



Robert Eller Associates, Inc.

CONSULTANTS TO THE PLASTICS AND RUBBER INDUSTRIES

A VIEW FROM AUTOMOTIVE TEXTILES

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EATP

**EXPANDING THE LIMITS OF
POLYOLEFIN TEXTILES**

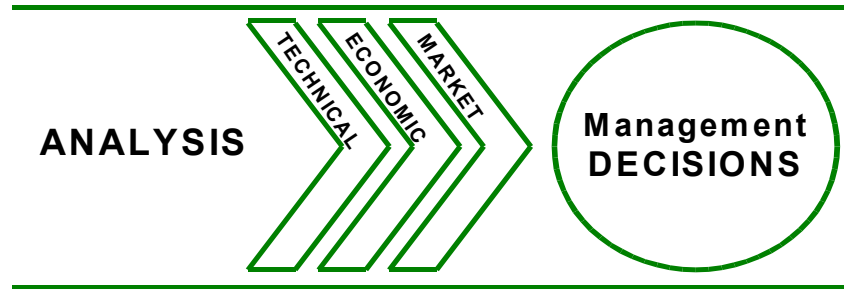
Budapest, Hungary

May 25, 2004

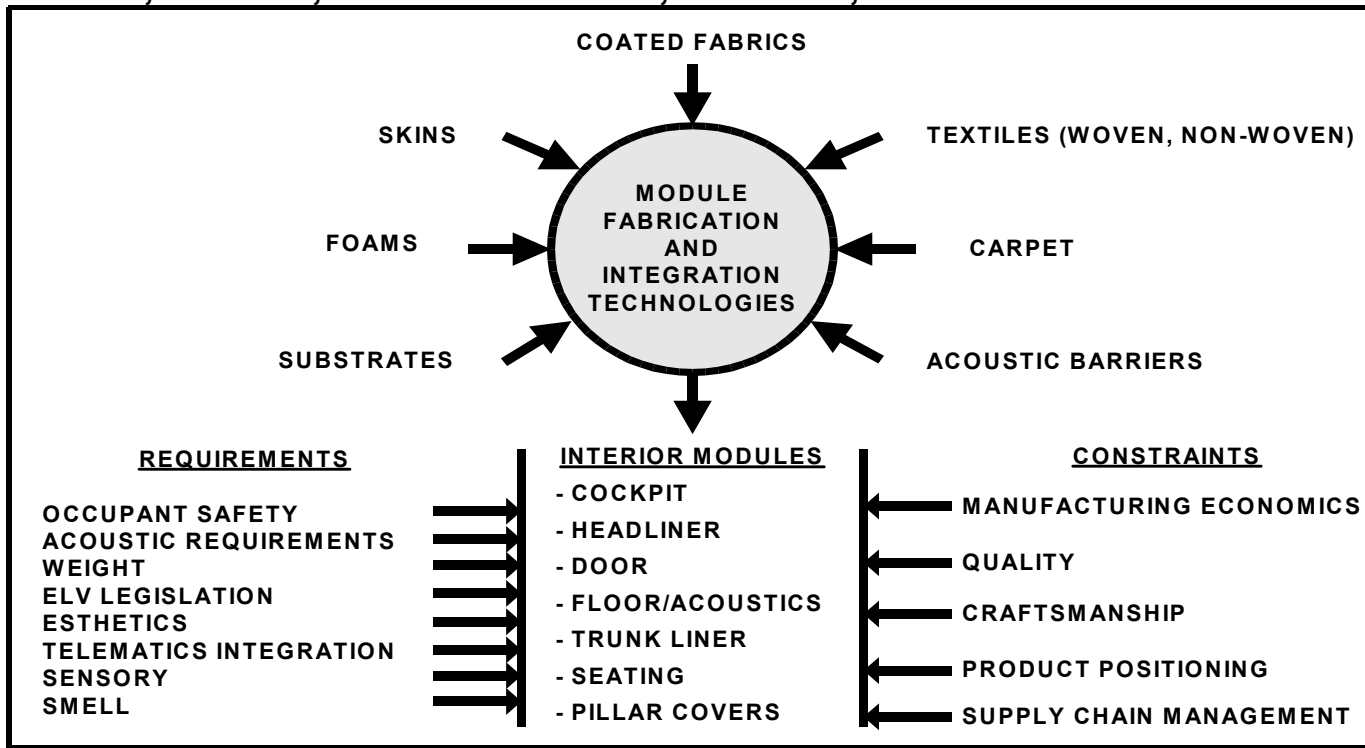
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PRESENTATION HIGHLIGHTS

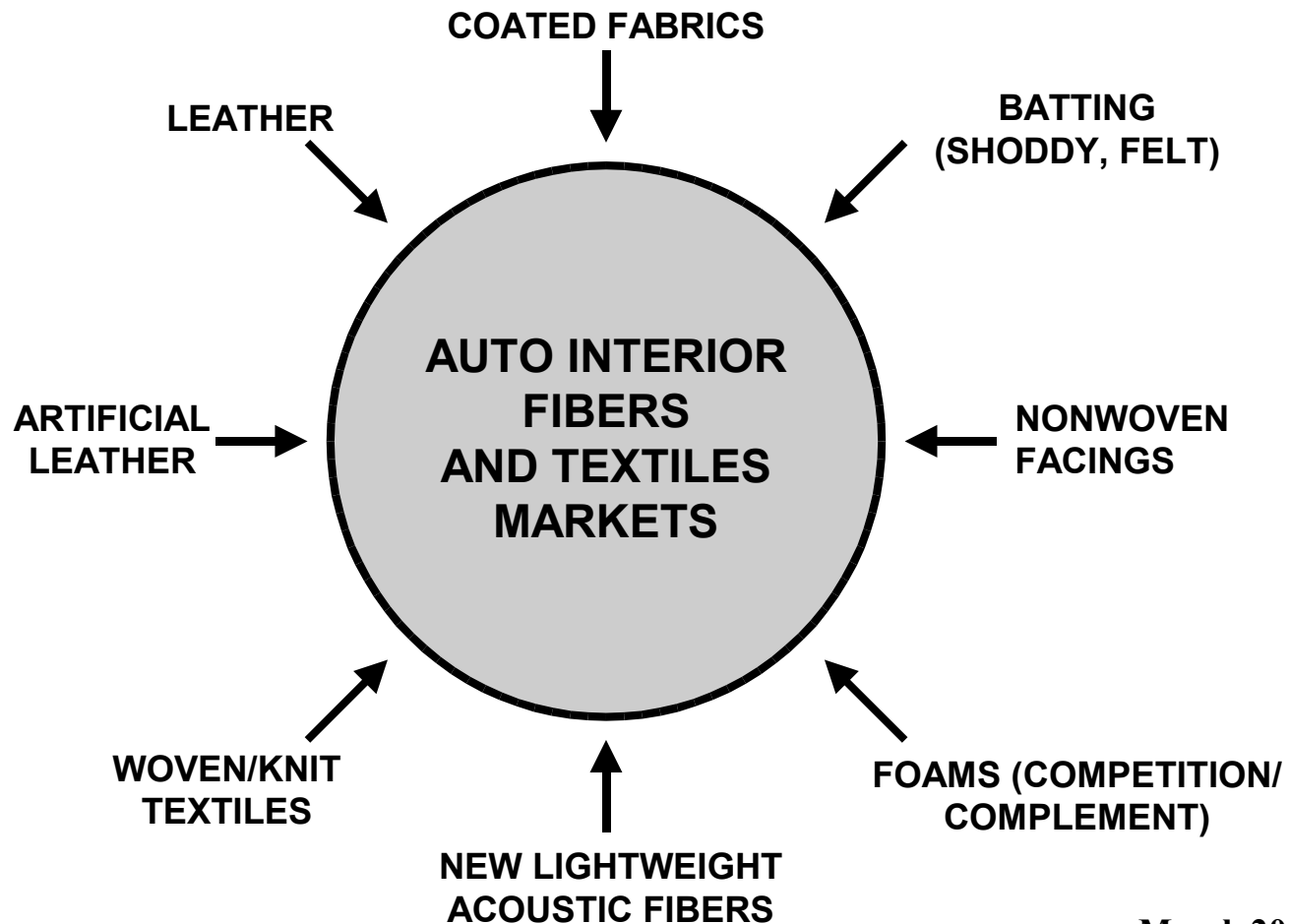
- **AUTO TEXTILES... A COMPREHENSIVE VIEW**
- **TEXTILE SUBSTITUTION DRIVING FORCES/TARGET MODULES**
- **EUROPE/N.AMERICA AUTO TEXTILE DIFFERENCES**
- **VALUE ADD STRATEGIES/VALUE CHAIN SHIFTS**
- **TEXTILE ROLE IN PROCESS COST SAVINGS**
- **THE FOAM/TEXTILE INTERFACE**
- **FLOOR/ACOUSTIC MODULES**
- **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



Opportunities for Advanced Technology Nonwoven Fabrics for Automotive Interior Surface and Construction Applications in NAFTA and Europe



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 POLYOLEFINS**
- **NEW SEMI-STRUCTURAL MODULES**
- **ACOUSTICS/ENERGY ABSORPTION (COMBINED?)**
- **ON-BOARD FUNCTIONS/POPULATED PANELS**
- **WEIGHT REDUCTION INCENTIVES**

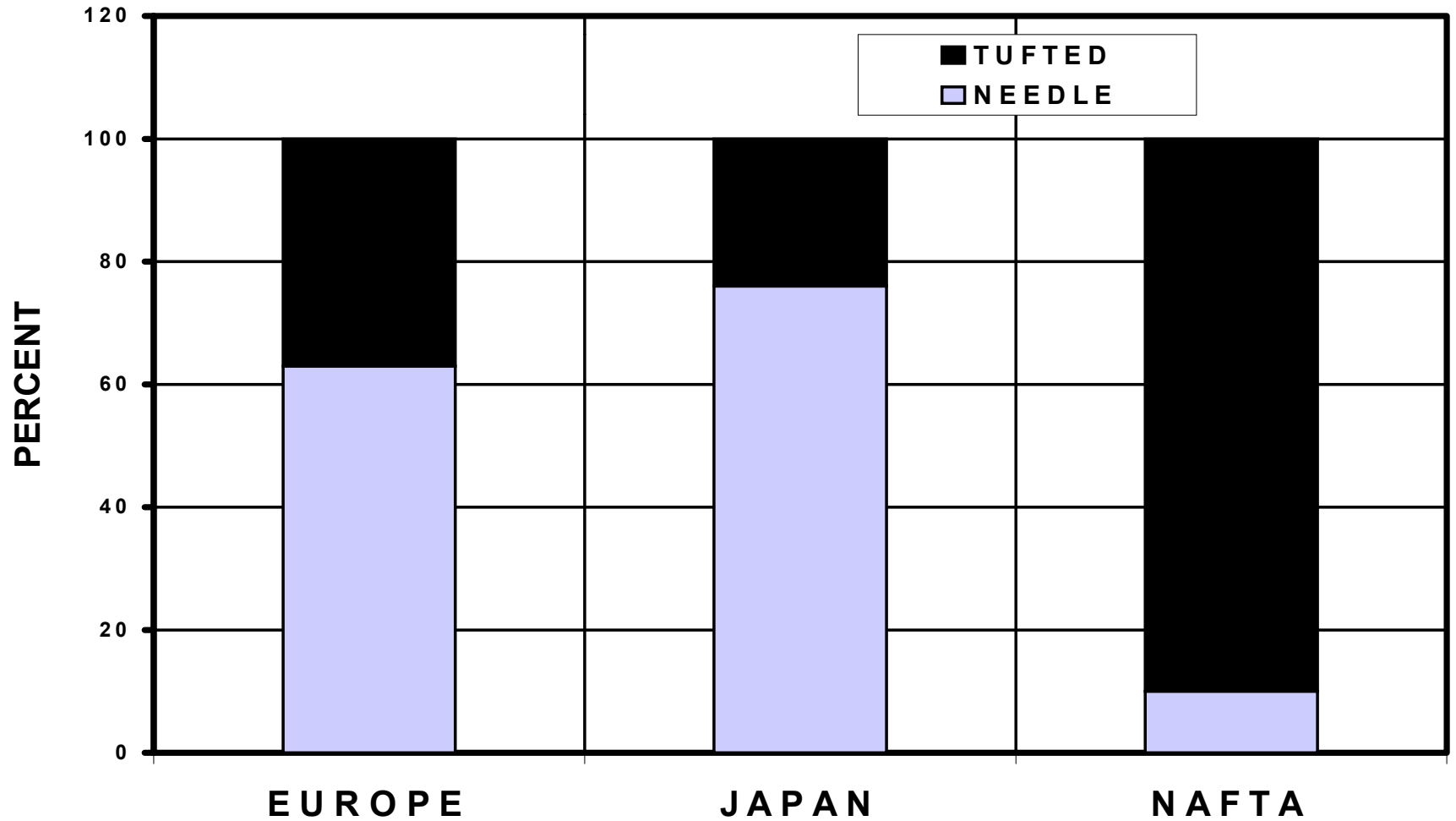
AUTO TEXTILE GROWTH TARGETS

- **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: MEDALLIONS, FOAMS, ACOUSTICS**
- **SUNVISORS: SHIFT TO EPP FOAM SUBSTRATE**
- **PILLAR TRIM: GROWTH OF BACK INJECTION**
- **CRAFTSMANSHIP: ALL MODULES**

EUROPE/NAFTA AUTOTEXTILE DIFFERENCES

TARGET MODULE/ KEY PARAMETER	AUTO TEXTILE CHARACTERISTICS
TRUNK/FLOOR MODULE	<ul style="list-style-type: none"> -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	<ul style="list-style-type: none"> -HIGHER IN EUROPE -FAVORS PO MONO-MATERIAL CONSTRUCTIONS
WEIGHT SAVE PRESSURES	<ul style="list-style-type: none"> -HIGHER IN EUROPE -WILL ACCELERATE IN NAFTA DUE TO: <ul style="list-style-type: none"> -FUEL PRICE INCREASES -REVISED CAFE REGULATIONS? -PROFITABILITY PRESSURES ON LIGHT TRUCKS
HEADLINER FACE FABRIC	<ul style="list-style-type: none"> -HIGHLY PENETRATED BY NWs IN EUROPE
CARPET FACE FIBERS	<ul style="list-style-type: none"> -HIGHER NW PENETRATION IN EUROPE
ACOUSTIC PERF. REQ'TS	<ul style="list-style-type: none"> -DIFFERENT FREQUENCIES, SIMILAR PERF. REQ'TS
COST PRESSURES	<ul style="list-style-type: none"> -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

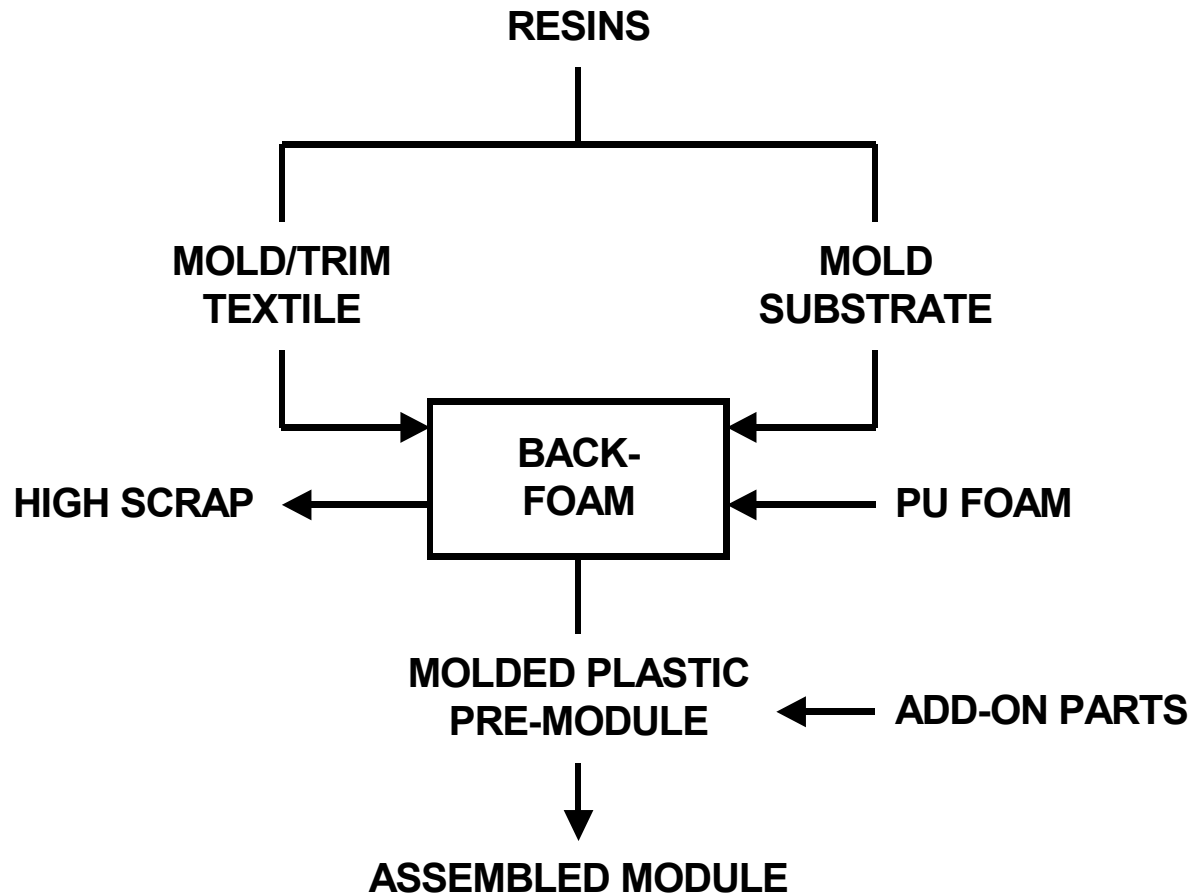
- **IMPROVED TEXTILE PERFORMANCE**
- **VALUE CHAIN POSITION SHIFT**
- **MAT'LS COST SAVINGS (ROLE FOR PO NWs)**
- **MODULE FABRICATION COST REDUCTION**
- **IMPROVED FUNCTIONAL CAPABILITIES:**
 - MICRODENIER (ACOUSTICS, DRAPE)**
 - ELASTIC PROPERTIES (VIA NEW PO RESINS*)**
 - ENERGY ABSORPTION**
 - SEMI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

** E..G FROM DOW, EXXONMOBIL, MITSUI, SUMITOMO*

SUPPLY CHAIN SHIFT STRATEGIES FOR AUTO TEXTILE SUPPLIERS

STRATEGY	EXAMPLE
FORWARD/BACKWARD INTEGRATION	<ul style="list-style-type: none"> -CUT/SEW, LAMINATION -TEXTILE SUPPLIER/MOLDER PARTNERING FOR PROCESS DEVELOPMENT
OUTSOURCING	<ul style="list-style-type: none"> -FOAMING SEAT PADS, HEADRESTS -FOAM/TEXTILE LAMINATION SHIFT
NEW TEXTILE TECHNOLOGIES	<ul style="list-style-type: none"> -ELASTIC PO NWs (RECENT RESIN DEVELOPMENTS-DOW/EXXON, MITSUI, SUMITOMO) -POLYOLEFIN FOAM LAMINATION -BACK-MOLDING OF KNITS AND NWs FOR PILLAR TRIM -FLAME LAMINATION ALTERNATIVES
SANDWICH LAYER CONSOLIDATION	<ul style="list-style-type: none"> -ON-BOARD ACOUSTICS -MICRO-DENIER INTEGRATION INTO NW CONSTRUCTIONS
REDUCE SECONDARY OPERATIONS	<ul style="list-style-type: none"> -BACK INJECTION -IN-MOLD AIRBAG DOOR SCORING -IN-MOLD TRIM AND ASSEMBLY

CURRENT MODULE FABRICATION (INEFFICIENT)

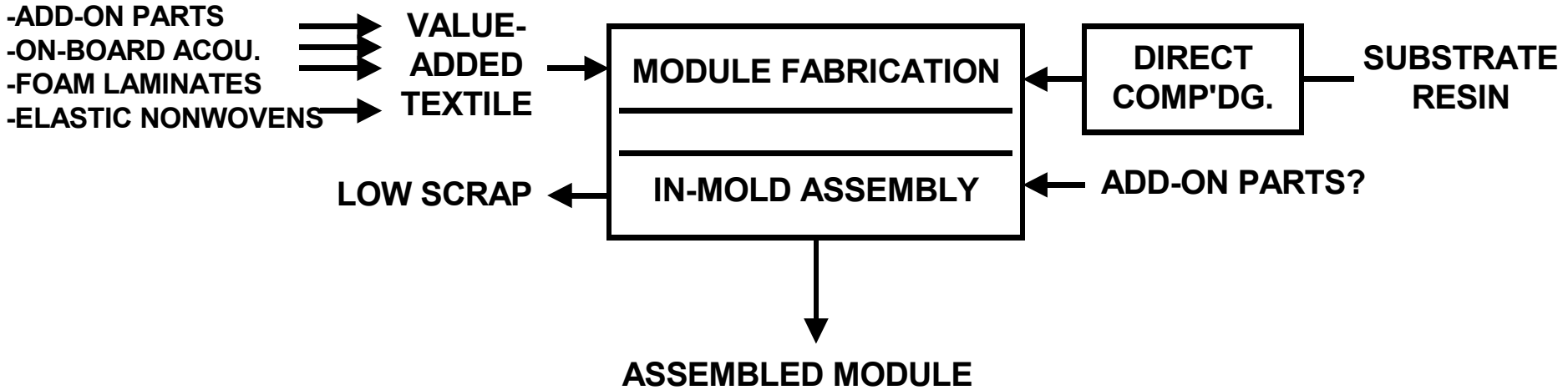


4-STEP OPERATION

SOURCE: ROBERT ELLER ASSOCIATES, INC., 2004

slide-mod fab 03.vsd

FUTURE MODULE FABRICATION (IDEAL)



(IDEAL) 1-STEP OPERATION

SOURCE: ROBERT ELLER ASSOCIATES, INC., 2004

slide-one step 03.vsd

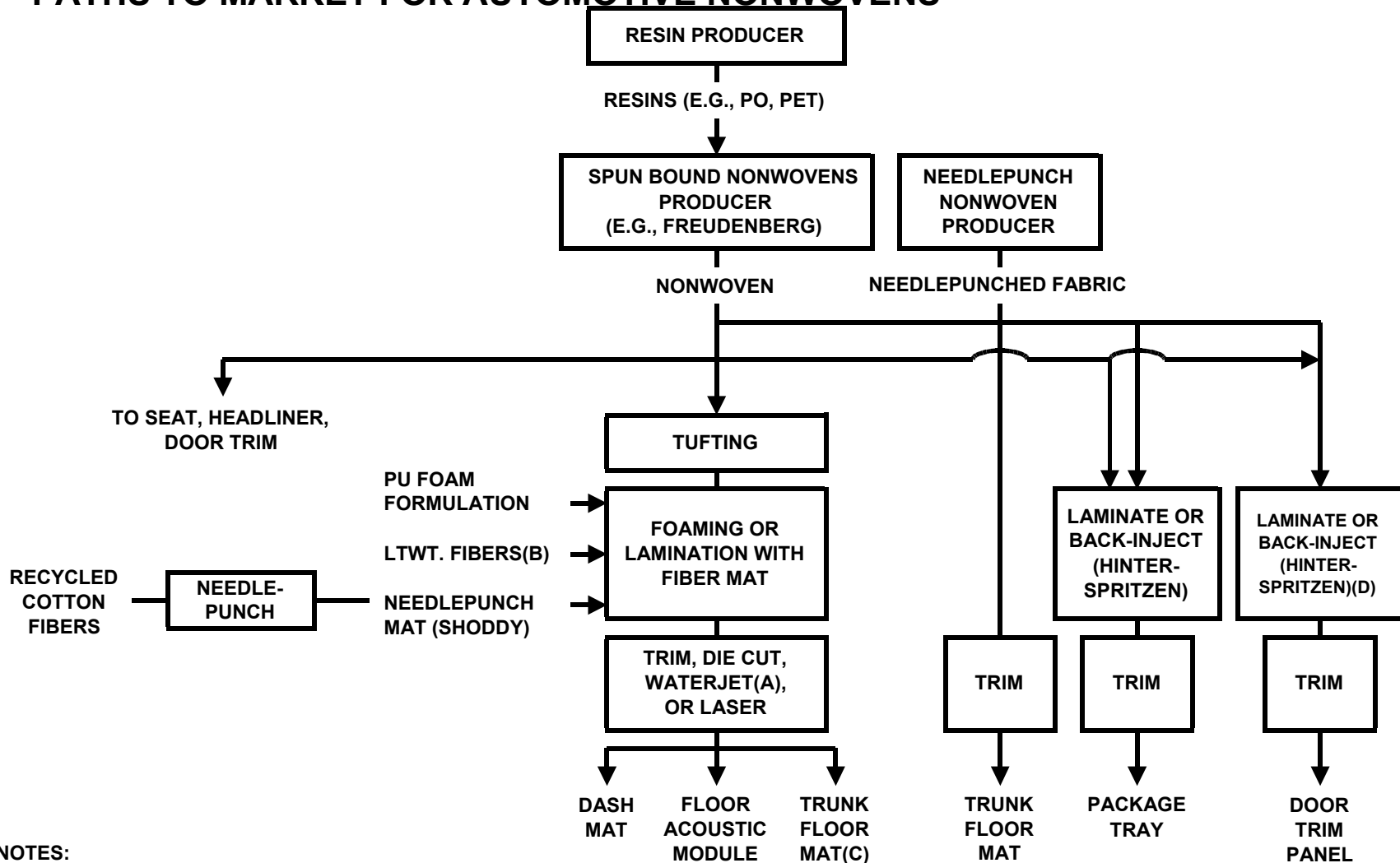
AUTO TEXTILES AND PROCESS COST SAVINGS

STRATEGY	EXAMPLE/APPLICATION
IN-LINE FORMING/ IN MOLD FORMING	<ul style="list-style-type: none"> -EPP FOAM/TEXTILE COMBOs -DOOR TRIM MEDALLIONS -HEADLINERS -FLOOR MODULES
BACK MOLDING OF TEXTILES	<ul style="list-style-type: none"> -WIDELY USED IN EUROPE -STARTING IN US -FAVORS POLYOLEFIN TEXTILES -ROLE FOR INTERMEDIATE LAYER
SANDWICH CONSOLIDATION	<ul style="list-style-type: none"> -FLOOR ACOUSTICS/TRUNK MODULE -DOOR TRIM INTEGRATED ACOUSTICS -SMART TEXTILES -HEADLINER/ENERGY ABSORBER

ADDING VALUE VIA IMPROVED TEXTILE PERFORMANCE CHARACTERISTICS

STRATEGY	EXAMPLE
IN-MOLD FABRICATION	-TEXTILES
LIGHTWEIGHT FIBERS	-FLOOR/ACOUSTICS, HEADLINER
SURFACE ESTHETICS	-MICRO-DENIER NONWOVENS -NEGATIVE FORMING -ELASTIC FIBERS
MICRO-DENIER NONWOVENS	-BETTER ACOUSTICS -IMPROVED DRAPE -REDUCED WRINKLING
CRAFTSMANSHIP	-JCI CRAFTECH® PROCESS
ELASTIC POLYOLEFIN NONWOVENS	-VIA NEW POLYOLEFIN RESINS -DOW, EXXONMOBIL, MITSUI, SUMITOMO
INTEGRATED ENERGY ABSORPTION	HEADLINER

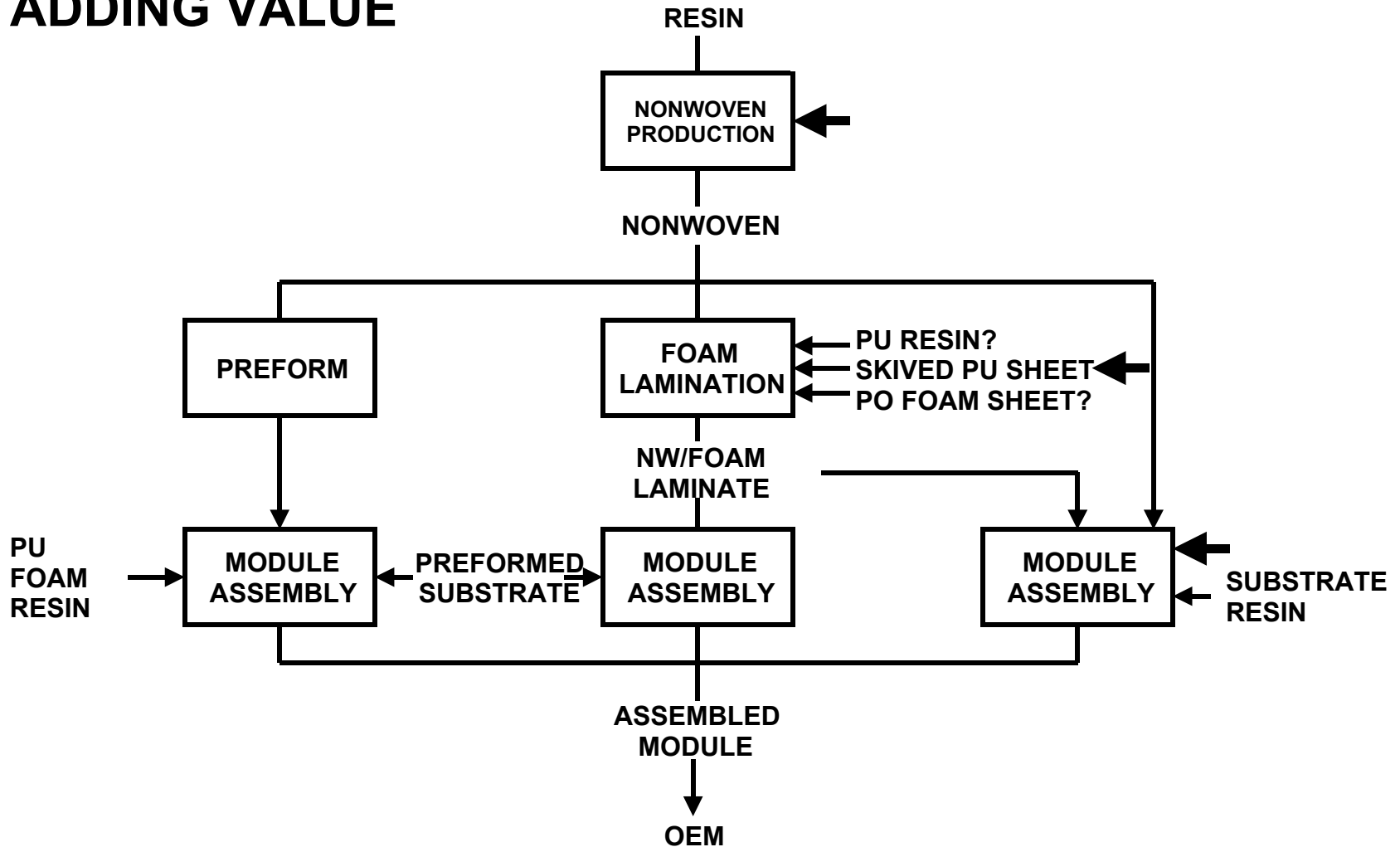
PATHS TO MARKET FOR AUTOMOTIVE NONWOVENS



- NOTES:
 OMITTS 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

nonwov ptr 03.vsd

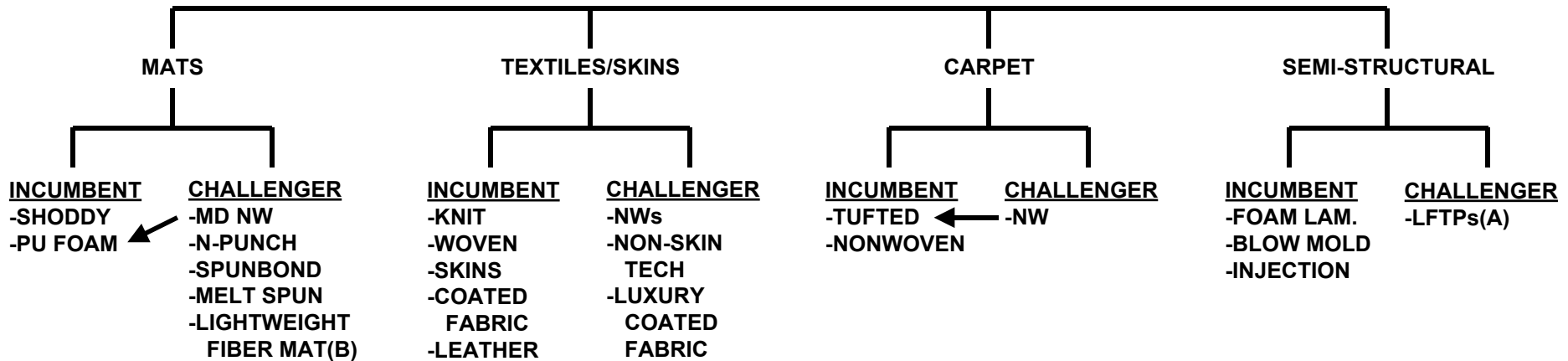
NONWOVEN PATH-TO-MARKET OPPORTUNITY FOR ADDING VALUE



NOTE: **➔** = VALUE ADD OPPORTUNITIES FOR NONWOVENS

SOURCE: ROBERT ELLER ASSOCIATES, INC/ JOHN R. STARR, INC. nw op-val ad 03.vsd
 AUTOMOTIVE NONWOVENS MULTICLIENT STUDY 18

NONWOVENS TARGET TREE (BY CONSTRUCTION TYPE)



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

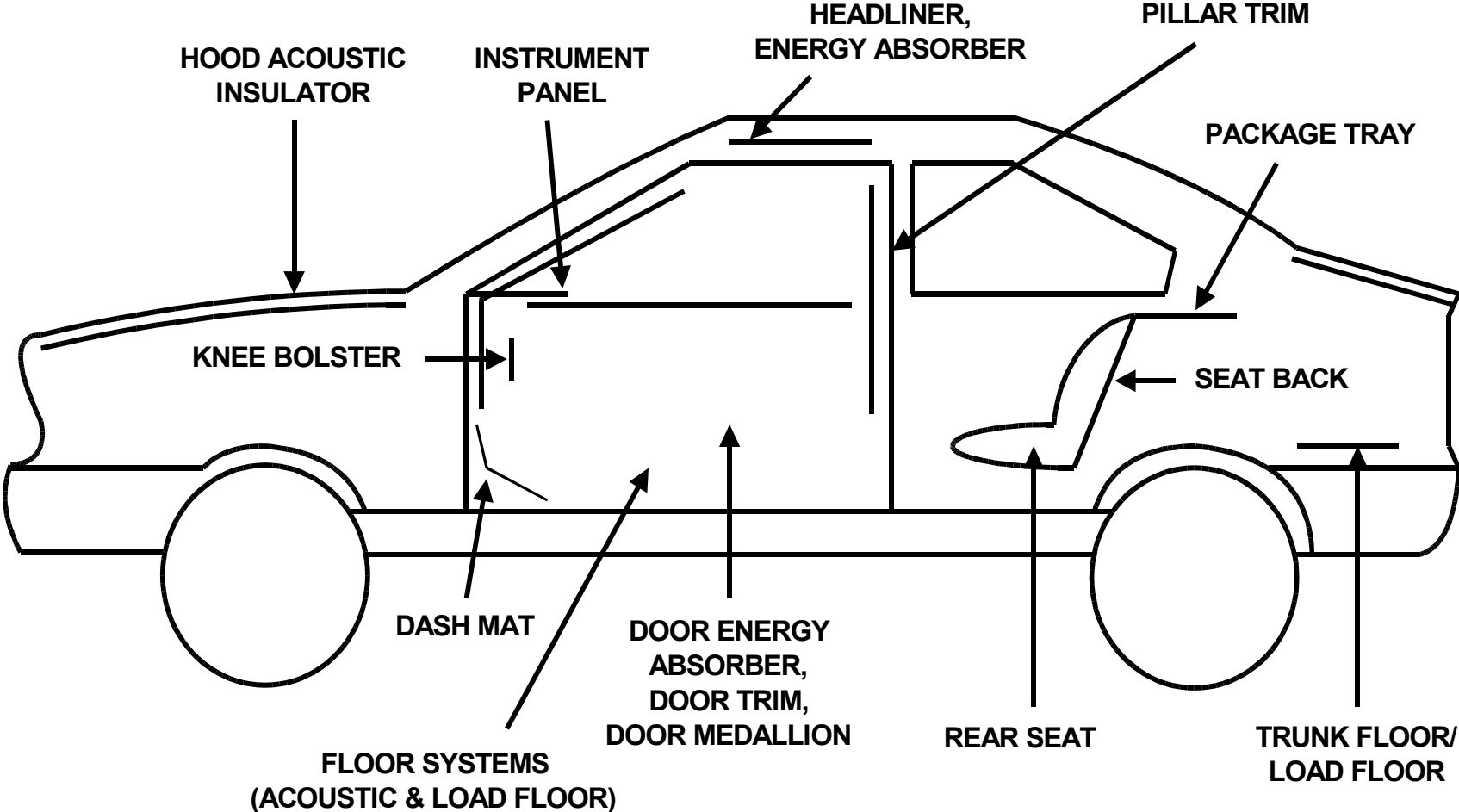
SOURCE: ROBERT ELLER ASSOCIATES, INC., 2004

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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



SOURCE: ROBERT ELLER ASSOCIATES, INC., 2004

DRIVING FACTORS FOR PO FOAM SUBSTITUTION

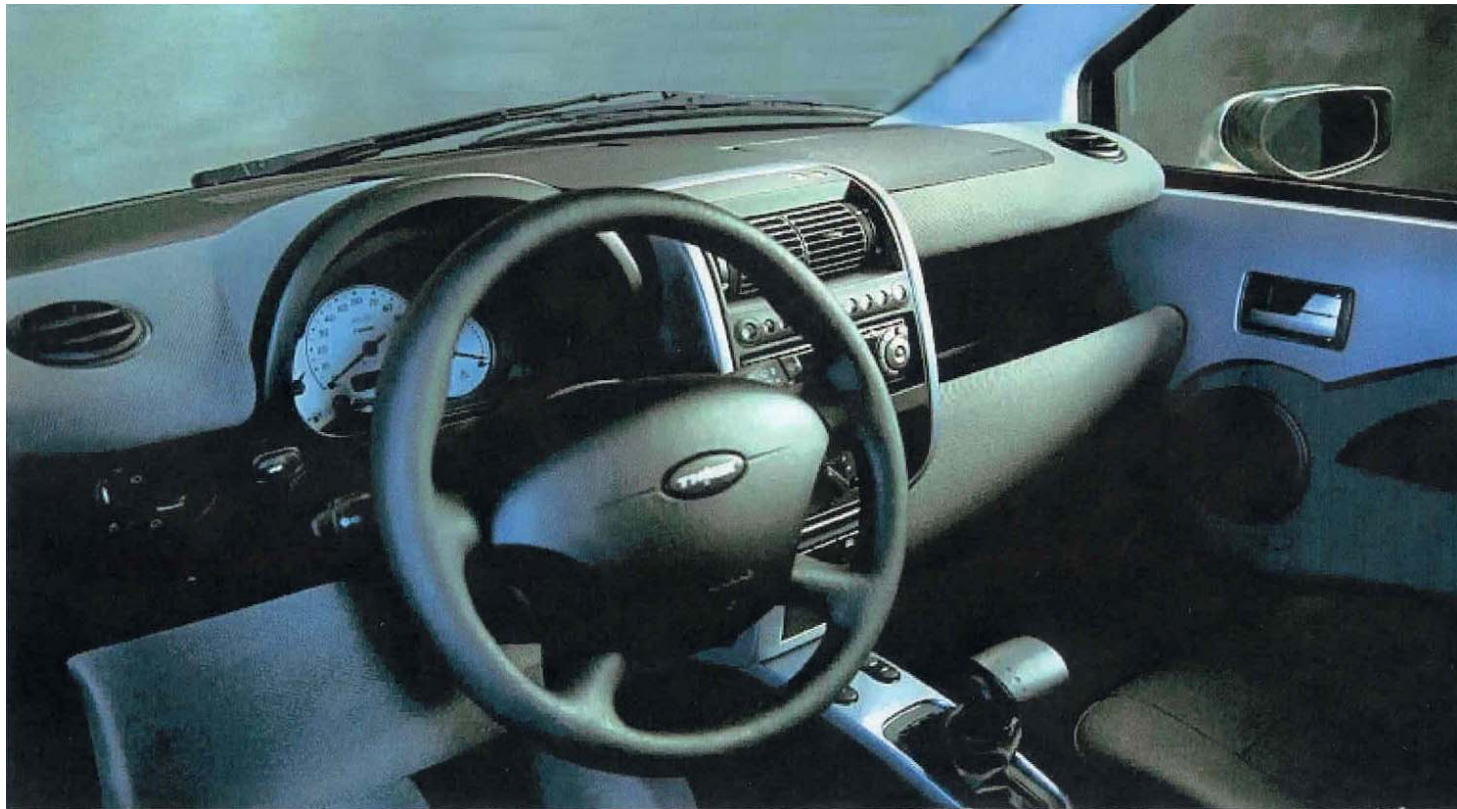
- **IN-MOLD TEXTILE/EPP FOAM
COMBINATION PROCESSES**
- **MICROCELLULAR PO SHEET FOAMS**
- **PROLIFERATION OF RADIATION
CROSSLINKING PO FOAM TECHNOLOGY**
- **LOW COST, NON-CROSSLINKED AND
CHEMICALLY CROSSLINKED PO SHEET
FOAMS**
- **PO FOAM/TEXTILE LAMINATE
POTENTIAL**
- **MARKET PENETRATION FOR THICK
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

LAMINATION METHOD	LAM SPEED M/M		NOTE
	TEX/ PUF	TEX/PO FOAM	
FLAME	30-60	10	--SLOWER FOR PO --ESTER-TYPE PUF REQUIRES FLAME RETARDANT
DIRECT CALENDERING	12	12	
HOT MELT FILMS	20	20	
HOT MELT SPRAY	30-60	20	PU ADHESIVES PRIMARILY
SCATTERING	12	12	

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



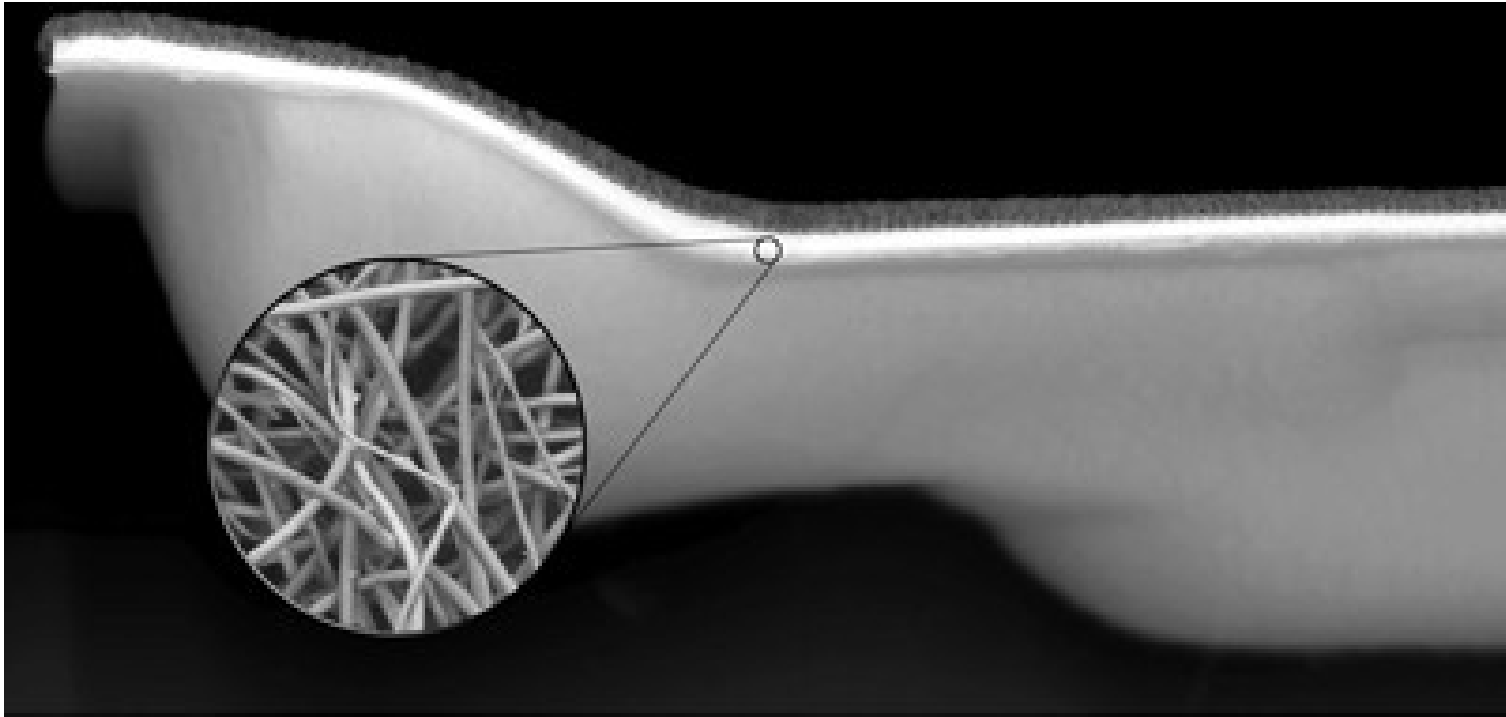
2005 FORD FREESTYLE LTD
SPARE TIRE COVER

EXAMPLE OF CURRENT DASH MAT LAYER CONSTRUCTION



SOURCE: COLLINS & AIKMAN

EXAMPLE OF ACOUSTICALLY TUNEABLE FIBER



Actfiber Sample of lightweight molded carpet system utilizing ActFiber. Acoustically tuned by controlling fiber length, blend and treated to increase densification where needed.

SOURCE: COLLINS AND AIKMAN

LIGHTWEIGHT FIBER REINFORCED THERMOPLASTICS (LFRTPs)

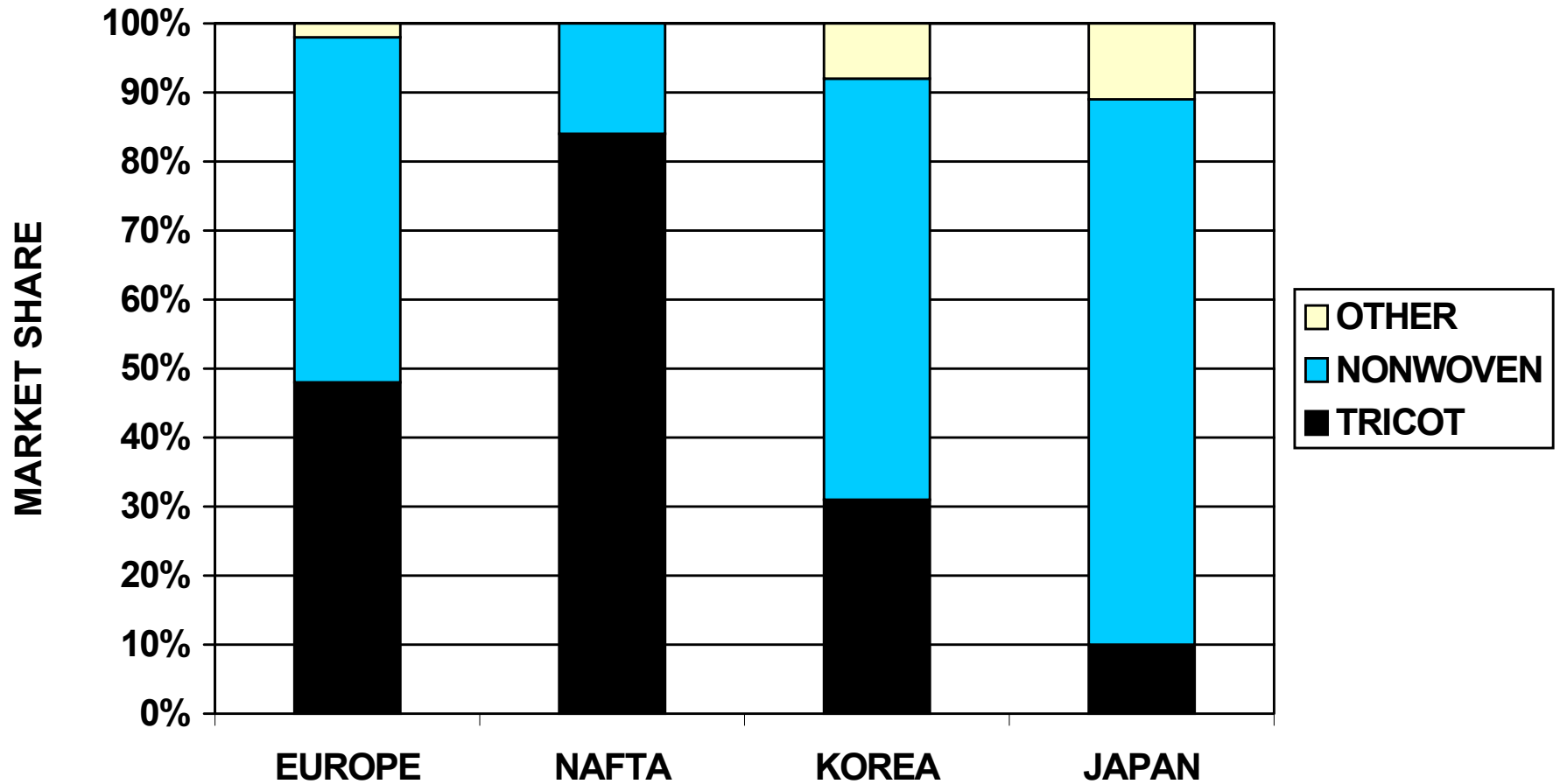
LFRTP SUPPLIER	NAME	PROCESS TYPE	NOTE
QUADRANT	SYMALITE®	DRY LAID NW	NEEDED
AZDEL	AZDEL SUPERLITE®	PAPER BASED	BASED ON ARJOWIGGINS
TOYOTA BOSHOKU		NW?	TOYOTA HEADLINERS
OTHER		NW	COMMERCIAL IN 2004

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**

NONWOVEN HEADLINER SHARES



SOURCE: FREUDENBERG VITECH

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)**
www.robertellerassoc.com
bobeller@prodigy.net