Department of the Navy SBIR/STTR Transition Program

Pending SYSCOM Review

Topic # N171-028

Lightweight Self-Start System for T56 Engine Driven Aircraft

Continental Controls and Design, Inc.

WHO

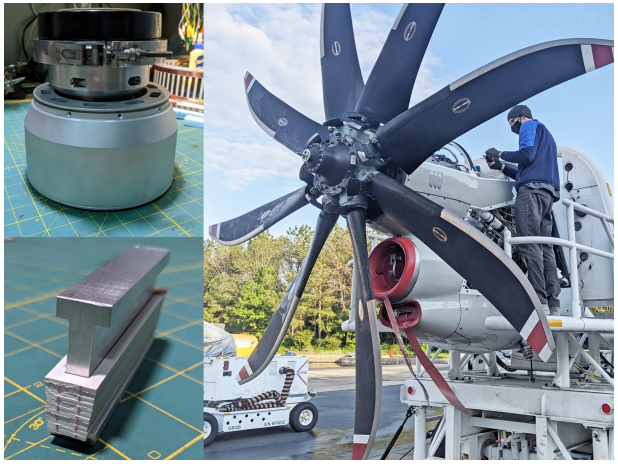
SYSCOM: NAVAIR

Sponsoring Program: PMA 231 E-2 Acquisition Program Office

Transition Target: E-2D Hawkeye

TPOC:
(301)757-2485

Other transition opportunities: Electric drives are proliferating on aircraft and other military and commercial vehicles; some examples are vapor cycle systems, UAV and VTOL propulsion, hybrid generators. Increased power density is always beneficial in weight constrained systems.



Courtesy Continental Controls and Design,2021

Notes: Clockwise from upper left 1) Prototype 25lbm starter motor for 5000SHP T-56 turboshaft engine. 2) Engine on test stand at Pax River after integrating electric start components. 3) A single stator tooth showing partial patent pending 'plate' winding of nearly solid copper. Doubling the slot fill halves the electrical resistance while cutting the thermal resistance even more.

WHAT

Operational Need and Improvement: The E-2D is the last carrier-launched Navy aircraft that needs ground support equipment for starting. This is both logistically expensive and operationally limiting. The conventional solution adds an onboard Auxiliary Power Unit but this would exceed the takeoff weight rating.

Specifications Required: A tight weight constraint limits the self starting weight gain to <200lbm. The current air turbine starter produces about 200NM of static torque and 30NM at 8300RPM with an outer diameter of about 8 inches and it delivers about 2MJ of energy to the single spool T-56 in ½ minute. An electric start system must meet these requirements over a broad range of environments to minimize turbine blade heating.

Technology Developed: The permanent magnet outer rotor uses a finely sectioned Halbach array to increase saturation flux density and patent pending formed 'plate' windings with about twice the slot fill of conventionally wound motors. The Inverter uses wide bandgap GaN switches to provide >99% efficiency.

Warfighter Value: Self starting allows streamlined carrier ops and increased access to remote airfields. Our high power density electric drive would be useful in many other military and commercial aerospace applications.

WHEN

Contract Number: N68335-18-C-0323 **Ending on:** September 30, 2022

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Trade Study and Topology Selection	Low	Feasibility Simulation	3	January 2018
Component Testing	Low	Dynamic Measurements	4	September 2019
Complete Subsystem Testing	Med	Battery Inverter, Motor Results	5	February 2020
Engine Start Test	Low	Consecutive Starts	6	April 2021
Aircraft Integration, CONOPS	Med	Environmental Testing	7	September 2022

HOW

Projected Business Model: CCD's business development team will determine the best course of action for manufacturing our EAS product with input of the original equipment manufacturer (OEM) subcontractor, which will likely involve license of manufacturing and integration rights. Prior to licensing, CCD will provide specialized services to mitigate risk and deliver confidence to our target customers. The specific manufacturing licensee depends on the program, the market, the primes, and subcontractors involved.

Company Objectives: CCD's goal is to integrate and transition this technology into government and prime contractor systems for facilitating low cost and reliable operation.

Potential Commercial Applications: Power drives are tending electric. The first application is clearly an onboard starting system but increased power density and efficiency through increased slot fill creates a larger space for electric drives. Potential military and commercial applications are vapor cycle systems, hybrid electric propulsion, starting for large and small turboshaft engines etc.

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