



CASE STUDY

ECM Proves Feasibility of PCB Stator Motors For Marine AUV Applications

Overview

ECM has been commissioned by leading defense contractors to design and prototype custom propulsion motors for Autonomous Underwater Vehicle (AUV) systems, demonstrating the advantages of replacing conventional radial flux motors with a motor utilizing ECM's printed circuit board (PCB) stator technology. Several industry leaders have, or are in the process of, standardizing on ECM's technology.

Benefits

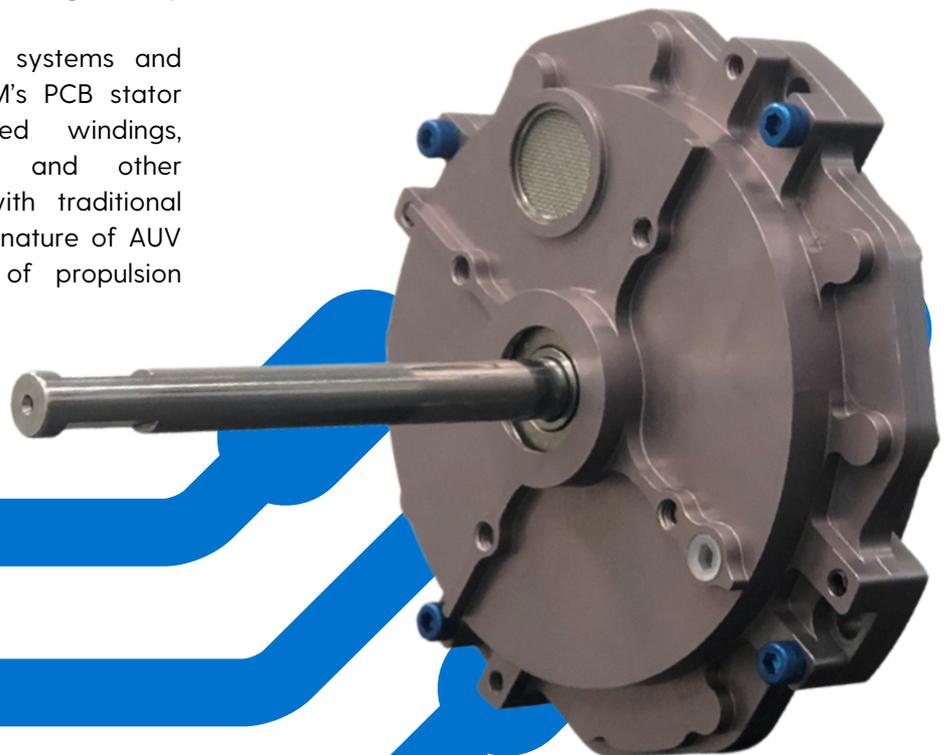
Motors developed with ECM's PCB stator technology and PrintStator software have been proven to offer many benefits for AUV propulsion systems over conventional technology. Superior efficiency, reduced weight, and an axial flux form factor in these advanced motors translates into bigger payloads, larger missions, and longer range. Additionally, ECM's solution is electromagnetically and acoustically quiet, which limits interference with on-board systems and allows for stealthy operation. ECM's PCB stator motors have fully encapsulated windings, significantly reducing vibration and other mechanical failures associated with traditional copper wound motors. Due to the nature of AUV missions, ensuring the reliability of propulsion systems is of utmost importance.

"After years of run time with our current propulsion systems, we turned to ECM in 2019 and asked them to design a motor optimized especially for our IVER4- 900 series of autonomous underwater vehicles [AUVs]. We needed the propulsion system to be highly efficient, super quiet, and more compact. ECM delivered.

Following exhaustive testing, both in the lab and in water, we have standardized on the ECM-design. Our IVER4-900s with ECM PCB stator motors are slated to ship to customers on multiple continents starting in late 2022."

Daryl Slocum

VP/GM Unmanned Maritime Systems – Ocean Server & Director of Product Development





Results

For one leading defense company, ECM designed and prototyped a 200W propulsion motor integrated

with PCB stator technology which provided a 91% nominal efficiency and offered a significant reduction in mass. Utilizing a specially designed housing and rotor design, ECM's motor weighed just 1.93kg. The custom motor also offered a significant reduction in electro-magnetic and acoustic noise allowing operation of a side scanning sonar and other sensors with negligible interference.

In a separate project, ECM was tasked with developing a 67W propulsion solution that would function in a salt- water flooded environment, utilizing the ambient liquid conditions for additional cooling. ECM has successfully designed and built motors that operate well in oil-filled, salt-water flooded and high-pressure environments. For this 67W motor, ECM used its PrintStator software to reduce the efficiency losses typically associated with salt-water filled motors in the PCB stator solution.

ECM's PCB stator motors have proven to be durable for AUVs and other applications operating in severe environments. A 300W motor that ECM developed with PCB stator technology has been undergoing high accelerated lifetime testing (H.A.L.T.) and as of October 2022, has been running continuously without issue for over 12,000 hours.

Next Steps

ECM's PCB stator motor solutions are currently being evaluated and integrated into several AUV platforms in both the defense and commercial sectors. ECM offers AUV integrators swift and precise prototyping, and the flexibility of the PrintStator software ensures PCB stator motors can be optimized to benefit propulsion solutions in a range of sizes. ECM's technology is currently being utilized in both flooded and oil filled motors. Increased efficiency, improved integration, and reduction of electromagnetic and acoustic noise are just a few of the benefits when a motor is designed with ECM's PrintStator and built with patented PCB stators, making the technology applicable for almost any industry.

To discuss the benefits of ECM's PCB stator technology within your product line, please email info@pcbstator.com or visit pcbstator.com/design-your-own to learn more about our 5-step integration process.

MOTOR PARAMETERS

Nominal Power [W]: 200
Speed[RPM] :1500
Torque[Nm] :1.7
Watts in : 219
Watts out : 200

Efficiency : 91.0%

Stator Mass (g) : 246
Magnet Mass (g) : 529
Steel Mass (g) : 793

Motor Mass (kg) : 1.93kg

