Faurecia Clean Mobility is a proud sponsor of the SAE Clean Snowmobile Challenge. Together, we can be a vehicle for change. Faurecia, the No. 1 manufacturer of automotive emissions solutions worldwide, offers innovative products that help automakers build light, fuel-efficient and environmentally friendly vehicles both for today and for the future. We provide solutions that help gasoline, diesel and hybrid powertrains achieve their highest efficiencies, while sounding unique and minimizing their impact on the environment. We are dedicated to achieving a greener tomorrow.

www.faurecia.com
Welcome to the 2017 SAE Clean Snowmobile Challenge

This is the 15th year that Michigan Technological University has hosted the SAE Clean Snowmobile Challenge, and we’re excited to welcome 21 teams from across the United States, Canada, and Finland.

The 2017 Challenge pushes teams to the limits of engineering in two categories. The IC Engines category requires development of a snowmobile that can be used in environmentally sensitive areas—such as our national parks or similar places around the world.

The Zero Emissions category makes the development of a snowmobile with good range and performance—while emitting nothing hazardous—a priority. Such vehicles are excellent for remote areas and Arctic spaces that absorb emissions, such as Greenland’s ice cap, so improving existing technology has real-world relevance.

Of course, none of this would be possible without the 130 generous sponsors you will see throughout this book, including Platinum Sponsor Faurecia Clean Mobility. We are proud to welcome many returning companies and organizations that support the Clean Snowmobile Challenge. Thank you for helping make this event a success.

I also want to extend special thanks to the many volunteers from the Michigan Snowmobile Association. Their invaluable mentoring and logistical support helps keep the Challenge on track.

On behalf of the organizers, the Keweenaw Research Center, and the Department of Mechanical Engineering–Engineering Mechanics, I welcome the volunteers and participants alike to Michigan Tech for the SAE Clean Snowmobile Challenge. We are honored to be your hosts.

Sincerely,

Glenn D. Mroz, President
Michigan Technological University
Dear CSC 2017 Participants and Organizers:

Welcome to the 18th Annual Clean Snowmobile Challenge in Houghton, Michigan.

Since its beginning, the SAE Clean Snowmobile Challenge has tested the engineering, innovation and teamwork skills of students from some of the top universities and colleges throughout the United States and Canada.

This event remains vitally important to your profession, the sport of snowmobiling, and society in general because it focuses on the engineering of quieter, cleaner, and more environmentally friendly machines.

You, along with the nearly 200 competitors from 21 schools representing the United States, Canada and Finland, are joining the next generation of engineers who will work to develop the technologies needed for safer, higher-performing, and more ecologically responsible snowmobiles.

The SAE Clean Snowmobile Challenge—along with the entire Collegiate Design Series—is a crucial part of SAE’s fabric. With more than 127,000 members in 100 nations worldwide, SAE continually works to advance engineering education to all levels of students and professionals.

Good luck to everyone competing in this event. I want to thank everyone for your hard work, support, and participation. I look forward to meeting at least some of you at the competition. Please enjoy the competition but remember the experiences and the learning that you gain this weekend will last throughout your lives.

Sincerely,

Douglas Patton
2017 President
SAE International
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<thead>
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<tr>
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</tr>
<tr>
<td>École de Technologie Supérieure (Diesel Team)</td>
</tr>
<tr>
<td>Indiana University–Purdue University Indianapolis (Diesel Team)</td>
</tr>
<tr>
<td>Indiana University–Purdue University Indianapolis (ZE Team)</td>
</tr>
<tr>
<td>Iowa State University (IC Team)</td>
</tr>
<tr>
<td>Kettering University (Diesel Team)</td>
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<tr>
<td>Michigan Technological University (IC Team)</td>
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<tr>
<td>Michigan Technological University (ZE Team)</td>
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<tr>
<td>North Dakota State University (Diesel Team)</td>
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<tr>
<td>Northern Illinois University (IC Team)</td>
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<tr>
<td>Rochester Institute of Technology (IC Team)</td>
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<tr>
<td>South Dakota School of Mines and Technology (ZE Team)</td>
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<tr>
<td>St. Cloud State University (IC Team)</td>
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<tr>
<td>University of Idaho (IC Team)</td>
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<tr>
<td>SUNY-Buffalo (IC Team)</td>
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<tr>
<td>SUNY-Buffalo (Diesel Team)</td>
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<tr>
<td>University of Minnesota Duluth (IC Team)</td>
</tr>
<tr>
<td>University of Minnesota Twin Cities (IC Team)</td>
</tr>
<tr>
<td>University of Waterloo (ZE Team)</td>
</tr>
<tr>
<td>University of Wisconsin–Madison (IC Team)</td>
</tr>
<tr>
<td>University of Wisconsin-Platteville (IC Team)</td>
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<tr>
<td>University of Wisconsin-Platteville (Diesel Team)</td>
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<tr>
<td>Université de Sherbrooke (EZ Team)</td>
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<td>Volunteers</td>
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<td>SAE International Staff, Advisory Board and Rules Committee</td>
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<td>Event Coordinators</td>
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<td>2018 Sponsorship Guide</td>
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## 2017 Event Schedule

### Monday, March 6

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>8:00 AM–7:00 PM</td>
<td>Teams arrive, Registration Opens</td>
<td>KRC/T3</td>
</tr>
<tr>
<td>8:00 AM–7:00 PM</td>
<td>Turn in Snowmobile Description Form</td>
<td>KRC/T3</td>
</tr>
<tr>
<td>8:00 AM–7:00 PM</td>
<td>IC and ZE Final Technical Inspections</td>
<td>KRC/T3</td>
</tr>
<tr>
<td>5:30–6:00 PM</td>
<td>Fire Safety Presentation</td>
<td>KRC/T3</td>
</tr>
<tr>
<td></td>
<td>Ansil</td>
<td></td>
</tr>
<tr>
<td>6:00–8:00 PM</td>
<td>Early Volunteers Reception</td>
<td>Joey’s Seafood, Houghton</td>
</tr>
<tr>
<td></td>
<td>Shop open until midnight</td>
<td>Pizza for students in shop</td>
</tr>
</tbody>
</table>

### Tuesday, March 7

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>7:30 AM</td>
<td>Judges’ Meeting</td>
<td>KRC/T3</td>
</tr>
<tr>
<td></td>
<td>Gage Products IC Fueling</td>
<td></td>
</tr>
<tr>
<td>10:00 AM</td>
<td><strong>Grand Opening Event</strong>*</td>
<td>KRC/T3</td>
</tr>
<tr>
<td>10:00 AM</td>
<td>Electric Sled Range Test</td>
<td>KRC/T3</td>
</tr>
<tr>
<td>10:00 AM</td>
<td>Endurance Run to Copper Harbor</td>
<td>KRC/T3</td>
</tr>
<tr>
<td>4:00–6:00 PM</td>
<td><em>Late lunch and discussion about future CSC competitions</em></td>
<td>Bonfire Steakhouse Bar and Grill</td>
</tr>
<tr>
<td></td>
<td>Courtesy of Horiba Instruments</td>
<td></td>
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</table>

Return to KRC—Shop open 6:00 PM–midnight

### Wednesday, March 8

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
<th>Location</th>
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<tbody>
<tr>
<td>7:30 AM</td>
<td>Presentation Judges’ Meeting</td>
<td>KRC Building 69</td>
</tr>
<tr>
<td>8:00 AM–5:00 PM</td>
<td>IC Design Presentations</td>
<td>KRC Building 69</td>
</tr>
<tr>
<td>8:00 AM–5:00 PM</td>
<td>AVL Lab Emissions Event</td>
<td>T5</td>
</tr>
<tr>
<td>8:00 AM–5:00 PM</td>
<td>Sensors Inc. In-Service Emissions</td>
<td>T5</td>
</tr>
<tr>
<td>8:00 AM–5:00 PM</td>
<td>Make-Up Endurance miles</td>
<td>KRC/T3</td>
</tr>
<tr>
<td>10:00–11:00 AM</td>
<td>Technical Presentation/Chalk Talk</td>
<td>KRC/T3</td>
</tr>
<tr>
<td>Noon</td>
<td><em>Lunch for the Presentation Judges</em></td>
<td>KRC Building 69</td>
</tr>
<tr>
<td>Noon</td>
<td>Courtesy of Michigan Tech Career Services</td>
<td></td>
</tr>
<tr>
<td>Noon</td>
<td><em>Lunch in the Shop—Cincinnati Chili</em></td>
<td>KRC/T3</td>
</tr>
<tr>
<td>Noon</td>
<td>Courtesy of the PCB Group</td>
<td></td>
</tr>
<tr>
<td>Noon</td>
<td><strong>Student Registration closes</strong></td>
<td></td>
</tr>
<tr>
<td>1:00–3:00 PM</td>
<td>Electric Sled Draw Bar Pull</td>
<td>KRC/T3</td>
</tr>
<tr>
<td>4:00–6:00 PM</td>
<td>Networking with Industry</td>
<td>Copper Country Mall</td>
</tr>
<tr>
<td>6:00–8:00 PM</td>
<td><strong>Snowmobile Public Display</strong></td>
<td>Copper Country Mall</td>
</tr>
<tr>
<td></td>
<td><em>Light refreshments will be served</em></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Courtesy of Michigan Tech Graduate School and Career Services</td>
<td></td>
</tr>
</tbody>
</table>

Shop open until midnight

(continued)
Thursday, March 9

8:00 AM–Noon  PCB and HEAD acoustics Noise Event  KRC/T3
8:30 AM–5:00 PM  Polaris Subjective Handling Event  KRC/T3
8:30 AM–5:00 PM  Emissions Events (continued)  KRC/T5
10:00–11:00 AM  Technical Presentation/Chalk Talk
                  Faurecia—Clean Mobility  KRC/T3
Noon  Pasty Lunch  KRC/T3
1:00–4:00 PM  ZE Design Presentations  KRC Building 69
1:30–2:30 PM  Altair Presentation
                  “Lightweighting Through Topological Optimization”  KRC Building 69
5:00–7:30 PM  SAE Milwaukee Section Meeting
                  Presentation by Horiba Instruments  KRC/T3
Announcements for Special Awards Finalists (Mandatory Attendance)  Fisher Hall 135
5:00–7:30 PM  Dinner provided for registered students and volunteers
                  by Michigan Tech ME-EM department

Shop open until midnight

Friday, March 10

7:30 AM  Judges’ Meeting  KRC/T3
9:00 AM–5:00 PM  Emissions Events (continued)  KRC/T5
10:00–11:00 AM  Technical Presentation
                  Sound Quality HEAD acoustics, Inc.  KRC/T3
Noon  Iowa Snowmobile Association–sponsored beef barbecue  KRC/T3
1:00–6:00 PM  Open Time to Enjoy the Keweenaw
                  Mt. Ripley Ski Hill, Dollar Bay Motorsports, Dan’s Polaris,
                  Houghton Powersports, M&M Powersports
5:00–6:00 PM  VIP Tours of ME-EM Building  ME-EM
6:00–8:00 PM  VIP/Volunteer Reception
                  Students—dinner on your own  Bonfire Steakhouse Bar and Grill

Shop open until midnight—sleds outside by midnight

Saturday, March 11

8:00–8:30 AM  NGK/NTK Cold Start Event  Outside KRC/T3
8:30–10:00 AM  Emission Testing (if necessary)  KRC/T5
10:00 AM  Polaris Acceleration Event*  KRC Test Course
11:00 AM  Polaris Objective Handling Event*
                  ZE Acceleration + Load Test  KRC Test Course
Noon  Judges Meeting to Review Scoring and Penalties  KRC T1
6:30 PM  Awards Banquet
                  Meals for the students courtesy of the PCB Group  Memorial Union Ballroom

* Public viewing opportunities
## 2017 SAE Clean Snowmobile Challenge

### 2017 Sponsors

#### Platinum Level (≥ $20,000)
- AVL Instrumentation and Test Systems, Inc.
- Faurecia Emissions Control Technologies
- MacLean-Fogg

#### Gold Level (≥ $10,000)
- Gold Level (≥ $10,000)
- Boss Snow Plow
- CAMSO
- Chrysler
- Coca Cola of Hancock
- Dassault Systèmes SolidWorks Corp.
- Dassault Systèmes SolidWorks Corp.
- Gage Products
- Horiba Automotive Test Systems
- International Snowmobile Manufacturers Association
- John Deere Electronic Solutions
- John Deere Power Systems
- NGK/NTK
- PCB Group, Inc.
- Sensors, Inc.

#### Silver Level (≥ $5,000)
- Continental Emitec
- Jiffy-tite
- Mahle Powertrain

#### Copper Level (≥ $2,500)
- American Council of Snowmobile Associations
- Ansool
- Ansel
- BASF
- Corn Marketing Program of Michigan
- Cummins
- E Controls
- HB Performance Systems
- HEADacoustics
- Heraeus
- Michigan Snowmobile Association
- Polaris Industries
- US Forest Service
- Woody’s International Engineering and Manufacturing, Inc.

#### Bronze Level (≥ $1,000)
- Airgas
- Altain
- AmericInn Lodge and Suites of Calumet
- Applebees
- Arctic Cat
- Association of Wisconsin Snowmobile Clubs
- BlueRibbon Coalition
- Bombardier Recreational Products
- Bonfire Grill
- Borg Warner
- Bosch Engineering
- Copper Country Mall
- Country Inn Suites by Carlson
- Dan’s Recreation
- Derby Track of Eagle River, WI
- Dollar Bay Motorsports
- Eagle Radio
- Ford Motor Company
- Great Lakes Sounds & Vibrations
- Heraeus
- Herman Hills Sugarbush
- Holiday Inn Express
- Houghton Community Broadcasting Corp.
- Houghton County Airport (CMX)
- Houghton Powersports
- International Association of Snowmobile Administrators
- Iowa State Snowmobile Association
- Jim & Kim Christiansen
- Joys Seafood & Grill
- Julie's Motor Inn
- Kohler
- Land & Sea (Dynomite)
- M&M Powersports
- Magnuson Copper Crown
- Magnuson Franklin Square Inn
- Manitowoc Crane
- Michigan Department of Natural Resources
- Milwaukee Tool
- Minnesota United Snowmobilers Associations
- Mitsubishi Electric US
- New York State Snowmobile Association
- Pasty.Net
- Pennsylvania Snowmobile Association
- Ramada Inn
- Re-Sol, LLC
- SAE Milwaukee Section
- Saskatchewan Snowmobile Association
- SkyWest United Express
- Super 8
- Superior Measurement Solutions
- The Library Restaurant
- Superior National Bank
- ThermoAnalytics
- UPPCO
- Voss Signs, Inc
- Washington State Snowmobile Association
- Yamaha
### 2017 Sponsors

#### Friends of CSC (< $1,000)

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<td>Michigan Tech Alumni Relations</td>
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<td>Indiana Snowmobile Association</td>
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<td>Inland Lakes Snowmobile Club</td>
<td>Michigan Tech Graduate School</td>
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<td>IR Telemetrics Inc</td>
<td>Michigan Tech Transportation Institute</td>
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<tr>
<td>Jim’s Foodmart</td>
<td>Mike Zuke Enterprises</td>
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<tr>
<td>KEDA</td>
<td>Pat’s Foods/Festival Foods</td>
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<tr>
<td>Keweenaw Brewing Co.</td>
<td>Quality First Aid &amp; Safety</td>
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<tr>
<td>Keweenaw Convention and Visitors Bureau</td>
<td>Quincy’s Restaurant and Lounge</td>
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<td>Keweenaw Peninsula Chamber of Commerce</td>
<td>ReMax</td>
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<tr>
<td>LB’s Chill-n-Grill</td>
<td>Roy’s Pasties &amp; Bakery</td>
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<td></td>
<td>Subway</td>
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<td></td>
<td>Superior IDEAS</td>
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<td></td>
<td>The Pines</td>
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<td></td>
<td>Tony’s Country Kitchen</td>
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<td></td>
<td>Triton Trailers</td>
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<td></td>
<td>UP Engineers &amp; Architects Inc</td>
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<tr>
<td></td>
<td>Valley Snowdrifters Snowmobile Club of Lake Linden</td>
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<td></td>
<td>Vollwerths</td>
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<td></td>
<td>Walmart</td>
</tr>
<tr>
<td></td>
<td>William and Mary Predebon</td>
</tr>
<tr>
<td></td>
<td>William and Pat Shapton</td>
</tr>
</tbody>
</table>

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**Supporting SAE Clean Snowmobile Challenge**

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Snowmobiles provide hours of exhilarating winter fun for many outdoor enthusiasts. The Snowmobile Industry has addressed the environmental impact of snowmobiles by reducing gaseous emissions and noise emissions on modern day sleds.

In the SAE International Clean Snowmobile Challenge 2017 student teams compete against one another in an effort to find novel solutions to the noise and gaseous emissions challenges presented by snowmobiles. The task is not so easy, because teams are also expected to maintain the snowmobile’s performance while keeping costs down. The snowmobiles are modified over a seven month period so time management is an additional factor in the challenge.

The goal of this competition is to generate new ideas and new technology that can be implemented on an industry-wide basis while giving University students real world teaming experiences and production challenges.

Twenty-five different teams are competing this 18th year of the SAEI Clean Snowmobile Challenge. In August, each University began preparing for the competition. And now just seven months later, the modified sleds are being tested for design, noise, exhaust emissions, fuel economy, cold start ability, acceleration, handling and a special emphasis on fuel economy. All teams must use ethanol fuels in the range of 10 to 70 percent blended with gasoline. But they will not know the percentage of “bio” content until the week is over. There is a diesel category and there is also a category for zero-emissions battery-powered sleds that could be used for research tasks in the North and South Pole Stations.

The spirit of the Clean Snowmobile Challenge is to stimulate high quality research that will help create win-win situations for snowmobilers, manufacturers, land managers, and those concerned with the environment. The end result is a great experience for young students in a meaningful engineering project as well as the opportunity to be part of a dedicated team effort.
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### Available Points

<table>
<thead>
<tr>
<th><strong>Internal Combustion Class</strong></th>
<th><strong>Minimum Points for Minimum Performance</strong></th>
<th><strong>Maximum Additional Points for Relative Performance in Event</strong></th>
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<tbody>
<tr>
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<tr>
<td>Engineering Design Paper</td>
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<td>Manufacturer’s Suggested Retail Price (MSRP)</td>
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<td>Brake Specific Fuel Consumption</td>
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<tr>
<td>In-Service Emission</td>
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<tr>
<td>In-Service Fuel Economy</td>
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<tr>
<td>Oral Presentation</td>
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<tr>
<td>Fuel Economy and Endurance</td>
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<td>Weight (no points in CSC 2014)</td>
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<tr>
<td>Acceleration</td>
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<td>Objective Handling and Drivability</td>
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<td>Cold Start</td>
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<td>Static Display</td>
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<td>Objective Noise</td>
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<td>Subjective Noise</td>
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<td>No-Maintenance Bonus</td>
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<td><strong>Total</strong></td>
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<td><strong>1,550</strong></td>
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<th><strong>Maximum Additional Points for Relative Performance in Event</strong></th>
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<td><strong>Event</strong></td>
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<td>Manufacturer’s Suggested Retail Price (MSRP)</td>
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<td>50</td>
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<tr>
<td>Lab Emissions</td>
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<td>300</td>
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<tr>
<td>Brake Specific Fuel Consumption</td>
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<tr>
<td>In-Service Emission</td>
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<tr>
<td>In-Service Fuel Economy</td>
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<tr>
<td>Fuel Economy and Endurance</td>
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<tr>
<td>Draw Bar Pull (new)</td>
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<td>Acceleration + Load Event</td>
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<td>Subjective Handling</td>
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<td>50</td>
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<tr>
<td>Static Display</td>
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<tr>
<td>Objective Noise</td>
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The official spark plug of the SAE CLEAN SNOWMOBILE CHALLENGE

GOOD LUCK TO ALL OF THIS YEAR’S PARTICIPANTS!

Cold Start Sponsor
2017 SAE Clean Snowmobile Challenge

Saturday, March 11, 2017
Cocktails/Entertainment—6:30–7:30 PM • Dinner—7:30–8:30 PM
Welcome and Recognition—Jay Meldrum, Michigan Tech KRC

Participation Plaques—Presented to all teams that compete in CSC 2017
Michigan Snowmobile Association Endurance Award—Presented to the teams that complete the Endurance Event (IC and DUC only)
NGK Spark Plugs/NTK Sensors Cold Start Award—Presented to the teams passing the Cold Start Event (IC, DUC, and ZE combined)
Gage Products Award for Best Fuel Economy—Presented to the team receiving the most points in the Fuel Economy and Endurance event (IC only)
International Engineering and Manufacturing (Woody’s) Award for Best Acceleration—Presented to the team winning the Best Acceleration Event (IC only)
Polaris Industries Award for Best Handling—Presented to the team winning the Objective Handling Event (IC and ZE combined)
PCB Group Award for Quietest Snowmobile—Presented to the team receiving the most points in the Noise events (IC only) Dinner for all students courtesy of the PCB Group. CAMSO Track Voucher
Society of Automotive Engineers Award for Best Design—Presented to the team receiving the highest total score in the Engineering Design Paper, Oral Design Presentation, and Static Display events that also received passing scores in the Emissions, Noise, and Acceleration events (Separate Awards for IC and ZE)
Cummins Award for Best Design—Presented to the team receiving the highest total score in the Engineering Design Paper, Oral Design Presentation, and Static Display events that also received passing scores in the Emissions, Noise, and Acceleration events (DUC Class)
CAMSO Award for Best Performance—Presented to the team receiving the highest total score in the Acceleration and Handling events, that also passed the Noise and Emissions event (IC only) CAMSO Ice Series Track Voucher
AVL Award for Best Emissions—Presented to the team receiving the best score in the emissions event (IC and DUC)
Continental EMITEC Award for Best Value—Presented to team with the best balance between cost, fuel economy, and performance (IC only)
Sensors Inc. Award for Lowest “In Service” Emissions—Presented to the team that has the lowest “in service” emissions (IC and DUC)
DENSO Award for Innovation—Presented to the team that in the opinion of the organizers has the most innovative solution Cash Prize $500 (IC, DUC, and ZE combined)
Mahle Powertrain—Presented to the team that in the opinion of the organizers has the best engine design Cash Prize $500
HB Performance Systems—Presented to the team with the best implementation of the HB Trail Trac system Cash Prize $500 (IC and DUC only)
ENOVATION CONTROLS—EControls CAN-do Fuel Injection Award—Presented to teams demonstrating the best implementation and understanding of student-designed engine controls and calibration in the opinion of the organizers. Prize of CANCapture cable and software (3 (IC and DUC Only)
BlueRibbon Coalition Award for Most Practical Solution—Presented to team with the best balance between cost and measured noise and emissions reduction (IC and DUC only)
Keweenaw Research Center Range Event Award—Presented to the team that travels the farthest distance on a single charge (ZE only)
Keweenaw Research Center Award Draw Bar Pull Award—Presented to the team with that wins the Draw Bar Pull Event (ZE only)
Horiba Instruments Special Award
Milwaukee Tool Special Award
Bill Paddleford Founder’s Award for Most Sportsmanlike Conduct—Trophy and $1,000 cash prize courtesy of AVL awarded to the team recognized by other participants as being the most sportsmanlike (IC, DUC, and ZE combined)
Faurecia Award for the Most Innovative Emission Design—Presented to the team with the most innovative emissions design in the opinion of the organizers Cash Prize $1,000 (IC or DUC)
Cummins Award for the Third Place Diesel Utility Class—Presented to the team with the third highest point total in the DUC who also passes emissions and noise events $500.
DENSO Award for the Second Place Diesel Utility Class—Presented to the team with the second highest point total in the DUC who also passes emissions and noise events. $750
John Deere Award for the First Place Diesel Utility Class—Presented to the team with the highest point total In the DUC who also passes emissions and noise events $1,000
John Deere Electronic Solutions—Presented to the teams with the highest point total in the ZE category. ZE Teams must travel more than 10 miles and must be able to pull a load of at least 200 pounds to take first, second, or third place. Cash Prizes of $1,000, $750, $500 for First, Second, and Third Place
American Council of Snowmobile Associations Award for Third Place Overall IC Class—Presented to the team with the third highest point total that also passes emissions and noise events. Cash Prize $500 (IC only)
American Council of Snowmobile Associations Award for Second Place Overall IC Class—Presented to the team with the second highest point that also passes emissions and noise events. Cash Prize $750 (IC only)
International Snowmobile Manufacturers Association Award for First Place Overall Winner—Presented to the team with the highest point total that also passes emissions and noise events. Cash Prize $1,000 (IC only)
MacLean-Fogg Cup Presentation—Presented to the winner of the IC Class.
Award Banquet Closing Remarks—Next Year’s Game
MOBILE EMISSIONS CALIBRATION GASES

The right gases, the right expertise to help you comply with new regulations.

Pure and mixed specialty gases for accurately calibrating vehicle emissions monitoring equipment.

You’ll find it at Airgas.

Federal and state legislation aimed at reducing vehicle engine emissions has a large impact on automobile manufacturers, as well as car and truck service centers. Making sure your emissions inspection and maintenance program complies with new regulations—including calibrating your mobile emissions testing equipment—can be overwhelming. Unless you partner with Airgas.

Airgas has been providing major automotive manufacturers, as well as government and private engine testing facilities, with emissions calibration gases and expertise for nearly a quarter century. Our pure gases and mixtures meet all state certifications as well as Federal U.S.M. 340 and S.A.M. specifications.

Rely on Airgas for:
- NIST-traceable mixtures to meet California’s Bureau of Automotive Repair (BAR) and EPA specifications which contain carbon monoxide, carbon dioxide, propane and nitric oxide in high-pressure
- Direct traceability with ±1% analytical accuracy to NIST ERMs and NTRMs through the nation’s largest fleet of NTRMs
- NIST traceable NO gas mixes down to 0.45 ppm, and NOx as a certified value below 25 ppm
- Maximum shelf life and stability resulting from expert cylinder treatment
- Pure gases and support gases according to Part 1065
- Dynamic blending for zero-blend tolerances, multi-packs, 40% H2/He and UZ air tube trailers
- 40% H2/He mixes with THC down to 0.2 ppm and blend tolerance of +0.4% absolute is available from RO (close to having THC <0.00ppm)

- Airgas provides the full line of BAR gases to engine emissions testers, including a full line of California Bureau of Automotive Repair (BAR) Calibration Gases: BAR 97 High, BAR 97 Low, BAR 97 Zero, BAR 90 Mid, BAR 90 Low, and BAR 84 Low
- Diesel Fuel Testing Standards
- You’ll find it all with Airgas, including: gas generators, disposable/zero-air gases (for sensors), gas cabinets, gas panels and distribution systems, and a complete line of safety products

Get to Know Airgas
- Airgas was the first to provide the industry with NTRM Primes (10 ppm NO, NOx)
- Airgas was the first to have laboratories with ISO 17025 accreditation
- Airgas provides size 3004 aluminum cylinders with 60% more product than the industry standard 150A
- Airgas is close by — you are never more than 60 miles from an Airgas provider that can meet your calibrated gas needs for automotive emissions

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MSG-158
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MacLean-Fogg Clean Snowmobile Championship Cup

To create the MacLean-Fogg Clean Snowmobile Championship Cup, which will be in the possession of the winning IC team for a year, MacLean-Fogg Component Solutions partnered with Detroit’s Gyro Creative (gyrocreative.com) and artist Sergio De Giusti.

The work of the Italian-born, Detroit-area artist has been widely exhibited in both the United States and Europe in such places as the Detroit Institute of Arts, the Smithsonian, the British Museum, and the Council of Cultural Affairs in Stockholm, Sweden. He has produced bronze panels for the doors of the Church of San Vito in Maniago, Italy, and designed medallions for the Department of the Treasury in Washington, DC.

De Giusti’s Michigan works include commissions for Detroit’s Italian Consulate offices and Wayne State University, where his bronze sculpture of General Anthony Wayne stands in the Centennial Courtyard. He also created the bronze Christ figure for the processional cross used at the Silverdome Mass during the 1988 visit of Pope John Paul II.

His awards include a 1991 Michigan Creative Artist Grant, a 1996 Arts Achievement Award from Wayne State University, and the 2008 Wayne County International Artist Award. Italy bestowed the title of Cavaliere upon him for achievements in the field of art.

Best-of awards, glass mugs, and all laser engraving on awards

Jano Chappell Johnson, the Laser Lady, has been engraving in the Keweenaw for many years. At her Hancock studio, she works with trophies, ribbons, plaques, and awards made of glass, wood, plastic, vinyl, and acrylic. She also creates one-of-a-kind, personalized gifts and heirlooms for every need. You can reach the Laser Lady at 906-482-2412.

Endurance Run Plaques and the Electric Series Glass Awards

Donica Hope Dravillas of Copper Harbor, Michigan, is an artist who concentrates in ceramic and glass design. Donica often creates by means of Raku, casting, and glass fusing. She strives to reflect her natural environment in the imagery of her creations. Her works can be seen at her gallery and studio. The Garden Brook in Copper Harbor.

Donica is the maker of the Endurance Run plaques, the Electric Series glass awards, and the Diesel awards. The plaques are designed from a handmade, casted mold and made of porcelain. The Electric Series awards are composed of a bird’s-eye maple base and a clear and dichroic glass design. The Diesel awards are a Raku process perfected by Donica.

For more information concerning Donica’s work, you may contact her at dhoped@hotmail.com, 906-289-4919, or 9286 Manganese Road, Copper Harbor, MI 49918.
A tribute to Bill Paddleford


As he moved through life, Paddleford pulled out those one-liners with a deadpan tone at the most appropriate of times. His humor often interrupted the tension of a heated situation around him, including Teton County Wyoming Commission meetings, where he sat as a commissioner for a decade.

“People will scream like mashed cats.”

“That would be just like stroking a cat backward.”

“This is worse than cats and dogs living together.”

“There is no excuse for bad manners.”

“I am the true Western redneck,” he was fond of saying.

“I’m not the sharpest knife in the drawer.”

“Better fare hard with good men than feast it with bad.”

“Never grow a wishbone where your backbone should be.”

Bill Paddleford was the co-founder with Lori Fussell of the SAE Clean Snowmobile Challenge which started in the year 2000 and was held for the first three years in and around Wyoming’s Teton County and Yellowstone National Park.

The “Most Sportsmanlike” Award was Bill’s inspiration and has been given in the name of the co-founders every year.

This award is dedicated to his memory.

After a long long battle with cancer, Bill passed away at the young age of 55.

The first Clean Snowmobile Challenge (CSC) was held in March 2000 in Jackson Hole, Wyoming, and included some events in Yellowstone National Park. CSC was the inspiration of Lori Fussell, president of the Institute of Science, Ecology, and the Environment, and Bill Paddleford, Teton County commissioner. The organizers combined forces with the Society of Automotive Engineers Collegiate Design Series Competitions to provide a venue for universities to tackle issues related to snowmobile noise and gaseous emissions. Universities from across the upper US and Canada compete each year in this event. The Challenge has had a positive impact on the snowmobile industry, proving that snowmobiles can be made clean and quiet. The International Snowmobile Manufacturer’s Association (ISMA) is the largest sponsor of the Challenge. The four largest snowmobile manufacturers—Arctic Cat, Bombardier [Ski-Doo], Polaris, and Yamaha—commit cash and engineering resources to the event and to the teams every year.

In 2003, the Challenge moved to the Upper Peninsula of Michigan, where it is hosted by the Keweenaw Research Center (KRC), a research arm of Michigan Technological University, located in Calumet, Michigan. The Keweenaw area of the UP is known for its scenic, well-groomed snowmobile trails and boasts 200 to 300 inches of snow annually. KRC maintains a 900-acre winter test track used by the military and the automotive industry, as well as snowmobile manufacturers, and provides a pit area for the Challenge teams.

Each year there is a new twist or underlying theme in the rules to keep the competition fresh. For example fuel blends are changed each year. Sometimes ethanol is the fuel of the competition in various blends from 10 to 85 percent. Diesel is also a fuel choice for those teams that want to compete in the utility class of the competition. There is also a Zero Emissions (electric) category for designing a completely electric sled for use in a more scientific setting like the North or South Pole areas where gaseous emission would skew the results.

Innovations introduced at CSC are have shown up on production sleds like the direct injection now used on Ski-Doo 600cc and 800cc snowmobiles. Several thousand new engineers have been exposed to the engineering challenges of balancing performance with emissions and noise as a result of this competition over the past 15 years. In the end, snowmobiles need to be fun to ride and need to retain a level of performance demanded by the consumer.

CSC 2017 is the week of March 6-11, 2017 at Michigan Tech. Teams must engineer a flex-fuel snowmobile this year. The amount of ethanol blended with gasoline will not be known by the students until the competition is over. For more information, contact Jay Meldrum, Lead Organizer, at jmeldrum@mtu.edu 906-487-2750 or mtukrc.org/snowmobile.htm. Public viewing of events during the week is welcome and encouraged.
The distance between ordinary and... exceptional

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Go Further
## 2017 SAE Clean Snowmobile Challenge

### Overall Standings/IC Category

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<th>Year</th>
<th>Clarkson University</th>
<th>École de Technologie Supérieure</th>
<th>Iowa State University</th>
<th>Michigan Technological University</th>
<th>Northern Illinois University</th>
<th>Rochester Institute of Technology</th>
<th>St. Cloud State University</th>
<th>University of Buffalo, SUNY</th>
<th>University of Idaho</th>
<th>University of Minnesota Duluth</th>
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### Total Teams Entered

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Good luck to all the participants in the SAE Clean Snowmobile Challenge. Have a safe ride!

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**Clarkson University**

**Faculty Advisor:** Robert Davis  
**Team Leader:** Riley Murphy  
**Team Members:** Joshua Valentine, Matthew Honickman, Kyle Matuszyk, Dominic Cascino, Travis Decker, Jonah Allen, Joseph Battaglia, Matthew D’Agostino  

**Design Overview:** The Clarkson University Electric Knights have developed an electric snowmobile based on the 2016 Polaris Widetrak LX platform. The battery system consists of four modules, two being in parallel and two in series, providing a total of 5.44 kWh of energy and up to 24.6 kW of continuous power at maximum voltage. A Curtis 1238 motor controller is used to manage an extremely efficient Curtis AC20 motor. The AC20 motor has a continuous torque of 72.5 ft lb at 4500 RPM.  

**Sponsors:** Snap-On, Covestro, Ingles Performance, Allied Wire & Cables, Vicor, Camso, Molex, TE Connectivity, Waytek, Gates, Evolve, Polaris
Faculty Advisor: David Morgan
Team Leader: Guillaume Verner

Design Overview: 2016 Ski-Doo MXZ 129” with a 600 ACE modified to a direct injection system instead of port injection to improve burn quality, thus reduce consummation. This unique system is controlled by a Motec M142 computer. The exhaust system is equipped with catalysts. We have modified suspension and drive components to reduce noise.

Sponsors: AÉÉTS, Camso, CVtech, Emitec, ÉTS, Génération Sports, Honeywell (Garrett), Itek, Kimpex, Kohler, NSK, Omnifab, PolyAlto, Qualipièces, RACÉ, Solidworks, Soucy, TPI, Weidmuller

Faculty Advisor: David Morgan
Team Leader: Guillaume Verner

Design Overview: 2017 Ski-Doo Tundra Sport 137” with a Kohler KDW1003 engine. We decided to use this engine considering it's a small size diesel engine. It's easy to adjust and work with since it is mechanical injection and we highly believe it is really reliable. It's a great choice for a utility diesel sled and a great challenge to install. It is equipped with a turbocharger to improve performance and obtain an acceptable trail speed. The exhaust system is also equipped with a Diesel Oxidation Catalyst and a Diesel Particulate Filter to reduce emissions.

Sponsors: AÉÉTS, Camso, CVtech, Emitec, ÉTS, Génération Sports, Honeywell (Garrett), Itek, Kimpex, Kohler, NSK, Omnifab, PolyAlto, Qualipièces, RACÉ, Solidworks, Soucy, TPI, Weidmuller
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2017 SAE Clean Snowmobile Challenge

Team Advisor: Razi Nalim

Team Leaders: Joshua Manis, Michael Golub

Design Overview: IUPUI’s first internal combustion entry into the competition will be the diesel category. Using a Kubota 3-cylinder engine to power a Polaris RMK 800 snowmobile. This light weight mountain sled paired with the heavy diesel without any added boost should be able to do 35 mph and compete in all the events. We also designing a pressure wave super charger that we will use in future years. The overall goal of this year is to prepare the chassis to be ready to run with the super charger supplied by the Nalim’s project group.

Sponsor: Razi Nalim

---

Team Advisor: Jin Zhang

Team Leaders: Abdulaziz Almakhifi, Muhamad Alsigoor, Mohammed Abusaq, Ahmed Alnemer, Abdullah Alqahtani

Design Overview: Our system contains two parts. First part is the high voltage which consists of the battery pack, high voltage disconnect, the motor controller, throttle wiper connection (W) and throttle high connection (H), 3-phase motor, and the kill switch LV. Second part of the system is the low voltage which consists of high/low voltage disconnect, IMD, tether, kill switch, key switch, crank, the latching relay (contactor), dash, light, 12V battery, and key switch input high voltage.

Sponsor: IUPUI
Wishing all participants *sweet* success!

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Email: hermanhillssugarbush@outlook.com  
Website: hermanhillssugarbush.com
**Iowa State University**
Ames, Iowa

**Faculty Advisor:** Dr. Greg Luecke  
**Team Leaders:** Jesse Rhodes, Dan Zimmerman  
**Team Members:** Austin Dewberry, Tyler Talatian, Nick Begley, Sylvia Farley, Espen Cleveland, Gavin Graupman, Charlie Bootsmler, Derek Smith  
**Fuel:** Flex-Fuel Ethanol

**Kettering University**
Flint, Michigan

**Faculty Advisor:** Dr. Gregory Davis  
**Team Leader:** Alex Rath  
**Team Members:** For the 2017 Clean Snowmobile Challenge, the Kettering University team implemented a turbocharged common rail diesel engine into a Ski Doo Tundra sport utility sled. The engine is controlled with an open source ECU running student developed code and emissions are reduced using a cooled EGR system.  
**Sponsors:** Denso, GM Foundation, FCA, Ford Motor Company, Honeywell, Nord Ride Motorsports, Robert Bosch Corporation, Woodward, Accurate Technologies
**Faculty Advisor:** Jason Blough  
**Team Leaders:** Mark Brouwer, Paul Hanafin  
**Team Members:** Mikaela Carlson, Josh Carpenter, Alex Davis, Alyssa DePauw, Austin Dohse, Garrett Kraut, Bryce Litschauer, Alexis Pinson, Shane Severn, Trevor Smith, Heather Mensch, Tanner Smith, Jacob Vuillemot  
**Fuel:** Lithium Ion  
**Sponsors:** Armaco, Denso, Ford, GM, FCA, John Deere, Milwaukee, Nexteer, Meritor, Mitsubishi Electric

**Advisor:** Jason Blough  
**Team Leaders:** Nick Brodowski, Richie Bogus  
**Team Members:** TJ Slabaugh, AJ Rettig, Terry Gregoricka, Justin Scholl, Michael Casanova, Carter Davis, Cody Heller, Alyssa DePauw  
**Sponsors:** Polaris, Bramo, Denso, Ford, GM, Bosch, FCA, John Deere, Milwaukee, Nexteer, Meritor, Mitsubishi Electric  
**Fuel:** Lithium Ion
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**Faculty Advisor:** Dr. Robert Pieri  
**Team Leader:** Nick Dirnberger  
**Design Overview:** The North Dakota State University Clean Snowmobile Team, Team 101, is participating in the Diesel Utility Class of the 2017 SAE Clean Snowmobile Challenge competition. The design features a 2015 Polaris Widetrak LX chassis, donated by Polaris Industries, powered by a Yanmar 3TNM72 diesel engine. Custom-made primary and secondary clutches donated by TEAM Industries will be transferring the power from the lower RPM diesel engine to the Hi-Lo gearbox. The exhaust will be routed using stainless steel piping donated by MagnaFlow and treated using a diesel particulate filter from a 2009 Volkswagen TDI and a diesel oxidation catalyst donated by MagnaFlow. The snowmobile will ride on a studded track courtesy of Camso. The tunnel has been coated in LizardSkin Sound Control coating donated by LizardSkin. The hood of the snowmobile will sport a custom-made snowmobile wrap donated by Fargo Office Sign Company.  
**Sponsors:** MagnaFlow, Polaris Industries, John Deere, Camso, TEAM Industries, LizardSkin, Office Sign Company, Trail King, NDSCS Precision Machining Technology

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**Faculty Advisor:** Dr. Federico Sciammarella  
**Team Leader:** Rich Stueber  
**Team Members:** Pryce McDaniel, Kyle Jackson, Paul Cummings, Josh McCoy, Greg Zolton, Jon Rothmeyer, Mike Waloch  
**Fuel:** Flex-Fuel Ethanol  
**Sponsors:** Woody’s Traction, EVS, Illinois Association of Snowmobile Clubs, DeKane Sno-Trackers, G-K Trailblazers, Hampshire White Riders, IL Region 6, IL Region 5, IL Region 3, Polaris, NIU College of Engineering and Technology, Klim, Nielsen Enterprise, Track USA, The Powder Pro, Klotz, Emitec, BASF, Horiba, Chapel In the Pines, IDEAL INDUSTRIES
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### 2017 SAE Clean Snowmobile Challenge

#### Faculty Advisor: Dr. Daniel Dolan

#### Team Leaders: Trevor Gunderson, Dan Krieger, Joel Erickson, Alex Frye

#### Design Overview: The team utilizes a versatile chassis from Polaris Inc. as a platform to build from. Using off the shelf components as well as drive systems from industry leaders such as Brammo Inc., the team builds an electrically driven snowmobile.

#### Sponsors: Polaris Industries, Brammo Power, Gigavac, Covestro, Kemet Electronics, SDSM&T SOAP, SDSM&T CAMP

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### 2017 SAE Clean Snowmobile Challenge

#### Faculty Advisor: Dr. James Lee

#### Team Leaders: Team Manager—Jason Ganje, Project Manager—Eric Oswald

#### Design Overview: 2016 Polaris Rush Axys. 2 cylinder 4 stroke motor swap.


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### Participant Profile

**University of Idaho**  
**Moscow, Idaho**

**Faculty Advisor:** Dan Cordon and Steve Beyerlein  
**Team Leaders:** Mark Woodland and Jason Maas  
**Design Overview:** The University of Idaho’s entry into the 2017 SAE Clean Snowmobile Challenge is a 2013 Ski-Doo MXZ-TNT chassis with a low speed 800cc direct-injected two-stroke engine modified for flex-fuel use with blended ethanol/gasoline fuel. A direct injection system was used to improve fuel economy and decrease emissions while maintaining a high power-to-weight ratio. Noise was reduced by operating the engine at a lower speed and by strategically placed sound absorbing/deadening materials within the engine compartment. A muffler was designed to incorporate a three-way catalyst, which reduced engine emissions without greatly reducing power output and decrease sound output.

**Sponsors:** 509, Aerocharger, AiroLEDs, Auralex Acoustics, Avid Products, BCA, Biketronics, Boyesen, BRP, Cascade Clutch, Department of Electrical Engineering University of Idaho, Department of Mechanical Engineering University of Idaho, E-Lab, Elk Butte Recreation, ETAS, Heraeus, HMK, Ice Age Performance, Idaho Motorcycle Specialties, Idaho State Snowmobile Association, Imperial Supplies, Klim, Knowles, Makita Power Tools, Millennium Technologies, Modular Exhaust, NIATT, Polymer Technologies Inc., Red Bull, Silent Running, Slednecks, Starting Line Products, SnoDrifters of Latah County, SnoWest, Spokane Winter Knights, Synerject, Thunder Products, Valley Powersports, WPS, WSSA, Wagstaff

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**St. Cloud State University**  
**St. Cloud, Minnesota**

**Faculty Advisor:** Dr. Ken Miller  
**Team Leaders:** Heather VanSlyke & Gene Studniski  
**Design Overview:** The team took a 2015 Polaris Rush Pro-S and dropped in a 2016 Polaris RZR XP 1000 engine. The focus behind the engine swap was to get an engine that would run cleaner and then add on a catalytic converter and route the exhaust into the Rush muffler. The engine swap required a new engine mount, a new steering post, exhaust routing, the addition of a battery and radiator, and the team combined the air box with their gas tank to save space with the throttle body / intake facing directly into where the gas tank rested originally. Since the RZR engine is twice as big as the Rush, we had to add a reinforcement plate for the chassis walls. We also had to add turbo weights to the original Rush primary to try and replicate the RZR clutch.

**Sponsors:** Polaris Industries, Bikeman Performance Group, Up North Sports, the VanSlyke family, Dynojet, Mies Outland of St. Cloud, Sportech, IMMI, Rehab Wraps, Mimbach Fleet, Woody’s, NGK, Northland Process Piping, Rapid Performance/Affordable Chassis, Northern Metal Processing, Jiffy-tite, UPONOR, Woodland Development Corporation, Joshua Muonio, Analog Technologies, Cretex, Old Capital Tavern, Randall Metalworks, SCSU MME Dept.
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**Faculty Advisor:** Dr. Jason Armstrong  
**Team Leaders:** Nick Marchesiello, Casey Amidon

**Design Overview:** The University at Buffalo CSC team has returned to the IC gasoline class with a turbocharged Arctic Cat Bearcat 3000LT. The small-displacement turbocharged engine will provide a marketable riding experience while also performing very well in emissions testing, producing a clean, fun snowmobile.

**Sponsors:** BorgWarner, Dobeck Performance, Specialist Components, Custom Laser, Curve Industries, StudBoy, Trailtech, SledWrapz, Arctic Cat, Solidworks

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**Faculty Advisor:** Dr. Jason Armstrong  
**Team Leaders:** Nick Marchesiello, Ethan Schonhaut

**Design Overview:** The University at Buffalo CSC team has been leading the way in diesel snowmobile technology and in 2016 brought the first common rail direct injected turbo diesel snowmobile to competition. This year, UB is back with a perfected snowmobile, complete with a Emitec catalyst, diesel particulate filter, and an EGR system to bring clean diesel technology to the forefront of the competition.

**Sponsors:** BorgWarner, Dobeck Performance, Specialist Components, Custom Laser, Curve Industries, StudBoy, TrailTech, SledWrapz, Polaris, Solidworks
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### Participant Profile

**University of Minnesota Duluth**

**Duluth, Minnesota**

**Faculty Advisor:** Puttagounder Dhanasekaran Swaminathan

**Team Leaders:** Jacob Schofield, Nels Eide

**Design Overview:** This year the Arctic Cat ZR 3000 Turbo is centered around a twin cylinder, 700cc 4-stroke engine. In an effort to reduce emissions and improve fuel economy, the engine package features an intercooled turbocharger, cooled Exhaust Gas Recirculation, Heraeus 3-way catalyst, flex-fuel capabilities, and a standalone Haltech ECU. To keep sound levels to a minimum, a custom designed, 3-chamber muffler was implemented, using a rear exiting tunnel exhaust. Advanced engine and chassis dyno testing has allowed the ZR 3000 Turbo to achieve greatly reduced emissions and sound levels, while maintaining high performance and manufacturability.

**Sponsors:** Arctic Cat, Honeywell, Haltech, Advantage Emblem and Screen Printing, Diemold Tool, FXR, Northern Engine, Cedar Machine, Camso, Minnesota Power, CP Carrillo, United Piping Inc., Brean Marketing, Kibblewhite Precision Machining, Team Industries, Amsoil, Bell Intercoolers, Cayman Textiles, Lake Superior Consulting, Ford, Archer Brothers Racing

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**University of Minnesota Twin Cities**

**Minneapolis, Minnesota**

**Faculty Advisor:** Professor William Northrop

**Team Leaders:** Frank Siracusa, Jacob Heezen, Ryan Derrick, Dean Kolar, Ryan Stringer

**Design Overview:** The 2017 UMNCST has chosen a 2015 Polaris Indy600 SP in order to provide a clean and quiet snowmobile while still providing the power to weight ratio and handling characteristics that enthusiasts expect. The two stroke engine was modified with the addition of a BASF three way catalyst and Continental ethanol sensor.

**Sponsors:** Polaris, Camso, C&A Pro, Celestica, Minnesota Measurement, Race Coatings, Horizon Commercial Pool Supply, Specialty MFC Co., OEM Heaters, Ford
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Team Leaders: Jessica Tsang, Isaac Boersma
Team Members: Jessica Tsang, Isaac Boersma, Peter Reeser, Victoria DeRooy, Jesse Friesen, Dirk Friesen, Nick Mulder, Andrew Constantinescu, Sapphire Giberson, Isabella Huot, Camille Williams, Casey Palermo, Thomas Forsythe, Chris Campbell
Fuel: Lithium Ion batteries

Design Overview: The 2017 Wisconsin/Rotax Advanced Combustion Efficiency (WRACE) 674 is built on a 2015 Ski-doo MXZ Sport Chassis. The optimized intake, exhaust, and engine control strategies, combined with flex-fuel capabilities, make the WRACE a highly efficient powertrain. The integrated exhaust gas recirculation loop combined with a three-way catalyst effectively reduces emissions. The design features a Rotax ACE 600 four-stroke engine, bored and stroked to 674 cc, providing a clean, quiet and high performance internal combustion snowmobile.

Sponsors: Snap-On, Milwaukee Tool, Ford, Polaris, Chrysler, Continental, Ecklund Motorsports, Wisconsin Corn Promotion Board, Castle Racing, College of Engineering University of Wisconsin-Madison, Department of Mechanical Engineering University of Wisconsin-Madison, Woodward Mototron Control Solutions
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congratulates the participants in the Clean Snowmobile Challenge for their vision for the future of snowmobiling.

Good Luck to all the participants!

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Team Leaders: Will Bryant, Brandon Miller
Sponsors: Arctic Cat, Kubota, Hayes Brakes, Camso, Larson Davis, Nitro Lubricants, Waupaca Foundry, Monroe Trucking, Bikeman Performance, Garage-Toys, FXR, HMK, Wells by Welch, Byron Snow Bears, Kettle Moraine Riders, Isaar Trailriders, Oneida Swamp Stompers,
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Dennis Lovell, Measurement Instruments
Dennis Zoet, MSA
Derek Frie, Polaris
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Don Apple, AVL
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Greg Westrick, DENSO
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Hugh Blaxill, Mahle Powertrain
Hung-Li Chang, CARB
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Keith Johnson, ThermoAnalytics
Kelsey Esquinas, Faurecia
Ken Beaufact, Gage
Kim Christensen, Self
Kris Zdral, NGK/NTK
Kurt Person, HB Performance Systems
Kyle Mattfield
Kyle Schouard, Polaris
Lee Knoll, AVL
Lee Matfield, Self
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Mike Green, Self
Mike Lally, The Modal Shop
Mike Lasecki, EMP
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Peter True, HB Performance Systems
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<td>Lead Organizer</td>
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<td>Co-organizer</td>
<td>William Predebon, Michigan Tech ME-EM</td>
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<td>Master Scorekeeper</td>
<td>John Houk MSA</td>
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<td>Subjective and Objective Handling, Acceleration</td>
<td>Kyle Schounard, Polaris Industries</td>
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<td>Event Program</td>
<td>Arlene Collins and Trevyn Payne, Michigan Tech</td>
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<td>Photography and Video</td>
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<td>Allison Mills and Cyndi Perkins, Michigan Tech</td>
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12 Metal Works Day
15 Energy Day
19 Manufacturing Day
21 & 22 PCA Student Success Days
25 Business Careers Day
26 Career Fair Cook Out
26 Alliance for Computing, Information & Automation (ACIA) Mixer
27 CAREER FAIR

OCTOBER
3 Rail Day

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SAE Members and Students are invited to a personal résumé critique session at the CSC or after by Dale Wiza of Professional Engineering Placements (dale@engineeringplacements.com, c 414-807-9663)

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36 2017 SAE Clean Snowmobile Challenge

Sunday-Thursday 11:30 am–10:00 pm  
Friday-Saturday 11:30 am–11:00 pm

Chicago style/thin crust pizza,  
Charbroiled steaks, Pasta, Seafood, Burgers,  
Sandwiches, Appetizers, Desserts,  
Chili-Soups-Salads

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As the global leader in catalysis, BASF has unmatched expertise in developing innovative, cost-effective emissions control technologies for a wide range of applications from snowmobiles to construction equipment. We are committed to enabling clean air for a healthier world and sustainable future. When clean air loves off-road equipment, it’s because at BASF, we create chemistry.

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GOOD LUCK TEAMS!
Snowmobiling has a way of bringing people together and bridging communities. There’s no better way to get the most out of winter. Spend time with family and friends, explore new places, and experience nature’s beauty. You’ll see winter in a whole new way ... all from your snowmobile.

Winter’s more fun on a snowmobile. Find out more at www.gosnowmobiling.org.
Good Luck Participants!

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HAVE FUN!

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The In-Service Emissions event was developed by Michigan Tech to gather actual field emissions data, complementing the laboratory emissions test. Sensors Inc., in Ann Arbor, Michigan, donated a portable emissions measurement system (PEMS) for this event. The five-gas analyzer measures total hydro-carbon (THC), carbon monoxide (CO), and oxides of nitrogen (NOx) while the snowmobile is on the trail. The PEMS sits on a sleigh with battery power and a snorkel to reach to the exhaust sampling port on the sled.

Since the PEMS measures constituent concentrations, it is also necessary to measure the flow rate of either the exhaust or the fuel. Through a generous donation from Re-Sol, of Auburn Hills, Michigan, a fuel flow system allows us to make this measurement. The Re-Sol system uses coriolis flow meters to measure mass flow. Knowing the density of the fluid, the flow rate can be calculated.

This year another generous donation from Re-Sol has allowed us to reduce the weight of the sleigh by 200 pounds. Previously, the weight of the sleigh was equivalent to two heavy riders. This lighter-weight sleigh should give us results more consistent with lab emissions tests.
THE BOSS has your back. That’s how we’re made. That’s what defines our mission—to help clear your path to success with reliable, high-performance designs that save you time. Like our Poly Power-V XT. Its slick poly surface and aggressive blade curl combine to throw snow higher and farther than the competitors. And it’s built to last for years of duty, like every blade that bears our name. So when the toughest jobs lie ahead and there’s money out there to be made, it’s good to know THE BOSS and its strong network of authorized dealers are always squarely behind you.

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Superior Ideas makes cutting-edge university research available to everyone, letting users make tax-deductible donations to projects that matter most to them—such as the Clean Snowmobile Challenge. Michigan Tech’s support as a leading research university ensures that Superior Ideas projects truly are the best of the best.

Find research that matters most to you and help bring projects to life.

The following snowmobile groups have supported the Clean Snowmobile Challenge or a participating team in some way since the inception of the Challenge. The organizers and the teams thank you sincerely.

American Council of Snowmobile Associations
Association of Wisconsin Snowmobile Clubs
Byron Center Snowmobile Association (Wyoming)
Idaho Snowmobile Association
Indiana State Snowmobile Association
Inland Lake Snowmobile Club (of Michigan)
International Association of Snowmobile Administrators
International Snowmobile Manufacturers Association
Iowa Snowmobile Association
Michigan Snowmobile Association
Minnesota United Snowmobile Associations

New York Snowmobile Association
North Side Snowmobile Club (New York)
Ontario Federation of Snowmobile Clubs
Oregon State Snowmobile Association
Pennsylvania Snowmobile Association
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For more information:
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AVL is a proud sponsor of the SAE Clean Snowmobile Challenge
Leading the pack in brake technology since 1946, Polaris, Arctic Cat and other industry leaders turn to Hayes Performance for their disc brakes.

Whether you’re on the trail, in the mountains or on the track, Hayes keeps you in control.

For the 8th consecutive year, Hayes is proud to be participating and lending our technical engineering experience to the 2016 SAE Clean Snowmobile Challenge.

Good luck to all the teams in this year’s SAE competition.

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It all starts at connection.sae.org: your link to the membership community.

Through this forum, members can connect to other industry professionals, the SAE Membership Team for support, and much more:

• Learn about the latest member benefits and volunteer opportunities
• Get involved in discussions on the latest technical topics and increase your professional network
• Engage with other mobility engineering professionals like you in the industry-specific Aerospace, Automotive, or Commercial Vehicle sector communities
• Explore industry spanning topics in the cross-sector Open Forum

If you have any questions about your membership or your benefits, please contact your membership team:

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(Outside U.S. & Canada)
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To find out more, visit sae.org/membership.
Big enough to build a 95 litre, 16-cylinder engine that cranks out over 4,000 horsepower.

(Now we just need to build a bigger snowmobile.)

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Congratulations to every team in this year’s Clean Snowmobile Challenge.

You inspire us to keep forming ingenious solutions.

Discover upcoming career fairs, browse current openings and apply online to form your future at macleanfogg.com/careers
Proud supporter of the SAE Clean Snowmobile Challenge for more than 10 years

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It isn’t easy being green, but we think it’s worth it. Our green ways are a part of everything we do – from the products we make to the community programs we support.

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- Hydraulics: complex, multi-circuit system design integrating pilot, proportional, and direct acting controls with high pressure components.

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Good luck to all participating teams!
At John Deere we take pride in developing technology and equipment that help billions of people achieve a better quality of life. And, our engineers are committed to doing it in ways that safeguard our environment. Our focus on environmental stewardship is reflected in everything we do – within our own operations as well as the products and services we provide to help our customers and communities operate efficiently and conserve natural resources. That’s why we’re proud to be a sponsor of the Clean Snowmobile Challenge.
Clean Snowmobile Challenge
March 5–10, 2018

The SAE Clean Snowmobile Challenge (SAE CSC) is a competition among US, Canadian, and Finnish universities to develop a prototype snowmobile that exceeds the current standards for exhaust emissions and noise output. These demanding requirements provide student engineers with a unique opportunity to explore and develop new technologies for engines, exhaust systems, noise reduction, and fuel economy.

More than 200 students participate annually, with up to twenty-five collegiate teams testing their engineering designs against one another during this exciting six-day event. Universities from Michigan, Idaho, Wisconsin, New York, South Dakota, Colorado, Ontario, Alberta, Quebec, Alaska, Minnesota, North Dakota, Indiana, and Maine are among the regular attendees. There are three categories in the competition:

• A gasoline snowmobile designed for groomed trails in environmentally pristine areas, such as National Parks;
• A fully electric or Zero Emissions snowmobile designed for use in the North or South Poles, where gaseous emissions might skew research results; and
• A diesel-engine-powered snowmobile designed for utility use—for example, in a cross country ski hill business or a snow-covered research environment where extreme mobility or towing is essential.

Sponsorship provides your company with excellent exposure in support of engineering education and research. You can heighten your brand awareness among students, faculty, industry representatives, snowmobilers, environmentalists, and public-land managers. In addition, you will be helping to find a solution to the problems associated with snowmobile use in environmentally sensitive areas.

Levels of sponsorship range from Bronze to Platinum. In addition to the benefits associated with each level, sponsors will have visibility in promotional brochures, press releases, the Clean Snowmobile Challenge event program, as well as a listing on the SAE website. As a sponsor, your company or organization will also have the opportunity to host a luncheon or banquet, provide volunteers to work at the SAE CSC, become involved with committees, network with industry and academic professionals, and recruit future employees from participating students in a cost-effective manner.

All contributions to the SAE CSC will be made through the Keweenaw Research Center, a nonprofit research arm of Michigan Technological University. Jay Meldrum, director of the Keweenaw Research Center, and William Predebon, chair of the Department of Mechanical Engineering-Engineering Mechanics, are the lead organizers of SAE CSC.

If you are interested in becoming an SAE CSC sponsor, please contact
Jay Meldrum at 906-487-2750 or jmeldrum@mtu.edu
or return your SAE CSC Sponsor Pledge Form to
Michigan Tech/KRC, 1400 Townsend Drive, Houghton, MI 49931-1295

Visit our website at mtukrc.org.

Please help make this event possible—
BECOME A SPONSOR TODAY!
2018 Sponsorship Levels

Platinum Level—$20,000
All Diamond-Level benefits, plus
• Space for five 3-by-5-foot banners on-site
• Full-page four-color ad in event program

Diamond Level—$15,000
All Gold-Level benefits, plus
• Opportunity to name an award and present at the award ceremony (limited availability)
• Space for three 3-by-5-foot banners on-site

Gold Level—$10,000
All Silver-Level benefits, plus
• Space for two 3-by-5-foot banners on-site
• Opportunity to place one decal (five square inches or less) on every competing snowmobile
• Four tickets to Award Banquet

Silver Level—$5,000
All Copper-Level benefits, plus
• Three tickets to Award Banquet
• One 3-by-5-foot banner on-site

Copper Level—$2,500
All Bronze-Level benefits, plus
• Link to your company/recruiting website from the SAE Collegiate Design Series Sponsor webpage
• Two tickets to Award Banquet

Bronze Level—$1,000
• Opportunity to recruit on-site among participating engineering students and display product on-site
• Full-page black-and-white ad in event program
• Table space at student-industry networking event

Customized sponsorship packages are available.
Please contact:
Jay Meldrum
906-487-2750 • jmeldrum@mtu.edu
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- Bronze (> $1,000)
- Gold (> $10,000)
- Copper (> $2,500)
- Diamond (> $15,000)
- Silver (> $5,000)
- Platinum (> $20,000)

All contributions will be acknowledged in the annual event program.

We pledge the following amount: $________________

- Our donation is enclosed.
- Date funds will be available _____/_____/

We would like table space for the student-industry networking event. □ YES □ NO

Contact Name ____________________________________________________________
Phone ________________________ Email _______________________________________

Would anyone at your organization be willing to be a volunteer at the competition?

- YES - NO

Thank you for your support of the SAE CSC!
Please tear completed form from booklet and mail or fax to
Jay Meldrum, Keweenaw Research Center
Michigan Technological University, 1400 Townsend Drive, Houghton, MI 49931-1295
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