



Robert Eller Associates, Inc.

CONSULTANTS TO THE PLASTICS AND RUBBER INDUSTRIES

ENGINEERED FABRICS IN AUTOMOTIVE INTERIOR APPLICATIONS

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PRESENTED AT:

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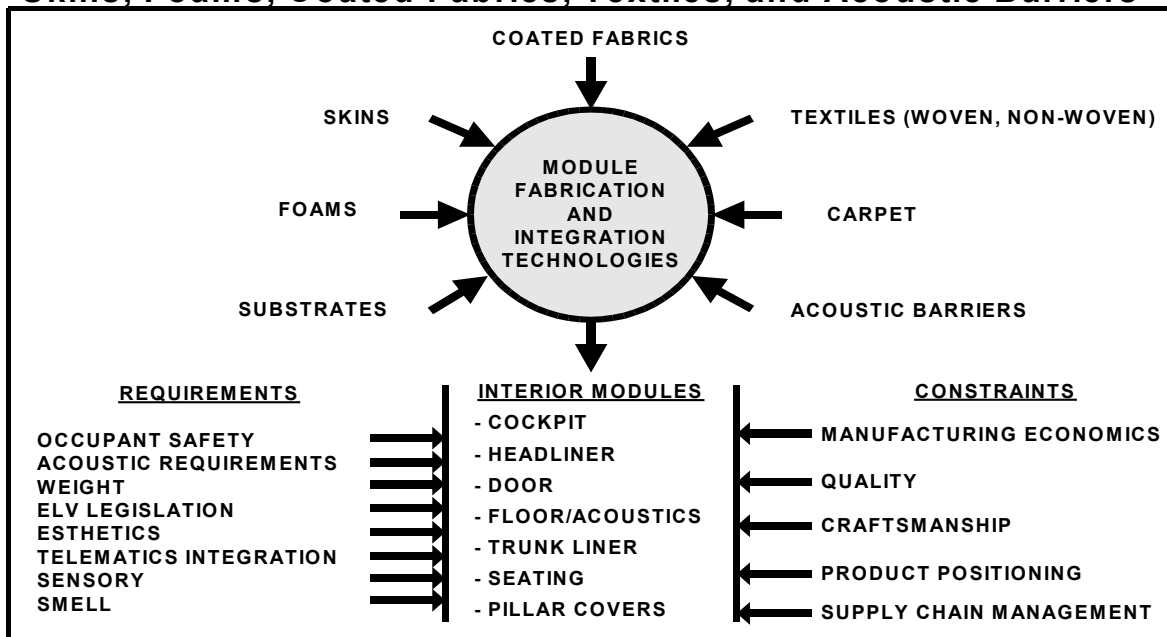
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PRESENTATION HIGHLIGHTS

- **ENGINEERED AUTO TEXTILES... SOME DEFINITIONS**
- **DRIVERS/TARGETS**
- **EUROPE/NAFTA TEXTILE DIFFERENCES**
- **VALUE ADD STRATEGIES/VALUE CHAIN SHIFTS**
- **PROCESS COST SAVINGS**
- **THE FOAM/TEXTILE INTERFACE**
- **FLOOR/ACOUSTIC MODULES**
- **HEADLINERS CHANGES**
- **PATHS-TO-MARKET SHIFT**
- **BASED ON :**
 - SOFT TRIM MULTICLIENT (REA)**
 - AUTO NONWOVENS MULTICLIENT(REA/J.R.STARR)²**



Automotive Interior Soft Trim: Skins, Foams, Coated Fabrics, Textiles, and Acoustic Barriers



Prospectus for a Global Multiclient Industry Analysis
Robert Eller Associates, Inc.

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*Technical, Economic, Market Analysis in
Support of Management Decisionmaking*

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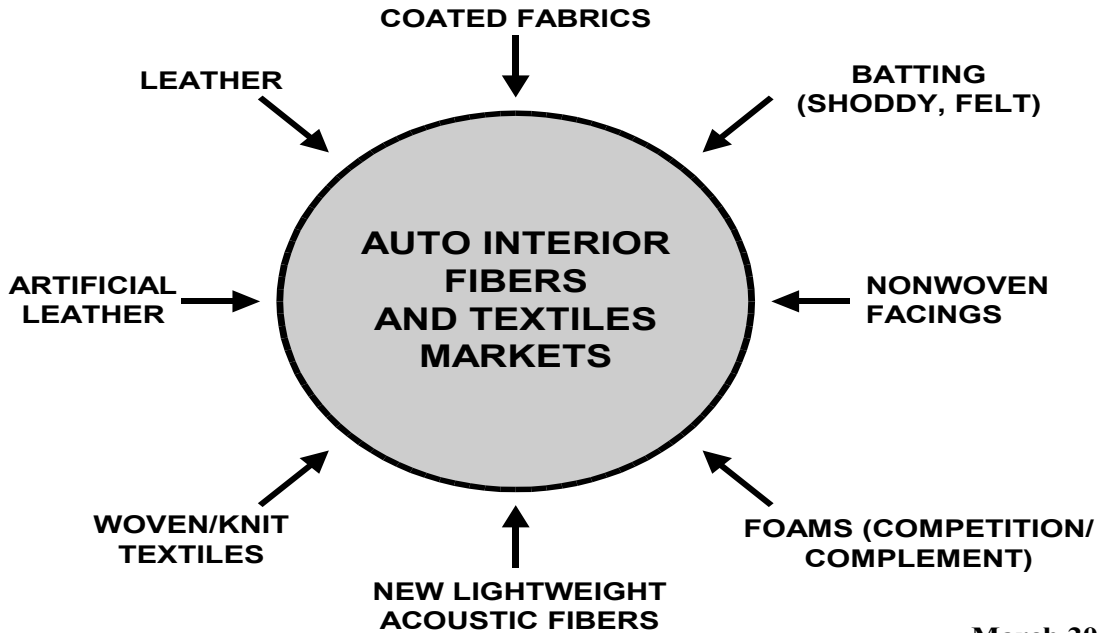
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**Opportunities for Advanced Technology
Nonwoven Fabrics for Automotive Interior
Surface and Construction Applications
in NAFTA and Europe**



March 2004

ENGINEERED AUTO TEXTILES...A COMPREHENSIVE VIEW

- **BATTING(INCUMBENTS VS NEW LT WT FIBERS)**
- **FACE FABRICS(NW VS KNITS AND WEAVES)**
- **CONSTRUCTION FABRICS**
- **BARRIER/ADHESIVE FABRICS**
- **SEMI-STRUCTURAL COMPOSITES**
- **NONWOVENS**
- **ARTIFICIAL LEATHERS**
- **ROLE FOR PROTEIN –BASED FIBERS**
- **NEW GENERATION COATED FABRICS**
- **SMART FABRICS**

ENGINEERED AUTOTEXTILE DRIVERS

- **PROFIT SQUEEZE ON TEXTILE SUPPLIERS**
- **MODULE COST SAVINGS**
- **AFFORDABLE LUXURY FABRICS**
- **V.O.C. REDUCTION**
- **MONOMATERIALS MODULES**
- **MODULE FABRICATION COST SAVINGS**
- **IMPROVED ESTHETICS(PRINT,3D,TOUCH)**
- **“SMART” VEHICLE GROWTH**
- **SUBSTRATE/FOAM SHIFT TO POLYOLEFINS**
- **NEW SEMI-STRUCTURAL MODULES**
- **ACOUSTICS/ENERGY ABSORPTION**
- **ON-BOARD FUNCTIONS/POPULATED PANELS**
- **WEIGHT REDUCTION**

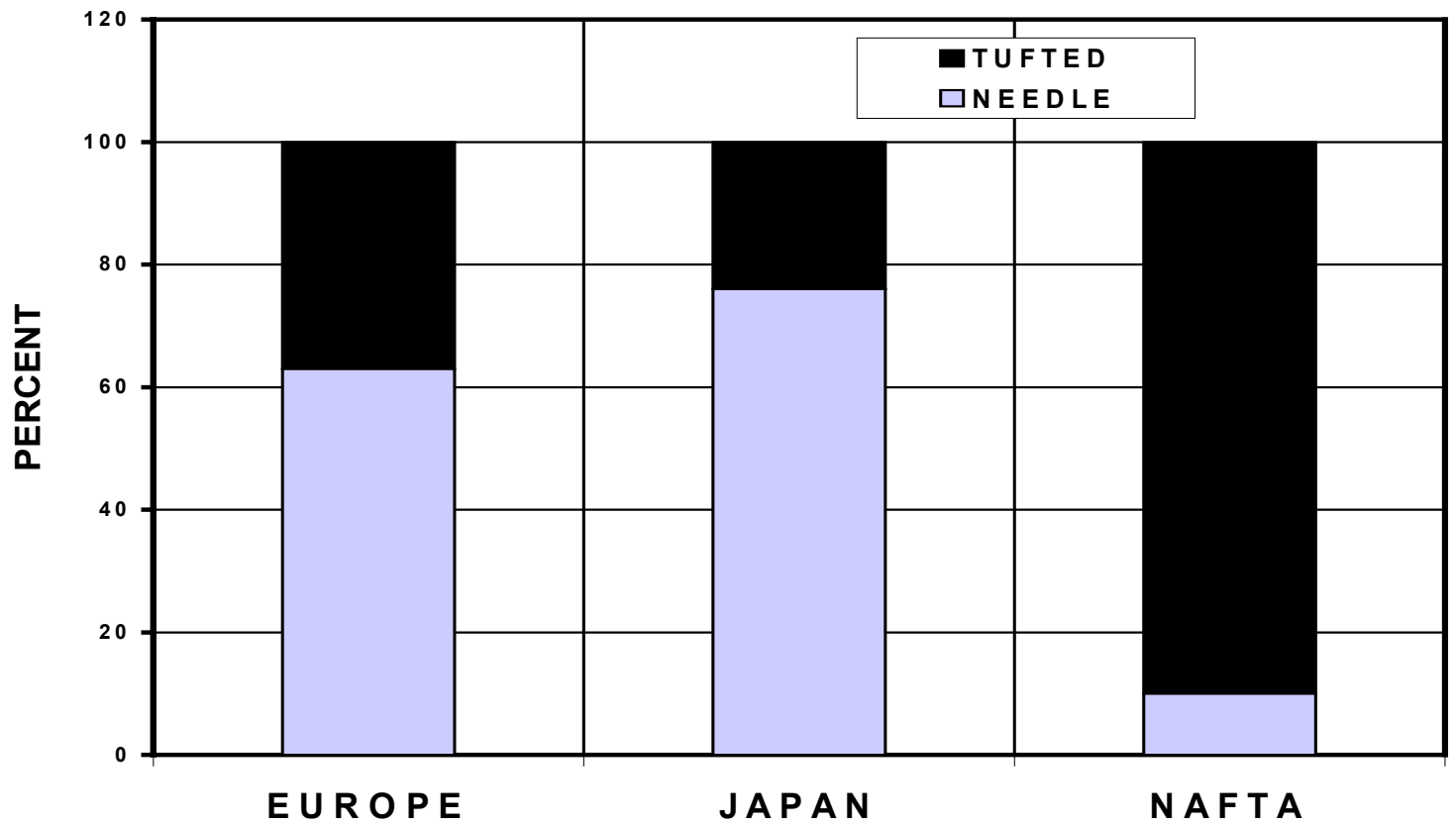
ENGINEERED AUTO TEXTILE TARGETS

- **AIRBAGS:GLOBAL 330 MM SQ.METERS IN '05**
- **HEADLINERS:PROCESS SHIFTS, ACOUSTICS,EA**
- **FLOOR/ACOUSTICS**
- **TRUNK MODULE:RAPID GROWTH, EA INTEGRATION, SEMI-STRUCTURAL COMPOSITES**
- **DOOR TRIM:MEDALLIONS, FOAMS,ACOUSTICS**
- **HOOD LINERS:SHIFT FROM FIBERGLASS?**
- **SUNVISORS:SHIFT TO EPP**
- **PILLAR TRIM :GROWTH OF BACK INJECTION**
- **CRAFTSMANSHIP: ALL MODULES**

EUROPE/NAFTA AUTOTEXTILE DIFFERENCES

TARGET MODULE/ KEY PARAMETER	ENGINEERED AUTO TEXTILE POSITION
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	-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 PROPERTIES: ENGINEERED AUTO TEXTILES

- **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**

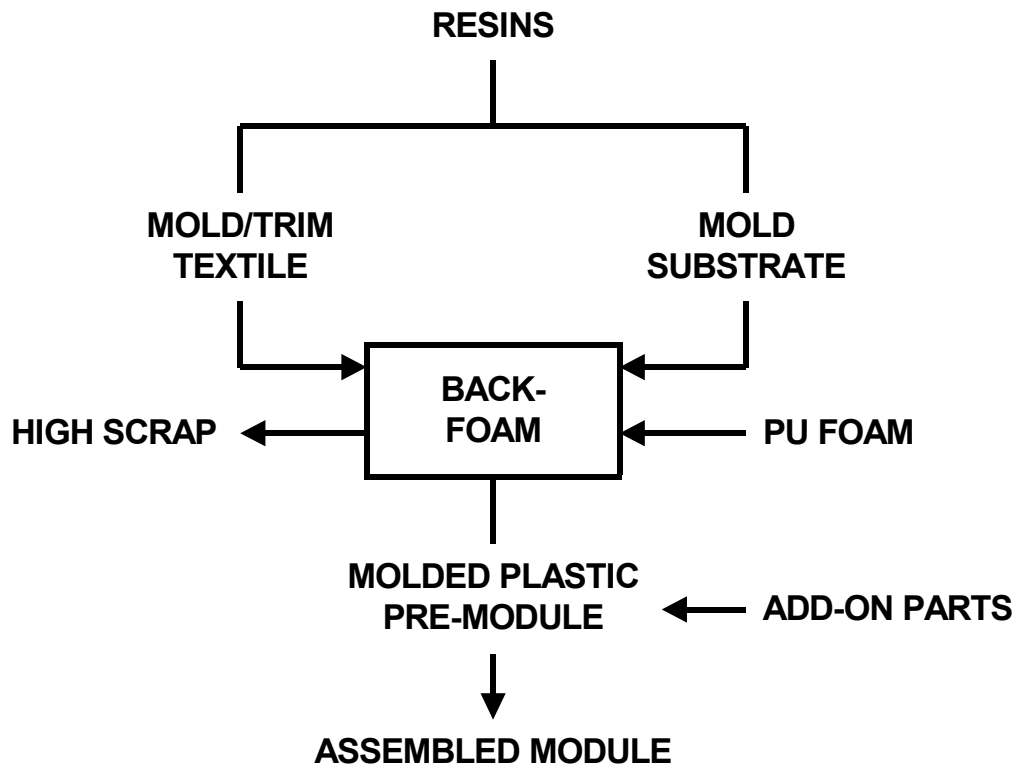
VALUE ADD STRATEGIES

- **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**
 - SMART TEXTILES**

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 -MICOR-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)

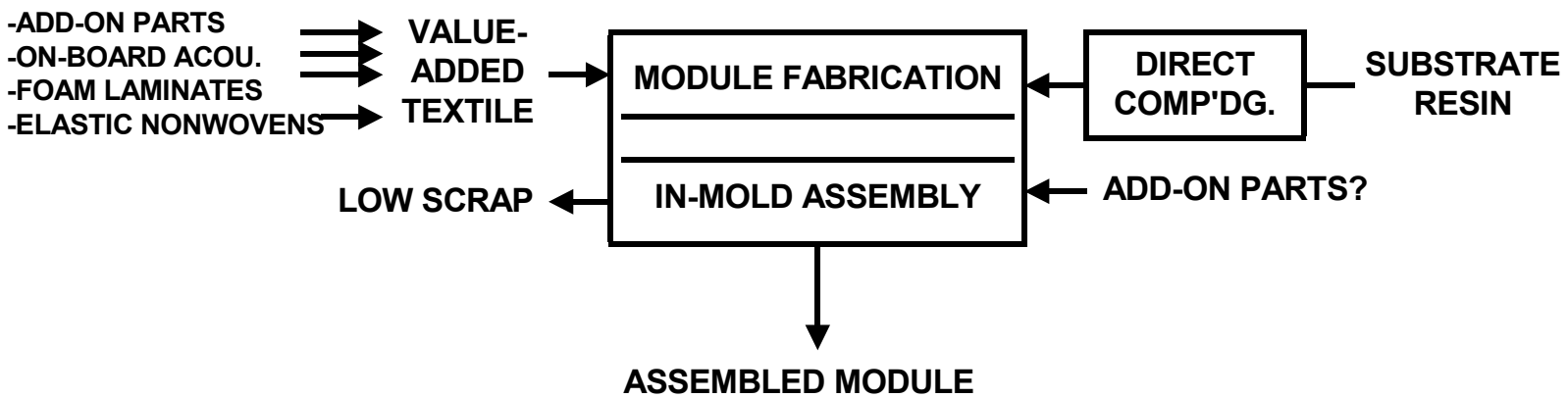


4-STEP OPERATION

SOURCE: ROBERT ELLER ASSOCIATES, INC., 2004

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FUTURE MODULE FABRICATION (IDEAL)



(IDEAL) 1-STEP OPERATION

SOURCE: ROBERT ELLER ASSOCIATES, INC., 2004

slide-one step 03.vsd

PROCESS COST SAVINGS FOR ENGINEERED AUTO TEXTILES

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

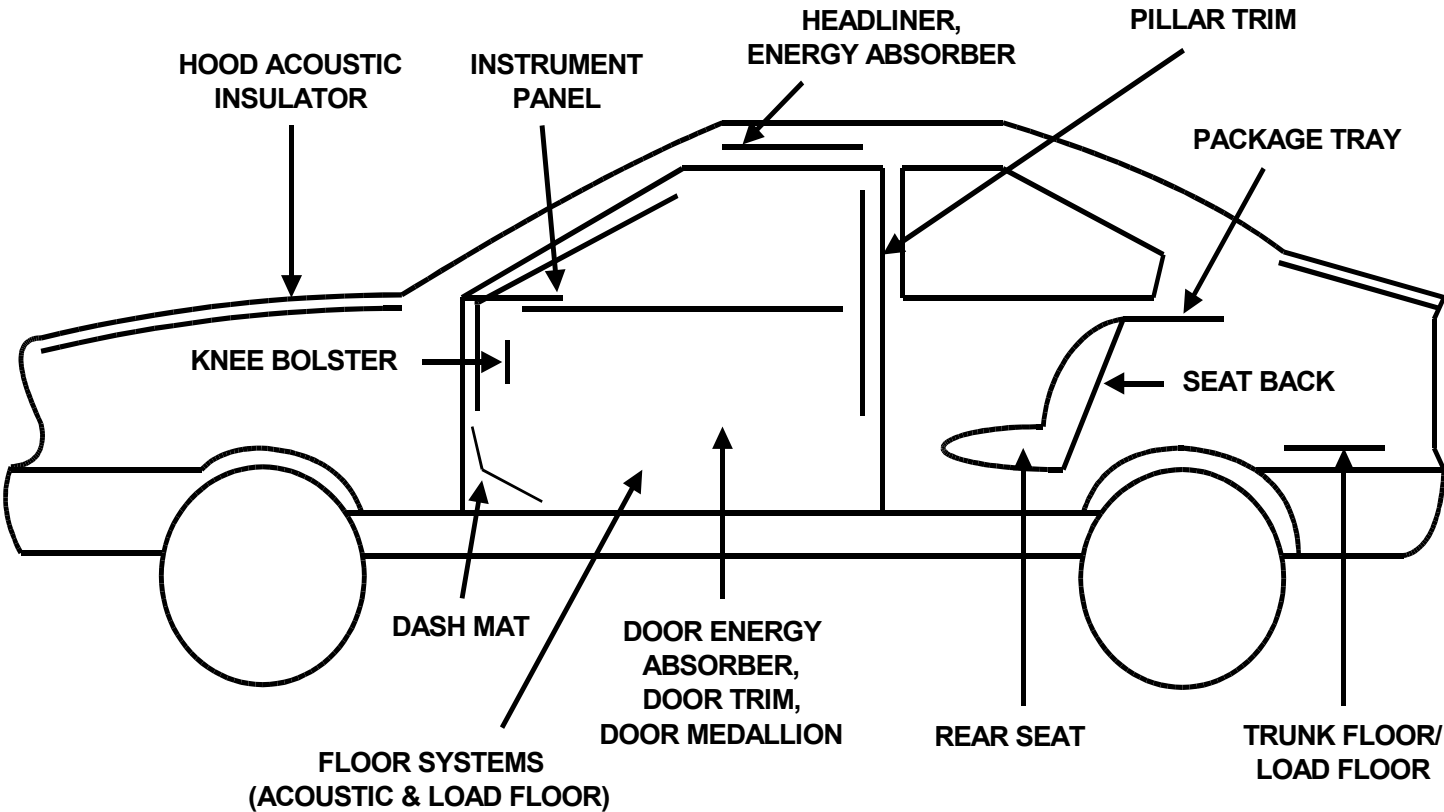
ADDING VALUE VIA IMPROVED TEXTILE PERFORMANCE CHARACTERISTICS

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 PO NONWOVENS	-VIA NEW POLYOLEFIN RESINS -DOW, EXXONMOBIL, MITSUI, SUMITOMO
LUXURY FABRICS	SEATING, DOOR TRIM, INSTRUMENT PANEL

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

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EPP SEMI-STRUCTURE/TEXTILE COVERING CONCEPT



SOURCE: TARACELL

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)**

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	

SOURCE: REA/J.R.STARR AUTO NONWOVENS MULTICLIENT

TEXTILE/FOAM COMPETITION IN FLOOR /ACOUSTIC MODULE

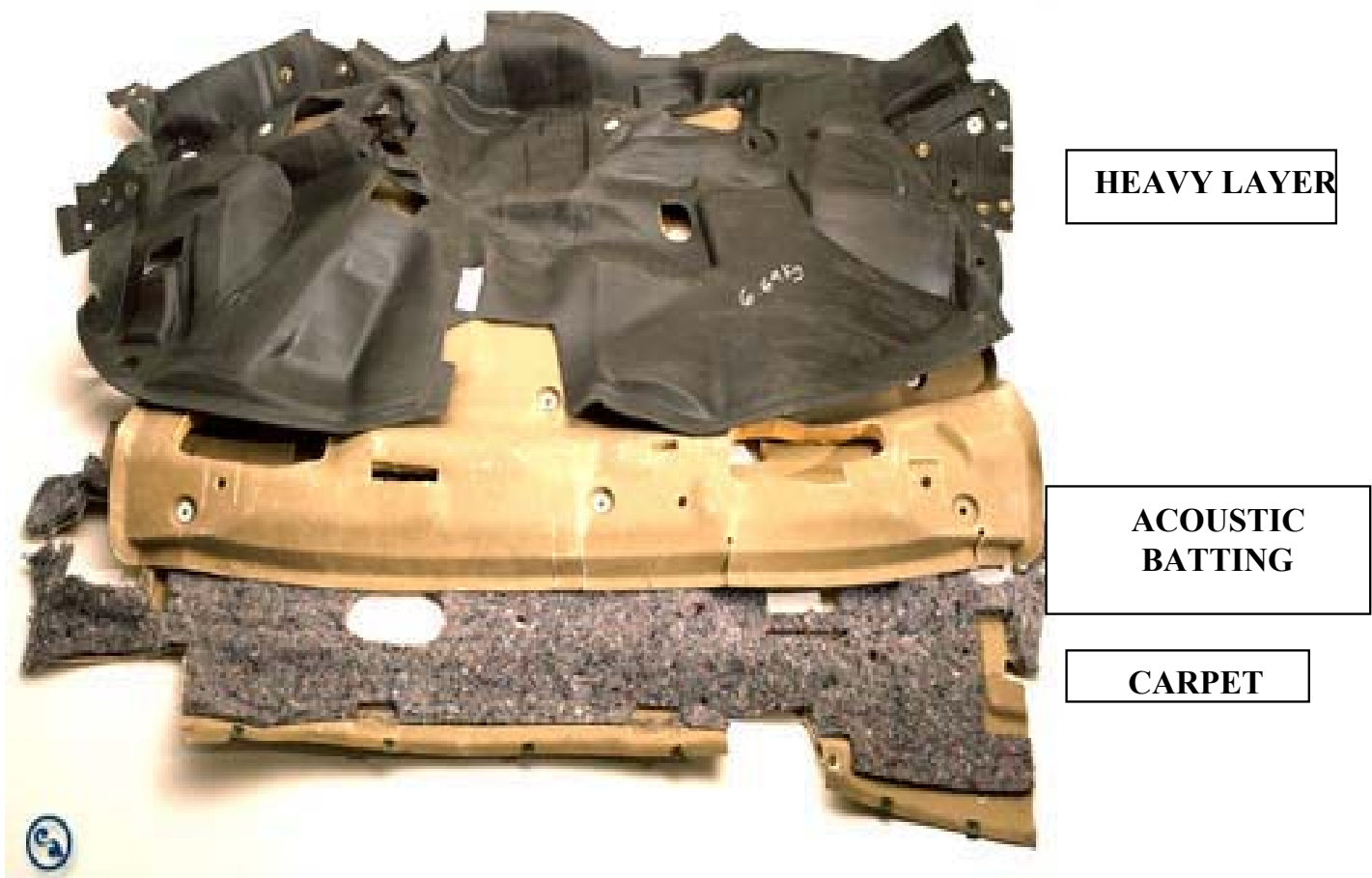
- **CURRENT MULTIMAT'L CONSTRUCTION:**
 - **HEAVY LAYER(FILLED EVA,SEBS)**
 - **FOAM OR LIGHTWEIGHT FIBER LAYER**
 - **CARPET**
- **MAJOR ACOUSTIC TIER 1s DEVELOPING
LIGHTWEIGHT FIBER CONSTRUCTIONS→
REDUCE OR ELIMINATE HEAVY LAYER**
- **CONSOLIDATED TRUNK MODULE GROWTH**
- **INTEGRATED FLOORS EVOLVING**
- **FOAM VS FIBER COMPETITION**



2004 BMW X3 2.5i-NON HINGED SPARE TIRE COVER



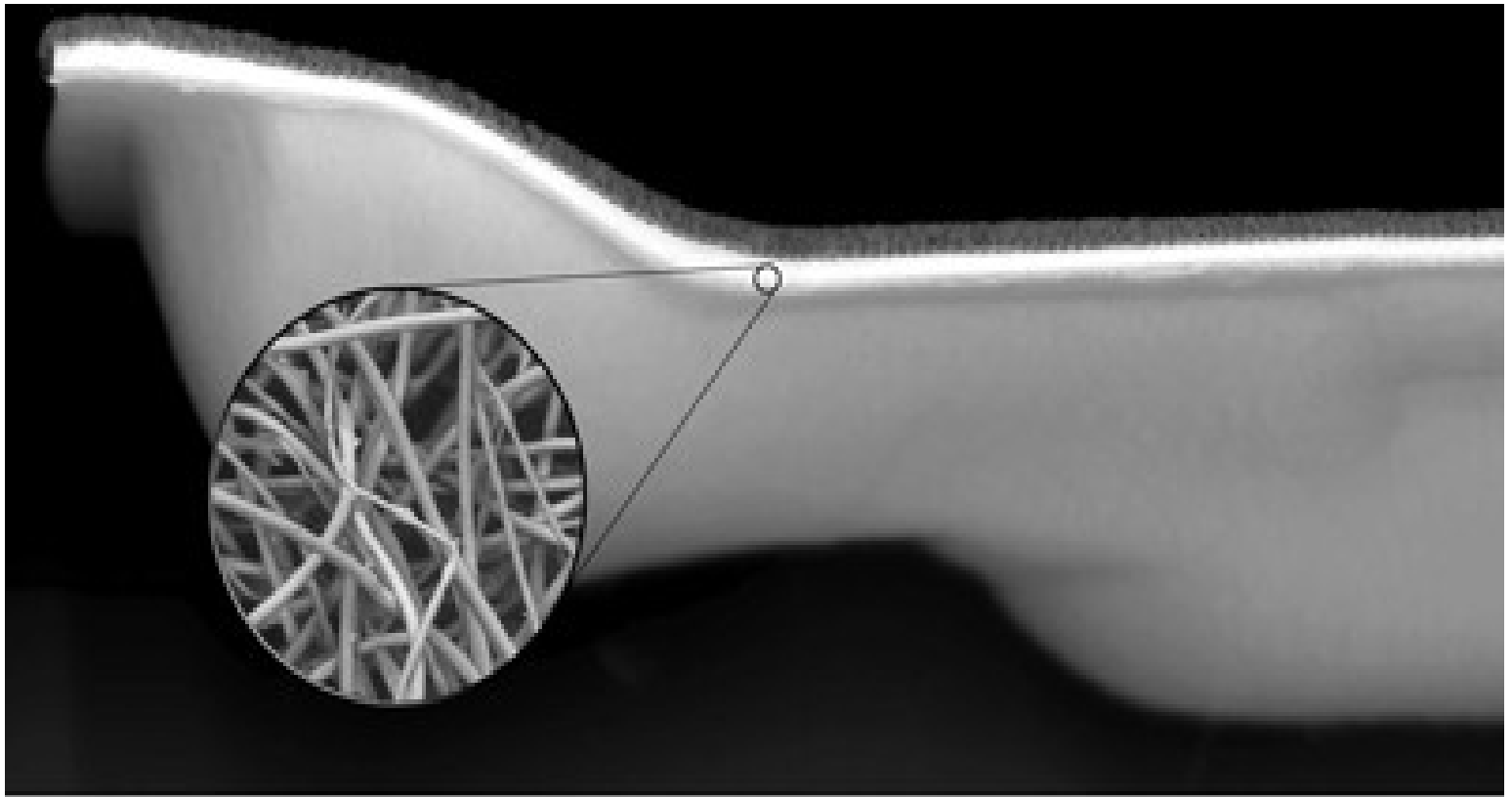
EXAMPLE OF CURRENT DASH MAT LAYER CONSTRUCTION



SOURCE: COLLINS & AIKMAN

EXAMPLE OF ACOUSTICALLY TUNABLE FIBER

SOURCE: COLLINS & AIKMAN

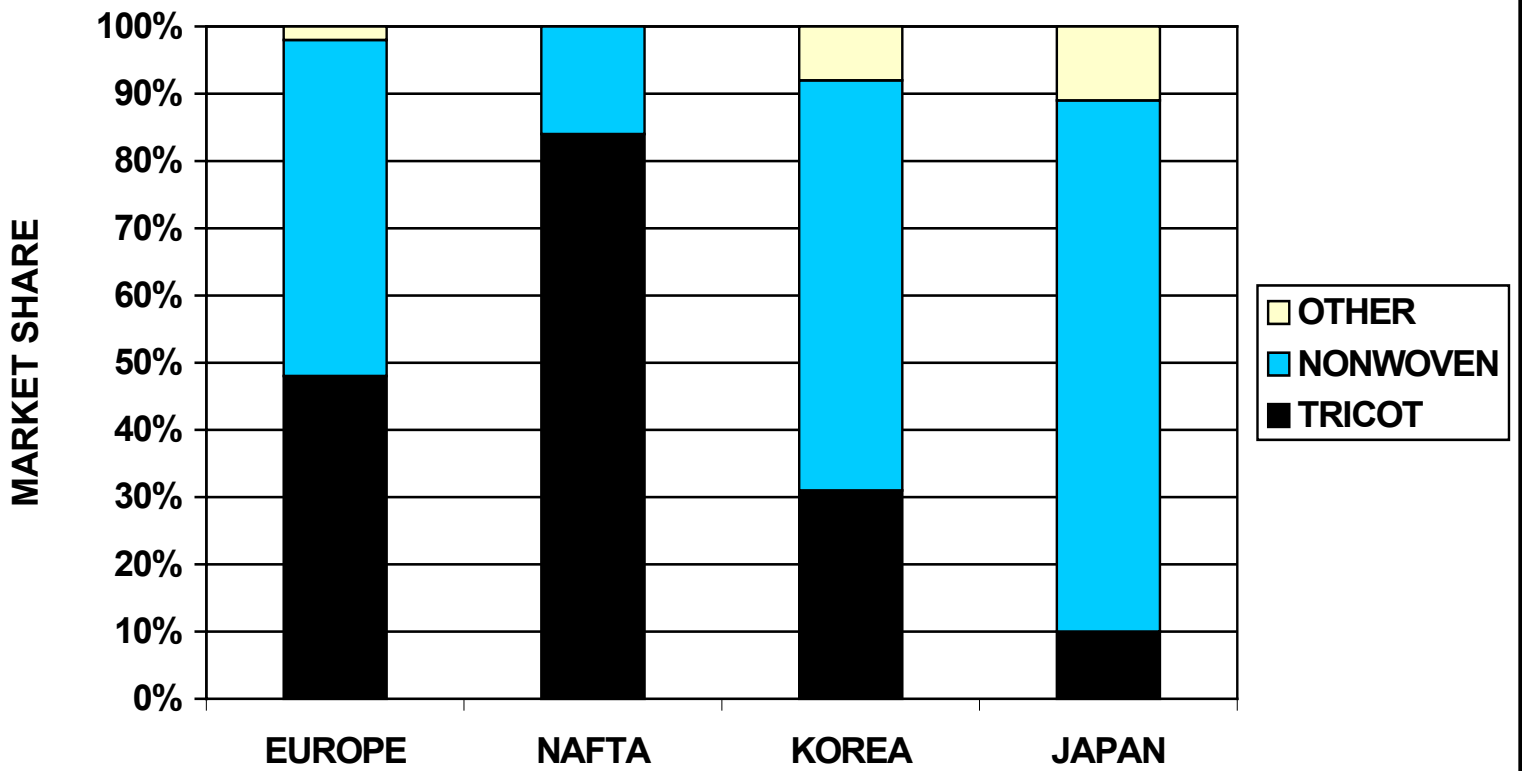


AcTfiber Sample of lightweight molded carpet system utilizing AcTfiber. Acoustically tuned by controlling fiber length, blend and treated to increase densification where needed.

PET/PO FIBER BATTLE IN HEADLINERS

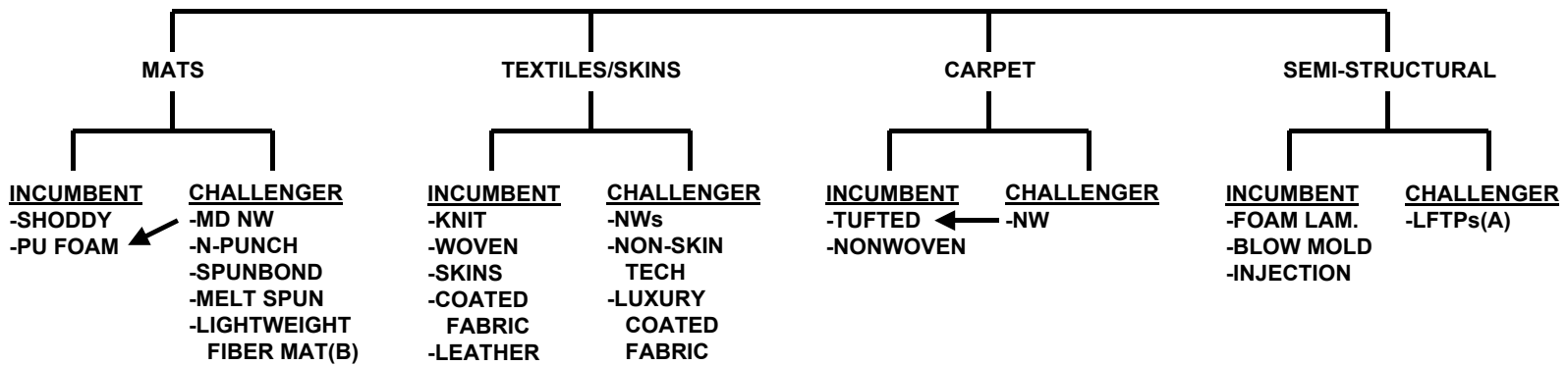
- **KEY MODULE FOR NW/KNITED COMP'N. IN FACE FABRIC**
- **USAGE DIFFERS BETWEEN REGIONS**
- **REQUIREMENT FOR ENERGY ABSORPTION COUNTERMEASURES, NEW LIGHTING APPROACHES & IMPROVED WORKPLACE SAFETY WITH AN EMPHASIS ON**
 - **INTEGRATING ENERGY ABSORPTION**
 - **USE OF LIGHTER WEIGHT ACOUSTIC LAYERS**
 - **SUBSTRATE BATTLE:**
 - LIGHTWEIGHT FIBER MAT(BI-COMPONENT NWs)**
 - GR-POs(QUADRANT, AZDEL, BP's CURVE)**
 - EPP BEAD FOAMS**
 - **PO SUBSTRATE APPROACHES FAVOR PO NWs AS FACE FABRIC**

NONWOVEN HEADLINER SHARES



SOURCE: FREUDENBERG VITECH

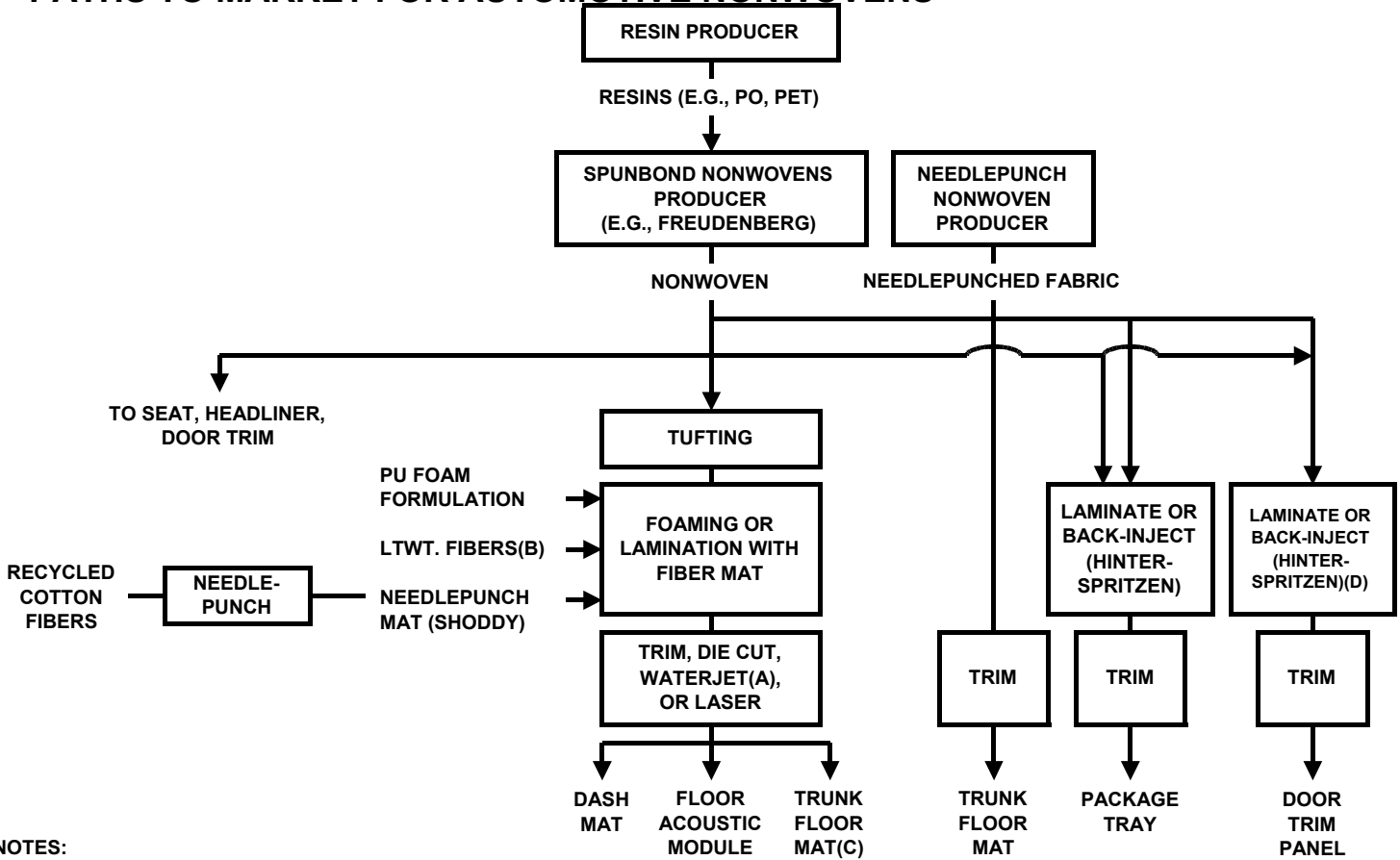
NONWOVENS TARGET TREE (BY CONSTRUCTION TYPE)



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

SOURCE: ROBERT ELLER ASSOCIATES, INC., 2004
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PATHS TO MARKET FOR AUTOMOTIVE NONWOVENS

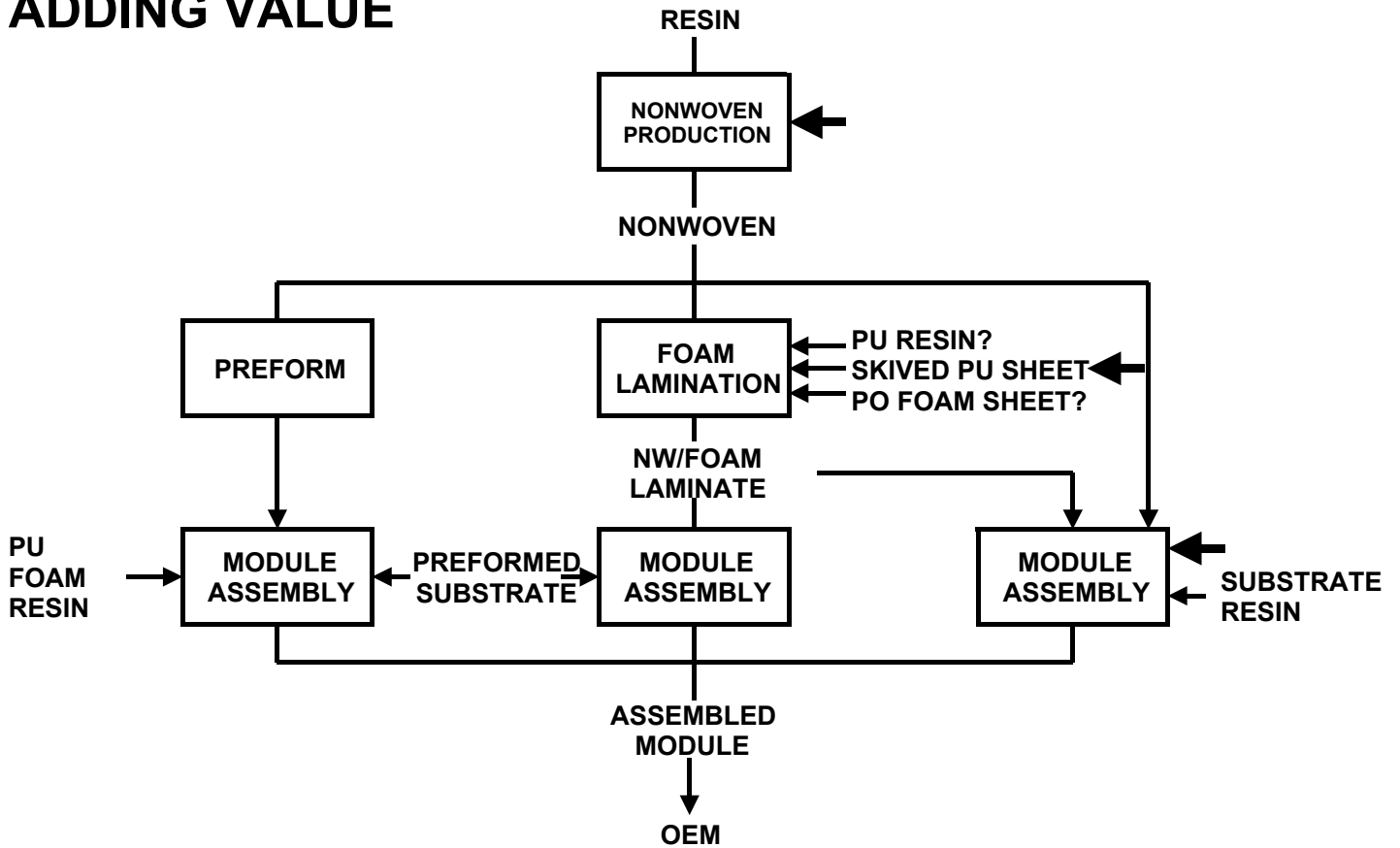


- NOTES:
 OMMITS HYDROENTANGLED (ABOUT 6% MKT. SHARE)
 (A) DOMINANT METHOD
 (B) E.G., AcT™ (C+A), ULTRALIGHT™ (RIETER), SonoTec AT (LEAR), DUAL IMPEDANCE FIBER (PELZER)
 (C) HIGH END VEHICLES ONLY
 (D) EPP FOAMS MAY BE USED FOR HINTERSPRITZEN

nonwov ptm 03.vsd

SOURCE: ROBERT ELLER ASSOCIATES, INC./ JOHN R. STARR, INC.
 AUTOMOTIVE NONWOVENS MULTICLIENT STUDY 31

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 32

SUMMARY

- **MANY ENGINEERED TEXTILE GROWTH DRIVERS**
- **VALUE ADD OPPORTUNITIES VIA:**
 - TEXTILE PROPERTIES**
 - VALUE CHAIN POSITION**
 - MODULE FABRICATION TECHNOLOGY**
- **PO TEXTILES WILL GROW**
 - NONWOVENS SHARE GAIN(MICRODENIER/ELASTIC)**
 - COATED FABRICS**
- **GROWTH OF BACK-MOLDING IN N.A. MARKET**
- **ROLE FOR PROTEIN-BASED FIBERS**
- **INCREASED USE OF:**
 - **3D FABRICS,PRINTED FABRICS**
 - **MICRO-DENIER NWs**
- **CONT'D PENETRATION OF SUEDE-LIKE LUXURY FABRICS(ALCANTARA, CLARINO,NUBUCK,OTHERS)**
- **EUROPE/US TECHNOLOGY CONVERGENCE**

ADDITIONAL ENGINEERED 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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