AUTOMOTIVE INTERIORS TECHNOLOGY RESPONSES TO ECONOMIC AND GLOBALIZATION PRESSURES
PRESENTATION OBJECTIVES

• IDENTIFY MACRO-ECONOMIC EFFECTS ON AUTOMOTIVE INTERIORS

• EXAMINE AUTOMOTIVE SUPPLY CHAIN TURBULENCE EFFECTS

• IDENTIFY THE DRIVING FORCES FOR AUTOMOTIVE INTERIORS SUBSTITUTION

• PROVIDE AN OVERVIEW OF CURRENT/FUTURE INTERIORS TECHNOLOGIES

• EXAMINE THE PLASTIC RESIN FABRICATION TECHNOLOGY COUPLE
U.S. REAL GDP GROWTH

SOURCE: ROBERT ELLER ASSOCIATES LLC, 2008

b/mydox/Auto Industry/US Vehicle Sales.xls
U.S. DOLLAR DECLINE

TRADE-WEIGHTED VALUE OF U.S DOLLAR

March 1973 = 100

SOURCE: FEDERAL RESERVE BOARD
R/mydox/papers/ATI 08.ppt
GLOBAL VEHICLE SALES OUTLOOK

Annual Growth
1990-2000  2.3%
2000-2006  2.8%
2006-2012  3.8%

Veh. Sales, MM Units

0  10  20  30  40  50  60  70  80  90

GENERAL MOTORS
R/mydox/papers/ati 08.PPT
### U.S. GDP GROWTH RATE & VEHICLE PRODUCTION

<table>
<thead>
<tr>
<th>YEAR</th>
<th>GDP GROWTH RATE, %</th>
<th>N. AMERICAN VEHICLE PROD'N., MM UNITS</th>
<th>Y/Y PROD'N. DECLINE/ GAIN, %</th>
<th>NOTE/EXAMPLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>0.8</td>
<td></td>
<td></td>
<td>9/11 attack</td>
</tr>
<tr>
<td>2002</td>
<td>1.7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2003</td>
<td>2.4</td>
<td>16.3</td>
<td>41.2</td>
<td></td>
</tr>
<tr>
<td>2004</td>
<td>3.7</td>
<td>16.3</td>
<td>0.0</td>
<td></td>
</tr>
<tr>
<td>2005</td>
<td>3.1</td>
<td>16.4</td>
<td>0.6</td>
<td>Profitability decline</td>
</tr>
<tr>
<td>2006</td>
<td>2.9</td>
<td>15.9</td>
<td>-3.0</td>
<td>Profitability decline, bailouts, consolidation</td>
</tr>
<tr>
<td>2007</td>
<td>2.2</td>
<td>15.5</td>
<td>-2.5</td>
<td>Profitability decline, bailouts, consolidation</td>
</tr>
<tr>
<td>2008</td>
<td>1.5</td>
<td>14.5</td>
<td>-6.9</td>
<td>Profitability decline, credit difficult to obtain, further acq’ns. of distressed suppliers</td>
</tr>
<tr>
<td>2012</td>
<td>16.3?</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Sources: IMF, Ward's, Robert Eller Associates LLC, 2008
REGIONAL AUTO MARKET GROWTH

VEHICLE SALES HISTORY BY REGION, 2000-2007

<table>
<thead>
<tr>
<th>Region</th>
<th>2000</th>
<th>2007</th>
<th>CAGR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Global</td>
<td>6.9%</td>
<td>-0.6%</td>
<td>3%</td>
</tr>
<tr>
<td>Europe</td>
<td>1.9%</td>
<td>10.4%</td>
<td>6.9%</td>
</tr>
<tr>
<td>Total AP</td>
<td>3%</td>
<td>21.3%</td>
<td>-0.6%</td>
</tr>
<tr>
<td>Total NA</td>
<td>10.4%</td>
<td>13.2%</td>
<td>1.9%</td>
</tr>
<tr>
<td>Total LA</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>China</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>India</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
</tbody>
</table>

SOURCE: ROBERT ELLER ASSOCIATES LLC, 2008
R/mydox/papers/ATI 08.ppt
7MM NEW VEHICLES ARE EXPECTED TO COME FROM CHINA, INDIA AND THAILAND BY 2012.

SOURCES: CSM; ROBERT ELLER ASSOCIATES LLC, 2008
FUEL EFFICIENCY REQUIREMENTS WILL DRIVE SUBSTITUTION

GAS PRICES vs. FUEL EFFICIENCY (2007)

<table>
<thead>
<tr>
<th>Country</th>
<th>Core Gasoline</th>
<th>Taxes Added</th>
</tr>
</thead>
<tbody>
<tr>
<td>U.S.</td>
<td>$2.71</td>
<td>$0.40</td>
</tr>
<tr>
<td>JAPAN</td>
<td>$2.36</td>
<td>$1.88</td>
</tr>
<tr>
<td>EUROPE</td>
<td>$2.03</td>
<td>$4.11</td>
</tr>
</tbody>
</table>

SOURCE: AUTO NATION
r/mydox/papers/ATI08-FUEL.xls
N. AMERICAN VEHICLES HAVE GAINED WEIGHT, INCREASED HORSEPOWER, AND NOT IMPROVED FUEL EFFICIENCY (MPG) OVER THE LAST 20 YEARS

SOURCE: EPA
R/mydox/papers/ACS08-FUEL.xls
R/mydox/papers/ATI 08.ppt
U.S. VEHICLE FLEET COMPOSITION SHIFT, 2006-2007

- FULL-SIZE SUV, -15%
- STD FULL-SIZE CAR, -24%
- FULL-SIZE MPV, -18%
- MID-SIZE PICKUP, -16%
- STD SPECIALTY, -11%
- COMPACT, +4%
- FULL-SIZE CROSSOVER, +69%
- MID-SIZE CROSSOVER, +74%
- STD MID-SIZE, +8%
- COMPACT SUV, +24%

SOURCE: ROBERT ELLER ASSOCIATES LLC, 2008
FLEET TRENDS: AUTOPLASTICS IMPACTS

“In Geneva, the focus was on the U.S. – how to cope with the currency crunch and adapt Europe’s green technology in a country headed for $4 gasoline.” AUTO NEWS, 3-10-2008

“As automakers feel heat from environmental movement, engineers find solutions that are quick, clean and cheap.” AUTO NEWS, 3-10-2008

“U.S. Auto Makers Show European Flair”
WSJ 3-25-2008

“As dollar dives, automakers juggle global strategies.” AUTO NEWS, 3-10-2008

“Cheaper small cars are part of VW’s U.S. plan.” AUTO NEWS, 3-10-2008

SOURCE: ROBERT ELLER ASSOCIATES LLC, 2008
### EUROPEAN SMALL CARS ARE PP INTENSIVE

<table>
<thead>
<tr>
<th>VEHICLE</th>
<th>PP (kg)</th>
<th>PP/PLASTICS (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Citroen C4</td>
<td>90</td>
<td>56</td>
</tr>
<tr>
<td>Toyota Aygo</td>
<td>47</td>
<td>52</td>
</tr>
<tr>
<td>Toyota Auris</td>
<td>71</td>
<td>51</td>
</tr>
<tr>
<td>Toyota Yaris</td>
<td>64</td>
<td>47</td>
</tr>
<tr>
<td>Opel Corsa</td>
<td>65</td>
<td>44</td>
</tr>
<tr>
<td>Ford Mondeo</td>
<td>72</td>
<td>41</td>
</tr>
<tr>
<td>Fiat 500</td>
<td>60</td>
<td>49</td>
</tr>
<tr>
<td>Mercedes C-Class</td>
<td>72</td>
<td>34</td>
</tr>
</tbody>
</table>

Source: Mavel
# KEY AUTOMOTIVE TRENDS & DRIVING FORCES

<table>
<thead>
<tr>
<th>TREND</th>
<th>AUTOPLASTICS IMPACT</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dollar weakness</strong></td>
<td>- Foreign investment in N. America (state wealth, plastics fabricators)</td>
</tr>
<tr>
<td></td>
<td>- Increased U.S. vehicle exports</td>
</tr>
<tr>
<td><strong>Stagnant Western auto growth/rapid non-West. auto growth</strong></td>
<td>- Investment in non-Western regions by U.S. Tier 1s</td>
</tr>
<tr>
<td></td>
<td>- Reluctant U.S. capex by U.S. Tier 1s</td>
</tr>
<tr>
<td></td>
<td>- Plastics suppliers invest in non-Western regions</td>
</tr>
<tr>
<td><strong>Raw material price increase</strong></td>
<td>- Tier 1/compounder profitability squeeze</td>
</tr>
<tr>
<td></td>
<td>- TPO preference</td>
</tr>
<tr>
<td></td>
<td>- Optimize material efficient solutions</td>
</tr>
<tr>
<td></td>
<td>- Fabrication technology optimization trend (reduced unit operations, scrap reduction)</td>
</tr>
<tr>
<td></td>
<td>- Petrochem investment shift to monomer-rich regions (asset light strategies)</td>
</tr>
<tr>
<td></td>
<td>- Autoplastics supply chain consolidation</td>
</tr>
<tr>
<td><strong>Fuel efficiency pressures</strong></td>
<td>- U.S. fleet shift toward PP intensive vehicles</td>
</tr>
<tr>
<td></td>
<td>- Light-weight solutions gain share</td>
</tr>
<tr>
<td><strong>Cont’d. U.S. domestic OEM share loss</strong></td>
<td>- Japanese/European/Korean Tier 1 and TPE compounder share gain</td>
</tr>
</tbody>
</table>

SOURCE: ROBERT ELLER ASSOCIATES LLC, 2008
PETROCHEM PRICE INCREASES
GLOBAL COMPETITION
OFFSHORE COMPETITION
IMPORTED COMPETITORS
RAW MATERIAL PRICE INCREASES
FUEL COSTS (PROD. LINE FIT)

VEHICLE PRICE DECREASES

LEGACY COSTS, LABOR PRESSURES

SOURCE: ROBERT ELLER ASSOCIATES LLC, 2008
SUPPLY CHAIN SHIFT/
FLEET COMPOSITION EFFECTS

- Supply chain implosion drives resin/compound/fabrication/technical innovation (restraining effect of cash/profitability crunch)
- Resin suppliers forward integration to compounding?
- Tier 1s shifting to in-line compounding
- Expanding resin property envelopes
- Strengthening of Japanese resin suppliers/compounders in N. America and Europe
- Renewed growth of European compounders in N. America ($ weakness driver?)
EXAMPLE TECHNOLOGY SHIFTS IN AUTO INTERIORS

- Multi-component molding (several processes)
- In-line compounding (ILC, DLFRT, IMC)
- Interior semi-structural substitutions
- Elimination of IP cross-car beam?
- Thermoplastic elastomer (TPE) growth (olefinic and styrenic)
  - Styrenic TPE vs. olefinic TPE for airbag doors
  - Body seal substitution for EPDM rubber
- Growth of injection molded foams
- Increased use of single compound for multiple interior and exterior components (Fiat 500 example)
- Innovation in rear storage area
- Continued substitution for thermoset rubbers
- Lighting innovation
- Plastic glazing effects
NEW HIGH GROWTH TPE FABRICATION TECH.: LARGE-PART, 2-SHOT MOLDING

CURRENT PROCESS

COMPOUNDING

MAKE SKIN

TRIM SKIN

TRIMMED SKIN

SCRAP

PU FOAM FORMULATION

BACK-FOAM

SUBSTRATE

MOLD SUBSTRATE

TRIM

NON-RECYCLABLE SCRAP

DOOR TRIM OR INSTRUMENT PANEL

ASSEMBLY

- LABOR INTENSIVE
- HIGH SCRAP
- MULTI STEP

2-SHOT

TPE COMPOUND (CAN BE FOAMABLE)

SHOT 1

SHOT 2

3-LAYER DOOR TRIM OR INSTRUMENT PANEL

ASSEMBLY

- LOW LABOR
- LOW SCRAP
- SINGLE STEP

- 1-2 CLOSELY RELATED MATERIAL FAMILIES
- EASILY RECYCLED
- HIGH CRAFTSMANSHIP

SOURCE: ROBERT ELLER ASSOCIATES LLC, 2008
R/mydox/papers/ATI 08.ppt
2-Shot Molded Door Medallion

Vehicle: Dodge Caliber ('07)
Molder: Lear
Material: Thermoplastic Elastomer On PP
<table>
<thead>
<tr>
<th>Part:</th>
<th>Instrument Panel Upper</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skin Compound:</td>
<td>COPE (Foamed Pibiflex from P Group)</td>
</tr>
<tr>
<td>Substrate:</td>
<td>PBT/ASA (Ultradur\textsuperscript{R} S4090IGX from BASF)</td>
</tr>
<tr>
<td>Injection Machine:</td>
<td>Engel</td>
</tr>
<tr>
<td>Foam Technology:</td>
<td>Trexel</td>
</tr>
</tbody>
</table>

**SOURCE:** ROBERT ELLER ASSOCIATES LLC, 2008
2-SHOT, SOFT TOUCH BROADENS APPLICATIONS

Vehicle: Chrysler Jeep Liberty '08
Skin: Localized TPE soft touch
Process: 2-shot
Tier 1: IAC
Product: Fan shroud
Manufacturer: Sur-Flo
Material Type: TPV (Nexprene)
TPE Supplier: Solvay Engineering Polymers
Note: Used in Dodge Ram HD pickup
Two approaches: Fluid transfer and melt breakthrough

Competition: 3D sequential co-extrusion blow molding

Developer: IKV (Germany)

e.g. mat'l's.: PP (hard segment) + TPE (soft segment)

Initial example applications: cooling ducts, air intakes
IN-LINE COMPOUNDING (ILC)

• Competes with glass mat thermoplastic (GMT)
  - ILC generally has better properties

• Example current/potential applications:
  - Seat pans/backs
  - Door hardware module/door carrier
  - Hatchback inner panel
  - IP carrier
  - Rear trunk module
    -- load floor
    -- spare tire well
  - Underbody shields
## ILC PROPERTIES vs. LGF PELLETS

<table>
<thead>
<tr>
<th>PROPERTY</th>
<th>UNITS</th>
<th>ILC-PP</th>
<th>LGF-PP</th>
<th>% GAIN FOR ILC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tens. Mod.</td>
<td>GPA</td>
<td>9.7</td>
<td>9.8</td>
<td>-1</td>
</tr>
<tr>
<td>Flex. Mod.</td>
<td>GPA</td>
<td>8.1</td>
<td>8.2</td>
<td>-1</td>
</tr>
<tr>
<td>Tens. Str.</td>
<td>MPA</td>
<td>145</td>
<td>113</td>
<td>+28</td>
</tr>
<tr>
<td>Flex. Str.</td>
<td>MPA</td>
<td>201</td>
<td>161.3</td>
<td>+25</td>
</tr>
<tr>
<td>Notched Izod</td>
<td>KJ/M²</td>
<td>33</td>
<td>22</td>
<td>+50</td>
</tr>
</tbody>
</table>

Source: Husky
IN-LINE COMPOUNDING: CURRENT STATUS

- Example of efficient supply chain response
- Starting with GF reinforced resins
- Competes with LGF-PP, concentrates, GMT
  - ILC generally has better properties
  - ILC raw material cost, process cost save vs. LGF-PP
  - Equipment costs 50-75%> conventional injection
  - Large parts (<5 lbs.) favor ILC
  - LGF-PP has 80-85% market share
- 3 equipment suppliers competing (Krauss Maffei in lead)
- Example interior applications:
  - Seat pans/backs
  - Door hardware module/door carrier
  - Hatchback inner panel
  - IP carrier
  - Rear trunk module
Vehicle: Mercedes C-Class
Weight: 4.3 kg
Substitution drivers:
- Impact strength for crash resist.
- Ability to integrate shape features
- Corrosion resistance

Mat'l.: GMT-PP combination (random glass mat & fabric)
Vehicle: Mercedes A-Class
Material: Abaca fiber/PP
Substitution drivers:
- Good stiffness weight balance
- Green solution
- Energy saving (natural fiber vs. glass roving)
CARGO MGT.: INNOVATION TARGET ZONE

Vehicles: Ford: Escape, Mariner, Tribute
Cover: Blow molded PP
Well Structure: Expanded PP foam
Surface: Molded-in carpet

BIOPOLYMER CANDIDATES

• Natural Fibers:
  - vegetable (bast, kenaf, leaf, fruit, wood)
  - animal (wool, hair)
  - mineral (long/short glass mats, basalt)
  - carbon fibers (high-end applications)

• Polylactic Acid (PLA)

• Soy (Ford seating)
RECENT TOYOTA BIOPOLYMER ACTIVITY

- Past Kenaf use: in 27 (mostly high end) models since 2000
- Recent Kenaf commitment:
  - Toyota Boshoku starting integrated production facility in Indonesia from seeds through molded parts
  - Joint development with Indonesian Tobacco and Fiber Crops Research Institute (ITFCRI)
  - Key challenges are
    -- stabilization of quality
    -- cost efficiencies via volume production
- Seed quality is key
  -- stable crop yields
  -- ability to grow in arid regions
BIOPOLYMER CANDIDATES FOR AUTOMOTIVE APPLICATIONS

BIOPOLYMERS

- MATRIX
  - HC-BASED (E.G., PP)
  - BIOPOLYMER
    - PLA
    - POLYAL-KANOATE
    - SOY

- FIBERS
  - NATURAL
    - VEGETABLE
      - FLAX
      - SISAL
      - COTTON
      - COCONUT
      - PINE
      - OTHERS
    - ANIMAL
      - VEGETABLE (E.G., WOOL, HAIR)
      - ANIMAL (E.G., WOOL, HAIR)
  - MINERAL
    - CARBON
  - SYNTHETIC
    - HC-BASED
    - BIO-BASED (BIOFIBERS)
      - VIRGIN
      - REGENERATED
      - PLA
      - POLYAL-KANOATE

BAST FIBERS
- FLAX
- HEMP
- KENAF
- HENNEQUIN
- JUTE

LEAF
- SISAL
- CURANA
- BANANA
- BAMBOO

SEED
- COTTON
- KAPOTE

FRUIT
- COCONUT
- PINE
- OTHERS

WOOD
- LONG GLASS
- SHORT GLASS
- BASALT
- FIBERS (a)
- MATS
- REINFORCED MOLDING COMPOUND
- DIRECT COMPOUNDED
- WOOD FLOUR
- WOOD FIBER

NOTE: (a) CANDIDATE FOR HEADLINERS (TOYOTA)

SOURCE: ROBERT ELLER ASSOCIATES LLC, 2008
NATURAL FIBER APPLICATIONS

BUSINESS TABLE
LoPreFin™

HEADLINER
KENBOARD-FOAM™

SPARE WHEEL COVER
KENBOARD™/LoPreFin™

INSTRUMENT PANEL
LoPreFin™

ELECTRONIC COVER
KENBOARD™/LoPreFin™

CARPET COVER
KENBOARD™/LoPreFin™

DOOR INTERIOR TRIM
LoPreFin™

KENBOARD™

DOOR INSERTS

PARCEL TRAY
LoPreFin™/KENBOARD™/KENBOARD-FOAM™

SOURCE: R+S TECHNIK GmbH

r/mydox/papers/ATI 08.ppt
LEDs AND LIGHT PIPES SHIFT INTERIOR LIGHTING

Technology: LEDs, gaining power, smaller footprint
Applications: Cascading illumination, instruments, logos
Substitution drivers:
- Night/day lighting
- Reduced night vision interference
- Lighting footprint reduction
- Cost save vs. bulbs
PU CONTINUES DOMINATION OF HIGH END

Vehicle: BMW 5 Series
Part: Center front armrests
Material: Molded PU

Photo Source: Grammer
TREND TOWARD SELF-SUPPORTING IPs?

Eliminates cross-car beam
Dimensions: Narrower/thinner IP; frees up space
Some displays: Invisible until required
Commercial status: 3 launches in 2008?
Tier 1: Faurecia
- 2007 DCX DODGE RAM
- SUPPLIER: JYCO (COMPOUND, PROFILE, DESIGN)
- LITTLE GUY SCOOPS THE BIG GUYS
- MATERIAL: o-TPV
- FIRST o-TPV DYNAMIC BODY SEAL

SOURCE: JYCO
CONTINUED GROWTH OF 2-TONE

Vehicle: BMW (2-color door trim panel)
2-color Skin Supplier: TS Trim
Substrate: Wood fiber/PP
Tier 1: JCI
<table>
<thead>
<tr>
<th><strong>Vehicle:</strong></th>
<th>Corvette</th>
<th><strong>Notes:</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Skin:</strong></td>
<td>Leather upper</td>
<td>- Invisible (seamless)</td>
</tr>
<tr>
<td><strong>Substrate:</strong></td>
<td>PP</td>
<td>airbag cover</td>
</tr>
<tr>
<td><strong>Tier 1:</strong></td>
<td>IAC</td>
<td>- Logo in leather</td>
</tr>
</tbody>
</table>
Vehicle: None yet  Tier 1: JCI
Process: "Perfect Fit" TF skin, injection molded substrate
Note: Perfect Fit minimizes gaps between surfaces and colors. Perfect Fit is evolution of CrafTec process. Decoration can be via painting or stitching (JCI CrafTec process).
Vehicle: Fiat 500
Resin supplier: Borealis (Daplan EE168AE)
Molder: Plastal (Poland)
Resin: Single material TPO
(also used for exteriors and bumper)
Vehicle: Chev. Malibu '08
Module: Instrument panel
Tier 1: Faurecia

Notes:
- 2-tone TPO skin (O'Sullivan)
- Deep instrument cluster
- Sculptured 2-tone surface
Vehicle: Chevrolet Malibu ('08)
Component: Rear door trim panel
Tier 1: JCI
Notes: - Broad color range, contrasting colors break up monotone look
- Faurecia is IP Tier 1; Delphi is console Tier 1
Vehicle: Chevrolet Malibu 2008
Module: Front door trim panel
Tier 1: JCI?
Note: 2-tone skin/foam 60% coverage
Vehicle: Dodge Ram (2009)  
Module: Instrument panel  
Tier 1: Visteon  
Upper Panel: TPO  
Retainer: PC/ABS

Notes:  
- Stitching on sport version  
- 2-tone tech. (all trim levels)  
- Upper and lower glove boxes; large, best-in-class glove box volume  
- Redesigned instr. cluster face  
- Lg. HVAC louvers in center stack
Vehicle: Ford F-150
Module: Instrument Panel
Tier 1: JCI (via Saline plant acquired from ACH)

Notes:
- Large, visible, vertical airbag door
- Integrated Topper pad
### SOME EXAMPLE INTERMATERIALS/INTERPROCESS COMPETITIONS

<table>
<thead>
<tr>
<th>COMPONENT</th>
<th>CHALLENGER</th>
<th>INCUMBENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Door trim skin</td>
<td>- 2-shot TPE</td>
<td>- TF-TPO</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- PUs</td>
</tr>
<tr>
<td>GF-PP applic. (several)</td>
<td>- ILC</td>
<td>- LGF-PP</td>
</tr>
<tr>
<td>Headrest/some seat applic.</td>
<td>- EPP</td>
<td>- PU foam</td>
</tr>
<tr>
<td>IP skin</td>
<td>- PU/IM 2-shot</td>
<td>- PU spray</td>
</tr>
<tr>
<td></td>
<td>- TPE 2-shot</td>
<td>- Slush(a)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- TF-PP</td>
</tr>
<tr>
<td>Headliner substrate</td>
<td>- Ltwt. GMT</td>
<td>- GF-PU</td>
</tr>
<tr>
<td>Spare tire tubs</td>
<td>- LGF-PP</td>
<td>- Steel</td>
</tr>
<tr>
<td></td>
<td>- ILC-PP; GMT</td>
<td>- SMC</td>
</tr>
</tbody>
</table>

**Note:** (a) May be TPU, PVC, TPE slush

SOURCE: ROBERT ELLER ASSOCIATES LLC, 2008
SUMMARY

• Macroeconomics:
  - driving + limiting technology innovation (in U.S.)
  - severe profitability squeeze

• Supply chain turbulence will continue and reshape:
  - industry structure (path to market)
  - interiors technologies
  - profitability

• Fuel prices:
  - major weight-save driving force
  - shifting fleet composition (OEM profitability impacts)
• Interiors technology drivers:
  - internationalization of the N. American fleet
  - supply chain efficiency
  - upgrade quality/craftsmanship requirements
  - PP continued share gain (via new technologies)
  - GF-PP structural capability share gains
  - bioplastics share gain
• Economic and market drivers are in place.

• Improved interiors technologies are available.

• Capital availability/willingness to commit in N. America uncertain.