Overview
The Center for Innovative Materials Processing at Penn State required a solution to designing and fabricating a lightweight quadcopter that is fully adjustable and composed of metallically additive manufactured joints. The quadcopter had to have the capabilities of a conventional drone on the current market.

Objectives
- Design and print inner and outer joints for the quadcopter
- Combine and connect necessary electric components for drone to function
- Perform finite element analysis on joints to ensure proper durability
- Configure electrical components with carbon fiber exoskeleton and metal joints

Approach
- Studied quadcopters on the market to obtain better understanding of necessary capabilities
- Sponsor's customer needs were to match the best quadcopters on the current market
- Concept generation and selection was performed to draft best shape for flight stability and power
- Existing manufacturing and drafting processes for drones were analysed before designing process
- The group visited the sponsor to fully establish expectations and to initiate the fabrication process
- Finite element analysis was performed on joints in SolidWorks program to access model durability
- Three primary stages of CAD models were generated over the duration of the project
- Three primary prototypes were developed until final was created with metallic joints
- Flight testing was performed for each prototype to assess flight stability of each design
- Need for improvement of each prototype was based off of primarily durability and flight stability
- The first couple of prototypes crashed due to joint weakness so FEA was performed to strengthen each design

Outcomes
- All customer needs were met and the group fabricated a quadcopter that had a stable flight pattern
- The drone matched the flight time, payload carrying and durability characteristics of products on the current market
- The new aluminium metallically additive manufactured joints proved more durable than plastic joint upon impact
- Future firms can utilize this process to efficiently produce fully adjustable quadcopters with ease