

SAE Clean Snowmobile Challenge

By Michel Garneau

Some of you may have heard about the CSC as it is an event whose profile is coming up every year. Before we get into the specifics about the competition itself, we should first begin by shedding light on the organizing body behind this event as it does help to put the nature and purpose of the Challenge in its proper context.

What is the SAE

The SAE, or Society of Automotive Engineers, is a body which counts more than 84,000 member engineers, business executives, educators, and students from more than 97 countries. The group was formed in 1895 and their mission is to share information and exchange ideas for advancing the engineering of mobility systems.

What is the Clean Snowmobile Challenge?

Each year the SAE organizes the “Clean Snowmobile Challenge”, an intercollegiate design competition for university students from all over the world. The goal of the competition is to design a snowmobile (primarily for riding on groomed snowmobile trails) that is more environmentally friendly than those currently available on the market. Pollution, noise levels, and energy consumption are all evaluated. The modified snowmobiles are also expected to be cost-effective so the use of unreliable, expensive solutions is strongly discouraged. Entries are restricted to teams of undergraduate and graduate students from accredited universities.

From its humble beginning...

It all began in the Fall of 1998 when two individuals, Bill Paddleford and Dr. Lori Fussell, joined forces to work towards a common goal: the reduction of noise and emissions from snowmobiles without sacrificing performance. In the Spring of 1999, the SAE joined up with these two individuals and a Jackson Hole, Wyoming-based advisory board to organize a new collegiate design competition, the first Clean Snowmobile Challenge (CSC). In the Summer of 1999, seven universities from the US and Canada accepted used snowmobiles and the challenge of modifying them for rigorous evaluation in the categories of emissions, noise, performance, design, fuel economy and cold starting ability. In March of 2000, the first annual CSC was held in Jackson Hole. In spite of only having six months to work on their entries, technical innovation abounded, as did impressive results. The following year entries doubled and the event was won by the University of Waterloo, from Waterloo, Ontario, the only Canadian entry ever to finish on the top step of the podium. The event remained in Jackson Hole in 2001 and 2002.

In 2003, the event moved to the Keweenaw Peninsula in Michigan, under the auspices of Michigan Tech, and has remained there ever since. Participation and innovation continued to flourish and 2004 even saw the entry of a hybrid

snowmobile. Last year's competition saw a total of 16 entries, 12 of which were four-strokes with 4 being two-strokes.

Events

The snowmobiles must participate in numerous tests design to permit evaluation on the basis of various criteria. The tests include:

- Emissions Test
- Fuel Economy/Endurance Test
- Trailer sled towing test
- Noise Event



- Acceleration Testing Event
- Cold Start Event
- Handling/Drivability Event (subjective test)
- Shock Input Test Event

In addition, the teams themselves are evaluated according to their Engineering Design Paper, their Oral Design Presentation, their Static Display, and finally their Technology Implementation Cost Assessment. As you can see, the evaluation process is quite rigorous and thorough.

Categories and Awards

While there can only be one overall winner, the broad basis of testing does make it possible for teams to be recognized for excellence in certain specific areas. For this reason, various awards are handed out at each CSC. These include:

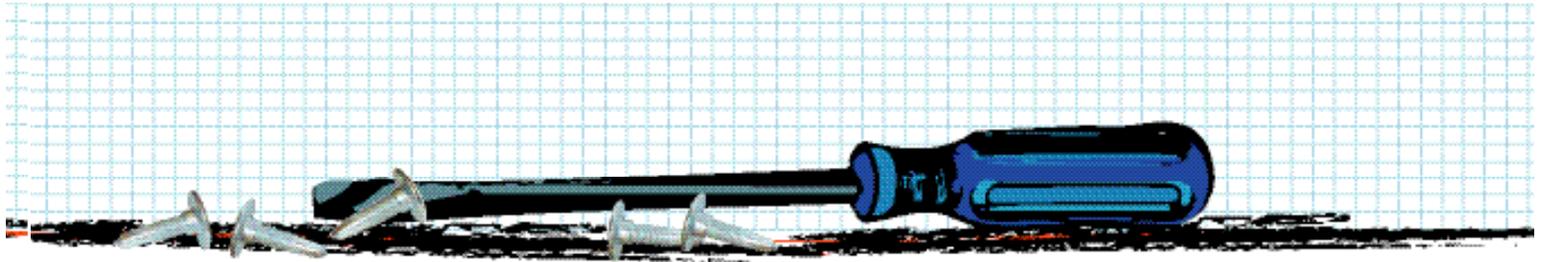
Overall Winners: Presented to the top five teams in terms of total points.

Best Performance: Presented to the team receiving the highest total score in the acceleration, handling, and braking events.

Best Emissions: Presented to the team receiving the best score in the emissions event

Best Design: Presented to the team receiving the highest total score in the Engineering Design Paper, Oral Design Presentation, and Static Display Events.

Best Fuel Economy: Presented to the team receiving the most points in the Fuel economy/endurance event.



Quietest Snowmobile: Presented to the team receiving the most noise points in the noise and acceleration event.

Most Practical Solution: Presented to team with the best balance between cost and measured noise and emission reduction.

Best Value: Presented to team with the best balance between cost, fuel economy, and performance.

Founder's Trophy: Trophy awarded to the team recognized by other participants as being the most sportsmanlike.

Best Ride: Presented to the team with the best combined score in the Rider Comfort and Subjective Ride events.

Best Zero Emissions: Presented to the Team with the highest point total in the ZE category.

Welcome to 2006

The 2006 version of the CSC will bring with it various new developments. Following the impressive display of the McGill Electric Snowmobile at the 2005 competition, the 2006 CSC will have an all new Zero-Emission category. These entries will be judged separately, although they may compete along side IC engine designs during some events.

Also new is the introduction of a principle known as "beat the standards." To earn points in emissions this year, participants must design a sled that meets the 2012 emissions standard just as the manufacturers will have to. To earn points in noise, they will have to pass the Snowmobile Industry noise test, just as the manufacturers have to. In addition, a subjective noise test has been added which represents the public's perception of the sound quality associated with snowmobiles. This last criteria is especially noteworthy, especially given what we are living in Quebec at this time.

Why a "zero-emissions" category?

Some research environments are very sensitive, the slightest form of contamination (in this case hydrocarbon emissions) can skew research findings. As a result, the scientific community has long been asking for a "zero-emissions" vehicle for transporting researchers and support staff to and from research sites. However, limited range and performance have been limiting factors that have precluded the successful development of commercially available models. Recent advancements in battery and motor technology have finally made it possible to realize vehicles with ranges adequate for some purposes. Zero-emissions personnel transportation would allow the operation of more distant satellite camp facilities, and allow access to areas previously accessible only by foot. So, as you can see, there is a very practical side to this new category.

Rules

A brief overview of some of the more important rules :

Engine

Modifications to the engine, including substitution of a different engine, are allowed. In terms of engine types, two-stroke, four-stroke, and rotary engines are permitted.

• Engine displacement limits:

(a) Four-stroke spark ignition engines: 960 cc max

(b) Two-stroke and rotary, spark ignition engines: 600 cc max

(c) Diesel engines: 1135 cc max

• Block heaters are not allowed.

Chassis and suspension

Modifications are permitted but certain constraints apply:

• The snowmobile's skis and ski suspension may be modified, however, the snowmobile must remain ski-steered.

• Sleds must have a minimum of six (6) inches usable ski and track suspension (with rider aboard).

• The snowmobile's track may be replaced with a different track but it must be a commercially available, one piece, molded rubber snowmobile track.

• The use of track studs is allowed.

• Slide rail lubrication systems are not allowed.

• The snowmobile chassis (bulkhead and tunnel) must be from a stock qualified snowmobile (one that was produced in a quantity of at least 500 units).

• No changes are allowed that would nullify compliance with



federal, state, or provincial safety regulations.

On-site modifications and maintenance

No changes or modifications to snowmobiles will be allowed after safety/tech inspection except for:

• Those required to bring the snowmobile into compliance with the requirements and restrictions of the rules.

• Those required to return the snowmobiles to operating condition after a breakdown.

• Those considered standard maintenance items

We're all winners

So there you have it. As you can see, the CSC is designed to challenge young minds to find innovative solutions to long-standing challenges to the activity of snowmobiling. You can bet that the manufacturers follow this event quite closely, not only for possible research ideas, but also for future employees. In the end, the very existence of this event means that we all win in the end. For more information on the competition, please visit

<http://students.sae.org/competitions/snow/>

We will now examine two notable entries from Quebec universities in this noteworthy event. Enjoy!