



Technology with Vision

Capital Markets Day 2017

*The Art of Light – New Paths in the
Automotive Lighting Technology*

Lippstadt, June 29, 2017



Disclaimer

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This document contains an English translation of the accounts of the Company and its subsidiaries. In the event of a discrepancy between the English translation herein and the official German version of such accounts, the official German version is the legal valid and binding version of the accounts and shall prevail.

Capital Markets Day 2017

The Art of Light – Lippstadt, June 29, 2017

TIME		TOPIC	WHO
09:30		Registration and Welcome	Dr. Kerstin Dodel
10:00	30 min	HELLA Group: HELLA's Path of Profitable Growth	Dr. Rolf Breidenbach
10:30	30 min	Electronics: Innovation Driver for the Mobility of Tomorrow	Dr. Rolf Breidenbach
11:00	30 min	Lighting: New Paths in the Automotive Lighting Technology	Markus Bannert
11:30	15 min	Aftermarket: Unique Position along whole Value Chain	Bernard Schäferbarthold
11:45	15 min	Special Applications: Leveraging of Automotive Strengths	Bernard Schäferbarthold
12:00	30 min	HELLA Group: Financials & Perspectives	Bernard Schäferbarthold
12:30	45 min	Q&A-Session	all
13:15	45 min	Lunch	all
14:00	40 min	Focus Topic: The Art of Light – Digitalization of Lighting with new HD Technologies	Kamislav Fadel
14:40	20 min	Coffee Break and Transfer	all
15:00	60 min	Focus Topic: The Art of Light – Product Demonstration in Light Tunnel	Dr. Michael Kleinkes / Dr. Karsten Eichhorn
16:00	90 min	Focus Topic: The Art of Light – Visit of State-of-the-Art Lighting Plant	Franz-Georg Osdiek / Florian Fischer
17:30	30 min	Closing remarks (expected end ca. 18:00)	all

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We delivered what we have promised

HELLA Group – Where do we come from?

WHAT WE HAVE PROMISED?

KEY ACHIEVEMENTS

<p>Innovation Leadership</p>		<p>Leading technology positions in Automotive, Aftermarket and Special Applications to tackle major market trends and future customer demands!</p> <p>Highlights:</p> <div style="display: flex; justify-content: space-around; align-items: flex-end;"> <div style="text-align: center;">  LED Headlamps </div> <div style="text-align: center;">  Radar </div> <div style="text-align: center;">  Energy Management </div> <div style="text-align: center;">  Diagnostic Tools </div> <div style="text-align: center;">  Work Lights </div> <div style="text-align: center;">  Modular Lighting Systems </div> </div>
<p>Market Leadership</p>		<p>Worldwide development and production footprint to capture global growth opportunities!</p> <p>Highlights:</p> <div style="display: flex; justify-content: space-between; align-items: center;"> <div style="text-align: center;"> <p># of new sites since 2012</p>  </div> <div style="text-align: center;"> <p>Development: + 9</p> <p>Production: + 6</p> </div> </div>
<p>Resilient Business Portfolio</p>		<p>International customer portfolio to strengthen resilience and to capture worldwide growth opportunities!</p> <p>Highlights:</p> <div style="display: flex; justify-content: space-between; align-items: center;"> <div style="text-align: center;"> <p>Sales growth with Asian OEMs</p>  </div> <div style="text-align: center;"> <p>Δ2012 → 2016 +16% p.a.</p> </div> </div>
<p>Operational Excellence</p>		<p>Further strengthening of operational excellence by structural, process- as well as HR-related improvements!</p> <p>Highlights:</p> <div style="display: flex; justify-content: space-between; align-items: center;"> <div style="text-align: center;"> <p>Reduction of customer line returns thanks to optimized quality management</p> </div> <div style="text-align: center;"> <p>Δ2012 → 2017 -43%</p> </div> </div>
<p>Profitable Growth</p>		<div style="display: flex; justify-content: space-between; align-items: center;"> <div style="text-align: center;"> <p>SALES CAGR 2012 → 2016</p>  </div> <div style="text-align: center;"> <p>Adj. EBIT CAGR 2012 → 2016</p>  </div> </div>

Note: Adjustments include restructuring expenses and supplier default (FY 15/16). Please note that where sums and percentages in the presentation have been rounded, differences may arise as a result of commercial rounding

Over the last years HELLA was 1st to market with several technologies which support strong market positions



Innovation Leadership – Automotive

SELECTED INNOVATION HIGHLIGHTS



Advanced LED Headlamps

Global Market Position

#1-2

Milestones

- 2006** Cadillac Escalade Platinum: Full-LED headlamp (1st to segment)
- 2010** Audi A8: Full-LED headlamp with AFS functions (1st to market)
- 2013** Audi A8: LED Matrix headlamp with glare-free high beam (1st to market)
- 2016** Mercedes E-Class: LED Matrix with glare-free high beam (1st to market)



24 Ghz (NB) Radar Sensors

Global Market Position

#1

Milestones

- 2009** Audi Q7: Introduction of Lane Change Assistant (1st Generation)
- 2012** Audi A8: Lane Change Assistant + Pre-Crash Rear (2nd Generation)
- 2014** VW Golf: Blind-Spot Detect + Rear Cross Traffic Alert (3rd Generation)
- 2017** Opel Mokka: Lane Change Assist + Blind Spot Detect (4th Generation)



Intelligent Battery Sensors

Global Market Position

#2

Milestones

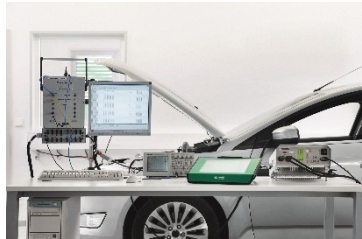
- 2005** BMW 5-series: Introduction of first IBS product (1st Generation)
- 2008** Hyundai Sonata: Rollout of IBS product in Korea (2nd Generation)
- 2012** VW Passat: Global VW platform for IBS product (3rd Generation)
- 2015** Honda Accord: Global platform for IBS product (4th Generation)

HELLA continuously launched new product innovations in its Aftermarket and Special Applications segment



Innovation Leadership – Aftermarket & Special Applications

SELECTED INNOVATION HIGHLIGHTS



Diagnostic Tools



Work Lights



Modular Lighting Systems

Market Position

#1 in Germany

Milestones

- 2010** Mega macs 66: First diagnostic system with real-time repair concept
- 2013** Hella Gutmann launches the modular system CSC tool
- 2014** Hella Gutmann launches mega macs 56
- 2017** Mega macs tools equip workshops and passenger cars with DoIP applications

Global Market Position

#1

Milestones

- 2008** Introduction of Power Beam series for halogen replacement
- 2013** High-power LED work lights with plastic heat sinks set new standards
- 2014** Q90 LED high-performance work light with plastic cooling elements
- 2016** New generations of Ultra Beam LED and Oval 100 LED work lights

Market Position

#1 in Europe*

Milestones

- 2010** Modular hybrid combination rear lamp with optional LED modules
- 2011** First LED 90mm Modular Headlamp
- 2015** Full-LED rear combination lamps for MAN and DAF Trucks
- 2016** Launch of modular lamp series Shapeline

* Market leader in Europe with LED 90mm modular headlamps for the Recreational Vehicles segment

Based on its global network HELLA has continuously expanded into new regions and won new customers



Market Leadership – Global footprint



GLOBAL FOOTPRINT

	FY 2015/16	Δ2012→2016
Sales in €m	~6,352	+8% p.a.
# employees	~33,689	+6% p.a.
# development sites	~41	+9
# production sites	~28	+6

GERMANY

	FY 2015/16	Δ2012→2016
Sales in €m	~2,362	+3% p.a.
# employees	~9,705	-1% p.a.
# R&D staff	~2,824	+1% p.a.
# sites	17	+1

37%

NORTH & SOUTH AMERICA

	FY 2015/16	Δ2012→2016
Sales in €m	~937	+16% p.a.
# employees	~4,690	+13% p.a.
# R&D staff	~492	+20% p.a.
# sites	13	+5

15%

EUROPE w/o Germany

	FY 2015/16	Δ2012→2016
Sales in €m	~2,059	+8% p.a.
# employees	~13,389	+10% p.a.
# R&D staff	~1,584	+16% p.a.
# sites	15	+1

32%

ASIA / PACIFIC / RoW

	FY 2015/16	Δ2012→2016
Sales in €m	~993	+18% p.a.
# employees	~5,905	+8% p.a.
# R&D staff	~1,461	+17% p.a.
# sites	24	+8

16%

Sales share

KEY ACHIEVEMENTS

- Since 2012 **set-up of 15 new development and production sites** to increase customer proximity and capture global growth opportunities
- **Strong sales growth in Asia/Pacific/RoW (+18% p.a.) and North & South America (+16% p.a.)**

* As of balance sheet date (May 31, 2016)



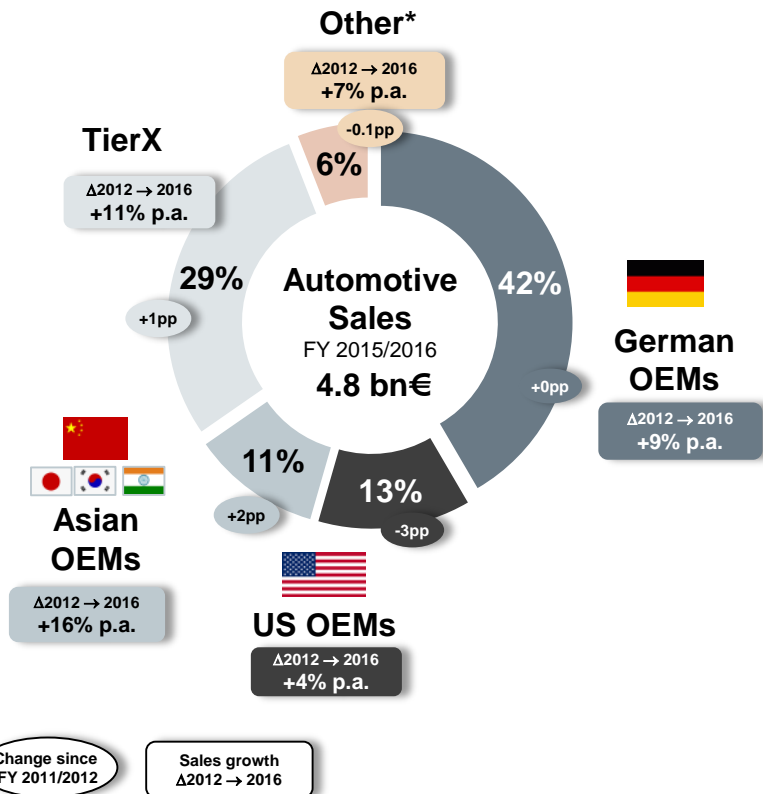
Based on its global network HELLA has continuously internationalized its customer portfolio



Resilient Business Portfolio – Global customer base



CUSTOMER PORTFOLIO AUTOMOTIVE



KEY ACHIEVEMENTS

- **Growth with German OEMs** as they play an important role in bringing HELLA innovations to the market
- **Increasing business with Tier 1 suppliers**, especially in Electronics for subsystems
- **Further internationalization** of portfolio towards **Asia** in last years
- **Highest sales growth with Asian OEMs** (+16% p.a.), especially with **Chinese OEMs** based on local for local solutions in the SUV and Premium segment
- **Only moderate sales growth with US OEMs** due to focused acquisition strategy

* including European OEM (ex Germany) and trucks

Note: Please note that where sums and percentages in the presentation have been rounded, differences may arise as a result of commercial rounding.



By strengthening its operational excellence HELLA further improved its competitiveness in the last years

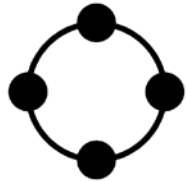


Operational Excellence

LAYER

KEY ACHIEVEMENTS

STRUCTURE



- **Strong increase of R&D headcount** by more than 35% and **further shift** of R&D headcount share **to best-cost-countries** by approximately 15pp to around 50% in the last five years
- Further **improvement of production footprint**, e.g. by consolidation of production capacities in Germany, relocation of Special Application plant to best-cost-country
- **Strengthening of global corporate center structure**, e.g. in Romania, Vietnam

PROCESS



- Long lasting **improvement programs dedicated** to all **business divisions** continued, e.g. around EUR 250m savings last financial year
- **Stringent quality management**, e.g. customer line return decreased by 43% in the last five years
- Implementation of O365 and **new communication tools** to enable efficient processes and virtual collaboration within global HELLA network

PEOPLE



- **Performance oriented culture** established, e.g. implementation of KPI based bonus system for management, worldwide roll-out of standardized performance appraisal
- **Systematic talent development**, e.g. roll-out of global leadership academy for top management with >400 participants since 2016
- Continuous **employee qualification programs**, e.g. implementation of efficient e-learning platform for worldwide trainings for instance for compliance topics

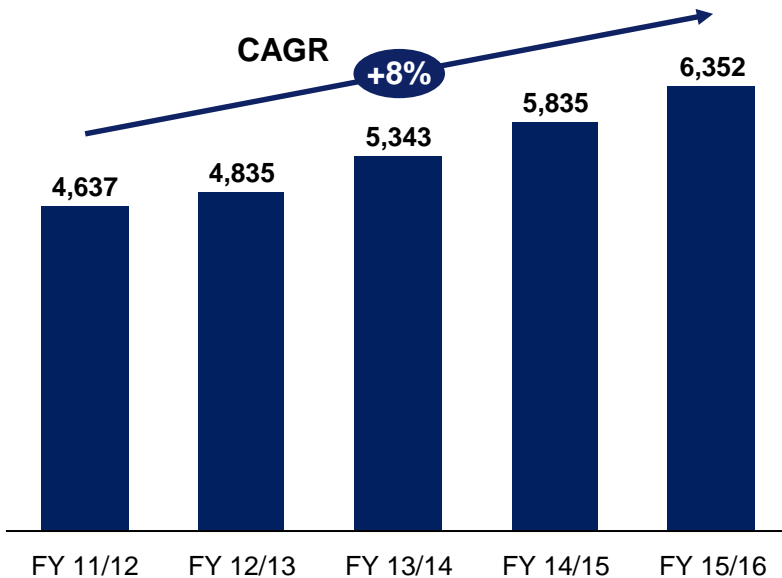
HELLA has shown sustainable profitable growth since automotive crisis



Profitable Growth

SALES

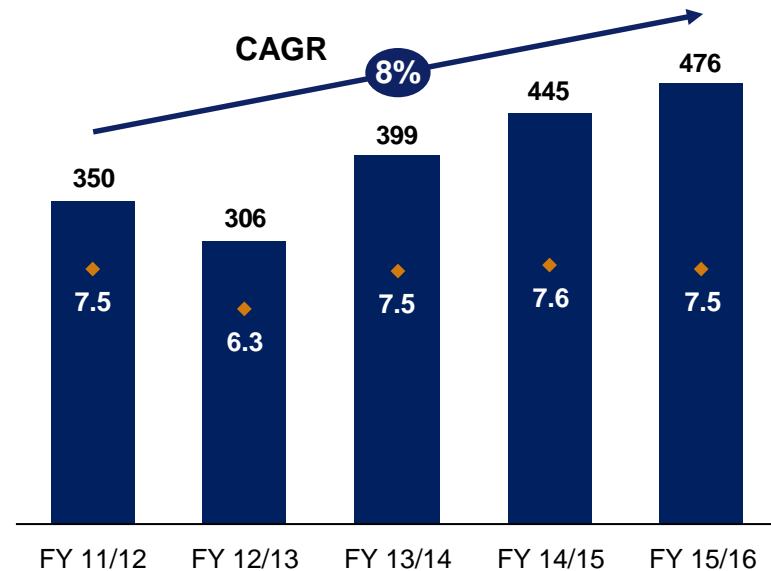
in million EUR



ADJUSTED EBIT

in million EUR

◆ Adj. EBIT Margin (%)

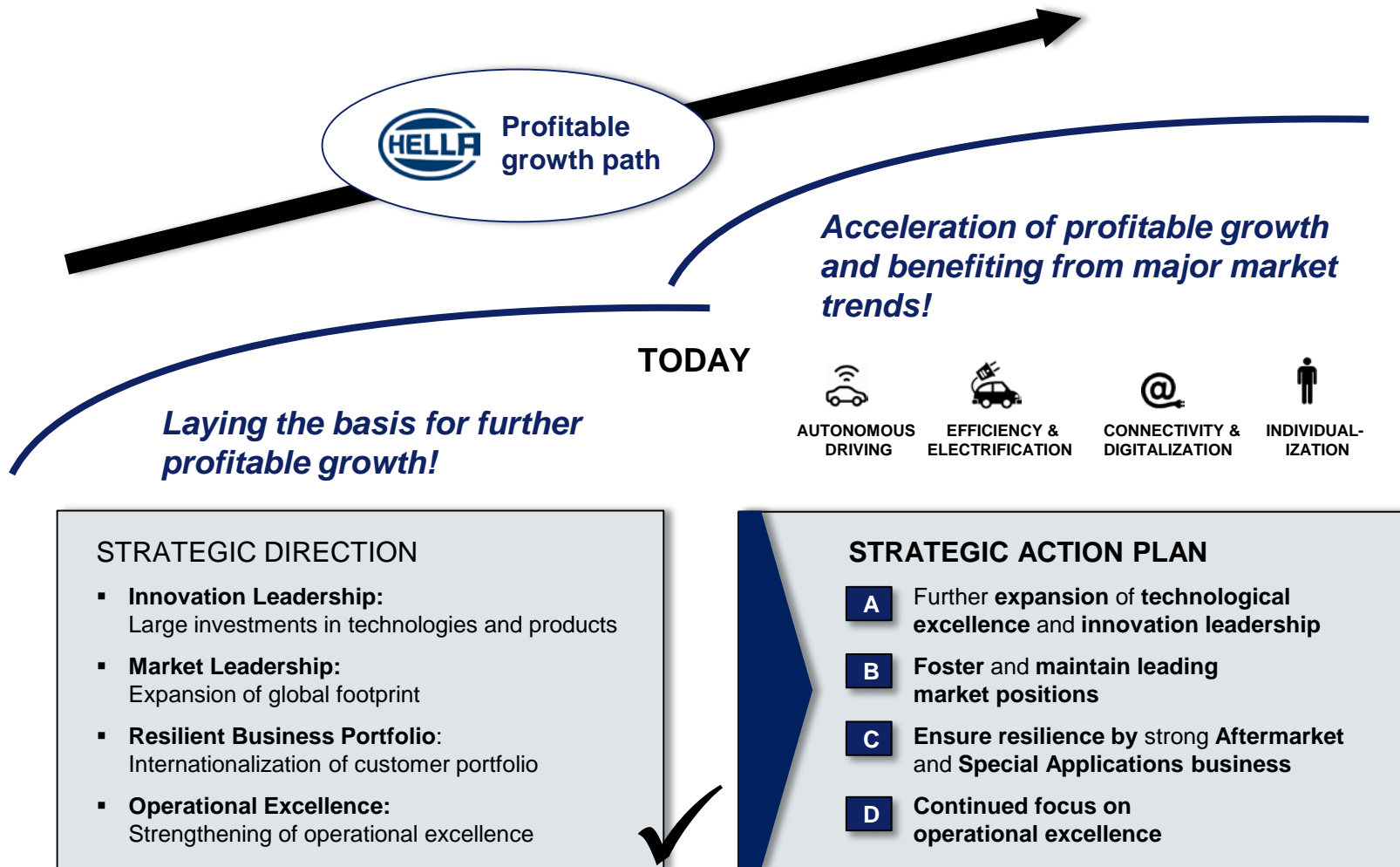


- **Sustainable growth** during the last years mainly driven by **Automotive**
- **Aftermarket** and **Special Applications** also with positive **growth**

- **Continuous EBIT increase** despite **large investments** in **structure** and **know-how**
- **Overall stable margin level** through **growth** driven by **technology leadership** and **increased efficiency**

HELLA is well prepared to accelerate its profitable growth path and to benefit from major market trends

HELLA Group – Profitable growth horizons



HELLA will benefit in its core business thanks to favorable positioning along major automotive market trends

Tailored offering for major market trends

A Further expansion of technological excellence and innovation leadership

MAJOR
AUTOMOTIVE
MARKET
TRENDS

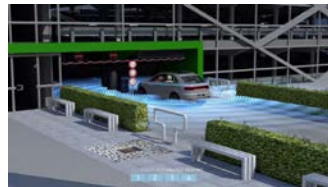
AUTONOMOUS DRIVING



Automated



EFFICIENCY & ELECTRIFICATION



Electrified



CONNECTIVITY & DIGITALIZATION



Connected



INDIVIDUALIZATION



Individualized



POSITIONING



- **Autonomous driving sensors** for front, side and 360° surround view
- **Front camera software**
- **Advanced front-lighting systems** for assistance functions and optical illuminations

- **Fuel system and energy management technologies** for all powertrain concepts
- **Energy efficient lighting technologies** such as LED

- **Intelligent sensor technology** to connect vehicles with environment
- **High definition headlamps** with digitalized features

- **Optical elements for individual styling** with advanced exterior and interior lighting systems
- **Passive entry systems for individualized functions**






To capture global growth opportunities HELLA will pursue a tailored strategy for key regions

Tailored regional market strategy

B Foster and maintain leading market positions

MARKET DEVELOPMENT

HELLA STRATEGIC DIRECTION

	MARKET / TECHNOLOGY	FOOTPRINT
 <p>NAFTA</p> <p>Light Vehicle Production* Δ2016 → 2020 +1.2% p.a.</p>	<ul style="list-style-type: none"> ▪ Maintain current customers while building new partnerships ▪ Push roll-out of already existing Electronic products, e.g. Intelligent Battery Sensor and rear radar ▪ Bring new products to market, e.g. humidity sensor, illuminated grills, light carpets 	<ul style="list-style-type: none"> ▪ Expansion of production footprint for electronics by setting-up new plant in Mexico, especially to cover booked business ▪ Further localization of R&D capabilities for lighting, especially to enable complete development of full LED headlamps in Mexico
 <p>Europe</p> <p>Light Vehicle Production* Δ2016 → 2020 +1.4% p.a.</p>	<ul style="list-style-type: none"> ▪ Strengthen partnership with leading OEMs as well as TierX based on innovative product solutions, e.g. ▪ Development focus on high-definition lighting technologies (LCD) ▪ Consistent roll-out of radar products and business model for camera software 	<ul style="list-style-type: none"> ▪ Increase development resources for focus technologies / products, e.g. expansion of camera software team at HELLA Aglaia in Berlin by 100% ▪ Construction of new plant for Electronics in Lithuania
 <p>China</p> <p>Light Vehicle Production* Δ2016 → 2020 +2.8% p.a.</p>	<ul style="list-style-type: none"> ▪ Increase sales share with Chinese OEMs ▪ Strong growth with products related to electrification and autonomous driving, e.g. Battery Management System, Mild Hybrid Voltage Converters, Radar Systems ▪ Focus on LED lighting solutions: latest full LED headlamp technology as well as low cost LED solutions for the local market 	<ul style="list-style-type: none"> ▪ Extension of electronic plant in Shanghai, especially for Body Electronics and Energy Management products ▪ Ramp-up of JV HELLA-BHAP Lighting plant in Tianjin in October 2017 ▪ Increase of local R&D capabilities for LED and selected electronic products (full system and/or application development know-how)

*Source: IHS (as of June 2017)

Ensure ~25% share in Aftermarket and Special Applications to strengthen and maintain business resilience

Strong Aftermarket & Special Applications business

C Ensure resilience by strong Aftermarket and Special Applications business

SEGMENT STRATEGIC DIRECTION



AFTERMARKET



SPECIAL APPLICATIONS

- Push “LEDfication” in all customer segments; especially agriculture, construction bus & coach, and trailer
- Growth in Electrics and Electronics, e.g. further application of Automotive products (e.g. Intelligent Battery Sensor) to requirements of special vehicles
- Drive product innovations by set-up of advanced engineering team
- Use growth opportunities in Americas
- Further optimization of production footprint including capacity ramp-up in best-cost-countries

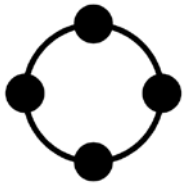
HELLA will focus on major “enablers” to support its further profitable growth path

Continued focus on operational excellence

D Continued focus on operational excellence

LAYER STRATEGIC DIRECTION

STRUCTURE



Further capacity optimization and structural improvements

- **Flexible capacity increase** in selected regions, especially in Eastern Europe, China, Mexico
- Further **investments in corporate functions**, e.g. compliance and data security organization
- **Balancing of roles and responsibilities** across global HELLA network

PROCESS



Continuous improvement of operational efficiency

- Continuation of **operational improvement programs**
- Further **standardization of processes** by implementation of Business Process Management
- Consistent **roll-out of Lessons Learned**, e.g. improvements in assembly and pre-production areas (e.g. line balancing, multi machine handling) from Eastern Europe
- Usage of **advanced methods/tools for development and validation** purposes, e.g. machine learning

PEOPLE



Attractive organization for recruiting and retention of qualified employees

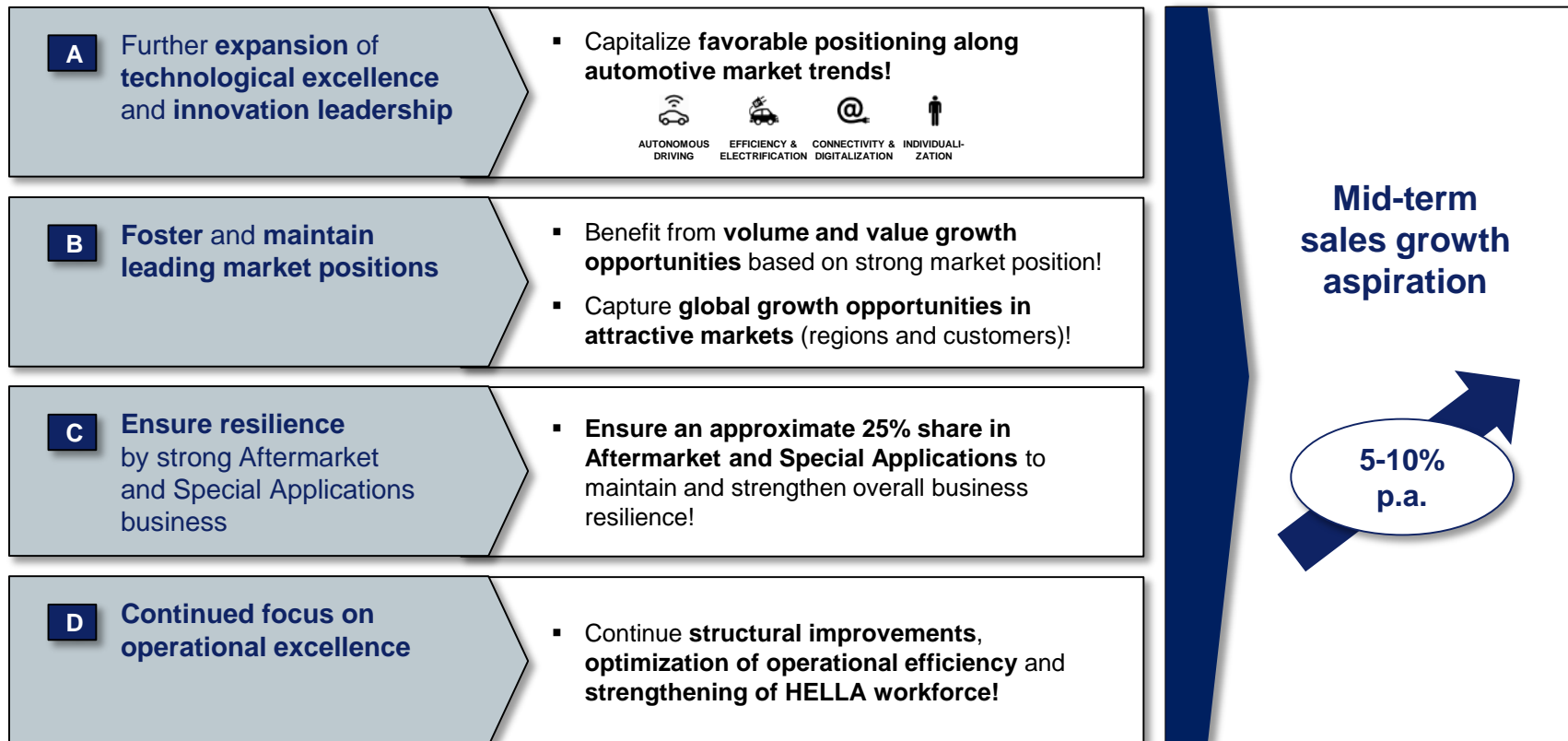
- Focus on **attraction and retention of workforce with required skill-sets**
- Continuous **employee qualifications** (leadership training program, global skill management)
- **Sharpen employer branding**
- Implementation of consistent **strategic workforce planning**

Based on the defined strategic action plan HELLA's aspiration level is to realize a mid-term growth between 5 and 10 percent p.a.

HELLA Group – Strategic outlook

STRATEGIC ACTION PLAN

*Acceleration of profitable growth
and benefiting from major market trends!*



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The electronic segment has been successfully developing over the last years and is main driver of HELLA's growth path

Segment Electronics – Where do we come from?

WHAT WE HAVE PROMISED?

KEY ACHIEVEMENTS

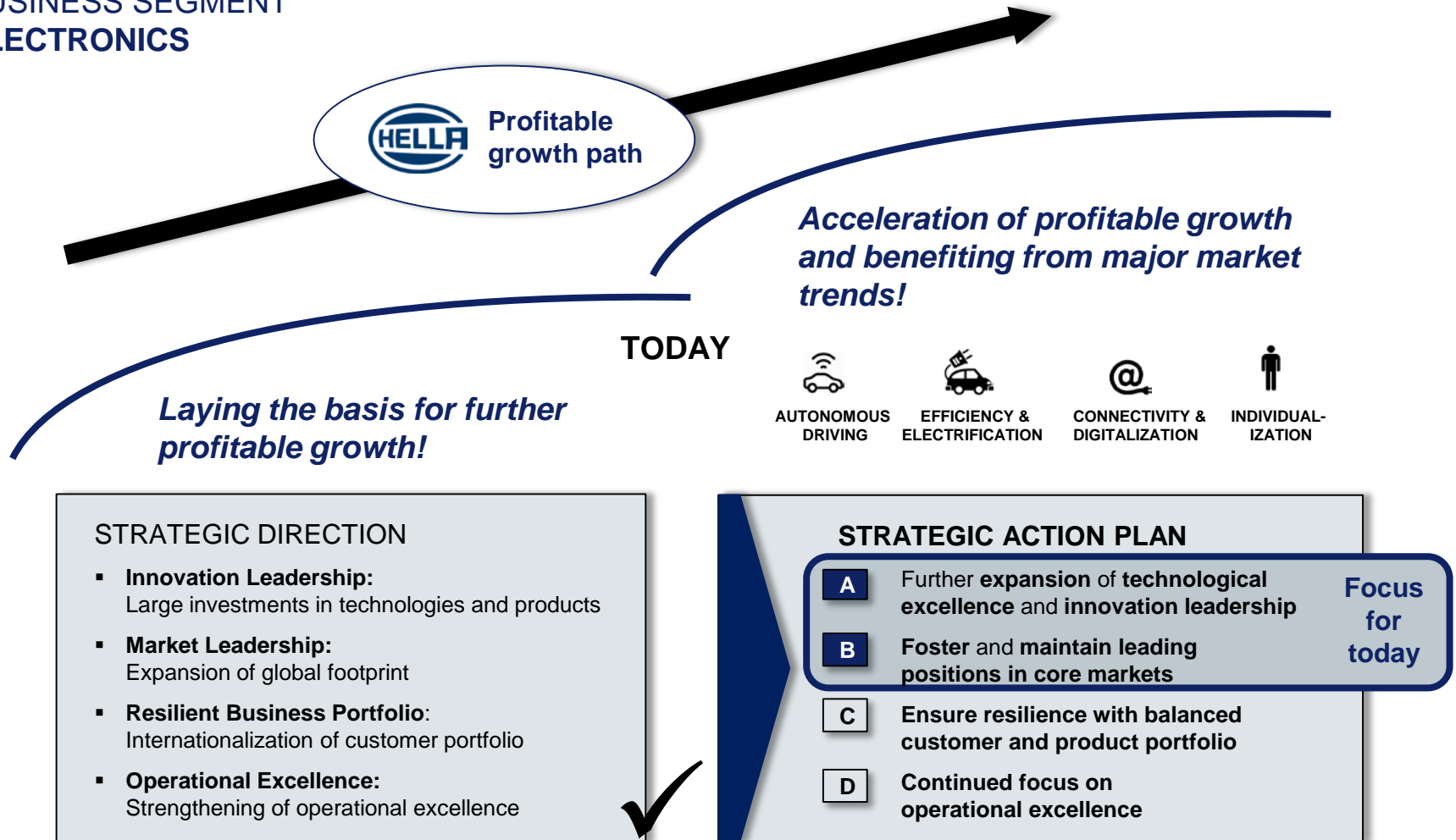
<p>Innovation Leadership</p>		<p>Leading positions based on core technologies and innovative business models to tackle major market trends and future customer demands!</p> <p>Highlights:</p> <div style="display: flex; justify-content: space-around;">  Pumps  Radar  IBS  APS  BCM </div>
<p>Market Leadership</p>		<p>Worldwide development and production footprint to capture global growth opportunities!</p> <p>Highlights:</p> <div style="display: flex; align-items: center;"> <p># of new sites since 2011</p>  <div style="margin-left: 20px;"> <p>Development: + 5</p> <p>Production: + 3</p> </div> </div>
<p>Resilient Business Portfolio</p>		<p>International customer portfolio and balanced product portfolio to capture worldwide growth opportunities and act towards trends and demand shifts!</p> <p>Highlights:</p> <div style="display: flex; align-items: center;"> <p>Share of high growth products</p> <div style="margin-left: 20px; border: 1px solid black; padding: 5px; background-color: #003366; color: white;"> <p>2016: ~65%</p> </div> </div>
<p>Operational Excellence</p>		<p>Continuous optimization programs to foster operational excellence along three major layers!</p> <p>Highlights:</p> <div style="display: flex; align-items: center;"> <p>Customer line returns in parts per million</p> <div style="margin-left: 20px; border: 1px solid black; padding: 5px; background-color: #003366; color: white;"> <p>Δ2012 →2017 -90%</p> </div> </div>

<p>Profitable Growth</p>		<p>SALES CAGR 2012 → 2016</p> <div style="text-align: right; margin-top: 20px;">  </div>
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In Electronics HELLA will especially focus on further innovations for automotive market trends to foster leading market positions

Segment Electronics – Strategic growth horizons

BUSINESS SEGMENT ELECTRONICS



The major automotive market trends offer significantly more opportunities than risks to HELLA's electronic business

Segment Electronics – Benefiting from major market trends

A

MAJOR
AUTOMOTIVE
MARKET
TRENDS

AUTONOMOUS DRIVING



Automated



EFFICIENCY & ELECTRIFICATION



Electrified



CONNECTIVITY & DIGITALIZATION



Connected



INDIVIDUALIZATION



Individualized



IMPACT ON



Scenario:
AD level 3 & 4

Scenario:
FY 2020/21

UPSIDE POTENTIAL

Electronic
portfolio

Opportunities for volume and value growth
e.g. ADAS Software, Radar, Body Actuators, Climate Sensors

Opportunities for volume and value growth (e.g. DC/DC-Converter, Battery Management System)

~15% negative

e.g. Fuel Control Module, 12V IBS

Opportunities for volume growth (e.g. noise sensor) and value growth (e.g. passive entry systems and air quality sensor)

Opportunities for volume growth for selected HELLA sensors (e.g. gesture control) and passive entry systems

Focus for today

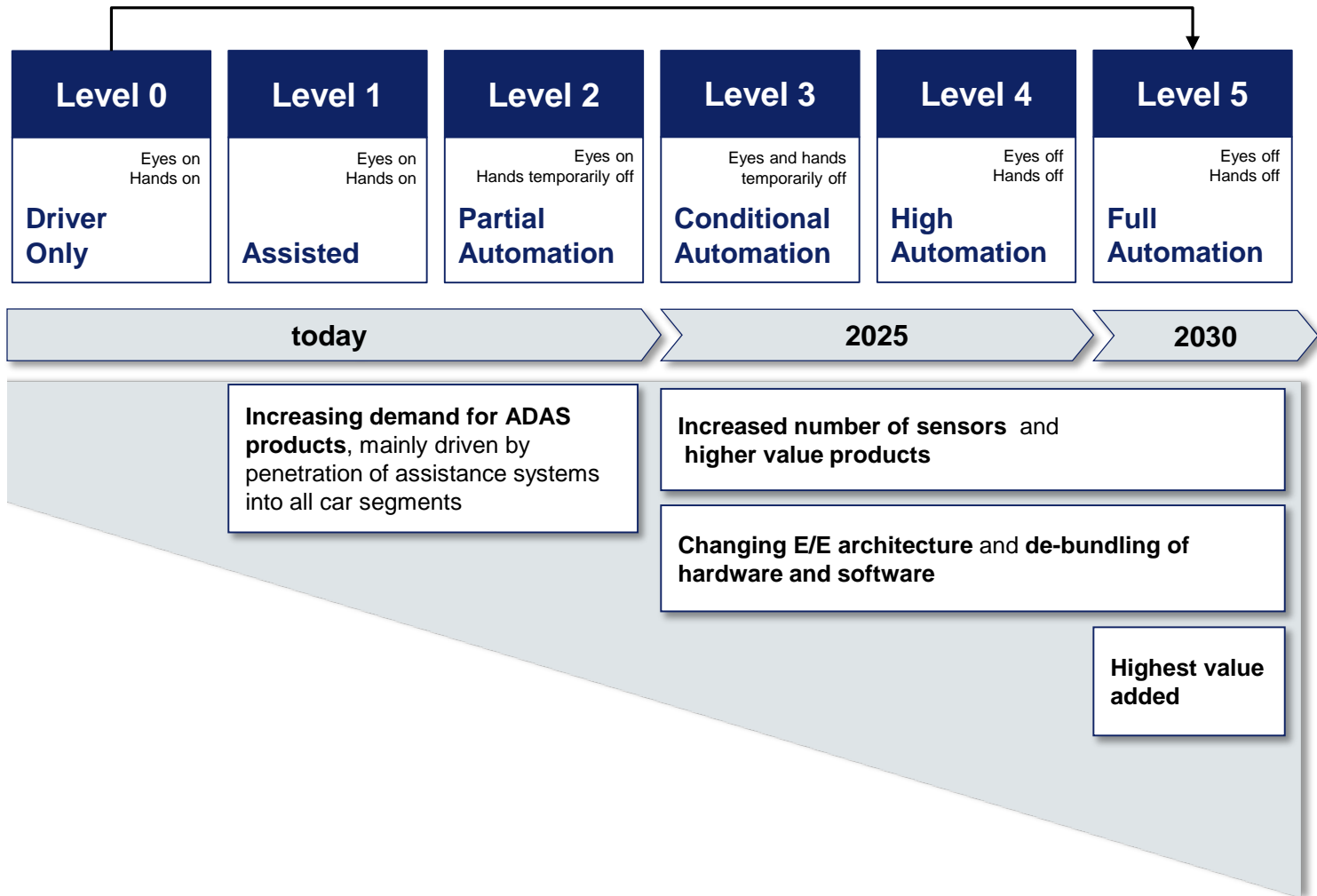


The transition from Driver Assistance functions to Automated Driving Functions will happen gradually

Segment Electronics – Trend overview Autonomous Driving

A

AUTONOMOUS DRIVING

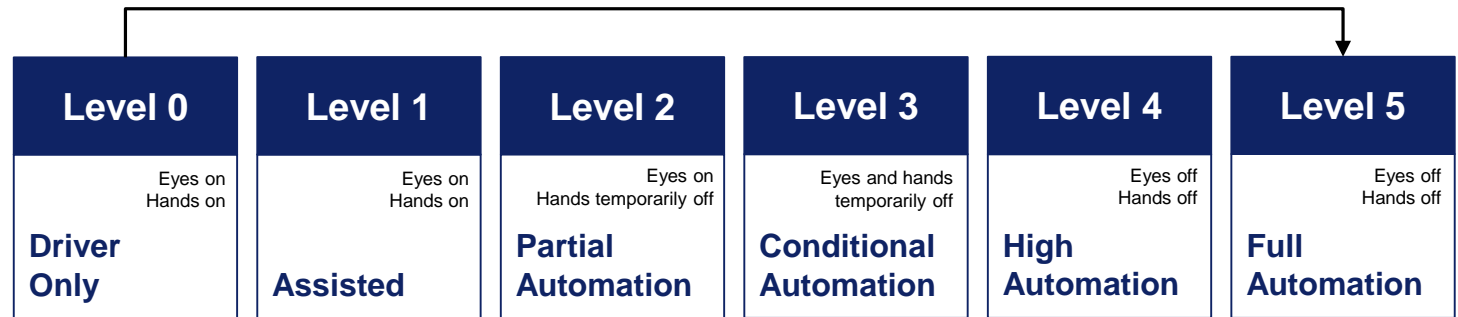


To participate in autonomous driving trend HELLA focuses on attractive software and sensor solutions

Segment Electronics – Technologies for Autonomous Driving

A

AUTONOMOUS DRIVING



CONTENT PER VEHICLE

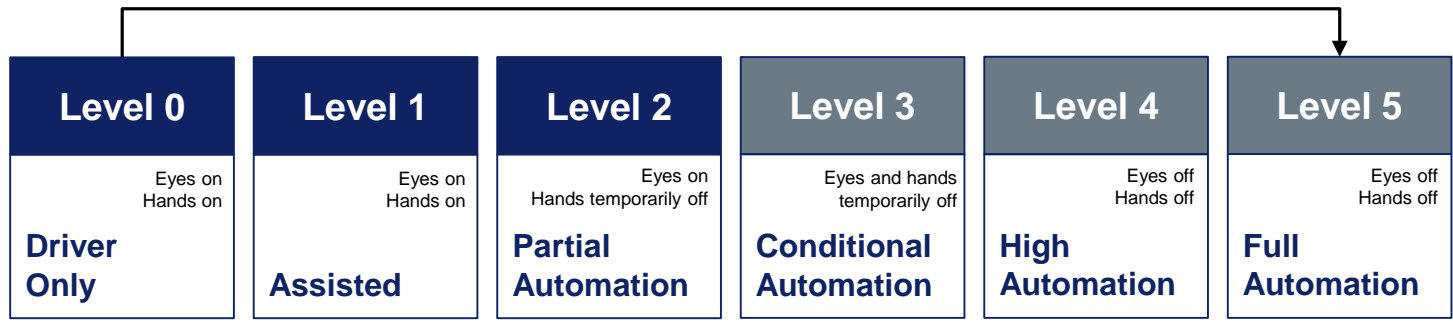
Focus for today



Focus on advanced vision IP and development approaches to enable roadmap towards autonomous driving

Autonomous Driving – Technology Highlights (1/3)

A



Current Assistance Functions (NCAP 2018):



**Traffic Sign
Detection**



**Lane
Detection**




**Light Source
Detection**




**Pedestrian
Detection**

Conventional computer vision approach

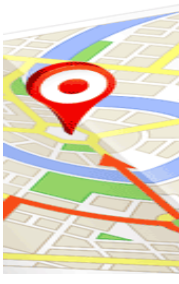
Based on Deep Learning



**Semantic
Freespace**



**Semantic Path
Planning**



**Visual
Localization**

New business model for camera software: Flexible, scalable approach for realization of autonomous driving functionality

Autonomous Driving – Technology Highlights (2/3)

A



TECHNOLOGY

Camera Software: „Software as Product“

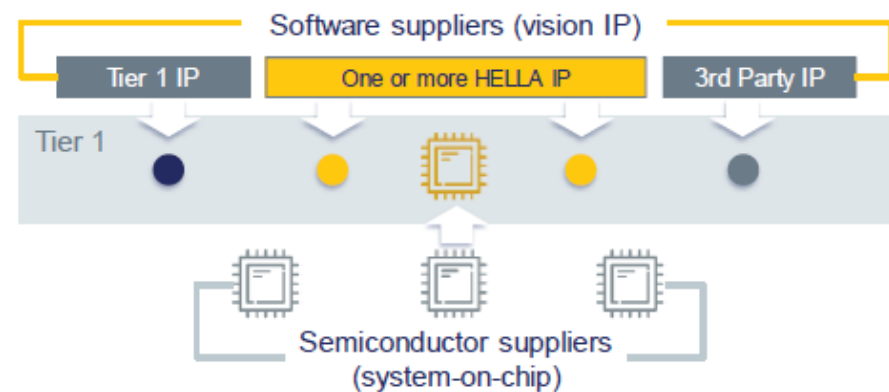
Current Market Model

CLOSED SYSTEM

- Proprietary microprocessor with fixed software package
- System-on-chip and vision IP fixed („blackbox“ approach)
- Limited options for integration and extension of system for customers
- No support for USP creation at customer side

HELLA Approach

OPEN SYSTEM as flexible, scalable package



KEY BENEFITS

- Open systems supports **various scalable hardware platforms** and **vision IP from different sources** (own IP, 3rd-party IP)
- **Freedom of choice at customer side** which vision IP and system-in-chip to integrate → creation of USPs possible
- Flexible, scalable approach enables **cost-efficient solutions for volume markets**



HELLA's 77 GHz radar sensor solution enables efficient 360° environment recognition for the entire vehicle

Autonomous Driving – Technology Highlights (3/3)

A



TECHNOLOGY 77 GHz Radar Sensor



KEY FACTS

- Highly integrated RF-CMOS Radar System Chip
- Higher functional object detection performance
- Dimensions: 65 x 61 x 15 mm

KEY BENEFITS

- **Reduced size & weight** (significant package reduction compared to previous sensors)
- **Identifies & reacts to approaching vehicles from front-side** when entering a junction or pulling out forward from parking space
- **Identifies & warns of objects in blind spot**

MAIN FUNCTIONALITIES



Intersection Assistant



Automated Parking



Automated Driving



The electrification of the drivetrain leads to a variety of vehicle architectures with different costs and CO2 savings

Segment Electronics – Trend overview Efficiency & Electrification

A

EFFICIENCY & 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
CO₂ 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				
today	69%	28%	0%	2%
2020	34%	53%	5%	2%
2025	24%	47%	18%	3%

* CO₂ reduction related to local emissions only

** Assumptions on technical concept for high volume car

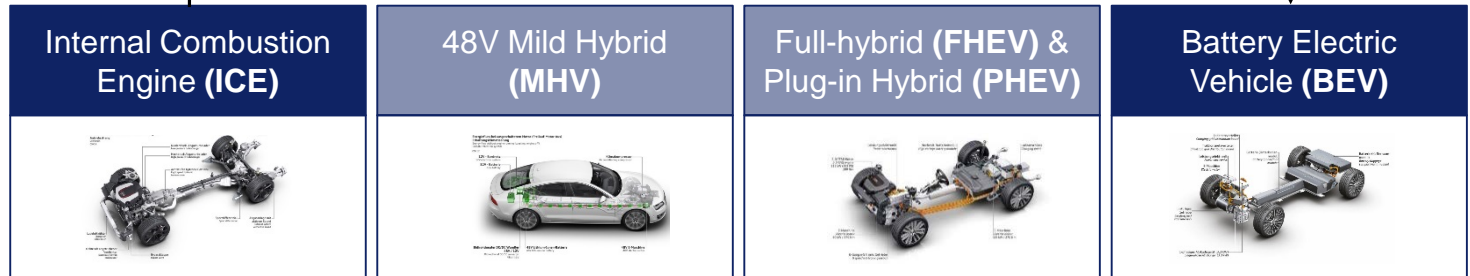
*** Source: IHS Engine Forecast, December 2016

HELLA continues to invest in attractive technologies and products to support electrification of the drivetrain






Segment Electronics – Technologies for Efficiency & Electrification

A

EFFICIENCY & ELECTRIFICATION



OFFERING

	 12V Intelligent Battery Sensor			1x
 12V DC/DC Converter	1x	 48V DC/DC Converter	1x	
			 Battery Management System BMU, CMU, HVS	1x
			 HV OnBoard Charger	1x
CONTENT PER VEHICLE	~50 Euro	<100 Euro	>400 Euro	>400 Euro

Focus for today



Consequent roll-out of 48V DC/DC converter in order to participate in growing 48V market, especially in China

Efficiency & Electrification – Technology Highlights (1/2)

A



TECHNOLOGY 48V DC/DC-Converter



KEY FACTS

- Conversion efficiency > 95%
- Power rating according to alternator up to 3kW
- Scalability thanks to multi-phase approach

KEY BENEFITS

- Enables **new applications such as stop/start and idle cruising**, whilst ensuring the supply of fuel-efficient power loads such as electrical power-steering actuators
- **Innovative vehicle applications**, which support fuel efficient drive concepts such as high power regenerative braking or engine-off coasting applications

Awarded by
3 Customers

MAIN FUNCTIONALITIES



Enhanced Start-Stop



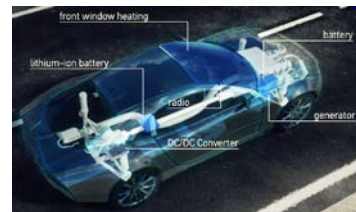
Engine-Off-Coasting



Boosting



High Power Braking



Backup Energy



Fuel Economy



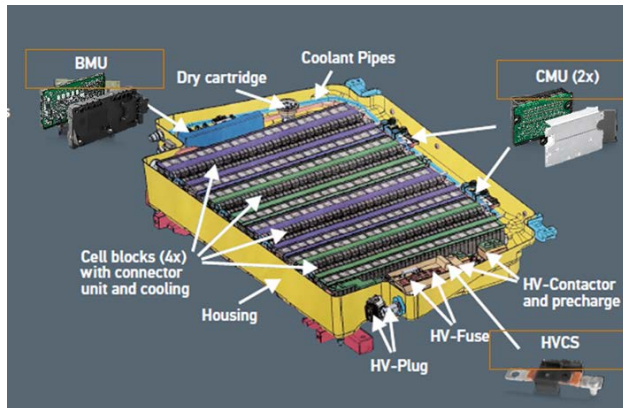
HELLA offers the full electronics solution for lithium-ion battery management system

Efficiency & Electrification – Technology Highlights (2/2)

A

HELLA TECHNOLOGY BATTERY MANAGEMENT SYSTEM

KEY FACTS



BMS ECU: Battery state calculation and control of safety functions

Cell Controller: Voltage and temperature measurements as well as cell balancing

High Voltage Current Sensor: Measurement of battery current

Insulation Monitoring Device: Measurement of insulation resistance between HV and LV

(Integrated) Relay Box: Charge, pre-charge and main relays packaged including control electronics

KEY BENEFITS

- **Modular and scalable platform** for 12V, 48V and high voltage lithium-ion batteries
- **Best-in-class insulation monitoring device** in exclusive cooperation with BENDER

MAIN FUNCTIONALITIES

CALCULATE BATTERY STATE

- State of Charge
- State of Health
- Power capability
- Resistance

PROTECT BATTERY AND VEHICLE DRIVER

- against
 - Battery overheating
 - Over voltage and current
 - Contactor State of Health (SoH)



MEASURE

- Current
- Cell voltages
- Cell temperatures
- Battery voltages

CONTROL

- Contactor
- Communication
- Limp home
- Pre-charge




To capture global growth opportunities and foster leading market positions a regionally tailored strategy will be pursued

Segment Electronics – Leading positions in regional core markets

B

MAJOR MARKET DEVELOPMENTS

STRATEGIC DIRECTION – ELECTRONICS

 <p>North & South America</p>	<ul style="list-style-type: none"> ▪ Increase demand for powertrain efficiencies, e. g. IBS take rates expected to rise ▪ Trend towards Autonomous Driving; investments expected below levels in Europe and Asia 	<ul style="list-style-type: none"> ▪ Focus on roll-out of Energy Management products ▪ Further market penetration of rear radar ▪ Explore market potential for 48V product introductions ▪ Expansion of production footprint by set-up of new plant in Mexico, especially to cover booked business ▪ ...
 <p>Europe</p>	<ul style="list-style-type: none"> ▪ CO2 standards and diesel issues drive market for PHEV and BEV ▪ Increasing demands for higher level Autonomous Driving technologies 	<ul style="list-style-type: none"> ▪ Drive acquisition and scale R&D footprint to further penetrate Energy Management products (e.g. BMS and 48V DC/DC converters) ▪ Consider next product launch for 24 GHz sensors and introduce 77 GHz sensors ▪ Roll-out of Autonomous Driving software ▪ Construction of new plant in Lithuania ▪ ...
 <p>Asia / Pacific</p>	<ul style="list-style-type: none"> ▪ Strong push for BEV fostered by government regulations and infrastructure investments ▪ Autonomous driving for China megacities desired ▪ “Made in China 2025” strategy 	<ul style="list-style-type: none"> ▪ Focus on large JVs of Western OEMs and increase share with top local Chinese OEMs by 10pp to 40% ▪ Develop local for local solutions for increasing electrification, e.g. BMS, 48V DC/DC converter ▪ Expansion of Electronics plant in Shanghai, by 19/20 local production for full product portfolio ▪ ...

HELLA is well prepared to capture further growth potential in electronics by benefiting from major market trends

Segment Electronics – Strategic outlook

BUSINESS SEGMENT ELECTRONICS

STRATEGIC ACTION PLAN

*Acceleration of profitable growth
and benefiting from major market trends!*

A Further expansion of technological excellence and innovation leadership

Capitalize **favorable positioning along automotive market trends!**

- Autonomous Driving: Push 77 GHz radar and new business model for camera software!
- Efficiency & Electrification: Launch 48 DC/DC Converter and Battery Management system!

B Foster and maintain leading positions in core markets

Capture **global growth opportunities in attractive markets!**

- North & South America: **Consistent roll-out of existing products & technologies!**
- Europe: **Focus on innovative solutions for automotive market trends!**
- China: **Continue localization and push solutions for increasing electrification!**

C Ensure resilience with balanced customer and product portfolio

Drive **further internationalization of customer portfolio!**

- Increase share with top local Chinese OEMs by 10pp to 40% in China!
- Establish closer link to Korean OEMs!
- Explore additional growth potential with US OEMs!

D Continued focus on operational excellence

Continue **optimization programs and standardization of processes!**

- Improve reliability and efficiency of Time-to-Market organization!
- Ensure achievements in Design to Cost and re-Design to Cost!

Capital Markets Day 2017

The Art of Light – Lippstadt, June 29, 2017



TIME		TOPIC	WHO
09:30		Registration and Welcome	Dr. Kerstin Dodel
10:00	30 min	HELLA Group: HELLA's Path of Profitable Growth	Dr. Rolf Breidenbach
10:30	30 min	Electronics: Innovation Driver for the Mobility of Tomorrow	Dr. Rolf Breidenbach
11:00	30 min	Lighting: New Paths in the Automotive Lighting Technology	Markus Bannert
11:30	15 min	Aftermarket: Unique Position along whole Value Chain	Bernard Schäferbarthold
11:45	15 min	Special Applications: Leveraging of Automotive Strengths	Bernard Schäferbarthold
12:00	30 min	HELLA Group: Financials & Perspectives	Bernard Schäferbarthold
12:30	45 min	Q&A-Session	all
13:15	45 min	Lunch	all
14:00	40 min	Focus Topic: The Art of Light – Digitalization of Lighting with new HD Technologies	Kamislav Fadel
14:40	20 min	Coffee Break and Transfer	all
15:00	60 min	Focus Topic: The Art of Light – Product Demonstration in Light Tunnel	Dr. Michael Kleinkes / Dr. Karsten Eichhorn
16:00	90 min	Focus Topic: The Art of Light – Visit of State-of-the-Art Lighting Plant	Franz-Georg Osdiek / Florian Fischer
17:30	30 min	Closing remarks (expected end ca. 18:00)	all

The lighting segment has successfully developed over the last years, mainly due to its technology leadership and global footprint

Segment Lighting – Where do we come from?

WHAT WE HAVE PROMISED?

KEY ACHIEVEMENTS

<p>Innovation Leadership</p>		<p>Leading positions based on core technologies and innovative business models to tackle major market trends and future customer demands!</p> <p>Highlights:</p> <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;">  LED Headlamp </div> <div style="text-align: center;">  Ambient Interior light </div> <div style="text-align: center;">  Rear lamp </div> <div style="text-align: center;">  Multi lens array </div> </div>
<p>Market Leadership</p>		<p>Worldwide development and production footprint to capture global growth opportunities!</p> <p>Highlights:</p> <div style="display: flex; align-items: center;"> <div style="margin-right: 20px;"> <p># of new sites since 2011</p> </div> <div style="margin-right: 20px;">  </div> <div style="border: 1px solid black; padding: 2px 10px; background-color: #003366; color: white;">Development: + 4</div> </div> <div style="border: 1px solid black; padding: 2px 10px; background-color: #003366; color: white; margin-top: 5px;">Production: + 3</div>
<p>Resilient Business Portfolio</p>		<p>Balanced technology portfolio to capture worldwide growth opportunities for premium as well as volume markets!</p> <p>Highlights:</p> <div style="display: flex; justify-content: space-between; align-items: center;"> <div style="margin-right: 20px;"> <p>Share of LED headlamps*</p> </div> <div style="border: 1px solid black; padding: 5px 15px; background-color: #003366; color: white; border-radius: 10px;">2016: ~30%</div> </div>
<p>Operational Excellence</p>		<p>Continuous optimization programs to foster operational excellence along three major layers!</p> <p>Highlights:</p> <div style="display: flex; justify-content: space-between; align-items: center;"> <div style="margin-right: 20px;"> <p>Customer line returns in parts per million</p> </div> <div style="border: 1px solid black; padding: 5px 15px; background-color: #003366; color: white; border-radius: 10px;"> $\Delta 2016 \rightarrow 2017$ -49% </div> </div>

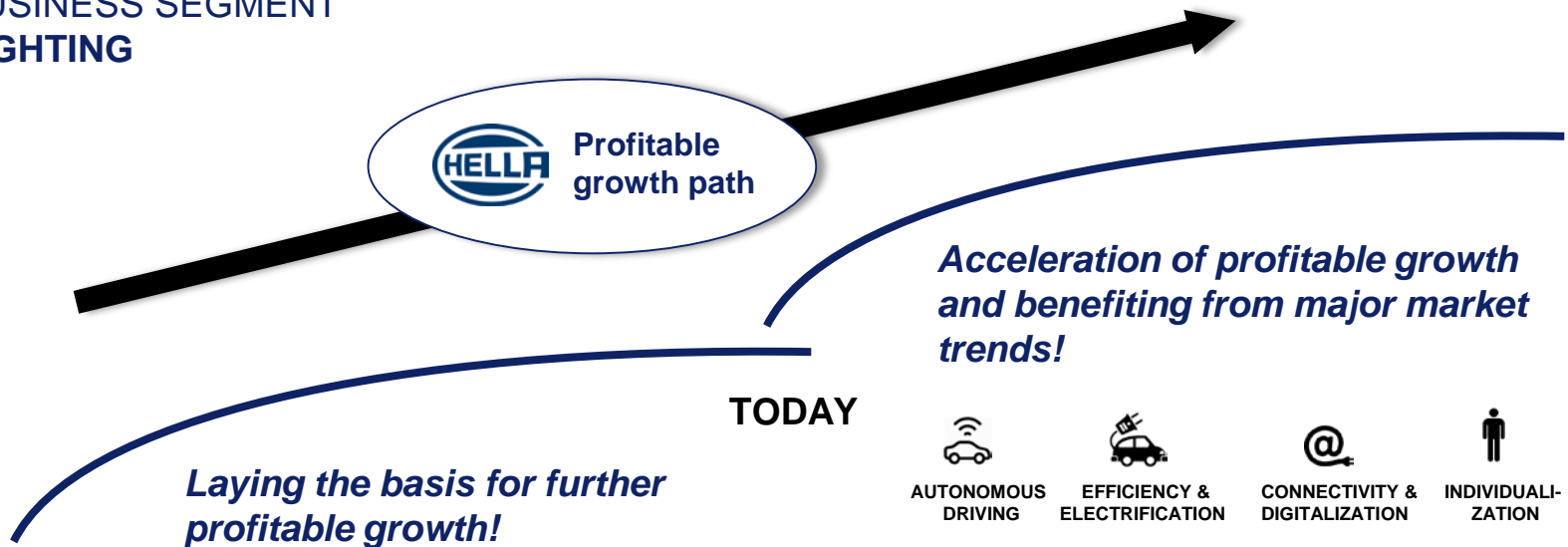
<p>Profitable Growth</p>		<p>SALES CAGR 2012 → 2016</p> <div style="text-align: right; margin-top: 20px;">  </div>
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*) relating to HELLA's headlamp sales

HELLA will focus on further lighting innovations for automotive market trends to foster leading market positions

Segment Lighting – Strategic growth horizons

BUSINESS SEGMENT
LIGHTING



STRATEGIC DIRECTION

- **Innovation Leadership:**
High investments in technologies and products
- **Market Leadership:**
Expansion of global footprint
- **Resilient Business Portfolio:**
Internationalization of customer portfolio
- **Operational Excellence:**
Strengthening of operational excellence

STRATEGIC ACTION PLAN

- A** Further expansion of technological excellence and innovation leadership
- B** Foster and maintain leading positions in core markets
- C** Ensure resilience with balanced customer and product portfolio
- D** Continued focus on operational excellence

Focus for today

HELLA's lighting products and innovations will play a relevant role for all major automotive market trends

Segment Lighting – Benefiting from major market trends

A

MAJOR
AUTOMOTIVE
MARKET
TRENDS

AUTONOMOUS DRIVING



Automated



EFFICIENCY & ELECTRIFICATION



Electrified



CONNECTIVITY & DIGITALIZATION



Connected



INDIVIDUALI- ZATION



Individualized



IMPACT ON



Lighting
portfolio

UPSIDE POTENTIAL

- Need for advanced front lighting systems for AD Level 1 - 3 to improve driver's visibility
- Introduction of new lighting features for L4+, e.g. for communication purposes
- Increasing importance of Car Body and Interior Lighting for illumination of autonomous driving vehicles

- Increasing demand for LED solutions as energy efficient light source

- Further digitalization will drive development of advanced and high-definition headlamps with freely configurable light distributions and additional customer functionalities
- Increasing demand for light-based options to communicate e.g. via headlamps, interior and car body lighting

- Increasing demand for ambient interior light (e.g. multiple styling features for passengers) and advanced exterior illumination (e.g. welcome scenarios or illuminated grills)
- Increasing relevance of styling options will drive demand for advanced lighting technologies (e.g. Holographics with 3D effects and OLED)

Focus for today



Innovations in lighting technologies are driven by progress in light sources, sensors, actuators, electronics and software

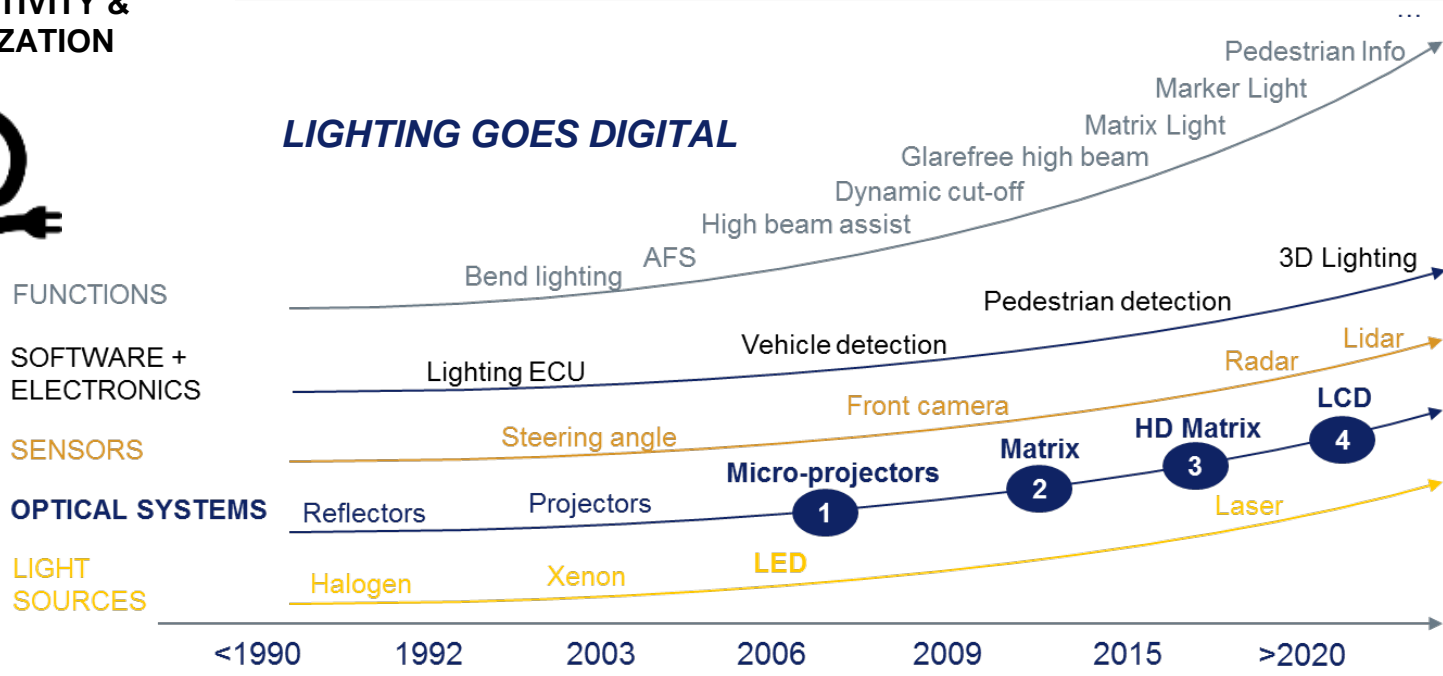
Segment Lighting – Trend overview Connectivity & Digitalization

A

CONNECTIVITY & DIGITALIZATION



LIGHTING GOES DIGITAL



Major innovative lighting systems

Expected market growth*

1	2	3	4
LED Low	LED Advanced	LED Advanced next generation	High definition
Δ2016 →2022 >35% p.a.	Δ2016 →2022 >20% p.a.	Δ2016 →2022 >20% p.a.	SOP >2020

* Global headlamp market (Source IHS as of March 2017 and HELLA)



Further digitalization in lighting technologies will increase HELLA's content per vehicle

Segment Lighting – Technologies for Connectivity & Digitalization

A

CONNECTIVITY & DIGITALIZATION



OFFERING



Focus for today



HELLA started the roll-out of Advanced LED headlamps as first lighting supplier in 2016

Connectivity & Digitalization - Technology Highlights (1/2)

A



TECHNOLOGY Advanced LED next generation



KEY FACTS

- First step to high-definition lighting system
- 84 LED Chips in 3 rows
- Adaptive driving beam



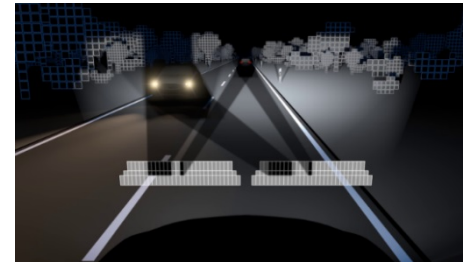
KEY BENEFITS

- **Allows a freely configurable light distribution**
- **Enables greater illumination** which is up to 2.5 times greater compared with regularly available systems
- **Increased resolution** by a factor of 3.5
- **Superior design options**

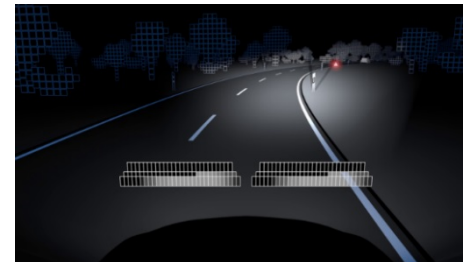
Red Dot Award for
Trendsetting Design



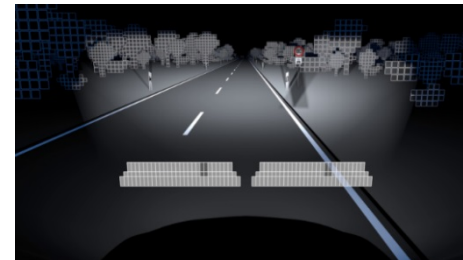
MAIN FUNCTIONALITIES



Glare-free
high beam



Electronic
bend light in
low beam
function



Reduced glare
(e.g. from
reflections by
traffic signs)



High definition LCD headlamp accelerates functionalities and customer benefits

Connectivity & Digitalization – Technology Highlights (2/2)

A



TECHNOLOGY High definition LCD headlamp



KEY FACTS

- High definition lighting system
- Liquid Crystal with >50.000 Pixel

KEY BENEFITS

- **State of the art functions**, e.g. bend light, glare-free high beam, etc. with optimized end-user impact
- **New functionalities**, e.g. C2P (Car To Pedestrian) and C2D (Car To Driver)
- **High end resolution**

NEW FUNCTIONALITIES



Pedestrian marking



Projection of cross-walk



Highlight the walk way

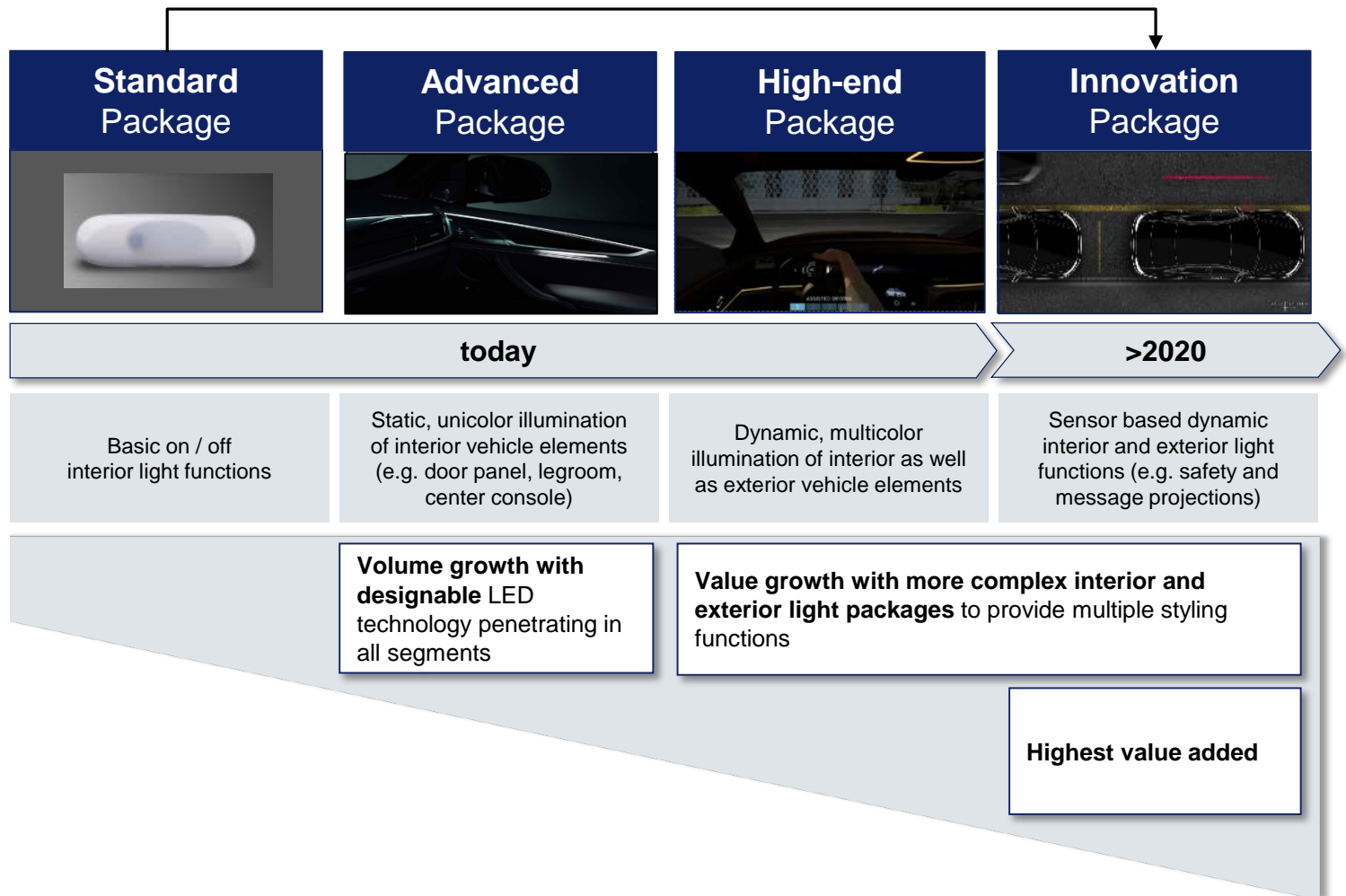


Increasing demand for personalization of vehicles drives growth for light-based design features and functionalities

Segment Lighting – Trend overview Individualization

A

INDIVIDUALI-
ZATION



HELLA's interior lighting and car body lighting portfolio offers tailored solutions for personalized features

Segment Lighting – Technologies for Individualization

A

INDIVIDUALIZATION



	Standard Package	Advanced Package	High-end Package	Innovation Package
	 Courtesy Lamp 1x	 Dome Lamp 1x	 Overhead Console 1x	
OFFERING		 Static Ambient Lighting 1x	 Dynamic Ambient Lighting System (basic) 1x	 Dynamic Ambient Lighting System (sensor based) 1x
			 Multi lens array (basic) 1x	 Multi lens array (sensor based) 1x
				 Grill Illumination 1x
FUTURE CONTENT PER VEHICLE	> 8 Euro	> 50 Euro	> 150 Euro	> 300 Euro

Focus for today



Enhancing user experience and safety with HELLA's dynamic ambient lighting system

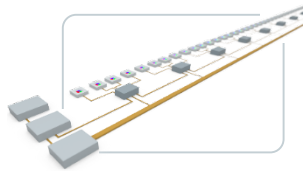
Individualization – Technology Highlights (1/2)

A



TECHNOLOGY Dynamic Ambient Lighting System

KEY FACTS



- Competence in light & electronics
- Light as a complementary information source for driving tasks
- Infinite number of high speed light scenarios

KEY BENEFITS

- **Integration** in customer E/E architecture
- **Supports** partially and high automated driving
- **Enhances safety** in complex traffic situations through warning function
- **Improves driving comfort** by personalization of light

MAIN FUNCTIONALITIES



Future option

Advanced Welcome Scenario



Future option

Collision Warning



Future option

Ambient & Relaxing



HELLA's multi lens array improves comfort and safety by supportive road projects for different driving situations

Individualization – Technology Highlights (2/2)

A



TECHNOLOGY Multi Lens Array



KEY FACTS

- Generation of sharp, contrasting and homogeneous images
- No loss of the graphic even by partially dirty lens, 170 micro projection lenses per Multi-Lens-Array generating 1 image
- Integration of projections with car sensors

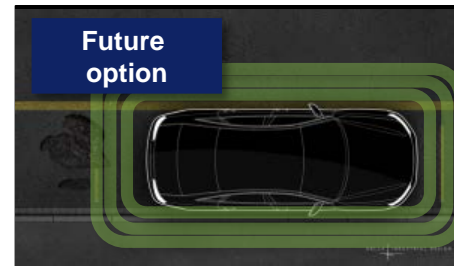
KEY BENEFITS

- **Enhances safety** through communication with pedestrians and other vehicles
- **Evokes emotions** by dynamic / changing lighting
- **Enables information** about autonomous driving status

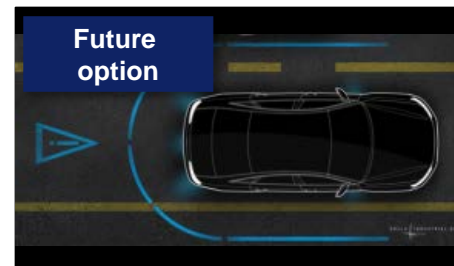
MAIN FUNCTIONALITIES



Welcome Light



Driving Status Projections



Safety Projections






To capture global growth opportunities and foster leading market positions a regionally tailored strategy will be pursued

Segment Lighting – Leading positions in regional core markets

B

MAJOR MARKET EXPECTATIONS

STRATEGIC DIRECTION - LIGHTING

 <p>North & South America</p>	<ul style="list-style-type: none"> ▪ Increasing demand for LED products ▪ Premium brands demanding high-end technology 	<ul style="list-style-type: none"> ▪ Push advanced LED headlamp business with US OEMs ▪ Offer modules for rear combination lamps to handle increasing complexity ▪ Broaden customer base for car body lighting ▪ Further localization of R&D capabilities
 <p>Europe</p>	<ul style="list-style-type: none"> ▪ Shorter development cycles ▪ Customers search for differentiators in terms of technology and styling ▪ Demand for complex applications 	<ul style="list-style-type: none"> ▪ Focus on innovation leadership in Europe as high tech breeding ground ▪ Offer animated functions for Rear Combination Lamps ▪ Increase modular designs for Car Body Lighting ▪ Establish development resources with clear customer focus for Interior Lighting
 <p>Asia / Pacific</p>	<ul style="list-style-type: none"> ▪ Largest end-customer acceptance for new lighting applications ▪ Trend to higher tech LED systems for upcoming car gen. ▪ Chinese OEMs as early & fast adaptors of new innovations 	<ul style="list-style-type: none"> ▪ Focus on LED: fast growth with high and low cost headlamps solutions ▪ Foster growth in the area of interior lighting and car body lighting ▪ Further strengthen local R&D capabilities ▪ Fully leverage Joint Venture business in China

HELLA is well prepared to capture further growth potential in lighting by benefiting from major market trends

Segment Lighting – Strategic outlook

BUSINESS SEGMENT LIGHTING

STRATEGIC ACTION PLAN

*Acceleration of profitable growth
and benefiting from major market trends!*

A Further expansion of technological excellence and innovation leadership

Capitalize **favorable positioning along automotive market trends!**

- Connectivity & Digitalization: **Develop new functionalities out of high definition headlamp systems and penetrate LED low cost solutions**
- Individualization: **Push advanced interior and exterior illumination**

B Foster and maintain leading market positions

Capture **global growth opportunities in attractive markets!**

- North & South America: **Gain market share with top US OEMs**
- Europe: **Successful roll out of HD technologies to customers**
- China: **Push high and low LED solutions and seek further cooperation**

C Ensure resilience with balanced customer and product portfolio

Drive **further internationalization of customer portfolio and explore balanced technology mix!**

- **Stringent allocation of resources** (anchor technologies like Halogen, growth technologies like LED, harvesting like Xenon and development categories like LCD)

D Continued focus on operational excellence

Continue **optimization programs and standardization of processes!**

- **Improve assembly and pre-production areas and reduce non-quality expenses**
- **Enhance and standardize logistic processes**

Capital Markets Day 2017

The Art of Light – Lippstadt, June 29, 2017












TIME		TOPIC	WHO
09:30		Registration and Welcome	Dr. Kerstin Dodel
10:00	30 min	HELLA Group: HELLA's Path of Profitable Growth	Dr. Rolf Breidenbach
10:30	30 min	Electronics: Innovation Driver for the Mobility of Tomorrow	Dr. Rolf Breidenbach
11:00	30 min	Lighting: New Paths in the Automotive Lighting Technology	Markus Bannert
11:30	15 min	Aftermarket: Unique Position along whole Value Chain	Bernard Schäferbarthold
11:45	15 min	Special Applications: Leveraging of Automotive Strengths	Bernard Schäferbarthold
12:00	30 min	HELLA Group: Financials & Perspectives	Bernard Schäferbarthold
12:30	45 min	Q&A-Session	all
13:15	45 min	Lunch	all
14:00	40 min	Focus Topic: The Art of Light – Digitalization of Lighting with new HD Technologies	Kamislav Fadel
14:40	20 min	Coffee Break and Transfer	all
15:00	60 min	Focus Topic: The Art of Light – Product Demonstration in Light Tunnel	Dr. Michael Kleinkes / Dr. Karsten Eichhorn
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17:30	30 min	Closing remarks (expected end ca. 18:00)	all

The Aftermarket segment successfully developed over the last years and contributed to HELLA's growth path

Segment Aftermarket – Where do we come from?

WHAT WE HAVE PROMISED?

KEY ACHIEVEMENTS

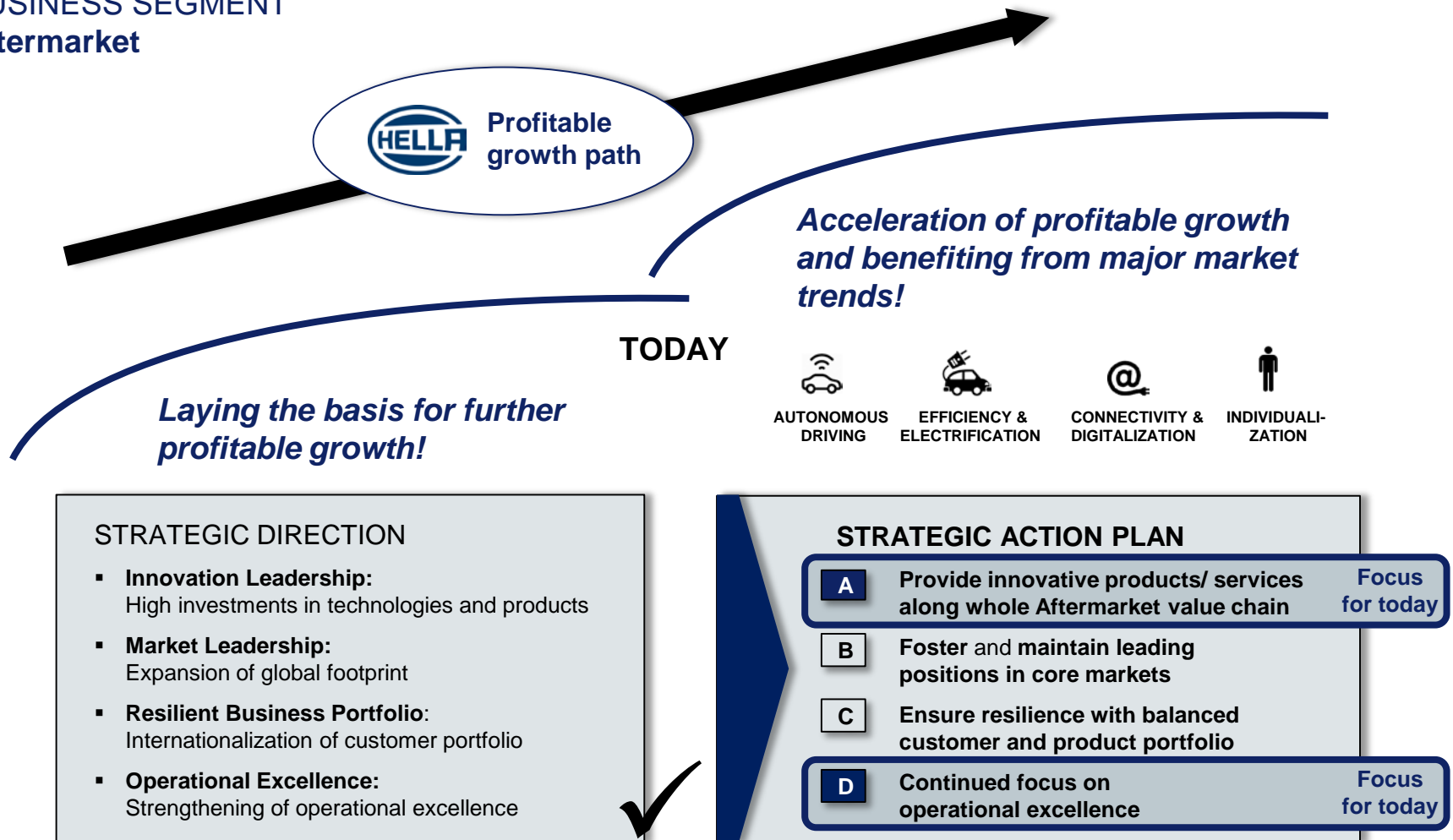
<p>Innovation Leadership</p>		<p>Leading positions based on broad product portfolio and innovative services to tackle major market trends and demand shifts!</p> <p>Highlights:</p> <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;">  Digital Business Model </div> <div style="text-align: center;">  Diagnostic Tools </div> <div style="text-align: center;">  Services </div> </div>
<p>Market Leadership</p>		<p>One of the largest international sales and service networks after expansion and portfolio widening!</p> <p>Highlights: Top positions in Europe along the value chain</p> <div style="display: flex; align-items: center;">  <div> <p>Wholesale: #1  #2  #3 </p> <p>Workshop: #1    #3 </p> <p>IAM: own sales presence in > 25 countries</p> </div> </div>
<p>Resilient Business Portfolio</p>		<p>Uniquely positioned along major parts in the Aftermarket value chain to address Independent Aftermarket, Wholesale Distribution, and Workshop Products</p> <p>Highlights:</p> <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;">  IAM </div> <div style="text-align: center;">  WD </div> <div style="text-align: center;">  WP </div> </div>
<p>Operational Excellence</p>		<p>Continuous optimization programs to foster operational excellence along three major layers!</p> <p>Highlights: Non-quality expenses (NQE)</p> <div style="text-align: right; margin-top: 10px;"> <div style="background-color: #003366; color: white; padding: 5px; border-radius: 10px; display: inline-block;"> Δ2012 → 2016 -23% </div> </div>

<p>Profitable Growth</p>		<div style="display: flex; justify-content: space-between;"> <div style="text-align: center;"> <p>SALES CAGR 2012→2016</p> <div style="background-color: #003366; color: white; padding: 10px; border-radius: 50%; display: inline-block; font-size: 24px; font-weight: bold;">+3%</div> </div> <div style="text-align: center;"> <p>EBIT CAGR 2012→2016</p> <div style="background-color: #003366; color: white; padding: 10px; border-radius: 50%; display: inline-block; font-size: 24px; font-weight: bold;">+1%</div> </div> </div>
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HELLA will use its unique position along the whole Aftermarket value chain to drive further growth

Segment Aftermarket – Strategic growth horizons

BUSINESS SEGMENT
Aftermarket



IAM keeps strengthening its core product portfolio and seeks further cooperation for third party OE competence

Independent Aftermarket – Strategic action plan

A



FOCUS ON:

1 Strengthening of HELLA's OE core products

2 Partnership with strong 3rd party OE suppliers for IAM

Products



Vehicle-specific lighting



Electronics



Strategic directions

- **Expand portfolio** and **leverage own OE know-how** with special focus on E/E and more complex products, e.g. radar sensors
- **Shift from crash to wear parts**
- **Roll-out of global portfolio** into regions and **leverage of local portfolio** additions

- **Enhancement of HELLA portfolio by 3rd party OE products** and leverage of distribution network and proximity to customers



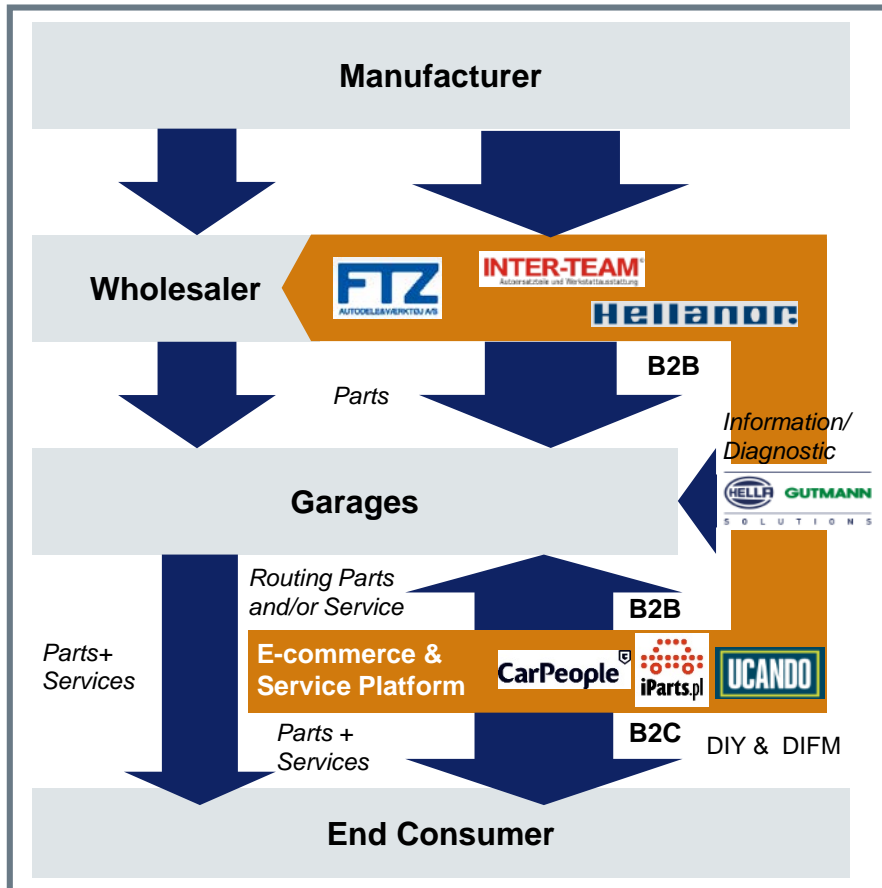
HELLA's integrated wholesale concept ensures broad and deep customer reach in order to generate further growth

Segment Wholesale – Strategic action plan

A



POSITIONING ALONG VALUE CHAIN



STRATEGIC DIRECTION

Capture chances from digitalization

- Intensification of **E-commerce business** in Denmark and Poland
- Further development of **service platform** in first market Denmark and roll-out to further wholesale markets
- Increase in customer loyalty with **digital solutions**, e.g. connected cars and telematics
- Strengthen **B2C business** and further **end-user services**



HELLA enables workshops to conduct complex repair and maintenance activities with innovative and cost efficient solutions

Workshop Products – Strategic action plan

A

State of the art workshop equipment to address more complex car

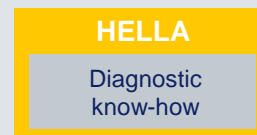
Provide **professional workshop equipment** e.g. multi-brand diagnostics, air-conditioning service as well as testing and adjusting tools e.g. for **camera and sensor calibration**

Example: Camera and sensor calibration



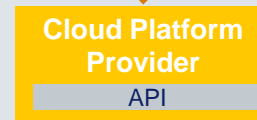
- Growing importance of cameras and sensors due to **automotive megatrends** (e.g. autonomous driving)
- **Easy application** for all brands, smart and cost-efficient solution
- Tool offers **independent workshops** possibility to **extend business activities** beyond traditional scope

New cloud-based workshop solutions to solve diagnostic problems



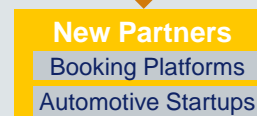
HELLA

Diagnostic know-how



Cloud Platform Provider

API



New Partners

Booking Platforms
Automotive Startups

Existing diagnostics business model

- Localized **offline data base**, not accessible for external parties
- Technical support offered by **hotline**, e.g. for interpretation of complex failure codes into easy-to-understand failure analysis

Cloud platform

- HELLA know-how is transferred to a **cloud platform**
- Third parties can **access data base through web services** like API
- **Predictive services** become possible

New applications

- **New partners** access the data base to offer **innovative** services and applications for car diagnostics (“micro services”)
- Examples: driver logbooks, pay-per-diagnosis

By strengthening its operational excellence, the segment Aftermarket will further improve its competitiveness

Segment Aftermarket – Operational Excellence

D

LAYER

STRATEGIC DIRECTION

STRUCTURE



Further strengthening of organizational set-up in IAM

- Further **implementation of key account organization** to strengthen customer focus
- Full **integration of workshop products organization into IAM organization** to realize synergies
- **Combination of sales, product, and data management in one organization** to ensure efficient coordination of business activities

PROCESS



Continuous improvement of internal processes

- **Optimize order fulfillment process**, e.g. by better truck / container utilization, consolidation and regionalization of supplier base
- **Push focus on active portfolio management** to increase stock rotation and to streamline product portfolio as well as use of make-to-order approach
- **Further roll out of state-of-the-art IT solutions** to increase process quality and efficiency, e.g. further roll-out of standard ERP system, full utilization of CRM tool

PEOPLE



Continuous focus on recruiting and retention of qualified employees

- **Roll-out of tailored employee qualification programs**. e.g. Order Fulfillment Academy, Leadership Academy
- **Hiring of qualified and skilled people** to be prepared for digital challenges

The Aftermarket segment is an important pillar of HELLA's further profitable growth path

Segment Aftermarket – Strategic outlook

BUSINESS SEGMENT AFTERMARKET

STRATEGIC ACTION PLAN

*Acceleration of profitable growth
and benefiting from major market trends!*

A Provide innovative products and services along whole Aftermarket value chain

Strengthen **product offering along whole aftermarket value chain!**

- IAM: **Strengthen OE product portfolio** and **seek additional partnerships**
- Wholesale: **Further develop digital business models**
- Workshop: **Launch new diagnostic tools and (digital) services**

B Foster and maintain leading market positions

Capture **additional growth opportunities** in Aftermarket!

- **Develop Aftermarket concepts** considering future decision makers
- **Investigate inorganic growth opportunities** for wholesale business in Europe

C Ensure resilience with balanced customer and product portfolio

Leverage **unique positioning in Aftermarket to attractive markets**

- **Roll-out of global IAM product portfolio** into all regions and leverage of **successful local products**
- **Expand wholesale network** in Poland
- **Further penetrate European core markets** with diagnostics tools and services

D Continued focus on operational excellence

Continue to **focus on improving operational excellence!**

- **Strengthening of organizational set-up** along whole Aftermarket value chain
- **Continuous improvement of internal processes**

Capital Markets Day 2017

The Art of Light – Lippstadt, June 29, 2017

TIME		TOPIC	WHO
09:30		Registration and Welcome	Dr. Kerstin Dodel
10:00	30 min	HELLA Group: HELLA's Path of Profitable Growth	Dr. Rolf Breidenbach
10:30	30 min	Electronics: Innovation Driver for the Mobility of Tomorrow	Dr. Rolf Breidenbach
11:00	30 min	Lighting: New Paths in the Automotive Lighting Technology	Markus Bannert
11:30	15 min	Aftermarket: Unique Position along whole Value Chain	Bernard Schäferbarthold
11:45	15 min	Special Applications: Leveraging of Automotive Strengths	Bernard Schäferbarthold
12:00	30 min	HELLA Group: Financials & Perspectives	Bernard Schäferbarthold
12:30	45 min	Q&A-Session	all
13:15	45 min	Lunch	all
14:00	40 min	Focus Topic: The Art of Light – Digitalization of Lighting with new HD Technologies	Kamislav Fadel
14:40	20 min	Coffee Break and Transfer	all
15:00	60 min	Focus Topic: The Art of Light – Product Demonstration in Light Tunnel	Dr. Michael Kleinkes / Dr. Karsten Eichhorn
16:00	90 min	Focus Topic: The Art of Light – Visit of State-of-the-Art Lighting Plant	Franz-Georg Osdiek / Florian Fischer
17:30	30 min	Closing remarks (expected end ca. 18:00)	all

Despite challenging market environment, Special Applications segment contributed positively to HELLA's development

Segment Special Applications - Where do we come from?

WHAT WE HAVE PROMISED?

KEY ACHIEVEMENTS

<p>Innovation Leadership</p>		<p>Leading positions based on core technologies and transfer of OE competence to tackle major market trends and future customer demands!</p> <p>Highlights:  Modular Lighting Systems  LED Work lamps</p>
<p>Market Leadership</p>		<p>Strong market positions as supplier of innovative lighting products in defined target markets based on leverage of LED know-how!</p> <p>Highlights: #1 positions in Europe  Agriculture  Recreational Vehicle  Trailer</p>
<p>Resilient Business Portfolio</p>		<p>Broad customer base and regional diversified portfolio to strengthen resilience and to capture worldwide growth opportunities.</p> <p>Highlights: Sales growth with Indian truck, bus and agro customers</p> <p style="text-align: right;">Δ2012 → 2016 +15% p.a.</p>
<p>Operational Excellence</p>		<p>Continuous optimization programs to foster operational excellence along three major layers!</p> <p>Highlights: Non-quality expenses (NQE)</p> <p style="text-align: right;">Δ2012 → 2016 -23%</p>

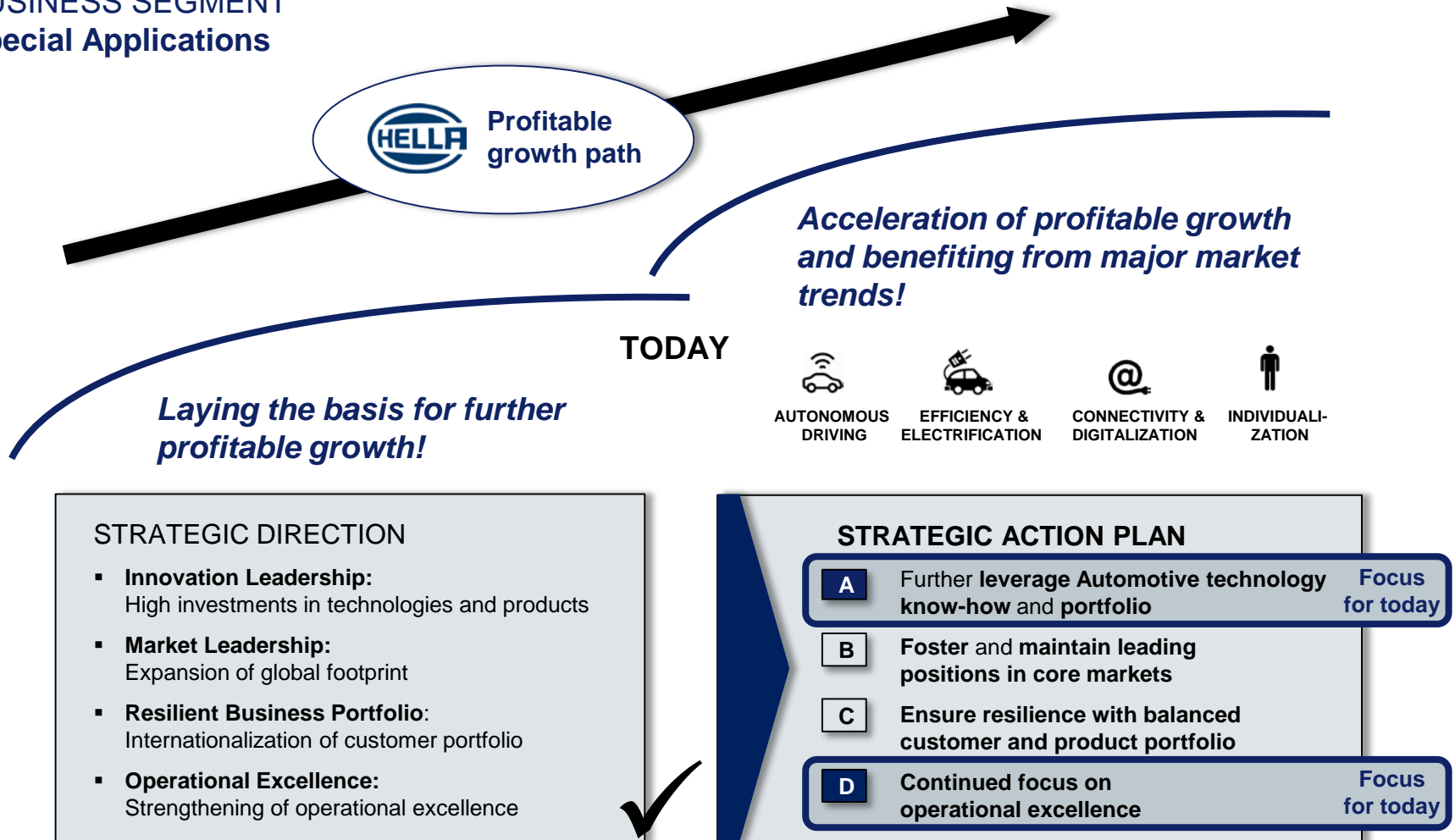
<p>Profitable Growth</p>		<p>SALES* CAGR 2012→2016 +1%</p> <p>EBIT* CAGR 2012→2016 +4%</p>
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* Sales and EBIT development for Special OE

Strategic focus in Special Applications will be on leveraging HELLA's Automotive know-how and on operational excellence

Segment Special Applications – Strategic growth horizons

BUSINESS SEGMENT
Special Applications



By leveraging HELLA's Automotive know-how, Special Applications can address major industry trends for special vehicles

Segment Special Applications – Technology leadership

A

Drive LEDfication in all customer segments

- Further **focus on offering of LED solutions** and participate in LEDfication trend e.g. in recreational vehicles, trailers and agricultural vehicles



- Invest into **innovative product roadmap**, e.g. Shapeline and multi-function lamp platform
- **Revitalize products** e.g. modular work lamps and rear lamps
- **Drive advanced engineering** e.g. light tunnel and matrix beam

Push further application of Electrics / Electronics

- Transfer and **adaptation of electronic automotive know-how** to further participate in Electrification trend for special vehicles
- Focus on **application of existing Automotive products** e.g. pedal sensors
- **Extension of Electronics scope** e.g. radar solutions for smart farming to avoid collision and to measure seeds and speed



Continuous transfer of OE technology to SOE applications!

In order to strengthen its competitiveness, Special Applications will focus on further improving operational excellence

Segment Special Applications – Operational Excellence

D



Special Applications is well prepared to support HELLA's profitable growth path

Segment Special Applications – Strategic outlook

BUSINESS SEGMENT
Special Applications

STRATEGIC ACTION PLAN

*Acceleration of profitable growth
and benefiting from major market trends!*

A Further leverage
Automotive technology
know-how and portfolio

Continue to **leverage synergies** out of Automotive portfolio and **capitalize** favorable **market trends!**

- LEDification: **Offer innovative LED solutions for special vehicles**
- Electrification: **Expand product portfolio for Electric / Electronics (E/E)**

B Foster and maintain
leading market positions

Enforce **development of market leading innovations / products!**

- **Strengthening of application engineering**
- **Search for attractive cooperation opportunities in E/E**
- **Capture additional growth opportunities in Mining, Marine, Forklifts, TierX**

C Ensure resilience with
balanced customer and
product portfolio

Capture **global growth opportunities** in attractive markets!

- Europe: **Defend market position**
- Americas: **Enforce organic growth based on lighting portfolio through leverage of best cost country solutions**
- India: **Penetrate market based on local for local strategy**

D Continued focus on
operational excellence

Continue to **focus on improving operational excellence!**

- **Further capacity optimization and structural improvements globally**
- **Continuous focus on improving internal process efficiency**
- **Complexity reduction**

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We delivered what we have promised

Financials – Where do we come from?

WHAT WE HAVE PROMISED?

KEY ACHIEVEMENTS

<p>Innovation Leadership</p>		<p>Continuous investment in innovative portfolio with high value-added and growth!</p> <p>Highlights: R&D Ratio Ø 2012-16 9% Gross Profit Margin Ø 2012-16 27%</p>
<p>Market Leadership</p>		<p>Worldwide growth and market outperformance with increasing share outside Europe!</p> <p>Highlights: Growth Ø 2012-16 8% Outperformance Ø 2012-16 4.5pp</p>
<p>Resilient Business Portfolio</p>		<p>Continuous development of non-auto business and solid financial profile to provide strong fundament for future development!</p> <p>Highlights: Share Aftermarket & Special Applications Ø 2012-16 26% Leverage ratio Ø 2012-16* <1.0x</p> <p><small>*FY end Net Debt /EBITDA</small></p>
<p>Operational Excellence</p>		<p>Continuous measures to facilitate operating leverage with structural improvements, group wide programs and performance oriented culture!</p> <p>Highlights: Savings from comprehensive program toolkit 2016 ~ EUR 250m</p>

<p>Profitable Growth</p>		<p>SALES CAGR 2012→2016 +8%</p> <p>Adj. EBIT CAGR 2012→2016 +8%</p>
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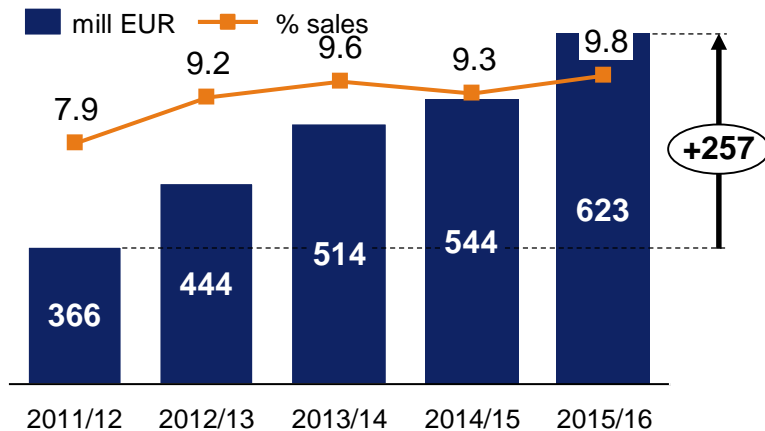
Note: Adjustments include restructuring expenses and supplier default (FY 15/16). Please note that where sums and percentages in the presentation have been rounded, differences may arise as a result of commercial rounding

Over the last years HELLA continuously invested to further develop innovation leadership position



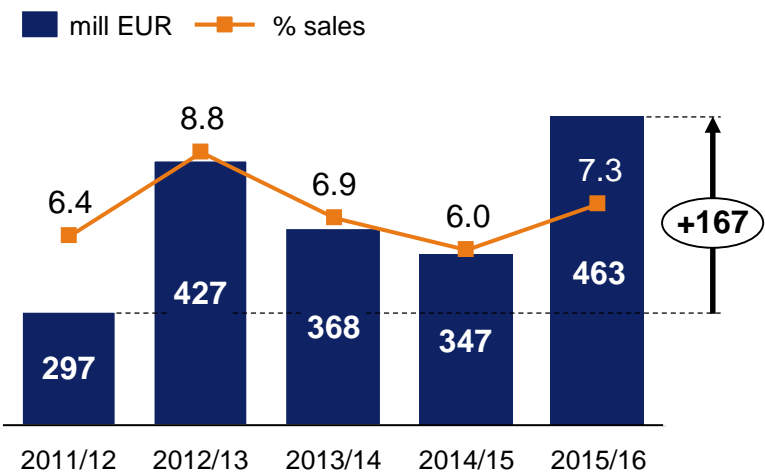
Innovation Leadership

R&D Expenditures



- R&D spending driven by **successful acquisitions of customer projects** which drive future growth
- Specific **R&D investments** to further **develop technology leadership position**
- **Peak** in R&D ratio mid of FY 15/16 reached; slight decrease and **stabilization** since then

Net CAPEX

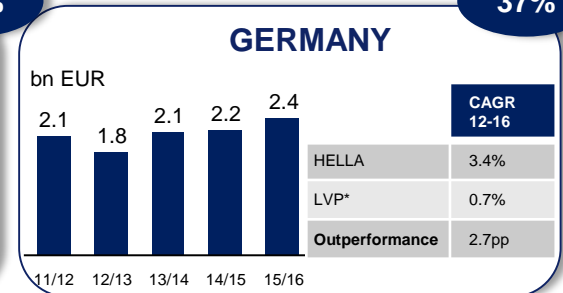
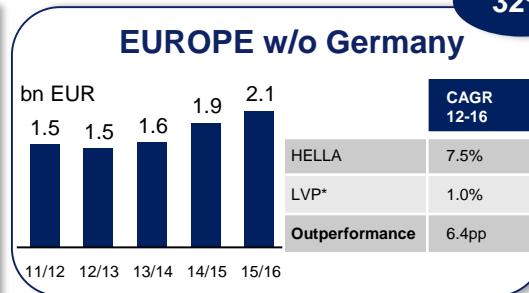
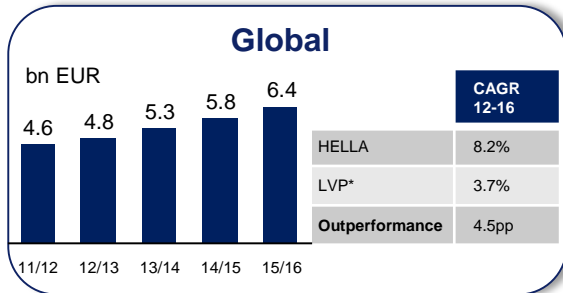


- **Majority of Net CAPEX share related to investment** in customer-specific tools and machinery driven by **booked business**
- **Investment** in global footprint to follow **best cost country** approach and to increase customer proximity
- **Reimbursements** of customer with inherent volatility

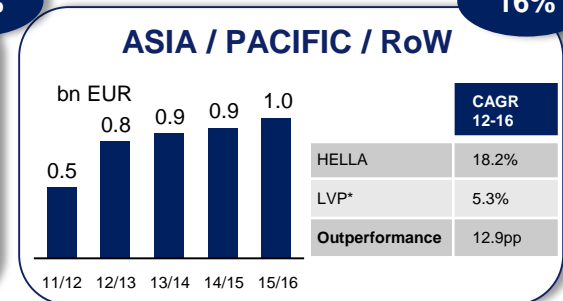
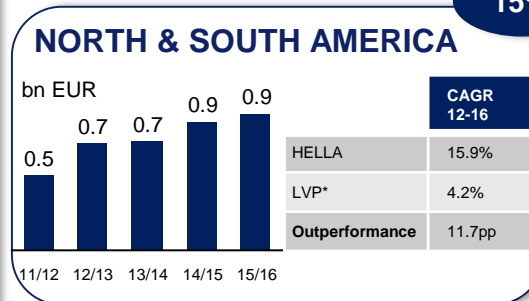
Based on its global network HELLA has continuously expanded into new regions and customers



Market Leadership



- ### KEY ACHIEVEMENTS
- Sales CAGR 2012-16 of 8%, outperforming Light Vehicle production by 4.5pp
 - Strong sales growth in Asia/Pacific/RoW (+18% p.a.) and North & South America (+16% p.a.)



Sales share

*Light vehicle production shows the CAGR for calendar year 2011-2015; Source: IHS (as of March 2017)

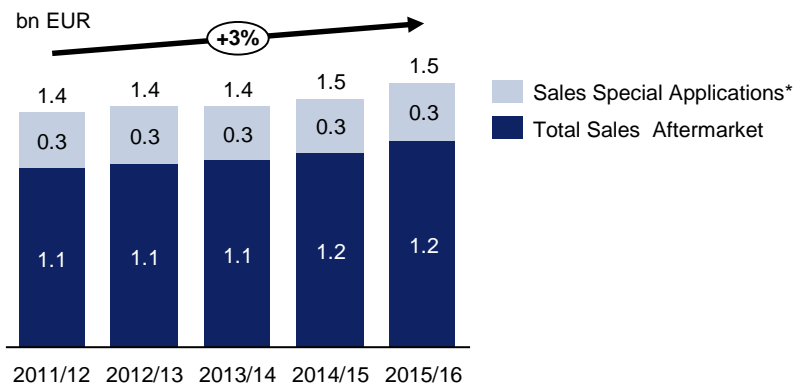


HELLA has continuously invested in Aftermarket and Special Applications business and ensured a solid balance sheet



Resilient Business Portfolio

Sales Development Aftermarket & Special Applications

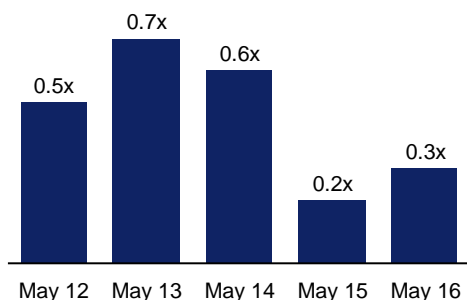


*excluding divested industries and airport lightening business

- Aftermarket with positive sales development due to portfolio extension, customer proximity, and expansion
- Steady contribution to group EBIT and FCF
- Special Applications levers core technologies to broad customer base with limited investments and capital allocation; sales development suffered from weak agricultural market
- Industries and Airport Lighting business did not develop according expectations and was divested in FY 15/16

Financial Structure

■ Leverage (Net debt / EBITDA)



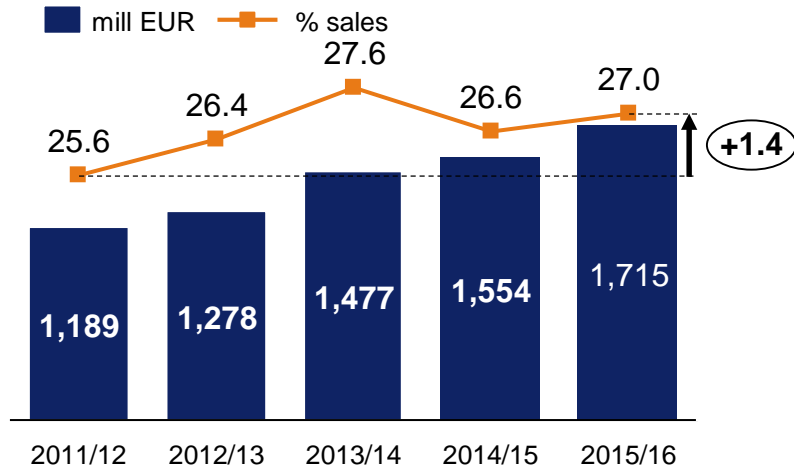
- Solid balance sheet, with investment grade rating
- Prudent financial policy throughout the cycle with leverage <1x
- Leverage ratio at 0.3x and cash & assets at 842 mill. EUR as April, 2017

By strengthening its operational excellence HELLA further improved its competitiveness in the last years



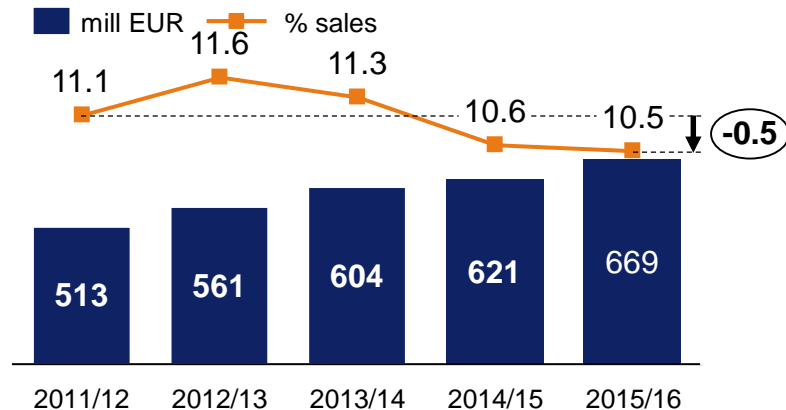
Operational Excellence

Adj. Gross Profit



- Improvement of Adj. Gross Profit Margin driven by innovative product portfolio
- Development in FY 14/15 mainly due to higher launch costs in Eastern Europe
- Continuous optimization of structures and processes support margin improvements:
 - improvement program focusing on productivity and efficiency increases
 - roll-out of lessons learned in Eastern Europe
 - stringent quality management
 - production relocations to best cost countries

Adj. SG&A



- SG&A development with continuous improvements after FY 12/13 due to strong investments in corporate functions
- Thereafter continuous improvements driven by
 - strengthening cooperate centers in best cost countries
 - using shared service center approach with reduced overhead functions
 - dedicated programs in all business divisions continued
 - systematic roll out of competence and skills management

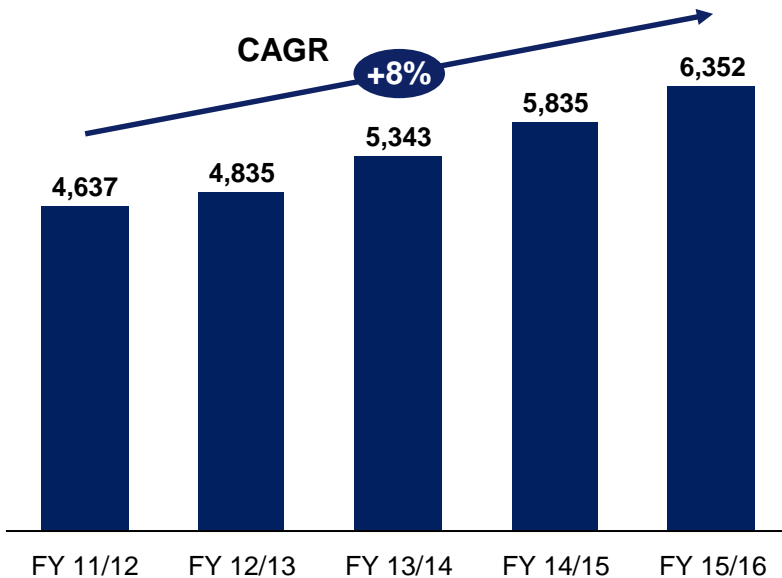
HELLA has shown sustainable profitable growth since automotive crisis



Profitable Growth

SALES

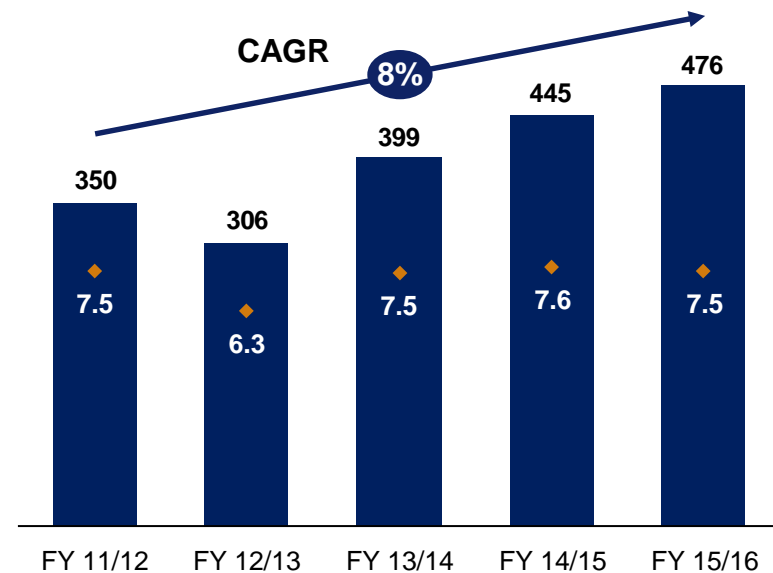
in million EUR



ADJUSTED EBIT

in million EUR

◆ Adj. EBIT Margin (%)

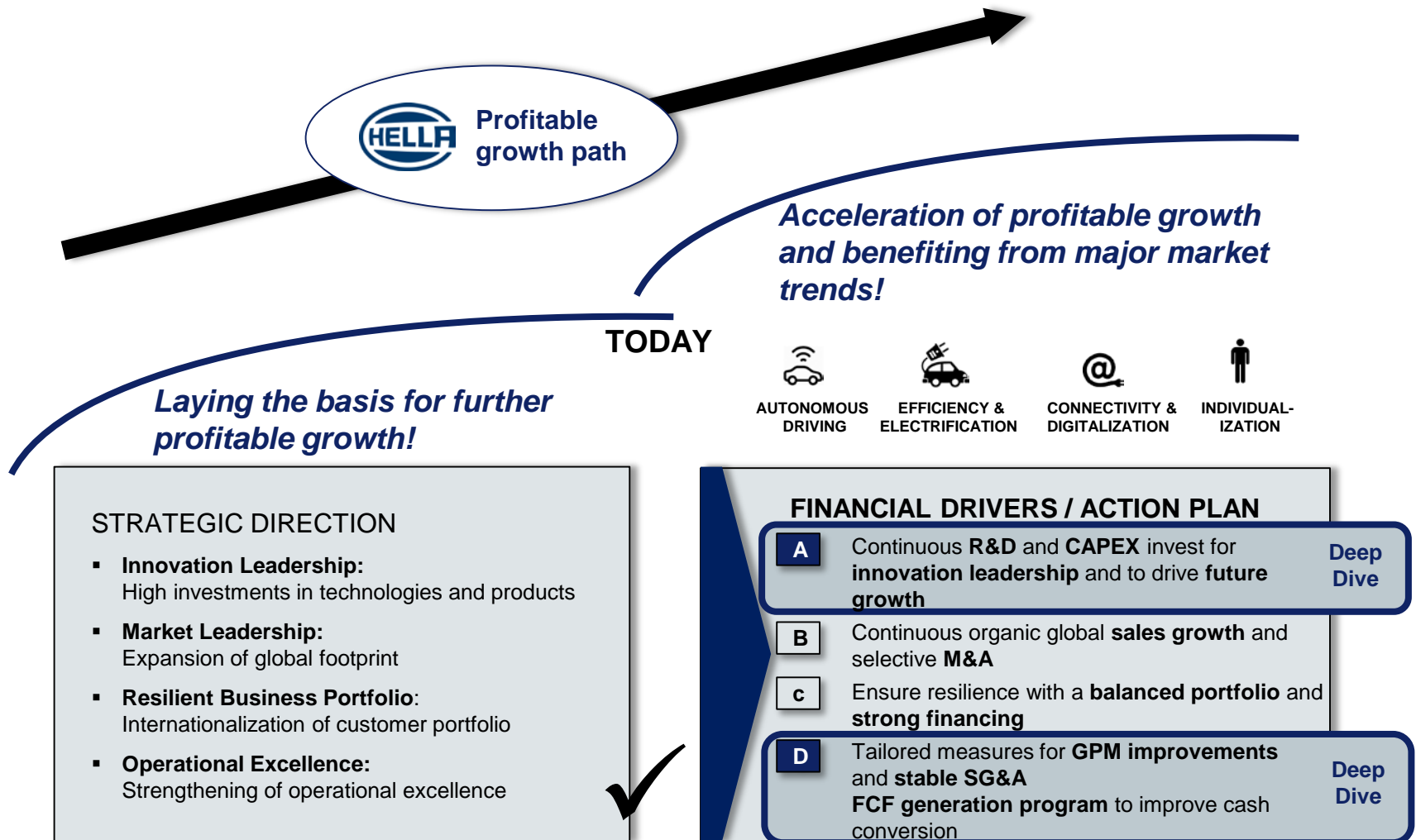


- **Sustainable growth** during the last years mainly driven by **Automotive**
- **Aftermarket** and **Special Applications** with positive **growth**

- **Continuous EBIT increase** despite investments in **global structures** and **R&D**
- **Overall stable margin level** through **growth** driven by constant **gross margin improvements**

HELLA is well prepared to accelerate its profitable growth path and to benefit from major market trends

Financials – Profitable growth horizons



HELLA will maintain innovation leadership position and invest in future growth

High focus on R&D and CAPEX efficiency

A

R&D Ratio

mid term* target:

level
around
9.7%



- R&D investments follow booked business; roughly 70% of R&D spending is related to future projects
- Stable mid term R&D ratio target in view of increased order intakes and conscious investments in opportunities
- 20% of R&D invested in market trends and enhancement of product portfolio
- Areas of investments:
 - Lighting: LED/ HD headlamps, Body car & interior lighting
 - Electronics: radar, camera software, LIDAR, energy mgmt.
 - Aftermarket: e-commerce & service platforms and diagnostic tools
 - Special Applications: LED modules and radar solutions
- Low R&D capitalization level < 10%

Net CAPEX / Sales Ratio

mid term target:

level
around
7.5%

- CAPEX planning is correlated to expected sales development, investments based on booked business
- CAPEX efficiency is a crucial pillar of HELLA strategy to improve cash flow generation
- HELLA with continuous investment in technologies and innovations: further CAPEX in electronics and lighting facilities and tools reduce CAPEX improvements
- Possible volatility of Net CAPEX due to shifts in reimbursements
- Mid term Net CAPEX level of around 7.5% is targeted

*mid term comprises expected development until FY 19/20

HELLA will continuously focus on improving Free Cash Flow generation

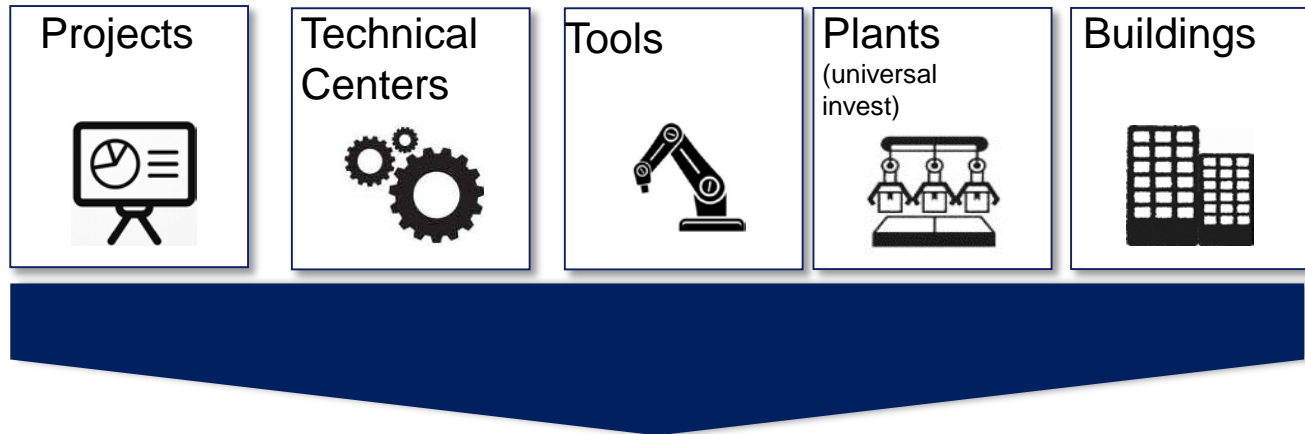
Cash Conversion Project – CAPEX

A



EFFICIENT CAPITAL ALLOCATION KEY TARGET

CAPEX Cluster



Priorities

- Efficiency targets defined to each of these clusters
- Regular meetings with clear decision criteria for investments
- Action tracking on improvement measures for CAPEX efficiency on short and long term
- Results tracked on board level

CAPEX Taskforce and **CAPEX Control Board** implemented to **continuously** review all investments







HELLA will show continuous organic global sales growth driven by volume & value add and seeks selective M&A Growth Opportunities

B

ORGANIC GROWTH

Volume growth and value growth within HELLA product portfolio driven by **booked business and trends**

				
ELECTRONICS	value ~8x	value ~8x	value ~2x	
LIGHTING			value ~10x	value ~30x

Based on presented examples today; estimated increase in value add from bottom to high end of potential content increase

mid term target sales growth between 5%-10% p.a.

Strong ties to top international OEMs and local OEMs in respective regions with tailored products and established customer proximity

					
NAFTA		Europe		China	

INORGANIC GROWTH

Seeking **selective M&A** opportunities in Europe (Wholesale) and globally (selective technologies and competences in Automotive & Special Applications)

All M&A targets need to add to the overall business and strengthen strategic positioning



HELLA will ensure resilience with a balanced portfolio and solid financing

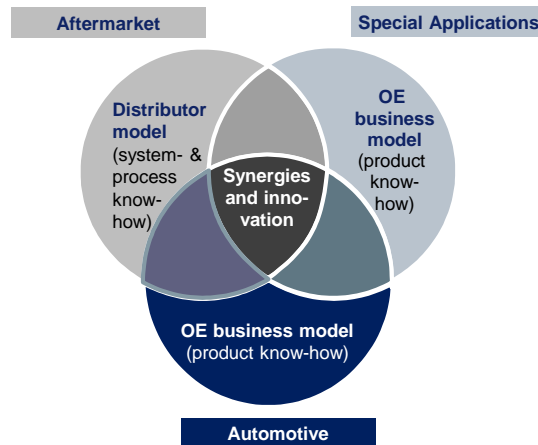
Portfolio and Financing

C

Aftermarket and Special Applications

mid term target:

continuous improvement on EBIT and Cash Flow generation

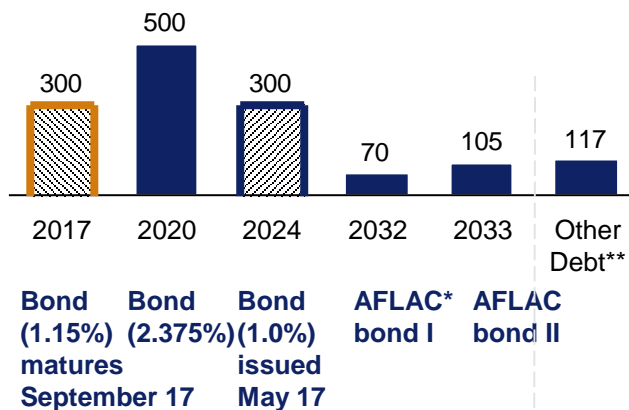


- Aftermarket provides innovative technologies and services along the whole Aftermarket value chain
 - Growth opportunities through portfolio optimization, broadened customer reach with e-commerce/ e-service offering and innovative diagnostics
 - Strengthen competitiveness through continuous improvement programs
- Special Applications leverages lighting and & electronic know-how e.g. with tailored LED modules, IBS and radar to increase growth dynamics and improve long term margins

Leverage

mid term target:

Net Debt / EBITDA <1X



- Well balanced debt portfolio
- New issuing (senior, unsecured / bearer debt) for attractive conditions
- Long term financing secured

*Abbreviation for "American Family Life Insurance Company"



HELLA will continuously improve its operational excellence and increase its competitiveness

Continuous focus on improvements

D

Gross Profit Margin

mid term target:

increasing

STRUCTURE



- Localization strategies and global supply base, focus on closing the price cost scissor with respect to materials

PROCESS



- Further reduction of NQE, zero failure aspiration
- Further improvement of project maturity & launch readiness
- Roll-out of lessons learned from Eastern Europe

PEOPLE



- Consistent strategic workforce planning

S&GA Ratio

mid term target:

overall stable

STRUCTURE



- Further development of corporate center structures
- Further investments in corporate functions, e.g. standardized systems and data management

PROCESS



- New business process management approach for further standardization
- Reorganization of logistics processes

PEOPLE

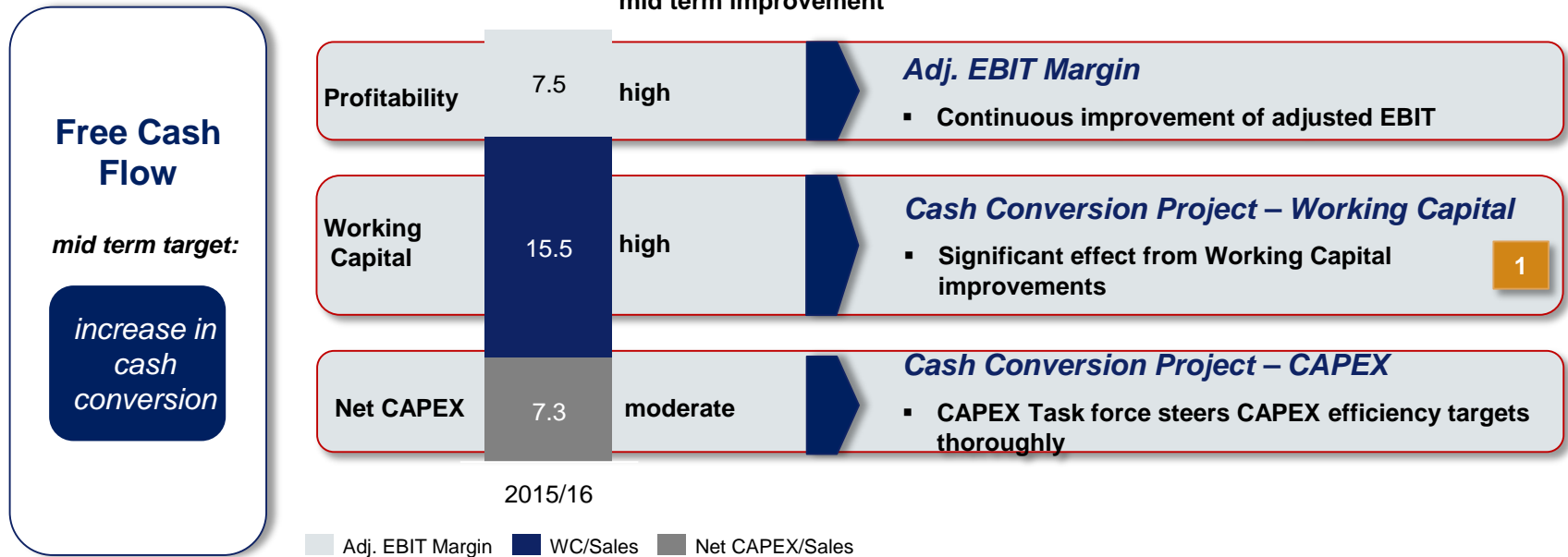


- Continuous employee qualifications

HELLA will continuously focus on improving Free Cash Flow generation

High focus on FCF conversion

D



- Mid term target to increase cash conversion ratio
- HELLA will drive Cash Flow generation with increased profitability, strong WC improvement and increase CAPEX efficiency
- Significant effect from Working Capital improvements

Cash Conversion Ratio = $OCF(\text{Operative Free Cash Flow}) / EBIT(\text{Earnings before interest})$

HELLA will continuously focus on improving Free Cash Flow generation

Cash Conversion Project – Working Capital

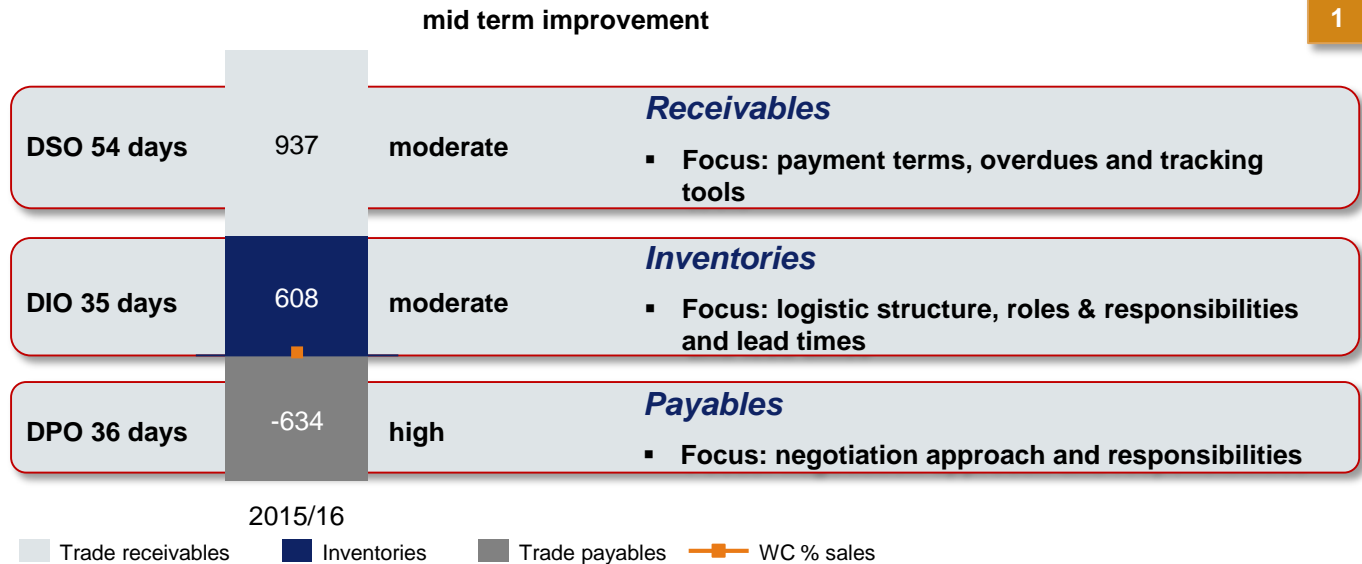
D

1

Working Capital / Sales

mid term target:

decreasing by 3pp



- Working Capital with **strong potential for improvement**, group wide Working Capital program initiated:
 - **clear responsibilities**, top management **governance**, **defined structures** and **targets!**
 - concentrates on all **layers of working capital**: receivables, inventories, and payables!
 - **all business divisions** involved with **tailored actions!**
- Potential to **reduce Working Capital/ Sales** ratio in the next 3 years **by 3pp!**

HELLA will continuously focus on improving Free Cash Flow generation

Cash Conversion Project – Working Capital

D

1

Governance

Steering and responsibilities

- **Steering committee: executive management board**
- **Project lead: CFO**
- **Project set-up finalized: targets defined, ongoing reviews**

Focus topics on group level

- Support on data management
- Drive **understanding of key figures** groupwide
- Improve processes (e.g. liquidity planning)

DSO

Focus: payment terms, overdues and tracking tools

- Implement **worldwide standardized payment terms** with clear management approval process
- Implement **systematic invoicing delivery** process to reduce open billing
- **Reorganize overdue tracking** and process to create ownership and accountability at the responsible manager
- **Implement standard reporting** and continuous tracking per local entity – **reduction of manual efforts** using data warehouse solution

DIO

Focus: logistic structure, roles & responsibilities, and lead times

- Foster **localization of components and finished goods** within HELLA production footprint
- **Harmonize inbound logistics concepts** to production needs with global Purchasing organization
- Implement rolling **ISR** and **target deployment** to all order fulfillment leaders
- **Reduce lead-times** with suppliers and plants

Further means

- **Review inventory allocation** from slow to fast movers
- Global **logistic structure** and **tool landscape** for analytics

DPO

Focus: negotiation approach and responsibilities

- **Clear responsibilities** with **lead-buyer approach** to ensure clear responsibilities on "supplier level"
- Clear prioritization: **Tailored negotiation approaches for top 200 suppliers**

Further means


- Usage of HELLA's leverage
- Specific platform for documentation and knowledge-transfer: (planning of activities, documentation of progress and quantification/ reporting of results)
- Monthly reviews

Based on the defined strategic action plan, HELLA aspire to realize positive development of its performance indicators

Financial – Perspectives

Acceleration of profitable growth and benefiting from major market trends!

STRATEGIC ACTION PLAN

		FY 2017/18	mid term target
<p>A Continuously strong investments in R&D and CAPEX</p>	<ul style="list-style-type: none"> Capitalize favorable positioning along automotive market trends! 	<p>Sales growth excluding FX between 5-10%</p>	<p>Sales growth between 5-10% p.a.</p>
<p>B Continuous organic global sales growth and selective M&A</p>	<ul style="list-style-type: none"> Benefit from volume and value growth opportunities based on strong market position! Capture global growth opportunities in attractive markets (regions and customers)! 	<p>Adj. EBIT growth between 5-10%</p>	<p>Continuous improvement of adj. EBIT</p>
<p>C Ensure resilience with balanced portfolio and prudent financing</p>	<ul style="list-style-type: none"> Ensure an approximately 25% share in Aftermarket and Special Applications to maintain and strengthen overall business resilience! Ensure long term-oriented, balanced financing! 	<p>Adj. EBIT margin around 8%</p>	<p>Increasing cash conversion</p>
<p>D Tailored measures for GPM improvements, stable SG&A, and higher FCF generation</p>	<ul style="list-style-type: none"> Continue optimization programs and standardization of processes! Improve operating leverage and cash conversion! 		

Capital Markets Day 2017

The Art of Light – Lippstadt, June 29, 2017

TIME		TOPIC	WHO
09:30		Registration and Welcome	Dr. Kerstin Dodel
10:00	30 min	HELLA Group: HELLA's Path of Profitable Growth	Dr. Rolf Breidenbach
10:30	30 min	Electronics: Innovation Driver for the Mobility of Tomorrow	Dr. Rolf Breidenbach
11:00	30 min	Lighting: New Paths in the Automotive Lighting Technology	Markus Bannert
11:30	15 min	Aftermarket: Unique Position along whole Value Chain	Bernard Schäferbarthold
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12:30	45 min	Q&A-Session	all
13:15	45 min	Lunch	all
14:00	40 min	Focus Topic: The Art of Light – Digitalization of Lighting with new HD Technologies	Kamislav Fadel
14:40	20 min	Coffee Break and Transfer	all
15:00	60 min	Focus Topic: The Art of Light – Product Demonstration in Light Tunnel	Dr. Michael Kleinkes / Dr. Karsten Eichhorn
16:00	90 min	Focus Topic: The Art of Light – Visit of State-of-the-Art Lighting Plant	Franz-Georg Osdiek / Florian Fischer
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Digitalization of Lighting with new HD technologies

From candela to digitalization

1886 <



No possibility to switch on or off the light from the vehicle



Candela

With the candela technology we were not able to switch the light on and off from the car. There were no switches



Lighting is older than the automobile

Digitalization of Lighting with new HD technologies

From candela to digitalization

1886 <



No possibility to switch on or off the light from the vehicle

1908



With the first electrical Lamp we introduced the first switch in the automotive lighting. The digital era began



Digital = to represent something with digits

Easiest system:
binary system (0 = off, 1 = on)

1st electrical headlamp

One Light-source = One function = 2 status on/off

1 switch possible

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With the first electrical Lamp we introduced the first switch in the automotive lighting. The digital era began

2003



The idea to move the beam pattern is also old but the technology was not available.



Willys Knight 70 A (1928)



Rolls Royce (1934)



Tucker Torpedo (1948)



Citroen DS (1968)

Some historical cars available, but...

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Dynamic bending light ~ 2003
Using actuators for swiveling of a former static light distribution

General calculation:

~Swiveling for one headlamp: $-7,5^{\circ}$ to $+15^{\circ}$ \rightarrow $22,5^{\circ}$ total swivel area
Actuator: (First system introduction $\sim 0,3^{\circ}$), current systems $\sim 0,1^{\circ}$

~ (75) 220 positions of a former static light distribution possible!

Result: 220 positions x 2 switches + 2 switches =

442 possibilities

... most effect full and recognizable functionality ...

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2010



The ADB introduction opened a new era for the digital light

ADB – adaptive Driving Beam (introduction with Xenon)

Adaptive cut-off line



Glare free high beam



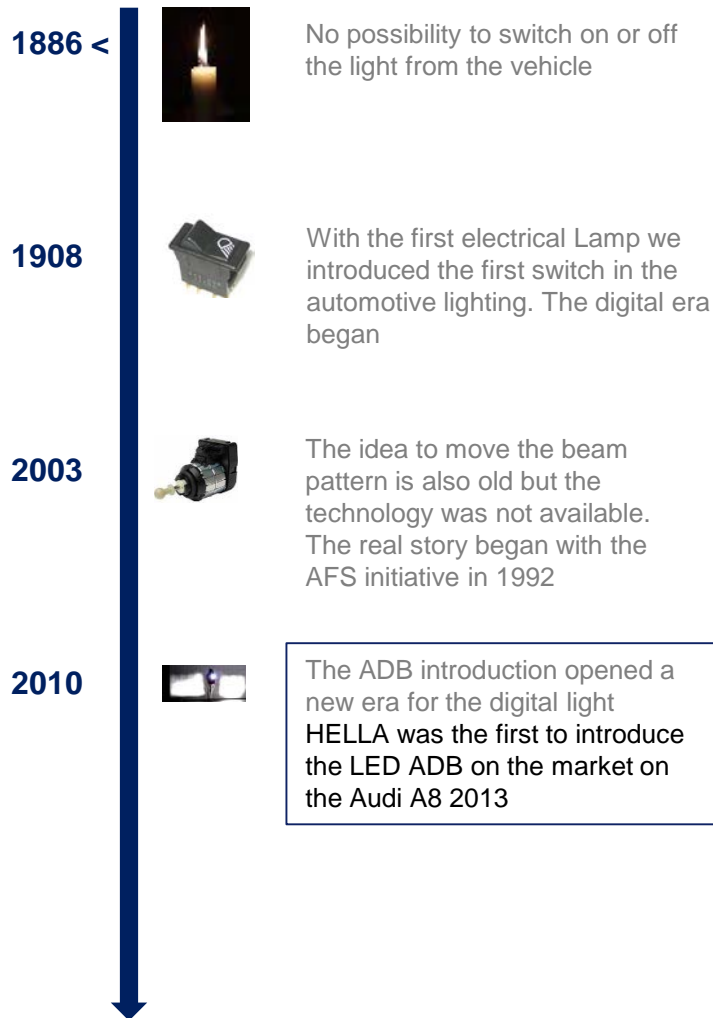
H: 440 positions of a former static light distribution possible

V: 400 positions possible (most for smooth transitions)



Result: 440 possibilities (horizontal) x 400 (vertical) + 2 switches = **~176,000 possibilities**

Digitalization of Lighting with new HD technologies

From candela to digitalization



MATRIX BEAM 5 reflectors each with a 5-chip-LED

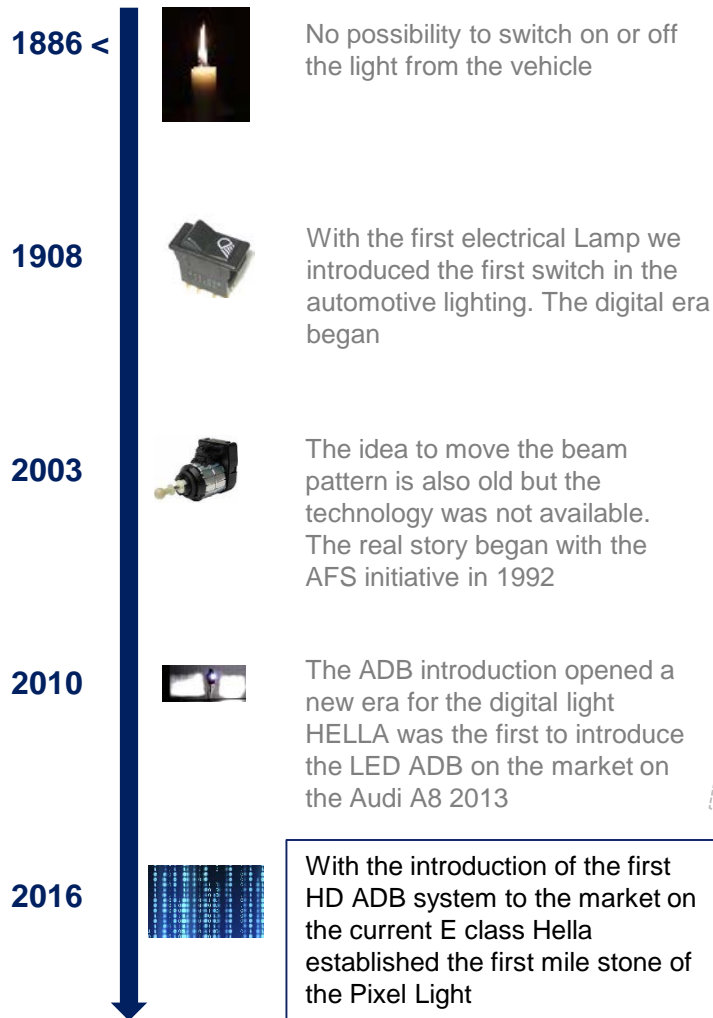
	<ul style="list-style-type: none"> • First glare-free high beam functionality masking out of up to 8 different road users at the same time • 25 individually controllable segments per headlight • Vehicles driving ahead are detected in a distance of 300- 400m 	FEATURES
	<ul style="list-style-type: none"> • Elimination of glare for oncoming vehicles • Increased safety: 30m more detection distance means 1,3s additional response time • Reduced driver fatigue due to an automatic system 	BENEFITS

966 million light distributions due to dimming, pixelation and separation...



Digitalization of Lighting with new HD technologies

From candela to digitalization



3.row: High beam
2.row: Low beam/ high beam
1.row: Low beam

Secondary optics (PMMA lens)
Primary optics (silicone)
Circuit board with 84 LED chips (mounted individually) integrated in control unit with heat sink

TOP FACTS

- // Resolution increased by a factor of 3.5
- // Ultra-high speed, precision and performance
- // Freely configurable light distribution
- // Up to 2.5 times greater illuminance compared with regularly available systems

of possible light distributions is hard to count ...

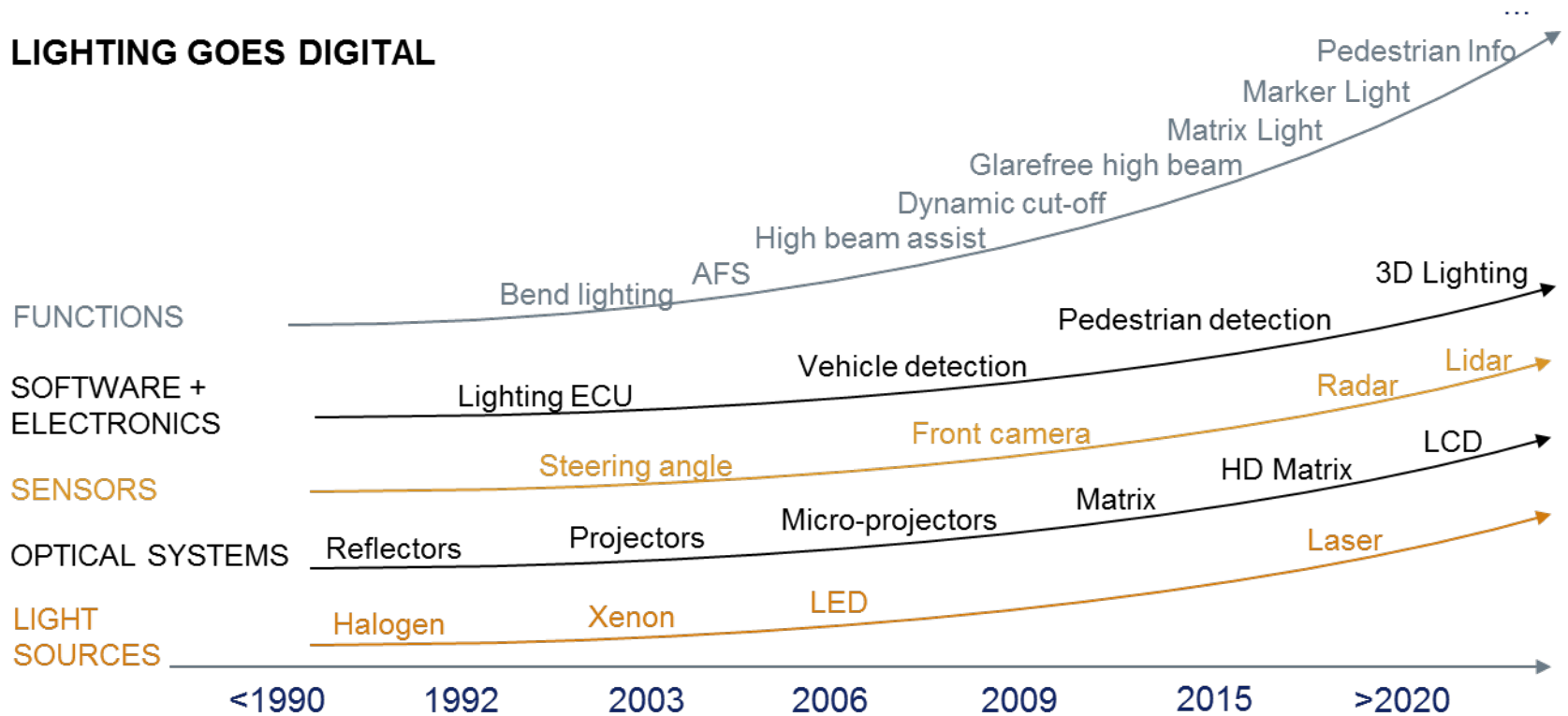
HIGHER RESOLUTION =>

- // Precision
- // Permanent use of high beam
- // Reduced glare
- // Glare-free hazard lighting

Digitalization of Lighting with new HD technologies

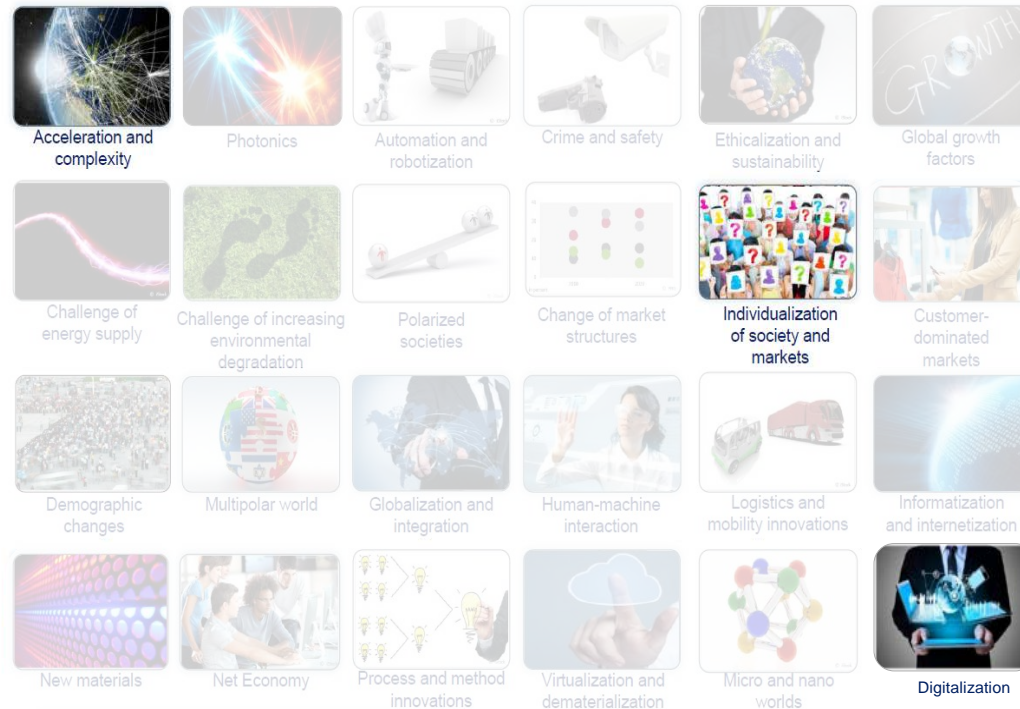
From candela to digitalization

LIGHTING GOES DIGITAL



Digitalization of Lighting with new HD technologies

Use cases: Mega Trends



Comments

- The **acceleration and complexity trend** is visible through the constant increase of the car models and options in parallel to more and **more technology evolution and growing globalization**
- The **Individualization mega trend** is driving the product evolution dramatically. The **most visible** side of this trend is **STYLE and use case on demand**
- The **Digitalization trend** in the Lighting industry is linked to the light pixelization and Software. This is pushing strongly the lighting technologies and **enlarging the skill matrix to the electronic and software field**

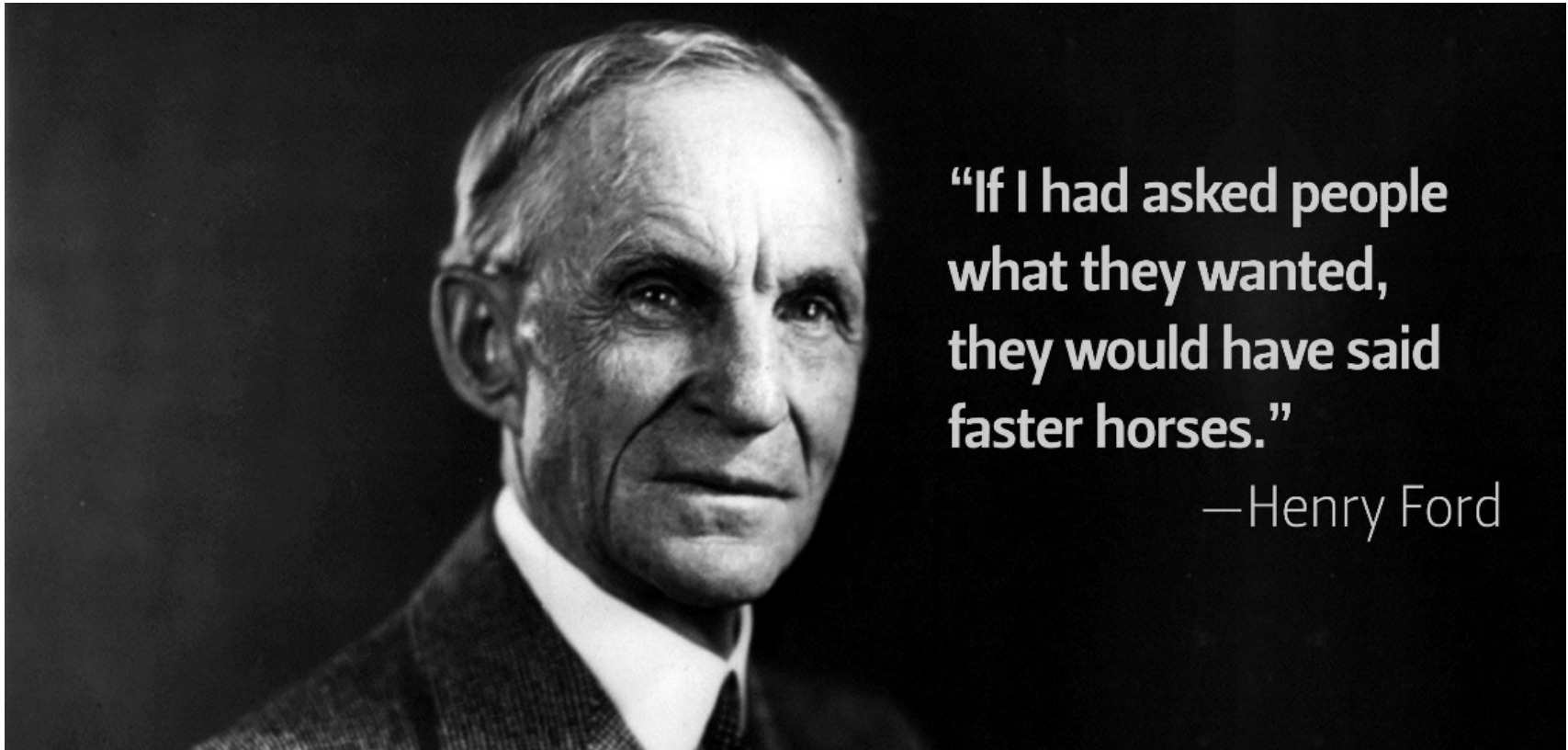
Digitalization of Lighting with new HD technologies

Use cases: Mega Trends



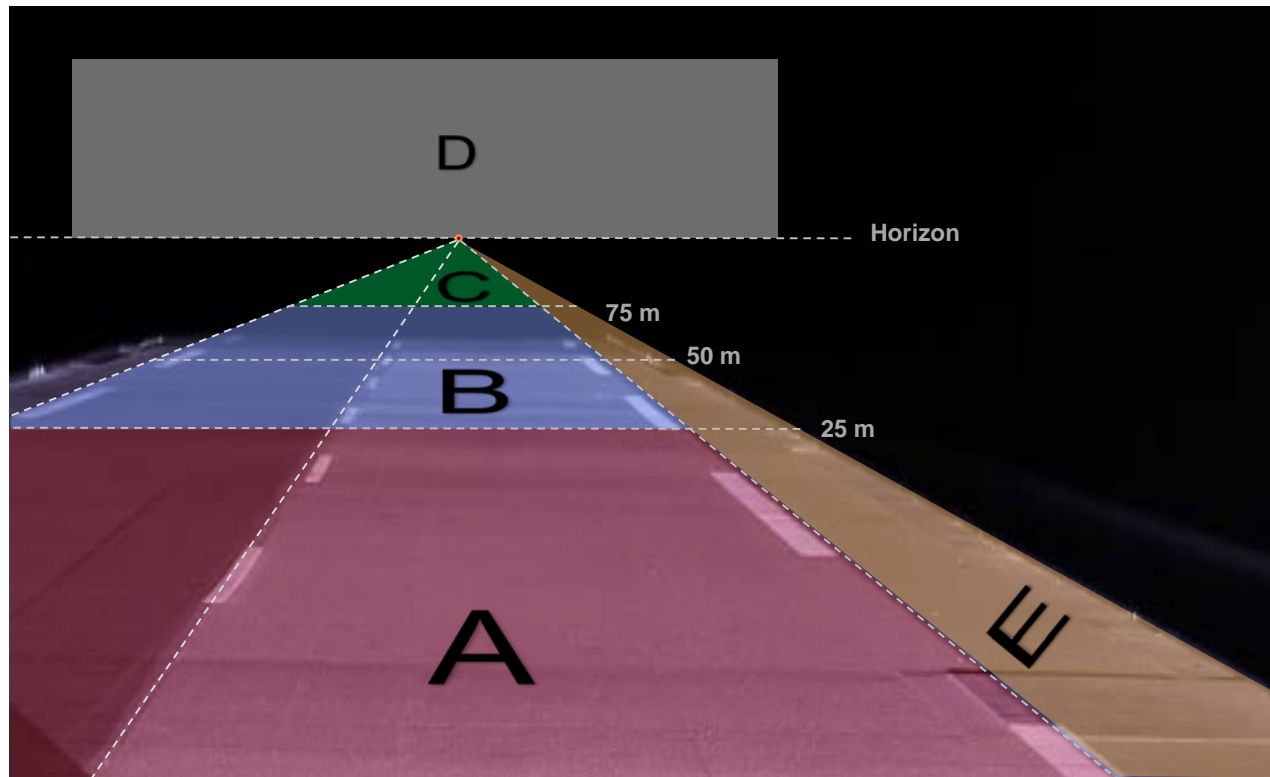
Digitalization of Lighting with new HD technologies

Use cases: Mega Trends – Motivation Digital Light



Digitalization of Lighting with new HD technologies

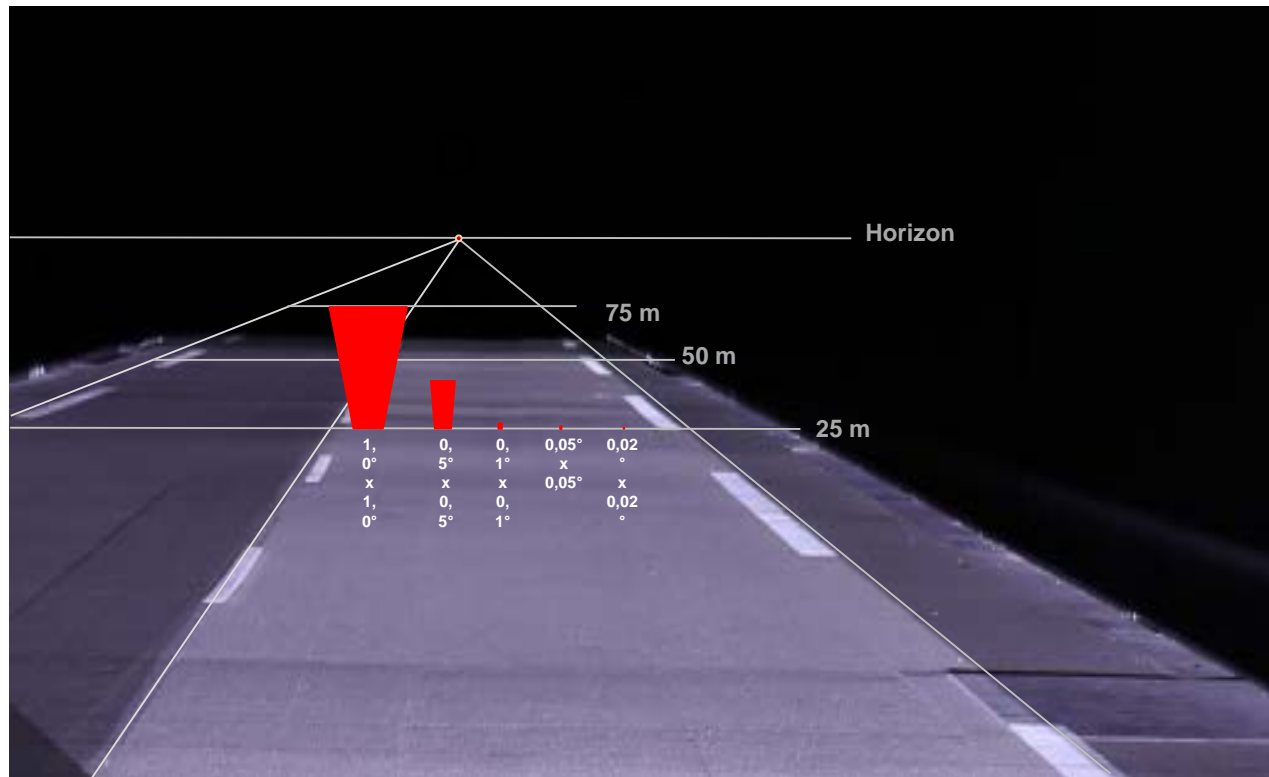
Use cases: Field of action



Digitalization of Lighting with new HD technologies

Use cases: Resolution

The size of a pixel is classified in 3 different classes: $0,02^\circ \rightarrow 0,05^\circ$, $0,05^\circ \rightarrow 0,1^\circ$, $0,1^\circ \rightarrow 1^\circ$



Digitalization of Lighting with new HD technologies

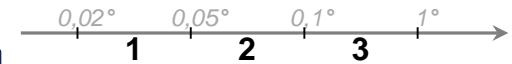
Use cases: Clusters

Functional

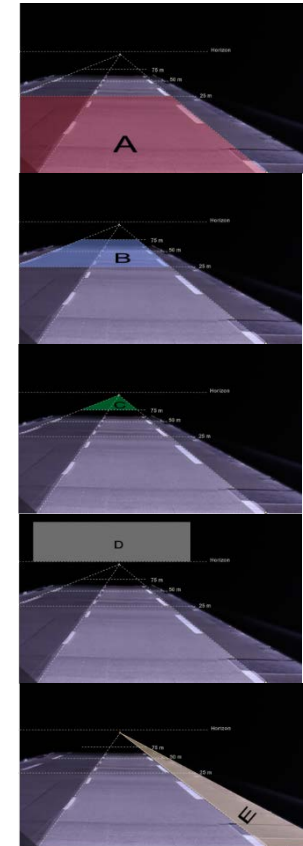
Car to Pedestrian

Car to Driver

Scenery



1	The beam pattern to adapt to the curves: Swiveling Low beam	B3
2	Cut off on optimal position in function of the speed to ensure better visibility	C2
3	Enlarge the beam pattern if the car is at low speed, sharp curves or stopped and TI	A3
4	Adapt the beam pattern to the bad weather conditions	A3
5	Automatic switch to UK, EU and SAE beam pattern	C3
6	Automatic referencing of beam pattern to the 0 position	C2
7	Adjustable sharpness of the cut offs	C2
8	Beam's pattern shape and intensity adaptable to the speed	A, B, C3
9	Advanced Driving Beam (ADB)	D3



Digitalization of Lighting with new HD technologies

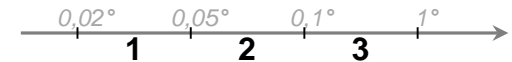
Use cases: Clusters

Functional

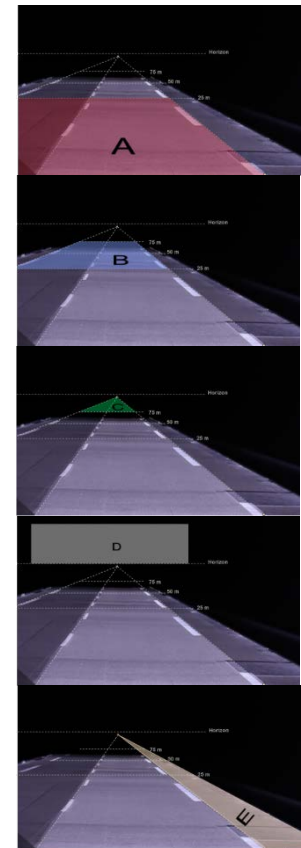
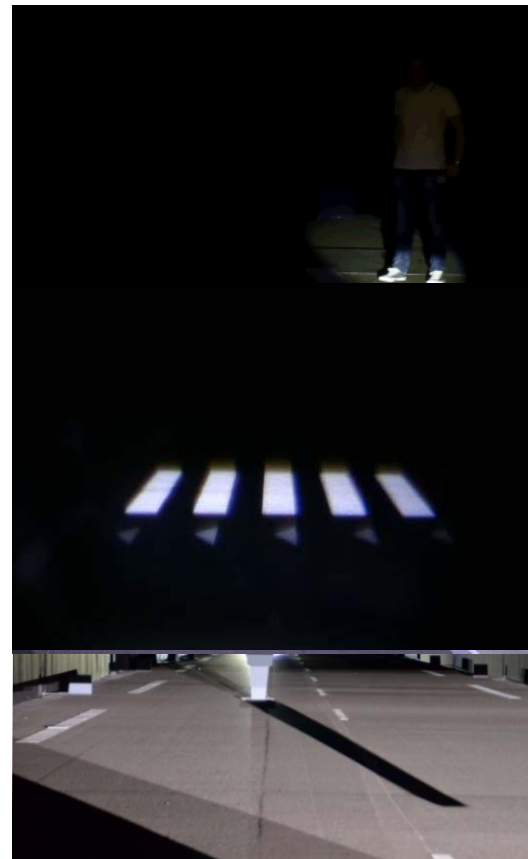
Car to Pedestrian

Car to Driver

Scenery



- | | | |
|----|---|----------|
| 10 | Car pedestrian detection alert by: | |
| | Negative | A, B, C3 |
| | Marking him with flashing light | B, C3 |
| | Marking his feet's, ... | B, C3 |
| 11 | Highlight the 'walkway' area in the critical situations | E3 |
| 12 | Projection of pedestrian path (zebra) in front of the pedestrian and information's that he can cross safely | A2 |



Digitalization of Lighting with new HD technologies

Use cases: Clusters

Functional

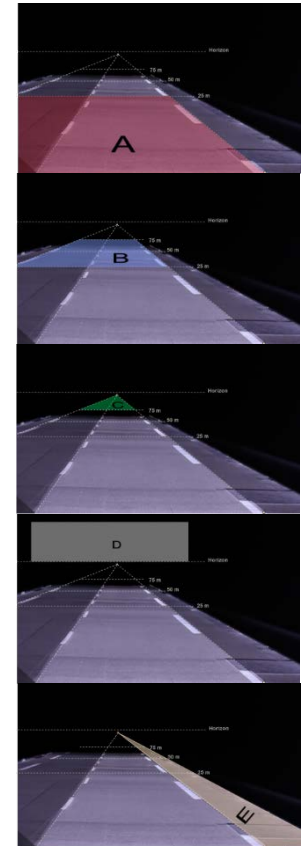
Car to Pedestrian

Car to Driver

Scenery



- | | | |
|----|--|------|
| 13 | Project optical lane assist allowing the driver to visualize his trajectory | AB2 |
| 14 | Highlight the driving path | ABC2 |
| 15 | Warn about eventual hazards | A2 |
| 16 | Project animated navigation information on the road to maximize the driver sight on the road (Arrows changing the dimension and the shape when getting closer to the crossroad, speed limits) | AB1 |
| 17 | Illuminate intelligently the non respected traffic signs | D2 |



Digitalization of Lighting with new HD technologies

Use cases: Clusters

Functional

Car to Pedestrian

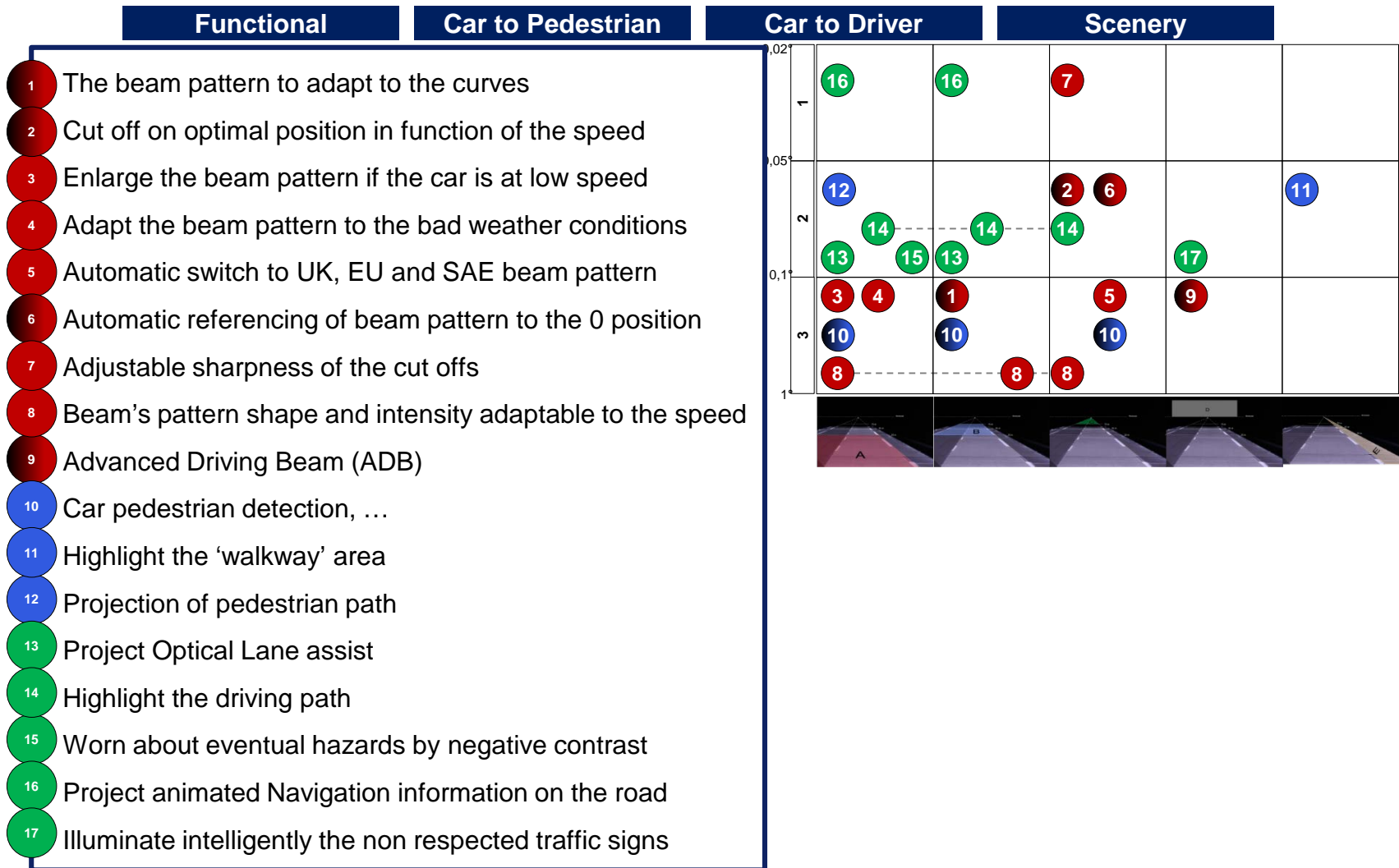
Car to Driver

Scenery



Digitalization of Lighting with new HD technologies

Use cases: Summary



Digitalization of Lighting with new HD technologies

Use cases: Summary

STATE-OF-THE-ART FUNCTIONS

e.g. bend light, glare-free high beam, etc. with optimized end-user impact

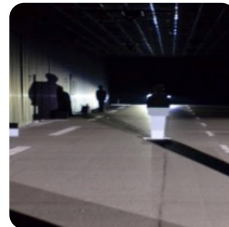


Advanced Driving Beam



C2P (CAR TO PEDESTRIAN)

New functionalities e.g. pedestrian marking, guided attention, highlight the walk way etc.



Pedestrian marking

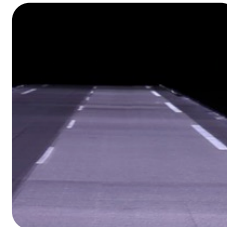


C2D (CAR TO DRIVER)

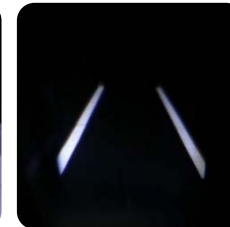
New functionalities e.g. accentuation of driving lanes, optical lane assist, hazard warning, etc.



Highlight the walk way



Extended driving light



Optical lane assist



Hazard warning

Ideal technological solution to be selected based on requirements analysis of currently identified use cases for light functions (required resolution, contrast, intensity, illumination zone)

Digitalization of Lighting with new HD technologies

Use cases supported by technology

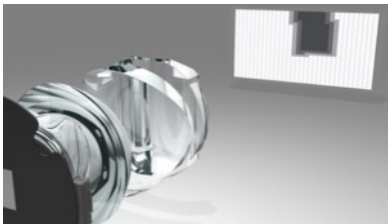
DIGITALIZATION OF LIGHT



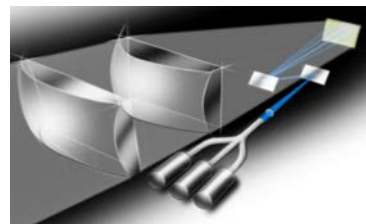
- Holistic environment sensor system as key enabler for new functionalities
- New use cases contributing to car safety and driving comfort
- Implementation of new functions through software updates and software upgrades



NEW HIGH-DEFINITION TECHNOLOGIES



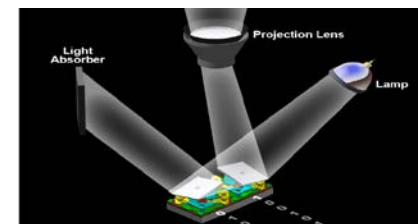
μAFS
(solid state-light)
~4.000 Pixel



Laser Scanner
<10.000 Pixel



LCD
(Liquid Crystal)
>50.000 Pixel

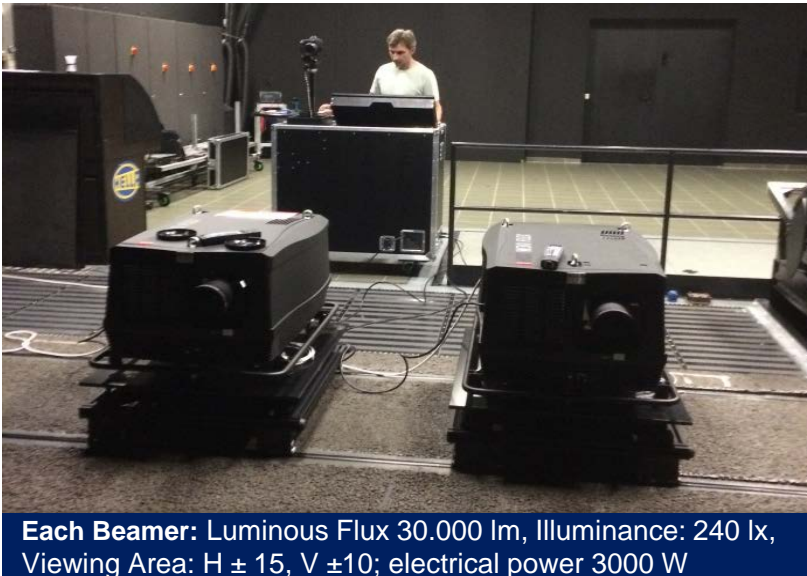


DMD
(Digital Mirror Device)
>500.000 Pixel

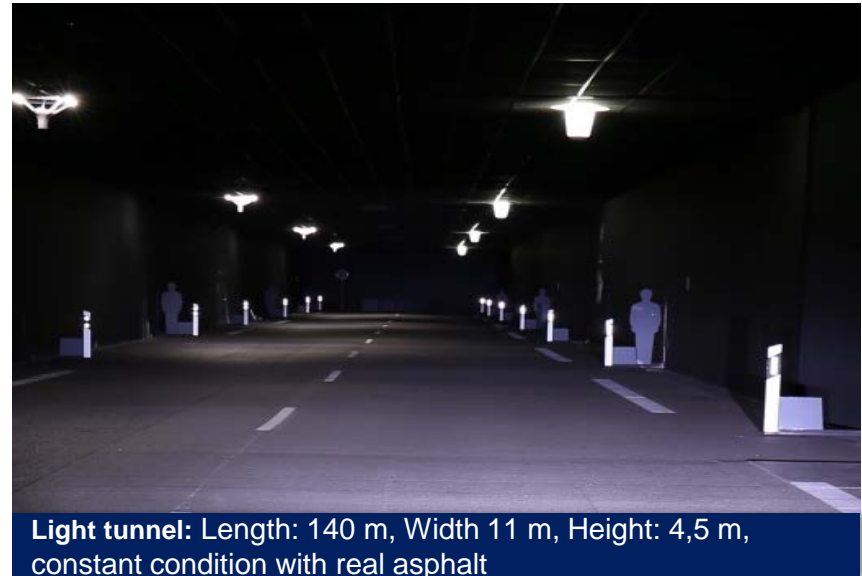
Digitalization of Lighting with new HD technologies

Use cases supported by technology

Beamers: Simulate / show every use case



Reality: Light tunnel environment for beamers



For each functionality / Use case the requirements for resolution, contract, intensity, etc. can be evaluated in reality.

These results in combination with the technological capability of new HD-technologies can be used to select the appropriate one

Digitalization of Lighting with new HD technologies

Use cases supported by technology



μAFS (solid state-lighting)
~4.000 Pixel



LC-HD (Liquid Crystal)
>50.000 Pixel



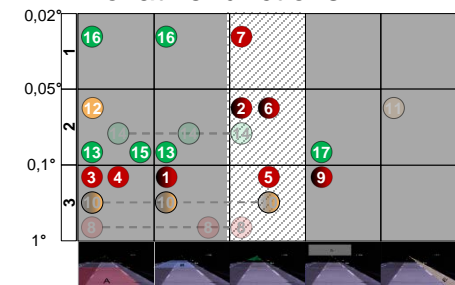
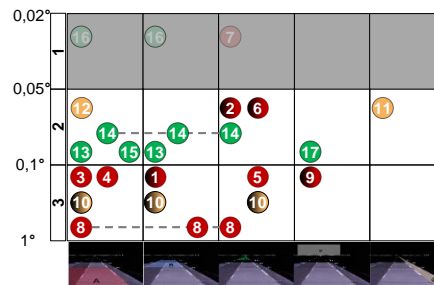
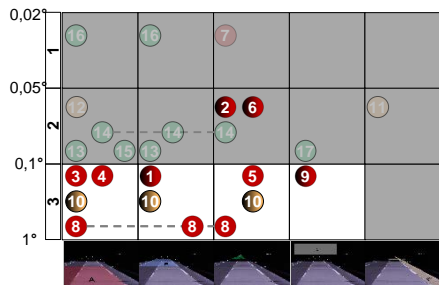
DLP (Digital Light Projection)
>500.000 Pixel

Characteristics

- ⊖ Relatively **moderate** resolution
- ⊕ **Full** illumination zone
- ⊖ **Limited** presentation of innovative functions

- ⊕ **High** resolution
- ⊕ **Full** illumination zone
- ⊕⊕ **Very Good** presentation of innovative functions

- ⊕⊕ **Very high** resolution
- ⊖ **Reduced** illumination zone, combination with high beam module necessary
- ⊕⊕ **Very good** presentation of innovative functions



LCD-Technology is fitting best for „high resolution“ and biggest area of coverage on the street
(balanced flexibility for new functionalities)

Digitalization of Lighting with new HD technologies

Use cases summary: Key take away

- **Use cases can be clustered:** Functional, Car to pedestrian, Car to Driver and Scenery
- The use cases are characterized by **2 major physical parameters: Field** and **Resolution**
- Define your **use cases** and functionalities **first** then speak **technology**
- **The customer value is in the use cases**

Digitalization of Lighting with new HD technologies

The art of Light



LIQUID CRYSTAL HD

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Technology with Vision

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