A VIEW FROM AUTOMOTIVE TEXTILES

PRESENTED BY:
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PRESENTED AT:
EATP
EXPANDING THE LIMITS OF
POLYOLEFIN TEXTILES
Budapest, Hungary
May 25, 2004
B/mydocs/papers/budapestex
PRESENTATION HIGHLIGHTS

• AUTO TEXTILES... A COMPREHENSIVE VIEW
• TEXTILE SUBSTITUTION DRIVING FORCES/TARGET MODULES
• EUROPE/N.AMERICA AUTO TEXTILE DIFFERENCES
• VALUE ADD STRATEGIES/VALUE CHAIN SHIFTS
• TEXTILE ROLE IN PROCESS COST SAVINGS
• THE FOAM/TEXTILE INTERFACE
• FLOOR/ACOUSTIC MODULES
• NEW ENTRANTS VIA LIGHT WEIGHT FIBER MATS
• HEADLINER COMPETITION
• PATHS-TO-MARKET SHIFT/ROLE FOR PO TEXTILES
• BASED ON :
  - SOFT TRIM MULTICLIENT (REA)
  - AUTO NONWOVENS MULTICLIENT (REA/J.R.STARR)
Automotive Interior Soft Trim:
Skins, Foams, Coated Fabrics, Textiles, and Acoustic Barriers

Robert Eller Associates, Inc.
Opportunities for Advanced Technology
Nonwoven Fabrics for Automotive Interior
Surface and Construction Applications
in NAFTA and Europe

AUTO INTERIOR FIBERS AND TEXTILES MARKETS

- Coated Fabrics
- Batting (Shoddy, Felt)
- Artificial Leather
- Nonwoven Facings
- Woven/Knit Textiles
- New Lightweight Acoustic Fibers

March 2004
AUTO TEXTILES..A COMPREHENSIVE VIEW

• BATTING(INCUMBENTS VS NEW LT. WT. FIBERS)
• FACE FABRICS( NWs VS KNITS AND WEAVES)
• CONSTRUCTION FABRICS
• BARRIER/ADHESIVE FABRICS
• SEMI-STRUCTURAL COMPOSITES (LIGHTWEIGHT FIBER REINFORCED THERMOPLASTICS)
• NONWOVENS(PET,POLYOLEFIN,BICOMPONENT)
• ARTIFICIAL LEATHERS
• ROLE FOR PROTEIN –BASED FIBERS?
• NEW GENERATION COATED FABRICS?
• SMART FABRICS
AUTOTEXTILE SUBSTITUTION DRIVERS

- TEXTILE PROFIT SQUEEZE → VALUE SEARCH
- MODULE COST SAVINGS REQUIREMENTS
- AFFORDABLE LUXURY FABRICS
- GLASS FIBER ELIMINATION (TOYOTA, HONDA)
- V.O.C. REDUCTION
- MONOMATERIALS MODULES
- SURFACE ESTHETICS (PRINT, 3D, TOUCH)
- SUBSTRATE/FOAM SHIFT TO POLYOLEFIN
- NEW SEMI-STRUCTURAL MODULES
- ACOUSTICS/ENERGY ABSORPTION (COMBINED?)
- ON-BOARD FUNCTIONS/POPULATED PANELS
- WEIGHT REDUCTION INCENTIVES
AUTO TEXTILE GROWTH TARGETS

• AIRBAGS: GLOBAL 330 MM SQ.METERS IN ‘05
• HEADLINERS: PROCESS SHIFTS, ACOUSTICS, EA
• FLOOR/ACOUSTICS
• TRUNK MODULE: RAPID GROWTH, EA INTEGRATION, SEMI-STRUCTURAL COMPOSITES
• HOOD LINERS: SHIFT FROM FIBERGLASS?
• DOOR TRIM: MEDALLIIONS, FOAMS, ACOUSTICS
• SUNVISORS: SHIFT TO EPP FOAM SUBSTRATE
• PILLAR TRIM: GROWTH OF BACK INJECTION
• CRAFTSMANSHIP: ALL MODULES
## EUROPE/NAFTA AUTOTEXTILE DIFFERENCES

<table>
<thead>
<tr>
<th>TARGET MODULE/KEY PARAMETER</th>
<th>AUTO TEXTILE CHARACTERISTICS</th>
</tr>
</thead>
</table>
| TRUNK/FLOOR MODULE         | -DEVELOPMENT TARGET IN BOTH REGIONS  
                             | -EUROPEAN “BEER CRATE” LEGISLATION  
                             | -“TALL CARS” INCREASING FASTER IN NAFTA  
                             | -EUROPEAN SPARE TIRE COVER DESIGNS MORE ADVANCED (SEE REA PHOTOS) |
| RECYCLING PRESSURES         | -HIGHER IN EUROPE  
                             | -FAVORS PO MONO-MATERIAL CONSTRUCTIONS |
| WEIGHT SAVE PRESSURES       | -HIGHER IN EUROPE  
                             | -WILL ACCELERATE IN NAFTA DUE TO:  
                             |   -FUEL PRICE INCREASES  
                             |   -REVISED CAFE REGULATIONS?  
                             |   -PROFITABILITY PRESSURES ON LIGHT TRUCKS |
| HEADLINER FACE FABRIC       | -HIGHLY PENETRATED BY NWs IN EUROPE |
| CARPET FACE FIBERS          | -HIGHER NW PENETRATION IN EUROPE |
| ACOUSTIC PERF. REQ’TS       | -DIFFERENT FREQUENCIES, SIMILAR PERF. REQ’TS |
| COST PRESSURES              | -MORE SEVERE IN NAFTA |
COMPARISON OF REGIONAL TRENDS IN AUTOMOTIVE CARPET (2002)

SOURCE: ROBERT ELLER ASSOCIATES, INC. / JOHN R. STARR, INC. AUTOMOTIVE NONWOVENS MULTICLIENT STUDY
CURRENT/POTENTIAL AUTO TEXTILE PROPERTIES

• IMPROVED ACOUSTIC CONSTRUCTIONS
• ELASTIC (NONWOVENS, KNITS)
• UV RESISTANCE (POLYOLEFIN NWs)
• CRAFTSMANSHIP (VIA PROCESS PARTNERING)
• DRAPE/TOUCH
• NEW FABRIC COATINGS (POs, SILICONES)
• NEW LUXURY FEEL FABRICS
• MICRODENIER (NONWOVENS TO NANOSCALE?)
• “SMART“ PERFORMANCE
• INTEGRATION OF ENERGY ABSORPTION
VALUE ADD STRATEGIES

• IMPROVED TEXTILE PERFORMANCE
• VALUE CHAIN POSITION SHIFT
• MAT’LS COST SAVINGS (ROLE FOR PO NWs)
• MODULE FABRICATION COST REDUCTION
• IMPROVED FUNCTIONAL CAPABILITIES:
  - MICRODENIER (ACOUSTICS, DRAPE)
  - ELASTIC PROPERTIES (VIA NEW PO RESINS*)
  - ENERGY ABSORPTION
  - SEMI STRUCTURAL CAPABILITIES
  - SMART TEXTILES

* E..G FROM DOW, EXXONMOBIL, MITSUI, SUMITOMO
## SUPPLY CHAIN SHIFT STRATEGIES FOR AUTO TEXTILE SUPPLIERS

<table>
<thead>
<tr>
<th>STRATEGY</th>
<th>EXAMPLE</th>
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<tbody>
<tr>
<td>FORWARD/BACKWARD INTEGRATION</td>
<td>-CUT/SEW, LAMINATION</td>
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<tr>
<td></td>
<td>-TEXTILE SUPPLIER/MOLDER PARTNERING FOR PROCESS DEVELOPMENT</td>
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<tr>
<td>OUTSOURCING</td>
<td>-FOAMING SEAT PADS, HEADRESTS</td>
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<tr>
<td></td>
<td>-FOAM/TEXTILE LAMINATION SHIFT</td>
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<tr>
<td>NEW TEXTILE TECHNOLOGIES</td>
<td>-ELASTIC PO NWs (RECENT RESIN DEVELOPMENTS-DOW/EXXON, MITSUI, SUMITOMO)</td>
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<tr>
<td></td>
<td>-POLYOLEFIN FOAM LAMINATION</td>
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<tr>
<td></td>
<td>-BACK-MOLDING OF KNITS AND NWs FOR PILLAR TRIM</td>
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<td></td>
<td>-FLAME LAMINATION ALTERNATIVES</td>
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<tr>
<td>SANDWICH LAYER CONSOLIDATION</td>
<td>-ON-BOARD ACOUSTICS</td>
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<tr>
<td></td>
<td>-MICRO-DENIER INTEGRATION INTO NW CONSTRUCTIONS</td>
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<tr>
<td>REDUCE SECONDARY OPERATIONS</td>
<td>-BACK INJECTION</td>
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<tr>
<td></td>
<td>-IN-MOLD AIRBAG DOOR SCORING</td>
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<td></td>
<td>-IN-MOLD TRIM AND ASSEMBLY</td>
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</tbody>
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CURRENT MODULE FABRICATION (INEFFICIENT)

RESINS

MOLD/TRIM TEXTILE
MOLD SUBSTRATE

HIGH SCRAP PU FOAM

BACK-FOAM

MOLDED PLASTIC PRE-MODULE

ADD-ON PARTS

ASSEMBLED MODULE

4-STEP OPERATION

SOURCE: ROBERT ELLER ASSOCIATES, INC., 2004
FUTURE MODULE FABRICATION (IDEAL)

- ADD-ON PARTS
- ON-BOARD ACOU.
- FOAM LAMINATES
- ELASTIC NONWOVENS

VALUE-ADDED TEXTILE

MODULE FABRICATION

IN-MOLD ASSEMBLY

DIRECT COMP'DG.

ADD-ON PARTS?

SUBSTRATE RESIN

LOW SCRAP

ASSEMBLED MODULE

(Ideal) 1-STEP OPERATION

SOURCE: ROBERT ELLER ASSOCIATES, INC., 2004

slide-one step 03.vsd
## AUTO TEXTILES AND PROCESS COST SAVINGS

<table>
<thead>
<tr>
<th>STRATEGY</th>
<th>EXAMPLE/APPLICATION</th>
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<tbody>
<tr>
<td>IN-LINE FORMING/IN MOLD FORMING</td>
<td>-EPP FOAM/TEXTILE COMBOs&lt;br&gt;-DOOR TRIM MEDALLIIONS&lt;br&gt;-HEADLINERS&lt;br&gt;-FLOOR MODULES</td>
</tr>
<tr>
<td>BACK MOLDING OF TEXTILES</td>
<td>-WIDELY USED IN EUROPE&lt;br&gt;-STARTING IN US&lt;br&gt;-FAVORS POLYOLEFIN TEXTILES&lt;br&gt;-ROLE FOR INTERMEDIATE LAYER</td>
</tr>
<tr>
<td>SANDWICH CONSOLIDATION</td>
<td>-FLOOR ACOUSTICS/TRUNK MODULE&lt;br&gt;-DOOR TRIM INTEGRATED ACOUSTICS&lt;br&gt;-SMART TEXTILES&lt;br&gt;-HEADLINER/ENERGY ABSORBER</td>
</tr>
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## ADDING VALUE VIA IMPROVED TEXTILE PERFORMANCE CHARACTERISTICS

<table>
<thead>
<tr>
<th>STRATEGY</th>
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<tbody>
<tr>
<td>IN-MOLD FABRICATION</td>
<td>- TEXTILES</td>
</tr>
<tr>
<td>LIGHTWEIGHT FIBERS</td>
<td>- FLOOR/ACOUSTICS, HEADLINER</td>
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<tr>
<td>SURFACE ESTHETICS</td>
<td>- MICRO-DENIER NONWOVENS</td>
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<tr>
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<td>- NEGATIVE FORMING</td>
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<td>- ELASTIC FIBERS</td>
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<tr>
<td>MICRO-DENIER NONWOVENS</td>
<td>- BETTER ACOUSTICS</td>
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<td>- IMPROVED DRAPE</td>
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<td>- REDUCED WRINKLING</td>
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<tr>
<td>CRAFTSMANSHIP</td>
<td>- JCI CRAFTECH® PROCESS</td>
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<tr>
<td>ELASTIC POLYOLEFIN NONWOVENS</td>
<td>- VIA NEW POLYOLEFIN RESINS, DOW, EXXONMOBIL, MITSUI, SUMITOMO</td>
</tr>
<tr>
<td>INTEGRATED ENERGY ABSORPTION</td>
<td>HEADLINER</td>
</tr>
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</table>
PATHS TO MARKET FOR AUTOMOTIVE NONWOVENS

RESIN PRODUCER

RESINS (E.G., PO, PET)

SPUN BOUND NONWOVENS PRODUCER
(E.G., FREUDENBERG)

NEEDLEPUNCH NONWOVEN PRODUCER

NONWOVEN

NEEDLEPUNCHED FABRIC

TO SEAT, HEADLINER, DOOR TRIM

RECYCLED COTTON FIBERS

NEEDLEPUNCH

PU FOAM FORMULATION

LTWT. FIBERS(B)

NEEDLEPUNCH MAT (SHODDY)

FOAMING OR LAMINATION WITH FIBER MAT

TRIM, DIE CUT, WATERJET(A), OR LASER

DASH MAT

FLOOR ACOUSTIC MODULE

TRUNK FLOOR Mat(C)

LAMINATE OR BACK-INJECT (HINTERSPRITZEN)

TRIM

TRUNK FLOOR MAT

PACKAGE TRAY

DOOR TRIM PANEL

LAMINATE OR BACK-INJECT (HINTERSPRITZEN)(D)

TRIM

TRIM

TRIM

NOTES:
OMITS HYDROENTANGLED (ABOUT 6% MKT. SHARE)
(A) DOMINANT METHOD
(B) E.G., AcT™ (C+A), ULTRALIGHT™ (RIETER), SonoTec AT (LEAR), DUAL IMPEDANCE FIBER (PELZER)
(C) HIGH END VEHICLES ONLY
(D) EPP FOAMS MAY BE USED FOR HINTERSPRITZEN

SOURCE: ROBERT ELLER ASSOCIATES, INC./ JOHN R. STARR, INC.
AUTOMOTIVE NONWOVENS MULTICLIENT STUDY
NONWOVEN PATH-TO-MARKET OPPORTUNITY FOR ADDING VALUE

NOTE: → = VALUE ADD OPPORTUNITIES FOR NONWOVENS

SOURCE: ROBERT ELLER ASSOCIATES, INC/ JOHN R. STARR, INC.
AUTOMOTIVE NONWOVENS MULTICLIENT STUDY
NONWOVENS TARGET TREE (BY CONSTRUCTION TYPE)

MATS
- INCUMBENT
  - SHODDY
  - MD NW
  - N-PUNCH
  - SPUNBOND
  - MELT SPUN
  - LIGHTWEIGHT
  - FIBER MAT (B)
- CHALLENGER
  - PU FOAM

TEXTILES/SKINS
- INCUMBENT
  - KNIT
  - WOVEN
  - SKINS
  - COATED
  - FABRIC
  - LEATHER
- CHALLENGER
  - N-PU FOAM
  - LIGHTWEIGHT
  - FIBER MAT (B)

CARPET
- INCUMBENT
  - FOAM LAM.
  - BLOW MOLD
  - INJECTION
- CHALLENGER
  - LFTPs (A)

SEM-STRUCTURAL
- INCUMBENT
  - NW
  - NONWOVEN
- CHALLENGER
  - NW

NOTES:
(A) AZDEL SUPERLITE®, SYMALITE
(B) FROM RIETER, C+A, LEAR, PELZER

SOURCE: ROBERT ELLER ASSOCIATES, INC., 2004
lg/myfiles/visio/NW Target Tree 04.vsd
FOAM/TEXTILE INTERFACE

• FOAMS COMPETE AND COMPLEMENT FIBERS
• PO SHEET FOAM/TEXTILE LAMINATES STARTING (EUROPE/JAPAN)
• PO SUBSTRATES AND FOAMS DRIVING PO NONWOVENS INTO MARKET
• NEW PO FOAM/TEXTILE INTERFACES:
  - HEADLINER (ENERGY ABSORBER INTEGRATION)
  - HEADRESTS
  - SEATING (STARTING AS INSERTS)
  - SUNVISORS (WIDELY USED IN EUROPE)
  - DOOR TRIM MEDALLIONS (RENAULT LAGUNA II)
  - VW TARGET
AUTOMOTIVE FOAM/TEXTILE INTERFACES

- HOOD ACOUSTIC INSULATOR
- INSTRUMENT PANEL
- HEADLINER, ENERGY ABSORBER
- PILLAR TRIM
- PACKAGE TRAY
- KNEE BOLSTER
- DASH MAT
- DOOR ENERGY ABSORBER, DOOR TRIM, DOOR MEDALLION
- REAR SEAT
- TRUNK FLOOR/LOAD FLOOR
- FLOOR SYSTEMS (ACOUSTIC & LOAD FLOOR)
- SEAT BACK

SOURCE: ROBERT ELLER ASSOCIATES, INC., 2004
DRIVING FACTORS FOR PO FOAM SUBSTITUTION

• IN-MOLD TEXTILE/EPP FOAM COMBINATION PROCESSES
• MICROCELLULAR PO SHEET FOAMS
• PROLIFERATION OF RADIATION CROSSLINKING PO FOAM TECHNOLOGY
• LOW COST, NON-CROSSLINKED AND CHEMICALLY CROSSLINKED PO SHEET FOAMS
• PO FOAM/TEXTILE LAMINATE POTENTIAL
• MARKET PENETRATION FOR THICK SHEET FOAMS (E.G. FROM DOW)
EPP SEMI-STRUCTURE/TEXTILE COVERING CONCEPT

SOURCE: TARACELL
TARACELL IP EPP SEMI-STRUCTURE/TEXTILE COVERING CONCEPT

SOURCE: TARACELL
BMW 6-SERIES DOOR MEDALLION

SKIN VS TEXTILE EXAMPLE
SIDE AIRBAG REQUIREMENT
EXAMPLE ENTRY
POINT FOR
POLYOLEFIN
TEXTILE/FOAM
LAMINATES

SOURCE: REA PHOTOS
TEXTILE/PO FOAM LAMINATES

- TEXTILE/PO FOAM LAMINATES SHOW POTENTIAL FOR PENETRATION INTO INTERIOR SOFT TRIM MODULES BASED ON:
  - IMPROVED THERMOFORMABILITY VS. TEXTILE/PU FOAM LAMINATES
  - IMPROVED RECYCLABILITY
  - MATERIAL AND PROCESS COST SAVINGS

- TEXTILE/PO FOAM LAMINATES PENETRATION OF PO NWs

- UV RESISTANCE, ABRASION RESISTANCE ELASTIC PROPERTIES AND MICRODENIER TECHNOLOGY WILL FACILITATE PO NONWOVENS PENETRATION
## COMPARISON OF PU AND PO FOAM LAMINATION

<table>
<thead>
<tr>
<th>LAMINATION METHOD</th>
<th>LAM SPEED M/M</th>
<th>NOTE</th>
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<tbody>
<tr>
<td></td>
<td>TEX/PUF</td>
<td>TEX/PO FOAM</td>
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<tr>
<td>FLAME</td>
<td>30-60</td>
<td>10</td>
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<tr>
<td>DIRECT CALENDERING</td>
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<tr>
<td>HOT MELT FILMS</td>
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<td>20</td>
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<tr>
<td>HOT MELT SPRAY</td>
<td>30-60</td>
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<tr>
<td>SCATTERING</td>
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<td>12</td>
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</tbody>
</table>

**SOURCE:** REA/J.R.STARR AUTO NONWOVENS MULTICLIENT
TEXTILE/FOAM COMPETITION IN FLOOR / ACOUSTIC MODULE

• CURRENT MULTIMAT’L CONSTRUCTION:
  – HEAVY LAYER (FILLED EVA, SEBS)
  – FOAM OR LIGHTWEIGHT FIBER LAYER
  – CARPET

• MAJOR ACOUSTIC TIER 1s DEVELOPING LIGHTWEIGHT FIBER CONSTRUCTIONS → REDUCE OR ELIMINATE HEAVY LAYER

• CONSOLIDATED TRUNK MODULE GROWTH

• INTEGRATED FLOORS EVOLVING

• FOAM VS FIBER COMPETITION
2004 BMW X3 2.5i-NON HINGED SPARE TIRE COVER
2005 FORD FREESTYLE LTD SPARE TIRE COVER
EXAMPLE OF CURRENT DASH MAT LAYER CONSTRUCTION

SOURCE: COLLINS & AIKMAN
EXAMPLE OF ACOUSTICALLY TUNEABLE FIBER

SOURCE: COLLINS AND AIKMAN
# Lightweight Fiber Reinforced Thermoplastics (LFRTPs)

<table>
<thead>
<tr>
<th>LFRTP Supplier</th>
<th>Name</th>
<th>Process Type</th>
<th>Note</th>
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<tbody>
<tr>
<td>Quadrant</td>
<td>Symalite®</td>
<td>Dry Laid NW</td>
<td>Needle</td>
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<tr>
<td>Azdel</td>
<td>Azdel Superlite®</td>
<td>Paper Based</td>
<td>Based on Arjowiggins</td>
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<tr>
<td>Toyota Boshoku</td>
<td>NW?</td>
<td></td>
<td>Toyota Headliners</td>
</tr>
<tr>
<td>Other</td>
<td>NW</td>
<td></td>
<td>Commercial in 2004</td>
</tr>
</tbody>
</table>

Source: Robert Eller Associates, Inc
PET/PO FIBER BATTLE IN HEADLINERS

• KEY MODULE FOR NW/KNITTED COMP’N. IN FACE FABRIC
• USAGE DIFFERS BETWEEN REGIONS
• REQUIREMENT FOR ENERGY ABSORPTION COUNTERMEASURES, NEW LIGHTING APPROACHES & IMPROVED WORKPLACE SAFETY WITH AN EMPHASIS ON:
  – INTEGRATING ENERGY ABSORPTION
  – USE OF LIGHTER WEIGHT ACOUSTIC LAYERS
  – SUBSTRATE BATTLE:
    LIGHTWEIGHT NONWOVENS (BI-COMPONENT)
    GR-Pos (QUADRANT, AZDEL, TOYOTA BOSHOKU)
    EPP BEAD FOAMS?
  -INTEGRATION OF EA COUNTERMEASURES INTO NWs
  – PO SUBSTRATE APPROACHES FAVOR PO NWs AS FACE FABRIC
POLYOLEFIN AUTOMOTIVE TEXTILE
PROPERTY IMPROVEMENT TARGETS

• WEAR RESISTANCE—Seating, door medallion
• UV RESISTANCE—Horizontal exposed surfaces
• COLORABILITY—Carpet
• PRINTABILITY—Backmolded pillar trim
• HEAT RESISTANCE—Hood liner
• STIFFNESS RETENTION—Headliner/airbags
• FORMABILITY—Trunk module
AUTOMOTIVE POLYOLEFIN TEXTILE GROWTH PATHS

• PET/PA TEXTILES → PET NWs → PO NWs

• PET/PU FOAM LAMINATES → PET/PO FOAM LAMINATES → PO NW FOAM LAMINATES

• GLASS/PP BATTING → PET BATTING → ALL PO-BASED COMPOSITES
SUMMARY

• POLYOLEFIN TEXTILES WILL GROW IN AUTOMOTIVE VIA:
  - NONWOVENS SHARE GAIN
  - MICRODENIER NONWOVENS
  - ELASTIC NONWOVENS
  - COATED FABRICS
  - POLYOLEFIN FOAM SUBSTITUTION IN TEXTILE LAMINATE
  - GLASS FIBER SUBSTITUTES
  - GROWTH OF SEMI-STRUCTURAL COMPOSITES
  - GROWTH OF BACK-MOLDING (IN N.A. MARKET)
  - EUROPE/US TEXTILE/MODULE TECH. CONVERGENCE

• TEXTILE SUPPLIERS HAVE VALUE ADD OPPORTUNITIES VIA:
  - TEXTILE PROPERTIES
  - VALUE CHAIN POSITIONING
  - MODULE FABRICATION TECHNOLOGY

• FURTHER PROPERTY IMPROVEMENTS REQUIRED
ADDITIONAL AUTO TEXTILE RESOURCES

• AUTO INTERIOR SOFT TRIM MULTICLIENT (PROSPECTUS):
  bobeller@prodigy.net

• ADVANCED AUTOMOTIVE NONWOVENS MULTICLIENT
  (PROSPECTUS)
  bobeller@prodigy.net
  jstarr@johnrstarr.com

• INTERIORS AT THE 2004 DETROIT AUTO SHOW
  (A DOWNLOADABLE PHOTO DATABASE AND COMMENTARY)
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  bobeller@prodigy.net