Michael L. Sena Consulting AB
Mobility Research Report

The Business of Telematics

Where we are today, and where it looks like we'll be tomorrow

Author:	Michael L. Sena
Original Date of Writing:	August 4, 2003
Revision Date:	November 1, 2004
Number:	POSP008
Recipients:	
Date Provided:	

(REF: \GENERAL\POSP008_VO1a)

Preface

Mobility Research Reports are intended to generate discussion within the Intelligent Transport Systems (ITS) community. The community is defined in its broadest scope, and includes environmental and city planners and map and travel guide publishers, as well as the individuals associated with organizations that have thus far been the drivers behind ITS efforts. This widening of the forum for discussion is recognition of the important role that can be played by those who are responsible for designing the environments in which ITS solutions will operate, and by those who have traditionally provided the tools used for human orientation and wayfinding.

Each paper expresses the personal views of the author, with a focus on the interrelationships between the designs of the systems, services and infrastructure which are proposed to improve personal and collective mobility and the planning and design of our habitat. The fundamental premise of these papers is that land use and built form policies are inseparable from traffic and transportation policies.

Michael L. Sena Consulting AB is an independent company providing specialist consultancy in the design and development of mobility systems for in-vehicle and pedestrian usage, including navigation, traffic information and fleet management. The principal of the company, Michael L. Sena, is an internationally recognised expert in digital map databases, location-based services, navigation and telematics. He served as an expert delegate to both the European CEN and international ISO standards committees.

The company was founded in 1983, and since then, has worked closely with decision-makers and their staff to develop successful mobility system solutions that are on the market today.

MICHAEL L. SENA CONSULTING AB
Åsa Stationsväg 22 • S-430 31 Åsa • Sweden
Phone: +46 340 656 890 • Fax: +46 340 656 880
Mobile: +46 733 961 341
E - M A I L - m l . s e n a @ m l s c a b . s e

Mobility Research Reports

1. Route Guidance Systems: Luxury, Convenience or Necessity	October 9, 1997
2. A National Roads Database of Sweden: A Future Scenario	April 22, 1998
3. Digital Maps in the Worldwide Automotive Context: Applications of Digital Maps in Cars and Other Land-based Vehicles	May 1, 2000
4. Digital Maps in the Worldwide Automotive Context: Implications of Advances in Driver Information and Assistance Systems on Digital Map Data	December 22, 2000
5. The Dis-Integration of the Mapping Industry: And Where the Money Will Flow in The Emerging Location-based Services Industry	November 28, 2001
6. Interoperable Map Data Media for Navigation Systems	July 4, 2002
7. Off-board Navigation: More irresistible than on-board?	July 11, 2003

Table of Contents

Introduction

This **Mobility Research Report** is about telematics, what the business of telematics is today, and what it could be tomorrow, why the vehicle industry should continue its telematics development efforts, and why the purchasers of these vehicles will come to appreciate the features and services that telematics will provide. Telematics is a complex subject, with many very difficult technical problems that must be solved and with no clear business solutions for those companies that are trying to participate in this still very new area. This **Report** attempts to simplify the complexity without trivialising it. I have tried to describe the problem areas, mainly on the business side, but addressing the technical side as well, because much of what is possible today is dictated by the limitations of the systems we have at our disposal.

Telematics is two-way communications between a vehicle and a service center, or between a vehicle and another vehicle. Data communications is a pre-requisite for all services. Voice communications is necessary for some functions, desirable for others, and non-essential for most. Adding a positioning device in the vehicle and mapping capabilities at the service center enables a range of location-based services to be provided. Telematics services can be vehicle-centric, driver-centric and/or passenger centric, but in all cases telematics refers to services which are delivered to a vehicle to enhance safety, security and comfort, and from a vehicle to provide information about the vehicle, its passengers or the vehicle's interaction with the transportation infrastructure.

This definition of *telematics* is my own. I have modified and extended the definition during the past seven years since I first used the term in a report for Volvo Car Corporation in 1996. I have seen it used in market reports describing autonomous navigation systems, as well as in the context of service delivery to wireless devices outside the vehicle environment. I do not include these applications. In my opinion, limiting the definition of *telematics* to the vehicle has the advantage of focusing our attention on three special conditions:

❑ High-speed movement (as opposed to stationary or walking users) and its impact on both service delivery and connectivity;

❑ The provision of services to a person engaged in driving a vehicle; and,

❑ The interface between internal vehicle systems and the communications and positioning device, and the different types of services that can be delivered depending on the degree of their integration.

This **Report** is organised as follows:

❑ It begins with an introduction on the state of the telematics industry, with observations on what has occurred during its

approximate seven-year history, why it appears to be out of favour with business analysts and the industry press, and what is going on inside the car companies.

❑ In the second section I discuss the various business models that are used by the companies offering telematics systems, such as OnStar's giveaway, and look at alternatives that are emerging.

❑ In the third section I analyse market drivers from the perspective of the car manufacturers, the government, and the end-users of telematics systems, and try to identify factors that would cause positive or negative change during the coming five-to-ten years.

❑ In the fourth section I look at the companies and organisations that are installing and operating telematics solutions. These are the customers for all the companies, large and small, that are offering telematics solutions. Key decision makers' major decision factors are identified.

❑ In the fifth section I make an attempt to define market size and growth rates, while fully admitting that this is an extremely difficult task to undertake.

❑ In the sixth section I look at the companies that are competing in seven categories of telematics business. For each category, I discuss the market leader, the new challenge, those who are struggling to stay competitive, and any group trying to re-define the market through disruptive technology.

❑ In the seventh section I describe five relatively new entrants to the field, and attempt to describe what is special about their offering or approach that would lead to them being successful in the future.

This **Report** is not a market or system survey. There are companies that collect and catalogue system information, and do a good job of it. There are financial analyst companies that report on the companies that are involved in telematics and the potential revenues that might be generated, and a few of them do a respectable job of this task. This **Report** looks at Telematics from the inside, and attempts to provide insights about the business for companies who are currently working in this business, or who are considering whether to enter it. Its purpose is the same as my consulting practice: to help these companies succeed.

The Business of Telematics

Where we are today, and where it looks like we'll be tomorrow

I. The current state of affairs: Putting the present into context

The original concept for telematics was developed by Ford Motor Company, or at least their filing for a European patent would indicate that they believed they were the inventors of telematics.[1] Ford worked in cooperation with Motorola and Westinghouse Security Services. Motorola built the in-vehicle device that integrated wireless communications and a GPS device. Westinghouse Security Services built the service center for managing the messages from and to the vehicle. The Ford Lincoln **RESCU** system service went live in 1996. It was followed shortly after by General Motor's **OnStar** service for the Cadillac that was developed for GM by their subsidiary at the time, EDS.

Between 1996 and 2002, most car manufacturers either had operational telematics programs, were in the process of developing systems, or had evaluated the requirements and decided to wait for a more opportune time to implement. Companies with active telematics programs in Europe were: Volvo, GM, Mercedes, BMW and Fiat. In North America, they were: Volvo, GM, BMW, Mercedes, Saab, Nissan Infinity, Toyota Lexus, Honda Acura, Subaru, Audi, Jaguar, and Lincoln. Those who had started and then halted their programs included Renault and Ford. In June 2002, an event occurred that shook the confidence of the nascent telematics industry at its foundations. Ford closed Wingcast, its telematics joint venture with Qualcomm. Ford had already spent over $100 million in Wingcast, and Qualcomm had invested a further $25 million. The venture had asked for a further infusion of capital equal to the amount already spent to carry it through to product release.

Ford's new CEO, William Clay Ford, had recently replaced Jac(ques) Nasser, and Wingcast had been a cornerstone of Nasser's determined effort to convert Ford from an automobile assembler to an information company. Bill Ford claimed that the closing of Wingcast did not reduce the company's commitment to and belief in telematics. It was merely a decision that Ford did not need to own the service infrastructure, as Nasser had thought. Nevertheless, many business

---

[1] European Patent Application Number EP 0 789 498 A3, 06.05.1999 (May 6, 1999). The original date of filing was December 11, 1996. The applicant is listed as Ford Motor Company, Dearborn, MI, and the inventors are Garth Stephen, Mark Timm and Walter Dorfstatter.

analysts, the press, and most importantly, investors, took Ford's actions as a sign that telematics was not the next big thing after the Internet, and either they lost interest or turned negative toward telematics and its proponents. Almost overnight, the entire industry appeared from the outside to have pushed the break pedal with both feet. Was it entering an over-wintering mode from which it would emerge like a hibernating bear the next spring, or would it just go on sleeping for a few dozen more years like Washington Irving's Rip Van Winkle in the short story of the same name?[2] This has been the theme of most of the articles published on telematics during the past two years.

It was different on the inside. The auto industry did not suddenly drop all of its telematics projects. The engineering research and development departments in Detroit, Stuttgart, Gothenburg and Paris have kept on working, rethinking their strategies and building newer and better systems. Budgets have been much harder to justify, but work on all aspects of telematics has continued. Even Renault and Ford, who had stopped the commercialisations of their respective telematics systems, re-organised their activities under new management and focused on laying the proper groundwork for both services and the in-vehicle systems through a co-operative effort between the two companies in conjunction with a third, PSA Peugeot Citroën, in a venture called Signant. While this venture was cancelled in January, 2004, it appears to have been due to differences in company philosophies than lack of support of telematics. PSA announced it new telematics services in the third quarter of the same year, and both Renault and Ford have continued with in-house developments.

Telematics is entering its adolescent stage of development, with second-generation systems ntroduced in Europe in the fourth quarter of 2003 by DaimlerChrysler's Mercedes and by BMW[3]. These systems, both in the vehicle and in the service infrastructure, look very similar to the Volvo On Call system, which was already second generation when it was first delivered to the Swedish market in 2001.

DaimlerChrysler with Tegaron and BMW with Passo (now ATX Europe), have adopted Volvo's approach developed together with WirelessCar. They are even working with one of Volvo's customer service center providers, Mondial, to offer similar services as the **Volvo On Call** system. General Motor's **OnStar** Europe introduced its new systems in 2004, and these too look similar to the

---

[2] **Rip Van Winkle** begins during the war of American Independence (1775-83), and tells of a farmer living in a village built by Dutch settlers at the foot of the Catskill Mountains on the Hudson River, in upper New York State. Van Winkle falls asleep, and dreams of the seventeenth-century explorer who gave his name to the Husdon River, with the crew of his ship, the Half Moon. He awakes twenty years later to find America is no longer a British colony and the world is a very different place. The news media and stock market analysts may prefer to sleep through the painful years of introducing the new vehicle technologies, of which telematics is one very important part, because what goes on during these years does not make for very interesting reading or cause shareholder value to make significant jumps. If there are any Rip Van Winkles in charge of telematics developments inside the car companies, their companies will likely be gone before they eventually wake up.

[3] First Generation Telematics system were single country systems, with no international roaming, no transaction billing, and limited voice functions with call-backs to the vehicle the common method of voice interaction. Second Generation systems include two-way voice and data communications, full safety and security services, and many convenience services.

Volvo/WirelessCar solution. Volvo is also committed to a European-wide rollout, with The Netherlands, Germany, Belgium, France and Italy scheduled for market introduction in 2004/2005.

It is highly probable that these introductions will be downplayed by the car companies, just like the industry has been very cautious about discussing their telematics plans in public and at conferences. Their telematics managers, when they do make public statements, have stopped talking about telematics as a moneymaking service opportunity. It is a hardware option and a customer service feature, they say. Some companies are even spreading dis-information about their programs, trying to make their competitors think that they are out of the telematics business, when the absolute reverse is true. They are hoping that some of their competitors will miss the wave, like GM Europe missed the diesel engine wave. In a recent *Automotive News Europe* article, Opel Chairman Carl-Peter Forster admitted that at the same time that Opel decided to abandon diesel engines, new technology was introduced (by competitors) that made diesel engines more efficient and powerful. "We sat on the train going in the wrong direction," he said. They lost image and market share as a result, he added.[4]

Volvo's approach in the UK serves as a good example of how telematics is being re-positioned. **Volvo On Call** is currently sold in the UK as part of a so-called "communications package", that includes the hands-free telephone with Volvo On Call buttons, the DVD-based **RTI navigation** system, and a high-end audio system. Total cost for this package is approximately £2650. The VOC system adds £300 to the package, which without it is £2350[5]. The customer receives one year free subscription with 25 free minutes for the year, one free SOS call and one free roadside assistance call. The customer will be obliged to pay for additional services, such as remote door unlock or stolen vehicle tracking, using a direct debit account set up with Volvo. Subscription to VOC services will continue in the second year and subsequent years automatically unless the customer specifically cancels, and the customer will pay approximately £8 per month for the subscription after the first year.

I do not believe that most car company executives ever viewed telematics systems as differentiators that would help to sell vehicles—or determine whether a new model would be a success or failure. Volvo's decision not to include Volvo On Call from the outset in their new flagship product, the XC90, is a clear indication that the industry did not see the inclusion or exclusion of telematics as a critical sales feature. Even Jac Nasser's vision of a future Ford with Wingcast at its center was not car-centric. Wingcast would deliver location-based services to consumers, and the car would be just one of the methods of receiving this information. Telematics was just one of the many features that their cars would have.

---

[4] Automotive News Europe; October 20, 2003; p. 12.
[5] Volvo On Call is not available on the C70, the XC90 and the older model S/V40.

Although they may not have seen telematics as a differentiator, car company executives have been unclear about their views on whether telematics would become a necessary feature (standard fit), or an option that they would have to develop and offer. There is a major difference between a standard fit differentiator and a must have option. The standard fit differentiator, like side impact air bags or skid control, helps buyers decide between one brand and another. For example, an American buyer might pay more to buy a Volvo S80 rather than an Oldsmobile because it has these features as standard fit. A must have option, if not available, usually does not discourage a buyer who truly wants a particular car, like the Volvo XC90, but their absence does make the buyers less enthusiastic about the brand, and probably would cause them to buy another brand next time if other aspects of the vehicle did not live up to expectations. The exclusion might also cause them to not recommend the car to friends.

Today, car makers in all major markets cannot deliver their luxury models without a navigation system—either as a standard fit or as a customer option—but up until late 2003, they could still deliver these models without telematics. This now seems to be changing. At least at the high end of the market, there now seems little doubt that a consensus has been reached among the OEMs that <u>telematics is essential as a must have option</u>, which is why BMW, Mercedes, and Volvo are expanding their service infrastructures. Once they do this, all of the luxury brands will have to follow. It is similar to the navigation system phenomenon, where it has become essential for a high-end car buyer to have a navigation system for simple prestige reasons.

This is not to say that deciding in favour of telematics is a sure thing. Sometimes car company executives get it wrong, like GM Europe did with diesel engines. What companies like Ford, GM, Renault, PSA, Fiat, Volkswagen and the Japanese manufacturers do in Europe during the next three years will determine whether telematics will reach mass market status by the end of this century's first decade, or whether, like route guidance systems, it will continue to be a luxury brand item until it is replaced by a new, "disruptive" technology. There are already disruptive variations of the current in-vehicle route guidance model that are appearing, like the navigation radio from Blaupunkt and the Smartnav system from Trafficmaster and Motorola.

Like route guidance, telematics must be proven as a functioning technology. The companies involved in the system and service delivery chain—service companies like WirelessCar, ATX, T-Mobile Traffic, and system companies like Motorola, Siemens, Blaupunkt and Autoliv, who have the most to gain or lose by the success of failure of telematics—will determine the future of the telematics. If the systems work and if the services are delivered efficiently and cost-effectively, the car companies will continue to develop and install them. If the systems do not work—or if the services do not meet or exceed customers' expectations—telematics will go into a long period of hibernation.

Recent Trends

There are <u>several technical approaches</u> aimed at reducing both hardware and operations costs that are currently being evaluated by the car industry and its suppliers. One approach, already tried by Ford, is to have a <u>customer SIM-card</u> both for telematics services and private voice services. The objective is to remove the SIM-card from the entire hardware and operations equation and thereby significantly reduce costs.

The second approach is to have an <u>embedded telematics SIM-card</u>, but to limit telematics functions to data-only services. Any services that truly require live operator intervention, such as roadside assistance and emergency assistance, would be directed to the customer's private wireless device using Bluetooth, 802.11b, or a similar wireless LAN interface. All data services would be handled by an embedded SIM-card that is purchased by the OEM, the system manufacturer, or the service provider for a one-time cost. Ongoing costs for service usage would be billed to the customer and/or the OEM. Except for the limit on voice transactions, this is similar to Volvo's approach, in which there is an embedded SIM-card and Volvo has the billing relationship with the SIM-card provider (Vodafone Sweden)[6].

Embedded, data-only SIM-cards are being promoted by the network operators who claim that it is the only way they can offer the OEMs lower prices for data services. The network operators who provide the SIM-cards say that the regulators in each of their countries force them to offer equal pricing to all customers. They cannot, according to the regulators, offer one pricing structure to one set of customers, and a second to another set--as long as the services are equal. So, they argue, if the OEMs are willing to change the service so that only data is offered, they can lower the data prices below what they charge their other customers who want both data and voice.[7]

This data-only approach is also being promoted by several groups working on next generation systems. Chrysler in the US has a variation of this approach in which they use the customer telephone for limited telematics services and communicate with it using Bluetooth. I assume that when they move to a more complete service offering they will have an embedded data-only connection device (depending on the technology used).

<u>Another trend is the switch from GSM/SMS to GSM/GPRS (General Packet Radio Service).</u> The main drivers for the switch to GPRS are a potential reduction in data transfer cost, and an increase in the amount of data that can be transferred in a shorter period of time. GSM/SMS is used by the majority of telematics systems in Europe. Even though the amount of data that can be transferred is limited to

---

[6] Volvo has a full-function SIM-card purchased from Vodafone. Volvo purchases SIM-cards from Vodafone and delivers them to Autoliv, their telematics system supplier, who install them in each of the telematics systems that are delivered to the Volvo factory for installation in vehicles. .

[7] This is first-hand information, not hearsay.

160 character messages, the method is reliable and fast, and SMSs can be sent from both the in-vehicle device and from the service centers.

GPRS, with its always-on connectivity and faster data transfer rate, will enable more services, such as diagnostics, software maintenance and software uploads, and off-board navigation, that require larger data transfers that are both impractical and costly with GSM/SMS. However, GPRS is not yet a stable technology. It does not yet work as flawlessly as SMS. Another major problem is that the network operators have not yet signed GPRS roaming agreements to the extent that they have for SMS.   And the connection must be established by the wireless device, which means that for some services there will have to be a continuation of SMS alongside GPRS or some time.

Automotive OEM-supplied Telematics

Purpose

To allow the car and the driver to communicate with other cars, other drivers and the transportation service infrastructure.

Alternatives

• Stopping to find a telephone booth and hooking up a cable from the car with a dial-up modem.

Prerequisites

• A communications device integrated with the vehicle's systems.

• Connectivity across all possible boundaries (physical, technological, jurisdictional).

• A functioning service infrastructure

User's Value Proposition

 A trade-off between the chances of having an accident or a mechanical problem, or requiring some form of emergency assistance and the cost of connectivity

The Automotive Company's Value Proposition

Enable ITS. No ITS without connectivity

II. Business Models

The Telematics Value Chain
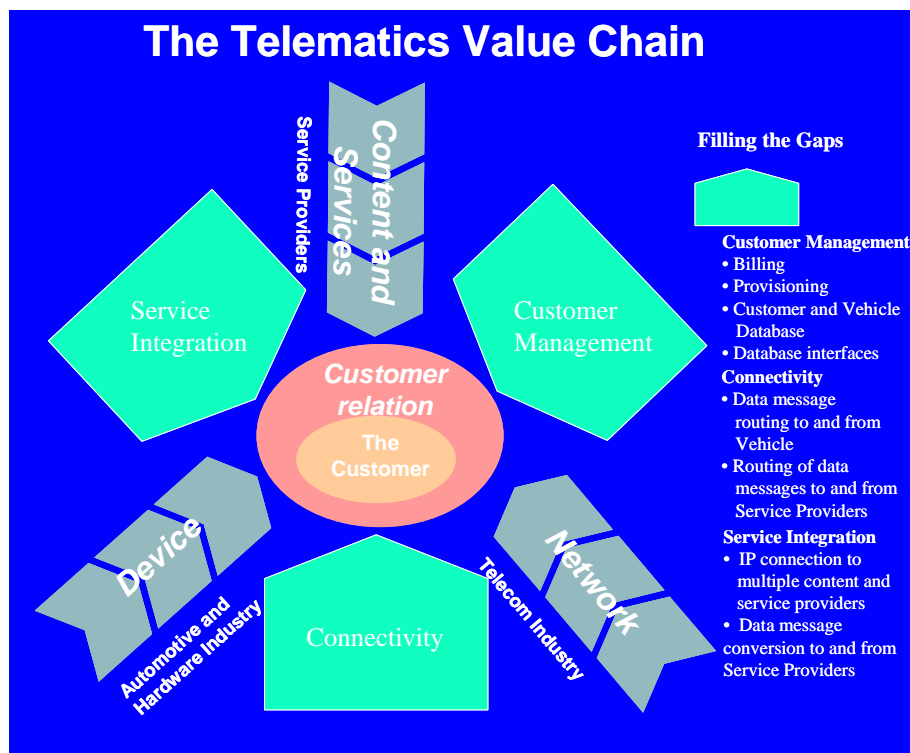
Automotive Original Equipment Manufacturers

As long as the automotive OEMs continue to drive the business of telematics hardware, and continue to own the customer relationship, they will determine the business models. Thus far, they have tried the following:

- ❑ Hardware purchase plus subscription plus transactions
- ❑ Hardware purchase plus transactions
- ❑ Hardware purchase plus subscription
- ❑ Free hardware plus subscription (GM OnStar North America)

GM includes *OnStar* hardware as a standard feature in about one-half of the cars it sells in North America. In other words, as far as the car buyer is concerned, OnStar is free. He or she can either choose to use the free roadside and emergency assistance services or not. They can either sign up for the different OnStar service packages or pass them up. OnStar has collected three million subscribers in the US during a six-year period. A simple cost revenue model shows that, in the long term, giving the system away can actually generate higher revenues than selling the hardware. After six years, the give-away option generates a net profit of $37.5 million less than the system sale option, and surpasses it in the seventh year[8].

System Give-away Option

---

[8] These are my estimates based on my own assumptions and information that is available about OnStar service costs. They have not been confirmed by OnStar.

Cost and Income Components	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Total
Annual Customer Addition	500,000	500,000	500,000	500,000	500,000	500,000	
System Cost-Customers	$100 Million	$100 Million	$100 Million	$100 Million	$100 Million	$100 Million	$600 Million
System Cost-Total	$550 Million	$550 Million	$550 Million	$550 Million	$550 Million	$550 Million	$3.3 Billion
System Income	0	0	0	0	0	0	0
Cumulative Customers	500,000	1,000,000	1,500,000	2,000,000	2,500,000	3,000,000	3,000,000
Service Income	$50 Million	$100 Million	$150 Million	$200 Million	$250 Million	$300 Million	$1.5 Billion
Profit/(Loss) from Customers	($50 Million)	0	$50 Million	$100 Million	$150 Million	$200 Million	$450 Million
Gross Profit/(Loss) Total	($600 Million)	($550 Million)	($500 Million)	($450 Million)	($400 Million)	($350 Million)	($2.85 Billion)

Assumptions

1. Three (3) million customers over six years the result of giving away the system as a standard option to all car buyers.

2. Subscriber acquisition spread equally over all years.

3. No income from system sale. Total price to customer if sold $700. Total paid by OEM to system supplier $200. Foregone income $500.

4. System Cost-Customers is the cost of systems installed in eventual subscriber vehicles times the cost per system. System Cost-Total is the total number of systems installed, which is 50% of 5.5 million annually, times the cost per system installed ($200).

5. Service income per subscriber assumed to be $100 per year, estimated as an average for all services less the costs for operation.

System Sale Option

Cost and Income Components	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Total
Annual Customer Addition	125,000	125,000	125,000	125,000	125,000	125,000	
System Cost-Customers							
System Cost-Total	$62 Million	$62 Million	$62 Million	$62 Million	$62 Million	$62 Million	$372 Billion
System Income	$106.3 Million	$106.3 Million	$106.3 Million	$106.3 Million	$106.3 Million	$106.3 Million	$637.5 Million
Cumulative Customers	125,000	250,000	375,000	500,000	625,000	750,000	750,000
Service Income	$12.5 Million	$25 Million	$37.5 Million	$50 Million	$62.5 Million	$75 Million	$262.5 Million
Profit/(Loss) from Customers							
Gross Profit/(Loss) Total	$56.8 Million	$69.3 Mil	$81.8 Mil	$94.3 Mil	$106.8 Mil	$119.3 Mil	$438.3

Assumptions

1. Seven hundred fifty thousand (750,000) customers over six years is the result of selling the system as a non-standard option to all car buyers. This is the take-up (around 5%) for similar non-standard options in the same price range.

2. Subscriber acquisition spread equally over all years.

3. Income from system sale. Total price to customer $850. Total paid by OEM to system supplier $500 (Higher prices because of lower volumes). Income of $500 spread over sales company, Parts, Service and Accessories, OnStar.

4. System Cost-Customers is the cost of systems in stalled in eventual subscriber vehicles times the cost per system. System Cost-Total is the total number of systems installed, which is 50% of 5.5 million annually, times the cost per system installed.

5. Service income per subscriber assumed to be $100 per year, estimated as an average for all services less the costs for operation.

In both cases, the hidden cost of installing approximately 2.5 million OnStar telematics systems per year produces an annual loss of $350-$500 million during the first six years. Because of the competitive

pressures in the US market during the past few years, GM would not have been able to recover these costs through price increases. GM, under orders from their development boss, Bob Lutz, has begun to eliminate options that customers once paid for but that became standard, like ABS and passenger air bags. There is a danger that OnStar may also be eliminated, but so far it has remained a standard fixture in one-half of the company's models.

Alternatives to the current business models are already emerging, led by hardware suppliers, network operators and service suppliers.

Hardware Suppliers

Companies like Blaupunkt and Motorola sell aftermarket telematics systems, and either have a direct relationship to the eventual customer, or provide an opportunity for a customer to connect directly to a service provider. The automotive OEM is removed from this equation. The service provider can be any combination of content or network service provider, with the customer installing its own SIM-card in some instances (the Blaupunkt navigation radio), or the system functioning with an embedded SIM-card (the Motorola SmartNav system).

I believe that the after-market systems will be introduced into the low- to medium-priced vehicles first, and will be used primarily to compete with portable wireless devices. This is pure speculation, but I am convinced that they will achieve a high level of penetration--higher than the 33% market share their aftermarket systems have in the route guidance system market--once they are able to offer reliable off-board navigation and traffic information services. They are a much more logical alternative to fastening a PDA or a telephone with a miniscule screen on the instrument panel. I am confident that the 1-DIN system that is now available from Blaupunkt will be copied by most of the hardware suppliers. What the "vehicle-dependent" systems don't pick up, the wireless devices will. I have been testing off-board route guidance service delivery on wireless devices (e.g., Polaris from Telmap and Wayfinder from Wayfinder). These systems are almost as good as the first generation route guidance system I have installed in my car, the first RTI system introduced by Volvo in 1996. The aftermarket systems will get better, and they will be supplemented with more of the convenience and customer-centric services. Within three years I believe that any consumer will be able to afford to have a basic telematics system and service in any vehicle.

Autoliv, supplier of the Volvo On Call system, is unusual because it had not been active in either the communications hardware business, like Ericsson or Nokia, or in the in-vehicle electronics business, like Siemens or Blaupunkt. They entered the telematics systems field primarily as a result of their purchase in 1998 of Nokia's 50% interest in Autoliv-Nokia, the joint venture for Nokia's automotive-related activities, and Sagem's 50% in interest in Sagem-Autoliv, the joint venture for electronics. Nokia had been a supplier to Volvo for an initial version of the Volvo On Call system. Autoliv took over this

relationship, and eventually has provided Volvo with versions of the telematics system for its full range of vehicle models.

Network Operators

Most of the network operators already have location-based services that they offer to their customers. These services have been purposely limited because of the lack of precise positioning devices (GPS) built into the wireless devices, and the still unstable GPRS service. It is highly likely that most, if not all, driver- and passenger-centric services—even manual emergency services—will be delivered via the customer's own wireless device.

The diagram below shows what types of services can be delivered to the different types of hardware platforms. Portable wireless devices that have a built-in positioning device can deliver the majority of services. The integrated telematics systems, like Volvo On Call, OnStar, and BMW Assist, can deliver more specialised services, like remote door lock and unlock, automatic crash notification, remote software downloads, etc. This is because they have access to the vehicle's sensors while the portable devices do not. Vehicle dependent devices that are built for aftermarket installation have one additional service that is relatively certain: stolen vehicle tracking.

Many of the telco's have basic offerings that they will upgrade once location-enabled phones become more commonplace. We will start to see the low-end systems in respectable numbers starting in 2005. That's my best guess. The after-market systems from Blaupunkt and others will take at least two more years because they have to build up their service infrastructure. If a company like Volvo or DC or BMW starts to offer the system for its existing vehicles, as opposed to its new vehicles, then they could gain momentum sooner. Keep in mind, these systems cannot provide the full telematics functionality, but it could be a good start, and it would add volume to the service providers.

Service Suppliers

Membership Services

The auto clubs and other member services organisations will develop devices that they will provide to their members. ANWB in The Netherlands is the most advanced at this time. They have a black box developed originally in cooperation with Acunia (now defunct), and they have already started to distribute a PDA-based navigation system called Engin, developed together with Navigon.

Connectivity Services

An alternative model is being proposed by a new entrant, Ygomi Ltd/LSP. They are proposing to supply the SIM-card to the OEM. The OEM pays them a one-time, life-time fee for each new customer (i.e. no monthly or annual charges) and receives all call-routing services. Customers or the OEM pays for data or voice call services, and a

service charge is added on to each transaction by Ygomi Ltd/LSP. The difference between the Ygomi Ltd/LSP proposed service and the services provided by WirelessCar is that LSP are purely a gateway. They maintain no database and offer no content or workstation service. For a further description see Section 8: New Entrants.

The diagram below pictures three types of systems, and the services that each of the systems can provide. The integrated system is built into the vehicle, like Volvo On Call, OnStar, and BMW Assist. These systems have access to the vehicle's sensors and can provide all possible services, subject to the OEM deciding to include the necessary in-vehicle software and provide the service. Location-enabled portable systems are wireless devices (e.g. telephones or PDA's) with either a built-in GPS device, or a cable or Bluetooth connection to a GPS. They have no connections to the vehicle's systems, neither the non-mission-critical systems, like audio and speedometer, or the mission-critical systems, like the crash sensors. They cannot provide any services that require access to vehicle systems.

The vehicle-dependent systems, like the Blaupunkt radio or some of the other after-market telematics systems, require a connection to the vehicle in order to operate. They do not work outside of a vehicle environment. They may use the vehicle's audio system to deliver voice instructions, take distance moved from the odometer, share a GPS device, and possibly have access through a gateway to the vehicle's alarm system. The only service that they can offer that the portable devices cannot is stolen vehicle tracking. The reason is that they have the possibility to access the vehicle's alarm system through the vehicle's bus.

Possible Services on Different Types of Devices

Integrated
- **Theft Notification**
- **Remote Diagnostcs**
- **Remote SW Download**
- **Dynamic ADAS**
- **Automatic Crash Notif.**
- **Remote Door Control**
- Emergency Assistance
- Roadside Breakdown Assistance
- Concierge Services
- Route Planning and Directions
- Position Advice
- Traffic Information
- Technical Assistance
- All other mobile applications adapted to the driver environment
- **Stolen vehicle tracking**

In-vehicle Devices

Location-enabled Portable

- Emergency Assistance
- Roadside Breakdown Assistance
- Concierge Services
- Route Planning and Directions
- Position Advice
- Traffic Information
- Technical Assistance
- All other mobile applications adapted to the driver environment

Vehicle-dependent

- Emergency Assistance
- Roadside Breakdown Assistance
- Concierge Services
- Route Planning and Directions
- Position Advice
- Traffic Information
- Technical Assistance
- All other mobile applications adapted to the driver environment
- **Stolen vehicle tracking**

The OEM as the single controller of the telematics customer relationship is a temporary phenomenon. I believe that the OEMs will leave the convenience service side of telematics as soon as they have built the necessary infrastructure to provide the safety and security functions and have the systems in place to do the things that they are really building in the telematics systems to do. In the bubble diagram, these are the items in red:

- ❑ Theft Notification
- ❑ Remote Diagnostics
- ❑ Remote Software Download
- ❑ Dynamic Advanced Driver Assistance Systems (using map data)
- ❑ Automatic Crash Notification (ACN)
- ❑ Remote Door Control

III. Market Drivers

Car Manufacturer's Perspective

The automotive industry does not normally invest in high risk projects. The payback for success is minimal and the result of a failure can be catastrophic. The automotive industry as a whole is characterised by low or negative growth that is cyclical. Car and light truck sales in Western Europe increased in 2000 and 2001 over the previous year by only 1%. They decreased by 1% in 2002 over 2001, and decreased by a full 3-4% in 2003 over 2002. Sales are projected to rise again in 2004 as the world economy emerges from war and recession (although as of this writing, hostilities continue in Iraq, Israel and Afghanistan, and sky rocketing oil prices threaten to derail the still-shaky economic recovery). Some automotive companies have been more affected than others by economic conditions, but for different reasons. Fiat's sales have plummeted because it simply stopped building cars that people wanted to buy, compared to its closest competitors, Renault and Peugeot/Citroen, as well as the Japanese small car companies.[9] Jaguar produced more cars, but the company neglected one of the most important drivers in the automotive industry today: cost control.

Product development cost control and operations cost reduction are the two most important considerations for car manufacturers today. They are desperately trying to increase shareholder value. As Fiat's current struggles show, and in the past those of companies like Chrysler, Jaguar, Rover and many others bare witness, profitable companies survive, the others are acquired or forced out of existence by unhappy shareholders.[10] The global economic recession has put pressure on sales, and car companies have used financial incentives (rebates, low interest and no interest loans) to compete for the available buyers.[11] Margins on cars sold in today's market are razor thin. In 2003, GM made an average of only $350 on every car it sold. It actually loses money on most of its sedans sold in the US. Volvo makes an average profit of $435 per vehicle, but makes an additional $1800 per vehicle on parts, service and accessories. To use another razor analogy, the car has become the razor, and parts, services and accessories have become the razor blades.

There are a few exceptions to this rather grim picture of the automotive industry. Toyota is the most notable exception, along with

---

[9] Starting in 1998, Fiat began losing money. In 2002, the company lost €2.74 billion. In 2003, the loss was reduced to €2.06 billion, but the company does not expect to break even before 2006. While Fiat is still the best-selling brand in Italy, with 28% of the market in 2003, it lost a full 2.2% market share during the last year alone. Ford of Europe reported a loss of $1.1 billion in 2003, up from $549 in 2002. GM had an overall profit of $1.12 billion in 2003, with $1.16 billion coming from North America and $577 million from its Asia Pacific region. GM had losses of $286 million in Europe and $331 million in Latin America-Africa-Middle East. (Automotive News Europe: April 5, 2004).

[10] Vehicle manufacturers collectively have had a negative shareholder value creation of –20.8% during the period of 1992 to 1998. This was during the period that the overall market was increasing.

[11] In 2003, the average industry incentive per car sold in the US was $2,426. For the European automakers selling in the US, the amount was $1,648.

Renault and Nissan, BMW and Porsche.[12] In 1980, Toyota's global market share was 5%. In 2003 its market share had risen to 10%, and it surpassed Ford Motor Company as the world's second largest automaker in terms of volume, after General Motors. It has set a goal of 15% by 2010, and few doubt that it will achieve this goal. Why is Toyota outperforming most of its rivals? According to an analysis of the company in Harvard Business Review, Toyota strives for "extreme competitive advantage".[13] They have developed a production system that is so much better than any other automaker's, say the authors, that they can produce a great variety of high-quality vehicles at very low cost, at both high and low volumes. In the U.S., their Lexus is tops in customer satisfaction (along with Nissan's Infinity), and their Camry is one of the best-selling models among all brands. Toyota has opened its factory doors and dared its competitors to copy Toyota's production techniques. So far, no one has been able to duplicate their success.

Most of the rest of the automotive manufacturers will need to find revenues through cost savings.[14] They have pressed their Tier One suppliers extremely hard during the past ten years, and there is little more they can give in price reductions. The main areas left to cut costs are in the marketing and warranty areas. One area of possible savings is warranty breakdown assistance.

The practice was started by Volvo in the US more than twenty years ago and eventually was adopted by all car companies and spread to Europe. It is a large marketing outlay for every car company, and the cost-cutters inside the companies would like to halt the practice. But consumers have come to expect it, and the auto companies have recognised that it provides opportunities for customer relationship management as well as direct financial contributions. For example, if a breakdown does occur, with warranty breakdown assistance, the car is usually taken to the owner's dealer or the closest dealer in the brand network. If the customer used its motor club membership (e.g. AAA, AA, RAC) for assistance, the car would be taken to the closest repair station.

Next to cost issues, market share protection is the highest priority for car manufacturers. They have found that the best way to maintain market share is to promote brand loyalty, that is, to keep existing customers rather than investing in acquiring new ones. They have to match or better their closest competitors in customer satisfaction surveys, and they have to match or better their closest competitors in the consumer reports surveys—value for money and the most features for the least amount of money.

---

[12] Renault and Nissan had a combined profit of €7.7 billion in 2003, second only to Toyota. BMW is headed for another record year in 2004, and pulled even with Mercedes-Benz in global production in 2003, at 1.13 million unite. (Automotive News Europe; April 5, 2004)

[13] *Harvard Business Review*; HardBall: Five Killer Strategies for Trouncing the Competition; George Stalk, Jr., and Rob Lachenauer (April 2004).

[14] VW instituted a €2 billion cost-cutting program in 2004, labelled ForMotion. The company had a 60% drop in operating profit in 2003.

Standing out in a crowded car market is not easy, especially since the automotive industry is characterised by homogeneity. Cars have different styling, different feature packages, different prices, but at the core, they are all basically the same product[15]. Companies compete within narrow buyer brackets: income; age; life-style; location. They compete to keep market share and possibly to steal a few fractions of percentage points from their competitors.

Companies rarely have a monopoly on features for more than a car season because their competitors adopt and adapt them as soon as they know about them. Their competitors know about them usually because auto companies are keen to invest in competitive research, and their Tier One suppliers are selling the same products to all the companies in the industry. Cars have also achieved a level of sameness because there are few rewards for sticking out from the crowd.

No one wants to be first with something new unless they are almost certain that their competitors will follow shortly after. If they do not follow, it means that the feature has been a failure and their investments worthless.

Chrysler pioneered the talking car a few decades ago. *Your left rear door is ajar*, monotoned the Dodge Dart. "It is definitely NOT A JAR; it's a door, and it's open," screamed back the irritated driver, on his way to the dealer to have the voice disconnected. Chrysler's competitors did not copy the feature, although all of them probably had it ready to install if it had been a success among consumers.

Auto companies invest in cost control and cost reduction, and better information systems and processes to achieve both. They invest in what their competitors invest in, and they invest to learn about what their competitors are investing in. They have not normally invested in shared infrastructure projects to achieve competitive advantage, and when they have (e.g. Wingcast or Covisint[16]) they have been major disappointments. The risk of failure is too great. Unlike other industries, like pharmaceuticals, there is no possibility of major growth in the existing markets. If anything, with the demographics of Europe showing population contraction beginning in the second decade of this century, fewer cars will be sold in Europe in the coming years. New markets, like China, are growing slowly, and new, local competitors are being established to meet demand. Unlike pharmaceuticals, where there are thousands of different illnesses that need treatment, the car industry builds one basic product that is very similar to all of its competitors' products.

---

[15] "General Motors and Coca-Cola (have) enjoyed a relatively stable product paradigm—for more than a century, cars have had four wheels and a combustion engine and consumers have sipped caffeine-laced soft drinks." Gary Hamel and Liisa Välikangås: *The Quest for Resilience*; Harvard Business Review, September 2003.

[16] Covisint LLC was formed in 2000 by GM, Ford, DaimlerChrysler, PSA/Peugeot-Citreon, Renault and Nissan. It was intended to create an online trade exchange for suppliers and automakers. After pouring more than $500 million into the enterprise, it was dismantled and sold in February 2004 to Compuware Corp., a software and technology service firm in Detroit.

I have found the diagram below to be useful for describing the decision factors driving the auto industry, the "hot buttons", particularly for describing how not to sell telematics. Up until mid-2002, when telematics was being promoted as the next big thing after the Internet, its salesmen were trying to sell it as a high growth driver and a significant differentiator. Since all the other business paradigms had already been broken by the "new economy", they assumed that the automotive industry was suddenly non-risk averse. All of these tactics and assumptions were completely opposite to the conditions of the auto industry. A more highly risk-averse, low growth and low complexity industry than the automotive sector would be difficult to find. It is the complete opposite of the pharmaceutical industry.

Investment Decision Factors

Risk - The degree to which investments involve high risks. Risk averse companies, like those in the automotive sector, invest in cost control and competitor information. Companies that are not risk averse make large investments in shared infrastructure and projects that attempt to achieve competitive advantage.

Growth - The degree to which investments provide an opportunity to achieve significant growth. Companies in sectors that have minimum or negative growth, such as the automtive industry, invest in efforts to protect market share, while growth sectors, like pharmeceuticals and energy exploration, invest in expanding capacity.

Growth

Automotive   *Pharmeceuticals*

Risk

Complexity

Complexity - The degree to which investments can increase complexity and create greater product differentiation. Companies in industries that are highly complex can work in very narrow niches and develop new products that solve particular problems and satisfy specific market needs. The automotive sector creates variations of the same product with the same basic performance objective. There is very little complexity. Investments are made in identifying which features that are introduced by competitors are likely to be required by the market.

Those trying to sell the idea of telematics into the car industry, whether from the inside or from the outside, must position telematics as a feature that first and foremost will reduce costs, keep customers loyal, and will be a feature that all other cars in its class will have in the near future. They should stop promoting telematics as a growth opportunity. The growth component is as a non-core business, which even at its best, does not add significantly to the core's source of revenue for car sales and sales of parts, services and accessories.

The implications for telematics are clear. No one wants to be first with a pan-European telematics service because the costs are extraordinarily high and it is not enough of a differentiator to drive sales. On the other hand, when one or two companies have achieved it, all of the companies must follow.

As long as DaimlerChrysler, BMW and Volvo had working systems in their home markets only, there was no pressure on the lower-end manufacturers to develop systems. When all three manufacturers announce new market openings during the Autumn of 2003 and Spring of 2004, it is likely that many of the other manufacturers will begin to roll out their own products. These products are already under development, even though they are not discussed publicly.

The principal reason that a car company should bear the cost of installing a telematics system in its vehicles is to get a communications device into the vehicle to achieve cost reductions, and to enable better communications with the customer.

Cars today are mobile electronics devices, computers on wheels, but they are totally isolated computing systems. Today, a non-connected computer (i.e. to the Web, to a network) is an anachronism, completely out of place. Connecting their vehicles to the information infrastructure should be one of the highest priorities for the automotive OEM. Older customers may tolerate having to drive to their dealer to connect up to the OEM's private and proprietary network in order to perform a simple software upgrade—as is the case today—but younger, more computer savvy buyers will see this as awkward and unnecessary. The first company to understand this and implement it will definitely—if only briefly—have a competitive advantage.

Providing safety, security and convenience services, like those offered today by GM's OnStar, BMW, Volvo, and DaimlerChrysler, are just the beginning of what the automotive companies will be able to do for their customers while improving their own abilities control costs and enhance their chances to build a long-term customer relationship.

Government Perspective

Governments are concerned with the social and economic costs and benefits of transportation systems and infrastructures. They are most concerned about reducing traffic accidents and deaths, and optimising their investments in transportation infrastructures (roads, rail, public transport equipment, etc.). Governmental agencies in all major automobile markets have contributed human and financial resources in support of Intelligent Transportation Systems (ITS) initiatives, and they appear willing to continue to do so in the future.

As with most vehicle-related issues, the vehicle industry and governments will be at opposite poles with respect to their reasons for supporting telematics. Nevertheless, I expect governments to be one of the major driving forces behind telematics systems installations. Governments will have a major effect on the rate of growth for

telematics systems through both enabling and restrictive legislation: enabling through tax incentives for installing certain types of equipment, such as traffic information systems and navigation; and, restrictive through requiring either car manufacturers or vehicle owners to install other types of equipment, such as toll collection equipment and intelligent speed adaptors.

An example of the enabling side is in The Netherlands, where the minister of the environment has recently proposed that navigation and traffic information systems should be standard fit in cars and trucks because of their demonstrated ability to reduce traffic congestion[17]. He has proposed legislation that would encourage car and truck owners to pay the extra costs of these systems, and for the services needed to support them. It is noteworthy that the main opposition to this proposal comes from the car industry's own lobbying group, ACEA. They do not want to add systems as standard because they feel that they will not be able to recoup the costs through vehicle price increases. They would rather keep these systems as customer options, or as part of special option packages.

The Netherlands would also have been first with a mandatory GSM/GPS-based toll collection system for all motorists if it had not been for a change of government from labour to conservative. A consortium was to have been selected to manage the development of the systems for recording the roads travelled and time of journey, and then sending this information to a central data management service for preparing regular invoices to motorists. The systems were to have the possibility of delivering value-added services to motorists, such as traffic information and route guidance, and even offering the safety and security services of current telematics systems.

The Toll Collect system in Germany that was scheduled to go live in late 2003, but has experienced several delays, is a realisation of this same concept, although for commercial vehicles. All trucks operating in Germany will be fitted—for free—with a black box telematics system. Its principal purpose is to report road of travel and time for tolling purposes, but it is planned that these systems will also deliver telematics services, and that the systems will be open for service providers outside of the telematics consortium operating Toll Collect[18].

The European e-Safety initiative, which had its official kick-off in Lyon, France in September 2002, has as its goal a 50% reduction in traffic deaths by 2010. French officials, in order to reduce traffic-related deaths, have said that they will purchase new cars only if they are equipped with speed control devices. Some systems operate with GSM/GPS-based systems, and these systems are being evaluated at the European Commission level and by national governments. Peugeot and Renault already have such systems. A big worry for car manufacturers and their suppliers is that the European market will

---

[17] It is not clear in the article, seen in Automotive News Europe, on what the minister is basing his claim that navigation systems reduce traffic congestion. There are no research studies identified in the article. It is one of the main selling points used by the system manufacturers and the vehicle OEM's who install them, but I know of no research that prove the results.
[18] The Toll Collect consortium consists of DaimlerChrysler, Cofiroute and Deutsche Telekom.

become fragmented and require different solutions, as is the case with toll collection systems.

End-user Perspective

According to a recent survey[19] conducted in Europe of 55,000 car drivers, the top reasons for buying a new car are:

- ❑ Price

- ❑ Reliability

- ❑ Comfort

Beyond the top three reasons, other reasons vary by nationality and stage in life. Quoting from the survey results:

- Germans worry least about safety or car style

- The French value security

- The British and young buyers in general, care most about style

- Speed ranks among the lowest considerations of all buyers, but it is important to the under 35-year-old age group, especially men.

- Women are most influenced by safety and security.

An automotive product planner or marketing executive will be hard pressed to find a clear indication from available research that a consumer will choose to buy their brand because it has a telematics system, or will pay real money to have a telematics system and its services. There are no surveys of which I am aware that show either telematics or other in-vehicle systems or services as a reason for making a certain car purchase. There are consumer surveys that have been made by organisations like J.D. Power which have tried to determine which ITS features consumers might like to have, and their potential for purchasing vehicles with these systems.[20] The top four items on their wish list were roadside assistance, vehicle diagnostic information, real-time traffic and navigation information.

However, if we go beyond the model of telematics as a box with buttons, and look at how the fundamental components of telematics systems will be used in delivering a better, safer, more convenient and, perhaps, less expensive driving experience, there are clearly areas where consumers will accept these systems even though they may not ask for them specifically.

There is growing support among the public for speed safety systems. A market research report funded by the Federation Internationale de l'Automobile (FIA), indicates that "70% of those surveyed would support an audible in-car warning or a dashboard display that alerts them to the legal speed limit on residential roads and on trunk roads in

---

[19] Survey conducted by TGI Europa 2003. Data analysed by Nick Hiddleston, international research director at media buying and planning specialist Initiative Media. Report in Automotive News Europe, July 28, 2003.
[20] JD Power 2001 Automotive Emerging Technologies Study – Wave I & II

built-up areas."[21] This result is consistent with results reported by the Swedish National Roads Administration following their tests of ISA (Intelligent Speed Adaptation) in Sweden.

Support for tolling schemes is mixed. Residents inside toll zones are in favour, while those immediately outside oppose them since they are the ones who will be most affected by them. Surveys of London residents following the institution on road user charging in Central London confirm these findings. Proposals by the Mayor of London to extend the zones have shown that there are split feelings. Those inside the new areas welcome them because they will pay lower fees (10% of the total £5 per day), and those in the new adjacent areas dislike them because they will have to pay to drive into areas that previously were free. The technology used in London does not require any in-vehicle systems. It is all based on cameras photographing vehicle registration plates and comparing the numbers to a database of those who have paid their fees for the day.

As traffic congestion worsens in large urban areas, more tolling schemes will be implemented, and the technology for tolling will increasingly be via telematics devices installed in vehicles, rather than with other methods.

This has already started in the commercial truck arena. A new scheme in Germany for heavy truck tariff payments is based on telematics devices being installed in every truck that drives in and through the country. These devices are being installed for free by a consortium that is charged with managing the entire operation and collecting the tariffs.[22] When the German government announced the winner of the competition that was held to select tolling operator, there was an organised effort by competitors to each of the winning team companies to prevent them from having a monopoly on delivering telematics services. The objectors eventually prevailed, and the consortium has established a separate company that will manage all third party telematics services delivered to the in-vehicle devices.

Advanced Driver Assistance Systems

The automotive industry has already started to sell rudimentary advanced driver assistance systems that function with the aid of vision systems, usually radar. Automatic headlight steering to guide lights around corners is one of the first such systems, and it is being heavily advertised on billboards and in the media. The next generation of these systems, available near the end of this decade, will use geographic data to provide an "electronic horizon" to the ADAS applications. The road of travel with a positional accuracy that is ten times greater than what is available today and with much higher levels of attribute richness, will be used to guide these next generation systems.

---

[21] Reported in The Intelligent Highways (September 15, 2003), page 10.
[22] The Toll Collect consortium consists of DaimlerChrysler, Deutsche Telekom, Siemens and Cofiroute.

Today, map data in vehicles is used for navigation systems. This data is delivered to the applications on CD/DVD media that can be up to eighteen months out of data when the customer receives it from the car manufacturer, the system supplier or the map data producer. Although inaccuracies in the data for navigation purposes are inconvenient, they are rarely lift-threatening—unless, of course, the navigation system is being used in an emergency service. When this data is used for braking assistance or curve warning, it must be 100% up to date.

These higher demands in the data will necessitate constant updates of both the physical infrastructure and the attributes associated with the features in the infrastructure. This requirement is one of the principal reasons that car companies are working hard to install a communications device in their vehicles and to ensure that a communications infrastructure is in place to deliver data to and receive data from their vehicles.

What are the prospects for these factors changing positively or negatively during the coming 5-10 years and beyond?

Nils Bohr is attributed with saying, *"Prediction is difficult, especially when it involves the future."* However, concerning telematics, there are certain <u>inevitabilities</u>, and a number of <u>predictabilities</u>.

The Next Twenty Years

Inevitable	Invention	Predictable
Given the choice, individuals will choose to travel in their own vehicles, according to their own schedules	**Personal Mobility**	The trade-off between societal costs and personal mobility will make the private automobile an increasingly less attractive option
Governments will legislate road usage pricing in order to reduce the societal costs of congestion	**Collective Mobility**	Traffic congestion will eventually eliminate the advantages of personal mobility
Globalisation will increase the need to transport goods for both manufacture and distribution, increasing the demand for road transport as the most cost effective option	**Commercial Mobility**	Traffic congestion will eliminate the advantages of trucks over fixed rail and air transport
Economic growth is now largely dependent on businesses and consumers using more data	**Information Mobility**	Information available to individuals will eventually exceed our ability to process and use it
Individuals desire more, not less, customisation	**Ownership Mobility**	Private cars will eventually become too expensive for most people to own

Many telematics developments have made significant progress because of one or a combination of the three market drivers listed above (i.e. <u>consumers want them, governments demand them, companies offer them</u>), and these developments will be brought to

market as products or services during the coming ten years. In the diagram below, the yellow boxes are developments that can be commercialised based on research and product development that has been occurring during the past decade. Floating car data for traffic information collection is already deployed by, for example, ITIS in the UK, and by Trafficmaster and Targa Services in Italy. Centralised map databases used in off-board navigation systems are in 2003 already being introduced to the market on a small scale. Systems from Wayfinder (Sweden), Telmap (Israel), and T-Mobile Traffic (Germany) are in the early commercial phase. Blaupunkt's navigation radio will be the first large-scale introduction of this technology.
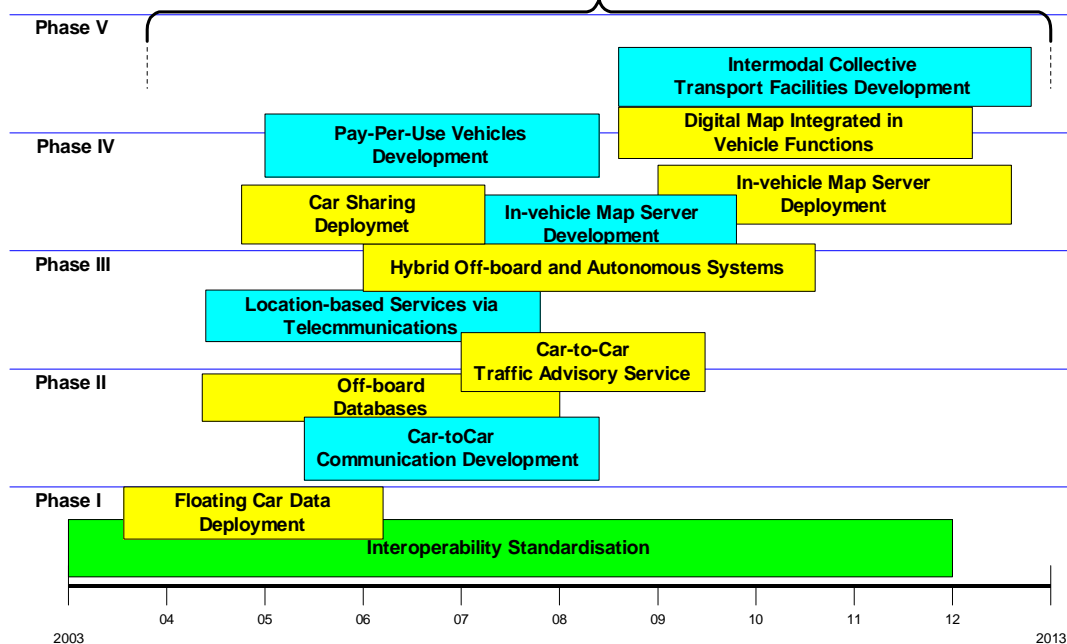
These services require an in-vehicle device that combines telecommunications and positioning—a telematics device. As they are implemented by the vehicle OEMs and their suppliers, and as they grow in number, they will foster an increasing demand for connectivity, for end-to-end telematics solutions and all the services that support these solutions.

Michael L. Sena Consulting AB

Atomotive OEMs In-vehicle Systems Development Roadmap - 2003-2013

Michael L Sena - 24 December 2002   Digital Map Production - ADAS

Phase V	
	Intermodal Collective Transport Facilities Development
Phase IV	**Pay-Per-Use Vehicles Development**
	Digital Map Integrated in Vehicle Functions
	In-vehicle Map Server Deployment
	Car Sharing Deploymet
	In-vehicle Map Server Development
Phase III	**Hybrid Off-board and Autonomous Systems**
	Location-based Services via Telecmmunications
Phase II	**Car-to-Car Traffic Advisory Service**
	Off-board Databases
	Car-toCar Communication Development
Phase I	**Floating Car Data Deployment**
	Interoperability Standardisation

2003   04   05   06   07   08   09   10   11   12   2013
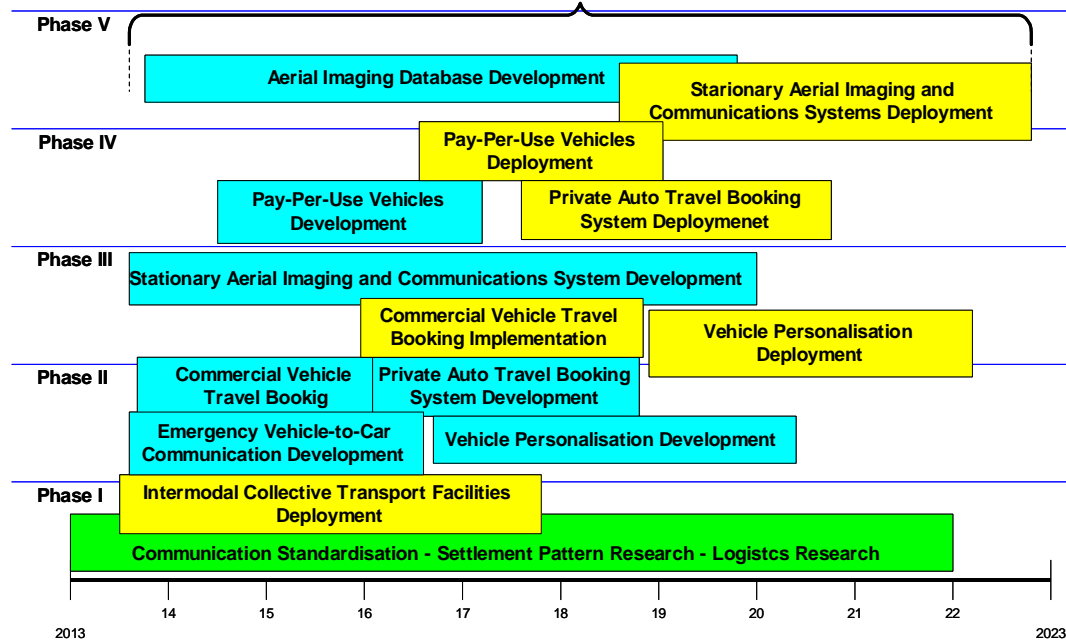
The automotive OEMs, their Tier One suppliers, and many of the small companies who support them, have decided on their research objectives for the coming decade—again based on their best guesses of what their commercial customers will have to purchase and install because of the push of government and the pull of consumers—and they include the items in the blue boxes. Car-to-Car communications, in-vehicle map server development (to simultaneously support navigation and Advance Driver Assistance Systems), and pay-per-use vehicle development are all being worked on for implementation in the following decade or sooner.

Michael L. Sena Consulting AB

Automotive OEMs In-vehicle Systems Development Roadmap - 2013-2023

Michael L Sena - 24 December 2002   Digital Map Production - Aerial Overlay and Public Service Interfaces

Phase V	

Aerial Imaging Database Development

Starionary Aerial Imaging and Communications Systems Deployment

Phase IV

Pay-Per-Use Vehicles Deployment

Pay-Per-Use Vehicles Development

Private Auto Travel Booking System Deploymenet

Phase III

Stationary Aerial Imaging and Communications System Development

Commercial Vehicle Travel Booking Implementation

Vehicle Personalisation Deployment

Phase II

Commercial Vehicle Travel Bookig

Private Auto Travel Booking System Development

Emergency Vehicle-to-Car Communication Development

Vehicle Personalisation Development

Phase I

Intermodal Collective Transport Facilities Deployment

Communication Standardisation - Settlement Pattern Research - Logistcs Research

2013   14   15   16   17   18   19   20   21   22   2023

Within the 2013 to 2023 timeframe, the research projects of the previous decade should see implementation and commercialisation, as shown in the yellow boxes. The research program for the 2013-2023 timeframe is less certain. However, through a combination of interviews with car manufacturer research program directors and constant analysis of technical and business information sources, I have pieced together a picture of what I believe is a highly likely pattern of development of ITS products during the next decade, as shown in the blue boxes in the diagram above.

IV. Customers: The companies that install and operate telematics solutions

There are seven business areas where telematics customers are found:

- ❏ Automotive Connectivity
- ❏ End-to-End Telematics
- ❏ Telematics Call Center Services
- ❏ Fleet Services
- ❏ Content Services
- ❏ Telematics Software Development
- ❏ Network Services

Each one of these business areas has unique characteristics that require tailored solutions as well as off-the-shelf products.

Automotive Connectivity

This business area involves managing the data interface between telematics-equipped vehicles and the services that are delivered to the vehicle. Customers for this service are vehicle manufacturers who equip the cars, trucks, busses, and other vehicular equipment with two-way data communications systems.

There are thirty-seven global vehicle manufacturers. Of that total, four of them are companies based in India that produce fewer than 125,000 cars per year. First Auto (Chinese) and AutoVaz (Russian) are reasonably large producers, and while they may be long-term prospects for telematics systems and automotive connectivity, they are unlikely candidates in the short term.

Of the remainder, ten are primarily truck manufacturers and will be considered in other business areas. That leaves twenty-one prospective companies who control an additional thirty-eight wholly- or partly-owned subsidiaries. For example, GM includes Holden, Opel, Vauxhall and Saab. Ford includes Aston Martin, Jaguar, Land Rover and Volvo Car Corporation. In addition, there are brands within companies like GM, Ford and Toyota and others that have independent development programs. Examples are Cadillac for GM, Lincoln for Ford, Infinity for Nissan, Mini for BMW, and Lexus for Toyota. So the total number of prospective customers approaches 70, most of which are selling cars in Western Europe. The number of prospects is lower in North America where Fiat (Fiat, Lancia, Alpha Romeo), Renault and PSA (Peugeot and Citroën) have no sales at present.

Many of the car producers are already part of a telematics sphere. Most of the spheres are still loosely defined, with members joining or leaving and the hardware solutions left up to the individual companies.

Volvo is, in theory, part of the Ford sphere, but has its own telematics solution with WirelessCar that is not shared by any of the other Ford Group companies.

Ford Telematics Sphere diagram available separately. Diagrams unable to be copied into PDF format.

Two spheres, GM and Fiat, are intertwined through ownership (GM owns slightly less than 10% of Fiat). GM has set up the OnStar sphere in North America. This is an end-to-end solution. As seen in the diagram below, a number of non-GM brands have taken OnStar on board in the US.

General Motors North America Sphere diagram available separately. Diagrams unable to be copied into PDF format.

In Europe, the OnStar sphere is much more diffuse, with GM subsidiary Saab joining the Fiat sphere.

General Motors Europe Sphere diagram available separately. Diagrams unable to be copied into PDF format.

OnStar Europe is going to do what OnStar North America has done, initially in Germany, and eventually in all of Europe. Their business and operations model will be the same as OnStar North America's, and similar to Volvo's. The reason they have had difficulty in the past is that they tried to push all of the development of infrastructure on country suppliers, like ADAC in Germany and the AA in the UK. The OnStar organisation thought that they did not have to own anything. What they found out was that they were duplicating all services in every country, and paying for these services. Also, they had no control over the customer information. They were giving their customers to the service providers, rather than keeping them for themselves. Volvo probably realised the same thing before they actually implemented their services, which is most likely why they asked WirelessCar to build its centralised infrastructure. OnStar just took a longer time to figure it out. Why didn't they choose to use WirelessCar's services or those of Tegaron or Passo, instead of building it themselves with Accenture? Because Accenture is building the systems to tie back into their own internal administrative, sales and marketing systems, and they did not see any of the other companies as a software developer of the calibre of Accenture (see the section later in this Report on partnerships).

When all of the companies who are already tied into a sphere and an end-to-end solution are added up, approximately sixteen companies are removed from the list of potential customers for an independent

telematics service provider[23]. The sixty companies/brands remaining sold approximately 11.5 million cars in Western Europe in 2003. Volvo Car Corporation, as an example, represents around 2% of that total, with 216,000 cars sold in Europe in 2003 (out of a worldwide total of 420,000). Volvo sold its telematics system in Europe, Volvo On Call, only in Sweden during this period. Sweden represents 21% of Volvo's total European sales. The system was not available on three of the car models (XC90, C70 and S/V40), which accounted for 13% of the sales, so Volvo Car's penetration of the European market was less than one-half of one percent in 2002.

As the table below shows, there are still a number of prospects that have no current systems and no ties to any service providers. Winning them as customers will depend on how well a telematics service provider matches up with their decision-makers' demands.

Major Brand Prospects (excluding GM, Fiat and related companies)	No. vehicles sold in Western Europe 2003	Sphere[2]
BMW	628,366	Own With ATX
DaimlerChrysler	924,719	Own With T-Mobile Traffic
Ford	1,572,498	Ford[1] Volvo
Honda	193,067	None
Hyundai Group	365,337	None
Mazda	208,101	None[1]
MG Rover	135,944	None
Mitsubishi	129,348	None
Nissan	413,605	None
Porsche	32,972	None
PSA Group	2,098,353	None
Renault	1,501,078	None
Toyota Group	716,183	None
Volkswagen Group	2,575,871	None

---

[23] The sixteen companies are: Alfa Romeo, Audi, Buick, Cadillac, Chevrolet, Fiat, GMC, Honda Acura, Lancia, Masarati, Opel, Pontiac, Saab, Subaru, Toyota Lexus and Vauxhall

Source: Automotive News Europe – 2004 Global Market Data Book

1. All companies potentially part of an eventual Ford sphere

2. Own means they have a current telematics offering and have developed a sphere with telematics service providers, content and applications servers. None means that they do not have a telematics solution currently on the market.

Key Decision Makers

There are three principal centres of decision-making for the companies in the above list:

- ❑ Germany
- ❑ United States
- ❑ Japan

The German companies make individual and collective decisions, as do the Japanese. In matters that relate to standards, companies in each of these countries first meet among themselves to decide what is best for industries within their own countries. Each company is represented on a working group that focuses on a particular standards area. The working groups meet on a regular basis. They report to a steering group who meet quarterly or bi-annually. Steering group representatives then report back to their respective management boards.

Daimler Chrysler Sphere diagram available separately. Diagrams unable to be copied into PDF format.

There are many examples of this in the automotive sector, one being the German exodus from AMI-C to form the Most Consortium[24]. MOST was primarily a German initiative to promote a Germany company solution. An even more recent example is the establishment of a group called AUTOSAR (AUTomotive Open System Architecture) which was formed by German carmakers BMW, DaimlerChrysler and Volkswagen, and automotive systems suppliers Bosch, Continental and Siemens, to jointly develop and commercially release a standardized electrical/electronic architecture concept.[25]

German management tend to select other German companies with whom to develop solutions that are used by their company and other

---

[24] • AMI-C - Automotive Multimedia Interface Collaboration - Develop a set of common specifications for a multimedia interface to motor vehicle electronic systems in order to accommodate a wide variety of computer-based electronic devices in the vehicle.

• MOST - Media Oriented Systems Transport - A initiative with similar aims as AMI-C

[25] Articles covering the announcement of AUTOSAR's formation appeared in the October 20, 2003 issue of Automotive News Europe and the October 15, 2003 issue of The Intelligent Highway. In the latter publication, it is stated that AUTOSAR "will cover telematics, man-machine interfaces, multimedia systems, and body electronics, powertrains, and chassis control and safety systems. Why work outside the official standards bodies, CEN for Europe, SAE for the US or ISO for international activities? No mention of this small detail in the write-ups.

German companies. There are clear examples of this in the telematics field, with BMW choosing Passo (at the time part of the German conglomerate Mannesmann), DaimlerChrysler establishing Tegaron with Deutsche Telekom, and VW setting up Gedas. The German car companies collectively sell 30% of all cars in Europe (4.3 million of 14.685 million in 2002). However, they wield a much larger influence within certain fields, like navigation and telematics, because of their heavier investments in technology and dominance in the luxury brand segment where ITS solutions are mostly sold.

Working as a supplier to the German automotive industry in Europe requires a physical presence in Germany at a minimum, and preferably an established business with native-speaking German management.

The Japanese companies Nissan and Mazda have split decision-making. Nissan is part of Renault and Mazda part of Ford. Nissan has much more independence than does Mazda, and the decision-making group for ITS solutions is in Europe, divided between their Paris and Cranfield, UK offices. Nissan must still obtain approval for any telematics developments from the Japanese engineering management, and at the same time check with their respective owners on their development plans. With Renault no longer part of Signant, more decision-making power resides internally.

The other Japanese companies, Toyota and Honda, have European offices that can make local market decisions, but anything that requires new hardware or modifications to existing hardware needs to be reviewed in Japan. Toyota introduced RDS-TMC as an add-on service in the UK to its Aisen navigation system. Coordination of this modification to the navigation system was managed out of the European office for both Aisen and Toyota working closely with the UK traffic data producer, ITIS. However, all work was done in Japan, and approval was given by the head of engineering in Japan.

Working with Japanese companies in Europe is best handled through an existing Tier One supplier, and by making direct introductions in Japan.

Ford's European division has exerted a great deal of independent decision-making power in the past in matters related to ITS strategy and investments. They have been able to choose their own ITS solutions, including navigation and telematics systems. There are some signs that this independence is being restricted. Ford's financial crisis is at the core of the demand in Detroit for greater control over spending. Another factor influencing Ford's ability to make decisions about telematics investments is its relationship to the Premier Automotive Group's centres of excellence. Volvo has been the company responsible for leading the Telematics and Active Safety Centres of Excellence, while Jaguar has had the responsibility for navigation systems. With Signant now disbanded, Ford no longer has to try to coordinate with two non-Ford companies, Renault and PSA.

Customers for End-to-End Telematics

End-to-end telematics is the delivery of a complete hardware and service solution to the car manufacturers. OnStar in North America is the principal practitioner of E2E telematics. They specify and have manufactured the hardware device, including a communications module, GPS device, antennae and HMI. They deliver the device to the OEM for factory installation. They organise all network services and they deliver all customer services, either directly or through third parties. There are two groups in Western Europe involved in end-to-end telematics services[26]:

❑ OnStar Europe – currently working with Accenture and TeleInfo to develop telematics systems and services.

❑ Targa Infomobility – their bConnect service, formerly known as TargaSys, provides services to systems developed for Fiat Group models by Magneti Marelli, Blaupunkt and Siemens VDO.

OnStar and Targa Infomobility are Integrators[27]. They manage all the steps necessary to generate profits from the telematics concept. Through their owners, they have invested the capital needed to set up the entire infrastructure, and to get the telematics units in the vehicles. In the classic sense, the Integrator approach is best used when speed-to-market is not critical, technology is proven, customer tastes are stable, and innovation is incremental. Telematics meets only the first and last criteria. The majority of the current telematics customer base is made up of Orchestrators, like Volvo, DaimlerChrysler and BMW, who focus on some steps and link with partners to carry out the rest.[28]

Customers for Telematics Call Center Services

Most of the companies in this sector have built their own infrastructure solutions for delivering telematics call center services. Originally viewed as an advantage, it turned out to be a problem for their eventual customers because of the high cost of adapting their systems to the in-vehicle technology and the types of services desired by the automobile OEMs. ADAC in Germany, The AA or RAC in the UK, and most of other automobile and travel clubs have difficulty competing on a pan-European basis.

One of the companies that had not developed its own telematics service systems, Mondial Assistance, turned their lack of an infrastructure solution into an advantage, and have emerged as the industry sector leader. They are now working with solutions provided to them by three different automotive connectivity companies:

---

[26] There was a third: Signant – a tri-venture among Ford, PSA Peugeot Citroen, and Renault. Signant was disbanded in January 2004.

[27] James P. Andrew and Harold L. Sirkin, *Innovating for Cash*; Harvard Business Review (September 2003)

[28] Ibid. Orchestrator approach is best used when there is a mature supplier/partner base; there is intense competition with a need for constant innovation, strong substitutes exist, and technology is in its early stages.

WirelessCar for Volvo Cars; T-Mobile Traffic for DaimlerChrysler's Mercedes; and, Passo (now ATX Europe) for BMW.

Customers for Fleet Services

Customers are companies or governmental organisations that have, or are developing, businesses around the delivery and processing of location-based information. They include the following groupings:

- Commercial telematics – fleet management services, including tracking and tracing, route planning, traffic alerts. Commercial telematics providers include Daimler-Benz *FleetBoard*; Volvo Trucks *Dynafleet*. Others include delivery services, like Fedex and UPS, and taxi companies.
- Consumer telematics – safety, security and convenience services, including simple positioning up to route guidance delivery to in-vehicle devices: GM/*OnStar*; TargaSys *bConnect*; Volvo Cars' Volvo *On Call*; Vodafone Passo; T-Mobile Traffic (formerly Tegaron); ATX for in-vehicle telematics services.
- Commercial and consumer security – monitoring homes and businesses and providing routing advice to security personnel. ATX home and business protection services; Brinks; Securitas.
- Commercial and consumer non-vehicle related location-based services – including services delivered over the Internet (Web portals) as well as delivering wireless services. Telecom services, such as 3; Vodafone Live; Orange.
- Emergency services – police, ambulance, fire, military and other emergency services. BT Cellnet in UK;
- Traffic management information services. Traffic information centres (TIC); traffic flow data systems

Customers for Content Services

Blaupunkt still does not have a pan-European service partner for its radio navigation system. It works with a small provider in Germany, and now has an agreement with bConnect (Targa Infomobility) to service its Fiat Punto OEM system. Other hardware vendors will follow Blaupunkt's lead. It is possible that wireless device manufacturers, like Nokia, Siemens, SonyEricsson and others will follow Motorola's lead and offer services similar to SmartNav and ViaMoto. ViaMoto is the mobile phone-based service version of SmartNav that Motorola introduced in the US on AVIS rental cars. As reported in the April 1 2003 issue of *The Intelligent Highway*, AVIS customers receive a Motorola handset containing an integrated GPS receiver, speakerphone and the ViaMoto software. The user contacts the AVIS Assist call center and asks for directions to an address or point of interest. Turn-by-turn directions are sent as a data packet and announced sequentially when cued by the location of the user. The cost of the service to the customer is $10 per day.

V. Market Size and Growth Rates

What is the relative size of each of the business sectors and how are the estimates of market size developed

When it comes to predicting the size of the telematics market, there are no experts. There are so many ifs, ands, and buts that everything is a guess. The only thing that is important is what the potential market is for each individual company. That is why I have winnowed it down, eliminating all of the customers who already have a dancing partner. There are, as I said, about 10.5 million new cars sold per year in Europe that are totally up for grabs.

Even if every one of the companies all started to introduce systems in 2004 (which they have not done), they would not have sold more than around a few thousand telematics-equipped units per year each in the first years because they are still not selling in all countries. It is in 2005/2006 that the sales will begin for the companies that do not already have systems in the market, so my best guess is that there will be sales of around 10,000-20,000 units for the late starters (PSA and possibly Renault), and 20,000-50,000 for the five leaders (GMOnStar, Fiat, BMW, DaimlerChrysler and Volvo) in 2005. That is a total of approximately 150,000-350,000 (1.2-3%). Sales will pick up quickly following this because more countries will be added by the early entries, and more companies will come into the business among the late starters.

The growth rate will depend on the factors I describe in the Growth Rate section. In addition, the after-market systems will begin to be sold into the existing car market. As I said earlier, an equal number of after-market to new car telematics systems is a likely scenario starting in 2005.

What factors need to be considered when developing market projections

The basis for a telematics market estimate has to be the number of new vehicle (car, truck, bus, construction equipment) sales in the major markets, and the number of vehicles in use in those markets. All of the market studies begin with these numbers. Where they go wrong is in their estimates of product and service take-up. The only reliable market reports are those for the fleet management market. This is because fleet management is a proven market that has a well-defined set of customers and suppliers. Reports that have tried to estimate the size of the telematics market have grossly overestimated the volumes and underestimated the timeframe of implementation. The same is true for content services delivered to location-based systems.

What should be included in and excluded from market size projections

Many of the market studies with "telematics" in their title include autonomous navigation systems in their projections. One of the most recent examples of this is a report titled "European Telematics: The European market and trends for on-board and off-board navigation systems." The second title tells what the report is about, but the lead title says something totally different. In other reports, particularly those produced by equity capital market analysts (e.g. Dain Rauscher Wessels), both the integrated systems from Tier One suppliers like Siemens VDO, Melco and Blaupunkt and the PDA-based systems from ALK, PTV and TomTom are mixed together with fleet management systems and pure telematics systems like Volvo's *Volvo On Call* and GM's *OnStar*. The current TSP's, with the possible exception of T-Mobile Traffic, do not have a position in the autonomous navigation value system chain. It is only when off-board service delivery is used to deliver data to devices that do not have on-board data storage that connectivity and content delivery services are required.

Frost and Sullivan in their 2001 report on telematics seemed to finally get the inclusions correct, even if their financial projections may have been a bit overly optimistic. They forecast that in 2007, 12.7 new vehicles equipped with telematics hardware will be sold in North America, and that the <u>paying</u> subscriber base will be 21.96 million (as distinguished from the total subscriber base of 30.63 million) by the end of 2007.

These numbers are not realistic, given the current implementation of telematics systems. Even assuming that all car manufacturers follow GM's lead with OnStar and install telematics systems as standard fits in 50% of their vehicles, fewer than 7 million cars per year would be sold with telematics included. Even this number is probably too high.

Is telematics price sensitive

System provider perspective

Every indication we have from the OEMs offering telematics systems and services is that the systems are price sensitive. Volvo On Call's slow take-up in Sweden has most probably been due in part to their high purchase price (13.000 SEK). This could be the reason that Volvo UK decided to include Volvo On Call as part of an options package and to place a purchase premium on it of only an estimated £300 (i.e. what the package cost before the addition of Volvo On Call, and what it cost afterward). The vehicle and telematics system industry seems to be in agreement that the purchase price for a telematics system with basic safety (e-call and b-call) services cannot be more than $700, and preferably lower than $500. Telematics systems are much more price sensitive than navigation systems, which cost between $1500 and $3000 factory installed.

The main reason for their price sensitivity is the uncertainty by both seller and buyer about their value proposition. Telematics systems are still new to consumers; the normal car buyer in Europe has not seen or experienced the advantages of telematics. Car manufacturers have not yet developed a consistent policy concerning telematics, nor have they communicated a convincing message to their prospective buyers concerning their long-term commitment to providing truly useful services.

Service provider perspective

The business case for telematics in each market is heavily dependent on obtaining appropriate pricing from all suppliers. The major service price issues are minute costs from the SIM-card supplier, call center operator per minute charges, per invoice charges from the billing agent, and charges from the telematics service provider. The service providers have high fixed costs for infrastructure and personnel that can only be recouped through volume service usage. During the early stages of a telematics implementation, low volumes are common, resulting in losses on service provision by all service providers.

Customer perspective

The only real experience we have to use for customer price sensitivity is OnStar, and they are not open to sharing their statistics. At this stage, we do not have any solid evidence that customers are price sensitive to the different services. Using OnStar, it is clear that they believe the systems should be perceived by consumers as being free, with payment being made only for services.

Usage figures for GM's OnStar in the US

❑ OnStar – Over 3 million subsribers

❑ 63% renewal rate for Personal Assistance Services (J.D. Power survey)

❑ OnStar's monthly usage

- 700 automatic airbag requests

- 700 stolen vehicle location requests

- 250,000 routing calls

- 28,000 remote door unlock requests

- 15,000 GM Goodwrench remote vehicle diagnostic alerts

- 13,000 roadside assistance calls

- 7,000 emergency calls

- 2,000 "Good Samaratin" calls (people who just need someone to talk to)

Growth Rates

There are two growth scenarios for telematics:

- ❑ Slow, steady growth in the range of 2-5% of total new car sales resulting from fitting telematics systems as an option on the majority of luxury brands by 2005.

- ❑ Rapid, accelerated growth resulting from a combination of low-cost standard fit devices in most models, and government legislation requiring or encouraging the installation of systems.

Factors currently influence the growth rate of telematics

New car and truck sales

Worldwide new vehicle sales are predicted by most market forecasters to grow by 5-6% through 2005, from 49,516 million units in 2003 to 53,867 million units in 2005. These increases will be sufficient for most car companies to continue to fund their telematics developments. It is not sufficient to make them standard fit. Much of this growth will come from developing countries where telematics system infrastructures will not be available for many years in the future.

Types of vehicles sold

The luxury car segment will share in this growth and support a steady increase in telematics systems. It is more likely that other luxury car makers will follow Volvo's lead in Europe and incorporate telematics in an option package, rather than making them standard. The situation is different in North America, where it is more common for a dealer to order cars for display to attract buyers, rather than to build cars to customer specification. Buyers in the US are used to comparative shopping, and buying what they see, rather than ordering a car and waiting for several weeks (or months) for delivery. For the US market, it is more likely that telematics systems will be standard fit in a model range.

Technical capabilities

A major breakthrough for telematics will occur when the emergency services <u>are able to communicate directly with vehicles</u>. This is not likely before the next decade. There are initiatives that have started in Europe led by the European Commission's mobility services sector directorate general for the information society (DG Info). They have published a report titled *Information and Communications Technologies for Safe and Intelligent Vehicles*. The report provides a set of guidelines for different areas of safety, including vehicle-to-vehicle and vehicle-to-infrastructure communications. A budget of €8 million has been provided by the EC to be spent over a three-year period in <u>research</u> into standardisation and technological developments. Only after the research phase can there be any progress toward a single, standard approach in all European

countries. By then, countries like the UK, which already have a method of enforcing vehicle-to-emergency services communications, will have to be convinced to adapt their current approach in order to harmonise to a standard. When it comes to standardising at the public policy level, there are always significant delays. Perhaps a decade is an optimistic estimate.

Until the results of initiatives like those in eSafety are completed in all of the major European countries, systems will be dependent on connectivity and data routing services, like the one for Volvo On Call in the UK, or for first contact services like OnStar in the US or Volvo On Call in Sweden and the US.

Wireless communications

As the usage of GPRS spreads and as network operators finalise their roaming agreements, GPRS will replace GSM/SMS as the message bearer. This will increase the range of services that can be provided, but more importantly, it will decrease the cost of data communication. Gradually also, 3G will be introduced. 3G technology will simply make it easier and faster to download large amounts of data to the vehicle and enable new services that cannot be contemplated with today's 2G and 2.5G technology.

What factors could influence growth rates in the future

The biggest influence on growth rates will be government actions. Government authorities will increasingly view telematics as an alternative to investing in infrastructure or adding personnel. Automatic speed controls installed on vehicles is a substitute for police speed controls and installation and maintenance of cameras, and it is a cost that is borne by either the consumer or the automotive industry. The vehicle industry will resist any attempts by government authorities to introduce telematics systems as standard options because such an action will reduce their revenue opportunities and increase their costs.

VI. Companies Competing in the Telematics Space

Customers for unbranded telematics connectivity services are principally car the truck OEMs who integrate telematics devices in their vehicles. There are a limited and well-defined number of competitors in this sector.

There are additional business sectors where companies will find customers, as described in **Section 3: Customers**. Each of these business sectors has its own set of firms with their respective capabilities for meeting market needs. Some companies can compete in several business sectors, while others, because of the structure of their offering, are limited to a single sector.

Within each sector, there are four categories of competitors:

Market Leader – This is a company that has high market visibility, characterised by broad brand recognition and well developed external relationships. There can be more than one market leader, or there can be no clear market leader. In the automotive manufacturing and sales sector, it would be difficult to name a company that is clearly in the lead. Although General Motors sells more vehicles than any other company, its total market share has been shrinking. Ford was close to overtaking GM a few years ago, but Ford is now struggling. DaimlerChrysler gained in size and market share following its acquisition of Chrysler[29], but Chrysler's losses have weighed heavily on DC's share price. Only Toyota seems to have solid momentum, while Renault (with Nissan) and PSA have put together some very good years in recent times.

New Challenge – This is a company that has exhibited strong capabilities for meeting market needs, but has not yet achieved brand recognition or developed an extensive network of external relationships. New challengers eventually either achieve market leadership, or are relegated to the struggling companies.

Struggling – This is where the majority of companies are positioned. They compete for what is left over after the market leaders have taken the largest share. They attempt to develop new capabilities and move up into the new challenge sector, or they try to build external relationships and define new competitive ground by establishing a new market reference.

New Market – Within every business sector there are customer segments—they can be large or small—that are not served by available offerings. An example is navigation aids for small boat owners. When navigation aids for boats were introduced twenty years ago, positioning devices were prohibitively expensive for all but large shipping companies. When GPS devices were introduced, a large segment of the market opened, but small boat owners were still excluded. As GPS devices became less expensive, they became

---

[29] It was not a merger as originally billed. A recent US court ruling in favour of a suit brought against DC for lost share value by Chrysler shareholders confirmed that it was a takeover.

affordable by all boat owners. Each business sector has a new market player who is attempting to redefine the competitive landscape by introducing a new concept that is less expensive than the current offerings.

Automotive Connectivity

Automotive Connectivity Unbranded

	New Challenge LSP	Market Leader ATX WirelessCar
Capability of Meeting Market Needs	T-Mobile Struggling	IBM New Market

Market Visibility
=Brand Recognition +
External Relationships

Market Leader

ATX Technologies now have a North American and European presence. In August 2003, they completed the purchase of Vodafone Passo, the division of Vodafone that was responsible for BMW telematics services in Europe. Passo was originally founded within the Mannesmann group of companies, before Mannesmann was taken over by Vodafone. BMW have worked with Passo since they initiated communications services to their vehicles, and have provided Passo technology to ATX to service their vehicles in the US market. Vodafone had a 20% share in ATX prior to the purchase of Vodafone Passo, and they have retained this share even following the acquisition. It is highly likely that BMW helped to engineer the acquisition of Passo by ATX. ATX became BMW's telematics service provider in North America in 2002, after initially working with Cross Country Automotive Group, Volvo Car's TSP in North America.

ATX claim to have approximately 350,000 customers in North America with BMW, DaimlerChrysler and Lincoln and Infinity as their major customers. Combined with the taking over of BMW's business in Europe, they are the clear market leader in automotive connectivity.

New Challenge

During 2002, an established company announced that it was entering the field of automotive connectivity. The company is SEI (Shields Enterprises Inc.), founded and run by T. Russell Shields, a person who is well-known in the automotive industry as the founder and

original owner of Navigation Technologies (now called Navteq). He was also one of the founders of the ISO working groups for Intelligent Transport Systems, and the founder of the North American and international ITS societies. The company that has been formed to develop the telematics services business is called Ygomi Ltd/LSP. LSP stands for Land Side Platform and is similar to WirelessCar's Universal Telematics Network. The business idea behind Ygomi Ltd/LSP is to provide pass-through telematics connectivity at the lowest possible price.

Struggling

T-Mobile Traffic, formerly Tegaron, are clearly struggling today. They have DaimlerChrysler's Mercedes brand and Volkswagen's Audi brand as customers, but their future is very unclear. DC have voiced doubts about continuing to work with a telematics service provider that is owned by a network operator. DaimlerChrysler sold their 50% share in Tegaron to T-Mobile because DC wanted to have 100% control, but T-Mobile would not give up their share. DC have a contract with T-Mobile Traffic for their TeleAID system that is due to expire in one-two years.

Passo were also struggling, with only BMW as a customer, until they were purchased by ATX.

Two clubs within the ARC Transassistance Group, the Automobile Association in the UK and ADAC in Germany, were competing for OEM telematics business in direct competition to the other TSP's. They were both selected by Ford and GM OnStar as solution providers in their respective markets. ADAC continue to work with OnStar services in Germany on a very low level, but Ford terminated their German and UK telematics offering in mid-2002. ADAC have closed down their ADAC Telematics Group, and the AA has effectively done the same. Officially, the ARC clubs are willing to work with the automotive OEMs on their telematics offerings, but they see their role increasingly as content and call-taking service providers, not as unbranded connectivity providers.

New Market

Fixed operations in the vehicle with proprietary message formats and protocols, and non-standard service-side architectures, are the main reasons why there is a need for companies delivering telematics connectivity services. WirelessCar, T-Mobile Traffic, ATX, and Ygomi Ltd/LSP serve the combined role of interpreter and guide, converting messages from their native protocol to something that is understandable by the service side players, and then directing the messages to the appropriate receivers. They also reverse the process for messages to the vehicle.

If the receivers and senders could understand each other without an interpreter, and if the messages knew where to go without a traffic cop, many of the services provided by the current connectivity providers would not be needed. This is the purpose of standards.

There are, however, no standards in place today, and it is unlikely that there will be any during the coming five-to-ten years. There are two opposing camps attempting to introduce a de facto standard into the vehicle environment. One is the OSGi (Open Services Gateway initiative) led by IBM working with companies like Acunia (now defunct), and the other is the Windows CE for Automotive group led by Microsoft. Both of these groups would like to replace the tailor-made connectivity solutions of today with their own "standard" software platforms that could be installed in all vehicles. Instead of the intelligence being at the switching centre, the intelligence would be in the vehicle, and communicated to the vehicle whenever a change occurred.

End-to-End Telematics Services

End-to-End Telematics Solution

	New Challenge	Market Leader
	Signant	OnStar-NA
Capability of Meeting Market Needs	OnStar-EU Targa	Motorola Blaupunkt
	Struggling	New Market

Market Visibility
=Brand Recognition +
External Relationships

Market Leader

OnStar North America are the clear market leader in end-to-end telematics solutions. They were founded by General Motors in 1996, and began operations in 1997. Since then, they have collected over 3 million paying subscribers. In addition to all GM models, Toyota Lexus, Saab, Honda Acura, Subaru and Audi also offer OnStar on their models. Three million may not seem like a large number of subscribers in over six years of operation, especially since GM made it standard fit on one-half of its models a few years ago. That means that approximately 2.5 million cars per year are fitted with On Star. Of those who have OnStar installed in their vehicles, only 20% are actually paying for the continuation of services offered after the first year. Still, that is a better take-up rate than any other automotive OEM has achieved in terms of penetration, and three million subscribers is close to thee million more than their closest competitor.

OnStar is not an international organisation. Each market operates its telematics business as it sees fit, while still using the OnStar brand, or, if they choose, another brand. In South America, GM has introduced a system called ChevyStar. The hardware developer, EDT, is an Israeli Tier One automotive supplier. The services are delivered by a company set up by GM and EDT called RoadTrack.

New Challenge

Wingcast were due to start competing with OnStar in North America during the third quarter of 2002. They were shut down at the end of the second quarter of 2002. There are currently no rivals to OnStar North America as and end-to-end telematics system and service provider. Signant were the closest thing to a new challenge. But the venture of Ford, Renault and PSA became stuck in 2003, and they were closed by mutual agreement of all parties in January 2004.

Struggling

OnStar Europe and Targa Infomobility are intended to provide end-to-end solutions. OnStar Europe has had two failed starts in the UK and Germany, where they had major problems with their hardware supplier, Motorola. They have had three management changes during the past five years. They now appear to be stable, and have begun a new initiative using Accenture to build a complete infrastructure solution for them that will look similar to Volvo's WirelessCar system when completed.

Targa Infomobility's bConnect operation, recently renamed from TargaSys, claim to be profitable. They have Fiat's brands as customers for telematics services, and they have just added Citroen. They have also recently begun to deliver off-board navigation services to Blaupunkt systems installed in certain Fiat models. Targa Infomobility have recently reorganised, changed their name, and broadened their service package. They are trying to re-enter as a new market player.

New Market

Motorola and Blaupunkt are attempting to change the telematics paradigm with new types of systems that can be sold into the aftermarket or to OEMs. Blaupunkt are now introducing a 1-DIN radio that has a built-in GPS receiver and GSM module. In the back of the radio unit is a SIM-card slot for the customer's own SIM-card. A special roof-mounted antenna is part of the package. In includes radio, GPS and GSM antennae in a single unit. As an aftermarket product in Germany only, the customer can obtain route directions and route guidance. The service operator is a small German company called Tele Info. Blaupunkt have sold the system into Fiat. Targa Infomobility's bConnect is the service navigation provider.

Motorola's SmartNav system is a one-button telematics system that currently offers only navigation system operator and automatic services. It can easily become a vehicle-dependent telematics device, offering most of the telematics functions available on integrated systems.

Neither of these products consider the problems of GPRS roaming or the potential blocking of SMS messages in foreign networks. They work in one country only. By linking them through a connectivity provider, like WirelessCar, they could be competing with OEM devices in a very short period of time.

Telematics Call Center Services

Telematics Call Center Services

	New Challenge	Market Leader	**Market Visibility** =Brand Recognition + External Relationships
	ATX ANWB	Mondial	
Capability of Meeting Market Needs	ADAC AA	ITIS TrafficMaster	
	Struggling	New Market	

Market Leader

Mondial are now the market leader for telematics call center services in Europe. ATX have this position in the US.

New Challenge

Challenging Mondial will be ATX Europe. They are working with Mondial on the BMW account, but they may not be satisfied to continue to give away part of the business to a competitor.

Struggling

The automobile clubs, with the exception of ANWB, are struggling. ANWB are in the process of taking over the position within the ARC Group once held by ADAC and AA as the leader in telematics activities.

New Market

ITIS and Trafficmaster are entering the telematics call center business through aftermarket systems. ITIS was named by GM OnStar as a service operator for traffic information in the UK, and Trafficmaster are working with Motorola providing call taking services for SmartNav.

Fleet Services

Logistics and Fleet Management

New Challenge	Market Leader
Targa Infomobility	PTV
Webraska	Network Operators
Struggling	New Market

Capability of Meeting Market Needs

Market Visibility
=Brand Recognition + External Relationships

+

Market Leader

PTV, founded in 1979, provides software, consulting, hosting, traffic and transportation planning (its roots), logistics research and what they call "mobility solutions". Their mapping product, map&guide, was created by a separate company that was founded and owned by the brother of PTV's CEO and owner. It was acquired and integrated into PTV a few years ago. Map&guide continues to be sold as a standalone PC-based product, and as a distributed server-based product for MSE's (e.g. the German automobile club ADAC uses map&guide as an integrated part of its customer service operator workstation), and the technology has been incorporated into PTV's server platform. At an early stage, PTV saw the potential of the Internet for delivering all types of map related services. They currently have over three hundred customers who use them as an ASP. Customers include banks, insurance companies, and automotive companies. They have also developed an off-board navigation system based on a PDA, and it will be introduced into the DaimlerChrysler A-Class vehicles. The client side software was developed by 3SOFT.

New Challenge

Targa Infomobility have now reorganised and introduced a new range of services, including fleet management, under the bConnect name. They are in a position to challenge the market leader because they have a platform for the mapping-based applications and direct contact with the fleet systems.

Struggling

Webraska were among the first companies to develop a mapping and routing server for interfacing with thin clients, specifically GSM telephones using the Wireless Application Protocol. They were also among the first to offer an ASP model. Telecoms in Europe were keen to enter the consumer location-based services arena, and they were Webraska's first customers. In 2001, the company raised over $50 million from investors, principal among which was a US company, Apax. Webraska expanded worldwide and acquired AirFlash. The consumer LBS market did not materialise as the company—and the investors—had expected, and the company has undergone a complete management change with major cost cutting. The new CEO, and American and former CEO of MapQuest, was appointed by the board after they fired the founding CEO. Webraska has been forced for economic reasons to abandon the ASP model in favour of licensing its platform. Progress has been slow on converting customers into software licensees. One of its most promising offerings is an off-board navigation application called IbDN Lite. IbDN stands for Internet based Distributed Navigation.

New Market

Network operators Orange, Vodafone, Three T-mobile and others are already offering both workforce management and fleet management services. Because they use cell-based positioning, they are not competing at present with the black box systems. As the new telephones with integrated GPS become available (Three introduced its new GPS telephone in Sweden this week), they will offer increased functionality for lower costs.

Content Services

Content Services

	New Challenge	Market Leader	
Capability of Meeting Market Needs	Mondial		**Market Visibility** =Brand Recognition + External Relationships
	ARC Clubs	Navteq	
	Struggling	New Market	

Market Leader

There is no clear market leader in content services. The automobile clubs were positioned as market leaders in the early stages of telematics, but are now struggling.

New Challenge

Mondial are one of the competitors to the automobile clubs for automotive OEM roadside assistance services. Others are Europassistance and Green Flag (UK only). Unlike the clubs, which are all country-based, Mondial do have an international organisation. The operations in each country have a common set of services and a single set of quality standards. A single contract can be negotiated for services in all markets. Thus far, Volvo, DaimlerChrysler and BMW have chosen them as a service provider in the UK, and DC and BMW have selected them as well for their non-German countries in Europe.

In all cases, Mondial are working with systems provided by the OEMs' telematics services providers: Passo (ATX Europe) for BMW; T-Mobile Traffic for Mercedes; and WirelessCar for Volvo. In most cases they are connecting to third party roadside assistance providers as well. They have gained a great deal of experience in connections to the emergency services and integrated with the local wireless carriers. By working with the OEMs and their partners, Mondial have learned what it takes to deliver a quality telematics service. They will soon be ready to compete in other business sectors if they choose to do so, including automotive connectivity.

Struggling

The major automobile clubs in Europe, North America and Australia were the undisputed market leaders for telematics content and call center services when telematics systems were first introduced by the automobile OEMs. The German Club, ADAC, the largest motoring organisation in Europe, had until recently a special telematics group. The American Automobile Association in the US set up AAA Response as a dedicated telematics business. Six or more years later and with many euros/dollars spent, they have little to show for their efforts. These groups have country-specific solutions, not pan-European or worldwide offerings. Even though they have 30-40% of households in their respective markets as members of their organisations, they do not have a way of delivering what the automotive OEMs truly want—cross border transparency.

New Market

Navteq (formerly Navigation Technologies Corporation) is a data supplier, but during the past five years they have flirted with the idea of being an applications provider as well. With their SDAL product, they have delivered navigation tools directly to system integrators, including Delphi, Pioneer and Panasonic. Their Real Time Map (Service) was originally intended to deliver data and applications to ASP's, including telematics service providers for mapping applications. They have backed away from this model and are currently concentrating on map data supply and partnerships with application developers, like PTV, Navigon, Telmap and others. However, they are the logical supplier of full content services, and are likely to be encouraged to take on this roll by their OEM customers for off-board navigation system services.

Telematics Software Development

Telematics Software Development

	New Challenge	Market Leader	
Capability of Meeting Market Needs	Accenture SEI	IBM EDS	
	TSPs	Standards	
	Struggling	New Market	

Market Visibility
=Brand Recognition + External Relationships

Market Leader

IBM are the market leader because they have established relationships with the automotive OEMs, and they are able to build telematics solutions from the core business software out to the vehicle. This is clearly an advantage over outside-in approaches applied by the early software developers because the telematics applications can be directly related to profitability improvements instigated by the business units. According to a company publication[30], IBM's stated role in the telematics sector is to provide the IT in the background. They claim they provide technology and infrastructure software for in-vehicle telematics units like and embedded Java Platform with OSGi framework, and infrastructure including communications gateways and billing solutions, as well as hosting services for customers. Whether they have this today or not, they are ready to build it for any of the OEMs as soon as asked.

EDS have had a position as a market leader, having built the OnStar North America platform, but they have not been able to capitalise on this and leverage it into any other major telematics contracts.

New Challenge

Accenture have been very heavily promoting their telematics software development group. They were selected by OnStar Europe to build a complete back office, connectivity gateway and service integration platform. Accenture have the size, credibility and the boardroom access to become the market leader.

---

[30] Embracing change in a challenging world: An IBM automotive industry perspective; IBM United Kingdom Ltd. (2003)

If Ygomi/LSP can gain a foothold in the telematics services business, SEI, as an established software development house, have the capabilities to become a force in the market.

Struggling

All of the TSPs, large and small (ATX, T-Mobile Traffic, WirelessCar, Cross Country, Mondial, etc.) will have difficulty keeping up with the major players. Their in-house IT departments are not prepared to provide OEM-grade software development. When the time comes to integrate telematics software with enterprise software, they will struggle to meet the stringent requirements of the OEMs.

New Market

Today, most telematics units use several content protocols (e.g. GATS, ACP), communications protocols and bearer services[31]. There are no software standards, and no common operating system, either in the vehicle or in the service centers. Eventually, there will be standards at the platform and service levels. The closest we have today to a standard is work on a test bed based on OSGi that serves as a gateway in the vehicle between the vehicle functions and the services.[32] When standards do arrive, and solutions can be delivered as product modules, the large software services companies will lose their advantages.

---

[31] • GATS - Global Automotive Telematics Standard protocol
• ACP - Motorola's proprietary Application Communications Protocol
• GTP - Global Telematics Protocol. Developed within the Telematics Forum in Ertico ITS Európé, the objective was to combine GATS and ACP to create a standardised solution that will create a mass market for telematics. The principal developers are Vodafone, one of the original developers of GATS, and Motorola.

[32] Open Services Gateway initiative.

Network Services

Network Services

	New Challenge	Market Leader	
Capability of Meeting Market Needs	Vodafone	T-mobile	**Market Visibility** =Brand Recognition + External Relationships
	National Network Operators **Struggling**	Small Network Operators **New Market**	

Market Leader

It is interesting that two of the early movers in telematics, DaimlerChrysler and BMW, both felt initially that it was necessary to partner with a network operator. They have subsequently realised that this is not an advantage after all. DaimlerChrysler sold its interest in Tegaron to its joint venture partner, Deutsche Telekom T-Mobile, and BMW has helped to orchestrate Passo's exit from Vodafone. The OEMs also initially thought that there was a big business in serving as a virtual network operator, reselling air time to their telematics customers. It appears now that the OEMs have settled into an uneasy partnership with the network operators, having realised that they have distinctly different agendas. The network operators want to maximise traffic, voice and data. The OEMs are mostly interested in passive connectivity, that is, having the possibility of delivering voice and data without having to use it very often. The network operators cannot ignore the OEMs because eventually there will be millions of devices with someone's SIM-card installed, but they have begun to look for ways to minimise their cost exposure in their automotive OEM business, and develop solutions of their own.

T-Mobile have been the leader in both areas. They are developing universal SIM-card that can be re-homed in each market and provide low-cost, data only services for embedded devices. They are also bringing their own systems to market, like the T-Mobile Scout, an off-board navigation system.

New Challenge

The Vodafone telematics group is a legacy of Mannesmann Passo, which then became Vodafone Passo following Vodafone's acquisition of Mannesmann. The group was spun out of Passo prior to Passo's

acquisition by ATX, and are now responsible for driving a telematics strategy within the Vodafone group. They are very active in, and serve as chair of, the Global Telematics Protocol group, which has now developed a protocol based on the two principal competitors, GATS and ACP. They have supplied the first re-homing SIM-card solution to the market with Volvo.

Struggling

The large national network operators, like TeliaSonera or BT Cellnet, are trying to figure out how they are going to get into the vehicle market. Most of them feel they do not need to make any efforts, believing that the OEMs will eventually give up on the embedded SIM-card concept and move all communications to a customer-owned device. Some are focusing on introducing their own location-based services to handsets, and seeing these devices as eventual mass market substitutes to special-purpose in-vehicle devices.

New Market

While the large, multi-national network operators are developing global solutions, and the large nationals are concentrating on local solutions, a few astute small network operators are potentially sitting on a comparatively large income source. The OEMs will have to get their SIM-cards from someone, and they will need to get them at the lowest possible prices. Small country network operators who have a few hundred thousand customers may be much more flexible in their dealings with an OEM, than a large multi-national who will want to dictate its own terms.

Partnerships and Alliances: Why are they necessary?

Companies need partnerships to help them secure contracts with customers in each of the customer categories by providing services that are better than its competitors'. What this means is the following:

SIM-card supplier – To provide automotive connectivity to some clients, it may be necessary to supply network services and to function as the network services provider for the OEM. A TSP needs a partner who can deliver a SIM-card for the lowest possible, one-time price, and who is able to provide full roaming services for GPRS.

Black Box supplier – There are customers who want end-to-end solutions. A recent example is an RFP sent out by Belgacom for tracking and tracing and two-way communications with its fleet of 4,000 service vehicles. They wanted the full range of telematics services that a TSP can provide, but they also wanted the in-vehicle devices. A system developer partner was needed who could deliver a solution that worked seamlessly with a connectivity solution.

Call Center Services – Some customers may wish to contract for call center services through their connectivity partner. This is what DaimlerChrysler have done for their pan-European rollout. T-Mobile Traffic has been the contracting partner for Mondial's call center

services. This can be contrasted to Volvo's direct contracting for the call center services in each market while contracting with WirelessCar as their TSP.

Fleet Management System and Services – This is both a hardware and software provider who can satisfy the requirements of commercial customers.

Content – To complement a telematics workstation solution, a TSP needs to have a relationship with a mapping, traffic information, traveller services and point of interest content supplier. The supplier should be able to deliver, at a minimum, pan-European services, but preferably world-wide content. The services should be reliable, and the content the best available.

Software Services – EDS, Accenture and IBM are dangerous competitors to the TSPs. EDS developed OnStar's entire solution in North America. Accenture is already meeting with existing TSP customers and promoting a solution that looks identical to what they are developing for GM's OnStar Europe division. IBM is doing the same for Hyundai in Korea. EDS, Accenture and IBM have access to customers through the board room. The TSPs need to either develop first class software development capabilities in-house, or to find a partner who will work under their direction (which Accenture, IBM, HP, or EDS will not) and who can provide world class software.

VII. New Entrants

- ❑ SEI/Ygomi LSP
- ❑ Motorola
- ❑ Blaupunkt
- ❑ Nokia
- ❑ EDT/Telmap

SEI/Ygomi LSP - In spite of the financial difficulties experienced by all of the organisations involved in the telematics value chain, new players continue to enter the market. Among the new entrants is SEI/Ygomi LSP. SEI stands for Shields Enterprises Inc., a company that was formed by T. Russell Shields in the mid-60s as a computer consulting business. Ygomi LLC is the company formed by Russ Shields and his wife, Yuka Gomi, to perform the groundwork for establishing the telematics business, as well as driving other ventures. LSP stands for "Land Side Platform", the name given to their telematics services solution.

T. Russell Shields is a formidable character in the international Intelligent Transport Systems industry. He is putting at risk both money and prestige in his attempt to prove that he can succeed where others have failed or are struggling to make money in telematics.

- What is driving him into this new market?

- Does he have a better idea of how to tackle the telematics problem, or is he counting on better execution to win customers and generate profits?

- Are there any companies that are encouraging him in his move into the telematics services arena?

SEI have talked freely to potential customers and other interested parties about their basic business concept, without non-disclosure agreements, so we will hold ourselves to this public information. I can say what is commonly known and what they have shared with their prospects without NDA's. As far as the contract with the network operator, LSP would own it. They order the SIM-cards, supply them to the hardware manufactures, and receive the invoices from the network operator for all usage, and invoice the OEM or customer for services used. That is the major difference between them and WirelessCar or ATX North America.

The other part of their approach is that they work directly with the hardware operator of choice to the OEM. For example, if Siemens VDO are the hardware supplier to BMW who uses Motorola as their sub-supplier for the telephone module, LSP works with Siemens and Motorola to ensure that the data protocol translation is correct, that the phone numbers on the SIM-card are correct, and that all functionality required for directing the data messages is provided. The role of the OEM shifts from being the purchasing agent for the telecommunications services to being the orchestrator of the services delivered from and to the vehicle. But this can vary, according to the

OEM. Since, in the LSP concept the OEM do not purchase the SIM-card, they could choose to have only a relationship with the customer that related to vehicle functions, and the customer could choose his or her own services among a range of services available publicly.

SEI/Ygomi have described a fundamental design for their "Land Side Platform", and it is clear that it is very similar to WirelessCar's Universal Telematics Network. It is intended to function as a message router. Like WirelessCar's UTN, LSP provides a single interface to multiple in-vehicle platforms, sending and receiving messages and converting them as necessary. The database management and other customer-specific back office functions are not viewed as part of LSP, but are ancillary functions that can be built or managed by SEI as a separate outsourcing contract, or developed by the OEM's IT department, or any other third party.

The billing concept is tied to an important aspect of LSP. Ygomi LSP see themselves as the suppliers of the SIM-cards to the system developers or the vehicle OEMs. How they intend to do this and their business model are proprietary. One can speculate that they will either need to purchase SIM-cards for each country, or attempt to negotiate with a single carrier for one SIM-card for all markets, similar to what Volvo has done with Vodafone. If they control the SIM-cards and have the billing relationship with the SIM-card supplier, they will also have the relationships to the local wireless carriers in each market. They will need a method of measuring usage and billing for this usage.

Russ Shields has experience with long-term investments. With his other ITS business, the map database content company Navteq, he convinced his co-investors to wait for more than fifteen years to see profitable figures. He applied a pricing model that was based on a one-time cost for content. The price was low enough to make the proposition reasonable for the higher-end segment of the automobile market for navigation systems, but high enough to produce a profit once navigation systems achieved a moderate penetration of the luxury car segment. The key was to achieve market dominance with one essential navigation system ingredient, the map data.

He seems to be applying a similar strategy to telematics: One-time cost for the SIM-card that is high enough to generate an eventual profit, but low enough to make it attractive to their customers, the system developers and the vehicle OEMs. Instead of selling updates to map CDs, LSP will attempt to make money by adding a margin to message traffic. What is also known is that LSP are looking to open up ownership of the operation to system developers and/or vehicle OEMs. This, too, is similar to the Navteq formula where customers were offered equity, spreading the risk, lowering Russ Shields' financial exposure, and giving Navteq a broader base of support.

SEI/Ygomi LSP have commitments to perform proof of concept tests of the LSP concept in Europe from DaimlerChrysler, and in the US from BMW. DC have made no secret that they want to have an alternative to T-Mobile Traffic by the time their current contract expires

in 2005, and BMW have shown a willingness to investigate alternatives to their current telematics service provider, ATX North America and ATX Europe (formerly Vodafone Passo). The result of these tests will largely determine whether LSP is a long-term threat to the other established telematics service providers, or fades from the telematics scene.

Shields has brought into SEI two key staff with extensive telematics experience: Michael Noblett from OnStar and Graeme Smith from Ford. Noblett, who is based in the US, is Managing Director of LSP Automotive Strategy. Smith, who is based in the UK, is Vice President and Managing Director of SEI Europe, leading the European side of the LSP developments. He continues to attract other high-quality individuals to his company. With the recent (late summer 2004) IPO of Navteq, Russ Shields will have even more cash available to support his long-term view of being the number one telematics service provider on the planet.

The other new entrants are the system developers. Until recently, they seemed satisfied with their role as in-vehicle hardware suppliers, allowing the car OEMs, network operators and content suppliers to fight over who had the customer relationship and who organised service delivery. They are now beginning to form their own partnerships and organise both content and service delivery so that they too can have a primary customer relationship, or have more control over the distribution and sale of their products.

Motorola – Motorola is the supplier of a large majority of telematics systems. They have now started to enter the service market. They have developed an off-board navigation system called ViaMoto that has been implemented in conjunction with Avis Car Rental in the US (Avis Assist), and with Trafficmaster in the UK (SmartNav). In the Avis instance, the in-vehicle system is a Motorola GPS-enabled Iden i88s mobile handset with ViaMoto software. Drivers who rent the handset speed-dial a special number and use the speakerphone to request a destination address or place. The call is taken by an operator at Unity Call Centre Group, who have access to Motorola's off-board navigation server. The operator inputs the route request and the result in the form of voice and text is then downloaded to the Motorola phone. The driver is then given voice instructions, which are synchronised with the phone's GPS positioning.

The SmartNav system and service in the UK operates in a similar fashion. The difference is that the driver has the system installed in the vehicle. The on-board device consists of the positioning and telecommunications hardware with the associated software. A single SmartNav button is installed at a convenient location on the instrument panel. The driver pushes the button and receives a similar service as with Avis Assist. Since Trafficmaster is a principal gatherer and supplier of traffic information, the routes that are provided take into account the latest traffic incidents.

Motorola's move into off-board navigation services can be seen as a first step toward a full telematics offering. There is nothing preventing Motorola from adding an emergency button to the navigation button, or adding a roadside assistance button to the suite. Without connections to the vehicle's data bus, it will be difficult to add certain services, like remote door unlock or automatics crash notification, but combining some of the more traditional telematics safety and security functions with the off-board navigation, including traffic-based routing, can make their offering very attractive for consumers.

Blaupunkt - Traditional on-board navigation system vendor, Blaupunkt, a subsidiary of Robert Bosch in Germany, have developed an off-board navigation system that is integrated with a 1-DIN radio module. It includes GSM/GPRS and GPS components, as well as a special antenna that combines radio, GPS and telephone receivers. The small display is used to show manoeuvre icons, and names of streets, landmarks and points of interest. A SIM-card holder is built into the back of the radio so that the users insert their own SIM-cards and pay for communications separately from the services. The first aftermarket service was available in Germany during 2003. TeleInfo is the service provider. Blaupunkt is also working with Targa Infomobility in Milan, Italy, a telematics service provider in the Fiat family, and with Fiat to develop an OEM version of the off-board system. This platform is perfect for a radio-based telematics system, and adding other telematics functions and services is an obvious future development.

Nokia – Nokia have recently awarded a worldwide contract for a portable navigation service that will be offered to customers who purchase some of their high-end, GPS-enabled phones. The service provider they have chosen is still (as of October, 2004) confidential. Nokia already allow users to download from their web site applications and settings for services. The problem with selling their own services is their lack of a billing relationship with their customers. However, they can offer services for flat fees at the time of purchase, or even afterwards, and these services can be activated by sending data messages to the phone. They have had to convince their application service providers to work on a subscription basis, rather than on a transaction basis, and the ASP's in turn have had to convince their content providers to do the same. It appears to be working. A phone with a GPS device can offer many telematics services, and these too are a logical next step for Nokia, as they are for Motorola and Blaupunkt.

EDT/Telmap – E-drive are a telematics black box manufacturer. Telmap is a software developer of mapping applications. Together they have delivered a telematics solution to General Motors South America. It is called ChevyStar, and is GM South America's equivalent to OnStar in North America and Europe. EDT, together with GM, have built and operate a call center. Telmap have provided all of the telematics call center software, from the operator workstation and customer database, to the mapping application. The system and services are now sold in Ecuador. Brazil, Columbia and Mexico are to be brought on line shortly.

EDT are in the process of moving their base of operations from Israel to the US. They have recently had a major infusion of capital that they will use to expand their market presence and develop new products. Telmap have a solid customer base in Europe and Israel, and several major customers in the telecommunications segment where they have delivered both navigation and fleet management applications.

Telmap are a company with roots in Israel and the UK. They are one of over a dozen companies owned by Current Science Group, which is based in London. Telmap's administrative and engineering offices are in Herzlia, the high tech community to the north of Tel Aviv. The company was founded in 1999 as a location-based services software development firm. They have created a unique offering of server, client and client-server products, and have attracted an impressive list of customers during its relatively short history. They include, among others, network operators Three, Orange and T-Mobile; hardware companies Nokia, Motorola and EDT; service companies Mondial Assistance and ANWB; and with EDT, automotive company General Motors. Telmap are in the process of aggregating a worldwide, route guidance level database using data sourced from, among others, Navteq, Map-IT, Map Data Sciences and GDT (now part of Tele Atlas).

VIII. Summary and Future Outlook

There is little doubt that the original concept of telematics is under severe scrutiny, and that car industry executives are questioning whether the investments made thus far are justifiable and the technical and business approaches taken correct. There is also no question that telematics was sold to the financial markets as the automotive sector's response to the information age, and the way that car companies, that have notoriously low market capitalisations, were going to be able to generate dotcom-like share holder value for their owners. There are good reasons for integrating a communications device into a vehicle, which is what telematics provides, and hopefully I have convinced the reader of in this *Report*. However, telematics alone is not going to convert car companies into high growth, high profit operations. Profits can and should improve, but high growth is not in the nature of the car manufacturing and sales business at this stage of its industry existence.

Updating software in the vehicle; reporting faults that can be fixed by such updates; delivering information from the car on the surrounding traffic situation; providing the latest information on the transportation infrastructure to the vehicle for ADAS functions; sending out a mayday in case of an accident; unlocking the car when the keys have been left inadvertently inside. These are a sample of what telematics enables. It is about improving the safety, security and convenience of the driving experience for the customer, and thereby improving the value proposition of cars over available alternatives.

But it is not just any phone that will be sending and receiving messages; it is very doubtful that a mobile handset which a car owner may or may not happen to bring into the car on any given day can deliver critical safety and security functions. It is my belief that the device delivering driver safety and mission critical services will be embedded, owned and operated by the car manufacturers or agents designated by them to do so on their behalf.

Between today and when telematics devices are available in all vehicles there is much that needs to be done.

- The telecommunications infrastructure needs to provide reliable service everywhere at affordable prices. There are too many gaps in service, too many uncertainties when one operator hands off to another, too few well-adhered to standards at the operations level, and far too many breaks in data service. It is likely that some government regulation will be needed to accomplish both functionality improvements and cost reductions.

- The IT platform in the vehicle needs to become more standardised, more stable, and less brand-specific. When cars were isolated objects that could function with only the input of the driver, everything could be purpose-built if the buyer could afford it. If cars are going to function within a transportation

infrastructure based on communications, there are going to have to be standards established that everyone accepts and adheres to.

- Now that the car companies have decided to replace electrical systems with electronic, the car manufacturers are going to have to figure out how to get paid for fixing cars remotely rather than fixing them in their dealers' workshops. With 80% of today's profits derived from parts, accessories and service, the car companies cannot afford to give anything away that their customers had paid for previously.

Telematics will be available in all vehicles by the end of this decade. Whether the drivers of the vehicles will be aware of this fact, or whether it will be just another system among the increasing number of systems that are invisible to the driver, remains to be seen.

Many companies will make businesses out of delivering systems and services to the car manufacturers and the car owners. Cars will be safer, both for their occupants and pedestrians, and they will be easier to drive by an increasingly elderly population. They will be more convenient to own.

Telematics will be responsible for many of these improvements.

Notes: