JAPAN MOBILE SERVICES – EVALUATING A NEW-ECONOMY OPPORTUNITY FOR A U.S. INDUSTRIAL

by

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Submitted to the Sloan School of Management and the Department of Electrical Engineering in partial fulfillment of the requirements for the degrees of Master of Business Administration and Master of Science in Electrical Engineering

In conjunction with the Leaders for Manufacturing Program at the Massachusetts Institute of Technology
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ABSTRACT

The platform for General Motor's OnStar telematics service is the product of collaboration between old and new economy capabilities. Cellular wireless service is combined in vehicle with a global positioning satellite sensor that facilitates the upload of location-based information to a call center where live agents receive and service customer requests. In addition, substantial re-engineering of vehicle electronics systems has permitted the transmission to the call-center of diagnostic and emergency information such as engine performance and airbag deployment notification.

With plans in place to support one million *North American* subscribers by the end of calendar year 2000, OnStar began an assessment of opportunities in Japan, the second largest one-country vehicle market. This was managed jointly between OnStar and e-GM, the e-business division of General Motors. The author of this thesis was a co-lead for this effort during his internship from June through December. The purpose of the assessment was to identify opportunities to satisfy three objectives for General Motors:

1) To be a profitable mobile services provider in the Japan market, regardless of the platform chosen for service delivery.

2) To develop relationships with non-automotive Japanese partners.

3) To develop market knowledge and experience in Japan that may be exported to other regions.

This thesis documents that assessment and its conclusions. It include an assessment of the current state of Japanese mobile services in and around the vehicle, the proposal of two very different market-entry strategies, evaluation of those strategies from a financial perspective, and conclusions and recommendations for GM's future approach to investment in the area of Japanese telematics.

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As I ponder the last two years and the many blessings that have helped to make this thesis possible, there are a number of people who deserve my thanks and gratitude. The Leaders for Manufacturing program has been one of the best experiences of my life. The energy that was captured to make the program a reality over a decade ago is still alive and well in the LFM students and staff.

I would specifically like to thank Donald Rosenfield for his guidance and support throughout my entire experience at MIT. His tireless efforts in support of the LFM program do not go unnoticed. I would also like to thank Richard Larson from the school of Electrical Engineering and Charlie Fine from the Sloan School of Management who have served as valuable guides as this thesis work has come together.

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1.1 GM BACKGROUND

General Motors Corporation, with global automotive sales of over 8.7 million vehicles in 1999, is the largest vehicle manufacturer in the world (1, p.32). However, market share has declined steadily in the recent past, with US brand leader Chevrolet declining from around 19% in 1990 to about 15% in 2000 (1, p. 114), overall US market share declining from 33.9% in 1992 to 28.9% in 1998, and worldwide market share declining from 15.5% in 1995 to 14.1% in 1998. Margins have also come under pressure, with return on sales falling from 4.1% in 1995 to 2.1% in 1998.

Perhaps due to investor excitement over "new economy" enterprises, GM's stock has performed poorly in recent years compared to the market as a whole. Whereas in 1982-1983 both the S&P 500 and GM stock traded with P/E multiples of around 10, by 2000 the S&P 500 had risen to around 30, while GM still traded at 10 (1, p. 9).

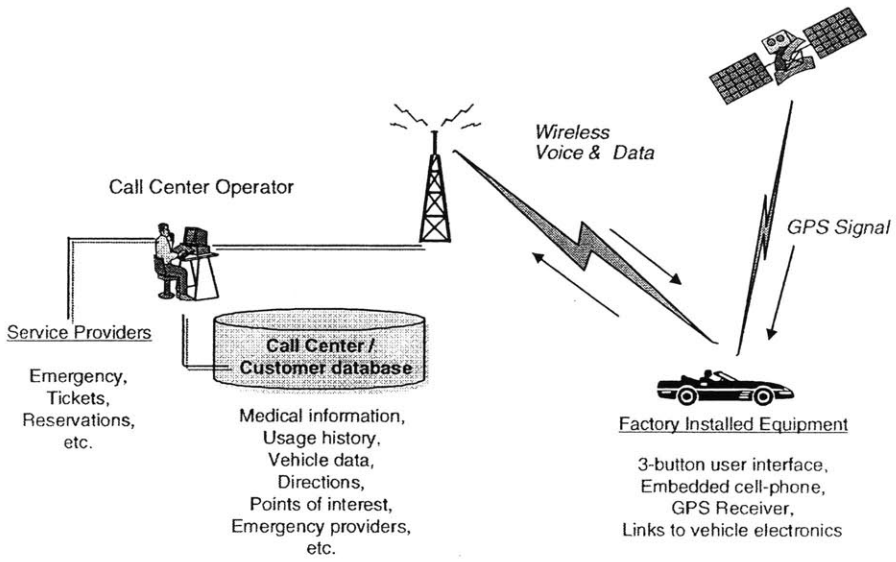
In opposition to these trends, GM management has sought to bolster revenue growth as well as the company's image with investors by moving toward the "new economy." Some of these efforts have centered on the identification of new business opportunities intended to generate revenue from internet-related and service-based business models. In the Fall of 1999, GM announced the formation of "e-GM", whose mission is "To make GM the global leader in e-business in the auto industry, and apply the power of its technology innovations and the Internet to redefine the way it does business with consumers, dealers and suppliers." GM Vice President Mark Hogan, formerly President of Small Car Group, was appointed to lead the new Division, and simultaneously promoted to Group Vice President.

Even prior to the creation of e-GM, GM made new economy forays through acquisition and internal development. In 1994, GM purchased Hughes, Inc., including its satellite TV business. In 1996, GM launched the OnStar suite of vehicle-based wireless services.

1.2 ONSTAR OVERVIEW

OnStar's basic platform is the product of collaboration between old and new economy forces. Cellular wireless service is combined in vehicle with a global positioning sensor that facilitates upload of location-based information to a call center where live agents service customer requests. In addition, re-engineering of vehicle electronics systems has permitted transmission to the call-center of diagnostic and emergency information such as engine performance and airbag deployment notification.

Figure 1 – OnStar North American Service Architecture



The combination of these capabilities has resulted in the creation of a new business-model for General Motors: one which is based on ongoing service revenues, not single-transaction purchases of new vehicles.

The services that can be conceptualized for OnStar fall into different categories of user-need. These span areas including security, convenience, and entertainment. Current services are concentrated in the areas of security and are comprehended within a "Basic" subscription plan. A "Premium" plan is created by layering in several convenience-related services.

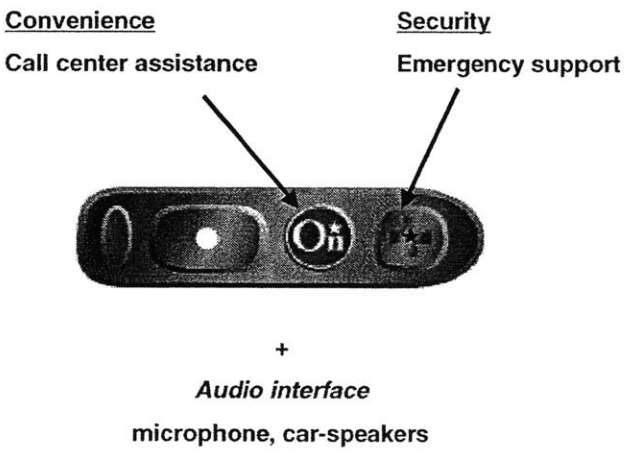
Table 1 –OnStar Services

Basic (Safety & Security) Plan	Premium Services Plan
- Automatic Notification of Air Bag Deployment - Emergency Services - OnStar MED-NET - Roadside Assistance - Stolen-Vehicle Tracking - AccidentAssist - Remote Door Unlock - Remote Diagnostics - Hands-Free Communication	- Route Support - RideAssist - Information/ Convenience Services - Concierge Services *Plus, soon-to-be-offered* - Personal Calling - Virtual Advisor

Although OnStar began its life as an option available only on GM cars, the service has expansion plans including contracts with other automotive manufacturers in the US such as Toyota, Honda, and Subaru. These contracts will permit OnStar to reduce average cost per subscriber by leveraging its infrastructure (including call center and information technology investments) across a broader user base.

Recent growth in number of users (one million are expected by early 2001) has been driven by: (1) the inclusion of OnStar as part of a standard, factory-installed package in a broad set of GM vehicles; and (2) providing the first year's subscription free of charge. Thus, the near-term success of OnStar in the North American market depends largely on the rate of customer retention after the initial free subscription period.

Figure 2 – OnStar User Interface



2 PROJECT OVERVIEW

2.1 ONSTAR EXPANSION

2.1.1 Geographic Expansion

OnStar has also had its eye on markets outside of North America, and recently conducted an analysis of potential geographic expansion opportunities worldwide. Criteria used for evaluation included basic indicators such as the number of vehicles for which OnStar service was judged to be relevant ("volume"), the adequacy of the wireless cellular telecommunications network ("infrastructure"), and per-capita income and technology acceptance by customers ("demographics") for each region.

2.1.2 Japan Initiative

Japan was identified as a potential market opportunity because of the following factors:

Volume

Nearly 2 million relevant vehicles sold per year. (Relevant vehicles are all passenger vehicles excluding small, mini, and lower medium categories.)

Infrastructure

Continuous cellular coverage via a common standard.

Demographics

Per capita income 20% higher than the US. Around 60 million wireless cellular subscribers.

The sophistication of wireless infrastructure and penetration of wireless usage in Japan leads the rest of the world by several years. In May of 2001, so-called "third-generation" wireless coverage is expected to be initiated in Tokyo on a trial basis at data rates of 64Kbps by wireless provider NTT DoCoMo (current services are provided at 9.6Kbps). It will be fanned out nationally to widening segments of the population over the following calendar

year. This coverage will eventually permit download rates of 384 Kbps and upload rates of 64 Kbps. In contrast, Europe is not expected to launch 3G services until 2002 at the earliest, and the US not until 2003 or beyond.

Because such high speed mobile wireless technology will proliferate more quickly in Japan than elsewhere, the Japan market may represent an opportunity for OnStar to learn about customers, services and technology in the Japan environment prior to possible deployment in North America and other regions.

2.1.3 Project Objectives

In recognition of this possibility and the above evaluative criteria, in June of 2000 an assessment of opportunities for OnStar-like services in Japan was begun as a joint effort between e-GM and OnStar, co-led by the author of this document. The purpose of that assessment was to identify opportunities to satisfy the following three objectives for General Motors:

1) To be a profitable mobile services provider in the Japan market, regardless of the platform chosen for service delivery.

2) To develop relationships with non-automotive Japanese partners.

3) To develop market knowledge and experience in Japan that may be exported to other regions.

2.1.4 Facilities and Data Sources

The research project was based at GM facilities in Tokyo, Detroit, and Troy, Michigan. Access to project data at all sites was required, including: outputs of a study by a strategy consulting group, information regarding OnStar's assessment of various geographical markets, e-GM and OnStar market research conducted in Japan for the project, and the output of a syndicated study of automotive customers' information and communication needs by Japanese market research firm IID. Note that GM's actual cost data is proprietary and was not relied on for this thesis.

3 STRATEGIC ANALYSIS OF ONSTAR IN NORTH AMERICA

In the spring of 2001, OnStar will have over one million active subscribers. In evaluating the potential for business in the Japan environment, it is helpful to understand the strategic factors supporting OnStar's success in North America.

3.1 ONSTAR SERVICE WAS "FIRST OF ITS KIND"

OnStar has exploited a first-mover advantage. Except GM, no American automotive manufacturer has developed a telematics capability.

By growing ahead of competitors, OnStar has lowered the cost of its installed systems by obtaining volume discounts from hardware suppliers and service providers, and by continuously improving the cost of installations. GM has made investments necessary to "design-in" telematics equipment for low-cost factory-installation in most of its vehicle lines. It has also invested hundreds of millions of dollars in a brand-marketing campaign to popularize the "OnStar" name and service offering. Finally, by growing its subscriber base, OnStar has generated promotional support via "word-of-mouth" from existing customers. This supplements paid promotional efforts and reduces overall customer acquisition cost.

An auto manufacturer attempting to start its own, competing telematics business will face upfront costs including initial design-in, promotion, and call-center set-up, as well as volume-dependent costs from suppliers, learning-curve effects, and the amortization of call-center operations costs. These "scale economies" imply that new entrants would face a cost disadvantage verses OnStar until obtaining comparable scale.

3.2 THROUGH GM, ONSTAR HAD ACCESS TO 1/3 OF NEW VEHICLES

The market for users of a given manufacturer's telematics service is bounded initially by the total number of vehicles it is able to put on the road. Thus, General Motors, who sells roughly one-third of all new vehicles today, has had greater initial growth potential than any other single manufacturer.

Other manufacturers have chosen to outsource telematics to ATX, Inc., which aggregates services across multiple manufacturers. It provides private-label telematics to luxury lines such as Mercedes-Benz (DaimlerChrysler) and Lincoln (Ford).

3.3 MOBILE DATA SERVICES MARKET JUST DEVELOPING

When OnStar initiated service, overall cell-phone penetration was relatively low, and there were few potential substitute services for directions or other location-dependent information. Today location-dependent information is available in text form via cell-phone screen, and by voice through "voice-portal" applications such as "Tell Me" and "Be Vocal." Whereas OnStar was able to publicize and build its initial brand in an environment in which it provided unique services, new entrants today must compete against these services in order to build their initial subscriber base.

3.4 HIGH PROPORTION OF CELL-PHONE USAGE OCCURS IN VEHICLE

OnStar reports that 70% of all U.S. wireless minutes are consumed while driving (2). Thus, customers generally handle a great deal of their wireless communication needs when in vehicle. This provides support for the value of future service releases by OnStar, such as "personal calling", whereby the OnStar apparatus is used as a voice-activated, hands-free car-phone.

3.5 SAFETY AND SECURITY THE SOURCE OF PRIMARY CUSTOMER VALUE; NAVIGATION NOT OF CENTRAL IMPORTANCE

The basic OnStar package is centered on safety and security, which is highly valued by OnStar customers. Consistent with this positioning, OnStar provides all its functionality through voice-enabled interfaces. There is no screen to distract drivers, who are able to keep their "hands on the wheel and eyes on the road" at all times. An added perspective is that since screen-based navigation systems have fared poorly in the US, the lack of perceived demand for this equipment has enabled OnStar to pursue an approach based on much simpler, cheaper hardware.

4 COMPARISON: JAPAN VS. NORTH AMERICA

4.1 GM-AFFILIATES MAKE UP A SMALL FRACTION OF MARKET FOR TELEMATICS

Relatively speaking, GM sells few GM-manufactured vehicles in Japan. However, it does have significant equity stakes in three Japanese automotive manufacturers (Table 2).

Table 2 – GM's affiliated Japanese vehicle manufacturers

Manufacturer	Primary Vehicles Sold in the Japanese Market	Approx. Annual Unit Sales	GM's Equity Stake
Suzuki	Mainly minis (engine displacements less than 660 cc)	0.6 M	20%
Subaru	Split between sporty practical passenger sedans/wagons and minis	0.3 M	20%
Isuzu	Commercial trucks	0.1 M	49%
GM	GM brands including Saab and Opel	0.04 M	100%

GM-affiliated vehicles collectively account for approximately 1 million of a market of 5-6 million vehicles annually. Although in aggregate this is a significant fraction of automotive sales, few of these customers are likely to be interested in a consumer telematics package.

First, GM-affiliated vehicle sales through Isuzu (with sales of order 100K annually) are largely to businesses. If the commercial market constitutes an opportunity for telematics services, it is one that serves needs distinct from those in the consumer sector[1]. Of the remaining 90% of GM-affiliated vehicles sold, about 75%, or 750K, are in markets for very small "mini-cars" or "second cars". The mini-car (or "K-car") segment is populated by customers who are extremely price-sensitive in their purchase, having bought cars with tiny

[1] Opportunities in the commercial sector lie outside the scope of this thesis.

engines (less than 2/3 liter) for around $10,000 or less. Thus, any services and hardware sold in those markets need to be priced very low. Current OnStar hardware has an MSRP[2] of three to five hundred dollars, which amounts to a substantial fraction of the value of such a low-priced vehicle in a price-sensitive and margin-sensitive market-place.

The remaining set of vehicles potentially relevant to OnStar-like services represents annual sales of at most 200K. In contrast, GM passenger vehicles in North America account for annual sales of about 5-6 million, about 25 to 30 times the size of sales of analogous Japanese vehicles.

Table 3 - GM and affiliated vehicle registration, 1998

	GMJ	**Isuzu**	**Subaru**	**Suzuki**	**Total**
Passenger Car	30,908	4,204	15,410		50,522
Passenger Car (small)	13,239	2,351	109,423	33,879	158,892
Passenger cat Total	**44,147**	**6,555**	**124,833**	**33,879**	**209,414**
Truck		21,766			21,766
Truck (small)		57,206	1,507	14,697	73,410
Truck Total		**78,972**	**1,507**	**14,697**	**95,176**
Bus		1,223			1,223
Mini			79,998	343,169	423,167
Mini Truck			80,055	183,703	263,758
Mini Total			**160,053**	**527,406**	**686,925**
Grand Total	**44,147**	**86,750**	**286,393**	**575,982**	**993,272**

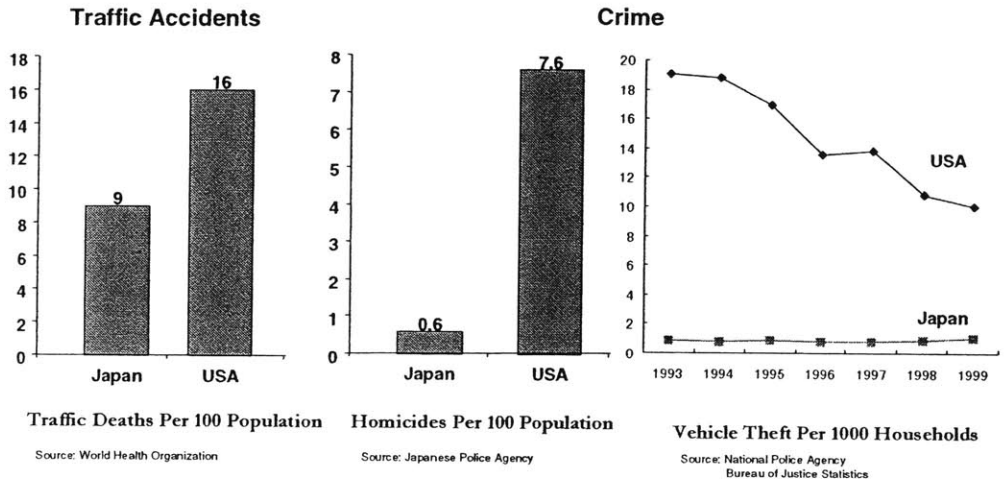
Thus, the GM-affiliated customer base is by itself not likely to support a viable consumer telematics service in the tradition of OnStar's North American services. Instead, one must either provide telematics far more cheaply (so as to make it possible to capture demand within the "mini" segment) or expand the customer base beyond GM affiliates.

[2] MSRP = Manufacturer Suggested Retail Price

4.2 SAFETY AND SECURITY ACCOUNTS FOR LITTLE REVENUE GENERATION; NAVIGATION IS A KILLER APPLICATION.

Out of more than seven existing telematics services only one, operated by Daimler-Chrysler for Mercedes-Benz customers, provides safety & security functionality. Indeed, most of the Japanese vendors to whom we spoke during the course of this study were skeptical about Japanese customer's willingness to pay for safety and security functionality. Driving in Japan, while it is easy to get lost, is much safer than elsewhere. Accident and crime rates are far lower than in the U.S. (see Figure 3).

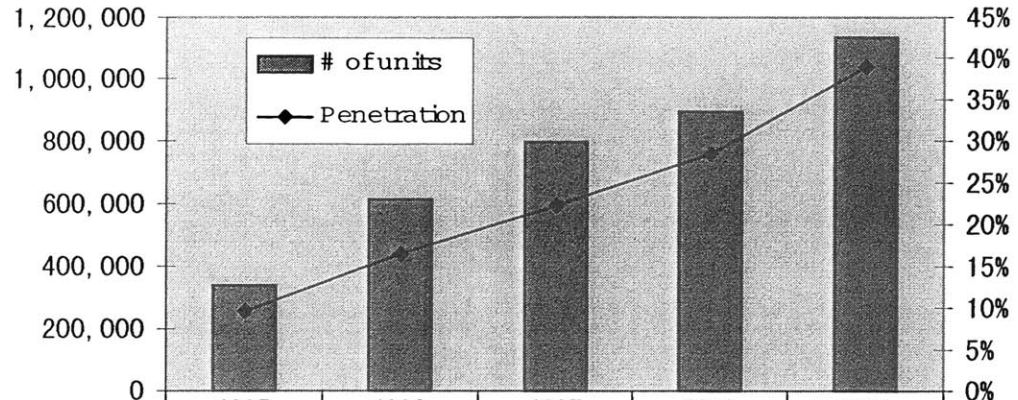
Figure 3 – Safety Statistics in Japan



In contrast, Japanese drivers' interest in vehicle navigation is high. Currently over 30% of drivers choose to equip new vehicles with navigation equipment (see Figure 4). Recent year-to-year growth in unit sales is over 15% within the context of a vehicle market where sales have been roughly flat or declining. This equipment includes location-sensing hardware (GPS) as well as a dash-mounted screen with on-board database (CD or DVD-ROM) to provide current locations and directions. The prices for these systems currently range

between 100,000 and 200,000 yen. This is three to four times the price of OnStar equipment in the U.S., with a much higher penetration of new vehicle sales.[3]

Figure 4 – Car navigation system sales as a fraction of new car sales excluding minis and trucks[4]



	1995	1996	1997	1998	1999
# of units	337, 183	612, 656	795, 864	893, 944	1, 135, 166
Penetration	10%	17%	22%	28%	39%

Reference (3)

Navigation systems provide particular value to customers in Japan because roads in city areas are convoluted and the addressing system is of limited use as a navigational tool. Houses in Japanese cities are labeled by city, neighborhood, and block. Within that labeling, they are numbered in the order built. Street names are omitted from most addresses, and blocks are often not square. Thus, locating a new place requires considerable attention, even with a map.

The use of a dash-mounted screen for navigation is recognized as potentially distracting, but widely accepted. Such use is in fact master-minded and perpetuated by the Japanese government. A government-operated infrastructure referred to as 'VICS' (Vehicle

[3] I.e., OnStar activates only several hundred thousands of subscriptions per year in a market where over seventeen million vehicles are sold annually.

[4] In Figure 4 – Car navigation system sales as a fraction of new car sales excluding minis and trucks, penetration is estimated as units sold divided by sales of passenger vehicles excluding all minis and trucks. This is inaccurate because navigation systems may also be relevant in some trucks and vans. However, exclusion of minis is reasonable: it is unlikely that such systems would be installed in a mini-vehicle due to the costs involved (typically 10,000 to 20,000 yen) compared to the price of the vehicles (typically 100,000 yen).

Information Collection System) tracks and electronically distributes traffic data for visual display and automated route determination (see Figure 5). The system transmits data via FM broadcast channels and highway beacons throughout Japan. A range of display mechanisms of varying degrees of sophistication make use of this information (see Figure 6).

Figure 5 – Vehicle Information Collection Systems (VICS)

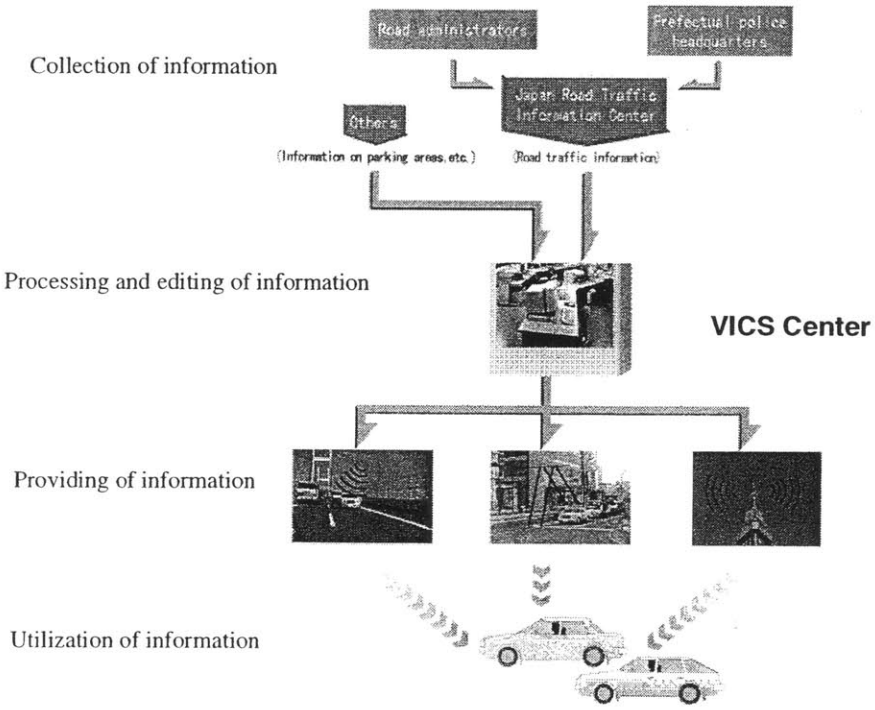
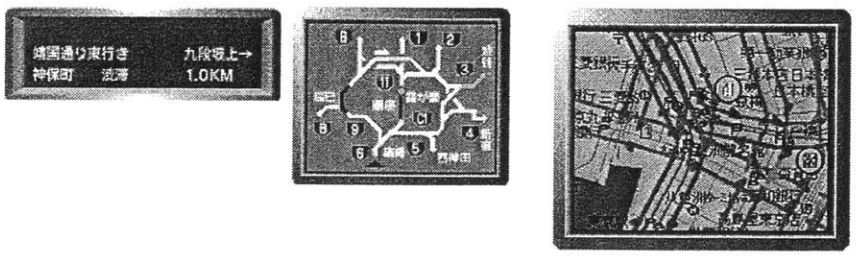


Figure 6 –In-Vehicle Displays for VICS Information



Level 1 **Level 2** **Level 3**

4.3 THE MOBILE DATA SERVICES MARKET IS WELL DEVELOPED

VICS represents a single-minded implementation of mobile data services for the sole purpose of distributing traffic information to drivers en route. More generally, the Japanese market for mobile services is broad and well developed. Such services include the following:

- **Voice communication via cell phones.** As of March 31, 2001, there were 66.8 million mobile phone subscriptions, up from 58.9 million in March 31, 2000 (4). By the year 2000 Japan was expected to have had a population of 127 million people, with 108 million over age 14 (5). Thus, the number of subscriptions per consumer aged 15 and over is above 62%. Saturation is expected at penetrations between 80% and 90% (6). At the above adoption rates, saturation should be achieved within two years

- **Data communication via cell phones.** As of March 31, 2001, 52% of Japanese cell phone users subscribed to some form of "wireless web" service (4). This is up from 17% a mere ten months earlier. Such rapid adoption is aided by a cell-phone replacement cycle of under a year.

Other data services are in their initial stages, including:

- **Data services via PDA** (personal digital assistant): In most cases, these utilize the cell-phone as a communication link. Others have that capability built in or provided by clipped-on wireless modem.

- **Data services via in-car navigation system**: Beyond the VICS infrastructure used for information about traffic congestion, telematics systems offering various convenience and entertainment services are being sponsored by vehicle manufacturers. Three of the first to introduce such systems were Toyota, Nissan, and Honda. All three utilize the vehicle navigation screen, GPS, and a cell phone embedded or docked in the unit to provide text and graphic information services.

Figure 7 – Features of Some Initial Telematics Systems

	TOYOTA (Monet)	NISSAN (Compasslink)	HONDA (Internavi system)
CITY GUIDE	- Shopping guides - Restaurant Guides - Events / Town map - JTB Hotel info - Sightseeing spots	- Restaurant guide - Sightseeing spots - Events - Tel number search	- Tel number search (shopping, food, travel, outdoor events) - Gourmet catalogue
PRODUCTIVITY & COMMUNICATION	- Email	- Email	- Email
TRANSPORTATION	- Traffic info - Possible road closure information - Parking spots - Live video feed of traffic spots	- Parking spots	- Help map - Recommended route - Driving plan
NEWS & ENTERTAINMENT	- JRA horse-race info - News / Headline news / Weather	- News / weather news - Golf course / ski field weather	- Weather info
EMERGENCY & SAFETY	- JAF - Nearest hospital / police station - Toyota service shop	- Help - Hospital location - Car dealers - JAF dialup	

Below is a description of unique aspects of these services.

4.3.1 Toyota Monet

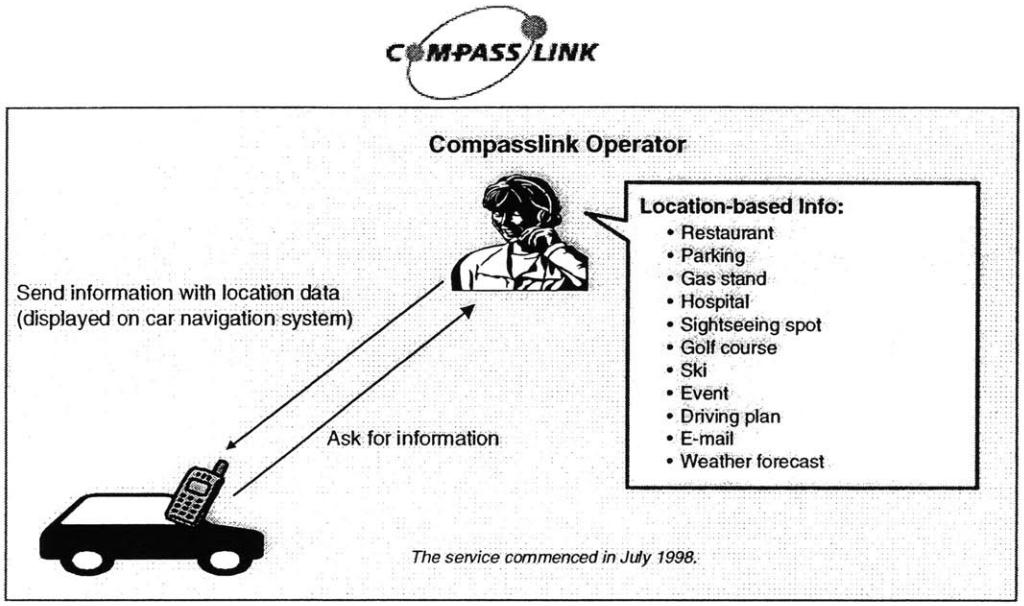
In the Monet system of Toyota launched in November 19997, an electronic female voice reads out requested information over car speakers. Monet also understands simple spoken commands, such as "news" and "sushi."

4.3.2 Nissan Compass-Link

Nissan's Compass-Link system, launched in July of 1998, utilizes a call-center with live operators to respond to requests from car navigation users. Information can be relayed verbally but also can be downloaded electronically by operators. An example is route-setting. Car navigation systems can be quite challenging to master. Perhaps the most

difficult part of usage is locating and setting the initial destination and route. The Compass-Link operator is able to locate this information and set the route remotely.

Figure 8 – Nissan Compass-Link



4.3.3 Honda Internavi

Honda's Internavi system, launched in August of 1998, allows users to access their own personalized web page from a PC to pre-select driving destination, route, and other travel information. The user then has the choice of either accessing this information wirelessly from their car, or downloading it to a memory card that can be inserted in the car navi system. In addition to such pre-loaded information, users can wirelessly access content from the internet or the Internavi operations center. Finally, Internavi allows Honda customers who have *not* purchased a navigation system to create and utilize a Honda web page to conduct travel planning from their homes or offices, and it allows access to this information from web-enabled phones and PDAs. By the middle of last year over 40,000 Honda customers were reported to have registered for this variety of the Internavi service.

4.4 MANY VEHICLE MANUFACTURERS AND OTHERS OFFER TELEMATICS SERVICES

GM was without significant direct competition when it introduced its safety-and-security focused OnStar services in the U.S. However, in Japan a service providing emergency notification has existed for over three years. This is ITGS/E-call, operated by Daimler-Chrysler Japan in support of Mercedes drivers. In addition to information and convenience services, ITGS/E-call runs a call center whose functions include emergency support and. automatic airbag deployment notification. The E-call call center was reported by industry sources to have been expanding service in the fall of 2000. Figure 9 summarizes all services launched through July of 1998.

Figure 9 – Initial, proprietary approaches to telematics

All prices in yen.

Type	Name	Launch	Unique Features	HW Price**	Service Pricing	Members
Proprietary Content	ITGS/E-call* (Daimler-Chrysler Japan)	4/97	Real-time map updates; automatic airbag deployment notification	Not available	Admission: free Monthly: 1k + cellular costs	Not available
	Monet (Toyota)	11/97	Real-time traffic video	50k	Admission: 2.5k Monthly: 0.6k + cellular costs	10,000 in 3 yrs
	Compass link (Nissan, Mitsubishi, BMW)	7/98	Live operator assistance	50k	Admission:3k Monthly: 2.5k + cellular cost	2,000 in 2 yrs

*ITGS - Intelligent Traffic Guidance System; E-call - Emergency Call

** HW Price includes adapter and/or hands-free kit added to navi. Excludes navi price of 100k-200k.

Reference (7)

As can be seen from their membership numbers these operations have enjoyed little success. Potential contributing factors include: systems are difficult to operate, have slow download speeds (data rates range from 4.8 kbps to 9.8 kbps -- the transmission speed for i-Mode), lack compelling content, and have poor content for the price.

Perhaps to address these factors, services introduced subsequently support open internet access and waive subscription fees, choosing instead to charge fees per data packet or service usage (Figure 10).

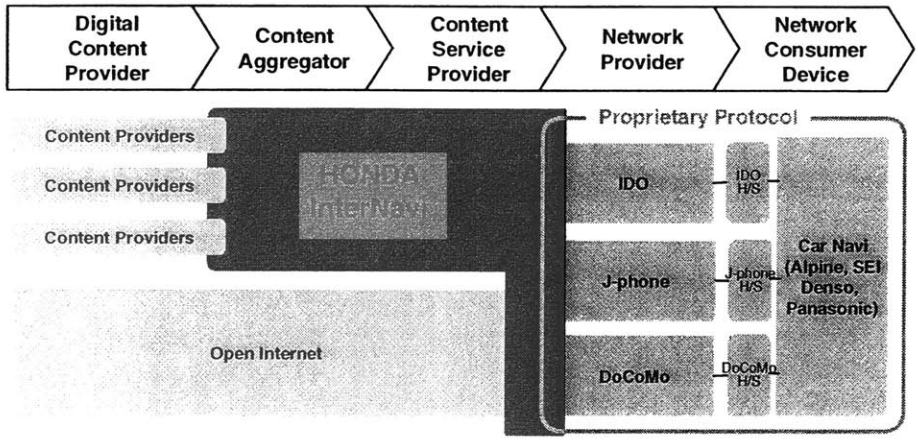
Figure 10 – Recent telematics approaches with non-proprietary content

Type	Name	Launch	Unique Features	HW Price	Service Pricing	Members
Open Content	**Internavi (Honda)**	8/98	Personalized trip-planning web-site linked to in-car service; open internet access	46k	Admission: 2.5k Monthly: free + cellular costs	7,000 in 2 yrs
	Telemax (Mazda)	06/00	Personalized web page, i-mode content on map	Not available	Free except cellular costs	Unknown
	i-Navi Link (NTT DoCoMo)	07/00	i-Mode content on the map	Not available	0.1k per request + cellular costs	Unknown

Reference (7)

Honda adopts a dual approach, providing location-based services (those integrated with GPS and navigation) in a proprietary manner, but also allowing users to view the open internet (Figure 11). It has also succeeded in convincing some equipment manufacturers and content providers to use its internally developed standard for transmitting location-based information. Use of the standard allows compatible navigation systems to extract location information from properly formatted web pages.

Figure 11 – Honda Internavi Service



Services introduced more recently by NTT DoCoMo and Mazda (which utilizes DoCoMo's service) go further in providing opportunities for content. DoCoMo has extended its approach from the handset world to the world of car navigation systems. That is, for a fee

per use plus cellular costs, customers are able to utilize location-based content or i-mode content that is formatted according to DoCoMo's specifications. And with 22 million existing i-mode customers and tens of thousands of available content sites (as of March 31, 2001) it should have no problem spreading standards for location-based services. Mazda, rather than maintain its own proprietary system, has chosen to construct service around the system architected and controlled by NTT DoCoMo.

Figure 12 – Value chain for NTT DoCoMo's i-Navi-Link

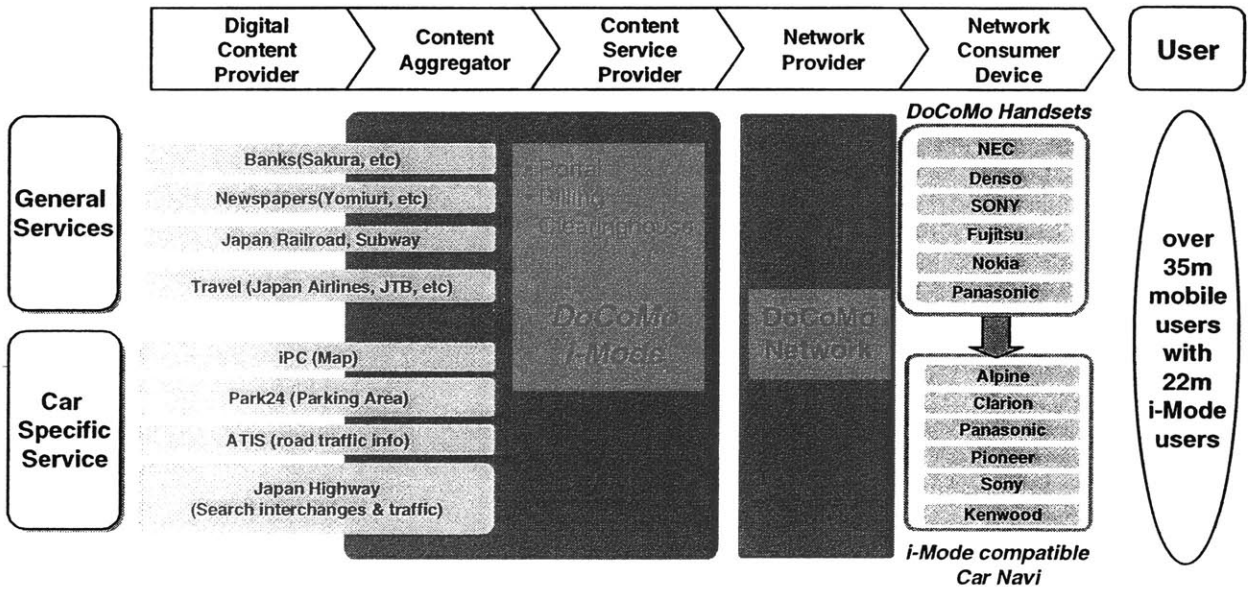
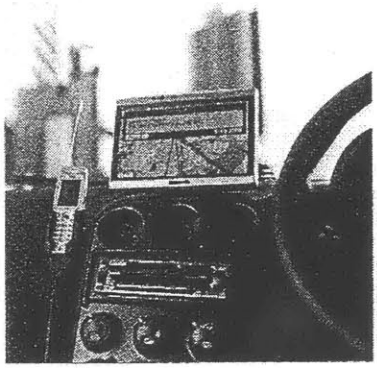


Figure 13 – Equipment and display for DoCoMo i-Navi-Link Telematics



At the same time, car navigation manufacturers (a fragmented market of more than ten consumer electronics companies) are scrambling to define their own standards that would permit service independent of both equipment manufacturer and network service provider.

Figure 14 – Press release: consumer electronics firms cooperate on standards for internet-enabled car navigation

Monday, August 14, 2000
Sony, 39 Others Join To Standardize Car Navigation System

TOKYO (Nikkei)--Forty companies have launched an association with the aim of standardizing a next-generation car navigation system, The Nihon KeizaiShimbun learned Monday.

The firms include Matsushita Communication Industrial Co., Sony Corp. and major map producer Zenrin Co.

In an effort to promote the use of the navigation system, the body will standardize communications protocol such as that used in transmitting data on roads, buildings and other map information.

The navigation system, which is expected to be commercialized as early as next year, will enable drivers to get map data and a wide range of other information via the Internet through a cell phone embedded in the system.

The system will also act as an information terminal, capable of exchanging e-mail, making restaurant reservations and downloading music or games.

In fact, some car navigation manufacturers already offer telematics services to go along with their more advanced car navigation systems (little detail was known about these systems at the time of this study).

In the area of safety and security, a broad consortium of automotive manufactures, car navigation manufacturers, telecommunications companies, and government agencies have co-invested since September 1999 in a jointly owned company focused on the design and operation of in-vehicle emergency response systems. The company is called Japan Mayday, and has defined a set of standards for emergency response that utilize wirelessly connected navigation services. The "Helpnet" approach will put a button on compatible car-navigation systems that users can press for immediate connection to an emergency call center. As of the summer of 2000, the founders of Japan Mayday expected to start service in September of that year, concurrent with the launch by Toyota of a vehicle containing a factory-installed

version of the equipment. Factory-installed versions of Helpnet support automatic emergency notification for airbag deployment. Led by a retired president of the Japan police, Helpnet's founding team consists of semi-retired executives from majority owners, including Toyota, NTT, Nissan, and others. In some respects, the business resembles a public service, with an initiation fee of 6000 yen, and an *annual* subscription fee of 4000 yen (under 40 US dollars).

Figure 15 - Japan Mayday Service Co., LTD (HELPNET)

Shareholders

Vehicle Manufacturers

- Toyota
- Nissan
- Honda
- Suzuki
- Daihatsu
- Mazda
- Mitsubishi

Communication Companies

- NTT Communications
- NTT DoCoMo
- au (IDO)
- KDDI

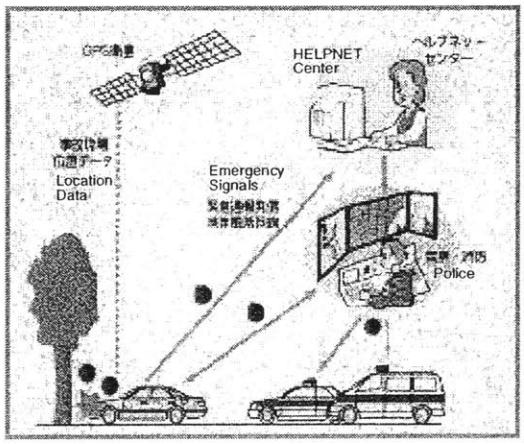
Navigation System Manufacturers

- Panasonic
- Aishin AW
- Calsonic Kansei
- Denso
- Alpine
- Clarion
- Fujitsu ten
- Pioneer

Insurance Companies

- Tokio Marine and Fire Insurance Company
- Yasuda Marine and Fire Insurance Company
- Mitsui Marine and Fire Insurance Company
- Chiyoda Marine and Fire Insurance Company

Service Features



4.5 SMALL PROPORTION OF CELL-PHONE USAGE IN VEHICLE

Since they drive less than North Americans, Japanese drivers meet a relatively small fraction of their overall communications needs while driving. Whereas it is not uncommon for a North American to spend 1-2 hours driving daily and make 70% of phone calls from the car, Japanese drivers drive an average of only about forty to fifty minutes daily (8). Many city dwellers spend an equal or greater amount of time commuting by train or on foot, so that the majority of customers' mobile communications needs are probably met outside the vehicle. Thus, the maximum value that can be provided by a separate, in-car system for mobile communications is small compared to a system that can be used outside the car, and

Japanese may therefore not be willing to pay as high a price for a separate, in-car service as North Americans.

5 ADDITIONAL INFORMATION ON GM'S RELEVANT STRATEGIC ASSETS

Any mobile service venture that GM creates in the Japan environment will benefit to the extent that it can apply capabilities already developed by the North American OnStar team. These capabilities include the following:

5.1 INTEGRATION WITH VEHICLE ELECTRONICS

GM, and more specifically OnStar, has more experience designing communication links to in-vehicle electronics than any other organization. This has included design of air-bag deployment sensors, systems for communication of various vehicle diagnostics, and convenience features like remote door unlock and horn honk.

However, two points must be given careful consideration in evaluating these capabilities. First, the efforts required to design such systems are extremely specific by vehicle model. Whereas OnStar believes that preparation of factory-installed equipment for a vehicle line that has an electronics infrastructure consistent with that of GM may take as little as a year, the efforts required to perform the same work on vehicle models of Japanese affiliates may take three years.

Second, the intellectual property on which these systems are founded is not strategically defensible. There are multiple ways to construct the integration with vehicle electronics for a given vehicle line, and industry standards govern important aspects. Therefore GM cannot "lock-up" access to the requisite capabilities through patents or secrecy.

What GM/OnStar does have is experience integrating telematic electronics in vehicles to serve customers. It should be able to perform this integration more quickly than less experienced players.

5.2 VOICE RECOGNITION

From 2001 onward implementations of OnStar in North America will include a set of features referred to as the "Virtual Advisor." It involves the inclusion of vehicle hardware and server-side software which enables OnStar customers to review and manipulate online content sources using voice recognition and voice synthesis. It is literally a "voice portal" similar in spirit to services provided on handsets by "TellMe" , "BeVocal", and others. It is intended to be personalized via user pre-configuration of online web-pages.

These voice recognition capabilities require a significant level of development, testing, and integration within actual vehicles. However, voice recognition functionality is somewhat specific by language, and technology development for Japanese voice-recognition is approximately one year behind English.

Nevertheless, OnStar has significant experience in integrating voice recognition in a uniquely noisy vehicle environment. It should therefore be able to perform such integration more quickly than inexperienced players.

6 INFERENCES FROM PRELIMINARY U.S./JAPAN COMPARATIVE ANALYSIS

The comparative analysis above suggests the following:

6.1 ANY NEW MOBILE SERVICE VENTURE IN JAPAN WILL FACE SIGNIFICANT COMPETITION.

Customers will have multiple choices for satisfying their mobile service needs inside the vehicle. Furthermore, competition is likely to come from experienced sources -- firms who have been providing mobile services for several or many years.

6.2 THE MOST SUCCESSFUL SERVICES WILL LEVERAGE SYSTEMS ADOPTED FOR USE OUTSIDE THE CAR.

Customers have already invested heavily (in yen and learning) in order to adopt mobile service solutions that meet needs outside the vehicle. They will continue to utilize those services in the future, and will spend far more time using such services outside the car than they will spend using any service inside the car. Therefore any service offering that attempts to *replace* that investment while consumers are in the car (instead of supplement or complement it in an efficient fashion) will appeal to few customers.

6.3 IT IS UNCERTAIN WHETHER JAPANESE CUSTOMERS WILL PAY FOR SERVICES RELATED TO SAFETY & SECURITY.

First, the introduction of such services would need to overcome skepticism among necessary participants in Japanese industries (communications, electronics, automotive). Currently, the fraction of overall mobile service revenue coming from safety and security is small. Second, Japan is a far "safer" environment than the U.S.

6.4 THE MOST SUCCESSFUL SERVICES WILL INCLUDE OR COMPLEMENT NAVIGATION

Navigation services are a subsidiary part of U.S. OnStar's primarily safety-focused. In Japan, navigation plays a more fundamental role, and will soon achieve high levels of penetration. OnStar in Japan must comprehend this difference, either by providing navigation service or by designing systems and strategy to work in tandem with navigation providers.

6.5 POTENTIAL CONSUMER MOBILE SERVICE REVENUES FROM GM-AFFILIATED VEHICLES ARE SMALL.

Customers of GM affiliates account for a specialized share of the overall vehicle market and cannot be counted on to support a viable mobile service business in and of themselves.

6.6 ONSTAR HAS SIGNIFICANT CAPABILITIES FOR VEHICLE INTEGRATION OF TELEMATICS BUT THESE MAY NOT BE READILY APPLICABLE IN JAPAN

OnStar should be able to implement voice-recognition and safety-focused systems more quickly than inexperienced players. However, this may take several years, and other entities in the Japanese market have already developed these capabilities at some level.

7 PRELIMINARY ANALYSIS: CONTENT AGGREGATION OPPORTUNITIES

In August of 2000, a consulting team assisted in evaluation of market trends and competitive environment for mobile services in Japan. The conclusions from that analysis were two-fold. First, it was concluded that OnStar services in the North American vein were in-viable, primarily due to an assumed lack of customer interest in safety and security. Second, the recommendation was made that GM form alliances with partners to bring to market a content aggregation business. The proposal was to aggregate location-based and other content relevant to driving and travel in order to create a mobile web-portal for car navigation systems and other internet access channels. By doing so, GM and its partners would address a need for collection and integration of such services that would grow as open standards proliferated.

It was reasoned that with the significant increase in data transmission rates starting in 2001, a set of service possibilities would come into existence that would be exciting to customers. Furthermore, the trend toward proliferation of open standards would create an environment in which such services would be easy to generate. And finally, an increasing fraction of car-navi systems will be equipped with data-communications links. These capabilities will continue to penetrate manufacturer-installed equipment as in current telematics systems. However, they will also penetrate the large number of navigation systems (about half the total) installed in the aftermarket that are unaffiliated with vehicle manufacturers. Therefore an audience for more open services is expected. Given proper coordination and a billing mechanism operated by the content aggregator, these services will proliferate and generate revenue, much as has the content available via i-Mode.

The suggestion was not only to capture a percentage of the revenues available for such services in Japan, but also to gain experience and a set of alliances by which services might eventually be deployed in the U.S.

Before evaluating this proposal, we first take a look at potential Japanese consumer reaction to new telematics services, both the North American OnStar model and the content

aggregation model. A full strategic evaluation of both ideas is presented in Section 9, incorporating feedback from market research.

8 MARKET RESEARCH

8.1 QUALITATIVE RESEARCH

8.1.1 Objective

The objectives of qualitative research was to obtain feedback on a range of potential service options including the content aggregation model described in Section 7. This feedback could then be used to evaluate the viability of these options as well as tailor them in preparation for design of a precise service offering. More precise design could then involve more rigorous and narrow quantitative research at a later date.

The primary questions to be answered by the qualitative research were: "How might customers react to the overall service concept and its features? Does it appeal to them, and if so, would they consider purchasing it? Based on the outcomes of the research, what might be the most fruitful areas to pursue?"

Within the scope of this document, the results of research are primarily intended to help address the question "is there market demand for such a service?"

8.1.2 Methodology

The qualitative research consisted of focus groups held in November, 2000. Attitudes about two primary service concepts were discussed with different sets of Japanese drivers. Concept A, consisting of services built upon the existing architecture for car navigation systems, was discussed with groups segmented by technology usage. Concept B, consisting of OnStar services in the North American vein (including soon-to-be-released "Virtual Advisor" and "Personal Calling[5]" features) was discussed with groups segmented by age. The constitution of the groups and the study methodology is shown in Figure 16.

[5] Personal calling enables OnStar subscribers to use their OnStar equipment as a voice-operated, hands-free cell phone.

Figure 16 – Study Outline

Fieldwork date: November 11 (Saturday) & 12 (Sunday), 2000
Place : Shibuya Nexus
Sample size : 95 (see below for sample breakdown)

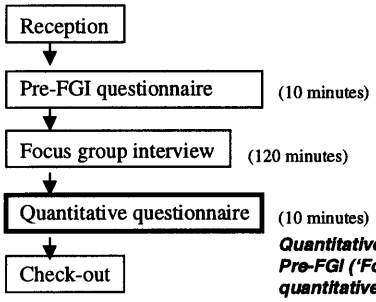
<Group A : Telematics / i-mode groups>

- Telematics users	8 participants (2 groups)
- Telematics rejecters	17 participants (2 groups)
- i-mode users	18 participants (2 groups)

<Group B : Age based groups>

- 18-34 years old	17 participants (2 groups)
- 35-49 years old	18 participants (2 groups)
- 50 years old or older	17 participants (2 groups)

Study flow :



Quantitative results were based on the results of Pre-FGI ('Focus Group Interview') questionnaire and the post-FGI quantitative questionnaire.

Subsequent to focus groups, participants filled out surveys to gather quantitative indications of reactions to concepts discussed. Survey questions regarding participants' attitudes (e.g. satisfaction, interest, or importance) were answered on a 5-point scale. For example:

> *"How much are you satisfied with the service?"*
>
> *1 = Very satisfied*
> *2 = Satisfied*
> *3 = Neither satisfied nor unsatisfied*
> *4 = Unsatisfied*
> *5 = Very unsatisfied*

8.1.3 General comments on participants

All participants were drivers living in the Tokyo area. The composition of the groups was 75% male, with the gender ratio even more skewed in tech-savvy group A.

Internet usage and cell-phone penetration was very high. Across all groups, 80% of participants answered that they often use the internet. Across aged-based groups alone, the fraction was 73%, with the lowest usage occurring in the 50+ age group (65%). Cell-phone penetration, at 94%, was even higher. The lowest penetration again occurred in the 50+ group, where 77% reported using a cell phone. The figure was 100% for the group aged 18-34, and 89% on average across all aged-based groups.

Car-navi penetration was also significant. In age-based groups, where selection was blind to factors correlated to car-navi ownership, the average penetration of car-navi devices was 31%. In addition, 48% of those participants (owners and non-owners) plan to equip their next car with a navigation system

8.1.4 Concept A - Services based on the architecture for car navigation systems in Japan

This involves making data services available on the screens of Japanese vehicle navigation systems, both manufacturer-sponsored and installed in the aftermarket. These could include a variety of convenience and entertainment-related services such as: information about points of interest, automatic notices of locally available services or products, parking reservations, information of personal interest, personal streaming "karaoke", MP3 download, and email, either as text or voice-synthesized. Some features, such as music download, would require third generation wireless support.

These services would be made available as seamlessly as possible inside and outside the vehicle. For example, they could be provided in the vehicle by "docking" a handheld in a port connected to the navigation equipment. Maximum attention would be given to making services available via multiple access channels (i.e., not only car navigation systems, but also on mobile phones, PDAs, and the fixed-line internet).

8.1.4.1 Questions of primary interest

In addition to the general objectives listed in section 8.1.1, research on concept A addressed the following sets of questions.

- Who are the current users of telematics or navigation systems? What do they like and dislike about these systems? What would they like to see improved?

- How might users of handheld wireless web services (who are assumed to represent the bulk of future potential customers) differ from other groups in their attitudes about navigation, and telematics?

- Finally, what might explain the low levels of customer acceptance of current telematics systems?

8.1.4.2 Primary Results

8.1.4.2.1 General comments regarding car-navigation ownership

The responses to certain survey questions were disaggregated according to whether a user did or did not own car-navigation equipment. Several top-level trends are noteworthy.

First, although the household incomes of car-navi owners, non-owners, and telematics users do not differ significantly, their driving patterns do. Non-navi users tend to use their cars more frequently for shopping, but navi users (and especially telematics users) drive substantially more on highways or for business purposes. Additionally, telematics users reported many more weekend trips than navi owners who do not use telematics.

Second, there were only eight telematics participants. The reason for the small number of users of telematics participants vs. other participants (about half the number obtained for other audiences) was that it was extremely difficult to locate telematics users. This is consistent with the low numbers of users reported for the major telematics services in section 4.4. However, the low market penetration is especially interesting in light of the fact that among the 15 rejecters, fully a third owned systems with telematics capability.[6] That is,

[6]Note, however, that among the 17 car-navi owners within the i-mode and aged-based groups (whose participants had not been selected on the basis of their exposure to telematics), there was only one car-navi system with telematics capability, or about 6%.

although it is clear that a substantial fraction of car-navi owners have equipment capable of telematics, very few have actually chosen to activate service. Therefore telematics is much more widely available than it is utilized.

Third, most car-navigation owners who participated equipped their car with navigation systems as a standard feature or dealer option at time of sale (68%, or 27 out of 40 owners total across groups A and B). However, in the i-mode group, systems were mainly purchased in the after-market (67%, or 4 out of 6 total). Note that the widest selection and most advanced systems for car navigation are available in the after-market. Manufacturers and dealers offer more limited choices.

Finally, although in exit surveys of group A a high percentage of car-navi owners expressed interested in "replacing" current systems with a live advisor (35% overall), almost all reported that they are satisfied with their car navigation systems. Additionally, overall intent to purchase a car-navi system in the future (as measured by the fraction of participants indicating that they 'definitely' or 'probably' would do so) is very high (63%, vs. a current ownership level of 42%). Even among the age-based groups, who are more likely to respond in a way indicative of the general population, purchase intention is 48%, with current ownership of only 31%. Thus, market penetration in Japan of car-navi systems is expected to grow rapidly.

8.1.4.2.2 Telematics Users

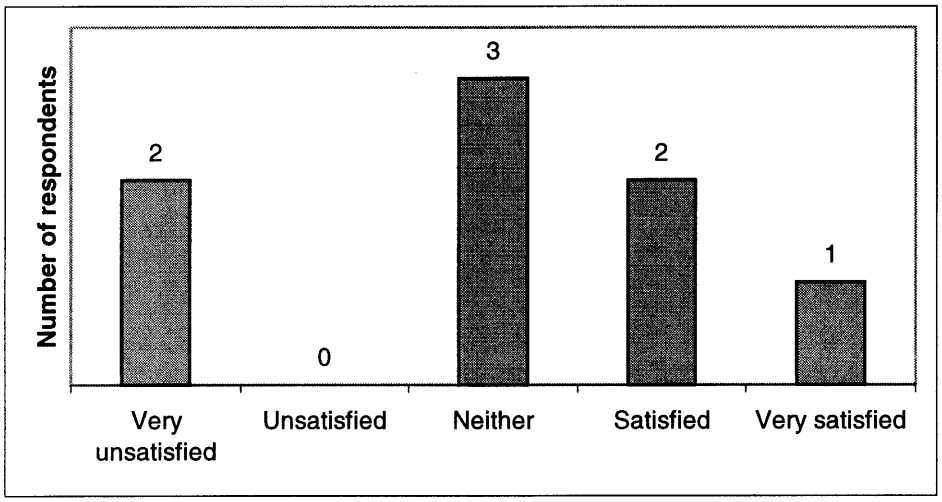
There were a total of eight participating telematics users: two users of Toyota Monet, two of BMW Assist (based on the Nissan CompassLink service), one user of Mercedes E-call, and two users of services attached to car navigation manufacturers. All had acquired their systems recently.

8.1.4.2.2.1 Attitudes of current telematics users

Participating telematics users own a range of different systems and vary widely in their opinions about them. *Figure 17 – Satisfaction of telematics users* depicts the distribution of responses. Note that since participants use systems which vary significantly from each other (e.g., BMW Assist and E-Call have live-advisor support, whereas Monet and the services

affiliated with car-navi manufacturers do not), the variance in satisfaction levels is attributable both to differences in product quality and user needs. In particular, the two owners of the Monet system reported that their reason for subscribing to the system was that in recently purchased Toyota Crowns the pre-installed navigation system is not compatible with VICS. Therefore their only way to get traffic information is by subscribing to Monet. The two "Very Unsatisfied" users in Figure 17 are probably the Monet subscribers. According to their comments during focus group interviews, their driving time and usage frequency is low, so they benefit little from their telematics systems.

Figure 17 – Satisfaction of telematics users with their current systems



To gain insight on the dispersion of user opinion and address potential reasons for currently low levels of user acceptance, we examine comments from telematics users in detail. *Table 4 – Telematics users' opinions regarding their current systems,* paraphrases all the comments from telematics users recorded in the focus group's written report.

Table 4 – Telematics users' opinions regarding their current systems

Aspects of current systems		
Unsatisfactory	**Divided**	**Satisfactory**
▪ Slow download speeds ▪ Hardware, phone, and subscription fees too expensive ▪ Can't check car email outside car ▪ Waiting for download of info you can't use (you get useless info along with the useful info) ▪ Required to have a specific wireless carrier – cannot use current carrier ▪ Call-center busy signals ▪ Extremely poor voice recognition results ▪ Traffic info out of date ▪ Navi system difficult to use ▪ No VICS; need Monet subscription just for traffic info ▪ CD/DVD update disks too expensive		▪ Advisor service for route guidance ▪ Advisor service to set navi route on small roads ▪ Advisor service to provide updated info ▪ Advisor who can provide you with precisely the needed information ▪ Info on shops and restaurants ▪ Info about sightseeing and tourist spots when traveling ▪ Touch panel ▪ Hands free function for phone

The degree of support for "live advisor" services (such as those provided in the BMW Assist system) is impressive. Equally impressive is the long list of complaints that users had. Note, however, that some of these complaints have nothing to do with telematics per se. Poor voice recognition, lack of VICS support, expensive update disks, and navi systems that are difficult to use are all aspects of the design for the base navigation systems, not their telematics support.

The telematics-related reasons for current-user dissatisfaction can be categorized as in Table 5.

Table 5 - Reasons for dissatisfaction with current telematics services

1. *Slow data speeds*
2. *Content not precise enough to meet users' needs*
3. *High prices*
4. *Lack of integration or compatibility with customers' other communications systems (i.e., existing network service or email address).*

Customers appear to enjoy the live advisor assistance and information about shops, restaurants, sightseeing and tourist spots while traveling. Unfortunately, it is not known whether the participants who make use of this information are obtaining it from their navigation screens, or from a live advisor. Nevertheless, in Table 6 we present a list of hypothetical subscription and retention reasons consistent with the data in Table 4.

Table 6 – Reasons for subscribing to current telematics systems

1. *Advisor assistance, especially with routing (route information, choice, or setting)*
2. *Information relevant to location and travel (local shops, restaurants, and tourist information)*

In *Table 7*, participants' comments on new features are paraphrased. (In some cases, these ideas were posed by the focus group moderator. In other cases, they were initiated by participants.)

Table 7 – Telematics users' comments on and ideas for new features

New features		
Rejected	**Divided**	**Supported**
▪ Mobile shopping ▪ Compose email in car ▪ High data costs from downloaded content (music, maps, etc.) ▪ Navi can be detached and as PC	▪ Banking in car ▪ Video-on-demand in car ▪ Internet access in car ▪ Portable navi for use in and out of car	▪ Call-center service added to car-navi system ▪ Music download and transfer out of car ▪ Downloadable karaoke ▪ Latest maps downloaded and stored ▪ Information screened by preference, not just location ▪ Info on nearest hospital ▪ Show location of friend's cars on map ▪ Check car email anywhere ▪ Sharing info across car-navi, PDA, and home ▪ In-car ads that reduce the customer's subscription cost but are screened by preference ▪ Check on the status of your home from within your car; control home electronics (i.e., remotely check and lock your front door) ▪ Notification via hand-held phone if something happens to the car while you are not in it ▪ Services will be great for very busy business-people or salesmen

Two popular items are music download and updated maps. An additional theme in the ideas supported above is that to be relevant, even location-based information must be screened based on preference, not just location. That is, users do not want to wade through data. They want to obtain useful information with minimal search effort.

Finally, when asked in exit surveys about their attitudes regarding two service options (a high-end option which would function like a 3G versions of their current systems; a low-end option based on a smaller portable screen with downloaded maps plus a live advisor) current telematics users on average preferred the "high-end" concept even though the "low-end" concept would reduce purchase cost. Top-two-box interest and purchase-intention levels for the high-end service were much higher than levels for the low-end service.

8.1.4.2.3 Telematics Rejecters

Of the 17 rejecters of telematics services, 15 own and use navigation systems. Of the 15 navigation systems, 5 have telematics capability that the user has chosen not to activate. Others have heard of telematics service but declined to install a system that would enable them to subscribe to it.

8.1.4.2.3.1.1.1 Attitudes of telematics rejecters

In Table 8, we summarize telematics rejecters' comments on and ideas for telematics features.

Table 8 – Telematics rejecters' comments on and ideas for telematics features

Features		
Rejected/Unsatisfactory	**Divided**	**Supported/Satisfactory**
▪ Verbal route description from a live advisor (too complicated to understand or remember) ▪ Being dependent on live advisor for the route ▪ Wireless shopping for physical goods from car ▪ Composing e-mail in car ▪ Receiving e-mail in the car if you have to pay additional service provider for it ▪ Location-based incentives while driving (too distracting) ▪ Complication of existing navi ▪ Voice-rec on navi rarely works	▪ Ads (not coupons) to reduce the service's cost ▪ Maps downloaded to vehicle instead of disk-based service (concern about cost, service coverage)	▪ Live advisor to set a destination on your navi (i.e. CompassLink) ▪ Live advisor to consult when lost or in an accident ▪ Online banking in the car as better alternative to phone-banking ▪ Buying tickets on car screen as alternative to i-Mode screen, which is too small ▪ Navi system having information like that of guidebooks ▪ Music download if music is portable and not too costly ▪ Local car-park availability based on GPS ▪ Restaurants in the local area; other info based on location and what I want to do or need at the time ▪ Checking e-mail in a traffic jam ▪ Location-based ads, especially if they can be filtered by preferences ▪ Location-based incentives while parked ▪ Vehicle certificate, manual, and maintenance history in navi ▪ Voice recognition if it can be made to communicate like a human ▪ Voice recognition to simplify navi operation ▪ Automotive link/monitor that tells you what's wrong with the car so that you know before bringing it in for service ▪ Detachable navi that can be moved to back seat or different car ▪ Portable navi that can be used outside the car (wireless internet access, PC, etc.) ▪ Good for those driving a long time daily

These rejecters of telematics generated an impressive list of potential telematics features, some of which are already available. The group was not directly asked to discuss reasons for rejection. However, Table 9 lists reasons for rejection that are consistent with the data in Table 8.

Table 9 – Reasons for rejecting telematics

1. *Telematics will be too distracting and therefore dangerous while driving.*
2. *Telematics is too expensive.*
3. *I don't spend enough time driving for telematics to be worthwhile.*
4. *Telematics will be too difficult to use.*
5. *Telematics will not help me navigate better (my primary interest is navigation).*
6. *Telematics does not provide me with enough services that interest me [customers' interests varied widely].*

Finally, when asked in exit surveys about their attitudes on the two service options ("high-end" and "low-end") telematics rejecters expressed little preference. Top-two-box interest and purchase-intention levels for the high-end service were similar to those for the low-end service.

8.1.4.2.4 i-Mode Users

Of the 18 i-Mode users, only 6 owned car-navigation systems. If asked which one they prefer, members of this group on average favor the low-end service (based on down-loading) to the high-end service (based on CD/DVD ROM). Top-two-box interest and purchase-intention for the high-end service were substantially lower than corresponding levels for the low-end service. The higher levels of preference for low-end services than other groups may indicate greater price-sensitivity and/or levels of experience and comfort with mobile downloading.

8.1.4.2.5 Quantitative Summary

In the quantitative surveys, all participants in the Concept A study were asked to rate the attractiveness and importance of a number of features. Features that had top-two-box averages on both dimension greater than 50% are listed here.

1. Downloadable maps

Participants found this attractive as a way to maintain the most up-to-date routing information, especially if the downloaded information could be stored for later use. However, there is apparent price sensitivity to this function, as cost of data download was a frequently mentioned concern.

2. Location-based information

Up-to-date information about local surroundings was highly valued, including information about tourist attractions, weather, entertainment, dining, parking, and hospitals. One person mentioned that they wanted to see pictures of restaurants on their navigation screens in order to make a better choice. It was emphasized by several participants that location-based information must be filtered based not only on location, but also by users' personal preferences and by their interests at a given time. People do not want to wait for download of information that is not useful to them, nor do they want to sift through pages of text in their cars.

3. Links to car audio and music download

In-vehicle music download was one of the features that generated a significant interest and importance level among participants. However, it was emphasized that music should be storable for later use. Optimally, it also would be portable for use outside the car (home, portable music player, etc.).

4. Safety and security features

Overall, safety and security features such as theft tracking, automatic airbag deployment notification, and on-call emergency support generated a great deal of interest. The telematics rejecter group placed particular emphasis on such services, ranking it third out of sixteen features surveyed. Other audiences ranked it substantially lower.

5. Voice recognition

Assuming it could be made to have high recognition accuracy (e.g., far better than current systems), voice recognition was deemed strongly appealing.

6. GPS

Participants appreciated the importance and attractiveness of GPS in the operation of these systems.

Location-based advertising acceptable

In addition to the features listed above, a large fraction of participants appeared willing to tolerate location-based incentives and advertising, provided that these reduce the prices they pay for service, and provided that users have the ability to "opt-in," selecting the types of ads or coupons that they receive. Only 21% of participants felt that location-based ads would be either unattractive or very unattractive.

8.1.5 Concept B - North American OnStar

The primarily lessons from research on North American OnStar are summarized here.

8.1.5.1 OnStar safety and security plan well received

Overall 73% of attendees indicated that they were interested or very interested in the basic package (safety & security), and 58% indicated that they would probably or definitely consider subscribing. In focus groups, participants found vehicle theft tracking especially interesting.

8.1.5.2 Premium services much less popular

A minority of participants expressed interest or purchase intent for the premium plan, which includes non-emergency support such as route assistance and concierge services.

8.1.5.3 Personal calling and virtual advisor also relatively unpopular

Personal calling was appealing to a relatively low fraction of respondents. This lack of popularity was most extreme in the 18-34 year-old age-group, in which very few expressed interest or consideration to purchase. In informal polls taken within the focus group interviews, nearly all participants indicated that they use cell phones in their cars. However,

only a few polled said that they used a hands-free kit or expressed any intention of purchasing one in the future. Despite Japanese laws to the contrary, participants regularly and comfortably use cell phones in their vehicles while driving.

Virtual advisor was found most interesting to participants in the youngest age group, within which about a quarter indicated interest and intent to consider purchase.

8.1.5.4 Pricing estimates

In exit surveys, participants were asked to estimate the expected price and their willingness to pay for service elements discussed in the focus group interviews. Whereas OnStar premium and basic pricings in the U.S. differ by about $200 per year, respondents in these focus group indicated that they were on average not willing to pay any more for premium services than they were for basic services. OnStar premium services were perceived to add little incremental value above that provided by basic service.

8.2 SYNDICATED STUDY

GM also participated in a syndicated quantitative study of the interests and usage patterns of Japanese drivers with respect to automotive information technology.[7]

8.2.1 Phase 1 – Safety and security features found interesting

The initial phase of the study was a large scale survey (with several hundred respondents) directed at understanding drivers' attitudes and current usage of various information technology in and around driving (9). This included car navigation systems, cellular phones, web-enabled cellular phones, and multimedia equipment, as well as other technology and capabilities that are currently unavailable.

The primary lesson from Phase 1 was that despite opinions of industry experts that Japanese consumers would not care for functionality focused on safety and security, drivers indicated substantial interest in it. Participants were asked to indicate how appealing it

[7] Because this was a syndicated study to which GM does not own full rights of reproduction, the results are only alluded to here in summary fashion.

would be to "have a button" in their car that could be pushed to obtain remote assistance in an emergency situation. Respondents indicated more interest in that feature than in any other tested functionality:

8.2.2 Phase 2

The second phase of the study included a conjoint analysis of preferences of both car-navigation owners and non-owners regarding various service options (10). The functionality tested is shown in *Figure 18 – Options Tested via Conjoint Analysis.* Primary lessons from Phase 2 are summarized in this section.

Figure 18 – Options Tested via Conjoint Analysis[8]

		1	2	3	4	5	6
1	Voice Communication	Cell phone	Cell phone + Hands free	Cell phone + Hands free + Voice command	Cell phone + Hands free + Operator(50yen)		
2	Communication Using Text Message/E-mail	Cell phone	Cell phone + Monitor	Cell phone + Monitor + Vocalization			
3	Set Destination	Map disk	Information center(30yen)	Operator(50yen)			
4	Route Guidance	Symbols	Voice guidance	Symbols + Voice guidance	Map + Voice guidance	Latest Map + Voice guidance(300yen)	
5	Information Retrieved	Destination related information	Destination related info. + Search area service (*)	Internet full access			
6	Emergency	Cell phone	Emergency call button(3,000yen/year)	Automatic emergency call(10,000yen/year)			
7	Music/Karaoke	Radio	CD/MD/Cassette	On-Demand(100yen/song)			
8	Highway	without ETC	with ETC				
9	Portability	In-vehicle only	Both in and outside vehicle				
10	Monitor Size	43 × 32mm	60 × 60mm	75 × 128mm	88 × 155mm		
11	Price	30,000 yen	50,000 yen	70,000 yen	100,000 yen	150,000 yen	200,000 yen

(*)In addition to information related to the destination, one can also get the latest information on events, sales, etc. occurring near the current location.

[8] ETC = Electronic Toll Collection

8.2.2.1 Usage of navigation systems about to explode

The majority of respondents indicated intention to purchase a navigation system for their next vehicle. This is consistent with the smaller study conducted by GM.

8.2.2.2 Emergency functionality appears important, but willingness to pay for higher service levels is questionable

Results of Phase 2 with respect to overall utility of emergency functionality were inconclusive. Emergency-related options tested (including cell phone usage, an emergency button, and automatic emergency notification) accounted for approximately 7% of overall utility. However, the exact interpretation of this data is obscure, albeit not a good sign for OnStar. Automatic emergency notification (at a subscription fee of merely $100 per year) was ranked in such a manner as to indicate that it provided less utility than cell-phone usage. It is not clear how this should be interpreted. However, the highest utility implementation was a simple button that, for $30 per year, could be pushed in the event of emergency.

8.2.2.3 Live advisor services for destination setting questionable

The utility of a live operator who for a fee of 50 cents would help set navi destination was judged as rather low – indeed, it was ranked lower than reliance on map-disk alone. Again, the precise interpretation of the survey (not available to the author in English at the time of this writing) was somewhat unclear. In any case, the overall dispersion of utility for the category, 2%, indicated that the issue itself was not of great importance in the context of other choices tested.

8.2.2.4 Method of Route Guidance: When coupled with voice synthesis, symbols provide a large fraction of the utility attainable by full blown navi maps for some groups of customers

This overall category of choice accounted for 12% of overall utility. "Map plus voice guidance" obtained the maximum utility. However, "symbols plus voice guidance" obtained on average 70% of maximum utility for all respondents, 75% of maximum utility for respondents who do not currently use navigation systems, and almost 90% of maximum

utility for respondents who bought lower-priced navigation systems (i.e., those costing 150,000 yen or less).

8.2.2.5 The most important issue was electronic toll collection

This category alone accounted for 17% of the variation in utility.

8.2.2.6 Price accounted for 10% of overall utility

The price decision for the navigation system accounted on average for about 10% of overall utility. Maximum utility was attained at a price level of 70,000 yen. Minimum utility occurred at 200,000 yen.

9 BUSINESS EVALUATION OF MOBILE SERVICE OPTIONS

9.1 NORTH AMERICAN ONSTAR MODEL

9.1.1 Customers: Inferences from Market Research

Based on the market research for Concept B, there is a large segment interested in OnStar's basic plan. The study of Concept A provides additional support to this conclusion: safety and security ranks among those features most interesting to Concept A participants as a whole, and it appeals particularly strongly to telematics rejecters.

Since the safety & security package provides no regular navigation support, candidate customers for OnStar's basic service include both users and non-users of car navigation systems. Market research is consistent with the following characteristics of potential customers of OnStar's basic plan:

- they will pay something for services that protect them, their families, or their belongings from the effects of accident or theft
- they spend at least as much time in the car as the average driver, and probably more
- they value simplicity, and may have rejected a car-navi system because of cost or perceived difficulty of operation
- if they do own a car-navi system, they may have rejected telematics with an 'information' or 'recreational' focus because they feel it is frivolous, dangerously distracting, or too difficult to use

Analysis of the focus groups also indicates that a small but significant segment will be interested in OnStar's premium services. However, the RouteAssist service of the premium plan needs to be modified based on the market research and background analysis. The complexity of Japanese roads and addressing and the high level of usage of more sophisticated navigation services makes it unlikely that route guidance can be satisfactorily provide via human operators. A more viable option from a customer perspective would be to operate RouteAssist services in the spirit of the Compass-Link call center, providing destination-setting assistance and route advice to navi owners. Verbal route guidance by an operator may also be useful outside of cities or when a driver can consult a map. That said,

the following additional characteristics of potential customers for premium services are consistent with the market research:

- they spend more time than average in the car and tend to take more long trips on the highway than subscribers to the basic plan
- they may use their car for business purposes
- they are quite busy in their daily lives
- they reject complex systems

Customer response to options outside the two service plans is likely to be subdued. Market research has shown that the appeal of "personal calling" services is slight at best – most Japanese are quite comfortable continuing to use their cell phones in the car. It is very unlikely that many would pay a premium over current wireless prices for the right to use what amounts to a hands-free cell phone. Likewise, "virtual advisor" service does not currently hold much appeal to the broader population. However, it may appeal to some users of premium services, who probably drive more frequently.

9.1.2 Partners

Implementation of this model would necessitate OEM agreements with various Japanese vehicle manufacturers. This should be easiest to do with GM's Japanese affiliates. However, the scale enabled by such relationships alone is not sufficient to sustain a worthwhile business (see section 9.1.7).

GM would therefore need to look outside its affiliates. In this, it would need to overcome the fact that major automotive manufacturers in Japan already have their own approaches to the provision of telematics services. Thus, closing a deal would in many cases entail convincing a manufacturer to adopt an additional, competing approach to telematics.

The strategy for doing so would be based largely on OnStar's differentiation as a provider of safety and security services. I.e., given the significantly reduced costs and safety/security-focus of OnStar systems verses others, it could be argued that OnStar systems are designed to satisfy a different, non-competing set of needs than manufacturer-operated approaches. Thus, any revenues produced by OnStar systems would supplement those produced by

manufacturer systems, not compete with them. OnStar service could also be provided as an "option" within the context of manufacturer-operated systems.

However, an approach which differentiates OnStar as a provider of safety and security is strategically questionable over the long term, as it may limit opportunities for future growth outside of safety and security services. Additionally, OnStar may face the threat of backward integration of current telematics operations to include OnStar functionality within their own systems. Many existing telematics operations already operate a call center, and it would seem feasible to extend these operations to serve customers' safety and security needs, especially as navi costs drop to make it more broadly affordable.

A related question is whether, in a market which converges on modified navi as a telematics platform, customers will tolerate and pay for *two* brands and associated relationships. If not, then OnStar may have to function as a supplier that is invisible to the customer, with the manufacturer-operated telematics operator maintaining the real face with the customer and controlling access to future revenue streams. This would clearly limit OnStar's ability to charge needed margins for its services. (This issue is addressed in the financial model of section 9.1.7 by providing a variable percentage of subscription revenue to OnStar's partners.)

Finally, OnStar will face a substantial initial hurdle created by the need to convince auto manufacturers that their customers are interested in OnStar functionality: The consensus opinion at OEMs and other industry participants is that Japanese customers are not interested in services centered around safety and security. Additional, more rigorous market research might be needed to convince them that their customers will value these services.

9.1.3 Suppliers

Wireless cellular services in Japan are provided by three major suppliers. Market leader NTT DoCoMo is the dominant player. It is part of NTT Communications, a former government monopoly in which the government still owns equity. NTT DoCoMo has a 60% share of the market for wireless services, is the only carrier with complete nationwide coverage, and generally leads other carriers in new service provision by 6 months to a year. Of the other

two players, one, KDDI, is heavily backed by Toyota Motor Corporation, which owns its own telematics service and has already chosen to utilize Japan Mayday Corporation for its safety-and-security-related services. The remaining player is Japan Telecom, which runs cellular services under the J-phone name. As the last-place player with a history of grabbing market share through low prices, J-phone may be the most logical party to approach for a re-sale agreement or purchase of bulk minutes. It is also the only carrier known to have excess spectrum available. However, initially OnStar will only be able to guarantee usage from within a relatively small base of GM-affiliated installations. Thus, OnStar is unlikely to extract high margins from cellular wireless operators.

Indeed, any competition in the cellular market will work against OnStar in some ways. According to market research customers are comfortable with the use of their cellular phones while driving. They are therefore very unlikely to pay any premium vs. normal handheld services, and the lower the price of cellular services, the less customers will be willing to pay for in-vehicle "personal calling.[9]"

9.1.4 Competitors and Substitutes

OnStar will face a number of competitors, some of which focus on similar market segments and some of which do not do so currently, but may present a threat in the future.

Direct competition will include the "Helpnet" service by Japan Mayday, Inc., as well as Daimler-Chrysler's E-call service. Helpnet is focused on emergency response assistance, as is E-call. The low pricing of both providers will present an issue for OnStar. Helpnet, if it is to be believed, plans to charge only 4000 yen annually, less than $40 per year or $4 per month. Daimler-Chrysler's ITGS/E-call service is apparently being sold for 1000 yen per

[9] Unless 3G creates tremendous excess capacity for voice calls. This is an unknown based on how quickly 3G bandwidth is filled by bandwidth-intensive applications. Naturally, wireless carriers are working as hard as possible to facilitate the latter. In addition, it is likely that 3G deployment will go through a gradual ramp over a period of several years.

month, or less than $10 per month. ITGS/E-call includes convenience services (via screen-based telematics) as well as emergency services. However, OnStar may be helped by the high cost of traditional telematics equipment for the ITGS/E-call approach: the typical price now being charged for equipment that adds telematics capability to navigation systems is 40,000 to 60,000 yen, or $400 to $600. This price is in addition to the price paid for navigation equipment, which is 100,000 yen at minimum. . Mayday also is tying its services to navigation systems as a base platform. OnStar should be able to charge significantly less for its hardware (U.S. retail pricing is between three and six hundred dollars depending on the service), and may therefore still be able to charge a slight premium vs. ITGS/E-call for service provision. However, if Mayday truly operates its "Helpnet" service as a "non-profit" (which it appears to have the intention of doing) this could make it extremely difficult for OnStar to beat Helpnet on pricing, either with customers or in negotiations with automotive manufactures.[10]

Neither E-call's nor Mayday's services are currently as rich as OnStar's. They do not provide vehicle theft tracking or extensive integration with vehicle electronics. The same is true of Mayday. However, nothing significant stands in the way of either firm initiating those services (such as vehicle theft tracking) that do not require extensive vehicle design work.

Mayday, because of its ties to Japanese automotive manufacturers, may present the highest threat, especially if it can lock OnStar out of accounts at OEMs. Only time will tell. If Mayday or Daimler Chrysler exploit their early-mover advantages to contract with automotive OEMs before OnStar enters the market, it will be difficult to displace them: relationships are very important in Japanese business.

Nissan Compass-Link, which operates a call center for Nissan, Mitsubishi, and for the BMW Assist service, already competes in the "convenience" / "concierge" space. Again, if there appears to be an opportunity to do so, there may not be a lot (government approval processes aside) to prevent if from extending its operations into the safety and security space. However, its ties to the number two Japanese automotive manufacturer may prevent it from gaining many more contracts with automotive OEMs.

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[10] Alternatively, its non-profit nature could mean that it is not aggressive and not a competitive threat.

Also, if OnStar attempts to supply the safety and security functionality for the Japanese telematics systems of automotive manufacturers, it may face potential "backward integration" by other telematics services. However, this might be difficult since the approval cycle for domestic firms to start an emergency call center is likely to take several years. CompassLink could face the same problem – of course, it is not known for certain that they do not already have future plans to provide such services, in which case they would be likely to be part way through the application process. But it is more likely that they are depending on Helpnet to provide these types of services.

Nevertheless, OnStar will have a price advantage vs. other telematics approaches for those customers who are not interested in purchasing a navigation system, since OnStar allows avoidance of the big upfront cost of navigation equipment. However, E-call is likely to have the same sorts of capabilities, if it so chooses to deploy them. And additionally, as a consumer electronics item, cost of navigation equipment is moving ever downward.

Lastly, the Japan Automotive Federation (the Japan equivalent of the American Auto Association) provides roadside assistance to over 40% of Japanese drivers.

9.1.5 Capabilities

OnStar is probably better than other operations at performing the vehicle integration required. Therefore its ability to execute is probably superior to other entities that might attempt to compete directly (e.g. Daimler Chrysler E-call or Mayday). However, this must be weighed against the lead in time-to-market already enjoyed by these firms. In fact, an option that should be explored would be an arrangement to utilize Daimler E-call infrastructure as call center, as opposed to OnStar doing its own IT call center integration.

9.1.6 Barriers to Entry

GM as an international company has advantage verses local operations in that it can use international political relationships to speed the approval process for an emergency call center. Also, non-recoverable promotional expenses on the order of hundreds of millions of dollars are required to compete effectively in a consumer business of this sort. Taken

together, these two factors (and especially the former) may protect OnStar and its known direct competitors (Daimler E-call and "Mayday" services) from further direct competition within a niche of services focused on safety and security.

9.1.7 Financial Analysis

The financial model used here is a simplified version of the model used by OnStar in its initial evaluation of international expansion opportunities. This allows easy reference and comparison between model parameters before and after the study described in this document. However, by design, the model's simplicity also protects all detailed information about OnStar cost and margin projections for the various services, at the same time preserving enough structure to make possible a reasonable assessment of the business opportunity under discussion here.

The model encompasses three revenue streams. First, it includes revenue from services provided under a basic subscription plan centered on safety and security. Second, it considers revenue from premium subscriptions, which comprise basic service plus route guidance and concierge services from a live advisor. And third, it accounts for revenue generation from hardware sales – the equipment required in each vehicle in order to enable service.

The basic sales approach taken by OnStar during its growth phase is to provide the first year's service free. In the model, hardware is priced in such a manner as to offset the costs of providing a year's free service. That is, the gross margin on hardware sales to a given customer is approximately equal to the expected cost of serving that customer during their first year of subscription.

Model input parameters are described in *Appendix A: Model Parameters for simplified OnStar financial model.*

Note that the model considers only factory-installed implementation, not aftermarket approaches. Therefore service launch only occurs in 2003, after a substantial period of design activities needed in order to integrate OnStar services in a factory-installed fashion.

Also, note the use of the designation of "relevant" vehicles. The definition used in the initial study was as shown in Table 10.

Table 10 – Definition of 'Relevant' Vehicles for North American Vehicle Market

Vehicle Segments Included	Vehicle Segments Excluded
• Car High, Sport High, Large, Upper Medium, Intermediate • Truck / Commercial Large Utility, Medium Utility Large Family Wagon, Large Pickup, Medium Van Large Van, Light Commercial Medium/Heavy Passenger Car Derived	• Car Mini, Small, Lower Medium Small Family Wagon, Sport Low • Truck / Commercial Small Van, Medium Pickup

However, this definition is over-restrictive for the Japan marketplace. Japanese drive smaller cars, and they more frequently equip them with aftermarket electronics (the most common of which is the Television, followed by navigation systems). Thus, for the purpose of the study documented in this paper, a different definition is used.

Included: all passenger cars and trucks *except* mini-vehicles.

Excluded: mini-vehicles.[11]

That said, values for each parameter were inferred based on the market conditions described in the current study. These are compared in *Appendix B: Values of OnStar Financial model parameters* to values used for the initial financial assessment of the Japan opportunity.

[11] For the purposes of this document, since a detailed break-out of mini-vehicles by manufacturer was not available for non-GM-affiliated manufacturers, the number of mini-vehicles for each non-affiliated manufacturer are estimated based on the following algorithm: Total mini-vehicles = mini-cars + (21%) light-trucks. This estimation results in the appropriate number of mini-vehicles for the market as a whole. These mini-trucks are mini-cars with cargo space, either open (like a pick-up) or closed (like a van). Note that the correct percentage is used for GM-affiliated OEMs, since this data was available at the time of this writing.

Under the assumptions made, if OnStar obtained contracts with GM-Japan and its affiliates, but failed to obtain agreements with other auto manufacturers, this would amount to a 48 million dollar loss in today's dollars, or NPV = (48 million). See *Appendix C: Example financial valuation – OnStar Japan serving GM-Affiliated customers only.* In order to achieve NPV = 0, the amount of the total marketplace from which GM needs commitments is 16%. This is about 24% (almost 1/4) the volume of all non-mini passenger vehicles. Roughly 8% of this share of non-mini vehicles can come from GM and its affiliates. It would thus need a contribution of about 16% of non-mini vehicles to come from non-affiliated manufacturers. Stated in yet other terms, it needs commitments from non-affiliated manufacturers representing about 17% [i.e., 16/(100-8)] the volume of all non-mini vehicles sold by non-affiliated OEMs. Thus, glibly, GM would need to convince about 1/5 of its non-mini competition in Japan to adopt OnStar service in order to break even in the sense of positive NPV.

What would this mean if put in terms of agreements with specific manufacturers? Toyota, with 41% (vs. the 16% required) would be more than adequate, as would Nissan. However, no other single manufacturer would be adequate. Aside from that, contracts with multiple OEMs would be needed. Honda, with 12% of the relevant market, would be the next recommended target.

Other Manufacturer	Manufacturer's Share of Total Market	Percent of Mfr.'s Vehicles that are relevant (i.e. non-mini)	Mfr.'s share of the non-mini market-place
Toyota	29%	94%	41%
Nissan	13%	94%	19%
Honda	12%	66%	12%
Mitsubishi	10%	61%	9%
Mazda	5%	85%	7%
Daihatsu	9%	30%	4%

These results are highly sensitive to retention-rate (1 - "churn" as expressed in telecommunications circles) and to OnStar's penetration of relevant vehicles. Thus, if

OnStar can achieve higher retention-rate or penetration rates than the values assumed in the model, the fraction of volume needed from competitors will decline.

9.1.8 Conclusions

The business case for OnStar services in the tradition of the North American model is marginally viable but highly sensitive to retention-rate, penetration rate, and the fraction of non-GM-affiliated manufacturers that OnStar can sign up. From a practical perspective, one major OEM (i.e. Toyota, Nissan or Honda) is needed to justify the endeavor on financial terms. However, as of last fall no manufactures appeared to have expressed interest in such collaboration. To be truly attractive, the OnStar business model needs adaptation to competitive and market conditions in Japan.

9.2 SERVICES BASED ON THE EXISTING ARCHITECTURE FOR CAR NAVIGATION SYSTEMS IN JAPAN

9.2.1 Customers: Inferences from Market Research and Market Trends

Drivers are interested in a wide variety of services that will soon be supported via telematics on navigation-based platforms. As cost per bit decreases and technology improves, potential services will evolve beyond text-based information to include features that are interesting to more people. Additionally, existing services will be provided in a manner that is simpler and easier to use. Significant new features will include music-on-demand, photos of recreational locations, downloads of updated map information, and more accessible and varied location-based information (to match the interests of more people). Aside from the growth in bandwidth provided by the move to 3G transmission networks, these features will be enabled by improved voice recognition, the proliferation of standards for location-based data via GPS, and more widely used personalization engines to provide a filter for information transmitted to the end user.

In addition, as these technological enablers evolve to support it, opportunities will increase to provide meaningful, targeted advertising to customers on the go. These will be tolerated so long as they are truly relevant to customers' needs (e.g. location-based and screened

according to customer preferences and interests at the time) and customers have the ability to opt-out.

Many of these trends are occurring in handset as well as navi-screen channels of distribution. However, navi-screens have three differences from handset markets that will require fundamental modifications to handset services:

1. Screen size

   Because the screen is larger, data is more readily accessible on a car-navigation screen than a handset screen.

2. GPS

   Location-based information will be available sooner and more easily in the vehicle than on the handset

3. Travel

   Even more than with handsets, the central "mission" people have while they are connected telematically is to travel from point A to point B. Therefore content that is relevant to this purpose is will more likely meet the average user's needs than content that is not. This means that the most rapidly adopted content will helps customers with one of the following: (a) how to 'get there'; (b) where to go; (c) what to do when they arrive; (d) having a better experience on the way (entertainment, productivity) *without* jeopardizing their core purpose of transportation. In the Japan environment, where long trips are less common and directions are more complicated, the market has already rapidly embraced one application that fulfills the first part -- navigation tells people *how to get there.*

As bandwidth increases, standards for location-based information proliferate, and navigation systems continue to add telematics capability (particularly capability that provides more open access to a range of content sources), firms will become aware of the opportunity to gain

distribution over navi screens, and will construct content sources and applications that justify audience interest, just as has happened with i-Mode in the handset world.

However, because Japanese customers spend less time in their cars or on highways, and therefore have less attention to dedicate to these services , costs will have to fall low enough and services will have to become compelling and simple enough to be worth the price and attention paid to them. Again, this will happen as transmission speeds increase, cost per bit decreases, more open standards take hold, and enabling technologies like voice recognition and personalization become better developed and more prevalent.

Especially if this happens in a world where content is open (positive indications that this will occur are described in Section 4.4) then there will be large opportunities for "content aggregation." That is, many customers will appreciate it if someone helps select, organize, integrate, and make the best content accessible to them, just as Yahoo, MSN, or AOL attempts to do in the fixed internet world.

9.2.2 Competitors and Substitutes

Even if it is able to obtain the *best* partners, GM will still have significant competition in this area. Internet portals that are likely to have interest in this business include AOL Japan (now funded as a joint venture with NTT DoCoMo), Sonet (a Sony ISP), Yahoo Japan, and several other well-funded ISPs and portal pages.

Wireless carriers will have an interest, too. Potentially the strongest overall competition from any source may come from NTT DoCoMo, which already has a car-navi offering in exactly this area. It appears to be transferring its i-Mode business model to the car-navi world: that is, NTT DoCoMo will be the content aggregator, billing entity, and face with the customer (see Figure 12 – Value chain for NTT DoCoMo's i-Navi-Link). KDDI, which is part-owned by Toyota Motor Corporation, has been involved in supplying cellular communications services to telematics services for several years and also appears to be opening up access to their handheld EZ-web service via car-navi. And J-phone has already pioneered the availability of location-based maps on handhelds and adopted the Honda system for transfer of location-coordinates.

Existing telematics services will naturally plan to migrate their services in the most profitable direction. Those which are attached to individual automotive manufacturers may have some difficulties serving competitors through factory-installed implementations of equipment. However, (a) if standards become more open, customers may be able to subscribe to any service they want, irregardless of who installed the system; (b) industry coalitions for mutual gain do and will continue to exist – e.g. the Nissan/BMW/Mitsubishi usage of the CompassLink system.

Finally, car-navigation manufacturers themselves have begun to bundle telematics services within their systems, and constitute potential competition especially if their work on open standards goes beyond hardware and software protocols toward creation of a shared car-navigation portal (recall *Figure 14 – Press release: consumer electronics firms cooperate on standards for internet-enabled car navigation*).

9.2.3 Capabilities

GM's capabilities and strategic assets pertinent to the operation of this type of business in Japan are weak. OnStar in the US has focused its operations on "hands-free" technology designed to operate independently of a car navigation system. Furthermore, it does not actually own capabilities in voice recognition (except a small share in General Magic), and has no experience in Japanese-language voice recognition. Existing Japanese players (car-navi manufacturers and telematics providers) already do.

As a potential provider of emergency-support technology and services (i.e., those relied upon in the "base" OnStar package in North America), OnStar may have capabilities to contribute. However, as discussed in section 9.1.4, it already has potential competitors in this arena (Mayday, Daimler-Chrysler E-call), and it is unlikely that provision of these safety/security services will enable it to partake of revenue streams in the areas of information/entertainment, productivity/convenience if the core capabilities for providing those services originate with other firms. Fundamentally, safety and security services are useful, but not essential for a vehicle-centric mobile content aggregation business.

Finally, as we have seen in the financial analysis of section 9.1.7, the relevant Japanese affiliates of GM do not account for a financially significant volume in vehicle sales (the total number of *relevant* customers is of such a small scale that it is far from being able to collectively sustain an OnStar-like business). Mini drivers are very unlikely to install a navigation system which is 10% to 30% of the price of their vehicle.

Furthermore, since there is no direct relationship between the automotive manufacturers and the majority of their existing drivers, GM cannot utilize existing drivers of GM-affiliated vehicles to help initiate a business in this area without incurring significant upfront costs of customer acquisition (the affiliates do not even have access for marketing purposes to existing drivers' names and addresses). Such upfront costs are likely to be of the size that they would decrease the net value of these customer relationships to the point where they represent only a slight improvement over acquisition of unrelated customers.

9.2.4 Partners

Due to a lack of core capabilities that are required to compete in this area, GM would need to develop business relationships with multiple Japanese partners in order to launch this business. However, because GM even lacks a significant customer base for such a venture, there is little of local value that GM can offer partners that would entice them into a relationship on terms favorable to GM.

Of course, GM can offer access to capital. But this in itself will be insufficiently appealing to the firms that would be required to be competitively viable: major consumer electronics corporations, wireless carriers, automotive manufacturers, and established portals or ISPs. These are *not* startups, and are therefore unlikely to have any more trouble raising capital than GM (despite its enormity).

In fact, GM's meaningful strategic resources and capabilities all lie overseas.

9.2.5 Conclusions

The single perspective under which GM's involvement in this venture might have significant value as an independent Japanese business (both for potential partners, and for GM) is the international one, which we explore in the next section.

10 THE "INTERNATIONAL CARD"

GM has vehicle sales worldwide, and therefore the potential attraction to a local player of teaming up with GM in its local market may go beyond local considerations. More specifically, could GM leverage its global scope in relationships with potential Japanese partners in such a manner as to entice those partners into providing the support it needs to create a viable content aggregation business? Although GM has little to offer potential partners in the Japan market, should it attempt to justify their support via promises of increased collaboration internationally?

There are at least two aspects to consider in addressing this question, *could* GM accomplish this given organizational structure and strategies, and *should* it even want to. The first part, implementation, requires a more thorough look at GM's organizational structure in areas related to mobile services.

10.1 ORGANIZATIONAL ANALYSIS

The e-GM organization is an operating division of GM based in the Detroit area. However, it also has international units. These outposts have dual-reporting responsibilities, both into e-GM headquarters in Detroit and to GM international operating units for their region. For example, e-GM Japan reports into e-GM Asia Pacific (responsible both to GM Asia Pacific Automotive Operations and to e-GM headquarters in Detroit) as well as directly into e-GM headquarters. In general, funding for projects in e-GM Japan can come from either GM Asia Pacific or from e-GM headquarters.

OnStar, as a sub-unit of the e-GM division, obeys the same reporting structures. However, global expansion of the OnStar business raises fundamental and challenging questions about its optimal role in the GM corporate portfolio.

In the US, OnStar has announced that it is providing service to Honda (through Acura) and Toyota (through Lexus). By serving GM competitors, OnStar behaves as would an arms-length subsidiary that maximizes profits separately from its parent. Certainly, if OnStar was

not perceived by OEM customers as acting independently of GM, it would be very difficult for it to provide credible service to GM competitors.

However, OnStar is also a strategic resource in GM's corporate-level automotive portfolio. In that case, it should be deployed by GM in such a manner as to advance GM's integrated strategic objectives worldwide. Close relationships to GM's international automotive reporting units would then appear good way to accomplish this integration Like e-GM, OnStar then maximizes its value by acting as a resource for other GM units.

Whereas automotive OEM customers naturally desire an OnStar independent of its corporate parent, GM's international automotive groups benefit by maintaining a higher degree of exclusivity over OnStar capabilities. Such conflicting pressures must be carefully managed to implement effective global strategy. They create challenges for transnational projects.

10.2 STRATEGIC ANALYSIS

Given organizational considerations, it would be challenging for GM to offer credible international support in exchange for assistance in the Japan market. However, a more fundamental issue is to consider how it would create value by doing so. Unless it identifies some real business synergy in relationships with a potential Japanese partner, GM would essentially be giving away value in one market in order to gain value in another.

For example, take the case of wireless carriers. Let us imagine that GM obtains preferential treatment from a wireless carrier in setting up a mobile service business in Japan (above and beyond that offered by the carrier to other automotive manufacturers). In return, GM (or OnStar) might collaborate more closely with the carrier or its international partners in other regions. However, the US is a far more competitive market for wireless carriers than Japan – no single wireless carrier has a clear advantage over others in cost or functionality. Thus, by giving preferential treatment to a Japanese carrier in the U.S. environment, GM would be giving up opportunities to purchase the cheapest service from the lowest-cost bidder in a competitive and relatively efficient marketplace. Whatever support (and therefore

opportunity for value creation) GM gains in Japan, it would be likely to lose in the U.S. by giving away the chance to buy the best services in the U.S. market.

Giving special privileges to a Japanese carrier only makes sense if the Japanese relationship is going to provide some additional value to the U.S. business. Example might include operational experience, or the chance to transfer technology from Japan to the U.S. From the Japanese wireless carrier perspective, a similar analysis applies. Getting in bed with GM only provides value if GM can provide something extra in terms of insight, technology, or other factors that are critical to its business strategy – something that it cannot easily purchase in the open marketplace.

If the U.S. market evolves in the direction currently followed by the Japanese market (i.e., navigation systems in most cars, with telematics based on these navigation systems) then GM, as the leader in U.S. telematics, can probably provide this value to a Japanese firm seeking to enter the U.S. Given how much time American's spend in their cars, telematics will over the long term be an important consideration in the American business case of any enterprise involved in the wireless industry. However, what would be the value to GM? That value would primarily accrue from the chance to exploit its participation in the Japanese market to learn and develop capabilities faster than competitors "back home." Once developed, these capabilities could be more easily "exported" to the U.S. environment.

However, it appears currently that the U.S. telematics market will not evolve in a "Japanese" direction at all. OnStar is emphasizing a screen-less approach to telematics. They have made this position a core part of their emphasis on safety and security since it minimizes driver distraction. Other U.S. auto manufacturers and consumer telematics firms appear inclined to follow suit.

If this is the case, there will be little applicable knowledge to gain from a Japanese collaboration, and the net value-creation opportunities from the relationship will be slight.

11 RECOMMENDATIONS

Two recommendations for the future evolution of GM-related mobile service businesses in Japan are given below, one for each of the service options tested above.

11.1 RECOMMENDATION FOR CONTENT AGGREGATION CONCEPT A: CONTRACT WITH EXISTING TELEMATICS PROVIDERS TO SERVE GM-AFFILIATES

A content aggregation venture with significant GM ownership utilizing car-navigation equipment as a base platform is extremely unlikely. There are simply too many more experienced players already competing for this market, and GM has too little to contribute locally to such a business to justify an ownership stake among them or a new venture. However, this does not eliminate the potential value to GM-affiliated vehicle manufacturers of being able to offer their *own* customers telematics services in the future.

GM can add value to its affiliates and put itself in a position to gain potentially useful knowledge of screen-based telematics services by organizing interested parties within Suzuki, Isuzu, and Fuji Heavy Industries (Subaru) to jointly contract for telematics services with an emerging provider of such services. By contracting jointly for these services as opposed to independently, these companies can obtain better financial terms, and also have a better chance at negotiating access to future opportunities for value creation. In the negotiations required to contract for these services (primary candidates to approach should include Honda for their InterNavi system, NTT DoCoMo for their i-Navi link, and Nissan for their CompassLink system), GM and its Japan affiliates should push for an arrangement that would allow GM-affiliated companies to maintain the primary interface with their customers (or at least the appearance to customers of doing so), as well as maintain access to data generated from these customers' and their usage patterns. The customer relationship and associated customer data are resources that can be mined for future value opportunities that are difficult to estimate quantitatively, but are extremely important in the current automotive environment, in which manufacturers are beginning to realize and exploit the value of more direct customer relationships.

11.2 RECOMMENDATION FOR CONCEPT B: ADD SERVER-SIDE NAVIGATION

The business case outlined above for OnStar services in the North American model is viable but risky as a consequence of competition and Japanese customer needs that differ from those of North Americans. These factors together with negative industry sentiment regarding the value of safety and security services contribute to high uncertainty about OnStar's attainable level of overall market penetration.

With regard to customer needs, the following differences are central: (1) As a consequence of the complexity and opacity of the Japanese road network, navigation via interaction with a human operator alone would be very challenging, and therefore customers exhibit little interest in route assistance in the style of the OnStar "Premium package." (2) The average Japanese driver spends far less time in vehicle than the average American driver and takes a smaller proportion of longer trips, so their willingness to pay for services intended to occupy idle time in the vehicle is lower than otherwise.

To address these issues and increase overall penetration and revenue from vehicles on the road, OnStar should take two steps if it wishes to launch services in the Japan market:

1. Eliminate the subscription model in favor of a pay-per-use model for all services aside from those related to safety and security.

This would permit customers to use services as needed, thus capturing revenue from customers who anticipate that their relatively rare usage would not justify a fixed subscription fee.

2. Recast OnStar services to include server-side navigation support through low cost hardware available in the aftermarket.

Due to the high price-tag of navigation equipment (150,000 to 200,000 yen and up) and the obvious utility of navigation services on Japanese roads, there is a group of price-sensitive Japanese drivers who would like to have navigation services, but are unwilling to acquire them due to the large upfront investment required. In fact, in a survey of Japanese drivers

who rejected car-navi systems, price was the most frequently mentioned reason for rejection (11).[12] By offering server-side turn-by-turn navigation and specifying a smaller, symbolic (as opposed to graphic-intensive) screen supplemented by packet-based automatic voice-synthesized route guidance, OnStar can partner with a consumer electronics manufacturer to create navigation equipment that requires no CD/DVD-ROM database and has a much less expensive screen. This type of solution is consistent with results from the Phase 2 syndicated study described in section *8.2.2.4 (Method of Route Guidance: When coupled with voice synthesis, symbols provide a large fraction of the utility attainable by full blown navi maps for some groups of customers).* These changes should reduce the price to consumers of navigation equipment by at least a factor of two from current hardware.

Additionally, marketing this equipment through aftermarket auto-shops will expand initial distribution by eliminating the initial need for OnStar to obtain contracts with OEMs that already operate their own telematics services, and it will decrease time to market for launch by removing extensive design activities required for factory-installed vehicle integration from the critical path. It is also consistent with the expressed buying habits and preferences of participating i-Mode users described in sections 8.1.4.2.1 and 8.1.4.2.4.

Finally, it will on the short term remove OnStar from direct competition with telematics players who are pursuing an approach based on traditional navigation systems. Because it would be marketed as a "simple" solution to price-sensitive consumers, OnStar can argue to potential partners that it is expanding the market for telematics services, rather than cannibalizing their other lines of business.

This modification is consistent with OnStar's North American emphasis on simplicity of design and minimization of driver distraction. It is also consistent with OnStar's architectural approach to service provision, which keeps hardware costs low and permits remote upgrades by keeping system intelligence on the server instead of installing it in the car. Finally, the additional work needed to commercialize the system in Japan should be

[12] 53% of respondents mentioned price, which was the most frequently cited reason. 40% said that the information was available on other devices, and this was the second most often cited reason.

leverageable in the US environment since it represents a likely evolution path for current OnStar services.

12 CONCLUSION

Traditional OnStar in the Japan environment, though it appeared to be an interesting opportunity based on an initial assessment of broad market factors, turns out to be marginal and risky after a close analysis of competition, industry structure, industry sentiment, and financial data. A more lucrative opportunity may exist if OnStar can extend its business model to comprehend low-cost, server-side, turn-by-turn navigation as a technology disruptive to emerging navigation and telematics architectures. However, as transmission bandwidth increases, it will be increasing likely that other firms will attempt that approach. Therefore OnStar needs to act fast to evaluate feasibility, gauge customer acceptance, and obtain partners for such a venture.

Second, there is a near-term business opportunity for future telematics services in Japan based on emerging car-navi platforms, but *not* for General Motors and its affiliates. Instead, the relevant value which GM and its affiliates can realize is that inherent in opportunities to get "closer to customers." GM should organize its affiliates to negotiate deals with an emerging provider of Japanese telematics that will enable the affiliates to offer their customers a telematics solution as well as keep the door open on future value opportunities to be gained from developing richer, ongoing customer relationships.

Finally, the "international card" as a means of improving chances for the success of a Japan mobile service venture is limited by: (a) GM's ability to act as a "global" corporation as opposed to just a "multi-national"; (b) the likelihood of divergence between the trajectories of Japanese, screen-based telematics, and North American, voice-based telematics. However, if GM organizes its affiliates to contract for self-branded telematics services in the Japan environment, it will still maintain an opportunity to learn about the Japanese approach. This knowledge will be useful if and when the technologies employed by the North American telematics market-place converge with those in Japan.

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APPENDIX A: MODEL PARAMETERS FOR SIMPLIFIED ONSTAR FINANCIAL MODEL

Model Parameter	Description
Initial Industry Volume (2001)	Total unit passenger-vehicle sales (in thousands)
Industry Growth	Anticipated annual growth in unit sales
Growth in Perpetuity	Growth in free cash flows beyond the initial time horizon of the model
Retention Rate	Percentage of subscribers who continue their subscriptions from one year to the next
Premium Subscription Rate	Price per month of a premium subscription.
Basic Subscription Rate	Price per month of a basic subscription
Percent Basic Revenue to Partners	Percentage of revenue from basic services (not subscriptions) paid to partners.
Percent Premium Service Revenue to Partners	Percentage of revenue from premium services (not subscriptions) paid to partners.
Premium Subscription Penetration	Percentage of subscribers who choose the premium plan.
Activation Rate	Percentage of customers purchasing OnStar-equipped vehicles who actually activate their subscriptions (note that OnStar receives the hardware revenue for vehicle sales irregardless of activation).
WACC	Weighted Average Cost of Capital (financial Discount Rate in valuation)
Hardware Cost per Unit	Cost to OnStar of vehicle hardware.
GM & Affiliates Market Share	Unit market share of GM and its Japan affiliates. It is assumed that OnStar equipment will be installed in some percentage of these manufacturer's "relevant" vehicles (see below).
GM & Affiliates Percent Relevant	Percentage of GM and GM-affiliate vehicles sold that are realistic candidates for installation of OnStar equipment.
Other Manufacturers Market Share	Combined unit market share of the other manufacturers (besides GM or its affiliates) *in which OnStar equipment is being installed.*
Other Manufacturers Percent Relevant	Percentage of other manufacturers' vehicles sold that are realistic candidates for installation of OnStar equipment.
Initial Penetration of Relevant Vehicles	Percentage of relevant vehicles sold that are equipped with OnStar at sale during the year of OnStar's initial launch.
Saturated Penetration of GM & Affiliated Relevant Vehicles	Maximum percentage (achieved over time) of relevant vehicles sold by GM and its affiliates that are equipped with OnStar at sale.
Saturated Penetration of Other Relevant	Maximum percentage (achieved over time) of relevant vehicles sold by other manufacturers that are equipped

Model Parameter	Description
Vehicles	with OnStar at sale.
Years to Saturated Penetration	Number of years after launch before saturated penetration is achieved. During this time period penetration grows linearly from initial penetration to saturated penetration.
Initial Fixed Costs	Initial fixed costs (independent of subscriptions or vehicle sales).
Structural Growth Factor	Percentage growth in fixed costs resulting from a 1% growth in subscription revenue.
Launch Costs	Annual spend (on top of fixed or structural costs) required for OnStar's initial launch. Primarily composed of marketing and promotional expenses.
Launch Duration	Number of years required for launch.
Tax Rate	Corporate tax rate in Japan.

APPENDIX B: VALUES OF ONSTAR FINANCIAL MODEL PARAMETERS

Parameter	Initial	Current	Explanation
Initial Industry Volume (2001)	6400	6015	updated to reflect recent growth figures
Industry Growth	1.40%	same	
Growth in Perpetuity	5%	same	
Retention Rate	75%	70%	lower since competition – customers switch more frequently
Premium Subscription Rate	33.25	28.00	lower due to competition and lack of perceived customer value (see market research)
Basic Subscription Rate	16.60	12.00	lower due to competition (i.e. this is 20% premium over ITGS/E-call)
Percent Basic Revenue to Partners	0%	1.0%	nonzero because of competition
Percent Premium Service Revenue to Partners	0%	0.5%	nonzero because of competition
Premium Subscription Penetration	30%	15%	lower since competition and significantly higher price than many customers are willing to pay according to market research
Activation Rate	90%	same	
WACC	15%	17%	More non-diversifiable risk than a typical GM project (calculation by author utilizing SprintPCS and Nextel as comparables)
Hardware Cost per Unit	same	same	
GM & Affiliate Market Share	18%	same	
GM & Affiliate Percent Relevant	9%	31%	higher since smaller cars are more relevant in Japan than elsewhere
Other Manufacturer Market Share	83%	*variable*	The original assessment assumed all manufacturers install OnStar equipment on a penetrated fraction of their vehicles. This assessment will assume only certain manufacturers agree to do this.
Other Manufacturer Percent Relevant	41%	*variable*	Depends on specific OEMs. In general, a higher rate is used for same reason as above.
Initial Penetration of Relevant Vehicles	5%	same	
Saturated Penetration of GM & Affiliated Relevant Vehicles	40%	same	Even at 40%, this is only 2/3 of the fraction of customers who expressed purchase intent; also, the price being charged (base subscription rate) is well below "willingness to pay", due to competitive factors

Parameter	Initial	Current	Explanation
Saturated Penetration of Other Relevant Vehicles	20%	30%	We assume competition even within OEMs with which OnStar gains contracts. Therefore this is equivalent to capturing ½ of the share of 60% customers with some degree of purchase intent..
Years to Saturated Penetration	5	same	
Initial Fixed Costs	same	same	
Structural Growth Factor	10%	same	
Launch Costs	same	same	
Launch Duration	2	same	
Tax Rate	42%	same	

APPENDIX C: EXAMPLE FINANCIAL VALUATION – ONSTAR

JAPAN SERVING GM-AFFILIATED CUSTOMERS ONLY

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
New Car Sales	6,015	6,099	6,185	6,271	6,359	6,448	6,538	6,630	6,723	6,817	6,912
New GM & Affiliate Sales	1,072	1,087	1,102	1,117	1,133	1,149	1,165	1,181	1,198	1,214	1,231
New GM & Affiliate Installations			17	41	66	92	119	146	148	150	152
New Other Sales	-	-	-	-	-	-	-	-	-	-	-
New Other Installations			-	-	-	-	-	-	-	-	-
Total New Subscriptions	-	-	15	37	60	83	107	131	133	135	137
Continuing Subscriptions	-	-	-	11	34	65	104	147	195	230	255
Basic Sub Hardware Revenue	-	-	2,262	5,553	8,915	12,371	15,921	19,568	19,842	20,120	20,402
Premium Sub Hardware Revenue	-	-	293	713	1,145	1,589	2,045	2,513	2,549	2,584	2,620
Total Hardware Revenue	-	-	2,575	6,266	10,060	13,960	17,966	22,082	22,391	22,704	23,022
Basic Subscription Revenue	-	-	1,733	5,309	10,192	16,056	22,673	29,887	34,951	38,692	41,510
Premium Subscription Revenue	-	-	856	2,623	5,036	7,934	11,203	14,768	17,270	19,118	20,511
Total Subscription Revenue	-	-	2,589	7,933	15,229	23,990	33,877	44,655	52,220	57,810	62,020
Total Revenue	-	-	5,164	14,199	25,289	37,949	51,843	66,737	74,611	80,514	85,042
Basic Subscription Costs			886	2,778	5,408	8,591	12,199	16,141	19,007	21,121	22,711
Premium Sub Costs			574	1,799	3,502	5,564	7,900	10,453	12,309	13,678	14,708
Total Subscription Costs			1,460	4,577	8,910	14,155	20,099	26,594	31,316	34,800	37,418
Gross Subscrip Contribution Margin	-	-	1,129	3,356	6,319	9,835	13,778	18,060	20,904	23,010	24,602
Hardware Costs	-	-	3,398	8,269	13,277	18,422	23,710	29,141	29,549	29,963	30,382
Launch Costs			15,000	15,000	-	-	-	-	-	-	-
Structural Costs			15,000	18,095	19,760	20,897	21,758	22,450	22,830	23,075	23,243
EBIT	-	-	(29,694)	(31,743)	(16,657)	(15,525)	(13,724)	(11,449)	(9,085)	(7,323)	(6,001)
EBIAT	-	-	(17,223)	(18,411)	(9,661)	(9,004)	(7,960)	(6,640)	(5,269)	(4,247)	(3,481)
Working Capital?											
CAPEX?											
Depreciation?											
FCF	-	-	(17,223)	(18,411)	(9,661)	(9,004)	(7,960)	(6,640)	(5,269)	(4,247)	(3,481)
PV	-	-	(12,581)	(11,495)	(5,156)	(4,107)	(3,103)	(2,213)	(1,501)	(1,034)	(724)
Cum PV of Cash Flows	(41,913)										
Terminal Value	(30,455)										
Discounted Terminal Value	(6,336)										
Total Net Present Value	(48,249)										