



Media and Financial Analysts Day 2017
From Trends to Innovation in Acoustic and Thermal Management

Sevelen, October 31st, 2017



Agenda

From Trends to Innovation in Acoustic and Thermal Management

Martin Hirzel, CEO

1. **New Mobility Trends**
2. Autoneum 2025
3. Conclusion

Autoneum Approach to New Automotive Trends

Ciro Gaudino, Head Competence Center New Mobility

1. Competence Center New Mobility: Mission and Achievements
2. New Mobility: Challenges and Opportunities
3. New OEMs: Leveraging our Core Competences
4. Innovating for New Mobility

Industry 4.0 / Predictive Maintenance Project

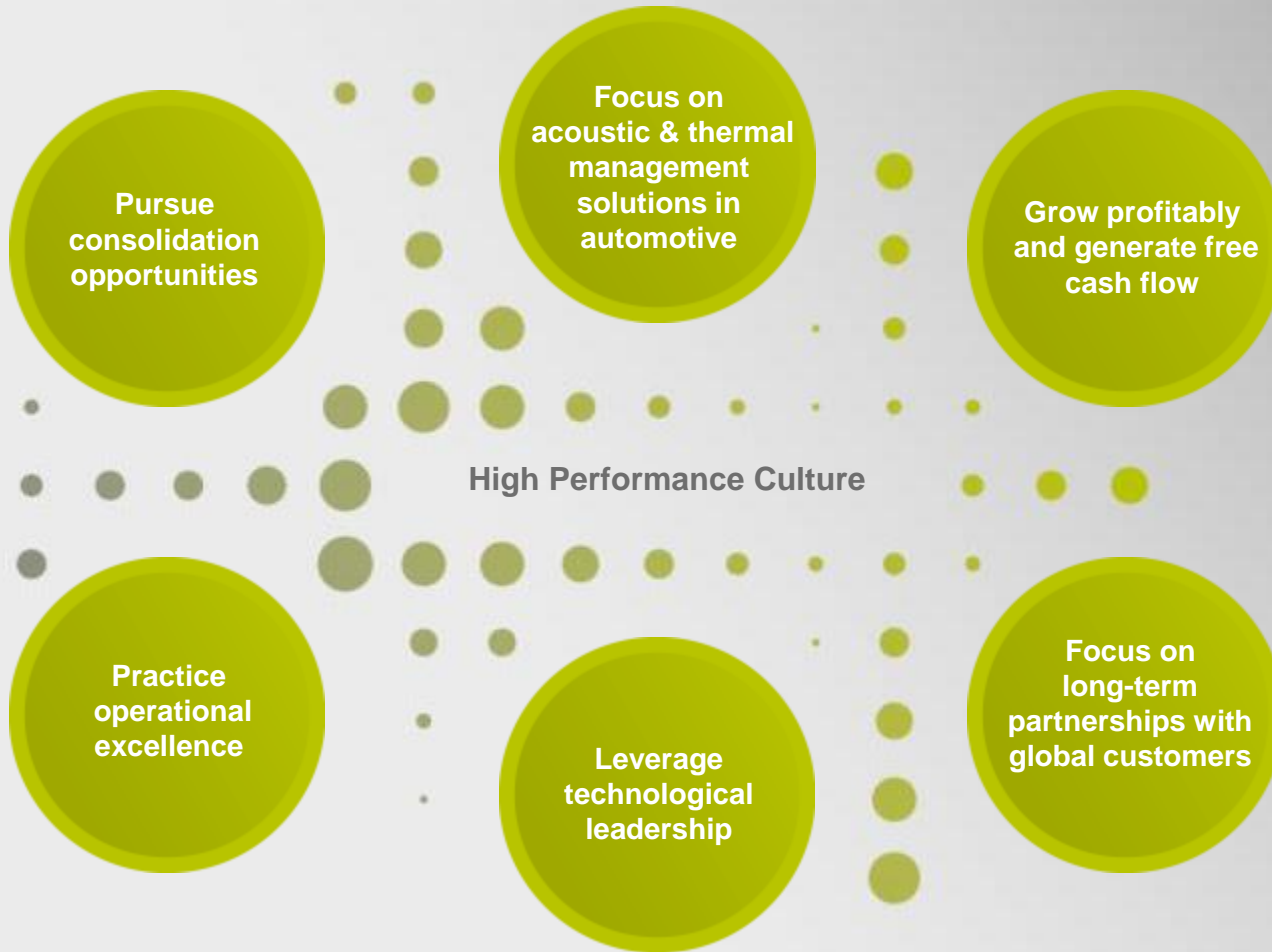
Domonkos Gaspar, Head Global Manufacturing Digitization

Manufacturing Simulation with Virtual Reality

Ahmad Abdallah and Carolyn Pankow, Manufacturing Project Engineers

Strategic Priorities

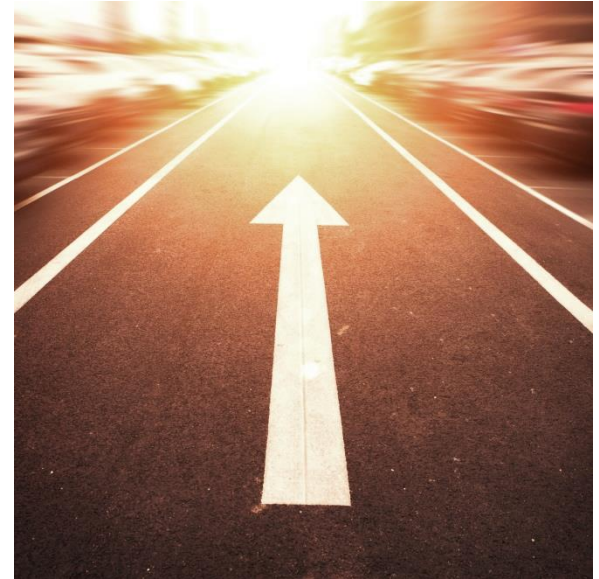
Pillars of Sustained Success



Targets 2020

Accelerate Profitable Growth

- Net sales of CHF 2'600 million
- Emerging markets >20% share in Group's net sales
- EBITDA margin of 12%
- Equity ratio >40%
- RONA >20%
- Target dividend payout of at least 30% of net profit attributable to shareholders of Autoneum Holding Ltd



New Mobility Trends

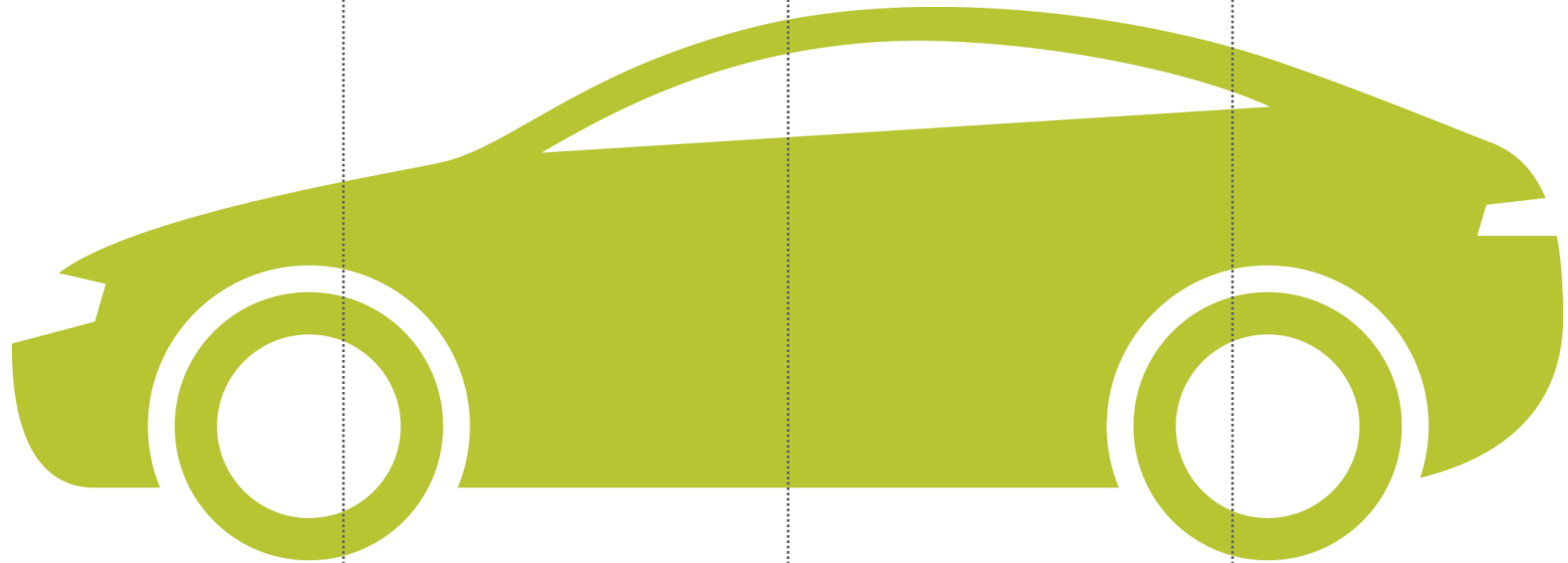
Impacting the Automotive Industry Beyond 2020

E-Mobility

Connectivity

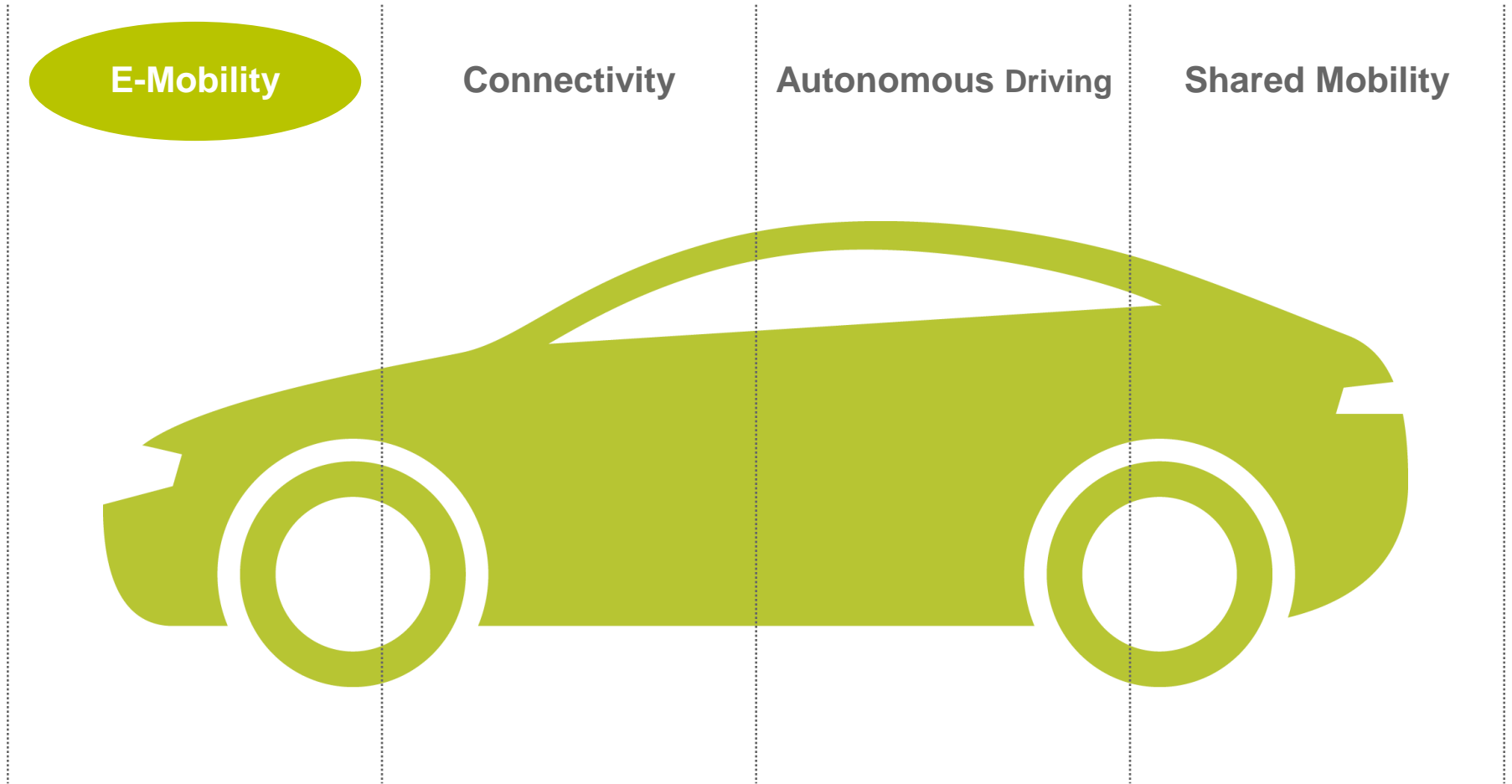
Autonomous Driving

Shared Mobility



New Mobility Trends

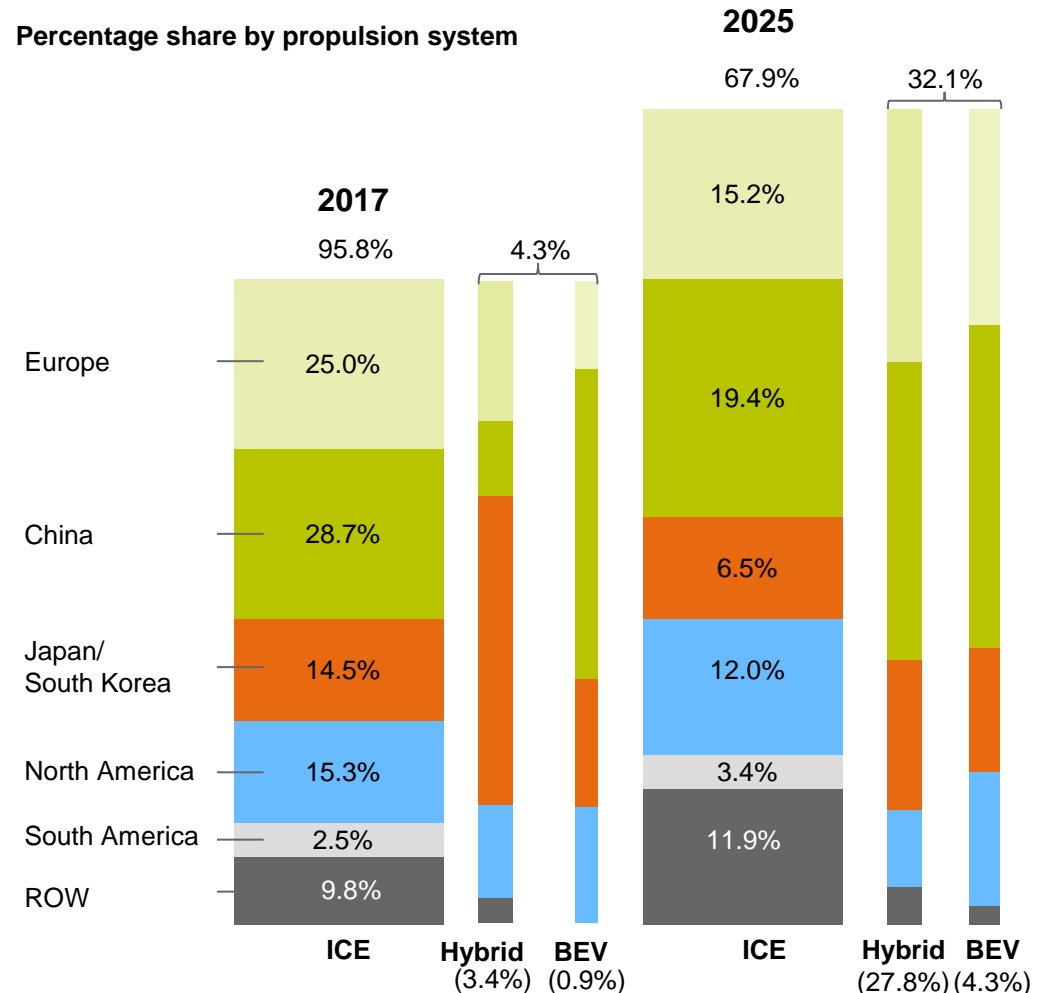
Electrification



Drivers of Future Mobility

Increase in Electric Powertrains

- Sharp increase of new powertrain concepts
- Electrification of the powertrain by all OEMs, particularly with:
 - Mild/Full Hybrid
 - Plug-in Hybrid
- In 2025, only 4% of all vehicles are expected to be pure electric vehicles (BEVs)



Source: IHS 2017

E-Mobility

OEM Strategies and Targets

OEM	Volumes	Models
	0.5 million by 2018 / 1 million by 2020	
	15-25% of sales	> 10 BEVs by 2022
		4 PHEVs, 4 BEVs
	1.5 million HEVs and 30K FCV	
		13 BEVs and PHEVs
	20% of European sales	8 BEVs, 12 HEVs by 2022
	67% of sales by 2030	
	15-25% of sales	12 BEVs, 13 HEVs by 2025
		7 PHEVs, 4 BEVs
	1 million cumulative by 2025	
	30K Bolts in 2017	20 xEVs by 2023
	20-30% of sales	> 30 BEVs
	240K units	16 BEVs, 5 PHEVs
	400K units cumulative	27 BEVs, 7 PHEVs
	600K units (200K domestic)	13 BEVs, 17 BEVs

Sources: UBS Report "Electric Car Teardown", Autoneum.

 < 2018
 < 2021
 2025 > 2030

Autoneum's Current E-Car Supply

Broad Range Equipped by Autoneum

Product family	BMW i3	Chevrolet Bolt	Nissan Leaf	Renault Zoe X10	Daimler B-Class
Volumes 2017	32,000	30,000	35,000	31,000	4,500
Carpet systems	o	o	o	✓	o
Inner dashes / interior insulators	o	✓	✓	✓	o
Dampers and stiffeners	o	o	✓	✓	o
Underbody shields	o	o	✓	✓	✓
Wheelhouse outer liners	o	o	✓	o	o
Engine encapsulations	✓	/	✓	/	/
Hoodliner / Outer dashes	o	o	✓	✓	o
NVH development	✓	/	✓	✓	o

✓: Part supplied by Autoneum o: Part supplied by competitors /: Part not required

Autoneum's E-Car Supply 2018 – 2020

Delivery of Two New Players

Product family	2018 OEM	2018 OEM	2018 New OEM	2019 OEM	2019 New OEM	2019 OEM	2019 OEM	2020 OEM	New OEMs
Carpet systems	✓	o	o	o	o	o	✓	✓	
Inner dashes / interior insulators	✓	✓	o	o	✓	✓	✓	✓	
Dampers and stiffeners	o	o	o	o	/	o	o	o	
Underbody shields	o	o	✓	✓	✓	✓	o	o	
Wheelhouse outer liners	o	✓	o	o	✓	o	✓	o	
Engine encapsulations	o	/	o	o	RFQ ongoing	/	/	o	
Hoodliner / Outer dashes	o	/	o	o	✓	✓	RFQ ongoing	/	
NVH development	/	/	RFQ ongoing	/	✓	RFQ ongoing	/	/	✓

✓: Part supplied by Autoneum o: Part supplied by competitors /: Part not required

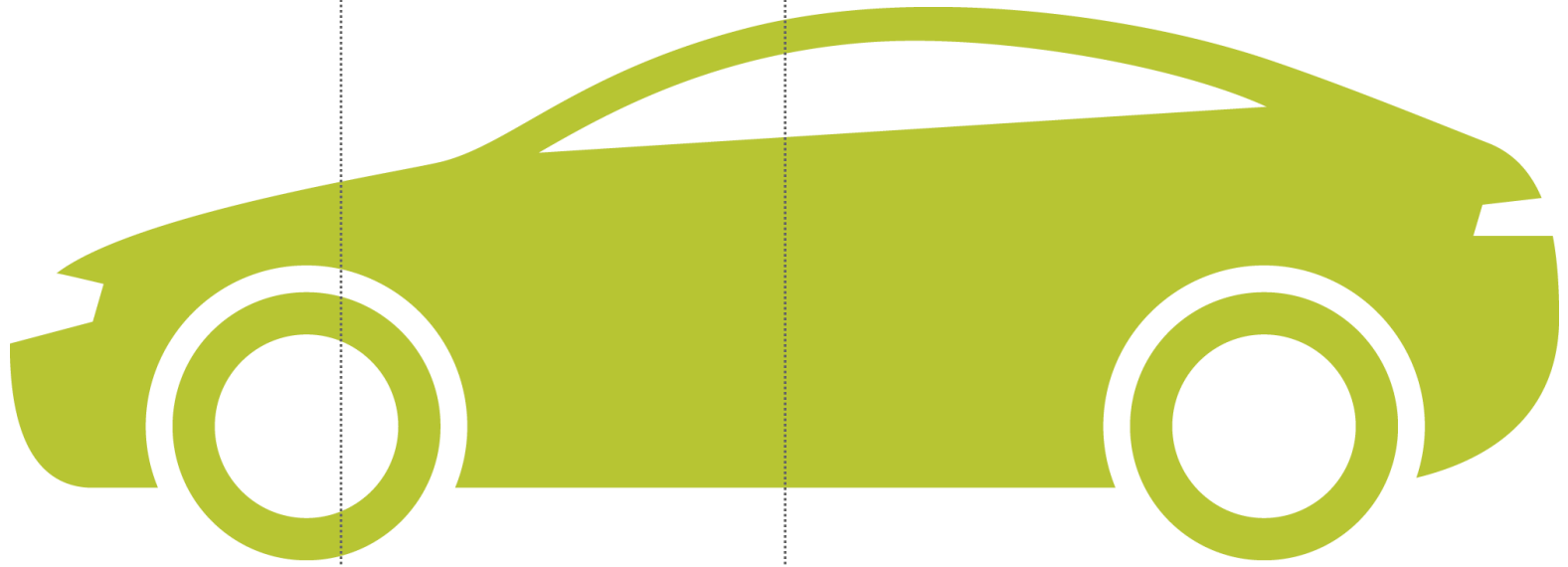
New Mobility Trends

Autonomous Driving & Shared Mobility

E-Mobility

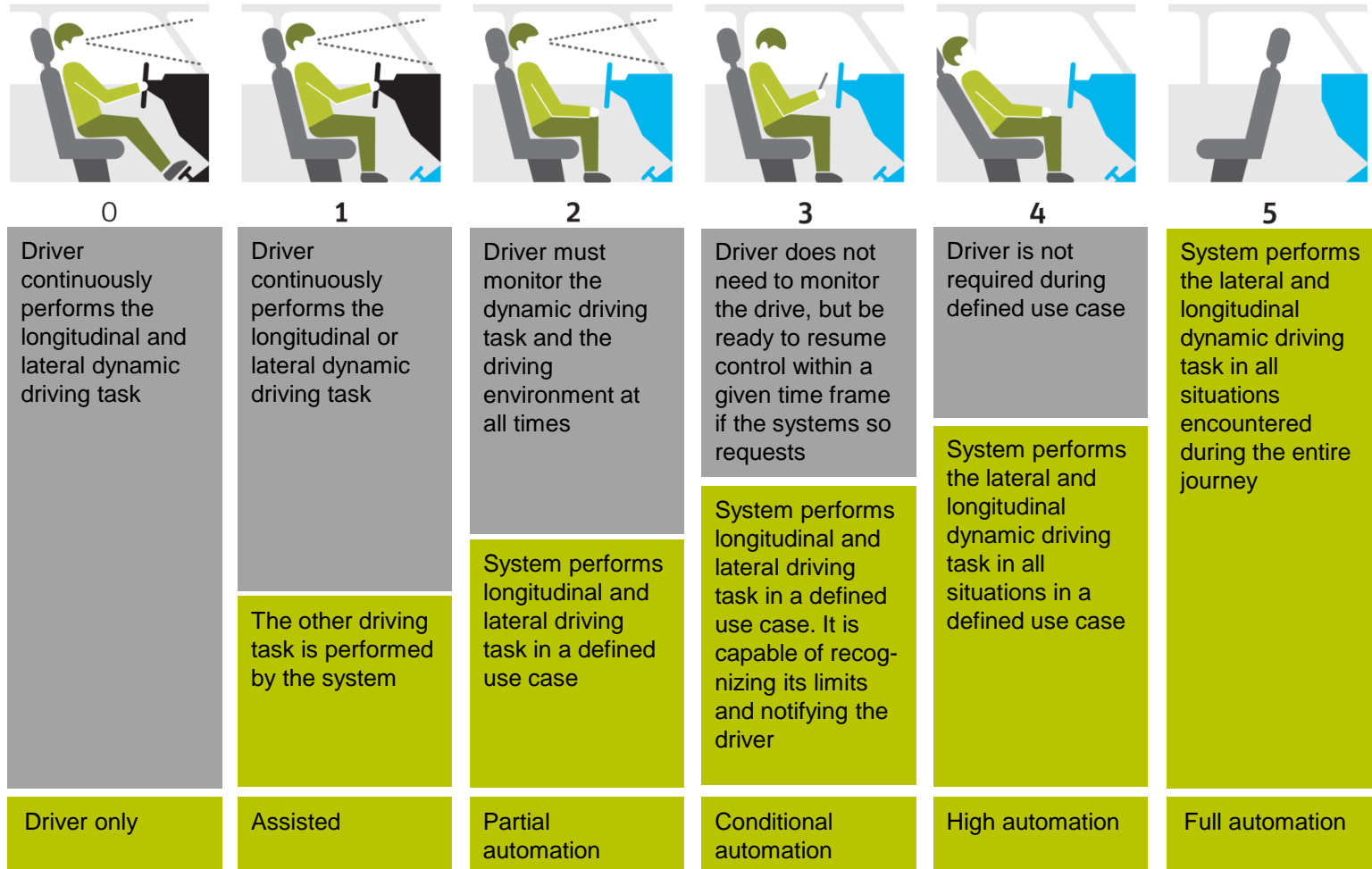
Connectivity

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New Mobility Trends

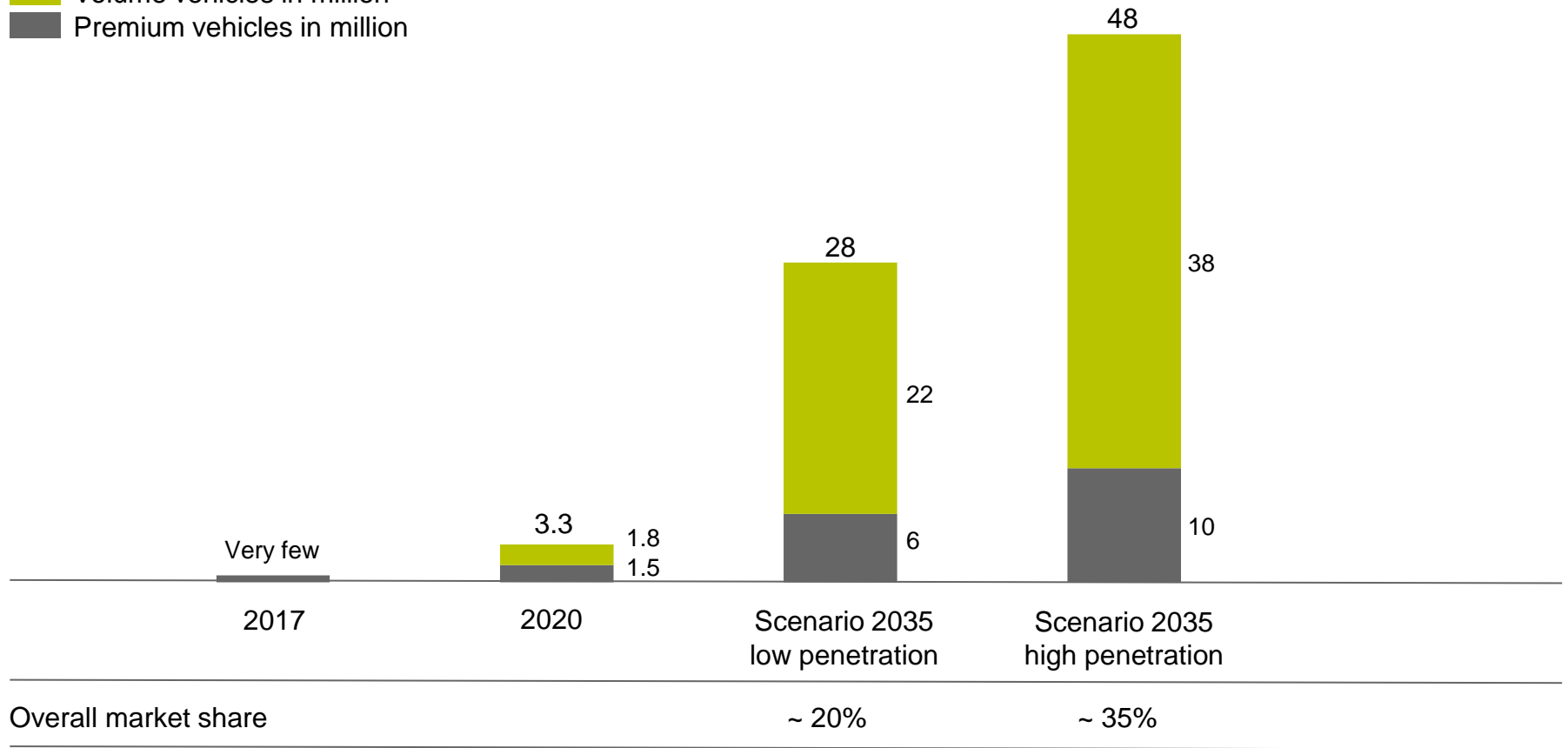
The Five Levels of Autonomous Driving



Sources: OICA, Autoneum.

Fully and Partially Automated Vehicles Market Volume Assumption 2017 – 2035

■ Volume vehicles in million
■ Premium vehicles in million



Sources: LMC Automotive, Oliver Wyman, Autoneum.

Self-Driving Cars and Shared Mobility

High Sales Potential

Self-driving cars

Wellness, work, communication and entertainment:
passengers will expect absolute silence and a healthy interior environment

Sustainability:
Sustainability of products and production processes will be a key element in all future vehicles, independent of the powertrain and the degree of autonomous driving

Interior architectures:
the instrument panel will shrink and leave more room for comfortable surfaces with acoustic absorption to compensate sound reflecting glass roof

New materials and function integration:
development of novel attractive surfaces and work on the integration of acoustic and thermal functions in new materials

Shared mobility

Tough interiors:
resistance to dirt, cleanability and wear resistance will play a major role in fleets of shared cars

Fleet customization:
fleet operators will demand technologies to personalize the interiors of their vehicles

Aftermarket:
replacing of worn out interior parts in shared cars with high utilization might offer opportunities for new business

Design to cost:
Autoneum's leading simulation tools help to design the best compromise between performance and cost

Conclusion

New Mobility Trends: Impact on Product Portfolio

Product families	BEV including private autonomous	Private autonomous ICE	Shared ICE including autonomous	Shared BEV including autonomous
Carpets	↑	↑	↑	↑
Floor insulators	↓	✓	✓	↓
Inner dashes	✓	↑	✓	↓
Wheelhouse liners	↑	↑	✓	✓
Underbody panels	✓	↑	✓	✓
Engine bay	↓	↑	✓	↓
Heatshields	↘	✓	✓	↘

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Industry 4.0 / Predictive Maintenance Project

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Our Assumption

By 2025, the World Will Be More...

Asian



Electric



Efficient



Sustainable



Autoneum 2025

Strategic Focus Areas



Accelerate Asia



**Innovate for
E-Mobility**



**Drive
Digitalization**



**The Green
Company**

Autoneum 2025

Strategic Focus Areas



Accelerate Asia



Innovate for E-Mobility



Drive Digitalization



The Green Company

Innovate for E-Mobility

Main Actions to Consolidate our Technology Leadership

Competences

- **Competence Center New Mobility** in the heart of Silicon Valley to understand the needs and functions of products dedicated to e-mobility



People

- Job rotation experience in place to disseminate the **Silicon Valley innovation culture** in Autoneum's technical community



Business

- Monitor start-up ecosystem and feed innovation in R&T
- Develop business and relationships with new OEMs
- Leverage on digital transformation
- Provide data on new mobility to the global organization



Autoneum 2025

Strategic Focus Areas



Accelerate Asia



Innovate for E-Mobility



Drive Digitalization



The Green Company

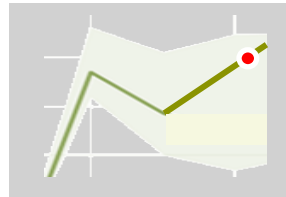
Industry 4.0

Our Definition

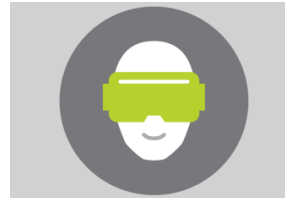


Industry 4.0

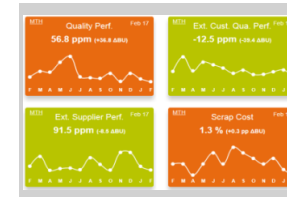
Current Projects



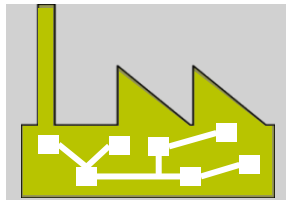
Predictive Maintenance



3D Simulation of Layout and Flows



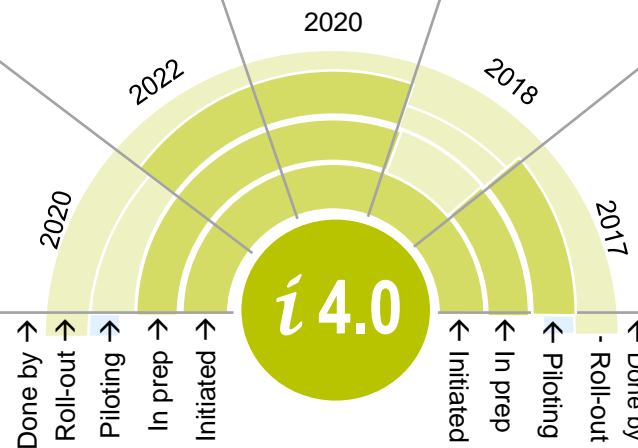
Business Intelligence Suite



Manufacturing Execution System



Cobots



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Domonkos Gaspar, Head Global Manufacturing Digitization

Manufacturing Simulation with Virtual Reality

Ahmad Abdallah and Carolyn Pankow, Manufacturing Project Engineers

Conclusion

New Mobility Trends Support Future Profitable Growth

- New mobility trends such as e-mobility and autonomous/shared driving provide business opportunities for Autoneum
- Autoneum benefits from its proven long-standing NVH and thermal expertise
- Trends are early anticipated in the innovation pipeline
- New OEMs offer potential for outsourcing of NVH development
- For Autoneum digitalization is all about operational excellence



Industry trends such as e-mobility and autonomous/shared driving as well as Industry 4.0 support Autoneum's target of profitable growth

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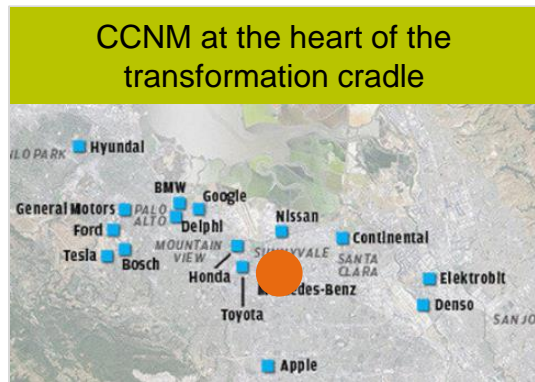
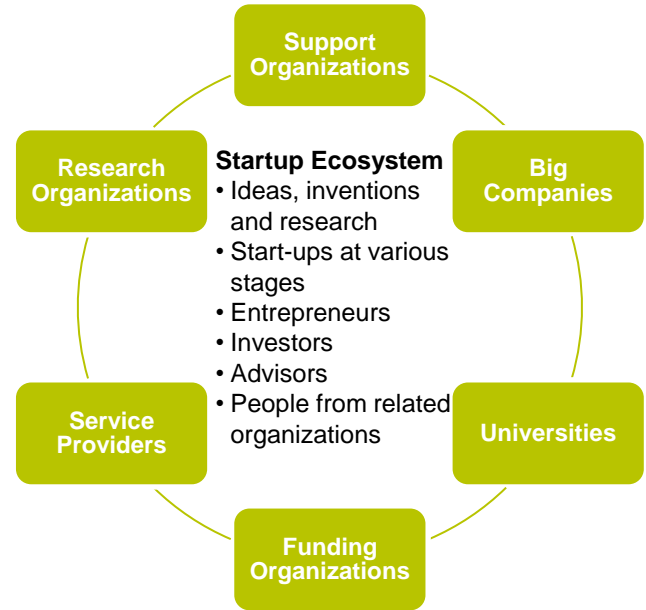
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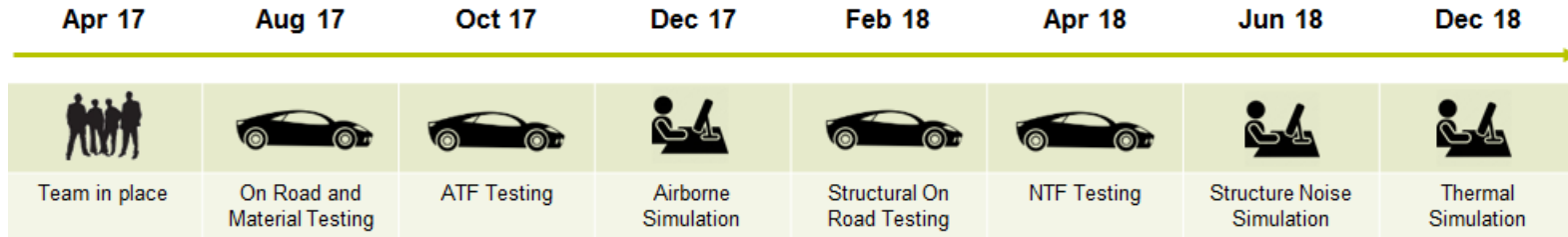
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Competence Center New Mobility (CCNM) The Mission

- Actively monitor ideas in the start-up ecosystem and feed innovation in R&T
- Establish mutual beneficial relations with new OEMs
- Leverage on digital transformation
- Support the global organization with facts and data on new mobility



Competence Center New Mobility (CCNM) Achievements and Outlook



- Six months after start, unit is fully operational in engineering services (simulation and testing)
- Provision of engineering and products to new OEMs
- Mapping of OEM startups and research activities in major American and Chinese universities
- Launch of projects on synergies between acoustics and virtual reality

Services	Simulation Tool							Material Measurement				Vehicle Measurement				Prototyping tools				
	Hypermesh	Visual SISAB	Revamp	MSC Nastran	Matiab	Radloss	VisualTherm	RadTherm	Material Database	Elwis S/A	Alpha Cabin	Isokell	Care+	Acoustic Chamber	Vib Meas Equipments	Road Acq. System	Datalog and Thermocouples	Equipment	3D Scanner	Digital Camera
Airborne Noise Vehicle Simulation	●	●	●		●				○	○	○	○	○							
Airborne Noise Vehicle Measurements														●				●	○	
Structure-Borne noise Vehicle Simulation	●			○	○	●			○	○										
Structure-Borne noise Vehicle Measurement															○					○
Vehicle Benchmark														●	○	●	●			○
Vehicle Road Measurement															●	●				○
Vehicle Benchmark									○	○				●	●					○
Vehicle Component Measurement									○	○	○	○								
Material NVH Parameter									○	○			○							
Prototyping																		○	●	○
Prototype to Geometry																			○	○
Component Thermal Insulation Simulation							○													●
Vehicle Thermal Comfort Simulation							○	○												●

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New Mobility

Excel at Trend Analysis to Unlock Potential

 <p>BEV/HEV</p>	<p>E-motors / Batteries / Vehicle architectures</p>	
 <p>Autonomous Driving</p>	<p>Customer expectation</p>	
 <p>Shared Mobility</p>	<p>Ownership</p>	

Topics	Opportunities
Powertrain tonal noise	Specific treatments, diagnostics and simulation
Weight down	Leverage lightweight portfolio
Aerodynamics	Extended underbody coverage
Dominant road noise	Textile exterior treatments
Sustainable technologies	Leverage recycled fiber technologies
Lack of heat sources	Use sound package for thermal comfort
Style of interior	Innovation in new materials
Comfort in autonomous driving	New levels of quietness
Shared use	Durability, cleanability

E-Mobility in the Spotlight

Unpleasant Noise

- Only in acceleration or at very low speed, electric powertrain is perceivably quieter than IC engine
 - Electric motors have annoying high frequency tones that need to be treated
 - Energy recuperation at brake also causes unpleasant noises
-
- Road and aerodynamic noise become dominant at constant higher speeds
 - These noise sources do not carry “emotions” → must be silenced



Frequent speed variation



Cruise condition

E-Mobility

Noise Perception Assessment of Various BEV Models

- 47 NVH experts and non-experts
- 8 BEVs assessed (A to H)
- Even in driving conditions favorable to electric motors, the sound experience of e-models can be disappointing

5 Satisfying

Condition fulfilling the expectation, no problem identified

4 Fair

Condition not ideal but not considered a real problem

3 Disappointing

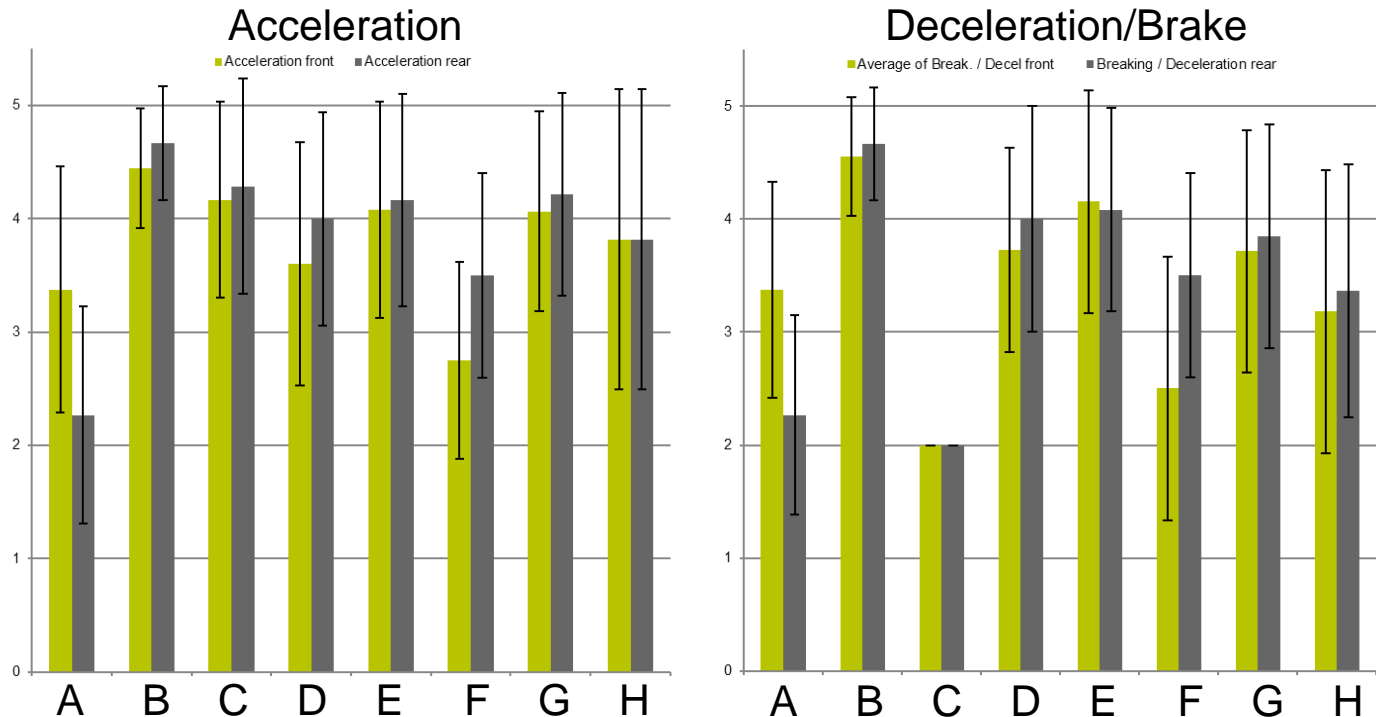
Condition less than desirable and borders on annoying

2 Annoying

Condition annoying and some corrections desired

1 Unacceptable

Condition totally unacceptable must definitely be fixed



E-Mobility

Noise Perception Assessment of Various BEV Models

- Road noise and aerodynamic noise remain important differentiation factors also for BEVs

5 Satisfying

Condition fulfilling the expectation, no problem identified

4 Fair

Condition not ideal but not considered a real problem

3 Disappointing

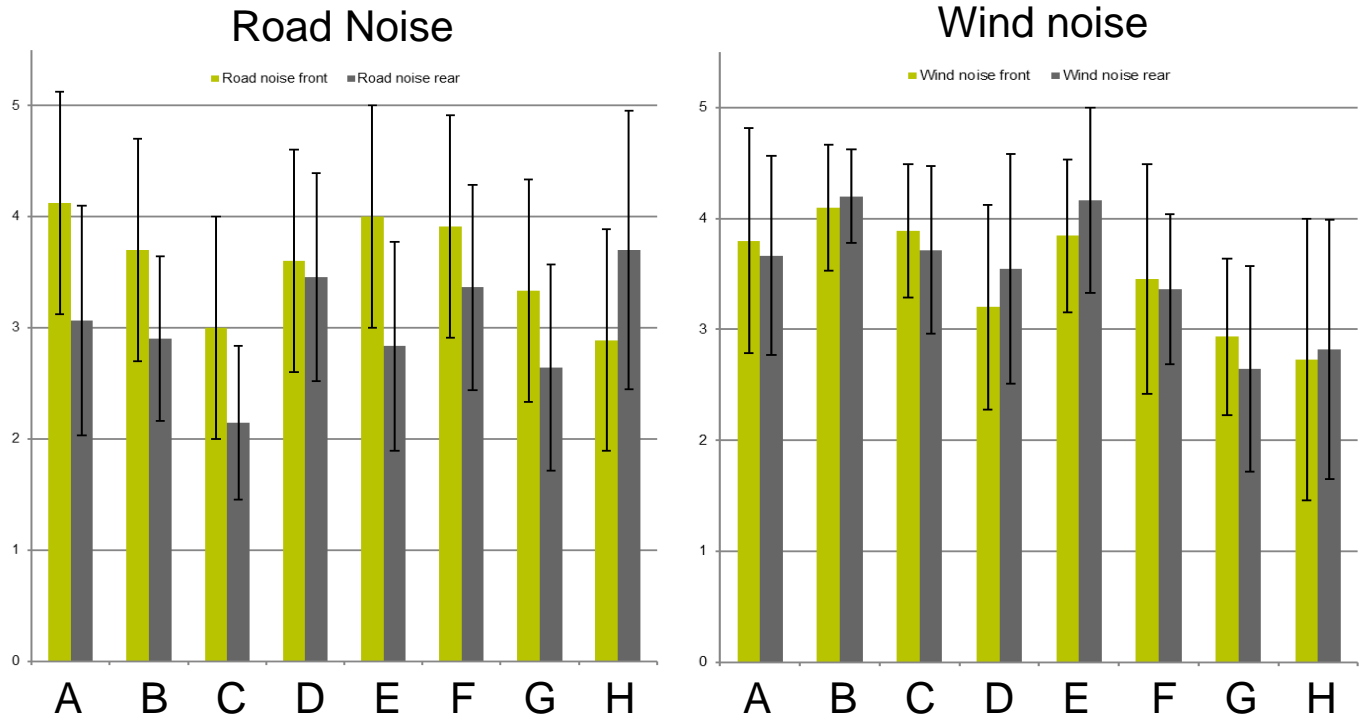
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Market Development of Electric Vehicles

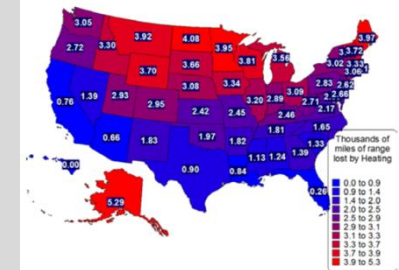
Outlook on Autoneum Offering Development

	2017	2022	2027
Scenario	<ul style="list-style-type: none"> ➤ Few BEV models on the market ➤ Pioneering OEMs ➤ Low production volume 	<ul style="list-style-type: none"> ➤ More BEV models on the market ➤ All OEMs ➤ Growing production volume 	<ul style="list-style-type: none"> ➤ Many BEV models on the market ➤ All OEMs – autonomous/shared driving ➤ High production volume
Players	<ul style="list-style-type: none"> • Few pioneer OEMs • Automotive start-ups and digital giants moving into Automotive 	<ul style="list-style-type: none"> • New OEMs successful in scaling up • Traditional OEMs 	<ul style="list-style-type: none"> • New OEMs successful in scaling up • Traditional OEMs
Technical focus	<ul style="list-style-type: none"> • Implement disruptive product contents • Acoustics has to be just right 	<ul style="list-style-type: none"> • Consolidate and improve disruptive product contents • Acoustics as differentiator in premium segments 	<ul style="list-style-type: none"> • Acoustics as differentiator in all segments
Autoneum actions	<ul style="list-style-type: none"> • Engineering services (simulation in particular) • Lightweight technologies adapted to BEVs • Develop innovative products 	<ul style="list-style-type: none"> • Engineering services (simulation in particular) • Joint developments with OEMs to identify consumer needs in new mobility • Adjust product portfolio 	<ul style="list-style-type: none"> • Provide engineering services (simulation in particular) • Offer disruptive specific products for new mobility

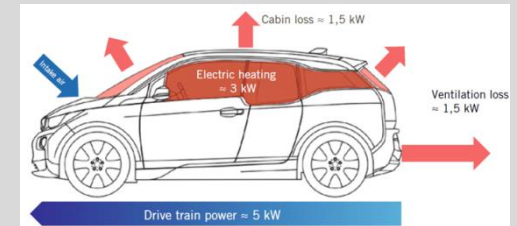
E-Mobility

Sound Package for Thermal Comfort

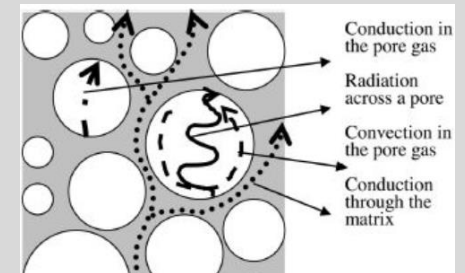
- In BEVs thermal comfort relies on the battery. This is not fully captured in laboratory tests and the discrepancy between the homologation drive range and the one in real use can reach 20%.



- Once thermally insulating glazing is adopted, the effect of thermally insulating trim can be substantial to reduce AC usage in both steady-state (thermal insulation) and transient condition (thermal insulation and inertia).



- Autoneum offers a unique asset combination of thermal management, acoustic competences and lightweight solutions.



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New Mobility OEMs and Start-ups in California, USA

Short List Ranking by Venture Capital


New OEM	Founding	Employees	EV*	AD*	SM*	Product Description	Production Capacity	Production Timing	Capital
NIO	2014	2000	x	x		Luxury Electric Car	8 prototypes produced	Planned for 2020	\$1 billion
Zoox	2014	500	x	x	x	Autonomous electric car	Prototype	Unknown	\$300 million
Tesla	2003	33,000	x	x		Luxury electric car	Over 200k vehicles sold	First produced in 2008	\$226 million (IPO)
Lucid Motors	2007	500	x	x		Luxury electric car	Prototype	Planned for 2019	\$200 million
Faraday Future	2014	1400	x	x		Luxury electric car	Prototype	Planned for 2018	\$13.75 million
Dubuc Motors	2013	50	x			Performance electric car	Prototype	Planned for 2018	\$2 million
NEXT	2015	10	x	x		Modular electric bus	Prototype	Unknown	\$160K
Hummingbird EV	2016	50	x			Hybrid/electric truck	Prototype	Unknown	N/A
Karma	2015	700	x			Performance hybrid/electric car	900 Reveros sold	First produced in 2017	N/A
SF Motors	2016	500	x	x		Autonomous electric Car	Prototype	Planned for 2019	N/A

Source: Web.

*EV: Electric Vehicle, AD: Autonomous Driving, SM: Shared Mobility.

Competence Center New Mobility (CCNM)

Current Activities with OEMs in Focus

Customer	Activities	Status
OEM-1 	Support for prototyping of vehicle	Ongoing
	Simulation activities: Statistical Energy Analysis model development for target setting	Completed
	Training for handling of the batteries provided by Lucid to CCNM	Completed
	Benchmarking and optimization on target vehicle for target setting	First round executed, second planned
OEM-2 (confidential)	Support creation of a material database measurements for NVH simulation purposes	Requesting measurements
	Request for quotation (RFQ) for a new vehicle	<ul style="list-style-type: none"> • Interior ongoing • Powertrain: request support to define engine encapsulation • Prototyping for suspension silencing • Regular contact to exchange status of activities
OEM-3 (confidential)	Introduction meeting at OEM with participation of DEC and Sales from Novi, USA (BGNA HQ); OEM considers Autoneum as acoustic integrator for its autonomous vehicle	Follow up meeting with CCNM planned to exchange technical information and prepare activity proposal
Traditional OEMs	17 RFQs received in 2017 on BEVs for technologies available in our product portfolio	Several RFQs on acoustic treatment of e-motors, gear box and electric components

Competence Center New Mobility (CCNM)

Opportunities for Our Leading Engineering Services

- New OEMs focus on disruptive product offering and have limited resources for acoustic development
- Autoneum can leverage on its renowned leading engineering capabilities:
 - Partnership negotiations with two new customers
 - Pre-developments and developments of BEVs ongoing with the majority of traditional OEMs
 - Directions for future innovation and business opportunities



Lucid Air by Lucid Motors:
Autoneum is partner for development and supply of acoustic package

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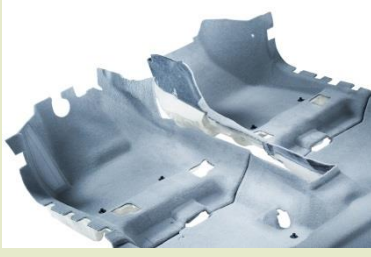




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Innovating for New Mobility

Selected Carpet Technologies

<p>Tune-It</p>		<div style="display: flex; justify-content: space-around; align-items: center;">    </div> <p>acoustics lightweight ecoway</p> <ul style="list-style-type: none"> • Improved control of AFR on main floor carpet to optimize carpet acoustic performance • Up to 25% lighter versus conventional latex/LDPE constructions • PET mono-material construction allows to re-spin fibers or filaments. Fibers can be looped back into the carpet substrate 	<table border="1"> <thead> <tr> <th>Topic</th> <th>Opportunity</th> </tr> </thead> <tbody> <tr> <td>Weight down</td> <td>Leverage lightweight portfolio</td> </tr> <tr> <td>Sustainable technologies</td> <td>Leverage recycled fiber technologies</td> </tr> <tr> <td>Comfort in autonomous driving</td> <td>New levels of quietness</td> </tr> </tbody> </table>	Topic	Opportunity	Weight down	Leverage lightweight portfolio	Sustainable technologies	Leverage recycled fiber technologies	Comfort in autonomous driving	New levels of quietness
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Sustainable technologies	Leverage recycled fiber technologies										
Comfort in autonomous driving	New levels of quietness										
<p>Clean-Tuft</p>		<div style="display: flex; justify-content: space-around; align-items: center;">     </div> <p>lightweight acoustics functionality ecoway</p> <ul style="list-style-type: none"> • Improved cleanability since the particles do not adhere to the fibers • Improved durability • High stain-resistance due to its hydrophobic surface 	<table border="1"> <thead> <tr> <th>Topic</th> <th>Opportunity</th> </tr> </thead> <tbody> <tr> <td>Shared use</td> <td>Durability, cleanability</td> </tr> </tbody> </table>	Topic	Opportunity	Shared use	Durability, cleanability				
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Innovating for New Mobility

Selected Exterior Acoustics Technologies

<p>Ultra-Silent</p>		<div style="display: flex; justify-content: space-around; align-items: center;">     </div> <ul style="list-style-type: none"> • 100% porous product covering large areas under the vehicle -> reduces interior and exterior noise • Benchmark fixation point strength and excellent stone impact performance for a high quality and durable product • 100% polyester composition ensures zero carbon emissions (VOC) as well as a full end-of-life recyclability 	<table border="1"> <thead> <tr> <th>Topic</th> <th>Opportunity</th> </tr> </thead> <tbody> <tr> <td>Weight down</td> <td>Leverage lightweight portfolio</td> </tr> <tr> <td>Aerodynamics</td> <td>Extended underbody coverage</td> </tr> <tr> <td>Dominant road noise</td> <td>Textile exterior treatments</td> </tr> <tr> <td>Sustainable technologies</td> <td>Leverage recycled fiber technologies</td> </tr> <tr> <td>Comfort in autonomous driving</td> <td>New levels of quietness</td> </tr> </tbody> </table>	Topic	Opportunity	Weight down	Leverage lightweight portfolio	Aerodynamics	Extended underbody coverage	Dominant road noise	Textile exterior treatments	Sustainable technologies	Leverage recycled fiber technologies	Comfort in autonomous driving	New levels of quietness	<table border="1"> <thead> <tr> <th>Topic</th> <th>Opportunity</th> </tr> </thead> <tbody> <tr> <td>Weight down</td> <td>Leverage lightweight portfolio</td> </tr> <tr> <td>Dominant road noise</td> <td>Textile exterior treatments</td> </tr> <tr> <td>Sustainable technologies</td> <td>Leverage recycled fiber technologies</td> </tr> <tr> <td>Comfort in autonomous driving</td> <td>New levels of quietness</td> </tr> </tbody> </table>	Topic	Opportunity	Weight down	Leverage lightweight portfolio	Dominant road noise	Textile exterior treatments	Sustainable technologies	Leverage recycled fiber technologies	Comfort in autonomous driving	New levels of quietness
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<p>Era-Light</p>		<div style="display: flex; justify-content: space-around; align-items: center;">     </div> <ul style="list-style-type: none"> • Benchmark in acoustic performance relevant to underbody • Durable product and consistent performance despite exterior application • Minimum added weight per acoustic performance increase • Potential mono-material solution 	<table border="1"> <thead> <tr> <th>Topic</th> <th>Opportunity</th> </tr> </thead> <tbody> <tr> <td>Weight down</td> <td>Leverage lightweight portfolio</td> </tr> <tr> <td>Dominant road noise</td> <td>Textile exterior treatments</td> </tr> <tr> <td>Sustainable technologies</td> <td>Leverage recycled fiber technologies</td> </tr> <tr> <td>Comfort in autonomous driving</td> <td>New levels of quietness</td> </tr> </tbody> </table>	Topic	Opportunity	Weight down	Leverage lightweight portfolio	Dominant road noise	Textile exterior treatments	Sustainable technologies	Leverage recycled fiber technologies	Comfort in autonomous driving	New levels of quietness	<table border="1"> <thead> <tr> <th>Topic</th> <th>Opportunity</th> </tr> </thead> <tbody> <tr> <td>Weight down</td> <td>Leverage lightweight portfolio</td> </tr> <tr> <td>Dominant road noise</td> <td>Textile exterior treatments</td> </tr> <tr> <td>Sustainable technologies</td> <td>Leverage recycled fiber technologies</td> </tr> <tr> <td>Comfort in autonomous driving</td> <td>New levels of quietness</td> </tr> </tbody> </table>	Topic	Opportunity	Weight down	Leverage lightweight portfolio	Dominant road noise	Textile exterior treatments	Sustainable technologies	Leverage recycled fiber technologies	Comfort in autonomous driving	New levels of quietness		
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Innovating for New Mobility

Selected Motor Noise Attenuation Technologies

<p>Theta-FiberCell</p>		<div style="display: flex; justify-content: space-around; align-items: center;">    </div> <p>lightweight acoustics structural</p> <ul style="list-style-type: none"> Combination of Theta-Fiber and Theta-Cell provides outstanding acoustic absorption at light weight 	<table border="1"> <thead> <tr> <th>Topic</th> <th>Opportunity</th> </tr> </thead> <tbody> <tr> <td>Powertrain tonal noise</td> <td>Specific treatments, diagnostics and simulation</td> </tr> <tr> <td>Weight down</td> <td>Leverage lightweight portfolio</td> </tr> <tr> <td>Comfort in autonomous driving</td> <td>New levels of quietness</td> </tr> </tbody> </table>	Topic	Opportunity	Powertrain tonal noise	Specific treatments, diagnostics and simulation	Weight down	Leverage lightweight portfolio	Comfort in autonomous driving	New levels of quietness	<table border="1"> <thead> <tr> <th>Topic</th> <th>Opportunity</th> </tr> </thead> <tbody> <tr> <td>Powertrain tonal noise</td> <td>Specific treatments, diagnostics and simulation</td> </tr> <tr> <td>Weight down</td> <td>Leverage lightweight portfolio</td> </tr> <tr> <td>Comfort in autonomous driving</td> <td>New levels of quietness</td> </tr> </tbody> </table>	Topic	Opportunity	Powertrain tonal noise	Specific treatments, diagnostics and simulation	Weight down	Leverage lightweight portfolio	Comfort in autonomous driving	New levels of quietness				
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<p>Hybrid-Acoustics</p>		<div style="display: flex; justify-content: space-around; align-items: center;">     </div> <p>lightweight acoustics functionality ecoway</p> <ul style="list-style-type: none"> Benchmark in acoustic performance relevant to underbody Durable product and consistent performance despite exterior application Minimum added weight per acoustic performance increase Potential mono-material solution 	<table border="1"> <thead> <tr> <th>Topic</th> <th>Opportunity</th> </tr> </thead> <tbody> <tr> <td>Weight down</td> <td>Leverage lightweight portfolio</td> </tr> <tr> <td>Dominant road noise</td> <td>Textile exterior treatments</td> </tr> <tr> <td>Sustainable technologies</td> <td>Leverage recycled fiber technologies</td> </tr> <tr> <td>Comfort in autonomous driving</td> <td>New levels of quietness</td> </tr> </tbody> </table>	Topic	Opportunity	Weight down	Leverage lightweight portfolio	Dominant road noise	Textile exterior treatments	Sustainable technologies	Leverage recycled fiber technologies	Comfort in autonomous driving	New levels of quietness	<table border="1"> <thead> <tr> <th>Topic</th> <th>Opportunity</th> </tr> </thead> <tbody> <tr> <td>Weight down</td> <td>Leverage lightweight portfolio</td> </tr> <tr> <td>Dominant road noise</td> <td>Textile exterior treatments</td> </tr> <tr> <td>Sustainable technologies</td> <td>Leverage recycled fiber technologies</td> </tr> <tr> <td>Comfort in autonomous driving</td> <td>New levels of quietness</td> </tr> </tbody> </table>	Topic	Opportunity	Weight down	Leverage lightweight portfolio	Dominant road noise	Textile exterior treatments	Sustainable technologies	Leverage recycled fiber technologies	Comfort in autonomous driving	New levels of quietness
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New Mobility

Conclusion

- With the CCNM, we have created the infrastructure to develop and offer innovations and services for new forms of mobility
- New Mobility creates market and technology opportunities for Autoneum
- Autoneum's expertise is in strong demand also by new OEMs
- Our product portfolio and innovation pipeline already today is geared at new mobility

Agenda

From Trends to Innovation in Acoustic and Thermal Management

Martin Hirzel, CEO

1. New Mobility Trends
2. Autoneum 2025
3. Conclusion

Autoneum Approach to New Automotive Trends

Ciro Gaudino, Head Competence Center New Mobility

1. Competence Center New Mobility: Mission and Achievements
2. New Mobility: Challenges and Opportunities
3. New OEMs: Leveraging our Core Competences
4. Innovating for New Mobility

Industry 4.0 / Predictive Maintenance Project

Domonkos Gaspar, Head Global Manufacturing Digitization

Manufacturing Simulation with Virtual Reality

Ahmad Abdallah and Carolyn Pankow, Manufacturing Project Engineers

Industry 4.0

Context and Expectations

As automotive supplier, Autoneum is embedded in a maturely digitalized supply chain environment:

- Paperless ordering and supply processes
- Digitally controlled just-in-sequence / just-in-time arrangements

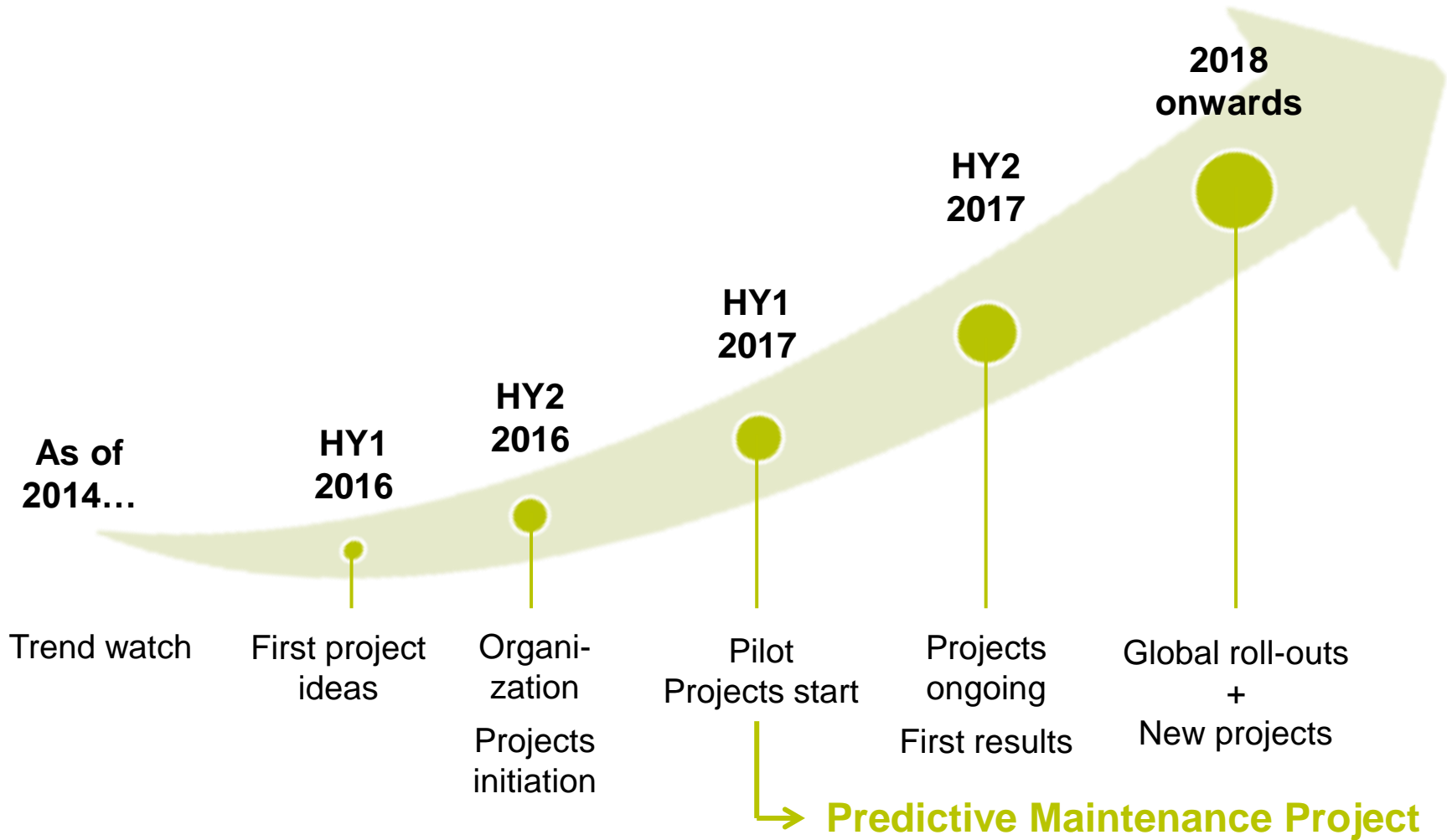
Our expectation towards Industry 4.0 is to improve operational excellence:

- Increase overall equipment efficiency (OEE)
- Cost reduction
- Competitive advantage



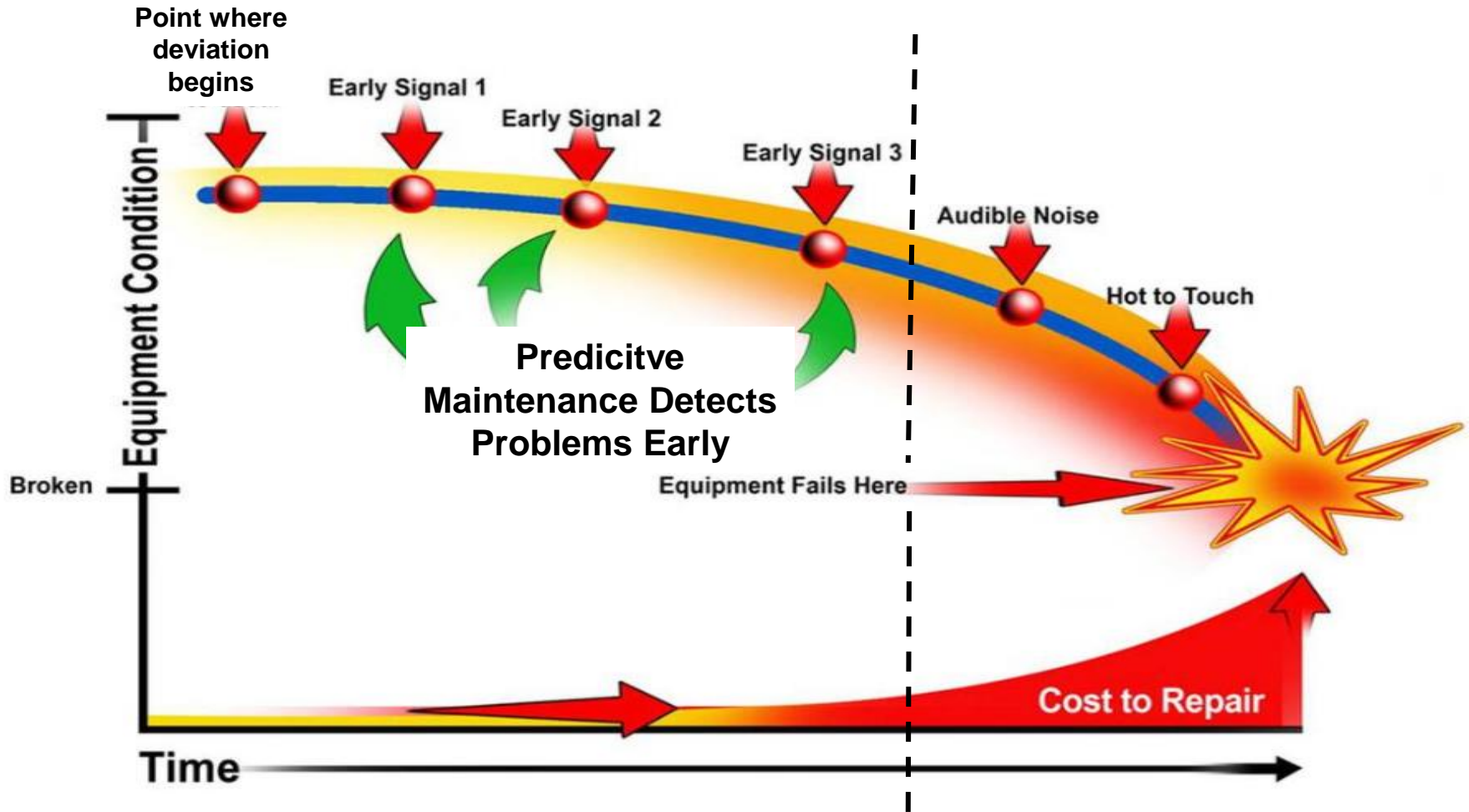
Industry 4.0

Achievements and Outlook



Predictive Maintenance Project

Target: Savings through early detection of failure indicators



Source: www.maintenancephoenix.com

Predictive Maintenance Project

High Returns Expected

Starting point 2016

- Innovative mindset in Autoneum
- Deep knowledge of machinery
- Maintenance as key area

Goals

- Improve OEE
- Utilize new tools for maintenance
- Define internal showcase

Opportunities

- Large amount of machinery to be acquired, equipped with industry 4.0 capability
- Accelerate reduction of cost of repair and alternative costs
- Additional cost savings through extension of lifetime of machinery
- Improve maintenance culture
- Availability of qualified vendors

Predictive Maintenance Project

Key Success Factors

Integrated approach to design

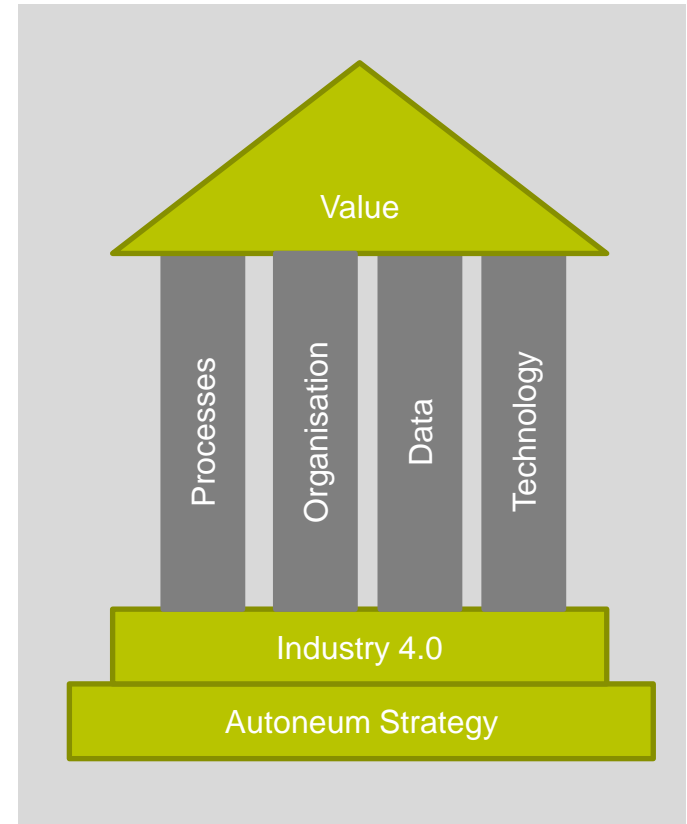
- Process and organization
- Processes adjusted and developed
- Data cleansed and standardized

Focused project on existing machinery to test feasibility

- One technology selected: felt line
- Inclusion of all related functions

Agile project management

- Results in shortest possible time
- Management of learning curve
- Fast adaptation to internal & external constraints



Predictive Maintenance Project

Optimized Overall Equipment Efficiency



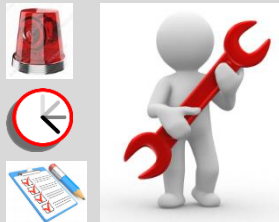
Environmental data



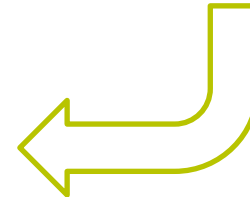
Machine data



Analysis of data and prediction of breakdown probability

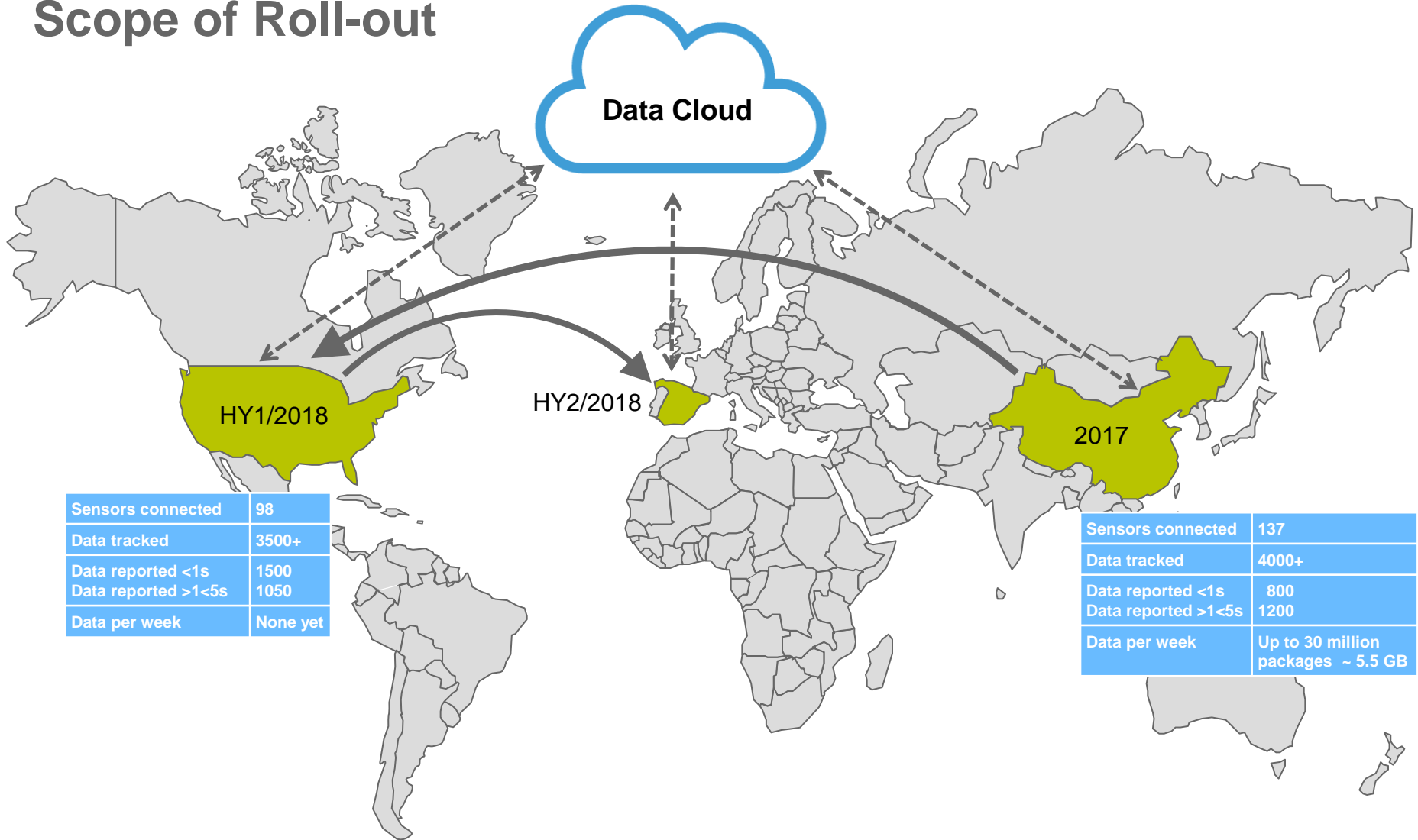


Coordination of maintenance activities



Predictive Maintenance Project

Scope of Roll-out

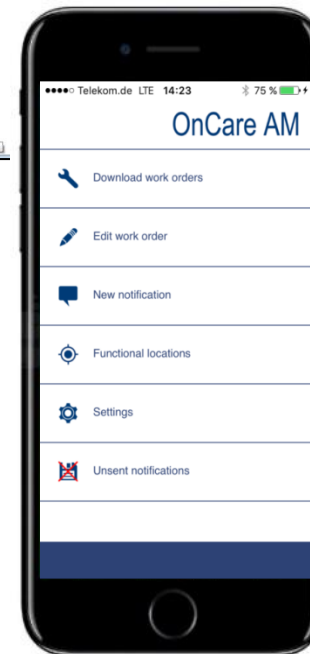
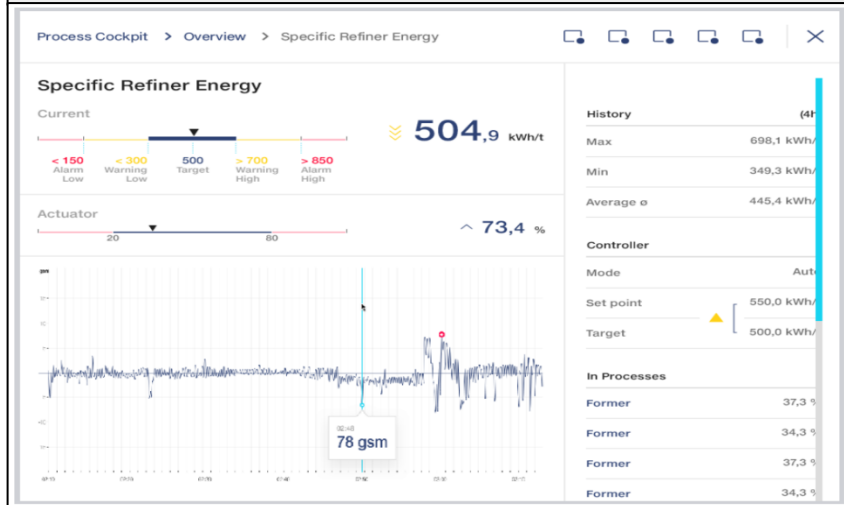
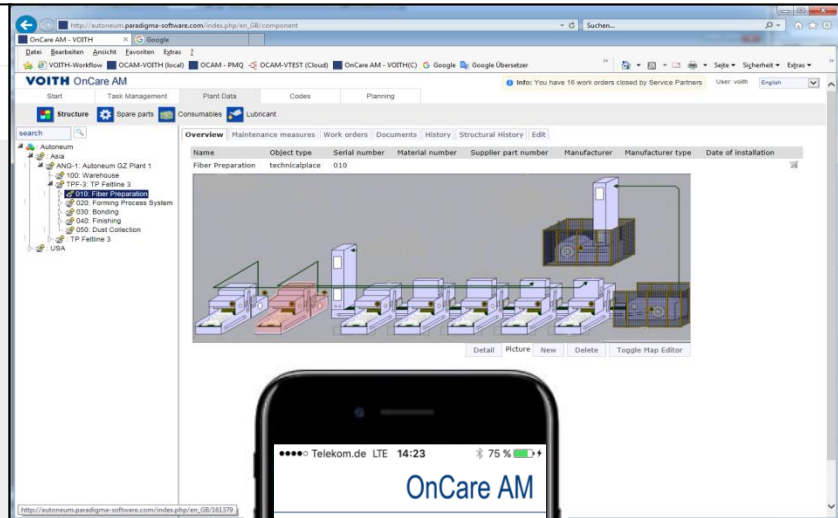
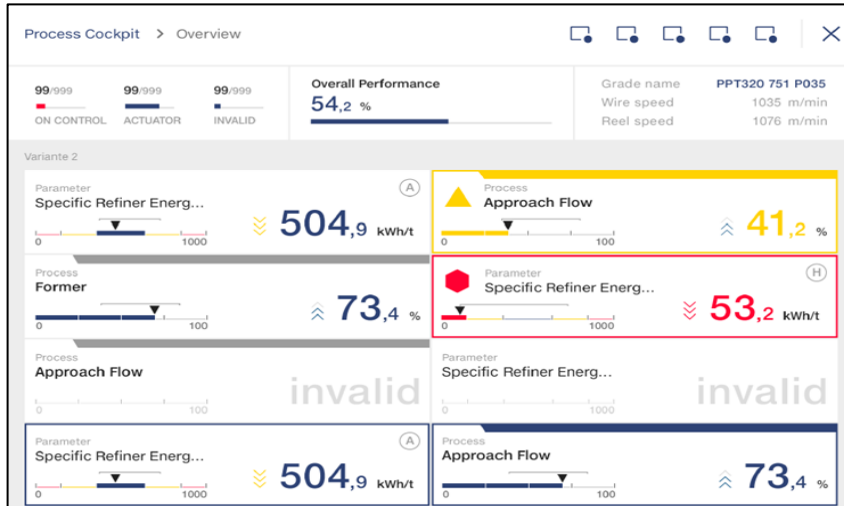


Sensors connected	98
Data tracked	3500+
Data reported <1s	1500
Data reported >1<5s	1050
Data per week	None yet

Sensors connected	137
Data tracked	4000+
Data reported <1s	800
Data reported >1<5s	1200
Data per week	Up to 30 million packages ~ 5.5 GB

Predictive Maintenance Project

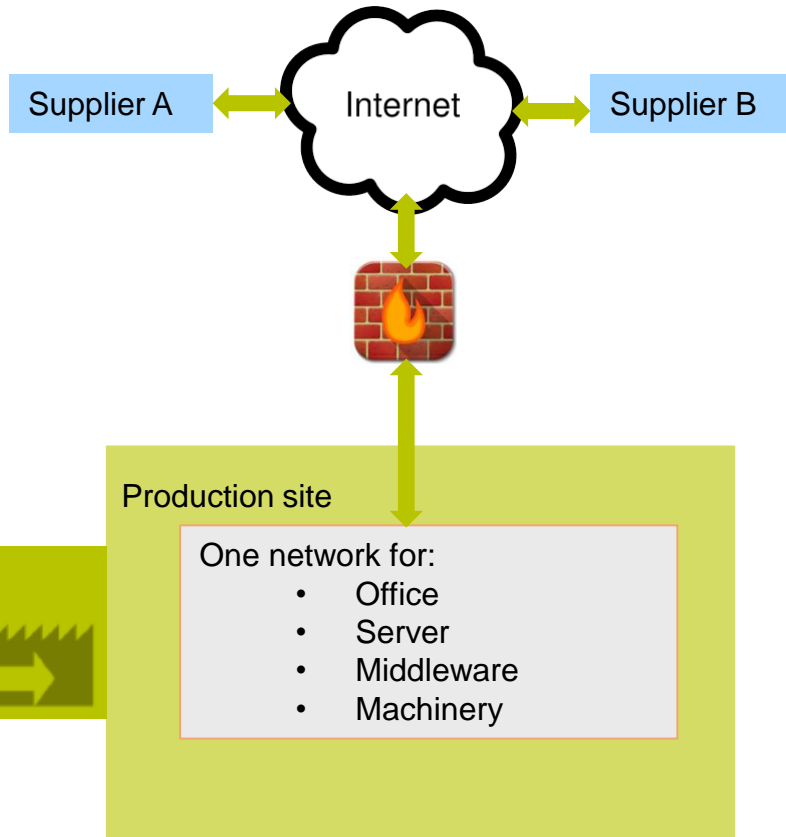
Machine Condition Monitoring and Failure Prediction



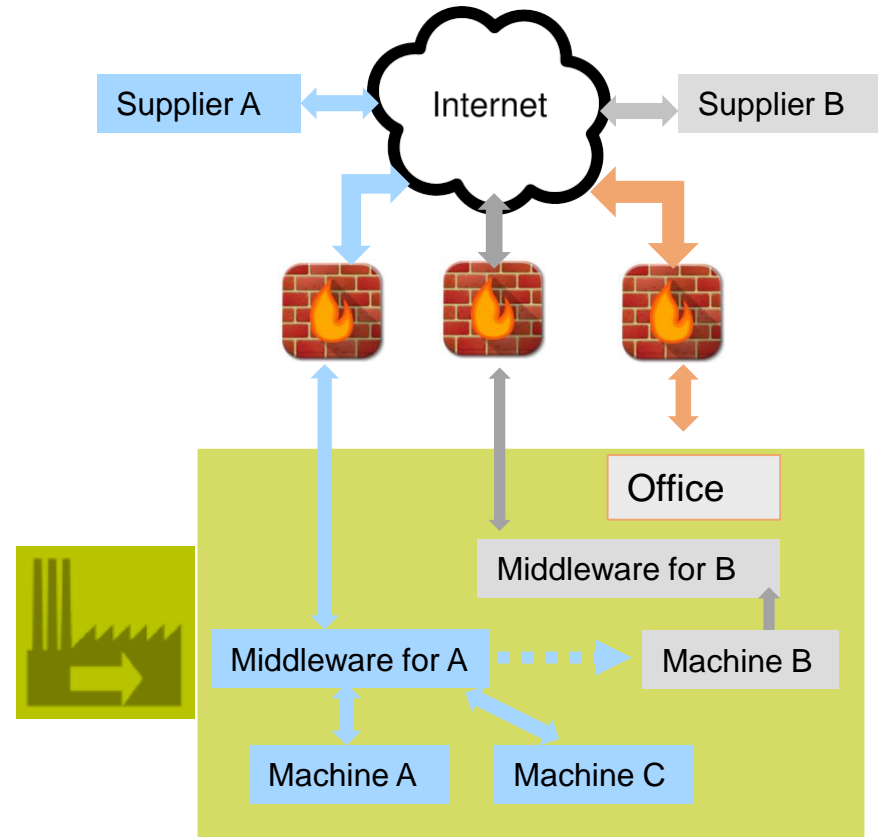
Predictive Maintenance Project

Data Security

Starting Point




New Design



Predictive Maintenance Project

Findings So Far

- ✓ Expected benefits reachable
 - ✓ Standardization is advantageous for whole maintenance area
 - ✓ Despite complexity, operations management eagerly engaged
 - ✓ Projects on track
 - ! High amount of data to be collected, checked, maintained
 - ! Development of necessary internal know-how not to be underestimated
-  Predictive maintenance proves to be an added-value initiative:
Growing volume of machines connected promise exponential leverage

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Industry 4.0 / Predictive Maintenance Project

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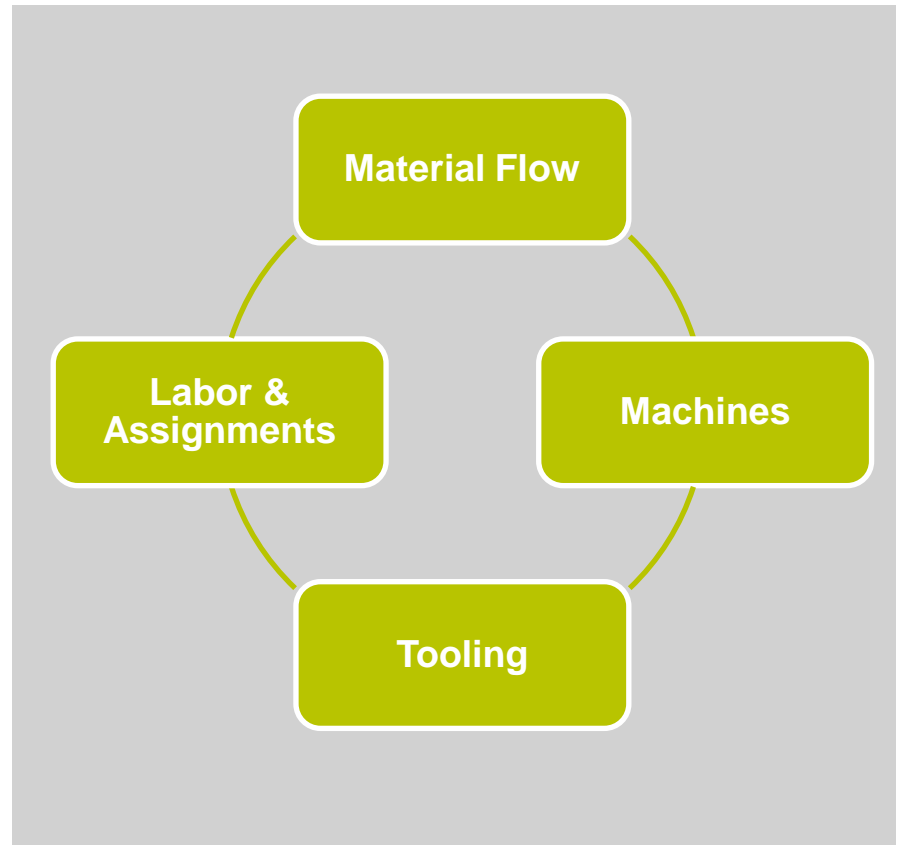
Manufacturing Simulation with Virtual Reality

Ahmad Abdallah and Carolyn Pankow, Manufacturing Project Engineers

Computer-Based Manufacturing Simulation

Simulation of Optimum Production Process

- Set-up of plant/cell layout based on Computer-Based Manufacturing Simulation
- Use of 3D simulation software to create an entire plant production process
 - Simulation of plant/cell layout in a 3D environment



Computer-Based Manufacturing Simulation

Benefits

- 3D simulation allows viewing of the entire production process before equipment installation
- Virtual reality allows one to experience the process
- New business quoting
- Initial equipment verification
- Production process improvements
- Future state evaluations or “what if” scenarios
- Cost savings



Simulation of NVH cells at Aiken plant (SC), USA

Manufacturing Simulation for Plant Optimization

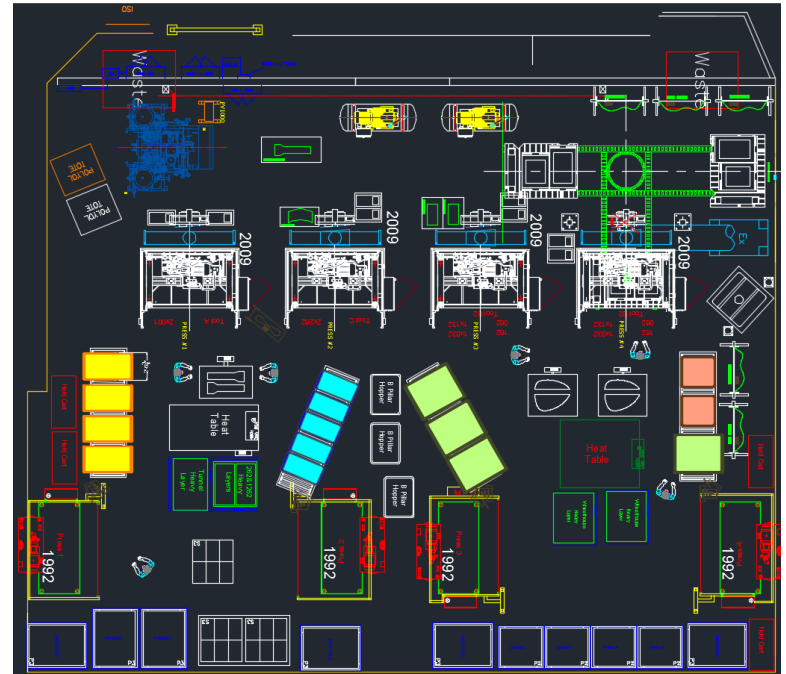
Equipment Movement Project at Aiken (SC), USA

Scenario:

- Move equipment from previous plant to new building

Actions:

- Analyze current status
- Finalize future status
- Evaluate whether task can be executed by three shop floor workers instead of four
- Adapt production process accordingly



Original layout of Aiken plant (SC), USA

Manufacturing Simulation for Plant Optimization

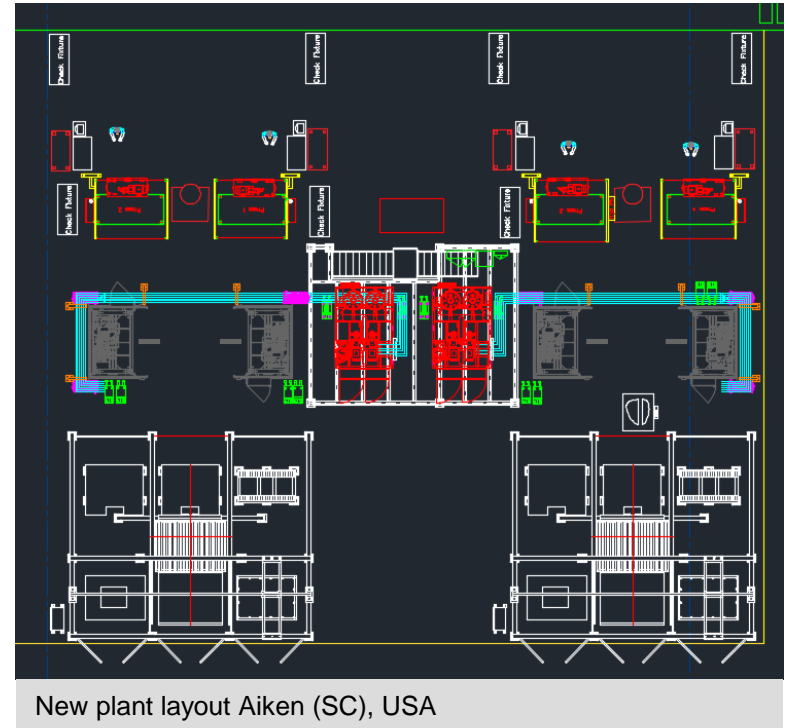
Achievements and Savings

Achievements:

- Two layouts (current equipment, new equipment) completed
- Manning: reduction of one worker per shift
- Employee engagement and buy-in to changes by the use of virtual reality obtained

Savings:

- Staff reduced by six operators at two cells
- Savings: USD 300,000 per year



Manufacturing Simulation / Virtual Reality

Global Roll-out and Standardization

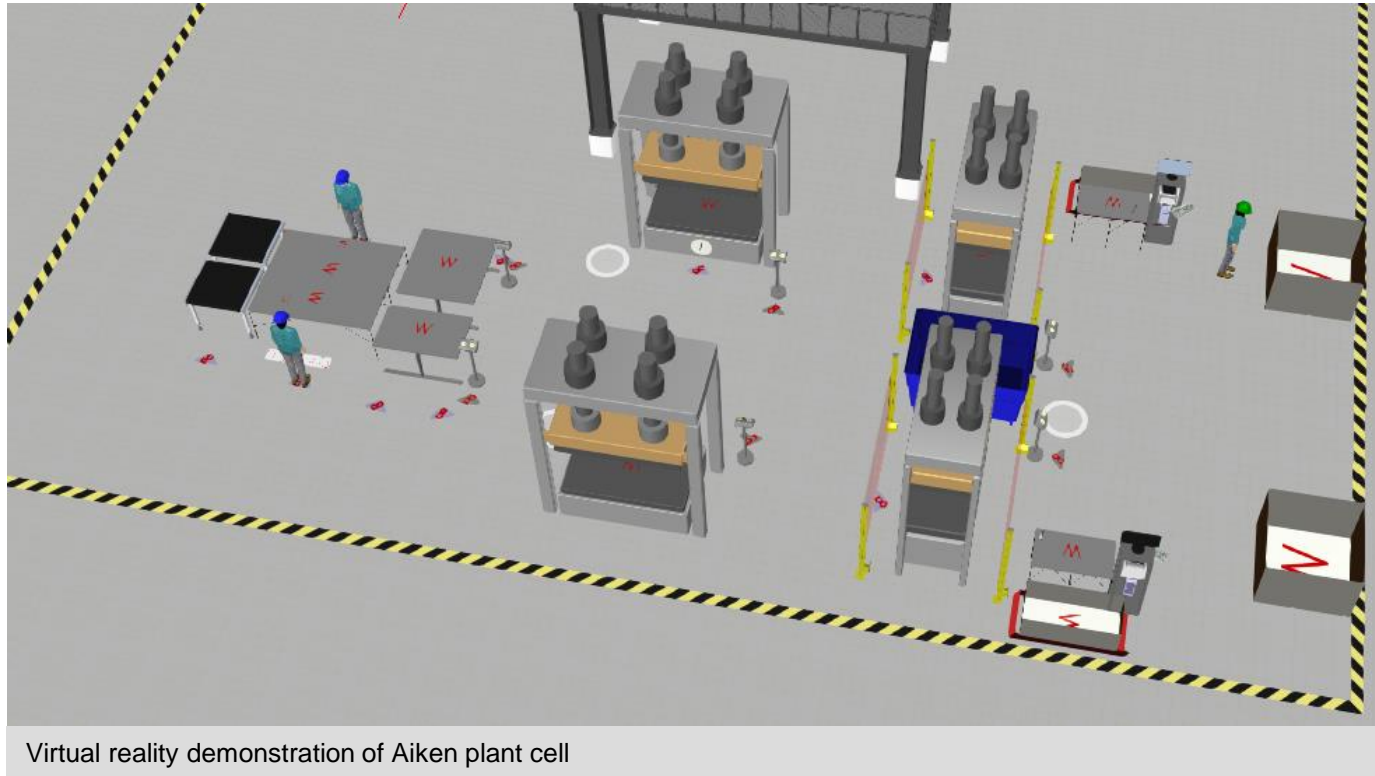
Mid-Term:

- Continuous improvement of new cells
- Design of new plants using manufacturing simulation in Hungary and China
- Adjustment and expansion of equipment and cell library to Autoneum standards

Long-Term:

- Creation of Autoneum equipment library
- Establishment of global expert network to support standardization and roll-out
- Development of guidelines and training package
- Implementation of visualizations & trainings across the global organization

Manufacturing Simulation / Virtual Reality Demo



autoneum

A wide, paved road with white lane markings curves through a lush green field. The sky is a clear, vibrant blue with several fluffy white clouds scattered across it. The road leads the eye from the bottom left towards the center of the frame, where it disappears into the distance.

Mastering sound and heat.

Contacts and Event Calendar

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Annual General Meeting 2018	March 28, 2018

Autoneum listed on SIX Swiss Exchange

Ticker Symbol	AUTN
Valor Number	12748036
ISIN	CH0127480363

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