The Specialty Equipment Automotive Company of the Future: Guideposts for Strategic Planning

by

September 2008

The statements, findings, and conclusions herein are those of the authors and do not necessarily reflect the views of the project sponsor.

Acknowledgements

As with any project, this report is the result of many people contributing in a number of ways. The authors of this report would like to thank those in industry who assisted in this effort by sharing their vision of the future strategic challenges for the specialty equipment market. Their willingness to participate and enthusiasm for the topic made this project possible. As with many CAR studies, the generous time provided by industry experts was a critical aspect of the research. CAR would like to thank those that contributed their thoughts, ideas, and direction.

The authors would like to thank Daniel P. Malone, of Butzel Long, for his considerable contribution to the content and editing of Section 2.4: Product Safety-Related Legal Obligations Faced by Specialty Equipment Suppliers. His contribution to the very important legal issues added greatly to the effort.

Several of our associates played important roles in this effort. Chris Powers contributed valuable input into the planning and execution of the project. Chris also supported the interview process. Mark Birmingham and Valerie Sathe-Brugeman assisted in data gathering, preparation, and analysis. Denise Semon contributed with project management.

Also, this report was vetted by a select group of SEMA Chief Executives. This group proved to be a strong sounding board for the researchers, and offered many valuable additions.

Finally, the authors thank the Specialty Equipment Market Association (SEMA) for its support of this project. Chris Kersting, CEO, and the Executive Board showed vision in believing that, while their member companies were facing significant near-term tactical challenges, it was important for the organization to offer guidance on the more strategic challenges member companies will face in the coming years. John Waraniak, Vice President, SEMA, also provided vision and enthusiasm to ensure that this effort would be of value to SEMA member companies.

Brett Smith,
Manufacturing, Engineering & Technology Group

Richard Wallace,
Transportation and Information Systems Planning Group

Bernard Swiecki,
Economics and Business Group

Center for Automotive Research
1000 Victors Way, Suite 200
Ann Arbor, MI 48108
734.662.1287
www.cargroup.org

Representatives from the following companies contributed to this report either though interviews, survey response, review or a combination of those actions. Other companies participated, but asked not to be identified. CAR and SEMA appreciate their efforts.

Azentek

Alpine Electronics of America, Inc

BMW, USA

Clarion, U.S.A

Caltrans

Chrysler, LLC

Continental, Inc.

Coker Tire

Delphi, Inc

Denso, Inc.

Dealer International Services

Dub, Publishing

Ford Motor Company

General Motors Corporation

Hughes Telematics

Michigan DOT

NAV-TV

New York DOT

Nissan Motor Manufacturing Corp., USA

OmniAir

Robert Bosch LLC

SKF, USA

Stillwater Designs

Telcordia Technologies

Toyota Motor Sales, USA

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Executive Summary

The Specialty Equipment Market Association (SEMA) and the Center for Automotive Research (CAR) have engaged in a multi-phased project to create business strategy guideposts for SEMA members. The first report in the program—*The Specialty Equipment Company of the Future: Guideposts for Technology Forecasting and Strategic Planning*—identifies strategic challenges for SEMA and its member companies in the mid-term (3-7 years). The information presented is based on a series of interviews with thought leaders from vehicle manufacturers (VMs), original equipment (OE) parts suppliers, specialty equipment (SE) suppliers, and other auto industry stakeholders. These interviews were supported by literature reviews and other data gathering techniques.

CAR and SEMA, through discussions with industry thought leaders, have identified six topics (or research areas) that are critical to the long-term success of the specialty equipment market. These six are:

1. Vehicle manufacturers' specialty equipment market strategies
2. Length and volume of model runs
3. Order complexity and limiting options at the assembly plant
4. Product safety-related legal obligations faced by specialty equipment suppliers
5. Body chassis electrical/electronics and the specialty equipment market
6. Opportunities in the connected vehicle market for specialty equipment suppliers

It is the premise of this project that some SE suppliers are interested in working more closely with—or at least gaining a better understanding of—the vehicle manufacturers' plans. Furthermore, while it is certain that many SE suppliers do not wish to do business directly with the vehicle manufacturers, it is equally certain that how vehicle manufacturers view the SE market, and plan for specialty equipment on their vehicles, will be important to all SEMA member companies in the coming years.

From interviews and associated public sources, CAR researchers further identified **five** vehicle manufacturer strategies that will be important for SEMA member companies to understand, and proactively act upon, over the next five years. These are identified below:

1. Many vehicle manufacturers are increasingly interested in the specialty equipment market. However, the level of interest varies greatly. Some companies viewed the specialty equipment market as a potential access point for consumer electronics, and little else. Others are considering how to effectively bring SE suppliers into the product development process for a wide range of connected vehicle, performance, chassis and appearance products.

2. There was a general consensus that the SE market for performance, chassis, and appearance components was very segment-specific. Future strategies for vehicle manufacturers reflect that concentration. Several companies indicated they were emphasizing small (and performance) cars, sport utility vehicles and pickup trucks in their plans. Many respondents did not expect mainstream segments, such as mid-size cars and crossover utility vehicles, to offer opportunities for specialty equipment in the near future.

3. Vehicle manufacturers will continue to nurture in-house performance brands. Several of these brands may increasingly leverage SE performance brands. During discussions

with automakers, it was clear that in-house brands that rely on the VM partner-branded components will continue to exist. Several VMs, however, indicated interest in increasingly leveraging SE brands for performance vehicle lines.

4. There is a growing—but still somewhat limited—trend for the vehicle manufacturers to design their vehicles for accessorization. All VMs interviewed made it clear that a trusting, long-term partnership with selected SE suppliers would be beneficial. It is important for SEMA to offer pathways for member companies to establish, and grow, relationships with the VMs (and OE suppliers). It also may be valuable for SEMA to offer critical technology and strategy advisories regarding future change for those members who choose not to participate directly with the VMs. Current SEMA programs (e.g., measuring sessions and technology transfer) were highlighted as a means to continue to increase the communication between VMs and SE suppliers. Several VMs indicated these sessions could be expanded upon to permit diagnostics-type data to reach the SE market ***earlier and more comprehensively***.

5. The dealership remains the final frontier and a challenging opportunity. The VM dealership network may provide opportunity for growth─not only for those member companies wishing to accessorize new vehicles, but also for consumers wishing to add specialty equipment to their current (used) vehicle. For many consumers, the ability to have an installer of specialty equipment partnered with the dealer may offer a comfort level not currently offered by independent installers.

The vehicle segmentation and product redesign trends developing in the automotive industry present a challenge for specialty equipment suppliers. These trends include: a decrease in the number of platforms offered in the U.S. market and an increase in the number of sales for each platform. There also will be an increase in the number of nameplates offered on each platform.

The ability to create and integrate a wide range of electronics technologies and components is critical to the success of SEMA member companies. It is also important to understand how non-electronic-based components may be affected by the rapid application of electronics to the vehicle. The pace of change in automotive electronics technology continues to accelerate at an unprecedented rate—in part, driven by SEMA member companies. While consumer electronics have trended toward an open architecture (for a variety of reasons), this has not been the case for automotive electronics. Identifying trends in architecture strategies, their implications and possible responses will be a key for SEMA member companies.

Conclusions

The *Specialty Equipment Supplier of the Future*, the initial report for the SEMA CAR Research Program highlighted several important topics for consideration—and action. Some of these have been a confirmation of industry truisms, while others have shed light on future challenges. Whether a confirmation or revelation, the following topics are expected to shape the specialty equipment industry in the next 3-7 years:

Structural Change; Tactical Turmoil; Strategic Opportunity: The automotive industry is undergoing what is arguably its biggest structural change in decades. Participants─from the largest vehicle manufacturer to the smallest specialty equipment company─are re-examining what must be done to remain competitive in the coming months and years. This structural change may present opportunity to forge new relationships and business models between the automotive industry and the specialty equipment market.

An Inflection Point for Some, a Steady Course for Others: The interview process identified several vehicle manufacturer/specialty equipment market strategies that present opportunity for SEMA member companies. SEMA and its member companies are strongly urged to consider proactively addressing each of the topics. However, CAR researchers believe two of these strategies are extremely time-sensitive. First, as noted above, many vehicle manufacturers are currently facing significant structural change. Several manufacturers are looking to the SE market for creativity and partnerships. It is important for SEMA and its member companies to continue to develop programs to grow the relationships between the VMs and SE suppliers. Second, most vehicle manufacturers continue to focus their performance, chassis, and appearance specialty equipment strategy on small cars, specialty cars and light trucks. The changing market presents an opportunity—in small cars─and a challenge in the decline in pickups and SUVs for SE suppliers. The changing mix of light vehicles makes it clear that the things that worked for many SE suppliers in the past may not work in the future.

The Paradox: More Nameplates, Fewer Platforms: The U.S. market is seeing a decreasing number of platforms and a rising number of nameplates. Both automakers and suppliers will therefore be challenged to engineer a wider variety of vehicles and components with distinct features and appearances, while using more common platforms and parts. Also, because model life spans will be shorter and redesigns will be performed more frequently, specialty suppliers will see an increase in the number of projects they will face at any one time.

Body and Chassis Electrical/Electronics Remain at Arms Length: The over-riding concern for the VMs is that aftermarket access into the electrical/electronic system may modify the integrity of the vehicle. In the case of the chassis E/E system, any modification may alter safety. The challenge for SE suppliers is to continue producing and installing product that do not have an adverse impact on vehicle safety, yet adapt to a more electronically integrated vehicle. The message from most respondents was clear: the SE market, while potentially considered a partner, is not likely to be allowed access behind the firewall.

The Connected Vehicle--SEMA Members May Step to the Forefront: Vehicle communications and connected-vehicle technology offer important opportunities for specialty equipment manufacturers along several dimensions. It is possible, even likely, that products offered by SEMA members may be the enabler for accelerating the deployment of connected-vehicle systems and allow this technology to reach a critical mass. For this to materialize, closer cooperation with VMs and greater involvement in regulatory and standards processes will be needed.

1. Introduction

The Specialty Equipment Market Association (SEMA) and The Center for Automotive Research (CAR) have engaged in a multi-phased project to create business strategy guideposts for SEMA members. The first report in the program—The Specialty Equipment Company of the Future: Guideposts for Technology Forecasting and Strategic Planning—is to identify strategic challenges for SEMA and its member companies in the mid-term (3-7 years). The information presented is based on a series of interviews with thought leaders from vehicle manufacturers (VMs), original equipment (OE) parts suppliers, specialty equipment (SE) suppliers, and other auto industry stakeholders. These interviews were supported by literature reviews and other data gathering techniques.

1.1: The SEMA-CAR Research Program

The specialty equipment market relies in large part on the direct-to-customer distribution channel. CAR estimates that less than one percent of the specialty equipment market is direct to the assembly plant. Further, less than 5 percent of specialty equipment sales are through the new car dealer—either installation occurs at the dealer or at independent installers associated with the new car dealer. For those companies that supply parts either directly to the assembly plant or through the dealer, the topics addressed in this report are inherently important. However, CAR researchers believe there are critical lessons to be learned from this report for the companies that supply the estimated 95 percent of specialty equipment which is sold directly to the end user.

These companies may be interested because partnering with the VM (or dealer) may offer another profit stream. Clearly, in a very challenging market, any opportunity for increased sales is worth investigating. In addition, those companies that partner with VMs at their point of sale will gain a strategic product placement, potentially increasing the visibility of the specialty brand. This may present a competitive threat to those companies that do not participate. Finally, new technologies and vehicle manufacturer strategies may directly affect a SEMA member company's ability to make products that are compatible with future vehicles. To that point, this report will investigate technology and business strategy trends that may present challenges for specialty equipment product segments.

The automotive industry—both original equipment and aftermarket—is experiencing rapid and dramatic structural changes and is currently in a state of significant upheaval. As a result, many industry participants are experiencing what can best be described as tactical tunnel vision. These companies, faced by severe near-term market vehicle technology and product development challenges and uncertainties, have been actively addressing tactical operational concerns–often at the expense of strategic long-term planning. While this is understandable, even necessary, it does present potential risk and opportunity costs for these companies.

This SEMA-CAR program is intended to assist SEMA member companies by investigating strategic concerns and challenges of importance to them. This report will address six topics, each to varying degrees of depth. It is our intention to identify scenarios and possible strategies for responding to these topics. The project is designed to illustrate the coming challenges and create a forum for discussion (both within companies and between stakeholders) and a framework for scenario planning. Individual companies will most certainly respond differently to these strategic challenges. That creativity is the essence of SEMA. The goal established by the SEMA-CAR program is to look ahead at what is coming down the road and give advanced notice of industry and vehicle changes—the task is for the individual companies to take time to understand and address those strategic challenges.

This report will create business strategy guideposts for SEMA member companies as they *proactively work to create innovative products.* It will help SEMA member companies ensure that their specialty equipment products are developed in a manner that enables continued application to future motor vehicles. The project will identify technology trends, vehicle manufacturer strategies, industry trends, and federal policies that will guide SEMA members in the coming decade.

CAR and SEMA, through discussions with industry thought leaders, have identified six topics—or research areas—that are critical to the long-term success of the specialty equipment market. These six are:

1. Vehicle manufacturers' specialty equipment market strategies
2. Length and volume of model runs
3. Order complexity and limiting options at the assembly plant
4. Product safety-related legal obligations faced by specialty equipment suppliers
5. Body chassis electrical/electronics and the specialty equipment market
6. Opportunities in the connected vehicle market for specialty equipment suppliers

For this report, these topics will be presented in two parts. The first part will consider strategic business Issues and include strategic sections of items 1, 2, 3, and 4. The second will focus on electrical/electronic technology strategy—topics 5 and 6.

Strategic Business Issues: Based on an interim report analysis, CAR and SEMA agreed that there was value in exploring strategic topics identified by respondents early in the interview process as critical. The authors have illustrated the strategic importance and direction of each topic and attempted to place them in proper context for the SEMA member companies. It is not the intention of this report to fully investigate the four topics. It is reasonable that each of these could at some time be the focus of further strategic research.

Electrical/Electronic Technology Strategy: The automobile is increasingly becoming captive to the electron. From the numerous and varied portable electronics that consumers are bringing into the vehicle to the electronic roll stability that effects components and all the way to the tire on the road, nearly every SE component is affected by electronics. This transformation was driven home to the specialty equipment market recently by the federally mandated roll stability control (RSC) regulations. The manufacturers responded by using electronic stability control (ESC) systems and technologies having direct implications for many specialty equipment products and modifications. The impact RSC regulation had on the SE market was an important factor in leading SEMA to begin to create a strategic vision concerning complex technologies.

The rapid integration of in-vehicle infotainment and connected vehicle technology also offers opportunity for both unexpected regulation and strategic consideration. This report leverages information from CAR's Connected Vehicle Proving Center (CVPC) to investigate the role specialty equipment suppliers may play in the implementation of these new technologies. **(*For this report, CAR will use the term connected vehicle to encompass all in-vehicle infotainment and connected-vehicle technologies*.)**

Finally, for this project, the researchers have clearly divided the aftermarket between the repair and replacement market and the specialty equipment market. All discussion, unless otherwise noted, pertains to the specialty equipment (SE) market and the suppliers of those components.

1.2: The Operating Environment

It is valuable to explore the market conditions during which this research and subsequent report were completed. According to H. Wilbur Ross[1], the automotive industry–and by direct relationship, the specialty equipment market–have been subjected to three economical bubbles in the last decade: a housing bubble, an automotive incentive bubble and an (on-going) oil bubble. These 'bubbles' have played a significant role in the current upheaval. They are also an indicator of strategic change to the industry.

The housing bubble, starting in the early to mid-1990s and bursting in late 2006, created an enormous amount of wealth (both real and perceived). A large part of that wealth was spent by consumers buying more expensive vehicles than may have been possible without the wealth-effect created by the bubble[2]. With the bursting of the housing bubble and ensuing credit crunch, consumers had appreciably less wealth (again, real or perceived), and have been more restrained in their purchases—either buying less expensive vehicles or significantly delaying new car purchases. The collapse of the housing market has both direct and indirect effects on the specialty equipment market. Obviously, fewer vehicles sold means reduced opportunity for specialty equipment purchases. Equally important is the reduction in available credit for consumers as they look to buy specialty equipment for their existing vehicles.

Another recent driver for the U.S. automotive market, and one that has enormous impact on the specialty equipment market, is the incentive bubble (2001-2007). Driven by union contracts, cost concerns and increasing competition, the manufacturers—usually led by the Detroit Three–used incentives to keep assembly plant capacity utilization high. The 2007 labor contracts between the Detroit Three and the UAW will likely lead to a reduction in this reliance on incentives to maintain capacity utilization. Conversely, the lower sales volumes of 2008 will likely pressure automakers to consider incentives to move product. Of special importance to the specialty market is that many of these incentive-created sales were in the light duty truck segment—an important segment for SEMA. As the incentives reduced transaction prices, it is likely that customers were able—and willing—to spend more on specialty equipment. This incentive strategy led to artificially increased vehicle sales, and likely, an increase in specialty equipment spending per vehicle.

The third 'bubble', is that of increasing oil prices (2001-current). According to Ross, speculation has added $40-$50 dollars per barrel to the price of oil. This added cost has likely decreased annual vehicle sales by 500,000 for 2008, and possibly another 250,000 for 2009. This oil bubble has had the double-edged effect of reducing the sale of new vehicles, and decreasing discretionary spending—both factors that affect specialty equipment sales. According to MasterCardPulse (a survey of consumers), it is estimated that the increased cost to consumers was approximately $207 billion in the first half of the year.

[1] Presentation at Ward's Interiors Conference, Detroit, MI, June 6, 2008.

[2] For this discussion, the housing bubble will refer to both the (perceived) increased wealth effect from the rapidly rising housing valuations, as well as the extremely low interest rates that allowed home-owners to refinance with much lower monthly payments.

Table 1.1: The Automotive Industry Environment—2008

Event/Bubble	Years	Automotive Industry	Specialty Equipment
Housing/credit	1995-2006	Consumers used increased wealth to buy more and more expensive vehicles	Increased discretionary income for specialty equipment purchases
New vehicle incentives 'battle'	2001-2007	Enriched the vehicle mix, more light trucks	Lower price for vehicles led to more discretionary money for specialty equipment
Oil Price	2001-current	Reduced sales, change in mix away from light trucks	Change mix of new vehicles—structural shift away from light trucks, which had been strong market for specialty equipment. Also there has been a very sharp decline in demand for used light trucks.

While other pressures have affected the industry, these three 'bubbles' are indicative of the upheaval currently driving the specialty equipment market. In many ways, the interviews for this project reflect that upheaval. How SE suppliers respond to these challenges tactically will determine the short-term health of the industry. However, the authors of this report believe the strategic challenges addressed, taken in the context of the current transition, will prove to be equally important as the specialty equipment industry strides to weather the current storm and move forward.

A final point on the current operating environment: during the interview process: it was clear the automotive industry is undergoing what arguably is its biggest structural change in decades. Each automaker is re-examining what must be done to remain competitive in the coming decade. It is further apparent that, because of this upheaval, several companies are closely examining their strategies with the specialty equipment market. ***This structural change may present the opportunity to forge new relationships and business models between the automotive industry and the specialty equipment market.***

2. Strategic Business Issues

2.1: Vehicle Manufacturers' Specialty Equipment Strategy

This section will investigate future strategic actions vehicle manufacturers (VMs) are taking with regard to the specialty equipment market. It is the premise of this project that some SE suppliers are interested in working more closely with, or at least gaining a better understanding of, the vehicle manufacturers. Further, while it is certain that many SE suppliers do not wish to do business directly with the vehicle manufacturers, it is equally certain that how vehicle manufacturers view the SE market and plan for specialty equipment on their vehicles will be important to all SEMA member companies in the coming years.

Often, vehicle manufacturers are viewed as a monolithic entity with respect to strategy. In reality, each manufacturer has its own specialty equipment strategy and, even within each manufacturer, the strategy is not necessarily consistent throughout the organization. It is reasonable to say that, with regard to the specialty equipment market, there are individuals at the vehicle manufacturers that 'get it', those that don't 'get it' but are willing to try to understand, and those that don't want to 'get it'—ever. Often, all three types work at the same company.

From interviews and associated public sources, CAR researchers have identified **five** vehicle manufacturer strategies that will be important for SEMA member companies to understand, and proactively act upon, over the next five years. These are identified below:

- Many vehicle manufacturers are increasingly interested in the specialty equipment market—and are currently evaluating future opportunities.
- Most vehicle manufacturers are focusing their performance, chassis and appearance specialty equipment strategy on the small car, specialty car and light truck segments.
- Vehicle manufacturers will continue to nurture in-house performance brands. Several of these brands will increasingly leverage SE performance brands.
- There is a growing—but still somewhat limited—trend for the vehicle manufacturers to design their vehicles for accessorization.
- The dealership remains the final frontier and a challenging opportunity.

As interview respondents were assured, all information gathered in the interview process will be presented in generic form. CAR researchers have supplemented the information gathered in interviews with publicly available information. *Importantly, any company-specific data presented in this report is gathered from publicly available data.*

2.1.1: Vehicle manufacturers are increasingly interested in the specialty equipment market:

Vehicle manufacturers indicated they are examining their relationships with the specialty equipment market. However, the level of interest varies greatly. Some companies viewed the specialty equipment market as a potential access point for consumer electronics, and little else. Others were considering how to effectively bring SE suppliers into the product development process for a wide range of connected vehicle, performance, chassis and appearance products.

It is clear that the current difficult market conditions have stimulated several vehicle manufacturers' interest in the SE market. Some respondents indicated that the current sea-change offers an opportunity, and need, to differentiate their company from the others. They see a partnership with specialty equipment suppliers as an avenue to do so.

Vehicle manufacturers appear to be heading down three divergent paths for specialty equipment. First, several companies view the idea of working with the SE market as an opportunity to differentiate themselves in a very competitive market. These companies are, to varying degrees, creating strategies that will greatly leverage the specialty equipment market. Second, there are companies that have on-going experience with the SE market—usually through in-house performance groups—who expect to continue their current strategy with little expectation of increasing (or decreasing) involvement with the SE market. Finally, there is one domestic manufacturer that appears to be—at least temporarily—de-emphasizing the specialty equipment market. Overall, the VM strategies suggest there will be increasing opportunity for SE suppliers to collaborate with vehicle manufacturers during the next several years.

Through the interview and discussion process, it became clear that there were several vehicle manufacturers that are currently working to create a vision for the integration of specialty equipment. Three companies have, or are strongly considering, programs to increase the level of contact with the specialty equipment market. Two companies expect to continue programs currently in place, and are considering increasing the level of interaction. One company is pulling back from participation (although there is expectation that their in-house performance program will continue to leverage outside brands).

2.1.2: Most vehicle manufacturers are focusing their performance, chassis and appearance specialty equipment strategy on the small car, specialty car and light truck segments:

There was a general consensus that the SE market for performance, chassis and appearance components is very segment-specific. Future strategies for vehicle manufacturers reflect that concentration. Several companies indicated they are emphasizing small (performance) cars, sport utility vehicles and pickup trucks in their plans. Most manufacturers do not expect mainstream segments (such as mid-size cars and crossover utility vehicles) to offer opportunities for specialty equipment in the near future. However, a few respondents strongly believe that all vehicle segments offer good opportunity for increased personalization. Given the recent, and substantial, change in the vehicle sales mix for the U.S., this significant drop in light truck sales has important implications for SE suppliers.

Scion, Toyota's highly visible specialty equipment experiment brand, was mentioned numerous times, and by many respondents. As an example of the creativity and opportunity in the small car segment, Scion is the embodiment of the specialty equipment alteration approach. Toyota created a vision to build a 'monospec' car at the factory to keep costs low despite low volumes, and do any necessary customization downstream, either at portside or at the dealer. CAR can not estimate how successful this approach has been from a cost point of view, but from a revenue perspective (price maintenance, volume growth, conquest rates), Scion appears to have been very successful.

Several companies indicated that the Scion model was interesting, and under contemplation. However, a few questioned the overall long-term effectiveness of the brand. It is likely any company that follows the Scion model will have to strongly consider how to further develop the SE supplier relationship. Scion has created a good reputation for working with SE suppliers. However, several respondents indicated a perceived shift by Scion to rely increasingly on TRD (Toyota's in-house performance partner) for Scion components, at the expense of SE suppliers. Respondents believed this was indicative of the constant battle between the in-house partner and specialty equipment suppliers. One respondent believed that, to be effective in the long-

term (i.e., more effective than Scion), it would be necessary to develop long term multi-generational relationships with SE suppliers—even at the possible expense of the house brand.

While Scion created a vision for customers to use small cars as a canvas, the light duty pickup truck provides a unique canvas for consumers and SE suppliers. Each manufacturer has an accessory strategy for its line of pickups. The pickup, with its greatly diverse usage applications, is unique to the industry. No other vehicle is used for such a wide range of commercial/work activities and offers so many lifestyle opportunities. Those manufacturers that have marketed pickup trucks have, in turn, had experience with after-production accessories. This knowledge should serve as an important guidepost for SEMA and its member companies and is absolute proof that the specialty market can add value to the VMs.

2.1.3: Vehicle manufacturers will continue to nurture in-house performance brands

Several vehicle manufacturers have their own in-house specialty equipment brands. Table 2.1 lists select in-house performance brands (and their chief attributes) from several vehicle manufacturers. A review of the table shows that several of the in-house brands are performance-focused, or are accessory-centric. Each manufacturer generally has both a performance brand and an accessory line. Some of the brands tend to be race-oriented. Many of the VMs use their performance brands to sell only 'store' brand components, while others have leveraged 'high-value' specialty equipment brands. During discussions with automakers, it was clear that in-house brands that rely on the VM partner-branded components will continue to exist. Several VMs, however, indicated interest in increasingly leveraging SE brands for performance vehicle lines.

Table 2.1: The Vehicle Manufacturer In-House Performance Brands

VM	OEM Badge	Division Name	VM integrated	Full Vehicles	Dealer Installation	Performance Parts	Accessories	Warranty with Dealer Installation
General Motors	V-Series	GM Performance Division	Yes	Yes	No	Yes	Yes	N/A
General Motors	N/A	GM Performance Parts	Yes	No	Yes	Yes	Yes	N/A
Chrysler	SRT	Mopar	No	Yes	Yes	Yes	Yes	No warranty for performance or race parts (replacement parts come with warranty)
Ford	SVT	SVT	Yes	Yes	Yes	Yes	Yes	No warranty for race parts. Warranty available for dealer installed performance parts
Nissan		NISMO	No	Yes	Yes	Yes	Yes	Yes
Toyota		TRD	No	No	Yes	Yes	Yes	No warranty for race parts. Warranty available for dealer installed performance parts
Honda		HFP/ A-SPEC	Yes	No	Yes	Yes	Yes	Yes
Mazda		Speed	Yes	Yes	Yes	Yes	Yes	Yes
Source: Published company sources								

As a reflection of the external market during the interview process, several respondents (including VMs, OE suppliers and SE suppliers) indicated that the next frontier for in-house performance groups (and non-affiliated SE powertrain suppliers) will be fuel efficiency. For example, Saturn has created a Greenline brand for its HEV lineup. They have attempted to position this as a companion brand to the Redline performance-branded vehicles. The general description of fuel efficiency included both better fuel economy and better performance with minimal fuel efficiency loss. There was general agreement that this presented a significant challenge for the industry. All agreed that it would be very difficult for SE suppliers to add significant value (i.e., improved fuel efficiency) to vehicles, especially if they were not able to get inside the firewall. (In most cases, this was not expected to happen. Access to electrical/electronic architecture is addressed in sections 5 and 6). However, at least one manufacturer indicated that allowing select SE suppliers to access powertrain control module information may provide a significant opportunity for creative solutions and differentiation.

It is important to note that respondents, and many of those who reviewed initial drafts of this report, did not believe that the traditional definition of performance (i.e., horsepower) would fade away due to the increased interest in fuel efficiency. Some even argued the current push by new car buyers and manufacturers for greater fuel economy would create great opportunity for the specialty equipment market—to supply power-enhancing technologies after the sale, much as it had a generation earlier when secondary vehicle purchasers looked for performance.

However, many respondents also believed that, in the future, the definition of performance would be broadened to include both faster and farther.

Importantly, the second phase of the SEMA-CAR strategic research program is planned to investigate mid-term powertrain opportunities for SE suppliers. The powertrain portion of the project is expected to be completed in the fourth quarter of 2008

2.1.4: There is an increasing—but still somewhat limited—trend for the vehicle manufacturers to design their vehicles for accessorization

The interviews brought out several interesting differences between the engineering and marketing functions at the vehicle manufacturers. Nowhere were these differences more evident than during discussions regarding designing products for accessorization. While most marketing representatives interviewed indicated great value in engineering a vehicle to more easily accept post-production accessories, engineers saw it somewhat differently. The most candid response from the engineering function was: "why should we increase our cost of engineering by drilling an extra hole, so that one out of a thousand customers can add an accessory—an accessory we probably won't even sell to them?"[3]

The marketing respondents were much more likely to view the design for accessorization as increasing the desirability of the vehicle. They see the opportunity to create a more saleable vehicle by affording customers the ability to easily add SE components. Not surprisingly, those in the marketing function also had a greater understanding of the brand value that accompanied many SE suppliers.

The light duty pickup truck was the one product for which the marketing and engineering functions seemed to agree that design for accessorization was important. It was clear the engineering representatives understood the value of designing a pickup truck for accessorization. These vehicle programs have incorporated such strategies to serve their commercial customers for years. Two VMs have extended the design for accessorization of the pickup to include lifestyle and customization SE components, as well. A few manufacturers indicated they were willing to apply the progressive attitude used to engineer pickups to other segments they viewed as high accessory candidates.

Respondents described their relationships with post-production conversion companies as an example of how they might work with the specialty market. It was clear that the engineers had a comfort level working with the commercial vehicle conversion companies—a comfort level that has been developed over many years. (Another interesting partnership, not examined for this project, is that of the Shelby Cobra Mustang.) SE suppliers should take note of this: all VMs interviewed made it clear that a trusting, long-term partnership with selected SE suppliers would be beneficial. It is important for SEMA to offer pathways for member companies to establish, and grow, relationships with the VMs (and OE suppliers). It may also be valuable for SEMA to offer critical technology and strategy advisories regarding future change for those members who choose not to participate directly with the VMs.

While some in the engineering function were willing to consider accessorization as a part of their engineering criteria—at least for certain vehicle segments—most were not sure that SE

[3] Interestingly, an associate of the person who made the comment responded by suggesting; 'they should consider doing it, because if they don't, the consumer may not purchase the vehicle.'

suppliers could be brought into the program at a significantly earlier stage. Nor did most believe SE suppliers would be allowed access behind the firewall. Instead, most VMs indicated the suppliers would be limited to the diagnostic data currently provided.

It is important to note that this was not a hard and fast rule. There is at least one company that is very aggressively investigating methods to bring SE suppliers directly into the product development process. There are others that expressed a personal belief in more fully engaging the SE suppliers, but have been unable to get corporate support. Most respondents expressed a willingness to permit SE suppliers access to the diagnostic data (the parts diagrams and diagnostic codes) in a more complete form, and even possibly at an earlier stage. This is an opportunity for all SEMA member companies and should be pursued.

Current SEMA programs (e.g., measuring sessions, and technology transfer) were highlighted as a means to continue to increase the communication between VMs and SE suppliers. Several VMs indicated these sessions could be expanded upon to allow diagnostics-type data to reach the SE market ***earlier and more comprehensively***. Furthermore, these programs have begun a process of building relationships. All VMs interviewed, however, were cautious about guaranteeing the quality of the SE supplier participating. Based on interviews, CAR believes these sessions have the opportunity to grow in importance over the next five years.

In summary, aside from small (and specialty) cars, light-duty pickup trucks and some utility vehicles, it did not appear there is, as yet, a strong push by many manufacturers to make design for accessorization a corporate goal. However, there are strong pockets within most VM engineering functions working to create a pathway. These pockets can provide both entry points for SE suppliers, and guideposts for further development.

2.1.5: The dealership remains the final frontier and a challenging opportunity

The VM dealership network may provide opportunity for growth—not only for those member companies wishing to accessorize new vehicles, but also for consumers wishing to add specialty equipment to their current (used) vehicle. (In a separate project, CAR is investigating the potential viability of adding specialty equipment sales and installation to vehicle manufacturers' light repair service centers.)

Initial findings from the dealer project are pertinent to the SEMA-CAR project. While the initial intention was to focus on the viability of off-site, dealer-owned, vehicle manufacturer-branded light service centers adding specialty equipment to their stores, two barriers quickly arose. First, there is a conflict between vehicle manufacturer-branded accessories and the SE supplier brand, .and second, there is the challenge of getting off-brand vehicles into the VM branded store. While these do not appear to be game-breakers, a parallel pathway has developed. The owner of a large auto group, with several brands in an auto mall, could open an off-site light service center at the entry to the auto mall. For many consumers, the ability to have an installer of specialty equipment partnered with the dealer may offer a comfort level not offered by independent installers. There has been some interest from large automotive groups regarding this idea.

If specialty equipment products were available when a vehicle purchase decision is made, purchasers of new (or used) vehicles would be able to include specialty parts and installation in the financing plan for their vehicle, allowing them to drive off the lot with a fully customized vehicle rather than completing customization over a period of months or even years. For the dealer, this approach offers the opportunity for a new revenue stream—potentially, outside the

cost constraints of the dealership. In addition, it offers another distribution channel for the SE supplier.

In the past, dealer installation programs have often failed because management was unable to change the existing culture at the dealership. Current dealer culture revolves around the vehicle and its financing. It has been historically difficult to alter this model and convince dealers that the sale does not need to end once the consumer has agreed to purchase and finance the base product. By incorporating an off-site installation center, in-dealer culture could remain essentially unchanged yet the dealer credibility could be transferred to the associated installer. Dealers would then work to ensure that as many customers as possible made their way to the off-site installer. Once the consumer arrived at the installer, he/she would be greeted by specially trained staff with a sales and service capability not previously seen at the dealer level.

Dealers are currently struggling to maintain profitability, and consequently, would appear to be more open to investigating alternative revenue streams. Although findings thus far appear to support the business case for off-site installer programs, further research is required to better understand the complete financial picture. Based on qualitative data, CAR research indicates that a detailed business case, as well as support from the associated VMs, is necessary to ensure dealer participation.

There are several viable models for this dealer-connected 'off-site' installer model. Currently, SEMA members include independently owned installers and have a pilot installer certification program underway in ten major markets. This program offers the opportunity for SEMA members to achieve status as ProPledge installers—including meeting educational, professional and technical standards, as well as warranted work. This then offers automotive dealers a viable partner for specialty equipment installation—both for parts sold through the dealership or via some form of hand-off to the ProPledge installer.

The VMs can also choose to implement and support a program which encourages dealers to develop the capabilities in-house. However, with few exceptions, this pathway has been fraught with problems in recent years. Finally, as mentioned above, large dealer groups also may be candidates for an offsite installation center (again, either partnered with a SEMA member installer or on their own). It is worth consideration that the in-house dealer group model may be a viable candidate for the SEMA ProPledge certification program.

2.2: Adapting to the Changing Length and Volume Runs for Models and Platforms

This section will provide an outline of the vehicle segmentation and product redesign trends developing in the automotive industry. Discussion and likely implications of these trends for specialty suppliers follow. The trends observed include:

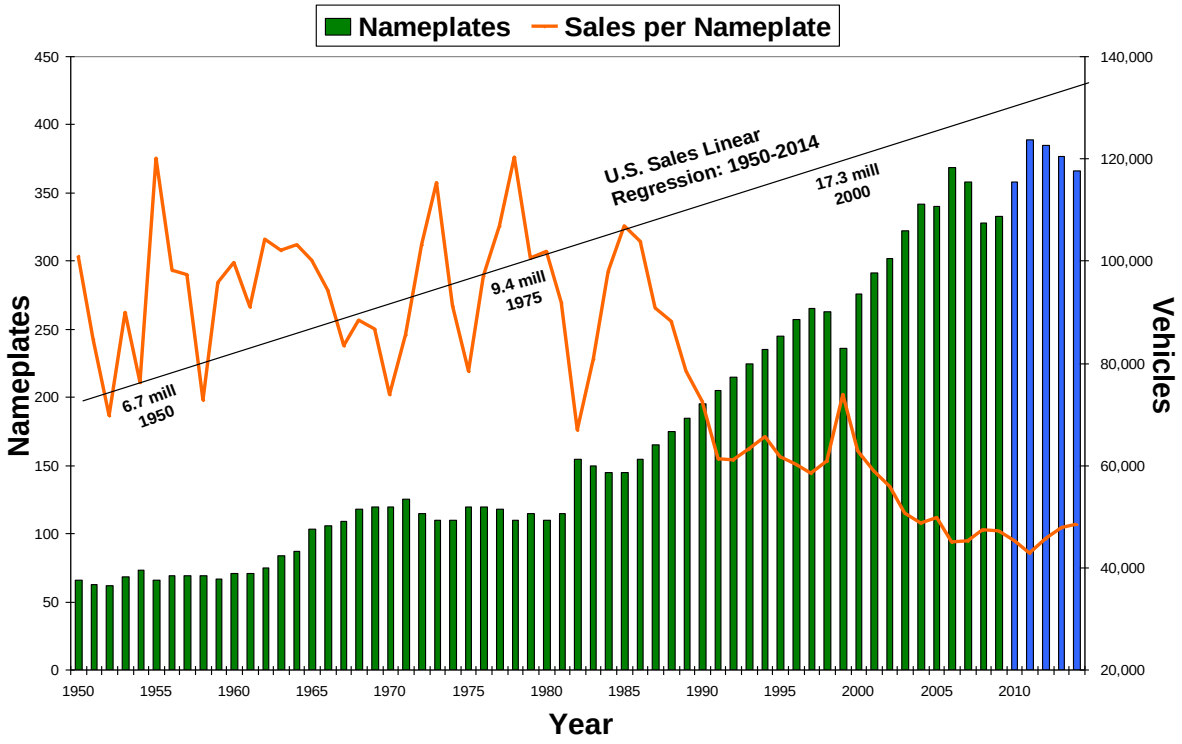
- A decrease in the number of platforms offered in the U.S. market
- An increase in the number of sales for each platform
- An increase in the number of nameplates offered on each platform
- An increase in the number of nameplates offered in the U.S. market
- A decrease in the number of vehicle sales per nameplate
- A market shift toward passenger car unibody products and away from truck-based, body-on-frame vehicles

The U.S. light vehicle market is undergoing a transformation that will ultimately change it to resemble the vehicle markets of Europe and Asia, more closely than it ever has before. Driven by surging energy prices, consumers have begun to dramatically change their vehicle

purchasing preferences. Because the most dramatic changes are currently underway, the findings in this section are likely to evolve in the near future. All tables and charts are based on source data from CSM Worldwide, with analysis by CAR.

Chart 2.1 provides a historical perspective on the number of nameplates offered in the U.S. market, as well as the average sales per nameplate. The regression line representing sales growth of the overall market shows a gradual increase in annual sales from a level of 6.7 million units in 1950 to 17.7 million units in 2014. Growth in the number of nameplates, however, has occurred at a faster pace, resulting in declining sales per nameplate. While the number of sales per nameplate fluctuated cyclically during the first four decades highlighted, a clear negative trend appears beginning in 1990. Sales per nameplate are expected to stabilize at around 50,000 units annually in the foreseeable future. The trend of an increasing number of nameplates, coupled with decreasing sales per nameplate, is a clear indication that the U.S. market is becoming more fractured and specialized. The details of this trend, as well as likely implications for specialty suppliers, are discussed in the following pages.

Figure 2.1: U.S. Market Nameplate Proliferation, 1950-2014



Source: CSM Worldwide

Table 2.1 provides a numerical summary of changes in the composition of the U.S. light vehicle market. Data is provided for the years 2003 and 2008, as well as a forecast for 2014. The changes in the overall U.S. market are dominated by two distinct trends. The number of platforms is expected to decline significantly from 141 in 2003 to 93 in 2014 while the number of nameplates on the market is expected to rise from 322 to 366 over the same time period. Given that the market is expected to grow slightly, from 16.3 million units in 2003 to 17.7 units in 2014, automakers are expected to produce higher volumes of vehicles on each of their platforms but sell fewer units of each model produced. While average vehicle volume per platform was about

116,000 in 2003, it is expected to rise to just over 190,000 by 2014. At the same time, the number of nameplates will rise from 322 in 2003 to 366 in 2014.

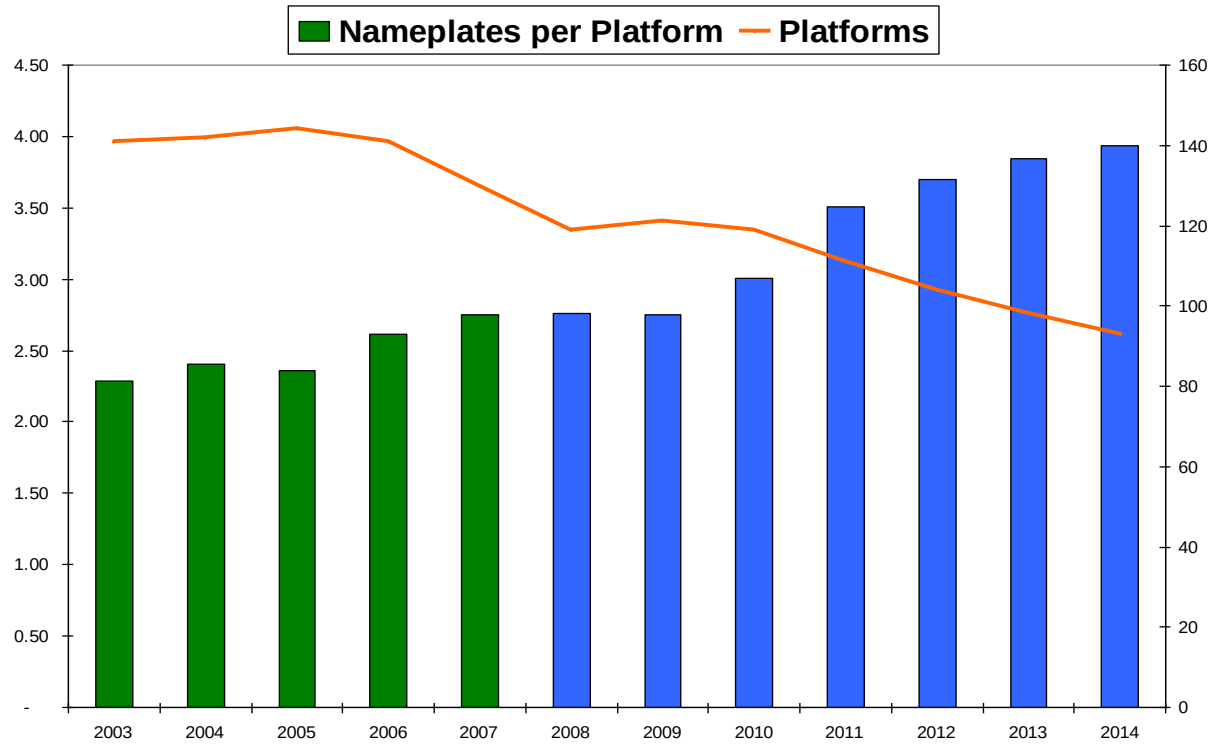
Table 2.2: U.S. Market Segment Summary 2003, 2008, 2014

2003							
	Market	**Passenger Car**	**Light Truck**	**Full-Frame**	**Unibody**	**Combined Car**	**Lower Specialty Car**
Sales Volume	16,260,000	7,116,229	9,143,771	5,854,623	3,289,148	2,558,886	674,014
Nameplates	322	179	143	84	59	42	33
Platforms	141	73	68	32	36	31	24
2008							
	Market	**Passenger Car**	**Light Truck**	**Full-Frame**	**Unibody**	**Combined Car**	**Lower Specialty Car**
Sales Volume	15,504,822 (-4.6%)	6,905,425 (-3.0%)	8,599,397 (-6.0%)	4,160,978 (-28.9%)	4,438,419 (+34.9%)	2,446,441 (+4.5%)	584,037 (+13.3%)
Nameplates	328 (+6)	159 (-20)	169 (+26)	72 (-12)	97 (+38)	40 (-2)	29 (-4)
Platforms	119 (-22)	45 (-28)	74 (+6)	27 (-5)	47 (+11)	26 (-5)	23 (-1)
2014							
	Market	**Passenger Car**	**Light Truck**	**Full-Frame**	**Unibody**	**Combined Car**	**Lower Specialty Car**
Sales Volume	17,726,253 (+9.0%)	7,608827 (+6.9%)	10,117,426 (+10.6%)	3,948,039 (-32.6%)	6,169,387 (+87.6%)	2,952,179 (+15.4)	802,193 (+19%)
Nameplates	366 (+44)	187 (+8)	179 (+36)	51 (-33)	128 (+69)	47 (+5)	36 (+3)
Platforms	93 (-48)	32 (-51)	61 (-7)	17 (-15)	44 (+8)	26 (-5)	22 (-2)

Source CSM Worldwide

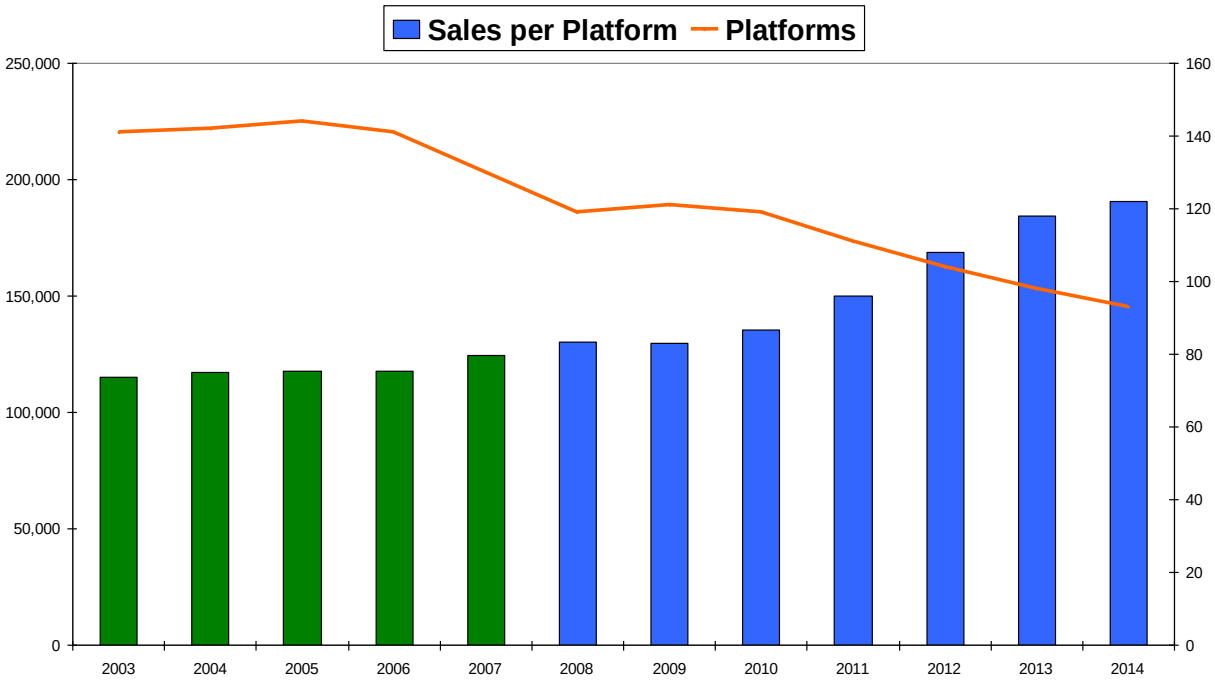
Charts 2.2 and 2.3 provide a visual representation of the gradual decline of the number of platforms offered in the U.S. market and the consequences of this decline. The decline is accompanied by increases in both the number of sales per platform and the number of nameplates built on each platform.

Figure 2.2: U.S. Nameplate Proliferation 2003-2013



Source: CSM Worldwide

Figure 2.3: U.S. Market Platform Proliferation 2003-2014



Source: CSM Worldwide

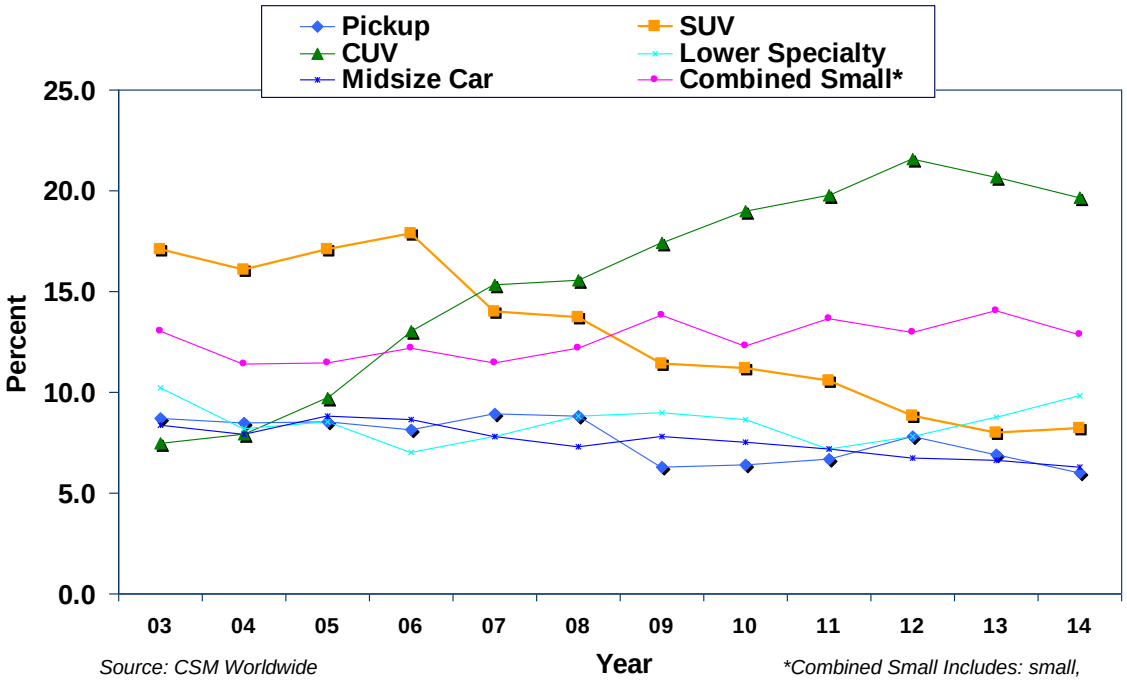
The U.S. market is expected to undergo a transformation that is perhaps best described as paradoxical. While the decreasing number of platforms on the market points to an increase in commonality, the rising number of nameplates is an indicator of increasing specialization. Having a variety of platforms and maintaining a larger "parts bin" of components are both tools that could potentially be used by automakers and suppliers to develop and produce the wide variety of products the market will call for in the near future. The need to reduce costs by using fewer platforms and maximizing the use of common components, however, will make it impossible to use these tools. In fact, since fewer platforms are expected, the task will actually be made more challenging. Both automakers and suppliers will therefore be challenged to engineer a wider variety of vehicles and components with distinct features and appearances while using more common platforms and parts.

Some suggest the forecasted increase in the number of nameplates may pose a new challenge to specialty suppliers. In the past, because the market was more generalized and fewer differentiated products were available, consumers turned to specialty market products to individualize their vehicles. With a larger number of nameplates and variants on the market, this theory suggests that consumers will need fewer specialty equipment products to differentiate their vehicles—since fewer look-alikes will exist. Since automakers have begun offering a wider variety of products than ever, some suggest there will be less desire to differentiate via the specialty equipment market.

However, differentiation is not necessarily the driving factor for specialty equipment buyers. The challenge highlighted above does not take into account the continued trend for many buyers to personalize all products they buy. Specialty equipment buyers have shown that they are driven by the desire to personalize their vehicles as a statement of style. Differentiation is important to many of these buyers, but the ability to change a grille for style purposes or even paint a vehicle as a statement of individuality is an equal driver.

Chart 4 provides the distribution of nameplates on the U.S. market broken out by select segments. The most dramatic change depicted is the rapid rise in the number of nameplates expected to be offered in the Crossover Utility Vehicle (CUV) segment. A clear replacement is taking place: while the Sport Utility Vehicle (SUV) segment offered the largest number of nameplates through 2006, its rapid decline will be replaced by new models built on car platforms in the form of CUVs. The other segments depicted (including pickups, small cars, midsize cars, and lower specialty cars—predominantly "sports cars") are not expected to experience significant changes in the number of nameplates.

Figure 2.4: U.S. Market Nameplate Distribution by Segment

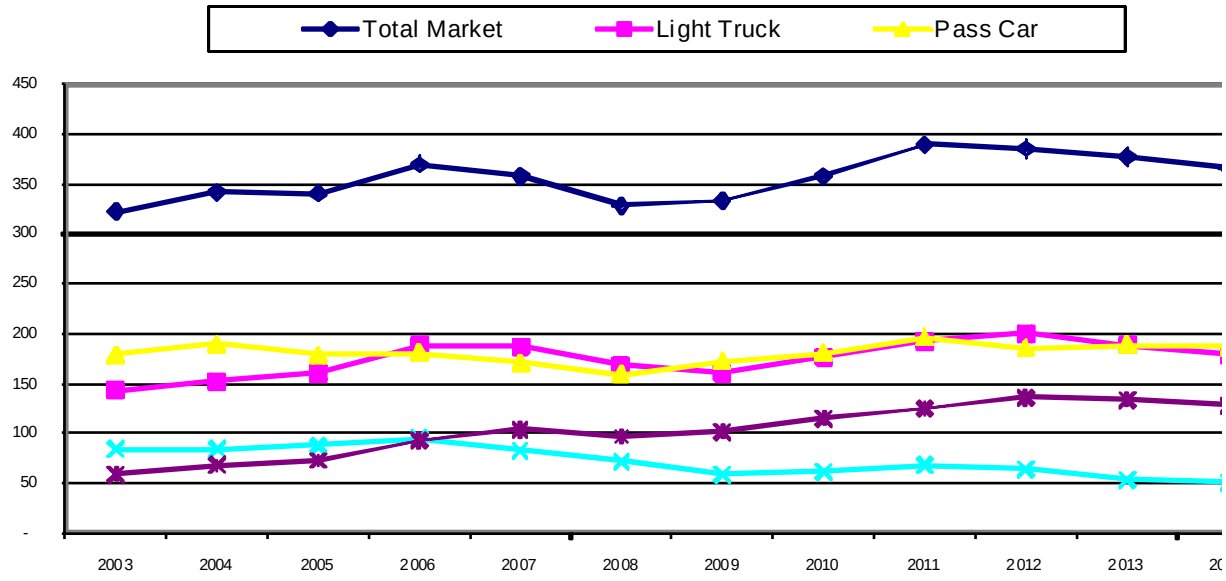


Source: CSM Worldwide

**Combined Small Includes: small, mini, and compact car*

Chart 2.5 provides a breakout of nameplate distribution for select vehicle types from 2003 through 2014. The most noteworthy development is expected to be a migration away from body-on-frame vehicles to those built using unibody architecture. In 2003, body-on-frame products (with 84 offerings on the market) outnumbered unibody products (with 59 offerings). By 2014, a dramatic change is expected that will result in unibody products—with 128 products—more than doubling the 51 body-on-frame products expected in the U.S. market.

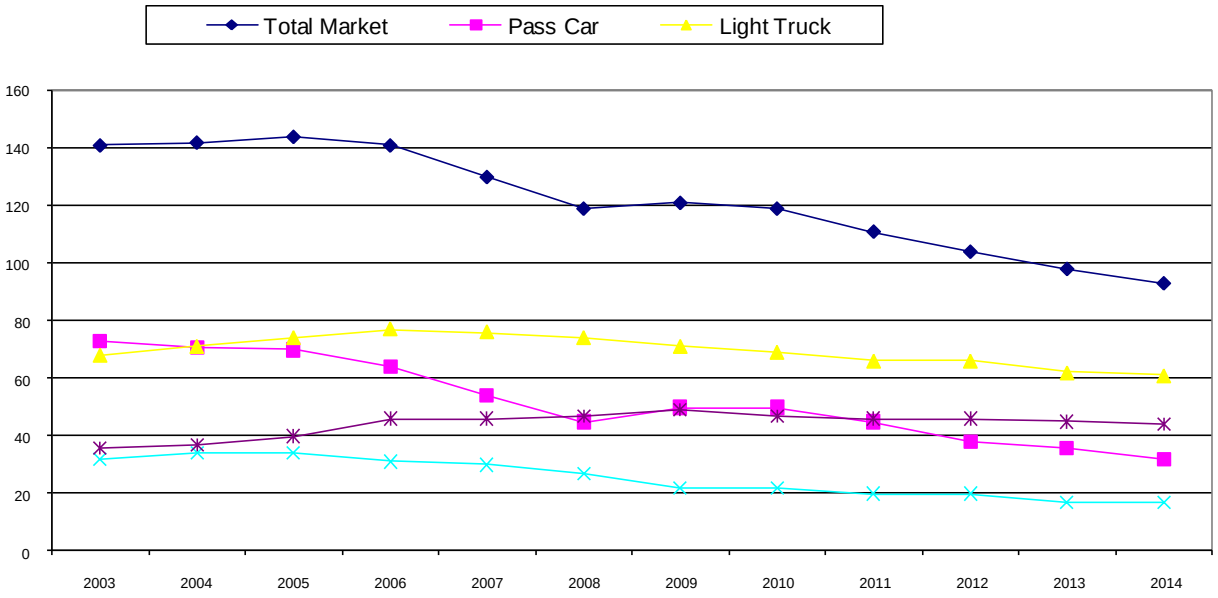
Figure 2.5: U.S. Market Nameplate Distribution by Vehicle Type



The migration away from body-on-frame architectures is likely to have the largest impact on specialty suppliers that manufacture suspension and steering-related products, or any product that relies on the vehicle's frame as an attachment point. Unibody vehicles also use powertrains that have more commonality with passenger car powertrains, as opposed to the truck powertrain components used in virtually all body-on-frame vehicles. Specialty suppliers that manufacture performance-enhancing engine and powertrain products will be impacted by this development, as well as by the emergence of alternative powertrains discussed previously.

Chart 2.6 provides a breakout of the number of platforms offered on the U.S. market for select vehicle types. The most significant development in this area is the dramatic decline in the number of platforms expected to be offered. The total number of vehicle platforms on the U.S. market remained steady (about 140) through 2006. Beginning in 2007, a sharp decline can be observed which will ultimately bring the number of platforms offered on the U.S. market to 93 by 2014. This reduction is all the more significant when the growth in the U.S. market is taken into account. The market is expected to grow by about 1 million units during the timeline covered in the chart, from about 17 to about 18 million units.

Figure 2.6: U.S. Market Platform Distribution by Vehicle Type



Source: CSM Worldwide

The decline in the number of platforms offered on the U.S. market may prove to be an opportunity for certain specialty suppliers whose products are closely related to specific vehicle platforms—either due to function or installation limitations. For example, because average vehicle volume per platform will increase from about 116,000 in 2003 to just over 190,000 by 2014, a supplier whose product has been developed for a specific platform will experience an increase of about 64 percent in the number of vehicles on which the product can be installed.

The last decade has seen the automotive industry transformed by concomitant trends of increased specialization and increased commonality. These trends are expected to continue in the foreseeable future. For specialty suppliers, these changes bring both risks and rewards. The increasing number of nameplates will bring with it a decrease in sales per nameplate. This development will be a challenge for specialty suppliers whose products are closely associated with vehicle body panels and trim. The decreasing number of platforms, however, will be both

an opportunity and a risk for suppliers whose products are closely associated with vehicle structure. The increasing number of sales expected for each platform promises to bring higher sales volumes for suppliers who successfully adapt their products to a specific platform. Suppliers who are not able to make their product work on a specific platform, however, will find a larger share of the market closed to them. At the same time, model lifespans will be shorter and redesigns will be performed more frequently. Suppliers will therefore see an increase in the number of projects they will face at any given time.

2.3: The Specialty Market Assisting Vehicle Manufacturers in Meeting Customer Needs as the VMs React to Changing Market Demands

This section will briefly investigate future strategic implications for SE suppliers enabled by an effort by vehicle manufacturers to reduce manufacturing complexity at the assembly facility. Investigation of this research area was driven by two separate events─both of which were reactions to the current market conditions.

- There has been an increased interest in reducing vehicle assembly plant complexity, and thus cost, without reducing consumer choice.
- The rapid rise in energy prices has created interest by many manufacturers in adapting global products to the U.S. market.

The changing market demands also present strategic opportunity for those SE suppliers that do not wish to deal directly with the VMs. As manufacturers look to leverage the SE market to either reduce complexity at the plant or to enable global products to be adapted to local markets, they will, by the nature of the act, make their vehicles more accessible for all SE suppliers.

2.3.1: Reducing assembly plant complexity

Certainly, assembly plant complexity is not a new topic for the automotive industry. For some audiences, vehicle manufacturers will gladly highlight the number of model/option variations that can be built at a plant—illustrating the great flexibility the plant offers. For example, the number of build options at a pickup plant can be well into the hundreds of thousands. Conversely, for other audiences, they may wish to showcase the efficiency of their assembly plants. Realistically, the two are not compatible—in fact, build complexity and plant efficiency are inversely related.

As recently as twenty years ago, in an effort to limit the number of build options, some manufacturers offered air conditioning as a dealer-installed option. Over the past several decades, there has been a general trend in the industry to add content complexity to the assembly plant. Much of this has been due to the seemingly exponential increase in available options. Yet, it was also an attempt to control quality. Installation at an assembly plant presents considerably less opportunity for error than does installation at a dealership.

Several companies have addressed this challenge by limiting build options which usually entails building only three or four option packages. This strategy greatly reduces complexity at the plant, but it also limits choice for the consumer. The discipline to limit build options has been a greater challenge for some manufacturers than for others. For example, Honda and Toyota (in general) offer significantly fewer build combinations than do the Detroit Three.

The Scion experience presents an extreme example of reduced plant complexity. An initial pillar of the vision was to offer low-cost vehicles which could be customized by the consumer. Toyota's resolution for this was to greatly reduce the production options in Japan, so the factory would not be burdened by high levels of variation and cost. Initially, Scions from the factory

varied only by automatic versus manual transmission and external paint color (all interiors are black.) To avoid added cost to the plant and long lead times, final customization is done in the United States─either at the port of entry or at the dealer.

Ford has indicated they are planning to greatly reduce build combinations at their assembly plants. For example, the Lincoln MKS has 300 build options, compared to over 50,000 for the no-longer-produced Lincoln LS.[4] It is likely General Motors and Chrysler will follow. This is certain to reduce cost at the assembly plant. However, it is also likely to reduce the chances that an individual customer's desire for personalization will be satisfied.

In the case of Ford, it is viable that the SE market may play a role in filling the void left by reduced build options. This is especially interesting because Jim Farley, Group Vice President of Marketing and Communications, has been one of the leaders in this effort. Farley also was a driving force behind Scion while at Toyota.

CAR researchers believe this strategy presents a strong opportunity for SEMA member companies. The ability for SE suppliers to assist VMs by taking complexity out of the plant—especially for lower cost vehicles─would be a strong incentive for the VMs. However, the challenges are great. Of critical concern to the VMs is the ability for the dealer installation to meet factory-installed quality goals. Section 2.1.5 describes the challenges and opportunities of developing a closer relationship with VM dealer networks.

2.3.2: The rapid rise in energy prices has created interest from many manufacturers in adapting global products to the U.S. market

The recent, and rather rapid, increase in the price of oil and concomitant price of gasoline has increased interest in high-mileage vehicles. This has caught many vehicle manufacturers with a void in their product line-ups. It is likely manufacturers are considering the following actions as steps to deliver products to meet what appears to be a structural change in consumer choice:

1. Substituting more fuel efficient vehicles: Bringing in more efficient vehicles from global operations.
2. Substituting powertrains: Adding existing downsized engines (i.e. turbocharged versions, etc.) to current vehicles that don't offer them.
3. Powertrain enhancements: Adding technology to current engine and transmission offerings to increase fuel economy.
4. Incorporating alternative powertrains into existing vehicle platforms: Developing a hybrid or other type of powertrain for an existing vehicle.
5. New powertrains and new platforms: Developing vehicles specifically intended to incorporate new powertrain technologies, materials and/or design (e.g. the Toyota Prius, or the General Motors Chevrolet Volt).

These five actions represent the gamut from the least complicated solution to the most complex. They also generally represent the least expensive response to the most expensive. Option 1 presents the simplest and quickest response for the VMs. It also is the most interesting to SE suppliers. A company may reach into its global portfolio to deliver vehicles that afford better fuel economy. These vehicles are often smaller and have significantly less content than current

[4] Wilson, Amy, *Ford Cuts Equipment on '09s*, Automotive News, February 18, 2008.

U.S. offerings. The SE market is ideally positioned to assist VMs in adapting global vehicles to meet needs of U.S. car buyers.

The SE supplier may offer both the VM and the consumer opportunity for increased fuel efficiency. However, the powertrain is greatly a regulated component of the vehicle. Only those components that interact with the vehicle's safety system are (possibly) more regulated than powertrain components. State and federal emissions regulations are likely to present significant hurdles as SE suppliers develop components that satisfy consumer needs for powertrain performance (either fuel efficiency or horsepower). This is certainly not news to those that currently supply such parts. However, it is likely that increasingly stringent local, state and federal regulations may present an increasing challenge in the coming years.

Many respondents suggested fuel efficiency (and associated emissions testing) would be the biggest challenge and opportunity for the SE market in the coming years. Several respondents suggested there would be far more stringent local emissions testing in the coming decade. These more stringent standards will require VMs to develop even more controlled powertrain operating systems. The inability for SE suppliers to access these closed systems may prove to be problematic.

An important point made by several VMs and OE suppliers interviewed was that it will be critical for SE suppliers to develop products that can meet the anticipated new regulations. Many believe that the complexity of the VM powertrain systems (hybrid electric, gasoline direct injection, etc) will make it more difficult for the SE market to deliver products that not only meet the consumer's needs, but also are able to pass annual emission tests. While respondents agreed the SE market has overcome this challenge in the past, there was a strong belief by several respondents that the complexity of future VM systems would exclude anyone not partnered with the system designer.

Others indicated that this is an opportunity. The SE market has provided enormously creative powertrain technology in recent years and has experience in meeting state and local regulations. According to the opportunists, the increased interest by the consumer in fuel efficiency technology is a boon to the SE market. There are already many companies working to develop specialty equipment solutions to the fuel efficiency challenge. Many believe they will have the opportunity to prosper in this new environment, even with the expectation of increasingly complex powertrains.

A general estimate for the cost to homologize a vehicle—to prepare an existing vehicle for entry into the United States provided all business conditions are met (reasonable product, capacity availability, etc.)—would be approximately $50 million. An important caveat to consider is that the cost of homologization may have decreased in recent years. Through the increased application of computer-aided tools, manufacturers are rapidly decreasing the time—and cost—required to engineer (or make engineering changes to) vehicles, thus permitting quicker and less expensive adaptation for markets for which the vehicle may not have initially been targeted.

It is interesting to include the Scion model in this discussion. The initial product line-up for Scion in the U.S. included two Japanese market models. The Xa and Xb were marketed in the U.S. as unique and quirky. Had Scion been launched today, they could have certainly added fuel efficiency to the marketing plan. Realistically, the de-contented Scion offerings were not strong entries. It was the creativity of the specialty equipment market that allowed Toyota to create a marketing 'buzz' surrounding the Scion products. Ford, GM, Chrysler—and even Nissan, Toyota, and Honda—have vehicles for sale outside the U.S. market that, due to current gasoline

prices, may be viable for conversion to the U.S. market. CAR researchers believe the SE market is ideally positioned to assist vehicle manufacturers in rapidly adapting products to the U.S. market.

2.4: Product Related Global Sourcing Issues for Specialty Equipment Suppliers

Specialty equipment suppliers face a multitude of legal duties and obligations, some of which concern the safety of the products they design, manufacture, and sell. Liability exposure of manufacturers and others can be enormous. It is, therefore, essential that companies have an understanding of the governing laws wherever they manufacture or sell their products. Moreover, because the applicable laws in this area vary from state to state, it is highly advisable for aftermarket manufacturers to consult with their attorneys on the applicable laws.

2.4.1: Legal risks associated with sourcing components from overseas

The challenges specialty suppliers face in dealing with legal liability can be compounded when they engage in global operations. Globalization, whether in the form of international sourcing or international sales, is a double-edged sword. It can counter the promise of financial savings and increased revenue with increased risk, uncertainty and potential legal liability.

For legal purposes, a U.S. importer of a foreign component is treated under the law as the manufacturer of that product. This approach can create considerable responsibility for the supplier that manufactures overseas. Even though it may have limited knowledge and control over the quality, durability, and performance of the parts it imports, it can be held accountable for the losses resulting from failure to meet applicable standards (e.g. negligence, breach of warranty). Supply chain monitoring and quality control measures are, therefore, essential.

A recent case illustrates an example of international liability negatively affecting a specialty supplier. The firm in question was a small operation named Foreign Tire Suppliers (FTS). The company imported tires from China which were then sold in the automotive aftermarket in the United States. Some were mounted on a vehicle involved in a fatal accident. The survivors and families of victims filed lawsuits against the importer, among others. They also attempted to undertake legal action against the manufacturer of the tires which was based in China. The attempt to seek restitution from the Chinese firm proved fruitless. Moreover, a decision from NHTSA required a recall of all possibly defective tires. Under U.S. law, the importer faced the same legal obligations as the OEM and was, therefore, responsible for carrying out the recall. The estimated cost of the recall was $90 million. The company decided it would not be able to shoulder the cost of the court settlements and the required recall. After completing a small part of the recall, the company closed down.

The injured consumers were, therefore, left with no remedy. The U.S. importer went out of business, and the consumers who bought the defective tires were stuck with them. At the same time, the Chinese firm who produced the defective tires walked away without being held responsible. For the majority of specialty suppliers, a legal strategy of closing down the company in the event of a large legal settlement or an expensive recall is simply not viable. Even more than original equipment suppliers, these firms are often dependent on the brands and reputations they may have spent decades building. In order to protect themselves from possibly catastrophic legal liability, a careful international strategy is of paramount importance.

Numerous similar examples, combined with the fallout from other defective Chinese products ranging from toys to toothpaste, have put pressure on the U.S. government to prevent similar problems in the future. To that end, NHTSA has signed a Memorandum of Understanding with the Chinese government to work to prevent the distribution of unsafe or defective parts.

Moreover, new legislation regarding best practices for import product safety is imminent. A manufacturer choosing to import parts from overseas, could be regarded as the products' manufacturer and held accountable for any resulting recalls or damages.

Specialty suppliers face potential legal responsibility–not only when products turn out to be defective but also when they turn out to be a counterfeit version of a product made by another manufacturer. To be subject to counterfeit liability, a U.S.-based specialty supplier need not be involved in the design of the product in question. Simply turning a blind eye when the supplier may have had reason to suspect a counterfeit product is sufficient. Evidence as abstract as invoices from the overseas part manufacturer that are not clearly written may be sufficient reason to suspect the producer of counterfeiting or other illegal activity.

Specialty suppliers also need to be aware of foreign companies counterfeiting their products and packaging in order to sell them to unknowing distributors. Examples have surfaced in which the foreign companies counterfeiting a specialty supplier's product have turned out to be the specialty supplier's Chinese suppliers. Providing a foreign company with the engineering data necessary to use them as a supplier may also give them (or another company with which the supplier may be affiliated) the information they need to make counterfeit parts and packaging. Once again, careful monitoring and vetting of international partners is critical.

2.4.2. International harmonization of vehicle safety and environmental standards

A final example of a development that can affect an Aftermarket Supplier's legal obligations involves an international trend aimed at harmonizing environmental and safety standards that, if adopted, will create regulations that will need to be met down the road. It is, therefore, advisable to be aware of these developments.

Efforts being undertaken to harmonize vehicle and vehicle component standards globally bring both opportunities and challenges to specialty suppliers. The process allows for interested Non Governmental Organizations (NGOs) to participate in the formulation of a proposed global technical regulation. For suppliers who have successfully certified a product to conform to such global standards, new markets around the world open without incurring the cost and effort to satisfy numerous certification processes. On the other hand, suppliers who are unable to meet a given standard will find their products unsuitable for sale in all the markets around the world that have adopted the particular harmonized standard.

The task of harmonizing automotive safety standards has been championed by the United Nations World Forum for Harmonization of Vehicle Regulations (WP.29). It consists of a variety of government and non-government bodies. At this juncture, two groups exist within WP.29. One group consists of 46 Contracting Parties to the 1958 Agreement.[5] The United States is not a signatory to that agreement. The other consists of 28 Contracting Parties to the 1998

[5] Germany, France, Italy, Netherlands, Sweden, Belgium, Hungary, Czech Republic, Spain, Yugoslavia, United Kingdom, Austria, Luxembourg, Switzerland, Norway, Finland, Denmark, Romania, Poland, Portugal, Russian Federation, Malta, Malaysia, Greece, Ireland, Croatia, Slovenia, Slovakia, Belarus, Estonia, Bosnia and Herzegovina, Latvia, Bulgaria, Turkey, Macedonia, European Union, Japan, Australia, Ukraine, Republic of South Africa, New Zealand, Azerbaijan, Lithuania, Cyprus, Republic of Korea, and Thailand.

Agreement.[6] The United States is a signatory to this agreement. Many nations are Contracting Parties to both agreements. Participation in WP.29 is open to all UN Member States and Regional Integration Organizations, Intergovernmental Organizations, and Non-Governmental Organizations (NGOs). The latter must be approved by the United Nations. Essentially, the 1958 Agreement seeks harmonization on both technical issues (e.g. definitions, performance, test protocols), as well as subsequent administration and enforcement issues (e.g. type approval, sanctions). Once adopted, the ECE regulation becomes a voluntary international regulation, as in the case of the 1998 Agreement. The difference from the 1998 Agreement rests with the "voting to adopt" under the 1958 Agreement. There, Contracting Parties who vote to adopt (requires 2/3 present and voting) are then bound to accept products that meet the regulation. But, as discussed herein, they are not bound to adopt the regulation into their national law.

The 1998 Agreement, on the other hand, allows Contracting Parties to participate in the collaborative process of formulating harmonized technical regulations (e.g. field of application, technical prescriptions, test methods) while retaining sovereign identity (e.g. no certification procedure, no type approval). Unlike ECE regulations, GTRs become enforceable regulations if, and only to the extent that, Contracting Parties incorporate them into their respective legal systems. The 1998 Agreement, therefore, strives for globally harmonized regulations.

As the number of harmonized regulation increases, it will be important for specialty equipment manufacturers to monitor these developments and to understand the impact of this trend on their companies. To date, UNECE has adopted proposals on harmonizing standards for parts including: a wide variety of lighting and lamps; vehicle braking; protection of vehicles against unauthorized use; devices for indirect vision; installation of lighting and light-signaling devices; rear-marking plates for slow-moving vehicles; replacement brake linings; headlights emitting an asymmetrical passing beam; headlights emitting a symmetrical passing beam; hand controls, and indicators; safety belts; speed limitation devices and retro-reflective markings.

The UN harmonization effort described above will primarily impact global harmonization of standards in─among other markets─the U.S., the European Union, and Japan. Several countries in which vehicle production has been growing rapidly (e.g., China, Russia and India) are also involved in harmonization efforts. As they get more involved, the role these countries play will be critical in determining how this trend will impact the global automotive industry.

[6] United States, Canada, Japan, European Union, France, United Kingdom, Germany, Italy, Russian Federation, Republic of South Africa, Hungary, Norway, Malaysia, Luxembourg, Turkey, Finland, China, Korea, Slovakia, New Zealand, Netherlands, Azerbaijan, Romania, Spain, Sweden, Cyprus, India, and Lithuania.

3. Electrical/Electronic Technology Strategy

This section describes the vehicle electronics technology (body/chassis, vehicle to vehicle (V2V)—and infrastructure (VII)—integration, and infotainment electronics) and its application in the automotive specialty equipment market: The ability to create and integrate a wide range of electronics technologies and components is critical to success for SEMA member companies. It is also important to understand how non-electronic-based components may be affected by the rapid application of electronics to the vehicle. The pace of change in automotive electronics technology continues to accelerate at an unprecedented rate—some of which has been driven by SEMA member companies. While consumer electronics have trended toward an open architecture (for a variety of reasons) this has not been the case for automotive electronics. Identifying trends in architecture strategies, its implications, and possible responses will be a key for SEMA member companies.

CAR has identified several trends in E/E technology strategy that will affect SEMA members. These are presented in two sections:

- Body/chassis electrical/electronics and the specialty equipment market
- Opportunities in the connected vehicle market for specialty equipment suppliers

The two technology groupings present an important differentiation in strategy. Many of the SE suppliers in the body/chassis sector have traditionally offered components with little or no electronics incorporated into their products (e.g., tires, wheels, suspension components). Even those with electrical systems (e.g. sunroofs) have had relatively little need to interact with the vehicle—other than to get electrical power. Conversely, the electronics sector presents significant challenge.

The question for the groups differs significantly. For most body chassis SE suppliers, the concern is “can my component exist ‘as is’ in an increasingly electronically controlled vehicle?” For the SE supplier in the electronic sector, the question may more aptly be, “how much information will my device be able to exchange with the vehicle?” While the questions may be different, the answers are equally important to each group.

3.1: Body chassis electrical/electronics and the specialty equipment market

While the question of how the body/chassis sector of the SE market may evolve over the next several years may appear to be the more simple, the answer (and subsequent response) is no less challenging than that for the connected vehicle supplier.

The over-riding concern for the VMs is that aftermarket access into the electrical/electronic system may modify the integrity of the vehicle. In the case of the chassis E/E system, any modification may alter safety. And, from the manufacturers’ viewpoint, safety concerns are a show-stopper. The challenge for SE suppliers is to continue producing and installing products that do not have an adverse impact on vehicle safety, yet adapt to a more electronically integrated vehicle.

While safety is critical, such access could also have quality and warranty concerns. According to several respondents, VMs often get warranty bills when their customers do things to the vehicle that damage other parts of the car. One respondent gave the example of a recent experience with an electrical *aftermarket* component. According to the respondent, the component was causing low voltage lamps to burn out. The vehicle manufacturer chose to

cover the cost of replacing the lamps. An important point made by the VM representative was that most consumer goods manufacturers would not cover such damage. Accordingly, because vehicle manufacturers take more responsibility for their product than do most other industry manufacturers, there are more incentives to limit access.

According to many respondents, vehicle systems are currently designed with an operational signal range (i.e. hubs that will work with a range of tire and rim sizes). The sensitivity to modification varies by system. In general, the transition from passive to active safety features leads to increased complexity and sensitivity to alterations. For example, anti-lock brake systems are less sensitive to modification than the more complex stability control technology, which is very sensitive to variation.

There was also concern expressed over vehicle electrical loads—both power on and power off. VMs are constantly looking to downsize the battery to save weight. That means there is less power available. VMs plan for specific loads based on OE supplier information. As the robustness of the power distribution system is reduced, there is growing concern about what the SE market could connect to a vehicle's E/E system. Those specialty equipment suppliers who make products that use electrical power from the vehicle must continue to take this load limit into account as they design products for future vehicles.

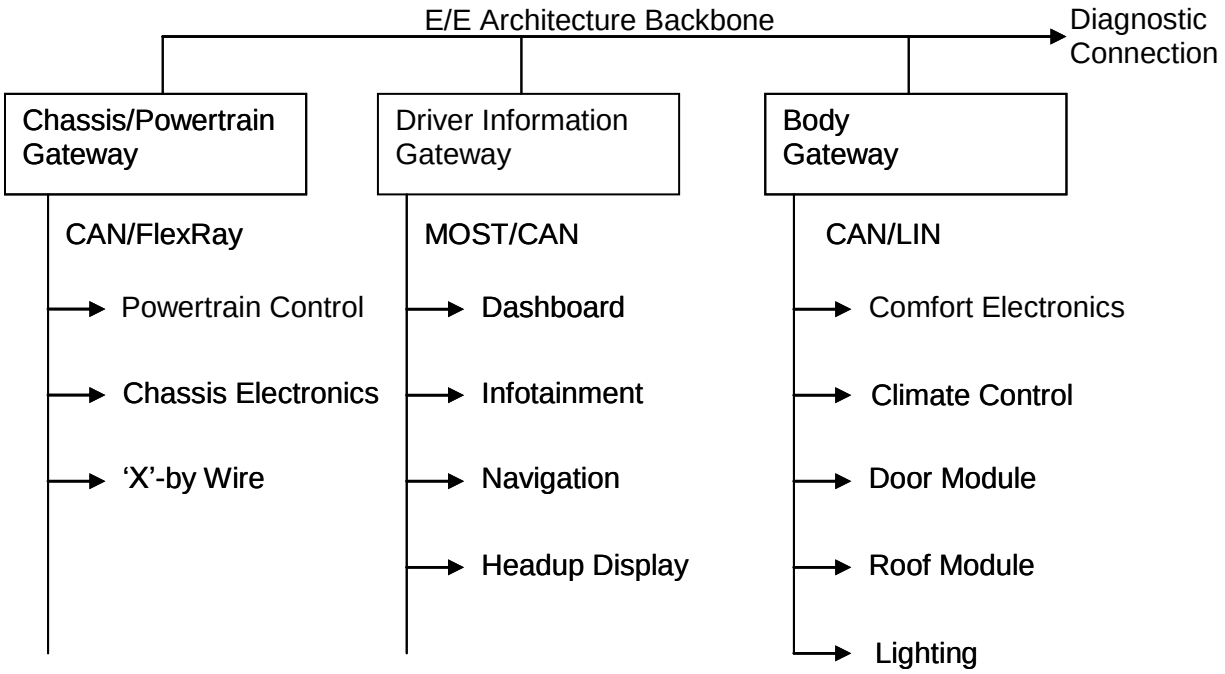
3.1.1: The electrical/electronic architecture

All VM and OE suppliers interviewed—with one exception—strongly believe the specialty equipment suppliers will continue to be allowed access to diagnostic codes from the chassis (and powertrain) controller-aided network (CAN), but will not be allowed access 'into the system'. Several respondents used the term firewall to represent both the computer terminology, and the physical firewall that separates the interior from the rest of the vehicle. Their belief was the SE supplier will not be allowed access beyond that point[7]. While there were many reasons given for this protective attitude, the over-riding concern was safety (and associated liability).

Figure 2.1 shows a generic vehicle electrical/electronic architecture. Generally, the vehicle E/E system is segmented into three major elements: powertrain/chassis, driver information and body. Access to each system is controlled to varying degrees. The powertrain and chassis gateway represents what respondents referred to as the firewall. With one exception, there was no expectation this information would be opened to SE suppliers. These modules (chassis and powertrain) currently use CAN-based communication protocol (although there is some movement in the industry to a faster protocol, FlexRay).

[7] It is worth noting that OBD (II) emissions controls presented this challenge over a decade ago. This lack of access has not necessarily hindered the powertrain SE market in recent years.

Figure 3.1: Generic Vehicle Electrical/Electronic Architecture



The driver information system is often managed by Media Oriented Systems Transport (MOST). MOST is currently the de-facto standard for multimedia and infotainment networking in the automotive industry. The technology was designed to provide an efficient and cost-effective method to transmit audio, video, data and control information between any attached devices. MOST is (intentionally) a more accessible protocol for SE suppliers than CAN.

The body gateway also is controlled via CAN, or alternatively, the local interconnect network (LIN) for less demanding applications. There was some disagreement over the access to this system. In general, the body system has seen increasing application of safety-related items (e.g., airbags). Because of concerns over safety, many respondents were very hesitant to expect increased access for most SE applications in this area.

The means offered to SE suppliers for access to information from these gateways (in a read only form) has historically been the diagnostic gateway (that is, access) to diagnostic codes. Respondents indicated this would continue to be the method of choice. Thus, as mentioned in previous sections of this report, it is essential for SEMA to continue to work with the VMs to allow SEMA member companies access to this diagnostic information at the earliest stage possible in the vehicle development process.

Finally, it is important to note that many SE suppliers have learned how to access most VMs' E/E systems (both read and write access). While this is commonplace, and often an effective method of overcoming the closed system, it is not viewed by the VMs as a positive outcome.

3.1.2: The firewall must protect the vehicle and the vehicle manufacturer

The message from most respondents was clear: the SE market, while considered a partner, is not likely to be allowed access behind the firewall. This presents challenges for the SE market.

Thus, an important element of this report was to identify those with visions to effectively overcome the barriers.

3.1.3: The authentication model

One potential solution to the challenge of controlling access was to use an authentication model. While this approach has been very common within the consumer electronics industry, it is much less so in automotive. Ideally, the model would include a means for consumers to identify that the component was in compliance with the vehicle manufacturers' systems. This would rely upon an authentication chip to manage communications between applications, the creation of legal agreements and a validation process.

Such a strategy would allow the SE market to access selected critical information, while still permitting the VM to control the end product. Respondents believed the authentication model was more applicable to the connected vehicle model than the powertrain or chassis E/E system. However, there was general agreement that it was a viable pathway to investigate.

One vehicle manufacturer was actively exploring this concept for its consumer electronics technology. Although they were not currently considering such a strategy for any other systems, they did not rule out the possibility of moving in that direction in the future.

3.1.4: The OE supplier vision for specialty market partnership

The OE supplier may offer an important pathway for SE suppliers to ensure their products appropriately interact with vehicle systems. Through discussions, it was clear OE system suppliers present an integration opportunity for the SE market. These OE suppliers offer a depth of understanding at the systems level that is not commonly found in the SE market. In the coming decade, they may serve an important role as communicators, coordinators and even evaluators. A few OE suppliers interviewed indicated they have considered business models that may include working with the SE market.

Most OE suppliers interviewed believe that SE components which replace OE equipment on electronically controlled systems—even those without electronics—are likely to need increased validation in the coming years. Driving this belief is an expectation that (as described above) the transition from passive to active safety features will lead to increased complexity and sensitivity to alterations. According to these respondents, products that interact with those complex systems *may* be at risk. Further, there is some expectation that any safety-related systems will come under increased scrutiny from federal safety regulations. That would likely increase the level of testing and verification for certain SE components.

According to this model, the OE supplier may find it strategically valuable to place itself between the VM and the SE supplier. As this report has described, there is increasing interest on the part of the VMs to access SE supplier offerings. Yet, due to constrained resources, many VMs are not able to access this market. An OE supplier with system knowledge could offer its customer the capability of validating—or at least evaluating—SE components for its vehicles. From the SE supplier viewpoint, a system integrator may offer access to integration knowledge across vehicle manufacturers.

Obviously, the key point continues to be that of OE certification—and more specifically, the need to be certified and the cost associated with certification tests. The OE supplier may offer SE suppliers testing and verification resources, but these may be costly and (as viewed by some SE suppliers) unnecessary.

The OE supplier as an integrator presents an interesting model. However, it appears for many SE suppliers, the value of this model may come down to the question of OE validation, or more specifically, "will my product need to be OE compatible in the coming years?" This report has investigated the question with a range of VMs, OE suppliers and SE suppliers. There is certainly not consensus. However, there is growing expectation by the VMs and OE system integrators that some body/chassis SE components may need to be system-certified in the coming years. There is far less certainty on that outcome from the SE suppliers.

3.1.5: The SE supplier-driven validation model

For many SE suppliers, the current model includes an iterative development process. For example, as a new technology is introduced on a vehicle, the SE supplier must develop (or adopt) and test a product for the new entry. Depending on many variables, including the amount of change in a new product and the experience of the supplier, this process could include several iterations to assure compatibility. Some SE suppliers, driven by new active safety features, have begun to investigate more rigorous self-testing strategies.

One example is worthy of highlighting–that of a company that has performed tests to measure its products' effects on a newly implemented vehicle system. Upon initially evaluating the technology on the new system, they found that their product (as initially designed) had negative effects on the vehicle system. After redesigning the system, the company chose to explore whether the vehicle, with their equipment, remained in compliance. Those tests proved the vehicle to be in compliance. They were also very expensive.

Upon successful completion, the company must now consider how to proceed with regard to evaluation of similar products on other vehicles. They are now considering the viability of using simulation software as a proxy for future testing.

An interesting outcome of these interviews has been the question of whether an organization such as SEMA could—or should—consider a strategy that allows member companies access to a site license for simulation software technology. As mentioned, there are simulation software programs available which may enable users to better predict the likely compatibility of their components with vehicle manufacturers' systems. Many SEMA member companies do not have the resources to access such software.

Although there are legal, licensing and competitive concerns, many respondents suggested it was of value for SEMA and its member organizations to investigate the possibility of easing access to these software packages. This could be done through a site licensing agreement, and could include training and support.

Much as SEMA has created standards for installers to gain recognition as Pro-Pledge accredited installers, many interviewees suggested the organization should create a standard that recognizes member products meeting OE-type standards. According to the respondents, this would raise the comfort level of VMs, dealers, and the consumer. Of course, such a program would certainly be costly and likely controversial.

3.2: Opportunities in the connected-vehicle market for specialty equipment suppliers

Since roughly 2001, the automotive industry and public-sector transportation agencies have been engaged in the development and testing of a set of technologies that fall under the banner of vehicle-infrastructure integration (VII) or, more simply, connected vehicles. This development entails the use of communication technologies–both vehicle-to-vehicle and vehicle-to-

infrastructure—to promote safety, improve mobility, and enhance personal convenience through consumer electronics, infotainment, location-based services, etc. These technologies offer both opportunities and risks for SEMA companies, and their ongoing development is complicated by a still-evolving regulatory regime. The opportunities stem from potential changes in automotive supply chains that may favor SEMA members, as well as from a potentially growing market for aftermarket electronics that contribute to connected-vehicle functionality. The risks come from several sources, including competition from legacy suppliers (such as Delphi, Continental, etc.), barriers against interfacing with embedded vehicle systems, and the uncertain regulatory environment. The opportunities and risks will change as technology continues to evolve, and these trends will affect the prospects for success for SEMA members in the connected-vehicle world.

CAR has investigated trends in the connected-vehicle space through several methods. First, CAR researchers completed a survey of technology experts from both the automotive and telematics sectors (as well as the public sector). Second, we conducted several interviews with connected vehicle experts from the automotive industry and beyond. This includes meetings with experts linked with the Connected Vehicle Trade Association (CVTA) and other organizations, including SEMA itself. Third, we participated in numerous connected vehicle forums, including the 2007 ITS America Annual Meeting, the 2007 and 2008 ITS Michigan annual meetings, the 2007 and 2008 Management Briefing Seminars, and the VII Tactical Deployment Workshop hosted by the OmniAir consortium in May 2008. Fourth, we have participated in meetings with officials responsible for the federal VII program, as well as those responsible for state-level programs in Michigan and California.

From these different sources of information, CAR has identified several broad trends that will affect SEMA members. These are listed briefly below and explored in more detail, with implications for SEMA members, in the sections that follow.

- The future of vehicle communications includes multiple channels.
- OEM firewalls will limit some options (and create others).
- On-board connected-vehicle hardware will range from fully embedded to not-at-all embedded.
- Connected-vehicle standards are partially in place and more are needed to spark the market.
- The regulatory environment that affects the connected-vehicle environment is critical and in flux.
- Data are critical (and thus may be lucrative).

3.2.1: The Future of Vehicle Communications Includes Multiple Channels

Current activity in the connected-vehicle world strongly suggests that the future will include several different communication technologies in use. While much of the history of VII to date has focused on Dedicated Short Range Communication (DSRC), operating at 5.9 GHz and based on the IEEE 802.11p standard, this is no longer the case. The early emphasis on DSRC is not surprising given that, in 1999, the Federal Communications Commission (FCC) reserved the 5.9 GHz spectrum for transportation applications.[8] In the last couple of years, however, DSRC development has moved slowly; meanwhile, cellular networks have become pervasive and capable of supporting many of the mobility and personal convenience applications once

[8] http://www.fcc.gov/Bureaus/Engineering_Technology/News_Releases/1999/nret9006.html, June 26, 2008

seen as part of the DSRC package. As a result, cellular and other nomadic technologies have served as the basis for an alternative path for connected vehicle development, presenting a whole new opportunity for specialty equipment suppliers. This change in focus from DSRC only to include all available channels has even been accepted at the federal level, as evidenced by USDOT awarding Caltrans with its largest grant under the SAFE TRIP-21 program: Caltrans's application focuses on use of cellular technology. The automotive industry, too, appears supportive of this change in focus, as evidenced by the release of Ford Sync and Chrysler's UConnect, both of which serve as a conduit for connecting aftermarket and consumer electronic devices to the in-vehicle info-structure.

Perhaps the strongest evidence for a future that includes multiple communication channels comes from CAR's Delphi Method forecast of the VII industry that was conducted in late 2007 and early 2008. This study included three 20-person expert panels, with each panel drawn from a different sector of the connected-vehicle world: public-sector transportation agencies, automotive companies (VMs and OE suppliers), and the telematics industry. All three panels selected 5.9 GHz DSRC as the most likely communication protocol to be used for critical safety applications (such as vehicle-to-vehicle active safety) by 2015, while all three also forecast cellular technologies in this role for traffic probe and fleet management applications. Respondents expressed less agreement on likely pipelines for media downloads and other personal convenience applications, but growing networks for broadband and next-generation cellular (3G and later 3.5 and 4G) suggest that needed bandwidth could come from this direction. Ultimately, these technologies will allow vehicles to become mobile nodes with IP addresses—that is, mobile points on the Internet.

Another likely future outcome is that, while specific applications may preferentially use one channel or another, ultimately applications will switch depending on available networks. Both the automotive and telematics panels overwhelmingly agreed that on-board vehicle technology will allow seamless switching between communication channels by 2020, with a strong majority of the telematics panelists in agreement that this will occur by 2015. (The automotive panel was not asked about 2015.) While the forecast for 2020 is certainly beyond the radar for many SEMA member companies, the majority of respondents expected this to happen in the next seven years—certainly a mid-term strategic issue and one that SEMA member companies should keep in mind.

3.2.2: OEM Firewalls May Limit Some Options (and Create Others)

Regardless of the mix of communication pipelines that support connected-vehicle applications, automotive manufacturers certainly will restrict interactions with the vehicle's data (CAN) bus, including the next-generation bus (FlexRay). This will be done for issues related to data security, safety, and intellectual property. This will limit the range of functions that aftermarket technologies can perform, but these limitations alone will not prevent aftermarket products and services from playing important roles in the connected-vehicle world. Beyond these limits, however, a great deal of data will be available from the vehicle to support aftermarket products and services. Therefore, important market opportunities will exist for SEMA members, despite some limitations caused by vehicle firewalls.

To a certain extent, these firewalls are less technical obstacles (engineering capabilities of SEMA members are more than sufficient for specialty equipment products to emulate OEM equipment), than they are possible legal hurdles. In this scenario, the VMs dictate what can be done and what cannot, putting liability on companies who choose to bypass these restrictions. This also opens up potential opportunities: SEMA members and other consumer electronics

firms can offer VMs and OE suppliers a faster product development cycle that could foster the creation of VM-sanctioned electronics products giving VM customers added performance and value, as well as peace of mind arising from the sanctioning or certification process. For this approach to be implemented successfully, VMs and OE suppliers would need to create open lines of communication with SE suppliers to ensure that aftermarket products were compatible with ongoing and planned model and E/E architecture changes.

Limitations imposed by data firewalls and proprietary data issues are likely to manifest in two primary areas. First, active safety applications (at least those sanctioned by the VMs) likely will be restricted to manufacturer-installed systems, unless completely self-contained aftermarket systems can be developed. Second, while much data still will be available from the vehicle bus, VMs will be selective in determining who will be able to understand or interpret all this data. For example, an aftermarket device may be able to communicate data that includes engine diagnostic information, but the VMs will prevent flow of information back into the bus (e.g., commands to actuate vehicle systems, such as brakes). Furthermore, not everyone will have the dictionary to interpret what all the information coming off the bus means.

Whether or not DSRC is the sole technology to support connected vehicle systems, the automotive companies view vehicle safety applications as falling naturally within their control. Indeed, GM's current OnStar system does not use DSRC, though GM is working on and has demonstrated DSRC-based safety systems (e.g., supporting cooperative forward crash avoidance). Automotive industry contacts associated with the Vehicle Infrastructure Integration Consortium (VII-C), the Crash Avoidance Metrics Partnership, and other entities have stressed to CAR that the automotive companies will not allow third-party technologies beyond data firewalls to interfere (potentially) with such critical safety applications as automated braking, application of electronic stability control, deceleration, etc. On the other hand, the automotive panel of CAR's Delphi forecast indicated a general willingness, by 2015, to allow aftermarket devices to interface with non-safety-critical data on the vehicle CAN bus.

Not to be overlooked, the automotive manufacturers themselves have recognized the importance of aftermarket technology in expediting the growth (market penetration) of connected vehicle technology. The VMs have estimated that, if connected-vehicle technology is installed on all new vehicles starting in 2009, then it will take until 2030 before all vehicles are equipped. While the benefits of this technology begin accruing before 100 percent market penetration, the benefits, especially the safety benefits, increase as more vehicles are equipped. With aftermarket installations used to accelerate deployment, the VMs estimate that 100 percent deployment can be reach by 2020—ten years sooner than relying on VMs alone.

3.2.3: On-board Equipment Will Range from Not-at-all Embedded to Fully Embedded

Connected-vehicle technology presents a wide range of possibilities regarding the degree of integration with the vehicle. This range runs the gamut from fully embedded, which can be defined as built into the vehicle at the manufacturing plant, to not-at-all embedded, which can be defined as aftermarket devices and technologies with no dependence on the vehicle whatsoever. Thus, at this extreme, SEMA members have an excellent opportunity to dominate the market. In between these two extremes, we can identify a few intermediate points of interest that offer potential market opportunities for SEMA members.[9] While the terminology for

[9] Of course, some SEMA members also serve as tier suppliers and thus have business interests in embedded systems, as well. This ability to serve niches that run the gamut from fully embedded to not-

these intermediate points is not standardized at this point, the basic descriptions of each are illustrative of the likely intermediate points. These include:

- Mildly embedded—relies on the vehicle only for power
- Moderately embedded—relies on vehicle for power and OBD2 data connection
- Almost fully embedded—aftermarket device that, for all intents and purposes, appears to the vehicle as original equipment (could be a dealer install)

On the less promising side of the equation, the automotive panel of CAR's Delphi study also indicated that about half of all new vehicles, by 2015, will possess embedded electronics systems (such as center stacks) that will not support aftermarket replacement or upgrades of specific pieces (e.g., communication devices, navigation systems). Thus, in such new vehicles, aftermarket specialty equipment products will need to be more self-contained, perhaps requiring no more than power from the vehicle (mildly embedded).

Onboard wireless systems are another important development related to both firewalls and how embedded connected-vehicle devices will be. Importantly, connected vehicle technology also includes the personal area network (PAN) within a single vehicle, and the forthcoming FlexRay bus standard includes wireless options. At the simplest level, this very short-range wireless technology already exists (e.g., hands-free Bluetooth devices that interface with the vehicle, as happens with Sync). At the more sophisticated level, wireless communication within the vehicle could link any number of embedded vehicle components, reducing the need for copper and fiber. This could permit the easy addition of aftermarket devices to the technology mix, but it also creates some possible barriers for SE suppliers. First, multiple communication standards are under development (e.g., wireless USB or WUSB and ultra-wideband or UWB), and SE suppliers face some market risks in trying to predict "the winner." While UWB appears to be ahead in the race, WUSB is backed by Intel and thus cannot be easily dismissed as late to market. Second, wireless in-vehicle networks present two possible technical hurdles for SE suppliers: (1) EMF interference could interfere with the operation and performance of aftermarket devices and (2) alteration of the vehicle for installation of even non-electronic SE equipment could disrupt operation and performance of embedded equipment. Of these two hurdles, the second is likely to present more of a challenge to SE suppliers.

3.2.4: Connected-Vehicle Standards Are Partially in Place and More Are Needed to Spark Market Growth

The connected vehicle world boasts a fairly mature standards environment which includes both private- and public-sector efforts, as needed for an integrative technology. On the private side, organizations such as ASTM, IEEE, SAE, MOST Cooperation, the OmniAir Consortium, the Telecommunications Industry Association, and other organizations have actively pursued and established standards to support vehicle connectivity.[10] On the public side, the US DOT, the FCC, the American Association of State Highway and Transportation Officials (AASHTO), and

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at-all embedded systems—to contribute to the value chain at multiple entry points—may prove to be a competitive advantage as the connected vehicle industry grows.

[10] SEMA members clearly are involved with some of the organizations, but not all of them. At a May 2008 workshop organized by the OmniAir consortium, for example, not a single SEMA member was present—presumably because none were invited or monitoring OmniAir announcements. Interestingly, several attendees, including one from US DOT and one of the authors of this report, pointed out that SEMA must be represented at the next such workshop.

others have played, and continue to play, active roles. The Intelligent Transportation Systems Joint Programs Office within the Research and Innovative Technologies Administration of the USDOT has done a fairly thorough job of cataloging ITS (including connected-vehicle) standards on the web, with brief descriptions of each standard and links back to standards organizations for more full details.[11] The standards are categorized by stage of evolution (i.e., whether they are under development, have been approved, or have been published). Some standards of particular importance to specialty equipment suppliers are described briefly below.

Dedicated Short Range Communication (DSRC)
Dedicated Short Range Communication (DSRC) has been a leading focus on federal connected-vehicle efforts since the 5.9 GHz spectrum was set aside for it in October 1999. In January 2006, the first standard concerning DSRC was established.[12] This first standard, ASTM E2213-03, provides wireless, wide-bandwidth, high speed communications for vehicle-to-vehicle and vehicle-to-infrastructure communication and is used to deliver high-speed messages over short distances.[13] In September 2006, another standard was set regarding DSRC message set dictionaries, SAE J2735.[14] This standard focuses on the interoperability between DSRC applications and is particularly intended for application developers, equipment manufacturers, and system integrators. It was published in December 2006.

Wireless Access in Vehicular Environments (WAVE)
One of the most critical sets of connected-vehicle standards is the IEEE 1609 Family of Standards for Wireless Access in Vehicular Environments (WAVE). This was created in January 2006[15] and, in short, defines the architecture, communications model, management structure, security mechanisms, and physical access for wireless communications in vehicular environments.[16] The predominant users of these standards are transportation professionals and automotive and traffic engineers involved with the design, implementation, and testing of WAVE devices. The IEEE 1609 family incorporates four specific standards:

- **IEEE P1609.1 - Standard for Wireless Access in Vehicular Environments (WAVE) - Resource Manager:** Specifies the services and interfaces of the WAVE Resource Manager application, and also describes and defines the key components of the WAVE system architecture, data flows, and resources at all points (standard published in November 2006[17]).
- **IEEE P1609.2 - Standard for Wireless Access in Vehicular Environments (WAVE) - Security Services for Applications and Management Messages:** Defines secure message formats and processing (published in September 2006).
- **IEEE P1609.3 - Standard for Wireless Access in Vehicular Environments (WAVE) - Networking Services:** Defines network and transport layer services, including addressing and routing, in support of secure WAVE data exchange (published in May 2007).

[11] See http://www.standards.its.dot.gov/ for the main page linking to standards.
[12] http://www.standards.its.dot.gov/news.asp#may08 June 24, 2008
[13] http://www.standards.its.dot.gov/fact_sheet.asp?f=66 June 24, 2008
[14] http://www.standards.its.dot.gov/fact_sheet.asp?f=71 June 24, 2008
[15] http://www.standards.its.dot.gov/fact_sheet.asp?f=80 June 24, 2008
[16] Ibid.
[17] http://www.standards.its.dot.gov/news.asp#may08 June 24, 2008

- **IEEE P1609.4 - Standard for Wireless Access in Vehicular Environments (WAVE) - Multi-Channel Operations:** Provides enhancements to the IEEE 802.11 Media Access Control (MAC) to support WAVE operations[18] (published in January 2007).

Traffic Management Communications
AASHTO developed a standard data dictionary and message sets (ITE TM 2.1) for ITS traffic management systems in April 2006. [19] The dictionary provides meta-attributes for data element sets, including both definitions and specific formats. The message sets include three message groups necessary to transport data between traffic management and ITS centers. This standard was published in November 2006, and a third version was in development in April 2007 that includes a larger range of data elements and message sets.[20]

While all these standards, and more, help create a level playing field that allows product developers, VMs, transportation agencies, and others to achieve interoperability, these standards alone (as they exist today) are not sufficient to provide assured connectivity. Examples of shortcomings include variations in different implementations of Bluetooth that prevent successful communication and inadequate integration in 802.11p DSRC and IEEE 1609 WAVE standards that hinder interoperability between different DSRC/WAVE devices. In addition, some product developers, VMs and others tweak standards at the margins for their own use (or purported competitive advantage) in ways that prevent full interoperability (e.g., of devices all claiming to be built on the MOST network). Completion of ongoing standards' efforts could go a long way toward allowing this industry to grow by providing a common communication and network environment on which developers can build.

3.2.5: Data Are Critical (and Thus May Be Lucrative)

To a large extent, data lies at the heart of the connected-vehicle value proposition. Data drives applications and services across the connected-vehicle spectrum; from cooperative safety features to location-based services to media downloads. As implied by the word "connected," these data originate both on-board the vehicle (e.g., sensor data) and off (e.g., real-time map data, traffic signal status, and email messages) and move in both directions. As a result, the connected-vehicle world contains business opportunities in nearly every aspect of data collection, data fusion and aggregation, data processing, and data storage and reselling. These opportunities are summarized in Table 3.2.1, which lists the kinds of entities interested in data associated with vehicle communications and the types of data that these entities are interested in (or likely to be interested in) obtaining and for which they may well be willing to pay.

As shown in Table 3.2.1, nearly all of the relevant data have spatial and temporal components—either data about the roadside or traffic at some specific location (and perhaps time) or data about services available at specific locations. Notable exceptions include media and infotainment downloads, which are not necessarily tied to any specific place, though one could easily imagine the development of tourist information downloads, complete with audio and video, that do have a spatial component. Thus, specialized equipment suppliers often will not have as much dependence on spatial information as do other members of the connected-vehicle value chain.

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[18] Ibid.
[19] http://www.standards.its.dot.gov/fact_sheet.asp?f=17 June 24, 2008
[20] http://www.standards.its.dot.gov/StdsSummary.asp?ID=516 June 24, 2008

Table 3.1: Connected-Vehicle Data and Potential Market Opportunities

Entities Interested in Data	Data Entities Might Pay for
Public-sector transportation agencies	Probe data (time-stamped vehicle speed, location, heading), asset management data (road condition, etc.), and road-weather information
Automobile manufacturers	Vehicle diagnostics and prognostics, driver behavior data
Original equipment suppliers	Component diagnostics and prognostics
Drivers (and passengers)	Real-time route guidance, map updates, media downloads, and infotainment
Marketers and providers of location-based services	Driver behavior, vehicle location*
Automotive insurance providers	Driver behavior

* Location-based services open up an entire avenue for selling access to vehicle environment for the provision of location-based information (some of which effectively is advertising) inside the vehicle.

3.3 Regulatory Environment Will Affect the Development of Connected-Vehicle Technology

Currently, the regulatory environment affecting connected vehicles is in flux, and the evolution of this environment has the potential to strongly affect the future of vehicle communications and connectivity. At the federal level, the National Highway Traffic Safety Administration (NHTSA) is responsible for development of regulations affecting vehicle safety in the United States. Interestingly, in CAR's recent Delphi study, most automotive panelists expressed the view that they do not expect new technology-enabled safety applications (such as lane departure warning) to be mandated by the government, while the telematics panelists expressed less confidence in this view of the future.

While potential future regulatory efforts offer the most uncertainty regarding future mandates, past and ongoing efforts can provide valuable lessons and insights into the possible effects of regulatory action on SEMA members. Most importantly, these past case studies suggest that SEMA members must take an active role in regulatory rule-making from an early date to have the most effect on the outcome of the regulatory process. To illustrate this point and other lessons for SEMA members, this section reviews two cases (Electronic Stability Control (ESC) and the Transportation, Recall Enhancement, Accountability and Documentation (TREAD) Act of 2000) in more detail and then examines near-term activities that NHTSA is exploring that could affect the specialty equipment industry.

3.3.1: Electronic Stability Control

In 2006, NHTSA mandated the staged deployment of Electronic Stability Control (ESC) on new vehicles.[21] The rationale for this mandate was increasing evidence that ESC can dramatically reduce the chance of a rollover crash, thus saving an estimated 5,000 to 10,000 lives per year. In 2004, studies conducted in Europe and Japan began to emerge showing the effectiveness of ESC.[22] These studies, however, relied on small sample sizes and their relevance to U.S. driving conditions was not completely clear. Therefore, the Insurance Institute for Highway Safety (IIHS) performed a study on the effectiveness of ESC in the U.S. The results, released in 2004, showed a 56% reduction in fatal single-vehicle crashes.[23]

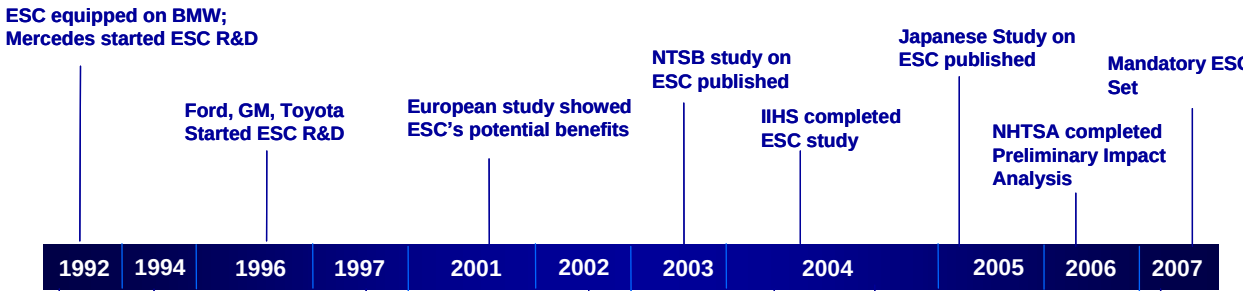
[21] http://www.designnews.com/article/CA6451550.html#_self June 20, 2008
[22] http://www.nhtsa.gov/cars/rules/rulings/PriorityPlan-2005.html#III June 20, 2008
[23] Ibid.

Based on these results, NHTSA initiated a program to develop several tests to quantify light vehicle handling. It performed crash data analysis on the effectiveness of ESC systems in preventing single vehicle crashes, developed handling test protocol to measure the presence of ESC, performed a preliminary benefit/cost estimate of ESC, and based on this information, created a mandate regarding implementation of ESC on vehicles sold in the U.S.[24] In its regulation, NHTSA opted for a graduated, four-year, phase-in plan:

- September 1, 2008 – 55% of all light vehicles
- September 1, 2009 – 75% of all light vehicles
- September 1, 2010 – 95% of all light vehicles
- September 1, 2011 – 100% of all light vehicles[25]

In 2006, when the mandate was announced, SEMA expressed concern about the possible impacts of this mandate on its members. At this point, however, SEMA's concerns were raised too late to effect the outcome. As shown in Figure 3.2, the ESC rule-making process began in 1992 and was near completion when objections were raised in 2006. Indeed, NHTSA targeted ESC for proposed rulemaking in 2002 and completed its preliminary investigation in 2004, the same year that the Insurance Institute for Highway Safety completed its study of ESC.

Figure 3.2: Timeline for ESC Regulation Process



For the most part, the implications of the ESC mandate on specialty equipment suppliers are for those dealing with wheels, tires, suspensions systems, brake parts and systems, and drive gear sets.[26] In response to these implications, SEMA wrote to NHTSA expressing concern that automakers do not know how their products will affect ESC systems.[27] Therefore, SEMA believes it is premature to create a mandate until more is known about what interactions will

[24] Ibid.
[25] http://www.designnews.com/article/CA6451550.html#_self June 20, 2008
[26] http://www.sema.org/main/semaorghome.aspx?id=56637 June 20, 2008
[27] Ibid.

occur. SEMA also advocated that ESC systems incorporate an adaptive learning capability that will allow them to recognize vehicle modifications and make adjustments accordingly.[28]

3.3.2: TREAD Act

In response to the Firestone/Ford SUV tire recalls, Congress enacted the Transportation, Recall Enhancement, Accountability and Documentation (TREAD) Act of 2000.[29] TREAD required that NHTSA create more than a dozen rules regarding tire safety and rollover propensity. As part of these rules, NHTSA determined that the most common cause of tire failure was under-inflation of the tire. Therefore, NHTSA introduced a tire pressure monitoring system (TPMS) requirement to alert a driver when one or more tires are under-inflated. In 2005, NHTSA unanimously approved a rule stating that, by September 1, 2007, all 2008 and later model passenger vehicles, trucks, and light buses must have a sensor-based TPMS.[30]

For SEMA members, the TREAD Act has significant consequences. It could boost aftermarket opportunities for replacement of TPMS sensors, as long as technical data can be shared with them.[31] Such sharing is not part of the NHTSA requirement, but many appear to believe that it is in the VMs' best interest to share such information. Furthermore, specialty equipment suppliers may also have the opportunity to retrofit older vehicles with tire pressure sensors, if the safety benefits they provide draw enough consumer demand.[32]

3.3.3: Near Term NHTSA Regulatory Activities

NHTSA is currently exploring several potential avenues for regulatory action that could have a significant effect on SEMA members. These are described briefly below.

Reduce Number of Occupant Ejections Due to Rollovers
There are three stages to this NHTSA effort:

1. Regulate side curtain air bags and improved glazing to protect the head in rollover crashes.
2. Establish occupant containment performance requirements and test procedures.
3. Establish performance requirements for rollover sensors, to ensure that air bags will deploy in a rollover crash.[33]

Sensors could be affected by aftermarket devices loaded into a vehicle; therefore, SEMA members should be aware of impeding rulemaking on this subject. The official deadline for final rule issuance is October 1, 2009.

2. Reduce Number of Crashes Associated with Driver Distraction
Due to the increasing proliferation of consumer electronic devices brought into vehicles, NHTSA is pursuing regulation of such devices while the vehicle is in motion, as well as technology that

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[28] Ibid.
[29] http://www.nhtsa.gov/cars/rules/rulings/PriorityPlan-2005.html#III June 20, 2008
[30] http://www.fleetmag.com/web/online/Industry-News/TPMS-Mandate-Will-Affect-all-New-Car-Buyers-in-2008/1$183 June 20, 2008
[31] http://www.sema.org/main/semaorghome.aspx?id=54435 June 23, 2008
[32] Ibid.
[33] http://www.nhtsa.gov/cars/rules/rulings/PriorityPlan-2005.html#III June 23, 2008

could help avert collisions due to driver distraction.[34] Regulations may potentially affect the design and installation of aftermarket products, because many of the potentially distractive devices at this point in time are consumer electronic products.[35] One of the ways NHTSA is responding to this is via a research program with Delphi Electronics.[36] Delphi is researching SAVE-IT (SAfety VEhicle using adaptive Interface Technology), an in-vehicle system that analyzes a driver's glance time when monitoring and handling distractions.

3. Data for Crash Avoidance Countermeasures

NHTSA is making a concerted effort to increase the amount of data on crash avoidance.[37] The study is called the National Motor Vehicle Crash Causation Survey (NMVCCS) and entails a nationwide, representative sample of about 30,000 crashes over a six-year period. The agency is also using the National Advanced Driving Simulator to get data on pre-crash factors and a 100-vehicle naturalistic driving behavior study. These endeavors tie into the driver distraction initiative, in that it is likely that some of the crashes studied will be due to driver distraction.

4. Pedestrian Impact Requirements

Although NHTSA does not currently have an active investigation into the development of pedestrian impact requirements, there are regulations in Japan and Europe. There is increasing pressure to create a Global Technical Regulation to communize the standards. There is also growing interest on the part of safety regulators, and even vehicle manufacturers, to include the U.S. market in the standard. Historically, SEMA members have been concerned with the ride height of bumpers. While it is uncertain what implication such regulation would have on the ability of consumers to alter a bumper after the sale, such a law would affect bumper and hood design. In general, manufacturers are taking two paths to meet pedestrian impact regulation. First, many are using lower stiffeners in the bumper, to lift the pedestrian. Some are also integrating the sensors and airbags into the bumper.

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[34] Ibid.
[35] http://www.nhtsa.dot.gov/staticfiles/DOT/NHTSA/NRD/Multimedia/PDFs/Crash%20Avoidance/2008/DOT-HS-810-704.pdf June 23, 2008
[36] Ibid.
[37] http://www.nhtsa.gov/cars/rules/rulings/PriorityPlan-2005.html#III June 23, 2008

4. Conclusions: Guidepost for Specialty Equipment Suppliers

The Specialty Equipment Supplier of the Future, the initial report for the SEMA CAR Research Program has highlighted several important topics for consideration—and action. Some of these have been, in reality, confirmation of industry truisms, while others have shed light on future challenges. Whether a confirmation or revelation, these topics are expected to shape the specialty equipment industry in the next 3-7 years.

4.1 Structural Change: Tactical Turmoil. Strategic Opportunity

The automotive industry is undergoing what is arguably its biggest structural change in decades. Participants from the largest vehicle manufacturer to the smallest specialty equipment company are re-examining what must be done to remain competitive in the coming months and years. In conducting this research, it was apparent that, several companies are closely examining their strategies with the specialty equipment market because of this upheaval. ***This structural change may present opportunity to forge new relationships and business models between the automotive industry and the specialty equipment market.***

Survival of this economic downturn is a tactical challenge faced by all industry participants. Many companies have become entirely focused on putting out day-to-day fires. They may be neglecting to prepare for the strategic shifts currently taking place. Based on interviews with a cross-section of vehicle manufacturers, original equipment suppliers, and specialty equipment suppliers, CAR researchers believe **there is great opportunity for those SE suppliers who weather the current storm.**

4.2: An Inflection Point for Some, a Steady Course for Others.

The interview process identified five vehicle manufacturer-specialty equipment market strategies that present opportunity for SEMA member companies. SEMA and its member companies are strongly urged to consider proactively addressing each of the topics. However CAR researchers believe two of these strategies are extremely time-sensitive. First, as noted above, many vehicle manufacturers are currently facing significant structural change. Several of the vehicle manufacturers are looking to the SE market for creativity and partnerships. **It is important for SEMA and its member companies to continue to develop programs to grow the relationships between the VMs and SE suppliers.**

Second, most vehicle manufacturers continue to focus their performance, chassis, and appearance specialty equipment strategy on small car, specialty car and light truck. For SE suppliers, the changing market presents opportunity—in small cars–and a challenge in the decline in pickups and SUVs. SE suppliers who serve the small car segments will have opportunity to grow with this change. However, those who have been successful serving the light truck market must consider how their products can be adapted to other segments. **The changing mix of light vehicles makes it clear that the things that worked for many SE suppliers in the past may not work in the future.**

It is likely there will be three pathways for SE suppliers in the coming years; **1) partner with OEMs**, **2) gain information through tech transfers and measuring sessions**, and **3) reverse engineering**. All three will be viable going forward, but those that choose the reverse engineering pathway will find it increasingly difficult and may also put the others in jeopardy. It was clear that the VMs had some level of distrust for some SE suppliers. The actions of a few SE suppliers could make trusting relationships between VMs and SE suppliers difficult to develop. Many respondents indicated SEMA needed to promote standards for their member

companies to meet if they were to be considered viable partners. Several VMs felt that the Technology Transfer and Measuring Sessions showed promise, but also indicated a rogue SE supplier could do great damage to the programs.

4.3: The Paradox: More Nameplates, Fewer Platforms.

The U.S. market is expected to undergo a transformation that is perhaps best described as paradoxical. While the decreasing number of platforms on the market points to an increase in commonality, the rising number of nameplates is an indicator of increasing specialization. Having a wide variety of platforms, as well as maintaining a larger "parts bin" of components, are both tools that could potentially be used by automakers and suppliers to develop and produce the wide variety of products the market will call for in the near future. The need to reduce costs by using fewer platforms and maximizing the use of common components, however, will make it impossible to use these tools. In fact, since fewer platforms are expected, the task will actually be made more challenging. **Both automakers and suppliers will therefore be challenged to engineer a wider variety of vehicles and components with distinct features and appearances while using more common platforms and parts.**

Changes in vehicle types include the market's shift away from body-on-frame vehicles to those with unibody architectures, which is closely correlated with the decline of the SUV segment and the associated rise of the passenger car-based CUV. Specialty suppliers who specialize in truck-based products will face an obvious challenge as a result of this development, as will those whose products use the vehicle's frame as an attachment point, including producers of suspension, steering, and brake products. These companies will face the need to either abandon obsolete product lines or to adapt their product range to include components for CUVs and the passenger cars on which they're based.

Specialty suppliers will find both challenges and opportunities as a result of these trends. Those who successfully adapt their products to a specific platform will realize higher potential sales volumes due to the rising sales volumes forecast for future platforms. Suppliers who are not able to make their product work on a specific platform, however, will find a larger share of the market closed to them. Specialty suppliers whose products are related to the vehicle body or trim will find the wider number of nameplates a challenge, as they will be forced to customize their products to fit on a wider array of vehicles. **Because model life-spans will be shorter and redesigns will be performed more frequently, specialty suppliers will see an increase in the number of projects they will face at a time.**

4.4: Legal Knowledge is Critical

Specialty equipment suppliers face a multitude of legal duties and obligations. Some of these obligations concern the safety of the products they design, manufacture, and sell. Liability exposure of manufacturers and others can be enormous. It is, therefore, essential that companies have an understanding of the governing laws in this regard wherever they manufacture or sell their products. Moreover, because the applicable laws in this area vary from state to state, it is highly advisable for aftermarket manufacturers to consult with their attorneys on the applicable laws.

4.5: The Need to Keep Informed

The VMs have often been described as the Sun in their solar system. While some SE suppliers may wish to be a part of the VM solar system, many others have no interest in being in the same galaxy, let alone the same solar system. This is, in many ways, understandable.

However, CAR researchers believe that it is important for those SE suppliers who do not wish be a part of the VM model to nonetheless be aware of pertinent trends. CAR researchers have identified three key trends worth monitoring by those not directly interested in partnering with the VMs. These are:

1. **The economic downturn has truly changed the industry.** This downturn appears to be a life altering event for several VMs. And, they are making the SE market a part of their solution. Those VMs are searching for SE partners. Those SE suppliers that heed the call may be presented with another profit stream, and strategic brand placement and visibility. However, they will certainly face significant cost and engineering challenges. Those that don't may miss the positive outcomes, but will certainly avoid some of the added development and certification costs.
2. **The U.S. automotive market is undergoing a once in a generation shift in consumer preferences.** While the shift from light trucks to passenger cars and smaller cross-utility vehicles has been well documented, and is of critical importance to many SE suppliers, there are other trends that must be monitored. This report identifies a trend by manufacturers for increasing nameplates, and reducing platforms. This trend is also critical to SE suppliers, and the products they market.
3. **Vehicle systems are designed with an operational range.** The sensitivity to modification varies by system. In general, the transition from passive to active safety features leads to increased complexity and sensitivity to alterations. For example, anti-lock brake systems are less sensitive to modification than the more complex stability control technology, which is very sensitive to variation. Because of this, most VM representatives and OE suppliers interviewed for this project believe it will be increasingly difficult to add specialty market components to vehicles. This report identifies potential regulations that may be indicative of coming restrictive actions.

4.6: Body and Chassis Electrical/Electronics Remain at Arms Length

The over-riding concern for the VMs is that aftermarket access into the electrical/electronic system may modify the integrity of the vehicle. In the case of the chassis E/E system, any modification may alter safety. And, from the manufacturers' viewpoint, safety concerns are a show-stopper. The challenge for SE suppliers is to continue producing and installing products that do not have an adverse impact on vehicle safety, yet adapt to a more electronically integrated vehicle. **The message from most respondents was clear: the SE market, while potentially considered a partner, is not likely to be allowed access behind the firewall.**

Two visions for overcoming this barrier are presented in this report. The authentication model would allow the SE market to access selected critical information, while still allowing the VM to control the end product. Respondents believe the authentication model is more applicable to the connected vehicle model than the powertrain or chassis E/E system.

4.7: The Connected Vehicle--SEMA Members May Step to the Forefront

Vehicle communications and connected-vehicle technology offer important opportunities for specialty equipment manufacturers along several dimensions. It is possible, even likely, that products offered by SEMA members may be the enabler for accelerating the deployment of connected-vehicle systems and allowing this technology to reach a critical mass.

Connected-vehicle hardware will run the gamut from fully embedded (and installed by automotive manufacturers) to not-at-all embedded (and supplied by SEMA and CEA members) with many possibilities in-between, all of which provide market opportunities for SEMA members

(perhaps working directly with automotive dealers). **Ultimately, SEMA and consumer electronics firms have a much shorter product development and replacement cycle than do the VMs. This suggests an ongoing need for advanced electronics to be supplied off-board to facilitate relatively frequent upgrading and replacement, presenting an important opportunity for SE suppliers.**