

Proceedings

**ATZ** live

Michael Bargende · Hans-Christian Reuss  
Andreas Wagner *Hrsg.*

# 20. Internationales Stuttgarter Symposium

Automobil- und Motorentechnik

Band 2



 Springer Vieweg

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# Proceedings

Ein stetig steigender Fundus an Informationen ist heute notwendig, um die immer komplexer werdende Technik heutiger Kraftfahrzeuge zu verstehen. Funktionen, Arbeitsweise, Komponenten und Systeme entwickeln sich rasant. In immer schnelleren Zyklen verbreitet sich aktuelles Wissen gerade aus Konferenzen, Tagungen und Symposien in die Fachwelt. Den raschen Zugriff auf diese Informationen bietet diese Reihe Proceedings, die sich zur Aufgabe gestellt hat, das zum Verständnis topaktueller Technik rund um das Automobil erforderliche spezielle Wissen in der Systematik aus Konferenzen und Tagungen zusammen zu stellen und als Buch in [Springer.com](http://www.springer.com) wie auch elektronisch in Springer Link und Springer Professional bereit zu stellen. Die Reihe wendet sich an Fahrzeug- und Motoren-Ingenieure sowie Studierende, die aktuelles Fachwissen im Zusammenhang mit Fragestellungen ihres Arbeitsfeldes suchen. Professoren und Dozenten an Universitäten und Hochschulen mit Schwerpunkt Kraftfahrzeug- und Motorentechnik finden hier die Zusammenstellung von Veranstaltungen, die sie selber nicht besuchen konnten. Gutachtern, Forschern und Entwicklungsingenieuren in der Automobil- und Zulieferindustrie sowie Dienstleistern können die Proceedings wertvolle Antworten auf topaktuelle Fragen geben.

Today, a steadily growing store of information is called for in order to understand the increasingly complex technologies used in modern automobiles. Functions, modes of operation, components and systems are rapidly evolving, while at the same time the latest expertise is disseminated directly from conferences, congresses and symposia to the professional world in ever-faster cycles. This series of proceedings offers rapid access to this information, gathering the specific knowledge needed to keep up with cutting-edge advances in automotive technologies, employing the same systematic approach used at conferences and congresses and presenting it in print (available at [Springer.com](http://www.springer.com)) and electronic (at Springer Link and Springer Professional) formats. The series addresses the needs of automotive engineers, motor design engineers and students looking for the latest expertise in connection with key questions in their field, while professors and instructors working in the areas of automotive and motor design engineering will also find summaries of industry events they weren't able to attend. The proceedings also offer valuable answers to the topical questions that concern assessors, researchers and developmental engineers in the automotive and supplier industry, as well as service providers.

Weitere Bände in der Reihe <http://www.springer.com/series/13360>

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Andreas Wagner  
(Hrsg.)

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*Hrsg.*

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## WELCOME IN STUTT GART

The car is currently undergoing a complete reinvention. And for us there is a lot at stake: our role as technological pioneers, our economic strength, many jobs and conservation of our natural resources. The Stuttgart International Symposium for Automotive and Engine Technology, now in its 20<sup>th</sup> year, is intended to enable a fruitful exchange of expertise and creative ideas in order to meet this great challenge. I am delighted to be the patron for this event, and I welcome the participants from all around the world to our state capital!

The automotive industry is an especially important component of our economic power, particularly in Baden-Württemberg. Going forward, these key industries must adapt to ecological and political climate requirements. But we can only shape the future of our automotive economy by working together with everyone involved in this process. My state government is also supporting this development with the cross-sector “Baden-Württemberg Automotive Industry Strategic Dialog”, because the transition to sustainable and digital mobility requires expertise from diverse areas – from business, science, trade unions, associations, civil society and politics.

With more than 100 lectures and 800 participants, the Stuttgart International Symposium is one of the largest congresses for vehicle and engine development in Europe. So I would like to take the opportunity to thank the organizers of this congress, and wish all the guests inspiring conversations and exciting new knowledge!

Winfried Kretschmann  
Prime Minister of the State of Baden-Württemberg

## **A WARM WELCOME**

### **The zero carbon car – technical challenges of the future**

The mobility transition and intermodal mobility; car sharing versus shared space, digitalization, automation and networking, e-fuels, batteries or fuel cells after all? The current discussions concerning the future of personal transport are generally characterized by uncertainty and open questions, rather than clear answers and confidence. This is perturbing the industry: unsettling it on the one hand and on the other hand making it more important than ever to get to grips with the issues involved.

With its focus on “The challenges of future technology” and its diverse program of lectures, the 20<sup>th</sup> Stuttgart International Symposium grapples with these questions. It hopes to help the industry approach these future-related topics and provide a platform for – potentially controversial – discussions.

The program structure has also changed. In response to requests from our participants we are now offering more opportunities for collaboration and networking:

- » In the World Café, you can work on specific solutions for current problems in our industry. The results of this creative unit will be presented directly to a wide audience directly before the podium discussion.
- » We'll be celebrating the Stuttgart International Symposium's 25<sup>th</sup> birthday with a stand party in the exhibition.
- » A poster session and a tour of the exhibition are further new features.

You can also expect some optical changes on location, along with some familiar elements!

**We are curious to hear your feedback and look forward to seeing you in Stuttgart on March 17 and 18, 2020!**

*Prof. Dr. Michael Bargende*

*Prof. Dr. Hans-Christian Reuss*

*Prof. Dr. Andreas Wagner*

# INDEX – Volume 2

## SECTION 1

### STRATEGIES FOR COMMERCIAL VEHICLE DRIVETRAINS 2030

Chairperson: Prof. Dr. Thomas Koch

**The future of combustion engines from the perspective  
of rail applications** 1

Andreas Wegmann, M. Gayer, J. M. Voith SE & Co. KG, VTA;  
B. Gay, M. Pister, Liebherr Machines Bulle SA

**Strategies for commercial vehicle drivetrains 2030** 3

Philip Scarth, FPT Motorenforschung AG

**The commercial vehicle in 10 years and beyond –  
Still with a classic ICE?** 5

Christian Weiskirch, A. Kammel, TRATON GROUP

### CONNECTED CAR

Chairperson: Prof. Dr. Andreas Wagner

**5G network infrastructure & autonomous driving –  
The next generation C-V2X technology** 7

Walter Haas, HUAWEI TECHNOLOGIES Deutschland GmbH

**Welcome to the photonic age in automotive industry** 9

Martin Enenkel, Jenoptik Optical Systems GmbH

**SEAT's digital transformation in two dimensions** 23

Sebastian Grams, SEAT S.A., VW Group



**FUELS**

Chairperson: Prof. Dr. Stefan Pischinger

**Methanol as an electricity-based fuel for plug-in hybrid electric vehicles** 31

Tobias Bieniek, K. Rößler, F. Otto, Mercedes-Benz AG

**E-fuels as chemical energy carrier under the aspects of costs and efficiency** 47

Martin Rothbart, J. Rechberger, AVL List GmbH

**Potential analysis and virtual development of SI Engines operated with DMC+** 49

Michael Grill, C. Wagner, M.-T. Keskin, M. Bargende, FKFS; L.Cai, H. Pitsch, ITV, RMTH Aachen University; S. Blochum, LVK, TU München

**ELECTRIC DRIVETRAINS**

Chairperson: Prof. Dr. Michael Auerbach

**Supporting the synthesis of electric drive systems with scenario management** 75

Adrian Braumandl, F. Marthaler, K. Bause, F. Ranly, IPEK, Karlsruher Institut für Technologie (KIT)

**Protection of e-axes and innovative drivetrains with multipurpose oil filter systems** 89

Marius Panzer, C. Wagner, A.-L. Winkler, A. Wöll, R. Bernewitz, MANN+HUMMEL GmbH

**Breaktor™ – advanced protection for high voltage circuits in electric vehicles** 101

Till Wagner, K. Calzada, Eaton Electrical Products Ltd

**E-MOBILITY**

Chairperson: Jürgen Schenk

<b>Range prediction and e-mobility – The complexity behind a length scale</b>	<b>111</b>
Rafael Abel, F. Beutenmüller, S. Stein, TWT GmbH	
<b>Calculation of driving consumption of an electric city bus</b>	<b>113</b>
Joscha Reber, L. Braun, EvoBus GmbH	
<b>Entrance to an electrified last mile ecosystem project “bring your own battery”</b>	<b>129</b>
Markus Geiger, B. Budaker, csi entwicklungstechnik GmbH; G. Lange, C. Schmidt, AUDI AG	
<b>How accurate can a range calculation of an electric vehicle be?</b>	<b>139</b>
Lisa Braun, EvoBus GmbH	

## SECTION 2

### TESTING

Chairperson: Prof. Dr. Karl-Ludwig Haken

**Testing in times of big data and machine learning** 155

Hendrik Bohlen, P. Assendorp, Werum Software & Systems AG

**Testing ADAS end-of-line – Avoid the hazardous effects** 157

Frank Heidemann, SET GmbH

**Consumption-relevant load simulation during cornering at the vehicle test bench VEL** 159

Martin Gießler, P. Rautenberg, F. Gauterin, Karlsruhe Institute of Technology (KIT)

### BIG DATA

Chairperson: Prof. Dr. Eric Sax

**AI and big data management for autonomous driving (AD)** 173

Frank Kraemer, IBM

**Semantic segmentation of solid state LiDAR measurements for automotive application** 179

Sören Erichsen, M. Schmidt, Ibeo Automotive Systems;  
J. Nitsch, Ibeo Automotive Systems, ETH Zurich;  
A. Schlaefler, Hamburg University of Technology

**Method for a scenario-based and weighted assessment of map-based advanced driving functions** 193

Carl Esselborn, M. Eckert, M. Holzäpfel, E. Wahl, Dr. Ing. h.c. F. Porsche AG; E. Sax, Karlsruhe Institute of Technology (KIT)

**FUEL CELL**

Chairperson: Prof. Dr. Helmut Eichseder

**Validation of fuel cell control units with powerful simulation platforms for fuel cells** 209  
 Abduelkerim Dagli, M. Seeger, MicroNova AG

**FCEV simulation – Electrochemical battery and fuel cell models on vehicle level** 219  
 Johann C. Wurzenberger, T. Glatz, AVL List GmbH; D. Rašić, G. Tavčar, AVL-AST d.o.o.; I. Mele, A. Kregar, T. Katrašnik, University of Ljubljana

**Holistic design of innovative cathode air supply for automotive PEM fuel cells** 235  
 Michael Harenbrock, A. Korn, A. Weber, MANN+HUMMEL GmbH; E. Hallbauer, MANN+HUMMEL Innenraumfilter GmbH & Co. KG

**ECMS based on system-specific control parameter adaption of a fuel cell hybrid electric vehicle** 251  
 Sergei Hahn, J. Braun, H. Kemmer, Robert Bosch GmbH; H.-C. Reuss, IVK, Universität Stuttgart

**SENSORS & ACTUATORS**

Chairperson: Prof. Dr. Karl-Ludwig Krieger

**Using machine learning methods to develop virtual NOx sensors for vehicle applications** 265  
 Robert Fechert, B. Bäker, S. Gereke, F. Atzler, IAD, TU Dresden

**Image-based condition monitoring of a multi-LED-headlamp** 281  
 Pascal Janke, J. Cai, HELLA GmbH & Co. KGaA; M. Niedling, L-LAB; T. Bertram, RST, TU Dortmund

**Measurement and testing of lidarsensors** 297  
 Andy Günther, B. Bäker, IAD, TU Dresden

## SOFTWARE

Chairperson: Prof. Dr. Lennart Löfdahl

**Credibility of software-in-the-loop environments for  
integrated vehicle function validation** 399

Indrasen Raghupatruni, S. Burton, M. Boumans, T. Huber, A. Reiter,  
Robert Bosch GmbH

**Big data driven vehicle development – Technology and potential** 315

Tobias Abthoff, P. Fank, D. Boja, NorCom Information Technology  
GmbH & Co. KGaA

**Continuous development environment for the validation of  
autonomous driving functions** 327

Sebastian Lutz, M. Behrendt, A. Albers, IPEK, Karlsruher  
Institut für Technologie (KIT)

## HYBRID POWERTRAINS

Chairperson: Prof. Dr. Christian Beidl

**Impact of future 48 V-systems on powertrain operation  
under real-driving conditions** 345

Daniel Förster, M. Timmann, R. Inderka, J. Strenkert, Mercedes-Benz AG;  
F. Gauterin, Karlsruhe Institute of Technology (KIT)

**Model based development of optimum control strategies  
for hybrid electric vehicles** 361

Christoph Pötsch, A. Cvikl, J. C. Wurzenberger, AVL List GmbH

**Virtual powertrain – Vehicle simulation on the engine test bench  
with an implemented P2 topology** 377

Sebastian Lachenmaier, L. Cross, C. Ferrara, A. Greis, M. Wüst,  
D. Naber, Robert Bosch GmbH

**MAHLE modular hybrid powertrain equipped with passive  
MAHLE jet ignition** 393

Neil Fraser, M. Berger, MAHLE International GmbH; S. Reader,  
M. Bassett, A. Cooper, MAHLE Powertrain Limited

**SECTION 3****EMISSIONS**

Chairperson: Prof. Dr. Georg Wachtmeister

- Phase change cooled manifold for RDE compliant powertrains** 409  
Thomas Arnold, M. Krause, IAV GmbH
- Analysis of scavenging air post-oxidation by means of 3D-CFD simulation including reaction mechanism** 421  
Rodolfo Tromellini, J. Przewlocki, F. Cupo, M. Bargende, IVK, Universität Stuttgart; M. Chiodi, FKFS
- Use of oxygenate blends as inflammation aid in diluted mixtures** 439  
Moritz Grüninger, O. Toedter, T. Koch, IFKM, Karlsruher Institut für Technologie (KIT)

**EE-ARCHITECTURE**

Chairperson: Prof. Dr. Gerhard Hettich

- Fault tolerant electric energy supply system design for automated electric shuttle bus** 441  
Marcus Goth, D. Keilhoff, H.-C. Reuss, IVK, Universität Stuttgart
- Concepts of functional safety in E/E-architectures of highly automated and autonomous vehicles** 457  
Dennis Niedballa, H.-C. Reuss, IVK, Universität Stuttgart
- Toolchain for architecture development, modeling and simulation of battery electric vehicles** 471  
Carl Friedrich Hettig, P. Orth, FEV Europe GmbH; M. Deppe, T. Pajenkamp, dSpace GmbH; C. Granrath, J. Andert, RWTH Aachen University

## **HEATING & COOLING**

Chairperson: Prof. Dr. Stefan Böttinger

- Model-based approach for on-demand temperature control** 485  
Alexander Herzog, IAV GmbH; M. Fuchs, IFT, Leibniz Universität Hannover; A. Vagapov, IAV GmbH und IFT, Leibniz Universität Hannover
- Preheating components with metal hydrides or lime –  
Small, high power, no additional energy** 501  
Mila Kölbig, I. Bürger, M. Schmidt, M. Linder, ITT, Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR)
- Fast running detailed battery thermal management models  
based on 1D-3D synergetic approach** 511  
Dig Vijay, N. Framke, P. Stopp, Gamma Technologies GmbH
- Artificial Intelligence in predictive thermal management  
for passenger cars** 529  
Felix Korhals, M. Stöcker, Daimler AG; S. Rinderknecht, TU Darmstadt

## **AGILE DEVELOPMENT**

Chairperson: Prof. Dr. Tobias Flämig

- Continuous integration in powertrain software –  
Today and tomorrow** 545  
Daniel Heß, D. Volquard, R. Siedel, F. Feyerherd, IAV GmbH
- Managing software evolution in embedded automotive systems** 557  
Lukas Block, IAT, Universität Stuttgart
- Agile systems engineering for critical systems** 573  
Christof Ebert, Vector Consulting Services; F. Kirschke-Biller, Ford

**POWERTRAIN SIMULATION**

Chairperson: Prof. em. Dr. Günter Hohenberg

**Discretization and heat transfer calculation  
of engine water jackets in 1D simulation** 583  
Florian Mandl, M. Grill, M. Bargende, FKFS/IVK,  
Universität Stuttgart

**Optical investigations for the optimization and calibration  
of 3D-CFD injection models** 605  
Simon Hummel, A. Vacca, M. Reichenbacher, K. Müller,  
A. Kächele, M. Koch, M. Bargende, FKFS/IVK, Universität Stuttgart

**Accelerated assessment of optimal fuel economy benchmarks  
for developing the next generation HEVs** 623  
Pier Giuseppe Anselma, G. Belingardi, Politecnico di Torino

**BATTERY**

Chairperson: Prof. Dr. Andreas Friedrich

**Front loading approach in battery development  
for generation update** 641  
Paul Schiffbänker, N. Dejanovic, AVL List GmbH

**CO<sub>2</sub>-neutral battery production in Europe –  
How to make it happen?** 655  
Robert Stanek, M. Hackmann, P3 automotive GmbH

**Greater sustainability with a second life of used electric  
vehicle batteries** 663  
Jürgen Kölch, EVA Fahrzeugtechnik GmbH

**Increased safety for battery electric vehicles  
by using heat-resistance stainless steels** 673  
Stefan Lindner, Outokumpu Nirosta GmbH



## **SPEAKERS, CHAIRPERSONS**

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TWT GmbH

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# The future of combustion engines from the perspective of rail applications

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# Strategies for commercial vehicle drivetrains 2030

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# **The commercial vehicle in 10 years and beyond – Still with a classic ICE?**

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## Abstract

The Commercial Vehicle Business is at the beginning of more disruptive change driven by electrification, automation and digitization. New technologies will be introduced with growing frequency. In the same time the demands from legislation but even more important from society to step out of fossil energy sources towards CO<sub>2</sub>-neutral transport solutions forces the manufacturers of Commercial Vehicles to continue to improve on the classic technologies but as well manage the transition into the new areas.

Long term the future for the Commercial Vehicles will be electric without any doubts, but the point in time when this will happen is discussed controversially between governments, politicians, manufactures but even within departments in the companies. And this discussion is not based on TCO-calculations, the purely TCO based tipping points will be reached in only a couple of years. Necessary infrastructures, customer acceptance, global scale and various uncoordinated incentives and initiatives are discussion topics that lead to a diffuse and fuzzy view on the total picture – which crystal ball is really the right one?

Same goes for the transition period, where the manufacturers will earn the majority of their income with the classic technologies also to finance the development of the next generations. Various opportunities are already available, from more evolutionary green drop-in fuels to more revolutionary hydrogen in internal combustion engines or fuel cells. Also in this more or less well known technologies it's unclear on which horses to put the bets on, but it is clear that it is impossible to develop solutions for all options.

Looking back in time the engineers have already demonstrated that whatever challenge a new fuel brings – the necessary technology will be made available. But can that be afforded for shrinking volumes or even niche-applications?

The future for in city applications like busses, distribution trucks and typical special vehicle for garbage collection, street cleaning and such is quite clear electric. The ecosystem is known and aside some infrastructure challenges and also necessary adoptions in operations the transition will happen quite fast. Also regional distribution and regional haulage can be handled with electrified vehicles quite soon. For busses operating interurban but for sure long distance maybe different solutions need to applied. Long haulage operation on the other hand can be handled with electric vehicles if you change the typical operation pattern or with the expected improvement in battery and charging technology. The situation becomes different, if the vehicle is used for work instead of transport. It makes heavy machinery mobile and with the internal combustion engine it delivers the power for the operation in almost every accessible spot in the world. And a refill of the high density energy storage is in this case easy to handle.

Can we change this within 10 years or will the modern ICE survive much longer?



# 5G network infrastructure & autonomous driving – The next generation C-V2X technology

Walter Haas, HUAWEI TECHNOLOGIES Deutschland GmbH

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# Welcome to the photonic age in automotive industry

Martin Enenkel, Jenoptik Optical Systems GmbH

# 1 The Photonic Age in Automotive Industry at start of page

The Photonic Age within the Automotive Industry has started already long time ago for more than 100 years. Coming from candles to illuminate drive ways to today's PIXEL Lighting and Laser beams in car headlamps or Organic-LED (OLED) in Backlighting.

Long Range LiDAR-Systems (Figure 1) supports Autonomous Driving and adequate driver information systems inform pilots from multicolor head up displays (Figure 2).

Car to Car commutation is used as a bi-directional communication to ensure safety handshakes.

Femto-Second Laser Equipment enables manufacturers to do micro drilling to define weakness sweat points at structure elements (Figure 3 +4) with batch size one.

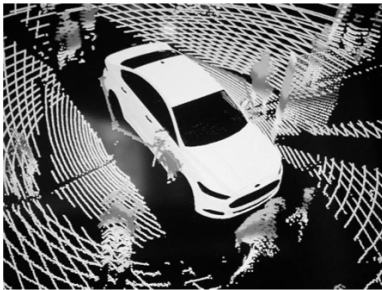


Figure (1)



Figure (2)

Photonics is enabler for:

- Autonomous driving and connected cars
- Digitalization



Figure (3)

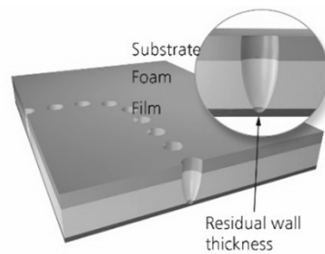


Figure (4)

Beam shaping optics allows to adjust laser tools to the customer needs in terms of material to handle, process timing and fit, from and function. Compared with multi axis robot cells, photonics makes the car production fast, more stable and more flexible (Figure 5+6).

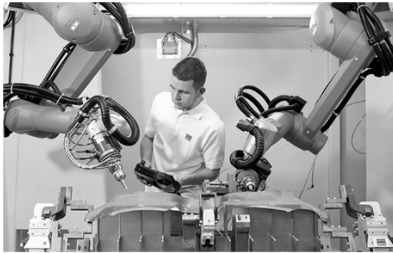


Figure (5)

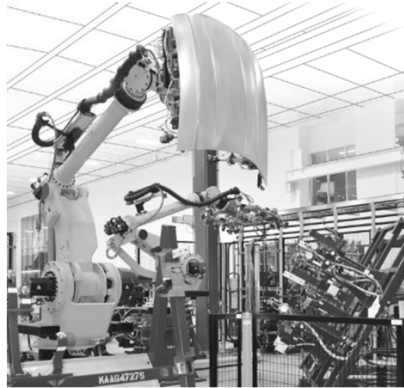


Figure (6)

Today's automotive industry is not only about car manufacturing or car parts and equipment, it is also about the environment. Traffic control, law enforcement (Figure 7) and safety and security (Figure 8) are major investment areas for photonics in the automotive industry.



Figure (7)



Figure (8)

Photonics makes roads and communities safer

## 2 Jenoptik Divisions are addressing areas in the Automotive Industry

Jenoptik addresses the automotive industry with his 3 divisions

- Light and Production (L&P)
- Light and Optic (L&O)
- Light and Safety (L&S)

**Light and Production Division (L&P)** provides engineering with focus on smart manufacturing and process automation for automotive industrial customers (Figure 9).

Therefore Photonics makes the car production faster, more stable and more flexible.

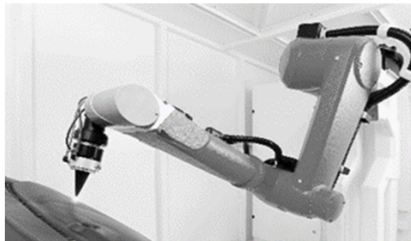


Figure (9) Division Light & Production for car manufacturing

**Light and Optics Division (L&O)** provides engineering with focus on state of the art opto-electronics. From component level, over modules (Figure 10) to full system solution for full integration as Tier#2 supplier.

Therefore Jenoptik brings Photonics at the heart of our OEM customers.

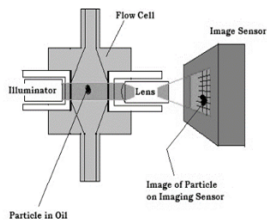


Figure (10) Division Light & Optics for car on board systems