

**Safety Technology Systems in
Commercial Vehicles
EXECUTIVE REPORT**

May 2004

Knibb Gormezano & Partners
INTERNATIONAL MANAGEMENT & TECHNOLOGY CONSULTANTS

The Old Vicarage
Market Place
Castle Donington
DERBY DE74 2JB
UNITED KINGDOM
Tel: +44 (0) 1332 856301
Fax: + 44 (0) 1332 856302
E-mail: consult@kcpauto.com
Web: www.kcpauto.com

TABLE OF CONTENTS

Knibb, Gormezano & Partners	1
Glossary	2
INTRODUCTION	3
Methodology and Scope	4
Acknowledgement	4
The Project	4
This Report	4
EXECUTIVE SUMMARY AND CONCLUSIONS	5
Active Safety Systems – A Route Map	5
Passive Safety Systems	5
Forecasts for Penetration	6
Analysis of the Relative Impact of Different Technologies	7
Quantitative Demand for Active Safety Systems	8
Vehicle Manufacturer Activity in Europe	8
International Comparisons	9
Operator Activity	10
Insurance Companies	10
Broad Cost/Benefit Analyses of the Major Systems	11
Suggested Actions for the Regulatory Bodies	11
Table of Contents for Full Study Results	13

Information contained in this document has been obtained by Knibb, Gormezano & Partners from industry sources believed to be reliable. However, because of the possibility of human or mechanical error by our sources, Knibb Gormezano does not guarantee the accuracy, adequacy, or completeness of any information and is not responsible for any errors or omissions or for the results obtained from the use of such information.

©Knibb, Gormezano and Partners 2004

KNIBB, GORMEZANO & PARTNERS

KGP is a Management Consultancy firm concentrating on the automotive and related sectors (including all transport equipment, agricultural and construction machinery, marine engines). We believe we are among the leaders in specialist automotive consultancy world-wide and can field acknowledged experts in all aspects of the business. Clients in the advanced economies of Europe, Japan and North America as well as those in the emerging economies of India, China and Russia etc will vouch for our professionalism and accomplishments.

The firm's services break down into three key segments:

- Market evaluation and strategy;
- Technology assessment and strategy;
- Business development and growth.

Within these three areas there are many individual deliverables including:

- Acquisition and joint venture search;
- Benchmarking;
- Commercial due diligence;
- Competitive appraisal;
- Distribution and servicing;
- Market research;
- Product Innovation Management;
- Technology Assessment & Forecasting;
- Technology transfer and licensing.

We work in both the OE and aftermarket, a major proportion of our efforts going into assignments for both the components and materials sectors.

The vast majority of our projects are conducted on the basis of single client commissions. However some studies on generic subjects of wide interest are multi-client. We also produce special reports on the industry from time to time. Our AutoBriefing newsletter is circulated to over 3,500 industry contacts worldwide.

GLOSSARY

ABS	Anti-Blockier Systems (Anti-Skid Brakes)
ACC	Adaptive Cruise Control
AM	Aftermarket
ASR	Anti-Schlupf-Regulung (Traction Control)
BBW	Brake-By-Wire
CDC	Continuous Damping Control
CW	Collision warning
DC	DaimlerChrysler
DIS	Driver information systems
DW	Drowsiness Warning
EBS	Electronic Braking Systems
EC	European Commission
ESP	Electronic Stability Program
FUPS	Front-underrun protection system
OEM	Original Equipment (Vehicle) Manufacturer
RSC	Roll-Stability Control
RSS	Roll-stability System
SBW	Steer-by-wire
TAS	Truck Active safety
TCS	Traction Control System (same as ASR)
TIS	Tyre inflation system
TPMS	Tyre pressure monitoring system

I

INTRODUCTION

This study into Active Safety Systems on commercial vehicles has been undertaken in response to a growing interest amongst vehicle manufacturers transport operators and regulatory bodies in finding ways to reduce road accidents involving trucks and thereby make a significant contribution to the European Commission's target of halving road deaths by 2010.

Most passive safety systems, such as seat belts, under-run protection or front impact absorption have all been legislated as legal requirements within the EC. Amongst the large number of Active Safety Systems we examine within this study only ABS has been introduced as a legal requirement. Indeed, Active Safety Systems other than ABS have only started relatively recently to be introduced by the vehicle manufacturers and taken up as options to a limited extent by truck operators. It was our belief in embarking on this study that the time was ripe to examine to what extent Active Safety Systems on commercial vehicles might evolve over the coming years and, more importantly, to what extent they might contribute to reductions in accident rates.

The research for the study was undertaken during the autumn of 2003. The research included a detailed study of the available and emerging Active Safety Systems, interviews with manufacturers, suppliers, operators and legislators. The research findings and ensuing analysis have led us to the conclusions, which are summarised in the following chapter.

The report contains the following specific information:

- A route map for the introduction of active safety systems in commercial vehicles and adoption rate scenarios;
- An analysis of the relative impact of different technologies;
- Analysis of the industry's quantitative requirements for active safety systems;
- Determination of percentage of accidents that can be avoided through active safety systems;

- Broad cost/benefit analyses of the major systems;
- Suggested actions for the regulatory bodies.

Methodology and Scope

This study has been carried out through wide-ranging interviews with key players in the sector as well as extensive desk research.

The geographic scope for this study is the European Union. However, account is taken of the global context by comparing the situation in Europe with key developments in North America and Japan. The study covers commercial vehicles (including trailers) with a GVW of over 6.0 tonnes.

Acknowledgement

In carrying out this research we had access to a large number of industry experts within the vehicle manufacturers, system suppliers, research institutions, fleet operators and the service industries involved in the sector. We are grateful for their contribution, without which this analysis would not have been possible.

The Project

This was a group sponsored project funded by vehicle and component/systems manufacturers. The client buy-in price is €20,000 with a discount for contributors to the research. All purchases come with the opportunity to discuss issues with members of the consulting team and receive a full presentation of the results and conclusions as well as multiple copies of the full report.

This Report

This executive report provides all the main conclusions and some of the detailed analysis provided from the study. It also includes a complete Table of Contents for the full study report.

II

EXECUTIVE SUMMARY & CONCLUSIONS

ACTIVE SAFETY SYSTEMS – A ROUTE MAP

Only ABS is currently legislated as a requirement on most commercial vehicles in Europe. Most Active Safety Systems are only in their 1st generation of development.

- We do not expect that the full benefits of the systems will be realised until 2nd or 3rd generation;
- Closer integration of the systems is also required to achieve full benefits;
- 2nd and 3rd generation will require more systems to be offered as standard to achieve significant penetration rates;
- Opportunities for aftermarket (AM) fitment will decrease;
- A factor, which is impeding the faster development of Active Safety Systems, is the question of where liability rests in the case of system malfunction – with the truck manufacturer or the systems supplier.

Passive Safety Systems

Whilst the focus for this report is Active Safety Systems, the role played by existing and future Passive Safety Systems needs to be taken into consideration. Passive Safety Systems, such as under-run protection systems, seat belts and airbags, deal with reducing the impact on potential casualties in the event of an accident. It is felt that Passive Safety Systems have largely been developed to the limit of their ability to contribute significantly to the reduction of road casualties. Many Passive Safety Systems are already the subject of legislation; however, in the case of seat belts the great majority of drivers are found not to be using them regularly.

This route map is based on our views of current technologies available, those under-development and discussions with leading truck manufacturers, systems suppliers and operators.

FORECASTS FOR PENETRATION

Based on the technology route map and an analysis of the effectiveness of active safety systems we have concluded that only a few major technologies will have a significant impact on active safety and therefore the penetration is forecast to be significant within this time period. These include ESP, ACC and Driver Monitoring.

Other technologies, such as Tyre Pressure Monitoring, may experience significant growth in the same period, but this will be to reduce tyre related costs and will not have a significant impact on active safety. It will be adopted by cost-conscious users, if the overall savings are clearly proven.

In the chapter Forecasts and Outlook we compare the above Non-Intervention Scenario with the Intervention Scenario, where legislation is introduced to make these four Active Safety Systems mandatory on new trucks throughout Europe. This analysis gives the interesting result that three of the Active Safety Systems, ESP, ACC and Lane Departure, have parc penetration levels running from 2 to 5 years ahead under the Intervention scenario. In the case of ESP this would result in a potential for lives saved of around 1400 between 2008 and 2025 if the results of GDV¹ research in Germany are extrapolated across the whole of Europe.

¹ Appendix A- The Accident Avoidance Potential of ESP in Trucks - Real Accident Analysis Findings; ATZ worldwide 5/2003 Volume 105

ANALYSIS OF THE RELATIVE IMPACT OF DIFFERENT TECHNOLOGIES

As the rate of application of Active Safety features on trucks in the short to medium term is forecast to be low, the potential impact they are able to have on reducing road casualties is therefore also low.

Worthwhile data on the causes and effects of accidents involving trucks is generally not available, which makes the analysis of the potential benefits of individual system technologies difficult to assess. DaimlerChrysler (DC), MAN and Volvo, the leading proponents of Active Safety Systems, have resorted to basing their own analyses on specific data they have researched, often with the assistance of academic institutions in Germany. Inevitably the sample sizes in such analyses are relatively small and reflect only the situation in Germany, which will differ from that in Spain or Finland, for example. Nevertheless, the DC, MAN and Volvo data will certainly have some applicability across national frontiers.

According to DC and MAN data the majority of truck accidents are rear end shunt, followed by impacts at crossing points. Although accident statistics are not widely available, and different sources appear to be at odds with each other, we believe that the major types of accident involving trucks are: vehicle rollover, rear end collisions, lane departure and leaving the road, due to driver drowsiness. A combination of ESP, advanced ACC, with integrated lane departure warning systems and driver monitoring will be widely available within 10 years. These should prevent a large number of these accidents, and we believe that up to 50% of these accident types could be prevented using these technologies in combination. However in addition to these accidents there will remain a share of accidents caused by vehicle failure, or by other road users. Active safety systems will not be effective in reducing these accident types significantly and we believe that these account for at least 50% of the overall total.

QUANTITATIVE DEMAND FOR ACTIVE SAFETY SYSTEMS

Our analysis of the state of development of Active Safety Systems, the vehicle manufacturers' activities and the reaction of the truck operators lead us to the conclusion that the rate of application of more Active Safety Systems over the short to medium term will be relatively low. This view is based on two main reasons:

- The fact that truck operators are highly cost-conscious in a very competitive market and will only invest in the systems, if overall cost-savings are perceived or are compelled to do so by legislation.
- The vehicle manufacturers have not made sufficient effort to promote the benefits and potential overall savings of the systems.

These issues are investigated in more detail in the chapter Forecasts and Outlook.

Vehicle Manufacturer Activity in Europe

Amongst the six main European truck manufacturers, DaimlerChrysler and MAN are setting the pace on the development and application of Active Safety Systems on their trucks. Volvo is moving to follow DaimlerChrysler and MAN, and has recently introduced ESP but Scania are perceived as concentrating on Passive Safety, while DAF and IVECO are followers.

Active Safety Systems are currently offered by the truck manufacturers as optional extras. Only EBS is now becoming widespread as standard equipment on trucks and trailers, leaving the remaining technologies currently available (e.g. ESP, Lane Guard and ACC) as optional extras, which are taken up by the truck operators only at very low rates (well under than 5% presently). The prospect of the vehicle manufacturers offering more Active Safety Systems as standard equipment in the short term seems remote; most preferring to try to recoup their investment costs for developing these systems on the basis of the prices charged for these low take-up rates, rather than introducing them as standard equipment across their ranges and benefiting from economies of scale in their costings.

The truck manufacturers appear not to have promoted awareness of the systems through detailed training of their dealer sales force.

Generally there is a lack of co-operation between truck and trailer manufacturers over the development of Active Safety Systems. This situation will have to improve, as the system technologies move towards further integration and their 2nd and 3rd generations.

INTERNATIONAL COMPARISONS

Approaches to the introduction of Active Safety Systems differ across the three main regions of automotive development, Europe, North America and Japan.

Within Europe initiatives to develop Active Safety Systems have largely been carried out at national level with only some activity at pan-European level. Germany is the most active country with government funding involved in a number of projects, linking together vehicle manufacturers, system suppliers, academic institutions, insurance companies and other interested parties. The Netherlands and Sweden are the next most active, followed by other northern European countries; the southern European countries have very little involvement.

Europe leads the rest of the world in the development and application of truck Active Safety Systems. The trucking business in each of the three regions is very different and this is reflected in the approach to Active Safety Systems. For example, whilst EBS is widespread on Western European vehicles, penetration is very low in the other two regions. This is due to a number of reasons:

- Traffic and road conditions are very different in the three regions;
- The Japanese market does not traditionally use such large numbers of articulated trucks as in Western Europe and North America;
- Braking systems are dominated globally by Western European suppliers;
- The North American truck market has a high percentage of extremely cost-sensitive owner operators;

- Disc brake penetration is North America and Japan is very low.

In comparison to Western European manufacturers, the North American and Japanese manufacturers appear to be placing more reliance on driver assistance in the form of Active Cruise Control, and Collision Warning systems. These are available in Europe, but considered to be less well developed than alternative systems.

Operator Activity

The fleet operators are generally poorly informed about the subject of Active Safety Systems. Fleet operators involved in the transport of dangerous goods and tankers are leading the way in the application of Active Safety Systems on their vehicles. This will affect the adoption of safety equipment in different sectors of the transport industry:

The truck manufacturers have made little or no effort to develop the business case for Active Safety Systems and to communicate the potential financial benefits to operators.

The fact that the great majority of Active Safety Systems are only made available by the truck manufacturers as optional extras means that the transport operator is immediately faced with the issue of increased capital or leasing cost for his truck. In a highly competitive market truck operators are reluctant to make investments that might place them at a competitive disadvantage.

Insurance Companies

The larger insurance companies demonstrate their interest in the development of Active Safety Systems by participating in their own and government-sponsored studies of the capability of various systems to contribute to lower accident rates.

However, it is most unlikely that insurance companies will introduce significant incentives for their customers to use the systems through lower insurance premiums. In any event the effect of any lower premiums would be very small in view of time it would take for trucks with Active Safety Systems to become a significant part of the overall truck parc. Therefore, if the adoption of Active Safety Systems is to take place in a reasonable time, it has to be mandated by the introduction of legislation.

BROAD COST/BENEFIT ANALYSES OF THE MAJOR SYSTEMS

It is clear that different systems exhibit widely different costs and benefits for the operators and to a significant extent they are both influenced by the type of operator. Later chapters in the report contain more detail on this. The impact of commonality with passenger car based systems is also assessed.

SUGGESTED ACTIONS FOR THE REGULATORY BODIES

With a lack of incentive from legislators and insurers and little demand from operators we believe that the European Union needs to address a number of issues to ensure Active Safety can in the future play a role in reducing accidents and their cost. The following areas need to be addressed at a government level:

- Lack of pan-European co-operation; individual countries are conducting studies without cross-border cooperation;
- Potential for improved co-operation between trailer manufacturers and truck manufacturers;
- Premature adoption of new technologies, leading to negative impact on future adoption rates due to poor market perception;
- Accident data availability and consistency;
- Driver training/hours (on a Pan-European basis);
- Significant reduction in the share of accidents caused by non-truck drivers

- Less duplication in technology development programmes;
- Promotion of the awareness and benefits of Active Safety Systems by government and truck manufacturers.

Specific areas in which the European Union and national governments need to put in place measures to promote Active Safety Systems include:

- Reduction of costs associated with developing and fitting Active Safety Systems through cost-sharing by the stakeholders;
- Continued investigation and development of new systems through a consortium of all major truck manufacturers, to share costs for new technologies between them;
- Education of operators by a combined truck industry body;
- Collection and analysis of accident data.

TABLE OF CONTENTS FOR FULL STUDY REPORT

Table of Contents	2
Glossary.....	7
INTRODUCTION.....	8
Methodology and Scope	9
Acknowledgement.....	9
EXECUTIVE SUMMARY & CONCLUSIONS.....	10
ACTIVE SAFETY SYSTEMS – A ROUTE MAP	10
Passive Safety Systems	11
FORECASTS FOR PENETRATION.....	11
ANALYSIS OF THE RELATIVE IMPACT OF DIFFERENT TECHNOLOGIES	13
QUANTITATIVE DEMAND FOR ACTIVE SAFETY SYSTEMS.....	14
Vehicle Manufacturer Activity in Europe.....	15
Operator Activity.....	17
Insurance Companies	17
BROAD COST/BENEFIT ANALYSES OF THE MAJOR SYSTEMS.	18
SUGGESTED ACTIONS FOR THE REGULATORY BODIES	19
ACTIVE SAFETY SYSTEM TECHNOLOGIES	21
Active Body Control (ABC)	23
Anti-Lock Braking Systems (ABS).....	24
Adaptive Cruise Control (ACC).....	25
Airbags (Passive Safety)	27

ASR (Traction Control).....	28
Brake Assist.....	29
Collision Warning	30
Curve Adaptive Lighting.....	32
Dead Angle Mirrors	33
Disc Brakes	34
Driver information and Assistance.....	35
Driver Monitoring	36
Electronic Braking Systems (EBS)	37
Electronic Stability Programme (ESP).....	39
Engine Braking.....	40
Lane Assist	41
Night Vision.....	42
Platooning.....	43
Retarders.....	45
Reversing Assist	46
Roll-over Warning.....	47
Seat belts (Passive Safety)	48
Steer-by-Wire (SBW).....	49
Tyre Pressure Monitoring Systems (TPMS)/Tyre Inflation Systems	50
Under-Run Protection (Passive Safety)	51
Advanced Vision Systems.....	52

Active Safety System Developments & Prospects.....	53
System Suppliers.....	53
2 nd and 3 rd Generation Systems	55
OE vs Aftermarket fitment	58
Development Steps for Technologies	60
Systems pricing	63
Future System Costs.....	64
Cost of Active Safety Systems	65
VEHICLE AND TRAILER MANUFACTURER ATTITUDES	66
OPERATORS	80
Research Findings	81
Other Research Findings	82
Image	82
Awareness of Active Safety Systems.....	83
Views on Specific Active Safety Systems	83
Shell Case Study – An Operators Views.....	85
Electric Handbrake Alarm.....	85
ESP	85
ACC.....	85
Front under-run protection systems	85
Driver Alertness Monitoring	85
Telematics -	86

Seat Belt Tensioners and Air Bags	86
Lighting (Curve Adaptive and Autodip)	86
TPMS	86
FORECASTS AND OUTLOOK	87
Accident Types.....	87
Adoption Rate Scenarios & Quantitative Projections	89
Scenarios and forecasts	90
The Non-Intervention Scenario – Penetration rates for new vehicles..	90
Scenarios for Parc Penetration - Assumptions	91
Conclusions on Penetration Rates.....	94
Adoption by Vehicle Type/Application.....	95
New EU Accession Countries.....	95
North America and Japan.....	96
USA.....	96
Japan.....	99
LEGISLATION AND INCENTIVES	102
LEGISLATIVE ENVIRONMENT.....	102
KEY ISSUES FOR GOVERNMENT.....	103
Government assistance	103
INSURERS	104
GDV – An Insurers View	104
APPENDIX A – Accident Avoidance Potential of ESP in Trucks – real accident analysis findings	106