THE WOODBRIDGE GROUP®

BIO-MATERIAL – BACK TO THE FUTURE WORKSHOP

The Canadian Opportunity for Bio-Fibres in Automotive Parts

Dr. Hamdy Khalil
Winnipeg, Manitoba
March 18-19, 2008

THE WOODBRIDGE GROUP®

Introduction to The Woodbridge Group

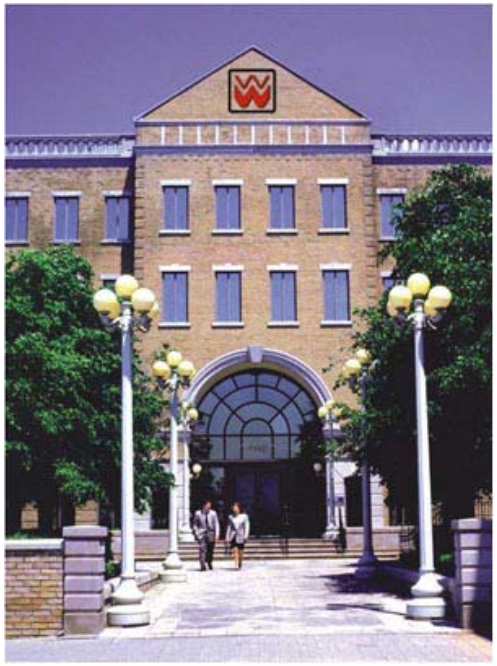
Who We Are
What We Do

THE WOODBRIDGE GROUP®

Mastering Science to Serve Our Customers™

Company Overview

- Private Canadian Company
- Established in 1978
- Independent supplier of Automotive urethane products
- Locations: 60 in 20 countries
- Employees: 5000+



Corporate Headquarters
Mississauga, Canada

Kipling Avenue Plant
Woodbridge, Canada
circa 1969

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THE WOODBRIDGE GROUP®

Mastering Science to Serve Our Customers™

Seven Families of Products

To Provide Comfort, Safety and Sound Management

Contourtech™ Performance Seating Urethanes

1. Molded Foam

Seat Cushioning, Head Restraints, Armrests

Stratas™ Optimized Headliner Component Solutions

2. Laminate and Substrate Foam

Headliners, Hoodliners, Sun Visors,
Seat Trim Cover Foam

ENERFLEX™ Automotive Safety Components

3. Energy Management Foam

Side Impact Bolsters, Roof Rails, Heel Blockers, Sun Visors, Knee Bolsters, Pillar Bolsters

STRUCTURE lite™ Versatile Lightweight Structural Solutions

4. Structural Foam

Seat Frames, Flip-Fold Seat Backs, Load Floors, Headliners, Pick-up Beds, Floor Pans,
Tonneau Covers, Sun Shades

5. Finished Interior Parts

Head Restraints, Armrests, Bolsters

6. Acoustical and Technical Foams

Dash Insulators, Transmission Insulators, Floor Systems

7. Assembly and Sequencing

Headliners, Finished Seat Assemblies,
Door Panels, Floor Mats, Interior Plastic Trim,
Drive Train Components,
Exhaust Systems, Steering Components

- **Seating Foam**
- **Energy-Absorbing Foam**
- **Headliner Foam**
- **Structural Foam**
- **Acoustical Foam**
- **Assembly and Sequencing**

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Global Alliances

Joint Ventures

- Poliuretanos Mexicanos Woodbridge (Mexico)
- Poliuretanos SW Leon (Mexico)
- Poliuretanos SW (Mexico)
- I.W. Foam Corporation (Japan)
- I. W. Foam Corporation Inc. (North America)
- Proseat Belgium
- Proseat France
- Proseat GmbH & Co. KG (Germany)
- Proseat Czech Republic
- Gestind (Italy)
- Gestind (Poland)
- Woodbridge Foam Fabricating (USA)
- Enerflex Solutions (USA)
- IWCT Co. (Thailand)
- Indepol S.L. (Spain)
- Wuhan Woodbridge GSK Foam Co. LTD. (China)
- Olympic Products LLC (USA)
- Dayou A-Tech (South Korea)

Technical Agreements

- MOBICA (Egypt)
- Automotive Component Holdings (Ford), Chesterfield, Michigan (USA)
- HFI Inc., Columbus, Ohio (USA)
- Hyundai Motor Company Ulsan (South Korea)

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THE WOODBRIDGE GROUP®

Mastering Science to Serve Our Customers™

Worldwide Presence

60 Facilities
56 Cities
20 Countries

ARGENTINA
Pilar

AUSTRALIA
Adelaide
Melbourne

BELGIUM
Hulshout*
Wetteren*

BRAZIL
Betím
Caçapava
Camaçari
São Bernardo (2 Facilities)

CANADA
Blenheim, ON
Brampton, ON
Kitchener, ON
Mississauga, ON
Sarnia, ON
Tilbury, ON
Whitby, ON
Woodbridge, ON

CHINA
Wuhan*

CZECH REPUBLIC
Mlada Boleslav*

EGYPT
Cairo*****

UK
Coventry
Manchester

FRANCE
Trilport*

GERMANY
Mörfelden*
Rüsselsheim*
Espelkamp*

INDIA
New Delhi *

ITALY
Bruzolo*

JAPAN
Anjo*
Nanno*
Tokyo

MEXICO
Leon*
Mexico City*
Saltillo (2 Facilities)

SOUTH KOREA
Ulsan*****
Gwangju*

POLAND
Bielsko Biala*

SPAIN
Barcelona*

THAILAND
Bangkok*

UNITED STATES
Addison, IL
Atlanta, GA
Auburn Hills, MI
Brodhead, WI
Chattanooga, TN*
Chesterfield, MI**
Columbus, OH***
Del Rio, TX
El Paso, TX
Fairless Hills, PA
Fremont, OH
Grand Rapids, MI
Greensboro, NC
Kansas City, MO (2 Facilities)
Romulus, MI
St. Peters, MO
Troy, MI (2 Facilities)

* Joint Venture
** Technical Agreement
*** Joint Production Agreement
**** Joint Venture
Minority Business Enterprise
***** Technical License Agreement

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THE WOODBRIDGE GROUP®

Mastering Science to Serve Our Customers™

Locations Description

60 Facilities
56 Cities
20 Countries

ARGENTINA

Pilar
Manufacturing Plant
- Molded Foam
- Structural Foam

AUSTRALIA

Adelaide
Manufacturing Plant
- Molded Foam
- Structural Foam
- Energy Management Foam

Melbourne
Manufacturing Plant
- Molded Foam

BELGIUM

Hulshout*
Manufacturing Plant
- Molded Foam

Wetteren*
Manufacturing Plant
- Molded Foam

BRAZIL

Betím
Manufacturing Plant
- Molded Foam

Caçapava
Manufacturing Plant
- Molded Foam

Camaçari
Manufacturing Plant
- Molded Foam

São Bernardo
(2 Facilities)
Manufacturing Plant*
- Molded Foam

Commercial Center

CANADA

Blenheim, ON
Manufacturing Plant
- Foam-in-Place

Brampton, ON
Manufacturing Plant
- Structural Composites

Kitchener, ON
Manufacturing Plant
- Energy Management Foam

Mississauga, ON
Corporate Headquarters

Sarnia, ON
Manufacturing Plant
- Energy Management Foam
- Structural Foam

Tilbury, ON
Manufacturing Plant
- Molded Foam
- Energy Management Foam

Whitby, ON
Manufacturing Plant
- Molded Foam

Woodbridge, ON
Manufacturing Plant
- Molded Foam
- Cut Foam
- Retail Foam Product
- Energy Management Foam
- Slab Foam
- Research, Product & Manufacturing Development
- Lamination

CHINA

Wuhan*
Manufacturing Plant
- Molded Foam

CZECH REPUBLIC

Mlada Boleslav*
Manufacturing Plant
- Molded Foam

EGYPT

Cairo***
Manufacturing Plant
- Molded Foam

ENGLAND

Coventry
Commercial Centre

Manchester
Manufacturing Plant
- Molded Foam
- Foam-In-Place
- Structural Foam

FRANCE

Trilport*
Manufacturing Plant
- Molded Foam

GERMANY

Mörfelden*
Commercial Centre

Rüsselsheim*
Manufacturing Plant
- Molded Foam

Espelkamp*
Manufacturing Plant
- Molded Foam

INDIA

New Delhi *
Commercial Center

ITALY

Bruzolo*
Manufacturing Plant
- Molded Foam

JAPAN

Anjo*
Manufacturing Plant
- Molded Foam

Nanno*
Manufacturing Plant
- Molded Foam

Tokyo
Commercial Center
Energy Management Products
- Sales & Engineering

MEXICO

Leon*
Manufacturing Plant
- Molded Foam

Mexico City*
Manufacturing Plant
- Molded Foam
- Energy Management Foam

Saltillo (2 Facilities)
Manufacturing Plant*
- Molded Foam

Manufacturing Plant
- Lamination

POLAND

Bielsko Biala*
Manufacturing Plant
- Molded Foam

SPAIN

Barcelona*
Manufacturing Plant
- Molded Foam

SOUTH KOREA

Ulsan***
Manufacturing Plant
- Molded Foam

Gwangju
Manufacturing Plant
- Molded Foam
- Foam-in-Place

THAILAND

Bangkok*
Manufacturing Plant
- Molded Foam
- Energy Management Foam

UNITED STATES

Addison, IL
Manufacturing Plant
- Molded Foam

Atlanta, GA
Manufacturing Plant
- Molded Foam

Auburn Hills, MI
Assembly & Sequencing Plant
- Automotive Systems

Brodhead, WI
Manufacturing Plant
- Molded Foam

Chattanooga, TN*
Manufacturing Plant
- Cut Foam

Chesterfield, MI**
Manufacturing Plant
- Molded Foam

Columbus, OH***
Manufacturing Plant
- Molded Foam

Del Rio, TX
Manufacturing Plant
- Lamination

El Paso, TX
Manufacturing Plant
- Slab Foam

Fairless Hills, PA
Manufacturing Plant
- Molded Foam

Fremont, OH
Manufacturing Plant
- Molded Foam

Grand Rapids, MI
Manufacturing Plant
- Molded Foam

Greensboro, NC
Manufacturing Plant
- Lamination

Kansas City, MO
(2 Facilities)
Manufacturing Plant
- Molded Foam
- Structural Foam

Assembly & Sequencing Plant*
- Automotive Systems

Romulus, MI
Manufacturing Plant
- Molded Foam

St. Peters, MO
Manufacturing Plant
- Molded Foam
- Foam-In-Place

Troy, MI
(2 Facilities)
Automotive Headquarters
- Sales & Engineering

Commercial Center****
Energy Management Products
- Sales & Engineering

* Joint Venture
** Technical Agreement
*** Joint Production Agreement
**** Joint Venture
Minority Business Enterprise
***** Technical License Agreement

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THE WOODBRIDGE GROUP®

Mastering Science to Serve Our Customers™

Customers

NORTH AMERICA

OEM	TIER 1
Acura	Araco
BMW	Blackhawk Automotive
DaimlerChrysler	Bloomington Seat
Ford	Collins & Aikman
General Motors	Endur-All
Honda	Faurecia
Isuzu	Gerneral Seating
Mitsubishi	Grupo Antolin
Navistar	Guilford
Nissian	HOWA
Renault	Insa
Subaru	Intier
Suzuki	Irvin
Toyota	Isrignhausen
Volswagen	Johnson Controls
	Lear
	Magee Rieter
	Rieter Automotive
	Setex
	Span America
	TISA
	Toyota Boshoku
	Trim Quest
	TS TECH
	UTA
	Yorozu

EUROPE

OEM	TIER 1
Audi	CIPA
BMW	Decoma
Citroen	Faurecia
DaimlerChrysler	Grammer
Evobus	Intier
Ford	Isringhausen
Honda	Johnson Controls
Jaguar	KAB Seating
Metrocab	Karmann
Nissan	Kigass
Opel	Landers
Peugeot	Lear
Renault	Recaro
SEAT	SITECH
Suzuki	TS TECH
Skoda	
Toyota	
Vauxhall	
Volkswagen	
Volvo	

SOUTH AMERICA

OEM	TIER 1
DaimlerChrysler	Araco
Fiat	Isringhausen
Ford	Johnson Controls
General Motors	Lear
Honda	TS TECH
Peugeot	
Scania	
Toyota	
Volkswagen	
Volvo Trruck	

JAPAN

OEM	TIER 1
Honda	Fuji-Seat
Mitsubishi	Fuji tuku
Suzuki	Howa
Toyota	Koberuku
	Marubishi
	Recaro
	Tachi-S
	Toyota Boshoku
	TS-Tech

KOREA

OEM	TIER1
Hyundai	Dayou A-Tech
Kia	HMC-Seating Group
Ssangyong	

AUSTRALIA

OEM	TIER 1
Ford	Air International
GM Holden	Araco
Mitsubishi	
Toyota	

THAILAND

OEM	TIER 1
General Motors	BKS
Hino	Cagiva
Honda	Delta TR
Isuzu	GST
Kawasaki	JSI
Nissan	NHK
Suzuki	SAS
Tiger Motor	TASI
Toyota	TSI
Volvo	TS TECH

CHINA

OEM	TIER 1
Honda	Wuhan Wan Hine
JiangLing	Faurecia/GSK Wuhan
Nissan	TSTECH/ GSK Wuhan
Peugeot	

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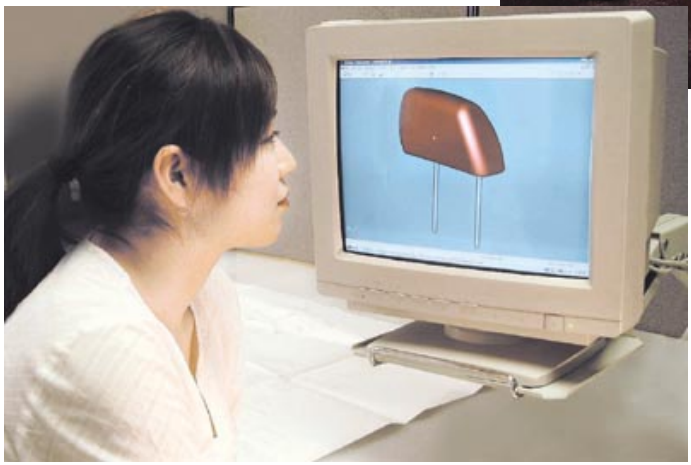
Mastering Science to Serve Our Customers™

Design & Development

Innovation In All Aspects Of Our Business

- Chemistry
- Product Design
- Manufacturing Processes
- Productivity Improvement
- Employee Creativity



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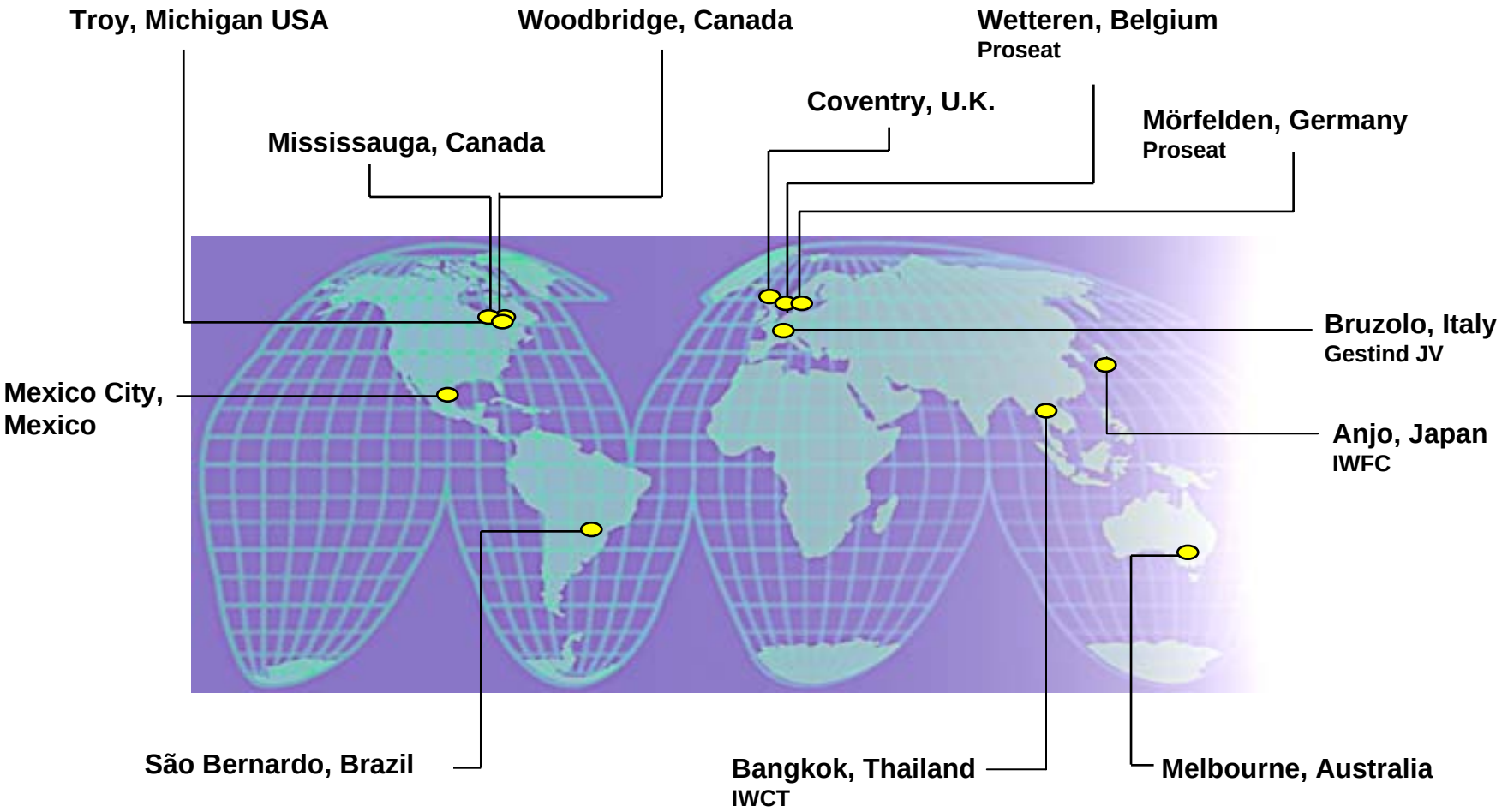
Global Development Centers



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Mastering Science to Serve Our Customers™

Vehicles We Supply

North America

GM
Buick Century
Buick LaSabre
Buick Park Avenue
Buick Rainier
Buick Regal
Buick Rendezvous
Cadillac DeVille
Cadillac Elderado
Cadillac Escalade
Cadillac Seville
Cadillac SRX
Chevrolet Astro
Chevrolet Avalanche
Chevrolet Blazer
Chevrolet Camaro
Chevrolet Cavalier
Chevrolet Cobalt
Chevrolet Colorado
Chevrolet Corvette
Chevrolet Equinox
Chevrolet Impala
Chevrolet Malibu
Chevrolet Malibu Maxx
Chevrolet Monte Carlo
Chevrolet Monza
Chevrolet Prizm
Chevrolet Silverado
Chevrolet Suburban
Chevrolet Tahoe
Chevrolet TrailBlazer
Chevrolet Van Express
Chevrolet Venture
GMC Canyon
GMC Envoy
GMC Jimmy
GMC Savana
GMC Sierra
GMC Sonoma
GMC Yukon
Oldsmobile Alero
Oldsmobile Aurora
Oldsmobile Bravada

North America

GM
Oldsmobile Intrigue
Oldsmobile Silhouette
Pontiac Aztek
Pontiac Bonneville
Pontiac Firebird
Pontiac Grand Am
Pontiac Grand Prix
Pontiac Montana
Pontiac Sunfire
Pontiac Vibe
Saturn Ion
Saturn LS/LW
Saturn Vue

Ford
Crown Victoria
Escape
Escort
Excursion
Expedition
Explorer
Explorer Sport Trac
F Series Pick Up
F Series Super Duty
Fiesta
Focus
Freestar
Lincoln Blackwood
Lincoln Continental
Lincoln LS
Lincoln Town Car
Lobo
Mercury Cougar
Mercury Grand Marquis
Mercury Mariner
Mercury Monterey
Mercury Villager
Mustang
Mystique
Ranger
Taurus
Thunderbird

North America

Honda
Accord
Accord - Coupe
Accord - Sedan
Civic
Element
Odyssey
Pilot

Renault
Clio
Scenic

Acura
EL
MDX
TL

Mitsubishi
Eclipse
Endeavor
Galant
Eclipse Spyder

Volkswagen
Jetta

Nissan
Altima
Armada
Estaquitas
Frontier
Maxima
Pathfinder
Platina
Quest
Sentra
Titan
Xterra

North America

Daimler Chrysler
Concorde
Dodge Dakota
Dodge Durango
Dodge Neon
Dodge Ram Pick up
Dodge Ram Van
Dodge Ram Wagon
Jeep Cherokee
Jeep Grand Cherokee
Mercedes-Benz M Class
Pacifica
PT Cruiser
Sebring
Town & Country
Viper

Toyota
Camry
Corolla
Matrix
Sequoia
Sienna

Mazda
Tribute
6 (Sedan/Wagon/Sport)

Infiniti
QX56

Isuzu
Rodeo

Suzuki
Vitara

Subaru
Legacy
Baha

South America

Daimler Chrysler
PT Cruiser
RAM Pickup

Ford
Amazon
Courier
F250
Fiesta Ikon
Fiesta Split
F-Series
KA
Lobo

GM
Astra
Avalanche
Aztek
Blazer
Cavalier
Chevy Corsa
Corsa 4200
Randezvous
S10
Silverado
Suburban
Sunfire
Vectra
Zafira

Fiat
Doblo
Fiorino
Marea/Brava
Palio 2V/Europa
Palio SW/Restyling
Stilo
Uno

South America

Renault
Clio
Scenic

VW
Gol
Jetta
Kombi
Quantum Santana
Saveiro
Tupi 249

IVECO
Daily
Ducato

Mitsubishi
L200
Pajero TR4

Toyota
Corolla

Nissan
Estaquitax Pickup
Frontier
Platina
Xterra

Honda
Civic
MU (FIT)

Europe

Opel/Vauxhall
Agila
Astra
Corsa
Frontera
Omega
Vectra
Vivaro/Trafic
Zafira

Land Rover
Discovery
Freelander

Rover
MG ZR
MG ZS
MG ZT
Rover 25
Rover 45
Rover 75

Nissan
Primera

Peugeot
106
206

Jaguar
S Type
X Type
XJ6
XJ6 Limo
XK8

Europe

Ford
Mondeo

Volkswagen
Golf

Audi
TT
A6

Citroën
Saxo

Daimler Chrysler
Smart

Honda
Accord
Civic 3 Dr.
Civic 5 Dr.
CRV

Toyota
Aygo

Australia

Ford
Falcon
Falcon Ute

GM
Holden Commodore
Holden Monario
Holden Statesman
Holden Ute

Toyota
Avalon
Camry

Japan

Toyota
Alphard
bB
Caldina
Coaster
Corolla
Deli Boy
GS(ARIST)
Land Cruiser
MRAK X
Noah
Platz
Primo/Arion
Probox/Succeed
Scion
Sienta
RAV 4
Vitz

Honda
Fit

Mitsubishi
Challenger
Chariot Grandis
Lancer
Pajero
Pajero Jr.

Suzuki
Aerio

Thailand

Nissan
Cefiro

Isuzu
JCM-321
DMAX
Wega

Toyota
Hiace
Hilux Tiger

Suzuki
Caribian
Vitara

HINO
HINO

Honda
Accord
City
Civic
CR-V
Jazz

Ford
Everage
Ranger

VOLVO
S-60
S-80
V 70
XC90

Toyota
Camry
Corolla
Soluna
Wish

Isuzu
DMAX

China

Honda
Civic
CRV

Jiang Ling
Landwind

Nissan
Tena

Peugeot
307

Korea

Hyundai
Verna
Santa Fe
Click

KIA
Bongo Truck
Carense
Sportage

Ssangyong
Musso

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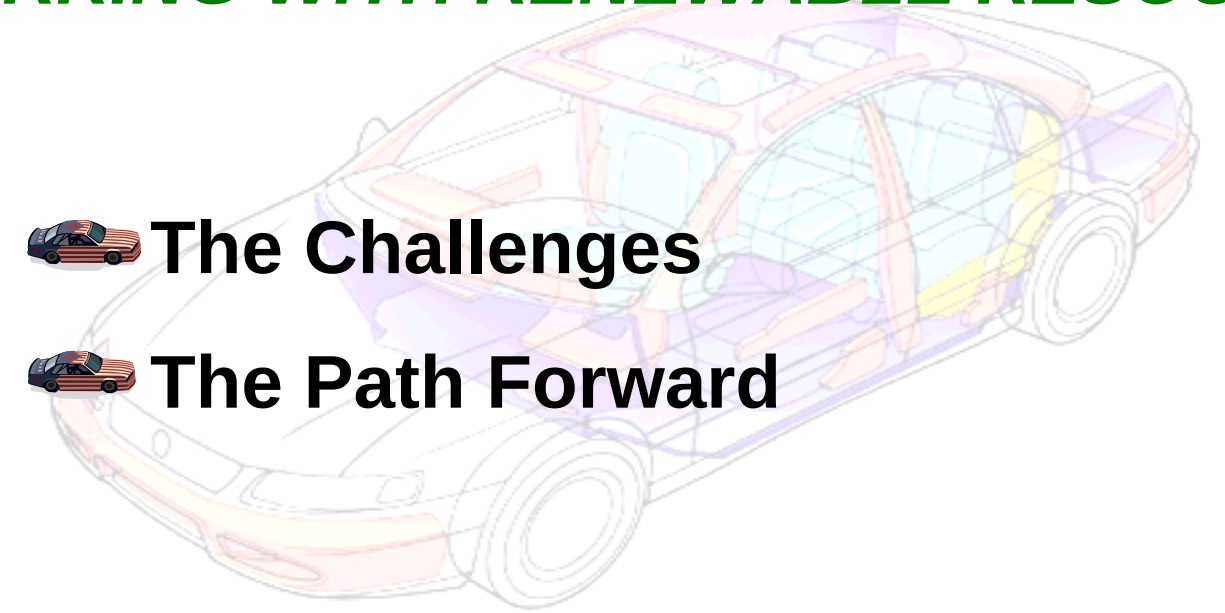
Mastering Science to Serve Our Customers™

WORKING WITH RENEWABLE RESOURCES



- **The Challenges**
- **The Path Forward**

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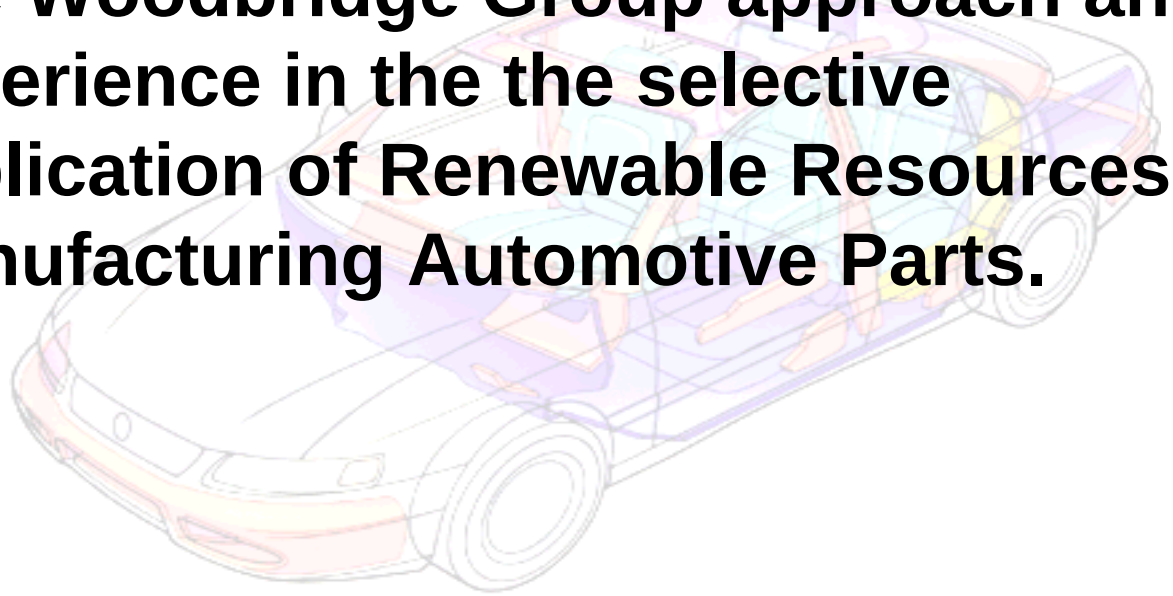
The Woodbridge Group approach and experience in the the selective application of Renewable Resources in Manufacturing Automotive Parts.



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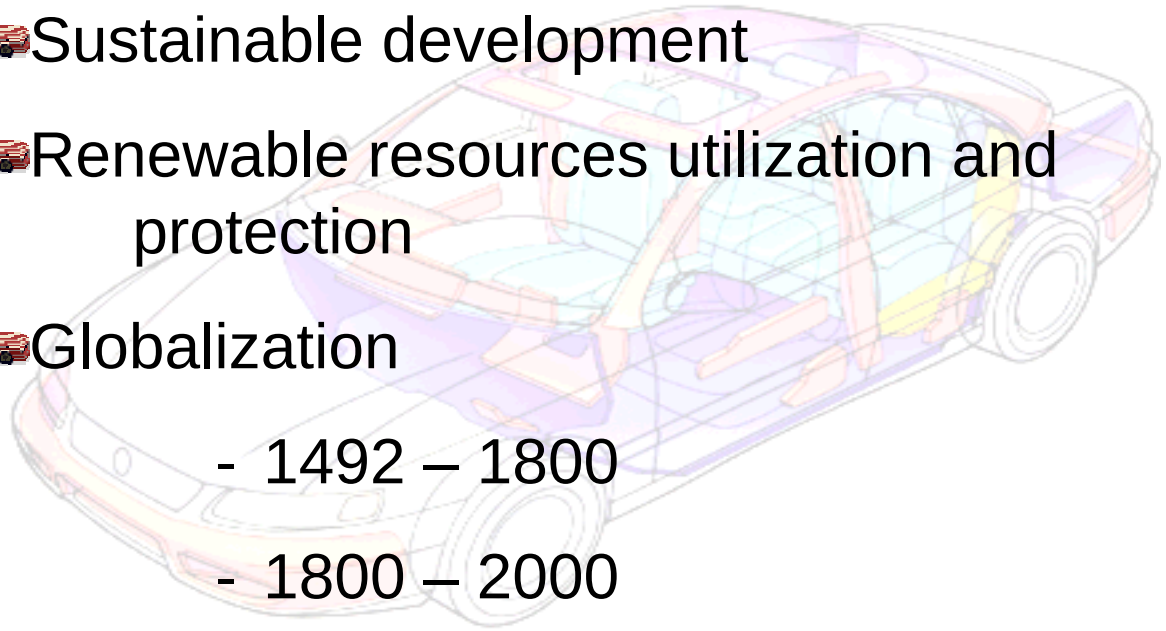
THE IDEALS OF THE 21ST CENTURY



- Sustainable development
- Renewable resources utilization and protection
- Globalization
  - 1492 – 1800
  - 1800 – 2000
  - 2000 –

  (Global knowledge work)

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RENEWABLE RESOURCES

WOODBRIDGE STRATEGY

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WOODBRIDGE SUSTAINABLE SUPPLY STRATEGY

- Manage the erratic fluctuation of the price of fossil oil based raw materials.
- Select key Renewable Resources.
- Capitalize on the abundance of Renewable Resources in the various world regions.
- Commission research at selected universities and research institutions.
- Collaborate with a partner who is vertically integrated relative to Renewable Resources.
- Develop proprietary materials.
- Develop technology to implement the new materials.
- Continue the development and implementation process.
- Work with customer.

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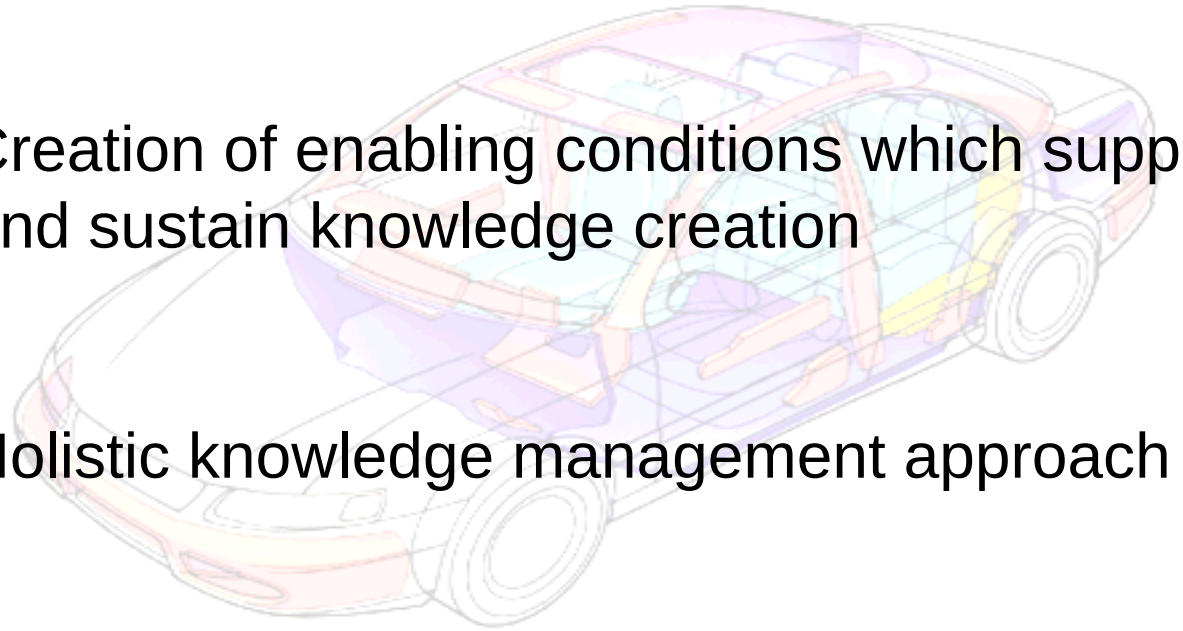
THE EXECUTION OF THE STRATEGY



- Creation of enabling conditions which support and sustain knowledge creation

- Holistic knowledge management approach

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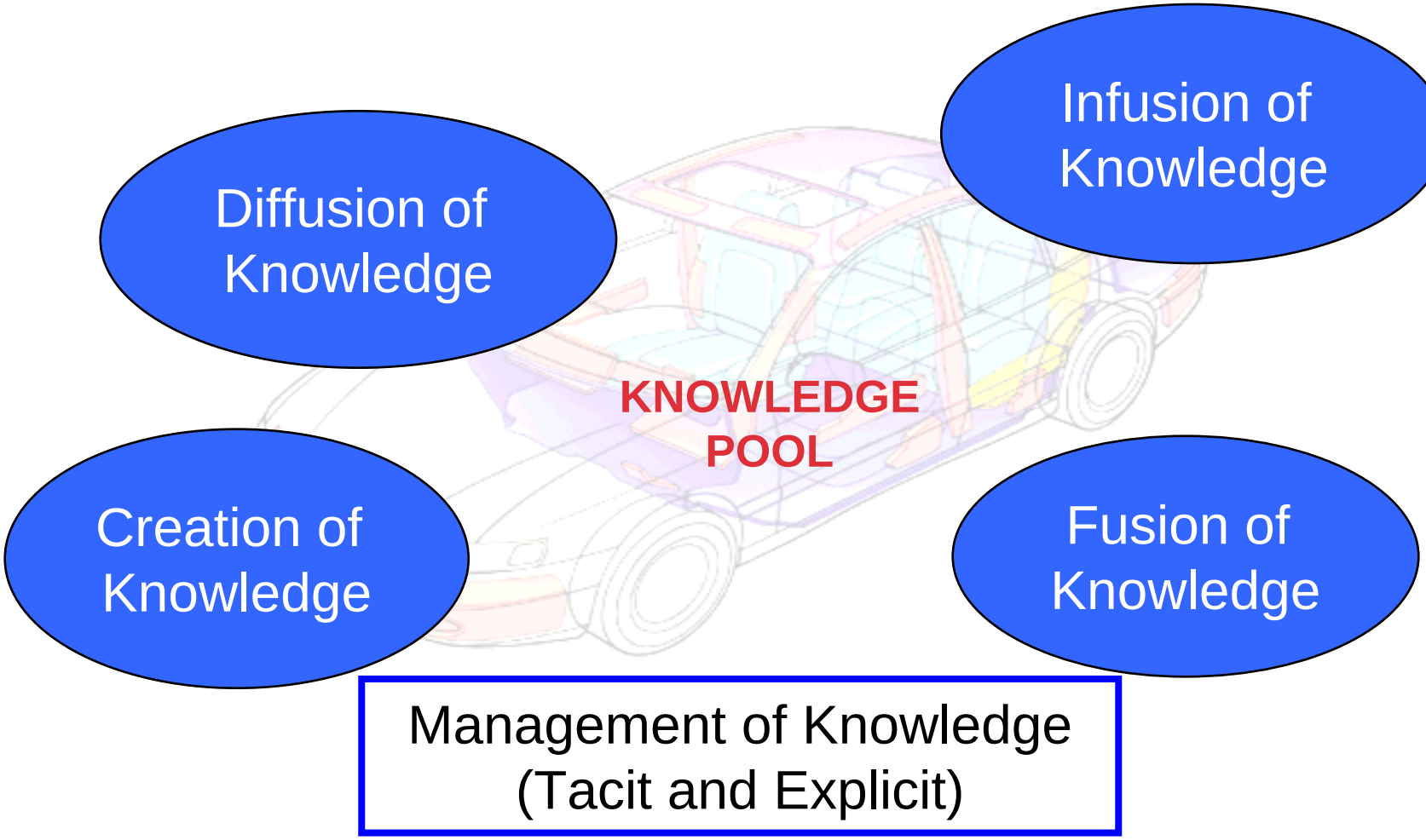
Mastering Science to Serve Our Customers™

OUR MODEL



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THE OPPORTUNITY

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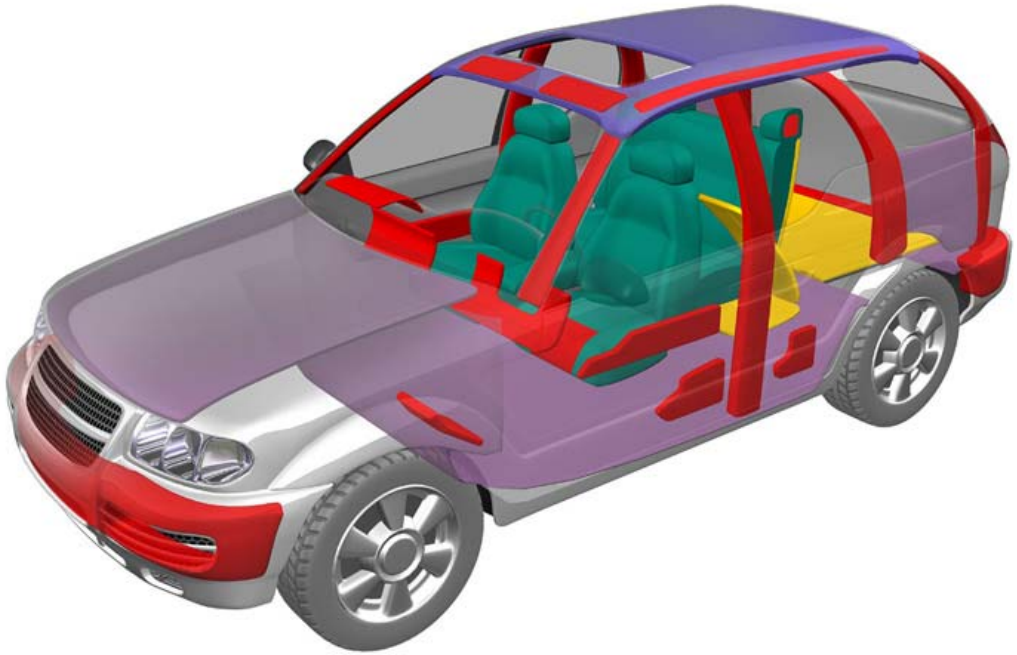

THE WOODBRIDGE GROUP®

Mastering Science to Serve Our Customers™

Premium Car Floor

Door Panel 2

THE WOODBRIDGE GROUP®

Mastering Science to Serve Our Customers™

Doors

Seat Backs

THE WOODBRIDGE GROUP®

Mastering Science to Serve Our Customers™

Seats

THE WOODBRIDGE GROUP®

Mastering Science to Serve Our Customers™

Rear Seat Panel

THE WOODBRIDGE GROUP®

Mastering Science to Serve Our Customers™

Headliner Extension - Minivan

THE WOODBRIDGE GROUP®

Mastering Science to Serve Our Customers™

Door Panel 1

Package Tray 1

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Mastering Science to Serve Our Customers™

Load Floor

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We are the only company that manufactures an Integrated Automotive Interior System:

- Automotive Seating
- Headrest
- Armrest
- Headliners
- Energy Absorbing Foam
- Hoodliner
- Acoustical Products
- Composites
- Elastomers

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Current Status

- Global uncertainty of Oil Supply
- Today Crude Oil is a key energy source and most important feedstock to the chemical industry.
- Global energy demand rises quickly (30% till 2020)
- Oil production will peak between 2010 – 20202
- Cars are much heavier than 10 years ago
- Green house gas
- Resource depletion
- Health and safety concerns (e.g. fibreglass)

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European Union End-of-Life Vehicle Directive

- 85% of all new vehicles should be reusable and recyclable by weight
- 10% for energy recovery
- 5% for landfills

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Encouraging Trends

- Growing Global Environmental Consciousness
- Search for Renewable Sources of material
- The agricultural/Bio Revolution
- Discoveries and rediscoveries of ways to have stronger, lighter and cost effective materials for Automotive applications
- Metal replacement

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THE FUNCTION OF FIBRES IS TO REINFORCE RESINS COMPSITES:

"STRUCTURAL MATERIAL CONTAINING HIGH-STRENGTH FIBROUS EMBEDDED REINFORCEMENT WHICH DEVELOP MECHANICAL PROPERTIES GREATLY SUPERIOR THAN THE BASE RESIN"

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REINFORCERS

Traditional Fibres

- Aramid
  - Meta –
  - Para -
- Carbon Fibres
- Glass Fibres

Natural/Bio Fibres

- Hemp
- Kenaf
- Flax
- Sisal
- Coconut Fibre
- Jute
- Cotton
- Wool
- Silk
- Etc.

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BIO-FIBRES

- ➢Lower cost
- ➢Lower density
- ➢Enhanced energy recovery
- ➢Co2 sequesterization
- ➢Much less abrasive to tooling moulds compared to glass fibres
- ØConsistency of quality
- ØSensitivity to temperature
- ØSensitivity to moisture
- ØFire retardency?
- ØNeed for surface modification (physical or chemical)

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BIO-FIBRES DESIRED ATTRIBUTES

- High Modulus
- Resistance to Abrasion
- Consistent Diameter
- Non-conductive
- Mildew Resistant
- Very low water absorption
- Good flame retardency
- No static build up
- Very low VOC release during application and service
- Matrix compatible

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CURRENT SURVEY SHOWS ON AVERAGE EACH CAR HAS 3.6 KG OF FIBRES

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WORLD PRODUCTION OF AUTOMOBILES

Region	Vehicles (Millions)
Europe	21.8
Japan/Korea	14.9
South Asia	14.7
North America	5.4
China	7.9
South America	3.9
Middle East/Africa	1.7
	70.3 Million

Requires 253.08 million kg of BioFibre per year

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THE OPPORTUNITY is 253.08 million kg of Bio-Fibre per year

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Current Bio Automotive Applications

Common Existing Uses for Biofibres

Package Tray Shelf Substrates – natural fiber/binder
Some door trim substrates – plastic/natural fibre composite
Cargo area floors – wood fibre
Rear seat backs – plastic/natural fibre composite
Door panel – natural fibre/binder inserts/quarter/panels
Headliner – fibre mats
Corvette floors – balsa wood composite
Wood veneer trim – wood veneer
Headliner energy management – Sisal/Flax
Package Tray – Basalt/Hemp
Foam Cushion Backing
Load Floor

Supplier Research Activities

Teijin-recycled PET and bio-based fabrics (PLA)
Magna (Research) – fibre reinforced door modules
Magna-Intier: assessed processability of PLA and soy polyol containing PU for door trim
Decoma: has investigated natural fibres with University of Toronto
Lear – Natural Fibre reinforced composites, soy foams
JCI – recycled PET, natural fibre reinforced composites, PHA
Meridian – Flax/PP package shelves for GM and Nissan
Goodyear – substitute biofiller made from maize starch in place of lampblack and silica in tires
Lower tier activity licensing natural fibre manufacturing technologies from Europe
Woodbridge - Composites

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CONCLUSION

Decades of development have allowed Petrochemcial processes to become incredibly efficient, leaving little room for companies to make up for rising carbon prices by further streamlining their production. In contrast, the technologies for processing biomass are relatively underdeveloped, so there is plenty of room for improving efficiencies.

It is not a matter of "IF'….It is a matter of "WHEN".

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THANK YOU FOR LISTENING