Current and Future automotive technology

How is Metair and its subsidiaries positioned to take advantage of these developments.

METAIR
INVESTMENTS LIMITED
automotive | industrial | retail

Wolfgang Ropertz

MD Lumotech PTY (Ltd)

METAIR INVESTMENTS LIMITED

(Listed on the Johannesburg Stock Exchange)

METAIR INVESTMENTS LIMITED
automotive | industrial | retail

AUTOMOTIVE COMPONENTS VERTICAL

- Heat Exchange products
- Air- Conditioning system products
- Wiring Harnesses
- Instrument Clusters
- Lighting products
- Plastic Injection Moulded products
- Ride Control products
- Brake System products

The Major Automotive Market Trends

METAIR INVESTMENTS LIMITED
automotive | industrial | retail

AUTONOMOUS DRIVING

Automated

- **Safety Regulations** (NCAP) are **pushing AD level 1-5**
- Increasing number of **partnerships for AD level 4-5**
- **Higher willingness of consumers to pay** for AD Features.

EFFICIENCY & ELECTRIFICATION

Electrified

- **Accelerated penetration** of electrified vehicles due **to incentives and regulatory push**
- Especially increasing **demand for mild hybrid solutions.**

CONNECTIVITY & DIGITALIZATION

Connected

- **Increasing importance of software:** increase in car **value shift from hardware to software**
- **75% of vehicles** estimated to have **internet connection by 2020**

INDIVIDUALI-ZATION

Individualized

- **Stronger focus** of OEMs and consumers **on vehicle design features**
- Increasing demand for passenger related **applications and functionalities.**

The Major Automotive Market Trends

Offer more opportunities than risks to Metair's Automotive Components vertical.

METAIR INVESTMENTS LIMITED
automotive | industrial | retail

AUTONOMOUS DRIVING

Automated

- ADAS (Advanced Driver Assistance Systems) **Increase use of Electronics & Sensors.**
- Resulting in **additional complex Wiring Harnesses.**
- **Advanced Lighting systems** including light based options for communication.

EFFICIENCY & ELECTRIFICATION

Electrified

- **Energy efficient** and **lighter componentry.**
- **Requirements to reduce weight** results in a move from steel to **high tech Plastic Materials.**

CONNECTIVITY & DIGITALIZATION

Connected

- Driven by requirements for **Improved systems**
  - **Safety**
  - **Navigation**
  - **Communication**
  - **Automation.**
- Digitalized vehicles increase operational efficiency by using real time data.

INDIVIDUALI-ZATION

Individualized

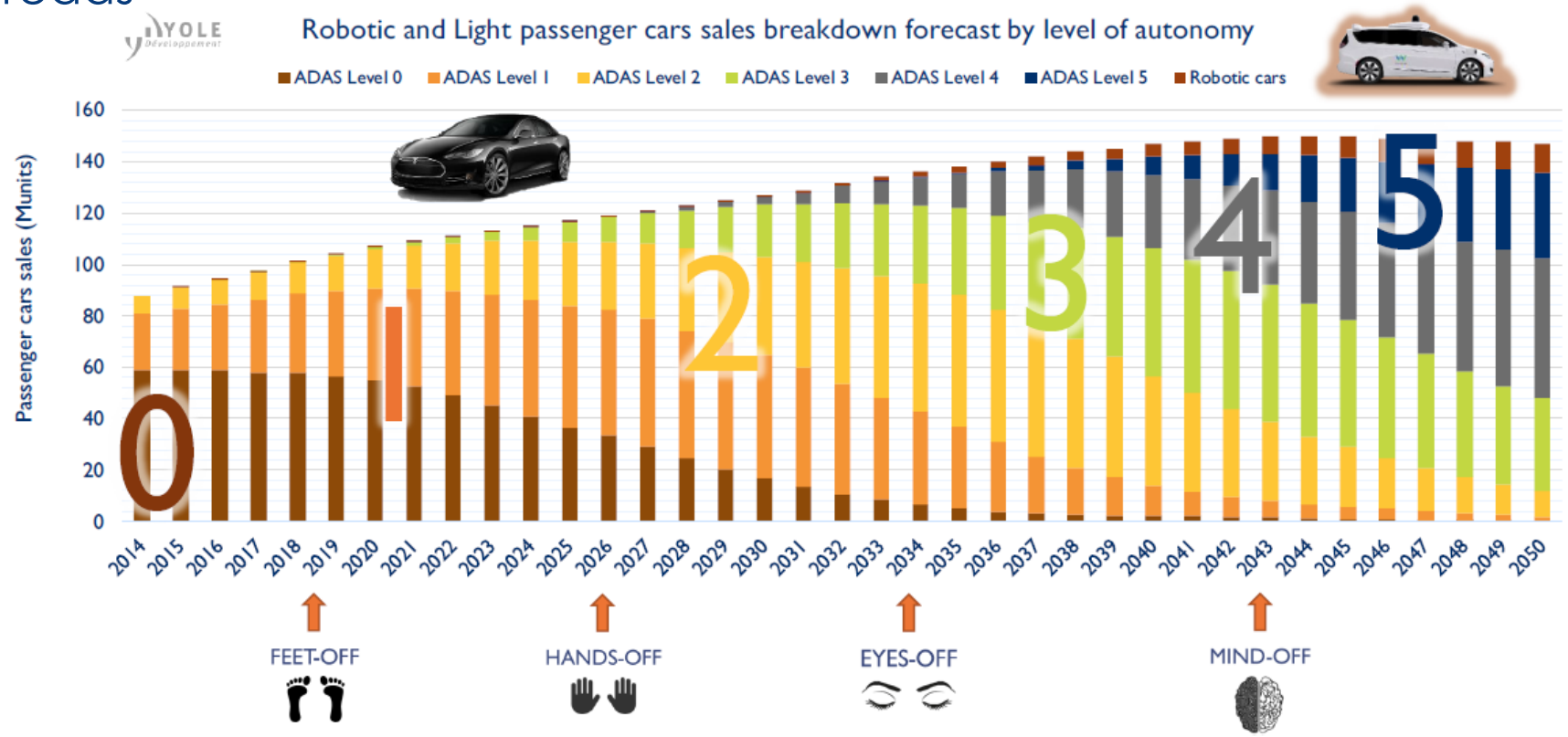
- **Electronics** enhance the Driving Environment.
- Optical elements for individual styling with advanced **exterior and interior lighting systems.**

Market Penetration of ADAS (Advanced Driver Assistance Systems)

METAIR INVESTMENTS LIMITED
automotive | industrial | retail

AUTONOMOUS DRIVING

Predictions & Timelines are varied depending which research report one reads



South African Manufacturers will take these International trends and time lines into account as vehicles and components are exported to more than 155 international markets.

Approximately 60% of total domestic light vehicle production is exported

The **Electrification** of the drivetrain leads to a variety of vehicle Architectures with different costs and CO2 savings

METAIR INVESTMENTS LIMITED
automotive | industrial | retail

EFFICENCY & ELECTRIFICATION

	Internal Combustion Engine **(ICE)**	48V Mild Hybrid **(MHV)**	Full-hybrid **(FHEV)** & Plug-in Hybrid **(PHEV)**	Battery Electric Vehicle **(BEV)**
				
	Conventional combustion engine (gasoline or diesel)	Combustion engine + electric motor which helps share the load	Electric motor charged by combustion engine or via plug-in from grid	Only one battery charged from grid or by fuel cell
CO^2 Reduction*		-10% to -20%	-30%	-100%
Additional Costs**		5% to 10%	50% to 60%	30% to 50%
Voltage		12V & 48V	12V &> 120V	
MARKET PENETRATION* share of light vehicle production worldwide**	With start/stop			
today	**69% 28%**	0%	2%	**0%**
2020	**34% 53%**	5%	5%	**2%**
2025	**24% 47%**	18%	8%	**3%**

* CO^2 reduction related to local emissions only
** Assumptions on technical concept for high volume car
*** Source: IHS Engine Forecast, December 2016

The **Efficiency requirement** necessitates a shift to high tech light weight components

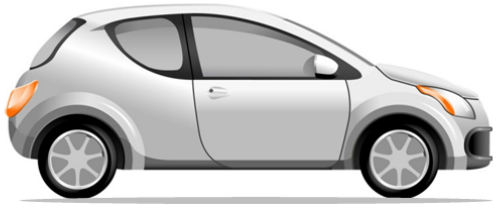
METAIR INVESTMENTS LIMITED
automotive | industrial | retail

EFFICENCY & ELECTRIFICATION

There is a shift towards **lightweight materials and engine downsizing to improve fuel efficiency.**
Materials in our vehicles will become increasingly specialized as component weights reduce.

Biz opportunity for replacement of materials for EV and Light Weight Car.

Conventional Car



COST oriented

Steel mainly

Materials will be Replaced

Future Mobility

WEIGHT oriented

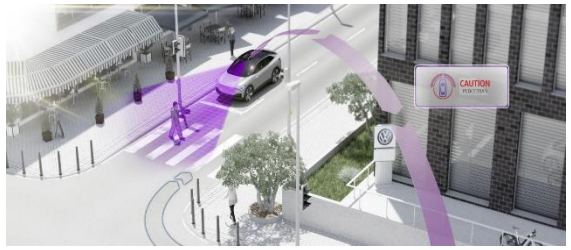
-Aluminum
-Plastics
-CF/GF FRP
-Magnesium Alloy etc.

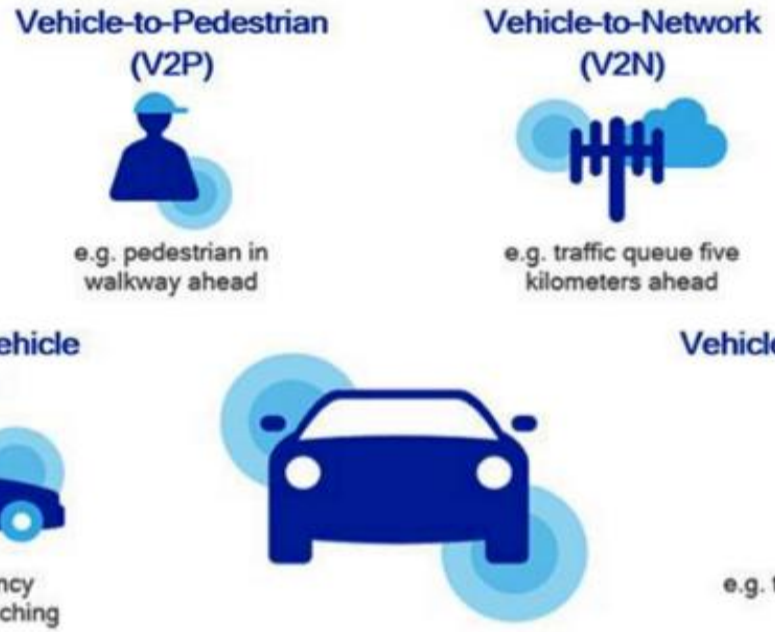
and these Recycle

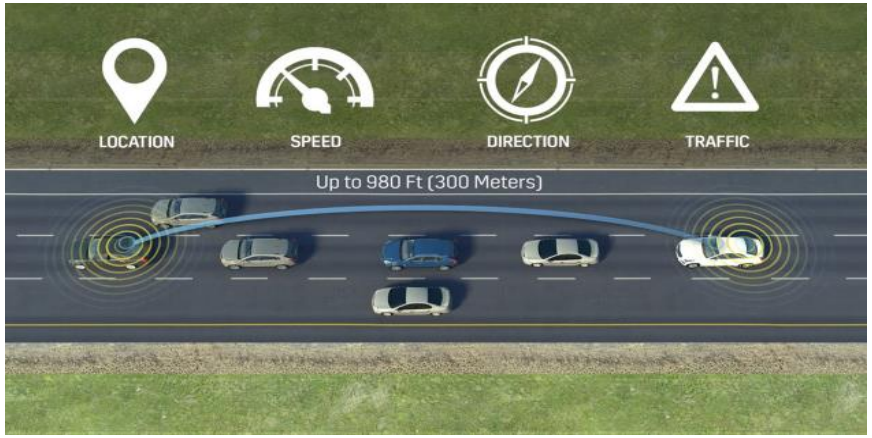
The **Connected Vehicle** to improve Safety, Navigation, Communication and Automation Systems

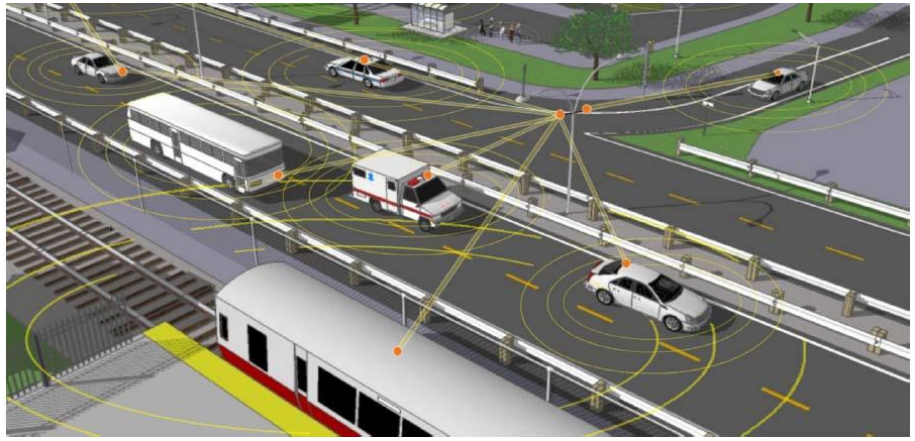
METAIR INVESTMENTS LIMITED
automotive | industrial | retail

CONNECTIVITY & DIGITALIZATION









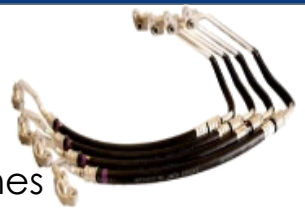
Individualization – Increasing demand for personalization of vehicles

METAIR INVESTMENTS LIMITED
automotive | industrial | retail

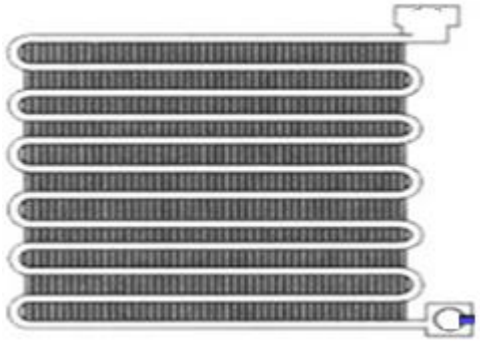
INDIVIDUALIZATION


SMITHS
MANUFACTURING (PTY) LTD

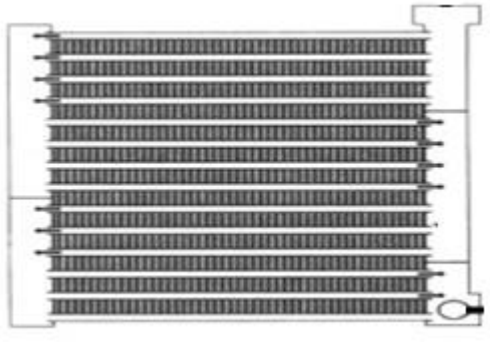
ELECTRIC VEHICLE READINESS

TYPE	PRODUCTS	ICE	HYBRID	Fuel Cell EV	Battery EV
AC Systems	 HVAC  A/C lines  Evaporator  Condenser	✓	✓	✓	✓
Wiper & Washer	 Washer & Pump  Motor & Linkages  Arm & Blades	✓	✓	✓	✓
Reserve Tank & ECU	 Reserve Tank  Engine Electronic Control Unit (ECU)	✓	✓	✓	✓

CONDENSER TECHNOLOGY MIGRATION



Serpentine
(1991)



Parallel Flow
(1995)

Multi-flow – Step IV
(2007)

Multi-flow REC
(2016)

	Serpentine	Parallel Flow	Multi-flow Condenser	Multi-flow Condenser
Fin Material Thickness	160 micron	**160** micron	**80** micron	**70** micron
Tube width	22 millimetre	**20** millimetre	**16** millimetre	**11.5** millimetre
Tube Thickness (mm)	3.6 millimetre	**2** millimetre	**1** millimetre	**1** millimetre
Benefit		Improved Performance & Material Reduction		

EVAPORATOR TECHNOLOGY MIGRATION

Fin & Tube

(1991)

Serpentine

(1995)

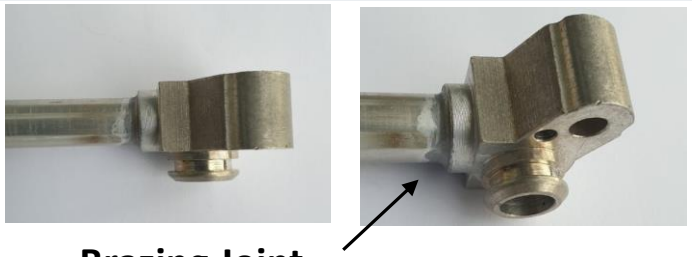
Revolutionary Slim

(2013)

	Fin & Tube	Serpentine	Revolutionary Slim
Fin Material thickness	160 micron	**160** micron	**70** micron
Manufacturing Process	Mechanically Jointed & Hand Brazing	Furnace Brazing	Furnace brazing
Tube Size	Ø8.0 x 0.7mm thick	84mm wide x 5.0 thick	17mm wide x 1mm thick
Benefit		Improved Performance & Material Reduction	

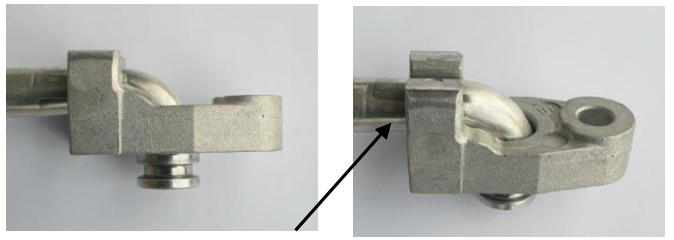
PIPES & HOSES TECHNOLOGY MIGRATION

Braze Technology



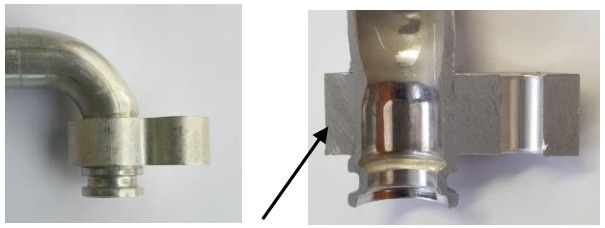
(1991)

Roll Form and Clench



(2005)

Roll form and Spinning



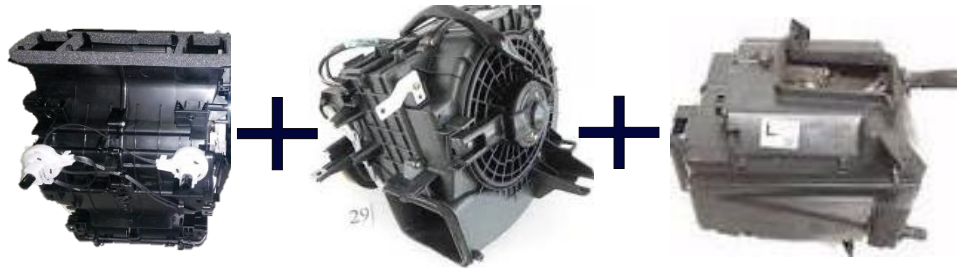
(2016)

	Brazing	Roll Form & Clench	Roll Form & Spinning
Pipe & Connector Joining Process	Brazing	Roll form & Clench	Spinning
Connector type	Extrusion + Machining	Pressure Die Casting	Extrusion & Cut to length
Benefit		Elimination of brazing	Material Reduction

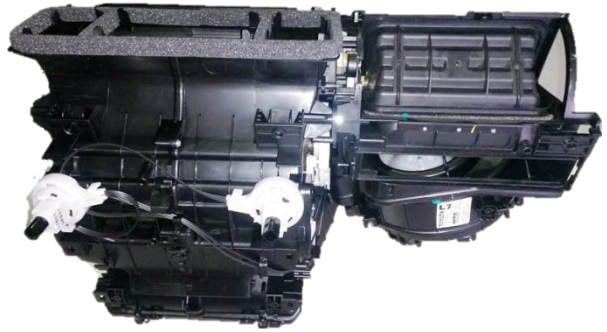
HVAC TECHNOLOGY MIGRATION

Modular HVAC Assemblies (1996)

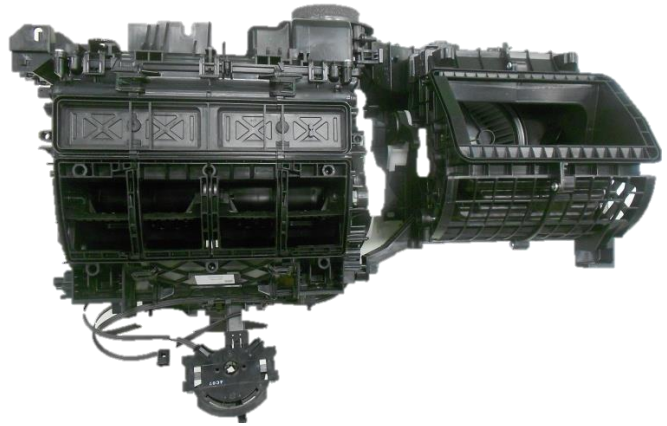
Evaporator Assembly + Blower + Heater



Integrated Units (AC3) (2003)



Integrated Units (MRAC) (2016)



1. 2K Moulding.
2. One touch clips.
3. Higher blower motor performance.
4. Locally Manufactured RS evaporator.
5. “Slidy” Door AIR MIX plate.

HESTO HARNESSES

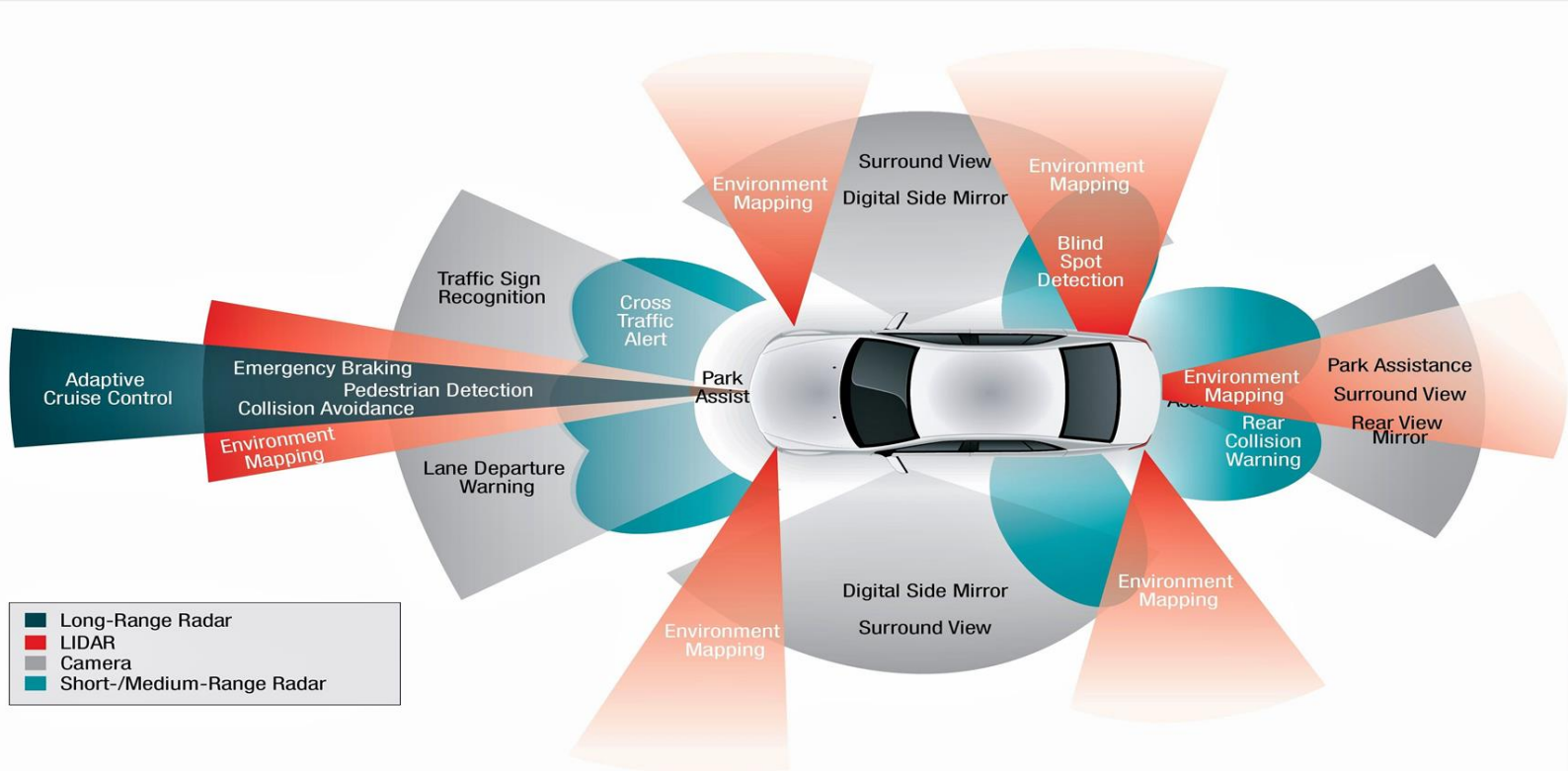
Unitrade 745 (Pty) Ltd

HESTO HARNESSES

METAIR INVESTMENTS LIMITED
automotive | industrial | retail

Wiring Harnesses

Wiring Systems will continue to get larger and more complex due to features added



Electric & Hybrid Vehicles require two sets of harnesses, ie

- **High Voltage – for Electric circuits**
- **Low Voltage – for Functional circuits**

High Voltage Aluminium Wire

HESTO HARNESSES

METAIR INVESTMENTS LIMITED
automotive | industrial | retail

Instrument Clusters

The Future Is Unclear – But the Technology is already available, and Yazaki continues to research

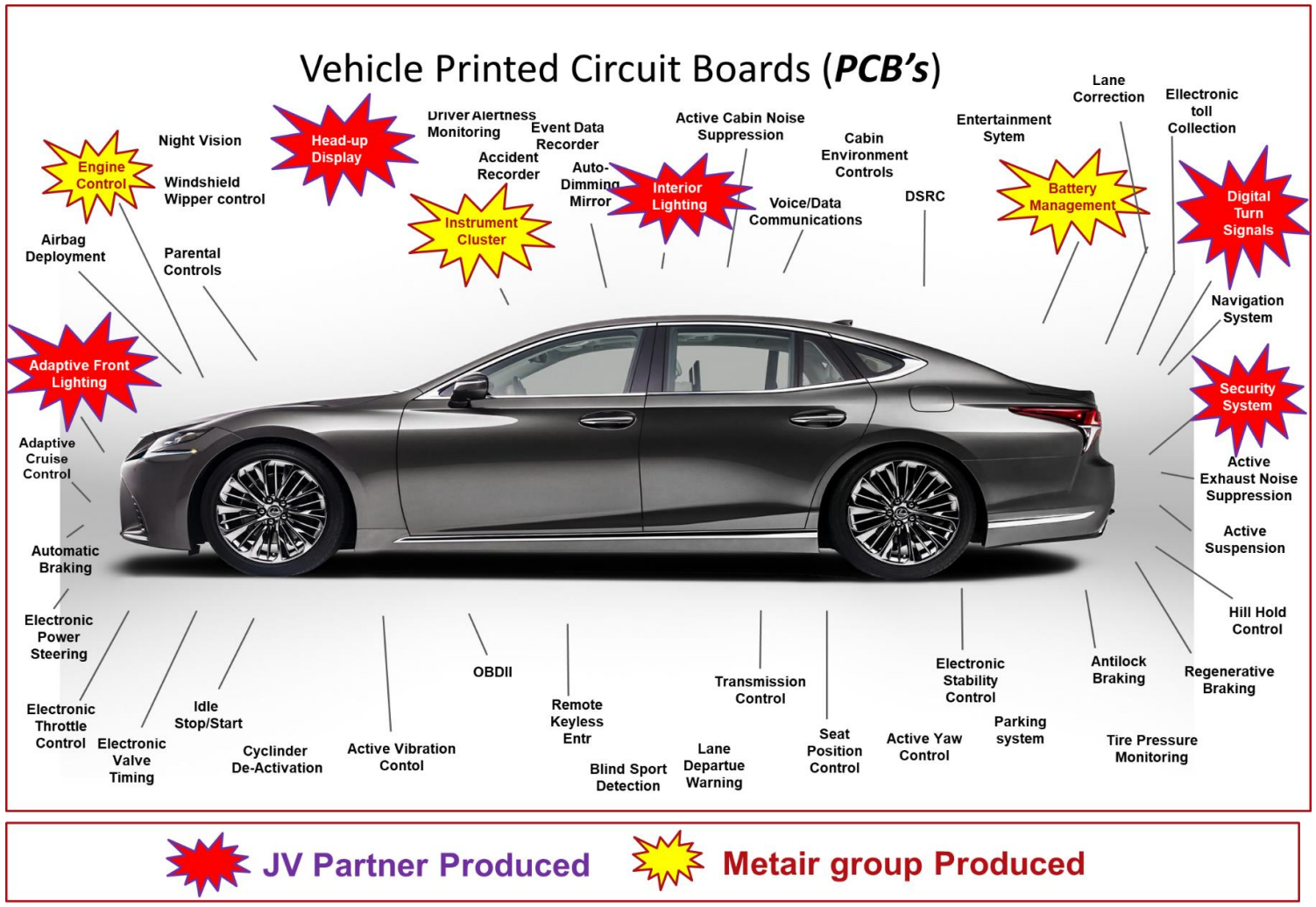
Current Lexus Cluster

Current Yazaki Technology

HESTO HARNESSES

METAIR INVESTMENTS LIMITED
automotive | industrial | retail

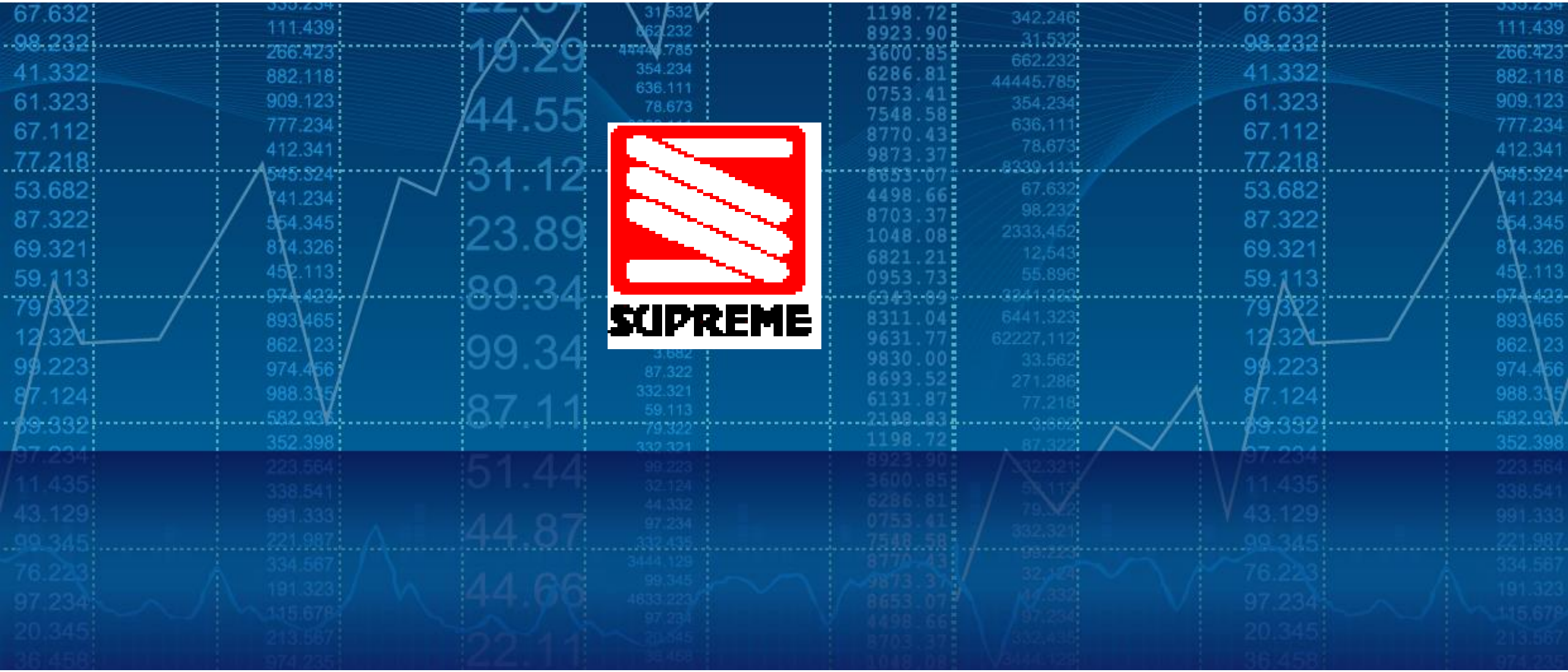
Printed Circuit Board Assembly



[Hesto studying PCB Manufacture]
Immediate requirement is for Instrument Clusters.

Also possible is for:

- LED Lights
- Engine Management Systems


SUPREME

Suspension systems remain relevant

METAIR INVESTMENTS LIMITED
automotive | industrial | retail

Product Range (Automotive Suspensions)


→ **Coil Springs**


→ **Leaf Springs**


→ **Stabiliser Bars**


→ **Torsion Bars**


→ **Special Projects**

Production Methods

- The manufacturing process of steel springs has not changed in the last 50 years except the painting due to corrosion concerns.

Hot Forming



Cold Forming

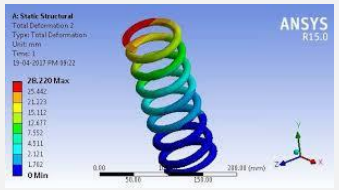

Painting (Powder and E-Coat)



New Technology and EV effect

Technology Disruptors

Weight Reduction Through Materials and Design

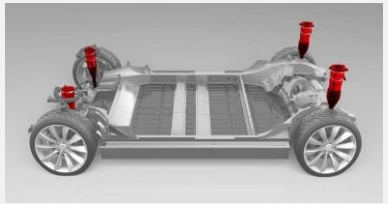


Composite Materials

Air Suspension

E.V. Future Changes

- In the short term E.V. vehicles will be heavier in weight requiring heavier suspension.



- The Tesla 3 has either steel or air suspension.

- Conventional workhorse and 4x4 pick-ups are more likely to change to Hybrid than full electric.
- Suspension weights will reduce for carbon emissions.

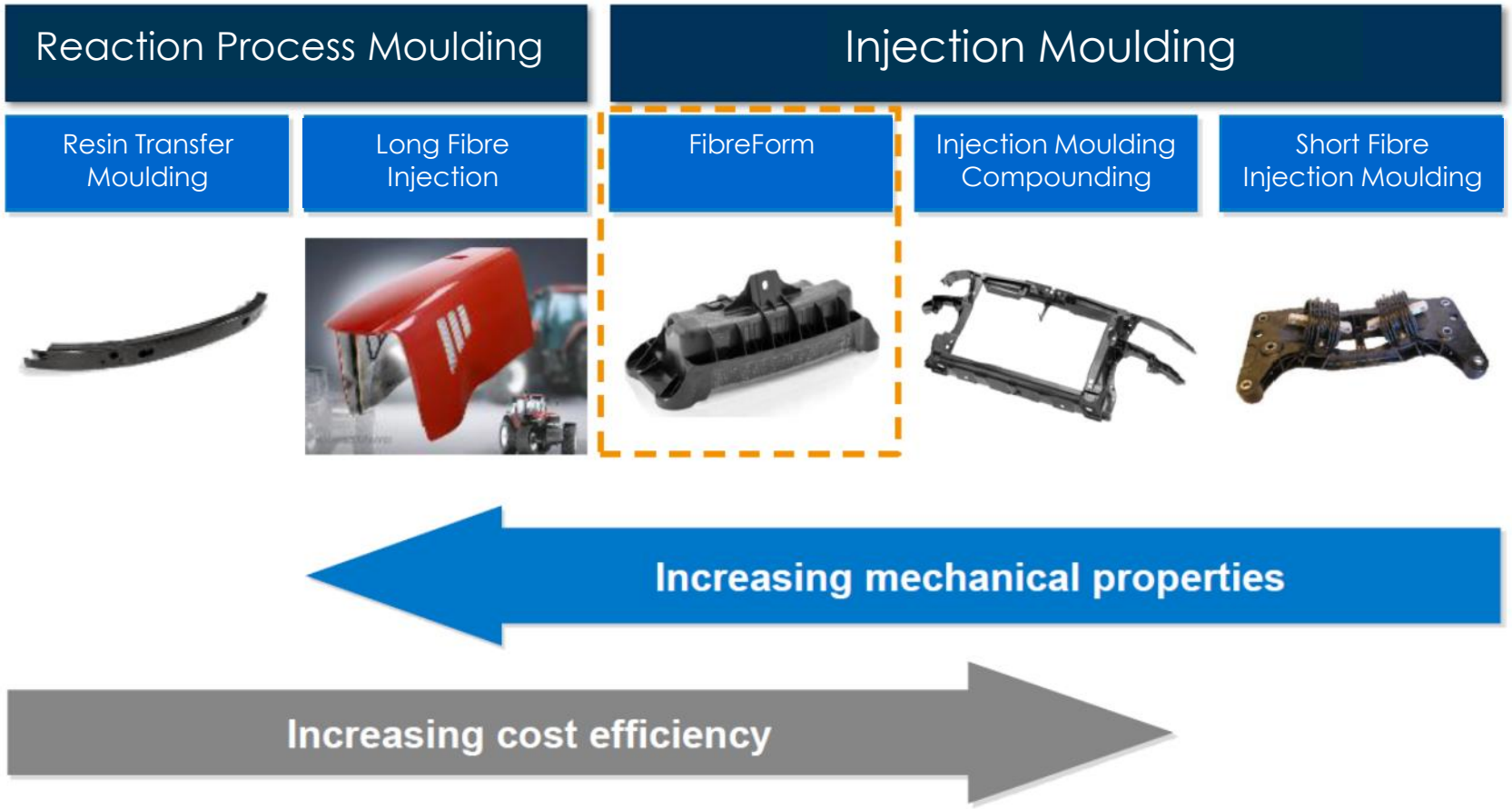

SMITHS
PLASTICS (PTY) LTD
AUTOMOULD (PTY) LTD

Technology Disruptions

Driven by requirements for improved efficiency and performance material technologies are being adopted to meet these requirements and reduce weight

Lightweight portfolio covers the entire range of requirements

Schematic lightweight technology portfolio



Technology Disruptions

ICE down-sizing effect

High-pressure turbocharging/intensive intercooling

Increase ICE Performance / Maintaining thermal & Mechanical strain strength.

LIGHTWEIGHT + HEAVY IMPACT RESISTANCE

CellForm (Mucell)
Foamed parts

IMC
Injection molding compounder
PA and Carbon Fiber + Mucell

25


LUMOTECH
lighting your way

The global automotive lighting market is undergoing huge change

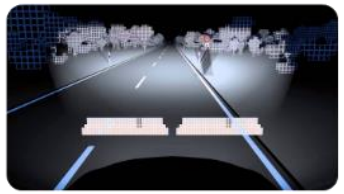
- Lighting has become part of the unique styling and communication package affecting all of the Market trends.

Electronic and digital technologies are transforming the automotive lighting industry, offering more design flexibility, increased efficiencies and new functionalities for manufacturers and consumers.

Lumotech is well placed to meet the future trends with a product line up of Lighting and Moulded components.

New Technology

Integration of Electronics allows communication via lighting systems to pedestrians and surroundings.

State of the art functions	C2P (Car to Pedestrian)	C2D (Car to Driver)
Bend light, glare free high beam, etc. with optimized end-user impact	New functionalities e.g. pedestrian marking, guided attention, etc.	New functionalities e.g. accentuation of driving lanes, projection symbols, etc.
		  
Advanced Driving Beam (ADB)	**Pedestrian marking**	**Extended driving light** **Projection of cross-walk** **Projection of animated navigation information**

- Many new features are being included in Automotive lighting which significantly **increases the value of these products.**

New Technology Examples

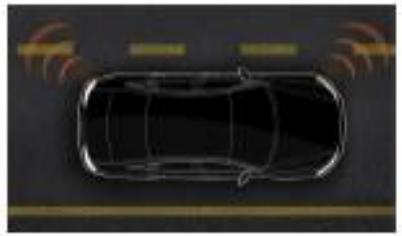
Additional signature light in bumper to differentiate between electric and normal cars

VW e-Up

Illuminated front grill

Interior Mood lighting

Contour illumination



Breakdown warning

Advanced safety projections

In Summary

METAIR INVESTMENTS LIMITED
automotive | industrial | retail

Products	Company	Relevance	Reason
Wiring harnesses	**Hesto**		The copper required for an EV increases on average by 80% as these vehicles require two separate electrical circuits – a 12-volt system for control circuits and a 360+ volt system as an energy source circuit.
Lighting & Plastic Products	**Lumotech**		Autonomous vehicles require additional visibility and therefore more lighting. Lights become an even more critical part of vehicle aesthetics and are also needed to meet regulatory requirements.
Heat exchange products	**Smiths Manufacturing**		Cooling for an internal combustion engine is no longer required. However, the battery in an EV requires a heat management system and energy is required to heat the cabin as there is no heat coming off the engine. Air conditioning systems will continue to be required.
Plastic products	**Smiths Plastics Automould**		EVs are around 20% heavier than current vehicles of a similar size. Plastic parts will be necessary to reduce weight and also assist with vehicle aesthetics. Autonomous driver sensors and aids will require plastic housings and other plastic parts.
Ride control products	**Supreme Springs**		Suspension parts are still necessary and heavier EVs will require increased ride control comfort. Producing lighter but higher strength suspension will require improved technology.

METAIR
INVESTMENTS LIMITED
automotive | industrial | retail

Thank You