3D Printed Aircraft Competition

SDSU San Diego State University

Team Quetzal

Department of Mechanical Engineering
2023-2024

Project Description

Team Quetzal have designed and manufactured a 3D printed aircraft with the purpose of entering the 3D Printed Aircraft Competition (3DPAC) hosted by Cal State Los Angeles. 3DPAC includes 3 separate competitions: flight, design and simulation. Per competition guidelines all lifting surfaces and aircraft components must be 3D printed except for electronics and select hardware. The aircraft is limited to 8 seconds of powered flight and must fly within a restricted area of 300 x 160 feet and remain under 35 feet.

Meet the Team

Charles Locke
Team Lead / Pilot

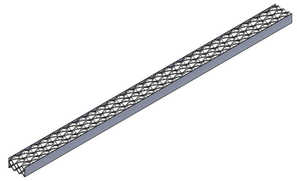
Edgar Flores
Procurement Lead / Design

Alonso Perez
Manufacturing Lead / Pilot

Ralvin Estacio
Design Lead / Test Lead

Spar Design

The spar is constructed using an origami structure which is inspired by Armory Technologies designs. The origami structure can be orientated in a certain direction which provides extra strength throughout the wing while still providing impact resistance.



Filaments

PLA+ (Polylactic Acid)- Stronger then normal PLA and provides extra flexibility. Used during prototypes and for spars.

LW-PLA (Lightweight PLA)- Reduces weight of prints by up to 65% compared to PLA.

PLA Aero- PLA material specifically designed for aircrafts. Has light weight characteristics similar to LW-PLA but has more impact resistant characteristics. Used mainly for the fuselage, nose cone and tail.

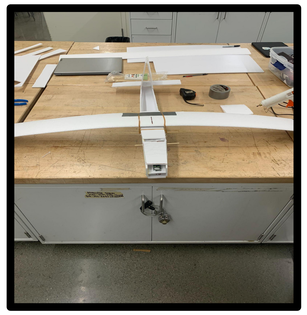
Nylon Carbon Fiber- Strong, rigid and lightweight material. Used for spars.

TPU (Thermoplastic Polyurethane)- Flexible material that allows for control surface movement. Used to attach the ailerons, elevators and rudder.

Prototypes

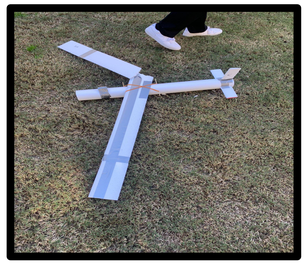
1st Prototype

- Constructed with foam, tape and glue.
- Used generic Cessna fuselage.
- Primary purpose was to test different airfoil designs; SD7037, MH60, ClarkY



2nd Prototype

- Constructed of foam, tape, sticks and rubber bands.
- Used a rounded foam fuselage.
- Primary purpose to test different chord lengths of the SD7037 airfoil.



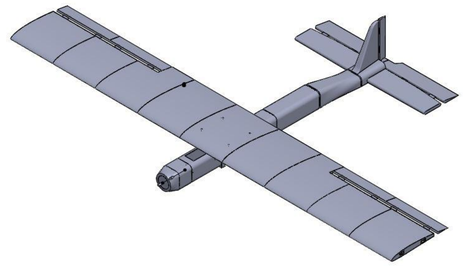
3rd Prototype

- Fully 3d printed using PLA+.
- Fully equipped with electrical components.
- Tape was used as hinges for control surfaces.

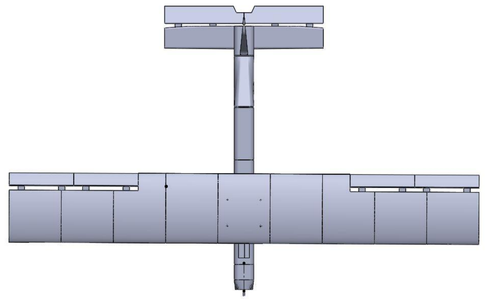
4th Prototype

- Fully 3D Printed using PLA Aero and PLA+.
- Fully equipped with electrical components.
- TPU hinges are used for control surfaces.

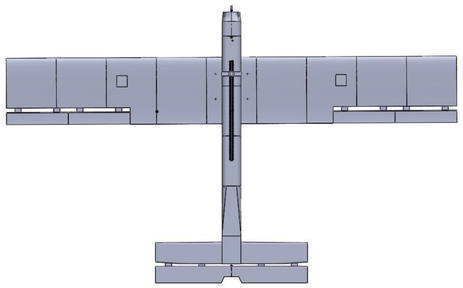
Final Design



Isometric View



Top View



Bottom View

Key Design Points

- Wing attached with rail system that allows for adjustable wing placement in order to locate the center of gravity.
- TPU hinges used to allow movement of control surfaces.
- Fully 3D printed using only PLA Aero.

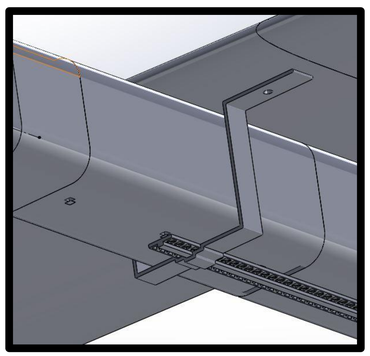
Acknowledgement

Team Quetzal would like to thank the following:

- **Dr. Scott Shaffar** for advising and this project.
- **Dr. Chuck Norris** for advising and sharing his expertise in aerospace and glider aircrafts.
- **Oscar Correa** for advising with his experience participating in last years team.
- **SSF** for providing the funding for the team.
- **Cal State LA** for hosting the 3D-PAC event.

U- Bracket Connection

- U-Bracket and rail design securely fastens the wing and the fuselage together.
- The design allows for the wing to slide along the fuselage and be secured at any point. This allows for the center of gravity to be located.
- The bracket and rail are 3D printed using PLA+.
- The bracket is fastened down using commercially available screws and wing nuts.



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