

Project Title: OpenUAS  
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# OpenUAS Project Description

## Project Summary

The OpenUAS project is a multidisciplinary undergraduate research team aimed at developing an open source fixed wing aircraft. The goal is to enable research teams, undergraduate/high school teams, and otherwise interested groups of people access to plans for a cheap, easy to manufacture, configurable fixed wing UAS to serve as an educational or test platform. These plans include 3D models, schematics, step by step instructions, and documentation for design decisions. The project seeks to provide a comprehensive experience for building a customizable fixed wing aircraft, akin to many similar resources already developed for quadcopters.

As an open source project, we will officially release the plans on a platform such as GitHub for the public to have access and provide feedback to the project. In this way the project will be continuous and improve upon itself according to those who utilize it. As alluded to, these plans will include a variety of resources, including instructions on how to manufacture and customize the airframe, choose and integrate electronic components (such as a motor or flight computer), and use and extend the software capabilities of selected platforms.

## Desired Outcomes

The desired outcomes of the project are twofold: provide the public with well documented and open source plans for a highly configurable fixed wing aircraft and develop a variety of technical and team oriented skills in those who work on the project.

The first outcome is concrete and, in the nature of open source projects, has a running deadline. We are aiming to have constructed and test flown our second iteration of the craft by the end of this semester i.e. the end of November 2020. The next iteration will have a deadline set in the near

future, and tentatively is the end of the following semester i.e. May 2021. Pending the outcomes of the test flights we will look to officially release a version of the design and documentation to the public.

The second outcome is more fluid and subjective, but we have taken and hope to take more steps to further the likelihood of success. In particular, the team has a leadership structure which enables the most technically literate to most effectively guide and teach those who are looking to learn these technical skills through the building and design of the aircraft. The team also provides workshops to team members to help develop particular technical skills including tools such as (Star CCM) CFD, XFLR5, and git. Furthermore, the team aims to provide these opportunities to learn and apply one's skills to underrepresented groups, and as such we prioritize our recruiting to women and minorities in STEM by recruiting through groups such as WiSE.

## NASA Directorate and ISGC Alignment

The OpenUAS project aligns with the NASA Aeronautics Research Mission Directorate insofar as the project seeks to enable research teams to more quickly and effectively carry out tests as a reliable and properly suited fixed wing test bed and develop passion and knowledge in aviation in younger generations as an educational module. In this way the project is seeking to contribute not only to the bleeding edge of technology as a way to help those developing new technologies for fixed wing aircraft, but also those that will be the next wave of contributors to the field of aerospace.

The goals of the ISGC align with the OpenUAS project in that the project is providing opportunities to a diverse set of students at Iowa State University. These opportunities include the development of a wide range of technical skills as well as soft skills such as communication and team management. Through the efforts of this project we enable undergraduate students from any major to contribute to a meaningful project and further along their skills as an engineer or otherwise.

# Detailed Budget Outline

Subteam	Material	Price	Quantity	Total	Reasoning
Manufacturing	50 yds Carbon Fiber Roll	\$1,424.19	1	\$1,424.19	Carbon fiber is our main material used in the construction of the Iron Bird. We are currently out of it, causing manufacturing to come to a screeching halt.
Manufacturing	Shop Vac	\$48.97	1	\$48.97	With our work with composite materials as well as the other manufacturing done in the lab, we need a reliable way to clean up after ourselves. We dont currently have a god way to do this and a shop vac will fix this
Manufacturing	Randomly Orbiting palm sander	\$59.00	1	\$59.00	To effectively shape our designs and get them to the correct tolerances, we will need a randomly orbiting palm sander
Manufacturing	JigSaw	\$99.00	1	\$99.00	Our designs require a lot of large cuts and cuts that require a very specific geometry, something a jigsaw will allow us to do. Without it, we cannot get the right geometry and tolerances through the basic handtools currently in use
Manufacturing	24 oz parting wax	\$12.25	1	\$12.25	Used in our carbon fiber layups
Manufacturing	Body Foam	\$40.04	3	\$120.12	Foam molds used to create the structure and the molds for the carbon fiber layup
Manufacturing	Flite Test Maker Foam White 30x40 Bifold (25 Pack) Water resistant	\$99.00	1	\$99.00	This foam board can be used for various parts of the UAS, including tail surfaces, electronics bay, and possibly the wing
Manufacturing	Midwest Carbon Fiber Tube .210 OD x .132 ID x 40"	\$8.39	4	\$34.36	Carbon fiber tube for interior wing and tail supports
Manufacturing	Midwest Carbon Fiber Tube .125 OD x .060 ID x 40"	\$6.39	4	\$25.56	Carbon fiber tube for interior wing and tail supports
Manufacturing	Carbon Fiber Roll Wrapped Twill Square Tube	\$49.73	1	\$49.73	Tail boom, connecting fuelage to tail surfaces on UAS
Manufacturing	N95 Masks	\$24.97	2	\$49.94	N95 masks used for when cutting into noxious materials like fiber glass for safety
Flight Test	Student Membership to the Central Iowa Aeromodelers radio-controlled aircraft flying field - 1 year	\$33.00	1	\$33.00	The Central Iowa Aeromodelers flying field is located about 7 miles South-South East of Ames. It has a 350ft long petromat runway and grass suitable for taking off and landing our UAS. This field is the best location locally, where the team can fly our UAS with little to no risk of damage to the aircraft due to the takeoff/landing location. To gain use of this field, our team pilot must be a member of the Central Iowa Aeromodelers Flying club.
Flight Test	Academy of Model Aeronautics (AMA) membership - 1 year	\$73.00	1	\$73.00	The AMA is a "governing body" for radio-controlled aircraft and includes limited liability insurance with its membership. AMA membership is mandatory for membership in the Central Iowa Aeromodelers club, including the use of their flying field.
Flight Test	Folding Aircraft Propeller - 12x10	\$13.00	2	\$26.00	A folding aircraft propeller will allow our UAS to land on its belly without damaging its propeller, motor, or motor mount.
Flight Test	Folding Aircraft Propeller - 13x10	\$14.00	2	\$28.00	A folding aircraft propeller will allow our UAS to land on its belly without damaging its propeller, motor, or motor mount.
Flight Test	Folding Aircraft Propeller - 14x10	\$15.00	2	\$30.00	A folding aircraft propeller will allow our UAS to land on its belly without damaging its propeller, motor, or motor mount.
Flight Test	Folding Aircraft Propeller - 14x12	\$15.00	2	\$30.00	A folding aircraft propeller will allow our UAS to land on its belly without damaging its propeller, motor, or motor mount.
Flight Test	38/5 Spinner for folding propeller	\$18.00	2	\$36.00	A folding aircraft propeller will allow our UAS to land on its belly without damaging its propeller, motor, or motor mount.
Flight Test	45/5 Spinner for folding propeller	\$25.00	2	\$50.00	A folding aircraft propeller will allow our UAS to land on its belly without damaging its propeller, motor, or motor mount.
Flight Test	38/08 Yoke for folding propeller	\$9.00	2	\$18.00	A folding aircraft propeller will allow our UAS to land on its belly without damaging its propeller, motor, or motor mount.
Flight Test	47/8 Yoke for folding propeller	\$10.00	2	\$20.00	A folding aircraft propeller will allow our UAS to land on its belly without damaging its propeller, motor, or motor mount.
Flight Test	Audio cable (2 pack)	\$8.07	1	\$8.07	Standard 3.5mm audio cable will enable us to connect two aircraft transmitters together for the purpose of training new UAS pilots.
Structures	Tail Wheel Bracket	\$3.39	1	\$3.39	Bracket for connecting tail wheel to UAS.
Structures	Tail Wheel	\$3.09	1	\$3.09	Tail wheel for UAS.
Structures	Landing Gear Tires	\$9.49	2	\$18.98	Main Landing gear tires for the UAS.
Structures	Axle Shaft	\$7.49	1	\$7.49	Axle shafts for landing gear wheels of the UAS.
Structures	Landing Gear Bracket	\$19.73	1	\$19.73	Main landing gear bracket for UAS.
Structures	Nose gear bracket	\$6.99	2	\$13.98	Nose landing gear bracket for UAS.
Lab Supplies	Adhesive Aluminium Ducting Tape	\$8.99	1	\$8.99	Aluminum tape is ideal for reinforcing control surface hinges and making patches.
Lab Supplies	Gorilla Clear packing tape	\$6.77	2	\$13.54	Clear packing tape for patching foam surfaces, reinforcing control surface hinges, and general use
Electronics	Benewake TFMINI-S Micro LIDAR Module (UART / I2C)	\$39.90	1	\$39.90	A lidar sensor is needed to detect the vertical distance of the UAS for the pixhawk to use the autoland feature
Electronics	LeddarTech LeddarOne Optical Rangefinder (3.3V UART)	\$125.00	1	\$125.00	A lidar sensor is needed to detect the vertical distance of the UAS for the pixhawk to use the autoland feature. This one is not as important to have if we have the benewake TFmini, but it would be useful to test the effectiveness of different lidar sensors
Electronics	PRT-10376 (LeddarOne connector)	\$1.95	2	\$3.90	Standard 6 pin female connector to interface with the pin header on the LeddarOne optical rangefinder. Quantity 2 for redundancy
Electronics	PX4FLOW smart camera	\$105.00	1	\$105.00	When used in tandem with a distance sensor, the PX4flow can detect velocity, which is necessary for the implementing optical flow feature
Electronics	Lidar Cable	\$5.50	1	\$5.50	Used to interface our lidar sensor with flight computer
				<b>\$2,746.72</b>	

*Note: This spreadsheet is attached to proposal email*