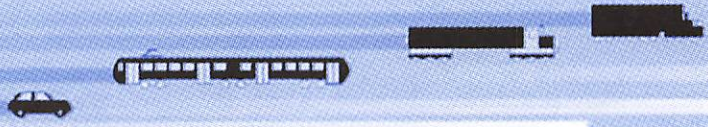


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# VTS NEWS



Connecting the Mobile World for 50 Years

IEEE VEHICULAR TECHNOLOGY SOCIETY NEWS



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NTT DoCoMo's M1000, combining 3G (W-CDMA), 2.5G (GPRS), 2G (GSM) and WLAN in a single handset. See our discussion on Page 3. (Photo NTT DoCoMo)

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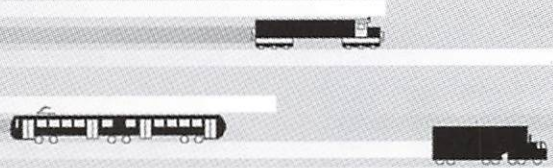
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## Foreword

James Irvine, Editor

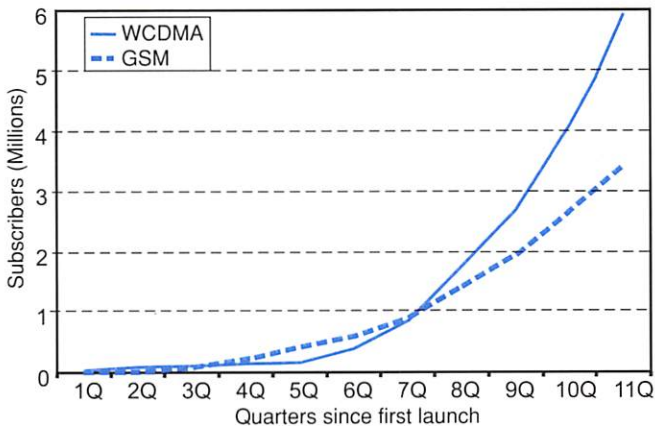
Is 3G finally coming of age? NTT DoCoMo announced 22 February 2005 that it had reached 10 million customers on its FOMA network, less than three and a half years since launch, and only 7 months since it had passed the 5 million customer mark. Overall, WCDMA has grown at a faster rate since launch than the successful GSM system, and this excludes the other 3G standard, cdma2000 1xEV-DO, whose deployment is easier on existing CDMA networks.

Reasons for FOMA's high upsurge in subscribers include innovative data services and handsets. The February announcement coincided with the development of the 700i

series of handsets, which emphasize style and ease of use. However, perhaps more interesting are products such as the M1000 which forms our cover photo for this issue. The M1000 is aimed at business users and offers POP and IMAP email access, as well as web access through an Opera browser on a 208 by 320 display. However, most significantly, the M1000 offers not just W-CDMA access, but also GSM, GPRS, WLAN and Bluetooth, in a 170 gramme package with 200 standby hours. The M1000 is the NTT DoCoMo version of the Motorola A1010, which will be available later this year.

There are other drivers for 3G, even if the customers' appetite for video calling and downloading has proved less than some expected. More flexible 3G networks offer operators cost savings even for voice services, which is driving some of them to try to tempt their subscribers to migrate for existing services.

However, in most of the world where coverage is ubiquitous the customer is interested primarily in the phone, not in its method of connection. With products like the M1000, the capability to connect to almost any technology is here. Seamless service roaming is a greater challenge, and even with these products is a long way off, but mobile operators with WLAN hotspot networks are already offering simple charging on a single account. For some, 4G is the convergence of different networks into a seamlessly connected product. It's coming to a high street near you this year.



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# Delivering Multimedia Content to Automobiles Using Wireless LANs

Kumar Ramaswamy and Jeff Cooper, Thomson Inc

**Editor's Note:** Thanks are extended to the Convergence Transportation Electronics Association for permission to reprint this article from its Convergence 2004 Proceedings. Copyright 2004 Convergence Transportation Electronics Association. The Convergence Transportation Electronics Association is an organization dedicated to the advancement of transport electronics technology and the support of mathematics and science education.

*This paper addresses technical and business issues relating to delivering multimedia content to automobiles using Wireless Local Area Networks (WLANs). Content delivery in the home and hot-spots are discussed. Two key delivery mechanisms - downloading and streaming are addressed and solutions proposed to reliably deliver content over the WLAN infrastructure. A key factor is the use of efficient video compression. Recent advances in video compression will be introduced and issues relating to encoding and decoding complexity will be discussed. Solutions to security and content protection are also addressed. The paper concludes with a discussion of possible business models.*

## Introduction

The first generation of information delivery into an automobile was broadcast AM/FM. The second generation exploited interactive paradigms using the cellular or pager infrastructure and was also capable of delivering broadcast content by satellite[1][2]. The interactive delivery mechanisms are used both for informational and communications purposes. There is increasing interest in content delivery to the rear-seat passengers and the DVD player playing packaged media content is becoming increasingly popular. Television receivers for rear seat passengers have also been available for well over a decade. Delivering rich multimedia content can be viewed as the next generation of information delivery to the front and rear seat occupants of an automobile. An excellent review of the trends for multimedia communications and business models was introduced in [3].

With the advent of broadband wireless networks, it is possible to consider wireless delivery of richer content to automobiles using several available infrastructures. The first obvious option is use of the ubiquitous cellular networks. The cost of delivering unicast entertainment content over the cellular infrastructure to the automobile is still prohibitively high.

Delivering multimedia content to the rear seat of an automobile is an increasingly important and interesting application. While the use of DVDs are common, it is easy to see that a richer class of information and entertainment

could be downloaded from devices in the home or a hotspot. For example, an educational or entertainment program watched partially by a child in the home during the evening or early morning could be downloaded into the automobile for continued viewing during the commute to the school. It is also possible to download movies or other favorite entertainment programs for long journeys from the home computer or personal video recorder(PVR). In addition, it is also possible to deliver useful information to the front seat driver/passenger. For example, a user who has mapped out a trip route using the Internet could easily download this information into the automobile in a map or voice format.

Usage of content retrieval capabilities in a hotspot can take on several forms. For example, for the rear seat viewer, it is possible to get a favorite game downloaded from a hotspot while on the road. In the hotspot scenario, it may be required that the content be delivered at several times the rate of the program itself.

The hotspot usage scenario can be extended to professionals on the road. As an example, consider a trucker at a rest stop. Information content (such as email, directions, trucking instructions, voicemail etc) and entertainment content (such as movies, sports etc can all be downloaded in the short period of 10-15 minutes that the trucker spends at the stop. While the task is easily achievable with the first category of content, it is a challenging task to deliver sizable video content in the given time frame with existing technologies.

The quality of video compression is a key factor in transporting video over the WLAN infrastructure. MPEG2 is a natural choice given the popularity of the format. However, emerging formats such as H.264 (aka MPEG4-AVC)[4][5] are twice as compression efficient while achieving the same quality. Several satellite and other broadband systems are currently considering upgrading to the more efficient compression format. Given the longevity of the automobile, it would be useful to adopt a forward-looking standard that provides the best quality and transport efficiency.

When a WLAN client is part of the automobile, it is easy to see that several classes of services can emerge.

Apart from the technology challenges of reliably and securely delivering the content, the business models also tend to be complex. Since the content is delivered through an home or hotspot infrastructure, the owners of the data pipe to these venues may expect a revenue sharing arrangement.

The rest of this paper is organized as follows. In the next section, we address the overall system architecture and describe the key components for this application. In Section 3, we address some of the wireless constraints and suggest

some solutions. In Section 4, we address the video compression related issues. Section 5 attempts to address the security problem and the next section will address some of the business related issues. Finally, we conclude the paper with some recommendations for a deployment scenario.

## System Architecture

The overall system architecture will depend on the distribution options and business models. Since the WLAN infrastructure is intended to address the secondary (last 100 meters) distribution scenario, it will be assumed that there is a primary infrastructure for delivery of the content. The models for a home network distribution and hot spot distribution could be somewhat different.

### Home Network Infrastructure

A home network distribution model will have a primary broadband distribution pipe terminating at the home gateway as shown in Figure 1. This could be a cable, DSL, satellite or terrestrial termination.

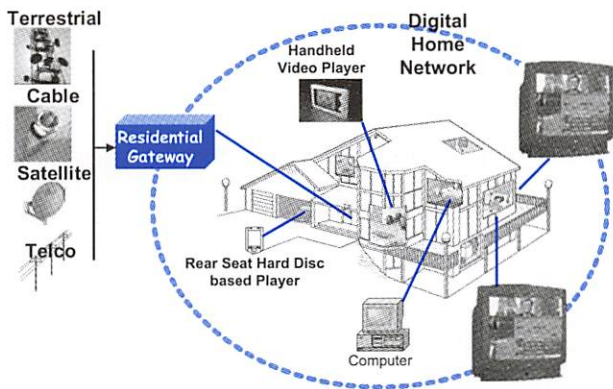


Figure 1. Home Network Distribution

The home network itself has a wired or wireless infrastructure. WLANs are the most obvious choice for a wireless infrastructure. This is indeed becoming very popular in the home environment for data distribution. A WLAN in a home today allows for the PC or laptop to be untethered and still have a connection to the Internet and other data services. An extension of this network would be the WLAN client device in the automobile.

There are two possible usage scenarios. A user on a personal computer locates content either on the Internet or in other devices in the home. This content is first downloaded into the PC and then wirelessly downloaded into the hard disc in the automobile. The reason for this two-step process is simply convenience. In this scenario, the device in the automobile is simply viewed as a peripheral of the personal computer and the WLAN simply serves to enable a wireless transfer from the personal computer to the automobile. A second usage scenario is downloading the content from the Internet or other home appliance directly into the automobile. In this scenario, the home network may be configured to be a cluster of peer devices which can communicate directly with each other and share the WLAN resource. In either scenario, downloading is the key transfer mechanism. Standard TCP-IP could be used to ensure an error free transfer. Streaming in this scenario is not very useful given the nature of the delayed usage model.

Content from certain devices in the home or from a network service provider could remain encrypted on the hard

disc of the automobile until it is ready to be decoded and displayed. This is very similar to the model used in PVR solutions today. There is, however, an added complexity compared to the PVR solution when content is stored on the automobile hard disc. In a PVR, the expectation is that a unique encryption scheme works for both streamed and PVR content since it is from the same service provider. In the case of the automobile, guaranteeing this can prove to be challenging from a business perspective. This problem will be discussed in a later section.

### Hotspot Network Infrastructure

Public hotspots could be an excellent source of content for the automobile equipped with a WLAN client and a hard disc device. It must be made clear that the type of services that can be provided with a hotspot infrastructure will depend on the amount of time a user spends at the hotspot. Figure 2 illustrates the generic concept. There are several possible scenarios and usage models that fit the hotspot model for content distribution. Let us consider the model of the hotspot in a gas station. For example, User 1 is interested in getting directions at a gas station. User 1 can either access the Internet through the Hotspot or use the walled garden services to get this and other local information downloaded into the car. A mobile professional could also use this infrastructure to automatically synchronize email and even download music content into the automobile. This scenario specifically addresses the front seat driver. Another scenario is User 2 who wants to download multimedia content for back seat entertainment. Once again, this can be content from the local walled garden offering or the Internet.

In either of the scenarios developed earlier, the service model is easily determined by hotspot providers and can take several forms including a per-use fee or other more complex models.

The type of content transferred to the automobile in a gas station maybe limited to the amount of time that a client takes to fill gas. This requires very high transfer rates on the network to transfer meaningful content into the car.

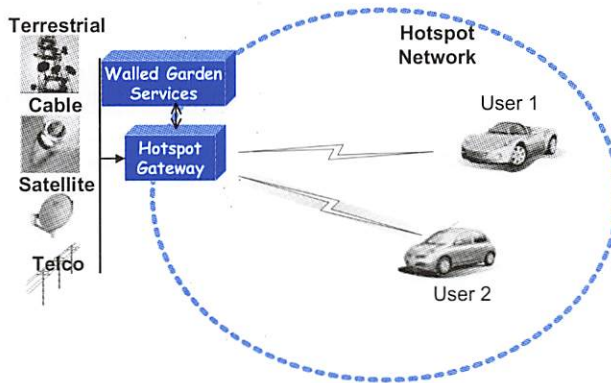


Figure 2. Hotspot Network Distribution

A second usage model for the hotspot network is a broadcast/rebroadcast model. Content from local television or other local information/entertainment could be broadcast or multicast using the WLAN infrastructure. However, this scenario is only meaningful if the automobile spends considerable amount of time at the hotspot. This is quite possible in a mobile home or a camping ground where the automobile spends considerable amount of time. In many camping ground areas and mobile parks, terrestrial reception

may be quite poor and cable hook ups may not be possible to a automobile. The broadcast/multicast usage model imposes a different set of criteria on the client device. There is no requirement for a hard disc drive and the cost of the client devices could hence be considerably less expensive.

### Client Device on Automobile

The device in the automobile should, in general, have a network interface, storage capability, one or more displays and some graphical user interface tools. Security and digital rights management provisions are optional and will depend on the service model that is adopted. It is assumed that a WLAN client device is available in an automobile to network with a home network or a hotspot. In order for this to be reasonably future proof, the WLAN client device in the automobile should support IEEE802.11b, IEEE802.11g and IEEE802.11a modulation formats[6][7]. This is a fairly realistic assumption given the current state of the art and cost structures for these radios. In case flexibility is expected, a compact flash or PCMCIA card slot for the radio can be provided. Through the lifetime of an automobile, it is conceivable that more efficient radio technologies may emerge and an easy upgrade path may be desirable.

We also assume that a hard disc is included in the entertainment system. Contents of this hard disc may be managed locally in the automobile or from a remote computer in the home. These contents could be visible in the home computer much like the content on other devices in the home network. It is also easy to logically separate contents that are intended for the rear seat and the front seat in the automobile while using a common external networking interface.

### WLAN Distribution Issues

WLANs have become extremely popular in the last few years as a means to untether end devices from the wired infrastructure. The most popular WLANs operate in the Industrial, Scientific and Medical(ISM) bands that have frequency allocations in the unlicensed 900MHz, 2.4GHz and 5GHz bands and the Unlicensed National Information Infrastructure(UNII) bands at 5GHz. The total bandwidth allocations and transmit power limits are listed in Table 1.

Type	Frequency (MHz)	Bandwidth (MHz)	Maximum Power(W)	Maximum EIRP(W)
ISM	902-926	26	1.00	4
ISM	2400-2483	83	1.00	4
ISM	5725-5850	125	1.00	200*
UNII	5150-5250	100	0.05	0.20
UNII	5250-5350	100	0.25	1.0
UNII	5725-5825	100	1.00	200*

\*200W EIRP applies only for point-to-point applications

**Table 1.** WLAN Spectrum Details

The effective isotropic radiated power (EIRP) limits allow for some directionality provided by antenna gains and could be very useful for access points to extend coverage. Also, operation on the unlicensed ISM bands mandates spread spectrum modulations only. Table 2 provides details of the modulation (CCK refers to complementary code keying and OFDM refers to orthogonal frequency division multiplexing) and throughputs supported by the various standards.

Both the IEEE802.11b and IEEE802.11g standard operate in the 2.4GHz ISM band while the IEEE 802.11a stan-

dard operates in the 5GHz band (both ISM and UNII). It must be noted that the available spectrum allows only a fixed number of non-overlapping channels to be simultaneously operated. Also, the data throughputs indicated in the standard theoretical throughputs. In practice, based on the quality of the link, the standard settles on the best possible modulation and correspond throughput. In addition, there are other overheads in the network layers of the IP stacks that are quite significant.

Standard	Modulation Type	Supported Data Rates (Mbps/sec)	Maximum Data Rate (Mbps/sec)	Band of Operation (MHz)
IEEE 802.11b	CCK	1, 2, 5.5, 11	11	2.4
IEEE 802.11a	OFDM	6, 9, 12, 18, 24, 36, 48, 54	54	5.x
IEEE 802.11g	CCK OFDM	CCK: 1, 2, 5.5, 11 OFDM: 6, 9, 12, 18, 24, 36, 48, 54	54	2.4

**Table 2.** Data rates supported by various WLAN modulation schemes

In the home environment, given the non-time critical download nature of the transaction between the automobile and the data sources in the home, the download speeds are not very important. A reliable download could simply use TCP-IP and reasonable performance can be expected.

In a hotspot environment, depending on whether it is a download application or a streamed broadcast/multicast, there are several issues. For the downloading application, there may be several users contending for the various available carriers. The hotspot gateway must have the intelligence to perform the bandwidth allocation function to maximize the use of the radio resource and ensure a degree of fairness among the users. UDP-IP is normally used for broadcast/multicast streaming. In that case, given that different users see vastly different channels, it is advisable to multiplex the compressed video streams, use a robust mode (such as Mbps/sec mode in 802.11b ) and add FEC at the application layer (if necessary) to maximize coverage. It must be realized that any such additions imply a deviation from the standard and hence some additional software in the application layer to support this application.

One other key issue in the use of WLAN and IP infrastructure for video transport is the mapping of compressed video frames into the IP packet structure. While no standardization exists for this specific task, there are several generic IETF RFC drafts that detail this mapping. There is work remaining to tailor the mapping to be suited for the home and hotspot environments (which present vastly different wireless error profiles) coupled with the frame size structures of specific video compression formats.

### Advanced Video Compression

A standardized video compression system is a key design element for delivering video to the automobile. The video compression system should support video streaming or downloading content to the vehicle. In addition, the terminal device in the car could be portable, and therefore the video compression system must be capable of operating on a handheld device. The main requirements for the video compression system therefore would be

- Low bit rate/high video quality – For streaming or download applications a low bit rate video compression system is needed. Streaming wireless networks have minimal bandwidth depending on the environment. In addition, to support download applications a low bit rate codec optimizes HDD video capacity and the transfer time to the vehicle.
- Low-Medium complexity – For portable devices used also in the car, then low power codecs are needed. In the case that the device is permanently installed in the vehicle then a higher complexity receiver is possible.

There are many digital video compression systems in use today in a variety of consumer and professional products such as digital broadcast networks, DVD, and content production. Many of these systems have employed the MPEG2 video compression standard. Due to the wide use of MPEG2, the cost of deployment has decreased rapidly (e.g. \$50 DVD players).

Over the past 10 years since the completion of the MPEG2 standard, there has been much research and advancement in video compression technology. The MPEG4-part2 standard was developed in the late 1990s and achieved 30% compression efficiency over MPEG2. MPEG4-part2 has found some uses for Internet file sharing, and

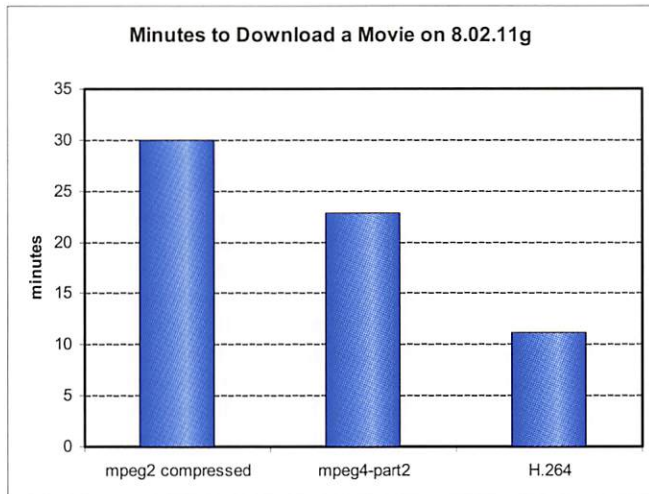
other applications. However, greater coding efficiency (higher compression) was needed to enable video content delivery over newer wireless networks and to promote HDTV.

During the last 4 years such an advance in compression efficiency has been developed in the H.264/MPEG4-AVC video compression standard. This standard was completed in 2003 for a low complexity profile called Baseline, and a more advanced Main profile which offers the most coding efficiency (20-30% more efficient than Baseline). Both of these profiles are excellent codecs for vehicle video systems.

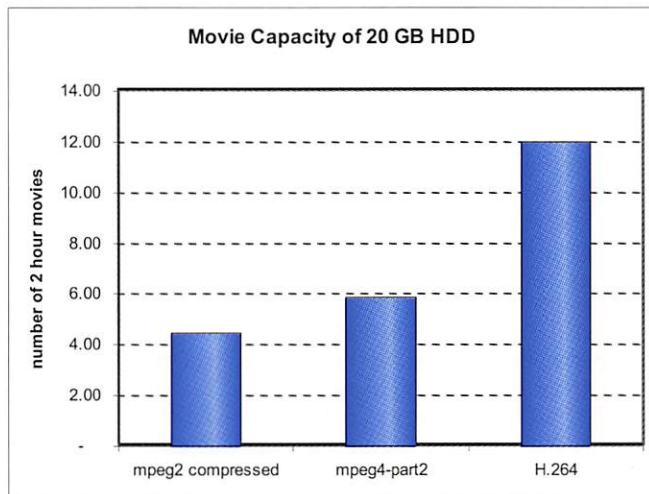
The H.264/MPEG4-AVC video compression standard can provide more than 2 times the compression efficiency of MPEG4-part2. This translates into several application advantages for the automobile video device. First, as shown in graph 1, the transfer time from a WLAN network is only 8-10 minutes for a H.264 compressed two hour movie versus 20-30 minutes using previous standards (Table 3). For the gas station application alluded to earlier, a ten minute wait for a movie download would be acceptable for most users. We are assuming an average transfer rate of 15 Mb/s using the 802.11g standard. Also, using multiple non-overlapping carriers, it will be possible to affect multiple transfers simultaneously from the walled garden server to several users. Second, with H.264 12 movies can be stored on a 20 GB hard disk drive in the car versus only 4-6 using previous standards (Table 4).

In streaming applications from wireless networks, the number of channels available greatly depends on the video compression system. H.264 enables 2-3 times more channels streamed in these wireless networks for the same allotted spectrum.

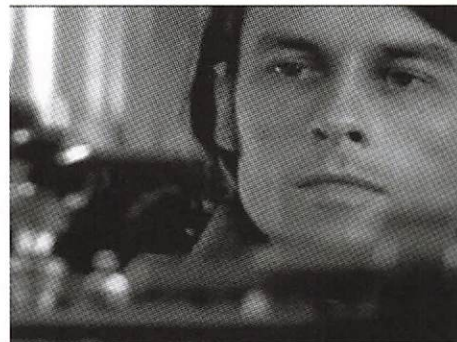
H.264 also provides much improved picture quality. The images in Figures 3 and 4 demonstrate MPEG4-part2 coded at twice the bit rate of H.264. With half the bit rate, H.264 does not create the blocking artifacts and other artifacts found on the MPEG4-part2 image. These still images can only demonstrate part of the effect.



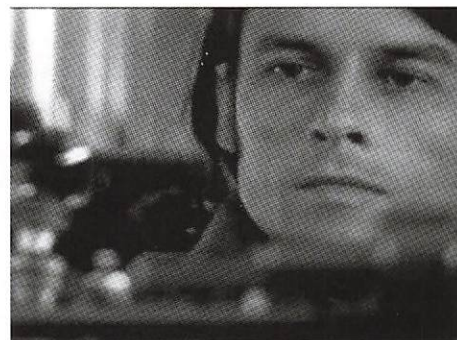
**Table 3.** Time taken to download a 2 hour movie using different compression standards



**Table 4.** Number of movies stored using different compression standards



**Figure 3.** H.264 main profile 354 Kbps



**Figure 4.** MPEG4-part2 ASP 704 Kbps

H.264 includes error resilient features such that the application developer can provide a robust video experience in lossy wireless networks. Depending on the loss characteristics of the network, the parameters of the H.264 bit-stream can be adjusted to optimize the error performance for a specific network.

H.264 also contains a network abstraction layer (NAL). The NAL provides a clean interface or API such that virtually any network protocol or file format can be supported. Standards for H.264 carriage over IP, MPEG2-TS, and the MPEG4 file format have been developed for example. H.264 NAL units are easily adopted to fit into any network system layer.

H.264 implementations have been appearing on the market since early 2003. In 2004 there have been numerous announcements for support of H.264 ICs for portable consumer electronic devices, high definition set top boxes, and real time encoders.

## Security and Content Protection

Content protection and wireless network security are key issues that must be addressed in order to enable content to be delivered into an automobile using WLANs. The set of issues are different depending on the environment of operation and the nature of the content.

### Home Environment

In the home environment, there are several issues to be resolved.

#### Fair use of Purchased Content:

A key question to answer is the following. Could legally purchased content (such as a DVD) or content subscribed to (such as a TV program) be transferred as is to the hard disc in the automobile or modified (to render it more suitable for wireless transfer) before it is distributed to the automobile? Does this constitute fair use? We contend that it is indeed fair use and should be allowed at least at a reduced resolution if it were to adhere to the fair use practice in the analog world.

### WLAN security

WLANs have had security issues in the early stages of development (using Wired Equivalency Protocol). These issues are getting rapidly resolved and there are several solutions including those adopted in IEEE803.11i or using ActiveX downloads[8] to enable a client agnostic solution. It is our contention that most wireless security issues are well resolved for communication between the automobile and other data devices in the home.

### Content Encryption Issues

Content provided by service providers are normally encrypted using a proprietary conditional access system. If this content were to be further transferred to the automobile, there are several choices.

- Decompress the content and recompress the analog output for transfer to the automobile. Such recompressions may be legally limited to a lower resolution/quality.
- Employ a smart card (similar to a second satellite receiver in the home) type system on the automobile that will enable the automobile to have the functions and features of a PVR in the home. In this case, the service is seamless and the automobile is simply viewed as an additional- room service in the broadband carrier network that is commonly deployed today.

- Use of software security tools (which may be perceived as being of a lower capability than a smart card based system) to protect lower resolution content delivered to the back seat of the automobile. It is even conceivable that the primary network service provider may either transcode the content on their local settop box or even send the content over their infrastructure targeting automobile applications.

### Hotspot Environment

In the hotspot environment, most of the challenges relate to WLAN security. As alluded to earlier, most of these issues have been resolved with strong security solutions. Since content obtained from a hotspot is accounted for with established business relationships between the walled garden service owner and the content owner, there are no additional fair use issues than the ones discussed earlier.

Due to the extreme sensitivity of the content distribution and fair use issue, we believe that only part of the answer lies with technology solutions including a strong security system. When the legal redistribution of content for fair use is resolved, the automobile system provides no major additional challenges.

### Business Models

Digital home networks using WLANs are challenged beyond data distribution (where it is a convenience) to offer a higher class of service with quality of service and stronger security measures for video distribution. There does not seem to be an obvious business model to support the extra features that it takes to support video distribution. In order for a broad range of video content to be made available to the automobile from devices/services terminating in the home, it is important that there be a meaningful business model. One option is for the broadband service provider to manage content delivery to the automobile much like they do it for a second room PVR. Given the proprietary nature of CA systems, this solution has the danger that the automobile security system may be locked to the broadband access vendor. Also, this solution does not work for fair use of DVDs (for example) purchased by a user who now wants it ripped into the hard drive in the automobile. A generic standardized smart card or SIM card interface supported by the device in the automobile may well be the answer to this problem.

For content distribution in a hotspot, content or information downloading may well be supported on a per-use basis or billed by the Wireless ISP using established business models. In this case, revenue sharing with the hotspot owner could have models similar to those established for Internet access.

For broadcast/multicasting applications, a model that may work well is to extend the current service enjoyed by the customer in the home to a hotspot service for an incremental fee. Credentials are established when the automobile is in the home network. These credentials are then verified when the automobile enters a hotspot and the correct class of service is made available. This could be a very useful service extension for a satellite operator, for example. The local hotspot owner may easily be able to support one or more extended services depending on the available bandwidth.

The cost of the device in the automobile will be determined by the display, the storage capability, the WLAN network interface and the cost of video decompression. While supporting multiple standards based video de-compression formats (such as MPEG2, MPEG4-AVC/H.264) may have added cost initially from a device perspective, it provides the



most future proof path for a variety of content to be made efficiently available in the automobile.

## Conclusion

We have discussed various aspects of video content distribution to an automobile from the home and a public hotspot. Based on current technology trends and pricing, we recommend the choice of multiple WLAN standards (IEEE 802.11b, IEEE 802.11a, IEEE 802.11g). We also recommend the support of an existing video compression format (such as MPEG2) and support for a more efficient standards based future format (H.264/MPEG4-AVC). Security and content protection solutions can range from renewable hardware solutions such as smart cards or software-based solutions. The nature of the solution depends on the delivery mechanism and the nature of the content.

In conclusion, we believe strongly that content distribution to automobiles using WLANs has strong potential. The decision of an automobile maker to introduce a WLAN device with storage, appropriate support for video decoding and security tools and relationships with network access providers is expected to be the key enabler for this business.

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## Joint Rail Conference

*Pueblo, CO May 16-18 2005*

The ASME Rail Transportation Division and the Land Transportation Division of the IEEE Vehicular Technology Society, are pleased to present the 2005 Joint Rail Conference (JRC) from 16-18 March 2005 in Pueblo, Colorado. For over 40 years, the annual JRC has been providing a unique and comprehensive forum for engineers, equipment manufacturers, rail maintenance and operations personnel at transit companies, government officials, and other professionals involved in the business of passenger and freight rail transportation to share operating experiences and learn about new and innovative activities in rail-way mechanical and electrical engineering.

The theme of the 2005 JRC is Research and Testing for Industry Advancement. The conference will start with an optional tour of the 53 square mile Transportation Technology Center where worldwide research is conducted by companies and agencies in the area of passenger, locomotive and freight equipment and railroad infrastructure. The two-day technical conference will focus on advances in design, analysis and testing of equipment serving rail industries.

The 2005 JRC will be held immediately following the

10th Annual Association of American Railroads (AAR) Research Review in Pueblo, Colorado. This will give attendees of either conference the opportunity to experience both conferences, broadening the experience and gaining new contacts and new technical perspectives.

Papers which will be presented in the electrical papers track are as follows.

### **Controlling and Executing Communications Based Train Control (CBTC) Installation & Testing with a CBTC-Ready Vehicle**

Rajee P. Alexander, *Booz Allen Hamilton*, Edwin Mortlock, *Parsons Transportation Group*

New York City Transit (NYCT) has undertaken a program to install CBTC (Communications Based Train Control) technology. While this significant undertaking involves many subsystems, the most complex subsystem, both technically and from the logistics of implementation, is the carborne.

The definition of the CBTC interface requirements in the R143 cars, a process that began one year prior to the award of the CBTC contract, was successful, although

complicated by a major change in design of the car-borne CBTC equipment, after the cars were delivered. That change necessitated a major modification to the interfaces. The subsequent installation and test of the actual CBTC equipment also brought many challenges to the project team.

Beginning in late 1998, NYCT contracted with a car builder (Kawasaki Rail Car, Inc.) to construct and deliver a CBTC ready vehicle. Sufficient space, power, mounting points, cabling was provided and functionality designed into the car-side subsystems. The interface design was originally developed for all 3 potential CBTC supplier systems, however after the award of a contract to the CBTC contractor in 1999; the interfaces were refined to match only the suppliers systems. New York City Transit, in partnership with the CBTC supplier undertook the task of installation and testing of the car-borne CBTC equipment in a 14 month production program. Prior to start of work, the Contractor developed an installation program manual. This manual has provided the insight and guidance needed for NYCT car shop personnel to understand the significance of the installation process, while also providing a mechanism to maintain records for verification of installation work.

At the time of writing, the installation and test activities are 11 months into this program. During installation, the use of statistical process control charts and the presence of support staff representing NYCT Capital Program Management (the CBTC sponsoring Department) helped to identify variances and led to corrective action to improve the installation process.

Finally, the testing process has involved significant coordination efforts between the contractor, car equipment engineering, rapid transit operations, project management, and force account labor. The testing has involved extensive static tests of single and coupled units and coordinated dynamic tests conducted on an existing operational line.

This paper discusses key interface implementations by the Contractor, testing tools and processes, and lessons learned on the car-borne installation, testing and commissioning program.

### **CBTC the Solution for Resignalling Lines under Revenue Service**

Corinne Braban, Jean-Pol Mura, *Siemens Transportation System*

All major cities in Europe, North and South America share one common feature: their transit systems which carry millions of passengers daily are getting old. There is a need to provide enhanced safety via continuous speed supervision and high efficiency train separation, whilst providing for more throughput. After briefly recalling the history of the signalling technology development and Siemens' expertise in this field, the author will discuss the challenges faced by the Signalling supplier and the Transit property in resignalling a line under revenue service and will review the key features of Communication Based Train Control systems that facilitate this endeavour. Animated slides will permit to grasp very quickly the principle of operation ( Moving Blocks, DSSS Radio, security aspects), explain and challenge the technical choices. More time will be devoted to practical cases like NYCT Canarsie Line, RATP's Ouragan program, BKV Budapest M2, Guangzhou L4 L5 etc..., their specific cut-over programs will be detailed as well as the benefits expected .

### **Hazardous Material Tracking for Rail Cars: Power Considerations and Field Test Results**

Robert Gray, *The Pennsylvania State University*

Current methods of rail car tracking have been described as inadequate for critical or secure transport of hazardous materials. Methods such as AEI tag reading provide position information for a fixed location while locomotive GPS information does not necessarily provide a positive identification of rail car location. Railroads stand to benefit from a reliable self-contained rail car tracking solution.

The primary elements of a tracking solution are: 1) The microprocessor controlled device, 2) the power supply, and 3) the antenna. Research was conducted in each of the three areas to yield a self-contained solution capable of providing rail car positional information based on customer requirements. With several capable GPS modules on the market, one of the biggest challenges proved to be the choice of a suitable power supply. This paper shall focus on the power supply and the engineering challenges involved in choosing one to meet the user electrical and environmental specifications.

The challenges behind a suitable power supply include:

1) Which type of power supply should be used? 2) How long will it last? 3) How much energy is require by the message transmitting device?, and 4) What are the environmental concerns? These questions were addressed by taking detailed energy measurements using LabView, investigating message latency, incorporating statistical analysis and deploying a rail car field test. The results of the study indicate that the tracking solution is capable of several years worth of reliable position information.

### **Strategy of Train Operation under Maximum Train Capacity in Mass Rapid Transit Systems**

Bwo-Ren Ke, Nanming Chen, *National Taiwan University of Science and Technology*

This paper presents an approach to optimise the running speed code of each signalling block between inter-stations of mass rapid transit systems with fixed-block signalling (FBS) system. Its object is to minimize train energy consumption with maximum train capacity under considerations of gradients of alignment, minimum headway of ATO system and train average speed and to reduce train peak power under proper selection of running speed code of each signaling block. The concept of equi-block signalling system is used to establish the block-layout of FBS system in this paper. Considering the effect of response delay of automatic train operation (ATO) system, jerk limit of train and constant train acceleration during the response delay of ATO system to formulate the braking distance between two speed codes, the genetic algorithm (GA) is applied to determine the shortest length and speed codes of signalling blocks. Safety is the principal consideration for any signalling system. Even in normal conditions, the block-layout must still have enough braking distance. The block-layout of signalling systems is designed by dividing equally the length between stations and the block length must be larger than the shortest braking distance. The block-layout of minimum energy consumption can be devised using the least signalling blocks by comparing energy consumption with different aspects and number of blocks. The dynamic programming (DP) is used to search the optimal combination of train running speed code of each signalling block for saving energy and reducing peak power on different aspects and numbers of signalling block. Single train running dynamics during each signalling block of inter-stations are simulated with different running speed codes and the limits of train

acceleration/deceleration and jerk. The main factors of affecting train peak power are the alignment, train weight and train acceleration. In this paper, the alignment and train weight have been considered, and then the train acceleration is tuned by PID control to meet limits of train velocity, acceleration/deceleration and jerk. This paper will illustrate the optimal result with four figures showing the block-layout between inter-stations, trajectory of train speed and speed limit, acceleration and jerk of train running and train power consumption, respectively.

### **Automatic Restart for Communication Based Train Control Systems**

Anton Mirtchev, *Bombardier Transportation*

Existing, fully automated, Communication Based Train Control (CBTC) system designs are facing a significant issue relative to system recovery due to a complete wayside Automatic Train Protection (ATP) computer outage, for both primary and backup.

This paper describes the problems related to CBTC automatic recovery and presents how the problem is handled with the Bombardier CITYFLOTM 450 and 650 automatic train control systems.

CITYFLO 450 and 650 designs use additional automatic recovery system called Train Registry System (TRS). This is an independent vital subsystem that tracks trains and non-initialized vehicles throughout the revenue service area, maintenance area and outside automatically controlled areas. This paper describes TRS basic operation and train detection mechanism.

### **Using Fiber Optic-to-Radio Frequency (RF) Conversion for Communication-Based Train Control**

Mark Lamborn, *Bombardier Transportation*, Matthew Thomas, *Andrew Corporation*

The design of the Automatic Train Control (ATC) Radio System for the Bombardier CITYFLOTM 650 (formerly called Flexiblok) has evolved into a system employing a fiber-optic based RF signal distribution system. In a communication-based train control system, the RF signal distribution system must achieve near-continuous signal coverage for the transit system's route and at the same time afford high availability through redundant design.

This paper begins with the background for the first-generation system using distributed line amplifiers, as were employed at San Francisco International Airport, Seattle-Tacoma International Airport, Dallas/Fort Worth International Airport, and SEPTA's Subway-Surface Line in Philadelphia.

The second-generation design uses a fiber optic-based approach that converts the base radio signal directly to an optical signal at the train control equipment room and recreates the RF signal up to 20 kilometers away. It is used for both radiating cable and line-of-sight antenna solutions. The advantages of this latest generation design are discussed, as well as how the approach is tailored for train control applications. The direction of RF technology in communication-based train control for the future is also addressed.

### **Security of Railway EOT Systems**

Paul Craven, *Simpson College*, Stephen Craven, *Wabtec Railway Electronics*

Most railway trains use an End of Train (EOT) device to communicate from the front of the train to the end of the train. The wireless protocol for these communications is not secure. This would allow a hostile person to initiate at will

an emergency braking event with most freight and passenger trains. This paper examines the vulnerability and recommends a new backwards-compatible protocol to reduce the threat.

### **The RUNE project: Integrity Performances of GNSS-Based Railway User Navigation Equipment**

Antonella Albanese, Livio Marradi, *Alenia Spazio*, *LABEN Division*, Giovanni Labbiento, *VIA Rail Canada Inc.*, Giovanni Venturi, *Ansaldo Segnalamento Ferroviario S.p.A.*

The RUNE project (Railway User Navigation Equipment) is aimed at demonstrating the use of GNSS Integrity and Safety of Life service characteristics for defining a satellite-based system to perform train location for safe railway applications.

ALS-Laben is leading a consortium for the development and demonstration of the RUNE equipment, under ESA contract. The project involves both a HW-In-the-Loop laboratory set-up as well as a 3 months field-testing on-board an experimental train of the Italian train operator Trenitalia. The primary objective is to demonstrate the improvement of the train self-capability in determining its own position and velocity, with a limited or no support from the track side, and to show that the equipment can comply with the European Railway Train Management System requirements.

The RUNE technical solution is based on GNSS receivers: navigation data will come from GPS with differential EGNOS corrections (European Geostationary Navigation Overlay Service) to enable autonomous and reliable determination of train position, velocity under practically all environmental conditions.

The system will offer another technological approach for the train location function: the use of GNSS signals integrated with inertial sensors and on-board odometers, in an "intelligent" system of mutual calibration, error filtering and error correction, represents a technical, industrial and operational challenge.

Availability and integrity requirements are the most challenging obstacles towards an ERTMS/ETCS compliant GNSS aided railway navigation equipment. RUNE is designed to take advantage of the current EGNOS integrity and wide area differential correction service and extend its availability through an hybrid navigation system based on GPS/EGNOS, INS and Odometer data processed by a navigation EKF.

The achievement of such objective would lead to the reduction of the frequency of physical balises with a significant reduction of the infrastructure costs by replacing with virtual balises, still maintaining the level of safety currently provided. RUNE will produce to the on-board Train Control equipment a balise-crossing message when a virtual balise is detected and in addition assists the locomotive engineer on approaching signal locations on the basis of a track map and on controlling the train velocity on the basis of allowed velocity profiles.

The RUNE equipment architecture in terms of sensors and navigation filter design were presented in previous work. This paper will focus on functional and performance test results that validate the proposed architecture in a realistic railway environment and integrated by laboratory tests.

### **A Practical Collision Avoidance System Implementation using Proven Signaling Components**

Chinnarao Mokkapati, Robert D Pascoe, *Union Switch & Signal*

This paper provides a description of a Collision Avoidance System (CAS) that is being developed by Union Switch &

Signal for a U.S. Railroad that carries both passenger and freight traffic. The CAS performs three main functions: automated traffic planning, vital positive train control, and vital collision avoidance. This CAS is being implemented in a cost-effective manner with proven signalling system elements such as the US&S MicroLok®II, MicroCab® and a standard computer-aided dispatching subsystem. This implementation will provide a higher level of safety and performance relative to the manual train control system currently in operation on the Railroad. The safety aspects of the CAS will be proven to be in compliance with the proposed FRA Rule 236 Subpart H requirements.

### **Multi-Stage Hybrid Drives for Traction Applications**

Paul Flaherty, *Goatlick Engineering LLC*

Recent increases in fueling costs have created new interest in energy storage technologies for transportation applications. Railroad locomotives often have high peak-to-average demand for power, which leads to poor fuel efficiency from diesel prime movers, or arcing and pitting of overhead catenary.

One approach to this problem has been the development of diesel-battery hybrid locomotives. A large bank of lead-acid batteries provides peak instantaneous power, while a constant speed, high-efficiency diesel-electric generator set provides average power to the battery bank. This arrangement has proven practical in the Green Goat and other hybrids, although sizing of the generator set for a particular application, such as switching a railyard, becomes crucial. In addition, battery wear must be accurately predicted for peak performance, and the battery bank itself must be replaced after a few thousand cycles, increasing cost and creating a lead disposal hazard.

Recent advances in capacitor design have created a new family of devices, known as supercapacitors. These devices have a mass-energy density which approaches lead-acid batteries, but with dramatically lower internal resistance and potentially limitless cycle life. However, the volumetric-energy density is much lower than batteries, thwarting a direct application in a practically sized rail vehicle.

In this paper, a multi-stage drive is proposed, which takes advantage of the best properties of each energy storage device – capacitor, lead-acid battery, and diesel prime mover. The capacitor provides high peak instantaneous power, absorbing the cyclic nature of the locomotive's power demands. The battery bank acts as a buffer stage, with fewer full discharge cycles and longer life. The diesel prime mover provides long-term sustaining power for the system. In overhead catenary applications, adding a supercapacitor stage reduces peak current through the wire-pantograph interface, reducing wear and improving lifetime of the entire system.

### **Cutting Traction Power Costs with Wayside Energy Storage Systems**

Louis Romo, *Vycon Incorporated*, David Turner, *Turner Engineering Company*, Brian Ng, *Brian Ng Engineering, Inc.*

New electrically propelled passenger trains use AC propulsion with induction traction motors and variable voltage, variable frequency drives. Benefits include higher performance, reduced starting energy use, regenerated braking energy, lower maintenance, and a broadened range of operating conditions. However, some Transit Operators have found that new trains have not fully delivered the economic benefits of regeneration.

An effective Energy Storage System (ESS) can capture the full energy savings benefit of regenerative braking and will reduce the peak power usage which incurs high peak power demand charges. Candidate ESS technologies include flywheels, supercapacitors, and batteries. This paper provides a set of typical requirements for a transit wayside ESS, and evaluates the strengths and weaknesses of the candidate technologies against the requirements.

Primary ESS benefits are energy savings and peak power reduction. The authors calculated potential savings for a generic ESS at two typical transit systems: a dense US heavy rail system with 10-car trains, and a US light rail line that runs trains of two to four Light Rail Vehicles (LRVs). In the heavy rail case study, a properly sized ESS will provide energy savings of up to 4.4 kWh per train start/run/stop cycle. This is a savings of 3.6 MWh per day per ESS, or 21% of the total energy. In the light rail case study, ESS will reduce the peak power demand by up to 119 kWh/H, or 23% of the total peak demand.

### **Renovation of Medium Capacity Transit System Traction Electronics at Taipei Rapid Transit System**

Bih-Yuan Ku, *National Taipei Univ of Technology*, Chin-Tsai Yeh, *Taipei Rapid Transit Corporation*

In this paper we present the Taipei Rapid Transit System (TRTS) program to replace the DC motor drive of the Medium Capacity Transit System (MCTS) with modern IGBT power circuitry. The MCTS in Taipei City is an automated guideway transit system built by Matra of France, and started revenue service only eight years ago. However, some of its traction power system components already suffered a break down rate as high as fifty percent, and improvement or replacement measure was called for long before the mid-life refurbishing. Rapid Transit system was introduced in Taiwan as late as 1990's. At the designing stage it was required that only test-proven technologies be adopted to ensure reliable service. Therefore, DC motor and power transistor drive were deployed on MCTS vehicles even modern inverter-type AC propulsion was in service in other transit systems overseas. That conception soon faced the difficulties as the rapid progress in computer and electronic technology makes parts and components obsolete sooner than expected. Adding to the problem is the withdrawal of Matra from the MCTS line shortly after its commercial service due to legal disputes. The result is that the operator of TRTS, Taipei Rapid Transit Corporation (TRTC) was left alone to assume full responsibility of maintenance and reparation without technical support from the original contractor. Five years after the MCTS line started commercial operation in 1996 it was found that the drive board for field circuit of DC traction motors suffered significant breakdown rate nearly fifty percent, and many boards broke down more than once even after it was repaired. The field circuit employed power transistors designed in 1980's with a large number of discrete components, resulting reliability problem and difficulties in service. With modern power electronics technology we replace the cumbersome circuitry for current-controlled transistors by simple and straightforward gate drive circuit for voltage-controlled IGBTs (insulated gate bipolar transistors). Also the large number of discrete components found in the original board is now replaced by modules and ICs, improving service reliability and life expectancy.

### **Security of ATCS Wireless Railway Communications**

Paul Craven, *Simpson College*, Stephen Craven, *Wabtec Railway Electronics*

This paper covers the Advanced Train Control Systems

(ATCS) protocol. ATCS is an open standard for Radio Frequency data systems in railroad networks. Currently ATCS is used for functions such as throwing track switches and changing track signals. Vulnerabilities in the ATCS protocol are discussed in this paper, along with a hobbyist program called "ATCS Monitor" that decodes the signals. Finally the paper looks at the current mitigating factors for these vulnerabilities and proposes additional ones.

### LED Flashing Signals for Rail Crossings: Matching to Properties of the Eye

Theodore E. Cohn, *University of California at Berkeley*

Rail crossing signals have a very long history. First versions were trainman's lanterns swung back and forth to attract attention. Their purpose was, and still is, to alert motorists to the imminent presence of a train. Thus their visibility and attention-getting qualities are key to their function. Signals intended to optimally stimulate the eye thus need to match properties of the filter. The design of these signals has to now, rested upon considerations of color, intensity and size. One principal and important feature of the eye, largely neglected until now, is its temporal processing. Integration over time, often assumed for the eye, is not an accurate description. Under most conditions the temporal characteristic is that of a bandpass, not low-pass, filter. A variety of commercial off-the-shelf replacements for incandescent bulb flashing signals are now available. Many are based upon light emitting diode (LED) technology. LEDs have the potential to meaningfully lessen operating and maintenance costs while also improving upon visibility. We have measured the temporal qualities of several such devices and find a wide range of usability. Some take full advantage of the temporal properties of the eye while others are deficient even compared to incandescent lamps. Some, including the incandescent standard, do not obey strict MUTCD constraints. Those LED fixtures that do not obey the strict MUTCD requirements are likely to give substantial visibility advantages over other alternatives. Our most striking finding is that the optimal attention-getting quality and visibility for paired flashing signals, for equal inten-

sity and color, requires a brief 'off' time between one lamp's extinction and the other's ignition. This particular configuration strongly stimulates the eye and, not incidentally, makes the pair of lamps look like a single lamp that moves, instead of two that flash. Long time rail professionals will recognize that as the look of both the original swinging lantern and the historically-interesting wig-wag, which flashing signals, themselves, replaced. Laboratory and field tests results will be described.

### DC Frame Fault & Ground Fault Field Testing on TriMet Portland Light Rail System

Kinh Pham, *Elcon Associates, Inc.*, Thomas Heilig, *Tri-Met Max Light Rail System*, Xavier Ramirez, *LTK Engineering - Imax Project*, Kai Looijenga, *TriMet*

TriMet traction power substations (TPSs) utilize a low resistance grounding system for the DC switchgear and rectifier equipment enclosures. The TPS negative bus is connected to a dc ground mat through a grounding diode. In addition to the basic dc overcurrent and rate-of-rise relays, each DC switchgear is provided with a low resistance frame fault current relay (device 64C) and a negative-to-ground potential relay (device 64V). Recently, TriMet has conducted several field tests: a) Bolted frame fault tests by applying 750Vdc to the dc switchgear enclosure with the grounding diode connected and then with the grounding diode removed, b) Ground fault tests by connecting the OCS contact wire to a OCS pole ground rod, the ground fault tests were also done with and then without the diode, c) To simulate an arcing ground fault, the ground fault tests were repeated with a 9 ohm resistor inserted in series between the OCS contact wire and the OCS pole ground rod.

This paper provides the test data and discusses the results of these frame fault and ground fault field tests. Technical analysis including personnel safety considerations are performed for various test configurations. The analysis will be focused on ground fault detection since most ground faults are undetected because of the very low ground fault current magnitudes which are normally not detected by the rate-of-rise relay.



## Chassis Control: An Overview of the Present and a Look to the Future

Betty Lou McClanahan, *MIT Media Laboratory*; Amedeo Visconti, *Ferrari spa*; Giampaolo Zen, *Northeastern University*

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*This paper was originally presented in a Convergence session entitled "Digital Driving Increases Consumer Value," suggesting that particular electronic innovations in the passenger vehicle have perceptibly increased the appreciation that consumers have for their vehicles. The paper explores this premise by focusing on chassis control systems.*

*The introductory section of the paper looks at some issues relating to these systems including the underlying concept of*

the car, costs, and integration. In the second section, the authors discuss some aspects of the Ferrari approach to the conception of the GT car. The third section looks at two contemporary trends, namely, that of the reduction of electronic content in the car, and the influence of F1 racing. In the final sections present a few thoughts about customer perceptions of chassis control systems and conclude with some future scenarios.

## Introduction

In the past twenty-five years, a number of startling new capabilities have come into passenger cars. These include the important production innovations introduced by Bosch: ABS (1978); traction control (1986); and electronic stability control (1995).

Chassis control systems continue to evolve and to add cost to vehicles today. Part of that growing cost is the integration of such systems and the resulting increase in vehicle testing and development times. It is conceivable that the extensive range of systems available today has evolved, in part, in response to a particular view of the car. The next section explores this vehicle concept.

## Car as Seamless Information Space

It is possible to argue that at least some of the increase in electronic content, both for purposes of comfort and performance, was strongly allied to the leading conception of the vehicle that arose during the 1990s. Here, we refer to ideas of the car as a "seamless information space" where the driver is engaged in activities (work, entertainment, communication) during the driving experience. In his 2000 Convergence paper, Dr. K. Prasad of the Ford Motor Company, outlined this view of "Seamless Mobility." [1]

### Tomorrow's Seamless Fabric of Mobility

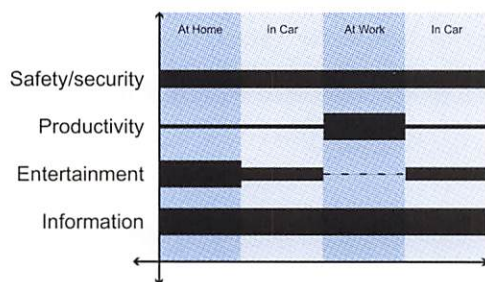


Figure 1. Tomorrow's seamless fabric of mobility.

In this view, all forms of electronic content are available continuously, and in a fully customizable form. As Prasad noted, "In a seamless fabric, services are no longer intermittent but are available continuously and with high quality. In Figure 1, which is taken from [1], the thicker lines indicate greater efficiency of services; the broken lines indicate disruptions in services.

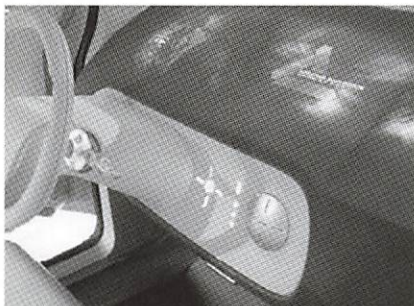


Figure 2. Ford 24-7 Concept.



Figure 3. Lancia NEA offered automatic lane-keeping.

Concept cars of the period that helped to illustrate this notion include the Ford 24-7 and the Lancia NEA.

The Ford 24-7 (2000, NAIAS) presented the driver with reconfigurable and customizable displays as well as with advanced telematic functions and voice controls. [2]

The Lancia NEA (Paris, 2001), overseen by designer Michael Robinson, was both aesthetically and technologically advanced. Robinson's 2000 Convergence paper presented his view of car design as embodying, in part, "the invisible," that is, the digital world living behind the mechanical world. [3]

In cars like these, driving was still seen as the primary task, of course, but the car was increasingly able to assist the driver with new capabilities of independent performance like automatic cruise control, brake assistance and lane-keeping. It is important to note, however, that at the same time that conceptions of the vehicle like these became prevalent, driver distraction also became a central research topic.

So far an extensive list of chassis control devices have been developed. These include:

- ADS: adaptive damping system (adjusts shock absorber proportional valves to control body motion)
- ABS: antilock braking system (maximum braking without wheel lock-up)
- SBC: sensotronic brake control (braking response depending on speed, maximum braking pressure in emergency situations, helps ESP to stabilize the vehicle in cornering)
- BAS: brake assist system (gives maximum braking pressure in case of emergency)
- ASR: anti slip regulation system (limits wheel-spin during acceleration, can be integrated with ABS)
- ESP: electronic stability program (traction control in cornering, often communicates with ABS and ADS)
- EBD: electronic brake-force distributor (adaptive control of rear brake pressure, replaces mechanical prop valve)
- MSR: torque return control (prevents wheel lock-up when decelerating)
- drive-by-wire throttle (electric connection between accelerator pedal and throttle valve)
- Adaptive accelerator pedal (pedal response changes with the driving style)
- Cruise Control (maintains specified speed and can also maintain desired distance from the vehicle ahead)
- drive-by-wire steering (like the Autonomy Hy-Wire concept, electric signals substitute for the steering shaft)
- F1 style steering wheel gearshift
- F1 style electro-hydraulic transmission
- F1 style launch control

## Costs

Increased electronic functionality in the vehicle, including chassis control systems, have had significant impact on vehicle cost, and can make up some 40% of total vehicle costs.

We can distinguish between two different directions in the utilization of electronics. On one hand, there are electronic products for improving vehicle performance. On the other hand, there are devices that improve vehicle comfort. The costs of the second type are usually larger, and in models with a strong comfort character, they can reach the 15% of the total cost. In addition to these two directions, we can mention those electronic devices targeted at increased safety and those mandatory for vehicle homologation.

Hardware costs significantly affect the total cost of the product nowadays. A reliable estimate of such cost is between 5 and 10% of the total cost of vehicle components, even though the edge between objects involving electronics and electronics itself is often not well defined, thus affecting any cost estimate. Different considerations govern the costs of software, that is, the development of software that governs the hardware products mentioned above. Here the values are not always clearly identifiable and they are often (but not always) included in the final cost of the hardware product.

It is clear that a key factor in this second cost typology is the production volume. Cost of software is inversely proportional to production volume. For large production vehicles this cost is negligible, while for niche vehicles it becomes significant.

## Integration

As the electronic content has increased, so has the difficulty of integration. The complexity of these integrated systems is now much higher than the sum of the single devices, because now we need to take into consideration the interaction between all the different variables. This causes testing times to become longer and the development stage more and more important.

Difficulties in integration also arise because of the difficulties in the implementation of “federated” electronic systems on the vehicle. On the one hand, OEMs are still evolving their internal engineering processes to manage integration. On the other hand, the rules for integrating systems may be standardized somewhat for lower level interactions, but not specified for higher level interactions. The rules here may be ad hoc or simply very complex.

Moreover, the idea of open systems may be somewhat stymied by current business models where suppliers maintain commercial advantages by providing complete topical systems in the vehicle.

It is widely recognized that the vehicle architecture no longer supports the optimal deployment of chassis control systems. The extensive use of subsystems designed to increase efficiency, driver safety and comfort has led to over 100 microprocessors spread over 5 distinct busses. Current vehicle systems are independent modules with limited communication. And current bus architectures (J1850 or CAN) suffer from bandwidth limitations, especially for more complex systems and drive-by-wire systems.

The industry absolutely understands and is responding widely to these issues with a number of initiatives. Bosch has termed its approach “Cartronic,” i.e., the notion of a standardized vehicle architecture. Another initiative is AUTOSAR, a consortium of OEMs and suppliers to address issues of integration.

A Motorola solution is the “Architected Vehicle,” a system

## The Architected Vehicle

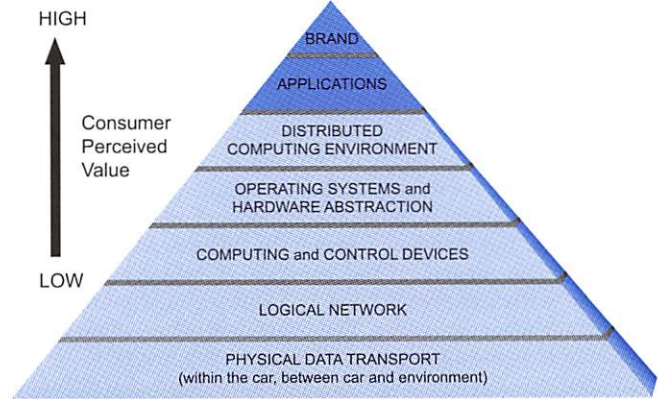


Figure 4. Automotive Information System Architecture

that sets down the rules for interactions at any level of the pyramid (Figure 4) so that implementation and interactions across subsystems are more straightforward.

This architecture conceives of the vehicle as a operating-system based network where the control and sensor elements are nodes of this network. It applies known techniques for creating secure, robust, high availability, and highly reliable systems.

The basis of the system is the “Switch Fabric” communication structure. (See Figure 5).

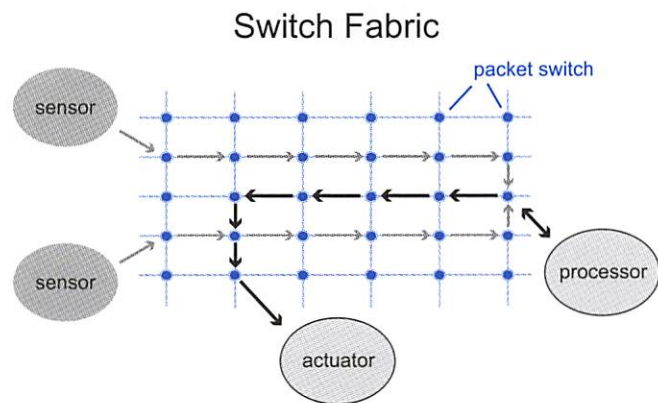


Figure 5. Switch Fabric Communication Structure

Systems like these are seen to provide significant advantages to the automotive industry by enabling the design of the vehicle as an integrated end-to-end system providing faster time-to-market at lower cost and higher inherent quality. They are also expected to provide reduced testing complexity and increased safety through sensor fusion systems.

At the present time, due to developments over the past decade, the customer has available a complete range of possible choices, ranging from lower cost cars where even ABS is an option to cars that try to do everything: enabling ‘work’ with a quiet, luxurious environment, and yet are well-behaved (extensive chassis control systems) in every respect, and yet still try to give a sporty feel to the driver.

## Ferrari Approach

As a manufacturer, Ferrari did not conform to the trend discussed earlier of expanding secondary information delivery

in the cockpit, but continued to seek improved performance and driving thrill in its cars. Cupholders and extensive storage were not introduced, although the 550 had room enough for a golf bag behind the two seats. Features like climate control and entertainment and navigation systems remained at a fairly basic level.

As is well-known, Ferrari continued to emphasize the presence and performance of the engine. In the 360 Modena (Geneva, 1999), for example, the V8 engine is always visually available, either through the window of the engine cover, or through the window behind the driver. Moreover, the sound of the intake, of the number of cylinders, and the exhaust is always present, but in a soft way, except for when the driver asks for power. The overall effect is almost as if the engine is a companion in the car to the driver.



**Figure 6.** 360 Modena: two windows on the engine.

Secondly, Ferrari continued to seek a unique styling approach that has its basis in a precise functionality. In the case of the 360, “aerodynamics was one of the fundamental design criteria which drove the whole design process of the car.” [4] The Ferrari customer is looking for something unique, and it is not necessary that the performance of the product is at some absolutely highest level, acceleration, for example. Ferrari does not need to be a leader in every domain.

In the case of the 360, a clean sheet approach to the styling was made after the determination of the aerodynamic parameters. The car was born as a whole concept, and a strong attempt was made to preserve this “wholeness” through the development process. The elevation view of the car features a strong character line sweeping downward which gives to some the sensation that the car is moving even when it is parked.

As Lorenzo Ramaciotti of Pininfarina, noted: “What is important is that the car raise positive feelings in the onlooker...but everyone has their own interpretation of the object.” [5]

One can make an analogy to watches. The performance, the accuracy of the watch is “commodified,” so to speak, because every watch is accurate. But it is the pleasure of the packaging, the uniqueness of the appearance, the specialization of the movement, that is valued by the customer.

The extended use of electronics purely for its own sake was not a selling point. Electronics was viewed as a means, and not a target. In fact, the view was that the customer should not perceive the workings of the electronic systems, and even should feel that the systems are mechanical.

The 360, along with the 550 Maranello, 456GT and the 355, featured an electronic damping control system, which



**Figure 7.** The Enzo and F1 cars side by side.

was to provide excellent handling, as well as a additional degree of comfort. In addition, the driver had the option to further harden the shock absorbers by 30%, by selecting the Sport mode.

The paddle shifting system is also taken directly from Ferrari’s experience in F1. Introduced in 1997 on the F335 F1 road car, the system gives the driver ease of use and increased safety as the hands do not leave the steering wheel. Combined with the drive-by-wire throttle, whose torque shaping during gearshift was obtained by selectively cutting off the engine cylinders, this gave the driver the possibility to gearshift without releasing the throttle pedal, and reducing the total gearshift time. The overall effect when driving could be likened to trying to control a spirited horse. One’s attention, and skill, should be fully engaged, at the height of awareness.

Finally, the importance of F1 success, and winning remained key. The impression of a “winning” car has a subtle effect on the customer. “A winning car changes the aesthetic parameter,” as Amedeo Visconti has remarked. When Ferrari wins at F1, that fact subtly changes the way customers, and others, perceive their cars. In short, a winning car is more appealing, looks better, is more highly valued. “Winning” becomes a reference point. Unlike aesthetics, where taste is arguable, winning is not subject to doubt (typically).

The introduction of specialized and limited production-run vehicles, such as the Enzo Ferrari (2002) illustrated this effect. The form of the Enzo is an interpretation of F1 chassis. It can be seen as a signal to the customer that there is a direct link between the winning state on the track and the GT cars.

The Enzo concept is that of “extreme sports car,” with a completely new engine design of 12-cylinder aspirated unit in a 65° V with maximum power output of 660 bhp at 7800 rpm. [6] The driver has two modes: Sport (traction control on), or Race (traction control off). In Race mode, for the first time at Ferrari, a “launch control” is available to the driver.

The “pure and hard” spirit of the car shapes the lines of both the exterior and the spartan interior. But the interface is designed to convey every breath of the car to the driver, to give the driver the “greatest possible awareness of the car’s behavior.”

For the Enzo, two pure performance targets were set: “to increase the grip limit in medium-fast bends by increasing downforce (lateral dynamics) while maintaining a very high top speed, over 350 km/h (longitudinal dynamics). The selection of these targets meant that conflicting aerodynamic configurations had to exist on the same car, and thus a concept of “active, integrated aerodynamics was developed.”



From the point of view of chassis control systems, the Enzo represents, for Ferrari, the first complete integration of vehicle control systems: engine, gearbox, suspension, ABS/ASR, and aerodynamics. This was achieved using an innovative approach to the design of the control system architecture, and to the development and fine-tuning of the subsystems. Only with the collaboration and specialist skills of the Gestione Sportiva (F1 team) could this be achieved.

The result is a unique “feel” to the car. As professional development driver Nick Longhi noted, “it has the feeling of a person behind the systems.”

Moreover, in his view, the traction control does not feel limiting, but becomes a system exploitable by the skilled driver for better performance.

## Trends

In this section, we will look at two important trends in vehicle electronics before moving on to customer perceptions.

### Reduction of Electronic Content

The recent announcement of Mercedes-Benz that it has removed a large number of electronic features from its cars is the indication of a larger industry trend. Noted by Electronics Vice President Stephan Wolfsried, “Last year we removed over 600 functions from our cars – functions that no one really needed and no one knew how to use.” [7]

In his recent presentation [8] at the 8th International Congress on Advances in Automotive Electronics, Wolfsried elaborated the view of what he called “the telematic zipper,” i.e., that electronic innovations and complexity have risen above average, while quality has not increased at the same level. He notes that the result has been highly networked and complex systems with system integration being undertaken with several suppliers. At the same time, MMI was underestimated, there was a lack of automotive-grade consumer electronics, and supplier resources and competencies were at times insufficient.

For the future, Wolfsried suggests focusing on innovations that customers can “notice, experience and operate.” These innovations must be possible without significantly increasing complexity. And quality must be a priority, through the use of mature technologies and innovations.

### Influence of F1 Racing

It is often stated that one reason for expensive racing programs, such as F1, is the transference of technology from those cars to production cars. Ferrari was the first to introduce one of the most successful: the F1-style steering wheel gearshift. This innovation is now adopted by other manufacturers including those in the FIAT group, BMW and Smart.

But there are not many more devices expected to pass from F1 to GT cars in the future. The current electronic technology in F1 cars is very sophisticated and quite different from that of GT cars. In fact, it has more in common with aerospace. Sensors, electronic units, and electronic systems, in general, are all derived from aerospace because of their accuracy, precision, robustness, and ability to work at high temperatures and high levels of vibration.

It is certain that one element that is transmitted from F1 to GT cars is the experience and expertise of the technicians and engineers, above all in analysis, testing and experimentation. F1 is a very important test stand for electronics in general.

But very few of the devices available now on GT cars can be used in F1, for example, ASR and MSR (traction control systems). But these, however, are very different from those

used in GT cars because of the regulatory controls. There is drive by wire and a sort of cruise control, which is used only during the transit of the vehicle through the pit lane where a speed limit exists. However, in F1, the electronic control of the following systems: suspensions, brakes, steering and aerodynamics, is not allowed.

Finally there is the F1 style steering gearshift and the electro-hydraulic transmission, but with no sophisticated systems to optimize the ideal gear: it is always the driver to decide when to shift without any automation or optimization.

The trend in regulations is to forbid “driver aids” as much as possible in order to maintain a higher level of spectacularity, and probably also to reduce costs. The regulations aim to have the car governed by the driver. Now, the F1 authorities are considering the potential suppression of the electro-hydraulic transmission and the return to the traditional gear shift. Nobody knows for sure how these trends may affect tomorrow’s GT cars. There could be some marketing element, but it seems likely that trends in GT cars will be divergent from those of F1 cars and will rather pursue the increase of “driver aids.”

There are significant modifications required for any F1 device that is going to be transferred to a production model, above all, for the matter of costs. F1 products are developed for a very limited series and with cost constraints very different from those of a car produced in several thousands or even in the hundreds of thousands.

## Customer Perceptions of Chassis Control Systems

A number of issues relate to customer perceptions of chassis control systems. Perhaps the situation is akin to medicine where a patient may have no formal medical training, but is expected to select and value services from a menu of options (HMOs, specialized doctors, treatments, etc.)

The Mayo Magazine [9] describes the approach called “evidence management” taken at the Mayo Clinic.

*“...it’s very hard for the average patient to judge the quality of the “product” on the basis of direct evidence. You can’t try it on, you can’t return it if you don’t like it, and you need an advanced degree to understand it—yet it’s vitally important. And so, when we’re considering a doctor or a medical facility, most of us unconsciously turn detective, looking for evidence of competence, caring, and integrity—processing what we can see and understand to decipher what we cannot. The Mayo Clinic doesn’t leave the nature of that evidence to chance. By carefully managing a set of visual and experiential clues, Mayo tells a consistent and compelling story about its service to customers.”*

In the case of vehicle handling and chassis control electronic systems, the situation is perhaps analogous. Like medical expertise, the systems controlling the car under emergency situations, or augmenting the driver’s inputs are both invisible and almost incomprehensible. These systems are invisible in that there are typically no displays that indicate ranges of values from the systems, although some stability control systems have an indicator that they have been activated. They are also invisible in that the components are not obvious to the customer, like the engine, for example.

Moreover, many consumers, including Ferrari customers, are not trained to evaluate vehicle handling and cannot assess it in any accurate or precise manner. That does not mean that consumers cannot distinguish handling characteristics at all. As Longhi noted, “There is definitely something that the average person can feel.”

Following this intuition, there is no doubt a trend among

OEMs to organize “driving experiences” for their potential customers. These include: “Auto Show in Motion” (GM) ; “Drive for Life” (Volvo), and the “Ultimate Driving Experience” (BMW). In these kinds of events, there is an effort made to improve consumer understanding of vehicle dynamics and to enable the consumer to experience the capabilities of the cars in a variety of situations. Some manufacturers, like BMW and Ferrari, also offer driving schools to their customers for more advanced theoretical and hands-on training.

Our impression is that many consumers enjoy learning about vehicle handling and welcome the chance to experience it firsthand. And there is no doubt that enthusiast publications who focus on handling are highly popular. Doug Milliken’s “Best Handling Cars” in Road & Track is an example of the kind of the work that both describes handling in an understandable way, and tries to educate the consumer. [10]

Nonetheless, for chassis control systems that come into play only in emergency situations, the consumer will oftentimes have only a vague sense of the effective working of such systems. In fact, a recent survey of vehicle sales managers by Skip Barber racing instructor Bob Green revealed that 42% of these managers were unable to activate ABS on the first try under controlled conditions. [11]

On the other hand, our perception is that skilled or professional drivers have begun to appreciate chassis control systems as “enabling” rather than “confining.” This impression is testimony to the sensitivity, and measure of slip, with which these systems are designed for sporty feel and handling.

## Conclusions

We would like to end by suggesting number of possible evolutionary pathways for the development of future chassis control systems. First, we suggest that emissions and gas consumption are a viable target for further electronic system development, one to which customers may assign considerable value. These systems perhaps could be enhanced with displays that enable the customer to accurately track performance in these areas. Such systems are already in play today, to a small extent.

Secondly, with the evolution of vehicle architectures, it is possible to think of vehicle behaviors as “options” which the customer can select. Already we see this concept beginning to materialize, in part, on the new BMW M5 (which is available only in Europe for the moment). [12]

For the future, one can imagine systems where slip can be fully customized, especially for skilled consumers. One can also imagine that vehicles with special dynamic behaviors will be created for exclusive customers. One also sees a growing appreciation of chassis control systems by the population of skilled drivers.

Moreover, we can almost see the necessity that manufacturers will use chassis control systems to increasingly distinguish their brands. Handling characteristics may come more to the fore, as competitive advantage. For this trend to succeed, however, consumers may need to be better educated to understand, evaluate and articulate handling characteristics.

Is it possible that we can easily see the day where chassis control devices become extensively deployed on almost all production cars? In that case, it is possible to argue that much additional investment in external (and intangible) influences on the customer (racing, historical information, sensations of exclusivity) developed by the manufacturers will be necessary for customers to select and value systems.

We would like to conclude with the thought that chassis control systems have brought a tremendous increase in personal safety to automotive mobility. In the next era of the history of these systems, for the broad span of consumers, we would like to see them enable a deeper engagement with the technical personality and behavior of the car and with the emotions of driving.

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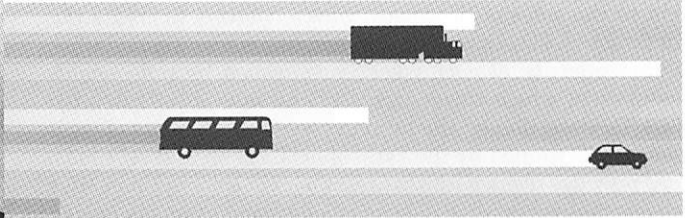
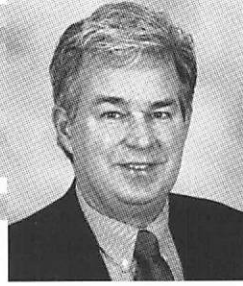
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## Automotive Electronics

Bill Fleming, Senior Editor

### MY 2005 Honda Acura Real-Time Navigation

Honda's Acura Division teamed with XM Satellite Radio Inc. and others to roll out a dashboard-based navigation system called 'AcuraLink' that displays real-time traffic congestion, accidents and construction on highways in 20 U.S. cities [1]. The AcuraLink system not only changes the delivery mode for traffic reports, but also uses a XM Satellite link instead of the more traditional cellular telematics link. Real-time data from the roadway sensors "Can be transmitted in a matter of seconds," an XM spokesman said. Near-real-time data can also come to AcuraLink from traffic helicopters and eyewitness reports, as well as police and fire emergency reports. Turnaround time for near-real-time data, however, is measured in minutes, not seconds.

Making the system work called for an intense engineering effort from manufacturers across the automotive electronics industry, including technical staffs at Acura, Alpine Electronics, Delphi, IBM's Pervasive Computing Division, Navteq North America, and XM Satellite Radio. XM's receiver "wades through a shotgun blast of data signals from its satellite to find the right data for a vehicle's Navteq-computed geographic location." The signal-processing electronics consist of an Alpine navigation system which houses a GPS unit and serves as a permanent storehouse of geographic information, and the AcuraLink/XM receiver, which collects the signals from the satellite. Both units are located in the Acura's trunk. Once the unit "knows" where it is from the Navteq system, it picks out location-specific traffic information for local highways, displays the road delays, and works with the navigation system to calculate the shortest route to the destination.

While the car is moving, the system is constantly sampling the data stream, looking for the traffic data that's relevant to its new location. An IBM text-to-speech engine that resides on the computing platform takes the resulting traffic information and converts it into a voice to give the driver turn-by-turn directions. Drivers who need guidance can also ask the navigation system for directions by using voice recognition and calling out street names. IBM Embedded ViaVoice software allows the system to recognize up to 1.7 million spoken street and city names, and then dole out turn-by-turn directions.

Traffic information also shows up on a screen in the center of the Acura RL's dashboard. It includes "accident and incident" data, together with weather, construction and accidents. All of the data are displayed as icons on the navigation screen. The display also shows traffic flows in the form of red (traffic < 20 mph), yellow (< 40 mph) and blue lines (> 40 mph), thus showing how fast traffic is moving along indicated highways, so the driver can tell at a glance

where the traffic congestion is and can decide whether or not to turn off to avoid it.

Acura rolled out the system as a standard feature in its redesigned MY 2005 Acura RL. The luxury sedan, lists for \$48,900. The system will likely remain in the luxury segment until suppliers can lower the system cost from its current level, believed to be in the \$1,000-to-\$2000 range, to the \$200 to \$400 range [1].

### Fuel Cell Cars Forecasted in 15 Years

A panel of experts at the Electric Drive Transportation Association conference last fall in Orlando, FL said that vehicular fuel cell technology won't be ready for at least 15 years. The panel outlined four hurdles [2]:

1. **Fuel.** The U.S. has no energy policy that calls for the creation of a system to produce and distribute hydrogen. Without one, there would be no way to replace gasoline with hydrogen because drivers could not refuel their fuel cell-powered cars.
2. **Safety.** To get cars to travel further than 200-to-400 miles per tank of hydrogen; stronger, safer tanks must be made.
3. **Standards.** There is no single set of standards that governs how hydrogen can be pumped into a vehicle. There also are no standards to address the engineering aspects of the fuel-cell/electric powertrain.
4. **Technology and Materials Cost.** Automakers do not have the facilities to mass produce fuel cells. Even if they did, the precious metals needed to produce fuel cells would make them too expensive for consumers. Engineers also have to make fuel cells that are smaller, produce more power, and work in cold temperatures.

### LED Daytime Running Lights

Originally, LEDs found use in center high-mount brake lights due to their long life and fast illumination/warning properties. Later, LEDs were used in taillights on MY 2005 Cadillac STS vehicles (each tail lamp having thirty LEDs) [3]. More recently, Audi announced that its MY 2005 A8 will use LEDs in headlight modules. The assembly, supplied by Hella, uses white LEDs for daytime running lights. The LEDs draw only 0.5 W, and potentially will last the life of the vehicle [4].

### Variable-Color Dashboard Backlighting

Ford Motor spruced up the MY 2005 Mustang with an instrument cluster in the dashboard that can be backlit by any of 125 possible colors. And drivers get to choose the color. The system relies on three LEDs, each generating a different color — red, green, and blue. Three acrylic light pipes carry

light to the sides of the gages, where it mixes to create the final color. LEDs cannot be dimmed like conventional bulbs, so the intensity of each color is controlled by pulse-width modulation, which turns each LED on and off at rates too quick for detection by the human eye. The intensity of each color is determined by the ratio of an LED on and off times. Ford provides users with six preset backlit color options. But drivers can personalize the car by adjusting intensity on the three LEDs to produce up to 125 colors [5].

## Headlight dazzle — lamps, reflective devices, ...

Three years ago, NHTSA published a notice, requesting comments and seeking information on the causes and potential safety risks associated with headlamp glare (FMVSS 108). After receiving and reviewing more than 5,000 public comments, the agency decided on five separate issues that may become the subject of rulemaking in the future, namely [6]:

1. auxiliary forward illumination devices
2. mounting height of headlamps
3. headlamp light source issues
4. HID headlamps
5. headlamp aiming.

NHTSA additionally identified research topics related to glare that it is contracting to universities for study. These include: (i) Research to quantify the benefits of reducing glare and improving headlamp performance, (ii) Human factors testing of driver reaction to various types of headlamps, (iii) The potential safety-related benefits of adaptive frontal headlighting systems, and (iv) Measurement of the effects of spectral distribution, lamp size, and luminance on glare and visual performance [6].

## Why Japanese Cars Ace Quality Tests

When it came to quality, Japanese entry-level vehicles sometimes actually do better than their big-budget luxury counterparts from North America and Europe. The Japanese approach to reliability may be their key to their higher product reliability [7]. The Japanese practice one important difference in their design and manufacturing process, and that was their so-called “functional build.” Their engineers don’t obsess about the quality of each individual component. Instead, they focus on the end result, and the adjustments needed to make a better product. They find that, with a good process, “you might take two bad parts, put them together, and still get a good assembly; and with a bad process, you can take two perfect parts, put them together and end up with a bad assembly.”

In many ways, functional build is a shortcut that says, “Let’s focus on consistency, and then move directly to the assembly process. That way, one can start making adjustments to the final assembly early in the process, instead of at the last minute.” In contrast, North American and European manufacturers too frequently subscribe to the idea that, “perfect parts make perfect systems.” As a result, extraordinary amounts of time are often spent haranguing vendors to build parts to exceptionally fine tolerances. Then, in the dwindling time that remains after perfect parts

are built, they concentrate on the total assembly. Finally, the remaining time is spent putting out fires and trying to figure out why the assembly isn’t perfect. The point here is that, “There’s nothing wrong with making perfect parts — if there is an infinite budget and an infinite lead time, then go ahead and try to make perfect parts.” According to the cited article, “the problem is that not very many engineers have enough time and enough money to make this method work — that’s when the ‘functional build’ approach should be considered [7].”

## Ultracapacitors take on Batteries in Hybrid Vehicles

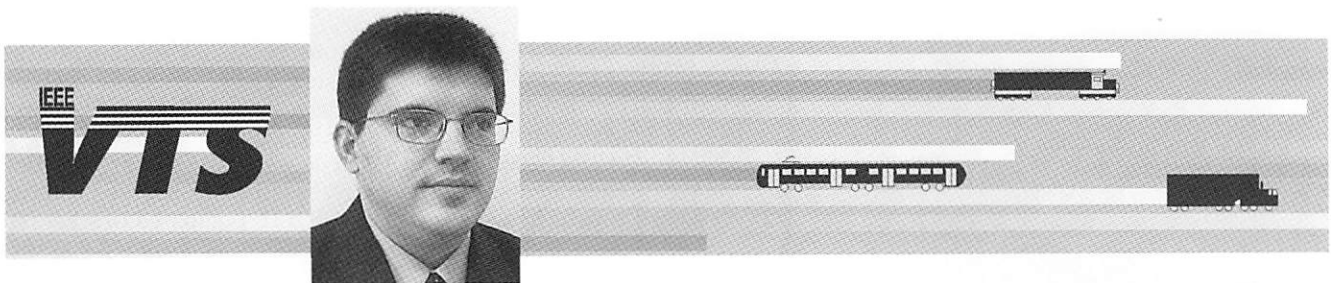
UltraCapacitors derive their name from their extremely large surface area (up to 2000 m<sup>2</sup>/g), which results from their ultra-porous electrodes. Compared to batteries, ultracapacitors can deliver up to 10 times the power, last up to 10 times as long, operate more reliably in extreme temperature conditions, and reduce environmental issues associated with disposal [8]. But, ultracapacitors can’t store as much energy as batteries.

Most fuel-cell cars on the road today use ultracapacitors for supplemental energy storage (because the fuel cell cannot immediately produce the power that electric motors need at startup). For example, “light” hybrid electric vehicles (system voltage < 100 V) are switching to ultracapacitors to extend battery life, and because ultracapacitors also excel at recapturing braking energy for regeneration purposes. Indeed, Hybrid Electric Vehicles (HEVs) are relegating battery energy storage to a secondary backup function.

It’s stated that, “No companies in Europe are using batteries in their future HEVs for market release in 2006-07 and beyond — they’re all using ultracapacitors [8].” The lack of durability and limited lifespan of battery packs is threatening to position battery-powered all-electric vehicles as niche products for intra-city shuttle buses, golf cars, or other specialized uses.

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## Mobile Radio

*Javier Gozalvez, Senior Editor*

### Research News

NTT DoCoMo announced that high-speed packet transmission with 1Gbps data rate in the downlink was achieved successfully in a laboratory experiment using 4G mobile communication radio access equipments on August 20, 2004, considering field experiments in the early next year. The implemented 4G radio access equipments employ variable-spreading-factor spread orthogonal frequency division multiplexing (VSF-Spread OFDM) radio access method and multiple-input-multiple-output (MIMO) multiplexing technique using new signal detection algorithm in order to achieve 1Gbps data transmission with 100MHz bandwidth in the downlink. DoCoMo achieved 100Mbps and 20Mbps data rate transmission in the downlink and uplink, respectively, in the outdoor environments with the moving speed of about 30km/h in July 2003. NTT DoCoMo is currently conducting indoor tests with various radio conditions as preparation for future field tests to develop a 4G global standard in coordination with the ITU.

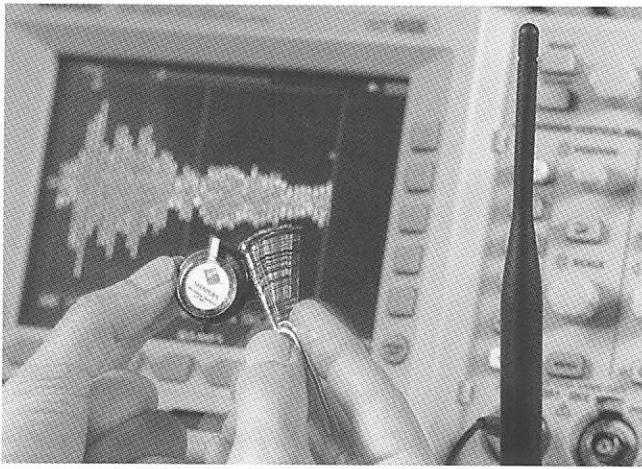
Siemens Communications has also announced that its research laboratories attained data speeds, in real time via mobile communication, of 1Gbps. In order to achieve its record-setting high speed, Siemens combined an "intelligent antenna system" consisting of three transmitting and four receiving antennas with OFDM. In order to reduce the computing power required at the receiver end, the researchers at Siemens developed new and optimized signal processing algorithms that can be efficiently implemented on the hardware modules that are available today. The experimental system operates in the 5-GHz band and has a bandwidth of 100 MHz. Siemens developed the experimental one-gigabit transmission system in collaboration with the Fraunhofer Institute for Telecommunications (Heinrich Hertz Institute) and the Institute for Applied Radio System Technology.

Nokia has demonstrated what it claims is the industry's first Mobile IPv6 call using Nokia's CDMA Dual-Stack handset. The demonstration highlights real-time streaming video with seamless handoff between two CDMA access networks using Mobile IPv6. Mobile IPv6 is a mobility protocol for IPv6 enabled handsets providing always-on capabilities and seamless mobility by enabling terminals to maintain their IP connectivity as they move across networks with different access technologies. Additionally, Mobile IPv6 provides route optimization techniques to reduce handoff latencies. Nokia supports dual-stack IPv4/IPv6/Mobile IPv6 in the terminals and the network, eliminating the need for NAT/PT mechanisms.

Siemens researchers have developed sensors that make do entirely without an electricity supply. Instead of actively transmitting measured data to a control center using ener-

gy, the sensors simply reflect the radio signal from a base station, with the measured data changing the characteristics of the returned signal. This technology considerably reduces maintenance costs. Until now most sensors have had one thing in common: they all use electricity. Modern high-tech sensors draw their energy from a battery or are connected by cable to a control center. The basic principle is always the same. The sensor receives a radio signal, a carrier frequency in the 2.5GHz microwave range and reflects this back to the transmitter. Depending on what state the sensor is in, the reflected radio signal changes – for example due to mechanical oscillations on a rotating part. The sensor transforms these vibrations into electrical current changes via a piezoelectric element made of a special ceramic. If the sensor in the device starts oscillating, the piezoelectric crystal generates electrical voltage changes that alter the radio signal in a characteristic way. The waves received from the base station are slightly displaced for a short time in phase with the voltage changes – the specialist term is "phase shift." The component in which this takes place, the so-called modulator, functions at the same time as the signal reflector. The signal it returns therefore reflects the rhythm of the vibrations of a component. In this way damage can be detected from the kind of characteristic pattern. According to Siemens researchers, the radio system is suitable not only for the monitoring of machines or rail vehicles but also for high-voltage systems. The wireless system, developed in collaboration with scientists at Clausthal Technical University, has already demonstrated that it functions and is expected to be ready for commercial production in the near future.

Pulse~LINK claims to have achieved the highest data rates ever transmitted and received for ultra wideband (UWB) wireless communications, demonstrating 667Mbps of throughput after forward error correction. The new high-speed chipset architecture, capable of surpassing one Gigabit, presents CE manufacturers with DVI (Digital Visual Interface), HDMI (High Definition Multimedia Interface), and 1394b cable replacement opportunities for interconnectivity of high-end multimedia devices and wireless streaming of HDTV. The company's Gigabit RFIC is presently in fabrication and evaluation kits based on the sample RFIC are planned for release in April 2005. Pulse~LINK is also introducing a new forward error correction (FEC) technology for wireless communications that it claims is far more efficient at extremely high data rates than the Viterbi FEC technology commonly used in other wireless communications. Along with providing higher data rate solutions, Pulse~LINK is developing longer-range UWB transmissions for WLANs. In recent demonstrations, the company transmitted two simultaneous HDTV signals



Siemens sensor make do without electricity

for "picture-in-picture" television through a combined seven inch thick concrete wall and an additional steel-frame dry-wall at 10 meters and has demonstrated the same two streams at distances of 25 meters through one steel-frame drywall.

Qualcomm has announced two innovations – 1xEV-DO Platinum Multicast, an evolution of CDMA2000 1xEV-DO; and FLO (Forward Link Only) technology, which is complementary to CDMA2000 and WCDMA networks. EV-DO Platinum Multicast and FLO technology are both multicast innovations designed to increase the capacity and reduce the cost of delivering video, audio and other content to large numbers of users simultaneously. The existing EV-DO forward link design uses CDMA to transmit data packets to a single user (unicast), or simultaneously to multiple users (multicast), during different time slots (called time division multiplexing, or TDM). Each packet is provided the full forward link power from one cell sector during its time slot. EV-DO Platinum Multicast further improves performance by reserving the same TDM time slot at all cells in a region and then transmitting one or more common packets within the reserved slot to all users in the region. Mobile devices receive the same packet from multiple cells and then soft combine the energy to improve reception. To simplify the soft combination of the common packets transmitted simultaneously from all cell sectors in multicast mode, an OFDM waveform is used for transmission during the common TDM time slot. The FLO multicast technology is designed for markets where dedicated spectrum is available and where regulations permit high-power transmission from



Warwick researchers turn phones into sunflowers

one or a small number of towers. As in Platinum Multicast, FLO transmits packets using OFDM. It is complementary to existing cellular networks because interactive services are supported within the mobile device using the CDMA2000 1X, 1xEV-DO or WCDMA cellular link. FLO is intended as an alternative to other multimedia multicasting technologies, such as DVB-H. Compared to other multicast technologies, FLO technology is designed specifically for use in mobile devices where low battery power consumption is critical.

Researchers at the University of Warwick, in conjunction with PVAXX Research & Development and Motorola, have devised a novel way to recycle discarded mobile telephones -- bury them and watch them transform into the flower of your choice. The institutions have created a mobile telephone case or cover that when discarded can simply be placed in compost in such a way that just weeks later the case will begin to disintegrate and turn into a flower. To achieve this result, a special formulation of PVAXX's biodegradable polymer range was developed in conjunction with materials researchers at Warwick, that produces a high quality finish but which also biodegrades easily in compost. Also, the engineers created a small transparent window in the case or cover in which they can embed a seed. The seed is visible to the user but will not germinate until the phone cover or case is recycled. For the first prototype telephones they have used dwarf sunflower seeds.

## Mobile Phones and Health Issues

According to a study conducted by the Institute of Environmental Medicine at Karolinska Institutet in Stockholm, the risk of developing the tumors, known as acoustic neuromas, almost doubled for persons who started using mobile phones at least ten years before diagnosis; with the risk increase being confined to the side of the head where the phone was usually held. The study, that still needs to be confirmed in additional studies, concerned around 150 acoustic neuroma patients and 600 healthy control patients. According to the researchers, only analogue phones were used for such a long period of time and they could therefore not determine if the same conclusions would apply when considering digital phones.

According to participants in the Reflex study, the radiation from mobile phones harm body cells and damage DNA in laboratory conditions. However, the authors of the study, that claim more research is needed to check whether the same effects can also be found outside laboratory tests, couldn't prove that mobile phones are a risk to health. The radiation used for the study was at SAR levels between 0.3 and 2 watts per kilogram.

The University of Essex (UK) is opening a new Electromagnetics and Health (EMH) laboratory to study the effect of mobile phone masts on human health. The two-year research project, that will also include new 3G masts, is funded by the Mobile Telecommunications and Health Research Programme. The new laboratory provides a highly controlled environment to eliminate other sources of radiation.

## Heterogenous Wireless Systems

TeliaSonera Finland has successfully conducted what it claims is the world's first EDGE-WCDMA packet data handover using Nokia equipment and terminals in a commercial network. TeliaSonera Finland's commercial network has been upgraded by Nokia to support intersystem handovers (ISHO) nationwide and the connection was conducted using the world's first terminal capable of EDGE-WCDMA ISHO -

the Nokia 6630 imaging smartphone. Handovers in the direction of WCDMA to EDGE and vice versa are especially important in the initial phases of commercial WCDMA deployment since WCDMA coverage will, in the early phases, not be as ubiquitous as GSM/EDGE service.

NTT DoCoMo, has announced the release of the N900iL, a dual-network 3G FOMA handset that runs on both the FOMA network and WLANs. The N900iL is specifically designed to support DoCoMo's exclusive PASSAGE DUPLX system for dual-network operation as both a standard FOMA phone and a VoIP mobile phone over a corporate user's internal WLAN.

Sony Ericsson has announced a new quad-band PC Card, the GC89, that combines global EDGE coverage with WiFi in a single card which is compatible with both Windows and Macintosh computers. The GC89 card delivers connectivity through EDGE, GPRS, CSD, SMS over the GSM 850, 900, 1800 and 1900 bands world-wide. And, for those areas covered by WLANs, the GC89 provides 802.11b and g connectivity with speed potential in excess of 50Mbps. The card also features compatibility with Release 4 of the EDGE standard.

Jeda Technologies has announced the launch of the Spreadtrum Communication's multi-mode TD-SCDMA/GSM/GPRS chipset solution SC8800 for mobile terminals. According to the firm, the chipset is the world's first single baseband solution that supports the three standards.

### 3G and 3.5G News

Nortel and mmO2 have successfully completed live wireless test calls using HSDPA demonstrating the capability to offer DVD-quality film and video, high-resolution interactive gaming and multimedia music tracks. The test calls were completed as a first phase of planned Nortel deployments across portions of O2's European UMTS network. Commercial field trials of the Nortel HSDPA solution begin in the second quarter of 2005 and are expected to include an integrated, commercial data card product. In the test calls, a five-Mbyte music file was downloaded in less than 15 seconds, compared to two minutes over a traditional dial-up connection. A 45-Mbyte MPEG video file was downloaded in about three minutes, compared to 15 minutes over dial-up. An e-mail with a five-Mbyte attachment was downloaded in 20 seconds.

mmO2 and Lucent Technologies have also announced plans to deploy one of the world's first super-fast, converged fixed-mobile networks for mmO2's subsidiary, Manx Telecom (Isle of Man). The commercial UMTS network-- which will incorporate HSDPA technology as well as Lucent's IMS (IP Multimedia Subsystem) solution -- will enable Manx Telecom to provide both wireless and wireline customers with "blended" mobile high-speed data, multimedia, and VoIP services. This HSDPA-enabled network will initially offer data speeds of 3.6Mbps and ultimately will support data speeds of up to 14.4 Mbps. Lucent's IMS will enable Manx Telecom to provide its customers with a wide array of compelling, multimedia services that can be delivered over both mobile and fixed networks. Under the agreement, Lucent will provide mmO2 with Bell Labs-developed wireless and data networking equipment, as well as network management and applications software.

Ericsson has demonstrated mobile broadband Internet access with video streaming and large downloads with HSDPA over a live WCDMA system, running traffic over the air. Performance information with data throughput up to 4.9 Mbps was shown at the China PT Expo Comm. Ericsson

is committed to numerous customer trials throughout 2004 and 2005, and expects commercial release of HSDPA during the second half of 2005. CDMA evolved HSDPA will significantly improve the available downlink peak data up to 14 Mbps, increasing the system capacity with up to three times and improve the end-user experience.

Cingular Wireless announced plans to begin deploying what it claims is the US fastest high-speed mobile wireless data network based on international standards. The 3G network will offer average data speeds between 400-700Kbps, and bursts to several Mbps on capable devices. Cingular will be building 3G UMTS with HSDPA networks in a number of major urban and suburban markets beginning in 2005. Cingular's recent acquisition of AT&T Wireless provided the company with the spectrum necessary to build the 3G networks. Cingular signed agreements with Ericsson, Lucent Technologies and Siemens to develop and deliver the infrastructure required for a broad-scale deployment of an expanded 3G UMTS/HSDPA network. Cingular said it expects to offer 3G services in most major markets by the end of 2006. Currently, Cingular customers can use EDGE to receive average data connection speeds up to 135kbps. EDGE is available to over 260 million people in more than 8,500 cities and towns, and in areas along 30,000 miles of interstate highways. In the near future, UMTS devices will be backward compatible with EDGE.

Vivo and Lucent Technologies have announced the commercial launch of a 3G CDMA2000 1xEV-DO network in the São Paulo, Rio de Janeiro and Sergipe regions. This Lucent-supplied network enables Vivo to provide mobile high-speed data services to businesses and consumers, at speeds of up to 2.4 Mbps, using 1x-EV-DO PC cards. Lucent has provided new Flexent Modular Cell 4.0 Compact base stations and enhanced existing Lucent-supplied base stations with channel cards and software to support CDMA2000 1X technology.

Orange has launched its 3G services in France and the UK. Following an initial trial program in several French cities and tests involving 5,000 users, Orange has deployed an extensive 3G network, covering: 61 of the country's 119 cities of over 50,000 inhabitants; 64% of the cities of over 100,000 inhabitants; 100% of the cities of over 200,000 inhabitants. Orange will also combine UMTS technology with roll-out of EDGE services to provide complementary "medium-bandwidth" coverage starting in spring 2005. This will result in coverage of 85% of the French population. In the UK, Orange claims to have the UK's broadest integrated 2G/3G network, with 70% of the population covered by its 3G network. Orange has 3G coverage in major cities, as well as popular locations such as business parks, mainline intercity railway stations, motorway service stations, airports, conference centres, and hotels. The operator expects to have between 1.5million and 2million 3G UK users by the end of 2006.

Telenor has opened its new UMTS mobile network for commercial use. At the time of launch, Telenor's UMTS network covers more than two million people in 70 cities and densely populated areas. By March 2005, 132 cities and densely populated areas will be covered, and all areas with more than 200 people will have full coverage by 2007. Sonera opened its UMTS network for commercial use in 20 localities in Finland on October 12, 2004. Sonera's UMTS network will reach maximum data speeds of 384 kbit/s.

EMTEL made, in Mauritius, the first call via the first African UMTS commercial network in October 16, 2004. Huawei provided EMTEL with an end-to-end UMTS solution including UMTS BTS system, core network together

with 3G mobile intelligent network, 3G mobile data service platform and UMTS terminals.

Algeria Telecom Mobile announced the launch of its UMTS pilot network, constructed by Huawei Technologies. The network covers many areas in the country's capital city Algiers, including the Office of the President, the headquarters of Algeria Telecom Mobile, and the International Exhibition Center.

Alcatel announced that it has been awarded by French Polynesia mobile operator, Tikiphone, a contract to implement 3G/UMTS pilot in French Polynesia. Alcatel will deploy by the end of 2004 UMTS/WCDMA technology through a turnkey field trial in Papeete for 6 months duration. Alcatel will supply and deploy the UTRAN of the pilot network, including UMTS Multi-Standard Evolium Base Stations, the Evolium Radio Network Controller and the UMTS Operation and Maintenance Centre.

Hutchison Whampoa has announced an updated current customer figure for its 3 Group businesses (3G operators) globally of 5.9 million, an 81% increase on the customer figure of 3.2 million announced on 19 August 2004. November gross customer additions were over 948,000 and for the first 14 days of December were over 496,000. These figures include 3's operations in Australia, Austria, Denmark, Hong Kong, Italy, Sweden and the UK. The company expects at least 6.5million 3G customers by the end of 2004. 3 in the UK has also announced that it has 80% population coverage for video mobile services. 3 claims to be the first network to reach this major regulatory milestone, three years before the requirement. The operator also claims to have the most extensive 3G network in the UK, with over 6,000 integrated radio sites.

Following the successful launch of the UMTS data card in February 2004 and the first two UMTS mobiles as of May 2004, Vodafone has announced the start of the mass business with UMTS mobile phones. Within the scope of its Christmas business, Vodafone offered seven UMTS mobiles and two UMTS data cards.

DaTang Mobile has successfully demonstrated the first TD-SCDMA Video Phone in Beijing. The video phone, using the Dilithium Networks 3G video telephony protocol stack, achieved high quality end-to-end video telephony with 15 frames/second video communications on 64 kb/s bearer. The demonstration also featured Dilithium Networks AnswerFast technology, which significantly reduces the session set-up time.

Qualcomm announced completion of test calls using its gpsOne assisted-GPS (A-GPS) technology on WCDMA/GSM/GPRS networks to help advance development of wireless location-based services for WCDMA markets. Calls were conducted independently with four leading infrastructure vendors, including Alcatel, NEC and Nortel Networks and with leading test equipment vendor Spirent. The gpsOne solution is integrated into select Qualcomm's Mobile Station Modem chipsets — including the MSM6250 chipset for WCDMA/GSM/GPRS and the MSM6275 chipset for WCDMA/HSDPA and GSM/GPRS/EDGE.

Lucent Technologies and Nordisk Mobiltelefon announced a CDMA450 network trial in Finland, delivering advanced, digital voice and high-speed data services at speeds of up to 2.4Mbps. The CDMA450 trial covers the Tampere region. CDMA 450 can provide greater geographical coverage from less base stations because it operates in the lower 450MHz radio frequency. In June 2004, Nordisk Mobiltelefon bought a spectrum license in Norway to provide communication services on the 450 MHz frequency band. Nordisk Mobiltelefon

aims to acquire further spectrum licenses for the 450 MHz band in Sweden and Finland. Nordisk Mobiltelefon also conducted live demonstrations of the technology with Nortel Networks and Digita Oy, the Finnish TV and radio mast operator.

Andrew Corporation will install what it claims is the world's first 3G wireless network for use in a public transportation system under a contract to upgrade the Hong Kong underground communications network. Andrew's design will use high-performance tuned radiating cables, large diameter feeder cables, new and relocated antennas at critical signal sites, new amplifiers and reconfigured transmission paths.

According to Bango, a mobile content provider, 3G users are downloading more content than 2.5G users. In fact, the company claims that average spend by users of 3G devices is approximately 60% higher, with higher priced multimedia content proving to be popular.

Dell'Oro Group reported that sales of mobility infrastructure equipment were up by \$155 million, or 2% in 3Q04, due in large part to strong sales of WCDMA equipment. According to the firm, WCDMA equipment sales increased by \$280 million in the quarter, which offset revenue declines of \$91 million and \$79 million of GSM and CDMA equipment, respectively. The Top WCDMA infrastructure vendors by revenue are: Ericsson, Nokia, NEC and Siemens.

The CDMA Development Group (CDG) announced that 100 carriers have deployed CDMA2000 technologies in 50 countries across six continents. To date, 97 CDMA2000 1X and 16 CDMA2000 1xEV-DO networks have been launched, 34 more are in deployment and 10 trials are being conducted. The group also reported that the CDMA2000 subscriber base surpassed 127 million users in September and is growing at 5 million per month. Asia-Pacific remains the largest and fastest-growing region for CDMA with 96 million users. The CDG also announced the completion of the CDMA Packet Data Roaming Exchange (CRX) specification. The specification covers network interconnection, RADIUS messaging, use of packet data applications while roaming, data exchange between third parties, data clearing and settlement, service scheduling, and service migration for Interstandard CDMA2000/GPRS packet data roaming.

## Spectrum Licenses

Hungary has awarded 3G mobile licenses to the three incumbent mobile operators: T-Mobile Hungary, Pannon GSM and Vodafone. The companies will pay an initial minimum fee and the rest of the purchase price will be based on future revenues. The companies are required to start providing UMTS services by the beginning of 2006. The Czech telecommunications regulator (CTU) has decided to launch a tender for a 3G license. Two of three incumbent operators already own a 3G license.

Germany's telecommunications regulator (RegTP) has issued a license for the development and operation of wideband PAMR to T-Mobile and Inquam. According to the regulator, the license, which will be valid until the end of 2020, allows for the development of wideband bundled radio networks and services for corporate communications.

Sweden is inviting bids to acquire a mobile phone license in the 450MHz band. The network is intended to provide extensive coverage in rural areas of the country.

## Technology News

Crown Castle and Nokia will pilot DVB-H technology in the US in order to bring TV-like services to mobile devices. The



pilot has started in October in the Pittsburgh, PA, area and it aims to prove and test the feasibility of DVB-H technology and related service systems in the US. Later on, the pilot will be expanded to test consumer experiences and acceptance of mobile phone TV service. DVB-H is a standard specified by the DVB Organization specifically for the transmission of TV-like content and data to handheld devices, such as mobile phones, which have unique requirements in terms of power consumption, screen-size and mobility.

Nokia and Telecom Italia are undertaking a joint project to drive forward mobile and fixed network service convergence. The trial phase of the service convergence project has been initiated, with the first deliveries and implementation of key enablers such as multi-radio terminals and the Nokia IP Multimedia Subsystem (IMS). The Nokia 9500 Communicator, which uses both GSM/EDGE and WLAN access technologies, is being used in the cooperation project. A key target of the project is the development of VoIP and other services, such as video sharing and push-to-talk, that can be provided over both mobile and fixed networks. The trial phase of the project will be completed during the 1Q 2005, and will be followed in later in the year by commercial deployment by Telecom Italia of selected solutions and services for the Italian market.

Nokia's Push to Talk over Cellular (PoC) end-to-end network solution will be launched by T-Mobile International for Europe's first commercial PoC service. The service will be commercially available in Germany in 4Q 2004 and will be introduced to other T-Mobile Markets soon.

Huawei Technologies has announced that it has built what it claims is the world's largest Softswitch network in China for China Mobile. The project was completed on November 27, 2004 with the aim of reducing operations costs and increasing network flexibility. This network is expected to carry 17951 provincial inter-network traffic across 31 provinces in China, with the total traffic equivalent to one-third of the traditional provincial network traffic. Huawei's mobile SoftSwitch system design is based on U-SYS NGN platform.

Qualcomm announced the release of what it claims is the world's only single-chip solution for CDMA2000 1X, which integrates a baseband modem, radio transceiver, power management and multimedia engines into a single chip. The US manufacturer also unveiled what it claims is the industry's first CDMA2000 1X radio transceiver — a component of this single-chip — a radioOne solution that combines radio receiver and transmitter functionalities into a single design using cost-effective RF CMOS process technology. Qualcomm's single-chip solution brings basic data and multimedia capabilities to entry-level wireless handsets with an architecture that lowers overall handset development costs. By integrating modem, RF, power management and multimedia into a single chip, the solution eliminates discrete components in handset design to lower development costs, reduce bill-of-materials costs and accelerate time to market. With the introduction of the first RF CMOS transceiver for CDMA2000 1X, the manufacturer has created a transceiver that overcomes interference issues. Previously, developing a transceiver for a full-duplex system such as CDMA2000 had been a tremendous challenge due to the interference experienced from placing the receive and transmit functions on the same device.

Siemens Communications will be integrating FLASH-OFDM technology into its portfolio of mobile broadband solutions. Under the terms of the agreement, Flarion will develop the basic 450 MHz-band equipment according to

Siemens specifications. FLASH-OFDM is a proprietary cellular broadband technology for data services that was developed by Flarion. FLASH-OFDM systems enable users travelling at speeds of up to 250km/h to utilize data services at average downlink speeds of 1 to 1.5Mbps, capable of bursting to 3.2Mbps in individual cases. The uplink typically offers users an average experience of 300-500kbps, bursting to 900kbps. According to the companies, FLASH-OFDM offers outstanding spectral efficiency and scalability, and provides an air interface for enterprise-class IP services.

Samsung has developed the MMCmicro memory card, an extremely small, low-power multimedia memory card (MMC) for mobile phones. The card, with dimensions of only 12141.1 mm, is one-third the size of today's common reduced-size multimedia cards (RS-MMC). According to the manufacturer, the card can read at 10MB per second and write at 7MB per second.

Nextel and Motorola have announced the availability of Direct TalkSM, a unique service that provides a back-up off-network walkie-talkie service for use when customers are outside Nextel network coverage areas. Nextel is the first US carrier to offer this type of off-network service integrated directly into a cellular handset.

UTStarcom has introduced MovingMedia 2000, an end-to-end IP-based infrastructure solution for CDMA/CDMA2000, that allows CDMA operators to transition to an all-IP network. The solution employs an advanced next-generation network (NGN) voice and data over IP architecture that distributes all the components of a CDMA system throughout the network, rather than in one centralized location.

## Wireless Data and Multimedia

TeliaSonera announced it has surpassed the 1million Multimedia Messaging Service (MMS) subscriber mark, reaching 1.1million MMS users as of November 2004. From June to August 2004, the operator reported an average of 1.3million MMS messages sent per month on its network in Sweden. According to the company, the use of MMS is most popular in special occasions such as holiday periods and Christmas. According to a study from Juniper Research, the global MMS market will reach \$42.5billion in 2005, more than double the figure for 2004. The study found that the critical mass of 25%+ penetration rate for MMS-enabled phones has been reached in many markets. However, the firm claims that in several markets, problems of compatibility and interoperability continue to harm the progress of MMS.

NTT DoCoMo has announced it has sold more than 1million FeliCa-enabled handsets since their introduction this summer. Users of the FeliCa service can use their mobile handsets as a debit card, being able to make purchases, as well as check current balances and payment records. For accessing the mobile wallet capabilities, the handsets need to be equipped with Sony's FeliCa smart cards, a contactless IC card technology that can store personal information and money electronically. The Japanese operator has also announced it has signed an agreement with mmO2 enabling O2 to launch the i-mode mobile internet service in the UK, Germany and Ireland.

Qualcomm announced that third-party BREW publishers and developers to date have earned more than \$200million from the sales of BREW-based applications. To date, there are 37 commercial operators in 24 countries offering BREW-based wireless services, with more than 180million BREW-based wireless applications being downloaded.

## Forums and Industry Alliances

Ericsson, Motorola, NEC, Nokia and Siemens announced that they have initiated a Co-operative Open OSS Project (CO-OP) under the framework of the TeleManagement Forum. The CO-OP members will work together on architecture specification, testing and verification of mobile network management systems (NMS). The goal of the CO-OP is to reduce the complexity of integrating network equipment and management systems from multiple vendors in mobile operator networks. Some of the key focus areas of collaboration are: common OSS system specification; standardized interfaces for peer-to-peer element management and out-of-the-box functionality; and agreeing on common testing and verification practices. The initial goal is to build on the TM Forum's NGOSS foundation and drive the implementation of a common system architecture for interoperable network management systems. Later, the project will present testing and verification procedures and reference implementations based on the agreed standards. The project will work closely with other key standardization initiatives such as OSS/J, 3GPP, 3GPP2.

NTT DoCoMo, Intel and IBM have released a new security specification called "Trusted Mobile Platform" (TMP). The specification can help make advanced mobile-commerce services such as electronic tickets and e-wallets for online purchases more secure and help protect against viruses and other software attacks. TMP has defined a set of hardware and software components that can be constructed to build devices offering different levels of security. TMP builds on well established, strong security techniques and applies them to the hardware and software architectures to define a trusted execution environment that protects the device both at boot time and during runtime. In addition, TMP has defined a protocol that allows the security state of a device to be shared with other devices in the network, enabling device level trust to be extended into the larger network. The specification is publicly available at <http://www.trusted-mobile.org/> for industry review.

Qualcomm has announced that major infrastructure vendors, including Airvana, Ericsson, Hitachi, Lucent Technologies, Motorola, Nortel Networks and Samsung, have selected its Cell Site Modem CSM6800 digital baseband modem for infrastructure and test equipment to lead global efforts to drive adoption of CDMA2000 1xEV-DO Revision A. Rev. A, supporting peak data rates of 3.1Mbps on the forward link and 1.8Mbps on the reverse link, enables rich wireless multimedia services such as high-speed upload of multimedia files and attachments, interactive gaming and a variety of IP-based services such as VoIP. Rev. A will also support real-time conversational services such as push to talk, video telephony and instant multimedia.

Alcatel and Datang Mobile announced that they have entered into a partnership agreement to foster the introduction of TD-SCDMA in China. Alcatel will support the research and development of TD-SCDMA and become the privileged partner of Datang Mobile for industrialization of TD-SCDMA products in China. According to the agreement, Datang Mobile will adopt Alcatel's core system and applications for TD-SCDMA solution. Thanks to this joint effort, the first TD-SCDMA products are expected to be delivered to the Chinese market by June 2005.

## Wireless, PMR and Public Safety

Rogers Wireless announced the first national implementation of Wireless Priority Service (WPS) in Canada, a feature which provides government-authorized wireless phone-

users, such as emergency personnel and select security sectors, with priority service on the Rogers Wireless GSM network during times of emergency, natural disaster or national security. The Rogers WPS feature enables emergency personnel to place critical wireless calls by moving these calls to the "front of the line" so that they may be completed using the next available wireless radio channel. WPS is a GSM-based technology that has already been successfully deployed by national security officials, emergency preparedness responders and critical decision makers as part of their national security program in the US.

Motorola announced that it has completed the initial phases of a technical trial of the company's first 4.9 GHz broadband solutions. According to the Motorola project team and public safety agencies in Tulsa, Okla., where the technical trial has been underway since September, the trial has proven the reliability and stability of the system. The Tulsa trial included a network management terminal and two access points; the access points are in suburban locations. Three vehicular client devices utilizing Motorola's ML 900 laptop terminals were also included in the trial. The applications tested to date include web browsing, Instant Messaging, email and chat, as well as streaming video.

Aloha Partners will be conducting a trial, targeting rural markets and the public safety sector, using Flarion's FLASH-OFDM technology in the 700MHz band. The trial, to be conducted in Tucson, will test Flarion's technology as a viable option for mobile broadband IP services.

The Siemens Communications Group has received orders from China and India to build mobile networks for railroad communication using the GSM Railway (GSM-R) communication platform. The first Chinese project entails equipping the 470 kilometer high-speed line from Jinan to Qingdao, south of Beijing. In India, the first project will involve Siemens equipping around 700kilometers of rail track for the Indian Railways subsidiary North Frontier Railways with GSM-R. GSM-R is a communication platform for voice and data services for a standardized rail traffic safety; its functions include support for the train's engineer and crew, both out on the line and in railroad stations. The new European Train Control System (ETCS) also utilizes GSM-R as its underlying communication system.

TCIL, a Government of India enterprise, is working with Nortel Networks through public tender to deliver a GSM-R network to help reduce railway operational costs, improve railway safety and deliver new services for passengers and employees. TCIL will deploy a GSM-R communications network for the 261-kilometer, 24-station rail line running between Eastern Railway divisional headquarters in Howrah (West Bengal's second largest city) and Pradhankunta. The new communications network is scheduled for completion within 12 months.

Nokia will supply the radio communication network for the Ji'nan International Airport in the Shandong province of China. The system will be the first of its kind in the Chinese aviation industry, and it will provide the airport personnel with seamless TETRA voice and data services. The Finnish manufacturer will provide a complete range of digital TETRA professional mobile radio solutions, including Nokia DXTip exchanges, Nokia TETRA base stations, Nokia DWS dispatcher workstations and a large number of Nokia TETRA terminals. Nokia has also been selected as the supplier of a digital radio communications system based on TETRA technology for the Guangzhou Metro Corporation in Guangdong province, China. Equipment deliveries will

begin at the start of 2005 and the system launch is expected to take place in the second half of year 2005.

The international public safety mobile broadband communication standardization Partnership Project MESA, welcomed 13 new Members to join the spectrum of companies and official bodies that make up the 76 Members of MESA. The international partnership, producing specifications for digital mobile broadband technology, now has participation from the United States, Canada, Europe, India, Korea, Australia, and Japan.

## Wireless LAN

Connexion by Boeing, a business unit of The Boeing Company, and NTT DoCoMo have announced the launch of a roaming service to enable users of DoCoMo's Mzone WLAN service to connect to the Connexion by Boeing high-speed Internet service in flight, beginning Oct. 22. Mzone users will enjoy a simple, seamless solution for accessing the full richness of the Internet when in flight, simply by accessing the Connexion by Boeing homepage and entering their Mzone username and password. Billing for the service will be added to users' existing Mzone bills. The service fee will be a flat rate. According to the companies, Mzone customers will be the world's first airborne passengers to receive integrated billing for high-speed Internet access while flying. Vodafone and Connexion by Boeing have also announced their intention to jointly trial the delivery of high-speed in-flight Wi-Fi connectivity to airline passengers.

The city of Atlanta plans to launch WiFi access across a number of major buildings and facilities in the metro area. The city has partnered with WiFi carrier Biltmore Communications and will market the paid-access WiFi service as Atlanta FastPass. The city will launch WiFi access in the Atlanta airport by March 2005. Atlanta plans to eventually make WiFi access citywide. In the meantime, the Pennsylvania General Assembly has passed a bill with a provision that would make it illegal for any 'political subdivision' to provide public telecommunications services like WiFi. This bill would not allow Philadelphia to build its WiFi network for the entire city unless it is up and running by the 1st of January 2006. Verizon Communications and other local carriers have been fighting against the decision of the city of Philadelphia to build the WiFi network. On the other hand, the city of Philadelphia argues that Verizon is not adequately serving much of the city.

Siemens has installed a novel system for monitoring speed limits. The radar from the "Sittraffic Lynx" family registers violations of the speed limit and creates digital photos of offending drivers' vehicles. The place, time, measured speed and digital photo are transferred by WLAN to a control center, where they are processed and made available to the responsible authority. Siemens has also announced that, in Vienna and five other cities in Austria, about 50,000 drivers purchase their car-park tickets by mobile phone and SMS, using the "m-parking". The companies claims that this service is now the most successful mobile-business project in Austria.

Taipei City's "M-City" (Mobile City) project has awarded a contract to Qware, which plans to operate a wireless broadband network based on Nortel's Wireless Mesh Network solution, to provide high-speed WLAN broadband access and new wireless services in Mass Rapid Transportation stations, selected commercial buildings and other key locations across the city. Qware expects to have 10,000 wireless access points in service by year-end 2005 to provide coverage for Taipei City, an area of 272 square kilo-



Siemens system for sending speed camera information by WLAN

meters where 90% of Taipei's 2.65 million people live. The southern city of Kaohsiung has also selected eASPNet Taiwan to provide a secure, reliable public WLAN network based on an advanced Wireless Mesh Network solution from Nortel Networks. The solution features an enhanced LAN architecture that is designed to go beyond traditional Wi-Fi hot spots to provide secure wireless coverage indoors and outdoors throughout an urban area or large campus. Edith Cowan University is also planning to roll out Australia's first wireless mesh network before the end of 2004.

Maxim has announced the release of two single-chip RF transceivers designed for single-band 802.11a and dual-band 802.11a/g WLAN applications. The MAX2828 covers the world-band frequency spectrum from 4.9 GHz to 5.9GHz, while the MAX2829 covers both 2.4 to 2.5 GHz and 4.9 to 5.9 GHz bands. The ICs feature a MIMO mode in which the phase angle of the local oscillator is held constant during transmit/receive operation, allowing multiple transceivers to be synchronized to the system reference oscillator. This feature is critical for 802.11n NxN MIMO radio and smart-antenna-based WLAN applications.

UBEC (Uniband Electronic Corp.) has announced the mass production of UW2452, an integrated 802.11a/g WLAN transceiver. UW2452 is the first 802.11a/g transceiver from Asia supporting full-band operation from 2.4 to 2.5 GHz (802.11g) and 4.9 to 5.9 GHz (802.11a/HyprLAN), including the recently approved IEEE 802.11j for channel frequencies used in Japan.

According to the report "Residential Wireless LANs: The Wi-Fi Triple Play" from In-Stat/MDR, Wi-Fi media devices will grow at a 104.7% compound annual growth rate to 44,601 total units shipped in 2008. The report also claims that, for the first time, Wi-Fi Mini PCI Cards represented the most Wi-Fi adapters shipped in 2003, displacing the former dominance of Wi-Fi PC Cards.

Tropos Networks has unveiled an initiative to support 802.16-2004 WiMAX as a point-to-multipoint backhaul link from its metro-scale WiFi networks to local points of presence. The company is also aiming to introduce WiMAX within the WiFi network to provide inter-cell connectivity. In the mean time, Wavesat has announced the delivery of what it claims is the first ever WiMAX chip, the DM256; the company is planning general availability in early January 2005. The DM256 is Wavesat's sixth generation of OFDM products and it is the first to comply with the IEEE 802.16-2004 standard.

## Short range wireless communications

Nokia and Royal Philips, together with Rhein-Main Verkehrsverbund (RMV), public transport authority for Frankfurt's greater area, have announced a joint project to trial a Near Field Communication (NFC) ticketing solution that uses mobile phones to access an existing contactless smart card ticketing infrastructure. The trial, which starts early 2005, will enable RMV's current customers to use Nokia 3220 phones equipped by tailored Nokia NFC shell covers to gain access to a local bus network in Hanau, a city near Frankfurt. The RMV electronic ticketing application will be securely stored on an integrated smart card controller in the phone, and is fully compatible with today's smart card-based ticketing products. Users will simply need to touch their phones against the contactless reader as they get on and off the bus to register their journey. NFC technology evolved from a combination of contactless identification (RFID) and interconnection technologies. NFC operates in the 13.56 MHz band, over a distance of typically a few centimetres.

The ZigBee Alliance has ratified the first ZigBee specification making the development and deployment of extremely power efficient, cost effective, low data rate monitoring, control and sensing networks a reality. Now that the ZigBee specification has been ratified, the Alliance will continue to validate the specification through expanded interoperability and scalability tests and future enhancements. According to the chairman of the alliance, there could be Zigbee-certified products as soon as the end of January, and single-chip Zigbee parts costing less than \$5 during the first quarter of 2005. Analysts are also predicting between 5 million and 50 million Zigbee devices in the first year. The standard is intended for wireless controls, of heating, lighting and security, and any other communication job that can be done with a short-range, low-power, long battery-life device.

The European Telecommunications Standards Institute (ETSI) has approved a new standard for the use of RFID in UHF frequencies. This news has even greater impact now that the Frequency Management Working Group of the European Conference of Postal and Telecommunications Administrations has approved the recommendation to make the frequency band associated with this standard available in their 46 Member countries. The ETSI Technical Committee - Electromagnetic compatibility and Radio spectrum Matters (ERM), has delivered a two part Standard (EN 302 208) that gives the industry much needed guidance on the minimum characteristics considered necessary to make the best use of the available frequencies for RFID.

The Bluetooth Special Interest Group (SIG) has laid out a 3-year plan to enhance the technology's performance, security and usability. The plan begins this year with the Bluetooth Version 2.0+ EDR (Enhanced Data Rate), which increases the data rates up to 3Mbps and decreases power consumption. In 2005, the group will work on security and privacy concerns, as well as enhancing the usability of multi-device scenarios (determines the number of devices that can communicate at a given time without interference). In 2006, the group has announced plans to include in the specifications multi-cast capabilities enabling a single message to be simultaneously sent to multiple devices. In a new report, In-Stat/SDR estimates the number of Bluetooth chips shipped to more than double in 2004 compared to last year, reaching 146million units.

## US Mobile Market

The Federal Communications Commission (FCC) has proposed to relax its current ban on the use of cellular telephones on airborne aircraft. The Commission proposed to permit the airborne operation of "off the shelf" wireless handsets and other devices so long as the device operates at its lowest power setting under control of a "pico cell" located on the aircraft, and the operation does not allow unwanted radio frequency emissions to interfere with terrestrial cellular systems. The Commission asked for public comment on whether the proposal should apply only to devices operating in 800 MHz band, or whether devices operating on other spectrum bands, such as the PCS band or AWS bands, should be included. The FCC is also asking for public comment on ways that the 800 MHz cellular spectrum could be used to provide a communications "pipe" between airborne aircraft and the ground. The FCC also adopted a flexible approach for licensing the 4 MHz of spectrum in the 800 MHz band currently dedicated to commercial air-ground service. The FCC decided to auction new licenses for this spectrum in three possible band plan configurations. No more than 3 MHz of spectrum (either shared or exclusive) could be acquired at auction or post-auction by a single entity; the two new licensees must provide air-ground service, meaning service to airborne locations. To ensure protection to adjacent public safety operations in the 800 MHz band, the Commission applied to 800 MHz air-ground licensees the same interference rules and other specific protections adopted earlier this year in the 800 MHz public safety proceeding.

Cingular Wireless, a joint venture between SBC Communications and BellSouth, has completed its previously announced merger with AT&T Wireless Services, creating what they claim is the nation's biggest wireless carrier with the largest digital voice and data network in the country. The newly combined company has more than 46 million customers and an extensive nationwide network. All required federal regulatory authorities, including the U.S. Department of Justice and FCC, have approved the transaction. Cingular also announced it has sold 10MHz of spectrum in Dallas and Detroit to MetroPCS. Cingular has also sold some of the former AT&T Wireless properties and spectrum to Alltel. The US operator also signed a deal with Triton PCS to acquire its licenses and network assets in Virginia. In exchange, Triton PCS will gain licenses and network assets in North Carolina and Puerto Rico.

Verizon Wireless has signed a definitive agreement with NextWave Telecom to purchase all of NextWave's PCS spectrum licenses, in 23 markets around the country, for \$3billion. The 10 and 20 MHz licenses, in the 1.9 GHz PCS frequency range, cover a population of 73 million people. NextWave is planning to roll-out a dual use network aimed at third party providers of advanced IP-based wireless services and public safety services to government users. The company has also leased 16.5MHz of Multipoint Distribution Service for a wireless trial network in the New York City area. Verizon Wireless also announced it has bought 10MHz of spectrum licenses in the 1900MHz frequency band from NTELOS.

Qualcomm has announced plans for a subsidiary to deploy and operate a nationwide "mediacast" network, delivering many channels of high-quality video and audio programming to 3G mobile phones at mass market prices. MediaFLO USA, a subsidiary of Qualcomm, intends to provide interactive multimedia services to consumers in cooperation with U.S. cellular operators. The US manufacturer intends to offer the network as a shared resource for U.S.

CDMA2000 and WCDMA cellular operators, enabling them to deliver mobile interactive multimedia to their wireless subscribers without the cost of network deployment and operation. MediaFLO USA will aggregate and distribute the content that is available to all MediaFLO partners and will provide seamless integration of this content with unique content that individual operators provide to maintain their competitive differentiation. The system will give TV stations and networks, cable TV and satellite operators and networks, and other content providers a major new distribution channel that complements their current offerings. The nationwide mediacasting network will deliver multimedia content to wireless mobile devices in the 700 MHz spectrum for which Qualcomm holds licenses. FLO technology in the 700 MHz spectrum (UHF channel 55) offers distinct efficiency and cost advantages in delivering content to a very large mobile subscriber base. Deploying high-power transmitters on tall towers provides superior coverage with 30 to 50 times fewer towers than cellular and higher frequency-based systems.

The FCC has allocated spectrum to allow Federal operations to be cleared from spectrum that has been allocated for advanced wireless services (AWS), including 3G systems. The Commission previously allocated the 1710-1755 MHz (1.7 GHz) and 2110-2155 MHz (2.1 GHz) bands for AWS. The 1.7 GHz band was transferred from the Federal Government for private sector use, but Federal operations at certain locations were to remain in this spectrum indefinitely. The NTIA developed a set of proposals to clear this spectrum so that it could be made available for AWS throughout the United States. To implement this plan, the FCC allocated spectrum to allow for the relocation of critical military and other operations into the 2025-2110 MHz (2 GHz) and 2360-2395 MHz (2.3 GHz) bands. Eleven Department of Defense (DOD) Tracking, Telemetry, and Commanding (TT&C) uplink earth stations, which are used to control military satellites, will be permitted to operate on a co-primary basis with incumbents in the Broadcast Auxiliary Service, the Cable Television Relay Service, and the Local Television Transmission Service in the 2 GHz band.

The FCC has improved the ability of public safety personnel to use spectrum at 4940-4990 MHz (4.9 GHz band). The Commission revised technical specifications in the 4.9 GHz band to allow manufacturers to adapt, for that band, technologies that are being used in adjacent spectrum bands, such as the 5.4 GHz Unlicensed National Information Infrastructure (U-NII) unlicensed band and the Intelligent Transportation System (ITS) band. Specifically, the Commission adopted two emission masks limiting interference potential for the band, one for low-power and one for high-power operations.

The FCC has adopted a Second Report and Order to further facilitate the introduction of new unlicensed wideband devices in the 6 GHz, 17 GHz and 24 GHz bands. These devices will include radar systems to improve automotive safety and tracking systems for personnel location, such as hospital patients and emergency rescue crews, as well as for functions such as inventory control. The Commission has increased the peak power limits and reduced the unwanted emission levels for 3 frequency bands that were already available for unlicensed operation: 5925-7250 MHz, 16.2-17.2 GHz, and 23.12-29 GHz, and indicated that higher peak power limits in these bands would facilitate wideband operations such as short range communications, collision avoidance, inventory control and tracking systems. The

Commission also amended its measurement procedures to permit frequency hopped, swept frequency, and gated systems operating within these bands to be measured in their normal operating mode.

US Cellular has introduced a flexible mobile phone Internet browser designed to automatically optimize websites to best fit a given terminal's display capabilities. nweb is a BREW-based application that also offers links to websites identified for their ease of use, content and popularity.

According to CTIA, US wireless subscribers increased by 14.5% (21million new users) in the 12-month period that ended in June. Use of wireless minutes also grew by 35%. Capital spending in the sector was up \$22.5billion or 16.8%.

TNS Telecoms has informed that 30% of spending on telecommunications services by US households was dedicated to wireless service while wired line service represented 29% of spending. The average US household spends \$47.87 on wireless service each month.

## Industry Forecasts and Surveys

According to Strategy Analytics, the global mobile handset market grew 25% in the third quarter of 2004, with 168million handsets shipped. The firm, expecting 670million handsets to be sold during all 2004, said growth benefited from a surging market handset replacement cycle in developed markets and vigorous growth in developing regions, notably Central and South America. Strategy Analytics expects growth to slow to 8% in 2005, from 30% in 2004, as the upgrade cycle begins to decelerate. Gartner estimates the mobile handset sales have increased by 26% in the third quarter, compared to a year ago, reaching 167million units. According to the firm, Nokia remains the major handset supplier, followed by Samsung, Motorola, Siemens and LG. However, In-Stat/MDR estimates that Motorola is the second major handset supplier followed by Samsung. A study from Canalys estimates that two thirds of the mobile phones shipped worldwide in 3Q 2004 were camera phones. In addition, about 56% of all phones sold in the first nine months of the year were camera phones.

Nokia has announced it expects: the mobile device industry in 2005 to grow approximately 10% in volume from the 630 million units Nokia estimates for 2004 and to grow also in value, but to a lesser extent; the annual 2008 camera phone market to be more than 600 million units and the smartphone market to be more than 200 million units; the global mobile subscriber base to surpass two billion users in 2006; the overall mobile infrastructure market in 2005 to be slightly up compared with 2004 in euro terms. Nokia is also targeting to achieve a mobile device operating margin of 17%-18% in the medium term (2-3 years) and an infrastructure operating margin of 14% in the medium term (2-3 years).

Screen Digest estimates the mobile gaming download market to be a billion-dollar industry by the end of 2004 and to be worth \$6.4billion by 2010. The firm has also said that Japan and Korea account for almost 80% of the global market; in these countries, mobile games ARPUs for games-enabled handsets were four times higher than in Western Europe and America last year.

Juniper Research has predicted the global mobile commerce market, excluding mobile entertainment, will be a \$40billion industry by 2009, fuelled by a growth in micropayment volumes. The firm believes the average Western European will make approximately 28 transactions a year via a mobile phone by 2009, with the average cost of each transaction being \$3. Juniper expects the purchase of

tickets using mobile phones will dominate the growth in m-commerce.

According to a survey conducted by In-Stat/MDR in the US, 86% of the wireless subscribers are interested in one or more Location-Based Services (LBS) applications. Of that group, 56.7% stated that they would be willing to pay a premium fee for LBS features. 35% of the people surveyed found privacy issues a concern, although 82% of this group said they would be less uncomfortable if they could easily switch-off the location capabilities of their phone.

## Other News

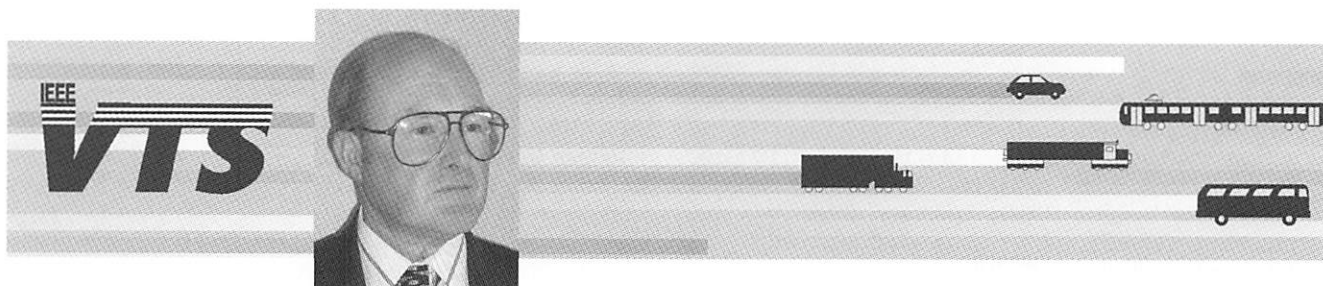
Ofcom, the UK telecoms regulator, has published the Spectrum Framework Review -- its strategy for securing the optimal use of the civilian radio spectrum. The review sets out four key recommendations to address this problem: allow the market to decide the best use for new spectrum allocations; allow licence holders to trade spectrum in an open market and change the use they make of spectrum rights to develop new technologies and offer different services to customers; define the rights of spectrum users; increase the amount of licence-exempt spectrum. Ofcom will, over time, apply this market-led approach to over 70% of the radio spectrum (currently 0%).

The ITU has said that by mid-2004 there were 1.5 billion wireless subscribers (about 25% of the world's population) worldwide. The growth is being driven by developing countries, reaching 829 million. The value of global mobile business reached \$414 billion in revenue in 2003, a tenfold increase since 1993.

The Internet Corporation for Assigned Names and Numbers (ICANN) has begun commercial and technical negotiations with the applicant registries to approve the 'mobi' domain. A company using such domain could contain information and applications that could be easier to access from mobile devices.

France will allow public performance spaces to use mobile phone jamming devices; although emergency calls will be allowed through without interference. In Ireland, ComReg has also decided to permit the use of mobile phone interceptor base stations by licensed mobile network operators if they wish to install them.

Finland's Elisa and the Honkalampi Foundation have initiated a pilot in Joensuu to transmit video in Elisa's 3G network targeting the signing people and the speech impaired who use the interpretation service. In the pilot test, the sign language is transmitted, via the 3G network, from the bank counter to a sign language interpreter, who interprets the sign language into Finnish and vice versa.



## Standards

*Dennis Bodson, Senior Editor*

### IEEE-SA Standards Style Manual

The IEEE-SA Standards Style Manual IEEE standards developers can now preview the 2005 IEEE Standards Style Manual in PDF format on the IEEE Standards Association website. The new manual contains updates to style requirements and incorporates changes made to the IEEE-SA Operations Manual. Important changes that Sponsors and Working Group Chairs should be aware of include: Initiation of Mandatory Editorial Coordination at the start of the Sponsor Ballot Invitation, Submission of all relevant copyright permission letters at the start of the Sponsor Ballot Invitation, New format for normative references, New requirements for definitions, and Required use of IEEE templates for document development

A highlighted version of the PDF is also available, and shows the text that was changed for easy reference

### IEEE Begins WLAN Standards Projects to Aid Interworking and Station Management

The IEEE has begun work on two amendments to the IEEE 802.11™ standard for wireless local area networks (WLAN).

One will aid interworking between IEEE 802.11 equipment and external networks, and the other will enhance how network stations are managed.

IEEE P802.11u™, "Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications: IEEE 802.11 Interworking with External Networks," will harmonize the ability of IEEE 802.11 equipment and external networks to work together. The common wireless interworking framework it will provide will include protocol exchanges across the air interface and primitives to support the higher-layer interactions involved.

IEEE P802.11v™, "Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications: IEEE 802.11 Wireless Network Management," will create a complete and coherent upper layer interface for managing IEEE 802.11 devices in wireless networks. It will allow stations to perform management functions, such as monitoring, configuring and updating, in either a centralized or distributed manner through a layer 2 mechanism. It also will reconfigure the current management information base to accommodate greater device complexity.

IEEE 802.11 standards form a family of specifications that define how WLAN equipment should be produced so equipment from different manufacturers can work together. The standards are developed by the IEEE 802.11 Working Group, which is sponsored by the IEEE 802(R) LAN/MAN Standards Committee of the IEEE Computer Society. For further information, visit: <http://www.ieee802.org/11/>.

## **Multiband OFDM Alliance SIG Announces Completion and Availability of Ultrawideband Specifications to Members**

The MultiBand OFDM Alliance Special Interest Group (MBOA-SIG) announced that it has completed its physical layer (PHY) 1.0 specifications and is making these available to MBOA-SIG Promoter, Contributor and Adopter members. This move enables the MBOA members, who include many of the leading consumer electronics, personal computing, mobile phone and semiconductor companies, to finalize their standards-based ultrawideband chip and board-level designs. The issuance of the MBOA 1.0 specifications is particularly important to the more than 16 silicon developers, who are now developing customer samples, and will result in pre-production interoperability testing. All this activity, in turn, will ensure that future UWB products from multiple vendors will communicate with each other quickly and easily.

"This achievement by the MBOA-SIG is the result of over 100 engineers from more than 50 companies working together to create these specs. Altogether, more than 200,000 engineer man-hours and an unrelenting peer review process have yielded a rock-solid specification," said Stephen Wood, strategic marketing manager with Intel's R&D division and a member of the MBOA-SIG steering committee. "We are proceeding quickly to ensure interoperable consumer products in mass production."

Ultrawideband (UWB) is a wireless communications technology that operates in a newly allocated unlicensed spectrum. Advantages of UWB include low power consumption, very low cost/complexity with high data rates (640 Mbps over-the-air) and precision location capability. UWB specifications target emerging wireless personal area network (WPAN) communications. WPAN technology enables high-speed, short-range, cable-free connectivity for a wide array of multimedia consumer electronics, PC peripherals and mobile devices, including wireless USB, wireless 1394 and the emerging Wireless UPnP/IP protocols.

The MBOA-SIG has established a very extensive ecosystem of valuable companies throughout the value-chain and is working in close association with the WiMedia Alliance, the Wireless USB Promoter Group, and the 1394 Trade Association to bring a variety of interoperable products to market in 2005. Application targets range from Wireless USB and Wireless 1394 for PCs, printers, cameras, and other peripherals, to streaming video for PVRs, displays, and other consumer devices, as well as high-speed IP connections via the WiMedia WiNet PAL.

"This is definitely a milestone that has been achieved quicker than expected," said Joyce Putscher, director at market research firm In-Stat/MDR. "This progress bodes well for the efforts underway to complete the Wireless USB specification, since WUSB will demand much from the MBOA specifications." (See <http://www.usb.org/wusb/home>)

Concurrent to these activities, the MBOA-SIG has been moving forward in its organizational efforts and has created

four levels of membership: Promoter, Contributor, Adopter and Supporter. The MBOA-SIG has nearly one dozen committees covering PHY and MAC technical development and specification creation, worldwide regulatory advancement, and marketing. Promoter members are those members who additionally serve on the Steering Committee and include: Alereon, Hewlett Packard, Intel Corporation, Nokia, Panasonic, Philips Electronics, Samsung Electronics, Sony, Staccato Communications, ST Microelectronics, Texas Instruments and Wisair. In brief, Contributors help design the specifications in technical committees; Adopters receive final specifications; and Supporters are kept apprised of MBOA activities.

The MultiBand OFDM Alliance SIG ([www.multiband-ofdm.org](http://www.multiband-ofdm.org)) is dedicated to delivering the best overall solution for UWB with maximum emphasis on peaceful coexistence with other wireless services and to provide the most benefits to the broadest number of end consumers. MBOA was formed in June 2003 and now numbers more than 170 member companies. MBOA members include many of the most influential players in the consumer electronics, personal computing, home entertainment, mobile phone, semiconductor and digital imaging spaces. Collectively, these companies retain much of the world's expertise and experience in designing and building systems and silicon based upon UWB techniques.

The MBOA is working with worldwide regulatory agencies to promote and seek specific approval for MBOA-based devices worldwide. The MBOA has also created a forum for collaboration with and by all UWB ecosystem players including antenna vendors, test and measurement vendors, upper layer protocol applications, and interfaces. Dozens of engineers are active in various MBOA technical subcommittees developing and improving the specification in areas ranging from system definition, MAC, MAC-PHY interface, scalability, regulatory, and ranging.

MBOA members work in harmony with other organizations such as the WiMedia Alliance, Wireless USB Promoter Group, 1394 Trade Association, and the Consumer Electronics Association. MBOA members also remain active in the IEEE, and work with other industry bodies and consortia as appropriate.

## **ETSI Agreement Brings Mobile TV Closer to Commercial Launch**

Nokia has welcomed the announcement by the European Telecommunications Standards Institute (ETSI) that DVB-H (Digital Video Broadcast - Handheld) is to be adopted as the standard in Europe for mobile TV services. DVB-H is a new technology that enables the simultaneous transmission of multiple television, radio and video channels to mobile handheld devices. It combines traditional broadcasting standards with specific features for handheld devices. To receive DVB-H transmissions, handsets require an additional integrated receiver. Nokia plans to bring a commercial mobile TV handset with integrated DVB-H to market globally in 2006.

"This announcement is an important step forward in making commercial mobile TV services a reality," said Richard Sharp, Vice President, Rich Media, Nokia. "DVB-H is a groundbreaking technology that will facilitate the widespread adoption of mobile TV around the world. We are delighted that ETSI has adopted the DVB-H standard for Europe and started the trend for the global adoption of DVB-H."

Mobile TV presents a number of unique challenges, such as battery-powered receivers and a variety of situations of use (e.g. indoor, outdoor, pedestrian, inside moving vehicle). DVB-H provides the most efficient way of carrying multi-media services over digital terrestrial broadcasting networks to handheld terminals.

To overcome these challenges, DVB-H uses a variety of techniques including time-slicing to reduce a device's average power consumption, cell identifiers to support quicker signal scan and frequency handover as well as methods to improve signal strength in the mobile environment. The technical specification work has been done in the Digital Video Broadcasting Project (DVB), which is an industry-led consortium committed to designing global standards for the global delivery of digital television and data services.

DVB-H technology is being piloted in the United States by Crown Castle and Nokia. The pilot has started in October in the Pittsburgh, PA, area and it aims to prove and test the feasibility of DVB-H technology and related service systems in the United States.

## IEEE Starts Cellular Phone Battery Standard

The proliferation of cell phones continues to push demand for their lithium-ion and lithium-ion polymer batteries to new highs and has prompted the development of a new standard at the IEEE to improve their reliability. The standard, IEEE P1725™, "Standard for Rechargeable Batteries for Cellular Telephones," will be developed within the IEEE Standards Association Corporate Program.

The new standard will seek to make cellular phone batteries more robust by setting uniform criteria for their design, production and evaluation. It will consider battery and battery pack electrical and mechanical construction, chemistries, process control, qualification and packaging technologies, among other areas. It will be developed by companies that manufacture batteries, cells and handsets, as well as by carriers.

"IEEE P1725 will extend existing cell phone battery standards and help the industry meet future requirements," says Jason Howard, Chair of the Cellular Battery Standards Working Group and Energy Technologies Manager at Motorola. "It will set the stage for batteries that deliver more power and more energy density so they allow for phones that continue to add new functions and accommodate more intense use as cell phones grow ever more central to peoples' lives. Our ultimate goal is to improve the user's experience even as batteries grow more complex by addressing the entire system from battery cells and packs to the handsets they power."

## IEEE Approves Communication Standard to Foster Public Safety in Transportation Emergencies

Law enforcement and other agencies that respond to transportation emergencies need consistent ways to exchange information so they can improve response time and keep the public safe and informed. A new standard developed by the IEEE, IEEE 1512.2™, provides a uniform set of messages that can help accomplish this goal. IEEE 1512.2,

"Standard for Public Safety Incident Management Message Sets for Use by Emergency Management Centers," provides a means to reduce message duplication among the many parties involved in managing incidents during and after they occur.

Creating the standard involved reconciling the differing communication styles found in the many agencies that respond in transportation emergencies, such as local and state police, fire departments, 911 systems, incident management centers, public works departments and emergency management centers. Message topics involved in forging reliable communications include witness reports, site conditions and warnings, the location and the best approach routes to an incident, comments in logs on what occurred, agency contact names, and much more.

IEEE 1512.2 is part of the IEEE 1512™ family of communication standards that supports efficient communication in transportation emergencies. These standards create common message sets so all parties involved share information and control resources more easily. This can lead to reduced congestion, secondary collisions and how long it takes to clear an incident, as well as improved inter-agency coordination and safety for travelers and emergency personnel.

In addition to IEEE 1512.2, IEEE 1512 standards include:

- The base standard, IEEE 1512™, addresses message sets for traffic management, public safety and hazardous materials incident response in general.
- IEEE 1512.1™ provides traffic management message sets for transportation and public safety agencies in transportation incident management.
- IEEE 1512.3™ provides message sets for the management of hazardous materials in transportation incidents.

A "Guide to the IEEE 1512 Family of Standards" can be obtained at <http://grouper.ieee.org/groups/scc32/imwg/guide.pdf>.

IEEE 1512 standards are sponsored by the IEEE Vehicular Technology Committee and being done under the auspices of the US Department of Transportation. To learn more, visit: <http://grouper.ieee.org/groups/scc32/imwg/index.html>.

## IEEE-SA Standards Board Actions

The IEEE-SA Standards Board at their December 8, 2004 meeting approved the following Project Authorization Requests:

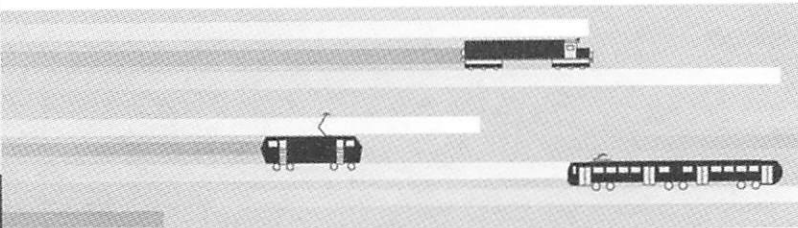
P1512.1, IEEE Standard for Common Traffic Incident Management Message Sets for Use by Emergency Management Centers, was extended to December 31, 2008. A copy of the file can be found on our website at <http://standards.ieee.org/board/nes/projects/1512-1.pdf>.

P1489 – IEEE Standard for Data Dictionaries for Intelligent Transportation Systems, was extended to December 31, 2006

## References

1. IEEE-SA News, Dec 26, 2004
2. IEEE-SA News, February 9, 2005
3. IEEE-SA News, February 21, 2005
4. MUNICH, ELECTRONICA, November 10, 2004
5. IEEE-SA News, November 18, 2004



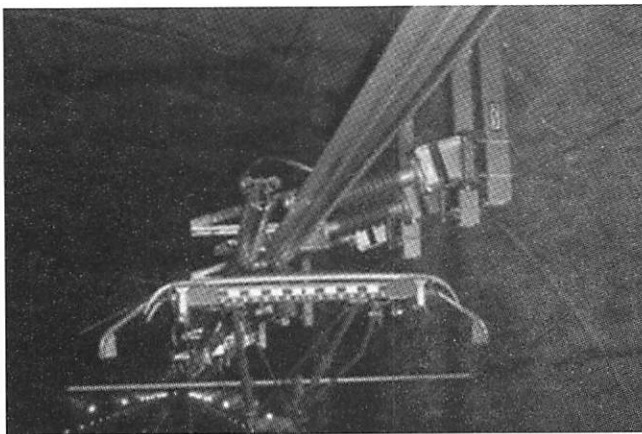


# Land Transportation

Harvey Glickenstein, Senior Editor

**Furrer+Frey has conducted tests of their overhead contact rail at speeds up to 124 mph.** The tests, which took place in cooperation with the Austrian Railways (OBB), occurred in a twin track tunnel last year. The conductor rail section was approximately 1.8 miles long. The tests were done with a single pantograph and with two pantographs placed 105 feet apart. OBB has approved operation at 124 mph pending further tests at 155 mph.

Use of overhead conductor rail for accommodating current collection reduces the tunnel diameter required as compared to the diameter required to account for the sag of catenary wire that is conventionally used to accommodate current collection. Until now conductor rail has been limited in application to slow speeds. Expanding its use to higher speeds would significantly reduce the cost of new tunnels for high speed lines.



Engineering challenges include expansion elements, section insulators, overlaps at turnouts, and the transition zone between the conventional catenary and the overhead conductor rail.

**Washington, DC broke ground for a light rail line in Anacostia on November 13, 2004.** Unlike the streetcars that operated in the District of Columbia until 1962, the light rail line will use overhead trolley wire for current collection. The streetcars in Washington, D.C. were not allowed to use overhead wires. Instead they used a third rail that was below the street and accessed through a slot in the street.

The 2.7-mile line will run along the CSX Shepard Branch from Pennsylvania Avenue to Bolling Air Force Base. One of the six stops along the line will be across the street from the Anacostia Metro Station.

The line is planned to open for revenue service in 2006.

Although Metro participated in the ground breaking across from the Anacostia Metro Station and is funding \$16.1 million of the projected \$50 million cost of the line, a contract for Metro to operate the line has not yet been signed. The District of Columbia is funding the balance of the cost

**Dallas Area Rapid Transit (DART) opened its newest 1.5-mile extension on November 13, 2004.** Victory Station is the first station along the West End corridor. The West End Corridor parallels the commuter rail line to Ft. Worth from downtown Dallas and then turns northwest past Love Field to DFW Airport. The new light rail line would enter the airport on the north side at the State Highway 114 Park & Ride, complementing the existing shuttle service from the commuter rail's Centreport/DFW Airport Station that reaches the south end of the airport. DART's plans call for a \$160 million tunnel and station under Love Field, but those plans received a setback when the Federal Transit Administration formally rejected the tunnel after DART had requested a preliminary review of the project.



DART Test Train at Victory Station

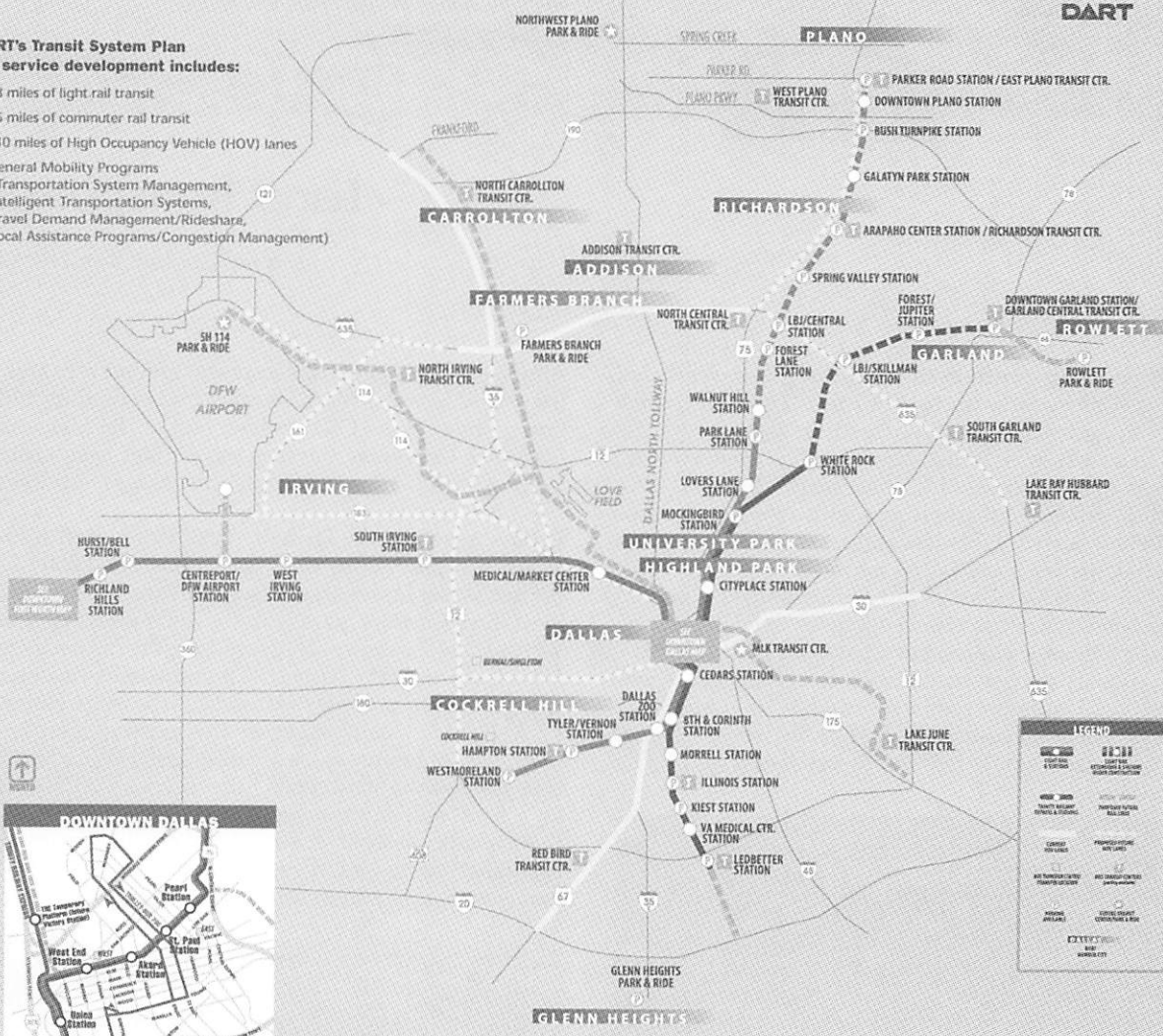
The service from the West End Station to Victory Station in the inset map of the DART rail system will be available for special events at the American Airlines Center, such as the Texas Stampede, from one hour before until one hour after the events. Limited evening service will also be provided Monday through Friday until the line is extended further.

The map overleaf shows the 49 miles of extensions presently planned or under construction.

**The 4-mile extension of Hiawatha Light Rail in Minneapolis from the Ft. Snelling Park & Ride to the**

**DART's Transit System Plan for service development includes:**

- 93 miles of light-rail transit
- 35 miles of commuter rail transit
- 110 miles of High Occupancy Vehicle (HOV) lanes
- General Mobility Programs (Transportation System Management, Intelligent Transportation Systems, Travel Demand Management/Rideshare, Local Assistance Programs/Congestion Management)



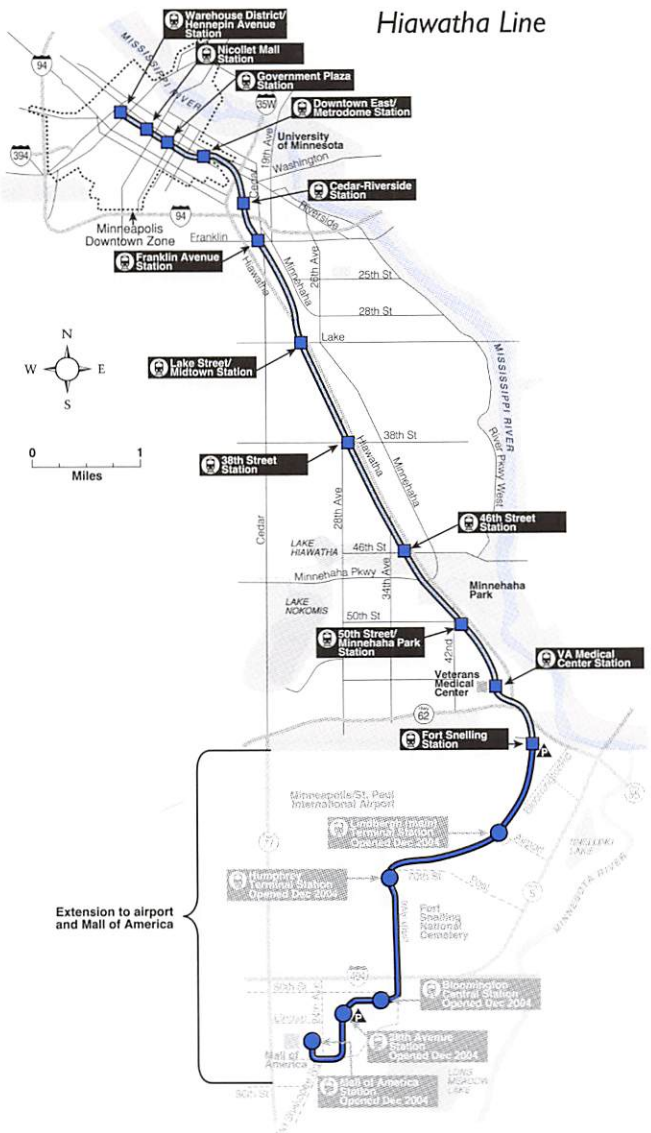
**PROJECTED DART RAIL CORRIDOR OPENING DATES**

- |  |  |
|--|--|
| <p><b>Northeast Corridor</b><br/>Mockingbird Station to Downtown Garland</p> <p>May 6, 2002 – White Rock Station to LBI/Skillman Station<br/>November 18, 2002 – LBI/Skillman Station to Downtown Garland Station</p>  | <p><b>Northwest Corridor</b><br/>Downtown to Carrollton</p> <p>2004 – Downtown to Victory Station<br/>2007 – Victory Station to Market Center/Oak Lawn<br/>2007 – Market Center/Oak Lawn to Northwest Highway<br/>2008 – Northwest Highway to Valley View Lane (Farmers Branch)<br/>2008 – Valley View Lane to Frankford Road (Carrollton)</p> |
| <p><b>North Central Corridor</b><br/>New Park Lane Station to Parker Road</p> <p>July 1, 2002 – New Park Lane Station to LBI/Central Station<br/>July 1, 2002 – LBI/Central Station to Galatyn Park Station<br/>December 9, 2002 – Galatyn Park Station to Parker Road Station</p> | <p><b>Northwest Corridor</b><br/>Northwest Highway to DFW Airport</p> <p>2009 – Northwest Highway to Las Colinas Urban Center<br/>2009 – Las Colinas Urban Center to State Highway 161<br/>2010 – State Highway 161 to DFW Airport</p>   |
| <p><b>Southeast Corridor</b><br/>Downtown to Pleasant Grove</p> <p>2006 – Downtown to Fair Park<br/>2007 – Fair Park to Buckner Blvd.</p>  | <p><b>Other Line Sections</b></p> <p>2009 – Northeast – Downtown Garland to Rowlett Park &amp; Ride<br/>2013 – Central Business District – New Line through Downtown<br/>2013 – South Oak Cliff – Ledbetter Drive to LBI Freeway (I-20)</p>  |

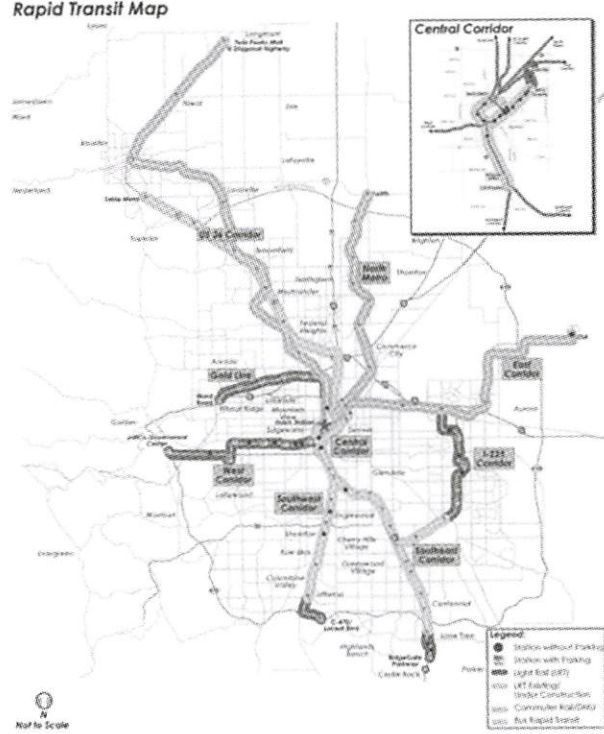
airport, Bloomington, and the Mall of America opened on December 4. The first eight miles of line, including 12 stations, opened in late June 2004.

Hiawatha Light Rail exceeded its ridership goals for the first three full months of service by 96% even before the extension opened. The ridership of nearly 1.4 million includ-

ed fans riding to Twins, Gopher, and Vikings games and mid-day lunchtime trips in addition to commuting trips. Under discussion is another light rail line that would connect Minneapolis with St. Paul. Central Corridor trains would also start at the Warehouse District Station, but would turn east after leaving the Metrodome Station. They



The Denver Referendum increases the sales tax from 0.6 percent to a full 1 percent. It is expected to fund an additional 119 miles of light rail and commuter rail over the next 12 years under the FasTracks Program.



FasTracks Program for Denver

would operate in a tunnel under the University of Minnesota and Washington Avenue. They would then run down the middle of University Avenue to the State Capitol before turning towards downtown St. Paul.

An alternative Bus Rapid Transit or BRT that is cheaper than the light rail proposal is also being reviewed. The major disadvantage of the BRT proposal is that the BRT would operate in the street through downtown Minneapolis, the University, and downtown St. Paul, subjecting it to substantial traffic delays that the Central Corridor light rail would be exempt from.

The November election saw rail propositions win in Austin, TX; Denver, CO; and Phoenix, AZ. In addition, the initiative in Seattle to scuttle the monorail that is presently under construction failed.

The proposition to build light rail in Austin passed with 62% of the vote. In 2000 a previous proposition that was widely expected to pass failed at the polls. The new proposition scaled down the previous proposal from a 52-mile electrified light rail line to a 32-mile line using diesel vehicles, mostly on an existing freight track. Austin will follow in the footsteps of New Jersey, whose River Line between Camden and Trenton is a diesel "light rail" line.

The ambitious schedule for the FasTracks program in Denver is Union Station and West Corridor Light Rail in 2013; US 36 Corridor Commuter Rail, East Corridor Commuter Rail, and Central Corridor Light Rail Extension in 2014; North Metro Corridor Commuter Rail, I-225 Corridor Light Rail, and Gold Line Light Rail in 2015; and Southwest Corridor Light Rail Extension, US 36 Corridor Bus Rapid Transit, and Southeast Corridor Light Rail Extension in 2016.

In Phoenix, the half-cent sales tax for transportation was extended an additional 20 years. Opponents of the sales tax were hoping that killing the tax would halt construction of the new light rail line in Phoenix and Tempe.

Initiative 83 in Seattle was intended to stop the 14-mile monorail line presently under construction. The monorail was vulnerable because of money problems that reduced portions of the system from double track to single track. The original monorail initiative passed by a very small margin, but the recall Initiative was defeated by a large margin.

The proposition to rescind the constitutional amendment that passed in 2000 requiring the construction of a high speed train in Florida passed. At the November meeting of the Florida High Speed Rail Authority (FHSRA) it was pointed out that there has been a law on the books in Florida since 1984 calling for construction of high speed rail. Under the Florida Constitution, the citizens have the ability to amend the Constitution any time the State Legislature fails to act on requirements of statutes. The high speed train amendment was put forward in response to the action of Governor Jeb Bush in canceling the previous high speed rail initiative called Florida Overland Express (FOX).

Once the constitutional amendment passed, the legislature was forced to fund the FHSRA. Bids were advertised for,

and a consortium led by Fluor Daniel and Bombardier was given the go-ahead for a line between Tampa and Orlando.

Governor Jeb Bush continued his opposition to the high speed rail initiative and the legislature only provided minimum funding for the project. An organization was created to lobby for repeal of the amendment and the repeal was approved by the voters in November 2004.

Notwithstanding the continued existence of a statute mandating high speed rail, the FHSRA immediately issued a stop work order to Fluor and Bombardier pending a meeting of the FHSRA to determine the next steps. The State Legislature appropriated \$4.5 million in each of fiscal year 2001/02 and 2002/03, but Governor Jeb Bush vetoed the appropriation for fiscal year 2003/04. The Federal Earmark is \$3 million for fiscal year 2001/02 and \$2.1 million for fiscal year 2002/03. The Federal Earmark of \$4 million for fiscal year 2003/04 requires an agreement with the Federal Transit Administration before funds can be released.

The Final Environmental Impact Statement (FEIS) for the project is 99% complete. The FHSRA approved the \$70,000 required to complete the FEIS from funds still available at its November meeting. The FEIS would be good for three years after approval if a method of restarting the project is found. The Authority is planning on revisiting its earlier choice of a route from the Orlando Airport to Walt Disney World that bypasses the Orange County Convention Center. If the route is changed, the FEIS would need to be modified, but money to accomplish that modification should be available from previously appropriated funding.

Governor Jeb Bush, citing the repeal of the constitutional amendment mandating the high speed rail program, has called on the FHSRA to disband and turn over its responsibilities to the Florida Department of Transportation, but the FHSRA has so far resisted that call.

**Bombardier has been awarded contracts for Communications Based Train Control (CBTC) for two lines of the Madrid Metro.** The \$135 million order covers CITYFLO 450 CBTC equipment, EBI Lock software-based interlockings, and control rooms.

Lines 1 and 6, on which the new system will be installed, consist of 54 stations and 25 miles of route. The onboard equipment will be installed on 117 trains.

The system being installed is based on manual train operation, although it has the capability of being upgraded to work in a driverless application. It uses onboard odometers calibrated by wayside transponders to determine the location of trains without the need for track circuits. Information is transmitted between the trains and the wayside on spread spectrum radio. The system is designed for use on segregated track.

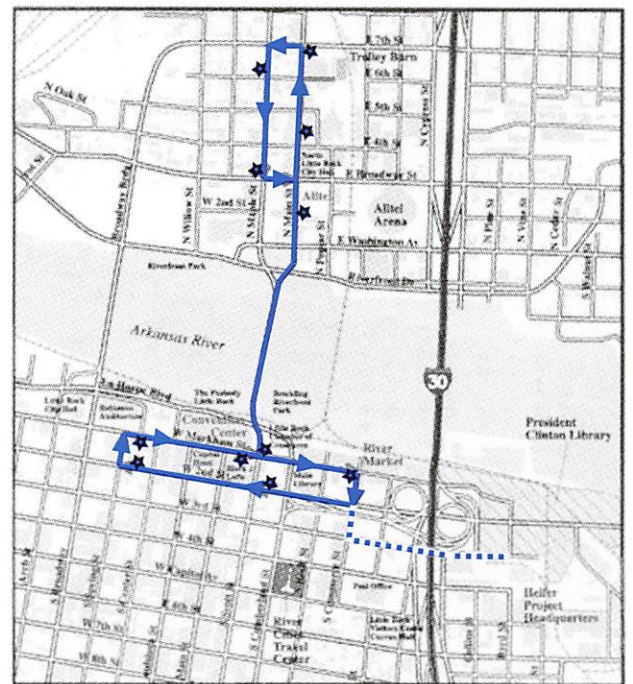
The 29-month project will be implemented in two phases. The first phase is to interface with the existing signal system. The second phase will replace all of the existing equipment with new equipment, including new jointless track circuits.

Bombardier is finishing the installation of a CITYFLO 450 system on SEPTA in Philadelphia. That installation is expected to go into revenue service in 2005.

The SEPTA system is on the downtown underground loop and has only one interlocking. The interlocking is an all-relay interlocking that is being retained. The system will not interface with the existing track circuits except as necessary at the interlocking. Trains will be able to close in at only three stations in the subway to allow for multiple berthing. At all other locations a separation from the train ahead will be enforced.

Due to the fact that the streetcars using the SEPTA system do not have modern slip/slide protection, it has become necessary to calibrate the odometer with transponders at each end of each station in the trolley subway in Philadelphia. In other respects the SEPTA installation will be similar to the Madrid one.

**Central Arkansas Transit Authority opened its River Rail Electric Streetcar System between Little Rock and North Little Rock on November 1, 2004.** The 2.1-mile system uses three vintage streetcars. The system is free. On the first Saturday of operation CATA was forced to limit passengers to 80 per car as they felt the 100 passengers per car that rode on Friday created a safety hazard.



- Vintage Streetcar Route Phase 1 (in operation)
- - - Vintage Streetcar Route Phase 2 (approved)
- ★ Steercar Route Platform (Phase 1)

River Rail Electric Streetcar System

Map courtesy Central Arkansas Transit Authority

## New Motor Vehicles VP

Bob Mazzola has decided to resign from the Board for personal reasons effective at the end of 2004. A long-standing Board member, Bob also served on the Convergence Education Foundation. He will be missed.

Appointed to replace him for the remainder of his term on the Board is Joseph F. Ziomek. Joe has long experience in the automotive electronics field, starting with Ford in 1963, and for the past 10 years he has had his own consulting company. Joe is currently Chairman of the Convergence Education Foundation, and his experience and enthusiasm will be a valuable asset for the Society.

## Elections

In the 2004 elections, Charles Backof, Dennis Bodson,

Tad Matsumoto, Eric Schimmel and J.R. Cruz, were elected to serve on the Board of Governors for the 2005-2007 term. Of these, the first four were incumbents standing for re-election. The 'new' member is J.R. Cruz, who was president of VTS for 2000 and 2001. J.R. had been on the board in a non-elected capacity as a past president.

In the Executive elections held at the last BoG meeting of 2004, Charles Backof stood down as President, having served the maximum two terms. Elected to replace him was Dennis Bodson, who had previously been Executive Vice-President. As noted above, Joe Ziomek was elected as VP Motor Vehicles. Harvey Glickenstein and Eric Schimmel stay in place as VP – Land Transportation and VP – Motor Vehicles respectively.

## IEEE VTS Board of Governors' Meeting, September 28, 2004

The final VTS Board of Governors meeting of 2004 was held on the 28th of September during VTC2004-Fall in Los Angeles. Present were elected Board members Charlie Backof, Dennis Bodson, Tracy Fulghum, James Irvine, Tad Matsumoto, Bob Mazzola, George McClure, Sam McConoughey, Tom Rubinstein, Eric Schimmel, Gordon Stüber, and Ray Trott. Also present were J.R. Cruz Jr., Past President; Harvey Glickenstein, VP-Land Transportation; Jae Hong, Lee, Chair VTC2003-Spring; Glenda McClure, Conference Coordinator; Fu-Chun Zheng, Chair VTC2006-Spring; Yu-Dong Yao, Education Committee Chair.

**Secretary's Report:** The Secretary has compiled full copies of all board-approved minutes to be sent to the IEEE to bring the microfilm archives up to date.

**Treasurer's Report:** George McClure reported on finances, which are healthy. Although administration is slightly higher than budgeted, this is more than matched by lower than expected transactions and newsletter expenses, and higher conference income, resulting in a net increase in revenue over budget for this point in the year of some \$150,000, or a total of \$213K surplus for the year to date.

**President's Report:** Eric Schimmel and Harvey Glickenstein were submitted as VTS contact points for IEEE New Technology Directions Committee (NTDC). The NTDC launched six New Technology groups: BioEng/BioTech, Displays, Distributed Intelligent Networks and Systems, Future Power and Alternative Energy Technologies (FPAET), Digital IP and Security. These groups provide opportunities to build synergies within IEEE and with non-IEEE societies. Mark Ehsani will represent VTS on FPAET.

Bob Mazzola is resigning effective at the beginning of 2005. With the endorsement of the Board, the president appointed Joe Ziomek to the Board position left by Bob Mazzola for the remainder of his term, which runs through 2006.

## Committee Reports

Ray Trott presented the **Awards Committee** report. There was some discussion regarding at which VTC to have the

awards luncheon, Stockholm, Dallas or both.

The **Education Committee** report was made in the form of presentation on IEEE XELL, the Xplore Enabled Learning Library, an online tutorial/learning experience. For 2004, 29 learning modules are targeted; for 2005, 35 modules are targeted. The cost per module was to be determined. J. R. Cruz will be the liaison to IEEE XELL.

The **Election Committee** reported on the elections to the board in 2004. Charles Backof, Dennis Bodson, J.R. Cruz, Tad Matsumoto, and Eric Schimmel were elected to serve on the Board of Governors for the 2005-2007 term.

**Publications Committee:** The **Transactions Editor** proposed a special section on UWB for the journal. After some discussion, the board recommended that the editor of Transactions proceed with a special section on UWB in 2005. J.R. Cruz, as Liaison to Publications, will consult with the editor regarding deadline details and the balance between invited tutorial papers and open submissions. It was also recommended that the editor consider special sections or issues on OFDM and cognitive radio for early 2006.

James Irvine reported on the **VTS News**. A new editorial organizational chart, much like the Transaction's, was presented and proposed for a more magazine-oriented organization. This was agreed. Charlie Backof agreed to take on the role of Senior Editor for Society Affairs.

## Conferences and Meetings

A general report on conferences was made by James Irvine. **VTC2003-Fall** (Orlando) was near to closing out, with about \$238K surplus. One of the lessons learned from this conference is that organizers should stick with their original paper submission deadlines. Another lesson is that the standard IEEE hotel contract makes negotiations with hotels much easier. Dennis Bodson reported on **VTC2004-Spring** (Milan). Generally, the surplus should end up being okay. He commended the Technical Committee for their service, especially given the late change of venue.

**VTC2004-Fall** was currently underway, and as of the previous evening had 1018 registrants. 1119 papers were to be presented at the conference. While generally it was held that this conference would end up being very successful, there was concern expressed, however at the dwindling attendance at tutorial sessions.

On **VTC2005-Spring** (Stockholm), unfortunately Eric Strom was not able to act as TPC co-chair, but Jens Zander was able to secure Ben Slimane as his fellow cochair. With the signing of the Clarion Hotel, the registration fee has been set at \$595, with \$295 per extra paper.

The organisation of **VTC2006-Spring** (Melbourne) and VTC's in general were discussed. There was some question as to whether the Melbourne Section was still interested in full sponsorship, as the officers there had changed.

After much discussion on the paper reviewing process for VTC, the following minimum standards for VTC conferences were agreed:

- abstracts will not be considered unless they are of at least two pages; however the length can be greater at the discretion of the Technical Program Chair.
- ideally three reviews should be obtained, and a paper must have at least two reviews before it may be accepted
- a paper must meet a minimum review score to be determined for the VTC by the Conference Committee, but that minimum may be no less than 3.0 on a scale of 1 to 5.

Bob Shapiro and Dinesh Rajan reported on **VTC2005-Fall** in Dallas. About three quarters of the organizing committee was in place, along with the core of the TPC. Drs. Lee and Grey will be co-chairs of the TPC.

Jae Hong Lee presented a report on the organizational efforts for the 2nd IEEE VTS Asia-Pacific Wireless Communications Symposium (APWCS), and gave a run down on possible support from chapters in the region. The President thanked Drs. Lee and Hatori for their organizational efforts in the region, and Jae Hong Lee was appointed Chapter Development Coordinator for the Asia-Pacific region.

**VTC2006-Fall:** Having visited a number of hotels and produced a comprehensive report, the Conference Committee recommended that VTC2006-Fall be held in the Hyatt Regency in Montreal. This was agreed.

**Technical Co-sponsorships:** It was agreed to provide

technical sponsorship for the second International Symposium on Wireless Communications Systems, which will be held in Sienna, Italy.

## Other Reports

Eric Schimmel presented a proposal for the ITU Liaison Budget proposal. To continue with and expand the activities of this committee, about \$16K-\$17K would be needed, and the Board approved this expenditure.

Sam McConoughey presented a report on **Membership Development**. The policy of offering free VTS memberships to non-VTS IEEE members who attend VTC was discussed.

Tom Rubinstein presented the **Webmaster's** report and **Digital Archive** report. A large number of missing volumes of Transactions have been located, leaving only Volume 1 outstanding. Good progress had also been made on locating copies of the proceedings of VTCs.

Tad Matsumoto reported on Finnish Chapter creation. Formation of the chapter is nearing completion. A possibility of VTC in Helsinki for 2009 was suggested.

Gordon Stüber gave the report on Fellowship Committee. There were 12 cases currently, 4 of exceptionally qualified, 7 highly qualified, and 1 qualified. The candidates were fairly geographically distributed, with half being from North America.

Dennis Bodson reported that the recent changes to the Constitution and By-Laws revisions will be published in VTS News, and, after 90 days, if there are no issues, the new version will be posted at the website.

## Election of Officers

The Board elected the following officers by acclamation, as all ran unopposed:

President: Dennis Bodson

Executive Vice President: Sam McConoughey

Treasurer: George McClure

VP – Mobile Radio: Eric Schimmel

VP – Land Transportation: Harvey Glickenstein

VP – Motor Vehicles: Joe Ziomek

The next meeting of the Board is set for Saturday, 5 February 2005, 8:30 AM at the Intercontinental Hotel in Dallas, Texas, USA.

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# Intelligent Transportation Systems Conference 2005

*13-16 September 2005, Vienna, Austria*

ITSC 05 will take place from 13th to 16th of September 2005 in Vienna, Austria and will continue the tradition of leading advances in basic research on technology related to intelligent transport systems (transport telematics), ITS applications and the interface between ITS technology and the society.

"ITS and the society" would like to compile and present the advantages of applications of intelligent transportation systems for the society. Finally all (the society) want to benefit from innovative developments, strategies, technologies etc. in the interdisciplinary range of the innovative transport systems, in order to use and to increase the efficiency of resources (above all time and infrastructure).

Vienna can be reached easily by plane, train or car. The Vienna International Airport connects Vienna with the world - many important European Cities such as Berlin, Frankfurt, Rome, Zurich or Milan can be reached within an hour or more.

Conference Chair: Dr. Reinhard Pfliegl  
Head of Technology Department

Conference Secretary:

Lydia Novoszel

Project Assistant

via donau - Österreichische Wasserstraßen Gesellschaft mbH  
Donau-City-Strasse 1, A-1220 Wien Austria

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Should you have specific questions on the submission of papers, the participation on the conference, or the exhibition please send your message to [office@itsc2005.at](mailto:office@itsc2005.at)



# VTC2006-Spring CALL FOR PAPERS

**MELBOURNE**  
Delivering the Promise of 3G

[www.vtc2006spring.org](http://www.vtc2006spring.org)

The 63rd IEEE Vehicular Technology Conference (VTC) will be held at the Grand Hyatt Melbourne, Melbourne, Australia, 7-10 May 2006. As the first ever VTC to be held in the southern hemisphere, the 63rd VTC (VTC2006-Spring) will feature world-class technical sessions and tutorials on, but not limited to, the following topics:

- |   |   |
|---|---|
| 1. Antenna systems, antenna arrays, and channel measurements and characterization.              | 8. Mobile ad hoc networks, mesh networks, and sensor networks |
| 2. Signal transmission and reception, signal processing, transceiver design, and air interfaces | 9. Mobility and location management and the related services  |
| 3. Multiple antenna systems   | 10. Mobile internet and all-IP networks                       |
| 4. Ultra wideband systems   | 11. Cross-layer design of wireless systems                    |
| 5. Future wireless communications systems, and their inter-working and convergence.             | 12. Mobile satellite systems                                  |
| 6. Spectrum efficiency, network capacity, and cognitive radio                                   | 13. Ambient wireless networks                                 |
| 7. Radio resource management and wireless quality of service (QoS)                              | 14. Vehicular electronics                                     |
|   | 15. Intelligent transportation systems                        |
|   | 16. Rail signals, communications, and control                 |

Prospective authors are invited to submit either *2-page summaries* or preferably *5-page full papers* electronically via the conference web page ([www.vtc2006spring.org](http://www.vtc2006spring.org)) or direct to [vtc06s.trackchair.org](mailto:vtc06s.trackchair.org)

**Important Deadlines:**

Submission due: 16 September 2005  
Author notification: 12 December 2005  
Camera ready papers due: 11 February 2006

**General chair:**

*Fu-Chun Zheng* ([fzheng@ieee.org](mailto:fzheng@ieee.org))  
Victoria University of Technology, Australia

**Technical Program Chair:**

*David Everitt* ([deveritt@ieee.org](mailto:deveritt@ieee.org))  
The University of Sydney, Australia

## Report on the 1st Vehicle Power & Propulsion Symposium

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The first Vehicle Power and Propulsion Symposium of VTS was held on October 6th, 7th, 8th 2004 at the "Union Internationale des Chemins de Fer" in Paris, France. The general chair of the symposium was Prof. T.M. Guerra, Université de Valenciennes, who organized the conference for VPPC with help from his research team. The committee expresses its most sincere appreciation to Prof. Guerra and his team for their efforts. This Symposium was a complete success both for the quality and number of the papers submitted and presented, the venue, the organization, and of the entertainment. Many of the attendees expressed that this was the highest quality conference they had attended in this technical area.

Over 175 participants attended this symposium. The organizers received 102 paper submissions and after review accepted 78 papers. 24 papers were rejected, which corre-

sponds to a rejection rate of 23.5%. Also, 7 papers were cancelled by their authors, which resulted in 71 oral presentations at the symposium. The symposium was organized in 20 sessions, including 5 invited sessions.

The authors who submitted papers were from 20 different countries: Algeria, Australia, Austria, Bulgaria, Canada, Chile, China, France, Germany, Italy, Japan, Korea, Mexico, Morocco, Netherlands, Serbia Montenegro, Sweden, Switzerland, United Kingdom, and United States of America. The list of authors breaks down as follows: France 89; Europe (w/o France) 43; North America 36; Asia 24; South America 8; North Africa 4; and 6 others.

The Vehicle Power and Propulsion Committee is also pleased to report the participation of representatives from such industrial companies as ABB, General Motors, PSA, Renault, Toyota, and VALEO.



Photos by Mark Ehsani

The conference featured a cruise on the River Seine, but real work was done as well!

The annual meeting of the IEEE VTS-Vehicle Power and Propulsion Committee was held during the Symposium in Paris. The VPP Committee now has 34 members, 11 from the US and Canada, 20 from Europe and 3 from Japan.

This year VPPC will be organizing its first international IEEE Vehicle Power and Propulsion Conference in Chicago, Illinois, on September 7 through 9, 2005. Professor Ali Emadi of Illinois Institute of Technology is the General Chair of this conference. The conference will be jointly sponsored by the Vehicular Technology and Power Electronics societies of IEEE. This conference promises to be yet another milestone in the development of this technical area within our society and IEEE. For more details about this year's

conference or to submit a paper or attend, please go to its web site: <http://vpp.iit.edu>

In summary, the VTS-VPPC has made great progress over the past year and has created some historic successes in serving the profession in this technical field. Since IEEE-TAB has declared the transportation electrical systems one of the "HOT" areas for IEEE, our initiatives and conference may emerge as the lead focus for this interest of the TAB. This will bring further credit to VTS.

I would like to express my sincere appreciation and gratitude for the continued hard work and support that VPPC and BoG members have contributed to our activities this year and into the future.

## Conferences of Interest

The following table shows VT-06 sponsored and co-sponsored conferences as well as related conferences not sponsored by the Society. While every attempt was made to ensure accuracy, you should contact the respective conference committee to confirm date and location.

DATE	CONFERENCE	LOCATION	WEB PAGE
13-17 March 2005	WCNC 2005	New Orleans, LA	<a href="http://www.comsoc.org/confs/wcnc/2005/index.htm">http://www.comsoc.org/confs/wcnc/2005/index.htm</a>
16-18 March 2005	2005 Joint Rail Conference	Pueblo, CO	<a href="http://www.asmeconferences.org/jrc05/">http://www.asmeconferences.org/jrc05/</a>
11-15 April 2005	European Wireless 2005	Nicosia, Cyprus	<a href="http://www.vde.com/ew05">http://www.vde.com/ew05</a>
16-20 May 2005	ICC 2005	Seoul, Korea	<a href="http://www.icc05.org">http://www.icc05.org</a>
29 May - 1 June 2005	VTC 2005-Spring	Stockholm, Sweden	<a href="http://www.vtc2005spring.org">http://www.vtc2005spring.org</a>
6-8 June 2005	IV'05	Las Vegas, NV	<a href="http://www.ieeeiv.org">http://www.ieeeiv.org</a>
19-22 June 2005	IST Mobile & Wireless Summit	Dresden, Germany	<a href="http://www.mobilesummit2005.org">http://www.mobilesummit2005.org</a>
5-8 July 2005	AP/URSI '05	Washington, DC	<a href="http://apsursi2005.org/">http://apsursi2005.org/</a>
25-27 July 2005	Electric Ship Technologies Symposium 2005	Philadelphia, PA	<a href="http://ewh.ieee.org/conf/ests05/">http://ewh.ieee.org/conf/ests05/</a> ✓
4-5 August 2005	2 <sup>nd</sup> Asia-Pacific Wireless Communications Symposium	Sapporo, Japan	<a href="http://www.ieee-jp.org/jc/chapter/vts/vt.htm">http://www.ieee-jp.org/jc/chapter/vts/vt.htm</a>
5-7 September 2005	ISWCS 2005	Siena, Italy	<a href="http://www.iswcs.org">http://www.iswcs.org</a>
11-15 September 2005	PIMRC 2005	Berlin, Germany	<a href="http://www.pimrc2005.de">http://www.pimrc2005.de</a>
13-16 September 2005	ITSC 2005	Vienna, Austria	<a href="http://www.itsc2005.at">http://www.itsc2005.at</a> ✓
19-21 September 2005	MWCN 2005	Marra kesh, Morocco	<a href="http://www.ctr.kcl.ac.uk/MWCN2005/">http://www.ctr.kcl.ac.uk/MWCN2005/</a> ✓
26-29 September 2005	VTC 2005-Fall	Dallas, TX	<a href="http://www.vtc2005fall.org">http://www.vtc2005fall.org</a>
15-17 October 2005	VES'05	Xi'an, Shanxi, China	<a href="https://150.135.155.192/ves05/index.php">https://150.135.155.192/ves05/index.php</a> ✓
28 November - 2 December 2005	Globecom 2005	St. Louis, MO	<a href="http://www.ieee-globecom.org/2005/">http://www.ieee-globecom.org/2005/</a>
8-10 May 2006	VTC 2006 Spring	Melbourne, Australia	<a href="http://www.vtc2006spring.org">http://www.vtc2006spring.org</a> ✓
17-20 September 2006	ITSC 2006	Toronto, Canada	<a href="http://www.ewh.ieee.org/tc/its/itsc2006/">http://www.ewh.ieee.org/tc/its/itsc2006/</a>
25-28 September 2006	VTC2006-Fall	Montréal, Canada	<a href="http://www.vtc2006fall.org">http://www.vtc2006fall.org</a>
22-25 April 2007	VTC2007-Spring	Dublin, Ireland	<a href="http://www.vtc.org">http://www.vtc.org</a>

Conferences marked '✓' have open calls for papers as of 1 March 2005. This list is based upon the conference calendar at our web site, which is updated more frequently than this list can be. To access it go to the following URL: <http://www.vtsociety.org/>, then click on "Conference List" in the left frame.