OPPORTUNITIES FOR ADVANCED TECHNOLOGY POLYOLEFINS IN AN IMPLODING AUTO SUPPLY CHAIN

PRESENTED BY:
Bob Eller, President
Robert Eller Associates, Inc.
Phone: 330 670 9566
bobeller@prodigy.net
www.robertellerassoc.com

PREPARED FOR:
POLYOLEFINS ’06
HOUSTON, TX
FEBRUARY 27, 2006
Bob/mydox/paper/PO 06.ppt
OUTLINE

• OPERATING HYPOTHESES
• CURRENT STATE OF THE AUTO INDUSTRY
• INDUSTRY STRUCTURE SHIFTS
• THE IMPLODING SUPPLY CHAIN
• ADVANCED TECHNOLOGY POLYOLEFINS AND THEIR CURRENT/POTENTIAL ROLE
• ROLE OF FABRICATION TECHNOLOGY
• EUROPE AND N. AMERICA COMPARED
• FUTURE VIEW
OPERATING HYPOTHESES

• THE SUPPLY CHAIN WILL BE RESHAPED
• VEHICLE PRICE DECLINES CONTINUE
• “HIGH” N.A. FUEL PRICES CONTINUE
• NET TECHNICAL INFLOW TO U.S. CONTINUES
• MATERIALS/PROCESS TECHNOLOGY IS A PATH TO ADDING VALUE
• FLEET COMPOSITION ADAPTS TO ECONOMIC PRESSURES
• MANUFACTURING SHIFT TO ASIA
• GLOBAL QUALITY STANDARDIZATION
CURRENT/FUTURE STATE OF THE AUTO INDUSTRY

- GLOBAL PRODUCTION DEMAND GROWTH APPROX. 3%/YR. THROUGH 2012
- GLOBAL DEMAND HISTORY +/- 5% OFF TREND LINE SINCE 1970 DESPITE GLOBAL CRISES
- GLOBAL VEHICLE AND SUPPLIER OVERCAPACITY
- STAGNANT U.S./EUROPE DEMAND
- DEMAND GROWTH SHIFT TO ASIA PACIFIC
- MINI/SMALL CAR (B SEGMENT) SHARE GAIN GLOBAL AND U.S.
- GROWTH OF DOMESTIC ASIA PACIFIC OEMs
- SHARE LOSS BY U.S./EUROPEAN DOMESTIC OEMs
GLOBAL LIGHT VEHICLE PRODUCTION TREND LINE

- 2011 GLOBAL SALES COULD REACH 75MM UNITS
- GLOBAL AAG = 3%/YR.
- ASIA PACIFIC GROWTH 5-6%/YR.?
- WESTERN GROWTH STAGNANT OR DECLINE
- GLOBAL FLEET SHIFT TOWARD SMALLER CARS
- VARIATIONS HAVE BEEN IN +/- 5% BAND SINCE 1970
AUTO MANUFACTURING SHIFTS TO LOW COST REGIONS

THE CHINA EFFECT:

• MAJOR SHARE GAIN (2X FROM 2005-2010)
• GROWTH OF SMALL CAR PRODUCTION
  – INEXPENSIVE PEOPLE CARRIERS (SMALL VANS, BUSES) FOR EXPORT TO EMERGING DOMESTIC MARKETS
  – SYRIA CURRENTLY MAJOR EXPORT TARGET
  – $5,000 TARGET PRICE
• RESIN SUPPLIER, CMPD’R., TIER 1 SHIFT STARTED CAUTIOUSLY
GROWTH OF AUTO MANUFACTURING SHIFTS TO LOW COST REGIONS

THE CHINA EFFECT:

• CHINA POWER GAIN IN MIDDLE EAST?
• GEELY/CHERY IN U.S./EUROPE? IN 2008
• DOWNTURN OF CHINA DOMESTIC MKT. WILL STIMULATE VEHICLE EXPORTS
• KITS WILL HAVE SIGNIFICANT SHARE
• WULING (GM), CHANG’AN (FORD JV) ARE SMALL CAR LEADERS
• GOVERNMENT ROLE
LIGHT VEHICLE PRODUCTION SHIFT, 1997-2011

SOURCE: ROBERT ELLER ASSOCIATES, INC., 2006
AN INEFFICIENT INTERIOR SUPPLY CHAIN WILL:

• SEE INTENSIFIED GLOBAL COMPETITION
• FURTHER GLOBALIZE
• FURTHER CONSOLIDATE
• FLATTEN
• INCREASE ASIA PRESENCE (AND FACE PARALLEL SUPPLY CHAIN)
• ACCELERATE EUROPE/N. AMERICA TECHNICAL/STRUCTURAL CONVERGENCE
• SEEK TECHNOLOGY SOLUTIONS TO THE PROFIT SQUEEZE
AUTOPLASTIC SUPPLY CHAIN IMPLOSION

PETROCHEM PRICE INCREASES
GLOBAL COMPETITION

OFFSHORE COMPETITION

HARDBALL PURCHASING PRESSURES
IMPORTED COMPETITORS
RAW MATERIAL PRICE INCREASES

VEHICLE PRICE DECREASES
FUEL COSTS (PROD. LINE FIT)

LEGACY COSTS, LABOR PRESSURES

RAW MATERIALS

COMPOUNDER

MATERIALS TECHNOLOGY LAG

PRICE COMMODITIZATION

SHIFT TO MORE ATTRACTIVE MARKETS

TIER 1 FABRICATOR

PROCESS TECHNOLOGY LAG

ELIMINATION OF EXTRA STEPS

TIER 2, 3 SUPPLIERS

MARKET SHARE LOSS

OVER CAPACITY

STOCKHOLDER PRESSURES

ASSEMBLY

PRESSURES PASSED DOWN THE SUPPLY CHAIN:

- PRICING PRESSURES
- SUPPLY CHAIN "MANAGEMENT"
- DEMAND SLOWDOWN
- REVISED SPECIFICATIONS
- GLOBALIZATION PRESSURES

ELIMINATE/REDUCE THE INEFFICIENCIES:
- MULTIPLE STEPS
- EXCESSIVE LOGISTICS
- SCRAP GENERATION
- INEFFECTIVE PROCESS TECHNOLOGIES
- SALES/MARKETING COSTS
- EXCESS LABOR COSTS
- OVER-GLOBALIZATION?

SOURCE: ROBERT ELLER ASSOCIATES, INC., 2006

re/mydox/tpecmcll/SPETPO05-implosion.vsd
lg/myfiles/visio/SPETPO05-implosion.vsd
POLYMER TECHNOLOGY, INFORMATION TECHNOLOGY
MACROECONOMIC INFLUENCES ON AUTOMOTIVE POLYOLEFINS

POLYOLEFIN TECHNOLOGIES:
- Resin
- Comp'dg.
- Fabricationtechnology
- Proliferation

- Broadened product envelope
- Lower systems costs
- Industry structure shift

End User Market, Macroeconomic Trends:
- Mfg. shift to lower cost countries (Asia, E.E., etc.)
- Entry of new countries into global mkt. economy
- Enlargement of global consumer class (3->6BN)
- Emergence of new worker class (+1.5BN)
- Relatively stagnant/slowed growth in Western economy
- Severe downward OEM price pressures
- Demand shift to newly industrialized countries
- Demand driven raw mat'l. price increases

Rubber Sector:
- Slow innovation in polymer technology
- Fabrication technology
- Very limited investment
- Low R&D levels

Global Market Structure/Macroeconomic Changes:
- Global horizontal collaboration replacing vertical chain of command & mkt. structure
- Supply chain restructure
- Global perf. standards
- Mfg. base shift (Eastward)
- Emergence of new, locally controlled OEM mfg.
- Shift in role of sales/mktg.
- Cont'd. OEM global mkt. consolidation? (b)
- Outward flow of profits from newly industrialized countries toward Western investment
- Increased terrorism
- Supply chain manipulation by major global OEMs

Polyolefin Effects:
- Sharp increase in rubber mkt. penetration by TPEs
- Demand shift Eastward
- Slow growth of Western markets
- Trend toward higher value POs in Western markets
- PO supply chain consolidation
- Industry structure shift
- Emergence of new, locally controlled resin and PO compound producers (a)
- Net global PO demand increase
- Shift toward new PO technologies

Notes: (a) A new parallel supply chain challenging the position of established Western polyolefin suppliers
(b) Partially offset by emergence of new, local competition in newly industrialized regions

ROLE OF ECONOMIC PRESSURES

• HIGH LABOR COSTS (N.A./EUROPE)
• RECENT RAW MATERIAL COST INCREASE SQUEEZE TIER 1s
• SHIFTS TOWARD MATERIALS AND TECHNOLOGIES CAPABLE OF MEETING REDUCED COST TARGETS
• EUROPEAN, N. AMERICAN AND JAPANESE INTERIOR TECHNOLOGY CONVERGENCE
• SUV PROFITABILITY LOSS IN N. AMERICA:
  – RENEWED WEIGHT SAVE INCENTIVE
  – PRESSURE FOR SMALLER VEHICLES
NEW TPE COMPETITORS, TECHNOLOGIES, AND TARGETS

PLASTOMERS

TPEs

OLEFINIC (α-TPEs)

STYRENIC (SBCs)

SUPER-TPVs

PVC TPEs

E-TPEs

TPO

TPV

HYDROGENATED (SEBS, SEPS)

SEBS ALLOYS/ BLENDS

SBC-BASED TPVs

SILICONE

ACRYLATES

FLUORO- ELASTOMERS

TPU

COPE

COPA

OTHERS

E-TPEs

p-TPV (PARTIAL CROSSLINKED)

f-TPV (FULLY CROSSLINKED)

BROADENED APPLICATION RANGE -- SKINS, AIRBAG DOORS

-BROADER USE OF METALLO ELASTOMERS
-IMPROVED ADHESION
-INCREASED SOFTNESS
-IMPROVED FOAM TECHNOLOGY
-NANO TPVs

SOURCE: ROBERT ELLER ASSOCIATES, INC., 2006
VALUE CREATION VIA MATERIALS

• IMPROVED REACTOR-TPOs
• POLYOLEFIN SUBSTITUTION FOR ETPs
• COATINGS ELIMINATION
  – IMPROVED MOLDED-IN COLOR
  – IMPROVED SCRATCH/MAR RESISTANCE
• PLASTOMER/HMS-PP COMBINATIONS
• FOAM QUALITY IMPROVEMENT
• SKIN/FOAM COEXTRUSION
• EPP & EPE/PS BEAD FOAMS
  – SEATING, DOOR TRIM, FLOOR
  – TEXTILE/FOAM COMBINATIONS
• GROWTH ROLE FOR HMS-PP
MAT’LS TECHNOLOGY (CONT’D.)

- ADVANCED TECHNOLOGY NONWOVENS POISED FOR GROWTH
  - MICRODENIER, BICOMPONENT
- ENHANCED ROLE FOR PLASTOMERS:
  - EPDM SUBSTITUTION (TPO)
  - LCB EAOs/HMS PP COMBINATIONS
    CHALLENGE p-TPVs
  - FIBERS (MICRO-DENIER, ELASTIC)
  - FILMS?, FOAMS
- FOAM QUALITY IMPROVEMENT
- SKIN/FOAM COMBINATIONS
- EPP BEAD FOAMS (SEATING, TEXTILE/FOAM)
- SBC-TPVs ENTERING(CHALENCE O-TPVs)
- MONO-MATERIALS CONSTRUCTIONS
INCREASED PLASTOMER ROLE

• LONG CHAIN BRANCHING:
  – POOR MAN’S CROSSLINKING
  – SKINS/THERMOFORMED APPLICATIONS

• TPO BUMPER FASCIA

• HIGH PROPYLENE PLASTOMER GRADES:
  – HIGH ELASTICITY TPO APPLICATIONS
  – COATED FABRICS?
  – FOAMS?
  – ELASTIC NONWOVENS
VALUE CREATION : FABRICATION TECH.

• 2 SHOT MOLDING
• RIGID/FLEXIBLE COMBINATIONS
• DIRECT COMPD’G (GF, FILLED, TPO?)
• CO-PROCESSING:
  - CO-BLOW
  - CO-INJECTION
  - COEXTRUSION
  - PROFILE EXTRUSION
• ON-BOARD FUNCTIONS (ACOUSTIC, ENERGY ABSORB)
• MONO-MATERIALS CONSTRUCTIONS
• THERMOFORMING
## SOME INTERIOR COMPETITIONS

<table>
<thead>
<tr>
<th>MODULE</th>
<th>COMPETITORS</th>
</tr>
</thead>
<tbody>
<tr>
<td>FLOOR, HEADLINER</td>
<td>- FOAM VS. FIBER</td>
</tr>
<tr>
<td></td>
<td>- LT. WT. COMPOSITES VS. FOAM</td>
</tr>
<tr>
<td></td>
<td>- PET VS. PP NONWOVENS</td>
</tr>
<tr>
<td>HEADLINER “A” SURFACE</td>
<td>- NW VS. KNIT</td>
</tr>
<tr>
<td>HEADLINER SUBSTRATE</td>
<td>- PU FOAM VS. NW, PO FOAM</td>
</tr>
<tr>
<td></td>
<td>- PU FOAM VS. LT. WT. COMPOSITES</td>
</tr>
<tr>
<td>SKIN</td>
<td>- THERMOFORM VS. 2-SHOT</td>
</tr>
<tr>
<td></td>
<td>- SLUSH VS. SPRAY</td>
</tr>
<tr>
<td>ACOUSTICS</td>
<td>- FOAM VS. FIBER</td>
</tr>
<tr>
<td>ENERGY MGT.</td>
<td>- FOAM VS. R-TPO</td>
</tr>
<tr>
<td></td>
<td>- R-TPO VS. C-TPO</td>
</tr>
</tbody>
</table>
(CONT’D.)

SOME INTERIOR COMPETITIONS

<table>
<thead>
<tr>
<th>MODULE</th>
<th>COMPETITORS</th>
</tr>
</thead>
<tbody>
<tr>
<td>AIRBAG DOORS</td>
<td>- SEBS VS. TPO &lt;br&gt; - r-TPO VS. SEBS, c-TPO &lt;br&gt; - SINGLE VS. 2-SHOT</td>
</tr>
<tr>
<td>TRIM</td>
<td>- PAINT VS. IN-MOLD DECORATION &lt;br&gt; - PAINT VS. MOLDED-IN COLOR</td>
</tr>
<tr>
<td>DOOR TRIM</td>
<td>- INJECTION VS. THERMOFORM &lt;br&gt; - WOOD FIBER FILLED VS. TALC</td>
</tr>
<tr>
<td>SEATING</td>
<td>- LEATHER VS. TEXTILE &lt;br&gt; - LEATHER VS. LUX. COATED FABRICS</td>
</tr>
<tr>
<td>COATED FABRIC</td>
<td>NO OLEFINIC SUCCESS VS. PVC YET</td>
</tr>
</tbody>
</table>

SOURCE: ROBERT ELLER ASSOCIATES, INC., 2006
TYPICAL GLASS RUN CHANNEL CROSS-SECTION

NOTE:
(a) USUALLY FILLED PP

SOURCE: ROBERT ELLER ASSOCIATES, INC., 2006
Body Seal Example: Rear tailgate seal

Model: Jeep Cherokee

Manufacturer: Major Body Seal Tier 1

Material Type: EPDM Compound

Note: Foamed (sponge)/Solid (dense) Combination
# RUBBER SUBSTITUTION STATUS

<table>
<thead>
<tr>
<th>APPLICATION</th>
<th>STATUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>BODY/ GLAZING SEALS</td>
<td>- STARTED WILL GROW - HIGH POTENTIAL</td>
</tr>
<tr>
<td>HOSE</td>
<td>- NO SIGNIFICANT PENETRATION YET</td>
</tr>
<tr>
<td>BELTS</td>
<td>- UNLIKELY PENETRATION</td>
</tr>
<tr>
<td>BOOTS/ BELLOWS/ DUCTING</td>
<td>- SUBSTANTIAL PENETRATION - SHIFT TO HIGHER PERF. TPEs?</td>
</tr>
<tr>
<td>GROMMETS, BUMPERS, GASKETS</td>
<td>- STARTED</td>
</tr>
</tbody>
</table>
Manufacturer: Valeo
TPV Type: TPV
Manufacturer Location: Europe
Note: Example of boots/bellows and EPDM replacement.
Product: Airbag door  
Material Type: TPO (non-crosslinked)  
Note: Front and rear views
Product: Fan shroud
Manufacturer: Sur-Flo
Material Type: TPV (Nexprene)
TPE Supplier: Solvay Engineering Polymers
Note: Used in Dodge Ram HD pickup
Product: Crank case ventilation hose
TPE Grade Name: DuPont™ ETPV
Material Type: s-TPV
Process: Coextrusion
Status: Concept
Key Features: Blow-by gas resistance
Product: Current TSR air brake hose
Application: Class 6, 7, & 8 heavy truck
Manufacturer: Paccar/Goodyear
Note: Fiber reinforced
Product: Seamless passenger airbag lid
Vehicle: Honda Civic 2006
Material Type: Mitsubishi Chemical AP15 TPO
Process: Injection molding directly into soft thermoformed TPO skin, no paint, all plastic
Fabricator: Visteon
HOW TO CAPTURE VALUE

• TARGET SYSTEMS COST SAVINGS
• AVOID REGIONAL PERSPECTIVE LIMITATIONS
• TAKE FROM E/E, EXTERIORS
• SHORTEN THE SUPPLY CHAIN (RESIN SUPPLIER ROLE?)
• LOWER COST MATERIALS
  – R-TPOs CREATING OPPORTUNITIES
  – METALLOECNE/HMS PP COMBINATIONS
  – NONWOVENS
  – FOAMS
CAPTURING VALUE (CONT’D)

• FABRICATION TECHNOLOGIES
  – 2-SHOT MOLDING/LOW PRESSURE MOLDING
  – MONOMATERIALS CONSTRUCTIONS
  – ON-BOARD FUNCTIONS (ACOUSTIC, ENERGY ABSORPTION, STRUCTURE)
  – DIRECT COMPOUNDING/FABRICATION
  – THERMOFORMING

• ADVANCED TECHNOLOGY NONWOVENS POISED FOR GROWTH IN:
  - FACE FABRICS
  - FABRIC/FOAM COMBINATIONS
  - ACOUSTICS
  - SEMI-STRUCTURAL COMPOSITES
Specialty Thermoplastic Elastomers . . . Markets, Economics, Technology, Intermaterials Competition

A Europe/U.S./Japan Multiclient Industry Analysis
ROBERT ELLER ASSOCIATES, INC. January 2006
Automotive Interior Soft Trim: Skins, Foams, Coated Fabrics, Textiles, and Acoustic Barriers

Prospectus for a Global Multiclient Industry Analysis
Robert Eller Associates, Inc.
Opportunities for Advanced Technology
Nonwovens for Automotive Surface and Construction Applications in N. America and Europe
A Multiclient Study

AUTOMOTIVE NONWOVENS AND TEXTILES MARKETS

COATED FABRICS
LEATHER
ARTIFICIAL LEATHER
WOVEN/KNIT TEXTILES
NEW LIGHTWEIGHT ACOUSTIC FIBERS
FOAMS (COMPETITION/COMPLEMENT)
NONWOVEN FACINGS
BATTING (SHODDY, FELT)

January 2005