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ROBERT ELLER ASSOCIATES, INC.

**CONSULTANTS TO THE PLASTICS AND RUBBER
INDUSTRIES**

ROLE OF NONWOVENS IN AUTOMOTIVE INTERIOR SURFACE AND CONSTRUCTION APPLICATIONS

**PRESENTED BY :
ROBERT ELLER**

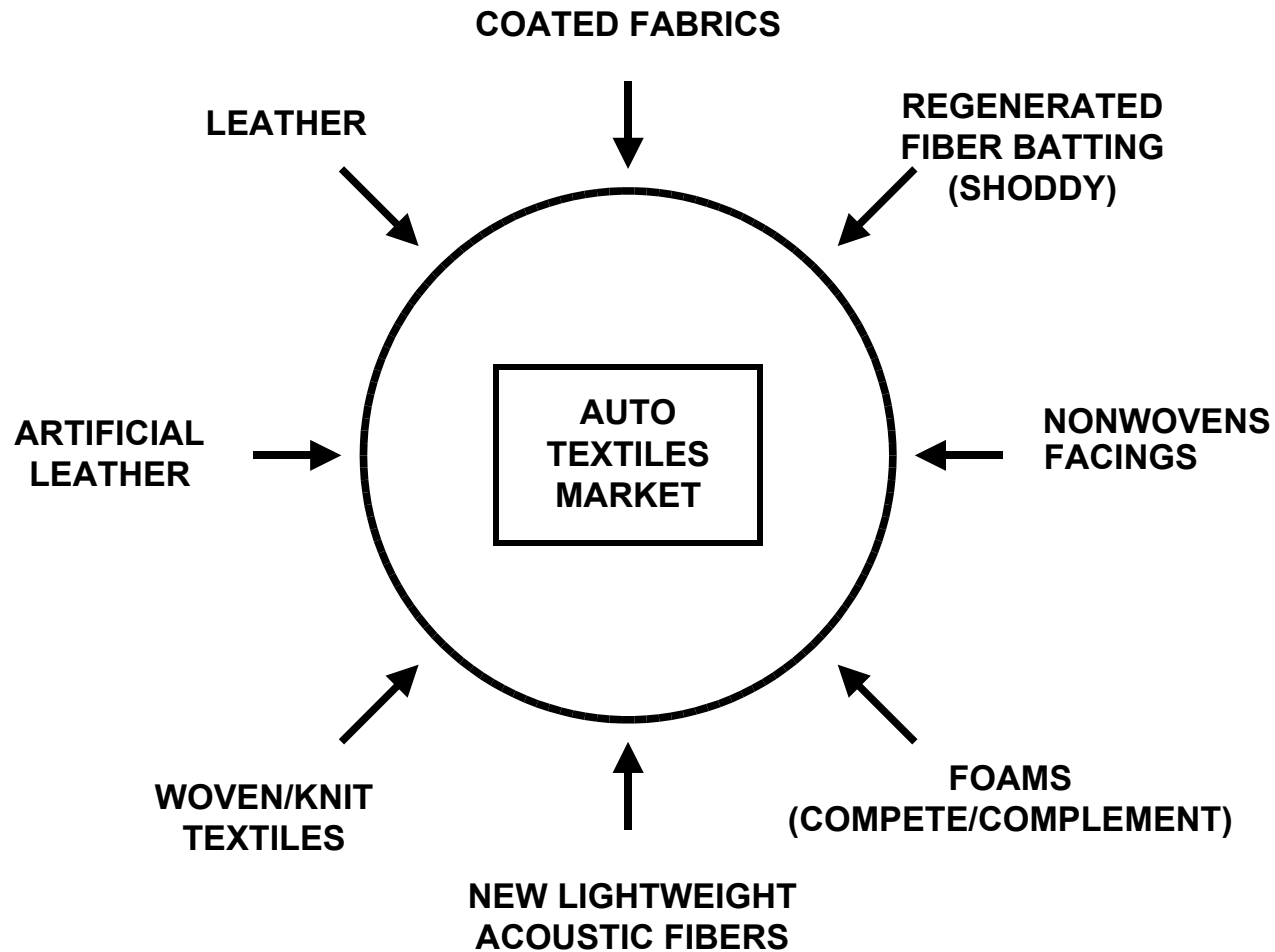
**PREPARED FOR:
AUTO INTERIORS 2003
DETROIT, MI**

MAY 15, 2003
papers/ai03

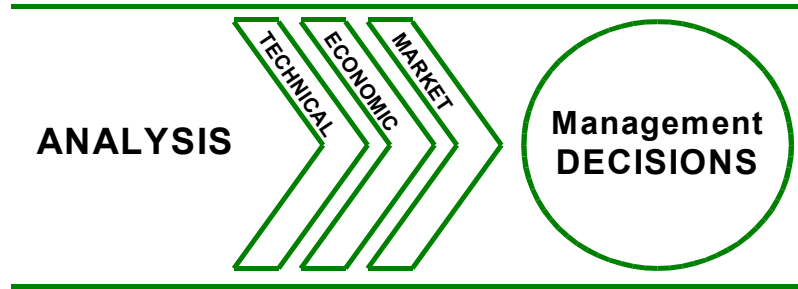
HIGHLIGHTS

- **THE AUTO INTERIORS MARKET**
- **DRIVING FORCES FOR SUBSTITUTION**
- **MATERIALS/PROCESS TECHNOLOGY SHIFTS → IMPLICATIONS**
- **INTERMATERIALS COMPETITION**
- **EUROPE/NAFTA DIFFERENCES**
- **HEADLINER**
- **FLOOR/ACOUSTICS MODULES**
- **DOOR TRIM**
- **VALUE-ADDED OPPORTUNITIES FOR NONWOVENS**

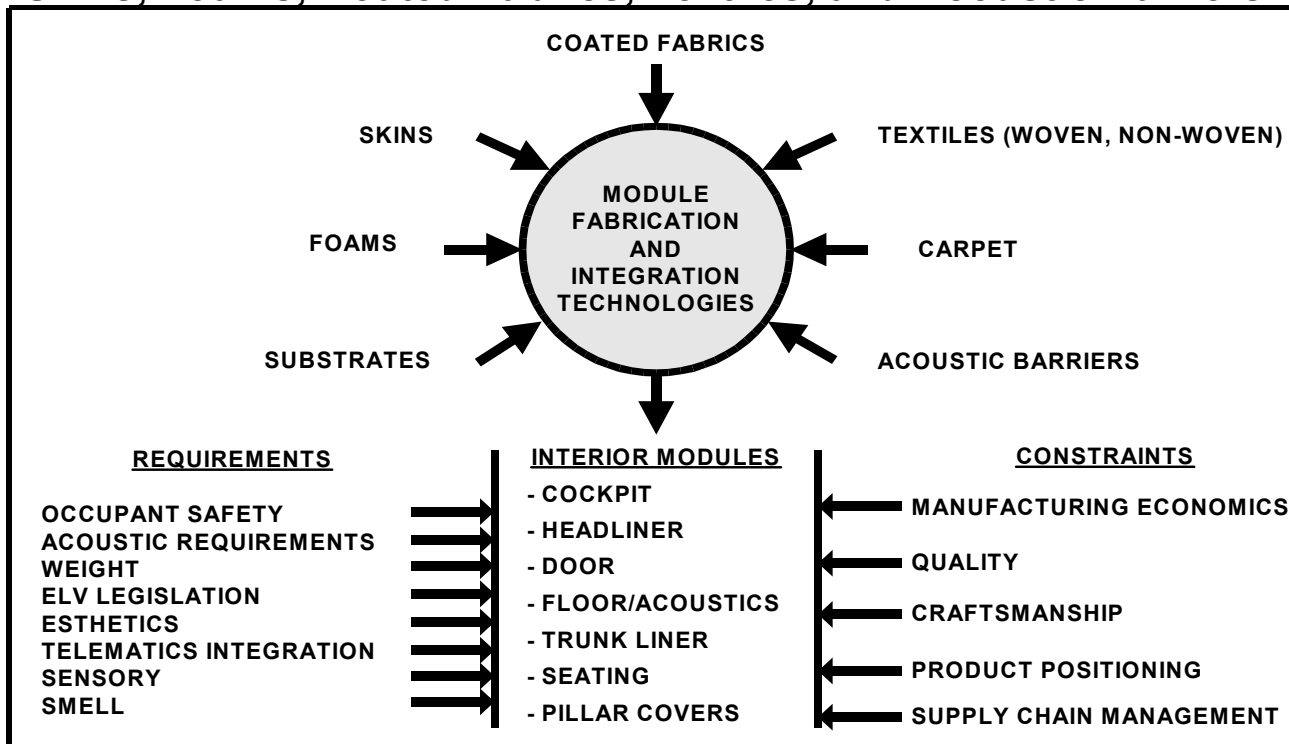
AUTOMOTIVE TEXTILES . . . AN ECUMENICAL PERSPECTIVE



SOURCE: ROBERT ELLER ASSOCIATES, INC., 2003



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



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

MULTICLIENT PROSPECTUS: NONWOVENS IN AUTOMOTIVE TRIM

- TECHNOLOGY,ECONOMICS FOR ADVANCED NONWOVENS**
- ANALYSIS/QUANTIFICATION OF CURRENT/FUTURE POTENTIAL**
- MODULE FABRICATION TECHNOLOGY IMPLICATIONS**
- EMPHASIS ON NEW NONWOVENS TECHNOLOGY**
- ALL INTERIOR MODULES**
- INDUSTRY STRUCTURE IMPLICATIONS**
- EUROPE/NAFTA**
- TO BE OFFERED JOINTLY BY ROBERT ELLER ASSOCIATES, INC. AND JOHN R. STARR,INC.**
- PROSPECTUS AVAILABLE**

SOME OPERATING HYPOTHESES

- **NEW NWs TECHNOLOGY → NEW TRIM MARKETS**
- **NW VALUE-ADD OPP'YS : UNDEREXPLOITED**
- **BOTH MATERIAL/PROCESS COST SAVING POSSIBILITIES**
- **MODIFICATION POSSIBLE IN FACE FABRIC AND LAYER CONSTRUCTIONS**
- **ACOUSTICS PROPERTIES CAN BE TAILORED**
- **CURRENT PENETRATION IS PRIMARILY IN HEADLINER, FLOOR SYSTEMS, PACKAGE TRAYS**
- **ONLY 17% OF POTENTIAL IS REALIZED TO DATE**
- **NO: SEATING(LIMITED), DOOR TRIM, PILLAR TRIM, AIRBAG**
- **NWs WILL PARTICIPATE IN NON-STRUCTURAL COMPOSITES**
- **NWs AND FOAMS COMPETE AND COMPLEMENT**

NEW TECHNOLOGY NONWOVENS' SUPERIOR ATTRIBUTES

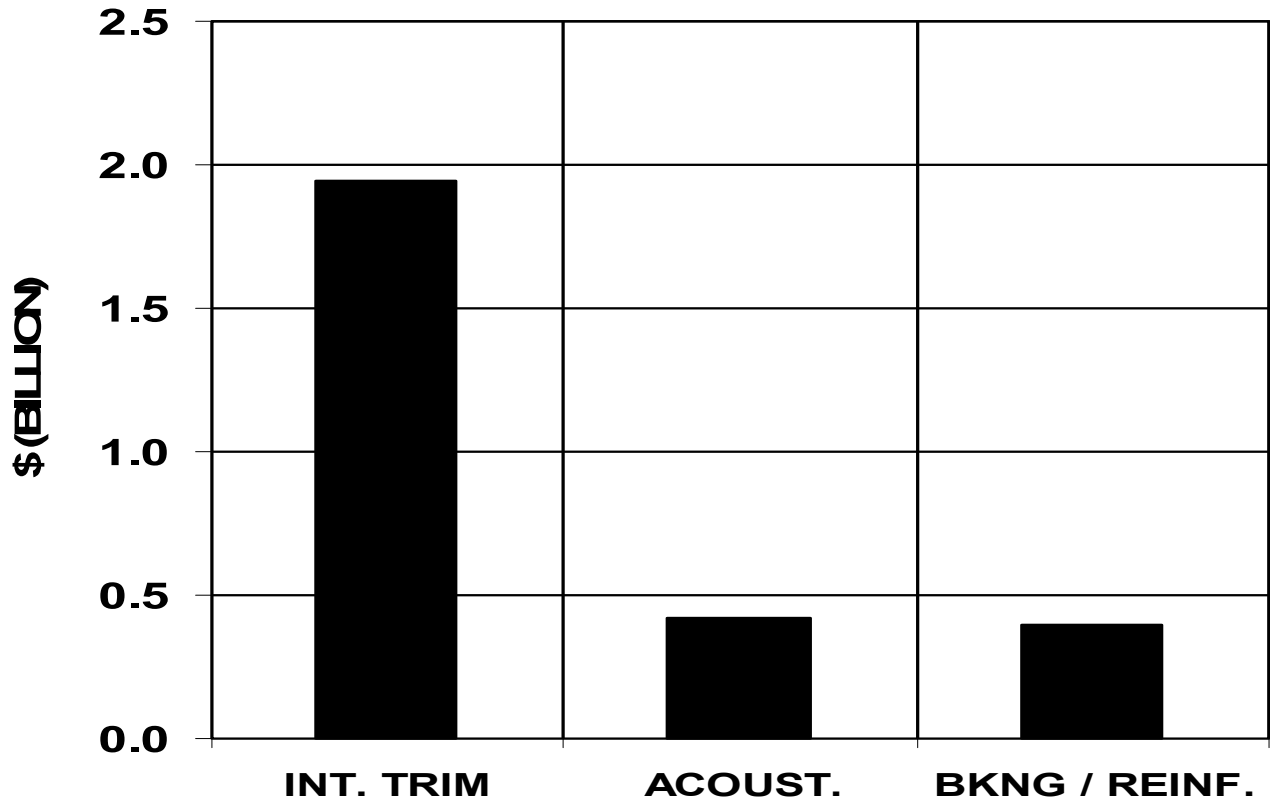
- **IMPROVED PERFORMANCE:**
 - SOFTNESS, TACTILE, CONFORMABILITY/DRAPE**
 - DURABILITY**
- **BREATHABILITY/CONTROLLED POROSITY**
- **ACOUSTIC/THERMAL INSULATION, FILTRATION**
- **UV RESISTANCE**
- **PRINTING, EMBOSSING, DYEABILITY**
- **NON-FRAYING (VS. TEXTILES)**
- **MICRODENIER**
- **FILTRATION**

SOME NW TARGET MARKETS(NAFTA)

MODULE	AREA (MM SM)	NOTE/PENETRATION
SEATING	90	STARTING EUROPE(SIDES)
FLOOR /ACOUSTICS	55	LT WT FIBER OPP'Y
TRUNK LINER	41	13% SHARE
HEADLINER	35	15% FOR FACE FABRIC
DOOR TRIM	32	START MEDALLIONS FOAM LAMINATION OPP'Y
DASH MAT	23	COMPETE WITH PU FOAMS

SOURCE: ROBERT ELLER ASSOCIATES, INC., SOFT TRIM MUTLICLIENT STUDY

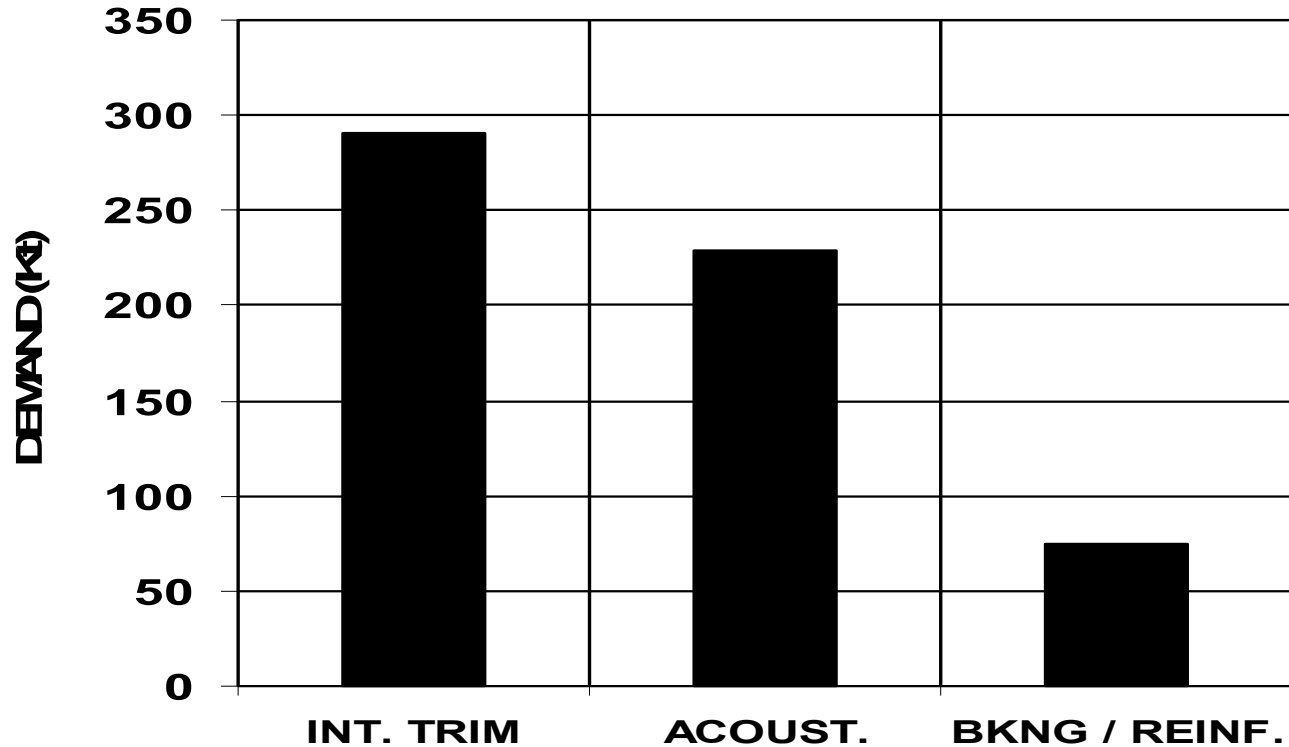
**AUTOMOTIVE FABRICS MARKET VALUE
(NAFTA/EUROPE), 2002**



**NOTE: INCLUDES TEXTILE, NONWOVEN,
WOVEN, COATED FAB., REGEN. FIBER BATTING**

**SOURCE: ROBERT ELLER ASSOCIATES, INC.,
JOHN R. STARR INC.**

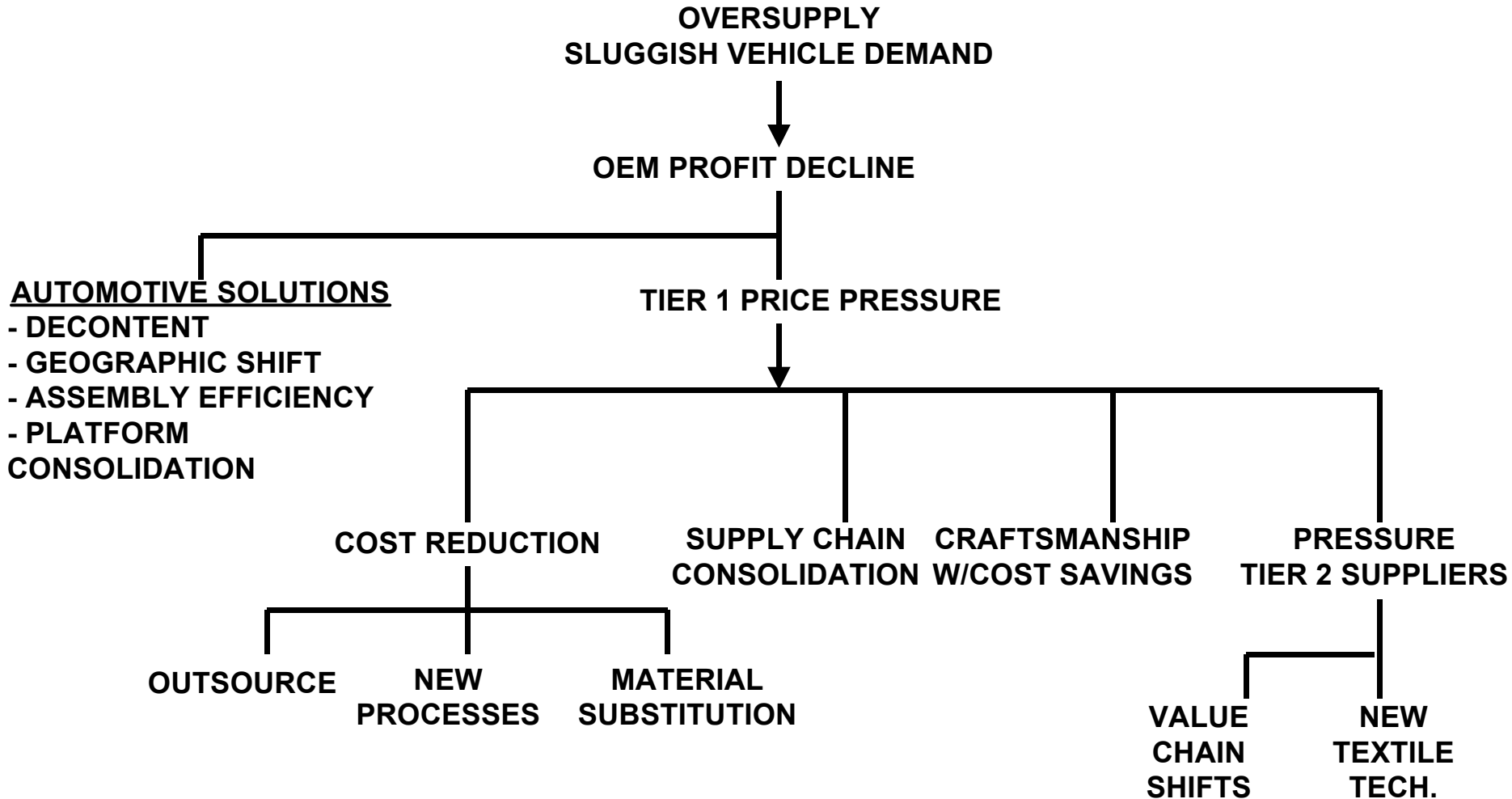
**AUTOMOTIVE FABRICS MARKET SIZE
(NAFTA/EUROPE), 2002**



**NOTE: INCLUDES TEXTILE, NONWOVEN,
WOVEN, COATED FAB., REGEN. FIBER
BATTING**

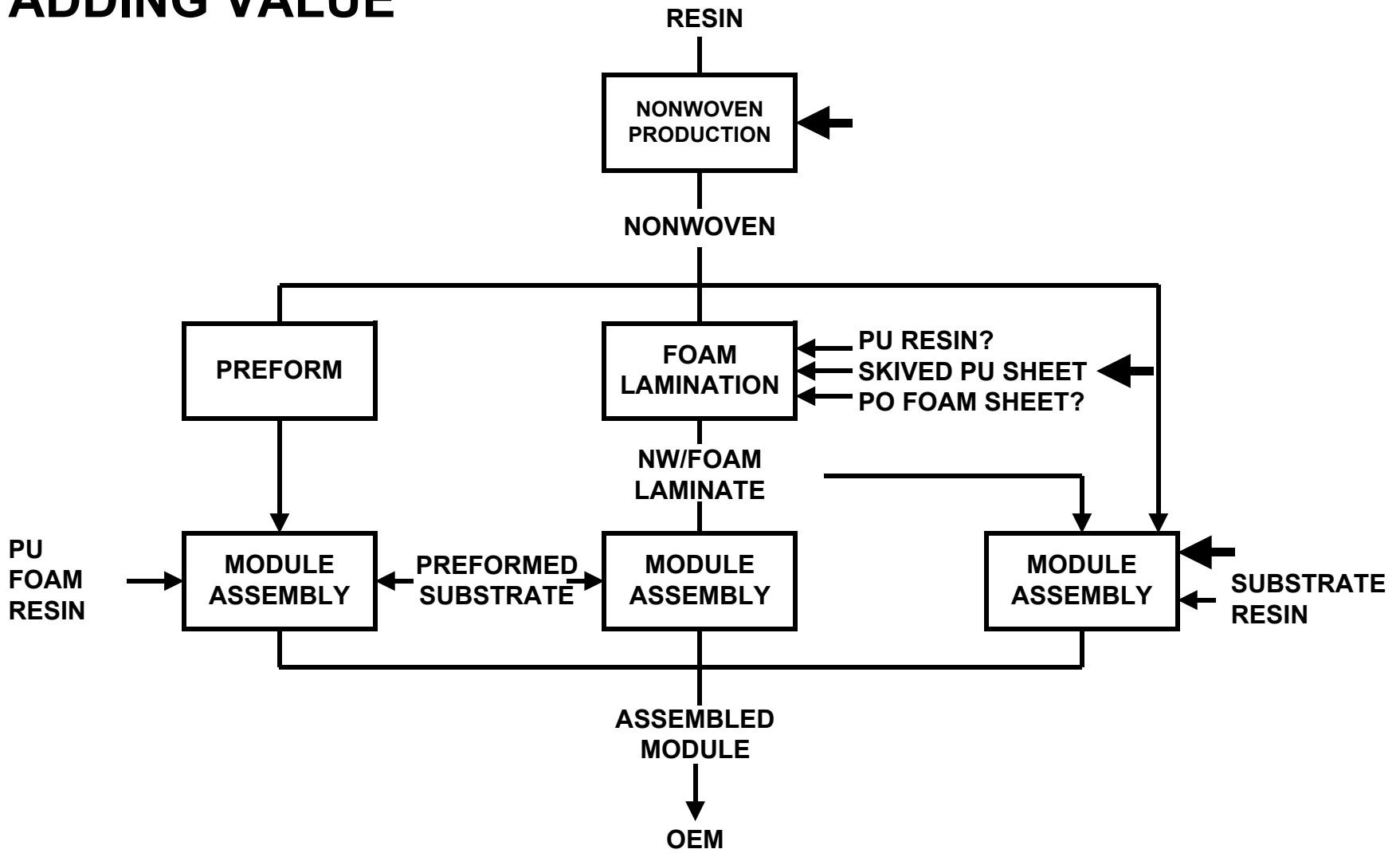
**SOURCE: ROBERT ELLER ASSOCIATES, INC.,
JOHN R. STARR INC.**

OEM/SUPPLIER DYNAMICS

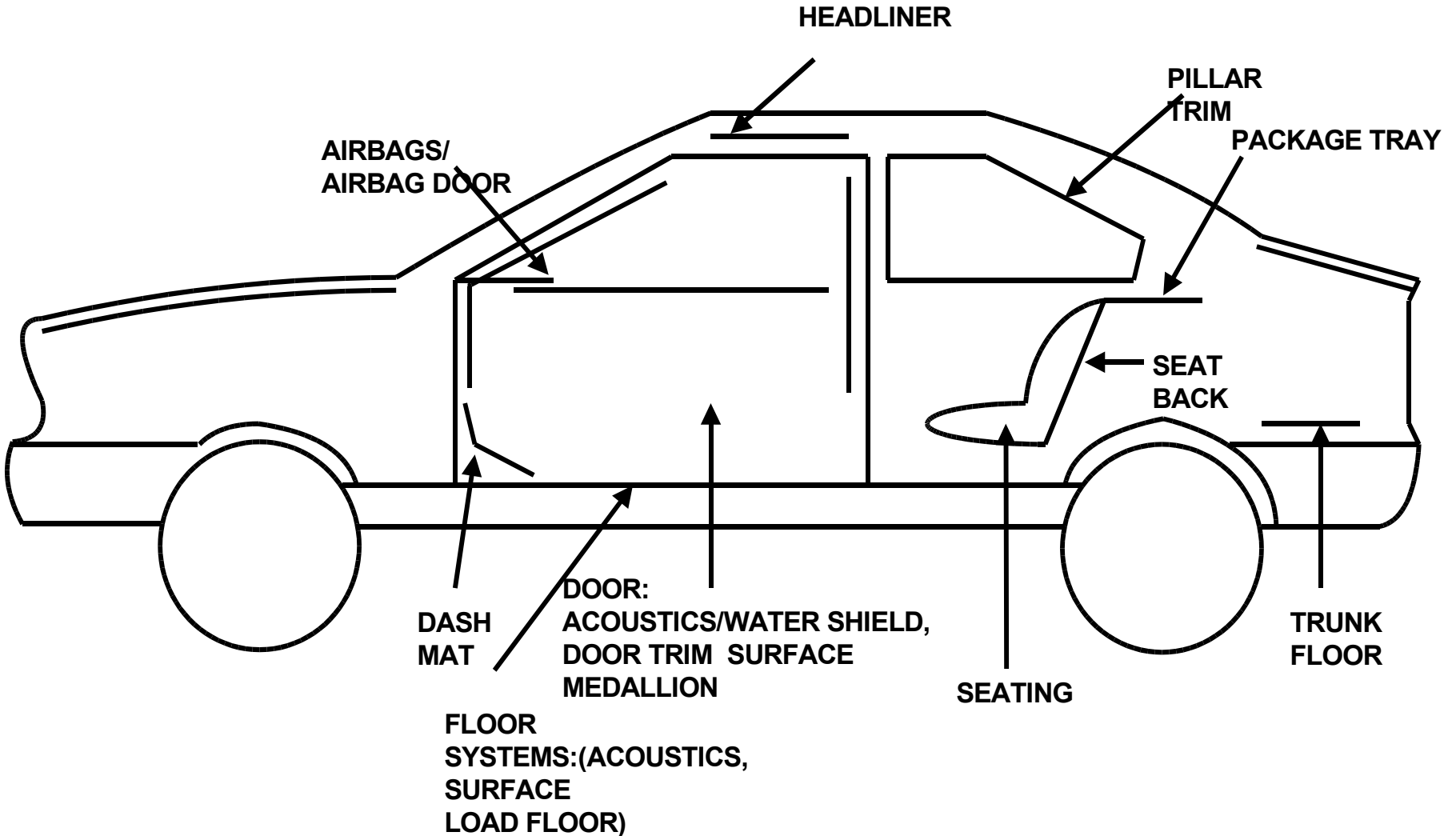


SOURCE: ROBERT ELLER ASSOCIATES, INC., 2003

NONWOVEN PATH-TO-MARKET OPPORTUNITY FOR ADDING VALUE



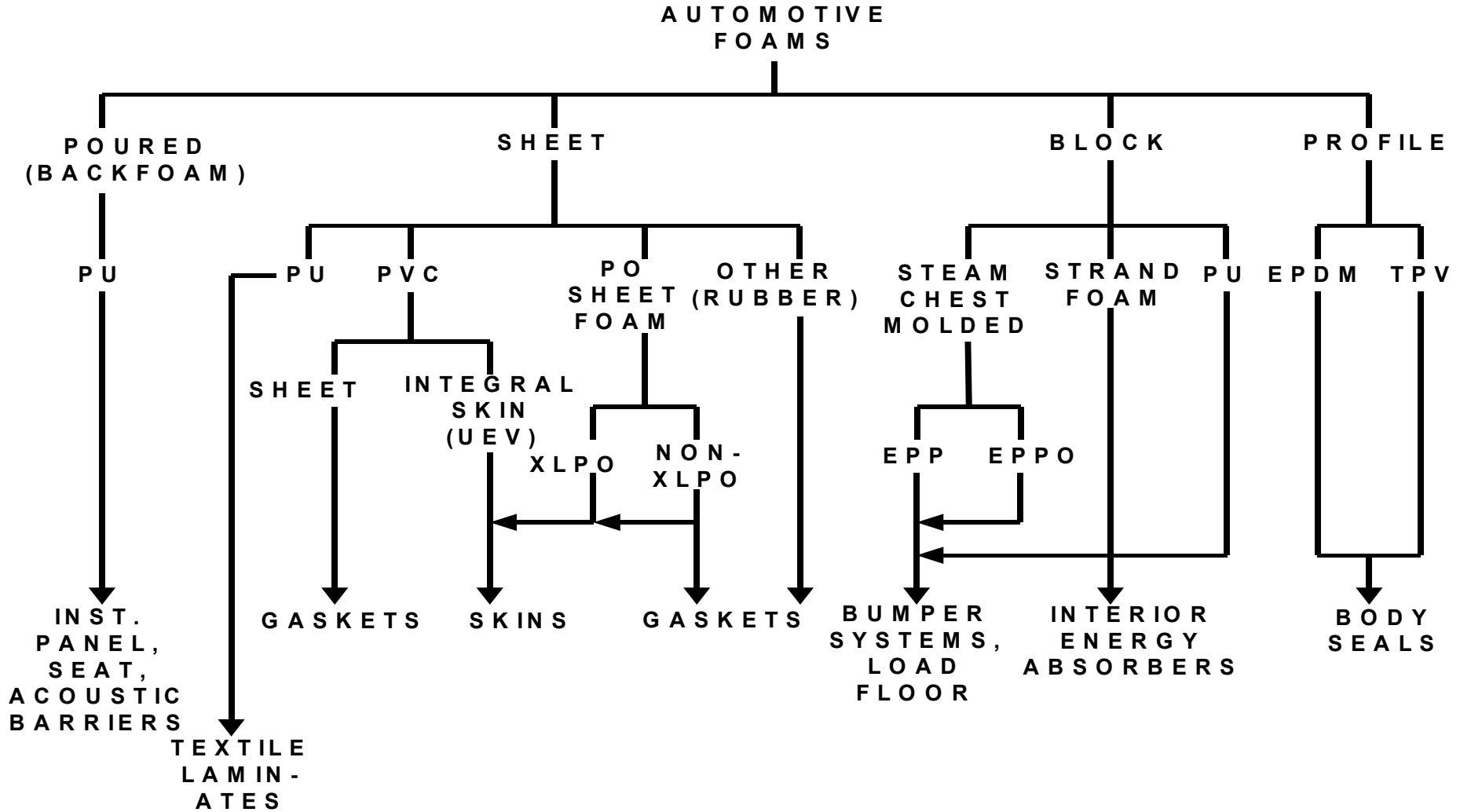
AUTOMOTIVE TRIM TARGETS FOR NONWOVENS



SOURCE: ROBERT ELLER ASSOCIATES, INC., 2003

foam tgts 02.vsd

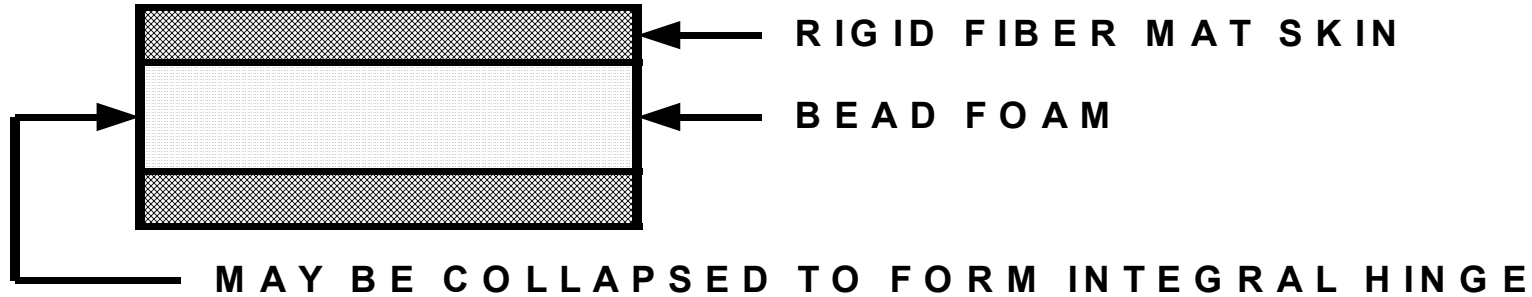
AUTOMOTIVE FOAM FAMILIES AND EXAMPLE APPLICATIONS



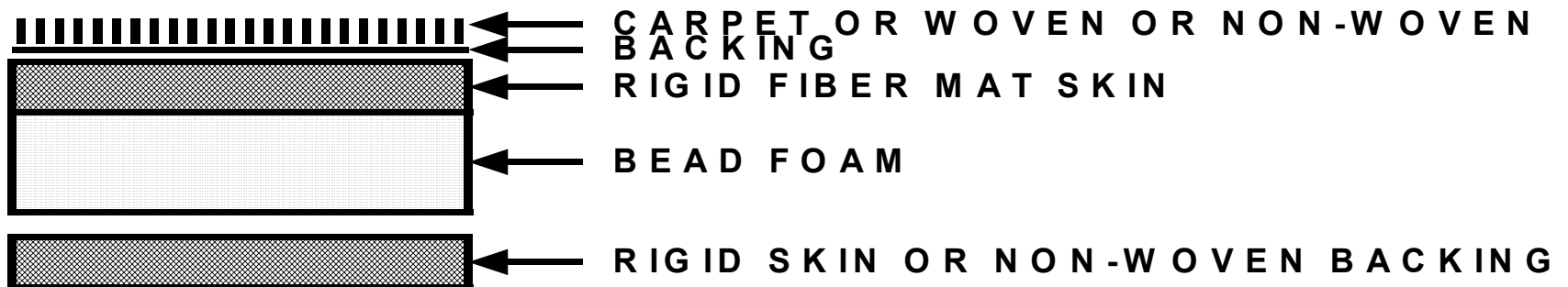
SOURCE: ROBERT ELLER ASSOCIATES, INC., 2003
foam families 02.vsd

RIGID SEMI-STRUCTURAL FOAM SANDWICH STRUCTURE

BARE:



CARPET/NON-WOVEN/WOVEN TEXTILE LAMINATE:



SOURCE: ROBERT ELLER ASSOCIATES, INC., 2003

rs foam sandwich 02.vsd

DRIVING FORCES FOR NONWOVEN GROWTH

DRIVING FORCE	ACTUAL OR POTENTIAL CHANGE	MATERIALS/PROCESS IMPLICATIONS AND EXAMPLES
PROCESS COST REDUCTION	MODULARIZATION -PARTS CONSOLIDATION -SANDWICH CONSOL.	ON-BOARD ACOUSTIC BARRIERS -"POPULATED" PANELS -ON-BOARD ACOUSTICS
ACOUSTIC PERFORMANCE	-REDUCED NOISE -EARLY ACOUST INVOLV. -TAILORED ACOUSTICS	-ELIM. HOT POUR PU FOAM SEATING -ENHANCED MICRODENIER POSITION
INTERIOR EMISSIONS	-NO-SMELL INTERIOR -REDUCED V.O.C./FOG	-REDUCED COATINGS -MATERIAL SHIFT -BINDERS ?
OCCUPANT SAFETY	HEAD/SIDE IMPACT REGULATIONS	-ENERGY ABSORBING FOAMS GROWTH -AIRBAG SOLUTIONS
END OF LIFE	-ELV LEGISLATION	-MONOMATERIAL SANDWICHES -RECYCLATE CONTENT, NFCs
FLOOR SPACE MANAGEMENT	SEMI-STRUCTURAL SANDWICHES	-AZDEL SUPERLITE -BEAD FOAMS -NONWOVENS
UTILITY FUNCTION/LOOK	-NON-CARPET FLOOR -INVISIBLE AIRBAG DOORS	-IMPROVED ESTHETICS - CRAFTMANSHIP

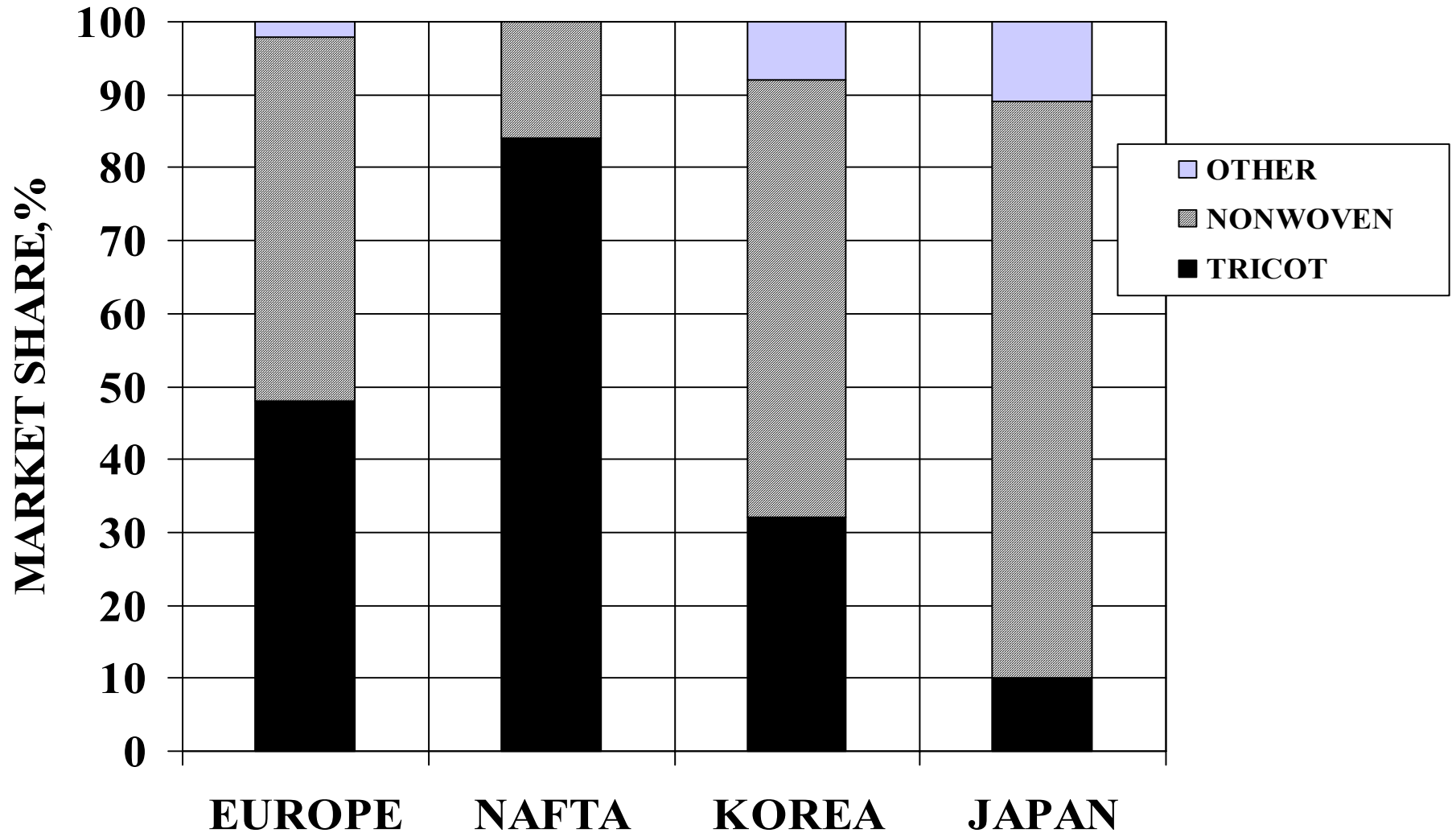
EUROPE/NAFTA DIFFERENCES

PARAMETER	NON WOVEN STATUS
HEADLINER FACE FABRIC	HIGHLY PENETRATED - EUROPE
FLOOR/SURFACE	HIGHLY PENETRATED- EUROPE
ACOUSTIC PERFORMANCE PRESSURES	SAME
COST SAVE PRESSURES	SAME?
WEIGHT SAVE PREMIUM	HIGHER IN EUROPE
POLYOLEFIN PRESSURES	HIGHER IN EUROPE FAVORS MONOMATERIALS
WT. SAVE VALUE	HIGHER IN EUROPE

HEADLINER

- **FACE FABRICS: NAFTA HAS LOWEST NW PENETRATION(15%→ 20% IN 2004,FORD,GM)**
- **TRICOT WILL DECLINE**
- **LOW VALUE MODULE**
- **PROFIT IS IN THE OVERHEAD SYSTEMS**
- **COST REDUCTION MAJOR DRIVER**
- **PP NONWOVEN OPPORTUNITY?**
- **HYDROENTANGLED NWs→ SHARE GAIN**
- **SUBSTRATES→PP FOAMS, AZDEL SUPERLITE®**
- **GLASS/PU LOSING MARKET SHARE**
- **EUROPEAN PENETRATION→NW GROWTH**
- **ACOUSTICS ARE CRITICAL**
- **ROLE FOR MICRODENIER NWs**

NON WOVEN HEADLINER SHARES

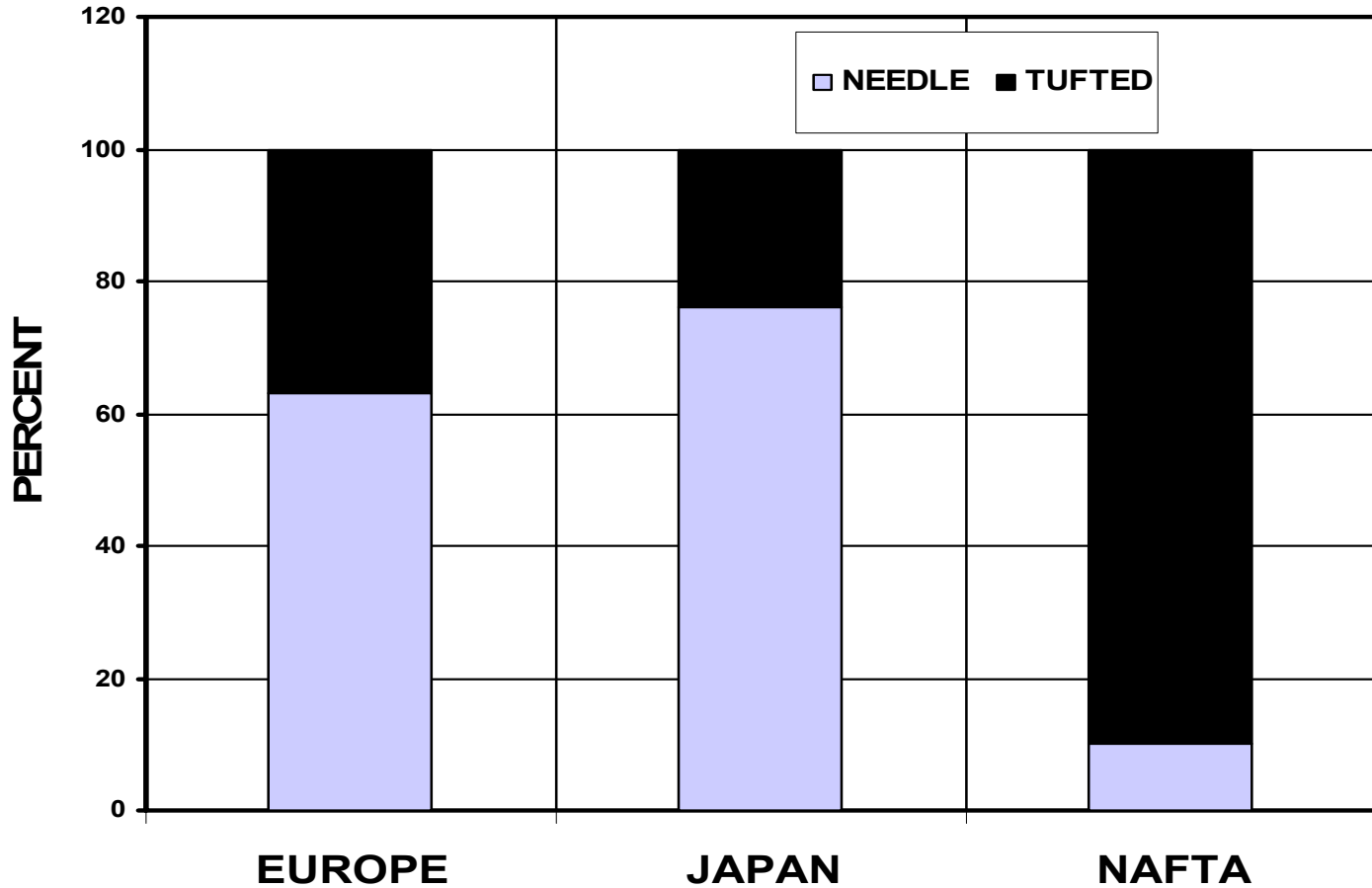


SOURCE: FREUDENBERG VITECH

FLOOR/ACOUSTICS

- **3-5 LAYERS**
- **INCREASED FUNCTION(E.G. LOAD FLOORS)**
- **SPUNBOND PET HAS 43% SHARE IN NAFTA BACKING**
- **IMPROVED ACOUSTICS REQUIRED**
- **HEAVY LAYER ELIMINATION→ NEW CONSTRUCTIONS**
- **HIGH NW PENETRATION IN EUROPE**
- **LT. WT. FIBER WILL CHANGE CONSTRUCTION**
- **FIBER/FOAM COMPETITION IN UNDERLAY**
- **ABILITY TO VARY IN XY AND Z-PLANES IS NONWOVEN ADVANTAGE**
- **MONOMATERIALS CONSTRUCTION OPPORTUNITY**

COMPARISON OF REGIONAL TRENDS IN AUTOMOTIVE CARPET (2002)



SOURCE: ROBERT ELLER ASSOCIATES, INC.;
SOFT TRIM MULTICLIENT STUDY

INCUMBENTS/CHALLENGERS IN AUTO ACOUSTICS

INCUMBENT	BARRIER TYPE		CHALLENGER	EXAMPLE LOCATION
	DAMP	INSULATE		
GLASS FIBER		X	-PLASTICS/CELL. -NONWOVENS	HOOD, OH SYSTEM
HEAVY LAYER	X		-METALLOCENES -ELIMINATE →LT. WT. FIBERS	DASH, FIREWALL, FLOOR, FENDER LINERS
MASTIC	X		-BETTER MASTIC -ELIMINATE?	FLOOR
PU FOAM (SKIVED)		X	POLYOLEFIN SHEET FOAMS	FLOOR, DASH, OH SYSTEM
PU FOAM (POURED)		X	EPP BEAD FOAMS	FLOOR PANELS
REGEN. FIBERS		X	TAILORED FIBERS	FLOOR, DOOR

ACOUSTIC BARRIER MATERIALS IN AUTOMOTIVE FLOORING

MATERIALS	CURRENT SHARE %		NOTE
	EUR	NAFTA	
REGENERATED CELLULOSE FIBERS (SHODDY)	20	50	SHODDY USE WILL DECLINE
PU FOAM	75	50	TUNED ACOUSTICS ACCELERATE PENETRATION
OTHER	5	5	
AZDEL SUPERLITE			
PO FOAMS			
PET/PP FIBERS			LT. WT FIBERS
NATURAL FIBERS			

DOOR TRIM

- **VERY LOW PENETRATION RATE**
- **TARGETS ARE:**
 - MEDALLIONS(PO FOAM LAMINATION OPP'Y)**
 - ACOUSTIC PADS/WATER SHIELDS**
 - FACE FABRICS**
- **CRAFTSMANSHIP OPPORTUNITY**
- **3D FORMING IS CHALLENGE**
- **IN MOLD FORMING OPPORTUNITY**
- **INTEGRATION WITH LOW PRESSURE MOLDING**
- **TEXTILE USUALLY MATCHES SEAT**

NONWOVEN COMPETITIVE INTERFACES

MODULE	INCUMBENT	NOTE
FLOOR:		
CARPET	TUFTED NYLON(NAFTA)	HI NW PENET. (EUROPE)
BACKING		SPUNBOND PET HAS 43%(NAFTA)
UNDERLAY	SHODDY, PU FOAM	LT. WT FIBER/FOAM COMPETITION
HEADLINER FACE FABRIC	TRICOT	15%(NAFTA) INCREASING
DOOR MEDALLION	WOVENS, KNITS COATED FABRIC,	NW STARTING (EUROPE) PO FOAM LAM. OPP'Y PP IS MAJOR SUBSTRATE
SEATING SIDE PANELS	PVC COATED FABRIC WOVENS, KNITS	NW STARTING(EUROPE) TPO COATED FABRIC START(EUROPE)

VALUE-ADDED DECORATION WITH NONWOVENS

TPE
VENEER:



IN-MOLD DECORATION (IMD)
BACK-PRINTED LAMINATES



IN-MOLD DECORATION (IMD):
CO-EX FILM/SHEET



SOURCE: ROBERT ELLER ASSOCIATES, INC., 2003

WHAT WILL DRIVE NONWOVEN GROWTH?

- **CONTINUED SEVERE PRICE PRESSURE**
- **MATERIAL COST SAVE**
- **PROCESS COST SAVE**
- **PERFORMANCE IMPROVEMENT**
 - UV RESISTANCE**
 - VOC/FOG REDUCTION**
 - OCCUPANT SAFETY**
 - ACOUSTICS**
 - FILTRATION**
- **MONOMATERIAL CONSTRUCTION**
- **PO SHEET FOAM/TEXTILE LAMINATION**
- **SURFACE ESTHETICS IMPROVEMENT**
- **VALUE ADD OPPORTUNITIES**

VALUE ADDED OPPORTUNITIES FOR AUTOMOTIVE NONWOVENS

- **IMPROVED SURFACE ESTHETICS**
- **AVOID PREFORMS**
- **IN-MOLD FABRICATION**
- **CRAFTSMANSHIP WITH COST SAVINGS**
- **DIRECT PU FOAM LAMINATION**
- **POLYOLEFIN FOAM LAMINATION**
- **IMPROVED/TAILORED ACOUSTICS**
- **IMPROVED PP NONWOVENS**
- **TARGET ALL-PP CONSTRUCTIONS**
- **X,Y AND Z-AXIS MODIFICATION**

SUMMARY

- **MATERIAL/PROCESS DRIVERS FAVOR NONWOVENS:**
 - ACOUSTIC REQUIREMENTS, WT. SAVINGS**
 - PROCESS COST REDUCTION**
 - MATERIALS COST REDUCTION**
- **NONWOVENS AND FOAMS WILL COMPETE**
- **CONTINUED SEVERE PRICE PRESSURES LIKELY**
- **RECYCLING - NOT U.S. DRIVER, SIGNIFICANT EUROPE DRIVER**
- **EUROPE- EARLY TECHNOLOGY LEADER**
- **EURO/NAFTA USE PATTERN WILL CONVERGE**
- **SYSTEMS/PROCESS TECHNOLOGIES – ADD VALUE**
- **HEADLINER, FLOOR-MAJOR EARLY TARGETS**
- **SEAT, DOOR TRIM, PACKAGE TRAY, PILLAR TRIM-NEXT TARGETS**
- **BARE ROLL GOODS VS SYSTEM SUPPLIER ROLE?**
- **POTENTIAL UNDER-EXPLOITED**

ABOUT ROBERT ELLER ASSOCIATES, INC.

- **TECHNICAL, MARKET AND ECONOMIC ANALYSIS IN SUPPORT OF MANAGEMENT DECISION**
- **AUTOMOTIVE – SPECIALTY**
- **OFFICES IN US AND EUROPE**
- **RECENTLY COMPLETED SOFT TRIM MULTICLIENT STUDY**

ABOUT JOHN R. STARR, INC.

- MANAGEMENT AND TECHNICAL CONSULTING FIRM SPECIALIZING IN NONWOVEN PRODUCTS FIELD, WORLDWIDE FOR 30 YEARS.**
- AUTOMOTIVE NONWOVEN AN IMPORTANT PART OF THE PRACTICE.**
- PARTICULAR FOCUS ON LEADING EDGE NONWOVEN TECHNOLOGIES WITH POTENTIAL TO DISPLACE OTHER NONWOVENS, WOVENS, KNITS AND OTHER MATERIALS**