Automotive Industry Environmental Scan
- key facts, priorities and major trends
Global Auto Industry Statistics

- **Global Vehicle Output:** ~ 66.4 million units annually
  (approx. 2.69-2.8 million are built in Canada – more than Michigan)

- **Global Economic Impact:** ~ $2.924 trillion
  (Canada – approx. $119 billion incl. parts & assembly)

- **Global Employment:** ~ 8.39 million people
  (Canadian employment is approx. 159,000 people + 350,000 indirect)

- **Global R&D Investments:** > $130 billion/year
  (Canadian investments estimated at $500M-$1B)

- **Global Tax Revenues:** > $666 billion/year
  (Canadian tax revenues estimated $14.93 billion)
The Auto Industry – A Puzzling Giant

- Cost of developing a new vehicle platform = $2-5B
- Vehicle output expected to climb to 75M by 2015
- Growth is expected in China & India (and possibly later in South America)
- Huge companies driven by a few strong personalities
- Strong imperative to be innovative & global in scope
- Driven by government regulation, geopolitical forces and brutal business competition,
- Extremely capital intensive manufacturing plants
- Very conservative business culture
Organization of the Auto Industry

- Original Equipment Manufacturers (OEMs)
- Tier 1 suppliers (sell products directly to OEMs)
- Tier 2 suppliers (sell products to Tier 1’s)
- Tier 3 suppliers (sell products to Tier 2’s)
Downloading Responsibility for RDT&E
The auto industry follows a highly disciplined Product Development Process (PDP)....
Auto Industry – Priorities and Concerns
(survey from the 2003 SAE Congress)
Energy prices are a key concern driving automotive design ...especially these days.
Canada’s Automotive Sector
Canada’s Auto Industry

North American OEM Headquarters
Chrysler – Auburn Hills Michigan
Ford Motor Co. – Dearborn, Michigan
General Motors – Detroit, Michigan
Honda N. Am. – Marysville, Ohio
Toyota N. Am. – Ann Arbor, Michigan
Nissan N. Am. – Farmington Michigan
International Truck – Navistar – Chicago

…plus well over 100 major supplier technology centres (including many leading Canadian companies) are located along the I-75 corridor between the Detroit-Windsor Tunnel and Auburn Hills, Michigan.

All of which are within this little red circle.
Canada’s Unique Challenges

Overcoming our Image

Canada Eh?

The American Way
Canada’s Automotive Research Network
AUTO21 NCE: A network of centres of excellence built on trust, accomplishment & strong partnerships
AUTO21 – Research Program Goals

ENVIRONMENT: Reduce the environmental impact of the manufacture, operation and end-of-life disposal of vehicles.

HEALTH: Enhance the safety of workers, occupants and the public in the manufacture and use of vehicles.

ECONOMY: Enhance the quality & performance of vehicles while reducing life cycle cost.

SOCIETY: Enhance the economic & social benefits derived from the manufacture and use of vehicles in Canada.
Research Themes

A - Health Safety & Injury Prevention
B - Societal Issues
C - Materials & Manufacturing
D - Powertrains Fuels & Emissions
E - Design Processes
F - Intelligent Systems & Sensors
Links to Other Organizations

Auto21
External Partnerships (examples)
Member Institutions (currently 42)
Automotive Powertrains and Design Processes Research
Powertrain Systems Evolution

Key Issues:

- System cost
- Batteries
- Plug-in hybrids
- Ultracapacitors
- ICE efficiency
- PEEM efficiency
- Vehicle safety & dynamics
- LW Materials

Internal Combustion Engine
Otto (gasoline) or Diesel ICE with automatic or manual transmission

Technology Disruption

Hybrid Powertrains
ICE + Electric Drive & Control

Technology Disruption

Fuel Cell Powertrains
+ Electric Drive and Control

TODAY/SOON

NOW / SOON

FUTURE?
Reducing Energy Consumption of Automobiles

*Powertrain – the Prime Mover*

- Optimal solution depends on the driving cycle of the user
  - Cylinder de-activation and/or clean diesels
  - Hybrids with ICE and electric drive and control

Implementation problems if fuel is changed (200,000 fueling stations in North America – trillions in infrastructure investments)

- Technically challenging and expensive to implement.
  - Fuel storage issues, batteries, capacitors, motor efficiency etc.

- Future of powertrains is likely to be very diverse.
  - Increase electrical + information technology content + less installed power and different fuels.

➢ *There are no simple answers and no single solution.*
AUTO21: Project Partnership Model

- Project ideas from private & academic partners.
- Partners define goals:
  - Relevance to industry
  - Academic excellence
  - Benefits to Canada
- Private + public sector funding (AUTO21)
- Solutions to technical problems
- Rights to commercialize intellectual property
- The chance to meet the brightest new people (potential future employees).
AUTO21 – User Sector Interaction Model

Mainly Institutional

Discovery

Commercialization of new knowledge by partners or via the AUTO21 KTTF

Mainly Industrial

Development

Early Deployment

Late Deployment
AUTO21 Research Project Class Models

Discovery Projects:
- highly speculative and risky research possibly requiring development of new knowledge in several fields
- longer term or uncertain prospects for commercialization
- somewhat lower level of external support
  ➢ Main interaction is with research personnel in the partner organization

Development Projects:
- less risky or speculative research with more certainty of direction and predictability of results and with a higher likelihood of commercialization on a shorter timeframe
- increased level of external support
  ➢ Main interaction is with development personnel in the partner organization

Deployment Projects:
- low level of risk or uncertainty of direction and strong likelihood of commercialization likely in a relatively short timeframe
- high level of external support
  ➢ Main interaction is with production personnel in the partner organization
AUTO21 Project Classes – Funding Cycle 1

Figures indicate the proportion of a given research project which falls into an activity category.

All figures from Research Project Leaders (May 2007).
AUTO21 project topology – Collaborative and Coordinated

AUTO21 projects fall into two categories in terms of organizational layout and overall aim:

• Type 1 projects link researchers together with a common interest in a topic but each person works relatively independently with their own partners. (Common Interest)

  These are referred to as **Coordinated Projects**.

• Type 2 projects have a strong linkage among researchers who work on a common task(s) with a common goal, usually with just one or two partners. (Common Goal)

  A good term for these activities is **Collaborative Projects**.
AUTO21 Project Types

Type 1 - Coordinated

Type 2 - Collaborative

Legend

- **Individual Network Researcher**
- **Researcher-Researcher Interactions**
- **Research-Partner Interactions**
- **Individual Partner Designator**
Academic Research & Innovation - Doing Right, Doing it Right and Measuring it
The Economy - Inputs and Outputs

Innovation

\[ \text{Research turns money into knowledge.} \]
\[ \text{Development turns knowledge into products.} \]
\[ \text{Production and Sales turns products back into money which enables the nation to progress.} \]
## Effects Measurement Framework

*– 3 metrics to address 3 audiences*

<table>
<thead>
<tr>
<th>Audience</th>
<th>ACTIVITIES:</th>
<th>OUTCOMES:</th>
<th>IMPACTS:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Academe</td>
<td>statistics reported in academic CV’s</td>
<td>direct results of the research such as patents, process changes, public policies</td>
<td>the effect on the final product</td>
</tr>
<tr>
<td>Partners</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Canadians</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Metric</td>
<td>2001</td>
<td>2007</td>
<td>% Change</td>
</tr>
<tr>
<td>-----------------------</td>
<td>---------</td>
<td>---------</td>
<td>----------</td>
</tr>
<tr>
<td><strong>Annual NCE Grant</strong></td>
<td>$5.778M</td>
<td>$5.8M</td>
<td>+0.37%</td>
</tr>
<tr>
<td><strong>External Partner Support</strong></td>
<td>$3.03M</td>
<td>$5.50M</td>
<td>+81%</td>
</tr>
<tr>
<td></td>
<td>Total = $24.9M (58% cash)</td>
<td>&gt;10% (of total private sector cash support of NCE’s)</td>
<td></td>
</tr>
<tr>
<td>Researchers</td>
<td>193</td>
<td>266</td>
<td>+38%</td>
</tr>
<tr>
<td>Students</td>
<td>163</td>
<td>524</td>
<td>+221%</td>
</tr>
<tr>
<td>Projects</td>
<td>28</td>
<td>41</td>
<td>+46%</td>
</tr>
<tr>
<td>Institutions</td>
<td>27</td>
<td>42</td>
<td>+56%</td>
</tr>
<tr>
<td>Partners*</td>
<td>115</td>
<td>&gt; 130</td>
<td>+13%</td>
</tr>
</tbody>
</table>

*AUTO21 has > 80 private sector partners + over 50 in the public & NGO sectors.
Universities – an underutilized asset in Canada

ANDREW POTTER

Maclean’s – June 12, 2006
Connectedness between universities and society – not a new idea.

“What happens at our universities affects the rest of society.”

“The university is both guardian and servant of the public interest and it cannot remain completely aloof from the rest of society and retain the confidence of society. The universities need to keep in close touch with the workaday world.”

“Common sense and practicality never come amiss, even in universities.”

“Farewell to the Ivory Tower”
J.A. Corry
Principal, Queen’s University
Developing the best people and the best technology for the future of Canada’s automotive industry

www.auto21.ca

www.nce.gc.ca