Development of Hammer Blow Device to Simulate Pyrotechnic Shock

10/22/15

Sponsored by: Robert Wells, Harris Corporation
Advisor: Dr. Kumar
Instructor: Dr. Gupta

By Team 12:
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Background

- Importance of testing effects of pyrotechnic shock in safe manner
  - Damaging to electronic components
- Recreating shock accurately is difficult
  - High acceleration and high frequency with a very short duration time
- Shock can be simulated with hammer impact test
  - Shock Response Spectrum (SRS) curves useful for estimating damage potential
- Currently, tuning of shock test system is done by trial and error, which is time consuming

Year 1: Team 15 designed and built test rig and created an effective way to

Project Goals

Year One:

Developed test device

Developed modeling and analysis software

Gathered SRS data for test parameters

Year Two:

Improve repeatability of test device

Decouple strike plate and frame

Improve hammer release

Optimize modeling and analysis software

Needs and Specifications

Customer Needs:

1. Repeatability of test device
2. Speed up processing of SRS curves
3. Reduce set of test parameters
4. Perform test on device with reduced set of parameters

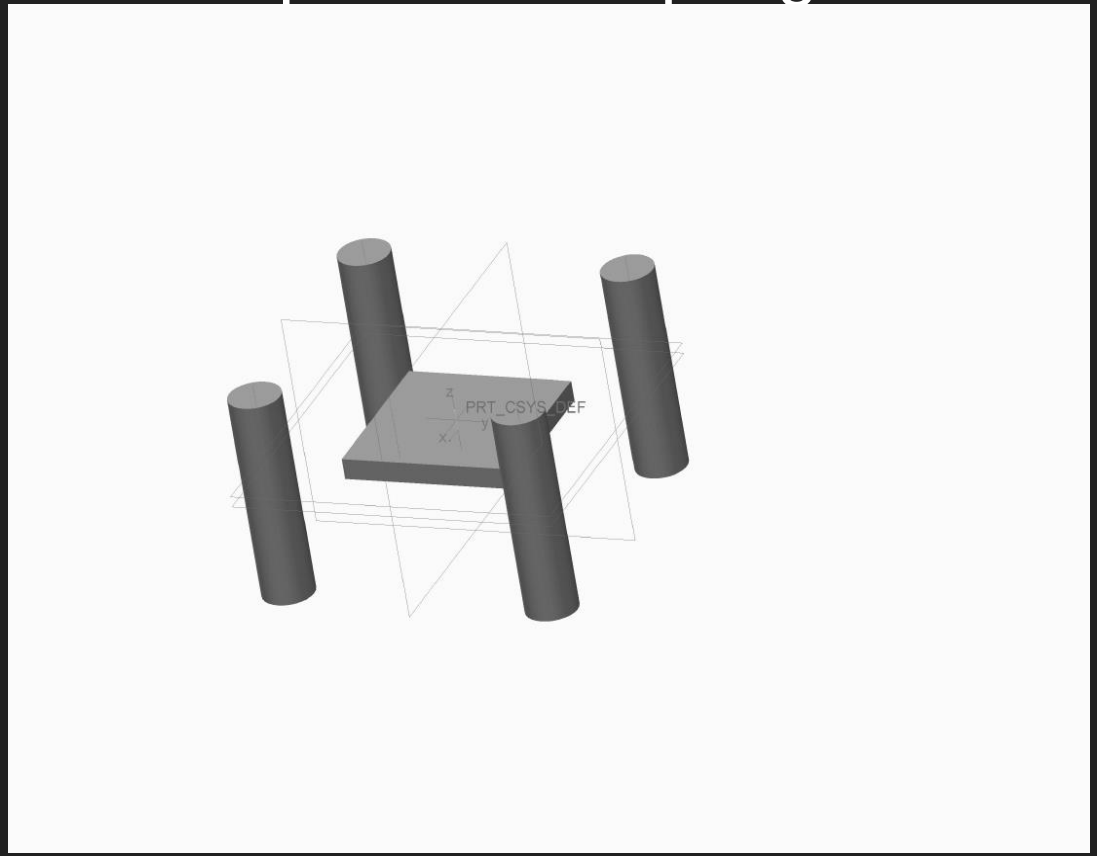
Product Specifications:

1. Test device capable of testing unit up to 50 lbs. and 16” L x 16” W x 12” H
2. Generate SRS pyrotechnic shocks of up to 5000 g peak and 10 kHz
3. Develop method to model test system to guide adjustment of test parameters

Component Design Ideas

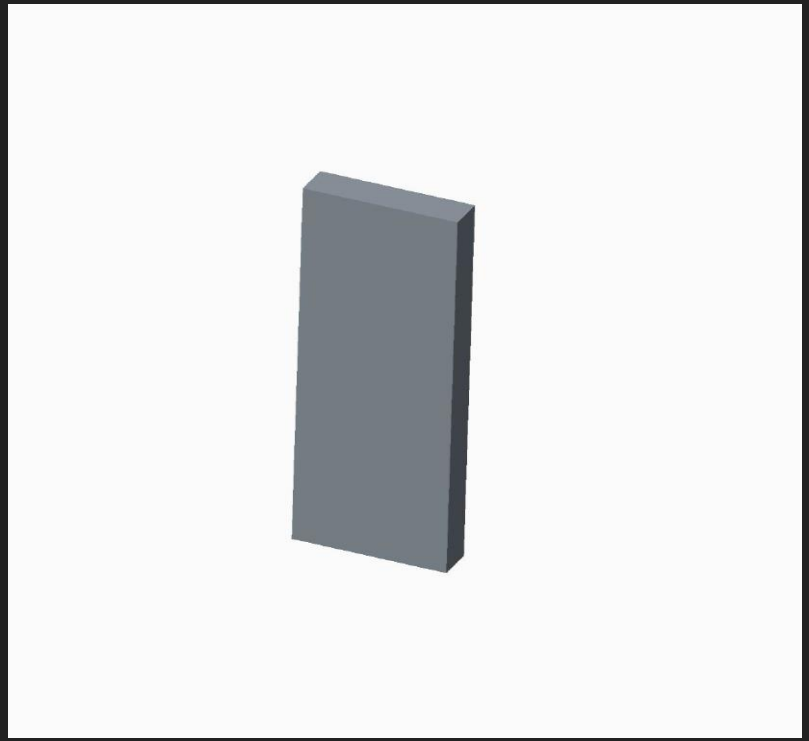
Component	Idea 1	Idea 2	Idea 3
Decoupling plate from frame	Hydraulic Damper	Magnetic Damper	Spring-mass Damper
Power Delivery System	Gravity	Actuator	
Release System	Electromagnetic	Quick Release	
Anchoring	Aluminum Plate	Wooden Plate	Steel Plate
Hammer Orientation	Vertical to Horizontal	Horizontal to Vertical	

Design Concept 1: Decoupling Plate



Presenter: Luis Lopez

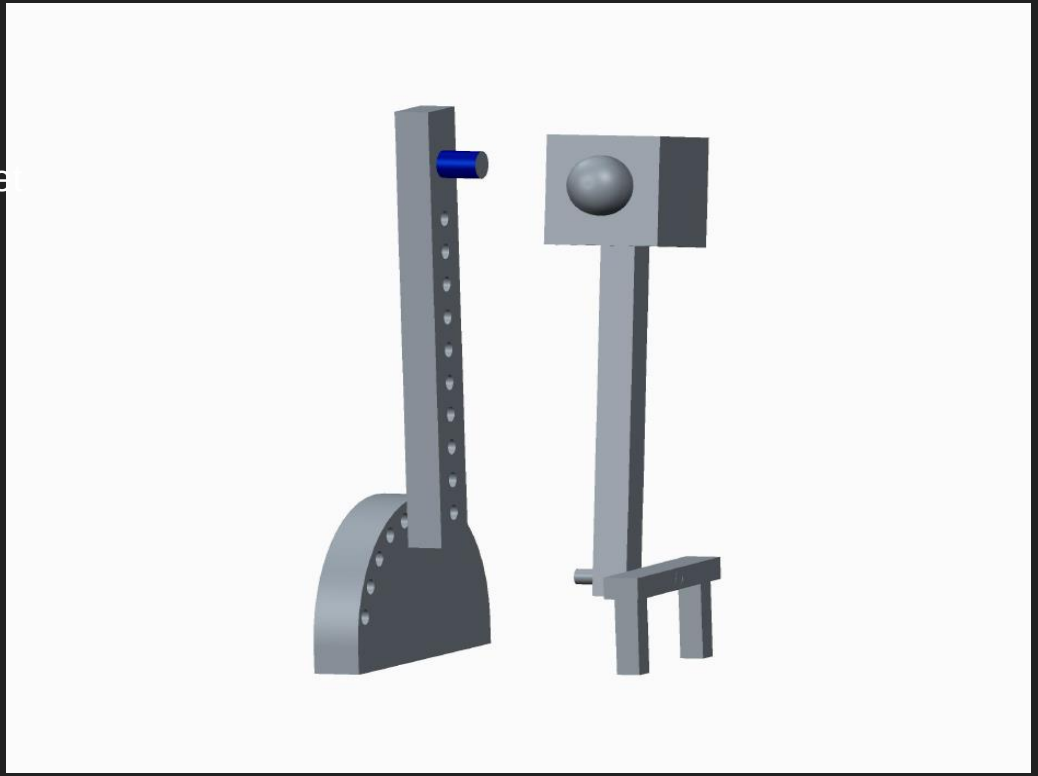
Design Concept 2: Anchoring



Design Concept 3: Hammer Drop release/orientation/power

Hammer Release
-electromagnet
-quick release

Hammer Drop
-free drop
-actuator



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Evaluation of Design Concepts

Factors:	Cost	Reliability	Repeatability	Usability	Accuracy	TOTAL
Spring Damper	**5**	**2**	**4**	**5**	**2**	**18**
Magnet Damper	3	3	4	4	3	17
Hydraulic Damper	**2**	**5**	**4**	**2**	**5**	**18**
Electromagnet Release	**4**	**4**	**4**	**5**	**5**	**22**
Quick Release	5	3	3	5	3	19
Power Actuator	1	3	3	3	4	14
Gravity Assist	**5**	**5**	**5**	**5**	**4**	**24**

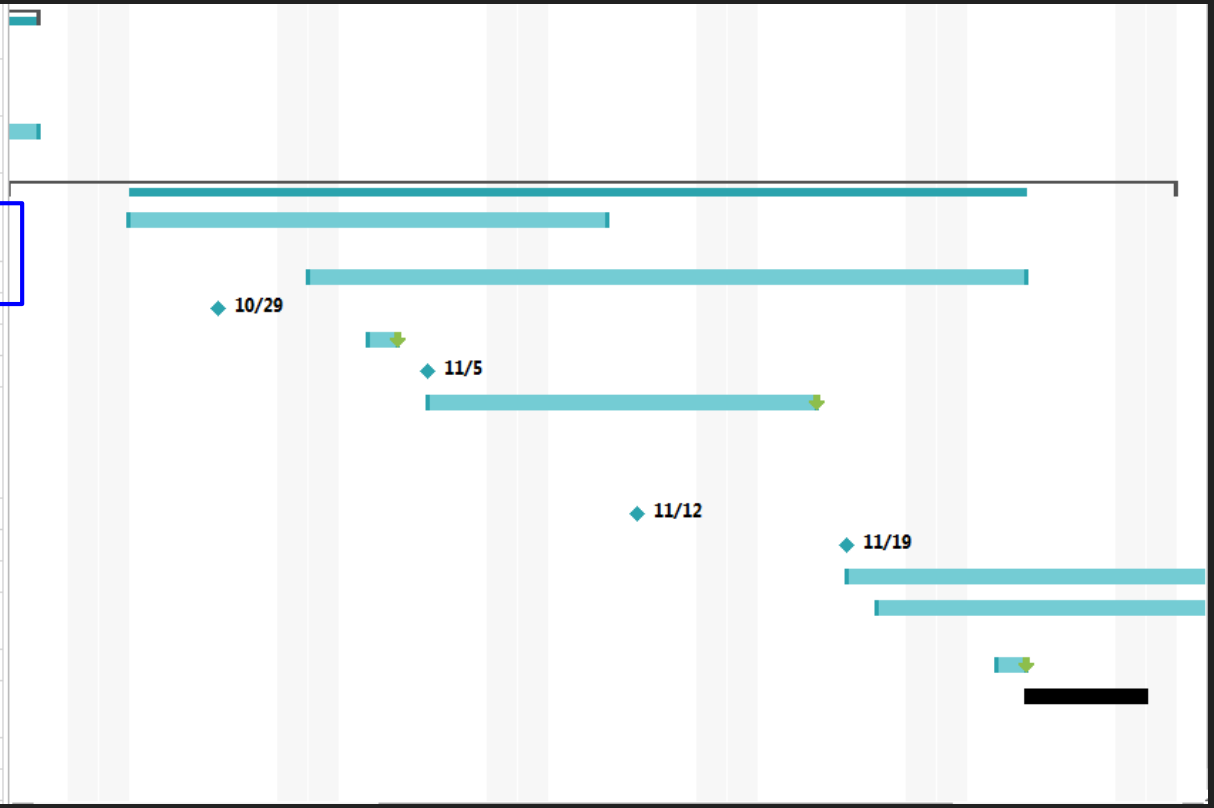
Presenter: Justin Vigo

Future Work

- Design Review with Sponsor this afternoon
- Refine designs and drawings
- Material and part selection
- Familiarization of software developed from last year
- Work on Midterm Report

Schedule

	Task Name	Start	Finish
	Final Design Selection	**Thu 10/15/15**	**Thu 10/22/15**
	Material Selection	Thu 10/15/15	Sat 10/17/15
	CAD Drawings/Refinem	Fri 10/16/15	Thu 10/22/15
	Build Time	**Thu 10/22/15**	**Sun 11/29/15**
	Material Acquisition	Mon 10/26/15	Tue 11/10/15
	Shop Time	Sun 11/1/15	Tue 11/24/15
	Sponsor Telecon 5	Thu 10/29/15	Thu 10/29/15
	Peer Evaluation	Tue 11/3/15	Tue 11/3/15
	Sponsor Telecon 6	Thu 11/5/15	Thu 11/5/15
	Midterm Presentation II: Interim Design Review	Thu 11/5/15	Tue 11/17/15
	Sponsor Telecon 7	Thu 11/12/15	Thu 11/12/15
	Sponsor Telecon 8	Thu 11/19/15	Thu 11/19/15
	Final Report	Thu 11/19/15	Tue 12/1/15
	Final Poster Presentation	Fri 11/20/15	Tue 12/1/15
	Peer Evaluation	Tue 11/24/15	Tue 11/24/15
	Thanksgiving Break (no school)	Wed 11/25/15	Sat 11/28/15
	Sponsor Telecon 9	Thu 12/3/15	Thu 12/3/15



Presenter: Tiffany Shaw

Conclusion

- Sponsor set new design goals for the test rig
- Design Concepts based on improving previous design
  - Spring vs. Hydraulic damper
  - Electromagnet release
  - Gravity assist
- Review with Sponsor to refine ideas
- Order Parts pending Sponsor approval

Questions?

References

1. Wells, Robert. “University Capstone: Development of Hammer Blow Test Device to Simulate Pyrotechnic Shock (Second Year Project).” 14 Aug. 2015.
2. DeMartino, Charles, Chad Harrell, Chase Mitchell, and Nathan Crisler. *Impact Testing and Pyrotechnic Shock Modeling.* Senior Design Team 15. 10 Apr. 2015. Web. 21 Sept. 2015. <http://eng.fsu.edu/me/senior_design/2015/team15/Final%20Report_Team15.pdf>.
3. DeMartino, Charles, Chad Harrell, Chase Mitchell, and Nathan Crisler. *Development of*
4. *Hammer Blow Test Device to Simulate Pyrotechnic Shock.* Senior Design Team 15. 10 Apr. 2015. Web. 21 Sept. 2015. <http://eng.fsu.edu/me/senior_design/2015/team15/NeedsAssessment.pdf>.