



IEEE

**VEHICULAR TECHNOLOGY SOCIETY**

**NEWSLETTER**

Vol. 34, No. 2, May 1987

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Editor: A. Kent Johnson

## **Holiday Inn Tampa International Airport**



**June 1-3, 1987  
37th Annual Conference**

## President's Message



**Robert Fenton**  
President  
IEEE Vehicular Technology Society

By now, I hope you have completed your plans to attend our 37th Annual Conference, VTC '87 in Tampa. If you have not, you should especially note that VTC '87 is highlighted in this Newsletter with a copy of the technical program included. Please examine the latter and note that our Tampa Conference Committee has compiled an excellent technical program with sessions in areas of high current interest and some outstanding panel discussions. Hopefully, this will convince you to join us for an outstanding technical event and an opportunity to enjoy Tampa.

Your Board of Governors will meet immediately after the Conference. Since the entire Board will be present both then and during the Conference, this will be a good opportunity for you to discuss matters of concern with Board Members and suggest issues that should be considered.

One Board action will be the election of a new slate of officers to serve for the upcoming year. Since I will have served my limit of two years as President of your Society, another Board Member will succeed me.

These two years, which have gone very fast, have been filled with IEEE and VTS activities. The experiences I've had were memorable and my participation has been a rewarding personal experience. I look forward to assisting the new officers and trying to keep Vehicular Technology on the MOVE!

Hope to see you in Tampa!

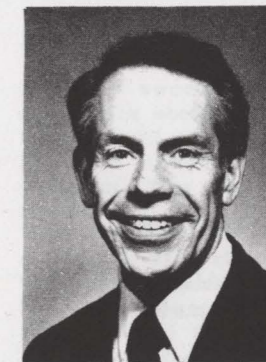
Best regards,

Robert E. Fenton

## Newsletter Staff

|   |   |
|---|---|
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## Editor's Notes



**A. Kent Johnson**  
Newsletter Editor

This edition of the newsletter features the upcoming Annual VTS Conference to be held June 1-3 in Tampa, Florida. Elsewhere in the newsletter you will find a complete listing of the papers to be presented at the conference and as you will see, the committee has arranged for an outstanding technical program. We hope you will be able to make it to Tampa and we look forward to seeing you there.

We would also like to extend sincere congratulations to two members of IEEE/VTS who were recently elected to Fellow Grade in the IEEE. They are:

Stephen S. Rappaport

For developing techniques for multiple-access communications and the acquisition of spread-spectrum signals.

Jerome G. Rivard

For leadership in the production and implementation of electronic control systems for vehicles.

We are proud to have these individuals as members of VTS and congratulate them on their accomplishment.

| Month of Issue | Final Copy to be Rec'd By VTS Editor | Target Mailing Date |
|----------------|--------------------------------------|---------------------|
| August         | 6-09-87                              | 7-13-87             |
| November       | 9-13-87                              | 10-15-87            |
| February       | 12-30-87                             | 1-27-88             |
| May            | 3-10-88                              | 4-14-88             |

# Society Officers and Board of Directors

## Board of Directors Report

### Samuel A. Leslie VTS Secretary

#### MINUTES OF THE IEEE VTS BOARD OF GOVERNORS MEETING

The IEEE VTS Board of Governors met on February 5, 1987 at the IEEE Washington Office at 1111 19th Street, N.W. The meeting was called to order at 9:03AM.

#### ROLL CALL

The following were in attendance:

|                    |                       |
|--------------------|-----------------------|
| # Robert E. Fenton | President             |
| # Roger Madden     | Vice President        |
| # Arthur Goldsmith | Treasurer             |
| # Sam Leslie       | Secretary             |
| # Evan Richards    | National Conf. Coord. |
| # Sam McConoughey  | Junior Past President |
| # Stu Meyer        | Senior Past President |
| # Fred Link        | Conference Site Sel.  |
| # Kent Johnson     | Newsletter Editor     |
| # Eric Schimmel    | CCIP                  |
| # Bill Misskey     | Assoc. Trans. Editor  |
| Bob McKnight       | Publicity Chairman    |
| Dick Uher          | Assoc. Trans. Editor  |
| Gaspar Messina     | Chapter Activities    |
| Neal Shepherd      | Propagation Committee |

(# denotes elected Board member)

Eleven of the fourteen present were elected Board members. A minimum of eight elected is necessary for voting on matters that come before the Board. Thus, a quorum was present.

Stu Meyer moved, Kent Johnson seconded that the agenda distributed by the Society President be adopted as presented. The vote was unanimous in favor.

Sam McConoughey moved, Roger Madden seconded that the minutes of the October 21, 1986 Board meeting be approved as published. The vote was unanimous in favor.

The Society President noted that Board Member Fred Link has been the recipient of the prestigious Fred M. Link Award from the Radio Club of America.

#### SOCIETY OFFICERS

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Society Secretary Society Treasurer

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(804) 385-7800  
(804) 525-7589 Home

#### BOARD OF DIRECTORS

NAME(Term thru) RESPONSIBILITY

|                           |  |
|---------------------------|--|
| Robert E. Fenton(88)      | President  |
| Arthur Goldsmith(87)      | Treasurer  |
| Leo M. Himmel(89)         | Chairman, Education Committee                          |
| A. Kent Johnson(89)       | Newsletter Editor                                      |
| Samuel A. Leslie(89)      | Society Secretary                                      |
| Fred M. Link(89)          | Chairman, National Site Selection                      |
| Charles Lynk(88)          | Chairman, Paper of Year Comm.                          |
| Roger Madden(87)          | Vice President   |
| Robert A. Mazzola(87)     | Chairman, Membership Comm.                             |
| George F. McClure(88)     | Chairman of Publications Comm. and Transactions Editor |
| Samuel R. McConoughey(89) | Immediate Past President                               |
| Stuart Meyer(88)          | Senior Past President                                  |
| William Misskey(87)       | Canadian Editor, Newsletter                            |
| Evan B. Richards(87)      | National Conference Coordinator                        |
| Eric Schimmel(88)         | Chairman, Personal Radio Comm.                         |

#### TREASURER'S REPORT

Arthur Goldsmith submitted his treasurer's report, and noted that the Society will probably finish the 1986 year with a surplus of around \$35K compared to a projected deficit of \$16K. Sam McConoughey moved, Evan Richards seconded that the treasurer's report be accepted as presented. The vote was unanimous in favor.

#### CONFERENCES AND MEETINGS

##### 1986 Dallas VTC

Evan Richards presented the Treasurer with a check of \$5176 for the balance of the proceeds from the 1986 Dallas Conference. He also discussed recommendations that the Dallas committee had for future conferences. In particular, the spouse's program was not well attended, and they recommended that future conferences could save money by down-scaling such programs. Also, they recommended obtaining better head counts for the luncheon and banquet meals.

##### MagLev & Linear Drives Conference

A copy of a letter from Tony Eastham was presented to the Board indicating that the Society's portion of the proceeds from the 1986 MagLev & Linear Drive Conference was \$825.84 (US). Bob McKnight indicated that he would like to receive timely information for the next MagLev & Linear Drive Conference for distribution through his publicity channels.

The Society is to be the technical sponsor for the next conference, which is scheduled for May 19-21, 1987 at Bally's hotel in Las Vegas.

##### Convergence Conferences

Evan Richards submitted a report from Bob Mazzola indicating that a record number of over 2200 attended the 86 Convergence Conference, with 900 being paid attendees.

##### 1987 Tampa VTC Conference (June 1-3)

Evan Richards reported that the 1987 Tampa conference planning and preparation is proceeding smoothly.

##### 1988 VTC Philadelphia Conference

The 38th Conference is scheduled for June 15-17, and will be held at the Holiday Inn - Center City, 1800 Market Street, Philadelphia, Pennsylvania, 19103. A new chairman has been named for this conference:

John Galanti  
Network Manager  
Bell Atlantic Mobile Systems, Inc.  
180 Mt. Airy Road  
Basking Ridge, NJ 07920

In addition, Jesse Russell is the technical papers chairman, and Bob Swint continues as the local arrangements chairman.

##### 1989 VTC San Francisco Conference

Fred Link reported that the San Francisco area is

anxious to host the 1989 Joint Railroad/VTC. Roger Madden moved, Evan Richards seconded that the Board accept the offer from San Francisco to host the 1989 Conference. The vote was unanimous in favor.

After discussion on possible dates and conflicts with other conferences, Sam McConoughey moved, Bill Misskey seconded that the date for the 1989 conference should fall in the window from April 10 to June 10, and is to be coordinated with the Railroad committee and the Land Transportation Chairman, Tony Eastham. The vote was unanimous in favor.

A problem with the location of the 1989 conference has been reported by Tony Eastham; the Board may have to revisit the issue, pending further inputs from the Land Transportation Committee.

##### 1990 VTC

The preferred location for the 1990 VTC is Detroit, however little response has been received from potential committee members in the Detroit area. Fred Link and Sam McConoughey is to continue pursuing Detroit as a potential area.

Sam McConoughey moved, Stu Meyer seconded that the Conference Coordinator's report as presented be accepted by the Board. The vote was unanimous in favor.

Also, Sam McConoughey moved, Bill Misskey seconded that an award of some form not to cost more than \$500 be presented to the Dallas Conference Committee for putting on a successful conference. Stu Meyer is to take appropriate steps for presenting this award at the upcoming Tampa Conference. The vote was unanimous in favor.

#### PUBLICATIONS

Bob Fenton reported that half of the papers presented at the Joint VTS/IES workshop at the Convergence '86 Conference will be available for review and possible publication in the Society's Transactions.

Kent Johnson reported that the February issue of the Society's newsletter will be mailed shortly.

Sam McConoughey moved, Bob McKnight seconded that the Publications report be accepted as presented. The vote was unanimous in favor.

#### COMMITTEE REPORTS

##### Transportation Systems

The secretary distributed by mail Tony Eastham's Land Transportation report. In summary, Tony reports that the financial report for the 1986 Maglev & Linear Drive Conference has been accepted by the IEEE. The 1987 Maglev & Linear Drive Conference appears headed toward success with 38 papers being accepted.

The IEEE/ASME Joint Railroad Conference scheduled for April 21-23 is progressing well. The 1988 Joint Railroad Conference is scheduled to be held at the William Penn Hotel in Pittsburgh, probably April 14-16.

Tony reports that ASME would rather hold the 1989 Joint Railroad Conference somewhere in the Mid-west or East Coast, as they feel that attendance may be low on the West Coast.

Nominations

Sam McConoughey submitted his nominations report with recommendations for President, Vice President, and Treasurer for the upcoming year. After considerable discussion concerning conflicts that several of the potential candidates may have, Arthur Goldsmith moved, Sam Leslie seconded that the nominations report be tabled until the Tampa meeting. The vote was unanimous in favor.

Kent Johnson moved, Arthur Goldsmith seconded that Sam McConoughey is to be commended on his progress for getting the Board election process back on track. The vote was unanimous in favor.

Membership

A written report from Mark Sihlanick indicates that the Society's membership had grown slightly (1.3%) for 1986, and that the total membership in the Society is now 2560. Sam McConoughey moved, Evan Richards seconded that the membership report be accepted as presented. The vote was unanimous in favor.

Publicity

Bob McKnight's written report indicated that he has sent press releases on upcoming VTS functions to some 58 magazines and newsletters that cover transportation, radio, communications, and automotive fields of interest. After discussion of the apparent lack of response to the Society's ads in the Potentials magazine, Bob McKnight moved, Roger Madden seconded that the ads continue in the Potentials magazine for the remainder of the year. The vote was unanimous in favor.

Kent Johnson moved, Evan Richards seconded that the Publicity Chairman's report be accepted as presented. The vote was unanimous in favor.

CCIP Representative

Eric Schimmel submitted a written report on the activities of the IEEE Committee on Communications and Information Policy. He indicated that the committee's activities are now more harmonious with the policies of the Society, and that the next CCIP meeting is scheduled for March 13. Sam McConoughey moved, Evan Richards seconded that the CCIP Representative's report be accepted as presented. The vote was unanimous in favor.

Transportation Electronics Fellowship

Roger Madden reported that IEEE specifies that a scholarship in the amount of \$5000 or over really should be called a fellowship. In addition, the Convergence Conference Committee recommends that the review committee be reduced to three members, all from VTS. Furthermore, they recommend that the title of the fellowship be changed to "Transportation Electronics". Roger has marked up the draft and has sent it back to Irv Engelson for review by the TAB awards committee.

Arthur Goldsmith moved, Kent Johnson seconded that the Board accept the text changes as presented for the Transportation Electronics Fellowship. The vote was unanimous in favor.

Noble Fellowship

Arthur Goldsmith moved, Kent Johnson seconded that the title and other pertinent information of the Noble Scholarship be changed to the "Noble Fellowship" in keeping with current IEEE policy. The vote was unanimous in favor.

A written report from Tony van den Heuvel indicates that everything is in order for the 1986 recipient to receive the second half of his award.

Bob Fenton noted that the notice sent out for the 1987 Fellowship applicants had not been changed to reflect recent Board action to increase the amount of the Fellowship. This matter is to be taken up at the Tampa Conference to determine the amount of the award for the 1987 recipient.

Chapter Activities

Gaspar Messina reported that he has received seven L31 reports from IEEE Headquarters, and based on these reports the Chapter of the Year Award goes to Cleveland, with the runner-up being the Sacramento ComSoc/VTS Chapter.

Gaspar also noted that he has occasionally received requests for potential speakers for the chapter meetings. Bob Fenton assigned Stu Meyer to head up a local committee to determine how chapter activities can be better supported with guest speakers. A possibility of providing a guest speaker for the Orlando ComSoc/VTS Chapter at about the time of the annual conference in Tampa was mentioned as one possibility. Stu Meyer is to contact Orlando in this regard to this possibility.

Fred Link moved, Kent Johnson seconded that the Chapter Chairman's report be accepted as presented. The vote was unanimous in favor.

Standards

One response has been received in regard to the IEEE 263 standard. Jack Neubauer is continuing to pursue this matter.

Ad Hoc Propagation Committee

Neal Shepherd reported that the committee is late on getting loose ends finished for the special issue, and they have a meeting scheduled shortly to try to put the issue to bed.

Neal further noted that the members of the propagation committee expressed a desire to continue after the special issue has been completed, with Neal as the chairman. Bob Fenton instructed Neal Shepherd to provide a firm proposal to the Board for financial support of essential travel expenses to support this committee work, with the proposal to be completed in time for consideration at the Tampa Board meeting.

Sam McConoughey moved, Stu Meyer seconded that the Propagation Committee Chairman's verbal report be accepted as presented. The vote was unanimous in favor.

Awards

In addition to the awards currently planned, Stu Meyers indicated that he is going to send out a

letter to all Board members soliciting additional inputs for the awards luncheon at the Tampa Conference. Roger Madden moved, Evan Richards seconded that the Awards Chairman's verbal report be accepted as presented. The vote was unanimous in favor.

Milestones Program

Sam McConoughey noted that the Detroit Milestone Event is scheduled for May 8. After discussion of what would be appropriate for this meeting, Evan Richards moved, Roger Madden seconded that the Society sponsor a luncheon or dinner meeting for this event, at which Lt. Russel Robinson will be an honored guest, and which is to cost no more than \$750. The Board vote was unanimous in favor.

Following the above motion, Sam McConoughey moved, Fred Link seconded that the Society also sponsor luncheon dinners for the Bayonne, NJ and Hartford, CT Milestone events, the cost of which is not to exceed \$750 at each location. The vote was unanimous in favor.

Professional Activities

Frank Lord's written report indicates that he has been selected to chair the USAB Manpower Committee for 1987. He also enclosed a fact sheet on section 1706 for the 1986 Tax Reform Act, which singles out engineers and similar technical professionals that are self-employed. Kent Johnson moved, Roger Madden seconded that the PACE Chairman's report be accepted as presented. The vote was unanimous in favor.

Coordinating Committee on Transportation

Arthur Goldsmith reported that the above committee had not met during the past year. However, the USAB Engineering R&D Committee did have three or four meetings, but no items of transportation or vehicular technology interest was covered. Roger Madden moved, Evan Richards seconded that Art's verbal report be accepted by the Board. The vote was unanimous in favor.

Fellows Program

A written report from Al Isberg asks for nominations for Fellow candidates. The Society had submitted three names last year, of which two had finally made the grade. Bill Misskey moved, Evan Richards seconded that the Fellows Award Chairman's report be accepted. The vote was unanimous in favor.

OLD BUSINESSCOMSOC Issue

Evan Richards moved, Kent Johnson seconded a motion that the Board reaffirm its opposition to the COMSOC's proposed scope increase to include vehicular communications technology. The vote was unanimous in favor.

IES Scope

The Society President is to continue monitoring the proposed change in the IES scope for possible conflicts with our Society's scope.

NEW BUSINESSConference Sponsorship

Bob Fenton discussed correspondence which he had received from IEEE HQ which defines wording that can be used in co-sponsoring a conference or other event with non-IEEE entities. In essence, to co-sponsor an event requires financial commitment and liability, whereas the Society can only "Participate" or "Cooperate" with an event if no financial commitment is involved. Suggested wording for a participating type of sponsorship might be "In cooperation with IEEE VTS" or similar language. Also, IEEE must be able to purchase conference records at cost where the Society co-sponsors an event. The sense of the Board was that the wording of participation with the various conferences be adjusted to meet the intent of the IEEE guidelines.

T&L Reimbursement for Board Members

The Board discussed at length a proposal to reimburse Board members for travel and living expenses when attending out of town Board meetings. No resolution was reached, and the Board directed Sam McConoughey to reword the proposal to reflect the inputs from various Board members. The Secretary is to mail the revised proposal to the Board members for review. This matter is to be addressed again during the Tampa Board meeting in June.

NEXT MEETING

Monday afternoon (June 1) was first selected as the next Board meeting date. After determining that there would be a conflict with sessions that are scheduled as a part of the Tampa VTC, Wednesday afternoon was selected as a more appropriate time. The Board meeting thus will be held at the Tampa VTC on June 3, and will run from 1:00 PM to 6:00 M. A Board dinner will be held that night at 7:00 PM, with the Tampa VTC committee members and their spouses being invited.

ADJOURNMENT

The meeting was adjourned at 4:05PM.

Respectfully submitted,

*Samuel A. Leslie*

Samuel A. Leslie  
Secretary



**Announcing the 37th IEEE  
Vehicular Technology Conference  
VTC'87**

Holiday Inn, Tampa International Airport, Tampa, Florida  
June 1-3, 1987

- ★ Mobile Radio Systems
- ★ Network System Design
- ★ Cellular Radio
- ★ Land-Air & Marine Communication
- ★ Satellite Mobile Communication
- ★ Antennas & Propagation
- ★ Land Transportation Systems
- ★ Vehicle Location & Navigation
- ★ Vehicle On-board computer systems

**CONFERENCE REGISTRATION FORM**

Name: \_\_\_\_\_ Company: \_\_\_\_\_

Business Address: \_\_\_\_\_

Telephone: ( ) \_\_\_\_\_

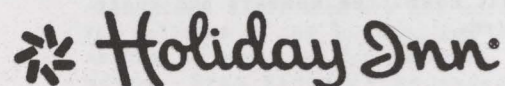
IEEE Member?  Yes  No If yes, membership number: \_\_\_\_\_

Are you presenting a paper at this conference:  Yes  No Are you a Session Chairman at this conference:  Yes  No

| Item   |                    | Member | Non-Member   | Total |
|--|--------------------|--------|--------------|-------|
| Full Registration (Sessions, Record & 2 Luncheons) | -paid before May 1 | \$140  | \$165        | _____ |
|  | -paid after May 1  | 160    | 185          | _____ |
| Limited Full Registration (Sessions & Record)      | -paid before May 1 | 110    | 135          | _____ |
|  | -paid after May 1  | 130    | 155          | _____ |
| Full-Time Student (Sessions only)                  |                    | 25     | 25           | _____ |
| IEEE Life-Time Member (Sessions only)              |                    | 25     | 25           | _____ |
| Additional Monday Luncheon:                        | _____ @\$16 each   |        |              | _____ |
| Additional Tuesday Luncheon:                       | _____ @\$16 each   |        |              | _____ |
| Additional Conference Records                      |                    | 45     | 55           | _____ |
|  |                    |        | <b>TOTAL</b> | _____ |

Mail registration form and payment in U.S. Dollars to:  
VTC'87 Registration, Department of Electrical Engineering, University of South Florida, Tampa, FL 33620 USA

**HOTEL REGISTRATION FORM**



**TAMPA INTERNATIONAL AIRPORT**  
4500 W. Cypress Street  
P.O. Box 25157  
Tampa, Florida 33622  
(813) 879-4800

IF RESERVING MORE THAN ONE ROOM, PLEASE LIST ONE NAME FOR EACH ROOM RESERVED  
PLEASE PRINT OR TYPE

RATES: \$66-Single \$74-Double \$5-Extra Person

FOR ARRIVAL ON \_\_\_\_\_ DEPART ON \_\_\_\_\_  
DAY/DATE DAY/DATE

PLEASE RESERVE \_\_\_\_\_ ROOM(S) FOR \_\_\_\_\_ PERSONS

NAME \_\_\_\_\_

ADDRESS \_\_\_\_\_

CITY \_\_\_\_\_ STATE \_\_\_\_\_ ZIP \_\_\_\_\_

CHECK IN TIME: 2:00 p.m.

CHECK OUT TIME: 12 Noon



**I.E.E.E.  
Vehicular Technology Conference  
June 1-3, 1987**

**RESERVATIONS**

- This reservation card must be used to insure accommodations and must be received by hotel no later than two weeks prior to intended arrival date.
- Cut off date for reservations is May 10, 1987 after which rooms will be sold on a space available basis at our published rate.

**GUARANTEE POLICY**

- You must guarantee your reservation with a first night's deposit or major credit card number.

**METHOD OF GUARANTEE**

\_\_\_\_\_ AMX \_\_\_\_\_ VISA \_\_\_\_\_ DISC \_\_\_\_\_ PERSONAL CHECK

\_\_\_\_\_ BAC \_\_\_\_\_ MC \_\_\_\_\_ DC \_\_\_\_\_ TRAVELERS CHECK

CC NAME \_\_\_\_\_

CC# \_\_\_\_\_ EXP. DATE \_\_\_\_\_

**REFUND POLICY**

- Full refund of deposit will be forfeited unless written cancellation is received one week prior to arrival date.



**IEEE VTS  
Vehicular Technology Conference VTC-87  
June 1-3, 1987**

Holiday Inn Convention Center  
4500 West Cypress Street  
Tampa, Florida 33622-2515  
(813) 879-4800

**Executive Committee:**

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**Technical Staff**

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Tony Easthan  
Queen's University  
William Fleming  
TRW - Auto. Product Tech.  
Sang Rhee  
Bell Laboratories

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**Registration Chairman**

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**Finance Chairman**

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(813) 530-8443

**Industrial Liaison**

Dave Kiewit  
Nielsen Media Research  
375 Patricia Ave.  
Dunedin, Florida 33528  
(813) 734-5473

The 1987 Vehicular Technology Conference is being hosted in sunny Tampa, Florida on June 1-3, 1987. The IEEE Vehicular Technology Society Board of Directors joins me in extending to you a cordian invitation to attend VTC'87. Make your plans to attend now and encourage your colleagues to join you. The program offers concerned professionals the opportunity to stay abreast in a field undergoing such dramatic change.

This year's conference provides one of the largest technical programs ever scheduled with 106 technical papers, and two special evening programs. The technical authors from the US, Europe, Japan, Canada, and elsewhere represent some of the leaders in international research and development in vehicular technology. These authors will present to you those topics which are experiencing the greatest amount of growth and development. Here is your opportunity to meet and discuss with these international leaders of research and development.

With this intense technical program, relaxation periods will be important; and the Tampa Bay area offers a variety of fun activities. Both the beach and Busch Gardens are within a one-half-hour drive from the hotel. Or you may wish to stroll through the shops of the Boat Yard Village; or to relax at some of the interesting restrants.

What ever you do, do come to the VTC'87 on June 1-3 in Tampa, Florida. We are certain that this conference will be beneficial to you, and are anxious to meet you.

*Allan R. Gondeck*

Allan R Gondeck  
General Chairman

# IEEE VTS Vehicular Technology Conference VTC-87

## Travel

The Tampa International Airport is easily accessed from most major domestic airports and several international airports. Free shuttle service is available from the airport to the Conference site at the Holiday Inn. Car rentals are available for attendees who wish to tour the area, however, a car is not necessary for attendees who have rooms in the Holiday Inn.

## Hotel

The Conference technical program is at the Holiday Inn, Tampa International Airport. The VTC'87 Executive Committee has booked a block of rooms at this hotel with the special rates of \$66 per night for single room occupancy, and \$74 for double occupancy. A hotel registration form is attached to this program. This form should be sent directly to the hotel. If you register at the hotel and do not use this form, be certain to identify yourself as a VTC'87 attendee so as to receive these special rates.

## Registration

Although attendees may register upon arrival at the Conference, advance registration by mail is strongly encouraged. Not only are the advance registration fees lower than those at the conference, but also advance registration will minimize the need to wait in line. The form for advance registration is attached to this program. Both this form and the registration fees should be mailed together to the University of South Florida as directed on the form.

Registration at the Conference is scheduled as:

|         |        |                         |
|---------|--------|-------------------------|
| Sunday  | May 31 | 5:00 p.m. to 8:00 p.m.  |
| Monday  | June 1 | 8:00 a.m. to 3:00 p.m.  |
| Tuesday | June 2 | 8:00 a.m. to 11:00 p.m. |

The charge for advance full registration is \$140 for IEEE members and \$165 for nonmembers. Full registration includes access to all sessions, a copy of the Conference Record, and two luncheons. Due to the expanded technical program, there will be no banquet at the VTC'87.

## Recreation

There is no formal recreation program scheduled. However, the Holiday Inn is within one-half-hour drive of the beaches and Busch Gardens. It is within two-hours drive of Orlando, which offers Disney World, Sea World, and Church Street Station; and within two-hours drive of Cypress Gardens.

## Technical Program

Monday

### MODULATION AND CODING TECHNIQUES - I

- "Probability of Error Analysis of Digital Partial Response Continuous Phase Modulation with Differential Detection in Mobile Radio Channels", S. M. Elnoubi, University of Illinois, Chicago, IL.
- "On the Use of Repetition Coding With Several Digital Modulation for Mobile Radio Communication", A.A. Ali, I.A. Alkadi, King Saud University, Riyadh, Saudi Arabia.
- "A Power-Efficient Linear Digital Modulator and Its Application to an Anti-Multipath Modulation PSK-RZ Scheme", S. Ariyavisitakul, S. Yoshida, F. Ikegami, K. Tanaka, T. Takeuchi, Kyoto University, Kyoto, Japan.
- "Performance Evaluation of Continuous Phase Modulation Techniques with Quadrature Optimum Receiver in the Presence of Adjacent Channel Interference", W. Rafai, S.C. Gupta, Southern Methodist University, Dallas, Texas.
- "Effects of Pulse Shaping on the Performance of Manchester Encoded Digital FM Signals with Discriminator Detection", C. Despins, M. El-Tanany, S. Mahmoud, Carleton University, Ottawa, Canada.
- "A Simple Formula for an FM Signal Under Rayleigh Fading", C.C. Loo, Communications Research Centre, Ottawa, Canada.

### ANTENNA DESIGN, PERFORMANCE, AND MEASUREMENTS

- "An AM-FM Cellular Vehicular Antenna System", L. J. Bogdon, J. N. Hines, H. Oswald, AT&T Bell Laboratories, Whippany, N.J.
- "Mobile Antenna Gain Measurement Error", A. Davidson, Motorola, Inc., Schaumburg, ILL.
- "Cellular Subscriber Antenna Configurations and Their Effects on Cellular System Design", T. Zagurski, T. Wong, U.S. West Cellular Group, Bellevue, Wash.
- "Characteristics and Applications of Antenna Cable for Highway Radios", T. Watari, Hitachi Cable, LTD., Japan.
- "Television Receiving Antenna Rejection of Land Mobile Signals", A. Davidson, Motorola, Inc., Schaumburg, ILL.

### SPEECH COMMUNICATIONS, AUDIO AND DATA PROCESSING, SIGNALINGS AND TRAFFIC CONTROL FOR MOBILE RADIO

- "Adaptive Speech Companding for Speech Transmission Over Mobile Channels", H.M. Hafez, R.A. Goubran, A.B. Kerr, Carlton University, Ottawa, Canada.
- "An Integrated Solution for Audio Processing and Signalings in Mobile Radio System", G. Chiappano, A. Colamonico, M. Donati, Italtel,

Milano, Italy.

- "Loading Consideration for Public-Safety Dispatch on Trunked Radio Systems", N.J. Haslett, A.J. Bonney, Metropolitan Toronto Police Force, Weston, Ontario, Canada.
- "High Speed Digital Mobile Facsimile With Effective Error Protection", Y. Furuya (C&C Systems Research Labs), H. Fukagawa, H. Matsui, NEC Corporation, Japan.
- "Hand-Off Procedure for Fuzzy Defined Radio Cells", D.M. Rodriguez, CINVESTAV, Mexico.
- "Key States Approach in the Analysis of Traffic Control Strategies in a Trunked Mobile System", Y.N. Doganata, California Institute of Technology, Pasadena, Calif.

### MOBILE SATELLITE COMMUNICATION - I

- "Propagation Measurements for the Aeronautical Satellite Channel", Andreas Neul, J. Hagenauer, W. Papke, F. Dolainsky, F. Edbauer, Institute fur Nachrichtentechnik, West-Germany
- "A New Data Management System for Mobile Satellite Propagation Data", A.V. Kantak, California Institute of Technology, Pasadena, Calif.
- "Compact Mobile Antenna for Mobile Satellite Communications", N. Terada, K. Satoh, F. Yamazaki, NTT Electrical Communications Lab., Kanagawa-ken, Japan.
- "L-band Phased Array Antennas for Mobile Satellite Communications", J. Huang, California Institute of Technology, Pasadena, Calif.
- "A Mechanically Steered Mobile Vehicle Antenna for Land Mobile Satellite Applications", V. Jamnejad

### PROPAGATION

- "Wide-Band Propagation Measurements at 900 Mhz", E. Damosso, B. Lingua, B. Missan, CSELT, Milano, Italy.
- "Ground to Vehicle Data Transmission Using Natural Propagation of Electromagnetic Waves in Tunnels", M. Heddebaut, P. Degauque, University of Lille, France.
- "Cellular Field Strength Measurements for the Design of an Over Water Cellular System in the Gulf of Mexico", D. Williams, US West NewVector Group, Inc., Bellevue, Washington.
- "Mobile Radio Signal Statistics in Non-Urban Environments", J. LeBel, Communications Research Centre, Ottawa, Canada.
- "A Comparison of Measured and Predicted 800 MHz Land Mobile Radio Signals", B. Bedford, Institute for Telecommunications Sciences, Boulder, Colorado.

### MOBILE COMMUNICATIONS - NEXT GENERATION SYSTEMS

- "Introduction of Digital Narrow-Band Channel Technology Into The Existing Cellular Spectrum in the United States", S. Halpern, AT&T Bell Laboratories, Whippany, NJ.
- "System Features - Next Generation Cellular Radio", D.S. Cheeseman, A.R. Potter, British Telecom Research Laboratories, Martlesham,

United Kingdom.

- "Considerations in the Use of the Allocation of Additional Cellular Spectrum", N. Ehrlich, AT&T Bell Laboratories, Whippany, NJ.
- "Mobile Telephony in the Next Decade", J. Hoff, Ericsson Radio Systems, Stockholm, Sweden.
- "Remarks on Radio Network Planning", A. Gamst, Philips GmbH Forschungslaboratorium Hamburg.
- "A New Mobile Communication System Using Autonomous Radio Link Control With Decentralized Base Stations", T. Hattori, A. Sasaki, K. Momma, NTT Electrical Communications Laboratories, Kanagawa-ken, Japan.

### TRANSPORTATION SYSTEMS

- "Microwave Vehicle Sensor", R. Garceau, Centre De Recherche Industrielle Du Quebec (QRIQ), Montreal, Canada.
- "Synchronizable Error Control Coding for Railway Track Circuit Data Transmission", D.N. Weedon, R.J. Hill, University of Bath, Bath, England.
- "ATCS: Advanced Train Control System Communication Architecture and Data Transmission Consideration", A. Sheikh, Lapp-Hancock Assoc., Ltd., Ottawa, Canada.
- "An Automatic Slip-Compensation Drive for Heavy Freight Locomotives", J.L. Greenwald, S.B. Kuznetsov, Pennsylvania Mining Machinery corp, Pittsburgh, PA; PSM Technologies Inc., Silver Springs, Maryland.
- "The Preliminary Design for High Speed Ground Levitation Vehicle - Single Side Short Secondary - Computer Aided Calculations for the Optimal Impedance and Active Force", Yung-Lung, National Taiwan University, Taiwan.
- "The Status of Development of Maglev Systems", A.R. Eastham, W.F. Hayes; Queen's University, Kingston, Ontario, CA; National Research Council, Ottawa, Ca; Canada.

### MOBILE SATELLITE COMMUNICATION - II

- "Land Mobile Communication Experiments with ETS-V Satellite", T. Ikegami, R. Suzuki, Y. Hase, S. Ohmori, K. Kosaka, Radio Research Laboratory, Koganei, Tokyo, Japan.
- "An Aeronautical Mobile Satellite System Study", M.K. Sue, Jet Propulsion Laboratory, Pasadena, California.
- "Multiple Access Protocols for the Federal Aviation Administration Air Traffic Control System", H.W. Chan, T.Y. Yan, V. O.K., California.
- "The Effect of Discrete Multipath on the Reception of Mobile Satellite Signals", P. Ho, J.K. Cavers, Simon Fraser University, Burnaby, BC, Canada.
- "Performance of Binary Multi-h Modulation for Fast Fading, Shadowed, Mobile Satellite Communication Channels", P.J. McLane, P.H. Wittke; Simon Fraser University, Burnaby, BC, CA; Communications Research Centre, Ottawa, Ont., Canada.

Tuesday

## MODULATION AND CODING TECHNIQUES - II

- "Performance of GMSK and Comparisons with the Modulation Methods of the 12PM3 Class", G. D'Aria, F. Muratore, V. Palestini, CSELT, Torino, Italy.
- "Worst Case Cochannel Interference and Spectrum Efficiency of GMSK in Cellular Mobile Radio Systems", S. M. Elnoubi, University of Illinois, Chicago, ILL 60680.
- "Error Performance of the FH/MSK System Under Frequency Selective Fading and Partial Band Tone Jamming", A.K. Elhakeem, F. Noor, Concordia University, Montreal, Canada.
- "Decision Directed Timing Recovery for Incoherent Detection of GTFM/FMSK", J.K. Carvers, Simon Fraser University, Burnaby, Canada.
- "Adaptive Locally Optimal Detectors for CPFSK in Non-Gaussian Noise", D. Zeghlache, S.S. Soliman, Southern Methodist University, Dallas, Texas 75275.

## NARROWBAND MOBILE COMMUNICATIONS

- "A Digital Narrowband Cellular System", J.A. Tarallo, G.I. Zysman, AT&T Bell Laboratory, Whippany, NJ 07981.
- "Adjacent Channel Interference Considerations in Narrowband FM Radio Systems", B.M. Hiben, M.R. Poulin, A.P. van den Heuvel, Motorola, Inc., Schaumburg, IL
- "Narrowband Coherent Data Transmission - Mobile", J.P. McGeehan, A. Bateman, University of Bristol, Bristol, England
- "Narrowband TDMA System for a New Generation Cellular Radio", J. Uddenfeldt, B. Persson, Ericsson Radio Systems AB, Stockholm, Sweden.
- "Radio Test Performance of a Narrowband TDMA-System", J.E. Stjernvall, B. Hedberg, S. Ekemark, Ericsson Radio System AB, Stockholm, Sweden.
- "Data Transmission Performance in a Narrow Band System", K. Tokuda, M. Kawabe, T. Sato, OKI Electric Industry Co., LTD., Tokyo, Japan.

## COMMUNICATION SYSTEMS DESIGN - I

- "Cellular Networking Functionality & Applications", J.J. McCarthy, AT&T Bell Laboratories, Lisle, ILL.
- "Frequency Coordination of Cellular Systems", D.M. Mangini, SNET Cellular, New Haven, CONN.
- "Integrating Secure Communications into 800 MHZ Trunked Systems", L.M. Mohl, M.D. Kotzin, Motorola, Inc., Schaumburg, ILL.
- "A Nationwide Paging Network", S.P. Lapin, Contemporary Communications Corporation.
- "Further Sharing of UHF Television by Private Land Mobile Radio Services", G.C. Hess, Motorola, Inc., Schaumburg, ILL.

## AUTOMOTIVE ELECTRONICS - I

- "Computerized System in Vehicles of Novel Construction", K.L. Longmore, Lotus Engineering Limited, SNorwich, Norfolk, England.
- "Concepts in Data Communications for Vehicular Systems", G. Schulmeyer, Motorola, Inc., Schaumburg, IL.
- "Development of On-Glass T.V. Antenna System", H. Kondo, H. Yotsuya, J. Ohe, Toyota Motor corporation, Washington, DC.
- "Onboard Diagnosis of Electronics, A Contribution to Vehicle Reliability, H.D. Fournell, H.E. Schurk, Bayerische Motoren Werke AG, Munich, W.Germany.
- "Personalization of Vehicles Via Electronics", W. Weishaupt, H.D. Fournell, Bayerische Motoren Werke AG, Munich, W.Germany.

## VEHICULAR TERMINAL AND BASE STATION EQUIPMENT DESIGN

- "Linear Amplifier Combiner". A.K. Johnson, R. Myer, AT&T Bell Laboratories, Whippany, NJ 07981.
- "Baseband Unit for Portable Cellular Radio Telephone", Teiji Okamoto, Yasuaki Takahara, Isao Akitake, Consumer Products Research Center, Hitachi Ltd., Totsuka-ku, Yokohama, Japan.
- "A Frequency Offset Booster with an Oscillation Prevention Function for Land Mobile Communications", H. Ohdate, NTT Electrical Communications Laboratories, Yokosuka, Japan.
- "Portable Telephones for 800 MHZ-Band Cellular Radio Systems", J. Nakagawa, M. Hikita, S. Hagiya, Y. Kuwamoto, A. Iwama, H. Kimura, T. Okamoto, S. Yagi, A. Yuhara, M. Ienaka, Hitachi LTD., Tokyo, Japan.
- "Thermal Performance of Trunk-Mounted mobile Equipment", G.W. Hsu, AT&T Bell Laboratories, Whippany, NJ 08981.
- "An Adaptive Estimator-Correlator Receiver for Multipath Fading Mobile Radio Channels", S. Sandeep, S.C. Gupta, S.S. Soliman, Southern Methodist University, Dallas, Texas.

## DIGITAL MOBILE COMMUNICATIONS

- "A Comparison Between the Three Mobile Digital Communication Systems", J. Tongze, China Electronic System Engineering Co., Peoples Republic of China.
- "Digital Cordless Telecommunications", R.S. Swain, et al, British Telecom Research Laboratories, Ipswich, United Kingdom.
- "Digital Mobile Transmission Channel Characterization From Experimental Measurements", J.Y. Chouinard, M. Lecours, G.Y. Delisle, Lava University, Quebec, Canada.
- "Delay and Echo Control in Digital Mobile Radio System", I.C. Symington, British Telecom Research Laboratories, Ipswich, United Kingdom.
- "Conception and Performance of the Cellular Digital Mobile Radio Communication System CD 900", K.D. Eckert, Sel Stuttgart, West Germany.
- "A Search Algorithm for Synchronization Over

Fading Dispersive Channels", S.S. Soliman, Southern Methodist University, Dallas, Texas.

## COMMUNICATIONS SYSTEMS DESIGN - II

- "Adaptive Equalization in TDMA Mobile Radio Systems", R. D'Avella, L. Moreno, M. Sant'Agostino, Italtel, Torino, Italy.
- "Comparison of Selection and Switched Diversity Systems for Error-Rate Reduction at Base Station Sites in Digital Mobile Radio Systems", J.D. Parsons, M.T. Feeney, University of Liverpool, Liverpool, United Kingdom.
- "B.E.R. Simulation of Wideband Mobile Radio Channels and Its Correlation with the Environmental Parameters", G. Falciasecca, M. Frullone, G. Riva, Universita di Bologna, Viale Risorgimento.
- "Hybrid Channel Assignment and Reuse Partition in a Cellular Mobile Telephone System", K. Salberg, B. Stavenow, B. Eklundh, Ericsson Radio Systeme, Lund Sweden.
- "A Characterization of the Reverse Control Channel in the Cellular System and the TACS", B. Stavenow, Ericsson Radio Systems, Lund, Sweden.
- "Interference Protection Ratios Between SSB, ACSSB, and FM Systems in the VHF Land Mobile Radio Band", L.M. Boucher, Communications Research Centre, Ottawa, Ont., Canada.

## AUTOMOTIVE ELECTRONICS - II

- "A Passenger Vehicle On-Board Computer System for Engine Control, Fault Diagnosis and Performance Measurement", G. Rizzoni, University of Michigan, Ann Arbor, Michigan.
- "A Multi-Channel Electronic Digital Taximeter That Can Deal With More Than One Passenger Simultaneously", S.S. Bedair, Air Force of the Arab Republic of Egypt, Cairo, Egypt.

Wednesday

## MODULATION AND CODING TECHNIQUES - III

- "ACSB - A Minimum Performance Assessment", L.T. Jones, W.A. Kissick, M.J. Treado, U.S. Department of Commerce, Boulder, Colorado.
- "Evaluation of RZ SSB Receivers Employing an Improved Linearizer", K. Suwa, K. Daikoku, NTT Electrical Communications Labs., Tokyo, Japan.
- "Co-Channel Measurements for AC SSB Voice Communications", A. Bateman, J.P. McGeehan, J.D. Marvill, University of Bristol, Bristol, United Kingdom.
- "Performance Comparison Between the SBC and CVSD Over the Rayleigh Fading Channel", S.U. Lee, Y.M. Chung, J.M. Kim; Seoul National University, Seoul;; Electronic Telecommunication Research Institute, Taejeon, Korea.
- "Reed-Solomon Error and Erasure Correction with PAM/FM in Mobile Radio Channels", G. D'Aria, G.

Tarioco, CSELT, Torino, Italy.  
"Modulation Waveform for 1200 BAUD DFSK Paging Transmitters", J.B. Velasco, Mobile Communications Research, Telettra, Spain.

## VEHICULAR DATA COMMUNICATIONS

- "Spectrum Utilization Efficiency for SIMULCAST Data Transmission Over Land Radio Channel", H.M. Hafez, G. Nehme, S.J. Towaij, Carlton University, Ottawa, Canada.
- "Data Over Cellular - One Year Later", G. Fontana, Ameritech Mobile Communications, Schaumburg, ILL.
- "A New Data Transmission System for Truck Dispatch", N. Morita, M. Sasaki, K. Suzuki, Matusushita Communications Industrial Co., Yokohama, Japan.
- "The Switched Tone Concept for Speech and Data Transmission Over Mobile Channels", H. M. Hafez, R.A. Goubran, Carlton University, Ottawa, Canada.
- "Limiting Data Rates in the Urban Mobile Channel", M. Dechambre, A.J. Levy, CNET, France.

## CELLULAR SYSTEMS ENGINEERING AND PERFORMANCE EVALUATION TECHNIQUES

- "New Directions for Cellular Engineering and Operations Tools", R.L. Brown, K. Cohen, L.K. Sakayama, AT&T Bell Laboratories, Whippany, NJ 07981.
- "Outage Probability Comparison and Cellular Coverage for Mobile Radio", V. Palestini, V. Zingarelli, CSELT, Torino, Italy.
- "Influence of Hand-Off Algorithms on the Performance of Cellular Radio Networks", R. Beck, R. Simon, A. Gamst, E.-G. Zinn, Philips Research Laboratories, Hamburg, Federal Republic of German.
- "The Los Angeles Cellular System - Maturing to the One-Mile Cell Site", J.D. Proffitt, J.G. Clancy, Pactel Cellular, Irvine, Calif.
- "Baltimore's Fort McHenry Tunnel Cell Enhancer", E.W. Quinn, Bell Atlantic Mobile System, Basking Ridge, NJ.

## INSTRUMENTATION, MEASUREMENTS, AND MOBILE EQUIPMENT DESIGN TECHNIQUES

- "On A Speaker-Independent Voice Activation Dialing Scheme", Y. Takizawa, S. Sato, A. Fukasawa, OKI Electric Industry Co., LTD., Tokyo, Japan.
- "Test Equipment for Digital Channel Analysis and its Application in Digital Mobile Radio", C. Gutzeit, AuBenstelle, Berlin.
- "Control Techniques and Power Saving Effect of Intermittent Operation in Radio Units for NTT High Capacity Land Mobile Communication System", K. Nagata, K. Kobayashi, S. Yuki, NTT Electrical Communications Laboratories, Yokosuka-shi, Japan.
- "Development of Channel Simulator for Mobile Radio Communications", S.C. Lee, J.M. Kim, H.K. Park, Chung Nam; ETRI; Yonsei University; Korea.
- "Detection of EMI in Portable Radios", Q. Balzano, O. Garay, Motorola, Inc., Plantation, Florida.

INTERNATIONAL PANEL DISCUSSIONS

MONDAY  
JUNE 1, 1987 7:00 - 9:00 PM

**CELLULAR SYSTEM PERFORMANCE EVALUATION AND OPTIMIZATION TECHNIQUES**  
CHAIRMAN: DUANE HUFF  
AT&T BELL LABORATORIES  
WHIPPANY, NJ

Cellular systems operators from various countries in the world will discuss the approaches being used to optimize the performance of their growing systems. Operational support tools and techniques used to evaluate and improve the performance of large cellular systems will also be discussed.

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TUESDAY  
JUNE 2, 1987 7:00 - 9:00 PM

**FUTURE DIRECTIONS OF CELLULAR TELECOMMUNICATIONS**  
CHAIRMAN: MIKE CALLENDAR  
BRITISH COLUMBIA TELEPHONE CO.  
BURNABY, B.C., CANADA

An international panel of cellular experts will discuss the future directions of cellular telecommunications including cellular ISDN and the evolution of the current cellular technology toward wireless access telecommunications network design. A need for an international standard and the current status of available technologies in each country will also be discussed.

VTS Tokyo Chapter Activities in 1986

The VTS Tokyo Chapter has been organizing and coordinating the VTS activities in Japan. It has been about 7 years since this chapter was established in 1979. The registered members are now about 100. Technical Meetings are held several times a year. The meetings cover all the technical subjects of VTS: Transportation, Communications, and Automotives. In 1986 the following subjects were reported and discussed:

- 1) F. Adachi, ECL of NTT, reported "R&D on mobile radio communications in UK," on February 13, 1986.
- 2) K. Yamada, JRC Lab., reported "Global Position System (GPS) receiver," on April 17, 1986.
- 3) M. Sakamoto, ECL of NTT, reported "Technical abstracts of papers presented in VTC '86," on June 13, 1986.

- 4) K. Shinkawa, Mitsubishi Electric, reported "New traffic control systems for Tokyo Bus Co. Ltd." on July 15, 1986.
- 5) T. Saijo, Shibaura Institute of Technology, reported "State-of-the-art in overseas linear motor car drive traffic systems", and "Technical abstracts of papers presented in Vancouver International Conference," on September 25, 1986.
- 6) Y. Furuya, NEC, reported "Technical abstracts of papers presented in Nordic Seminar on Digital Mobile Radio," on November 20, 1986.

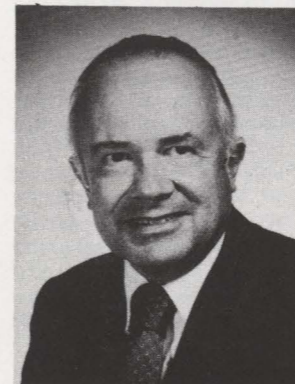
Moreover, in these few years Dr. S. McConoughey, Junior Past President, and Dr. J. Mikulski, Motorola, Inc., presented technical topics in mobile communications in the USA, which were held in high opinion by the chapter members.

In this year, Comsoc is going to hold GLOBECOM '87 in Tokyo in November. Therefore, in these days we are going to hold the chapter meeting. The VTS members, who are coming to Tokyo, please inform us.

Board of directors of the VTS Tokyo Chapter are as follows:

|               |   |
|---------------|---|
| Chairman      | Masanobu Watanabe<br>0422-45-9225<br>JRC LAB. 5-1-1, Shimo-Renryaku, Mitaka-shi, Tokyo, 188 Japan                                     |
| Vice Chairman | Takashige Saijo<br>03-452-3201<br>Dept. of Elec. Eng., Shibaura Institute of Technology, 3-9-14, Shibaura Minato-ku, Tokyo, 108 Japan |
| Secretary     | Kenkichi Hirade<br>0468-59-2790<br>Digital Mobile Commun. Sec. ECL of NTT<br>1-2356, Take, Yokoshka-shi Kanagawa-ken, 238-08 Japan    |
| Treasurer     | Shin Sasaki<br>0425-72-2151<br>Signal Commun. Sec. Railway Traffic Lab. of JNR<br>2-8-38, Hikari-shi, Tokyo, 185 Japan                |

# Professional Activities



**Frank E. Lord**  
Professional Activities Editor

## A Case of Class Discrimination

You may be surprised to learn that, as a group, engineers are being discriminated against under the Tax Reform Act of 1986, or hopefully, you have already read one or more of the several articles that have appeared in the trade press on the subject. Electronic Engineering Times provided particularly extensive coverage. If you happen to be from the North Jersey Section, you would have had the opportunity to attend the January 15th meeting on the subject arranged by Richard Tax at which Washington Office Staff Member Vin O'Neill appeared. The large attendance and vigorous participation were strong indicators of the degree of concern over the discriminatory features contained in Section 1706 of the Act.

At this meeting, Mr. O'Neill presented the IEEE's proposed position statement on Section 1706 which says in part: "Section 1706 of the Tax Reform Act adversely affects a specific segment of the nation's scientific, technical, and engineering workforce by depriving them of rights to which they have been entitled under prior law and which continue to apply to taxpayers in other professions and occupations. More specifically Section 1706 substitutes common law tests for past industry practice as the criteria to be used determining whether engineers, designers, drafters, computer programmers, and systems analysts who provide services to clients of technical services firms are to be treated as employees or as independent contractors for the purpose of establishing liability for the payment of income, Social Security, and unemployment taxes. ....

"The ability of the United States to grow and prosper in an increasingly complex and competitive world economy depends in no small part on our national strength in technical and scientific development. Instead of preventing our innovators, engineers, and scientists from becoming entrepreneurs, the

American people must demand that our Federal tax policies support and encourage the efforts of such individuals to engage in private enterprise."

Further developments have been summarized in the February 16 issue of the Legislative Report, written by Edith Carper and published by our Washington Office. Ms. Carper reports: "The questions raised by technical people on the meaning and scope of a seemingly discriminatory tax law amendment are valid ones, according to some members of Congress. The provision at issue--Section 1706 of the 1986 omnibus tax reform legislation--affects a specific segment of the technical workforce: engineers, designers, drafters, computer programmers, and systems analysts.

"The new law and the IRS guidelines issued January 22, 1987, say that technical specialists who use brokers or third parties to find jobs may be treated as employees, rather than as independent contractors or consultants. In order to claim status as independent contractors, those who use brokers must meet tough common law standards. Those standards are based on court precedents and are used by IRS to determine independent contractor status for certain other professional groups. If they fail to meet the standards, they will be treated as employees of the broker. There was some relief in the technical community that the IRS ruling "does not automatically convert" these technical people from independent contractors to employees.

"IEEE people are affected by Section 1706 and many members are communicating their concerns to Congress. IEEE has retained counsel to provide advice on interpretation, applicability, and the possibility of changing the law. A draft position paper has been endorsed by USAB OpCom stating that the organization will fight any legislation that imposes "unfair or discriminatory" treatment on engineers, scientists, and other technical personnel.

"Sympathetic members of Congress, sensing a lack of awareness in letting Section 1706 go through, have recently introduced bills to postpone the effective date of the law or to repeal it.



"On January 29 a member of the Ways and Means Committee, Rep., Judd Greff (R-NH) introduced a bill (HR792) to postpone the effective date of the provision for two years. In explanation, he said "much confusion" has resulted because this section was not properly reviewed before being approved. He conceded that Congress, in the period between enactment of the "safe harbor" provision in 1978, has studied its effect on real estate people and on "outside" salesmen but not on technical personnel. The Revenue Act of 1978 created the safe harbor for certain workers when the employer had a reasonable basis, such as past industry practice, for treating an individual as an independent contractor. The 1986 act removed the safe harbor for technical services personnel only.

"On the other side of the Hill, a Republican and a Democratic senator introduced a bill on February 5 to repeal the section altogether. In describing S.491 Sen. Alphonse D'Amato (R-NY) noted that in enactment of the safe harbor provision in 1978, it was stipulated that Congress would formally study the issue before taking further action. "The study was never undertaken. Yet Congress went ahead and removed the safe harbor for specific technical service workers..." D'Amato feels strongly that Section 1706 "must be repealed. Once these onerous provisions are eliminated, the Congress can study the entire independent contractor issue in a calm, deliberate, and dispassionate manner."

"Co-sponsor of the bill is Senator Chris Dodd (D-CT).

"Rep. Judd Gregg is inviting fellow House members to co-sponsor his bill. IEEE leaders have suggested that members affected by the provision should notify their representatives and request co-sponsorship or some other ameliorative measure."

I have mentioned the Legislative Report in this column from time to time. I recommend it highly to those who wish to keep current on legislative matters that affect our profession. Any member may get on the mailing list by writing the Washington Office of IEEE, 1111 19th Street NW, Washington, DC, 20036-3690 or calling (202) 785-0017.

If you believe that engineers deserve to be singled out for shabby treatment by our government, you need do nothing, just sit back and enjoy it. On the other hand, if you think that this treatment is inappropriate, then you should be writing and phoning your Senators and Representatives to let them know of your opposition to Section 1706 of the Tax Reform Act.

## Transportation Systems



**Bob McKnight**

Transportation Systems  
Editor

### Carnegie-Mellon sets up high speed transport center

Pittsburgh, Pennsylvania long known as a transport and steel center, now has an international center at Carnegie Mellon University for the study of high speed ground transportation. The High Speed Ground Transportation Center (HSGTC) received a grant of \$94,000 from the Commonwealth of Pennsylvania and will be operated by Mellon Institute's Industry Systems Center at Carnegie Mellon, headed by Dr. Richard A. Uher. The HSGTC budget will be \$750,000 by next year, according to Uher.

"The High Speed Ground Transportation Center will play an important role in the development of new industry and technology of high speed rail, both steel-wheeled systems and magnetic levitation, or maglev, systems," said Richard M. Cyert, president of Carnegie Mellon.

The initial goal is to develop a database of information on rail systems and high speed magnetic levitation, Uher said.

The center will work with the Pennsylvania High Speed Rail Commission, a state agency that is studying the feasibility of a 180-250 mph, 2-hour passenger service from Pittsburgh to Philadelphia, and the High Speed Rail Association, a multidisciplinary trade group. The HSGTC will work with these groups, with manufacturers and with others "to build the world's most reliable and complete source of information on high speed rail of all types."

State Representative Richard A. Geist, chairman of the High Speed Rail Commission, said the HSGTC will significantly aid the Commission by providing worldwide information that will complement the state feasibility study.

"At the Center we intend to provide a reference library of technical, financial and progress reports on high speed ground transportation projects," Uher added. "We will maintain a database of construction and operating costs, technologies, project time frames and short- and long-term job creation data."

"The existence of the Center in Pennsylvania will establish the state as the sole most knowledgeable and reliable source of information on key issues in this rapidly developing mode of ground transportation," Cyert said.

High speed rail systems and magnetic levitation systems are the two most advanced technologies entering the transportation field at this time. A high speed transportation system would allow passengers to travel across Pennsylvania in approximately two hours compared with seven hours by rail today. Other states studying high speed technology include Ohio, Florida, Texas, New York, Michigan, Illinois and a joint system through California and Nevada.

Japan's bullet trains, using high speed technology, operate at 130 mph and will soon increase to 155 mph. The system has carried more than two billion passengers without a single fatality or serious accident for 22 years.

The French TGV operates daily at 168 mph between Paris and Lyons, carrying 300,000 passengers per week. Other high speed trains are operating in Great Britain, West Germany, Spain and Italy.

Magnetic levitation trains, propelled by a powerful wave of magnetic energy along a specially fitted guideway, have been tested in various parts of the world. A West German consortium has built a 20-mile test track on which it has operated a maglev vehicle at 222 mph. The Japanese National Railroad has developed a maglev vehicle that has been tested at more than 300 mph.

### High speed ground transportation-- the historical perspective

At the January 22 opening of Carnegie Mellon's High Speed Ground Transportation Center, Dr. Richard A. Uher, director, described the significance of high speed ground transportation and its historical background. An abstract of his remarks follow:

When high speed ground transportation is discussed today, ground systems which cruise above 125-130 mph qualify. In this context, modern high speed ground transportation began in the United States with the development of the Metroliner service between New York City and Washington, DC in the middle sixties. These trains were designed and built with a top speed capability of 160 mph. They never achieved that goal.

The reasons generally given, in hindsight, are that an adequate prototype development and testing program was never carried out (in fact, all of the cars were produced before an adequate test program could be conducted), and the railroad between New York and Washington could never support high speed trains.

Initially, the Metroliner service ran with a top speed of 125 mph at about the same time that Japan began service on the New Tokaido Line (Shinkansen). The only

difference between the two services were that the Metroliner top speed became lower over the next few years because the track conditions became bad, while the Japanese continued their service at the same top speed (125 mph) while maintaining their track to keep the service going. Both the Metroliner and the Shinkansen services at that time would not be considered high speed in modern terms.

Research and development into high speed ground transportation was conducted by the Office of High Speed Ground Transportation of the Department of Commerce and then the US Department of Transportation in the late sixties and early seventies. The research resulted in two prototype vehicles: the first vehicle was called the Linear Induction Motor Research Vehicle (LIMRV); and the second was called the Tracked Air Cushion

Research Vehicle (TACRV). Both of these vehicles were tested at the Transportation Test Center near Pueblo, Colorado.

The LIMRV was a rail vehicle which did not use rotary motors driving the wheels (like regular locomotives) but was driven by a linear motor which developed thrust by magnetically reacting with an aluminum rail between the two tracks. The LIMRV had a top speed of 250 mph.

The TACRV had a top speed of 300 mph. Instead of using wheels, the TACRV rode on a cushion of air which was produced by compressors inside the vehicle.

At the same time, the OHSGT began a research effort on magnetic levitation and propulsion (MAGLEV). In this concept, the trains would be supported, guided and propelled purely through magnetic forces. Because the rails would no longer be required, top speeds from 250-400 mph on the ground could be the future for these types of trains.

Probably because of the large development efforts required for these programs (in the range of hundreds of millions of dollars), all of the programs were abandoned in the U.S., at least in the high speed arena.

Developments overseas from both of our shores were progressing rapidly and with full commitment. France was the first to put in the true high speed rail service by inaugurating the Train-Grand-Vitesse (TGV) in the late seventies. This train, on a day-to-day basis, achieves top speeds of 170 mph. An intense development program preceded the beginning of service.

Both the Japanese and the Germans began developing MAGLEV technology at the expenditure of hundreds of millions of dollars. Presently, the Japanese have achieved speeds of 300 mph with their MAGLEV system, while the Germans have reached speeds of 222 mph and by this summer hope to reach 250 mph. It is reported that Japan will shortly begin construction on their first commercial system between the airport and downtown in the city of Sappora, a distance of 30 miles.

Around the world, high speed rail developments are progressing at an ever increasing pace. Germany, Sweden, Great

Britain, Italy and Spain are developing high speed rail systems. Japan plans to raise the top speed of its Shinkansen type trains from 130 mph to 155 mph. France is expanding its TGV service from Paris toward Marseilles in the South, and is planning a southwest service to Bordeaux.

The US is not idle in considering high speed ground transportation. Several city pairs are talked about in planning or feasibility studies for high speed ground transportation. Some worth mentioning are: Philadelphia-Pittsburgh; Miami-Orland-Tampa-St. Petersburg; Los Angeles-Las Vegas; New York-Albany-Montreal; Chicago-Detroit; Cincinnati-Columbus-Cleveland; and Chicago-Milwaukee. Florida has issued a request for proposal to companies and consortia in order to grant a franchise to build and operate a system within the state.

The conference will conclude with a tour of Pittsburgh's new light rail maintenance facility, hosted by managers of the Port Authority of Allegheny County.

The symposium is being organized by Carnegie Mellon's Rail Systems Center under a grant from the Urban Mass Transportation Administration (UMTA). The program is sponsored by UMTA in response to rail transit industry needs. Cost per person including meals and materials is \$235.

For more information and reservations for the meeting write or call Linda Sue Boehmer, Manager, Microprocessors in Rail Transit Symposium, Mellon Institute, 4400 Fifth Avenue, Pittsburgh, PA 15213, phone number is (412) 268-2960.

### VTS seeks speakers to talk about radio, automotive electronics and land transportation

The Vehicular Technology Society is seeking knowledgeable engineers who are members of the Vehicular Technology Society and others to become members of a VTS speakers bureau. There is a need for such qualified persons to give technical talks or presentations at local chapter meetings of the Vehicular Technology Society.

What VTS is looking for are engineers with knowledge and expertise in subjects in the main stream of VTS activity:

- Radio- two-way, cellular, antenna design, equipment and systems.
- Land transportation including command and control systems for rail and rapid transit. High speed ground transportation is also included.
- Automotive electronics including microprocessor applications to passenger cars and trucks.

As some speakers may be asked to travel to distant cities to present their views to local VTS chapters, there will be some expense for travel and accommodations. Although details are worked out between the speakers and the local chapters, VTS generally picks up transportation costs while the local VTS chapter pays for hotel and costs incurred at that location.

The call is out for potential speakers, so for those interested, please write to Leo M. Himmel, Sr., Chairman VTS Education Committee, Communication & Signal Division, AAR, 50 F Street, NW, Washington, DC 20001, or call 202-639-2215.

Please include your educational and work experience as well as subjects you would be willing to address at VTS chapter meetings.

### Microprocessors in rail transit symposium set for Sept. 14-16

Effective management of rail transit systems equipment containing microprocessors will be the subject of a three-day symposium sponsored by Carnegie Mellon University at the Vista International Hotel September 14-16, 1987.

"The symposium is intended for rail transit personnel from transit authorities, manufacturers, consultants and researchers to enable them to better understand the operation and application of microprocessors to rapid transit systems.

"The symposium will help transit system managers to better specify, install, operate, and maintain microprocessor equipment. It will also help suppliers to better meet transit authority needs for new equipment and maintenance services," said Dr. Richard A. Uher, director of Carnegie Mellon's Rail System Center.

The symposium will cover managing microprocessor equipment already in use and preparing for upgrades and expansions. Critical issues facing transit authorities such as safety, access to proprietary software and management of private contract maintenance will also be addressed.

"The seminar focuses specifically on microprocessor equipment used in operating rail transit systems rather than on computers and microcomputers for support activities," said Linda Sue Boehmer, symposium manager.

"Propulsion, train control, automated fare collection, signage, communications and dispatching systems are all examples of transit equipment that may contain microprocessors," she explained.

"The use of microprocessors in transit systems has grown steadily since their first development in 1971," Ms. Boehmer said. "While providing important advantages, equipment using microprocessors must be specified, operated and maintained differently than conventional transit equipment. The purpose of this symposium is to provide an organized forum for the exchange of information on microprocessor equipment."



## THE CANADIAN REPORT

VTS NEWS FROM REGION 7



William J. Misskey  
Canadian Report Editor

All VTS Chapter Chairmen in Region 7 are once again reminded to submit any newsworthy item which you would like to appear in "The Canadian Report" to me at the following address:

William J. Misskey, P.Eng.  
Electronic Information  
Systems Engineering  
University of Regina  
Regina, Saskatchewan  
CANADA S4S 0A2

or telephone me at (306) 587-4096 or, by ENVOY 100 at WJ.MISSKEY. Please note the deadline dates for receipt of final copy listed on page 3 of every newsletter.

Any other readers or the IEEE VTS NEWSLETTER are also welcome to submit items of interest to Region 7 VTS members.

### APPEAL FOR PAPER REVIEWERS

THE IEEE TRANSACTIONS ON VEHICULAR TECHNOLOGY requires qualified paper reviewers in the area of Vehicular Electronics. Please contact me at the above address if you can provide some assistance in this regard or if you know of someone who can.

### TECHNICAL NOTE

This issue we have one interesting application in Vehicular Location Systems. VTS readers who wish additional information on this novel approach should contact:

Prof. R.J. Palmer, P.Eng.  
Faculty of Engineering  
University of Regina  
Regina, Saskatchewan  
CANADA S4S 0A2  
tel. (306) 584-4709

### SHORT RANGE RADIO LOCATION SYSTEM INSTALLED

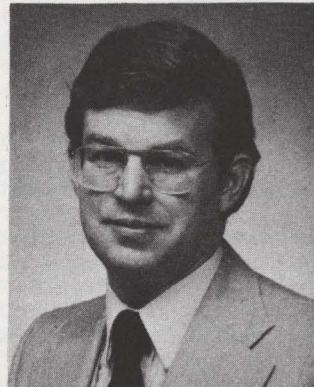
There are operations, such as farming and dredging that could benefit from a radio location system. A system that is targeted for these short range (1 mile) applications was installed by Accutrak Systems Ltd. of Regina, Saskatchewan, in February at the Kalium Chemical potash mine just outside of Moose Jaw, Saskatchewan. The dredge operates continuously, around the clock, every day of the year. The location of the dredge is displayed in Cartesian coordinates (x,y) in either feet or meters and is updated every two seconds. The displayed position helps the operator in determining his pass width and also provides the necessary coordinates to log the area covered. Kalium has long term plans in using the positional information to construct an automatic dredge.

The radio location system uses two stationary transceiver beacons and a mobile unit, each frequency modulating 438 MHz with a continuous wave. The module unit transmits a RF burst and this is received by the beacons which bounce the signal back in a time multiplexed fashion. The phase delay measured at the mobile unit is proportional to the distance which in turn is used to compute the x,y location.

The phase shift of the signal through the circuit is continuously measured and subtracted from the total phase delay and this gives long term stable locations, even if the circuits change due to temperature or age. A proprietary digital technique can read phase differences of less than 1 part in 10,000 with complete linearity and with no need to do analog to digital conversions.

As with all UHF radio equipment, multipath was encountered and modifications in software were necessary to ignore times when multipath cancelled the signal. The extent of error due to multipath is not known at this time. Further tests this summer will be conducted to test for error due to multipath, non-linearities, and accuracy.

# Vehicular Electronics

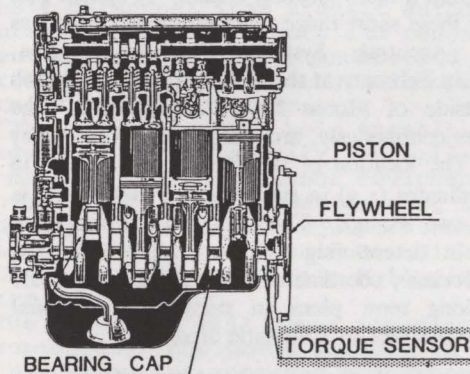


**Bill Fleming**  
Vehicular Electronics Editor

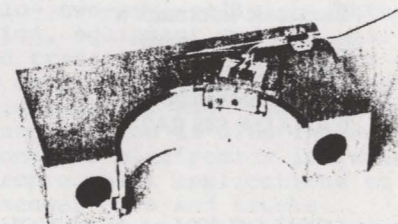
## TOYOTA INTRA-ENGINE TORQUE SENSOR

At this winter's SAE meeting, Toyota presented new developments on a miniature noncontact torque sensor [1]. The work is a step beyond that done in 1982 by this writer [2]. The sensor is installed in the rear main bearing of the engine crankshaft, and measures torque-induced changes of magnetic properties of the crankshaft nodular iron metal. To minimize sensor size (sensor dimensions are: 12 x 8 x 16 mm), the "Cross" sensing geometry, previously developed by O. Dahle of ASEA [3], was utilized.

The experimental sensor is mounted in a special, nonmagnetic bearing cap, made of austenitic stainless steel. An exposed sensing area of 12 x 3 mm is positioned, with air gap of 0.2 mm, opposite the nodular cast iron crankshaft surface. With signal processing, the sensor provides a near linear output signal with sensitivity of 0.16 mV/N-m (unamplified signal) and zero offset error of  $\pm 15$  N-m over a wide range of engine speed and temperature [1]. Since the calibration of the sensor depends on uniformity of crankshaft magnetic properties, sensor interchangeability is an important problem that must yet be solved.



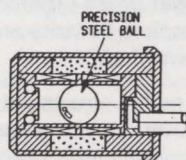
Location of Toyota Torque Sensor Inside Engine



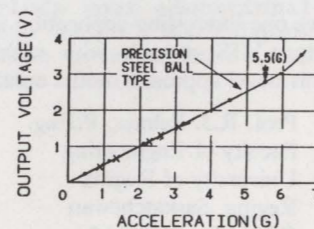
Installation of Torque Sensor (and Associated Thermocouple) in Bearing Cap

## DIESEL KIKI ACCELEROMETER/INCLINOMETER

Also at this winter's SAE meeting, Diesel Kiki reported on a new type of accelerometer/inclinometer for automotive application [4]. A steel ball, serving as a seismic mass, is contained inside a cylindrical-shell permanent magnet. Due to equilibration of magnetic forces, the ball is magnetically bound at the center of symmetry of the magnet. However, forces due to acceleration or inclination act to move the ball off center. An LVDT (linear variable differential transformer) detector provides a high-level output signal. The sensor features: ruggedness, low cost, and dc-to-10 Hz bandwidth response.



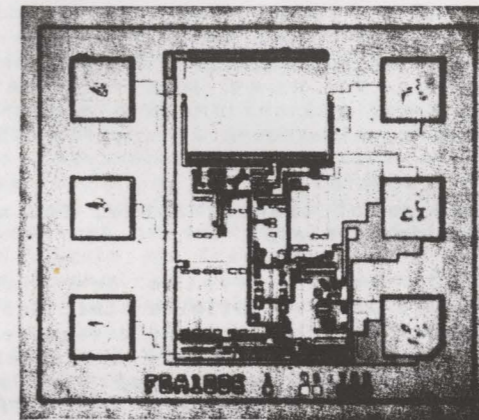
Cross Section of Diesel Kiki Acceleration/Inclination Sensor



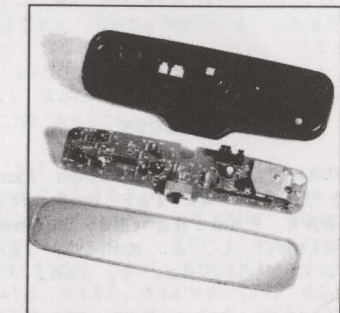
Response Characteristic Curve of Diesel Kiki Sensor

## FORD MOTOR HIGH-TEMPERATURE HALL SENSOR

For crankshaft, camshaft, and wheel position measurements; magnetic-based Hall effect sensors find wide application in automotive electronics. As engine technology tends toward higher-rpm, higher-temperature designs; more robust sensors and electronics are required. In addition, wheel-speed sensors are often mounted close to brake rotors, creating high temperature operating conditions. To satisfy this need, Ford Microelectronics Inc. has developed Hall sensors made from gallium arsenide, a material with about a 50 C higher operating temperature limit than that for silicon. These sensors will appear in Ford's antilock brake systems and engine controls as early as the 1990 model year [5].



Ford Motor Heat-Resistant Gallium Arsenide Hall Sensor Chip



Gentex, and Donnelly, Electrochromic Mirrors for 1989 Ford Vehicles

## GENTEX, AND DONNELLY, BOTH INTRODUCE ELECTROCHROMIC MIRRORS

Although electrochromics never made it as an automotive dashboard-display technology (because of slow transition response time), two Michigan companies think it'll go big in automotive rearview mirrors [6,7]. Despite the higher cost of electrochromic mirrors -- \$30 to \$50 apiece compared to \$2 to \$2.50 for conventional mirrors -- the luxury car market is enthusiastically accepting the mirrors.

Electrochromic mirrors feature: continuously variable, automatic glare reduction for night and day driving; integral lighting (added interior lighting); and integral warning indicators for low fuel, oil, coolant, washer fluid, or other information. Electrochromic mirrors are expected to show up on 1989 model year Fords, and on 1990 Cadillacs [6]. In addition, electrochromics may be suited for large-area applications such as variable-light sunroofs, rear hatches, and windshields [6].

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# Communications



**J. R. Cruz**  
Communications Editor

## ABSTRACTS

**"Error Probability Evaluation for Systems Employing Differential Detection in a Rician Fast Fading Environment and Gaussian Noise,"** L. J. Mason, IEEE Trans. Comm., Vol. COM-35, No. 1, Jan. 1987.

A method is presented for determining the error probability of a receiver using differential detection in the presence of Gaussian noise and fast Rician fading. Equations for the covariances of the fading component are derived, which include the effect of IF filter distortion. It is shown that these equations may be readily evaluated numerically. A simple formula for the error probability is derived for systems using BPSK and a matched filter receiver. An example of the error probability is given using this receiver. Also given is an example of a system using MSK with a practical IF filter. Different spectral shapes and bandwidths for the fading process are investigated for this example and their effect on the error probability is determined.

**"Channel Simulation to Facilitate Mobile-Satellite Communications Research,"** F. Davarian, IEEE Trans. Comm., Vol. COM-35, No. 1, Jan. 1987.

In designing a mobile satellite network, engineers and technologists are faced with wide-ranging issues for which there is no prior database. System engineers must address such issues as adequate margin to combat multipath fading, the level of adjacent channel protection required to allow transmission in narrow-band channels, the cochannel protection required to allow for frequency reuse in a multiple-beam system, and the level of intermodulation distortion tolerable for single-channel-per-carrier operation. Technologists, on the other hand, must determine the performance of various system components. For example, in the ground segment, modem and speech codec performance must be evaluated in the

presence of thermal noise, fading, and other impairments.

To enable system designers and technologists to optimize their design and pursue their research and development, the Jet Propulsion Laboratory has developed a mobile satellite channel simulator in hardware. This simulator has sufficient flexibility to facilitate many forms of tests and experiments.

**"Nyquist 3 Pulse Shaping in Continuous Phase Modulation,"** B. Sayar, S. Pasupathy, IEEE Trans. Comm., Vol. COM-35, No. 1, Jan. 1987.

Continuous phase modulation (CPM) schemes, using Nyquist 3 pulse shaping and correlative codes, are popular candidates for mobile radio applications. This paper presents a detailed study of the effects of Nyquist 3 pulse shaping on the spectral characteristics of CPM schemes with a modulation index of 1/2. The influence of pulse parameters such as its shape, bandwidth, coding polynomial, and truncation length on spectral characteristics such as main lobe, fractional power bandwidths, and out-of-band power levels is thoroughly investigated; error performance is also briefly analyzed. Among uncoded schemes, a new scheme using a pulse satisfying both Nyquist 3 and Nyquist 2 criteria is pointed out as a promising candidate and as a good compromise between spectral and power efficiencies.

**"Modeling Interference Effects for Land-Mobile and Air-Mobile Communications,"** C.E. Cook, IEEE Trans. Comm., Vol. COM-35, No. 2, Feb. 1987.

Analytic and computer models are presented that can provide an assessment of land-mobile and air-mobile communications performance in interference environments. The results obtained with these models, based on a communications region of operability criterion, include

the effects of greater-than-free-space propagation path losses associated with low-elevation signal paths. The analytic models are used to examine the effects of higher order path loss on signal-to-interference contours for single and linearly distributed interference scenarios. The computer model can be used to investigate link performance for interference environments in which the link assets and each source of interference are arbitrarily located in three dimensions. A propagation submodel permits independent calculation of the loss over each link or interference signal path. Computer-generated plots are presented that illustrate the effect of antenna heights and frequency on the shape of the signal-to-interference (S/I) contours. Of particular interest is the effect on link region of operability when either the link transmitter or the sources of interference are at a higher altitude than the other.

**"Laboratory Measurements and a Theoretical Analysis of the TCT Fading Channel Radio System,"** W. Rafferty, J.B. Anderson, G.J. Saulnier, and J.R. Holm, IEEE Trans. Comm., Vol. COM-35, No. 2, Feb. 1987.

This paper documents the laboratory and theoretical performance of a pilot-aided digital radio system. The technique considered transmits a midband pilot tone to improve the receiver data detection performance in a multipath fading channel and is referred to as the tone calibrated technique (TCT). We report on the performance of a 860 MHz prototype system carrying 2.4 Kbit/s data under Rician fading conditions. Both experimental and analytical results show that the error floor experienced with nonpilot-aided transmission methods is effectively removed by the TCT scheme, resulting in significant performance gains at high signal-to-noise ratio (SNR) values. The paper also examines the TCT system performance under typical operating conditions and presents a new analysis of the TCT theoretical error probability.

**"Direct-Sequence Spread Spectrum with DPSK Modulation and Diversity for Indoor Wireless Communications,"** M. Kavehrad, and B. Ramamurthi, IEEE Trans. Comm., Vol. COM-35, No. 2, Feb. 1987.

Direct-sequence spread spectrum with differential phase shift-keying (DPSK) modulation and code-division multiple-access is a promising approach for wireless communications in an indoor

environment, which is characterized in this paper by a Rayleigh-fading multipath channel. In this study, we consider two specific channel models having different path-delay distributions and average path power profiles. A star configuration, in which each user exercises average power control in transmitting to a central station, is the basic communication unit, which could be one cell in a cellular hierarchy. We obtain the performance of a single link between a user and its receiver in the central station, and consider two types of diversity, selection diversity and predetection combining to exploit the multipath.

A similar system with coherent PSK (CPSK) modulation has been studied previously for one of the channel models considered here. For the same channel model, we show that the irreducible error probability with selection diversity is about half an order of magnitude higher when DPSK is used instead of CPSK. With predetection combining, the performance improves significantly in comparison with selection diversity as the diversity order increases. DPSK modulation with predetection combining is akin to coherent PSK with optimal maximal-ratio combining, but is simpler to implement. The performance with selection diversity for a second channel model, which is based on measurements in an office building, is not significantly different. This indicates that the spread-spectrum approach is rather robust to the path-delay distribution and average path-power profile.

**"Analysis of GMSK with Two-Bit Differential Detection in Land Mobile Radio Channels,"** S. M. Elnoubi, IEEE Trans. Comm., Vol. COM-35, No. 2, Feb. 1987.

The effect of intersymbol interference (ISI) of Gaussian filtered minimum shift keying (GMSK) on the probability of error of two-bit differential detection is analyzed theoretically in fast Rayleigh fading characterizing land mobile radio channels. A closed form expression is derived for the probability of error. Numerical results are presented for cases of practical interest to researchers and designers of cellular land mobile radio systems.

**"Measured Characteristics of 800/900 MHz Fading Radio Channels with High Angle Propagation Through Moderately Dense Foliage,"** R.J.C. Bultitude, IEEE J. Select. Areas Comm., Vol. SAC-5, No. 2, Feb. 1987.

The probability of error for the transmission of digital information on fading radio channels is influenced by the statistical behavior of fading. This is characterized by the cumulative distribution function (CDF) for the received signal envelope, and the correlation of random variations across the channel bandwidth. It is therefore important for system design purposes to determine the distribution function for envelope fading, and the frequency correlation characteristics of radio channels in propagation environments where the use of digital radio systems is planned.

This paper details experiments that were conducted under conditions similar to those which would be typical on 800/900 MHz band satellite-mobile channels in rural environments. The impulse response functions of measured channels were estimated by operating a pseudonoise channel probe from a 65 m tower through deciduous trees to a receiver at close range. Measurement results include: channel impulse response estimates, envelope fading statistics, and double-sided frequency correlation plots. Comparisons are made between channel characteristics during the summer and during the autumn after the leaves have fallen from the trees. Estimates of digital channel capacity limitations are also given. Aside from the fading statistics, these channel characteristics have not previously been reported.

**"A Statistical Model for Indoor Multipath Propagation,"** A.A.M. Saleh, and R.A. Valenzuela, IEEE J. Select. Areas Comm., Vol. SAC-5, No. 2, Feb. 1987.

The results of indoor multipath propagation measurements using 10 ns, 1.5 GHz, radarlike pulses are presented for a medium-size office building. The observed channel was very slowly time varying, with the delay spread extending over a range up to about 200 ns and rms values of up to about 50 ns. The attenuation varied over a 60 dB dynamic range. A simple

statistical multipath model of the indoor radio channel is also presented, which fits our measurements well, and more importantly, appears to be extendable to other buildings. With this model, the received signal rays arrive in clusters. The rays have independent uniform phases, and independent Rayleigh amplitudes with variances that decay exponentially with cluster and ray delays. The clusters, and the rays within the cluster, form Poisson arrival processes with different, but fixed, rates. The clusters are formed by the building superstructure, while the individual rays are formed by objects in the vicinities of the transmitter and the receiver.

**"Trellis Coded Modulation for 4800-9600 bits/s Transmission Over a Fading Mobile Satellite Channel,"** D. Divsalar, and M.K. Simon, IEEE J. Select. Areas Comm., Vol. SAC-5, No. 2, Feb. 1987.

The combination of trellis coding and MPSK signaling with the addition of asymmetry to the signal set is discussed with regard to its suitability as a modulation/coding scheme for the fading mobile satellite channel. For MPSK, introducing nonuniformity (asymmetry) into the spacing between signal points in the constellation buys a further improvement in performance over that achievable with trellis coded symmetric MPSK, all this without increasing the average or peak power, or changing the bandwidth constraints imposed on the system.

Whereas previous contributions have considered the performance of trellis coded modulation transmitted over an additive white Gaussian noise (AWGN) channel, the emphasis in this paper is on the performance of trellis coded MPSK in the fading environment. The results will be obtained by using a combination of analysis and simulation. It will be assumed that the effect of the fading on the phase of the received signal is fully compensated for either by tracking it with some form of phase-locked loop or with pilot tone calibration techniques. Thus, our results will only reflect the degradation due to the effect of the fading on the amplitude of the received signal. Also, we shall consider only the case where interleaving/deinterleaving is employed to further combat the fading. This allows for considerable simplification of the analysis and is of

great practical interest. Finally, the impact of the availability of channel state information on average bit error probability performance is assessed.

**"Forward Error Correction Coding for Fading Compensation in Mobile Satellite Channels,"** J. Hagenauer, and E. Lutz, IEEE J. Select. Areas Comm., Vol. SAC-5, No. 2, Feb. 1987.

Fading in mobile satellite communications severely degrades the performance of data transmission. The channel is modeled with nonfrequency selective Rice and Rayleigh fading. Also, stored channel simulation is used for hardware data transmission. FEC coding with Viterbi decoding of convolutional codes, and Berlekamp-Massey decoding of Reed-Solomon codes, are used to compensate for the fading. In addition to interleaving, channel state and erasure information improve the performance of the decoder. The BER after decoding is calculated for specific codes on several channels and for different transmission schemes. Using very simple channel state and erasure information gives 2-7 dB additional coding gain. These gains have been verified by hardware data transmission on synthetic fading channels and stored mobile satellite channels.

**"Novel Techniques for Countering Multipath Interference Effects in Receiving Systems,"** E.J. Baghdady, IEEE J. Select. Areas Comm., Vol. SAC-5, No. 2, Feb. 1987.

Discrete multipath propagation is generally considered to impose severe limitations on the performance of receiving systems, and hence, on the information transmission capacity of a communication link. Much work has been directed to the problems of relieving multipath effects, generally concentrating on correction of the performance realized with the resultant of the multiple-path outputs.

In this paper, the emphasis is on separating the outputs of a small number of discrete paths not only for freeing the output of at least one usable path, but also possible for combining the various path outputs in constructive ways to take advantage of the additional signal energy that each path provides. Novel techniques for accomplishing this are described, based on converting directional and propagation-delay differences into very distinctive frequency differences by

synthetic Doppler methods. These techniques are of course applicable to facilitate the separation of various time and frequency overlapping signals arriving from different directions.

**"Telephoning on the Move - Dick Tracy to Captain Kirk,"** G.J. Lomer, IEE Proc. Vol. 134, Pt. F, No. 1, Feb. 1987.

For Dick Tracy of comic-strip fame and Captain Kirk of 'Star Trek', voice communication from tiny equipment over vast distances posed no problem, but in the real world of 1986 the situation is much more difficult. Historically, mobile telephone systems using HF, VHF and UHF radio have been developed since the Second World War with military and commercial systems evolving in parallel. Although often the military needs have led the technological developments, more recently civil systems have been taking the lead in many areas. Initially voice communication by mobile radio operated in closed groups of users on an 'all-informed' basis, but, more recently connection to the world's telephone network has been possible and incoming calls are automatically routed to mobile subscribers wherever they may be in the system - a real breakthrough in the concept of personal communication. But can this be extended ultimately to a worldwide system? And can the hardware really approach the convenience available to Dick Tracy and Captain Kirk? The paper considers some of the technical problems to be overcome in terrestrial radio systems and touches on the prospects for satellites to play a role in this, but concludes that it will be some time before we can match the facilities available to our fictional heroes.

**"Error Rate Prediction for NCFSK Digital Mobile Radio Systems,"** M.M. Pejanovic, J.A. Edwards, and I.S. Stojanovic, IEE Proc., Vol. 134, Pt. F, No. 1, Feb. 1987.

Error performance analysis for the VHF digital mobile radio system is presented. The binary frequency-shift keying (FSK) system using noncoherent (NC) demodulation, with a limiter/discriminator receiver, is considered. All major error-causing factors, such as signal fading, Gaussian and impulsive noise, are taken into account and the corresponding general expression for the error probability is derived. This expression is then applied to the bit error rate (BER) evaluations for the three adequate receivers, described by the different mathematical models of their impulse responses. The

calculated BER values are compared to the results obtained by measurements on the real laboratory models simulating the mobile radio systems considered. In conclusion, the mathematical model for the receiver impulse response yielding the best prediction results, when using the derived expression for the BER calculation, is proposed.

"Postdetection Diversity Using a Modified Phase-Correction Loop for Digital Land Mobile Radio," F. Adachi, and J.D. Parsons, IEE Proc., Vol. 134, Pt. F, No. 1, Feb. 1987.

A postdetection diversity system using a phase-correction loop modified by the inclusion of a differential demodulator (DD) or a frequency demodulator (FD) is described. Binary and quaternary digital modulation for DPSK and digital FM are considered. An analysis considering additive Gaussian noise shows that, although the diversity combiner proposed is inherently the postdetection type, the well known predetection equal-gain combining (EGC) or maximal-ratio combining (MRC) action can be

approximately achieved. A unified analysis of bit error rate (BER) is presented for a Rayleigh fading environment, and fairly simple results are obtained. It is shown that the diversity gain of postdetection EGC is about 0.62 dB inferior to that of postdetection MRC when two-branch diversity is employed.

"Multiple Criteria for Hand-off in Cellular Mobile Radio," D. Munoz-Rodriguez, and K.W. Cattermole, IEE Proc., Vol. 134, Pt. F, No. 1, Feb. 1987.

A cellular hand-off treatment based on cell membership degrees is presented. The proposed method permits the systematic incorporation of a variety of different weight criteria. An example of application is given, and it is shown that the procedure leads to a low number of handoffs without excessive cell coverage overlapping. If one of the criteria is derived from traffic levels, then traffic imbalance may be reduced without recourse to channel borrowing.

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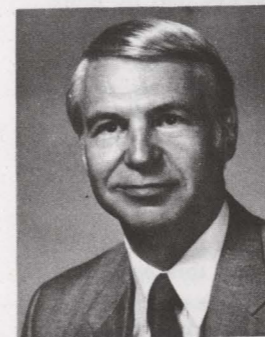
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**BACKGROUND**

**News From Washington**



**Eric Schimmel**  
Washington News Editor

WHO GETS THE "HAM" BONE

By the time this issue is mailed, the dates for filing Comments in two new FCC proposals will probably have passed, but they are of sufficient interest to the mobile radio community to warrant publication. More significant than the proposed spectrum allocations themselves, are the probable technological innovations and developments which will result. Narrowband and digital technologies will find these proceedings to offer new opportunities for visibility.

Docket 87-14 also promises to evoke an interesting political battle with the heretofore invincible amateur radio community. It has been several years since an FCC official made a public statement to the effect that the "hams" could not justify retaining the under-utilized 220-225 MHz band. It took some time but the Commission has now bitten the bullet on that issue. Could it be that they tactfully waited for Senator Goldwater to retire?

**General Docket No. 87-14**

In the Matter of

|                             |         |
|-----------------------------|---------|
| Amendment of Part 2         |         |
| of the Commission's Rules   | RM-4829 |
| Regarding the Allocation of | RM-4831 |
| the 216-225 MHz band.       | RM-4983 |

**NOTICE OF PROPOSED RULE MAKING**

Adopted: February 2, 1987 Released: February 12, 1987

By the Commission:

**INTRODUCTION**

1. By this action the Commission proposes to: 1) maintain the existing 216-220 MHz band allocation; 2) allocate the 220-222 MHz band on a exclusive basis to the land mobile service for both government and nongovernment operations; and, 3) allocate the 222-225 MHz band on a exclusive basis to the amateur service. This proceeding addresses only the allocation of this spectrum. A subsequent proceeding will address the necessary service rules for the new allocations that may result from this proceeding.

**Planning Activities**

2. Prior to the 1979 World Administrative Radio Conference (1979 WARC), the 216-225 MHz band was allocated on a primary basis to the government radiolocation service. There were secondary allocations in the 216-220 MHz portion of the band for the aeronautical mobile, fixed and land mobile services for telemetry operations; and, there was a secondary allocation in the 220-225 MHz portion for the amateur service. During the preparation for the 1979 WARC, it was determined that the 216-225 MHz band was not sufficient to meet future United States radiolocation requirements.<sup>1</sup> Therefore, this band was considered a candidate for reallocation for other purposes. At about the same time, a requirement for maritime mobile public correspondence was identified that could be accommodated in this band. Accordingly, the United States proposed at the 1979 WARC that the entire 216-225 MHz band be reallocated internationally to the maritime mobile service. That proposal was not adopted in its entirety. However, the 1979 WARC did allocate the 216-220 MHz portion to the maritime mobile service along with the fixed service on a primary basis and allocated the 220-225 MHz portion to the mobile service along with the fixed and amateur services on a primary basis. The 1979 WARC also provided for phasing-out the radiolocation service.<sup>2</sup>

3. Shortly after the 1979 WARC the Commission allocated the 216-220 MHz band to the maritime mobile service on a primary basis for the inland waterways communication system.<sup>3</sup> Secondary allocations in the 216-220 MHz band were retained for the aeronautical mobile, fixed and land mobile services for telemetry operations. Subsequently, the Commission reallocated the 220-225 MHz band to the amateur, fixed and mobile services on a coequal primary basis for nongovernment services.<sup>4</sup> The National Telecommunication and Information Administration (NTIA), in implementing the 1979 WARC results into the government table of frequency allocations, allocated the 220-225 MHz band on a coequal primary basis to the fixed and mobile services. However, NTIA and the FCC agreed that operations in the fixed and mobile services in the 220-225 MHz band would not be initiated until an allocation plan was developed for sharing the band by government and nongovernment users.<sup>5</sup> Later, an FCC/NTIA planning group recommended that a portion of the 216-225 MHz band be designated for narrowband land mobile operations on a shared basis between government and nongovernment users.<sup>6</sup>

**Petitions for Rulemaking**

4. The Commission also has received three petitions for rule making addressing allocations in the 216-225 MHz band. These were submitted by Land Mobile Communications Council (LMCC), Sideband Technology, Inc. (STI) and LAOAD Radio and Microwave Communications Consultants (LAOAD).<sup>7,8</sup> The petitioners requested that a portion of the 216-225 band be allocated to the land mobile service for narrowband voice operations (5 kHz channels). The petitioners argued that an additional land mobile allocation is needed to help meet the private land mobile spectrum requirements through the year 2000. They stated that current narrowband equipment designed to operate in the 150 MHz land mobile band could be easily modified to operate in the 220 MHz band. Further, they asserted that since transmission characteristics at 220 MHz are similar to those in the 150 MHz band, the 220 MHz band would be attractive to users who otherwise would be seeking channels at 150 MHz. They argued that the 220 MHz band would be a good place to implement 5

kHz channel land mobile operations, due to the light loading of the band and because a channelization plan would not have to work around existing FM channels.<sup>9</sup> LAOAD further requested a primary allocation to the fixed service in the 216-220 MHz band for narrowband voice and telemetry operations (5 kHz and 2.5 kHz channels respectively). LAOAD argued that there is a growing need for telemetry channels, noting particularly oil, gas and utility companies that need to monitor and control many remote stations from a single location.

5. In response to the petitions, there was strong support from the land mobile community for an allocation for land mobile; however, there was only modest support for a fixed allocation. There was strong opposition from existing maritime mobile and telemetry users operating in the 216-220 MHz band and amateurs operating in the 220-225 MHz band. These existing users claimed that these bands are needed to meet their own respective spectrum requirements. Further, broadcast interests were concerned about potential interference to the reception of TV channel 13 operations in adjacent spectrum at 210-216 MHz.

#### DISCUSSION

6. Based on our analysis and the comments submitted in response to the petitions, we believe that the present allocations in the 216-220 MHz portion of the band are appropriate and should be maintained. Accordingly, we are not proposing any allocation changes to this portion of the spectrum. With regard to the 220-225 MHz portion of the band, we are persuaded that this band is presently underutilized and that the land mobile service has needs that can be met in this region of the spectrum.<sup>10</sup> The propagation characteristics of this band make it useful for land mobile operations. Further, a land mobile allocation in this region of the spectrum would provide an opportunity for the further development of narrowband technologies. Therefore, we are proposing a 2 megahertz allocation to the land mobile service in the 220-222 MHz portion of the band.<sup>11</sup> The remaining 3 megahertz, 222-225 MHz, is proposed to be made an exclusive allocation for the amateur service. These matters are discussed below.

#### 216-220 MHz Band

7. The 216-220 MHz band is currently allocated to the maritime mobile service on a primary basis. Telemetry operations in the aeronautical mobile, fixed and land mobile services are permitted on a secondary basis.<sup>12</sup> We are not proposing any changes to this allocation.

8. We believe it would be premature to permit additional services in the 216-220 MHz band before the inland waterways communication system in this band has had a chance to develop as planned. It is also our belief that the geographical limitations on land mobile operations at 216-220 MHz necessary to protect broadcast TV channel 13 operations would be so restrictive that an allocation in this portion of the spectrum would provide little relief for land mobile. This would be especially the case in the major cities where land mobile demand is greatest.<sup>13</sup> Further, there is no international land mobile allocation in this portion of the band, so domestic land mobile operations would be secondary to operations of other countries that are operating in accordance with the international Table of Frequency Allocations. This might greatly restrict domestic land mobile operations near the borders. For these reasons we do not believe it is in the public interest to propose a primary land mobile allocation below 220 MHz.

9. We believe that the needs of the fixed services can be satisfied within the present secondary allocation in the 216-220 MHz band. We reject LAOAD's request to upgrade the secondary fixed allocation to primary. At this time, we are reluctant to take any action that might

restrain the development of the inland waterways communications system. LAOAD's request that narrowband voice operations be permitted in the fixed service may be more appropriately addressed in a separate proceeding dealing with service rules for this band.

#### 220-225 MHz Band

10. The 220-225 MHz band, which is allocated to the amateur, fixed, mobile and radiolocation services, is currently utilized only by the amateur and radiolocation services as noted above. The amateur usage is mainly for base/mobile repeater operations, along with some special operations.<sup>14</sup> The Commission is cognizant of the services performed by the amateur community in this band and the other amateur bands. We are also aware of the investment by the amateur community in equipment in this band. However, the loading of this band is light in comparison with the 144-148 MHz amateur band, which supports similar operations. The 144-148 MHz band supports over six times as many repeater operations (repeaters/MHz) as the 220-225 MHz band.<sup>15</sup>

11. The majority of the amateur operations in the 220-225 MHz band are base/mobile repeater operations and are located in the 222-225 MHz portion of the band. Accordingly, we believe that reallocating 2 megahertz, 220-222 MHz, to the land mobile service, would have minimal impact on current amateur operators and would provide much-needed spectrum for land mobile operations. Further, in view of the current light loading of the 220-225 MHz band, and the availability of other amateur bands, it appears that the future needs of the amateur service will continue to be satisfied. We anticipate that this proposed action will have little economic impact on amateur operators since amateur equipment operating in the 220-222 MHz band could be modified at minimal expense to operate in the 222-225 MHz portion of the band.

12. With regard to a fixed service allocation in the 220-225 MHz band, we believe the needs of the land mobile and amateur services, as addressed above, outweigh those of the fixed service. Furthermore, fixed services can be accommodated in higher frequency bands, whereas land mobile use is best suited to frequencies below 1 GHz. Therefore, we are proposing to delete the unimplemented fixed allocation in the 220-225 MHz band. In the 222-225 MHz band, we are also proposing to delete the unimplemented mobile allocation. This will provide the amateur service with an exclusive allocation in the 222-225 MHz band after January 1, 1990.<sup>16</sup>

#### PROPOSAL

13. In summary, we are proposing to reallocate the 216-225 MHz band as follows: (1) maintain the primary maritime mobile allocation in the 216-220 MHz band; (2) maintain the secondary aeronautical mobile, fixed and land mobile allocations in the 216-220 MHz band for telemetry operations only; (3) reallocate the 220-222 MHz band on a primary basis to the land mobile service for both government and nongovernment operations and delete the existing primary allocations to the amateur, fixed and mobile services; and (4) maintain the primary amateur allocation in the 222-225 MHz band and delete the existing primary allocations to the fixed and mobile services. The primary allocation to the radiolocation service for government operations in the 216-225 MHz band would be maintained until 1990, when radiolocation would become secondary except for one Navy radar system. Specific operating rules for the land mobile service at 220-222 MHz would be developed in a further proceeding.

18. This action is taken pursuant to Sections 4(i), and 303(r), of the Communications Act of 1934, as amended. Interested persons may file comments on this proposal on or before April 6, 1987, and reply comments on or before April 21, 1987. All relevant and timely comments filed in

accordance with Sections 1.415 and 1.419 of our rules and regulations (47 C.F.R. 1.415 and 1.419) will be considered by the Commission before final action is taken in this proceeding. In reaching its decision, the Commission may take into consideration information and ideas not contained in the comments, provided that such information is placed in the public file, and provided that the Commission's reliance on such information is noted in its final decision.

19. In accordance with the provisions of Section 1.419 of the Rules and Regulations, 47 C.F.R. 1.419, formal participants shall file an original and five copies of their comments and other material. Participants wishing each Commissioner to have a personal copy of their comments should file an original and eleven copies. Members of the general public who wish may express their comments without regard to form (as long as the docket number is clearly stated in the heading). All documents will be available for public inspection during regular business hours in the Commission's Public Reference Room at its headquarters in Washington, D.C.

20. For further information concerning this rule making contact Mr. Fred Thomas at (202) 653-8112, Office of Engineering and Technology, Federal Communications Commission, Washington, D. C. 20554.

CC Docket No. 86-495

In the Matter of

Basic Exchange  
Telecommunications  
Radio Service

RM-5442

#### NOTICE OF PROPOSED RULEMAKING

Adopted December 18, 1986; Released: January 16, 1987

By the Commission:

1. Before us is a "Petition for Rulemaking to Establish Basic Exchange Telecommunications Radio Service" filed by the Rural Electrification Administration (REA), National Rural Telecom Association, National Telephone Cooperative Association, the Organization for the Protection and Advancement of Small Telephone Companies, and the United States Telephone Association (hereinafter collectively "Petitioners"). Petitioners propose an amendment to Part 21, Subpart H of the Commission's Rules.

#### Petitioners' Proposal for BETR Service

2. Petitioners propose that Part 21 of the Commission's Rules be amended to allow telephone companies access to mobile and cellular frequencies, on a co-primary basis with the currently eligible applicants. These frequencies would be used for constructing radio loops between isolated subscribers and central office stations to provide basic telephone service in areas in which it is prohibitively expensive to construct and maintain wire or cable. Petitioners define "basic exchange service" as "the services provided by a common carrier or public utility defined as "telephone exchange service" in Section 3(r) of the Communications Act of 1934 (Section 153(r) of Title 47 U.S.C.), as amended, "and as 'access services'" defined in Section 69.2(a) of our Rules.

3. Petitioners suggest that eligible subscribers would not be required to obtain a Commission license to operate a station, so long as it does not exceed sixty watts effective radiated power and the antenna height does not exceed Section 17.7 criteria. Instead, a blanket authorization would be issued to the central office station which serves them.

4. Petitioners propose that the BETR service would have co-primary access to frequencies in the 450 MHz band and the 800 MHz band assigned to common carrier services in Subparts G and K, respectively, in Part 22 of our rules. Petitioners suggest that Frequencies shall be selected by an exchange carrier for approval and assignment by the Commission from the portion of the spectrum most suitable for basic exchange service uses from an operational standpoint. . . .

In addition, An exchange carrier submitting an application under this Subpart must submit a design for the proposed radio system that, when implemented, will avoid mutually harmful interference with the systems of other radio licensees sharing the assigned frequencies in other geographic areas.

5. Petitioners make a conservative estimate that there are total of 883,710 subscriber locations which either have no basic exchange service, or which use 4- or 8-party line service. The lack of service, argues Petitioners, is caused by the high costs associated with building and maintaining wire or cable links between widely dispersed subscribers and the central office locations. Petitioners point out that radio systems expressly designed for basic telephone service have the potential to lower these prohibitive costs, thus making basic telephone service available for the first time at these locations.

#### Comments on the BETR Proposal

6. Commenters on the Petitioners' proposal fall generally into three categories.<sup>1</sup> First, led by manufacturers of radio systems designed for basic telephone service, are those in unqualified agreement with the BETR proposal. Next, there are a number of telephone and cellular companies who are generally in favor of BETR, but who oppose the use of one or both frequency bands requested by Petitioners. Finally, there are commenters categorically opposed to the proposal. In addition, the National Association of Business and Educational Radio, Inc. (NABER) opposes sharing the use of any frequencies in the 800 MHz band for private radio services with the BETR service.

7. Among the commenters in agreement with Petitioners are International Mobile Machines Corporation (IMM) and M/A Com, Inc. (M/A Com). IMM states that it is designing and building a state-of-the-art digital radio telephone system specifically for BETR licensees. The system would provide a wireless local loop service, giving rural local exchange carriers the flexibility to offer service to isolated areas. Furthermore, IMM points out that its system offers an unprecedented spectrum efficiency. Due to digital modulation techniques, IMM says, four simultaneous conversations can be carried on one radio frequency pair. With this technology, a few frequency pairs could easily accommodate isolated groups of subscribers. IMM maintains that access to suitable frequencies on a co-primary shared basis will ensure uninterrupted basic exchange service to rural subscribers.

8. M/A Com is a company developing the telephone (styled "Ultraphone") for IMM's telephone system. M/A Com argues that the Commission should establish detailed technical specifications for the BETR service, and that these specifications should be the same as the specifications for the Ultraphone design. M/A Com argues that we should require digital encoding and modulation of voice signals, to ensure compatibility with Integrated Services Digital Networks. In addition, M/A Com disagrees with Petitioners that 60 watts of output power is adequate for fixed subscriber stations. M/A Com suggests that we should have flexible height-power rules for BETR. M/A Com also proposes that we specify directional antennas, a channel bandwidth of 20 KHz, and an emissions mask.

Finally, M/A Com asks whether the subscribers' tran-

scievers will be classified as "customer premises equipment" or as "transmission equipment" under the Computer II separate subsidiary requirements.

9. Commenters who support BETR but not the frequency bands requested include BellSouth Corporation, Southwestern Bell Corporation, GTE Service Corporation and GTE Mobilnet Corporation (filing joint comments), Contel Corporation, and, filing jointly, New Vector Communications, Inc., Mountain States Telephone and Telegraph Company, Northwestern Bell Telephone Company, and Pacific Northwest Bell Telephone Company. The foregoing commenters were opposed to use of cellular frequencies, but argued that the 450 MHz band would be appropriate for BETR service. However, Pacific Bell and Nevada Bell (filing joint comments) opposed the use of either 450MHz band or 800 MHz band, suggesting instead that we consider using the UHF-TV drop-in allocation for the BETR service.

10. Opposing the BETR proposal are McCaw Communications Companies, Inc. (McCaw), Cellular Telecommunications Industry Association (CTIA), and the Radio Common Carrier Division and the Cellular Telecommunications Division of Telocator Network of America (Telocator). Opponents argued, in essence, that the BETR proposal is redundant and/or not proved to be needed in view of the other methods available for basic telephone service to rural areas.

#### Existing Telecommunication Techniques for Rural Areas

11. The current rules for providing telephone service to rural areas are found in Part 22, Subpart H. These rules allow either telephone companies or non-wireline common carriers to provide fixed service over available 152 MHz and 450 MHz mobile frequencies to subscribers who cannot receive conventional wireline telephone service due to the prohibitive expense of constructing cable or wire to their remote location. However, the frequencies "are available on a secondary basis in the rural radio service, provided no harmful interference is caused to stations in the Public Land Mobile Service." Section 22.601(a) of the Rules. Prior to our decision to drop separate frequency allocations (the "fence") for wireline and non-wireline mobile services, *Report and Order on Reconsideration*, 99 F.C.C. 2d 311 (1984), secondary access to Public Land Mobile Frequencies was not a problem to telephone companies, because the separate frequency allocation and service areas protected by the State certification process would have prevented incursion by other telephone companies and by radio common carriers. With the recent removal of the "fence" between wireline and non-wireline frequency allocations, however, it is now possible for a non-wireline to apply for a frequency used by a wireline for rural radio service. Under the present rules, the wireline would have to give up the frequency in favor of its use by a mobile licensee.<sup>2</sup> It would be unrealistic to expect telephone companies to invest in a rural radio system in areas in which at least some of the allocated PLMS frequencies were not likely to remain available for the foreseeable future.

12. Another method of providing local exchange service to rural subscribers is the use of cellular telephony. In the *Cellular Lottery Decision*, 98 F.C.C. 2d 175 (1984), we considered the comments of several rural telephone companies in making our decision to maintain the wireline set-aside for all MSA and RSA markets. The telephone companies argued that "cellular will eventually supplant landline local exchange service in low density, rural areas." *Id.* at note 4. The licensing procedure is being expedited for RSA areas, which subdivide all non-MSA land areas in the country. Accordingly, in the not-

too-distant future, potential rural subscribers desiring telephone service will have recourse to a cellular licensee.

#### Discussion

13. Taking advantage of new technologies is our continuing responsibility as we seek new ways of accommodating the public need for scarce radio spectrum. Here, it appears that spectrum-efficient technologies are being developed that could solve the long-standing problem of bringing basic exchange telephone service to isolated areas.<sup>3</sup> The goal is undeniably in the public interest; the difficulty is in finding available spectrum so as not to take needed services away from existing or potential users.

#### 450 MHz Frequency Band

14. Petitioners argue that the general lack of available channels, secondary frequency assignments for fixed service, and the high cost of service are elements of Rural Radio Service which have rendered its use unsatisfactory. We agree that Rural Radio may now have considerable limitations due to its secondary status. With new technology for digital modulation techniques such as that described by IMM now offering the potential for economical rural radio service, we believe that it may be appropriate to consider giving this service co-primary access to the mobile 450 MHz frequencies.

15. Unfortunately, there are significant problems with combining fixed use in the Rural Radio Service and mobile use in the Public Land Mobile Service on the 450 MHz band.<sup>4</sup> First, Rural Radio Service licenses a number of wideband channels, generally for multiplexing between central offices. In fact, there is no bandwidth standard for any aspect of the Service. Moreover, the Commission's files contain no data on Rural Radio licensees other than their names, frequencies, and coordinates. Thus, there is no height-power information with which to calculate propagation characteristics and ultimately, interference contours. Even if such information were available, the Commission presently has no standard to calculate interference to a fixed station from mobile units. The Carey analysis exists for calculation of interference between two base stations in the Public Land Mobile Service, however, a Carey analysis between a base station and a central office, for example, would not necessarily result in a fixed subscriber being protected from interference from mobile units.

16. Accordingly, we request comments from the public on how it might be possible to expand the use of Rural Radio Service by making the 450 MHz frequencies available on a co-equal basis, as suggested by Petitioners. In particular, we request that Petitioners suggest standards for ensuring that potential BETR subscribers will not experience disruption of essential telephone services by interference from roaming mobile units.

#### Cellular Frequency Band

17. Petitioners also argue that although the feasibility and practicality of using cellular radio in rural areas will increase as costs of the technology decrease, there are nevertheless problems with using cellular radio. They argue that cellular service is designated primarily for mobile service, and only incidentally for fixed service. We note that if it were necessary to construct a cell site for each location needing basic exchange service, the cost would be likely to be prohibitive.

18. One problem we foresee with using cellular frequencies in the manner suggested by Petitioners<sup>5</sup> is that all cellular frequencies are licensed to specific entities. Thus, it would be inappropriate to allow companies or individuals access to these frequencies without the consent of the cellular licensees. In addition, Petitioners' proposal does not make provision for the management of frequency

coordination as cellular service becomes a nationwide network.

19. We believe that both Petitioners' and commenters' concerns may be met with the rule change we propose herein. We propose that RSA licensees<sup>6</sup> be permitted to use the cellular frequencies in any manner they choose, consistently with any State regulatory requirements, to provide basic exchange telephone service to subscribers within their CGSA. We tentatively conclude that there need be no technical limitations on this service other than the maximum height/power limits, the emissions mask, and the bandwidth limitation defined for the Rural Cellular service. Applicants would be required to show an estimated service contour area for all transmitters used in fixed service, based on the Carey method of propagation analysis, so that the Commission may ensure that no RSA licensee will cause its signals to exceed the boundaries of the RSA. Under this proposal, fixed service would be permitted without the considerable capital expenditures required for construction of the cell sites needed for mobile cellular service, and without the need to construct prohibitively expensive wire or cable to the central office.

20. We believe that such use of the cellular spectrum would promote its efficiency. It is unlikely that all available cellular channels will be utilized in areas in which population is so sparse that it is infeasible to offer even basic telephone service. Several commenters argued that rural areas should be allowed to mature their cellular services before the frequencies are applied to the BETR service. In our opinion, such use, far from interfering with cellular service in rural areas, may facilitate development of its full potential.

21. Although Petitioners address only basic exchange telephone service, which is generally the province of certificated wireline telephone companies, we propose that non-wireline licensees be afforded the opportunity to provide fixed service as well. The parties commenting in opposition to Petitioner's request, particularly Telocator, expressed an interest in offering fixed service to rural subscribers. We tentatively conclude that some areas may be well suited for non-wireline participation, in particular, areas not certificated to a telephone company, and areas for which no wireline cellular applications are received after the initial application phase. In addition, a non-wireline cellular licensee may "subcontract" with a telephone company to connect subscribers to the telephone company's central office. Of course, any services such as these are subject to State regulatory jurisdiction.

22. Some commenters, particularly M/A Com, requested that the technical parameters of Petitioners' BETR proposal be specified. By placing the service within the cellular rules, however, additional specifications may not be necessary. Moreover, coordination between mobile use of cellular frequencies and fixed use within each RSA would be the responsibility of each licensee. In addition, the interference problem is automatically handled because both MSA and RSA licensees must ensure that neighboring licensees have a service area free from interference.<sup>7</sup>

23. Another area for which we seek comments is whether it might be appropriate to limit the fixed cellular service described herein to certain regions, particularly those which are sparsely populated and which have a correspondingly significant number of households and businesses with no or substandard telephone service. For example, it may be inappropriate to permit fixed service along the Eastern Seaboard, since it is a heavily populated corridor with considerable mobile traffic, which can be expected to grow rapidly in the foreseeable future. The public is also invited to comment on whether a finite number of channels should be set aside in RSAs for fixed service.<sup>8</sup>

#### Private Radio Band

24. The Private Radio Bureau has identified 40 frequency pairs which are generally available in rural areas.<sup>9</sup> These could be made available on a co-primary basis for BETR service, subject to certain restrictions. First, they could not be used within 100 miles of the largest 54 SMSAs as identified in the Domestic Public Cellular Service; existing systems in the Private Radio Service would have to be protected by ensuring that BETR licensees were separated by 70 miles from stations on the same frequencies; and special frequency searches would have to be done for prospective BETR licensees in the Canadian Regions and within 68.4 miles of the Mexican border. Other technical parameters for BETR licensees using Private Radio frequencies would be the same as for Rural Cellular licensees. BETR licensees using Private Radio frequencies would, except for the above conditions, be included within the Rural Radio Service under Part 22 of our Rules for administrative purposes.

#### Summary

25. We conclude that each of the proposed frequency blocks has its advantages and disadvantages. While using 450 MHz frequencies is better due to improved propagation at lower frequencies, it may be difficult to find available channels and protect fixed users from both co-channel base stations and mobile roamers. Canadian clearance of these frequencies also must be obtained, and many apparently available channels are in fact not available for that reason. Use of cellular allocations has the advantages of availability, automatic base station interference protection and easy Canadian coordination, but again, it raises the issue of protecting fixed users from roaming mobile units which automatically scan all cellular channels. Private Radio channels appear to offer the best protection for fixed use, because mobile users in this service would be less likely to have automatic equipment, and less likely to attempt calls outside their areas. There are sufficient Private Radio frequencies available in all rural areas, although special allocations must be made, as noted above, near Canada and Mexico. On the other hand, frequency propagation in the 800 MHz band is poor, especially in areas of heavy foliage.

26. Comments are invited on the various alternatives. Petitioners are requested to provide factual data on telephone company demand for BETR service, the demographics of need for BETR service, and suggestions for protecting fixed users from mobile unit interference.

29. *Small entities affected and initial impact.* The proposed rules may have a mixed impact on rural telephone companies. They may have the additional expense, and potentially, additional revenue, of offering basic exchange service to a new class of customer.

30. *Reflect federal rules which overlap, duplicate or conflict with this action.* As discussed in this Notice, the proposed rules alter the Commission's existing rules with regard to the incidental use of cellular frequencies for fixed service, and with regard to the cellular allocation for mobile use. In addition, the proposed rules upgrade Rural Radio Service from secondary status to co-primary status with mobile common carriers. Other than the specific rules changed, to our knowledge there is no federal rule that conflicts with, duplicates, or overlaps the proposal made in this Notice.

33. Comments on all aspects of the analysis and proposed rules (see Appendix B) of this Notice are encouraged. Interested persons are invited to submit comments in accordance with Section 1.419 of the Commission's Rules, 45 CFR Section 1.419. Comments must be filed by March 30, 1987, and reply comments by April 27, 1987.





"TELECOMMUNICATIONS FREEDOM  
— TECHNOLOGY ON THE MOVE"



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- BASE STATION EQUIPMENT DESIGN

Six copies of a 500-word summary should be submitted by December 15, 1987 to:

D.L. Huff  
Technical Papers Coordinator  
IEEE VTC '88  
AT&T Bell Laboratories  
Whippany, New Jersey 07981

Authors will be notified of acceptance by January 29, 1988. The complete text must be submitted by March 31, 1988 and will be published in the 38th Vehicular Technology Conference Record, which will be available at the conference.