Year 2: Development of R.A.M.P.A.T. (Rapid, Affordable, Modular, Printed, Aerial Tiltrotor) for Emergency Response

Dixit, Aarit (School: Orlando Science High School)

When disaster strikes, the difference between life and death often comes down to timely information. First responders need an aerial view immediately, but current drones capable of both vertical takeoff and efficient forward flight cost thousands of dollars and rely on fragile global supply chains. This project developed a 3D-printable tiltrotor VTOL UAV that combines helicopter-like hover capability with airplane-like endurance at a fraction of the commercial cost. The airframe underwent four structural iterations and seven CFD-driven geometric optimizations to maximize efficiency and ensure a rigid, flight-worthy structure. The final design achieves 178 minutes of flight time, enabling it to search nearly 1,900 acres (equivalent to roughly 3,000 football fields) per flight using a $200 thermal camera, approaching 85-90% of industry-standard performance metrics. Total system cost is $978.42, less than 10% of comparable commercial platforms, representing an order-of-magnitude cost efficiency. This cost reduction is enabled by additive manufacturing and the novel application of tiltrotor technology to first-response scenarios. All components were fabricated using consumer-grade 3D printers or sourced from common electronics retailers and assembled in a basic workshop. This demonstrates that high-performance disaster-relief drones can be produced locally and on-demand, bypassing supply chains to serve communities anywhere in the world. By democratizing access to advanced aerial technology, this work empowers even resource-constrained organizations with a powerful new tool for saving lives. Future work will integrate AI-driven autonomy and swarm capabilities to further expand the reach of affordable aerial response.

Awards Won:

Fourth Award of $600

NC State College of Engineering: Alternates (not read aloud)