

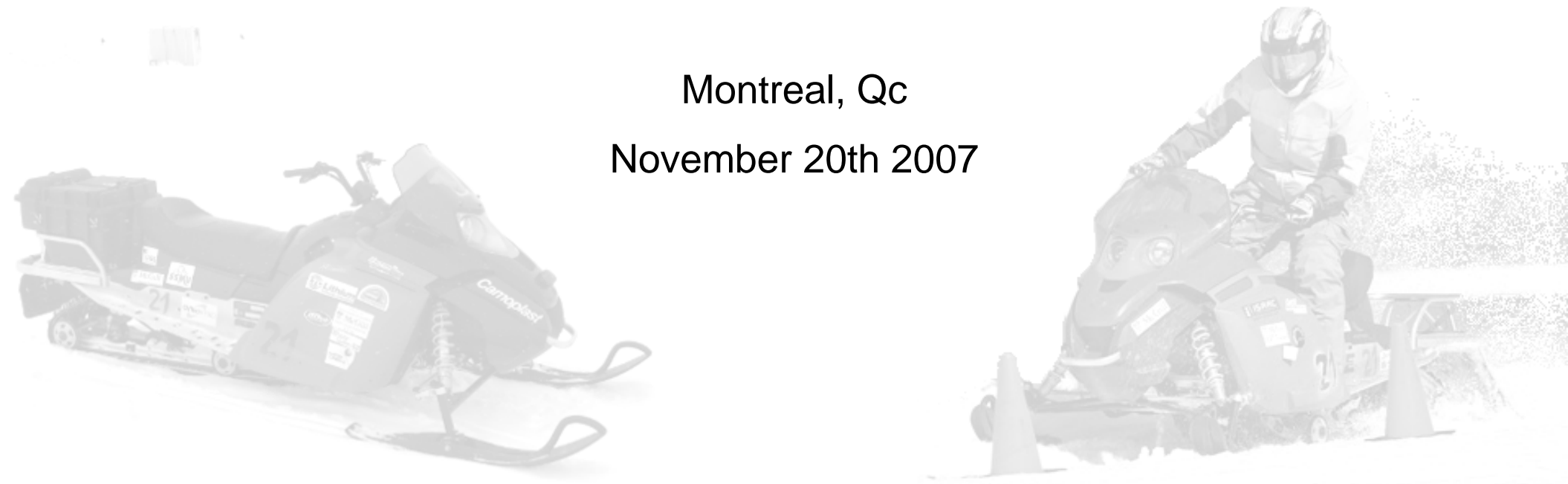
Value Engineering Success Stories: McGill University Advanced Vehicle Designs

Presented by: Simon Ouellette

CSVA 2007 Conference

Montreal, Qc

November 20th 2007



Background

***Simon Ouellette – McGill University
Mechanical Engineering Master Student***

- Project Manager
 - McGill University Vehicle Engineering Research & Tech. transfer project (VERT Project)

- Founder
 - McGill Electric Snowmobile Team
 - McGill Hybrid Snowmobile Team
 - McGill Formula Hybrid Team

Background

***Simon Ouellette – McGill University
Mechanical Engineering Master Student***

- Value Engineering Experience
 - McGill Value Engineering student (abrasion wear test equipment)
 - McGill Value Engineering project proposals
 - Integration of Value Engineering principles in prototype vehicle design process

McGill University Prototype Vehicles Designed Using VE Methodology

1. SAE Clean Snowmobile Challenge Electric Snowmobile
2. U.S. NSF Summit Station Research Base Zero-Emission Snowmobile
3. SAE Clean Snowmobile Challenge Hybrid Snowmobile
4. SAE Formula Hybrid Race Car



SAE Clean Snowmobile Challenge Electric Snowmobile

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SAE Clean Snowmobile Challenge

Electric Snowmobile

Events

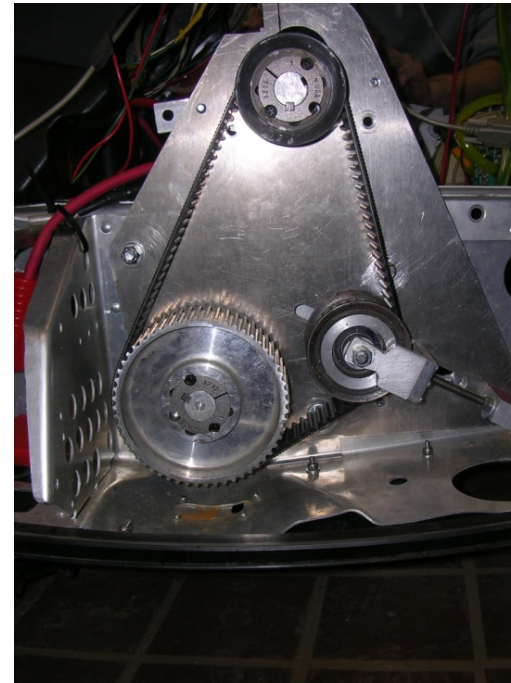
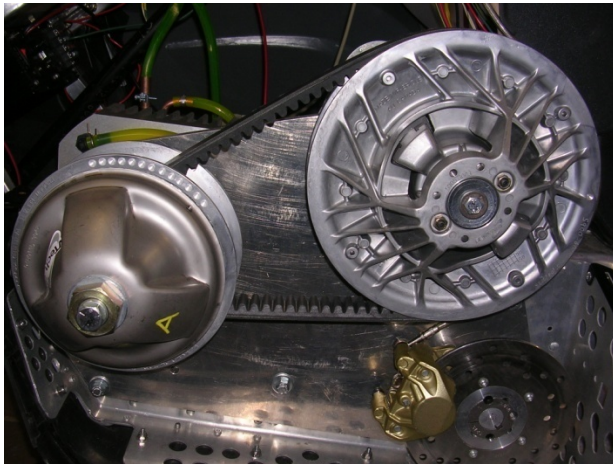
- Endurance Test
- Trailer Sled Towing Test
- Noise Event
- Oral Design Presentation
- Acceleration Testing Event
- Cold Start Event
- Static Display Event
- Technology Implementation Cost Assessment
- Subjective Handling/Drivability Event
- Objective Handling/Drivability Event
- Vehicle Weight Assessment
- Shock Input Test Event
- Engineering Design Paper



SAE Clean Snowmobile Challenge Electric Snowmobile

VE Focus (2006-2007)

Transmission System



SAE Clean Snowmobile Challenge Electric Snowmobile

SAE Clean Snowmobile Challenge 2007 Results

- 1st Place Overall
- Best Design
- Innovation Award
- Best Handling
- Range Award
- Cold Start Award



SAE Clean Snowmobile Challenge Electric Snowmobile

VE Focus (2007-2008)

Entire vehicle optimization for SAE Clean
Snowmobile Challenge 2008



U.S. NSF Summit Station Research Base Zero-Emission Snowmobile



U.S. NSF Summit Station Research Base Zero-Emission Snowmobile

U.S. NSF's Summit Station - Electric Snowmobile Design Requirements

- Range: 16km @ moderate speed (32km/h max)
- Towing capacity: > 500kg (mass on trailer sled)
- Reliability: nothing but standard maintenance per summer
- Easy to use/stable/manoeuvrable/forgiving: most users are 1st time snowmobile users
- Immune to extreme cold: -40C at night in May



U.S. NSF Summit Station Research Base Zero-Emission Snowmobile

VE Focus (2006-2007)

Meeting baseline performances with
maximum reliability



U.S. NSF Summit Station Research Base Zero-Emission Snowmobile

Summer 2007 Results

- No major issues
- Some premature wear on 2 shafts
- Most baseline performance requirements were met



U.S. NSF Summit Station Research Base Zero-Emission Snowmobile

VE Focus (2007-2008)

Increase performances and reliability with
small changes



SAE Clean Snowmobile Challenge Hybrid Snowmobile



SAE Clean Snowmobile Challenge Hybrid Snowmobile

Hybrid Snowmobile Design Requirement 2006-2007

Must Work...

Hybrid Snowmobile Design Requirement 2007-2008

Fuel: E85 or B10

Range: 160km @ ~45km/h avg. (72km/h max)

All electric range: > 10km

Stability & Manoeuvrability: better than 2006-2007 prototype



SAE Clean Snowmobile Challenge Hybrid Snowmobile

VE Focus (2006-2007)

Safety & Rule compliance
Cost (actual cost to the team)



SAE Clean Snowmobile Challenge Hybrid Snowmobile

SAE Clean Snowmobile Challenge 2007 Results

- Validated proof of concept
- Introduced the organizers to the concept of the plug-in hybrid
- Determined that more work needs to be done on heat management issues



SAE Clean Snowmobile Challenge Hybrid Snowmobile

Hybrid Snowmobile Design Requirement 2006-2007

Must Work...

Hybrid Snowmobile Design Requirement 2007-2008

Fuel: E85 or B10

Range: 160km @ ~45km/h avg. (72km/h max)

All electric range: > 10km

Stability & Manoeuvrability: better than 2006-2007 prototype



SAE Clean Snowmobile Challenge Hybrid Snowmobile

VE Focus (2007-2008)

Safety & Rule compliance
Cost (actual cost to the team)
Performance



SAE Formula Hybrid Race Car



SAE Formula Hybrid Race Car

SAE Formula Hybrid Competition Driving Events

- All electric acceleration
- Hybrid acceleration
- Handling course
- Endurance event



SAE Formula Hybrid Race Car

SAE Formula Hybrid Competition Format

Fixed amount of energy for the entire competition

$$\begin{aligned} &(\text{Baseline fuel energy}) - (\text{onboard battery energy}) \\ &= \\ &\text{Amount of fuel allotted} \end{aligned}$$



SAE Formula Hybrid Race Car

VE Focus

Safety & Rule compliance

Time and effort → \$\$\$/Probability = Time

Reliability

Performance



SAE Formula Hybrid Race Car

SAE Formula Hybrid Competition Results

- 1st place overall
- 1st place handling event
- 1st place endurance event
- 2nd place acceleration event
- 1st place marketing presentation



Partners and Sponsors



Questions

Chaire
CRSNG en génie de conception
McGill
NSERC Design Engineering
Chair



McGill
Faculty of
Engineering

