

# 2010 SAE Clean Snowmobile Challenge



Parade lap on the objective handling course.

# What is the CSC?

- The newest competition in the SAE International collegiate design series. Others include Formula SAE, Baja and others.
- Challenges engineering students to improve on existing snowmobiles to reduce emissions and noise and improve public perception.
- Events include: emissions bench test, in-service emissions, noise, handling, static display, cold start, endurance run, range, draw bar pull, acceleration.
- Hosted by Michigan Technological University, Keweenaw Research Center past eight years.
- I serve as a technical inspector, judge and sit on the rules committee.

# CSC History

- Began in 1999 in response to conflicts over snowmobile use in Yellowstone N.P.. Held in Jackson Hole, Wyoming first four years.
- Moved to Michigan Tech/KRC in 2003
- NSF became a major sponsor in 2008
- In 2010, 17 teams competed (5 ZE)
- The winning ZE team is offered the chance to send one team member and their machine to Summit Station.

# There are big teams



# There are little teams

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# 16 Teams Finished – That's a lot of students!



Two teams from Canada this year. In 2011, a team from Sweden intends to compete.

# Niche Applications for Zero Emissions

- Allows atmospheric and snow photochemistry scientists to access their sampling sites with ZE machines.
- Several spin-offs on the IC side, including catalytic exhaust after-treatment and oxygenated fuel.
- ZE machines may well fit the needs of Alaskan villages, where fuel prices are prohibitive.
- Other potential applications at ski areas – especially in Europe, where regular snowmobiles are becoming increasingly banned.
- Electric motors are unaffected by altitude.



# Electric Snowmobile At Summit

Dramatic performance improvements over the years:

- Up to 20 mile range
- Up to 75 mph top speed (de-tuned for Summit)
- High availability



# Bench Emissions Testing



# In Service Emissions Space Pod

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# In Service Emissions Testing

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# Sound Testing



# Acceleration Event

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Some of these machines are really fast! Pulling a trackie at the start of an acceleration run.

# Objective Handling



# Draw Bar Pull



Performed on grass this year.  
Gives objective numerical data to  
compare pulling power.

# Acceleration With Load

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This was supposed to be a combined range + load + handling event. The lack of snow made us come up with creative ways to demonstrate the ZE machines great utility functions, while keeping it interesting and fun.



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# New Challenges Every Year

- 2008/E20: 20% Ethanol, an oxygenated biofuel
- 2009/Flex Fuel: Engine controls had to recognize the fuel and alter mapping.
- 2010/Fuel Efficiency: The winning machine got almost 23mpg in truly poor snowmobiling conditions.
- 2011 – Maybe wheels??????

# A few challenges for organizers too!



Forecast: 60 degrees F and plenty of mud!!

# U of Wisconsin – Madison: 1st Place ZE



# Clarkson University: 2<sup>nd</sup> Place ZE



# McGill University: 3<sup>rd</sup> Place ZE

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# South Dakota School of Mines and Technology



# University of Alaska - Fairbanks

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# Innovation Award: SUNY-Buffalo



Bio-Diesel Powered  
Snowmobile!

# University of Idaho: Best Handling



Snowcross: Huge suspension travel; lightweight 2-stroke

# NSF Polar Programs & Summit Station

- Educational Outreach
- Meeting a need for ZE transportation
- Promoting appropriate technology solutions



**HIGH VOLTAGE  
ALWAYS ENERGIZED**

Questions??

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