

## FEATURES

<http://www.vtsociety.org>  
Vehicular Technology Society News  
Vol. 47, No. 3 issn 1068 5731  
August 2000

**4** The Latin-American Mobile Communication Marketplace

**8** Voice Driven Information Access in the Automobile

**11** The Millennium Dome Goes Digital



Digital Technology is making steady inroads into the Professional Mobile Radio Market. Jane Wenham describes the new TETRA system at the Millennium Dome in London.

### Contents

- 2 VTS Directory
- 3 Foreword
- 13 IEEE Antennas and Propagation Society
- 16 Mobile Radio
- 21 Transportation Systems
- 22 Automotive Electronics
- 25 Convergence 2000
- 27 Report on VTC2000-Spring
- 31 Maglev Technical Tour Report
- 32 IMT2000 Technical Tour Report
- 34 Professional Activities
- 35 Book Review - WCDMA for UMTS
- 36 Letters
- 37 News
- 38 Chapter News and Meetings
- 39 Questionnaire Results
- 40 17<sup>th</sup> May 2000 VTS Board Meeting Report
- 42 Calls for Papers
- 43 Next Generation Wireless Networks
- 44 Calendar of Events

## Vehicular Technology Society Executive Committee

President, **A. Kent Johnson**  
Brigham Young University  
1225 East Cambridge Court  
Provo, UT 84602  
Tel: +1 801 378 3726  
Fax: +1 801 378 7575  
E mail: a.k.johnson@ieee.org

Executive Vice President,  
**J. R. Cruz**  
The University of Oklahoma  
School of Electrical and Computer Engineering  
202 West Boyd, Room 219  
Norman, OK 73019 0631  
Tel: +1 405 325 4280  
Fax: +1 405 325 3836  
E mail: cruz@mailhost.ecn.ou.edu

Vice President Mobile Radio,  
**Eric J. Schimmel**  
6216 Hollins Drive  
Bethesda, MD 20817  
Tel: +1 301 530 7987  
E mail: e.schimmel@ieee.org

Vice President Land Transportation,  
**Harvey M. Glickenstein**  
PB Transit & Rail Systems, Inc  
3334 Adams Court  
Bensalem, PA 19020  
Tel: +1 973 565 4820  
Fax: +1 973 824 3140  
E mail: h.glickenstein@ieee.org

Vice President Motor Vehicles,  
**Robert A. Mazzola**  
R.A. Mazzola Associates.  
12500 Crystal Mountain Drive #620  
Thompsonville, MI 49683.  
Tel: +1 231 378 4722  
E mail: rmazzola@prodigy.net

Secretary, **Essam Sourour**  
Ericsson, Inc.  
7001 Development Drive  
Post Office Box 13969  
Research Triangle Park, NC 27709  
Tel: +1 919 472 7067  
Fax: +1 919 472 6555  
E mail: sourour@rtp.ericsson.se

Treasurer, **Charles Backof**  
Motorola  
8000 W. Sunrise Blvd.  
Fort Lauderdale, FL 33322  
Tel: +1 954 723 6152  
Fax: +1 954 723 6957  
E mail: EPOR16@email.mot.com

## VTS Board of Governors

**Charles Backof** ('01) *VTS Treasurer*

**Dennis Bodson** ('01)  
*Standards Committee Chairman*  
233 N. Columbus St.  
Arlington, VA 22203  
Tel: +1 703 243 3743  
Fax: +1 703 522 4342  
E mail: bodsond@worldnet.att.com

**J. R. Cruz** ('02) *Executive Vice President, IEEE Transactions on Vehicular Technology Editor*

**Robert Fenton** ('01)  
Ohio State Univ.  
2177 Oakmount Rd..  
Columbus, OH 43221  
Tel: +1 614 292 4310  
Fax: +1 614 292 7956  
E mail: fenton@ee.eng.ohio-state.edu

**Robert L. French** ('00) *IEEE ITS Council Representative*  
R&D. French Associates  
6137 Tuliptree Lane  
Nashville, TN 37221  
Tel: +1 615 673 6211  
Fax: +1 615 673 0311  
E mail: r.french@ieee.org

**John T. Gilsenan** ('02)  
13736 Lockdale Rd.  
Silver Spring, MD 20906 2117  
Tel: +1 202 647 2592  
Fax: +1 202 647 7407  
E mail: GILSENANJT@state.gov

**A. Kent Johnson** ('01)  
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**Anil T. Kripalani** ('02)  
*Membership Committee Chair*  
Qualcomm Inc.  
5775 Morehouse Dr., Rm L-514K  
San Diego, CA 92130  
Tel: +1 858 658 4241  
Fax: +1 858 658 2115  
E mail: anilk@qualcomm.com

**Melvin A. Lewis** ('00) *National Conference Coordinator, Conference Board Member*  
Lockheed Martin  
Ridge Hill M/S 29  
Yonkers, NY 10710  
Tel: +1 914 964 3820  
Fax: +1 914 964 2891  
E mail: m.lewis@ieee.org

**Robert A. Mazzola** ('00) *VTS Vice President, Convergence Conference Committee Representative, SAE Liaison, Long Range Planning Committee Chair*

**George F. McClure** ('00) *Past President, Conference Committees Chairperson, Public Relations / Publicity Committee Chairperson*  
1730 Shiloh Lane  
Winter Park, FL 32789  
Tel: +1 407 647 5092  
Fax: +1 407 644 4076  
E mail: g.mcclure@ieee.org

**Samuel R. McConoughey** ('01)  
*Past President*  
Mobile Communications Consulting  
13017 Chestnut Oak Drive  
Gaithersburg, MD 20878 3556  
Tel: +1 301 926 2837  
Fax: +1 301 926 2506  
E mail: mcon@compuserve.com

**Tom Rubinstein** ('02) *VTS Webmaster, Conference site selection, New member liaison*  
Motorola  
9980 Carroll Canyon Road  
P. O. Box 85036  
San Diego, CA 92186 9130

Tel: +1 858 530 8432  
Fax: +1 858 530 8313  
E mail: cegr01@email.mot.com

**Raymond C. Trott** ('00) *Awards Committees Chairperson, Paper of the Year Awards, Avant garde Awards*  
Trott Communications Group, Inc.  
1425 Greenway Drive, # 350  
Irving, TX 75038  
Tel: +1 972 580 1911  
Fax: +1 972 580 0641  
E mail: ray.trott@trottgroup.com

**James A. Worsham, Jr.** ('02)  
*Conference Board Member*  
BellSouth, Room 42U85,  
675 West Peachtree Street NE,  
Atlanta, GA, 30375  
Tel: +1 404 330 0381  
Fax: +1 404 330 0386  
E mail: jim\_worsham@snt.bellsouth.com

## VTS News Staff

Editor-in-Chief  
**James M. Irvine**  
Mobile Communications Group, EEE  
Strathclyde University  
George Street  
Glasgow G1 1XW Scotland  
Tel: +44 141 548 4072  
Fax: +44 141 552 4968  
E mail: j.m.irvine@ieee.org

## Senior Editors

Automotive Electronics  
**William J. Fleming**  
TRW Vehicle Safety Systems, Inc.  
4505 West 26 Mile Road  
Washington, MI 48094  
Tel: +1 810 781 7394  
Fax: +1 810 781 7274  
E mail: william.fleming@trw.com

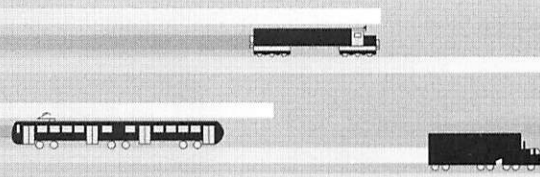
Transportation Systems  
**Harvey M. Glickenstein**

Mobile Radio  
**Javier Gozalez**  
C/ San Juan Bosco, n° 14-B 3F  
03005 Alicante  
SPAIN  
E mail: j.gozalez@ieee.org

Professional Activities  
**Frank E. Lord**  
35 Hartford Ave.  
San Carlos, CA 94070  
Tel/Fax: +1 650 594 0512

Chapter News & Meetings  
**Gaspar Messina**  
9800 Marguetta Drive  
Bethesda, MD 20817  
Tel: +1 202 418 1348  
Fax: +1 202 418 1412  
E mail: GMESSINA@fcc.gov

Washington News  
**Eric J. Schimmel**



## FOREWORD

*James Irvine, Editor*

In this issue we report the outcome of the recent VTS News questionnaire. This has given us a good idea of what members think. The obvious question is 'what are we going to do about it?'

A clear outcome of the survey is that members want the VTS News to keep them informed of what is going on in the field. Articles on recent technological developments were rated the most popular and useful. I am very fortunate to have a team of Senior Editors who spend considerable amounts of their time keeping abreast of developments and reporting them in their columns. The gap of mobile radio coverage has been filled, and from the next issue, Dennis Bodson will join the team with a new column to report on standards activities.

As well as the regular columns, we are reintroducing the practice of publishing feature articles giving a more detailed look at different subjects. The VTS has a wide variety of members with interests in the three different areas of the Society's activities – Automotive Electronics, Mobile Radio and Transportation. The aim will be to print articles which will interest both the specialist in the particular area, and also society members in the other two areas. In this the VTS News will complement the Transactions in Vehicular Technology by publishing articles with a broader scope than is appropriate for that publication. The aim will be to publish

at least three such articles in each issue, ideally one from each area, but that will depend on whose arms we can twist into writing. Volunteers, anyone?

The Board approved an increased budget for the VTS News to allow for the increased use of colour. This will allow us to improve our presentation of information.

Given the importance so many respondents placed on information about the society when it came to the aim of the VTS News, the usefulness on the society news type columns reported in the second part of the questionnaire was disappointing. It is clear that we need to improve our communication of the society's activities. We are looking at ways of doing this with chapter and meeting reports. The way we report Board of Governors' meetings has already changed with the printing a shorter report giving all the relevant information rather than the full minutes, which could be rather cryptic at times. Other reporting options will be looked at so you remain fully informed of what is going on.

Finally, a big 'thank you' to all those who took the time to respond and give their views. While this questionnaire is now completed, I am still very keen to hear members' views on the VTS News. So please, if you have any comments, suggestions, criticisms, etc., send them to me at the address opposite. Remember, the VTS is your society; the VTS News belongs to its readers.

Copy for 2000 issues of VTS News should reach Dr. James Irvine by:

<u>Issue</u>	<u>Due Date</u>
November 2000	September 4, 2000
February 2001	December 5, 2000
May 2001	March 6, 2001
August 2001	June 5, 2001

at Mobile Communications Group, IEEE, Strathclyde University, George Street, Glasgow G1 1XW Scotland, E mail: j.m.irvine@ieee.org.

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IEEE Vehicular Technology Society News is published February, May, August and November by the Vehicular Technology Society of the Institute of Electrical & Electronics Engineers, Inc. Headquarters of IEEE is at 3 Park Avenue, 17th Floor New York, NY 10016 5997. Printed in USA. Periodicals postage paid at New York, NY and at additional mailing offices. Postmaster: Send address changes to IEEE Vehicular Technology Society News, IEEE, 445 Hoes Lane, Piscataway, NJ 08855.

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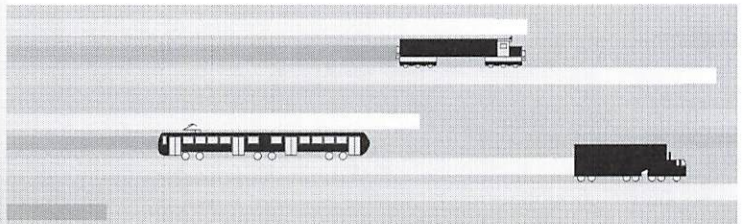
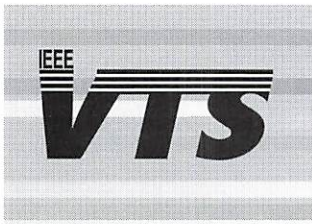
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Transactions on Vehicular Technology subscription price is \$20 per year for IEEE members. For non members, the price is \$175 per year.

Vehicular Technology Society News subscription price of \$15 is included in membership in VTS. For non members, the annual price for the four issues of February, May, August and September is \$30.

For inquiries and orders, see telephone numbers above.





# THE LATIN-AMERICAN MOBILE COMMUNICATIONS MARKETPLACE

Heidi Rivas Hernández, Special Projects Engineer, DIGITEL CORP

In this article, Heidi Rivas Hernández reviews developments for public cellular communications in the fast-growing Latin-American market.

## Introduction

In the last decade, the telecommunications industry in Latin-American experimented an explosive growth driven by demand of basic and enhanced services.

Total investments in Latin American telecommunications increased in the 1994-6 timeframe, from US\$ 3 billion to US\$ 7 billion, and will reach US\$ 10 billion in 1998 [1].

In fact, the number of mobile cellular subscribers has soared to over 39 million in 1999, up from just 100.000 subscribers in 1990, and 3.5 million in 1995. This means that today one in every four telephone user in Latin America depends on a mobile phone and, in some markets, the ratio is one in two [2].

These facts show an unforeseen scenario over those countries, which are considered developing nations: What is the reason of this unprecedented telecommunication growth?

## The Latin American market: reasons for growth

The general trend for development and increase of the Latin American mobile networks has been an advancement in stages from state-owned monopoly to privatisation, and finally to competition.

## Privatization

The globalisation of telephony and a minimum solution for a large-scale economy were the political justifications of the strongly regulated telecom environment, a business model imposed worldwide in last century [3]. Later in the advanced countries the old model lost its main justification: new services and a competitive market were required during a time of technological evolution.

Privatisation of state-owned telecom companies and partnership with foreign companies began in the late 1980s [4]. The deregulation was a result of the emerging need of the advanced economies as they fully accomplished the prior steps in their technological evolution. Deregulation became a necessity, even in those economies where telephony, far from being a universal commodity, was and still is considered to be a luxury [5].

The ability to invest in the telecommunications infrastructure increased when private companies took over. Little more than a decade ago, Chile was the first country in Latin America to sell its state-owned telecommunication company. Years later, in nearly every country in the region

the mayor telecom operator is either fully or largely owned by private investors [2].

For example in Brazil, the privatisation process of the Brazilian telecom system was certainly the mayor event in its economy in 1998. The long expected US\$ 27 billion auction was by a complete overhaul of its holding Telebras, the most important telecom company in this country [5].

## Competition

The implications on technology are already apparent to the general public, as more and more people realize the opportunities associated with the growth of mobile services, Internet access, cable TV, and new telecom services in general. While this is true world-wide, there are some important peculiarities to be considered in Latin American countries: In economically challenged environments, new telecom services are being introduced before the demand for plain old telephone service (POTS) is fully satisfied [6].

The competition between POTS, generally fixed network operators, and the mobile network operators is a fact in Latin America countries. The region has a particular characteristic: many countries have only a single fixed network that provides telecommunication services in all the national territory.

Geographical obstacles don't allow many of the POTS networks to achieve good coverage over their territories. Cable installation was very difficult in many Latin America

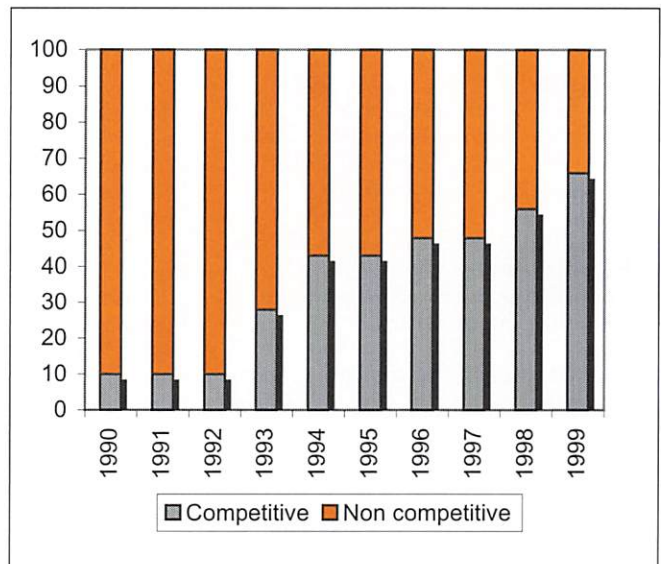


Figure 1. Competition in Latin American Cellular Markets (Source (2)).



populations. For this reason, competition between fixed network operators is the exception rather than the rule.

On the other hand, there are many mobile operators in competition with the goal of having the mobile market in their hands. This means that cellular phones may be the only phones for many subscribers.

The installation time of mobile services is much shorter than in the case of fixed network services, which require installation of very expensive and time consuming external plant. For this reason, the mobile network captures the users that live in the population with bad POTS coverage.

In fact, Paraguay and Venezuela have become the first countries in the region, and two of only a dozen in the world, where mobile phone users outnumber those who depend on a fixed line connection [2].

Over US\$ 10 billion has been raised in Latin America from new mobile cellular licenses since 1990. These payments come from the more than 60 new mobile cellular companies that have sprung up the region since 1990. By the end of 1999, two-thirds of Latin America had a competitive mobile market (see Figure 1) [2].

Other phenomena that make the Latin America scenarios more competitive were the implementation of new value added services like CPP (Calling Party Paid), prepaid and aggressive promotions such as two for one mobile phones and free minutes. For example, with the introduction of CPP in April 1998, mobile services in Chile enjoyed an incredible growth, with the number of cellular users increasing by 100% by the end of that year [7]. Another country that adopted this service was Peru in May 1999 and by the end of that year, the number of cellular subscribers increased over 150% compared to the previous year [2].

The behaviour of the market with the other service, prepaid, means that people who do not qualify for credit cards have the possibility of obtaining a mobile phone [8]. For this reason, 73% [8] and 60% [2] of mobile subscriber in Venezuela and Mexico respectively are prepaid users.

### Latin American Rapid Increases

Before the aggressive promotions and the privatisation, perspectives in telecommunications sector were not optimistic. For the low-income layers of the population it was difficult to get mobile phone and the subscription fee was very expensive. For example, in Chile the subscriber base grew from 36,000 in 1991 to 85,000 in 1993 [9] and in Colom-

bia, by the end of 1994, and there were 85,000 cellular telephone service subscribers representing only 0.23% of the total population of the country [10].

Actually, the Latin America market has been dimensioned to enormous proportions since the reforms and aggressive competition are playing an important role in the different countries.

Countries	Population 1999 (M)	1997 Mobile subscribers (k)	1998 Mobile subscribers (k)	1999 Mobile subscribers (k)
Argentina	36.58	1588.0	2530.0	4434.0
Bolivia	8.14	118.4	239.3	420.3
Brasil	167.99	4400.0	7760.6	15032.7
Chile	15.02	409.7	964.2	2260.7
Colombia	41.56	1264.8	1800.2	3133.7
Costa Rica	3.93	64.4	108.8	143.0
Cuba	11.16	3.0	4.1	5.1
Dominica Republic	8.36	133.5	255.9	255.9
Ecuador	12.41	126.5	242.8	383.2
El Salvador	6.15	40.2	106.1	382.6
Guatemala	11.09	64.5	111.4	351.2
Honduras	6.32	14.4	34.9	78.6
Mexico	97.37	1740.8	3349.5	7621.6
Nicaragua	4.94	7.9	31.0	69.0
Panama	2.81	17.0	80.0	242.0
Paraguay	5.36	84.2	231.5	435.6
Peru	25.23	435.7	743.0	990.0
Puerto Rico	3.89	367.0	580.0	580.0
Uruguay	3.31	99.3	154.5	316.1
Venezuela	23.71	1071.9	2015.0	3400.3
<b>Total</b>	<b>495.33</b>			<b>40535.6</b>

Table 1. Population and mobile subscribers for Latin American Countries (Source (2)).

In some nations the number of mobile phones per 100 inhabitants is as high as 15 (See Figure 2).

Now, mobile networks impose their domain over regions with limited resources and change them into attractive markets. Table 1 shows the increase of mobile subscribers over a 2-year timeframe, 1997 to 1999.

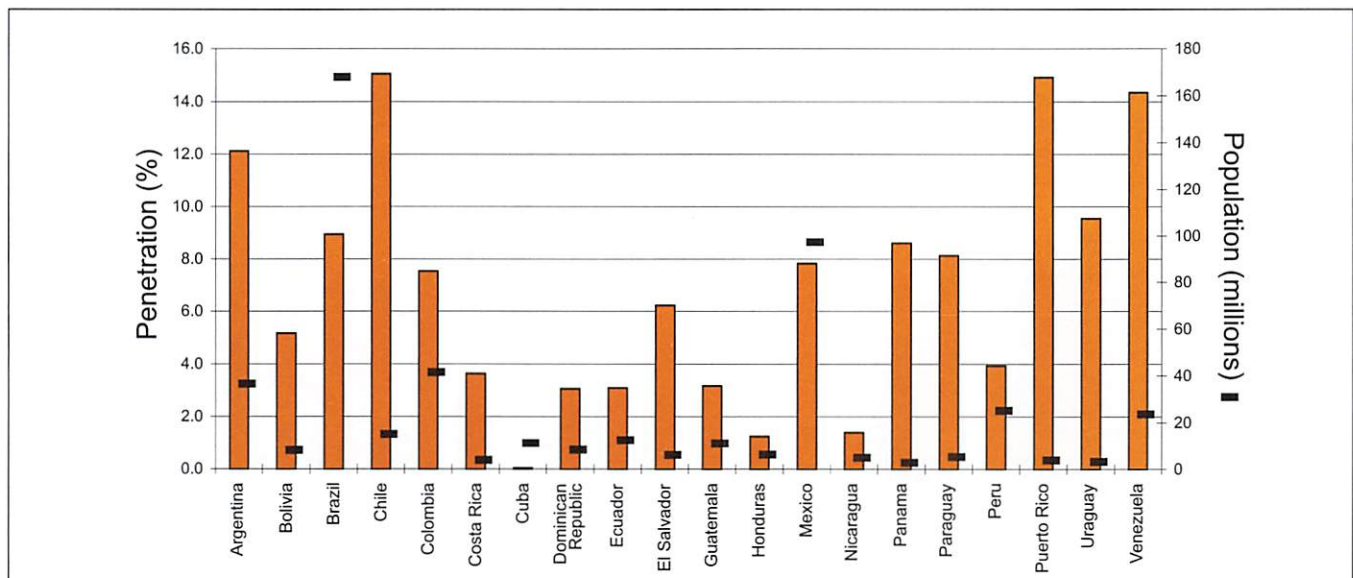


Figure 2. Number of Mobile Subscribers per 100 inhabitants (1999) (Source: (16)).



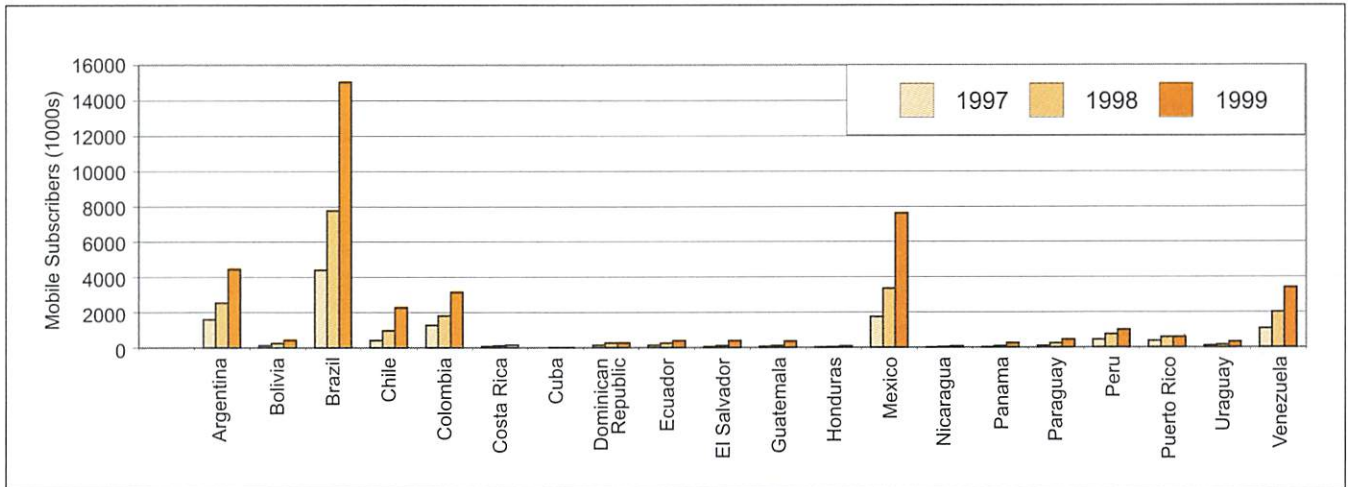


Figure 3. Mobile subscriber growth, 1997-9 (Source (2)).

For the last year considered in the Table 1 (1999) the Latin America region had a total of 40,535,600 mobile subscribers and taking account the population on these countries (495,330,000 inhabitants) we obtain a rate of 8 mobile users per 100 of inhabitants.

On the other hand, the growth rate over these years (1997, 1998 and 1999) is of significant value for evaluating the progress of the mobile market in Latin American countries. Figure 3 shows these values for each Latin America country.

### Latin America: a melting-pot

With the governmental reforms and the rise of regulatory agencies, parts of the radio spectrum were conceded to public mobile telephony operators.

In the case of Latin American countries, these regulatory agencies do not have any roaming agreement between their territories similar to the European agreement with the implementation of GSM. For this reason it is common to find mobile operators with different platforms like AMPS, DAMPS or TDMA, CDMA and GSM, even in the same country, living together in “harmony”.

In some nations there are one or more operators with different technologies. This is the case of Venezuela, which has 4 operators: a TDMA operator, a CDMA/AMPS operator and two GSM operators. Figure 4 shows the proportion of each platform in the Latin American mobile operators.

The concession type in the Latin America countries is regional concession. This policy decreases the costs associated with infrastructure and mobile solution implementation. Additionally, it permits a better provision of service to the

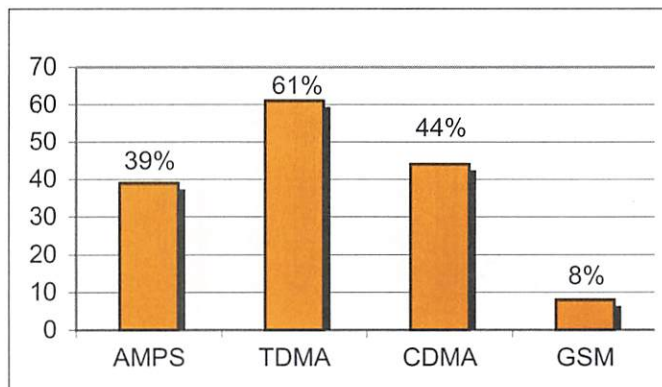


Figure 4. Breakdown of operators by technology (Source: (17), (18), (19), (21)).

entire assigned region. The result is that each country has many mobile operators within its territory. Figure 5 illustrates the number of mobile operators in each Latin America country.

### The Future

The future of the telecommunications is centred on the convergence between wireless and Internet. Countries with a high volume of Internet subscribers will justify the implementation of 3rd generation mobile systems.

In our case, Latin America has a number of hosts that are growing annually by more than 50%, and the growth of e-commerce has peaks of up to 1000% in some countries. The number of users annually rises by more than 30% and is estimated to reach between 20 and 65 million in 2003, according to varying studies. This figure shows that Latin America has higher growth rates than any other continent [11].

Table 2 shows the Internet access and the number of Commercial ISP users in some Latin American countries in July of last year (1999).

Internet users increased up to 12 million by November 1999 and will rise to 34 million in 2000 according to a study by marketing consultant Saatchi & Saatchi [22].

This figure – 12 million users in Latin America – justifies the implementation of any wireless platform that provides mobile Internet.

In fact, many Latin American countries are implementing solutions for wireless Internet using WAP (Wireless Application Protocol). For example, in Mexico (Iusacell) [12]

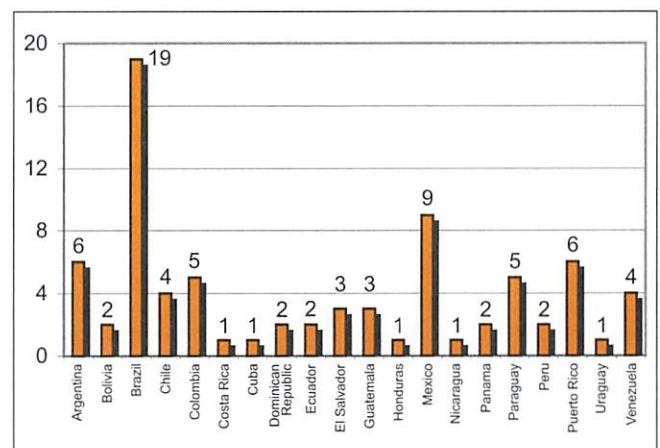


Figure 5. Number of Mobile Operators per Country (Source: (17), (18), (19), (21)).



Country	Date	Internet Users	% of population online
Argentina	April 1999	586,000	1.70
Bolivia	October 1997	8,000	0.11
Brazil	July 1999	2.7 million	1.70
Chile	April 1999	150,000	1.05
Costa Rica	April 1999	30,000	0.89
Colombia	April 1999	350,000	0.95
Cuba	May 1999	22,000	0.20
Dominican Republic	April 1999	25,000	0.32
Ecuador	October 1997	5,000	0.04
Mexico	April 1999	600,000	0.65
Nicaragua	April 1999	10,000	0.23
Paraguay	October 1997	1,000	0.02
Peru	April 1999	20,000	0.08
Uruguay	April 1999	90,000	2.83
Venezuela	April 1999	380,000	1.75
Latin America	July 1999	5 million	1.12

**Table 2.** Internet Access in Selected Latin American Countries (Source (20)).

and in Argentina (VeloCom) [13] installed WAP for the wireless Internet and e-mail for the first operator, and wireless Intranet through a Palm Pilot for the second one.

Other countries implement solutions over their platforms that provide services that simulate WAP sessions. In the Venezuelan case, Movilnet, has a feature in its voice mail platform that can translate text message in voice message and vice versa. With this feature, and the utilization of an Internet server, this company creates an e-mail service through its voice mail [14].

### Road to 3G

The evolution to third generation standard is an important event for all mobile platforms in the world.

"3G systems intend to be the solution to provide a low-cost, mass-market Wireless Information Society suitable for both developing and developed countries worldwide. For many people throughout the world living in areas where the fixed infrastructure services or current mobile services lack the necessary capacity or availability, 3G will provide their first experience of the emerging Information society with the socioeconomic benefits it will bring to all countries" said Dr José Leite Pereira-Filho in ITU TELECOM Americas 2000 [15].

This evolution considers a modular approach to upgrading each platform. Systems like CDMA, GSM and TDMA would implement 3G or 2.5G solutions in order to provide new services like video, high quality audio, multimedia and interactivity features.

In Latin American mobile operators are studying the possibility of implementing 2.5G solutions and the governmental regulatory agencies are considering 3G spectrum allocation.

For example, in Brazil at February 2000 was realized a seminar about 1900MHz spectrum allocation. Many providers were presents to deliver their comments and propose 3G solution for this band [15].

On the other hand, Digitel, a Venezuelan GSM operator with only a year of commercial operation, is actually considering the upgrade of its system using GPRS in order to have a 2.5G platform.

Now, the mobile market requirements are oriented to new wireless Internet services, and in the future the users will expect all these applications to compete with fixed networks.

The revolution is a fact and Latin America is prepared to receive it.

### References

- [1] B. Vianna, "New directions in Telecommunications". *IEEE Communications Magazine*. March 1998.
- [2] ITU. "Americas Telecommunication Indicators 2000". April 2000, <http://www.itu.org>
- [3] D. Yacoub, M. Waldman and H. Waldman. "Telecom R&D wake to Privatization in Brazil". *Global Telecommunications Newsletter*. February 1999.
- [4] E. Barbour, "Privatization and Strategic Alliances in Latin American telecommunications", 1997. <http://www.natlaw.com/pubs/spmxc5.htm>
- [5] M. Daoud Yacoub, H. Waldman. and M. Wohlers Almeida. "Privatization and Deregulation: Myths and Realities". *Global Telecommunications Newsletter*, November 1999.
- [6] H. Waldman, M. Daoud Yacoub and J. Romano. "Telecom Educational Challenges in an evolving technological scenario". *Global Telecommunications Newsletter*, June 1999.
- [7] M. Cowley, "Chile: competition intensifies in most competitive market" 1998. <http://www.ft.com>
- [8] V. Suarez, "How profitable will be investing in basic services in fixed networks?". January, 23 2000. *El Universal*. <http://www.eud.com> (in Spanish).
- [9] C. Heitmann, "Chile - Cellular Telecommunications. 1996." <http://svexport.org/lamission/ctele2.htm>
- [10] N. Potes, Mauricio. "The current status of Telecommunication in Colombia with a view to the future". *IEEE Communications Magazine*, May 1996.
- [11] E. Lenzen, "Information Technologies and Internet in Latin America" 1999 [http://www.interasia.org/vietnam/nahoi\\_lenzen.html](http://www.interasia.org/vietnam/nahoi_lenzen.html)
- [12] J. Rodriguez Payan, "Mexico's phones, updated Internet". June 2000. <http://es.internet.com> (in Spanish)
- [13] R. Masana, "Mobile Internet is getting stronger in Argentina". June 2000 <http://es.internet.com> (in Spanish)
- [14] <http://www.tun-tun.com>
- [15] ITU TELECOM Americas 2000. Summary of Dr. Leite's speech, <http://www.umts-forum.org/activities.htm>
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- [17] CDG (CDMA Development Group) Database <http://www.cdg.org>
- [18] GSM World Database, <http://www.gsmworld.com>
- [19] TDMA-EDGE Database, <http://www.tdma-edge.com>
- [20] INTERASIA Database Workshop Documentation [http://www.interasia.org/vietnam/nahoi\\_lenzen.html](http://www.interasia.org/vietnam/nahoi_lenzen.html)
- [21] AHCIET Database. <http://www.AHCIET.com> (in Spanish).
- [22] "Latin American net users expect to double". *Tecnology News*. November, 19 1999. *Tech Web*. <http://www.techweb.com>
- [23] "CDMA will make 3G wireless services a reality in Latin America: 1900 MHz spectrum allocation brings advanced service capabilities to region" February, 16 2000. <http://www.cdg.org>

*Heidi Rivas Hernández (heidi\_rivas@digitel.com.ve) is a Special Projects Engineer in the Digitel's Operation Department. An Electronic Engineer, she graduated in 1999 from Simón Bolívar University in Caracas -Venezuela.*



## VOICE-DRIVEN INFORMATION ACCESS IN THE AUTOMOBILE

Charles T. Hemphill, Rajeev Agarwal, Yeshwant K. Muthusamy, and Yifan Gong, Texas Instruments Incorporated

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*Until recently, the user experience in the automobile consisted of driving and listening to the radio. With recent advances in wireless communications and speech recognition, however, the possibilities for information access in the automobile have expanded tremendously. We describe our voice recognition technology and how it enables convenient voice interaction with information from the Web, E-mail, voice mail, and electronic map services. We also describe recent advances we have made in our technology to operate robustly in the harsh environment of the automobile. With these advances, we foresee driving in the future becoming much more safe, productive, convenient, and fun.*

### Introduction

We describe our work toward voice access to multiple information services within the automobile. In addition to the ability to dial phone numbers by speaking the digits, other examples of such services include name-based dialing, web browsing, accessing and sending E-mail by voice, and car navigation. Common to all of these services are the issues of accuracy, noise robustness, and utility/naturalness of the system.

Speech recognition has recently enjoyed some success in the PC market. Some of the factors of this success include improved microphone design, sufficient memory and CPU power, and improved algorithm design. Some of the algorithm improvements include increased vocabulary size, the ability to speak naturally without pauses between words (continuous recognition), and the tendency toward systems that work without training (speaker-independent recognition).

The noise environment of the automobile represents a central concern for recognition accuracy. Recent advances in microphone design that also apply to the car include close talking, active noise canceling microphones and highly directional array microphones. Such solutions provide the best speech signal for recognition, but might raise objections based on aesthetics or cost. In the section on voice dialing, we investigate noise robustness techniques that work well down to a 0 dB signal-to-noise ratio.

We assume that the automobile will include sufficient memory and CPU power at a reasonable cost for small to moderately large vocabulary applications. In some cases it

might be preferable to offload larger vocabulary tasks to a recognition server - we discuss this possibility in the context of some E-mail applications and car navigation.

To better support recognition tasks within the automobile, we have developed recognition systems that employ dynamic grammars and vocabulary. This means that the system can work in new contexts with new vocabularies and without training. This approach supports increased robustness and lessens resource requirements by limiting the context to exactly that needed at the time. The voice Web browsing application best illustrates this and we also use this approach for Email access and car navigation.

For most applications in the automobile, the system should work in "hands-busy, eyes-busy" conditions. This has implications for both the input and output interfaces. The input interface should be such that the user can talk to the system in a natural manner rather than having to remember cryptic commands. This often leads to the user making incorrect, incomplete, ambiguous, or inconsistent requests to the system. Consequently, R is important to have a dialog manager that interacts with the user to resolve these requests and ensures that the user obtains the desired information. For applications that require a displayless interface, the output of the system is in the form of spoken text generated by a text-to-speech system. The ultimate objective is to make the user's interaction with this system as similar to human interaction as possible. We explore these issues in both the E-mail access and car navigation systems.

### Voice Dialing

Voice dialing provides spoken name dialing, digit (phone number) recognition, and simple voice commands. The key issue involved in voice dialing is the robustness of the speech recognizer.

A speech recognizer used in an automobile must be robust to acoustic variations in the speech signal which do not carry linguistic information. Such acoustic variations, which may cause severe performance degradation, may be caused by:

- ◆ noises from the engine, AC, outside air flow, and tires, especially in highway conditions,
- ◆ speaker dialect and accent, and
- ◆ microphone frequency response, mounting positions (hand-held/hands-free), and the speakers position relative to the microphone.

The acoustic environment changes constantly as a function of driving conditions.



These performance improvements in extremely harsh conditions approach the error rate of 0.35% achieved in the original quiet office environment conditions.

**OUR TECHNOLOGY** – Except for name dialing, which is by nature speaker-dependent and thus trained to a specific user, a set of speaker-independent speech models must be initially provided. However, direct use of these models in the car without any adaptation will result in substantial loss of performance due to the above acoustic variations. We have developed two adaptation techniques to maintain recognition performance.

Our first adaptation technique deals with environment or background noise (adaptation to noise). With some noise data sampled in the car, the speech models are modified to accommodate noisy speech. This occurs automatically for each utterance allowing for dynamically changing background noise.

Our second adaptation technique deals with speaker and microphone variability (adaptation to speaker) [2]. Based on a few utterances recorded in the car with the browser control, engine off, the speech models are transformed to match the speaker and the interior acoustic environment of the car, including the microphone characteristics. We have the ability to adapt based on any number of utterances containing a variety of words. Although more utterances always result in lower word error rates, we find that as few as 5 to 10 utterances provide sufficient adaptation for continuous digit recognition.

**PERFORMANCE** – The two adaptation techniques can be combined to give improved accuracy in the car environment. To test the robustness of our recognizer, we tested these techniques on a connected digit recognition task containing one- to seven-digit utterances (TIDIGITS). We trained the speaker-independent speech models with the original training utterances collected in a quiet office environment. We then corrupted the test utterances with noise collected during typical highway driving. The noise level was scaled to produce a 0dB signal-to-noise ratio. For each test utterance, we automatically adapted the models for noise by using approximately the first 0.25 seconds of noise before detection of speech. To adapt to the speaker, we held out ten seven digit utterances chosen at random from the test set and tested on the remaining utterances. The following table represents the results where the recognition performance is measured by WER (percent word error rate).

Adaptation	WER
None	60
Noise	4
Noise and speaker	1

**Table 1.** Highway noise error reduction with automatic noise adaptation and 10 utterances for speaker adaptation (baseline of 0.35% WER on clean speech).

### Voice Web Browsing

The Web contains a wealth of information relevant to travelling. Some examples include information and schedules for dining, entertainment, and local activities. Because most pages on the Web assume a display, the driver might access the information before beginning a trip or passengers might access the information during a trip. In either case, voice makes information access more convenient given the inconvenience of a keyboard or mouse in the automobile.

We have developed an interface to the Web, called Speech-Aware Multimedia (SAM), that allows convenient

voice access to information [1]. SAM is a speaker independent, continuous speech, arbitrary vocabulary recognition system that has the following specific features for interacting with the Web:

- ◆ customizable speakable commands for simple browser control,
- ◆ speakable bookmarks to retrieve pages by random access using customized phrases,
- ◆ speakable links to select any hypertext link by simply speaking it,
- ◆ smart pages for natural spoken queries specific to pages, and
- ◆ speech-enabled Java to support voice interaction with Java Applets

To support these features, SAM has the ability to incorporate new grammars and vocabularies ‘on the fly’ The ability to handle a flexible vocabulary, coupled with the ability to dynamically modify grammars in the recognizer, gives SAM the feel of an unlimited vocabulary system.

**SPEAKABLE COMMANDS** – To control the browser, SAM provides spoken commands to display help pages, scroll up or down, go back or forward, display the speakable commands and bookmarks, add a page to the speakable bookmarks, and edit phrases for the speakable bookmarks. SAM has default phrases for these commands, but the user may change them, if desired, to more convenient ones.

**SPEAKABLE BOOKMARKS** – To reach frequently accessed pages, users may add pages to their speakable bookmarks. When adding a page currently displayed in the browser, SAM uses the title of the page to construct a grammar for subsequent access by voice. The initial grammar includes likely alternatives to allow, for example, either “NIST’s” or “N.I.S.T’s” in a page entitled “NIST’s Home Page”. The user may then add additional phrases to make access to the information more convenient or easier to remember. The speakable bookmarks remain active at all times giving users instant access to important information.

**SPEAKABLE LINKS** – Every time SAM encounters a page on the Web, it parses the HyperText Markup Language (HTML) to determine the links and the Uniform Resource Locators (URLs) associated with them. SAM then transforms the string of words into a grammar that allows likely alternatives as mentioned above. It checks several phonetic dictionaries for pronunciations and uses a text-to-phone mapping if these fail. We currently use a proper name dictionary, an abbreviation/acronym dictionary, and a 250,000 entry general English dictionary. The text-to-phone mapping proves necessary in many cases, including, for example, pages that include invented words (for example, “Yahooligans” on the yahoo page).

**SMART PAGES** – On some occasions, the point-and-click paradigm associated with links fails short. For a more flexible voice-input paradigm, we developed a mechanism called smart pages. Smart pages are simply Web pages that contain a link to a grammar appropriate for a page or set of pages. Using standard Web conventions, Web page authors may specify what users can say and interpret the recognized words appropriately for the context.

**SPEECH-ENABLED JAVA** – We have extended SAM’s smart page idea to the world of Java. Java, developed at Sun Microsystems, is a machine-independent, object oriented language that lends itself naturally to applications on the Web. We have developed an Application Program Interface (API) that allows Java authors to speech-enable their Java applets by specifying grammars and actions appropriate for various contexts. Speech-enabling an applet requires a small fraction of additional code. We are currently working with Sun Microsystems and others to develop a standard speech API for Java.

Java applets support a richer environment for creating Web-based voice applications. They can support the fill-in-the-blank type interface of smart pages, but they can additionally support local dialog with the user including play out of recorded or synthesized speech. The following example illustrates this:

User Query	System Action
"Flight Information" (Speakable bookmark)	"Please select an airline" (after loading a Java applet)
"American Airlines"	"Select a flight number" (loads number grammar)
"Five seventy-seven"	"Flight 577 departs terminal 3E, gate 3B at 7.33 AM"

**Table 2.** Interaction with a downloaded Java Applet for information on the road.

In this example, the driver can ask three simple queries to get important traveling information. Additionally, since gate information can change at the last minute, accessing it while driving can save a missed flight when on a tight schedule.

### E-Mail/Voice Mail Access

Over the past several years, the cellular telephone has become an important mobile communication tool. The use of voice mail has also increased over the same time period. It has become a common sight to see motorists using cellular telephones while driving - either talking directly to people or leaving voice mail for later conversations.

The last few years have also seen a dramatic increase in the number of people getting "online" by getting E-mail accounts and becoming Internet-aware. Communication by electronic mail, once limited to government research organizations, universities and high-tech companies, has now become commonplace. The convenience, speed and ease-of-use offered by E-mail has made it a viable, often preferred, alternative to other more traditional forms of communication, such as paper mail and telephones. Unfortunately, in the fast-paced world of today, it is not always possible for people to check their E-mail, respond to urgent messages, send out meeting notices etc., from the comfort of their homes or offices. Thus, there is a growing demand for access to E-mail while on the move.

How does one go about doing it? Have a laptop in the front-passenger seat running your favorite E-mail program? A clunky solution at best, not to mention the tremendous safety hazards of using traditional interfaces while driving! There is also the hassle of dealing with too many communication devices. Wouldn't it be convenient if the mobile user could access both E-mail and voicemail using a single device? One system that took care of receiving, sending and saving E-mail and voice-mail, obviating the need for two separate systems to handle these tasks? Texas Instruments is developing a Voice Email (VE) system that attempts to solve just these problems. We describe our system in greater detail below.

**SYSTEM OVERVIEW** - The VE system has a client-server architecture and is completely voice-driven. We use a speaker-independent speech recognition system for input and a text-to-speech system (speech synthesizer) to play back the messages and prompts. The system has a minimal display (for status messages) and is designed to operate primarily in a 'displayless' mode, where the user can effectively interact with the system without looking at a display. It currently extends previous collaboration with MIT [3] to handle reading, filtering, categorization and nav-

igation of E-mail messages. It will soon incorporate voice-mail send and receive (using Caller ID information) and later the capability to compose and send E-mail.

A key requirement of displayless user interfaces is the provision of constant feedback to the user about what the system is doing. Further, the user should, at all times, know exactly what to do, or should be able to find out easily (via a help feature). For people who prefer a display for non-driving conditions, an optional display can be incorporated into the VE system.

**CLIENT-SERVER ARCHITECTURE** - The server handles all of the E/voice-mail functions. It accesses the E-mail and voice-mail servers and handles the receiving, sending and storage of the E/voice-mail messages. It communicates with the client via sockets. The server also handles parts of the text-to-speech system and the speech recognition for sending messages. The server is implemented as a Java application.

The client provides the user interface and handles the reading, navigation, categorization, and filtering of E-mail and voice-mail messages. It has both speech recognition and text-to-speech capabilities and does not maintain constant connection to the server (to reduce connection time charges). It connects to the server only to initiate or end a session, check for new mail or to send a message. It also has an extensive help feature that provides guidance to beginners of the system and on request. The client is implemented as a Java applet. This has the advantage that it can be downloaded onto a user's in-car device on demand, if memory space is an issue.

### SPEECH RECOGNITION AND TEXT-TO-SPEECH

- The speech recognition is grammar driven; that is, it is not a free-form dictation system. The user can speak specified command phrases in a natural, continuous speaking style. Several alternates to each phrase are allowed (for example, "any messages from John Smith?" and "is there a message from John Smith?"). Further, the recognition is speaker-independent, which means a new user can start using the system without any training of the recognizer. The text-to-speech system operates in Email mode; that is, it can correctly speak out idiosyncrasies in E-mail such as addresses and dates.

### Car Navigation by Voice

Car navigation systems have been available for some time, but they have received only limited use. We can partly attribute this to the user interface used for such systems: often unnatural, sometimes clumsy, and potentially unsafe. Some systems use a touch screen while others use a rotating knob to enter destination addresses one alphanumeric character at a time. We are developing an application to obtain directions to different places in a city as naturally as possible - by voice I/O only. It could be incorporated either into a built-in computer in a car or into a cellular phone. This navigation system is primarily aimed at *hands-busy, eyes-busy* conditions such as automobile driving. An optional display is provided for conditions where the user may safely look at the screen, for example when the car is parked. The user can either get directions from the current location to a destination or just get the map of a particular location. The directions are spoken back to the user via a text-to-speech system. A dialog manager is used to handle all the interactions with the user.

Like the other applications mentioned above, the car navigation application has also been designed and implemented as a client-server architecture. The built-in car computer or cellular phone acts as a client. The user interacts with the client which in turn communicates with a remote server to process user utterances. A Global Positioning Sys-



tem (GPS) installed on the client side tracks the location of the user at any point in time. A web-based map service on the server side provides maps and directions. We currently use the MapQuest™ web site ([www.mapquest.com](http://www.mapquest.com)) for this purpose. Our speaker-independent speech recognizer recognizes the user's utterances and passes the result to the dialog manager which then interprets these utterances in context and determines the state of the dialog. If the dialog manager believes it has the proper information to satisfy the user's need, it sends a query to the map server that returns a map of the requested location. Otherwise, it interacts with the user to acquire the proper information. For example, if the user says "Where is the Doubletree Hotel?" and the system has knowledge of multiple hotels by the same name, it will first interact with the user to resolve this ambiguity before querying the map server.

This application covers different scenarios in which a user may need directions to some place. In some cases, the user may know the exact address or cross streets of the destination and might query the system for directions to these locations (for example, "How do I get to 8330 LBJ Freeway in Dallas?"). In addition, the system has knowledge of a list of common *points of interest* for the current city. These may include hotels, hospitals, airports, malls, universities, sports arenas, etc., and the user can get directions to any of these by referring to them by name (for example, "I need to go to the Dallas Museum of Art"). Finally, there are often instances where neither the user nor the system may know the exact destination. For example, the user may just say "Find me a Pizza Hut around here". In such situations, the system needs to access a yellow pages server to find a list of Pizza Huts, interact with the user to identify the one of interest, and then query the map server for maps and/or directions. Note that the yellow pages server has not yet been integrated into this application.

The navigation application has been designed such that the user is free to query the system using natural speech.

The speech interface provides a natural way for users to specify the destination, while the presence of a dialog manager ensures that users can have their queries satisfied even in the presence of missing, ambiguous, inconsistent, or erroneous information. The dialog manager also assists in constraining the grammars for the speech recognizer and in providing context-sensitive help. This dialog manager has been described in greater detail previously [4]. We have developed a laboratory demonstration of this system that handles street address (or intersection) and points of interest queries.

## Conclusion

We have presented four major speech recognition applications applicable to the automobile environment ranging from continuous digit recognition to car navigation. With our adaptation techniques, we can demonstrate acceptable accuracy results for recognition in this environment. We anticipate that this high recognition accuracy coupled with meaningful applications in the automobile will transform the way we think about the driving experience.

## References

- [1] C. Hemphill and P. Thrift, "Surfing the Web by Voice", *Proceedings of ACM Multimedia*, San Francisco, CA, November 7-9, 1995, pp. 215-222.
- [2] Y. Gong, "Source Normalization Training for HMM Applied to Noisy Telephone Speech Recognition", *Proceedings of Eurospeech*, Rhodes, Greece, September 1997, pp. 1555-1558.
- [3] M. Marx, "Toward Effective Conversational Messaging", MIT Media Lab Master's thesis, May 1995.
- [4] R. Agarwal, "Towards a PURE spoken dialogue system for information access", *Proceedings of the ACLIEACL Workshop on Interactive Spoken Dialog Systems*, Madrid, Spain, July 11-12, 1997, pp. 90-97.



## THE MILLENNIUM DOME GOES DIGITAL

Jane Wenham, Simoco Europe Ltd

*When the organisers of the Millennium Dome in Greenwich, London had to find a communications system for its 5,000 Dome staff, they decided to go digital by deploying a TETRA system supplied by Simoco. Their Jane Wenham gives an overview of the system.*

### History Behind The World's Biggest Dome

When the then Chairman of the Millennium Commission and Secretary of State for National Heritage, the Rt. Hon Peter Brooke CH MP first proposed in June 1994 the creation of a national Millennium Exhibition, no one doubted the sheer size and scale of the project, and the challenges this would present.

Over the next three years, an intensive sponsorship drive was conducted to garner support for the Dome project. By January 1997, the Government had agreed that the project would be taken forward by the New Millennium Experience Company (NMEC).

Thus the Millennium Dome was well on its way to becoming one of the world's most significant and famous Millennium projects.

### The Communications Challenge

Covering a ground area of 23 acres, the Millennium Dome is the largest building of its kind in the world. The Dome's attractions are divided into 14 different zones all designed

to represent a year-long celebration of British ideas and technology.

Over 16,000 visitors were recorded on New Years Eve alone, with a further 7 million visitors expected to visit the Dome during 2000.

To support all the activities and services available at the Dome, NMEC employ up to 5,000 staff ranging from hosts to cleaners, security guards to catering staff and tour guides to ticket masters. Of these, over 600 staff are actively working on the show floor at any given time during operating hours.

Of course the safety and security of visitors is of paramount importance to the staff and, with thousands of visitors each day, any number of crises and problems can arise. Staff need to be able to respond quickly to problems and emergencies, and it became obvious that a communications system was required that could support all the needs of fire and security services, alongside other operational and support staff, in order for the Dome to be able to function effectively and efficiently.

### Going Digital

The basic requirements of the communications system were simple but critical.

For clear and effective management, the user community needed to be divided up in to some 50 different operational groups, each with their own communications net. In addition, however, they needed the operational flexibility of being able to switch easily from group to group, when the need arises.

The system had to be able to cope with the traffic generated by anything up to 800 users, especially during an emergency.

Coverage was required throughout the whole of the site including the extremities of the 145 acre site and right through to the inside of all of the exhibit areas.

With responsibility for the safety of the public and the staff, the system had to be available 24 hours a day and for the life of the millennium project which was planned to be some 18 months.

TETRA voice quality is already proven, but the high ambient noise levels created by the crowds, the music and the exhibits meant that voice quality needed to be maintained under all circumstances.

Many of the eventual users of the handheld radios would have little experience of using this type of mobile communications network so the radios, and the system, needed to be clear and simple to use.

Due to the high profile of the New Millennium Experience a system was needed that could not be easily monitored by those with malicious intent, thereby maintaining the integrity of the system for the fire and security crews.

### The Solution

An open tender was offered in late 1998, during which NMEC looked at a variety of analogue as well as digital technologies, and from a number of manufacturers. By the end of the review, NMEC realised that an analogue system would not be capable of meeting these diverse and unique requirements.

Lack of sufficient radio spectrum was another important consideration making analogue technology difficult to implement and it was evident that cellular phones would be costly and would not provide the group working that was fundamental to the management of the facility.

Of the three available digital technologies considered (GSM, DECT, and TETRA), only TETRA could competently fulfil every requirement demanded by NMEC, including a strict budget. Whilst all digital technologies are effective, all

except TETRA had limitations that prevented them from meeting the Dome's stringent needs.

In the face of stiff competition, Simoco was awarded the project and enlisted to build and manage a digital TETRA network at the Millennium Dome. With less than three months to go, the challenge for Simoco was to get the TETRA network built and ensure that staff would be fully equipped and trained to use the system by the 31st of December 1999.

### Most densely utilised TETRA System to Date

In order to provide the comprehensive coverage and traffic capacity required by the NMEC, Simoco and their partner Frequentis provided a TETRA system consisting of one switch and four radio sites set up around the Dome. 800 of the Dome's ground staff were supplied with Simoco SRP01 TETRA handsets fitted with separate headsets.

By November, Simoco had begun installation and had completed the set up by the end of the month. Working within a tight schedule Simoco was able to have the Dome TETRA system up and running ahead of deadline and the system officially went live on New Year's Eve.

In order to ensure that staff were able to use the system effectively from its introduction, Simoco developed a training programme specifically for the dome staff. The first activity was to understand the operational processes and procedures to be implemented within the dome. This, in itself was an interesting exercise as many of the procedures were still being developed.

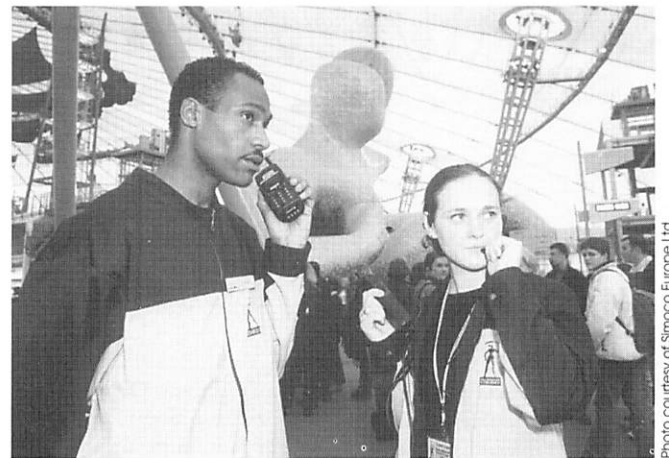
Simoco training staff then concentrated on the senior and middle management layers, ensuring that they had the knowledge needed to configure the system correctly and to carry the training on to the remainder of the staff.

For a two week period Simoco set up a user help desk to provide on site help to anyone who needed further assistance and also spent additional time with staff to ensure that everyone knew how to operate the system prior to opening the site to visitors.

A number of pieces of mobile equipment were provided, in addition to the SRP01 handsets, and the common user interface of all the Simoco TETRA equipment supplied meant that Dome management and staff were able to operate both types of equipment without additional training.

### Key Benefits

Good radio coverage was vital to the users and the four sites provided ensured that no user would find himself out of



Simoco SRP01 TETRA handsets in use in the Dome. The terminal on the right has an optional headset. The centerpiece of the Body Zone can be seen in the background.



touch with his colleagues. The high output power of the hand held equipment ensured that they had solid communications in both directions.

TETRA's fully digital medium coupled to the timeslot and channel trunking ensured that eaves-dropping would be difficult for even the more determined listener.

With the expectation of high visitor levels and many visiting dignitaries during the critical months following the opening of the Millennium Dome, Simoco voluntarily offered round-the-clock technical support to NMEC. Simoco personnel were constantly on hand to aid staff in understanding the capabilities of the system and ensuring that they made the best use of it.

Despite some initial nervousness due to the lack of familiarity of many in using radio communications, the ground staff soon became enthusiastic professionals of the digital airwaves, conversing and conducting their business with ease.

The system was configured to provide specialist user groups with their own private communications net, enabling each functional group to concentrate on their area of responsibility without the distraction of listening to other groups. The Dome management, however, are able to communicate with all of the groups as and when the need arises.

The use of headsets and integral microphones ensures that all communications can be properly heard, and with the additional benefit of providing hands free operation. This was particularly valuable to the more mobile users who ride round the site on scooters.

## Conclusion

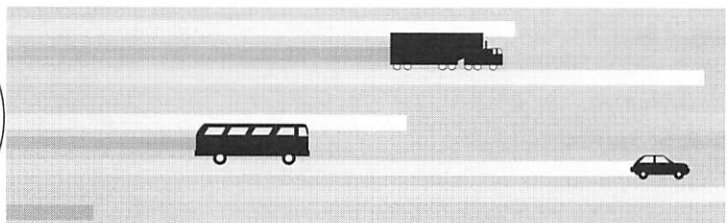
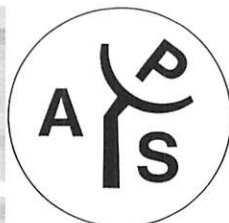
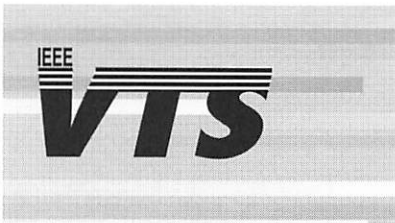
Since before the grand opening of the dome on New Year's Eve, the NMEC and its 5,000 staff have relied on Simoco's TETRA system to provide the communications necessary to ensure the smooth operation of the world's largest Dome.

The TETRA system deployed at the Millennium Dome today remains the most densely populated TETRA system in use in the world, with an average of 600 users operating together in a very confined area. This will give confidence to any organisation that plans to operate a large number of TETRA hand-helds in close proximity to each other.

With visitor levels increasing, and the holiday season underway, the Dome staff can continue to have confidence in one of their most vital tools and Simoco has committed to continue its technical support to all the Dome staff.

The levels of voice traffic remain high, giving Simoco some excellent experience of real system performance under high traffic conditions. In fact, this installation offers any organisation, that may be contemplating TETRA as a communications solution, an ideal place to visit. Not only can they witness a fully operational system, but they can also enjoy the unique experience of visiting a fascinating example of 21st century creativity.

*Jane Wenham (jane.wenham@europe.simoco.com) can be contacted at Simoco Europe Ltd., PO Box 24, St Andrews Road, Cambridge CB4 1DP England.*



## JOIN THE ANTENNAS AND PROPAGATION SOCIETY

Many VTS members work on mobile radio, but relatively few are members of the IEEE Antennas and Propagation Society. To give you an idea of the activities of the society, we are printing some information about it and a sample article from their magazine. They will be reciprocating by printing information about the VTS in their magazine.

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## Antennae

Giuseppe Pelosi\*, Stefano Selleri\*, and Barbara Valotti\*\*

\* Department of Electronic Engineering, University of Florence  
Via C. Lombroso 6/17, I-50134 Florence, Italy  
Tel: +39-055-4706-759, Fax: +39-055-4796767  
E-mail: [pelosi@ingfi9.die.unifi.it](mailto:pelosi@ingfi9.die.unifi.it), [selleri@ingfi9.die.unifi.it](mailto:selleri@ingfi9.die.unifi.it)

\*\* G. Marconi Foundation, Via Celestini 1  
I-40044 Pontecchio Marconi (Bologna), Italy  
Tel: +39-051-846121, E-mail: [babs@promet8.deis.unibo.it](mailto:babs@promet8.deis.unibo.it)

The main purpose of this short communication is to report the introduction of the word antenna in the scientific and technical terminology, going back in time from ancient times up to Marconi's first communications.

Before the rise of radio communications the word did exist, as may be verified by looking up in old English dictionaries, dating back to before the invention of wireless telegraphy. One of them reports [1]

**Antenna:...**a) ancient use - "a sail-yard;" from the Greek - to stretch out or forth. modern use - L. trans. of Aristotle - "horns" of insects sensory organ, occurring in pairs on heads of insects and crustacea; popularly called horns or feelers b) figuratively "feelers" - poetry c) botany...

Other dictionaries add some interesting notes, such as "...plu. - projecting horns of iron or bronze found on some ancient helmets..." [2], or they do not report the word at all [3].

Actually, the word *antenna* is derived from the classical Latin word *antenna*, which subsequently became, in late Latin, *antenna*, through the assimilation of the *mn* group<sup>1</sup>. This is a term of uncertain etymology, which, according to one hypothesis, originated from the Greek verb ἀνατιθημι = *put on*. According to other hypotheses, it derives from the Greek verb τέμνω = *cut* or τείνω = *stretch*.

In the Latin language, this term indicated the pole of the triangular (or Latin) sail, as well as that of the quadrangular sail. Most likely, the word belongs to the language of the art of navigation used in the Mediterranean Sea. The Latins, having no nautical tradition, borrowed it from the Greeks, skilled seamen, via the Etruscans<sup>2</sup>. Later, the word *antenna* was used to indicate [4]

*the long wooden pole (in one or two pieces joined together) transversal to the mast which receives the upper end of the Latin sail; a high and thin pole; a long pole made of wood, metal or other materials that, if placed vertically or transversally, has different uses (as a flag-*

*pole or for banners, instruments, weights, etc.); each of the mobile appendices of various form or size existing in the front part of the head of different species of insects with a tactile and olfactory function; etc.*

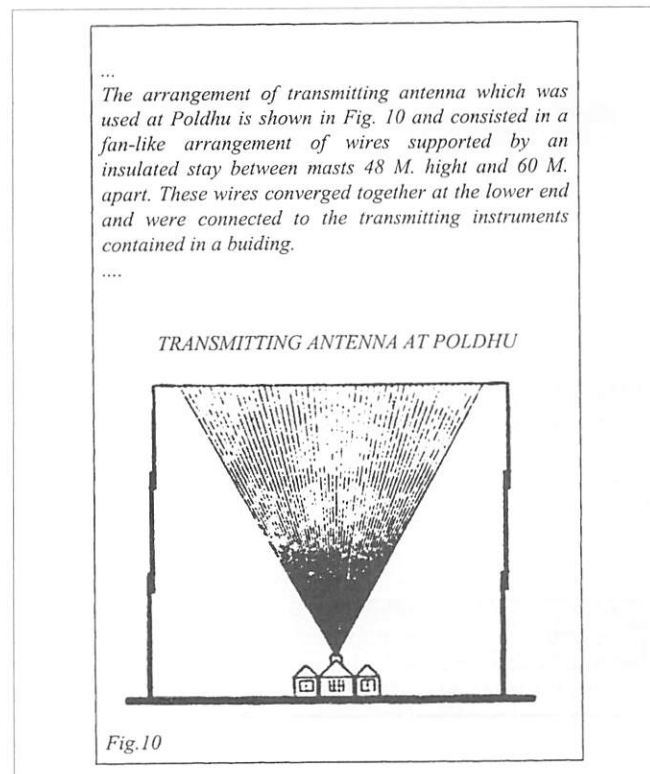


Figure 1. A reproduction of a portion of what appeared on page 435 of (5).

<sup>1</sup>The classical Latin language is traditionally that used by authors such as Cicero and Caesar. The late Latin language came into use from the third century AD on.

<sup>2</sup>The population controlling, in those times, the geographical area that now comprises Tuscany, Umbria, and Northern Latium. The Etruscans had trade contacts with the Greeks of Magna Graecia, and also exerted a great influence on the development of Rome around the sixth century BC.

<sup>3</sup>The term *aerial* is derived from the Latin *aereum*, which comes from *aer* (air), with a meaning of "is in the air" or "occurs in the air."

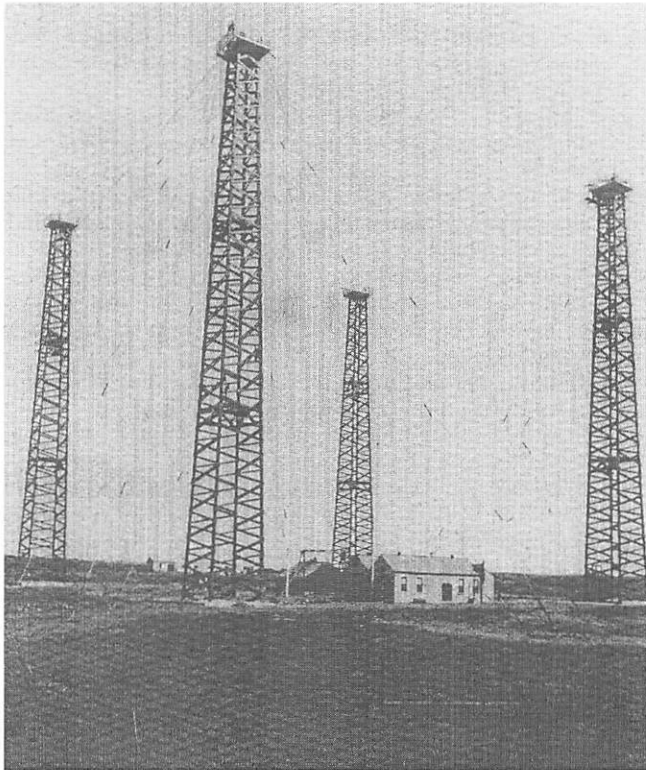


Figure 2. A photo of the Poldhu (England) antenna.

Actually the word antenna was not known in the first years of the history of radio communications. Instead, the terms aerial or *elevated wire system* were used. In particular, the word aerial<sup>3</sup> is still sometimes used in the context of the scientific and technical terminology as a synonym for antenna, albeit rarely.

The term *antenna* seems to have been used for the first time, in the present meaning of a receiving/transmitting system, by Guglielmo Marconi (Bologna 1874, Rome 1937), in a lecture held on May 1, 1909, at the *Koninklijk Instituut van Ingenieurs*. This lecture had been requested by the Dutch Royal Institute of Engineers, and was published later on in reference [5]. That paper described the history of wireless telegraphy. In particular, on page 435,



Figure 3. Guglielmo Marconi.

Marconi wrote about the Poldhu antenna (see Figure 1 for a reproduction of a portion of what appeared on page 435; see Figure 2 for a photograph of the antenna):

*The arrangement of transmitting antenna which was used at Poldhu is shown in Fig. 10 and consisted in a fan-like arrangement of wires supported by an insulated stay between masts 48 M. height and 60 M. apart. These wires converged together at the*

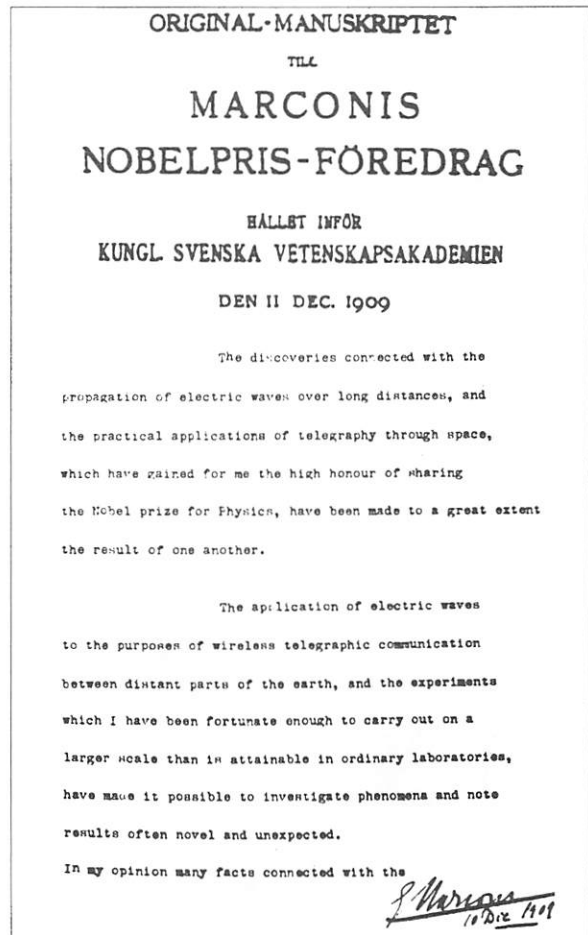


Figure 4. The cover and first page (with Marconi's signature) of Marconi's lecture on the occasion of the awarding of the Nobel Prize.

*lower end and were connected to the transmitting instruments contained in a building.*

It is important to note that Marconi did use the isolated word antenna in reference [5], but associated it with the present participle transmitting. Indeed, as observed before, at that time the term antenna in the Italian language was essentially a synonym for a high and thin pole (in practice, a meaning similar to that of the Latin word); the term had been used with this meaning on several occasions by Marconi [6]. This aspect is confirmed by the fact that, for radiating systems with horizontal structures parallel to the ground, Marconi used the term *aerial*.

Some months later, on December 11, 1909, Marconi gave a lecture at the Royal Academy of Science (Stockholm, Sweden) when he was awarded the Nobel Prize for Physics<sup>5</sup>. In the original manuscript for this lecture [7, 8], which is largely based on that of reference [5], the term antenna is used many times, always in the plural, and written in a different way: *antennas* (an English-like plural), *antennae* (the correct plural in Latin), and *antennaes* (probably a typographical error). It is clear that in the use of the word *antenna*, Marconi had the Latin term in mind.

In contrast to other scientific terms [9], the introduction of the word *antenna* into the technical literature as a synonym for a transmitting/receiving system went through

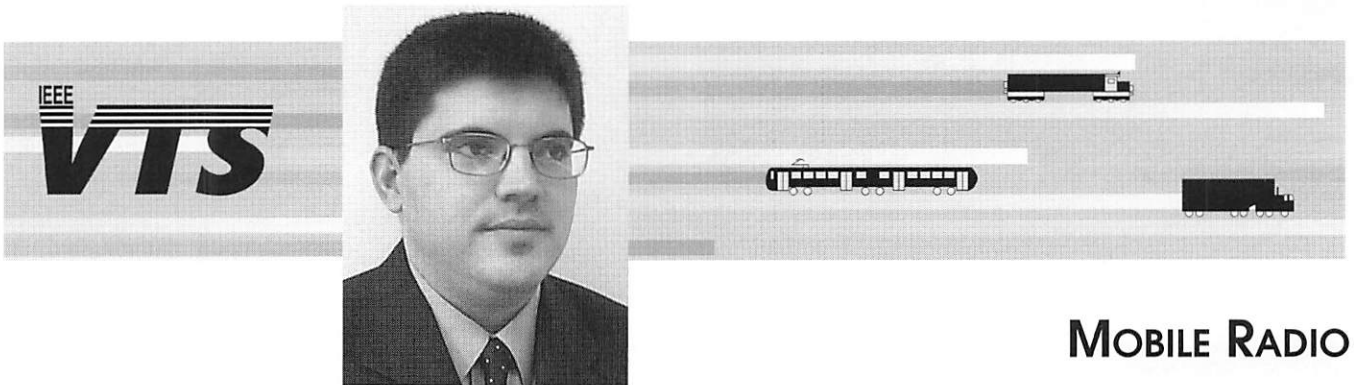
<sup>5</sup>The prize was awarded jointly to G. Marconi and K. F. Braum (1850-1918) "in recognition of their contributions to the development of wireless telegraphy."



many changes, since this word was used with other meanings before Marconi's scientific works.

## References

- [1] J. A. H. Murray (ed.), *A New English Dictionary on Historical Principles*, Oxford, 1888.
- [2] T. Sheridan, *A General Dictionary of the English Language*, J. Dodsley, C. Dilly, and J. Wilkie Pub., London, 1780.
- [3] *The Century Dictionary: An Encyclopedic Lexicon of the English Language Prepared Under the Superintendence of William Dwight Whitney*, Century Co., New York, 1889-1891.
- [4] M. Pfister (ed.), *LEI. Lessico Etimologico Italiano [Italian Etymological Lexicon]*, 2, Wiesbaden (Germany), Verlag, 1987, pp. 1570-1581.
- [5] G. Marconi, "The Most Recent Developments of Wireless Telegraphy," *De Ingenieur*, 22, May 1909, pp. 431-439.
- [6] G. Marconi, "Sulla Telegrafia Senza Fili [On Wireless Telegraphy]," in *Scritti*, Rome, Italy, 1941, pp. 101-131 (conference held on May, 7, 1903, in Rome).
- [7] G. Marconi, "Manuscript of the Lecture for the Nobel Prize," G. Marconi Foundation, personal communication.
- [8] G. Marconi, "For the Nobel Prize," in G. Bucciantie (ed.), *Marconi, Dedalo*, Rome (Italy), 1963, pp. 327-360.
- [9] G. Pelosi, "The Birth of the Term Microwaves," *Proceedings of IEEE*, 84, 2, February 1996, p. 326.



## MOBILE RADIO

*Javier Gozalvez, Senior Editor*

### 3rd Generation Mobile Radio

**Standards Activities :** 3GPP2 announced the completion of the cdma2000 release A specification. The cdma2000 has been submitted as part of the IMT2000 initiative. 3GPP2 also developed "cross-mode" specifications based on the recommendation of the Operators' Harmonisation Group (OHG). These specifications enable operation of cdma2000 on an evolved GSM-MAP network and WCDMA on an evolved American National Standards Institute (ANSI)-41 network and will be included in IMT2000. New work items for 3GPP2 include the definition of an all Internet Protocol network for wireless. The 3GPP2 organisational partners are ARIB, TTC (both Japan), CWTS (China), TTA (Korea), and Telecommunications Industry Association (TIA) (USA).

TIA also announced the publication of the ANSI/TIA/EIA-136 series, Rev.B, "TDMA third generation wireless" standard also known as "Universal Wireless Communications (UWC)-136". UWC-136 was approved by TIA engineering subcommittee TR-45.3. UWC-136 has also been submitted as part of the IMT-2000 initiative.

ITU gave final approval to the IMT-2000 radio interface specifications. The agreement came on the last day of the ITU radio communication assembly meeting in Istanbul from 1 to 5 May. According to Yoshio Utsumi, secretary general of the ITU the "decision is the result of over 10 years of considerable intellectual and engineering efforts by an entire industry determined to leapfrog the fragmentation which prevailed until now in the wireless world". Mr Blust,

director of technology strategy and standards at BellSouth cellular corporation (US) and Chairman of the ITU group of experts for IMT-2000 said that "it has revolutionised the methods of global standards development of wireless systems which can serve as a model for many standards endeavours beyond just IMT-2000".

The 3GPP's Mobile Competence Centre (MCC) has launched two new activities, known as tasks 160 and 161, related to the development of test specifications for the 3G mobile system. The scope of the MCC task160 is to develop conformance Abstract Test Suites (ATSs) for User Equipment (UE) based on technical specifications TS 34.123-1 for release 99. The scope of the MCC task 161 is principally to develop the UE test description for the packet-switched services in TS 34.123-1 for release 99.

The Alliance for Telecommunications Industry Solutions (ATIS, Washington) has made the confidentiality algorithm f8 and integrity algorithm f9 from the security architecture of the 3GPP system available to companies around the globe. Both algorithms are based on the KASUMI algorithm.

**3G licenses: auction or "beauty contest"?** After more than seven weeks and 150 bidding rounds, the UK auction for 3G licenses finally ended raising £22.47bn (\$35.61bn), seven times the amount expected. TIW, a Canadian company, won the largest license open only to new entrants. Vodafone AirTouch won the next largest license, while BT, One2One and Orange won the remaining three licenses.

The UK auction has opened a big debate on whether licenses should be auctioned or awarded by means of a beauty contest as was done by the Spanish and Finnish governments. The high prices paid for the licenses have also been largely criticised, especially by operators where it was yet to be decided the mechanism to award the licenses. Prof. Negroponte, director of the Media Lab at the MIT, qualified what happened in the UK as "disastrous" and as an "economically unsustainable" tax on Internet technology. European Commission officials also showed their concerns for the high prices as they could undermine Europe's competitive advantage in mobile phone services.

After intensive debates, France decided to award the four UMTS licenses through a "beauty contest". The contest will raise \$18.8 billion to the French government. The licenses will be attributed in the first half of 2001 for over 15 years. France Telecom, SFR (Vivendi), Bouygues Telecom, Suez Lyonnaise (teamed with Telefonica), Deutsche Telekom and TIW UMTS have expressed their interest in the licenses.

Germany finally approved a list of 11 bidders for up to six 3G licenses. The companies are: Debitel (Swisscom), Deutsche Telekom, Mannesmann, Mobilcom (with France Telecom), E-Plus, Group 3G (Telefonica and Sonera), Viag Interkom, Worldcom, Auditorium Investments (Hutchison), Talkline and Vivendi, the last two of which lately withdraw from the auction.

Ten applicants submitted bids to take part in November's 3G license auction (four licenses) in Switzerland. The bidders are: Cablecom Management, dSpeed, Hutchison 3G Europe, Orange, Sunrise, Swisscom, Team 3G (Telefonica, Sonera and One.Tel), Teldotcom, Telenor and T-Mobil.

The Netherland's 3G licenses auction, starting in July, has registered interest from ten potential bidders for the five UMTS licenses. Austrian telecoms regulator expects to award between four and six UMTS licenses in an auction to be held later this year. Twelve frequency packages of 2x5MHz will be offered. Belgium has also finally decided to grant its 3G licenses through an auction. Italy proposed a two-stage bidding process for awarding five UMTS licenses in June, combining a "beauty contest" and an auction. Sweden will award its four licenses through "beauty contest" as they said "consumers must come first" charging only \$11020 to each applicant. Portugal has also announced that the four UMTS licenses will be awarded via the "beauty contest". Countries like Ireland and Poland have not yet announced how they are to award the licenses.

Hong Kong's telecoms regulator is proposing alternative criteria for awarding 3G licenses after being criticised for not adopting the auction mechanism. They are proposing "also an auction but [judged] by criteria". Such criteria could be investment in the network and lower prices. New Zealand and Australia would auction the 3G licenses. South Korea announced the government may seek bids for the licenses; the selection procedure will be presented end of June. Countries like Thailand, Taiwan, Philippines and Indonesia are also considering the possibility of auctioning the 3G licenses. Japan plans to award three 3G licenses this summer to the best qualified bidders.

## Private Mobile Radio

**TETRA standard nears completion** : ETSI (European Telecommunications Standard Institute) announced that the drafting of TETRA (Terrestrial Trunked Radio) standard release 1 will be virtually completed by the end of 2000. ETSI project TETRA has already produced 131 deliverables and there will be about 70 addition publications this year. According to Brian Oliver, Chairman of ETSI project TETRA: "the TETRA standard has now reached maturity with almost 95% of TETRA release 1 finalised.

However, like GSM, TETRA will continue to evolve and a significant effort is now going into the planning of the next generation of TETRA". TETRA is a digital Private Mobile Radio (PMR) and Public Access Mobile Radio (PAMR) technology. Its main applications include public and national safety, emergency and security services and public access systems for use by professional commercial users and private systems. The ETSI project TETRA currently involves over 150 representatives. The TETRA standard is now used throughout Europe and is already deployed or will be deployed soon in the Far East, the Middle East, Africa and South America.

**Public Safety** : A new Partnership Project was launched between Standards Organizations in the US and Europe to address the needs of Public Safety users. ETSI and TIA announced at a conference, held in Washington D.C., for the public safety community, that they have launched a new partnership project, the Public Safety Partnership Project (PSPP), to address the standardisation needs of public safety users in North America and Europe. The PSPP will develop the Public Safety Mobile Broadband Specifications and their capabilities to support public safety community's technology needs. The PSPP will primarily address air interface data rates beyond current standards. At WRC2000, efforts already started to identify harmonized spectrum for emergency and disaster relief.

## m-commerce

The MeT Initiative, initiated by Ericsson, Motorola and Nokia, announced they will cooperate with MasterCard International's Global Mobile Commerce Forum. This Forum, which now has more than 200 participants, is a cross-industry initiative focusing on the development of secure mobile payments over a variety of technology platforms. The MeT initiative, launched in April, is working towards an open and common framework for mobile e-business, encompassing security and payment issues. Some of the key cornerstones identified by the initiative are WTLS (Wireless Transport Layer Security), WIM (Wireless Identification Module) and Wireless PKI (Public Key technologies).

The MIT Media Lab received a \$5 million donation from MasterCard International to help create the MasterCard Future of Transactions Laboratory. The lab will study the use of mobile phones, pagers and palmtop PCs for electronic transactions. Some of the main areas of study will be: mobile shopping, electronic exchanges, software agents, profiling and privacy.

MasterCard also teamed with Oberthur Card Systems to trial mobile commerce security worldwide. The first trial will take place in France and will be done in conjunction with France Telecom Mobiles, Credit Mutuel, Motorola and Europay International. The trial will use smart cards based on the EMV (Europay-MasterCard-Visa) standard.

Intershop (Germany), Nokia and Internet systems provider Integra also announced an electronic commerce pact for mobile phones.

Motorola and Certicom announced an alliance that will enable Motorola to use Certicom's Elliptic Curve Cryptography (ECC) technology throughout its wireless products (includes pagers, mobile handsets, WAP phones, WAP servers and other networking products). Some of Certicom's products include WTLS Plus™ for WAP implementations and Security Builder™ cryptographic toolkit.

International banks formed a mobile commerce association, named the Mobey Forum. The forum includes banks Deutsche Bank, HSBC, Merita Nordbanken, SE Banken and VISA. Manufacturers like Ericsson, Motorola and Nokia will also be involved. The forum will promote

non-proprietary standards such as WAP, WIM (Wireless Identification Module) and Bluetooth.

ETSI launched as well a Mobile Commerce Initiative. A workshop was held last April to explore standardization issues related to m-commerce.

### World Radiocommunication Conference 2000

The meeting, sponsored by the ITU, was held in Istanbul from 8 May to 2 June. The conference is the forum where countries decide on the shared use of the frequency spectrum to allow the deployment or growth of all types of radio communication services. The services include mobile communications, low earth orbit satellite systems, satellite broadcasting, aeronautical and maritime navigation, radio astronomy, earth exploration and deep space research. The conference is held every two to three years. The conference attracted this year 2037 delegates from 150 countries including 83 companies and 326 observers from 95 organisations. Among one of the most important milestones achieved by the conference is the approval of additional spectrum requirements for IMT-2000, giving green light to mobile industry in deploying confidently IMT-2000 networks and services. A key factor that enabled the global consensus is the fact that the agreement does not preclude the use of these bands for other types of mobile applications or by other services to which these bands are allocated. It will be therefore very important that regulators, when licensing spectrum in those bands, take into account the need for sufficient spectrum to meet the expected demand for 3G services. Moreover, each country will decide on the timing of availability at the National level according to need. Following mobile communications forecasts, ITU estimated that the required extra spectrum for IMT-2000 needed by 2010 is 160 Hz above and beyond that of the bands identified in 1992. The additional bands identified for the terrestrial component of IMT-2000 are: 806-960 MHz, 1710-1855 MHz and 2500-2690 MHz. The initial bands (1885-2025 MHz and 2110-2200 MHz) are unchanged. All bands identified for IMT-2000 have equal status. The conference also identified the use of additional frequency bands for the satellite component of IMT-2000.

New provisions were put in place by the conference to allow High Altitude Platform Stations (HAPS) to act as platforms for IMT2000 terrestrial component base stations. The ITU has also been tasked to complete signalling and communication protocols for IMT2000.

Agreements were also reached for the share use of bands between geostationary and non-geostationary satellite systems. The conference also provided additional allocations for the radio navigation-satellite service, which will be used to support a new satellite positioning system, Europe's Galileo. Allocations for High-Density Fixed Services (HDFS) were also agreed. HDFS provides wireless point-to-point and point-to-multipoint technologies ranging from Fixed Wireless Access to high-speed broadband systems such as Local Multipoint Distribution Service (LMDS).

The agreements reached have been welcomed by many organizations such as FCC, European Commission, TIA and UMTS Forum. More information about the resolutions and frequency allocations can be found at: [www.itu.int/newsroom/wrc2000/releases/imt2000\\_res-bands.html](http://www.itu.int/newsroom/wrc2000/releases/imt2000_res-bands.html)

### Mobile Internet

**Japanese Market Takes Off:** NTT DoCoMo's i-mode mobile system reached nearly 7 million subscribers by the end of May. According to NTT DoCoMo, the number of subscribers is increasing by 20,000 a day. Due to its huge success, NTT DoCoMo had to halve shipments of i-mode phones from

mid-April to the end of May as it faced server capacity and software problems. NTT DoCoMo forecasts 10 million subscribers by the end of this year and 20 million by the end of next year. "i-mode" is a packet based mobile Internet service with a speed of 9.6 kbits per second. It is text based with limited capabilities to send low quality still images. The system is based on compact HTML, and Java programming will be introduced later this year. At present, there are over 350 official content providers and over 7000 unofficial content providers. Some of the services offered are: newspapers, horoscopes, reservations for the bullet train or Japan Airlines, games, download of ringing tones or email. There has recently been speculation about the possibility of NTT DoCoMo trying to "export" overseas its i-mode system through a series of agreements. In Europe, DoCoMo acquired a 15% shareholding of KPN Mobile paving its way to the European market. In South America, the company acquired a 7% stake in Tele Sudeste Celular Participacoes. It also took 19% in Hong Kong's Hutchison Telephone Co (partially owned by Hutchison Whampoa Ltd) and is considering a tie-up with SK Telecom (South Korea). Hutchison Telecommunications already announced the launch of its wireless Internet service, Orangeworld, using NTT DoCoMo technology at the end of May.

DDI Corp's cell phone arm said it had about 2 million subscribers to its Web-access services, EZ Web and EZ Access at the end of May.

J-Phone, the mobile phone unit of Japan Telecom Co announced a total of 1.04 million subscribers to its J-Sky Internet service. These figures combined with those of i-mode makes the mobile phone the most popular way of accessing the Internet in Japan. At the beginning of April, the Japanese Posts and Telecommunications Ministry announced that wireless subscribers (56.9 million) exceed wireline subscribers (55.5 million) at the end of March.

**Wireless Application Protocol (WAP):** Some criticisms have appeared about the slowness of the WAP development. Some people point out NTT DoCoMo as a very important threat especially after its deal with KPN Mobile. Moreover, Phone.com and Geoworks are still fighting over the details of who patented what WAP technology.

Motorola and MobileOne demonstrated WAP over GPRS at the CommunicAsia 2000 in Singapore. Nokia claimed to have done the first WAP trial over WCDMA in Beijing. MicroTouch, a touch screen specialist, announced it is working on developing touchscreen displays for use in WAP phones and handheld devices.

A court in Paris blocked France Telecom's sell of its current WAP phones until the end of September as they lock users into the company's own WAP portal, being then considered anti-competitive.

### FCC news

The US Federal Communications Commission (FCC) proposed rule changes for the upcoming C and F Block auction. These changes will allow big carriers to bid in the auction. The 30 MHz block of spectrum to be auctioned was initially set aside in the mid-1990s for new entrants to the wireless industry. However, much of it was bought by companies that later filed bankruptcy. A Federal appeals court has now ruled that the FCC can now re-auction that spectrum. The FCC said it would re-auction the spectrum in 10MHz blocks (considered to be the capacity needed for 3G services). Established carriers will be allowed to bid for two of the three licences in large markets, with one set aside for new entrants, and to bid for one of the licences in small markets. However, certain restrictions were still held; US rules limit a single carrier to owning no more than 45 MHz of



spectrum in any one market. The US has not earmarked part of its spectrum for 3G licenses, so this coming auction is seen as the main opportunity to buy spectrum needed for allowing mobile Internet access. These auctions were later postponed until November 29 to provide additional time to prepare bids.

The Wireless Telecommunications Bureau announced the auction of licences for the 800 MHz Specialized Mobile Radio (SMR) Service General Category frequencies scheduled to begin on August. The Bureau proposes that the auction is composed of 1050 licences in the 851-854 MHz band. Six contiguous 25 channel blocks of 1.25 MHz bandwidth will be offered in each of the 172 Economic Areas of the US.

The FCC's 39GHz auction ended beginning of May raising a total net revenue of \$410,649,085. The licenses can be used to provide a variety of fixed Wireless services including local, long distance, high-speed data and Internet access information services. According to Chairman William Kennard "this auction has inserted 2173 new fixed wireless licences into the marketplace. Winning bidders have the potential to create robust competition to the local telephone companies and other local service providers". The auction ended after 73 rounds of bidding. A total of 2450 licences were auctioned. Licences were auctioned in 172 economic areas across the United States including cities such as New York, Los Angeles and Chicago. Licences were also auctioned in United States Territories in Guam and the Northern Mariana Islands, Puerto Rico and the United States Virgin Islands, and American Samoa.

The FCC's Wireless Telecommunications and International Bureaus approved the joint wireless venture between Bell Atlantic and Vodafone AirTouch and the merger between VoiceStream and Aerial. According to FCC's statement: "the Bureaus concluded that these transactions do not present competitive concerns. Rather, the creation of two new national wireless competitors likely will result in a various number of public interest benefits". Celco will be the vehicle for Bell Atlantic and Vodafone AirTouch to form a nationwide wireless business combining their cellular, paging, PCS and other wireless properties in the United States, serving more than 90% of the territory. This merger was conditioned to the sell off of overlapping cellular interests in five south-western US markets that will be acquired by Alltel. The combination of VoiceStream, that previously acquired Omnipoint, merges two major providers of GSM and creates a company covering more than 200 million people in the US.

The FCC was holding a Public Forum on May 3, addressing issues related to the development of secondary markets for radio spectrum. In late February, FCC chairman William Kennard, stated his desire that the FCC have "rules and policies that allow a secondary market in spectrum so that it flows as freely in the marketplace as any commodity". According to FCC's statement, "Secondary markets may facilitate greater utilization of spectrum. Spectrum licensees may be able to make capacity available for use on a temporary basis to meet demand".

FCC has allocated new spectrum and established rules for a Wireless Medical Telemetry Service (WMTS) allowing potentially life-critical equipment to operate on an interference-protected basis. The Commission allocated 14 MHz of spectrum in the 608-614 MHz, 1395-1400 MHz and 1429-1432 MHz bands, for use by medical telemetry equipment.

### Satellite mobile communications

At least four investor groups are bidding to rescue the Iridium satellite system, which failed in March to attract a qualified offer to rescue it from liquidation. IR Acquisitions Group, a Minneapolis-based investment company, has offer

\$61 million for the system with plans to convert it into a low-cost global cell phone business with a satellite feature. Another bid offer has been proposed by Venture Partners. This company claims to have agreements with Hughes Global Systems and General Dynamics to help operate the system. According to its chief executive, the contractors on his team have the approval from the US government to operate the system. Another bid comes from merchant bank Castle Harlan that offers \$50 million. Lawyers for Iridium argued last June for a bankruptcy court to accept the offer as it was the best available option.

According to officials from Teledesic and New ICO Global Communications, the two companies have no plans to merge (as of June) their systems denying previous speculations. Instead, Teledesic will use its ties with New ICO to kick-start its business plans.

Globalstar also seems to be in financial trouble after they reported a \$208.6 million net loss in the first quarter of 2000. The previously introduced discounts by Globalstar, after Iridium's bankruptcy, has raise new doubts about Globalstar's long-run viability.

Inmarsat has awarded a \$700 million contract to Astrium, formerly Matra Marconi Space, to build three satellites for its 4<sup>th</sup> Generation broadband satellite network. The satellites will be compatible with 3G mobile systems.

### Mobile phone health risks

The report "Mobile Phones and Health" published in the UK by the Independent Expert Group on Mobile Phones and Health, led by Sir William Stewart, concluded there was no evidence of a health risk. However, it recommended a precautionary approach to mobile phone use, particularly by children. It also said that transmission masts should not be erected near schools and more research should be done in this area. According to the report, an international standard for the assessment of Standard Absorption Rate (SAR) value should be adopted. Following the report, the UK government has announced a multi-million pound expansion of its research into the radiation effects of mobile phones.

A European program, Reflex 2000-2003, has also been launched to study the same issue. The program is conducted by nine centres from Germany, UK, Spain, Sweden and France. The study is based on the GSM Standard.

Japan has also taken actions following the increasing concerns about mobile phone radiation. The Ministry of Posts and Telecommunications will make mandatory for mobile phone manufacturers to keep their emissions to 2 watts or less for each kilogram of the user's weight. However, these new guidelines are still less strict than in US where the standard is of 1.6 watts or less per kilogram of the user's weight.

The FCC (US) and the LSGAC (Local and State Government Advisory Committee) announced the release of a "plain-English" guide on RF emissions to provide local governments and citizens with a better understanding of RF emission issues and to give guidance to ensure that antennas comply with FCC's limits to RF exposure. The guide is available at <http://www.fcc.gov/oet/rfsafety/>

The Cellular Telecommunications Industry Association (CTIA) and the US Food and Drug Administration signed a Cooperative Research and Development Agreement to study whether radiation from mobile phones are harmful to users. The research should last three to five years. The CTIA has also released its second annual "10 tips for using your phone safely while driving" in an attempt to warn about the danger of distractions caused by the use of wireless phones. CTIA also organizes the "National Wireless Safety Week".

## China Unicom discards national narrowband CDMA plans

According to the Official China Daily Business Weekly, China Unicom has decided to discard a national project using current CDMA technology. Instead, Unicom would likely be limited to a small-scale rollout of cdmaOne while continuing the expansion of GSM. Also, according to the chairman and chief executive officer of China Unicom, they will use the third generation CDMA system of Qualcomm and will start testing the system next year.

Despite this news, Qualcomm signed a series of R&D deals with eight Chinese Telecommunications companies. Under the terms of the agreement, the eight companies are allowed to license Qualcomm's CDMA technology to develop new handsets and equipment. Qualcomm would also supply chipsets and software to the companies.

## Bluetooth

The first Bluetooth public consumer trial is being undertaken by the Swedish Railway. Under this system, customers can book and pay train tickets, confirm bookings and connect to other networks. The Bluetooth LAN has been installed in Stockholm.

Ericsson unveiled the first Bluetooth-enabled mobile phones at the CommunicAsia trade fair in Singapore. The two handsets have WAP capabilities for accessing the Internet. Ericsson also unveiled at the trade fair a Bluetooth PC card enabling wireless communications between laptops and mobile phones. The card is designed according to PCMCIA specifications.

Lucent and Ericsson announced they are partnering to develop Bluetooth wireless devices based on Ericsson's Bluetooth core architecture.

Motorola also presented its first products using Bluetooth at a symposium in Monte Carlo. They include a car-kit allowing hands-free wireless communication and a modem card.

## Trade News

ITU TELECOM AMERICAS 2000, the fourth regional telecommunications exhibition and forum for the Americas region, was held from 10-15 April at Rio de Janeiro, Brazil. Around 17,000 trade visitors came to see the 303 exhibitors from the telecommunications, information technology and audio-visual entertainment fields. The forum put the spotlight on the opening of markets through liberalisation in Latin America, and on the dual boom of the mobile communications and Internet in the Americas region. More detailed information on these issues can be obtained in our feature article by Heidi Rivas on Page 4. At the opening press conference, Yoshio Utsumi, Secretary-General of the ITU, highlighted the progress in telecoms development over the past decade. But he added "much remains to be done, particularly in terms of promoting the further development of new technologies, and in terms of bringing access to all sectors of Society and not just the wealthy few." The forum encompassed a policy and regulatory summit, an infrastructure and applications summit, a TELECOM development symposium and various combined sessions.

The next ITU TELECOM event is Asia 2000, in Hong Kong, from 4 to 9 December 2000. In the year 2001 there will be regional ITU TELECOM events in Africa and in the Mid-

dle East and Arab states, with Americas and Asia events following in 2002. The ITU TELECOM World 2003, which will take place in Geneva from 12 to 19 October, will complete the cycle.

The core HIPERLAN Type 2 (HIPERLAN/2), which can provide a set of bit rates up to 54 Mbit/s, specifications have been published and can be freely downloaded from the ETSI web site [http://www.etsi.org/tbnews/0005\\_BRAN.htm](http://www.etsi.org/tbnews/0005_BRAN.htm). They include the physical, Data Link Control, packet based Convergence and cell based convergence layers.

Nokia and Motorola announced they will team to begin the standardization process for the 1XTREME technology. According to the companies, 1XTREME offers operators a cost-effective migration path to provide voice and data speeds up to 5.2 Mbps on a single 1.25 MHz CDMA carrier.

The UMTS Forum has established a new working group in order to solve the addressing and numbering issues faced by mobile operators as they install IP-based networks. This working group is meant to bring together the ITU and the IPv6 Forum.

France Telecom has bought UK mobile phone operator Orange for \$37.3 billion in a cash and share deal from Vodafone AirTouch. With this acquisition, France Telecom gets a UK 3G licenses and a strong base of European subscribers.

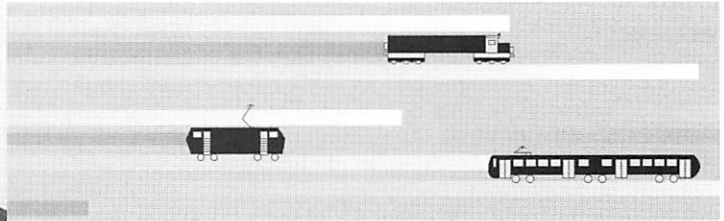
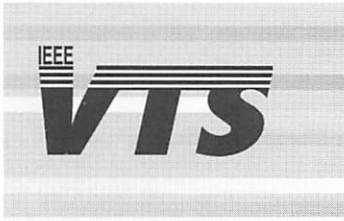
The digital audio broadcasting industry is pressing for deals with the GSM industry to turn GSM phones into portable digital radio sets. According to Mr McEwen, president of the World Digital Audio Broadcast (WorldDAB) Forum, "[this is mainly] pushed by the DAB providers". Apparently, at least one European GSM operator would already been working on a DAB project with Ericsson probably developing the DAB-enabled handsets. According to TeleGenis, a London-based GSM/DAB integrator, DAB-enabled GSM phones will be available in the UK towards the end of this year.

A £4 million three-year research project into 4th generation mobile phones is being backed by UK government and industry. The project will be carried out by the UK's Mobile Virtual Centre of Excellence (<http://www.mobilevce.co.uk/>), which is a collaborative partnership of wireless companies and seven UK universities. The project will cover areas such as software systems, networks and services, and wireless access.

ArrayComm, a smart antenna specialist, has developed its own technology, named i-BURST, to provide wireless broadband IP connections for laptops and other mobile devices. The company claims the technology can offer around 40Mbps in a 10MHz spectrum band and can be deployed the same way as cellular system with a base station covering several kilometres. The company announced it had won a trial license, at 2.3GHz, in San Diego. The company also maintains i-BURST works in any spectrum below 3GHz.

BellSouth and SBC Communications announced they will combine their US wireless operations to form the second largest wireless operator in the US. The joint venture, 60% owned by SBC and 40% by BellSouth, will reach 40 of the top 50 US markets.

The Global Roaming Forum met last April, in Chicago, to initiate work on an international roaming umbrella organisation, embracing different standards and technologies (including GSM, CDMA, TDMA and iDEN). Its goal is to promote common mobile handsets and interoperable network platforms.



## TRANSPORTATION SYSTEMS

Harvey Glickenstein, Senior Editor

### New Jersey Transit's Hudson Bergen Light Rail Line opened from 34th Street in Bayonne and West Side Avenue in Jersey City to Exchange Place on April 15.

At Exchange Place riders can transfer to the PATH trains to lower Manhattan. Exchange Place is also the site of many office buildings. The next portion to open will be from Exchange Place to Newport, the site of a major shopping center and also another interchange with PATH. This location serves PATH trains to midtown Manhattan as well as the PATH trains to lower Manhattan, Hoboken, Jersey City, and Newark, NJ that stop at Exchange Place.

The final portion of the Initial Operating Segment (IOS) from Newport to Hoboken is also under construction.

Twenty-First Century Rail Corporation, the winner of the design build operate maintain (DBOM) contract for the IOS, consisted of Raytheon Infrastructure—the builder and operator of the line, Itochu—the financier of the line, and Kinki Sharyo—the supplier of the rolling stock. Raytheon Infrastructure has recently been sold by the Raytheon Corporation to Morrison Knudsen—the successor to the company that built the Hoover dam.

New Jersey Transit is negotiating with Twenty-First Century Rail Corporation to extend the line further south in Bayonne and north of Hoboken through the Weehawken Tunnel under the Palisades. A final extension further north to the Vince Lombardi service area on the New Jersey Turnpike is even further away, although design has started on that segment.

Proposals are being looked at for service in Bergen County even beyond the terminus of the line at the Vince Lombardi service area.

A transit advocacy group has also proposed extending the line south of Bayonne to Staten Island. This would allow Staten Island residents to reach Manhattan without taking the famous Staten Island Ferry from St. George to South Ferry. The Bayonne Bridge between Bayonne and Staten Island was built to accommodate trolley cars, but such service was never implemented.

**Melbourne has ordered 59 low floor trolley cars from Siemens.** The cars are scheduled to be delivered in 2002. Swanston Trams, a subsidiary of the National Express Group, operates 17 routes in Melbourne under a 12-year franchise.

**The land connection between Denmark and Sweden is complete.** The first train to operate over the Øresund bridge-tunnel at the design speed of over 110 mph made its historic run on March 23, 2000. Official opening by the Queen of Denmark and the King of Sweden of the 5-mile bridge—the last portion of the bridge-tunnel to be completed—was sched-

uled for July 1. Revenue service was to begin the next day. The link reduces the travel time between Copenhagen, Denmark and Malmö, Sweden to 35 minutes.

**Pittsburgh has broken ground for its Stage II Light Rail Transit Project.** This project will include modernization of the twelve miles of its system that had not previously been upgraded.

In 1993 the Port Authority closed its 5.5-mile Overbrook Line. This line provided a faster route from the South Hills to downtown than the present route. The Overbrook Line could not accommodate the LRVs that operated on the present route and used outmoded non-air conditioned PCC cars. In addition the bridges and track bed were deteriorating, necessitating a major upgrade.

The rebuilt Overbrook Line will eliminate single-track sections and provide express service into downtown. The existing route will remain in service for mainly local service. Many of the stations on the Overbrook Line were located on the side of a mountain with no access except through staircases. Since elevators were not a viable option at these stations, and since the area was served by existing bus service, it was decided not to reopen these stations.

The Stage II Project includes expansion and modernization of the Operations Control Center at South Hills Village, purchase of 28 new light rail vehicles, a mid-life overhaul of the existing 55 light rail vehicles and improvements to the infrastructure including overhead wires, signaling, stations, and additional park and ride facilities.

**San Francisco inaugurated a new historic trolley service in March.** The F Market and Wharves historic streetcar service operates from Market Street to Fisherman's Wharf. In 1995 the line was instituted from Castro and Market Streets to the Transbay Terminal. The new extension bypasses the Transbay Terminal and operates over the Embarcadero to Beach and Jones streets.

**Electric bicycles are being pressed into service in the San Francisco area.** These electric bicycles feature a small electric motor and a battery. Under power the top speed of the bicycle is 20 mph. The range is 18 miles before the battery needs recharging.

The bicycles are available at the Palo Alto Bikestation. The idea is that a commuter rides the electric bike from home to the Caltrain station in Palo Alto. Companies in the Palo Alto area have been solicited to sign up for the program, which would allow the same bike to be used by one of their employees to travel from the Palo Alto Caltrain station to their jobs. The demonstration project was begun on May 16, Bike to Work Day.



**The Nottingham Express Transit (NET) in the UK is now under construction.** The 8.7-mile DBOM project was awarded to a consortium called Arrow Light Rail Limited, which includes Adtranz, the UK construction group Carillion, tram operator Transdev, and the local bus operator Nottingham City Transport. The contract is for 27 years with revenue service beginning in 2003.

The contract includes provision of 15 trams, a depot, and five park and ride sites. The system will interchange at two rail stations and be fully integrated with the local bus service.

**The Japan Transport Ministry is reviewing recommendations for increased rail service in Tokyo and Yokohama.** The recommendations include building more tracks between Tokyo Central and Ueno stations. Today many of the trains from the north end at Ueno and trains from the west and south end at Tokyo station. Local trains, such as the Yamanote Line, do connect the two stations.

The recommendations also include additional suburban lines, subway lines, and a new loop line in Yokohama.

At the recent VTC in Tokyo I stayed at the Shinagawa Prince Hotel and had a room overlooking Shinagawa Station. This station has 14 platform tracks used by JR trains, the successor to the former Japanese National Railways, and three platform tracks used by the private Keikyu Railroad.

Shinagawa, while an important station, is not the major railroad station in Tokyo. The two major stations are Tokyo Central Station to the north and Ueno Station, even further north.

Looking out of my hotel room there was always at least one train in motion. It was not unusual to see three or four trains operating parallel to each other. JR has eight main line tracks both north and south of the station. One set of these tracks serves the Yamanote Line, which boasts three minute headways all day long. During peak hours the Keikyu trains ran as close as every two minutes. These trains left their platform on the west side of the station,

crossed over all of the JR tracks, and then crossed two streets at grade before proceeding south towards Yokohama. There were times when the two track crossing remained blocked for as many as four trains before the roadway traffic was free to move!

These trains were not small. The Keikyu trains were anywhere from 8 to 14 cars long. Except for the Narita Airport express trains, which operated in sets of one to three 3-car units, the JR trains were 10 to 15 cars long. The Shinkansen trains, which bypassed the station completely on their own tracks, were all 16 cars long.

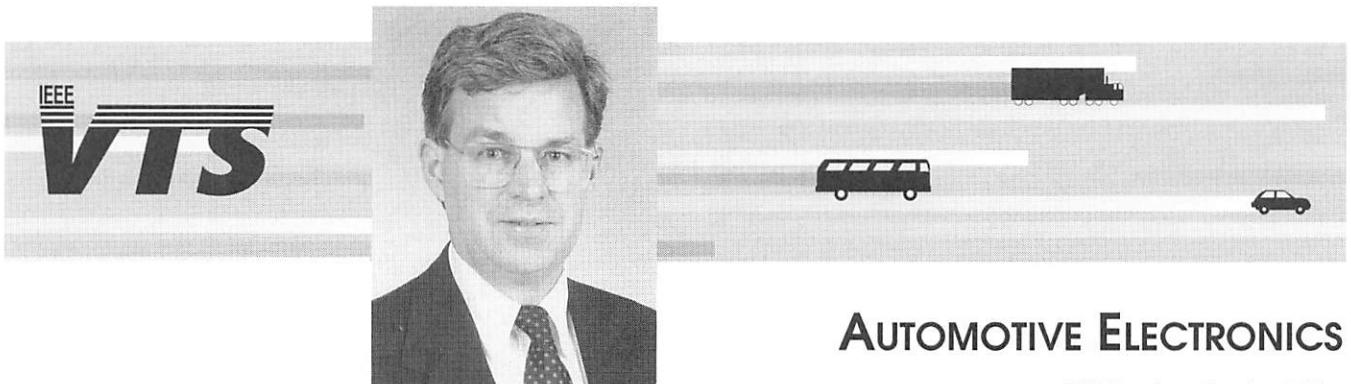
All of the trains operating through the area were electric. There was a diesel switch engine that was used for the yard immediately north of the station. Except for a very few locomotive hauled trains on JR, all of the trains either consisted of electric multiple unit cars or were integral trainsets like the Shinkansen trainsets.

**Xian, the Chinese city famous for the terra cotta figures, is proposing a metro line.** Construction of the 12-mile line is proposed to begin in 2002 with revenue service beginning in 2006.

**The Spanish National Railways (RENFE) has started the tendering process for between 26 and 40 high speed trainsets for the Madrid to Barcelona route.** The bidders are being asked to provide a plan for maintenance and one for financing the trainsets.

The trainsets must be capable of operating at least 250 mph in order to provide for a running time of 2 hours 30 minutes between Madrid and Barcelona.

RENFE has decided to signal the Madrid to Barcelona high speed line with the ERTMS signaling that has been proposed as the new European standard for signaling. Since the trainsets will also be capable of operating on the existing Madrid to Seville route, they will also need to be equipped with LZB signaling.



**AUTOMOTIVE ELECTRONICS**

*Bill Fleming, Senior Editor*

### Engineering Survey Results

WARD'S Auto World recently reported results of a reader survey, based on 469 respondents [1]. Some results were both interesting and surprising to me, and I thought that I'd pass them along.

For example, when asked, "which industry segment has the best engineers?;" OEM respondents naturally

felt that by a 50% to 20% margin OEMs had better engineers than did suppliers. On the other hand, supplier respondents conversely felt that, by a 40% to 25% margin, suppliers had better engineers than OEMs. And when supplier respondents were asked which of the OEMs generally had the best engineers, the results were as follows.

## Best OEM Engineers - according to supplier respondents [1]

DaimlerChrysler	23%	Honda (USA)	9
Ford Motor	18	BMW (USA)	5
General Motors	11	Volkswagen (USA)	3
Toyota (USA)	9	other & no answer	24

These results may be surprising. *I wish to note that I wasn't a survey respondent - I'm simply reporting the results listed in [1].*

Next, when asked which type of engineer is in the greatest demand in the automotive industry today, both OEM and supplier respondents agreed that the number one demand was for electrical/electronic engineers, followed closely by mechanical engineers, then product development, and then design engineers. Finally, both groups were asked, "whether, according to liability attorneys allegations, had they ever witnessed vehicle safety intentionally compromised in an effort to cut cost?" Both OEM and supplier respondents, by near identical percentages, said "no" by 92%, to "yes" 7%. It appears that the integrity of the automotive engineering profession with regard to vehicle safety is considerably better than liability attorneys would lead one to believe.

### Delphi Forecast for Automotive Electronics

The Office for the Study of Automotive Transportation, at The University of Michigan, Ann Arbor, MI, released its technology portion of its *Delphi X - North American Automotive Industry Forecast* [2]. Here are some of the forecasts for automotive electronics taken from this survey:

1. Electrical and electronic cost/content of vehicles is expected to increase by a factor of 1.6 from its 20% portion today, to 32% in 2009. Vehicles with at least one major multiplexed power system are forecast to increase eight-fold from today's 0.5% application rate, to 4% by 2009.
2. Higher-voltages, such as the 42 Vdc PowerNet [3], are forecast to be used on up to 30-percent of all vehicles in the next decade. Electric motor use is expected to increase by another 35% between today and 2009.
3. Telematics (e-mail, Internet, etc.) is forecast to be used on most luxury cars by 2009, and 30% of non-luxury cars. [A related item, on telematics-related driver-distraction safety issues, can be found at the end of this column].
4. Fast warm-up, electrically heated, catalytic converters are expected to be required to meet U.S. federal emissions standards at some time during the next decade.
5. By 2009, side airbags will be installed in 35% of passenger cars and 20% of light trucks, and an even greater percentage of vehicles (notably SUVs) will have rollover-protection inflatable curtains.
6. Real-time traffic-messaging vehicle systems, adaptive cruise control, and collision warning systems are expected to be in 15-to-20% of vehicles by 2009.

Overall, there's nothing all that startling in this forecast except the realization that come nine years from now, if one purchases a \$30,000 car, over \$10,000 will be needed just to pay for its electrical/electronics content.

### Pay-For-What-You-Use (Or Abuse) Car Insurance

Somebody had to invent it. Progressive Casualty Insurance, in Mayfield Village, Ohio, was awarded a U.S. Patent for an on-board electronic system to monitor real-time oper-

ation of an insured vehicle [4]. Apparently, the insurance base rate can start out low or high, depending on the driver's past record.

The patent states that, "a plurality of raw data elements, representative of the operating state of the vehicle or the actions of the operator, are monitored." In simpler terms, what this means is the following. Once a base rate is charged to a driver, then insurance surcharges, or discounts, are assessed depending upon: "occurrences of excessive hard braking, heavy acceleration, non-use or use of seat belts, excessive high speeds, non-use or use of turn signals, and/or disregard for or observance of traffic signs."

It appears that the above information will be obtained from existing onboard sensor inputs, together with GPS vehicle-location fixing, passive-key driver-ID codes, and map matching; thereby allowing surcharge/penalty driving events to be detected and recorded in a "black box." After data in the black box are read, a final insurance cost is calculated based on the base costs, surcharges, and discounts. There you have it - this is what might be called, "pay-for-what-you-use (or abuse) car insurance," based on actual recorded use or abuse of the insured vehicle.

### High-Speed Car Chases May Be Eliminated

After witnessing a high-speed police pursuit of a stolen vehicle and the deaths of two innocent pedestrians; Charles Gabbard, CHG Safety Technologies, Orange County, CA, developed, "HALT (High speed Avoidance using Laser Technology)." It functions both as an anti-theft device and as moving-vehicle apprehension device. The system must be installed on a vehicle. It includes engine immobilization electronics, along with laser light detectors in the vehicle front and rear lamp housings [5].

If a vehicle equipped with this system is stolen, or recklessly driven, police in either cars, motorcycles, planes, or helicopters can use a handheld laser gun to aim a coded light beam onto the fleeing car. Full-scale demonstrations of the effectiveness of the HALT system have been shown to several California police agencies. A police laser-gun can immobilize/halt a fleeing car at a range of up to half a mile. Once the coded laser signal is detected, the engine immobilizing electronics first reduce car speed to 15 mph, then it cuts the fuel completely, bringing the car to a controlled stop.

Gabbard, a retired aerospace engineer, is working with other aerospace engineers to have the HALT system legislated, and installed, on all new cars during vehicle manufacture. Currently, the system is available as an aftermarket product [5].

### Black Ice Warning Device

Because air, and road-surface, temperatures typically differ by as much as 4-to-8°C, knowing air temperature alone isn't enough to reliably detect when black ice danger conditions are present. To address this problem, Sprague Controls has developed an infrared road-surface temperature-measuring system, called RoadWatch [6]. By monitoring infrared radiation from the road surface, changes in actual road temperature, in real time, are detected. When the road surface cools to 1.7°C (35°F), a warning light alerts the driver to potentially icy road conditions. Two new RoadWatch systems, have been specifically designed for the heavy-truck industry.

### Kenworth's "Smart" Truck

Kenworth Truck Company's new T2000 High-Tech Truck was introduced at the Mid-America Trucking Show in Lou-



isville, KY on March 22, 2000 [7]. Their "smart" truck includes the following electronics features:

1. **Blind Spot Vision** - cab-mounted monitors display video received from miniature trailer-mounted cameras which assist in lane changes, backing up, and turning, thereby supplementing mirror and window visibility.
2. **Night Vision** - forward-looking night vision extends the driver's view farther down the road, and outward onto the shoulder.
3. **Drowsiness Monitor** - monitors driver performance in keeping the truck in its lane, and warns the driver of incipient lane departure.
4. **Navigation System** - both visual and verbal directions are available to the driver
5. **Brake-By-Wire** - instead of pneumatic braking, an electronic control system governs the truck's air brakes
6. **Anti-Theft** - fingerprint identification technology (of the driver) is used to enable engine start-up
7. **Front Brake Lights** - If another vehicle cuts in too close, or within the truck's safe stopping zone, the front-mounted brake lights flash rapidly for a few seconds to alert the other driver. *I trust this can't be used by aggressive truck drivers who might try to intimidate slower-moving vehicles ahead of them.*
8. **Satellite Broadcast Radio** - provides nationwide access to hundreds of radio stations and road traffic alerts

### Telematics/Distracted Study

In November, 1999, a two-year-old was killed in a collision caused by a man dialing his cell phone in Hilltown, PA, and it's now illegal in Hilltown for drivers to talk on mobile phones while driving [8]. There also was the widely publicized incident in Atlanta where a teenager, driving, and talking on her cell phone, swerved into a young mother and child, killing the child [9]. As NHTSA (National Highway Traffic Safety Administration) puts it, "it's not just taking your eyes off the road, a big part of the distraction is taking your mind off the road." To be sure:

*"NHTSA recently announced plans to expand its review of driver distractions to include Web services and other digital devices that car manufacturers intend to integrate into automobiles [8]."*

As wireless and net telematics technologies (e-mail, Internet, etc.) become mainstays of everyday U.S. life, a fear is rising that if digital devices in cars become a serious safety problem, Congress and NHTSA could find it necessary to intervene.

Based on the status of the vehicle (whether its moving, or whether its fixed), operation of in-vehicle telematics devices might be limited differently (full use when parked, restricted or no use when moving). Or, for example, a mid-dash computer screen for telematics could be mounted on a swivelable pivot. Whenever the car's transmission is in park, the driver could view the display, but if the car is moving, only the passenger can view, and if the driver swivels the display over for just a glimpse, the screen would shut off [10].

Preliminary study by NHTSA has shown that talking on a cell phone is very different from talking to a passenger inside the vehicle. "Your passenger knows you're driving and shuts up when you're in difficult traffic, as opposed to a cell phone partner" [11]. Notwithstanding, the present official NHTSA position is as follows:

*"There are insufficient data to indicate the magnitude of any safety-related problem associated with cellular telephone use while driving [11]."*

NHTSA has consequently initiated a field-data statistical study to attempt to correlate crash occurrences with the cell phone records of involved drivers.

NHTSA has designed, and plans to carry out, additional studies such as an on-road controlled vehicle driving-with-cell-phone safety investigation at their Ohio test-track facility. Telematics tasks such as phone dialing, radio tuning, e-mail retrieval, and destination entry, will be performed by 24 drivers in three age groups. A lead vehicle will unexpectedly hit its brakes (to minimize harm done if contact does occur, the lead vehicle will actually be a trailer-towed "fiberglass buck"). A second-phase part of this study will investigate hands-free dialing, hands-free talking, and speech recognition data-input alternatives, and their degrees of driving distraction. Eventually, forecasted for fall, 2000, more extensive studies will be done by NHTSA at their new state-of-the-art National Advanced Driving Simulator in Iowa [11].

### References

1. T. Murphy, "22<sup>nd</sup> Annual Engineering Survey," *WARD'S Auto World*, pp. 60-69; March, 2000.
2. D. Holt, "Technology," (editorial), *Automotive Engineering International* (SAE), p.6, April 2000.
3. J. Kassakian *et al.*, "Automotive Electronics Power Up," *IEEE Spectrum*, pp. 34-39, May 2000.
4. R. McMillan *et al.*, U.S. Patent 6,064,970, "Motor Vehicle Monitoring System for Determining a Cost of Insurance," assigned to Progressive Casualty Insurance (Mayfield Village, Ohio), issued May 16, 2000.
5. C. Gabbard, "CHG Safety Technologies Website, <www.halt2000.com>," website accessed on May 26, 2000.
6. J. Broge, "Black-Ice Warning Devices," *Automotive Engineering International* (SAE), p.112, May 2000.
7. J. Parietti, "Kenworth's New High-Tech Truck Focused on Safety and Driver Convenience," Kenworth News Release, <jparietti@pacar.com>, March 22, 2000.
8. J. Silva, "NHTSA Expands Driver Distraction Inquiry," *Automotive News*, p.16, Feb. 21, 2000.
9. R. Lebovitz, "Dealing With Driver Distraction," *Automotive & Transportation Interiors*, p.6, March 2000.
10. T. Moran, "Turned-Off Electronics Turn On Auto Suppliers," *Automotive News*, p.3 & p.79, March 13, 2000.
11. W. Garrott, "Recent NHTSA Driver Distraction Research," presentation at NHTSA's R&D Public Meeting, Romulus, MI, March 16, 2000.

# Convergence 2000

For over 25 years the Convergence Transportation Electronics Association (CTEA) has sponsored the premier automotive electronics conference in the world – Convergence. This conference has continually brought together the leading technologists, engineers, and executives in the world.

The theme for Convergence 2000 is Automotive Electronics: Delivering Technology's Promise. In the opinion of Convergence 2000 Conference Chairman, J. T. Battenberg III, the industry has yet to deliver that promise. Mr Battenberg, Chief Executive of Delphi Automotive Systems, goes on to say that the conference will provide a forum to answer the following questions "What must we do as an industry to deliver? What are the major challenges we face as we carry out this formidable challenge? What are our social responsibilities? What are the implications of this infotonics revolution?"

From October 16-18, 2000, the conference will showcase three executive panels and thirteen technical sessions examining everything from smart sensing, mobile information and entertainment to trends, standards and even the "electronic cocoon". Convergence 2000 will provide a thought-provoking, global forum for more than 6,000 attendees to participate and learn. Additionally, this year's event will have double the exhibit space of the last conference to showcase over 140 state-of-the-art exhibits. Due to the continued growth and overwhelming interest, Convergence 2000 will be held, for the first time ever, at Cobo Center in Detroit, Michigan.

The Keynote speakers for Convergence 2000 are a virtual "who's who" in the electronics and automotive industries. Participants include CEOs from Sun Microsystems; Sega Enterprises, Ltd.; Hewlett Packard; and AT&T, while the conference banquet will feature William Ford, Jr., Chairman of the Board of Ford Motor Company.

Electronics, technology and innovation exemplify Convergence – make plans to attend Convergence 2000.

## Keynote Speakers

After a welcome by the Convergence 2000 Chairman, J. T. Battenberg III, the conference will be addressed by Scott McNealy, Chairman and CEO of Sun Microsystems. Scott McNealy co-founded Sun Microsystems 17 years ago, and as CEO has he has steered the company to its position as the leading global supplier of network computing solutions with revenues last year of more than \$11.7 billion.

Sun has been pursuing a strategy of providing customers seamless connectivity – to anyone, anywhere, anytime on any device. A key part of this strategy has been the development of its Java™ technology, which is gaining acceptance throughout industry not just as a language for Internet software but also for more traditional applications and increasingly for embedded software.

After lunch, an address will be given by Shoichiro Irimajiri, president of Sega Enterprises Ltd., a \$3 billion company which is an industry leader in interactive digital entertainment media. Before joining Sega, Mr Irimajiri was executive vice president of Honda Motor Co. Ltd., where he was responsible for directing the company's development and production activities.

Tuesday begins with an address by Carleton (Carly) Fiorina is President and CEO of Hewlett-Packard Company (HP). She became President in July 1999, prior to which she spent a total of nearly twenty years at AT&T, and then at

Lucent, where she spearheaded the spinoff of that company from AT&T. For the second year in a row, she topped *Fortune* magazine's list of the most powerful women in American business.

Following the Awards Ceremony on the 18<sup>th</sup>, C. Michael Armstrong, Chairman and CEO of AT&T, will give a keynote address. AT&T is one of the world's leading communication services companies, with revenues of \$53 billion and more than 80 million customers. Before becoming chairman of AT&T in 1997, Dr Armstrong was for six years chairman and CEO of Hughes Electronics.

The Convergence 2000 banquet will be addressed by William Ford, Jr., Chairman of the Board of the Ford Motor Company. Mr Ford joined the company in 1979, working in a number of posts in the company before being elected to the board in 1988. He became chairman at the beginning of 1999.

## Technical Sessions

The thirteen technical sessions include over 75 papers. The sessions are:

### Electronic Cocoon

This session will deal with electronics that enhance the safety of the vehicle to prevent impending collisions, turning the vehicle into an electronic cocoon for safe, stress free driving. With the appropriate enabling technologies, vehicle electronics will actually assist in the prevention of collisions thereby providing a protective enclosure for the passengers. Electronics will sense the activity 360 degrees around the vehicle as well as the condition of the vehicle and surrounding environment so that all preventative measures possible can be taken to avoid collision. Electronics will turn the car into a safe haven, the driver's personal safety system.

### Infotonics, Part I: Dynamic Route Guidance

This first part of the Infotonics Sessions will compare Service Center vs. On Board Route Guidance, for example such subjects as fast algorithms that would optimize trips based on different criteria such as driving on the expressway, surface streets or avoiding certain areas that might be undesirable to drive in. These issues include comparisons of route guidance using turn-by-turn, map, or other means of communicating with the driver.

### Future Design Processes for Electronic Systems

This session addresses all aspects of future electronic system design from powertrain to infotainment vehicle applications. It consists of a series of methodological presentations that cover how to deal with shrinking time to market and increased electronic content demands; IP handling between OEMs and suppliers; reliability and testing of electronic systems; and an overview of existing tools and their automotive applications.

### Power Generation & Management

The average electrical load in a high end vehicle is expected to exceed several kW by 2005, and the current alternator/electrical system is incapable of supplying this load. There is already international acceptance of a new 42 V standard to help meet the challenge, and substantial discussion is occurring on the subjects of new, more efficient alter-

nator designs, combined starter/alternators, and the need for sophisticated energy/power management.

### **Occupant Protection**

This session considers what happens when the driver, with help of the Electronic Cocoon, cannot avoid a crash. We will cover the range of possible interventions from the time of an imminent crash to the time post crash when fast arrival of resuscitative help is crucial. Vehicle based intervention may include crash sensing and crash activation of integrated safety systems such as occupant restraints. Land based intervention may include the responsiveness of Emergency Medical Services. Vehicle to land based notification systems in case of a crash may include Onstar or other similar crash notification systems. Crash protection of children merits special attention for the session. Crash recorders are technically feasible today. How data from such recorders should be used to improve crash protection and how privacy of individuals should be protected will be discussed in our session.

### **Infotronics, Part II: Mobile Information**

We are scratching the surface with what kind of services might be provided in the way of information. Discussions will include electronic commerce, e-mail, stock market quotes, etc. The information must be given to the driver in a manner consistent with the driver workload. Other items could be information on congestion with some discussion of systems that exist today in Germany where the driver is given information about parking availability.

### **Electronics for PNGV's Fuel Efficient HEV's**

The year 2000 is a benchmark year for development and delivery of a New Generation of ultra-fuel-efficient (>70 mpg) hybrid-electric family-of-five-sized vehicles. Concept vehicles are being demonstrated in 2000 as milestone deliverables from the Partnership for a New Generation of Vehicles (PNGV), and possibly other programs. Those vehicles rely on a new generation of electronics and control systems designed for efficient energy management. This session focuses on the design, implementation and demonstration of these energy management systems. R&D efforts that have advanced electronic componentry for these energy management applications will also be described in this session.

### **Infotronics, Part III: Mobile Entertainment**

This session will discuss both the content of the entertainment that may be available and the technical issues, like how the content is delivered; broadband communication, antennas, display, and audio systems. Other topics include systems that deliver front seat television, movies or games for the back seat, etc.

### **Environment (Electronics Only)**

This session will deal with clean efficiency, fuel cells in hybrid vehicles as well as recycling, but with electronics as the focus. For example, the elimination of lead in electronic components that would facilitate the recycling of whole vehicles. Another aspect would be advanced engine controls, i.e., using electronics to reduce pollution and reduce emis-

sions further as well as improve fuel economy and thus minimize effects on the environment.

### **Robust Smart Sensing**

With the help of electronics we are moving beyond sensors to smart sensors. Such sensors, not only have self-calibrating features such as removing zero drift, temperature compensation, etc., but also can communicate with a data box so that information can be shared. Issues include the use of sensor fusion in vehicles to minimize the number of sensors and to make more intelligent use of existing sensors and those could be discussed, and new ideas to provide new sensors that could be used for the vehicle.

### **E/E Architecture**

A present automobile has a very complex power and signal distribution architecture, which is gradually being simplified, by having at least one communications bus. However, OEM's must ensure the capability of increased function is at a minimal cost impact to the customer. In the future, we expect that there may be more than one power bus (12V, 42V, etc.) to deliver the necessary functions customers will demand. The discussion should center on the questions; what is an electrical architecture, how does it drive the industry, what are the necessary standards, and who owns these standards? Another topic that can be discussed would be the life cycle mismatch between the vehicle and the electrical components. Life cycle of electrical components can be as little as a few months where as vehicles designed today would still be cold 10 years from now. Open vs. closed architectures in such extreme applications as multimedia and powertrain with traction control would be an item that could be discussed in this session. Additionally the session will address the processes and methodologies to design a future electronic architecture taking into account safety, fail safe modules, fault tolerance and diagnostics.

### **Distractions – Minimum; Attractions – Maximum**

The idea here is to discuss the human-machine interface as well as other human factors that affect driving. An important area would be to discuss driver workload so that information is given to the driver when the driver can absorb it. For example, one should avoid giving non-essential information (e.g., cell phone ringing) when the driver is attempting to pass or exercise a critical safety maneuver. The session may include regulations and legal issues for minimizing distractions to the driver.

### **Electronics and the Evolving Driving Experience**

The automobile and the experience of piloting a vehicle have been traditionally been key elements of cultural life worldwide, particularly in the United States. However the introduction of new electronic technologies into the automobile will now allow us to reshape the "driving experience" and what we mean by a "car". This session will review central ideas about the car and the driving experience as well as their re-definition as they are driven by the revolution in electronics.



## REPORT ON VTC2000-SPRING

The 51<sup>st</sup> IEEE VTS Vehicular Technology Conference, and the first to be held in Asia, took place in Tokyo from the 15<sup>th</sup> to the 18<sup>th</sup> of May 2000. More than 800 abstracts from 37 countries were submitted, with the largest contribution coming from the USA, followed by Japan, Korea, and then the UK. Of these papers, 385 had been accepted for oral presentation, and 165 for poster presentation. The total of 1009 attendees from 33 countries, about one fifth of whom were students, was the largest attendance since the conference was split into a twice yearly event. The committee had arranged that there were no evening panels, to leave delegates time to enjoy Tokyo's night life. One of the more unusual aspects of this was an area known as 'Electric City', where every possible electrical gadget was on display, although more expensive in their native country than many delegates were used to. Pride of place went to huge displays of mobile phones, with every possible shape and size from small to incredibly tiny, and a rainbow of colours from blues and greens to some rather garish varieties of pink. Most had large displays for i-mode, a few even dispensing with the keypad, replacing it with a larger touch-sensitive screen. The occasional phone even boasted a CCD camera for use as a video-phone, but although the stickers showed high-res colour images, the performance on a 9.6kbit/s link can only be imagined.

The conference was opened by Professor Hatori, who noted that 3<sup>rd</sup> Generation mobile communications (3G) were now completing standardisation and the focus was moving to 4<sup>th</sup> Generation (4G). The conference addressed the issues of these systems – 10-20 Mbps transmission, adaptive resource management, efficient use of the air interface, quality of service control, and multimedia.

The first speaker at the opening plenary was Prof. Yoshihiko Akaiwa, from Kyusyu University in Japan. A VTS Avant Garde awardee, he had over twenty years experience at NEC before moving to academia. He gave a review of digital mobile radio communications. Going digital allows voice scrambling, spectrum efficiency, and mobile multimedia. It started in 1978 with digital 2 way radio. For power efficiency, constant envelope modulation was used, and for encoding, Motorola introduced a single chip adaptive delta modulator. Since 1985, digital cellular systems have been studied with higher spectrum efficiency, reducing costs and giving hand-held terminals with long bat-

tery life. GSM followed in 1989 – the first commercial TDMA system. It had higher data rates requiring the use of an equaliser. It was expected in 1987 that with 300 mAh cells in 1993, GSM would give 25 hour standby compared with 9 hours standby for analogue systems in 1993. In 1990/1, IS-54 and PDC were introduced, using linear modulation for the first time to allow a narrow spectrum for compatibility of analogue channels. CDMA followed in 1993 with IS-95, the first spread spectrum system in cellular technology. He admitted that he does not have a mobile phone, although his 3 children do have them and his daughter asked why? Not, it seems, because his wife doesn't permit it, but because as a professor in pursuit of research funding he can't show favoritism to any one company. The next stage is 3G – multimedia and global roaming. There are two approaches – evolution or new build. EDGE and IS-136+ give evolutionary approaches from GSM and IS-136, whereas CDMA-MC does so for IS-95. W-CDMA, on the other hand, is an example of the new build approach. There is so much new technology it is difficult to keep up. Dr Akaiwa used to read all the papers from VTC – in the past this was a single slim volume. Now there are as many as 5 volumes, and two conferences. However, it is not some much that the technology is very different – it is more that advances in DSP allow greater possibilities. Standardisation has good and bad points. There are economies of scale, but it can block good new technology.

The next speaker was Mr Kei-ichi Enoki, Managing Director of the Gateway Business Department in NTT DoCoMo. With NTT since 1974, he is in charge of launching new multimedia services to customers, including i-mode. i-mode has been up and running for one year, so the wireless Internet is no longer just a concept. It has 6,780,737 subscribers as at 23<sup>rd</sup> April 2000, 491 application alliance partners (compared to 67 at launch) including banks, newspapers, travel, e-commerce, etc. There are also 11,091 voluntary i-mode web sites, including 20 search engines, and increasing at a rate of about 50/70 per day. There is now also some corporate use for company intranets. Users are increasing at a rate of over one million per month – 35 to 45,000 a day – making NTT DoCoMo the largest ISP in Japan. There are about 20 million Internet users in Japan, although the majority of them have work access only, so there are only about 5 million personal PC users. This is a very small market penetration, but there are 51 million mobile phone users, 30 million of which are NTT DoCoMo customers. By targeting mobile users, rather than personal PC users, NTT DoCoMo have a much larger customer base. i-mode uses packets switching and charges ¥0.3 (about 0.3 cents) per packet of 128 bytes. Being a packet system, the phone is always on to receive data, a significant difference from the circuit based WAP approach. i-mode uses a subset of HTML 3.0 with some additional tags, so there is no need



Photo by Mel Lewis

**Figure 1.** Professor Hatori opens the conference.



for a new language. This frees NTT DoCoMo from providing content - they only provide the platform. For example, a company called Bandai charges ¥100 (about \$1) per month to allow subscribers to download a new cartoon character per day. By the end of March, Bandai had over one million subscribers, and NTT DoCoMo makes money on the data charges each time a user downloads their characters. The next development is to have Java on i-mode phones, allowing the downward of agents, games, etc. With IMT-2000 next Spring, audio will be possible. A question was asked as to how i-mode compares to WAP. NTT DoCoMo is a member of the WAP forum. In 2nd generation systems, the bearer and upper layers are different (i-mode uses HTML, while WAP uses WML), so currently each country must choose its own solution. Much depends on content - this is a reason for i-mode's success. NTT DoCoMo is making proposals for the next version of WAP to bring it closer to standard Internet protocols. For 2.5G and 3G, i-mode and WAP will therefore converge.

The Technical Lunch on the first full day of the conference was addressed by Fuminao Okumura, General Manager of the Maglev System Development Department, Railway Technical Research Institute (RTRI), Japan. He is in charge of budget and long-term planning for the Maglev programme. Mr Okumura gave a history of high-speed trains. The Maglev test line holds a world record from Maglev transport at 552 km/h on 14th April 1999. In addition, a combined passing speed of 1007km/h has been achieved. The goal is to allow transport from Tokyo to Osaka in 1 hour, which requires speeds of 500 km/h. The aim is also to transport 10,000 people per hour for one-way traffic. Powell and Danby published a paper in 1966 on high-speed transport by magnetically suspended trains. Early development was made in 1970s, and 517 km/h was achieved along a 7 km long test line. This line had inverted 'T' shaped track rather than the current 'U' shape. In 1987, Japanese railways were privatised into six regional passenger companies and one freight company. In 1989 work started on the Yamanashi Maglev test line. It has a minimum radius of 8 km, with maximum grades of 4%. Over 85% of the line is in tunnel. This test line has proved feasibility of magnetic trains. Work is now concentrating on reliability and durability, cost reduction, and improvement in aerodynamics, with test runs taking place almost every day. The long-term plan is for Chuo Shinkansen project linking Tokyo and Osaka. This line will follow a different route from the existing line, avoiding the coast in an earthquake prone region. The Yamanashi test line is on the proposed route, which may therefore see test trains replaced by commercial inter-city services.

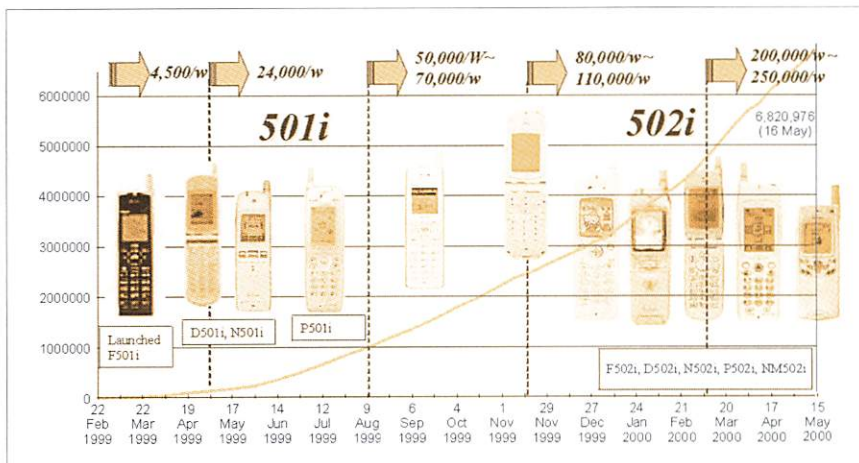


Figure 3. Growth of i-mode subscribers in Japan (Diagram courtesy of NTT DoCoMo).



Figure 2. Delegates enjoy the welcome reception.

The keynote address to the banquet was given by Dr. Keiji Tachikawa, President and CEO of NTT DoCoMo, Inc. He gave an overview on the current state of mobile telephony in Japan, then looked at i-mode, IMT2000 (WCDMA) and fourth generation systems.

He pointed to the room for growth in Japanese cellular traffic. Although, at the end of last year, Japan has the second highest number of mobile subscribers of any country (48.5 million compared to 76.3 million in the USA), the penetration rate is only 34.6%. Voice growth will be slow - lack of people, lack of time - but this will not be the case for data traffic. Japan is leading the way with i-mode data traffic. The i-mode service started last February, but now has more than 6 million users. New mobile services to be added this year include location navigation - pedestrian navigation (DoCo-navi), and car navigation, using GPS and i-mode. Other new services for this year are in the entertainment area: music distribution, games, and cinema preview.

NTT DoCoMo will spend ten billion dollars over three years from 2001 on IMT2000 deployment. Phase one deployment will start in May 2001, covering Tokyo and the surrounding area. Phase two will extend this to Osaka, Nagoya and surrounding areas. When phase 3 is complete in 2004, 95% of the population will be covered.

NTT DoCoMo is now looking towards fourth generation systems. These will have higher data rates - 2 Mbps for high-speed vehicles, 20 Mbps for pedestrians - and support for next generation Internet. Higher capacities will be required - five times that of third generation systems, with low system costs, perhaps at tenth of that of IMT2000. To achieve this, small cells, software radio, and adaptive antennas, etc. will be required. ITU-R WP-8F started in November 1999 to look at IMT2000 systems and beyond. NTT DoCoMo plan for fourth generation services from around the 2007-2010 period. They are currently looking for extra IMT2000 frequency, but from perhaps 2002 discussions may start on fourth generation frequencies, with specific allocations from perhaps 2004 onwards.

A feature of the conference were the panel sessions - eight in total. A recurrent theme of these panels were data services and how to provide them, either by 3G services or by wireless LANs or alternatives such as Bluetooth.

In the panel on *Deployment of IMT2000 - migration of 2G to 3G*, Chair Yukitsuna Furuya, from NEC, gave a background of an IMT2000 family. He started with the make up of the 3rd Generation Partnership Project (3GPP) and the standardisation of WCDMA & TD/CDMA, before going on to the other main proposal, CDMA-MC, and the make up of 3GPP2 which is standardising it, and the G3G harmonisation proposal so that CDMA-DS, TDD and



CDMA-MC can be connected to an evolved GSM Core Network and an evolved ANSI-41 Core Network. Finally, he covered UWC 136 standardisation. Mr Furuya said he thinks that probably different technologies will be adopted by different operators. A key point in the success of 3G will be to attract end users with small handsets and at a low price, better voice quality, faster and more data services, and finally a wide coverage. In his opinion, "island" coverage would not be attractive even at the beginning and with considering dual phones. To conclude his presentation, he indicated that 3GPP and 3GPP2 have agreed to collaborate; they will work separately but in a flexible way to be able to make both standards interwork together without having to modify any of them.

Mr Yasuda, from NTT DoCoMo, presented the IMT2000 system development of his company. The WCDMA system experiment from DoCoMo started in 1996 with a delivery end in 1997. Then the laboratory tests started 1998 and finished middle 1999. The field tests started at then end of 1998 and have been conducted until end 1999. The tests were conducted in Tokyo and the YRP area. Other system tests have been done in Beijing, Seoul, Bangkok and Singapore. Commercial service is expected to start spring 2001. Commercial equipment tests (based on specifications release 99 v3.x.y) are being undertaken this year, with construction due to start end 2000. Mr Yasuda announced three types of WCDMA terminals: a voice terminal, a data terminal and a visual terminal. The next phase should be car terminal and indoor terminals. Mr Yasuda indicated they are not intending to initially offer dual phones between IMT2000 and PDC. They expect to achieve more than twice the users per cell site than PDC. Finally, he said that research on 4G systems has already started.

Mr Flynn from Verizon indicated that even if forecasts still increase, there is still a low penetration of mobiles in the US. Wireless voice users are expected to pass wired users in 5 years. Also mobile Internet users should overpass PCs in five years. They offer CDPD and CDMA technology and expect to use for the first phase of 3G deployment the CDMA 1XRTT technology. Field trials are being undertaken. He expects networks to evolve to IP-oriented which will request open interfaces. His view is of uncertainty about the data rates and QoS requested by US customers. He pointed out that one of the reasons to select CDMA was its high voice quality.

Dr William Lee, from Vodafone Airtouch, centered his presentation about what he considered will be the technology of the future - that is the one used to pass from 3G to 4G. According to Mr. Lee, TDD is this technology as it has two operating modes. One of the modes requires 1.6MHz which is

substantially less than WCDMA, which requires  $2 \times 5$  MHz. This is particularly important after seen the prices paid by operators for 3G licenses in the UK. Moreover, TDD can dynamically handle asymmetric traffic and can require smaller handsets. Dr Lee believes we should use the least spectrum possible unless we really need more.

Another panel examining mobile data was *Wireless Packet Data Systems and Marketing Issues*. This panel was chaired by Dr Lee, who started the panel reviewing the challenges faced by 3G systems and then the different 3G technologies available.

Dr K C Chen, from National Taiwan University presented wireless packet data systems and marketing issues from a regulator and government perspective. Concerning the marketing issues, Dr Chen pointed out that the success of i-mode demonstrates there is a business possibility for cellular packet data. Some operators are facing a dilemma of whether to consider GPRS/EDGE or IMT2000. He summarised some open technical problems: enough applications to satisfy the users, interconnection with broadband networks (e.g. IP) and guaranteed QoS.

Dr Edward G Tiedemann Jr, from Qualcomm, presented the evolution of CDMA for packet services. He started with a review of current CDMA data deployments. He also indicated a move towards all-IP networks. Dr Tiedemann said Qualcomm has been working on 1xHHR, a high performance data system optimized for packet services before reviewing its technical characteristics.

Dr Yoshihiko Akaiwa, from Kyushu University, did a technical review of the benefits of packet transmission focusing particularly on PRMA. He also described a proposed dynamic channel assignment method for voice packet transmission where voice packets will have priority.

Dr Xiaxin Qiu, AT&T Labs, from AT&T labs, did a deep review on the EDGE technology indicating its target to support multiple service classes aligned with UMTS. She indicated that EDGE corresponds to the convergence of different TDMA technologies. EDGE adopted a phased development approach. Phase 0 focuses on best effort data services and should be deployed in 2002. Phase 2 (no phase 1) should align EDGE with UMTS core network and support UMTS QoS classes. Its goal is to support IP architectures. Phase 2 should be deployed in 2003.

Professor Hamid Aghvami, from King's College London had the interesting task of chairing the panel on *4<sup>th</sup> Generation Mobile Communications*. There are still a great many views on what exactly 4G is. One conclusion was that 3G has not been successful on global roaming. It was also felt that 4G should be more application oriented. Prof. Aghvami proposed a top-down approach that will start first with the applications and will then look at the technology. Some of the panelists indicated that both applications and technology, should be looked at the same time. The panelist from AT&T pointed out that looking at pricing of services, services like Video on Demand is far from being realistic. He also pointed out that if we consider 4G as only microcellular, technology is already available and could be deployed quickly. The representative of NTT DoCoMo forecast 4G systems for 2010. However, the problem would be availability of spectrum. He indicated that ITU should start talking about it around 2002 and allocation should be made between 2004-2008. An interesting point was also that NTT DoCoMo does not consider only human beings as potential clients but also vending machines, vehicles, pets, etc. In Japan this would mean a potential subscriber base of 360 million from a 120 million population. The panel finished with a discussion with the audience about what users want from future systems. Some of the opinions were global roaming, low prices, more con-

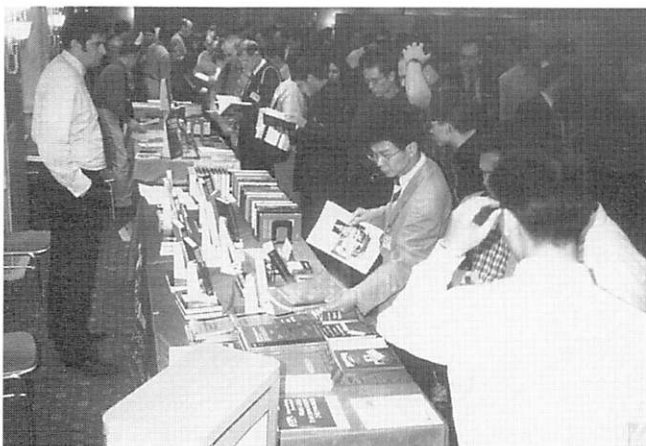


Photo by Mel Lewis

**Figure 4.** The two publishers present, John Wiley & Sons and Kluwer, did good business.



tent and finally to get rid of handicaps in today's communications devices (e.g., keyboards).

Data applications also dominated the *Pico-cell and Micro-Cell Wireless Access System and Technology* panel organized by Prof. Masao Nakagawa of Keio University.

Mr Jaap Haartsen, from Ericsson presented the concepts and vision of Bluetooth. Bluetooth is a technology targeting access to fixed lines (Ethernet) with low cost, low power and small size products. Its vision is to replace cables in today's communications devices. The panelist continued the presentation with a technical review of Bluetooth.

Mr. Yoshikatsu Nakagawa, from Nokia Japan, gave an overview of Bluetooth scenarios. Existing scenarios include office, home, and location independent use. An example of the latter would be a meeting, for example, where the computers from attendees would form an ad hoc network. To these he added a fourth – public environment. This is similar to the Infostation idea proposed by Winlab. The Bluetooth solution – Bluepac (Bluetooth Public Access) is being researched by the University of Bonn and Nokia. A Bluepac Agent would take the place of an Infostation Controller and Cellular IP would provide mobility.

Hideaki Sato, from Canon Inc., then looked at the Wireless Home Link. This is a wireless version of the IEEE 1394 standard, with 32-400 Mbps to provide a home multimedia network without wiring.

Elvino Sousa, from Sony discussed issues involved in designing an optimal high capacity microcellular system for local areas using a single cell approach. This approach requires different technologies to current cellular systems. A delegate questioned the relatively low rate of Bluetooth (700kbps to 2 Mbps compared to 20 Mbps and upwards of other systems). Mr Nakagawa answered by noting that high data rates require high power, so that devices using these sort of data rates are likely to be wired up for power anyway. The advantages of a wireless data link in such cases would not be as great as for battery operated portable equipment. Some in the audience also questioned Bluetooth as an access technology compared to wireless LAN for public access, but Mr Nakagawa pointed to the economies of scale from having a very large user base of Bluetooth enabled devices, as well as simpler hardware.

The *Mobile Gateway and Wireless Internet Access* panel gave an interesting contrast between the i-mode and WAP approaches to mobile Internet provision. Takeshi Natsuno of NTT DoCoMo gave a presentation on i-mode, and it was interesting to note that the number of subscribers, 6,820,976 as of 16th May 2000, was already over 40,000 up on the figure given by Mr Kei-ichi Enoki in his opening address! Users pay \$3 subscription and an average of \$12 for traffic charges in addition to any voice calls. On average, users download 10 home pages and 5 e-mails per day. They are seeing the positive feedback of the Internet model with i-mode. More users mean more content providers which means more users, etc. There is, of course, a chicken and egg problem – how to get and attract users without content? The solution was use HTML standard (or, at least, a subset of it). Alliance partners get a link from the portal page, whereas

independent providers have no connection with NTT DoCoMo, and simply have to provide pages using the HTML subset published by NTT DoCoMo on the Web. An obvious question is why not use WAP? This is because NTT DoCoMo already had a packet network. A phone is always on standby to send/receive traffic. Charges are made by the packet, not the time, at 0.3 cents per 128 bytes. NTT DoCoMo see a seamless move through to 3G. From now on, all NTT DoCoMo terminals will be i-mode capable.

Tsunenori Sasaya, DDI Corporation, described their EZWeb WAP service. They differentiate their product using personal information management via the Internet, using popular type handsets (cdmaOne) and using the WAP open standard.

Lars Sandberg, of Nippon Ericsson, discussed lifestyle changes with mobile technology. These have led to a reduction in "dead-time", and a blurring the distinction between work and leisure – work becomes more portable and a single point of contact may be used for both. He noticed importance of roaming – over half a billion roaming calls per month at the end of last year. Messaging also forms a large market, with three billion SMS messages in December 1999 (a ten-fold growth in one year).

Nigel Rundstrom from Nokia discussed the Mobile Information Society and the need for standardisation. There had been some surprise in the takeoff of mobile for Internet. The forecast is now that there will be more mobile handsets than PCs connected Internet by 2003. He discussed the drivers for development and standardization initiatives. These include the Symbian partnership, for standard wireless operating system (EPOC), optimised for the mobile environment; Mobile electronic Transaction (MeT) initiated in April 2000 by Nokia, Ericsson and Motorola, with the goal to develop an open and common industry framework for secure mobile electronic transaction; MobeY Forum – Mobile Financial Services, which was publicly announced in May 2000 by 14 leading financial institutions and mobile manufacturers; and SyncML – a standard for PIM synchronisation. He said that these initiatives assist in the evolution of mobiles into a "Personal Trusted Device".

One of the features of the conference was the degree of organisation involved. Each volunteer had a copy of the master-plan in the shape of a 75 page handbook with foldout timesheets giving exact details of who was doing what, where and how at all points throughout the conference. All this worked extremely well, with the only outward sign of the activity within being the flitting of the Conference Secretary, Tadashi Matsumoto, as he ensured that everything continued to run as planned.

The conference location gave many visitors their first chance to sample life in Japan. Tokyo is a very friendly city – it was almost impossible to open a map on the street without being asked by a passer-by if they could be of any help. Combined with its efficient transport system, which never got too crowded at rush-hour, it was particularly easy to explore. VTC will return to south-east Asia in the spring of 2003, when the hosts will be Seoul in Korea.

# Tour to Yamanashi Magnetic Levitation (Maglev) Test Center

On Friday, May 19 an inspection tour was held at Japan's Railway Technical Research Institute (RTRI) and their Yamanashi Magnetic Levitation (Maglev) test center. RTRI provided four engineers and a tour guide to take us first to the Maglev test center and then on to the Institute.

At the test center we had the opportunity to observe two test runs at 280 mph. The top speed attained by the Maglev train was 343 mph last year. We also observed the start of testing with a train leaving the station and entering the main line through a guideway switch. The switch consists of two vertical sections of guideway that move to create a continuous guideway for the train. It took about 20 seconds to operate from one position to the other.

The Japanese Maglev system differs from the German Transrapid system in two significant ways: The Japanese system uses a superconducting coil for the levitation, guidance, and propulsion; and the Japanese system has changed from the straddle-type system to one with the vehicles within a U-shaped guideway. Like the Transrapid system, however, the Japanese Maglev system provides the propulsion force by energizing wayside coils and controlling the train from the wayside rather than from on board the vehicles.

The superconducting coil mounted in the outside wall of the vehicle is energized at the beginning of the day and the current remains in the coil throughout the day due to the superconducting characteristic of the coil. A 600-ampere current is inserted in the coil by induction. A shorting strap is then closed allowing the current to flow around the entire coil. The energizing source is then removed. The coil is kept at the temperature of liquid helium by a refrigerator that includes both liquid helium and liquid nitrogen tanks. Passengers are shielded from the magnetic field by the steel sides of the passenger compartment.

Two sets of coils shaped like the figure 8 mounted vertically in the walls of the guideway provide the levitation and guidance for the vehicles. When the vehicle is moving, the current in the superconducting coil on the vehicle induces a current in the figure 8 coils on the wayside. This current generates a north magnetic pole and a south magnetic pole oriented vertically, with the north pole on top on one side of the guideway and the south pole on top on the other side.

Coils located in the guideway vertical walls behind the figure 8 levitation and guidance coils provide propulsion. These coils are switched on the wayside to provide a moving magnetic field to interact with the field produced by the superconducting coil on board the vehicles.

The train starts out running on rubber wheels within the guideway. As the speed of the train reaches about 90 mph, the induced currents in the figure 8 coils mounted on the vertical walls of the guideway levitate the train sufficiently to allow the wheels to be retracted. When the train is slow-

ing down, the wheels are automatically deployed as the speed is reduced below 62 mph. The clearance between the vertical and horizontal surfaces of the guideway and the moving train is about 10 cm.

At present, a generator provides hotel power, the power that is used for lighting and purposes other than traction, on board the train. In the revenue vehicles, it is planned to provide the hotel power by induction from the wayside.

The test vehicles have two different front ends. Although both have low shovel-nose fronts that sweep back, one is just a smooth curve while the other is a more complicated shape reminiscent of, but not identical to, the front of the Nozomi Shinkansen. The Nozomi is the latest Shinkansen train that operates at speed up to 190 mph. To date the results of the high speed tests on the Maglev train have not detected any significant differences in performance between the two shapes of front end (see Figure 5).

One of the major problems encountered by the Maglev trains occurs at the portals of the tunnels. Over 85% of the 11.5 mile test site is within tunnels. In Japan a major portion of any Maglev route would need to be in tunnels. Japanese National Railways (JNR) performed a great deal of engineering to handle the effects of portals on the Shinkansen high-speed trains. At the higher speeds of the Maglev trains, these solutions are not adequate. The Maglev train generates low frequency vibrations at the portals. These are not annoying in and of themselves, but within Japan they tend to cause the paper walls in nearby residences to vibrate.

After leaving the Yamanashi test site, we traveled to the RTRI. There we were welcomed by one of the two Executive Directors of the Institute and then taken to see three of the many projects underway there.

The first stop was to see the test apparatus for the Maglev coils. We were each given a sample of the superconducting coil used on the train. It consists of a flat piece of niobium-tin compound surrounded by a copper cladding. It is amazing that the small cross section supports a current of 600 amperes!

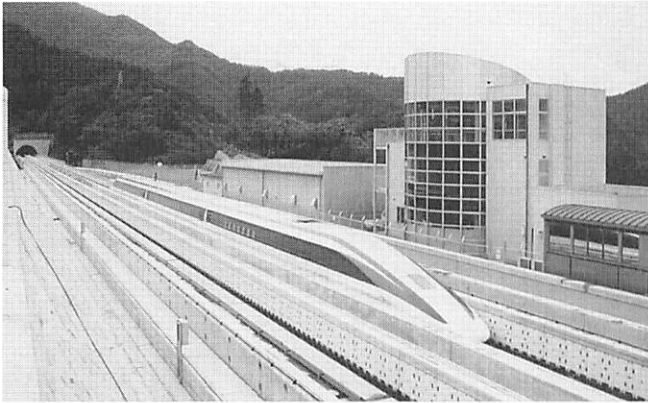
We also saw a test installation of a new device to help visually impaired people travel by themselves. Throughout the railroad and subway systems of Tokyo, Nagoya, and Kyoto I saw yellow rubber strips. As in the United States, there were truncated conical shapes on these rubber strips at the edges of platforms and at stairs. There were also continuous strips with elliptical shapes in the direction that such people could walk to get from track to track and from platform to platform.

The RTRI is testing a system to embed passive tags in the strips that have the conical shapes. These tags, like automatic equipment identification tags used by railroads and steamship companies, would receive radio signals and retransmit them in a code that would identify the serial number of the tag. The visually impaired person would have a radio transmitter/receiver embedded in the tip of his cane. It would send radio signals and be powered by penlight batteries. The system includes a computer the size of a paperback book and a speaker/microphone. As demonstrated to us, the person speaks into the microphone saying where he wants to go, such as to Track 1. As the person holding the cane approaches each tag location, the system announces the direction to go; right, left, or straight ahead; an obstruction such as a fare gate; or the distance to the next obstruction such as a set of stairs. The voice recognition system was quite good as we had two members of the tour group who speak Japanese successfully input locations to which they were directed. The system is still being tested with handi-



Photo courtesy of RTRI, Japan.

**Figure 5.** Comparison of test vehicle front ends.



**Figure 6.** The three car test train.

capped volunteers and no date for installation in the field was given.

## IMT2000 Tour

As part of VTC2000-Spring, an IMT2000 Technical Tour was held, on Friday 19<sup>th</sup> May, at Yokosuka Research Park (YRP) (<http://www.yrp.co.jp/>). The park opened in October 1997 as an international R&D base for telecommunications technologies. At the moment, more than 40 international laboratories have established an R&D center at YRP, employing around 4500 researchers. The research center is expected to grow to about 10000 people. Research work at YRP has centered around Intelligent Traffic Systems, stratosphere wireless relay system, mobile multimedia applications, next-generation cellular phone technology and electromagnetic environment technology.

Prof. Hatori, President of the Yokosuka Research Park R&D Committee, welcomed delegates, and then Ms. Mochizuki gave some insight on the mobile communications industry and its future evolution, particularly in Japan. The tour was in three parts:

- ◆ An explanation of Intelligent Transport Systems (ITS)
- ◆ IMT-2000 Demonstrations and Exhibitions
- ◆ Test use of IMT2000 prototypes and networks

The ITS tour started with a video presentation on the ITS Research Center in YRP, and the importance and impact of the ITS industry in society. ITS aims at transforming our vehicles into moving offices and at solving problems such as traffic accidents, traffic jams and environmental issues by using mobile communications technology. The video illustrated these problems and presented some ITS projects introduced in Japan. The VICS (Vehicle Information and Communication System center, <http://www.vics.or.jp/>) initiative provides drivers with road traffic information saving them driving time and helping them to avoid congestion areas. Another illustration of ITS is the Electronic Toll Collection project, introduced in Japan during this year, that enables drivers to be registered and billed for tolls automatically.

Visitors were then shown some of the ITS research undertaken at YRP. This work is focused on three main areas: Wireless Agent technology, Wireless multimode terminal technologies and radio-on-fibre transmission for road-side antennas. Wireless Agent technology applied to ITS will en-

We also saw the system that is installed at the RTRI for dynamic characteristic testing of rail vehicles. The system consists of rollers that can rotate the wheels of the vehicle under test at speeds up to 310 mph. The rollers can be adjusted for gauges as small as meter gauge and as wide as 1676 mm – allowing for broad gauge vehicles such as those in use in India to be tested. The rollers can also impart vibrations in the vertical direction, the lateral direction, or in a rolling motion. It normally takes about 5 weeks to test a vehicle – two weeks to set up the measuring devices on the vehicle, two weeks to test the vehicle, and one week to remove the measuring devices.

The RTRI tour, including the trip to the Maglev test center was a great success and we thank all of the people at RTRI, including the Executive Director, the people who came along on the tour to answer questions and who conducted the portions of the tour at the different facilities, and especially Mr. Ogino who arranged for the tour and answered questions throughout the tour.

able users and information suppliers of different access networks to have seamless access and to provide a wide variety of ITS services. The research undertaken for wireless multimode terminal technologies is focused on the study of high-frequency RF signals enabling communications with different frequencies and adaptive modulation/demodulation techniques. Finally, the radio-on-fibre transmission to road-side antennas research work allows economic transmission of information necessary to ITS users to multiple base stations.

The tour continued with a visit to some IMT2000 Stand-Alone demonstrations and exhibitions. NEC, Toshiba, Mitsubishi and Fujitsu presented some of their multimedia IMT2000 handset prototypes (some of the prototypes are shown in the pictures). Most of the handsets aimed at providing multimedia, videophone and browsing functionalities. There were demonstrations of new services like email and videoconferences linking several mobiles even though the link was a cable. All the handsets were characterised by their compact size and “fashionable style”.

Anritsu, Cybernet Systems, Yokogawa and Japan Radio Co (JRC) showed their IMT2000 testing solutions. Among the equipment exhibited by Anritsu was a 3GPP (WCDMA) signaling tester (BTS simulator), a signal generator and a transmitter tester. Cybernet demonstrated the MathWorks system-level simulation environment by showing how the tool can be used to simulate technologies such as Turbo coding. They also presented SignalMaster™, a tool used to create functional prototypes of new designs developed in Simulink.

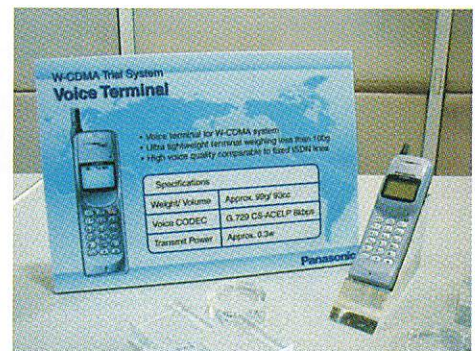
JRC presented several testing tools including a multipath fading simulator, a WCDMA simulator and a tester, MCPA rack for WCDMA, an OFDM modulator, an interference canceller system for use in CDMA base stations and a coin size GPS core simultaneously receiving 15 satellites. Yokogawa showed some of their IMT2000/MMAC testing solutions that comprised a multi-path fading simulator including the 3GPP channel models, a digital I-Q signal generator for 3GPP, WCDMA and TD-CDMA air interfaces and a synthesized vector signal generator.





**Figure 7.** 3G technology on show on the IMT2000 tour. Clockwise from above: Toshiba video phone; Mitsubishi concept phones; Panasonic WLAN application; Fujitsu WCDMA terminals, NEC WCDMA Voice Terminal; Panasonic Video Phone Demo, which was working on the tour via a cable; (centre) delegates enjoy the tour.

Photos courtesy of the respective manufacturers



The tour finished with an exhibition entitled “Test Use of IMT2000 prototype and network”. NTT DoCoMo, Nippon Ericsson, Panasonic and KDD/Hitachi were present. NTT

DoCoMo demonstrated two-way voice transmission between a compact Mobile Station (MS) and a functional MS using WCDMA radio access technology. The MSs were connected through a BTS installed on the roof of one of the YRP buildings. Panasonic showed in their stand a series of IMT2000/WCDMA prototype terminals. Amongst those shown, there was a WCDMA voice terminal, a WCDMA visual phone, a Wireless LAN application terminal, a data communication card terminal for WCDMA and a rescue helmet carrying a video camera to transmit live pictures of disaster sites. KDD/Hitachi presented their solutions for IMT2000 by giving an overview of their IMT2000 field experiment system. Finally, Nippon Ericsson presented their research activities and network solutions for 3G systems.

The IMT2000 technical tour succeeded to present recent technical advances in ITS and mobile communications systems, particularly on IMT2000. The testing equipment and handset prototypes showed that IMT2000 is not that far from being a commercial reality.

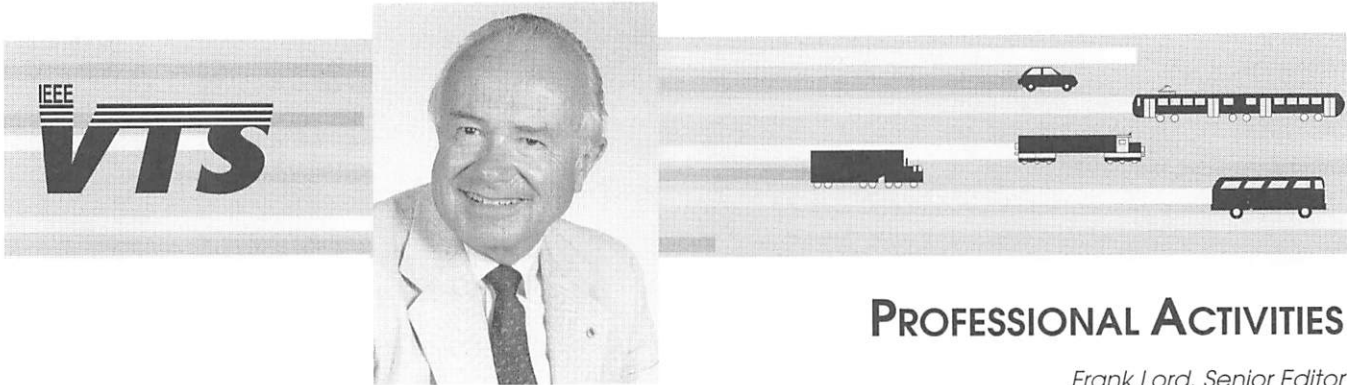
We would like to take this opportunity to thank all the people at Yokosuka Research Park for making this interesting tour possible.



Photo by James Irvine

**Figure 8.** The existing market. One of the scores of Toyko shopfronts devoted to mobile phones.





## PROFESSIONAL ACTIVITIES

Frank Lord, Senior Editor

### IEEE-USA Steps Up Information Exchange

The IEEE-USA web site, <http://www.ieeeusa.org> has been expanding to the point where members may obtain considerable information about the issues that are being addressed on their behalf. Members are encouraged to participate.

Also, President Merrill Buckley writes and posts a monthly column on professional matters that Section, Region and Society newsletter editors may utilize in their publications. Another type of information exchange can take place via coalitions which are sanctioned and are being encouraged. One such entity has been organized around the H-1B visa issue. This coalition is loosely structured so as to accommodate many diverse professional organizations. Since the AAES (American Association of Engineering Societies) member represents, in turn, 25 societies, it could be said that this coalition has about 40 participating organizations that also include the American Engineering Association (AEA), nurses' associations, American Scientists' Association, and an appropriate entity within the American Federation of Labor. We may not say "in unity there is strength" but we can say "in association there is some strength".

To encourage readers to delve into these areas I am reproducing an abridged version of what is now on the web at address <http://www.ieeeusa.org/grassroots/immreform/index.html> One important feature of this material are the links which connect you with material that is less reserved than items that appear in IEEE publications.

### Immigration Reform Grassroots Network

IEEE-USA supports improvements in the U.S. immigration system, including reforms to employment-based immigration programs such as the H-1B temporary visa, to ensure efficient utilization of the high-tech workforce and promote rewarding careers for U.S. engineers and scientists. In support of these goals, IEEE-USA communicates directly with Congress, works with other engineering societies through the American Association of Engineering Societies and participates as a member of the Immigration Reform Coalition. Last, and certainly not least, we encourage IEEE U.S. members to take an active role in expressing your own opinions and experiences to your representatives in Congress.

How you can help:

- ◆ Pay a visit, make a call, or send a message to your Senators and/or Representative conveying your views on legislation to increase entry of temporary foreign professional guest workers through the H-1B visa program. You can use IEEE-USA's Legislative Action Center to send a message.

- ◆ Write a letter to the editor of your local newspaper expressing your views.
- ◆ Read our suggested Talking Points and the background materials below to help hone your message before writing or calling.
- ◆ If you are an IT professional with a personal experience regarding the job market, H-1Bs, or age discrimination, provide feedback to the National Research Council's Computer Science and Telecommunications Board, which is doing a comprehensive study for Congress on Workforce Needs in Information Technology
- ◆ Volunteer your time and/or money to support candidates who are willing to make the H-1B visa program a campaign issue.
- ◆ Help support IEEE-USA's efforts by providing information on H-1B visa abuses and by joining IEEE-USA's grassroots network.
- ◆ Enlist the help of colleagues, fellow IEEE members, friends and family with similar concerns.

### Action Alerts and Legislative Bulletins

Current Action Alerts on the H-1B issue can be found in IEEE-USA's Legislative Action Center at <http://congress.nw.dc.us/ieee> These include:

**IEEE-USA Sponsored Study Analyzes H-1B Visa Population** On April 17, Georgetown University's Institute for the Study of International Immigration released an IEEE-USA sponsored study on H-1B Temporary Workers, which concludes that if pending legislation passes and the H-1B ceiling is set at 195,000, the population will peak at 710,000 in 2002. The report also forecasts that the permanent immigration system will absorb only 25,000 H-1B workers and their families each year, given historical trends, current caps on employment-based visas, and per-country ceilings on admissions. Less than 25% of the H-1B workers admitted under ACWIA are likely to be able to adjust.

#### IEEE-USA Issues Alerts Opposing S.2045

#### IEEE-USA Testifies at NRC IT Workforce Hearing IT Workforce Project Seeks Details of H-1B Abuses

The National Research Council's Workforce Needs in Information Technology Work Project is requesting input from high-tech professionals with details of H-1B program abuses and related incidents of age discrimination.

**Input Sought From IT Professionals** In the same legislation that last year increased the current cap on H-1B visas for temporary high-tech guest workers, Congress mandated a study by the National Academies of Science and Engineering on U.S. high-tech workforce needs over the next ten years, with emphasis on information technology (IT). The study was intended to provide Congress with a better understanding of

the high-tech workforce and whether continuing demand for IT workers justified an extension or further expansion of the H-1B visa caps when the measure expires in 2002. <http://www4.nationalacademies.org/cpsma/itwpublic2.nsf> gives more information on the Workforce Needs in Information Technology study. The IEEE-USA web site includes a link to the IT Workforce Project allowing input directly through its on-line questionnaire.

### Key Bills

Several bills have been introduced recently, details of which can be found on the web site. These include the Temporary Worker Temporary Relief Act, which aims to provide for a 3 year increase in H-1B visa ceilings and to implement additional measures to prevent fraud and abuse in the H-1B program. As well as eliminating numerical limits on H-1B admissions in 2001, 2002 and 2003 and transferring responsibility for maintenance of H-1B visas issued statistics from the INS to the Department of State, the bill includes transparency provisions, employer attestation requirements, minimum salary requirements, English language proficiency, and anti-fraud provisions.

The Hi-Tech Act of 2000 aims to amend the Immigration and Nationality Act to promote a fairer and more efficient means for using highly skilled workers, to improve the collection and use of H-1B non-immigrant fees and for other purposes.

Key provisions of The American Competitiveness for the 21st Century Act of 2000 bill include increases in H-1B speciality occupation admissions ceilings: 80,000 in 2000 (from 115,000 to 195,000); 87,500 in 2001 (from 107,500 to 195,000); and 130,000 in 2002 (from 65,000 to 195,000).

### Other Resources

The web site lists related IEEE-USA press releases, as well as a number of links to other resources to aid the reader in better understanding different perspectives of the issues discussed.

### How to Join

IEEE-USA is looking for members interested in public policy issues and legislative developments related to public policy issues and legislative developments related to immigration reform, temporary guest-worker programs, and related issues to join our Immigration Reform Grassroots Network. As a Network member, you will receive regular updates from IEEE-USA on immigration policy issues, including issue briefs, copies of related IEEE-USA position statements, legislative bulletins, and action alerts. As a Network member, we will ask you to respond to our Action Alerts by writing/contacting your representatives in Congress to offer your. To join, all you need to do is subscribe to the [ieeusa-immreform](mailto:ieeusa-immreform) mail list.

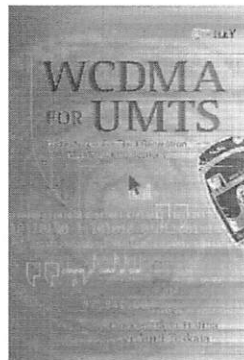
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## Book Review

### WCDMA for UMTS Radio Access for Third Generation Mobile Communications

Edited by Harri Holma  
and Antti Toskala  
Published 2000 by  
John Wiley & Sons  
ISBN 0 471 72051 8  
Price \$79.95

*Reviewed by Ian Groves*



Mobile wireless systems have become the ubiquitous means of mass telecommunications over the past 15 years. The early 'first generation', analogue systems were optimised for voice communications only but the proliferation of differing standards, particularly within Europe led to the development of a common digital based approach. The resulting 'second generation' system, GSM, now dominates the world mobile market; however this system, too, was designed and optimised primarily for voice services, albeit with the option for low speed data over the over the voice channel. Over recent years the growth in demand for access to internet based multi-media services on fixed networks has served as the driver for the 'third generation' a world-wide, high data rate, multi-media enabled mobile telecommunications system.

What is now emerging, globally, is a range of proposals under the generic title IMT2000 for a terrestrial system

based on five radio interfaces standards and three core network technologies – all of which should provide for full inter-working of services and applications in all continents!

Next generation mobile wireless systems clearly embrace a wide range of technical disciplines and are influenced in no small part by the underlying commercial and political aspirations of the many parties world-wide committed to its successful implementation. Indeed it is difficult for any individual to remain expert in all the necessary areas.

Within Europe the adopted approach is known as UMTS. A new radio interface based on WCDMA (Wide Band Code Division Multiple Access) is currently in the final stages of standardisation for a first release (R '99) and the initial UMTS system will be based on a GSM core network as enhanced to support the soon to be publicly launched GPRS packet data system.

The standardisation work for UMTS is being carried out under the auspices of 3GPP, the 3<sup>rd</sup> Generation Partnership Project and the editors and chapter contributors of this new book, all of whom are with Nokia, are to be congratulated on providing a detailed description of the WCDMA air interface and its utilisation and in providing a set of references to the appropriate 3GPP Technical Specifications.

Chapter 1 introduces the third generation air interfaces, the spectrum allocation, the time schedule and the main differences from second generation air interfaces. Chapter 2 presents example UMTS applications, concept phones and the quality of service classes. Chapter 3 introduces the principles of the WCDMA air interface, including spreading, the Rake receiver, power control and handover. Chapter 4 presents the background to WCDMA, the global harmonisation process



and the standardisation. Chapters 5-7 give a detailed presentation of the WCDMA standard, while Chapters 8-11 cover the utilisation of the standard and its performance.

Chapter 5 describes the architecture of the radio access network, interfaces within the radio access network between base stations and radio network controllers and the interface between the radio access network and the core network. Chapter 6 covers the physical layer (layer 1), including spreading, modulation, user data and signalling transmission, together with the main physical layer procedures of power control, paging, transmission diversity and handover measurements.

Chapter 7 introduces the radio interface protocols, comprising the data link layer (layer 2) and the network layer (layer 3). Chapter 8 presents the guidelines for radio network dimensioning, gives an example of detailed capacity and coverage planning and addresses GSM co-planning. Chapter 9 covers the radio resource management algorithms that guarantee the efficient utilisation of the air interface resources and the quality of service; these algorithms are for power control, handover, admission and load control.

Chapter 10 presents packet access in WCDMA and includes the results of dynamic system simulations. Chapter 11 analyses the capacity and coverage of the WCDMA interface at rates up to 2 Mbps. Chapter 12 introduces the time division duplex (TDD) mode of the WCDMA air interface and its differences from the frequency division mode (FDD). A brief overview of the characteristics of multicarrier CDMA, one of the alternative air interfaces proposed for IMT2000 is given in Chapter 13.

Whilst not a book for the novice, WCDMA for UMTS does achieve its objective in presenting a detailed description of the FDD operating mode. The TDD mode, which in the opin-

ion of this reviewer will have a very significant part to play in the future of UMTS, particularly given the asymmetric nature of multi-media traffic and the unpaired spectrum allocations available both now and likely as extension bands for UMTS, does not receive all the attention it deserves and, inevitably, the standardisation activities have moved on in both this area and that for packet access since the book was published. And for those seeking an overview of the complete UMTS System, the text does not address the core network for UMTS.

That said, this is the first book published to describe the UMTS air interface and I would certainly recommend it as the starting point for anyone seeking a way in to the 3GPP Technical Publications.

*Dr Ian Groves (isgroves@iee.org), formerly with BT Laboratories, is an independent telecommunications consultant and former Chair of the UK Third Generation Advisory Group*

*Order this book direct from the Publisher, John Wiley & Sons, at the special price of \$67.95 plus shipping & local sales tax. Please e-mail nlaverde@wiley.com, or send your order to Nelson Laverde, STM Marketing, John Wiley & Sons Inc, 3<sup>rd</sup> Avenue, New York, NY10158-0012 quoting VTS 8/00.*

**Editor's Note:** The VTS has arranged for a discount on this book as a service to members, but this should not be taken as a recommendation for a particular book, publisher or technology proposal. The review was commissioned by the VTS News, not the publisher. If you have an idea for a book review, please contact the editor.

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## Letters

May 19, 2000

Dear Sir,

I have the following informational comments on the excellent article by Amtrak's Mr. Andrew L. Jones ("Amtrak's Richmond Static Frequency Converter Project", on pages 4-10 of last issue, VTS News, Volume 47, No 2):

**Page 5, left-hand column, first paragraph.**

The following North American locomotives were motor-generator machines that converted the single-phase AC to DC for the traction motors. All but one of these electrifications were at 25 Hz. (The specified page numbers refer to Reference [1]).

- Detroit, Toledo and Ironton Railroad. Operated 1925 to 1930. Two units, 22kVAC to 600 VDC. (Pages 372-374.)
- Carol Mining Division of the Iron Ore Company of Canada (near Labrador City, Province of Labrador, Canada). Operating from 1963 to the present. Nine units, 2.3kVAC (60 Hz) to 600 VDC. (Pages 406-407 and 435.)
- New York, New Haven and Hartford Railroad. Class EF-2 freight locomotives (seven units) from General

Electric. Operated 1926 to early 1950's. 11kVAC to ?VDC. (Page 97.)

- Great Northern Railroad. 11kVAC to various DC voltages. Locomotive classes: Z-1 (of 1926 and 1928), five units; Y-1 (of 1928 and 1931), eight units; and W-1 (of 1947), two units (all retired 1956). Note; seven Y-1 units were used by the Pennsylvania Railroad (1957-1962). (Pages 167-173.)
- Virginian Railroad. Locomotive class EL-2B (four units). Operated 1948 to 1962. 11kVAC-600 VDC. (Pages 195-199.)

**Page 6, Figures 3 and 4.**

Pictured is a model of a three-phase high-voltage (12 kV) highspeed (200-250 km/h) Siemens and Halske railcar from 1901. This sample car (and a similar AEG railcar) were tested on a 22.5 km German military railroad (Zossen-Marienfelde, near Berlin) during 1901-1903. The three-wire "catenary" was only on one side of the single test track. (Details may be found in Reference [2]).

**Page 6, right-hand column, second paragraph.**

The mentioned 25 Hz phase balancer (three-phase input to single-phase output) was in use from 1914 (when the initial segments of the Philadelphia-to-Paoli suburban electri-

fication were energized) until 1971 (probably when PECO de-energized its last 25 Hz three-phase generator). (See "Schuykill" in Reference [3])

**Page 7, right-hand column, third paragraph.**

Note that Figure 9 was not printed in this publication. Also, the existing Richmond motor-generator frequency converters were capable of being directly fed by the 13.8 kV bus of PECO's Richmond Generating Station before that facility was retired. (See Figure 8 on page 7.)

Fred M. Perilstein, P.E.  
Springfield, New Jersey

**References**

- [1] Middleton, William D.; "When the Steam Railroads Electrified", 1974, Kalmbach Publishing Company, Milwaukee, Wisconsin.
- [2] Haut, F. J. G.; "A History of the Electric Locomotive, Volume II, Railcars and the Industrial Locomotive", 1981, A. S. Barnes and Company, La Jolla, California. Pages 34-37.
- [3] Jones, Andrew L.; "A New Power Supply for the Northeast Corridor", 1993 ASME/IEEE Joint Railroad Conference Proceedings, page 59. See the table labeled, "Original 25 Hz Traction Power Supply".

**Editor's Note:** As Mr Perilstein has pointed out, Figure 9 for Andrew Jones's article in the last issue went AWOL at some point during copy editing, and nobody noticed. Red faces all round. The missing figure is reproduced below. Our sincere apologies to Mr Jones, and thanks to Mr Perilstein for his helpful comments.



Photo ©2000 Andrew J. Lewis

**Figure 9.** One of the rotating frequency converters at Richmond Station.



**Call to Members in the Boston Area**

VTS is looking for a member who would like to take on the challenging opportunity of Chairperson which would both mold a chapter to the Boston, MA environment, and grow professional in the process.

If interested please provide a description of VTS Activities and interests to Gaspar Messina, VTS Chapter Activities Chairman at 9800 Marquette Drive, Bethesda, Maryland 20817 or Fax: 202-418-1412.

A selection committee will make the choice. The individual selected will receive full support in forming a chapter from the VTS Board of Governors.

The individual selected will have to take over on going work there from the interim chair for an upcoming conference in the Boston area this fall.

**Convergence 2000 Venue Change**

Due to the demand for exhibit space, the Convergence Conference has been moved to Cobo Hall in downtown Detroit from the Hyatt Regency in Dearborn where it has been held for over 20 years. The dates for the Conference remain the same i.e. October 16-18, 2000. Hotels in Detroit that are close to Cobo Hall include the Westin in Renaissance Center

and the Marriot (formerly the Omni). See the article in this issue for further details.

**Propagation Committee**

We regret that Sam McConoughey was slightly misquoted in the report of the 21 February 2000 VTS Board of Governors' meeting. The result left the impression that the Propagation Committee was no more!

The full text should have read, "Sam McConoughey expressed concern over the apparent demise of the Propagation Committee's *selected reprint volume on Land-Mobile Communications Engineering.*" the text in italics being omitted. This volume, originally issued in 1983, is a very useful compilation of many classic papers in mobile radio propagation, and as reported at the May Board meeting, plans are now well in hand for the reprint. A few missing words make all the difference here!

The IEEE VTS Propagation Committee's e-mail discussion-list has attracted almost 300 participants and the Propagation web site has had a few thousand visitors since the committee was reactivated last year. Anyone with an interest in radiowave propagation is encouraged to contribute to both the on-line discussion and the web site content. For more information, please visit <http://members.home.net/>

propagation/ or contact the Propagation Committee Chair, Dr. Dave Michelson, [dmichelson@ieee.org](mailto:dmichelson@ieee.org).

## Al Gross Awarded LEMELSON-MIT Lifetime Achievement Award

Mr. Al Gross, IEEE-VTS Fellow, and member of the VTS Distinguished Speakers Program, received a prestigious honor April 27, 2000, when he was given the LEMELSON-MIT Lifetime Achievement Award both as a pioneer inventor for wireless communication devices, and for his tireless commitment as an invention educator.

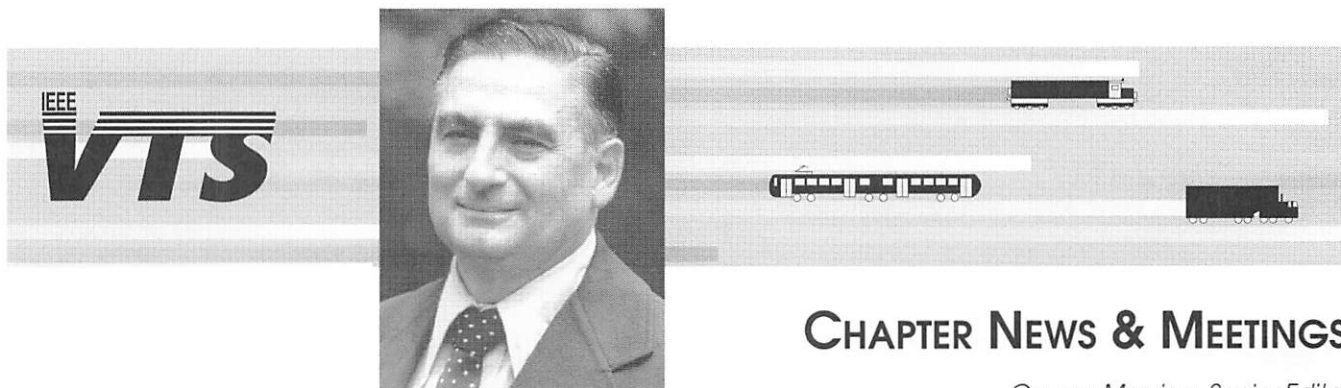
The award ceremony was held at the American Museum of National History in New York City.

## VTS Awards

Unfortunately our increased page budget has still been outstripped by the increase in material to publish, which has meant that the awards column for VTC2000-Spring has had to be held over to the next issue.

## VTC 2001-Fall Web Site

The address of the web site for VTC 2001-Fall, which will be held in Atlantic City, New Jersey, 7-11 October 2001 has changed from a dot.com to a dot.org. The new address is <http://www.fallvtc2001.org> A Call for Papers for the conference will appear in the next issue.



## CHAPTER NEWS & MEETINGS

*Gaspar Messina, Senior Editor*

### Note to VTS Chapters

VTS Chapters world-wide are eligible to receive \$100.00 at the end of the calendar year for submitting L-31 Meeting Attendance Forms reflecting their Chapter's periodic meeting to VTS Chapter Activities Chairman.

Gaspar Messina,  
9800 Marquette Drive,  
Bethesda, Maryland 20817, U.S.A.

### Philadelphia, Pennsylvania

This chapter has held two meetings recently. The first, on 8 March 2000, was an update on Amtrak's High Speed Programme, which was given by Mr Frank Grabouski from LTR Engineering. Then on April 12, Mr John Samean from Systra gave a talk on "SEPTA's Market Frankford Subway Elevated Line Automatic Train Control Project".

### Benelux

The Joint Chapter on Vehicular Technology and Communications made three best paper awards at VTC'99-Fall last September. These were:

- ♦ To **Y-C Liang, F Chin, and KY Ray Lui** for "Downlink beamforming for DS-CDMA Mobile Radio with Multimedia Services"
- ♦ To **A S Stefanov and T M Duman** for "Turbo Coded Modulation for Wireless Communications with Antenna Diversity"

- ♦ To **J S Hammerschmidt, A A Hunter and C Drewes** for "Comparison of Single Antenna, Selection Combining and Optimum Combining Reception at the Vehicle"

### Communications Symposium 2000

Also from the Benelux, the Chapter will be holding this event on 19 October 2000 at the IMEC Auditorium in Leuven, Belgium. Guest speakers include Prof Hikmet Sari, Pacific Broadband Communications, Prof. Savo Glisic, University of Oulu, Prof Lajos Hanzo, University of Southampton and Prof. Arogyaswami Paulraj from Stanford. Further details of the event can be found on <http://www.imec.be/IEEE-VTC/>

### New York Section

The IEEE NY Section Vehicular Technology and Communication Society Chapters will co-sponsor a technology-sharing forum: **Rail Signal System Innovations Forum** on October 18, 2000, 6:00 to 8:00 PM at **Nortel Networks** 320 Park Avenue, (50<sup>th</sup> ST) NYC.

Lead panelists will explain and answer questions on the Communication Based Train Control (CBTC) system that is being developed for the Southeastern Pennsylvania Transportation Authority and the new signal system being developed for the Southern New Jersey Light Rail Transit System with a shared Right-of Way for freight service.

Lead panelists are **John LaForce** and **Brian Middleton**. John is an IEEE Member, Voting Member on the IEEE



CBTC Standards Committee, and Deputy Chief Engineer Operations for SEPTA. Brian is the Booz-Allen & Hamilton Rail Systems Project Manager working on the NJ Transit Southern New Jersey Light Rail Transit System. Systems engineers, suppliers, installers, and operators are invited to share insights.

Future IEEE NY Section, Vehicular and Communication Society Technology Sharing forums are being planned for:

- ◆ Fiber Optic Communication networks for Rail Vehicle control,
- ◆ NYC Transit R-143 Rail Car propulsion, control, and signage,

- ◆ Automatic Bus Location and Control Systems, and
- ◆ Wayside and Railcar PA and Customer Information Systems

There is a \$35.00 charge for the forum and refreshments commencing 5:30 PM. **Advance registration is required for admission.**

IEEE Members and non-members may register for the October 18, 2000 forum by sending \$35.00 checks payable to IEEE NY Section to RT&T Inc., 30 Woodlake Dr., Croton-on-Hudson, NY 10520. IEEE Members please provide membership number and indicate interest in participating in one or more of the planned forums.

## VTS News Questionnaire Results

In the November 1999 VTS News, we published a short questionnaire to seek feedback on the areas members felt were most important for us to cover. Response to the questionnaire was quite good for a survey of this sort. In total, 45 responses were received.

Perhaps not surprisingly, there was unanimous support for the idea that it was important that the VTS has a newsletter. Anyone holding the opposite viewpoint would probably not have bothered to return the questionnaire. However, one respondent did point out that it was only important if it was done well.

Responses to the second question, "Do you think that the primary purpose of the VTS News should be to keep members informed about the VTS and its activities, or to keep members informed about developments in the area of the vehicular technology?", were interesting because although the intention was that the question be answered either/or, 23% of respondents picked both boxes. This includes almost all written responses – members filling out the questionnaire on the web found it physically impossible to choose both as it was set up as a radio box. Of those expressing a specific preference, technological developments were favoured.

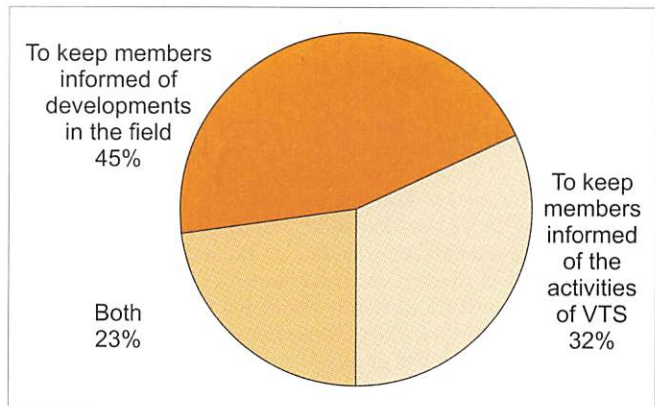


Figure 1. Primary Purpose of the VTS News.

The next question asked respondents to rate various types of articles on a scale of 1 (least important) to 5 (most important). The outcome is shown in Figure 2. The clear winner is technological reports on recent developments.

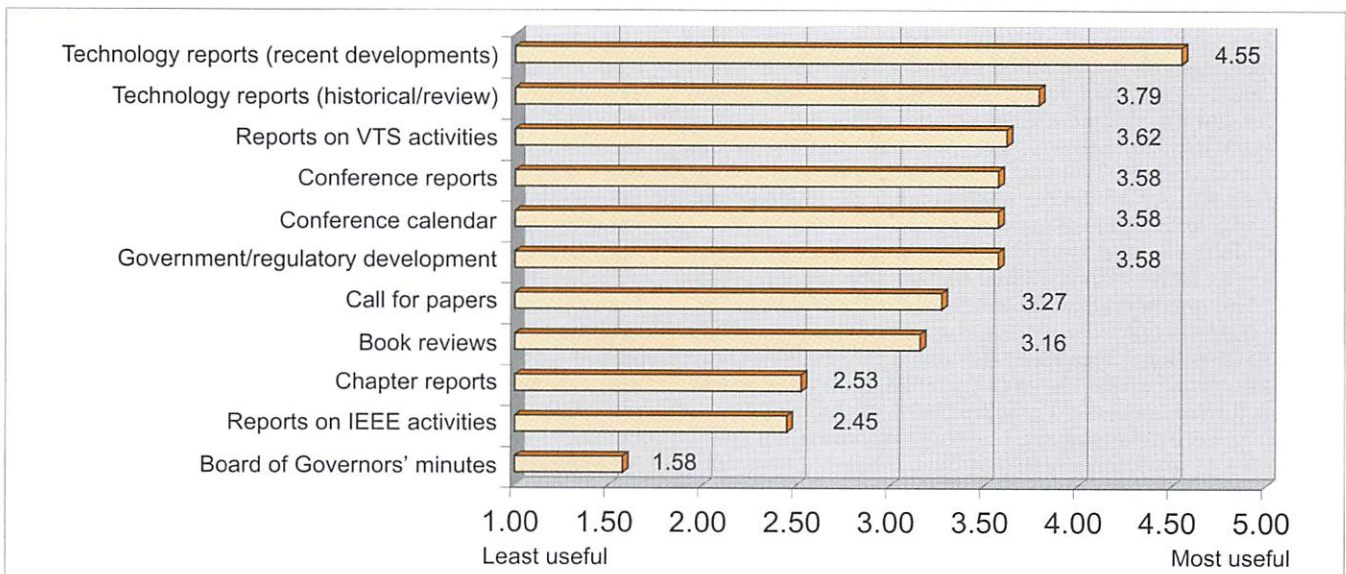


Figure 2. Ratings of usefulness of different types of articles.

Historical and review type technology articles, reports on VTS activities, conference reporters and the conference calendar come next along with government and regulatory development. Calls for papers and book reviews are not far behind. However, Board of Governors' minutes, chapter reports and reports on the IEEE activities do seem to be less popular. The latter is not particularly relevant to the VTS News as members can find the information out from other IEEE publications. The lack of interest in the first two, however, is disappointing.

The next question invited members to contribute to the VTS News. In fact about half of the respondents volunteered. Work and family commitments were the most common reasons for declining, although one member said that at 85 years of age, he should not contribute. With that level of experience, the opposite should be the case.

Respondents were invited to specify one single thing which would improve the newsletter for them. While these are obviously very specific to the individual they are none-

theless interesting. Information on upcoming conferences or conference programmes in advance were cited by number of responses. Understandable technical articles were the theme of a number of responses, with the wish for review type tutorial papers, and articles from practising engineers. One respondent noted the importance of tutorial articles, since it can be difficult for academics and engineers to admit to gaps in their knowledge. Requests for additional content range from the very general "overall increase in content" to requests for more land mobile radio communication articles and for more rail transit material, or a broader spectrum of coverage of transportation. The current format came in for praise, with the thematic grouping of articles and consistent format. The most innovative suggestion was for a "VTS people" column to list notable biographies.

Other comments were a few in number, but one sums up the whole exercise: "what is needed is value for money".

For a response from the Editor, please see the Foreword on Page 3.

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## 17th May 2000 VTS Board of Governors Meeting Report

The VTS Board of Governors' Meeting was held at VTC 2000-Spring in Toyko. President Kent Johnson was in the chair, with Board Members Charles Backof, Dennis Bodson, J. R. Cruz, Bob French, Anil Kripalani, Mel Lewis, George McClure, Sam McConoughey, Tom Rubinstein, Ray Trott, and Vice President Harvey Glickenstein. Also present at the meeting were Vijay Barghava, James Irvine, Jae Hong Lee, Tadashi Matsumoto and Reuvan Meidan.

Before the meeting started, a presentation was made to Tadashi Matsumoto in appreciation of his work for the conference. Mel Lewis, responsible for conference liaison, and Kent Johnson both agreed that he had set a new standard in conference organisation.

**VTS President Kent Johnson** reported that the new IEEE financial model, which would 'tax' societies to fund the central overspend based on members rather than surplus, has not yet been approved. This means that the claw-back is likely to be based on the amount of savings which each society has, so in effect the society was being taxed for doing a good job. Other societies are just as vocal in their opposition to the proposal. On other matters, in the 1998 citation report, Transactions in Vehicular Technology was rated 36<sup>th</sup> out of 208 for total number of citations and 51<sup>st</sup> out of 206 in terms of articles cited.

Kent Johnson said that there was a need for a Board Member to have responsibility for membership recruitment. The membership brochure also needs updating. James Irvine proposed over printing the next issue of VTS News so that all registrants at the next VTC receive a copy. This can be done within the existing budget and was agreed. Dennis Bodson suggested checking who of the conference attendees were not members, and those who were not could be given free six-month memberships. Some of them may then renew at the end of the year. This technique has been used successfully by the Communications Society. It was agreed to pass on all ideas to the membership board member when appointed.

**VTC 2001-Spring Chair Reuvan Meidan**, reported on plans for the conference. The technical programme committee is now staffed and an organising committee is in place. A call for papers is now available, with a deadline of the end of September 2000. The social programme includes a tour of Jerusalem rather than a banquet. Attendees will receive a CD and a booklet with extended abstracts rather than paper proceedings. They had hoped to dispense with paper copies of the proceedings, but as the proceedings are part of the IEEE All Publications package, hard copies must be produced.

**Ray Trott, Awards Committee Chair**, gave a list of the awards which would be presented at the conference. Full details will be included in the next issue of VTS News.

**Charles Backof, Treasurer**, reported that there was an exceptional increase in conference income from closed conferences which went through the books in 1999. This made 1999 a very good one for the society, with a \$419,000 surplus from an income of \$1,636,100 and expenses of \$1,216,500. Transactions costs were increased for the year - this is caused by increasing the page count. Subscription income increased due to an increase in the subscription charge for non-members. Given the transactions healthy ranking in the citation scale, IEEE headquarters had recommended another increase for non-members, but it was decided to scale this back due to the last increase, and the subscription will therefore rise from \$375 to \$385 for 2001. As of September 1999 there were 4545 members, 733 student members, 7 affiliates and 140 other members, making a total membership of 5436. It was noted that publications break even overall; profit in the transactions paying for the newsletter. Current reserves pay for one and a half years of running costs. Foundation accounts are generating enough income to offset expenses, and so are in good shape. The budget for 2001 was approved. It was also agreed to move \$100,000 to the long-term investment account.

**Sam McConoughey, Past President and Elected Board Member**, suggested that the society's founder, Jim

Evans, was not fully recognised. He proposed that the Avant Garde award be changed to the James Evans Avant Garde award with a purpose-designed medal.

**Administrative Matters** : There was a surplus of about 90 sets of hardcopy proceedings from VTC in Tokyo. It was decided to revise the number of printed copies suggested in conference guidelines. After some discussion as to whether to sell the remaining copies off at below cost price, it was decided not to do so given the number purchased at full price. It was agreed that in future only the copies required will be printed, with members wishing hard copies having to register before the advance registration deadline.

Mel Lewis proposed that the society purchase a higher quality electronic camera for recording meetings in conferences to increase the graphic content in the newsletter and other publicity material. This was agreed.

**VTS News Editor, James Irvine**, reported an agreement for the next August edition of the newsletter whereby the Antennas and Propagation Society would publish publicity for the Vehicular Technology Society in their magazine, and the Vehicular Technology Society would reciprocate in the VTS News. George McClure agreed to write the page for the Antennas and Propagation Magazine.

Sam McConoughey asked whether advertising had been considered for the newsletter. While this has been done in the past, it was not particularly effective. After some discussion, it was agreed that the primary purpose of the newsletter was as a resource to members and not as a source of income, and so would not be appropriate to seek advertising. The Newsletter Editor proposed an update to the front cover to allow the tag line, "Connecting the Mobile World" to be made more prominent. This was agreed, as were proposals to increase the budget of the VTS News to allow for increased content and use of colour.

**Web Based Wireless Course** : Mel Lewis made a presentation on the wireless course. There is still some further work required to complete the course, but after discussing the current state of work the Board felt that given what had been learned, a better use of the time may be to write off the original course. It was agreed to report the comments back to the chair of the Education Committee, Yu-Dong Yao. It was further agreed to proceed with the IEEE/VTS videos proposed on *Wireless Networking* and *CDMA* as stand-alone ventures.

**VTC 2003-Spring Chair, Prof. Jae Hong Lee** gave a short report on progress. This was followed by a report on **VTC 2002-Fall by Chair Prof. Vijay Barghava**. They have a contract with the Hyatt Regency in Vancouver for 24-28 September 2002, and room rates are approximately \$215 Canadian. They are aiming for about 350 oral papers, emphasising relevance, quality and industrial content. Vijay Barghava noted that many the papers in Tokyo were presented by students. This promoted some discussion on the relative merits of student participation and whether the conference committee should not plan on accepting more papers.

**Dan Noble Fellowship Chairman, Charles Backof**, who had already given his treasurer's report, reported on the Fellowship. They are planning to award the Fellowship in the fall.

**Dennis Bodson, Chair of the Standards Committee**, has updated web site with new rail standards. He is preparing for a new column for the VTS News from November. There is an online subscription scheme for new standards, and details of this will be included on web site. Dennis has recently been elected to the board of the IEEE Standards Association Board of Governors, where one of the entities he is responsible for is the VTS.

**J. R. Cruz, Editor of the Transactions on Vehicular Technology**, reported that the page count for the transactions for next year will be 2500 pages, which is the same as for last year. This increase had made a major dent in the backlog, and another year should allow the transactions to catch up. He has also tasked an associate editor to look at Manuscript Central, a program for electronically managing the review process for articles.

**Bob French, ITS representative**, reported that the last ITS Council meeting was in November 1999 and the next one was not planned until the first of October this year, so as yet there was nothing to report. The ITS Council is concentrating on its annual conference now it is established. He had agreed to review the ITS video and make recommendations regarding its possible updating to the ITS Council at its next meeting, which will be next October.

**Anil Kripalani, Elected Board Member**, agreed to take on responsibility for new member recruitment, and he will be assisted by George McClure, Sam McConoughey and Kent Johnson. The VTS brochure is to be updated.

**Mel Lewis, Conference Coordinator**, reported on the remaining conferences. **VTC 2000-Fall** in Boston is well under way. They have received over 1000 papers, and expect to accept around 700 of them. There is room to present 500 as oral papers, with the remainder as posters. Author notification is imminent. Only the Award Luncheon will be hosted; the remaining lunches will be pay-as-you-go lunch boxes with seating in the poster area to encourage networking. Five tutorials are arranged, with two more in the planning stages and the advance programme should go out in mid June. **VTC 2001-Fall** in North Jersey will be in the Sheraton Atlantic City Convention Centre Hotel between the 6<sup>th</sup> and 11<sup>th</sup> of October 2001, which avoids religious holidays. The IEEE will be handling registration, and a call for papers is being prepared. **VTC 2001-Spring**, **VTC 2002-Fall**, and **VTC 2003-Spring** were subject to separate reports earlier in the meeting.

**Jim Worsham, Elected Board Member**, sent in a written report on the past conferences which are not yet closed. The surplus from VTC'99-Spring exceeds \$72,000 and has been sent the IEEE, but the final audited accounts are not yet available, and until this is received by the IEEE the money will not be released. This is being pursued. For VTC'99-Fall in Amsterdam, final figures are awaited, but initial indications are to expect a loss of around \$10,000. The 1997 Joint Rail Conference has now been closed out. The 1999 Joint Rail Conference is still open. There is currently a small surplus, but there may be some final bills to come in.

It was agreed that the fine for late close out of conferences, from this autumn onwards, will be charged to the chapter or section proportion of a surplus rather than shared between them and the VTS, since it is the chapter or section's responsibility to complete the accounts on time.

**Bob Mazzola, Convergence Conference Committee Representative** and Vice President Motor Vehicles, submitted a written report. He reported that Convergence 2000 had to be moved from the traditional Hyatt Regency Hotel in Dearborn to Cobo Hall in Detroit, Michigan due to the overwhelming need for additional exhibit space. He has also worked with Bob Fenton in selecting this year's Convergence Fellowship Award recipient. The Award, which includes a \$12,000 stipend, will be presented by President Kent Johnson at Convergence 2000 in Detroit.

**George McClure, Publicity Committee Chair**, reported on the chapter development work he has been undertaking in conjunction with Gaspar Messina. An e-mail reflector has been set up to make communications with



chapters easier. Some chapters have been sending L31 forms as required to the IEEE in Piscataway, but not sending them to Gaspar Messina. In fact only three had done so. One problem was that there are many joint chapters with other societies. There was a subsidy of \$100 dollars to chapters who do send in the correct forms, and there is a need to advertise this. Gaspar Messina will be writing a report on the recent award for Al Gross for the newsletter.

**Tom Rubinstein** reported on **Conference Site Selection**. It had proved impossible to find anywhere in Region 9 to hold VTC in spring 2002. Birmingham, Alabama had proposed themselves as a site for VTC in spring 2003, and he proposed that this be the site for spring 2002. Some concerns were expressed regarding the draw of the location, and transportation links. After a vote, it was agreed to hold VTC 2002-Spring in Birmingham. For fall 2003, he had received an inquiry from Budapest, but due to location of spring

2003, the next conference should be held in North America. He will therefore suggest that they might think of spring 2004. On **new member liaison**, he has updated the letter from the President. A new member had suggested a compilation CD of conference records. He had made some updates to the **web site** since last board meeting, and has switched to a new domain vendor. The new vendor allows subdomains (such as conferences.vtsociety.org), as well as e-mail forwarding. The latter feature will be used to allow alaises to be set up for the various roles within the society (for example, president@vtsociety.org).

**Eric Schimmel, Past President** sent in a report stating that he hoped to start the election process in July to avoid having to hold a further board meeting after the one in September. Nominations were therefore required by the end of June.

The next Board meeting will be held at VTC2000-Fall in Boston.

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# Call for Papers

VTC2001-Spring

May 6-9, 2001

David Intercontinental Hotel, Tel Aviv, Israel

The VTC 2001-Spring will be held in Tel-Aviv, Israel. At this moment in time, the industry is at the brink of a revolutionary leap forward. That of moving from the plain telephone services to the new era of multimedia, internet and e-commerce services all for the mobile user. In view of the commercial success of wireless mobile telephony on one hand and the wireline internet on the other, their marriage is very much in focus of society and the focus of our conference. On this background papers are solicited along the following primary areas.

◆ **Antennas & Propagation (01)**

Adaptive Antennas and Arrays, Channel Measurement/Modeling/Prediction, Indoor Propagation.

◆ **Wireless Access (02)**

Multiple Access Technology, Spread Spectrum Technology, OFDM Techniques, Access Protocols, Channel Assignment, Spectrum Efficiency, Resource Allocation, 4G Methods.

◆ **Transmission Technology (03)**

Modulation/Demodulation, Source/Channel Coding, Interference Rejection, Equalization and Synchronization, Multiuser Detection, Software Radio, Transceiver Design.

◆ **Multimedia, Network, and Systems (04)**

Mobile Multimedia Technology, Mobile Data/Computing/Navigation Networks, Wireless Packet Networks, Media Access Control, Enhanced Mobility IP.

◆ **Wireless Personal Communications (05)**

IMT-2000, Broadband Mobile Communications Sys-

tems, Cellular Technology, Location Techniques, 2.5G and 3G System Performance, Radio Network Design, Power Control Techniques, SS7/AIN meets IP

◆ **Mobile Satellite Communications (06)**

Mobile Satellite Communications, LEO/MEO/GEO Networks, Navigation

◆ **Transportation Applications (07)**

Intelligent Transportation/Vehicle systems, Vehicular Electronics, Communication Interfaces for Vehicle Operators.

◆ **Applications (08)**

Wireless Internet Methods, Wireless E-Commerce, Software agents, Hybrid Solutions.

Authors should submit an extended abstract up to 2 pages. Forms for submission are, camera ready (in 3 original) hard copies, or soft copy in MS Word, PDF or PS. The submission must include the name, complete return address, telephone and fax numbers, the designation number of the Technical Subject Areas of the paper, and e-mail address of the authors. Submissions should be sent to:

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**The VTC 2001 Secretariat,**

Dan Knassim Ltd.

P.O.Box 193 1, Ramat Gan 52118, Israel

Web-Site:<http://www.congress.co.il/ieee-new>

Tel: +972-3-6133340 (Ext. 209), Fax: +972-3-6133341

Email: vtc2001@congress.co.il

**Important Dates**

◆ Abstracts due by September 30th, 2000

◆ Notification of acceptance December 15th, 2000

◆ Submission of full paper by February 15th, 2001

## 2001 IEEE/ASME Joint Rail Conference

April 17-19, 2001

Toronto, Ontario, Canada

New applications of technology in the railroad and rail transit industries are presented periodically at conferences and trade shows. The annual IEEE/ASME Joint Rail Conference offers a unique and comprehensive technical forum. Welcome the new Century and new Millennium at the 2001 Conference in Toronto. Join your peers to share information, learn about technology progress, share operating experience, and find new approaches to current and future challenges.

The Conference is sponsored by the Land Transportation Division of the Vehicular Technology Society (VTS) of the IEEE, and the Rail Transportation Division of the ASME

Papers are invited covering topics of current interest in system design, hardware/software development, transportation technology, service experience, or related issues. Papers are solicited from members of the supply industry, rail transportation corporations and rail transit agencies, governmental agencies, consulting/engineering firms, academia, technical organizations, and others for presentation and discussion at the Conference. Prizes will be awarded to the top 3 IEEE papers presented.

This year's conference will feature a special theme: New Technology to Meet the Rail Industry Challenges of the 21<sup>st</sup> Century. Papers in this area are especially appreciated. All papers of interest are welcome on:

- ◆ Rail transportation, high speed passenger rail, heavy rail transit, light rail transit, automated people mover, and magnetic levitated systems.

- ◆ AC and DC traction propulsion and control systems, electric power distribution and energy efficiency.
- ◆ Signal and communication systems, automation and microprocessor control, Communications-Based Train Control (CBTC), and EMI/EMC issues.
- ◆ Automated train dispatching, data management systems, and operation control centers.
- ◆ Maintenance procedures, monitoring and fault detection, safety and quality assurance programs.
- ◆ Computer modeling and simulation of transportation systems.
- ◆ New starts and renovation projects.
- ◆ Rail-Highway Intersection Warning Systems and related ITS applications.
- ◆ Other applications of electrical or electronic technologies in rail transportation.

Authors are requested to submit 200-300 word abstracts in 5 printed copies. Electronic mail submission preferred. If submitting by mail or fax, please forward a diskette copy of your abstract, preferably in Microsoft Word 97 format

### Frederick R. Childs, Papers Chair

Land Transportation Division, IEEE-VTS  
Port Authority Trans-Hudson Corporation (PATH)  
One PATH Plaza, JSTC-108, Jersey City, NJ 07306 USA

Tel: +1 201-216-6270, Fax: +1 201-216-6576

E-mail: fchilds@panynj.gov

### Important Dates

- ◆ Abstracts due by October 1st, 2000
- ◆ Notification of acceptance November 15th, 2000
- ◆ Submission of full paper by January 15th, 2001

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## Meeting Report - Next Generation Wireless Networks

Mel Lewis

VTS is pleased to report on a symposium on "Next Generation Wireless Networks" The Vehicular Technology Society was represented on the organizing committee by Mel Lewis, who you also may know as VTS conference coordinator. This meeting was held on 26 May 2000 at NJIT (the New Jersey Institute of Technology, in Newark).

This one day event was presented by the New Jersey Center for Wireless Telecommunications, NJCWT, which is a consortium of four research universities (NJIT, Stevens-Tech, Princeton, and Rutgers). The NJCWT has four focus areas: Propagation and RF Engineering, next generation wireless transceivers, wireless networking, and services/applications/technology transfer. The NJCWT conducts frequent seminars, workshops, and symposia on the topic.

We also learned that the center is backed by the New Jersey Commission on Science and Technology, with first year support of over one million dollars from that agency. Administration of the NJCWT is located at NJIT, and led by Prof. R. Haddad, its director (haddad@adm.njit.edu).

There were over 60 attendees - representing academia, industry, the IEEE, and government. The call for papers resulted in speakers from 3 continents (Australia, USA, and Europe). Dr. S.-T. Mau, dean of the Newark College of Engineering, a unit of NJIT, gave the welcoming address. Dr. Sirin Tekinay, associate director, (tekinay@adm.njit.edu)

gave an overview of the center (refer to [www.njcwt.org](http://www.njcwt.org) for much more information).

The theme of the symposium was wireless networks, characterized by new architectures allowing broadband services (voice, data, image, video) via circuit and packet switched environments, with emphasis on wireless access to the internet and location-aware wireless services.

The morning session covered such topics as mobility tracking as applied to wireless internet service, Infostations, InfoCity (and QoS to mobile hosts), wireless ad hoc networks and geo-location. There were also talks on wireless broadband multimedia and IP applications via mobile ATM satellites.

The afternoon session, was just as cutting-edge, with 4 papers on such topics as assisted-GPS for wireless phone location, evaluation of location determination technologies, GSM mobile positioning trials. A popular presentation described a merger of wireless, geolocation, and life sciences in a unique product which is under development by NJCWT and a newly formed company. There was a paper on enhancing coverage and fault recovery using geolocation, and finally a talk on designing a killer application (UMTS applications development).

A printed bound handout was available with registration, and a formal proceedings will soon be available (with extended versions of the papers) from Kluwer Academic Publishers.

# 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
22-25 August 2000	ISAP	Fukuoka, Japan	<a href="http://www.crl.go.jp/pub/ISAP2000/">http://www.crl.go.jp/pub/ISAP2000/</a>
10-13 September 2000	RAWCON '00	Denver, CO	<a href="http://rawcon.org">http://rawcon.org</a>
12-14 September 2000	European Wireless 2000	Dresden, Germany	<a href="http://www.comnets.rwth-aachen.de/Wireless2000/">http://www.comnets.rwth-aachen.de/Wireless2000/</a>
18-21 September 2000	PIMRC 2000	London, United Kingdom	<a href="http://www.pimrc2000.com">http://www.pimrc2000.com</a>
23-28 September 2000	WCNC 2000	Chicago, IL	<a href="http://www.wcnc.org/2000">http://www.wcnc.org/2000</a>
24-28 September 2000	VTC2000-Fall	Boston, MA	<a href="http://www.vtc2000.org">http://www.vtc2000.org</a>
1-3 October 2000	3rd IEEE Conf. on Intelligent Trans. Sys. ITSC-2000	Dearborn, MI	<a href="http://www.ewh.ieee.org/tc/its/itsc2000/cfp-itsc-2000.html">http://www.ewh.ieee.org/tc/its/itsc2000/cfp-itsc-2000.html</a>
1-4 October 2000	Mobile Communications Summit 2000	Galway, Ireland	<a href="http://www.mobilesummit.ie/">http://www.mobilesummit.ie/</a>
4-5 October 2000	2000 European Conference on Wireless Technologies	Paris, France	<a href="http://www.eumw.com">http://www.eumw.com</a>
4-5 October 2000	IV 2000 IEEE Intelligent Vehicles Symposium	Dearborn, MI	<a href="http://WWW.CE.UniPR.IT/iv2000/">http://WWW.CE.UniPR.IT/iv2000/</a>
16-18 October 2000	Convergence 2000	Dearborn, MI	<a href="http://www.convergence2000.org">http://www.convergence2000.org</a>
19 October 2000	Communications Symp. 2000	Leuven, Belgium	<a href="http://www.imec.be/IEEE-VTC/">http://www.imec.be/IEEE-VTC/</a>
22-25 October 2000	MILCOM 2000	Los Angeles, CA	<a href="http://www.milcom2000.org">http://www.milcom2000.org</a>
6-8 November 2000	APWC '00	Waltham, MA	<a href="http://www.eece.unm.edu/apwc2000">http://www.eece.unm.edu/apwc2000</a>
6-9 November 2000	7 <sup>th</sup> World Congress on ITS	Turin, Italy	<a href="http://www.torino2000.itscongress.org">http://www.torino2000.itscongress.org</a>
12-15 November 2000	WPMC-2000	Bangkok, Thailand	<a href="http://www.tc.ait.ac.th/wpmc.htm">http://www.tc.ait.ac.th/wpmc.htm</a>
19-23 November 2000	ICCS 2000 7 <sup>th</sup> IEEE Singapore Int Conf on Communications	Singapore, Singapore	<a href="http://iccs.cwc.nus.edu.sg/">http://iccs.cwc.nus.edu.sg/</a>
22-25 November 2000	5 <sup>th</sup> CDMA International Conference CIC 2000	Seoul, Korea	<a href="http://cic.etri.re.kr">http://cic.etri.re.kr</a>
27 November – 1 December 2000	Globecom 2000	San Francisco, CA	<a href="http://delson.org/si/gc00/">http://delson.org/si/gc00/</a>
17-20 December 2000	ICPWC '00	Hyderabad, India	<a href="http://www.citr.ece.uvic.ca/icpwc2000">http://www.citr.ece.uvic.ca/icpwc2000</a>
20-22 February 2001	EPMCC 2001	Vienna, Austria	<a href="http://www.epmcc.com">http://www.epmcc.com</a> ✓
17-19 April 2001	Joint Rail Conference	Toronto, Canada	See page 43 ✓
6-9 May 2001	VTC 2001-Spring,	Tel Aviv, Israel	<a href="http://www.congress.co.il/ieee_new/">http://www.congress.co.il/ieee_new/</a> ✓
11-15 June 2001	ICC2001	Helsinki, Finland	<a href="http://www.icc2001.com">http://www.icc2001.com</a> ✓
9-12 September 2001	WPMC'01	Aalborg, Denmark	✓
7-11 October 2001	VTC 2001-Fall	Atlantic City, NJ	<a href="http://www.fallvtc2001.org">http://www.fallvtc2001.org</a>
Spring 2002	VTC 2002-Spring	Birmingham, AL	
September 2002	VTC 2002-Fall	Victoria, BC	mailto: bhargava@enr.UVic.CA
Spring 2003	VTC 2003-Spring	Seoul, Korea	mailto:m.lewis@ieee.org

Conferences marked '✓' have open calls for papers as of 31 August 2000. 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.

Corrections and additions to this list are most welcome. We are particularly interested in adding listings for Automotive and Transportation conferences. Please send corrections and additions to Tom Rubinstein at [t.rubinstein@ieee.org](mailto:t.rubinstein@ieee.org).