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ENVIRONMENT

UNIVERSITY OF MINNESOTA
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MINI GRANT PROJECT SUMMARY

Please complete the project summary and return the completed form to Alyssa Johnson, Administrative Assistant at the Institute on the Environment, at joh10074@umn.edu. Paper copies will not be accepted. Please also attach any photos, publications, brochures, event agendas or other materials that were a result of the mini grant summary.

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| Date of Report Submission: | 4/7/2016 |
| Project PI & Dept/School | Emmanuel Enemuoh, Mechanical & Industrial Engineering Department, University of Minnesota Duluth |
| Project Title: | Clean Snowmobile Challenge |
| Grant Amount \$: | \$300.00 |

Project Context & Purpose

The University of Minnesota Duluth (UMD) Clean Snowmobile Club plans to design and analyze a new exhaust that is not only quieter but reduces emissions; implement an exhaust gas recirculation system (EGR); and design more mechanically efficient driveline. In addition to the hands on application of improved environmental design, the team will write a technical paper describing their innovative ways of improving the sustainability of snowmobile with targeted reduction in snowmobile emissions and noise by at least 10% and will enter into the 2015 annual clean snowmobile challenge at Michigan.

Work Completed

The team designed new driveline that made the entire drivetrain more efficient, using less fuel overall, also diminishing environmental impact. The exhaust system that the team developed through research had lower sound levels, and used a catalytic converter to burn any unburned fuel traveling through the exhaust that the EGR will not pick up. With the use of all three of these systems, the snowmobile ran much cleaner, greener, and quieter.

The team reduced emissions of a Polaris stock by 38% while maintaining 110 horsepower. This unique project required student teams to complete every portion of the design process: conception, development, manufacturing, testing, and production. This opportunity complements traditional classroom educational experience and impacts students from multi-disciplinary backgrounds.

Partnerships & Collaborations

Major Personnel

- Dylan Dahlheimer -Club President
- Emmanuel Enemuoh, Ph.D. -Faculty Advisor

Project Team Leads:

- Spencer Johnson - Mechanical Engineering, Undergrad, UMD, Vice President, Project Management
- Jack Seehof - Undergrad, UMD, Team Accountant, Monetary flow and account activity.
- Heather Tinus -Mechanical Engineering, Undergrad, UMD, Secretary and Public relations.
- Mark Boeckmann – Mechanical Engineering, Undergrad, UMD, Engine Team Lead.
- Brenden Bungert – Mechanical Engineering, Undergrad, UMD, Dyno Team Lead.
- Nicole Sovde – Mechanical Engineering, Undergrad, UMD, Exhaust Team Lead.
- Ryan Schefers -Mechanical Engineering, Undergrad, UMD, Chassis Team Lead.
- Nathaniel Anthony -Electrical Engineering, Undergrad, UMD, Electrical Team Lead.
- Alexander Britz -Marketing, Undergrad, UMD, Marketing Team Lead

UMD Technicians

- Darrell Anderson
- Michael Plante

Companies

- Polaris Industries
- Cliffs Natural Resources
- Heraeus
- Lake Superior Consulting
- New Page
- US Steel
- Camoplast
- RJ Sport and Cycle
- Performance Electronics
- Woody's
- Micro Squirt
- Northern Tool
- GPM Inc
- Kolar and Chesney Auto Parts

Project Outcomes & Impacts

The outcomes of this project have both intellectual merits and broader impacts. UMD clean snowmobile team placed 4th place at last year's competition and appreciated support from Institute on Environment. Also the team was awarded two awards as follows: Kohler Manufacturability award for practical design and Denso Innovation Award for chassis water dynamometer. The UMD team comprised of over fifteen students that competed against 25 different universities in a series of events.

The Clean Snowmobile Challenge is held every March at Michigan Technological University in Houghton, Michigan. These individual challenges are designed and run by industry experts to test every aspect of the snowmobile, as well as its design. This competition encourages teams to think outside the box and innovate creative solutions using the best technology available. This requires extensive engineering and modifications to an out of market engine, engine control unit, exhaust, intake, and drivetrain. The innovations are focused on increasing fuel efficiency, as well as a reducing sound and emissions of baseline stock and align with the goals of the IonE program extremely well.

The team is planning to enter into 2017 challenge with the following goals:

- 2017 Arctic Cat ZR 3000
- 700cc Four Stroke Inline Twin
- Garrett Turbocharger
- Low-Pressure Cooled Exhaust-gas Recirculation
- Haltech Custom Fuel Injection and Wiring
- Electronic Throttle control
- Rear-Exiting Exhaust With