



# **Release Lanyard Project**

**April 26<sup>th</sup> 2013**

**By: Andrew Baker, Tim Haynes, Styson Koide,  
David Lofgreen, Carly Siewerth, & Chris  
Temme**

# Overview

- ▶ Problem Statement
- ▶ Current Design
- ▶ New Design
- ▶ Testing
- ▶ Gantt Chart
- ▶ Conclusion
- ▶ References

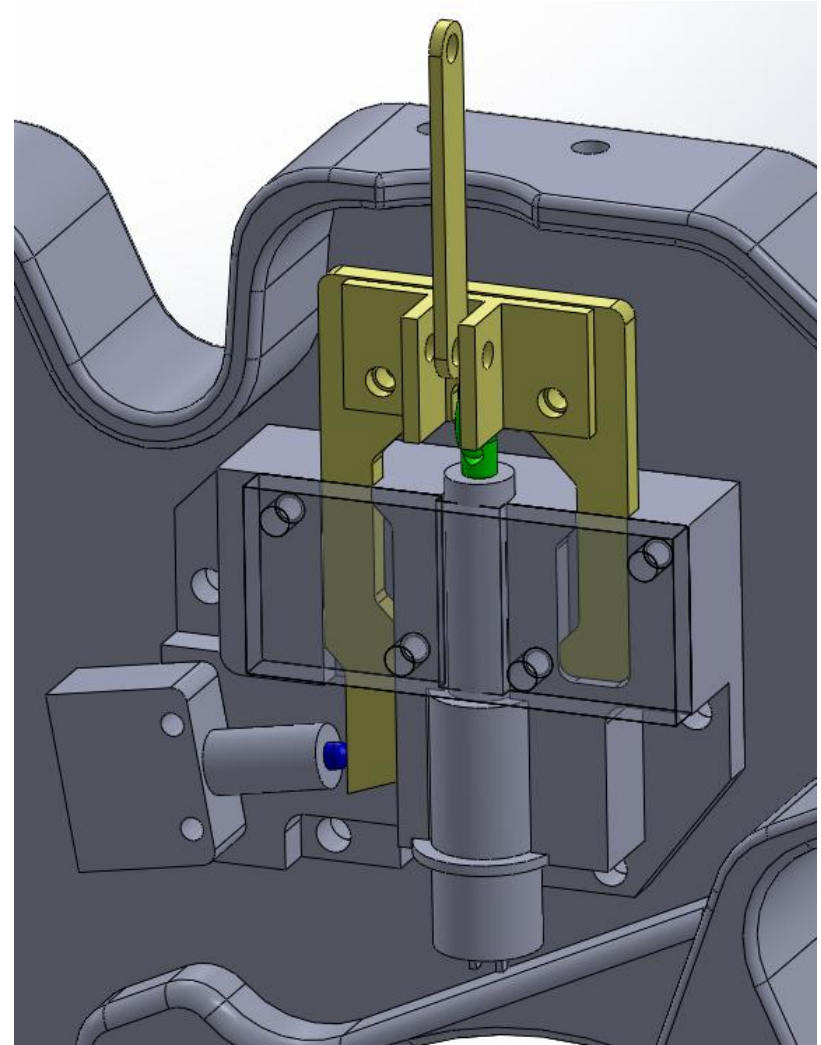
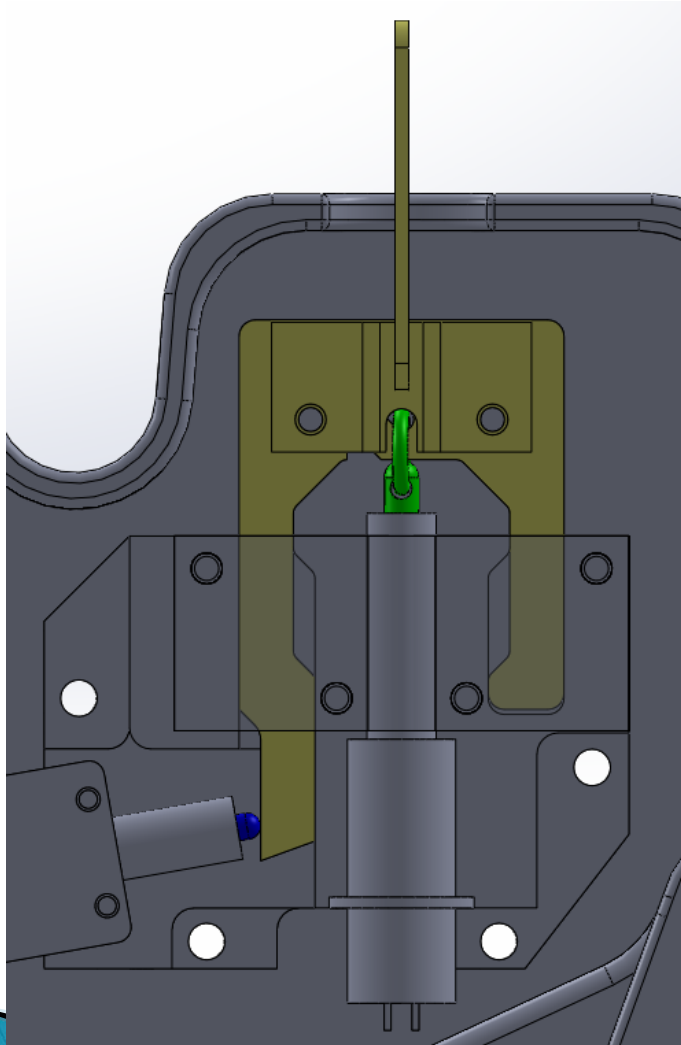
# Problem Statement

- ▶ Issues with freezing temperatures and debris
- ▶ Issues not activating weapons system
- ▶ Issues with poor installation
- ▶ Keep new design under \$300

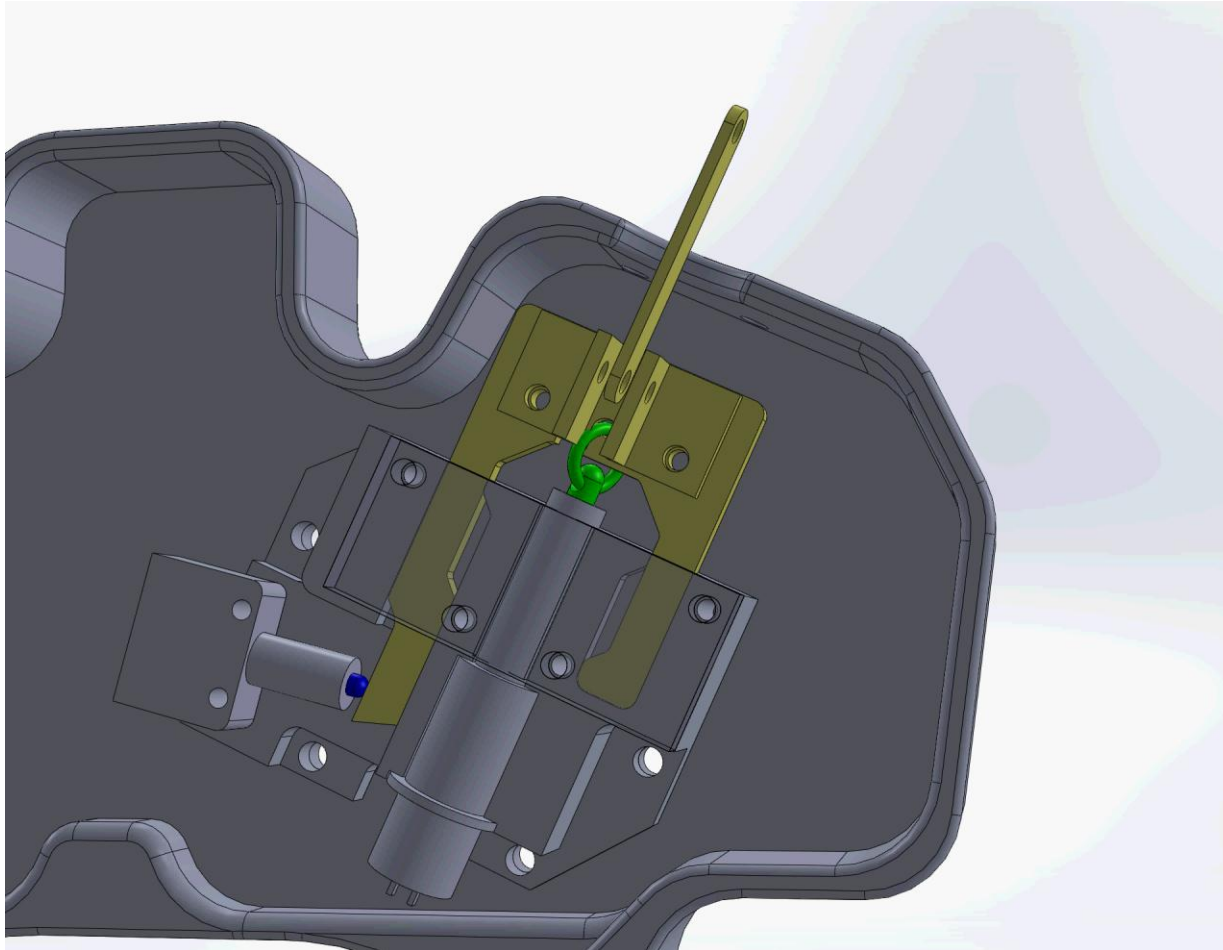
# General Constraints

- ▶ Temperature Range  $-60^{\circ}\text{F}$  to  $200^{\circ}\text{F}$
- ▶ Activation Force of 35–60lb.
- ▶ Breaking force of linkage 75lb.

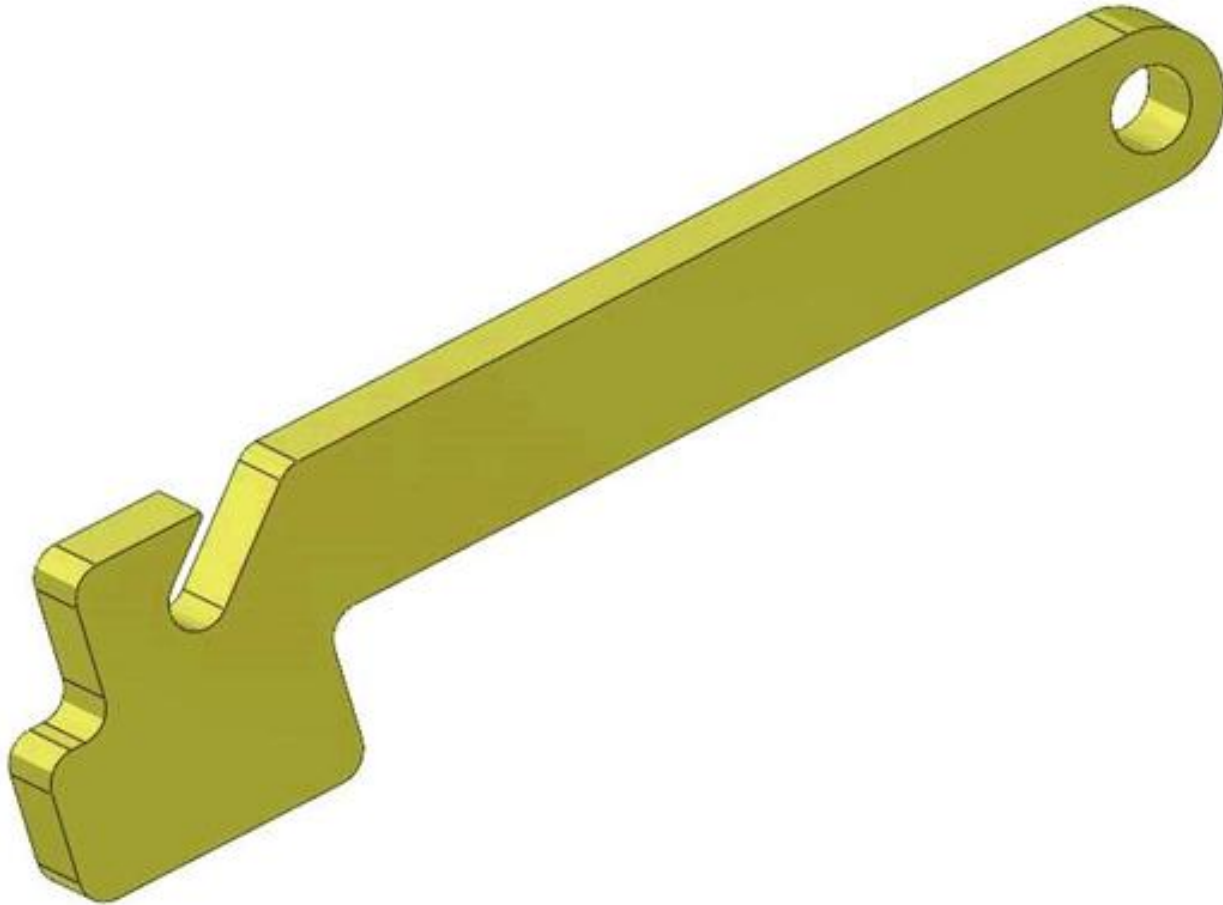
# Current CAD Design



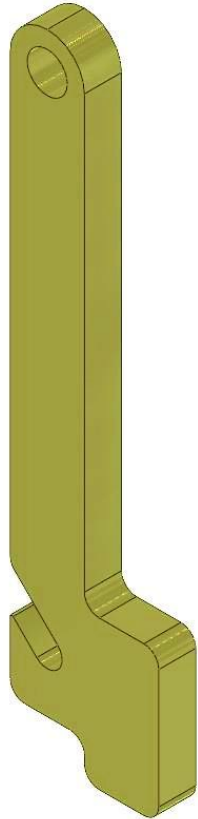
# Current Activation Slider



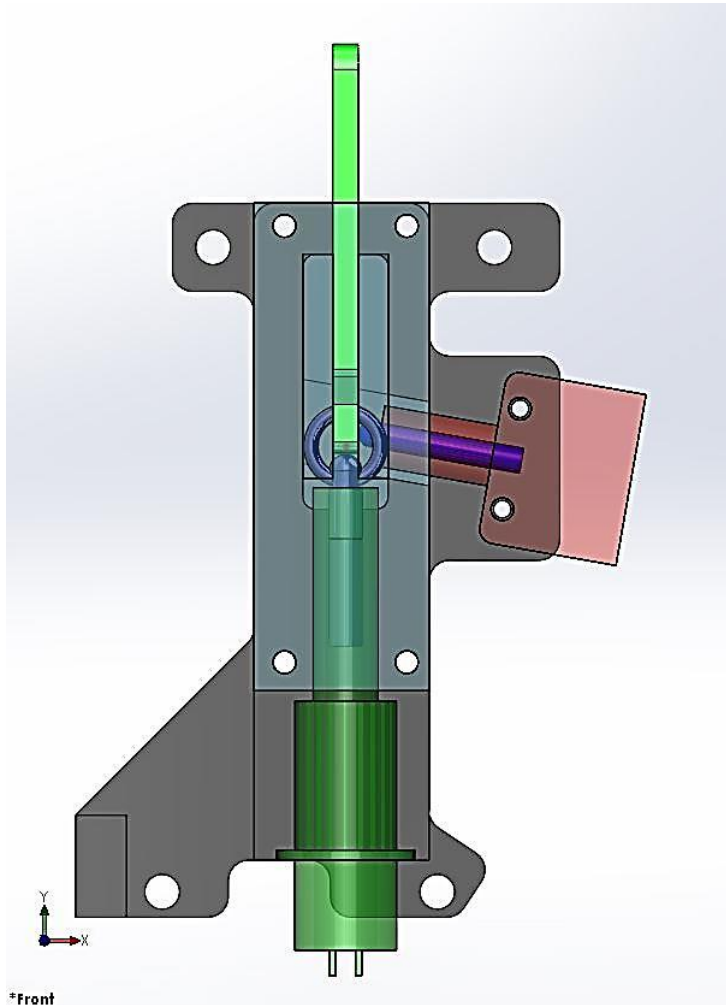
# New Slider Design



# New CAD Design

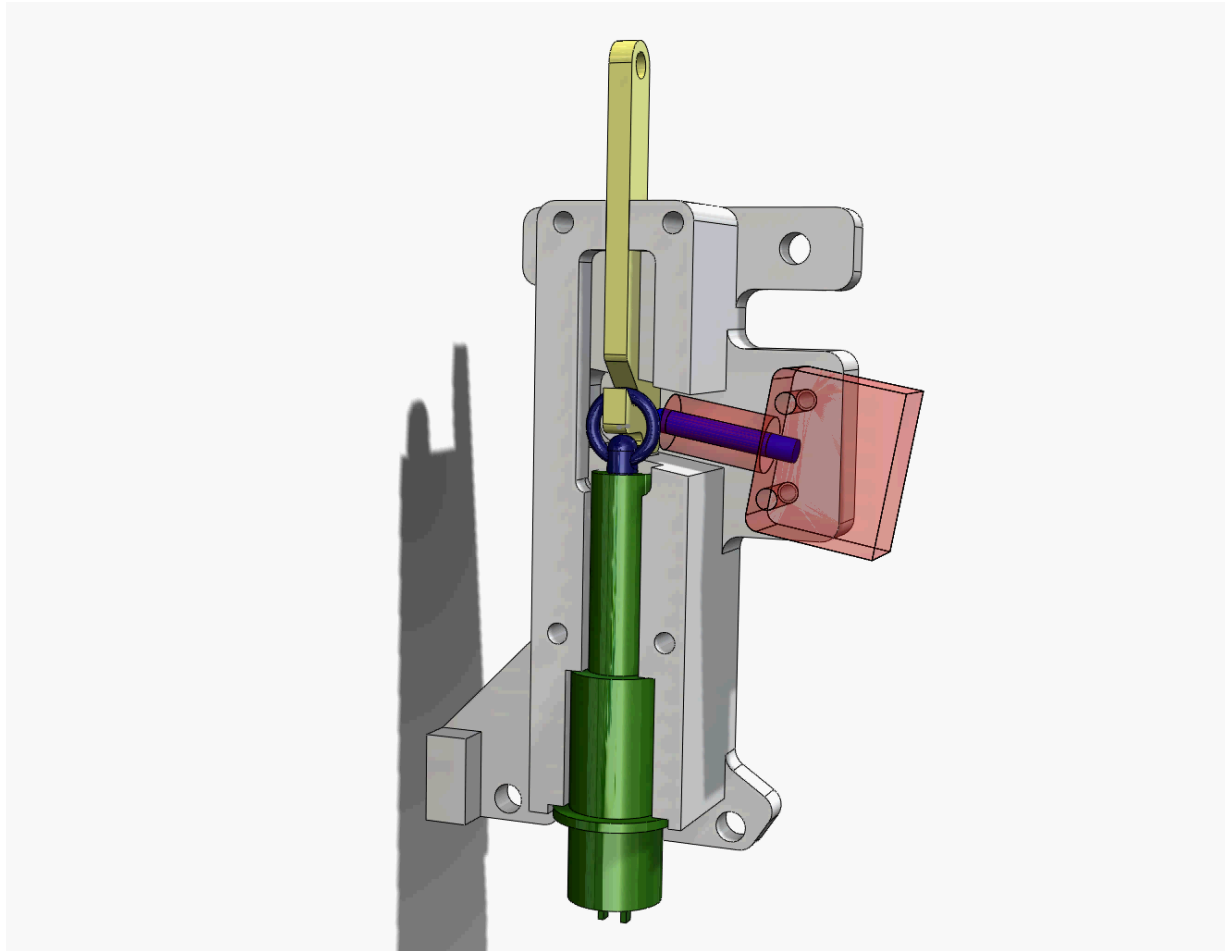


\*Isometric

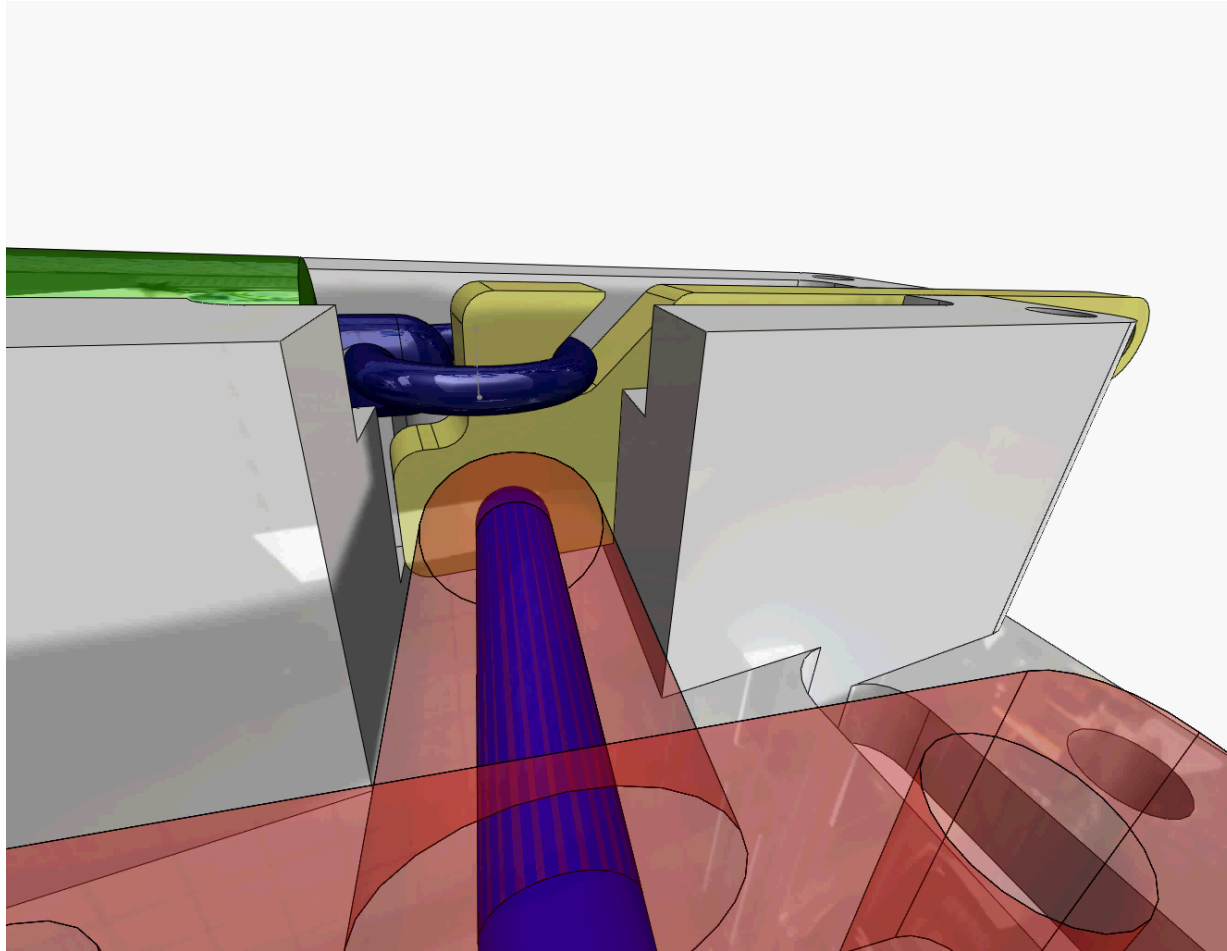




# New Activation Slider



# New Activation Slider

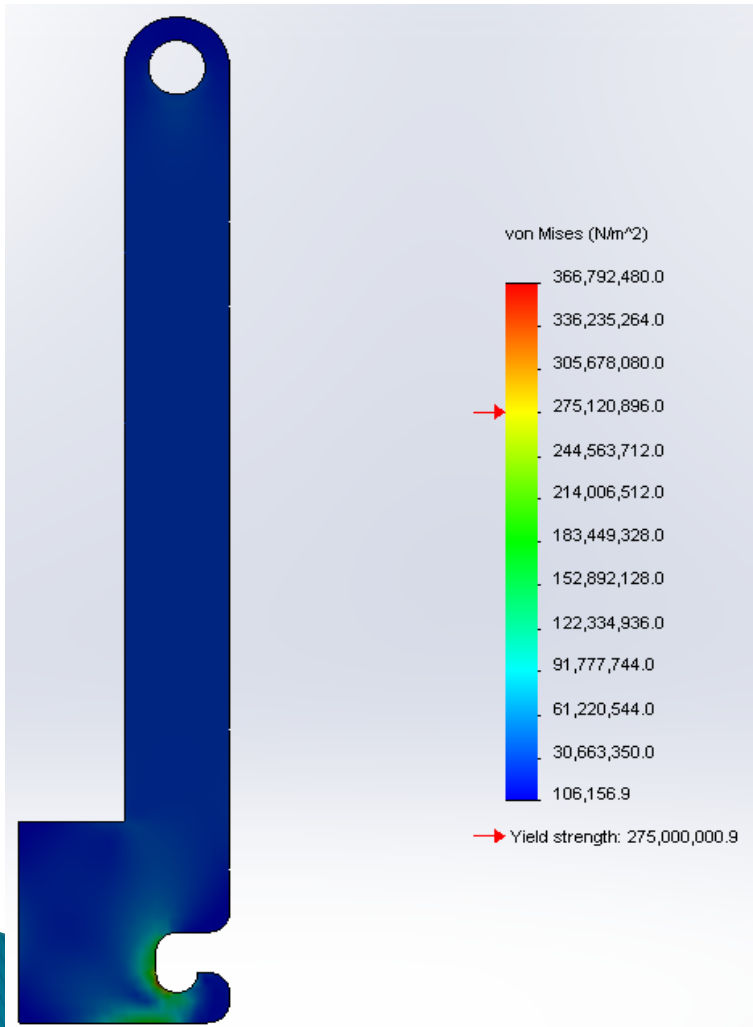


# Comparing

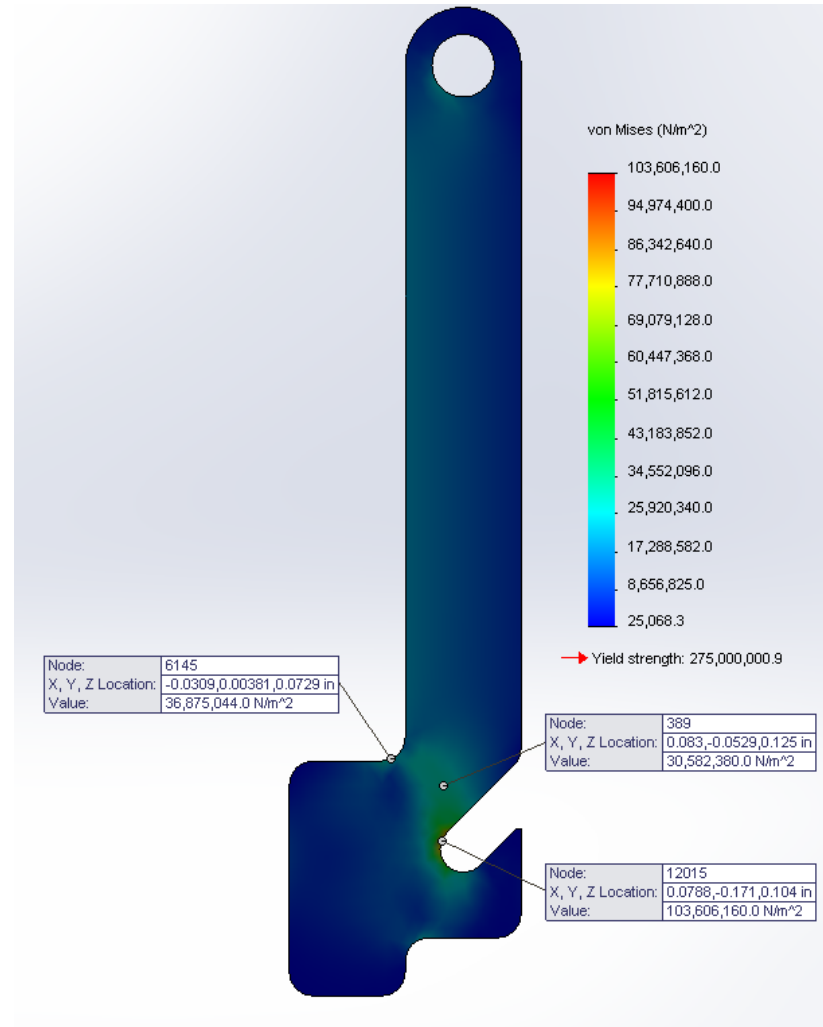
	Current Design	New Design	Reduction (%)
Volume (in <sup>3</sup> )	5.50	5.36	-2.55
Mass	0.21	0.21	-0.28
S.A. (in <sup>2</sup> )	63.22	58.84	-6.93
Concerning S.A. (in <sup>2</sup> )	11.48	6.74	-41.29
Mechanical Components	64.00	52.00	-18.75
Assembly Operations	6.00	4.00	-33.33
Machining Hours	2.60	2.10	-19.23
Machining Costs (\$)	200.00	150.00	-25.0

# FEA Model Testing

## First Iteration

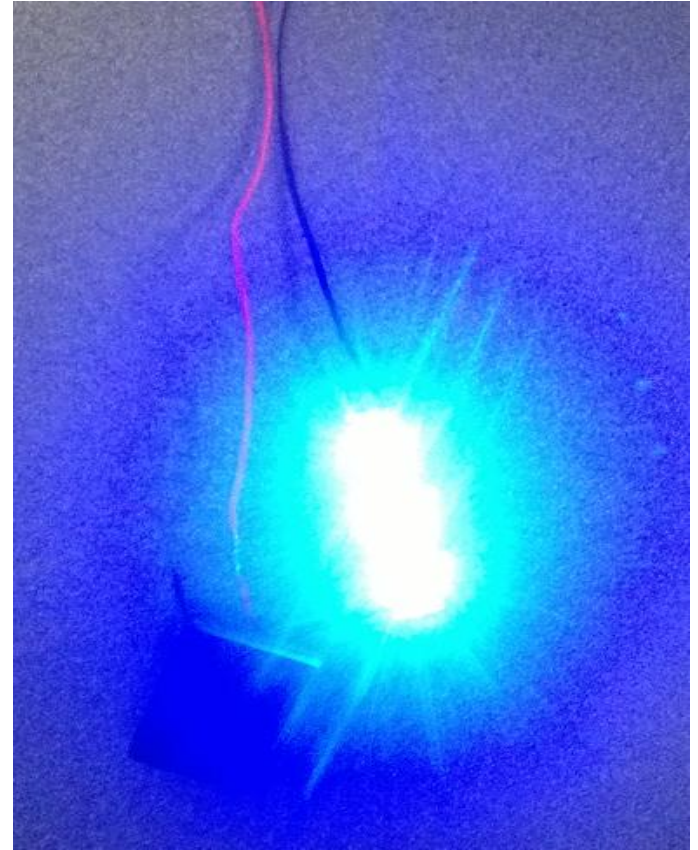
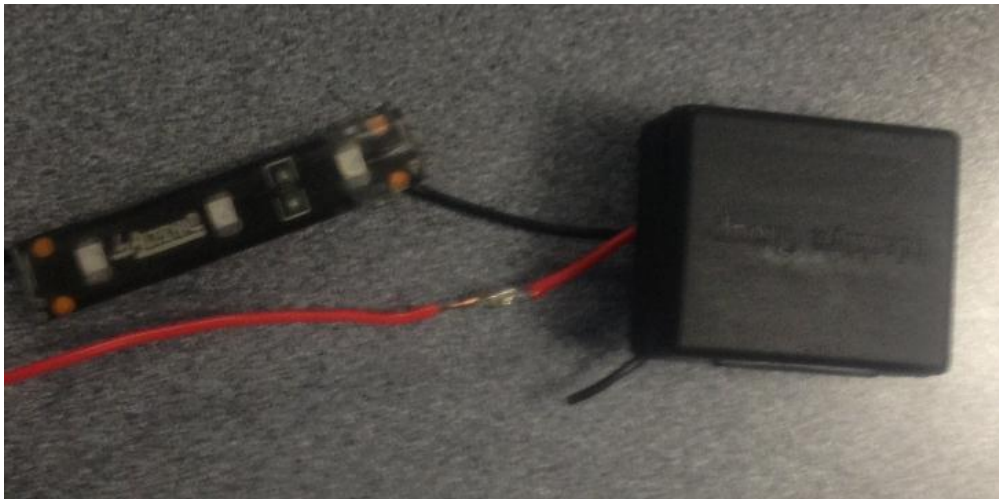


## Final Iteration



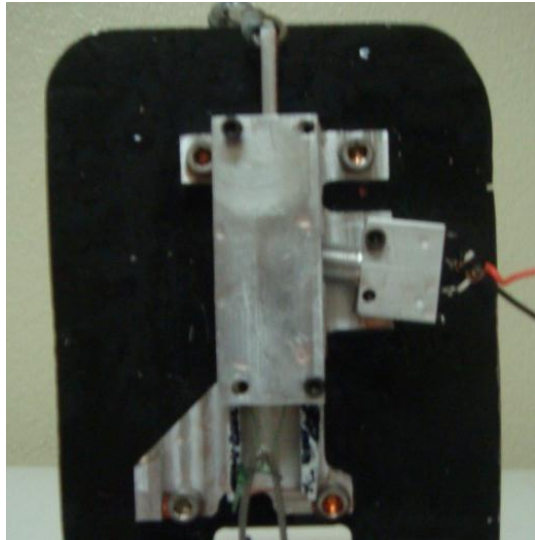
# Model Testing

- ▶ Materials
  - Battery
  - Light
  - Electrical wire
  - Battery mount

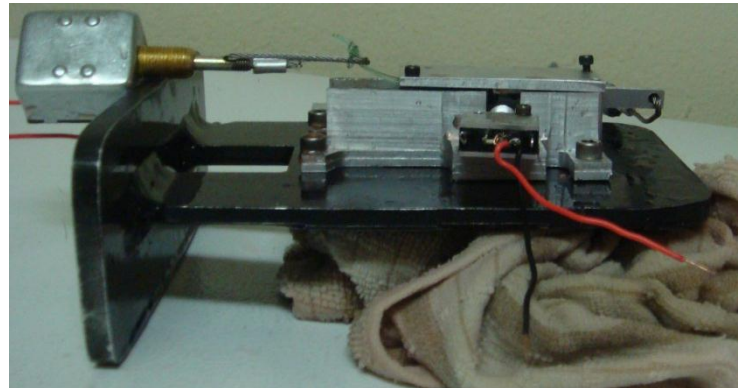


# Experimental Testing

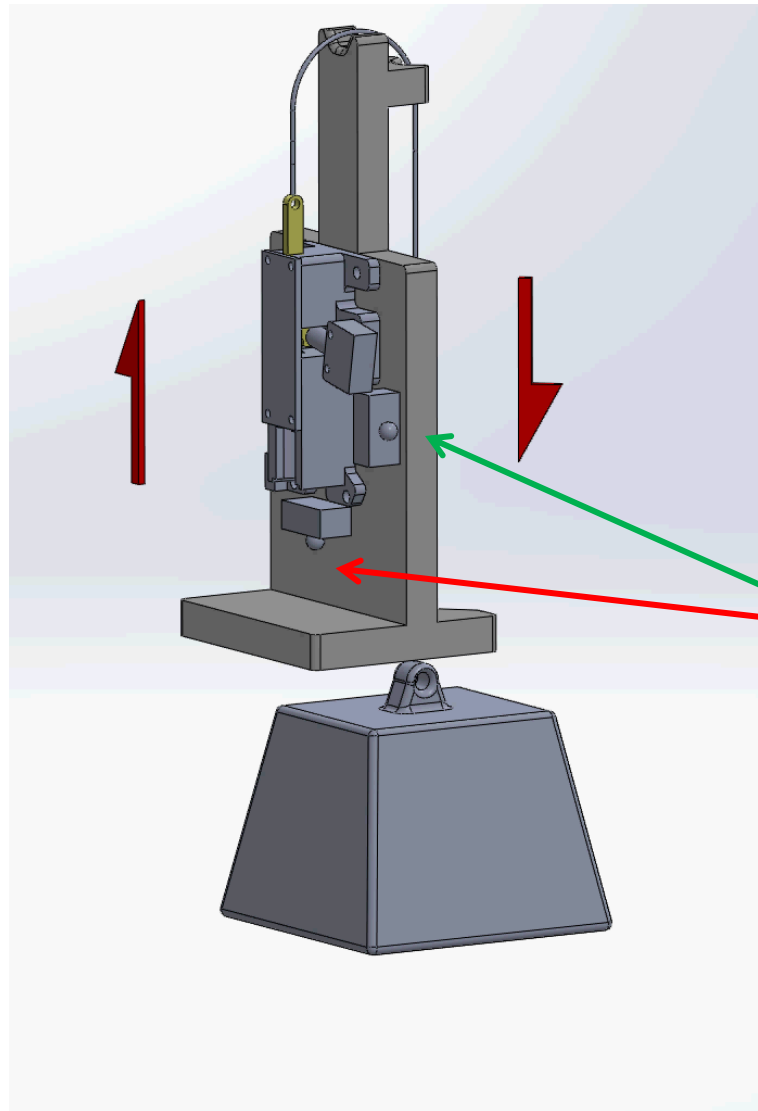
- ▶ 30 minute freeze time
- ▶ Spray every 10 minutes
- ▶ 2 types of freezing orientations



Vertical (Moderate Icing)

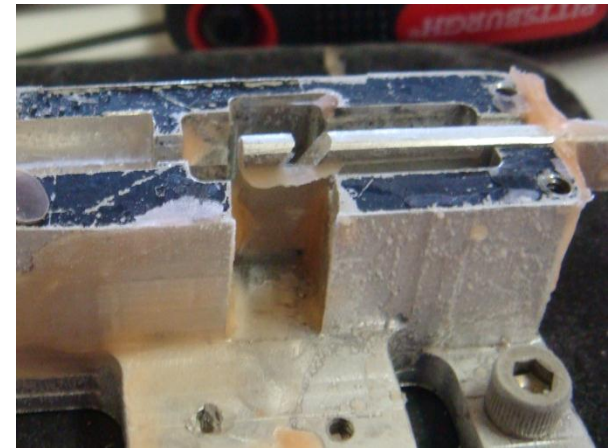
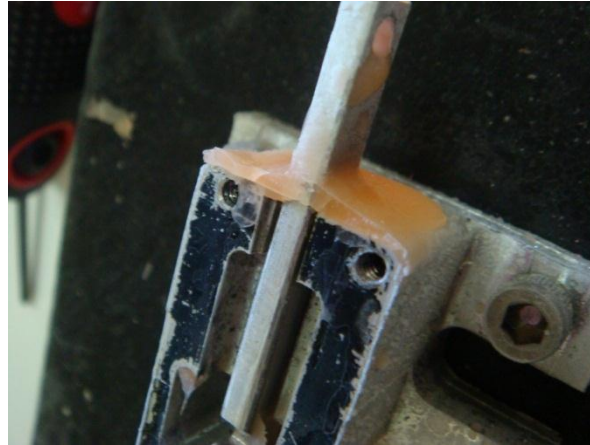
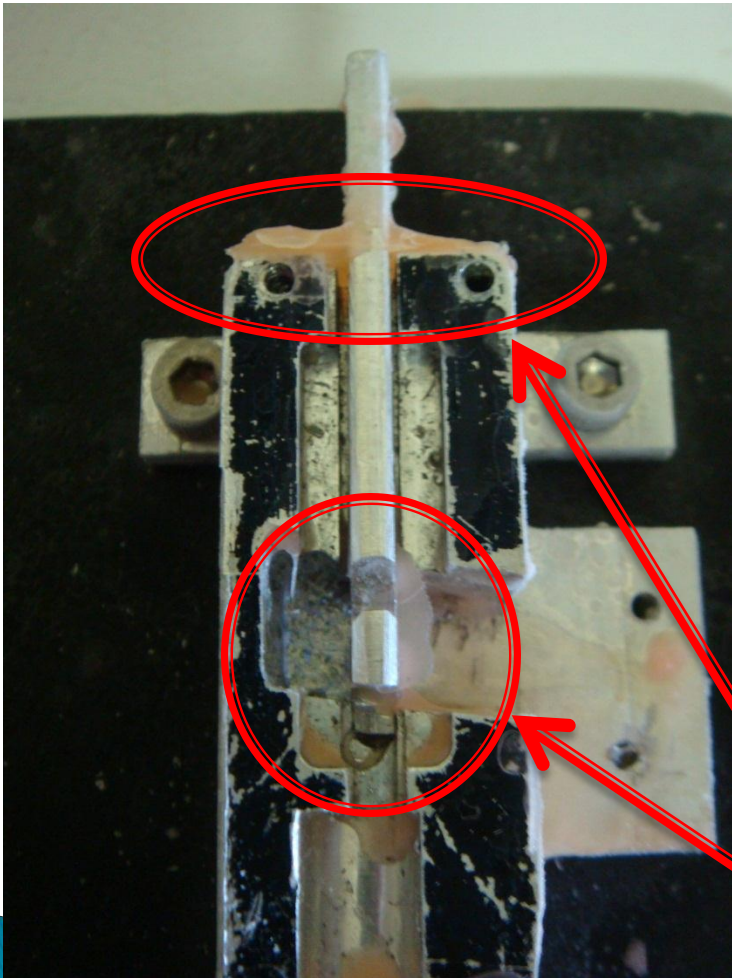


Horizontal (Heavy Icing)



Successful  
Activation

# Testing Conditions (Moderate)

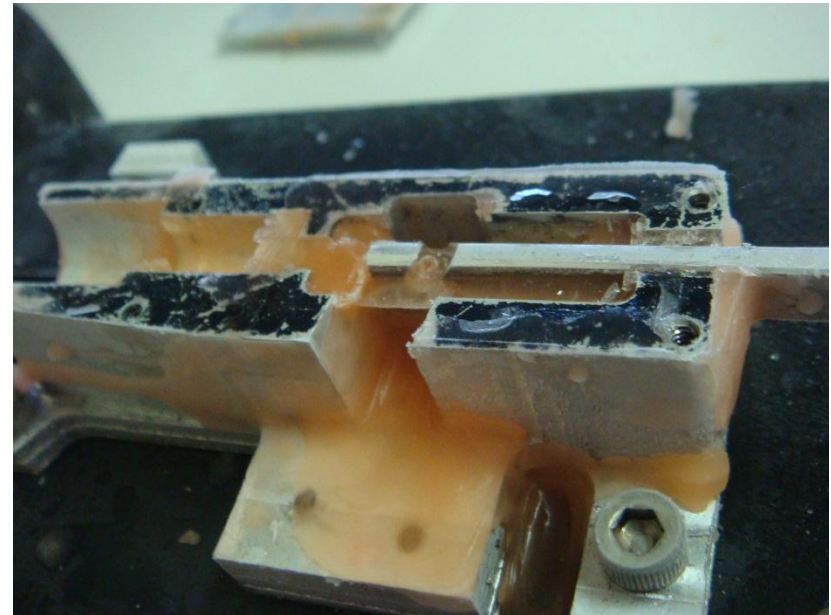
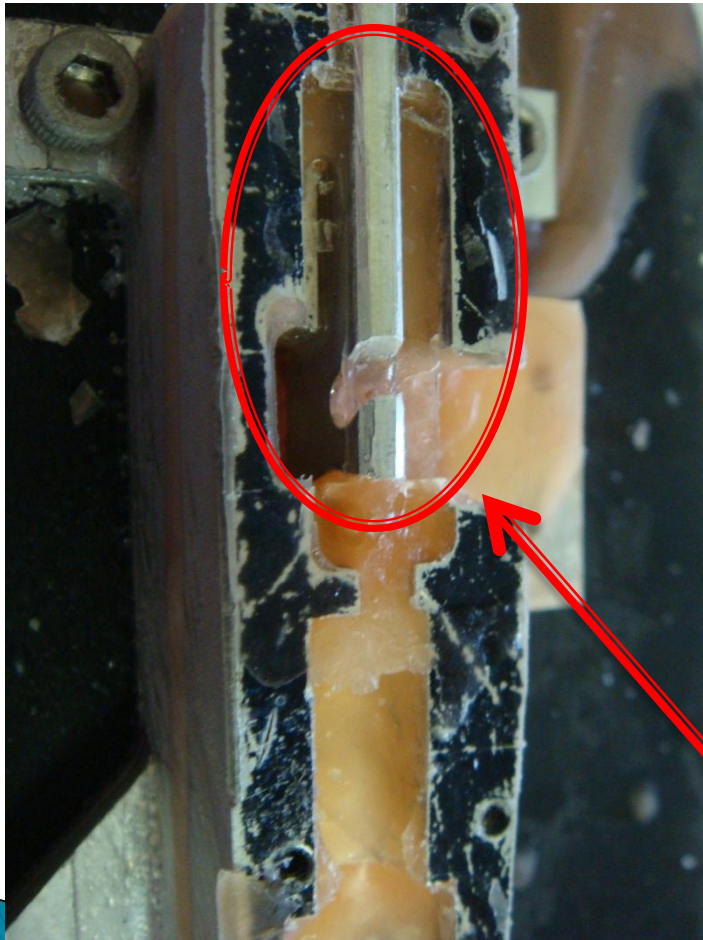


**Problem Regions**

Northern Arizona University  
Department of Mechanical Engineering



# Testing Conditions (Heavy)



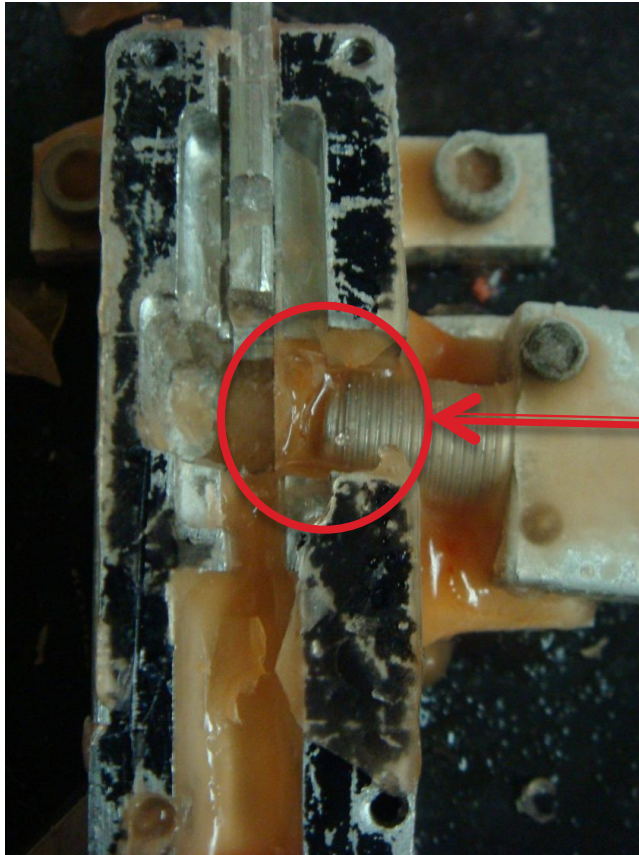
**Problem Regions**

Northern Arizona University  
Department of Mechanical Engineering

# Testing Results

	No Ice Build-up	Moderate			Heavy		
Weight (lbs.)	1	1	2	3	1	2	3
35	Pass	Fail	Pass	Fail	Fail	Fail	Fail
40	Pass	Pass	Fail	Fail	Fail	Fail	Fail
45	Pass	Pass	Fail	Fail	Fail	Fail	Fail
50	Pass	Pass	Fail	Pass	Pass	Pass	Fail
55	Pass	Pass	Pass	Pass	Pass	*Fail*	Fail
60	Pass	Pass	Pass	Pass	Pass	Pass	Pass

# \*Fail\*



Switch Failure

# Conclusion

- ▶ Problem Statement
  - Issues with freezing temperature and debris
  - Not activation
  - Poor installation
- ▶ Current Design
  - Failing under extreme conditions
- ▶ New Designs
  - Include new slider arm, battery mount, and switch placement
- ▶ Gantt Chart

# References

- ▶ Stephen Larimore
  - Raytheon Department Manager
- ▶ Kelly Convington
  - Raytheon Mechanical Engineer
- ▶ <http://chemistry.about.com/od/nitrogen/f/What-Is-The-Temperature-Of-Liquid-Nitrogen.htm>

# Questions?