

# DESCENT SYSTEMS FOR AN IMPROVED AND REUSABLE GEMINI CAPSULE

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## Overview

An MAE senior design team sponsor is seeking to safely land, after atmospheric re-entry from Lower Earth Orbit (LEO), a manned capsule on land as opposed to an ocean splash down. Preliminary designs of a descent system have been developed by the MAE team. In order to design this system extensive research was conducted regarding the original designs that the National Aeronautics and Space Administration (NASA) considered including a Rogallo wing and Parafoil descent systems. The design team focused upon the creation of various preliminary designs of the capsule descent systems. Extensive technical analysis was completed using modeling and simulation tools, such as Finite Element Analysis (FEA), which were critical during the design process.

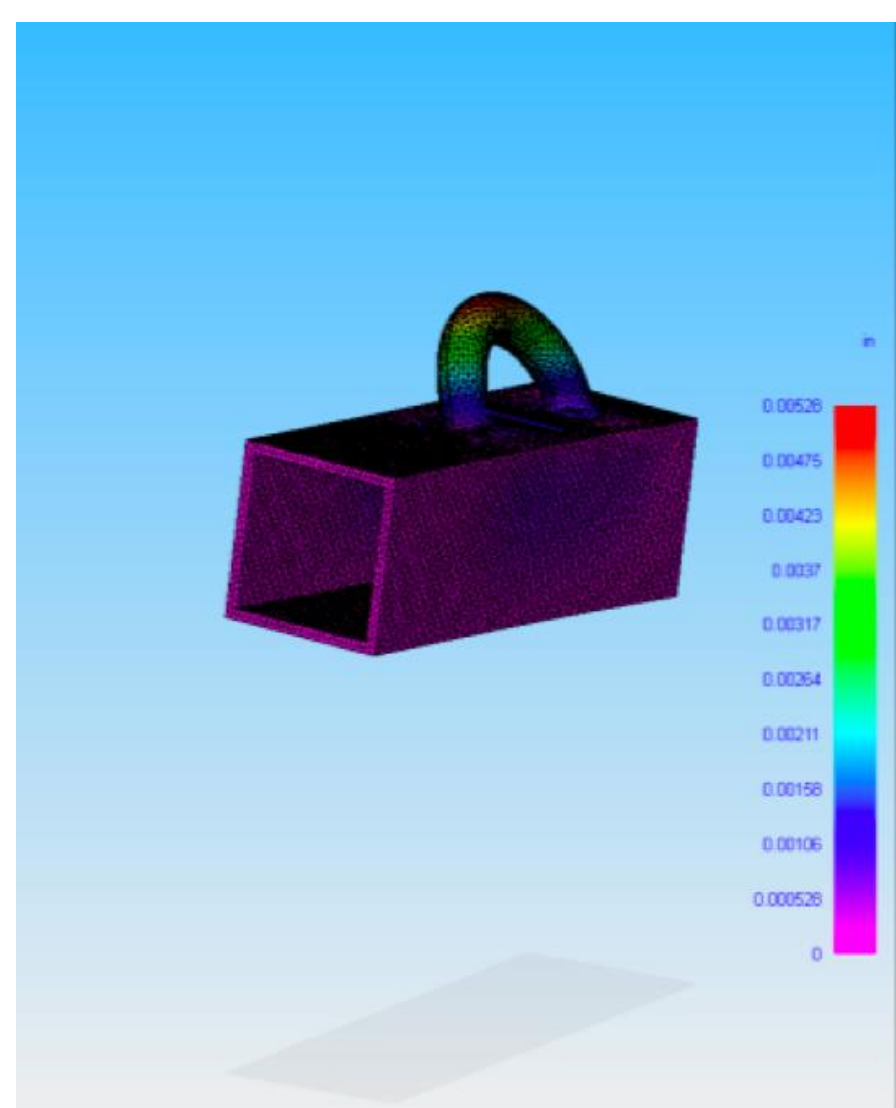


Figure 1: Rogallo Wing      Figure 2: Displacement

## Impact

This research provides MAE senior design students with critical spaceflight hardware design experience that will prepare the students for entry into the aerospace workforce. Additionally, via outreach efforts at various secondary education schools, younger students will gain knowledge pertaining to NASA's original capsule designs and exposure to current research in the MAE Department.

## Acknowledgements

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## Key Findings

The FEA provided the displacement and stresses that would be applied to a real world model of the Gemini capsule. The Computational Fluid Dynamics (CFD) predicted the applied pressure and velocity to the capsule. The results found via FEA will continue to aid future efforts by MAE design teams as the improved and reusable Gemini capsule is tested.

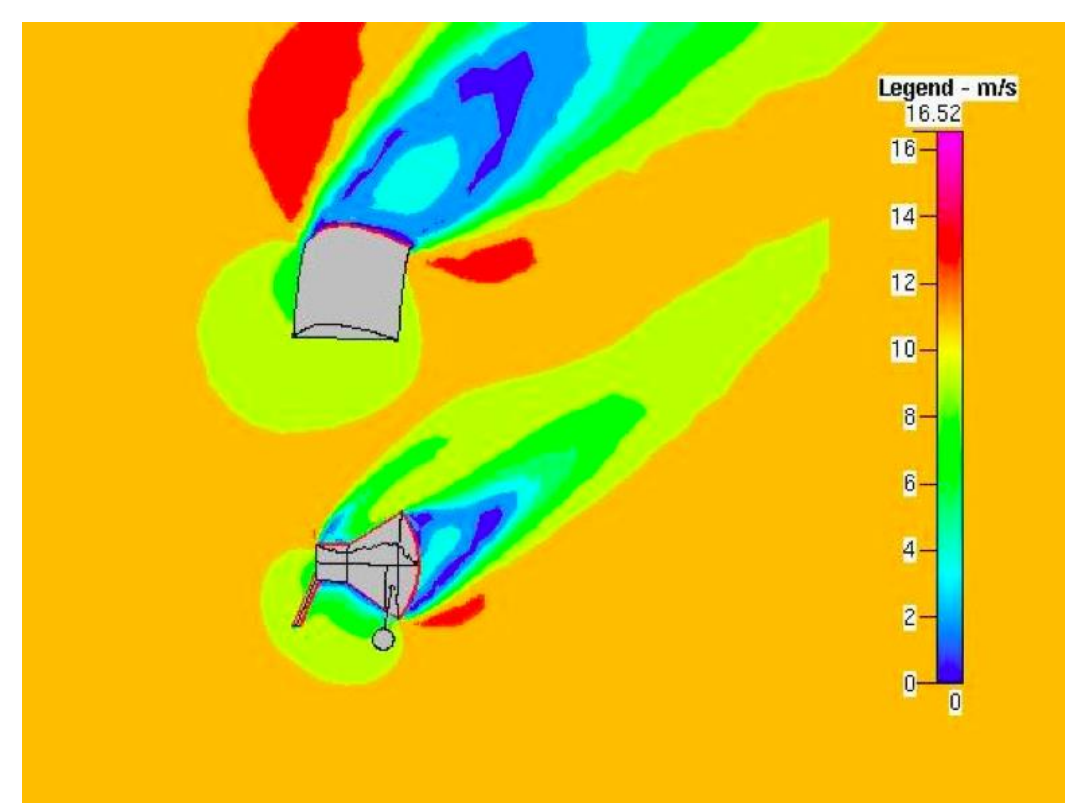


Figure 3: CFD Velocity

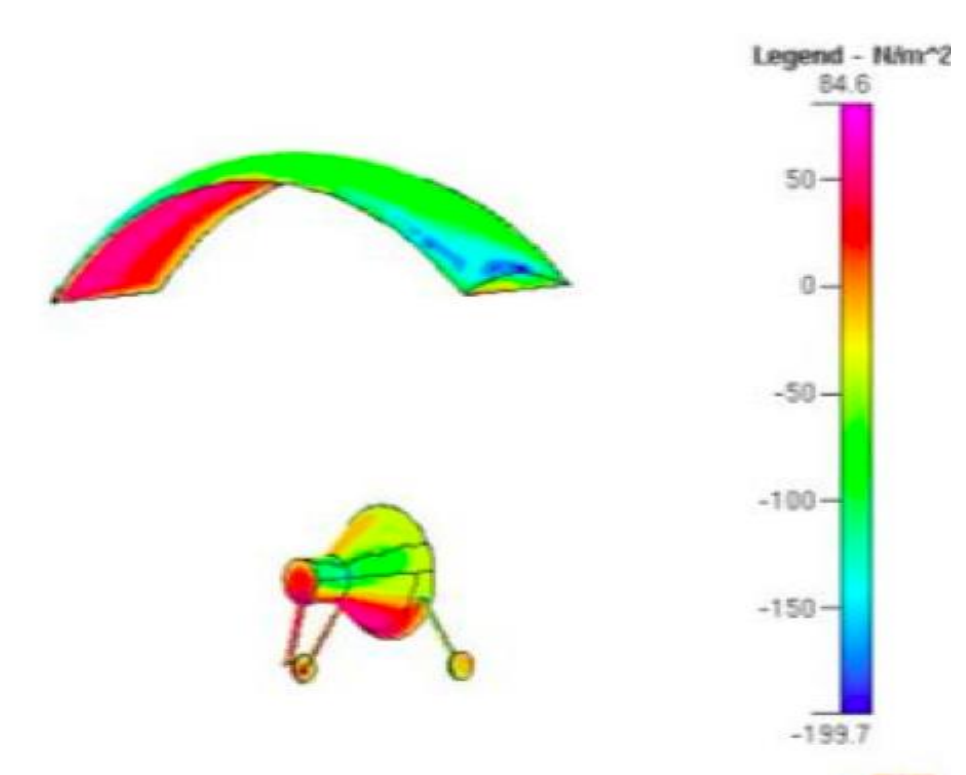


Figure 4: CFD Pressure

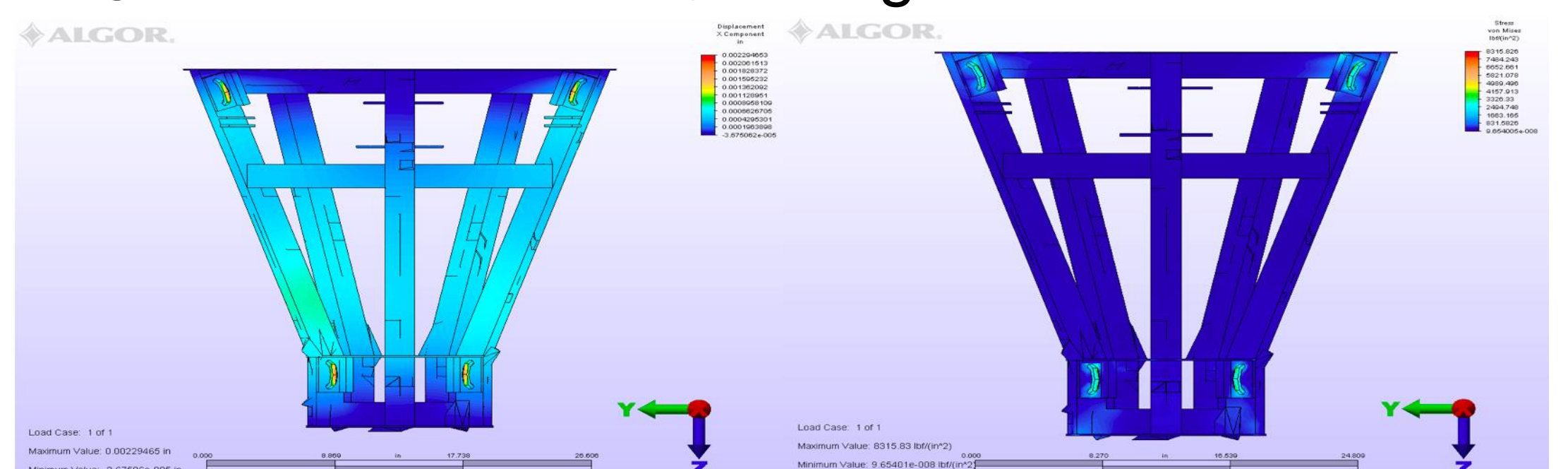


Figure 5: FEA Displacement      Figure 6: FEA Stress

## Explanation

The team sponsor's goal is to provide bi-annual commercial space flight launches into LEO with an emphasis upon placing student designed experiments and satellites into orbit. This partnership provides MAE senior design students manned space flight hardware design experience. Several design teams have designed and fabricated various hardware including a 1/3 scale model of a modified Gemini capsule and the landing gear. The design of the descent system began with a thorough definition of the requirements and constraints, followed by extensive research. After several design concepts were developed, a design was chosen and thorough technical analysis was completed that emphasized the attachment of a descent system to the 1/3 scale capsule.

