NATIONAL LABORATORY OF THE ROCKIES

Design, Manufacturing, and Validation of an Optimized Electric Machine Enabled by 3D Printing

Cooperative Research and Development Final Report

CRADA Number: CRD-20-17275

NLR Technical Contacts: Latha Sethuraman and Jon Keller

The National Laboratory of the Rockies is a national laboratory of the U.S. Department of Energy, Office of Critical Minerals and Energy Innovation, operated under Contract No. DE-AC36-08GO28308.

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Technical Report
NLR/TP-5000-97558
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Cooperative Research and Development Final Report

Report Date: September 23, 2025

In accordance with requirements set forth in the terms of the CRADA agreement, this document is the CRADA final report, including a list of subject inventions, to be forwarded to the DOE Office of Scientific and Technical Information as part of the commitment to the public to demonstrate results of federally funded research.

Parties to the Agreement: LaunchPoint Electric Propulsion Solutions, Inc.

CRADA Number: CRD-20-17275

CRADA Title: Design, Manufacturing, and Validation of an Optimized Electric Machine Enabled by 3D Printing

Period of Performance: 12/18/2020 – 12/17/2023

Responsible Technical Contacts at NLR:

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Name and Email Address of POC at Company:

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Sponsoring DOE Program Office(s):

Office of Energy Efficiency and Renewable Energy (EERE), Wind Energy Technologies Office

Joint Work Statement Funding Table showing DOE commitment:

Estimated Costs	NLR Shared Resources Government In-Kind
Year 1	$75,000.00
Year 2, Modification #1	$350,000.00
Year 3, Modification #2	$50,000.00
Year 4, Modification #3	$.00
TOTALS	$475,000.00

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Executive Summary of CRADA Work:

The collaboration between the National Laboratory or the Rockies' (NLR) and LaunchPoint Electric Propulsion Solutions, Inc. (LaunchPoint) focuses on manufacturing and additive design of electric machines enabled by DOE's program for three-dimensional printing (MADE3D) as applied to advanced drivetrains and their impact on turbine capital cost and lifetime energy production. Initial efforts will focus on the rotor structure and rotor core of the drivetrain including the active materials (electrical steel and magnets) and could later expand to the stator. The verification activities will be conducted with an instrumented electric machine and a small dynamometer.

CRADA benefit to DOE, Participant, and US Taxpayer:

- Assists laboratory in achieving programmatic scope
- Uses the laboratory's core competencies
- Enhances U.S. competitiveness by utilizing DOE developed intellectual property and/or capabilities.

Summary of Research Results:

Task 1: Design Engineering

a. Optimize the mass, torque and size of the rotor of the selected LaunchPoint electric machine with advanced topology techniques.
b. Evaluate the rotor design with structural and magnetic finite element analysis.
c. Develop engineering drawings and solid body models of the optimized rotor.
d. Transmit solid body models to LaunchPoint for review.
e. Evaluate motor design optimization results.
f. Lead publication of results.

NLR completed an initial optimization of a 6kw axial flux motor with specifications that were provided by LaunchPoint (subtask a.)

The CRADA was terminated, and no other tasks were started (or completed).

Task 2: Manufacturing

a. Have the rotor of the selected LaunchPoint electric machine 3D printed.
b. Verify that rotor meets tolerances per LaunchPoint drawings.
c. Coordinate printed material verification efforts.
d. Install and calibrate internal instrumentation as necessary.
e. Purchase the selected framed LaunchPoint machine with 3D printed rotors installed. Purchase price is $16,000 plus any applicable taxes.

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NLR purchased the rotor, but the CRADA was terminated, and the rotor was not sent to NLR.

Task 3: Validation

a. Purchase dyno fixtures for loaner framed LaunchPoint reference machine.
b. Lead instrumentation and validation procedure development.
c. Perform rotor spin validation tests.
d. Install and calibrate external instrumentation as necessary.
e. Conduct dynamometer validation tests on both a baseline and modified electric machine.
f. Evaluate validation results and develop report.

The CRADA was terminated before this task could be started (or completed).

This report serves to meet the requirement for the CRADA Final Report with preparation and submission in accordance with the agreement's Article X.

References:

None

Subject Inventions Listing:

None

ROI#:

None

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