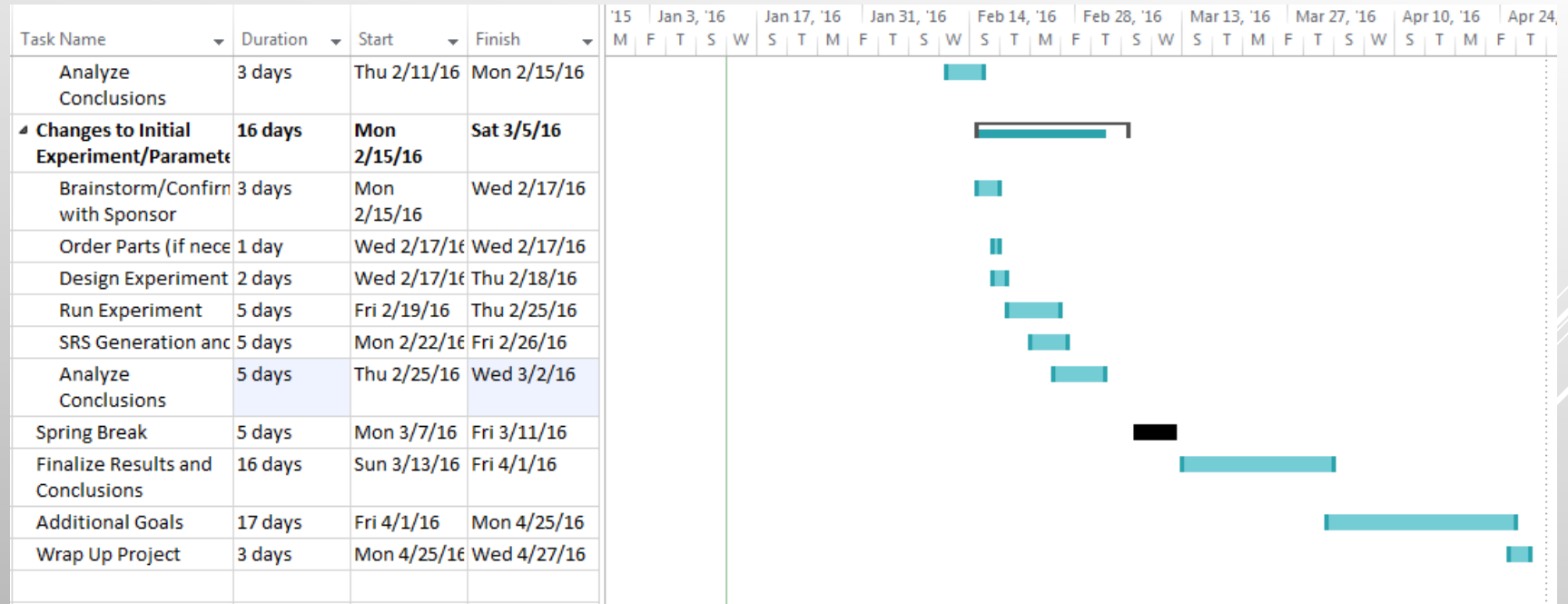   o   Slightly higher sampling rate

PLANS FOR TESTING

o Begin testing different variables and resulting SRS curve generation.
- o Hammer Weight
- o Strike Location
- o Sensor Location
- o Dampening

o Buy supplies for decoupling.

o Once decoupled, test variables again and see how decoupling has improved/affected the results.

GANTT CHART

GANTT CHART

Task Name	Duration	Start	Finish
Analyze Conclusions	3 days	Thu 2/11/16	Mon 2/15/16
⊿ **Changes to Initial Experiment/Paramete**	**16 days**	**Mon 2/15/16**	**Sat 3/5/16**
Brainstorm/Confirm with Sponsor	3 days	Mon 2/15/16	Wed 2/17/16
Order Parts (if nece	1 day	Wed 2/17/16	Wed 2/17/16
Design Experiment	2 days	Wed 2/17/16	Thu 2/18/16
Run Experiment	5 days	Fri 2/19/16	Thu 2/25/16
SRS Generation and	5 days	Mon 2/22/16	Fri 2/26/16
Analyze Conclusions	5 days	Thu 2/25/16	Wed 3/2/16
Spring Break	5 days	Mon 3/7/16	Fri 3/11/16
Finalize Results and Conclusions	16 days	Sun 3/13/16	Fri 4/1/16
Additional Goals	17 days	Fri 4/1/16	Mon 4/25/16
Wrap Up Project	3 days	Mon 4/25/16	Wed 4/27/16

CONCLUSION

- Pyrotechnic shock is the resulting violent vibrations from controlled explosions.

- We are charged with the task of testing the numerous variables that affect the SRS curves given a previously designed test rig.

- We have modified the design to create stability and eliminated other undesirable variables that are affecting the data.

- Our plans for the future are to collect data which we will use to systemize and correlate variables to specific SRS curve outputs.

QUESTIONS?

REFERENCES

"Pyro Shock Testing." Pyroshock Testing Simulation & Techniques. National Technical Systems, Inc., 2015. Web. 27 Oct. 2015. <https://www.nts.com/services/dynamics/shock/pyro_shock>.

DeMartino, Charles, Nathan Crisler, Chase Mitchell, and Chad Harrell. Pyrotechnic Shock Test Development - Midterm II Presentation Tech. no. 1. Tallahassee: FAMU-FSU College of Engineering, 2014.

Wells, Robert. "Conference Call with Mr. Wells, Mrs. Cooper, and Mr. Cornejo." Teleconference interview. 14 Jan. 2016.