Clean Snowmobile Challenge

- Sponsored by the Society of Automotive Engineers (SAE)
- Making snowmobiles more environmentally friendly

This project:
- Quieter with muffler
- Cleaner with catalytic converter (CAT)

Challenges:
- Muffler design is VERY difficult
- CAT must be easily removable
Hushpower Muffler

- Proven technology, not designing a muffler from scratch
- Hayden, Idaho
- Used on ATV’s
Sound Testing Procedure

SAE J-192 standard

15 mph  Full acceleration (150 ft)  Deceleration

(50 ft)  

Microphone

(control sled)
Initial Sound Testing

Muffler Sound Testing Results

- Stock
- 1 Hushpower
- 2 Hushpower in Parallel
- 2 Hushpower in Series
- 3 Hushpower in Series

Noise Level (dBA)
Flow Bench & Flow Testing

Object being flow tested

Testing stand

Vacuum power switches and fuse panels

Settling chamber

Pressure tap

Mass flow meter

One-way flow valves

Vacuum supply motors
Prototype

50 horsepower reduction
Catalytic Converter (CAT)

Removable CAT:

- Hushpower shell
- CAT stop ring welded into Hushpower shell
- Flange welded to shell to bolt on the end cap
- Air gap to insulate and prevents rattling
Emissions Results

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>CSC Limit</th>
<th>2011 Results</th>
<th>2010 Results</th>
<th>% Reduction</th>
<th>Pass/Fail</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO</td>
<td>\leq 275</td>
<td>272.98</td>
<td>209.94</td>
<td>-23%</td>
<td>Pass</td>
</tr>
<tr>
<td>HC</td>
<td></td>
<td>36.87</td>
<td>41.6</td>
<td>13%</td>
<td>-</td>
</tr>
<tr>
<td>NOx</td>
<td>3.91</td>
<td>5.8</td>
<td></td>
<td>48%</td>
<td>-</td>
</tr>
<tr>
<td>HC + NOx</td>
<td>\leq 90</td>
<td>40.78</td>
<td>47.36</td>
<td>16%</td>
<td>Pass</td>
</tr>
<tr>
<td>Escore</td>
<td>\geq 100</td>
<td>114.57</td>
<td>125.9</td>
<td>-10%</td>
<td>Pass</td>
</tr>
</tbody>
</table>

(pollutants measured in g/kW-hr)

- 4th in lab emissions
- 2nd for in-service emissions
Final Muffler

- 2.5” diameter
- Additional cone
- CAT

Fit better in chassis
Final Muffler Results

Muffler Comparison

- Stock
- Prototype
- Final

Pressure Drop (psi)

Air Flow Rate (cfm)

CHANGE IN SOUND LEVEL as compared to stock

- StealthCat Muffler without CAT
- StealthCat Muffler with CAT

140% stock backpressure
(≈20 hp reduction)

2.3 dBA quieter
Engine Tuning:
- Tune for Stealth CAT muffler
- Sound testing with tuned engine

Outer Shell:
- Aluminum shell with insulation
- Effect on sound level
Questions?