

Engineering Design Portfolio | Tristan Brasov

A selected portfolio of mechanical and aerospace design projects completed during undergraduate studies at the University of Missouri. Each section highlights an academic or industry-aligned project emphasizing analytical precision, engineering design, and applied problem-solving.

Table of Contents

<i>Senior Capstone Project.....</i>	2
<i>Aircraft Flight Performance Semester Project Fall 2024.....</i>	3
<i>Machine Element Design Semester Project Fall 2024</i>	5

Senior Capstone Project

Redesigned skid steer ramps, reducing weight by 60% and improving FOS from 1.5 to 2.1 using SolidWorks and FEA; validated performance through TIG-welded fabrication and full-load testing.

Improved Skid Steer Loading Ramps

Aaron Jewett, Jack Neidt, Joseph Rollinson, Sean Yates, TJ Minear, Tristan Brasov, Professor Poehlman

Assisted Keg Ramp

For the first 10 weeks of the semester, we worked with Logboat Brewing Company to design and fabricate an improvement to their Keg-filling process. With their current ramp (see below), the operator must "walk" each full keg, weighing 170 lbs, down an unstable ramp to the pallet.



Through site visits and discussions with operators, we decided to create a hands-off assisted ramp that would gently place the keg on the pallet.

Requirements of the assisted Keg ramp:

- Flip the keg 180° to right-side-up
- Span the distance from the filler to the pallet
- Minimal change to operation time
- Be constructed of stainless steel



Continued review of our material requirements and budget revealed that stainless-steel stock and components drove costs well above our cap, far more than non-corrosive alternatives. When we contacted Logboat to explore cost-saving options, they could not offer any further assistance. Thus, we had to find a new project at week 10 of the semester.

Improved Trailer Ramps

Each steel ramp weighs 85.89 lbs. and requires a 180-degree rotation to latch, placing considerable strain on the operator. The combination of weight and motion raises safety concerns, highlighting the need for a redesigned system to improve both safety and usability.




Design

Requirements of the Improved Loading Ramp:

- Must be lightweight and operate without rotation
- Needs to withstand an 8,000 lbs. static load
- Equal or greater factor of safety
- Exert minimal deflection



Key Design Improvements

- Utilized 6061 Aluminum to reduce weight
- Steel cable handle pull-out
- Increased U-channel thickness for strength
- Shortened ramp to lower maximum bending moment
- Implemented U-channel extensions to optimize budget
- Angled bottom piece for ground support



FEA HAPPY RAMPS™



Performance Metric	Old Ramp	New Ramp
Weight (lbs)	85.89	30.85
Adjusted FOS*	1.5	2.11
Maximum Deflection (in)	0.094	0.393

* While the simulated factor of safety for both designs falls below 1.5, the original design withstood the full load with no signs of failure or fatigue. A conservative FEA model likely underestimates true performance, validation tests have confirmed the reliability of the new design.

Fabrication

Raw bar stock was cut with a bandsaw, and bolt holes were drilled. Jigs were machined on a vertical mill to efficiently weld and ensure accuracy. The ramps were TIG welded and subsequently tested on the trailer. The testing focused on strength and stability under the weight of a skid steer.

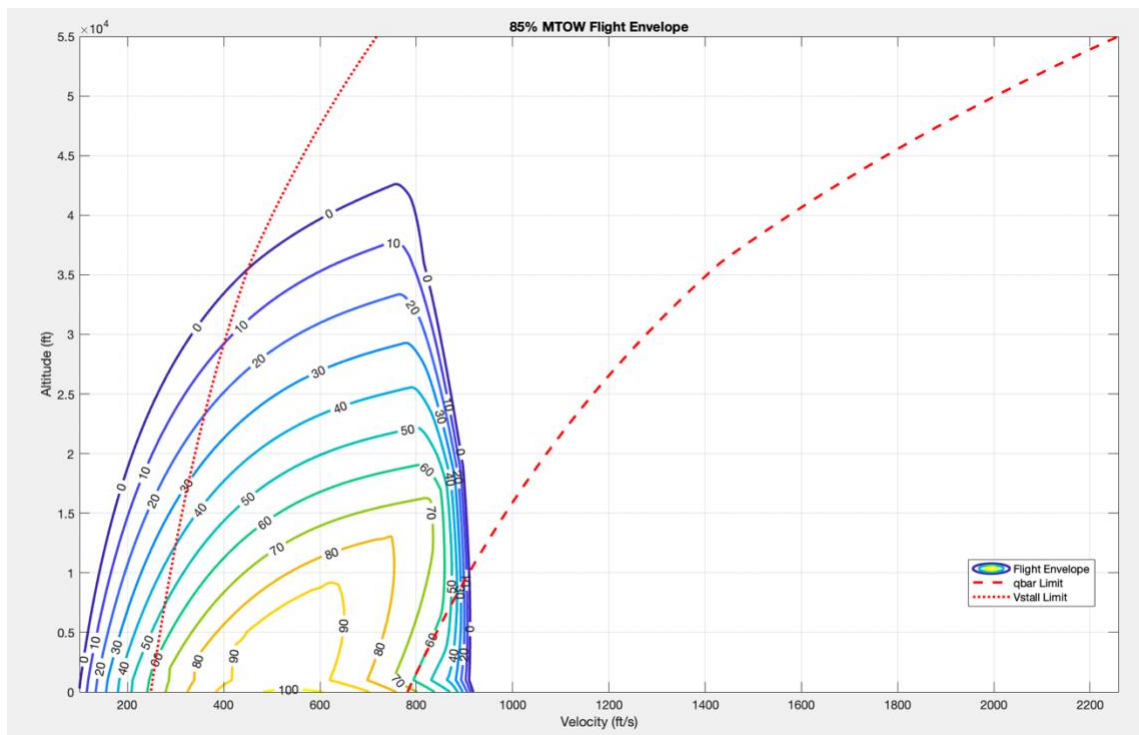


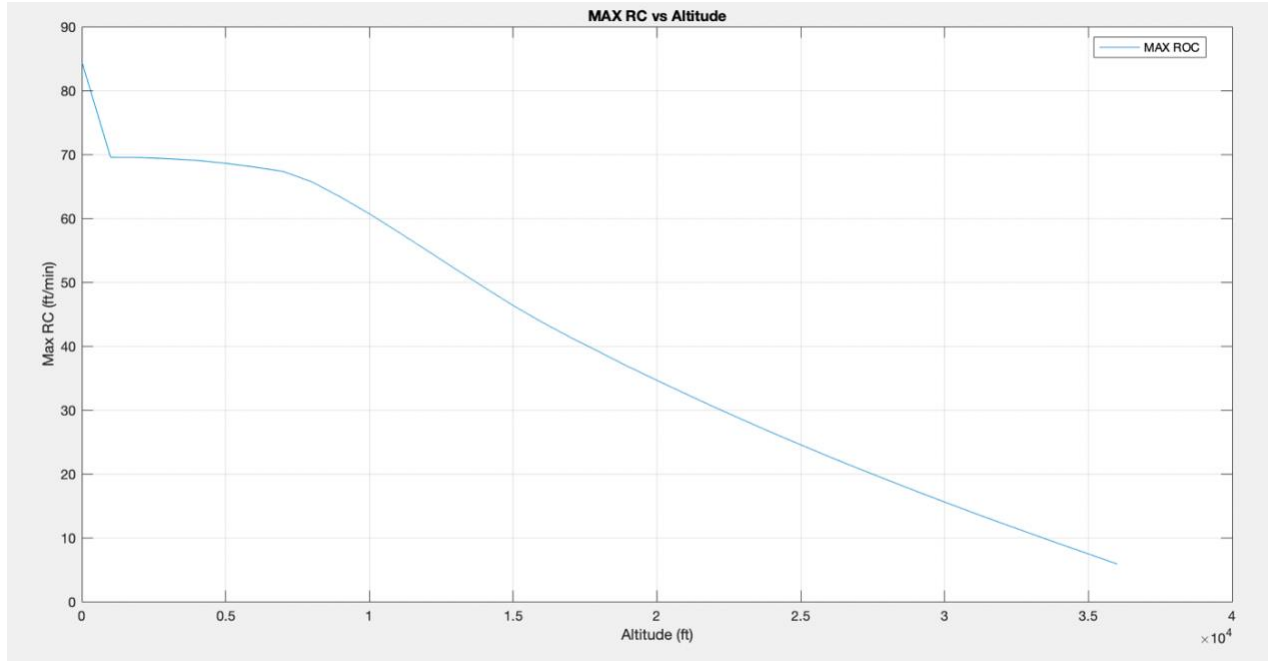
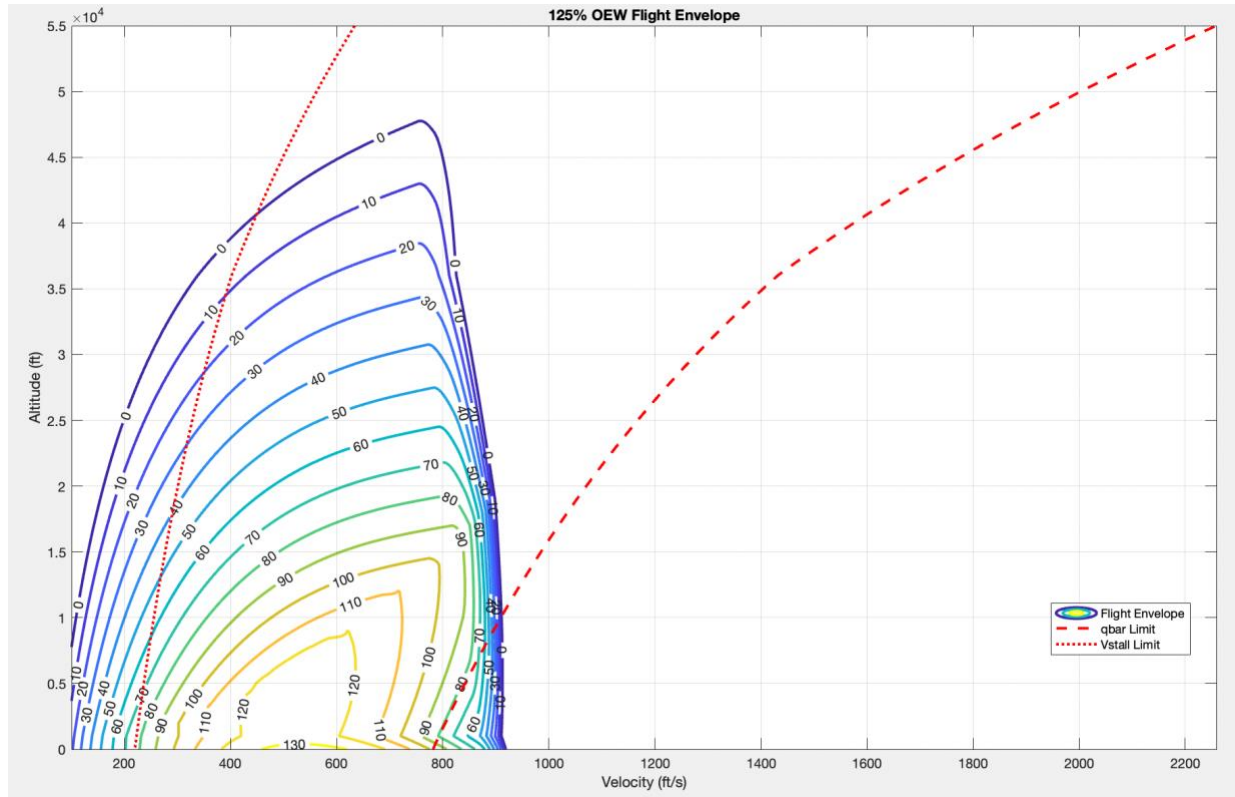

Lessons Learned

Regular and frequent budget reviews are essential to staying on track and adapting to changes. It's important to recognize when it's time to pivot and adjust plans accordingly. Successful collaborations depend on mutual commitment from all parties involved, and maintaining transparent communication is crucial throughout the process.

Aircraft Flight Performance Semester Project Fall 2024

The Gulfstream G550 mission analysis is centered on modeling flight envelopes and rate-of-climb performance to evaluate aircraft capability across operating weights. Two flight envelopes were developed, one at 85% of maximum takeoff weight and another at 125% of operational empty weight. These envelopes illustrate how available thrust, aerodynamic limits, and energy height interact through each phase of flight. The accompanying rate-of-climb figure quantifies climb performance versus altitude, derived from MATLAB simulations using excess power relations. Together, the envelopes and RC curve demonstrate how aerodynamic efficiency and thrust decay with altitude govern achievable climb rates and ceiling performance for the G550.





Machine Element Design Semester Project Fall 2024

Developed a compact two-stage reduction gearbox that increased torque by a factor of five while maintaining high reliability and manufacturability. The system consisted of four spur gears mounted on three steel shafts, supported by high carbon steel bearings with interference fits to ensure precise alignment. Detailed analysis included gear tooth stress, bending and contact fatigue, shaft deflection, and bearing life calculations, all verified to exceed a factor of safety of two. Using SolidWorks and manual calculations, the gearbox was optimized for minimal size, smooth power transmission, and a 10,000-hour operational lifetime. The final design balanced performance, material efficiency, and cost while demonstrating proficiency in mechanical design, tolerance analysis, and design for manufacture principles.

