

# Drone To Rover(D2R)

- Date: 10/6/2022
- D2R Team
- Project Advisor: Dr. Yongcan Cao, ECE
- Team Sponsor: USL Lab, UTSA
- Team Members: **Ehab Afsoonko, Conrad Obeng, Lexi McMinn, Mark James Jr.**
- “Expanding the world of Modifiable Drone Transit.”

# Team Biographies

- 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



# Problem Overview

If a user only has a machine that can navigate through the air, a large amount of functionality can be lost. However, having separate dedicated systems add cost and complexity to the end user experience. We will provide a solution by incorporating multiple methods of transportation into one system.

## Major Features:

- Quick switching from air to land vehicle
- Goes from air to land mode without external interaction
- Switch from quadcopter to VTOL fixed-wing
- Drone will retain info from previous flights
- Switch modes without compromising system functionalities



# Current Existing Solutions

## SYMA X9 Fly Car

<https://www.walmart.com/ip/Syma-X9-Fly-Car-4-Channel-2.4Ghz-RC-Quadcopter-WHITE/152680718>

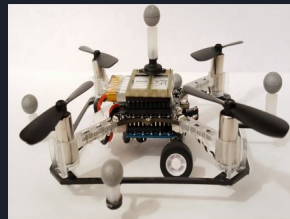
- \$50-\$80 “Toy Drone”
- Hybrid Drone with the ability for both land and air travel
- Wheel/blade combination cannot be altered



## MIT CSAIL ‘Crazyflie’ Drone

<http://groups.csail.mit.edu/drl/wiki/images/b/bc/Flyingdrones.pdf>

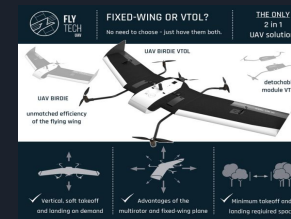
- Research Drone from MIT
- Small size with limited battery life
- Has two wheels instead of 4



## FlyTech Birdie VTOL Module

<https://surveydrones.ie/blog/flytech-uav-presents-the-2-in-1-vtol-update-to-their-surveying-fixed-wing-birdie/>

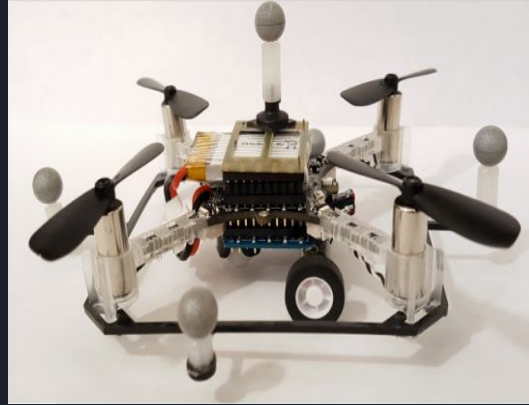
- \$17k+ “Professional Drone”
- Fixed-wing drone with attachable quadcopter arms



# Current Existing Solutions



SYMA X9 Fly Car



MIT CSAIL 'Crazyflie' Drone

**FLY TECH UAV**

**FIXED-WING OR VTOL?**  
No need to choose - just have them both.

**THE ONLY 2 in 1 UAV solution.**

**UAV BIRDIE**  
unmatched efficiency of the flying wing

**UAV BIRDIE VTOL**

**detachable module VTOL**

✓ Vertical, soft takeoff and landing on demand

✓ Advantages of the multirotor and fixed-wing plane

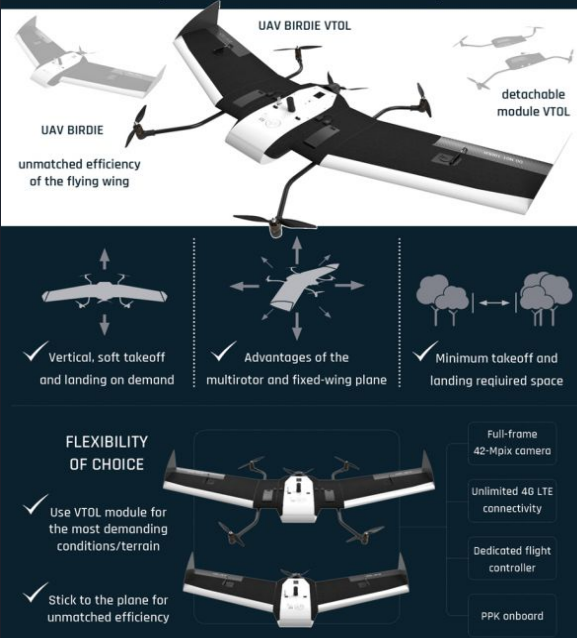
✓ Minimum takeoff and landing required space

**FLEXIBILITY OF CHOICE**

✓ Use VTOL module for the most demanding conditions/terrain

✓ Stick to the plane for unmatched efficiency

Full-frame 42-Mpix camera  
Unlimited 4G LTE connectivity  
Dedicated flight controller  
PPK onboard



FlyTech Birdie VTOL Module

# Marketing Requirements

Marketing Requirements	Engineering Specs	Justification
1. Air and ground transportation modes without physical interaction	The drone will need to switch between air and ground modes without any user interaction after initial take-off.	The main appeal of having a ground and air mode on the same machine is the ability to switch between said modes in the middle of transit.
2. Fixed-wing VTOL Module	The drone will have a fixed-wing module that will allow for sustained flight across long periods of time.	Fixed-wing VTOL is one of the main modes of transportation requested by the sponsor, as they require longer flight times than currently possible.
3. Foldable wing design for Rover mode	The drone will need to have a mechanism for the wings to fold up during ground interactions.	When the drone is in ground mode, having a mechanism for the wings to fold up will protect the wings from possible damage.
4. Flight/drive data consistency between mode changes	The drone should have the ability to retain previous flight/drive data after a mode switch.	Flight/drive data will often be used in determinations made after a mode switch, so retaining said data will allow for increased efficiency in drive/flight time decision making.

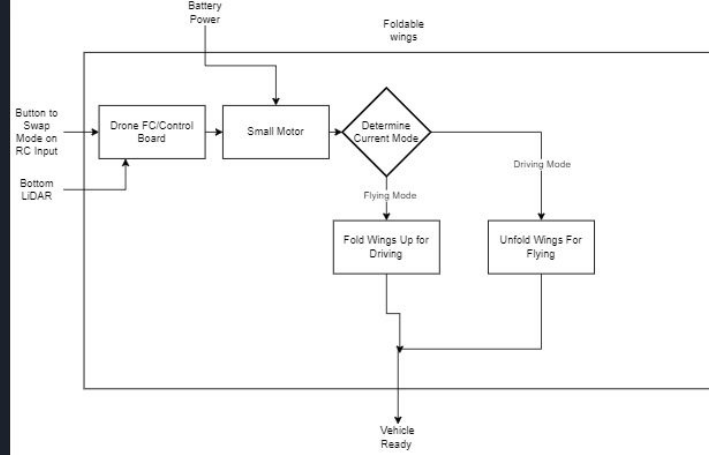
# Proposed Technical Solution

- Specialized Module for a new driving mode, including replacing existing landing feet with wheels
- Wings Fold Upwards To Make Possible Collisions Safer
- VTOL Module on side of drone body



# Design Block Diagram - Foldable Wings

- Depending on the current mode, drone will transition from being fly ready to driving ready







# Technical Work

- Creating a design for the wheel-wing hybrid arms
- Designing a mechanism for the foldable wing functionality
- Testing the flight controller/firmware for ground mode functionality
- Creating the VTOL module with two main components
  - The tail wing and propeller for the rear end of the drone
  - The fixed-wings on the sides of the drone body, connected to the top of the drone using an L-shaped connector
- Figuring out a method for data consistency between ground and air modes



# Approx. Budget

PARTS	PRICES
Motors (Exact number unknown)	\$30-\$60
New Flight Controller(Not confirmed)	~\$100
4x Wheels	\$20
Fixed Wings	~\$20
3D printing parts (Exact number of plastic unknown)	\$20-\$50



# Questions?