Telematics:
How Economic and Technological Forces Will Shape the Industry in the U.S.

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Executive Summary

Telematics is the emerging industry of communication, information, and entertainment services delivered to motor vehicles via wireless technology. Just a few years old, telematics will grow on the heels of the wireless industry in the next decade as 3G networks and interoperable wireless software platforms converge to meet consumer expectations and demands. To analyze the dynamics of the telematics space, it is essential to separate over-hyped claims of future services from that which is technologically feasible and economically viable. For example, limitations of Interactive Voice Response (IVR) technology combined with driver distraction concerns will dramatically shape the nature of future offerings. Ultimately, car manufacturers will own the customer, dominate the industry, and achieve profitability through car-specific services, such as navigation and telemetry (remote monitoring).

What is Telematics?
In the broadest sense, “telematics” refers to remote communications between systems and devices. The standard AM/FM radio available in cars for the last few decades is an example of a telematics device. Recent technological advances, however, have revolutionized and redefined the term “telematics.” Telematics now refers to the emerging industry of communications, entertainment, and information services delivered to motor vehicles via wireless technology.

Market Size
According to the Strategis Group, worldwide telematics subscribers numbered just 200,000 in 1999, but will increase sharply to 11 million by 2004. Figure 1 represents the size of the current and projected global telematics market as measured by total revenues derived from end users:

![Figure 1 - Worldwide Telematics Market Projections](chart)

The potential size of the telematics industry is enormous:
- Nearly 18 million vehicles are produced in North America annually
- According to JP Morgan, half of all new cars manufactured by 2005 will be equipped with telematics devices
- Consumers currently pay up to $1000 for telematics hardware systems
- Consumers currently pay telematics subscription fees of up to $33 per month
Demand for Services

Consumer Preferences

Telematics Service Provider (TSP) ATX Technologies claims a 94% renewal rate for its subscribers, but this is misleading because ATX supplies only the luxury car market. The telematics industry will not generate any profits until services are consumed by the masses. GM OnStar, which is available on virtually the entire GM line of cars, gives away the first year of service for free, but retention rates hover around 30%. Clearly, consumers are not willing to pay significant fees for the basic safety and security services offered today, and carmakers have yet to find a profitable combination of services and price.

The evolution of U.S. demand for telematics services will progress from a focus on safety and security today, to information and productivity, and then entertainment, in the future:

Figure 2 – Evolution of Consumer Telematics Interests

To date, the primary value to the consumer has been confined to an intangible feeling of comfort from knowing that in case of an emergency, help is just the push of a button away. Consumer tastes are shifting toward pragmatic services as well, such as roadside assistance and remote door unlock. Within the next couple of years, security and safety services will become commoditized and these basic services will be simply the price of admission for selling cars. Consumer prices will be driven down and carmakers will continue to lose money in telematics.

The next generation of telematics will include personal productivity and information services more robust than those offered today. Specifically, navigation and telemetry are consistent with an overall carmaker strategy that is focused on car-specific services. Internet content and entertainment services may become important in the long term, but carmakers must leave investments in product development for these exotic offerings to other service providers with specific expertise.

Navigation

Global Positioning Systems (GPS) technology has played a prominent role in the development of safety and security services, but has not yet been utilized to its full potential with regard to navigation. Current navigation solutions, which are little more than electronic road maps and can cost thousands of dollars, offer few advantages over more traditional, though less exciting
substitutes, such as paper maps and radio traffic reports. Studies indicate that 75% of motorists are interested in navigation, but compelling solutions have not yet entered the marketplace.

It is important to separate navigation systems from those that use real-time traffic to provide dynamic route guidance, and those that do not. Navigation systems based on IVR, electronic mapping, and GPS will appear before those that incorporate real-time traffic information. Some technical issues remain unresolved in network servers and particularly with regard to IVR technology, but these issues are quickly being resolved. Successful systems will employ route guidance algorithms that interface with digital maps and communicate audible directions to the driver, while limiting the necessity of processing voice input from the driver. In-vehicle screens with graphics and text are not necessary for robust, turn-by-turn, navigation solutions.

**Traffic Reporting**
The “Holy Grail” of traffic-based, dynamic route guidance systems are far from a reality in the U.S. Lack of Bandwidth and the questionable commercial viability of in-vehicle screens and traffic sensing networks limit traffic-based dynamic route guidance.

In the U.S., the traffic information industry is dominated by Metro Networks. Metro operates planes, helicopters, and fixed-position cameras to deliver traffic reports to over 2000 radio and television stations. The future of traffic reporting, however, belongs to personalized, real-time, interactive navigation assistance. U.K.’s TrafficMaster appears to be well positioned to emerge as a leading provider of traffic information to the telematics industry. TrafficMaster operates a detection network that collects, sorts, and manages live traffic information and converts it into average speeds, delays, and journey times. Dynamic route guidance services, whereby traffic sensor networks interact with GPS sensors on vehicles, may turn out to be the killer app of telematics.

In the long term, a technology referred to as Floating Car Data (FCD) may compliment, or even supersede, fixed sensor networks. FCD simply refers to traffic information obtained from sensors mounted on vehicles. Though FCD experimentation predates that of fixed sensor networks, it is not commercially viable today. Whereas independent content suppliers are creating fixed sensor traffic networks, carmakers would most likely make most FCD investments because they manufacture the cars.

**Telemetry/Remote Diagnostics**
Largely ignored by carmakers and the media is the promise of telemetry services. Telemetry represents a natural product development path for carmakers to follow, and 73% of consumers have an interest in it, far beyond Automatic Collision Notification (CAN) systems today. The majority of telemetry communication will be machine to machine, rather than machine to person.

The end goal of telemetry must be to save car manufacturers money, or drive revenues. For example, it makes little sense for a customer service center to just monitor a vehicle’s engine performance, because this function is already performed within the car. An effective telemetry solution would be one that notified the driver of a problem (or potential problem) and recommended a nearby service center. In this scenario, the consumer would derive a substantial benefit and the car manufacture could take a transaction fee from the service performed. While this scenario may seem just as farfetched as, say, video-on-demand in the car, it is much more relevant to a telematics discussion. The personalization and customization revolution began by the Internet will enter into telematics, but only through car-specific services.

Another way in which telemetry could provide value is by reducing marketing costs for automakers, and even shifting these costs to the consumer. For example, mailings that remind drivers of the upcoming need for 30,000-mile service could be eliminated and incorporated into telemetry services.
Remote monitoring and vehicle tracking systems for commercial fleet management are available today. The Qualcomm TRACS® line of products is one successful example. The technologies developed for these applications will gradually be adapted for use in consumer navigation and telemetry services as interest develops.

**Future Services**

Nothing is more uncertain than predicting consumer acceptance of services, but telematics providers in the U.S. should look for parallels in the evolution of the following:

- The fixed-line Internet
- The wireless industry in general
- The wireless industry in Europe & Japan
- The telematics industry in Europe & Japan

With few exceptions (navigation and telemetry, for example), telematics service development will follow, rather than lead, the wireless revolution. In general, services will not be accepted in the vehicle until they are first proven outside. The demand for information-based telematics services is speculative. Service providers are desperately looking to information, productivity, and entertainment services for profits, but this desperation could impair their judgment. It is imperative that providers critically analyze any proposed telematics service from economic, technological, and psychological perspectives. For example, location-based eCommerce, while intriguing in the abstract, in terms of cost and demand, are farfetched ideas within the vehicle.

Entertainment and eCommerce services may eventually come to the vehicle, but their arrival will be independent of carmakers. In other words, carmakers should allow other companies along the wireless value chain, such as PDA and handset manufacturers, portals and content providers, and network carriers, to drive these developments.

**Technology Issues**

**Embedded vs. Portable Devices**

All telematics devices in use today are embedded within the vehicle. In contrast, Wingcast has announced that it will offer systems whereby traditional wireless devices (such as handsets or PDAs) will dock into the vehicle.

The design cycle for an automobile is typically 3 to 5 years with an average life of 11 years. In comparison, wireless designs can become obsolete in just a couple of years. These two product development cycles will never be fully synchronized, so telematics systems may need replacements and upgrades several times throughout the life of the automobile. For this reason, truly embedded TCUs will die out.

**Modular Devices Will Win**

The debate between embedded and portable devices is misguided. The TCUs that will survive will be those that are modular, or plug and play. Similar to car radios, these TCUs will be easily replaceable. As a result, these devices will have the advantage of embedded systems, with the added benefit of easy upgrade. Hardware will never be completely standardized and modular across different vehicle brands because individual styling differences permit vastly divergent designs.

Although technological issues and consumer desires may create room for both portable and modular configurations in the short term, modular systems will triumph over portable devices for several reasons. Portable devices will raise new technical complications, such as call delivery, to the vehicle. Handset and PDA manufacturers would have difficulty overcoming these hurdles because they lack the necessary automotive electrical system expertise. Portable solutions raise a series of coordination issues between carmakers and suppliers. Furthermore, users would often forget to bring these devices into the car, rendering the telematics system virtually useless.
Until very recently, most experts predicted the convergence of handsets, pocket PCs, and PDAs into one all-encompassing wireless appliance. This scenario has not been realized. It appears that technological advances have not conquered problems such as screen and keyboard size. It would be a mistake for carmakers to pursue a portable device strategy because portable TUCs would shift power to consumers, or PDA/handset manufacturers, or wireless carriers. With the TCU within the vehicle, carmakers have captive users.

The integration of the vehicle with the home, office, and other mobile devices is uncertain. Hyped claims of using Bluetooth technology to connect handset or PDAs to cars may never be consummated; this would just add another layer of interconnect complexity that provides little benefit to the consumer. No company today has a complete understanding of all of these wireless markets. For modular devices (and carmakers) to win, carmakers must concentrate on car-related services (emergency, safety, navigation, telemetry, etc.), and leave other services (e-mail, e-commerce, etc.) to service providers with the requisite expertise.

Network Issues
The technical and economic complexities of 3G migration drive any discussion of the wireless industry. Telematics is no exception.

One difference between telematics and a typical wireless handset conversation is that telematics transactions typically involve simultaneous voice (conversation) and data (location) transmission. The timetable for 3G rollout is uncertain, particularly in the U.S. TSPs cannot accept 3G conversion as a given, especially in the next few years, so they must have plans for profitability in the absence of 3G networks.

The switch to packet-based networks could have an enormous impact on the pricing of telematics services. Specifically, packet-based networks give operators the opportunity to charge usage fees based on data transmission volume, as well as, time (bits vs. minutes).

Integrated Voice Response (IVR)
Technology Barriers
Voice Recognition is a technology that is always “18 months away.” For telematics, the car environment compounds voice recognition issues. For comparison, defense contractors have unsuccessfully invested millions of dollars and years of effort trying to make IVR work in extreme military environments. To the extent that IVR advances stall, complex telematics services that are driver-focused will stall as well because IVR is critical for safety. The following technical issues will continue to be important:

- Noise suppression
- Recognition algorithms
- Microphone placement
- Transducer characteristics
- Echo cancellation

Safety
Voice recognition technology is more important to telematics than the larger wireless industry because of safety and convenience concerns. “Hands free” operation facilitates any application and legislation may necessitate it. In the tradeoff between safety and productivity, safety will always win in the car. On the one hand, most productivity and entertainment services aimed at drivers will fail in the short to medium term because of IVR limitations, but on the other hand, these services aimed at passengers will fail due to the existence of superior substitutes. For example, if a passenger wants e-mail access in a car, he or she will surely use a PDA or a handset, rather than a TCU.

Automation
IVR is critical to automating communication and thus achieving economies of scale. Current U.S. telematics business models are not scaleable. A live operator is necessary to assist the user, whether for emergency, or navigation services. A proportionate number of call center employees must be added, as new subscribers are added. While live operators will always be necessary for certain situations such as emergencies, IVR will be critical to automate other transactions, such as finding a nearby restaurant.

**Current Value Chain**

The telematics value chain mirrors the overall wireless industry value chain with the vehicle serving as the service delivery platform:

![Figure 3 - Telematics Value Chain](image)

**Automotive OEMs & Telematics Service Providers**

Figure 4 presents a general overview of the Telematics Service Providers (TSPs) and automakers that have driven the development of the industry thus far, and that will play an integral role in its future:

![Figure 4 – Overview of Telematics Service Providers](image)

The telematics landscape is complex and dynamic, and the preceding chart is far from all-inclusive.

With OnStar systems installed in over 1 million cars, and available on 32 of 54 models by the end of 2001, GM has been the most aggressive carmaker in terms of telematics activity. GM is clearly...
the first mover, though whether this gives them an advantage is to be determined. Ford currently offers telematics on just a few luxury car models, but Wingcast will bring telematics services to the mass market as OnStar does. DaimlerChrysler offers telematics only on select Mercedes models and has no immediate plans to rollout services to non-luxury cars in the U.S. DaimlerChrysler is essentially waiting to see how the market unfolds, and banking on a second mover advantage.

The telematics opportunity for the automotive industry
In an auto industry characterized by excess capacity, thin profit margins, and sluggish top line growth, telematics represents a rare opportunity for innovation and brand differentiation. GM recently announced the discontinuance of the Oldsmobile line largely because young consumers did not view Oldsmobile as “hip” enough. Ford’s formation of Wingcast last year was an attempt, in part, to retain its slight lead over GM in consumers’ perceived innovation. Telematics has additional value to carmakers beyond marketing. Telematics offers a recurring revenue stream, similar to that of the very profitable financing segments of their businesses. In the long term, telematics will expand the relationship between carmakers and their customers, providing carmakers with valuable customer usage data. The recently announced ATX partnership with Customer Relationship Management (CRM) software leader Siebel hints at this enormous potential.

Wireless Carrier Selection
Verizon is the leading telematics carrier due in large part to its exclusive agreement with OnStar and its ongoing relationship with ATX. ATX, similar to its strategy with regard to automotive OEMs, does not have an exclusive deal with any one wireless carrier. Sprint will soon compete with Verizon via its partnership with Wingcast. Tegaron is, of course, locked-in with their co-owner, Deutsche Telekom.

Many network issues in telematics parallel those in the larger wireless industry: price, coverage and quality of service. Telematics also elevates the importance of reliability because safety and security are an integral part of today’s telematics offerings. A strong motivating factor in telematics purchases is the consumer fear of the need for emergency assistance in remote areas. Therefore, coverage and reliability are critical.

The wireless carriers that are successful in the telematics space will be those that are willing to work with TSPs and carmakers in terms of product development and 3G migration. In other words, existing successful wholesale models will for the most part translate to successful telematics models.

Content Providers
The prominence of content providers on the Internet does not necessarily translate to the wireless industry or telematics in particular. Navigation and telemetry will be the most important telematics content. Further in the future, other content, such as eMail, news, weather, stocks, and eCommerce may play a larger part in telematics. It is unclear whether consumers will want these next generation services because they are not yet widely accepted in the larger wireless industry (in the U.S.).

It is possible that traditional Internet content will not become part of telematics at all. Wireless Internet content may evolve separately and it may never converge with telematics.

Hardware Manufacturers
Telematics hardware manufacturers consist of two groups of firms:

1. Automotive parts suppliers (Delphi, Visteon, Denso, etc.)
2. Handset manufacturers and component suppliers (Ericsson, Motorola, Qualcomm, etc.)

PDA and Pocket PC manufacturers appear to be shut out of the telematics space because their primary advantage, screen size/Graphical User Interface (GUI), is not important to telematics.
offerings today. Delphi and Ericsson recently announced a partnership to develop a solution that is easily installed across many different vehicle models. Visteon and Nokia have partnered to offer a GSM-based solution for Europe. Qualcomm, of course, is intimately involved in telematics through Wingcast and plays a significant role in telemetry.

**Dominating the Value Chain**

To predict the evolution of the telematics value chain, players in the space should again look to the evolution of the following (while noting the similarities and differences of each with regard to telematics):

- The fixed-line Internet
- The wireless industry in general
- The wireless industry in Europe & Japan
- The telematics industry in Europe & Japan

**Automotive OEMs**

In the traditional mobile communications value chain, the carrier controls economic value, based on coverage and Quality of Service (QoS). The end consumer typically selects a carrier first and then contemplates a handset. The decision process is reversed in telematics. Customers will surely select a car first and carrier selection will be determined by this initial decision.

**The Telematics Role in the Auto Industry**

Although telematics offers novel benefits to car manufacturers, it is important to note that it will not revolutionize their business. According to UBS Warburg, GM OnStar, the leading TSP, will garner $6 billion in worldwide revenues in 2010. For a corporation expected to have nearly $300 billion in revenue in the same year, $6 billion represents a small amount. Because telematics will always be such a small segment of the mammoth automotive industry, carmakers would be advised to delegate many functions to suppliers and focus on the integration of telematics services. In particular, carmakers should spin off call centers and retain their own telematics brands.

Carmakers will be challenged by the need to develop new competencies to take full advantage of the telematics revolution. Carmakers must learn to integrate hardware and services from a new telematics value chain that is unlike the well-structured, traditional car value chain. Since carmakers have thus far shouldered most of the costs in setting up the telematics industry, they should have sufficient motivation to win the space.

**Owning the Customer**

It is imperative that carmakers retain ownership of the customer if they want to dominate the telematics industry and maximize profits. In a few years, TSPs will function primarily as call centers like they do today, but with an added emphasis on data acquisition. While TSPs may operate call centers, automakers must own the customer and effectively mine the data collected by the TSPs. Enormous value in telematics will lie in knowing the customer and using this knowledge to create profitable revenue streams. Because carmakers control the distribution channel to the consumer, they should always own the customer. Carmakers can ensure that they continue to own the customer by concentrating on integrating car-specific services with modular TCUs.

**TSPs**

As independent entities, TSPs will function essentially as call centers, or safety and security content providers. To maximize profits, call centers will need to use IVR whenever possible, and offer value added services when live operators are necessary. 24/7 availability and reliability will be even more important to telematics call centers than typical customer service applications.

TSPs may migrate to Mobile Virtual Network Operator (MVNO) models. In this capacity, they would essentially buy bulk minutes from carriers and resell these minutes, along with other
content services, to automakers. However, TSPs may not have sufficient scale to buy minutes at a better rate than the automakers can.

Figure 5 – Future Telematics Value Chain

Wireless Carriers
Carriers will struggle to position themselves as value-added TSPs, not just the ‘pipe’ providers. Two potential developments could shift economic value toward the carrier:
1. If telematics devices evolve into fully portable devices outside the vehicle
2. If the success of the industry is driven by consumer services (e.g., e-mail) rather than automotive services (emergency, remote diagnostics)

In the short to medium term, these developments will not play out.

Bargaining Power
In negotiations with carriers, carmakers should have a great deal of bargaining power because they assume they aggregate the demand of a large customer base and take care of billing. Consumer wireless access plans can cost as little as $.10/min, but current telematics wholesale prices to carmakers are far greater than this.

The key to carrier contract negotiation will lie in the ability of carmakers to design systems that are flexible across different carriers. If a telematics system can only be used with one carrier, or one network architecture (CDMA), carmakers will not be able to use the threat of switching to achieve low network access costs. Conversely, if a telematics system can be easily switched to work with other carriers (over-the-air, for example) carmakers will be able to negotiate very favorable network access costs.

Content Providers
With the exception of that which is related to navigation and telemetry, content will not play a dominant role in telematics. First, most content, in the traditional sense of the Internet, is still years away from reaching the car. At this point Internet content providers such as AOL and Yahoo may battle for control of the customer, but TSPs and automakers will already be entrenched in the business.

Content providers will be able to provide value to the extent that they generate consumer traffic for the carmakers. Carmakers can increase revenues by increasing usage. Content providers that increase consumer usage will always receive a piece of the revenues. In the handset world, portals have had difficulty gaining access to the end customer; this access will be even tougher to get in telematics.

Hardware Manufacturers
Automotive suppliers will try to balance the desire to standardize hardware and software to take advantage of economies of scale, with the desire to differentiate units to keep margins high. To the extent that telematics hardware remains embedded within the vehicle, tier 1 automotive suppliers will be the hardware suppliers of choice, and not the handset/PDA makers. If devices
become mobile and operable outside of the vehicle (we do not see this happening), wireless hardware manufacturers will play a more significant role. Auto parts suppliers will always control the distribution channel to the car manufacturer, while handset and PDA makers will have the requisite wireless expertise. Should a healthy telematics aftermarket develop, the role of hardware manufacturers will expand.

Can Automotive OEMs Find Profits in Telematics?
The following two competing schools of economic thought exist regarding telematics:

1. Telematics will become a profitable, albeit very small, part of the automotive industry.
2. Carmakers will never directly profit from telematics. Telematics hardware and services will be included with the price of all new vehicles, and used primarily to drive car sales.

Revolutionary product ideas often require heavy initial investment and produce little financial return for the first several years. The same will be true for telematics: investment now will pay immediate dividends in terms of market knowledge, and in the future, profits. Carmakers cannot earn profits solely from the basic emergency and security offerings of today, but with the proper strategy that balances technology, economics, and customer, carmakers can turn telematics services into a profitable revenue stream.

Figure 6 - Possible Telematics Revenues and Costs for Automotive OEMs

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Revenue Streams
The interesting question is not whether carmakers will dominate the industry; it is whether they will realize returns on their investments.

Hardware
Services present a greater revenue opportunity than hardware. In countless durable goods industries, the business model has shifted from one of earning a profit on the initial sale of the product, to earning profits only on follow on services. Many manufacturers essentially give away their product at cost, and then make money on the ensuing relationship that they established with the customer. Taken to an extreme, some manufacturers even lose money on the initial transaction. Telematics devices may eventually be commoditized and prices will certainly be driven down (especially as the devices move to non-luxury cars), but carmakers must be careful about losing money on the hardware because the magnitude of service revenues is uncertain at this point. Carmakers cannot forget that they are in the car business and most of their profits will always come from selling cars, and not services. In the short term, market experimentation and the need for individual car styling differences may allow car makers to earn a great deal of profits from telematics units.

Subscription Fees
Current OnStar subscription fees range from $17 (basic) to $33 (premium) per month, but this is expected to drop as competition increases. Telematics subscription prices can be compared to that of three other services:
• Wireless phone access  
Example: Verizon offers 75 minutes/month with no long distance or roaming charges for $25/month & a one time $35 activation fee
• Internet access  
Example: AOL offers unlimited monthly Internet access for about $20
• Automobile clubs  
Example: AAA offers roadside service for roughly $4-$8/month (A Direct comparison between telematics and AAA is difficult because AAA services are different from those offered in telematics, and these fees, of course, do not include a phone. Also, AAA fees vary greatly with geography and service level.)

Based on time or data transmission, telematics usage should generally be less than that of the Internet or mobile handsets because consumers will not spend hours surfing the web in their cars. Most current usage is emergency based, and thus, very small in terms of volume. Increasing usage will be the primary means in which to increase subscription fees.

Based on the above numbers, it appears that telematics subscription fees above $20 may not be sustainable. Psychologically, it is important that carmakers take into account consumers’ attitudes when pricing telematics services. Consumers are generally prepared to pay more for access, compared with content, which they feel should be free.

Advertising
Much is being said about location-based advertising in the wireless world, but little has been done so far. Privacy concerns are one potential barrier to location-based telematics advertising. Safety may be another concern, particularly if advertisements would appear visually, rather than audibly. Advertising revenues over the web have generally been less than originally expected, and advertising over the wireless web is unproven, so it is possible that telematics advertising revenues never materialize at all. The best opportunity that carmakers have to create advertising revenues is through navigation and telemetry services.

Transaction Fees
Transaction fees will not represent a significant portion of telematics revenues in the short term because eCommerce in the car will be limited. However, telemetry and vehicle repair will generate transaction fees in the long term.

Bottom Line
The primary operating costs are related to wireless network access and the call centers. Network carrier and call center contracts must be negotiated such that these costs are less than the subscription fees for which consumers are willing to pay.

Global Issues
The European and Japanese telematics industries may take paths that are far different from that of the U.S. To analyze these global markets, the following region-specific macroeconomic factors must be kept in mind.
• Wireless industry  
  o Infrastructure  
  o Carrier competition  
  o Consumer use  
  o 3G migration status
• Automobile industry  
  o Value chain  
  o Competition  
  o Consumer use  
  o Transportation infrastructure
• Culture
- Internet use
- Consumer tastes
- Demographics
- Government regulatory environment