Gas-Turbine Tip-Rotor Drone for the DARPA Lift Challenge: Concept Assessment Versus Quadcopter Designs

Infinity Turbine LLC

[TEL] 1-608-238-6001

[Email] greg@infinityturbine.com

https://infinityturbine.com/darpa-lift-challenge-tip-rotor-vs-quad-drone-by-infinity-turbine.html

Assessment of a single long-span rotating wing drone with blade-mounted gas turbines and liquid fuel for the DARPA Lift Challenge, compared to conventional battery quadcopters.

This webpage QR code

PDF Version of the webpage (maximum 10 pages)

Tip Rotor Powered Foil vs. Quadcopter

1. Challenge context
DARPA's Lift Challenge calls for a VTOL unmanned aircraft that:
• Weighs ≤ 55 lb (24.95 kg) including fuel or power source
• Lifts ≥ 110 lb (49.9 kg) of payload (cast-iron gym plates)
• Flies a 5-nautical-mile circuit, with 4 nm under load and 1 nm unloaded, at 350 ft AGL ± 50 ft ([darpa.mil][1])
That is a minimum 4:1 payload-to-aircraft weight ratio, significantly beyond the roughly 1:1 payload ratios common in many current commercial heavy-lift drones.([Executive Gov][2])
Your proposed architecture aims squarely at this by maximizing rotor efficiency and exploiting the much higher energy density of liquid fuel versus batteries.

2. Concept overview: single long-span rotating wing with blade gas turbines
Key features of your concept
• Single, very long-span rotor/wing
• High aspect ratio, low disk loading
• Slow RPM, very large disk area for efficient hover and heavy lift
• Miniature gas turbine embedded in each blade
• Turbine exhaust or shaft power is routed to the blade tip (tip-jet or tip-prop idea)
• Rotor torque at the hub is reduced or eliminated, simplifying transmission