

RESEARCH

PROBLEMS

- FULL-SIZE AIRCRAFT ARE EXPENSIVE
- ADVANCED TRAINING IS REQUIRED
- DRONE SOLUTIONS EXIST, BUT THEY ARE EITHER ROTORCRAFT OR FIXED-WING, BOTH OF WHICH HAVE LIMITATIONS
- VTOL FIXED WING DRONES EXIST, BUT ARE AIMED ENTIRELY AT HOBBYIST USE

CURRENT SOLUTIONS

ROTORCRAFT

ADVANTAGES	DISADVANTAGES
<ul style="list-style-type: none"> • CAPABLE OF VTOL • MANEUVERABLE • ABLE TO HOVER • DOES NOT REQUIRE RUNWAY 	<ul style="list-style-type: none"> • SHORT FIGHT TIME • SHORT RANGE • HIGH POWER USE • UNABLE TO CARRY HEAVY PAYLOADS

FIXED-WING

ADVANTAGES	DISADVANTAGES
<ul style="list-style-type: none"> • LONG FLIGHT TIME • LONG RANGE • LOW POWER USE • CAN CARRY HEAVY PAYLOADS 	<ul style="list-style-type: none"> • INCAPABLE OF VTOL • REQUIRES RUNWAY • LIMITED MANEUVERABILITY • UNABLE TO HOVER

APPLICATIONS

AERIAL PHOTOGRAPHY

- DRONES ARE MUCH CHEAPER THAN FULL SIZE AIRCRAFT
- ROTORCRAFT ARE IDEAL FOR HOVERING ABILITY AND CAMERA POSITIONING
- PLANES HAVE A MUCH LONGER FLIGHT TIME

AGRICULTURE

- DRONES ARE BECOMING MORE COMMON FOR CROP DUSTING DUE TO COST
- CROP DUSTING IDEALLY USES RANGE AND CARRYING CAPACITY OF PLANES
- RUNWAYS FOR PLANES ARE LARGE AND EXPENSIVE

MILITARY

- THE MILITARY USES DRONES FOR LONG-DISTANCE AIR STRIKES REQUIRING THE RANGE OF FIXED WING DRONES
- FIXED WING DRONES REQUIRE RUNWAYS OR LAUNCHING MECHANISMS AND CANNOT HOVER OVER TARGETS
- "IN A PERFECT WORLD, I WOULD HAVE THE CAPABILITY OF A REAPER OR A PREDATOR BUT NOT BE TIED TO A RUNWAY," -MAJ. THOMAS HEFFERN

CARGO

- MANY COMPANIES SUCH AS AMAZON ARE PLANNING TO USE ROTORCRAFT DRONES TO DELIVER PACKAGES
- THE MANEUVERABILITY OF ROTORCRAFT IS ESSENTIAL
- ROTORCRAFTS' LIMITED RANGE WILL MAKE LONG DISTANCE DELIVERIES DIFFICULT



JACKSON
SMITH

LOGAN
SIMON

PRACTICE SAFE FLIGHT.

VERTICAL TAKEOFF AND LANDING DRONE

PROBLEM STATEMENT

DRONES ARE EXTREMELY USEFUL IN MANY APPLICATIONS INCLUDING AERIAL PHOTOGRAPHY, AGRICULTURE, AND HOBBYIST USE. FIXED WING DRONES CURRENTLY REQUIRE A RUNWAY. HOWEVER, MANY APPLICATIONS REQUIRE THE LONG FLIGHT RANGE OF FIXED WING AIRCRAFT BUT LACK ACCESS TO A RUNWAY. WHAT IS NEEDED IS A FIXED WING DRONE CAPABLE OF A VERTICAL TAKEOFF.

GLOSSARY OF TERMS

VTOL: SHORT FOR VERTICAL TAKEOFF AND LANDING. DESCRIBES ANY AIRCRAFT THAT CAN TAKEOFF VERTICALLY AND WITHOUT A LARGE AMOUNT OF SPACE

ROTORCRAFT: ANY AIRCRAFT THAT USES ROTORS TO PRODUCE LIFT

FIXED-WING: ANY AIRCRAFT THAT USES WINGS/AIRFOILS TO PRODUCE LIFT

DESIGN REQUIREMENTS

MUST HAVE

- BE CAPABLE OF VERTICAL TAKEOFF AND LANDING (VTOL)
- HAVE FIXED WINGS FOR FLIGHTS OF AT LEAST 1 MILE
- HAVE A CONTINUOUS FLIGHT TIME OF AT LEAST 20 MINUTES
- BE ABLE TO STOP AND HOVER MID-FLIGHT
- BE ABLE TO SURVIVE MINOR CRASHES WITH THE GROUND AND STATIONARY OBJECTS
- BE ABLE TO LAND ON RUNWAY IN CASE OF EMERGENCY
- WORK WITH COMMON TRANSMITTER/RECEIVER TECHNOLOGY

NICE TO HAVE

- CARRY A CAMERA OF GoPro SIZE OR LARGER
- HAVE A FIRST PERSON VIEW (FPV) SYSTEM
- BE TAKEN OFF FROM A RUNWAY IF DESIRED
- AUTONOMOUSLY TRANSITION FROM VERTICAL TO HORIZONTAL FLIGHT AND BACK
- HAVE AN AUTOPILOT
- FLY FOR MORE THAN 30 MINUTES
- USE ONE SET OF ROTORS FOR VERTICAL AND HORIZONTAL FLIGHT
- BE AESTHETICALLY PLEASING

PROBLEM:	WEIGHT	BASELINE 1: ROTORCRAFT DRONE		BASELINE 2: FIXED WING DRONE		CONCEPT 1: TILT ROTOR HYBRID		CONCEPT 2: SEPARATE VERTICAL AND HORIZONTAL ROTOR HYBRID	
		RATING	WEIGHTED SCORE	RATING	WEIGHTED SCORE	RATING	WEIGHTED SCORE	RATING	WEIGHTED SCORE
CAPABLE OF VTOL	5	5	25	0	0	5	25	5	25
FLIGHT TIME	4	2	8	5	20	4	16	3	12
CAPABLE RANGE	4	2	8	5	20	4	16	4	16
FEASIBILITY	2	5	10	5	10	3	6	4	8
LIFTING CAPABILITY	1	2	2	5	5	4	4	4	4
TOTAL:			53		55		67		65

NOTE: THESE ARE PRELIMINARY NUMBERS AND ARE SUBJECT TO CHANGE WHEN MORE SURVEY DATA IS AVAILABLE.