SPEC-14-*001*

PROJECT SPECIFICATION

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Document Number:	SPEC-14-*001*
Document Name:	Project Specification
Release Date:	*February, 6st, 2015*
Author:	*David Debeau*
Version:	*A1*

Human Powered Airplane

Revision History

REV	DESCRIPTION	DATE	APPROVED BY
A1	*Initial Working Document*	*2/6/2015*	*David Debeau*

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1 PROJECT SPECIFICATION OVERVIEW

1.1 Executive Summary

The Human Powered Airplane (HPA) Project at UCI is the first HPA to be designed and built in the United States in twenty years. The project was initiated by Jacqueline Thomas, UCI Aerospace Engineer Class of 2014, with the aim to create a unique design with composite construction that is easily produced and commercially viable. There have been a handful of HPA designs that flew in the past but they're typically designed as a proof of concept, with ultralight composite structures with low factors of safety. These designs often last only one flight before being discarded or put on display.

UCI's HPA is engineered for safety and reusability. The aircraft has been meticulously documented and engineered using product lifecycle management software, a first for senior design projects at UCI. This project is a true testament to UCI's strength in fostering engineering talents as it aligns learning objectives with project goals and product delivery. It blends academic fundamentals with real-world engineering. On the academic side, students have independently studied and applied aerodynamic and mechanical concepts such as lift and drag modeling, thrust modeling, propeller design, aircraft stability and control, and composite structures modeling. For real-world engineering, students learned and applied engineering and manufacturing skills such as composite structure manufacturing, mold making, flight testing, data collection and data processing.

2 Product Description

2.1 Product Context

The Human Powered Airplane (HPA) project is unlike any existing HPA in the world. It utilizes a fuselage on wing design combined with a straight drive propeller, unlike other HPAs that utilize an underslung fuselage with a vertical chain drive. This is to cut down on drag and provide a more efficient power delivery system. Our HPA also does not use drag causing guide wires which are employed on all existing HPAs.

2.2 User Characteristics

The user of a commercially produced HPA of our design would be an outdoor adventurer. Someone who has some flying experience, either with ultra-light aircraft or gliders. Possibly wing-suit flyers or other extreme sport participants.

2.3 Constraints

The lack of project funds has been the main constraint for the project. The project gets approximately $1500, 3 times a year from student fees. This is the only money per year that can be relied upon completely. The lack of funds has resulted in the project having to use less than optimal manufacturing methods. With full funding and access to large ovens pre-impregnated resin composite manufacturing would be possible allowing HPA to save weight and time.

The lack of a unified space for HPA has resulted in the project being spread over multiple buildings and out buildings. While HPA has managed to work fine with the space provided it would be optimal to have a dedicated workshop for the project.

3 Requirements

3.1 Functional and Performance Requirements

- *The Airplane must be capable of being disassembled, transported using a covered box truck, and reassembled at the launch site. This will be confirmed by verifying that the components will fit within the standard dimensions of a large box truck.*
- *The Airplane must be able to fly unassisted for a period of at least 1 minute. This can be estimated using the power output from the pilot and weight/balance calculations from the Chief Engineer.*
- *The Airplane must be safe for the pilot to operate. A thorough inspection and testing of the aircraft will be conducted before the pilot flies the aircraft.*

3.2 User Requirements

- *The Aircraft must be capable of human powered takeoff and landing.*
- *The Aircraft must be capable of making changes in pitch and yaw.*
- *The Aircraft must be reusable.*

3.3 Maintenance Requirements

- *The Aircraft must be easily repairable with a minimal knowledge of carbon fiber and fiberglass manufacturing techniques.*