The Auto Sun is Rising

David E. Cole
Emeritus Chairman
Center for Automotive Research (CAR)

Monahan Endowment Lecture

Wayne State University,
College of Engineering
March 23, 2011

David is to be returned to Italy
A bit of cultural news for a welcome change!
His Proud Sponsors were Fast Food Chains...

Auto Problem

Mostly Revenue – with Depression Level of Sales
GM & Chrysler – Debt Reduction, Lean

Ford: Good & Bad News,
No Bankruptcy but High Debt

All Manufacturers & Suppliers
Have Been Hurt
But, The Sun is Rising Fast

Across the Land – Still
Amazing Level of Ignorance on
Auto Industry
The Perfect Storm

Competent New Players: China, India, …

Benefits
Policy
Money
Materials
Tools
Hyper Competition

Auto Industry

Auto Industry of the Future

A World of Vanishing Boundaries
Economic Contribution of the U.S. Automotive Industry

Auto Manufacturing

Manufacturers . . . . 313,000 + jobs
Parts Suppliers . . . . 686,000 + jobs
R & D Spending . . . $16 + billion

Source: BLS, NBF *Includes NAICS 3361, 3362
Economic Contribution Per Job

Auto Mfr. $329,000
Average Job $112,000

Source: U.S. Census Bureau Annual Survey Manufacturers 2005

Economic Multiplier

Auto Manufacturers – 10
Auto Parts Supplier – 5.7
**Auto Employment**

2010 – modest gains

2011 – 2013 + 100,000 per Year

---

**We Have Been Swimming a River**

That is Getting; Faster, Deeper, & Wider

But!
The Pot of Gold on the Other Side is Getting Larger

- Labor Cost Reduction
- Household Growth
- Pent-Up Demand
- Capacity Reduction
- Scrappage
- Return of Pricing Power

The Challenge:
Getting to the Other Side
But We Have Reached the Shallow Water
Domestics – Unbelievable Shift from about $2,000 Disadvantage to $2,000 Advantage

However, Will It Come Back . . ?
U.S. Light Vehicle Sales Forecast

Source: CSM Worldwide, J.D. Power
U.S. Light Vehicle Sales History and Forecast
Combined J.D. Power and CSM Worldwide Forecast
2007 - 2014

The New Break-even-
10-11 Million Sales
Beware: The Aging of the Boomers.

Demographics

“Boomers go Boom”

- Consumer Behavior
- Socio / Political
- Health Care
- Skilled Workers
- World Issue
Auto Industry -
Thousands of New Jobs – But Only
for the Educated

“This is Auto”

“Building America’s Tomorrow”
The Business Model is Changing Fast.

Old Business Model

- Vertical Integration
- Paper
- Slow
- Physical Prototypes
- Control
- Sequential
- Job for Life
- Kings
- Competition
- Acquisitions
- Structured

- Talk
- Bureaucracy
- Linear
- Lean
New Business Model

Virtual Integration
Paperless
Fast
Virtual Prototypes
People Flow
Coopetition

Listen
Anti-bureaucracy
Collaboration
Lean
Agile
Empowerment
e-enabled
Trust
Team
Parallel
Global
Coaches
Alliances
Flexible

It’s the Team, the Team, the Team
Global Integration - One Company World-wide

- Platforms
- Components
- R & D
- Plants
- Everything

Value of Global Economies of Scale are Huge
**Lean / Agile**

- Investment
- Engineering
- Manufacturing
- Everything

**Knowledge**

The Competitive Edge
Customer Pull  
Cars and Trucks  
Technology Push

Product and Process

Knowledge  
Innovation  
Competitive Advantage

Knowledge Application

Time
Do What You Know

Coming Soon:
“Auto Harvest”
Auto Technology

At the edge of a revolution?
Future Power Plants

- Gasoline
- Diesel
- Hybrid
- Fuel Cell

The Answer – ?

Technological Progress—When to Commercialize

$\text{Current Technology}$

Too early

$\text{Time}$
POWER TECHNOLOGY COMPARISON CHART

<table>
<thead>
<tr>
<th>TECHNOLOGY OPTIONS / COMPARISON PARAMETERS</th>
<th>ADVANCED GASOLINE</th>
<th>CLEAN DIESEL</th>
<th>HYBRID PARALLEL NON-GRID</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost</td>
<td>+$1,000</td>
<td>+$3,000</td>
<td>+$4,000 to +$6,000</td>
</tr>
<tr>
<td>Fuel Economy</td>
<td>+20%</td>
<td>+30%</td>
<td>+20% to +30% (with diesel +50%)</td>
</tr>
<tr>
<td>Non-CO₂ Emissions</td>
<td>Baseline</td>
<td>No₂ and Particulate Problem</td>
<td>-20% to -30%</td>
</tr>
</tbody>
</table>

“BOTTOM LINE”

• Not enough knowledge to pick winners and losers

• Different strategies for different companies

• Alliances necessary to overcome challenges

• Government incentives required…ultimately consumers decide
Coming Fast – Plug-in, Series Hybrids or Extended Range Electric Vehicles

Future Fuels
- Petroleum
- Bio
- Hydrogen
- NH₃

The Answer – ?
Future Gasoline Price –
$ 1.50 – $ 5.00 /gallon
Old Carbon Fuels Will Continue to be Used if they are Economic

2 Key Developments

- Lithium Batteries
- Cellulosic Bio Fuels

The Invention is Here!
Cellulosic Bio Fuels

- Lower Heating Value
- 2010 - 2015 - $1.00/gal?
- Cost Increase for E-85 Vehicle - $100
- Global Impact
- Development not Invention

Lithium Batteries

- 4 x Performance Lead Acid
- Many Chemistries
- Heat a Problem
- Key to Plug-in Hybrids
- Development not Invention
- Cost?
Liquid Energy BTU/ft³

Compressed Gas

Batteries

Challenge for Batteries

Life

Discharge Level
1. Battery Economics

- Manufacturing
- Materials
Life After the Car:  
The Grid!

Developments to Watch

- Vehicle/Infrastructure Integration
- Auto/Utility Integration
Climate Change – Divisive Conservation - Collaborative

Future Direction

It’s All a Matter of Economics
Success Factors

- Risk
- Obsolete Own Products
- Tough Problems
- Systems
- Knowledge
- Collaboration

World Class is a Moving Target