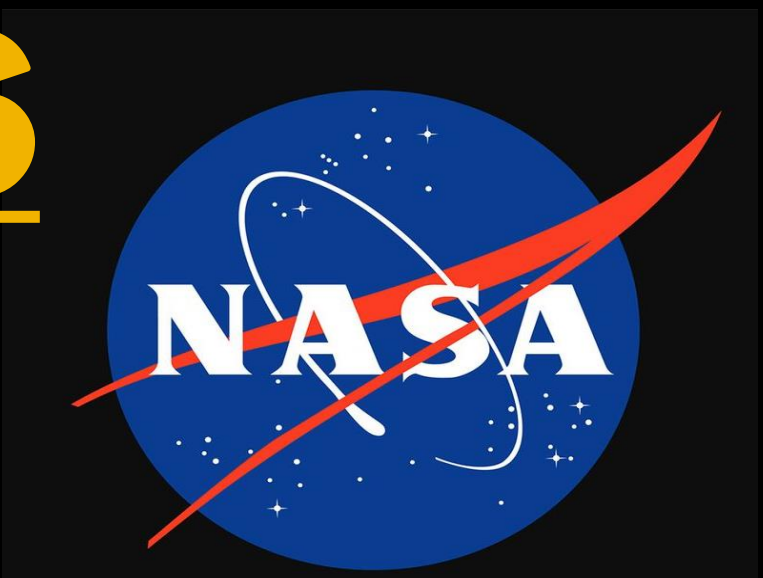


EXPO

engineering ▲ design

PRANDTL-D ADVANCING AUTONOMOUS UAVS FOR WILDFIRE PREVENTION

IAN CLUFF (ME), VIRGINIA HERBORD (ME), MATTHEW WEBER (ME), YIBO WANG (EE), KYLE HASH (CS), AKHIL KARRI (CS)

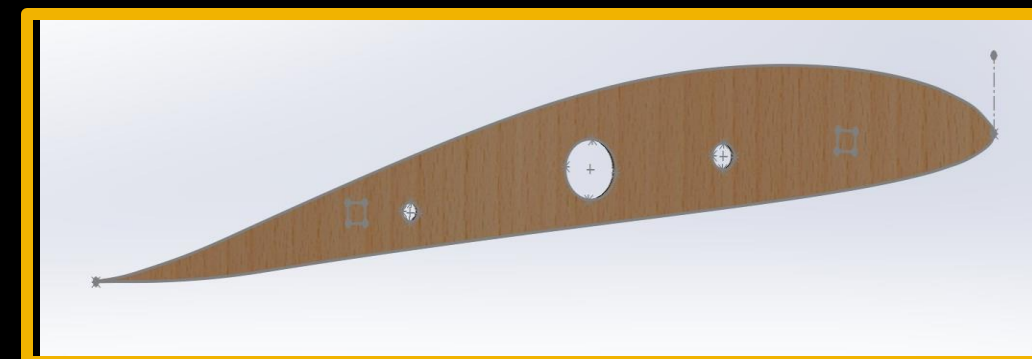


OBJECTIVE

Build an unmanned aerial vehicle (UAV) capable of detecting emerging fires while they are still manageable, ultimately preventing the devastating escalation of these disasters.

BACKGROUND

What is Prandtl-D?



- Distinct airfoil shape
- Twist in wing resulting in 11% reduction in drag
- Passive stability

Small scale aircraft designed and built

- Sling shot and belly landing
- No autonomy
- No visual feedback



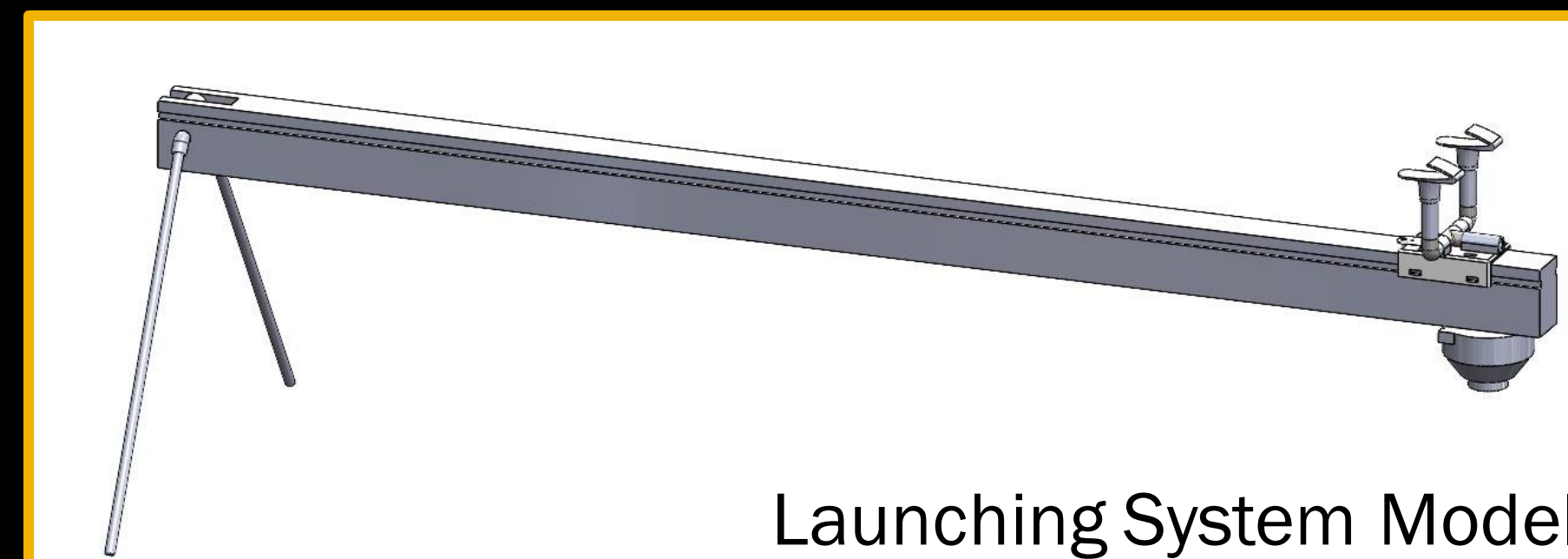
VALUE PROPOSITION

- Early wildfire detection and disaster prevention
- Autonomy
- Rapid response
- Cost conscious

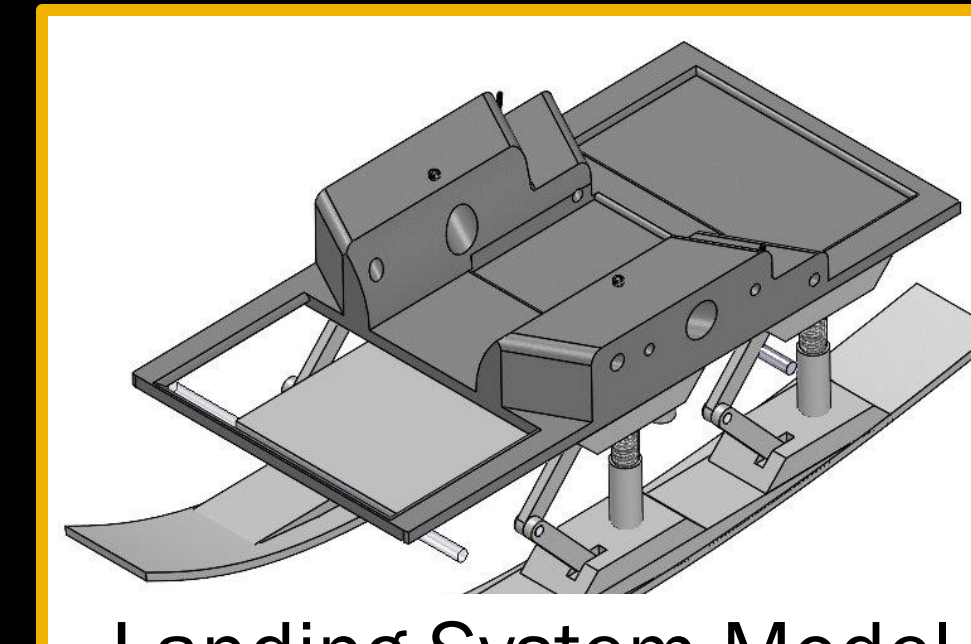
REQUIREMENTS

- Telemetry
- Autonomy
- Launching and retractable landing system

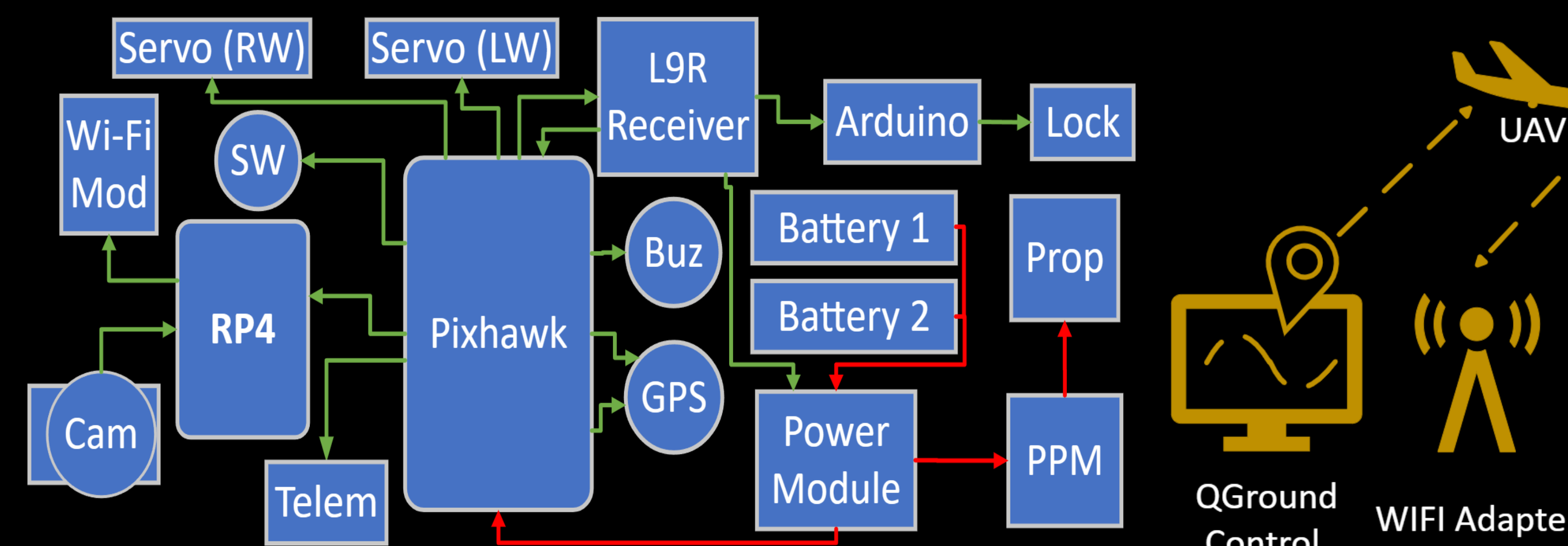
CONCEPTUAL DEVELOPMENT



Launching System Model

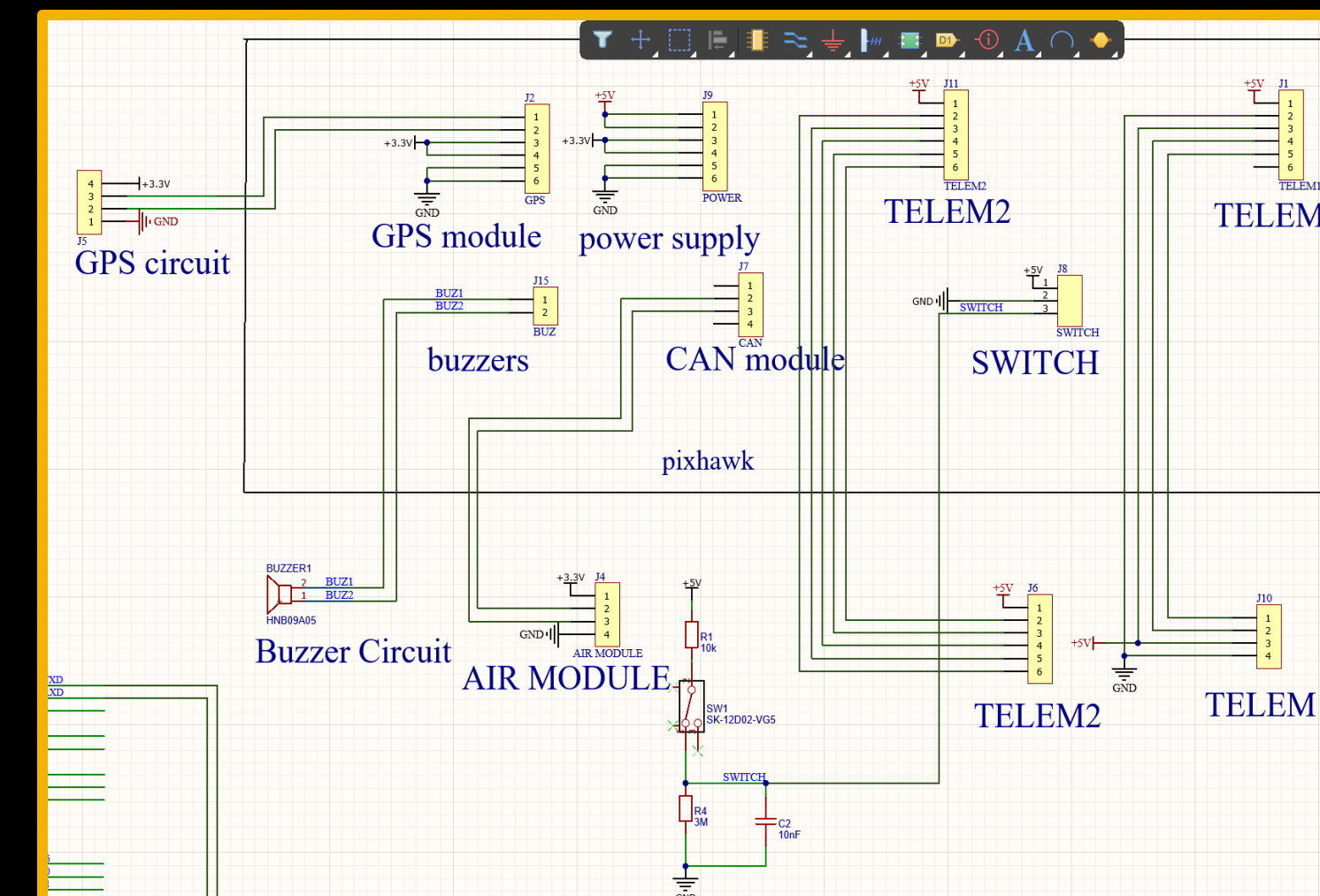
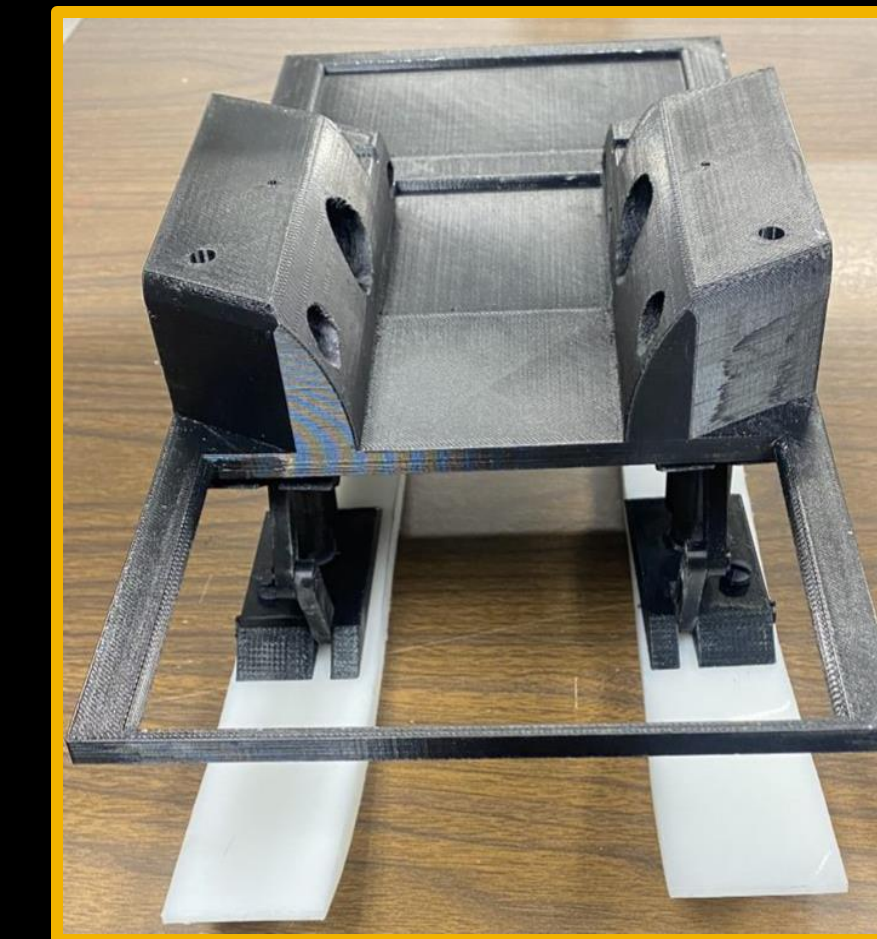


Landing System Model



FINAL DESIGN

Endurance	>1hr
Max Weight	11lbs
Max Thrust	8lbs
Max Speed	55 mph
Thermal Imaging Resolution	256 x 192
Max Distance for Thermal Imaging	400ft
Wi-Fi Broadcasting Range	1.9 miles



VALIDATION

Applied Methods of Design Validation:

- CFD Simulation (SolidWorks)
- PX4 Autonomy Simulation
- Field testing
 - Test launching system with weights
 - Drop test for landing system

CONCLUSION

The launching and landing system has proven to be highly reliable, demonstrating consistent performance under various test conditions. The thermal camera has been effectively integrated into the system, providing real-time data collection capabilities that are critical for the UAV's intended applications. Finally, the autonomy of the UAV has been exemplary, with precise navigation to pre-selected waypoints demonstrating the system's ability to operate independently and efficiently.

RECOMMENDATION

- Test flight programs
- Exploration of varied atmospheric conditions
- Investigation of alternative energy sources
- Broadening of mission applications
- Implementation of autonomous obstacle avoidance
- Extension of operational range

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2024 Capstone Project