Drone Conversion Appliances (DCA)

- Date: 10 March 2023
- DCA Team
- Project Advisor: Dr. Yongcan Cao, ECE
- Team Sponsor: USL Lab, UTSA
- Team Members: **Ehab Afsoonko, Conrad Obeng, Lexi McMinn, Mark James Jr., Matthew Moubray**
- “Expanding the world of Modifiable Drone Transit.”

Background/Overview Slide

Every UAV, drone, or RC plane on the market is a single modality kit and constrained to a single flight pattern. Our project aims to expand the number of vehicle transportation modalities for the ModiFly Quadcopter through the addition of a VTOL Fixed-Wing module. This will allow for user to take the mainframe from the Modifly Quadcopter and attach the VTOL Fixed-Wing module without the need to purchase and build a whole entire kit. The VTOL-Fixed WIng module features are:

- Longer flight duration
- Reduced battery consumption
- Vertical-Takeoff and Landing capability
- Higher forward propulsion
- Increase payload

Tasks Completed

- Finalized design of new quadcopter base
- Completed first test flight in quadcopter mode
  - Assembled ModiFly Frame
  - Wired motor mount connectors
  - Soldered 4:1 ESC
  - Flashed Pixhawk
  - Changed Ardupilot parameters
    - H-bridge drone frame
    - Pixhawk orientation/GPS
    - Virtual Motor PID Position
    - ESC Protocol
  - Assembled VTOL wingframes

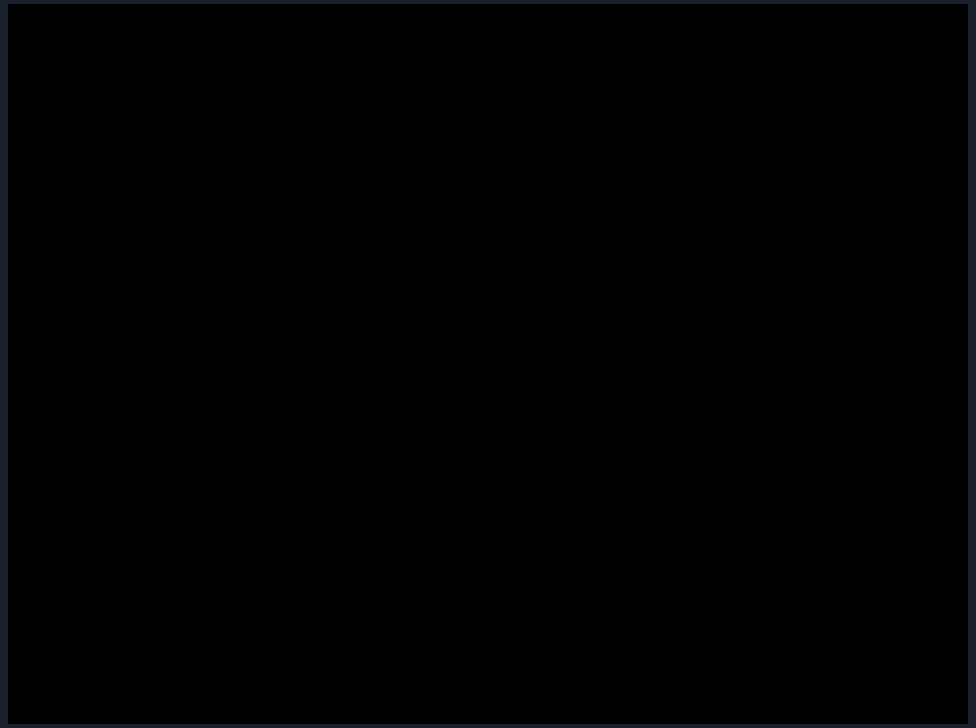
Current Problem or Obstacles Slide

- How to attach wings securely to quadcopter base?
- How to make the front propellers tilt forward without catastrophic failure during transition from VTOL mode to forward-flight mode?

Example of Final Product

This is what the final design will roughly look like. The base is currently configured for quadcopter mode, but the propellers will have larger blades and will be located near the end of the beams. They are attached to a piece of carbon fiber that is inside of the wings themselves. New connections will be fixed to these beams to ensure the “plug and play” compatibility with the Modi-fly Ecosystem.

First Drone Flight Test



Week 20 Team Project Contribution Report

Team Name:	Drone Conversion Appliances (DCA)			
Team Number:	14			
Week Number	20			
Week Start Date:	13 Feb 2023			
Week End Date:	17 Feb 2023			
Task Number:	Task Description:	% Complete on Start Date:	% Complete on End Date:	% Progress
Task 2	Updated ModiFly Base	75%	100%	25%
Task 3	VTOL Desgin Frame	0%	80%	80%
Team Role	Team Member Name:	UTSA ID:	Total hours worked:	Task Set
Program Manager	Conrad Obeng	fxy380	3	1,2
Secretary/Firmware Engineer	Ehab Afsoonko	czu525	2	1,2
Systems/Software Engineer	Lexi McMinn	yva363	2	1,2
Software/Robotics Engineer	Mark James jr	Eve717	2	1,2
Hardware Engineer	Matthew Moubray	yrb578	3	1,2

Week 21 Team Project Contribution Report

Team Name:	Drone Conversion Appliances (DCA)			
Team Number:	14			
Week Number	21			
Week Start Date:	20 Feb 2023			
Week End Date:	24 Feb 2023			
Task Number:	Task Description:	% Complete on Start Date:	% Complete on End Date:	% Progress
Task 1	Print ModiFly Base	0%	100%	100%
Task 2	Wire XT-60 connectors	0%	100%	100%
Task 3	VTOL Design Frame	80%	100%	20%
Task 4	Determine 4:1 ESC wiring schematic	0%	100%	100%
Team Role	Team Member Name:	UTSA ID:	Total hours worked:	Task Set
Program Manager	Conrad Obeng	fxy380	2.5	1,2,3,4
Secretary/Firmware Engineer	Ehab Afsoonko	czu525	1.5	1,2,3
Systems/Software Engineer	Lexi McMinn	yva363	1.5	1,2,3
Software/Robotics Engineer	Mark James jr	Eve717	1.5	1,2,3
Hardware Engineer	Matthew Moubray	yrb578	2	1,2,3,4

Week 22 Team Project Contribution Report

Team Name:	Drone Conversion Appliances (DCA)
Team Number:	14
Week Number	22
Week Start Date:	27 Feb 2023
Week End Date:	3 Mar 2023

Task Number:	Task Description:	% Complete on Start Date:	% Complete on End Date:	% Progress
Task 1	Solder 4:1 ESC	0%	100%	100%
Task 2	Set Ardupilot Parameters for Drone	0%	0%	0%
Task 3	Assemble VTOL Airframe	0%	100%	100%
Task 4	Connect Motors w/ Props to Carbon Rods	0%	25%	25%

Team Role	Team Member Name:	UTSA ID:	Total hours worked:	Task Set
Program Manager	Conrad Obeng	fxy380	4	3, 4
Secretary/Firmware Engineer	Ehab Afsoonko	czu525	2	1
Systems/Software Engineer	Lexi McMinn	yva363	3	3, 4
Software/Robotics Engineer	Mark James jr	Eve717	1	2
Hardware Engineer	Matthew Moubray	yrb578	3	3, 4

Week 23 Team Project Contribution Report

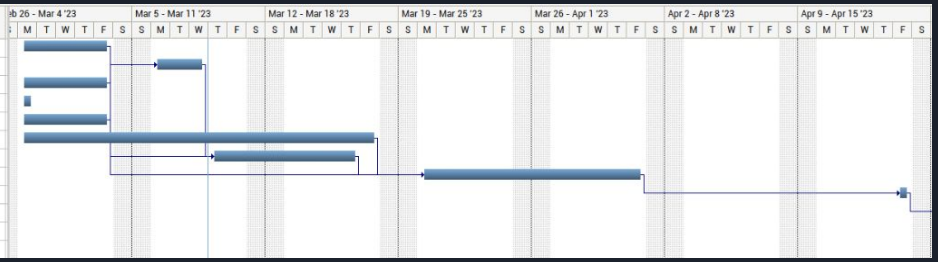
Team Name:	Drone Conversion Appliances (DCA)
Team Number:	14
Week Number	23
Week Start Date:	06 Mar 2023
Week End Date:	9 Mar 2023

Task Number:	Task Description:	% Complete on Start Date:	% Complete on End Date:	% Progress
Task 1	Get Ardupilot firmware flashed	0%	100%	100%
Task 2	Set Ardupilot Parameters for Drone	0%	100%	100%
Task 3	Quadcopter Hover Testing	0%	100%	100%
Task 4	Connect Motors w/ Props to Carbon Rods	25%	85%	60%

Team Role	Team Member Name:	UTSA ID:	Total hours worked:	Task Set
Program Manager	Conrad Obeng	fxy380	9	1,2,3,4
Secretary/Firmware Engineer	Ehab Afsoonko	czu525	3	2,3
Systems/Software Engineer	Lexi McMinn	yva363	7	2,3,4
Software/Robotics Engineer	Mark James jr	Eve717	2	2,3
Hardware Engineer	Matthew Moubray	yrb578	11	1,2,3,4

Work Breakdown Structure

	Name	Duration	Start	Finish	Predecessors	Resources	Custom 1	Custom 2	Custom 3
1	Ardupilot Firmware Flashed	5days?	02/27/2023	03/03/2023					
2	Parameters	3days	03/06/2023	03/08/2023	1				
3	Airframe Assembeled	5days?	02/27/2023	03/03/2023					
4	Carbon Rods sized	1day?	02/27/2023	02/27/2023					
5	ESC wired	5days?	02/27/2023	03/03/2023					
6	Connect Motors to Carbon rods	15days?	02/27/2023	03/17/2023					
7	Quadcopter mode flight test	6days?	03/09/2023	03/16/2023	1,2,3				
8	Fixed Wing VTOL flight test	10days?	03/20/2023	03/31/2023	5,6,7				
9	Implement tilting of front propellers	1day?	04/14/2023	04/14/2023	8				
10	Testing parameters for forward flight	1day?	04/28/2023	04/28/2023	9				



Ongoing and Upcoming Tasks

1. Design and test attaching wings to the new base
2. 3D print a connector that allows front propellers to tilt forward.
3. Verify the stability and structural integrity of new frame with wings attached during a hover test

Budget Slide

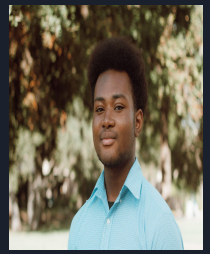
Item	Description	Cost
Pixhawk 2.4.8	Flight Controller	$150
iFlight Xing-E Pro 2207(4pcs)	VTOL Motor	~$66
HAKRC 45A 2-6S BLHeli_S 4in1 ESC	Motor ESC	$46
Turnigy Aerodrive SK3	Forward Propeller Motor	~$43.99
10x10x1000mm Carbon Fiber Rod	Carbon rods	$40

Budget Slide Con't

Item	Description	Cost
Micro Metal Gear Digital Servo Motor x4	Servo Motors	$15
4S LiPo Battery	Drone Battery	~$70
3x8mm Screws x2	Pivot Screws	$8
3mm Bolts x4	Motor Bolts	$4
3x45mm Bolts x4	Wing Mount Bolts	$7
3x20mm Bolts x4	Tilt Mount Bolts	$6
3mm Washers x8	Washers	$4

Biographies Slide

- Ehab Afsnooko - Firmware Engineer - C++, Python, Verilog, embedded systems
- Conrad Obeng - Engineering Manager - Python,Drone Engineering,Drone Firmware
- Lexi McMinn - Systems/Software Engineer - C++,Python,Verilog,VHDL
- Mark James Jr. - Software/Robotics Engineer- Python,C++,Java
- Matthew Moubray - Hardware Engineer - C++, Python, LabView, eCalc, Solidworks


Questions?