



University of Idaho

College of Engineering

FITS LIKE A GLOVE

IDAHO NATIONAL LABS: TENSILE

TESTING SYSTEM

Team Members: James Bradley, Matthew Uptmor, Jared Gray,
Logan Matti

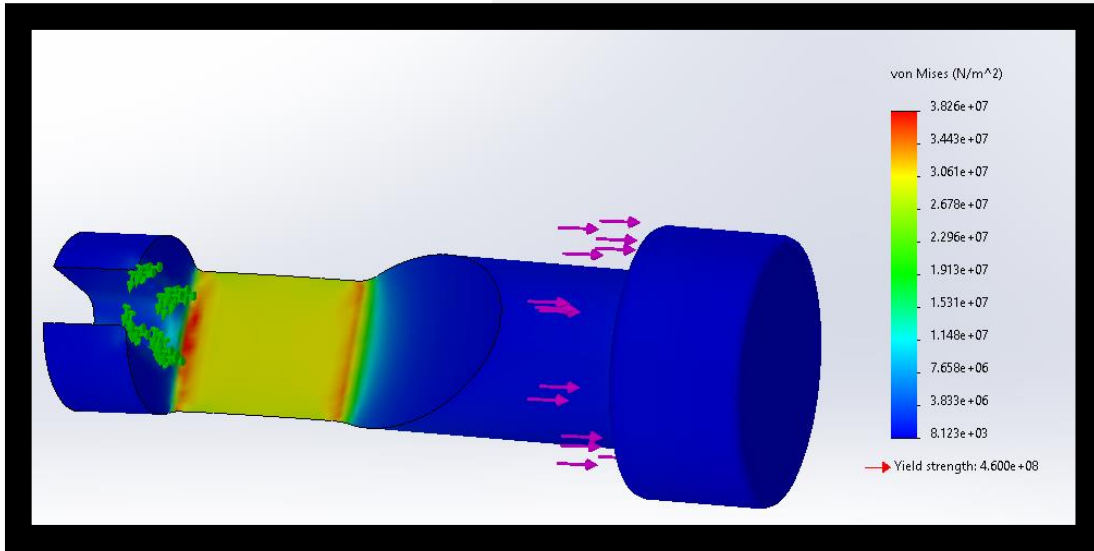
Sponsor: Randal Fielding, Idaho National Lab

PROBLEM STATEMENT

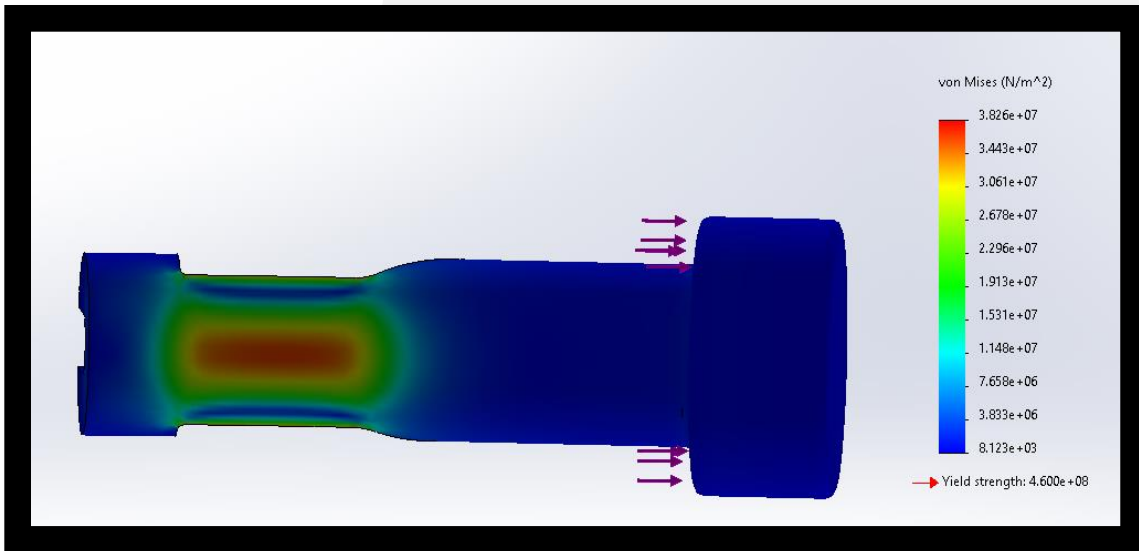


- Design a tensile testing system that will fit through an 8-inch access port inside a glovebox and can perform tensile tests at temperatures reaching 700 °C.

DOCUMENTATION

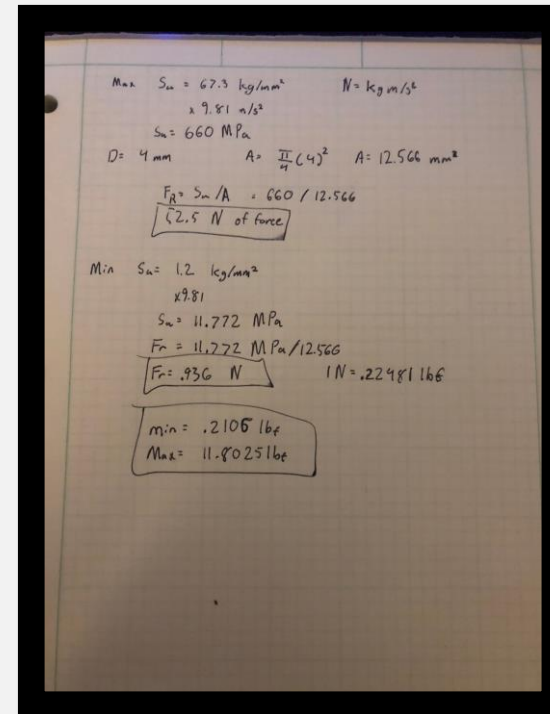


Stress/Force Analysis Simulation

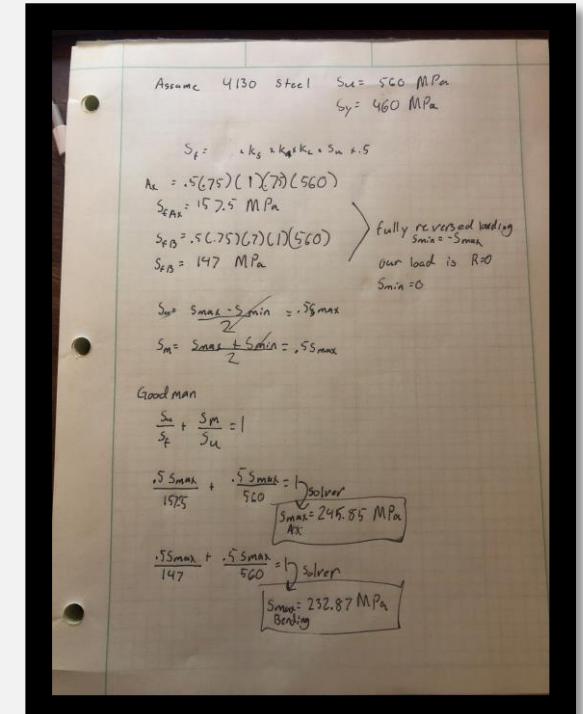


Stress/Force Analysis Simulation

From the stress/force analysis in solid works it shows that the forces that this part will experience will not be a risk of failure either in a single pull and will provide a near infinite life



Maximum and Minimum Force Calculations



Max Stress for Axial and Bending Forces

BUDGET



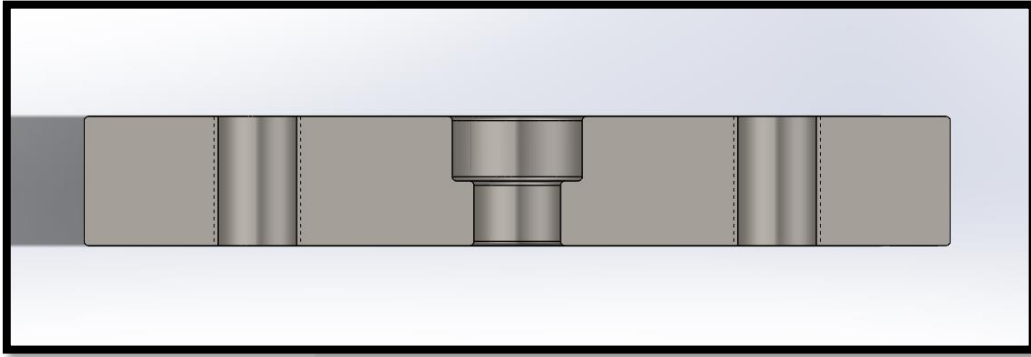
- The budget items:
- **Tensile Testing Machine Parts:**
 - **Stepper Motor:** Anaheim Automation 34Y Series 34Y1045-LW8 (\$50 - \$300)
 - **Load Cell:** Transducer Techniques
 - Model #: LPU-10K (\$600 – \$1000)
 - **Extensometer:**
 - Epsilon Technology
 - Model #: 7642

| Capstone Project Budget Template - Fall/Spring | | | | | | | | | |
|--|------|--------|-----|-----|----------|----------|--------|-----|--------------------------|
| Project: Fits | | | | | | | | | |
| Last Updated 9/17/2020 | | | | | | | | | |
| Expense Items | Year | | | | | | | | Item Total |
| | Sept | Oct | Nov | Dec | Jan | Feb | Mar | Apr | |
| Steel (for final Build) | | | | | \$ 500 | | | | \$ 500 |
| Stepper Motor | | \$ 250 | | | | | | | \$ 250 |
| Load Cell | | | | | \$ 1,000 | | | | \$ 1,000 |
| Wiring | | | | | | \$ 50 | | | \$ 50 |
| Fasteners | | | | | \$ 60 | | | | \$ 60 |
| Test Material | | | | | | | \$ 50 | | \$ 50 |
| Data Acquisition system | | | | | | \$ 1,000 | | | \$ 1,000 |
| Misc | | | | | \$ 500 | | | | \$ 500 |
| Heating Unit | | | | | | | \$ 500 | | \$ 500 |
| Shop Usage (est. Hrs): | | | | | | | | | Hours |
| Mill | | | | | 20 | 20 | 20 | | 60 |
| Drill Presses | | | | | 15 | 15 | 15 | | 45 |
| Lathe | | | | | 10 | | | | 10 |
| | | | | | | | | | 0 |
| | | | | | | | | | 0 |
| | | | | | | | | | 0 |
| | | | | | | | | | 0 |
| | | | | | | | | | 0 |
| | | | | | | | | | Expenses Subtotal |
| | | | | | | | | | \$ 4,185 |
| | | | | | | | | | \$ - |
| | | | | | | | | | \$ - |
| | | | | | | | | | \$ 209 |
| | | | | | | | | | \$ 4,394 |
| | | | | | | | | | \$ 5,000 |
| | | | | | | | | | \$ 606 |
| | | | | | | | | | Budget Excess |

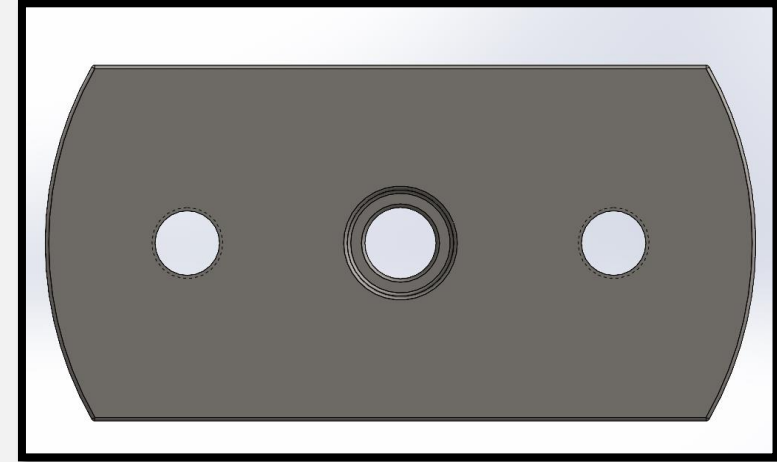
REQUIREMENTS AND SPECS



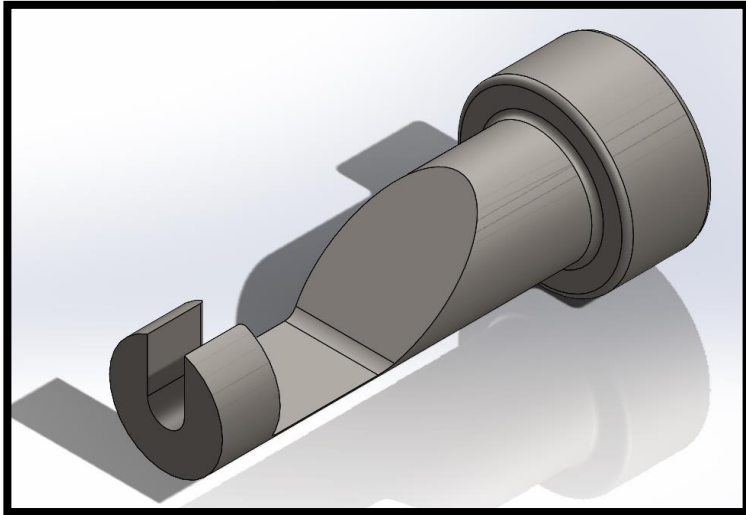
- Must be able to complete tests remotely
- Must be small as possible
- Must be electronically sparse as possible
- Must fit through 8in hole and be assembled in glove box.
- Must withstand temperatures up to 700°C



Sled Sectional View



Sled Top View



Sample Grip

CONCEPT DEVELOPMENT



| Task Description | Duration | Assigned | Sept | | | | | Oct | | | | | Nov | | | | | Dec | | | | |
|---------------------------------------|-----------|----------|------|------|------|------|------|------|------|------|-------|-------|-------|-------|------|-------|-------|-------|-------|------|-------|-------|
| | | | 9/3 | 9/10 | 9/15 | 9/17 | 9/24 | 10/1 | 10/6 | 10/8 | 10/13 | 10/15 | 10/22 | 10/29 | 11/5 | 11/12 | 11/13 | 11/20 | 11/27 | 12/4 | 12/11 | 12/18 |
| Product Requirements Document | 1 Weeks | Team | | | | | | | | | | | | | | | | | | | | |
| Research Operational Parameters | 5 Weeks | Team | | | | | | | | | | | | | | | | | | | | |
| Rough Draft Bill of Materials | 1 Weeks | LM, JB | | | | | | | | | | | | | | | | | | | | |
| Design Solution to Challenges/Problem | 7 Weeks | Team | | | | | | | | | | | | | | | | | | | | |
| Preliminary CAD Modeling | 12 Weeks | LM, JB | | | | | | | | | | | | | | | | | | | | |
| Concept Design Review | 2 Weeks | Team | | | | | | | | | | | | | | | | | | | | |
| Preliminary Coding Skeleton | 7 Weeks | JG,MU | | | | | | | | | | | | | | | | | | | | |
| First Round Prototyping (POC) (ABS) | 2 Weeks | JG,MU | | | | | | | | | | | | | | | | | | | | |
| Review and Revise CAD | 6 Weeks | Team | | | | | | | | | | | | | | | | | | | | |
| Review and Revise Coding | 6 Weeks | Team | | | | | | | | | | | | | | | | | | | | |
| Second Round Prototyping (ABS) | 2 Weeks | Team | | | | | | | | | | | | | | | | | | | | |
| Second Round Coding Review | 1 Weeks | LM, JB | | | | | | | | | | | | | | | | | | | | |
| Prototype Testing | 1.5 Weeks | Team | | | | | | | | | | | | | | | | | | | | |
| Final CAD Review | 3 Weeks | Team | | | | | | | | | | | | | | | | | | | | |
| Final Coding Review | 2 Weeks | Team | | | | | | | | | | | | | | | | | | | | |
| Purchase TTS Parts from BOM | 3 Weeks | LM | | | | | | | | | | | | | | | | | | | | |
| Machine Custom Parts from BOM | 3 Weeks | Team | | | | | | | | | | | | | | | | | | | | |
| Choose Final Testing Materials | 1 Weeks | Team | | | | | | | | | | | | | | | | | | | | |
| Final Assembly of Parts | 3 Weeks | Team | | | | | | | | | | | | | | | | | | | | |
| Final Product Review | 1 Weeks | Team | | | | | | | | | | | | | | | | | | | | |
| Final Budget Finished | 2 Weeks | LM | | | | | | | | | | | | | | | | | | | | |
| Testing Final Product | 2 Weeks | Team | | | | | | | | | | | | | | | | | | | | |

PROJECT SCHEDULE FALL SEMESTER



| Task Description | 2021 | | | | | | | | | | | | | | | | | | | | | | | |
|--|------|-----|------|------|------|------|-----|------|------|------|-----|-----|------|------|------|-----|-----|------|------|------|-----|------|------|------|
| | Jan | | | | | | Feb | | | | Mar | | | | | Apr | | | | May | | | | |
| | 1/1 | 1/8 | 1/15 | 1/22 | 1/26 | 1/29 | 2/5 | 2/12 | 2/19 | 2/26 | 3/5 | 3/9 | 3/12 | 3/19 | 3/26 | 4/2 | 4/9 | 4/16 | 4/23 | 4/30 | 5/7 | 5/14 | 5/21 | 5/28 |
| Product Requirements Document | | | | | | | | | | | | | | | | | | | | | | | | |
| Research Operational Parameters | | | | | | | | | | | | | | | | | | | | | | | | |
| Rough Draft Bill of Materials | | | | | | | | | | | | | | | | | | | | | | | | |
| Design Solution to Challenges/Problem | | | | | | | | | | | | | | | | | | | | | | | | |
| Preliminary CAD Modeling | | | | | | | | | | | | | | | | | | | | | | | | |
| Concept Design Review | | | | | | | | | | | | | | | | | | | | | | | | |
| Preliminary Coding Skeleton | | | | | | | | | | | | | | | | | | | | | | | | |
| First Round Prototyping (POC) (ABS) | | | | | | | | | | | | | | | | | | | | | | | | |
| Review and Revise CAD | | | | | | | | | | | | | | | | | | | | | | | | |
| Review and Revise Coding | | | | | | | | | | | | | | | | | | | | | | | | |
| Second Round Prototyping (ABS) | | | | | | | | | | | | | | | | | | | | | | | | |
| Second Round Coding Review | | | | | | | | | | | | | | | | | | | | | | | | |
| Prototype Testing | | | | | | | | | | | | | | | | | | | | | | | | |
| Final CAD Review | | | | | | | | | | | | | | | | | | | | | | | | |
| Final Coding Review | | | | | | | | | | | | | | | | | | | | | | | | |
| Purchase TTS Parts from BOM | | | | | | | | | | | | | | | | | | | | | | | | |
| Machine Custom Parts from BOM | | | | | | | | | | | | | | | | | | | | | | | | |
| Choose Final Testing Materials | | | | | | | | | | | | | | | | | | | | | | | | |
| Final Assembly of Parts | | | | | | | | | | | | | | | | | | | | | | | | |
| Final Product Review | | | | | | | | | | | | | | | | | | | | | | | | |
| Final Budget Finished | | | | | | | | | | | | | | | | | | | | | | | | |
| Testing Final Product | | | | | | | | | | | | | | | | | | | | | | | | |
| Product Validation | | | | | | | | | | | | | | | | | | | | | | | | |
| Deliver/Report Final Project to Client | | | | | | | | | | | | | | | | | | | | | | | | |

PROJECT SCHEDULE SPRING SEMESTER