



# QUALITY CONTROL IN AN AUTOMATED DEFENSIVE SYSTEM



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## Introduction

- I served as the Lead Test Engineer on a project to develop a defensive system for the Army Research Office
- Throughout the project, simulations and testing were required to ensure the product would function appropriately
- To this end, Failure Modes Effects Analysis (FMEA) and Finite Element Analysis (FEA) were used

## Objectives

- **PERSONAL:** Improve my abilities in FMEA and FEA to expand my capabilities as a test engineer
  - Measurable by number of times these tools were used to find design errors or ensure design success
- **LEADERSHIP:** Improve my skills in delegation, communication, and other administrative tasks
  - Measurable by relative workload share, team buy-in, and task completion
- **ADVISOR EXPECTATIONS:** Fulfill all project deliverables
  - Measurable by project deadlines missed

## Results

As can be seen in the table below, FMEA was used to analyze and weigh the risks of design decisions throughout the project.

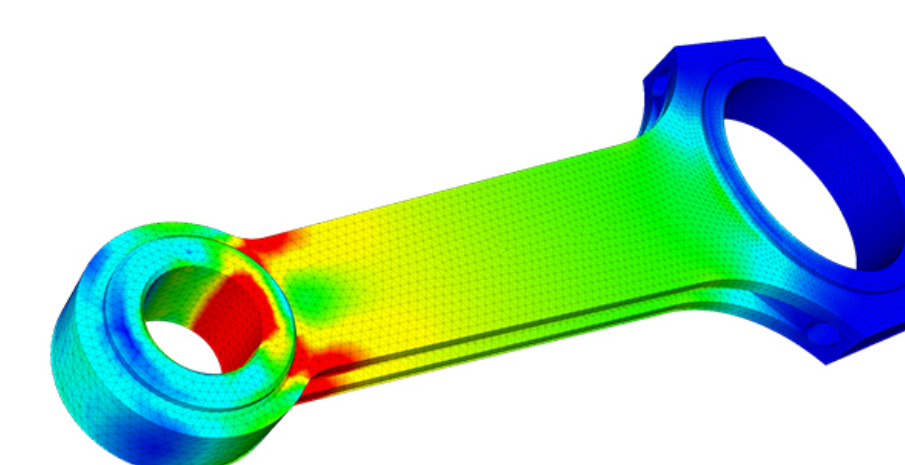
Unfortunately, due to confidentiality concerns, the results of the FMEA analysis are not available for a public poster. However, these results did influence the design and manufacturing process.

Consequences					Probability			
Severity	Classification	Safety	Equipment/Manufacturing Cost	Production Timeline	1	2	3	4
					Remote	Extremely Unlikely	Unlikely	Likely
4	Critical	Permanent or life-threatening electrical or mechanical injury	Damage exceeding 50% of budget (\$1000)	Setback of 1+ month	4	8	12	16
3	Catastrophic	Major electrical or mechanical injury	Damage exceeds 25% of budget, (\$500)	Setback of 3-4 weeks	3	6	9	12
2	Major	Repeated minor injuries	Damage exceeds \$100	Setback of 2-3 weeks	2	4	6	8
1	Minor	Minor injury	Damage exceeds \$50	Setback of 1-2 weeks	1	2	3	4

Table 4. Custom FMA Table For Use In Risk Analysis

Additionally, FEA was used to analyze several crucial components. The images of this also cannot be shared, but the results showed that the thicknesses of armor plating that the design included were sufficient to prevent warping or deflection of any components.

An example of FEA imaging is included below.



## Discussion

The objectives from each category were met to some extent during this project, despite the influence of COVID-19 on the project as it was being completed.

**PERSONAL:** FMEA and FEA were used to assist in the analysis and testing of the design. Due to my experience directing these efforts, which were used on five systems and numerous sub-components, I have become more familiar with these useful tools.

**LEADERSHIP:** As discussed further in my synthesis paper, I initially struggled with communication errors and delegation. Overcoming these challenges allowed me to improve my own skills in each of these important leadership tasks. All tasks were completed, and workload share shifted to be more equal throughout the semester.

**ADVISOR EXPECTATIONS:** All test engineering materials were completed by assigned deadlines. Some deadlines were affected due to restrictions put in place by the University’s response to COVID-19. Regardless, testing materials have been provided according to these new timelines.

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