Overview
As technology shifts to focus on renewable and clean energy, the aerospace industry is researching and testing aircrafts that reduce dependency on fossil fuels. Lockheed Martin has tasked our capstone team with conceptually retrofitting the Lockheed Electra 10 aircraft with an electric propulsion system. The Electra 10 was used by Amelia Earhart for her attempted flight around the world. Our capstone team modified the Electra 10 and conceptually designed an electric propulsion system to carry the aircraft across Earhart's intended flight path. This project was focused heavily on research to determine if modern electric propulsion technologies could power the Electra 10.

Objectives
To design a theoretical electric propulsion system on the Electra 10, our team conducted research on electric motor performance, modern aircraft design and materials, hydrogen fuel cells, and power distribution. Our main objectives were to use this research and define motor sizing parameters, weight reduction opportunities, calculate energy required, and design of the onboard power sources.

Approach
- Define the scope of project to include modifications to the plane construction and electric propulsion system
- Research current electric powered aircrafts and define the necessary components
- Perform the steps listed below to modernize the Electra 10 and decrease total weight
  - Calculate size and weight of the wings, tail, fuselage and tail
  - Remove the above components from the aircraft and calculate the center of gravity
  - Use aircraft design manuals to estimate weight saving based on modern manufacturing techniques
  - Apply weight savings to the aircraft to define the new weight of the plane
- Utilize the flight manual to calculate the most efficient flight path and required energy
- Parametrically size an electric motor following the steps listed below
  - Research current electric motors, record their max power, torque and gross weight
  - Create plots of power and torque density of the electric motors, include original Electra 10 Pratt and Whitney motor parameters
  - Estimate motor specifications based on created plot trendlines
- Design our power system using research and calculations on batteries and hydrogen fuel cells
- Determine the location for each component in the plane and calculate final center of gravity
- Create system architecture diagram using selected components and technologies required to meet performance parameters

Outcomes
- This project provides our sponsor with a system architecture and a diverse range of research for electric propulsion systems
- Our research and design selections points to where technology needs to be improved to utilize hydrogen fuel cells for commercial aircrafts