

THE HANSEN REPORT

ON AUTOMOTIVE ELECTRONICS

Vol. 23, No. 6

hansenreport.com

July/August 2010

Multiple AC Charge Coupler Standards for EVs Emerge

DC Fast Charging Standards Still in Early Stages

With automotive electronics standards like CAN, FlexRay, Autosar and Genivi, the Germans have been the pioneers, but when it comes to connecting plug-in electric vehicles to the grid, it is the Americans, with cooperation from the Japanese, who have been out front on standards.

"We always invited anyone to attend our meetings, but I think we did get an early step into this," said Gery Kissel, an engineering specialist with **General Motors** and the SAE J1772 task force leader, who began work on the AC coupler standard more than three years ago. "We had new product coming down the pike [the GM Volt extended range electric vehicle] and we knew we needed a standard. The Japanese, through JARI, have been aboard from day one," he added. JARI is the Japan Automobile Research Institute.

Mr. Kissel started standardization efforts with the AC interface because AC will cover 90% of the early charging requirements. "We wanted the lowest cost, most reliable AC interface we could design. We focused on that primarily because plug-in hybrids or extended-range electric vehicles like the Volt will be the predominant types you will see, at least initially, because of the cost of the batteries. To get a 100-mile range in a battery electric vehicle requires a substantial, very costly battery pack. Because EREVs have an engine, you can use a smaller battery pack that doesn't require a lot of charging power. The other reason is the infrastructure itself. Low power AC electrical outlets are everywhere."

Published in January 2010, SAE J1772 covers two levels of onboard AC charging. Level 1 handles 120 volt (100 volts
Turn to Charging, page 2

Revolutionary New Electrohydraulic Brake System

Integrated Brake System Is Smaller, Lighter, Simpler

Thomas Leiber—son of Heinz Leiber, the man who invented ABS—chose last month's automotive electronics conference in Ludwigsburg, Germany, to disclose the details of his integrated modular brake system (IBS), a development he and his father have been working on for six years at their firm, **LSP Innovative Automotive Systems GmbH**. The new electrohydraulic braking system, which fully integrates hydraulic braking, ABS and ESP into a much-simplified package, is not only superior in functionality to conventional pneumatic/hydraulic systems in mass production today, but is less expensive to manufacture, since it is half the weight, one-third the volume and 70 millimeters shorter.

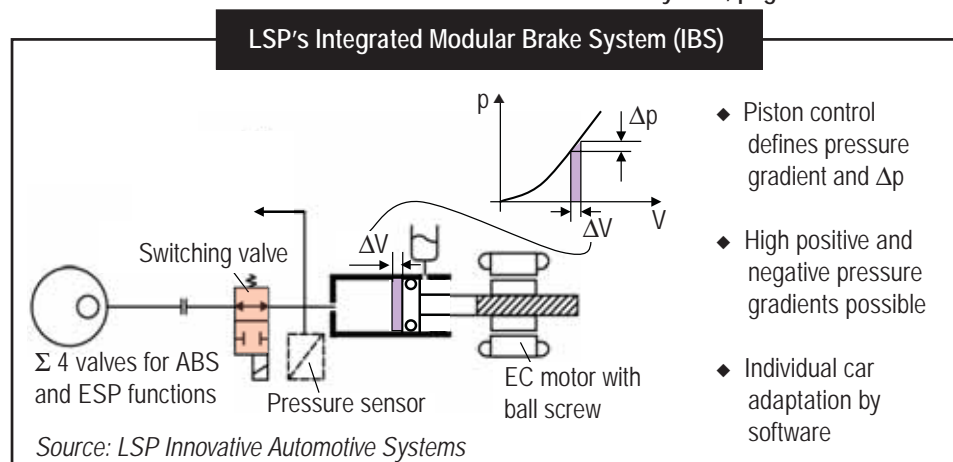
IBS replaces most of the components used in ABS/ESC systems today. There is no vacuum pump, no vacuum booster and no reciprocating pump for ABS. IBS requires only four solenoid valves and a pressure sensor. Conventional ESC systems have 12 valves.

The crux of the new braking system is a highly dynamic, electrically commutated (EC) motor that takes over the

function of brake force amplification, which in conventional systems requires a vacuum booster, as well as the pressure modulation at each wheel in ABS/ESC mode. The EC motor provides extremely accurate pressure control and thus significantly shorter braking distances, especially on slippery roads, with no trade-off in stability. Winter road tests in March of this year showed single-digit percentage improvements in the stopping distances of an LSP test car, a Golf V equipped with IBS, compared with a Golf VI with ESP Plus. The company expects to see even greater improvements in the future.

The motor has an integrated ball screw that moves a piston of a tandem master cylinder (TMC). In normal braking, the piston is moved forward to amplify brake force with all four valves open. When the target pressure is reached, the piston remains in a defined position or the valves are closed to maintain pressure. In ABS mode, the pressure at each wheel must be varied, and that is done by sequentially, and in some cases simultaneously, opening and closing the valves to each wheel while the piston of the TMC reciprocates very dynamically between different positions. The pressure gradients that can be

Turn to Brake System, page 3

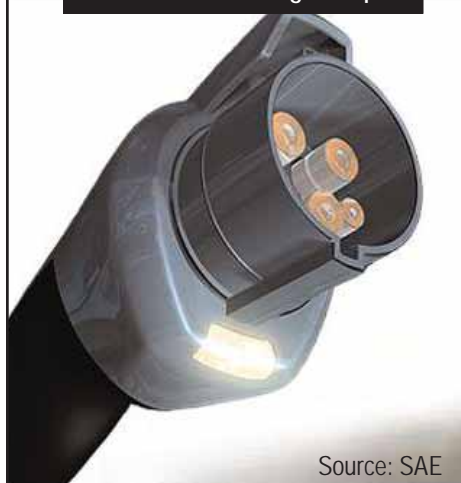


AC for the Japanese) charging from standard home outlets capable of 15 or 20 amps, about 1.9 kilowatts. Level 2 handles 208 to 240 volt AC charging at up to 80 amps, or 19 kilowatts. Not only does the standard comprehend physical characteristics such as the number of pins and their layout, but it also specifies some intelligence. For example, the charge plug that you hold in your hand cannot be powered until it is plugged into and commanded by the vehicle. And the vehicle must automatically detect that the plug is engaged to prevent anyone from driving away while it is still connected. Level 1 and Level 2 connectors have five pins: two for power, one for ground and two for the analog communications between the vehicle and the charging equipment.

But while NAFTA and Japan, which together are responsible for 21% of the world's vehicle production, are in harmony with SAE J1772, the rest of the world isn't. The International Electrotechnical Commission (IEC) is considering publishing standards covering three different AC connector/vehicle inlet pairs: a single-phase, 5-pin connector that corresponds closely to J1771; a three-phase, 7-pin connector proposed by German and other northern European carmakers; and a single- and three-phase, 5- or 7-pin connector for the Italians.

The Chinese, who have not yet formally joined the IEC committee, recently proposed yet another connector standard which, while similar to the German approach, is incompatible with any of the standards the IEC is developing.

SAE J1772 AC Charge Coupler



Source: SAE

SAE J1772 Charging Interface Terminology

◆ AC Level 1 Charging

120 V AC charging from standard 15 or 20 amp NEMA outlet, onboard vehicle charger (approximately 1.9 kw)

◆ AC Level 2 Charging

208 V – 240 V AC charging up to 80 amps, on-board charger (approximately 19 kw)

◆ DC Charging (Fast Charging)

Off-board charger connects directly to the vehicle's high-voltage battery bus. Charger is controlled by the vehicle, which allows for extremely high power transfer (>100 kw) and thus faster recharge times (minutes instead of hours). Actual charge rate is limited by battery chemistry, infrastructure and other factors.

Source: Gery Kissel, GM and SAE J1772 Task Force Lead

"We expect to issue IEC standards covering three types of AC connectors and inlets by the end of this year or very early next year," said Gregory Nieminski, who chairs the Industrial Plugs and Socket Outlets working group at IEC. "The challenge in Europe is that each country has its own national electric code regulations and they are different."

Even after the IEC's forthcoming standards are published, electric vehicle plug standardization will remain in a state of flux in Europe. "While we have an agreement, it isn't set in stone. Our standards are the type that will constantly need updating," said Mr. Nieminski. "In the next year or year-and-a-half I expect we'll be back at them, revising and improving them. The different connector types will eventually need to be merged so you can drive an electric vehicle from Italy to Germany without confusion."

That worthwhile objective, to move toward one AC connector throughout Europe, was agreed to by members of the European Automobile Manufacturers Association (ACEA) in a statement issued in June. ACEA called for a uniform solution for all new vehicles by 2017.

Fast DC Charge Systems

Mr. Kissel's SAE task force is now turning its attention to interface standards for high power (greater than 100 kilowatts) DC charging capable of recharging an electric vehicle in minutes instead of

hours. Such DC charging stations are intended for consumers and for businesses.

Unlike AC charging, where the charger is onboard the vehicle, the DC charger, which converts AC power to DC, is off board and connects directly through the charge coupler to the vehicle battery bus. Not all vehicles will have DC charging capability.

As a first step in a process that will take at least a year before a fast charge SAE standard is approved, Mr. Kissel's task force has been looking at the DC charge coupler that was developed for the Japanese market by JARI (see Japan Electric Vehicle Standard G105-1993). The JARI coupler is now being promoted globally by CHAdeMO, a group of 226 businesses led by **Toyota, Nissan, Mitsubishi Motors, Fuji Heavy and Tokyo Electric Power**. CHAdeMO is a shortened form for the equivalent of "charge for moving."

This connector has already been deployed in Mitsubishi Motors' i-MiEV electric vehicle launched in Japan a year ago. It will also be deployed in the Nissan Leaf electric vehicle due this fall in the U.S., Europe and Japan. The Leaf is coming to market with two charge receptacles: a

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The Hansen Report on Automotive Electronics is published 10 times a year, monthly; July/August and December/January are combined issues. The annual print subscription rate is \$787. Back issues are available for \$50 each. Index and multi-user electronic subscription information is available at www.hansenreport.com. Paul Hansen Associates is a strategy and market research firm consulting to the electronics industry.

Publisher/Editor Paul Hansen
Managing Editor/ Brianne Wolfe
Circulation Manager
Director of Marketing Michelle Long

ISSN 1040-1105

Brake System...

Continued from page 1

achieved with the highly dynamic motor are significantly higher than pressure gradients of conventional systems, particularly at lower pressures where pressure gradients are five times higher. By controlling the position of the piston, the pressure can be controlled very precisely.

The IBS motor was developed by LSP initially for use in electric valve trains. While electric valve train systems haven't gone into series production, LSP motors designed for that application have already been through more than 1,000 hours of engine testing.

"What is especially unique about the motor is its low inertia combined with extremely high torque," said Dr. Leiber. "Unlike most motors, which are designed to run at constant speeds, this motor is designed to accelerate and decelerate extremely fast. Its low inertia is provided by two air gaps between the rotor and stator, which makes the rotor extremely thin," he explained. The electrically commutated motor uses a Hall angle sensor.

At half the cost, IBS is an especially promising alternative to electric brake systems. It is far less complex and therefore more reliable. IBS requires 12 hydrau-

lic pipe connections compared with 180 contacts (60 connector pins plus 120 crimping contacts) for electric brakes.

"The hydraulic pipe connection to each wheel is well proven and extremely reliable," said Dr. Leiber.

LSP signed its initial tier-one licensing agreement for the integrated modular brake system two years ago, but went public in Ludwigsburg in June in order to drum up more global interest following a winter test presentation to major OEMs in March in Arjeplog, Sweden. That first agreement is with a German tier-one brake system supplier.

Dr. Leiber, who is currently in advanced talks with both Asian and U.S. suppliers and OEMs, expects to complete two more unrestricted licensing agreements in the very near future. "Asian companies are especially eager to get a hold of this new technology, while incumbents in Europe have a slower decision process," he noted.

Dr. Leiber acknowledged that selling a new brake system approach to the automotive industry has not been easy: "The big tier ones have made huge investments in their existing technology, so they are

hesitant to bring a new system to market, even though IBS uses many components that are already in mass production. Automotive tier ones generally try to avoid licensing, preferring their own developments. We went public and built our own test car to make it common knowledge that this is real. Our goal is to establish IBS as a global standard. At least two carmakers say they have concrete plans to put IBS into production."

LSP was founded in 1998 by Thomas Leiber and his father, Heinz Leiber, who prior to that was head of development at **Bosch** and later vice president of the electrical and electronics division at **Daimler-Benz**. While Thomas Leiber now owns the company and is CEO, Heinz Leiber actively contributes advice and ideas. With 20 employees, LSP focuses on innovative mechatronics systems.

Even though IBS is mature in functionality and has a series stage design, Dr. Leiber expects it will take four to five more years before it is brought to market in a production vehicle. "The normal process requires three years of winter testing, at least. Brakes are the most conservative system on the vehicle," he said. ♦

Charging...

Continued from page 2

J1772 Level 2 plug receptacle for charging at 110/220 volts, and a Level 3 CHAdeMO receptacle.

Having to install two separate receptacles is something SAE planners are trying to avoid and the reason they have been working on a single receptacle that will work for either AC or DC charging. "We're trying to bring it all down into one connector so it is simpler for the customer—just like fueling the car. There is only one spot for that," said Mr. Kissel. "While the Japanese have done a lot of good work with the CHAdeMO connector, it is incompatible with our [dual-purpose connector] approach."

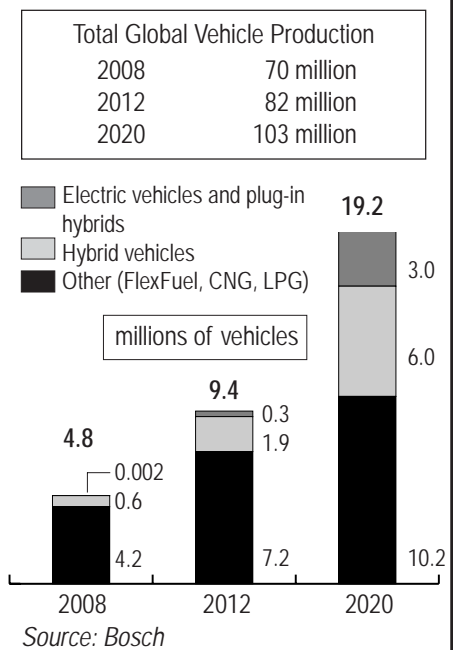
Along with their work on the quick charge, engineers working with the SAE on the dual-purpose AC-DC connector are also thinking about what standards might be needed to facilitate high-bandwidth communications between the grid and the vehicle. For example, while the

vehicle is connected to the charging station it could download large infotainment files or receive software updates.

"We will use powerline carrier (PLC) technology for off-board communications," said Mr. Kissel. "The data signal will come from the power pins, so we won't need any more physical pins to have this. Now we are trying to figure out which PLC technology is best; there are lots of different flavors. Besides us, some IEC/ISO groups are also looking at this and we hope to come up with a single physical layer, globally," he explained.

Indicative of how aggressively the world is pursuing vehicle electrification, the IEC has received responses from engineers in 17 countries who want to work on fast charging standards. "We have not yet held a formal meeting on DC charging hardware. We're just getting started. It will take up to two years before we finalize requirements," said Mr. Nieminski. ♦

Bosch Forecasts Penetration of Alternative Powertrains by 2020



The Company Profile...

Sirius XM Radio

Thumbnail Sketch

Non-GAAP pro forma results from Sirius XM are used throughout this profile.

Headquarters: 1221 Avenue of the Americas, New York, NY 10020; Tel. 212-584-5100; www.sirius.com

2009 Revenue: \$2,527 million

Net Loss: \$441.3 million

Net Cash Provided by Operating Activities: \$433.8 million

Working Capital Deficit: \$1,144 million as of March 31, 2010

Long-Term Debt: \$3,147 million

Stockholders' Equity: \$152.0 million as of March 31, 2010

Market Capitalization: \$3.75 billion as of July 23, 2010

Largest Shareholder: Liberty Media Corp., with 40% of shares; General Motors and American Honda are minor shareholders.

Employees: 1,514 at year end 2009

Sales per Employee: \$1.63 million

Product: up to 170 channels of music, sports, news, talk and weather programming broadcast coast to coast in the U.S.

Subscribers: 19,527,448, as of June 30, 2010, a 6% year over year increase

Subscription Price: \$12.95 per month plus \$1.98 music royalty fee

2010 Average Revenue per Subscriber: \$11.48 per month for the quarter ending March 31, 2010

Churn Rate: In the second quarter of 2010, just 1.8% of self-pay subscribers gave up their subscriptions each month, down from 2.0% in the second quarter of 2009.

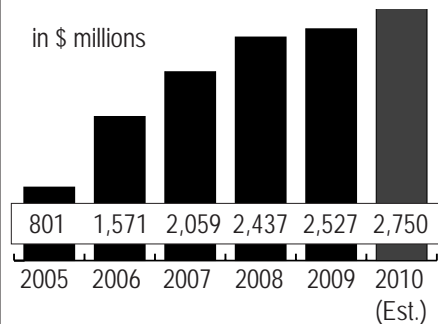
Background

In 1992 the United States Federal Communications Commission (FCC) allocated 25 MHz of the S-band, between 2,320 MHz and 2,345 MHz, for commercial satellite radio. Five years later, the FCC auctioned two SDARS (satellite digital audio radio service) licenses to broadcast in the S-band. One of those licenses was purchased by American Mobile Radio Corp., which became XM Satellite Radio; the other by Satellite CD Radio Inc., which became Sirius Satellite Radio. XM, founded in 1992, launched its first satellite in 2001; Sirius, founded in 1990, launched its first satellite in 2000.

Pro Forma Revenue and EBITDA

2005 to 2010 CAGR: 28%

in \$ millions



Adjusted EBITDA

Year	Adjusted EBITDA (\$ millions)
2005	(971)
2006	(679)
2007	(565)
2008	(136)
2009	463
2010 (est.)	575

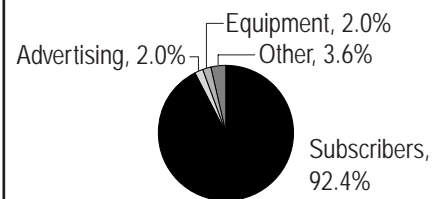
Sirius bought out rival XM Satellite Radio in a \$3.5 billion deal that received final FCC approval in July 2008, 17 months after the two companies first announced their intention to merge. XM shareholders received 4.6 shares of Sirius stock for each XM share they owned. Trading of XM stock was stopped on July 28, 2008. Shares of the combined company, now named Sirius XM Radio, are traded on the NASDAQ under the symbol SIRI. Both SDARS licenses are now held by the new entity.

Although XM built up its subscriber base earlier than Sirius, at the time of the merger each had about nine million subscribers. The Sirius satellite system consists of four orbiting satellites and 125 terrestrial repeaters that transmit to Sirius satellite radio receivers. Sirius has a spare satellite in storage and another under construction that is scheduled to be launched in the fourth quarter of 2011.

The XM network consists of four orbiting satellites, two of which transmit XM signals while the other two serve as in-orbit spares, and more than 650 terrestrial repeaters. XM plans to launch a fifth satellite in the fourth quarter of 2010. The terrestrial repeaters improve reception in

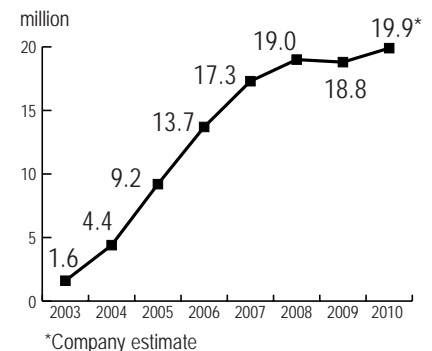
2009 Revenue by Source

2009 Total: \$2,527 million



Satellite Radio Subscribers by Year

2003 to 2010 CAGR: 43.4%



urban areas where tall buildings can block the satellite signal.

Facing high development costs and no revenue for several years until they began broadcasting, neither company had ever shown a profit and both had accumulated a significant amount of debt. As credit markets tightened in late 2008, after the companies merged, Sirius XM was able to refinance \$1.25 billion of XM's debt but still had more than \$1 billion coming due in 2009, at a time when automotive sales were falling fast and the company had agreed not to raise subscription prices as a condition of the FCC's approval.

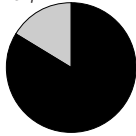
Close to declaring bankruptcy in February 2009, Sirius XM reached a \$530 million loan agreement with Liberty Media that gave Liberty Media a 40% share of the company. Liberty Media Corporation owns a large collection of media, entertainment and communications ventures including investments in QVC, Expedia, Starz Entertainment and the Atlanta Braves baseball team. Long term debt at the close of the first quarter 2010 was \$3.1 billion.

The Company Profile Continued

2009 Subscribers by Type

Total Subscribers Year-End 2009: 18,772,758

Paid promotional,
16.3%



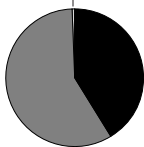
Self-pay,
83.7%

Note: Self-pay subscribers are those who pay for their own subscriptions. Paid promotional subscribers are those with free trials whose subscriptions are paid for by carmakers, who receive a discount from Sirius XM.

2009 Subscribers by Source

Total Subscribers Year-End 2009: 18,772,758

Rental, 0.6%



Retail,
41.2%

OEM, 58.2%

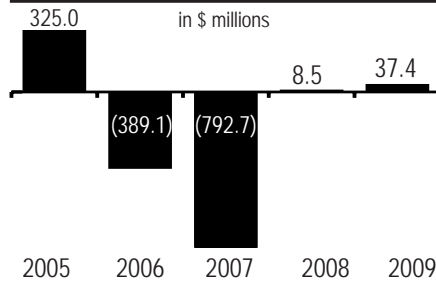
Post-Merger Integration

Once the merger of XM and Sirius was approved, the company turned its attention to integrating the day to day operations of the two organizations, eliminating redundancies and rationalizing their programming.

In a fourth quarter 2009 conference call with analysts, Sirius XM CEO, Mel Karmazin, said: "The merger provided significant cost synergies in our fixed cost base, which consequently allowed us to reach scale more quickly than others. Our fixed cost base dropped nearly \$350 million since 2007. This fact has allowed the combined company to increase pro forma adjusted income from operations in 2009 by nearly \$600 million in one year and by over \$1 billion over two years."

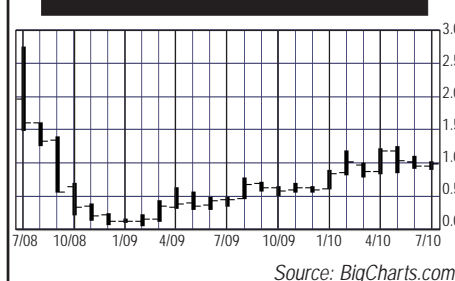
Of the more than 130 channels currently available on either the XM platform or the Sirius platform, 106 are common to both. By adding the Best of XM package for \$4 more per month, Sirius subscribers can receive a selection of popular XM programming. Likewise, XM subscribers can receive a selection of Sirius channels by subscribing to the Best of Sirius. This "best of" offering nearly eliminates any demand for the interoperable radio capable of playing both Sirius

Stockholders' Equity (Deficit) by Year



Note: Only 2008 and 2009 are pro forma results. 2005 - 2007 show stockholders' equity in Sirius Satellite Radio.

Sirius XM Stock Price 7/08 - 7/10



Source: BigCharts.com

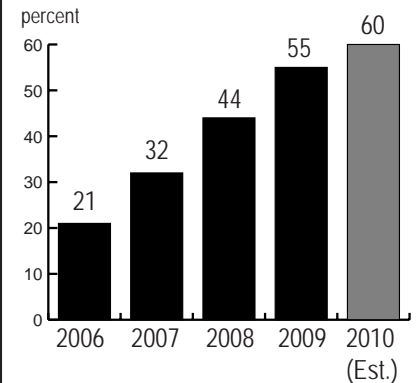
and XM channels that was mandated by the FCC as a condition of the merger.

The integration of the two companies' satellite fleets won't be complete for the foreseeable future, because the company says it expects to maintain both XM's and Sirius' satellite broadcasting infrastructure "for years to come." Shutting down one or the other system would quickly obsolete nine million receivers, which would have to be replaced at considerable expense.

Sirius XM declined to respond to a recent report from Strategy Analytics that OEMs had been notified by the company that the Sirius platform would be terminated by 2016, and that they must all plan to provide only the XM platform. However, the company's stated plans for future satellite launches do not seem to support that transition. Sirius XM has scheduled a 2011 launch of a new Sirius satellite and a third quarter 2010 launch of a new XM satellite. Each has an expected life of 13 to 15 years.

As part of its merger agreement with the FCC, Sirius XM agreed not to raise subscription prices beyond the basic monthly price of \$12.95 until July 28, 2011. The FCC did agree that the company could pass through cost increases for

Sirius XM Penetration of U.S. Auto Sales



After free trials, 47% of customers who bought vehicles with satellite radio receivers became paying subscribers.

acquiring the music it broadcasts. In July 2009, Sirius XM added a music royalty fee of \$1.98 per month. While the company has made no decisions on future pricing, it is reasonable to expect that it will raise subscription prices after July 2011.

All XM and Sirius radio receivers are created equal. They are built to spec using chipsets designed by Sirius or XM. "We put every manufacturer's satellite radios through type approval to make sure it meets our specs," explained Steve Cook, group vice president and general manager of Sirius XM's automotive division. "Whether it's made by Panasonic or Harman Becker, we don't see any difference in the way they process the satellite radio signals."

The satellite radio chipsets used in Sirius and XM receivers are sourced from two companies: STMicroelectronics, the primary supplier, and Analog Devices.

Connection with Carmakers

Sirius XM Radio's primary means of distributing satellite radios and acquiring new subscribers is through the sale or lease of new vehicles. According to company estimates, subscribers generated through automotive OEMs account for 58% of the total subscriber base. The company says it has agreements with every major automaker to offer either Sirius or XM satellite radios as factory-installed equipment in their vehicles sold in the United States. Most carmakers pay for

Sirius XM Radio

trial subscriptions at a reduced rate. In return, some receive a commission for subscribers who convert to self-pay status.

Sirius XM has agreements with many major carmakers to be informed when, and to whom, a certified pre-owned vehicle equipped with a satellite radio is sold, so that customer can be offered a satellite radio subscription. Sirius XM also has agreements (negotiated by XM Radio) to make bandwidth available to Honda and to OnStar for telematics data transmissions.

In the second quarter of 2010, the percentage of customers who converted their free trial subscriptions to paid subscriptions was 46.7%, up significantly from 44.3% in the second quarter of 2009. For the full year 2009, 55% of all new vehicles sold in the U.S. were equipped with satellite radios. Sirius XM says it is on target to increase the penetration of satellite radios installed in new vehicles to 60% in 2010. Already many premium car brands sold in the U.S. and even non-premium brands such as Hyundai and Kia have 100% penetration of satellite radio receivers. (See the list in column two.)

Competition

Competition among providers of audio entertainment is more intense than ever. When XM and Sirius satellites were launched in 2000-2001, AM/FM radio and CDs were the main competition. By 2007, when XM and Sirius applied for permission from the FCC to merge, they stated that their competition in the market for audio entertainment services included not only terrestrial radio and CD players, but HD Radio, Internet radio, iPods and other MP3 players, and mobile phones as well. These competitors give potential satellite radio subscribers attractive alternatives to paying nearly \$15 per month for in-car entertainment.

Only a small minority of Americans today listen to satellite radio programming; other audio entertainment platforms and devices are much more popular. According to data provided by Arbitron and Edison Research, only 12% of Americans 12 years of age and older own or use a satellite radio, whereas 64% have broadband Internet access, 52% say they have

These vehicle brands install Sirius XM radios in 100% of vehicles sold in the U.S.

Listed alphabetically

Acura
Audi
Buick
Cadillac
GMC
Hyundai
Infiniti
Jaguar
Kia
Lexus
Lincoln (except Town Car fleet vehicles)

access to online radio, 28% use or own an iPod, and 23% use or own an MP3 player other than an iPod. While just 9% of Americans have BlackBerries and 7% have iPhones, the use of these and other smartphones is accelerating rapidly.

Most satellite radio listening happens in the car, but carmakers have been quick to respond to consumer demand for portable device connectivity in their cars, which means increased competition for Sirius XM. Most carmakers already provide input jacks to play MP3 devices on the audio system, but Ford and BMW will be among the first to offer smartphone operability through the vehicle's controls, beginning in 2011. All major carmakers will follow suit soon afterward.

Smartphones will not only be able to play back stored music, podcasts and other audio programming on the vehicle's audio system, but they will also be able to stream Internet radio to the vehicle.

One knock on Internet radio is its cost. While access to sites such as Pandora are free, smartphone data plan costs could be going up. New iPhone users will soon have to pay AT&T \$25 per month to download up to two gigabytes of data, about enough for 400 songs or nearly 30 hours of music. That is considerably more expensive than satellite radio, although smartphones certainly provide additional functionality.

According to the same Arbitron/Edison Research study mentioned above, "Six percent of mobile phone owners have already streamed audio from their phones and played it through their car," despite

the present unavailability of factory-installed smartphone connectivity. Arbitron has estimated the U.S. total average weekly audience for online radio at 42 million (17% of people 12 years of age or older), most of whom listen at home or work, compared with Sirius XM's weekly audience, which Arbitron estimates to be 35 million mostly in-car listeners.

AM and FM broadcast music, however, is still the dominant in-car audio entertainment. Ninety-two percent of Americans over the age of 12 have access to AM/FM radio. A Nielsen Company study published in October 2009 found that AM/FM broadcast radio captured 74.2% of the listening time of a representative sample of in-car listeners; satellite radio accounted for just 5.5% of listening minutes.

It should be pointed out that not all listeners yield the same amount of revenue for broadcasters, according to Sirius XM. In 2009, each Sirius XM listener accounted for \$71 in revenue; a terrestrial radio listener accounted for between \$10 and \$20; and Internet radio listeners each delivered about \$1.25.

Satellite Radio's Strengths

Sirius XM Radio has two main advantages over AM/FM radio, including HD versions of AM/FM radio: Sirius XM broadcasts are available coast to coast, which eliminates the problem of lost signal as you drive out of an FM station's range; and most Sirius XM programming is commercial free.

When comparing satellite radio to Internet radio streamed to the car, Mr. Cook noted two more advantages of Sirius XM. "The first is that we have very high quality reception in the vehicle. That is not always the case with trying to stream Internet radio over today's 3G networks. Wireless networks were designed for voice traffic, not music. You get dropouts; the listening experience is very inconsistent." Sirius doesn't specify the bit rate or objectify in any way the sound quality of its radio broadcasts.

Another advantage, said Mr. Cook, is satellite radio's ease of use. "Changing satellite radio channels is much easier than changing Internet radio programs. On

The Company Profile Continued

FCC Approved Merging XM and Sirius with Conditions

When the Federal Communications Commission (FCC) first issued the only two satellite broadcast licenses in 1997, it ruled that one licensee could not acquire control of the other licensee. On July 25, 2008, after 17 months of consideration, the FCC approved the merger of XM and Sirius, deciding the merger would serve the public interest if the following "voluntary commitments" by the combined company were met.

- ◆ Cap subscription prices at \$12.95 per month for 36 months, and after 30 months the FCC will seek public comment on whether or not the cap should be extended or modified.
- ◆ Within three months following the merger, offer consumers alternative programming packages including: an "à la carte" option; "best of" packages that combine programming selected by the new

company from XM and Sirius channels for \$16.99 per month; a "mostly music" (or sports, news or talk) package for \$9.99 per month for each genre; "family friendly" packages for \$11.95 per month for either XM or Sirius, or \$14.99 per month for combined programs from both platforms.

- ◆ Make 4% of the channels available to Qualified Entities (minority-owned companies) and 4% to educational or informational programming.
- ◆ Offer consumers interoperable receivers within nine months.
- ◆ No exclusive manufacturing agreements; make IP available to any device manufacturer to develop satellite receivers.
- ◆ Provide service to Puerto Rico via terrestrial repeaters.
- ◆ No localized programming, advertising or blocking local sports broadcasts.

Sirius XM you can easily and safely hop from a commercial-free music channel to a major league baseball game, right over to an interview with Oprah Winfrey. You can't do that with Internet radio, and in the vehicle simplicity and ease of use is king."

Acknowledging the growing strength of the competition, Sirius XM notes in its 2009 10-K: "The past few years have seen a steady increase in the audio quality of Internet radio streams and in the amount of audio content available via the Web, resulting in a steady increase in Internet radio audience metrics. We expect that improvements from higher bandwidths and wider programming selection are likely to continue making Internet radio an increasingly significant competitor in the near future."

The company has begun participating in the Internet radio market. In 2009 it launched its Premium Online service, through which subscribers can access more than 120 channels for an additional \$2.99 per month. Last year Sirius XM released an app for the iPhone and iPod Touch that lets subscribers access the online content through those devices. In 2010 it added similar applications for sev-

eral models of Blackberry and Android mobile devices. Limited plans with 20 to 25 channels of Sirius XM content are available to mobile phone users through AT&T, Alltel, Sprint and RIM.

4G

Designed for data communications, 4G high bandwidth, low latency cell-phone networks, when they emerge over the next several years, will present more competition to Sirius XM satellite radio broadcasts, since they will improve the quality of audio and video downloads for smartphone users.

Even so, Mr. Cook is looking forward to the rollout of 4G and intends to take advantage of 4G to enhance the services Sirius XM offers. "Our competition continues to evolve, and 4G will ramp up the potential for even more audio competitors, but we also plan to use the technology to make our service more compelling," he said.

Sirius XM has not yet announced any specific service enhancements in the works. One possible application of 4G would be to time-shift a specific program. Subscribers could request a program that was broadcast at an inconvenient time

and download it to their car at a later date.

Data Services

While nearly all of Sirius XM's revenue will continue to come from its lineup of music, news and talk radio channels, the company has been adding a number of other services to its product line. For example, Sirius Backseat TV is available as a factory-installed option on select Chrysler, Dodge and Jeep models, and through aftermarket retailers.

Sirius XM also offers a number of telematics-like services that are useful to people in their vehicles. Sirius Traffic provides real-time traffic flow, accident alerts and construction related detours or delays to vehicles with navigation systems that have been adapted to present the information. The traffic flow feature costs \$3.99 per month.

Beginning with the 2009 model year, all Ford vehicles equipped with its Next Generation Navigation System received six months of Sirius Radio service and six months of Sirius Travel Link. Travel Link provides a suite of services that includes real-time traffic, weather, fuel prices, sports scores and movie listings. At the conclusion of the six-month trial, Travel Link subscribers pay \$1.99 per month on top of the cost of a Sirius XM radio subscription.

As a way to distinguish itself from smartphone apps, Sirius XM will concentrate on services like traffic flow, gas prices, weather, sports and stock updates. "We are trying to focus on data services that have relevance in the vehicle and need to be updated continuously. That is so much easier than trying to call up a bit of information on your smartphone," Mr. Cook noted.

Sirius XM expects the popularity of its data services to increase as more carmakers are installing large displays, even in vehicles without navigation. "Data services is clearly a growth area for us," said Mr. Cook, who suggested that other services will be introduced over the next several years. One example of future services the company is working on is providing airline flight information and airport delays. ◆

Alpine Electronics, Fiscal Year 2010

Fiscal year 2010 ended March 31, 2010.

FY 2010 Consolidated Sales: ¥168,586 million (\$1.8 billion); Audio Products Segment sales accounted for 42% of total sales; Information and Communication Equipment, 58%.

Change from FY 2009: down 14.3%

FY 2010 Net Loss: ¥1.25 billion, compared with a net loss of ¥9.3 billion the prior year

Outlook for FY 2011: Sales are expected to increase by 6.8%, to ¥180,000 million (\$2 billion). Alpine is forecasting a 2.5% net profit margin. Audio Products sales are expected to decrease slightly in FY 2011, by less than 1%. Information and Communication Equipment sales will increase 12.1%, according to Alpine.

Alpine says a shift in demand toward more compact cars, as a result of both government incentives to consumers and increased vehicle sales in emerging markets, was a factor in its sales decline. It also noted that because of the recession

fewer consumers were spending on high end audio-system options or aftermarket system upgrades.

Sales in the Audio Products Segment were ¥70.4 billion, down 20.3% compared with the previous year, due in part to a shift in consumer demand away from traditional CD players toward infotainment systems according to Alpine. Those integrated systems are sold through Alpine's Information and Communication Equipment Segment. Sales in that segment declined as well, but to a lesser degree, 9.4%. Alpine noted that navigation sales in Europe and the United States were tempered by the growing penetration of portable navigation devices and smartphones with navigation features.

Alpine has partnered with Nokia and NAVTEQ to incorporate Terminal Mode technology in future Alpine infotainment systems. Terminal Mode, developed by Nokia and the CE4A (Consumer Elec-

tronics for Automotive) organization, allows smartphone-based applications to be accessed and controlled through the vehicle's infotainment system. At the 2010 Consumer Electronics Show, Alpine launched its IDA-X305S head unit, which can stream Pandora Internet radio in the car using an app on the driver's iPhone.

In FY 2010, 82% of Alpine's sales were outside the domestic Japanese market. That trend is likely to continue in fiscal 2011 as Alpine introduces a line of new, cost-effective products designed for small and mid-sized cars in emerging markets.

The company will emphasize R&D investment in car information communications, especially navigation equipment, where it sees market opportunities. Alpine will also invest in lightweight, energy-efficient, inexpensive products for hybrid and electric vehicles, and in upgrading its line of driver-assist products such as rearview camera systems. ♦

Convergence 2010, Be There

If you are a player, or would like to be a player, in the global automotive electronics industry, the place to be on October 19-20, 2010 is Cobo Hall, Detroit. If you can afford to participate in only a couple of automotive electronics conferences each year, this is one you shouldn't miss.

Ford and Microsoft, with plenty of support from the **Society of Automotive Engineers**, have planned a conference that promises to inform and provide ample opportunity to network with the movers and shakers. Partnerships Driving Smart Mobility is the conference theme, inspired no doubt by the partnership between Ford and Microsoft that brought us the Ford Sync connectivity platform.

"Every technical session has an underlying theme of partnership associated with it," noted K. Venkatesh Prasad, senior technical leader, electrical and electronic system research and advanced engineering at Ford. Prasad is part of the team of Ford and Microsoft executives who have planned Convergence 2010.

"Another big emphasis this year is that consumer electronics devices have arrived in a very big way and many of the traditional business models are being challenged," said Prasad. "No longer does

everything have to be built into the vehicle. We can also embrace what is brought into the vehicle, such as smartphones, and what is beamed in from the cloud and elsewhere. That is changing the architecture, technology and business assumptions."

The Blue Ribbon Panel will address the implications of this extension of automotive electronics beyond the vehicle's ecosystem in a plenary session on Tuesday, October 19, at 10:00 a.m. The subject will be further explored in a technical session Tuesday afternoon. Other technical sessions will generously cover vehicle electrification, partnerships with academia, vehicle safety, systems engineering and creating value through collaborations.

In a plenary session on Wednesday morning, I will moderate the Carmakers Speak Panel, which will feature top electrical engineers from seven of the world's major carmakers. I will ask them about the challenges they face, about standards, how suppliers can help, about electrification, electronics reliability and where they think the next great automotive electronics innovations will come from.

Another Convergence 2010 highlight I am very much looking forward to is the

keynote address on Tuesday morning by Derrick Kuzak, group vice president, global product development, Ford Motor Company. Mr. Kuzak, who is a key architect of Ford's business turnaround, was for a time Ford's top electrical engineer—he is one of us.

For more please visit www.sae.org/convergence. ♦

The Carmakers Speak Panelists

- ♦ Jim Buczkowski, director of electrical and electronics systems engineering, **Ford**
- ♦ Micky Bly, executive director of global electrical systems, hybrids, electric vehicles and batteries, **GM**
- ♦ Marc Duval-Destin, director for research and advanced engineering, **PSA**
- ♦ Kristen Tabar, general manager, Electronics, **Toyota Motor Engineering & Manufacturing**
- ♦ Alan Amici, head of electrical/electronics engineering, **Chrysler**
- ♦ Yoshio Suzuki, senior chief engineer, **Honda R&D**
- ♦ Elmar Frickenstein, executive vice president of electrics/electronics and driving experience environment, **BMW Group**