


*Research and Development*

Light

Electronics





## ***Innovations for the Automotive Future***

**Light:** Research and Development form a strategic core competence in which Hella continuously invests at the highest level. LED technology and assistance systems with a promising future took center stage in the division Light during reporting year 2003-2004. Investments in the business division Light totaled € 55.8 million. Thanks to our innovations we have successfully positioned ourselves as technological leader in the motor vehicle lighting technology segment.

### **Assistive Light for the Most Demanding Safety Requirements**

The first adaptive light systems are currently entering series production, and at the same time our development is concentrating on the future. Our company worked jointly with vehicle manufacturers on a new headlamp generation during fiscal year 2003-2004. In the future, lighting technology will go beyond adaptive light functions to offer functionalities that will make significant improvements in traffic safety and assist the driver – for example in the form of direct marking of dangerous objects, and reduced dazzling of oncoming traffic.

### **LED Technology in Headlamps**

Diodes are firmly established as light sources in the area of signal lamps. In the near future, our company will also use LED technology extensively in headlamps, for high beam, fog lights and low beam, as well as for direction indicators and daytime running lights.

The possibility of using LEDs for main lighting functions result from the development of white light-emitting diodes. We built prototypes to demonstrate the potential and performance capability of the product to our customers during fiscal year 2003-2004. We worked intensively with light source manufacturers to develop LEDs that can be used in headlamps. Official approval of the new product generation is anticipated during the second half of this decade.

### **Ambient Light**

Further developments of interior lighting in the vehicle are currently greatly influenced by the topic of the production of light. Hella has been working on conclusive ambient interior lighting concepts since 1994 and has taken the first systems to series production. We are currently developing new approaches that take even better account of ergonomic aspects.



A development sample is checked before series production.

**Europe Goes for the Protection of Pedestrians**

In the European Transport Policy, the European Union has set itself the goal of cutting the number of accident victims in half by 2010. To do this, the fronts of all vehicles must fulfill much higher passive safety standards. From the end of 2005, stricter tests will be required. During the year under review we developed simulation tools for our headlamp systems. These simulation tools are validated by practical tests following the optimization phase.

The work is being done in close cooperation with Behr GmbH & Co. KG and the Plastic Omnium group of France, and offers high potential for synergies in the development of frontend modules. We are now beginning the preparatory conceptual work for the even more demanding safety requirements from 2010.

**Intelligent Combination Rear Lamp**

In addition to adaptive front lamps, we are also working on intelligent rear lighting. The ASIGNIS® – Adaptive Signal System – dynamically adjusts the intensity of the signal functions to the ambient brightness and to adverse weather conditions. At the same time, the signal pattern changes dynamically during various types of danger situations such as emergency braking, ABS activity, or accidents.

We have also developed new optical systems for signal functions in order to meet high requirements for the design of combination rear lamps and customers’ increased wishes to obtain a specific appearance using striking lighting technologies.

**Driving with Daytime Running Lights On Permanently**

A growing number of countries require daytime running lights because of the high safety effect. As the use of low beam in halogen main headlamps considerably reduces the service life of the bulbs while increasing fuel consumption, our company has developed LED daytime running light concepts. They have minimum energy consumption and ensure a functional life that is planned according to the service life of the vehicle. Implementing the concept within nine months, we brought the world’s first LED daytime running light to series production in the Audi A8.

**Technology for Drivers**

During the year under review, we further expanded the L-LAB research institute along with our partner, the University of Paderborn. In addition to researching and supporting technological innovations, the institute concentrated on processes to provide optimum assistance to the person behind the wheel.

The institute held the “1st International L-LAB Summer School 2003”, a one-week conference for experts from science and industry, in fall 2003. Eighteen employees and around twenty students are currently working in interdisciplinary teams for the automotive technology of the future.



Hella invests continuously in the development of software for vehicle electronics.

**Electronics:** Driver and passenger protection, software standardization, and complex sensor systems were the focus of our research efforts in the Electronics division. Hella invested a total of €102.1 million in electronics development during the past fiscal year, making us one of the leading innovation suppliers in this segment. The company as a whole spends an average of eleven percent of sales on this important field for the future.

#### **Infrared Sensor Technology for Accident Prevention**

We have received the first order for series production of the Adaptive Cruise Control (ACC) system, and our research has demonstrated the technical feasibility of an ALASCA infrared laser scanner suitable for automotive use.

ALASCA serves to prevent accidents: The scanner supports safe stopping and starting, controls the vehicle safety systems (airbag or belt tensioner) and initiates emergency braking in dangerous situations. How does it work? The laser scanner scans the environment in front of the vehicle and uses this information to determine what actions are needed in an emergency.

We provided the evidence of feasibility jointly with IBEO Automobile Sensor GmbH, a subsidiary of Sick AG, the market leader in industrial laser scanners. We will decide on development for series production depending on what impetus there is from the market.

#### **The First Automatic Parking Assistant**

Customer surveys have indicated that parking support is one of the functions most desired by drivers. Last year we further developed the rear view camera for this convenience function and initiated a benchmark for the available close-range sensor technologies. We have an initial order for series production.

Our aim is to offer autonomous parking support within two to three years. Some large series already provide the necessary electrically-supported steering. We plan to implement a Hella parking algorithm in a real vehicle by the end of the new fiscal year. Vehicle manufacturers have told us of their interest in this product, which shows that they recognize our development competence in the sector.

#### **Data Networking for Complete Driver Support**

We are further developing our second generation assistance systems in accordance with the driver assistance roadmap, which we regularly update with our customers. Most previous functions were realized with a single sensor technology. The fusion of information from various sensors allows us to expand the scope of application and to improve the intuitive perception of functional behavior by the driver.



### Sensor for Passenger Protection

Body and convenience electronics are a core competence at Hella. This is why we have set up an “incubator” for these at Advanced Development. During the year under review we prepared the basis for an out-of-position sensing system. A stereo camera determines whether the passenger seat is occupied and delivers information on the seat position and the passenger to an airbag system. We are currently developing our integration skills in this area further.

### Driver Assistance with Face Recognition

Access control, driver authorization, and personalization of the vehicle are basic functions of modern body and convenience electronics. Hella is in a good position in this regard thanks to its radio-based access control. Driver identification using biometric features allows immediate, intuitive adjustment of the vehicle (access, air conditioning, radio setting, and driving characteristics) to each driver. We are currently presenting a sample of fingertip recognition to vehicle manufacturers.

During preliminary development we began to evaluate the potential of camera-based face identification. We think there are synergies with seat occupancy recognition and observation of the driver with regard to concentration and line of sight. During a next step with the support of the L-LAB Institute, we want to develop intuitive information and warning strategies which are dependent on the driver and the context, and which have a high level of user-friendliness.

### Automotive Open System Architecture

Our company has been a member of the AUTOSAR development partnership since January 2004. The goal of the initiative is to standardize function interfaces, hardware interfaces, and software interfaces so that modules can be integrated into existing vehicle architectures across suppliers and vehicle manufacturers.

With the comprehensive use of standardized modules, the automotive industry hopes for greater efficiency in development, as well as higher quality for new vehicle model series startups, and increasing acceptance of new electronic functions.

<b>Research and Development, Hella KGaA</b>	<b>2003-04</b>	<b>2002-03</b>	<b>2001-02</b>	<b>2000-01</b>	<b>1999-2000</b>
Employees	2,053	1,819	1,688	1,561	1,507
R & D expenditure in million €					
Lighting technology	55.8	69.4	63.3	56.8	53.9
Electronics	102.1	87.5	75.7	68.2	57.9
Vehicle modules*	–	–	–	–	5.3
Aftermarket products	13.8	11.0	10.1	8.9	5.5
Other	–	–	1.3	0.5	1.7
<b>Total</b>	<b>171.7</b>	<b>167.9</b>	<b>150.4</b>	<b>134.5</b>	<b>124.3</b>

\* Independent company

