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New High Specific Power Motor Technology for All-Electric Class III UAVs

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We describe a new class of electric motor/generator technology with specific power in excess of 10kW/kg for a variety of applications including terrestrial and airborne hybrid and all electric propulsion.

The motor concept takes advantage of the fortuitous match between the recently developed low voltage, high current, small footprint MOSFET technology and the elemental (single turn) voltage and current required at the motor's gap.

The motor topology uses arrays of inverter Controlled Turn-less electro-mechanical Structures (CTS) where individual inverters control individual turn-less 3-phase motor elements (TLS) where the TLS is made of 3 single conductor shorted at the opposite end from the inverter and functions as a 3-phase motor winding. Each CTS measures around 6mm in the direction of motion and corresponds to a N-S pole pair. Since specific power is inversely proportional to the pole size, it is here enhanced accordingly.

This motor/generator concept has been configured for a variety of applications including terrestrial and airborne propulsion and generation, and various actuators for flight control and robotics where long strands of TLSs can mimic muscle fiber with much higher force density obviating the need for gear reduction. Furthermore, the integration of a new class of Li-Ion high specific power batteries with each CTS provides the double function of both the inverter capacitor and energy reserve providing an enhanced overall performance.

We will describe the underlying technology and discuss its implementation in various applications with emphasis on airborne propulsion.

Authors: Mr ZUCKER, Oved; Dr YU, Paul; Mr LIU, Christopher; BLUMENAU, Leif

Presenter: Mr ZUCKER, Oved

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