IEEE
VEHICULAR TECHNOLOGY SOCIETY
NEWSLETTER

Vol. 32, No. 3, August 1985 (ISSN 0161-7887) Editor: A. Kent Johnson

Society Presidency Changes Hands

Robert Fenton and Sam McConoughey

President's Message

Robert Fenton
President
IEEE Vehicular Technology Society

"New Challenges for Vehicular Technology." This was the theme of the 20th Annual Vehicular Technology Conference in Columbus, Ohio in 1969. The date was important to me as it marked my first major participation in a VT national function. Now, sixteen years later and Society President, I cannot help but think how little some things change. New Challenges--clearly this is just as relevant today, probably even more so than in 1969. The growth in our fields of interest, land-mobile communications, vehicular electronics, and transportation systems, is expected to be explosive and with this should come those new challenges as well as opportunities for our Society to grow and prosper.

One way this can be achieved is through extensive member participation in our annual conference. Our 34th, thanks to an outstanding job by John Murray and his Conference Committee, provided the participants with an excellent, thought-provoking technical program and warm western hospitality. Marvelous job, Boulder!

Our 35th will be held in Dallas, Texas at the Anatole Hotel on May 20-22, 1986. Al Markwardt the Conference Chairman, spent 4 days in Boulder carefully observing their operations, and I think he and his committee will have something special for us. You should receive the Call for Papers in the very near future. Plan now to submit a paper, or at the very least, mark this date on your calendar and plan to attend.

With prospects such as this, and with the assistance of an excellent, experienced Board of Directors, I hope to build on our past accomplishments and lay plans for the future.

Both Roger Madden, our new Vice President, and I appreciate the Board's vote of confidence in electing us. We also appreciate the willingness of Arthur Goldsmith and Sam Leslie to continue as Treasurer and Secretary, respectively.

Fortunately, both Sam McConoughey, now Junior Past President, and Stu Meyer, Senior Past President, will be available for counsel. A vote of thanks to these stalwarts for their past and continued support.

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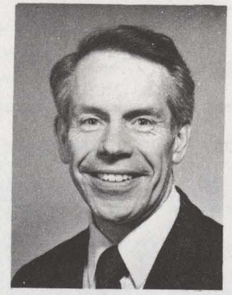
May	3-10-86	04-14-86
August	6-09-86	7-13-86

Editor's Notes



A. Kent Johnson
Newsletter Editor

Election Results

A ballot for the election of IEEE Vehicular Technology Society members to the Board of Directors was issued on March 6, 1985. The ballots returned have been counted, and the following candidates have been elected:

Term Ending December 31, 1986

Alvin M. Goldstein
A. Kent Johnson
Samuel A. Leslie
Fred M. Link
Samuel R. McConoughey

Term Ending December 31, 1987

Arthur Goldsmith
Roger D. Madden
Robert A. Mazzola
William Misskey
Evan B. Richards

We wish the newly elected members of the Board of Directors success and thank all nominees for their willingness to serve and for permitting their names to be included on the ballot.

On the Cover

Sam McConoughey, retiring VTS President, congratulates new VTS President, Dr. Robert Fenton, at the Board of Directors' meeting in Boulder, Colorado, on May 20, 1985.

Society Officers and Board of Directors

SOCIETY OFFICERS

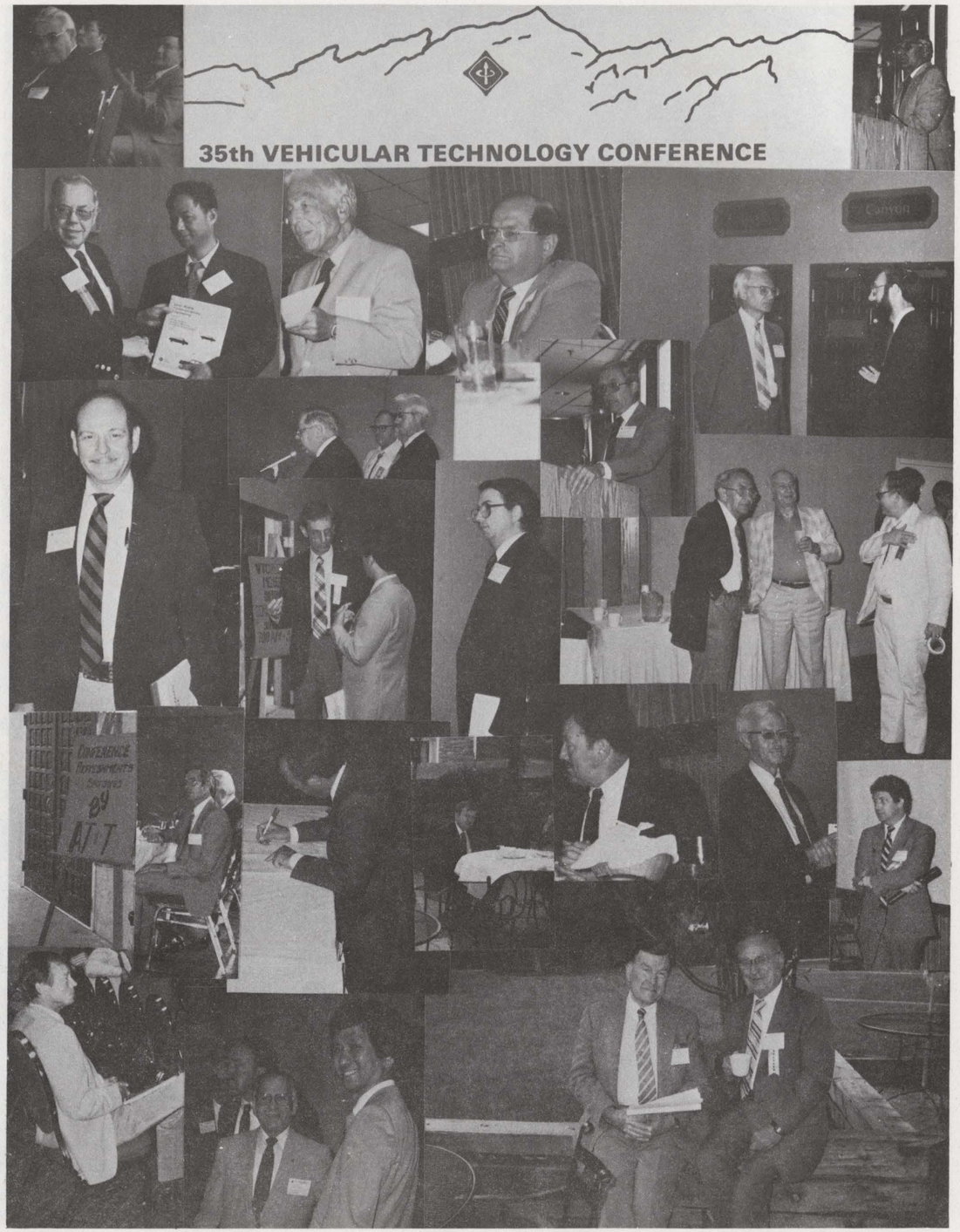
Society President	Society Vice President	Society Secretary	Society Treasurer
ROBERT E. FENTON Ohio State University 2015 Neil Avenue Columbus, OH 43210 (614) 422-4310 (614) 457-0479 Home	ROGER MADDEN Federal Communications Commission 1919 "M" St., N. W., Room 8202 Washington, D.C. 20554 (202) 632-7197	SAMUEL A. LESLIE U.S. Mobile Radio Dept. General Electric Co. Mountain View Road Lynchburg, VA 24502 (804) 528-7115 (804) 525-7589 Home	ARTHUR GOLDSMITH 4303 Wynnwood Drive Annandale, VA 22003 (703) 941-1323

BOARD OF DIRECTORS

NAME	RESPONSIBILITY	TERM ENDS
Robert E. Fenton	President	Dec85
Arthur Goldsmith	Treasurer	Dec87
Al Goldstein	Conference Coordinator	Dec86
A. Kent Johnson	Newsletter Editor	Dec86
Samuel A. Leslie	Society Secretary	Dec86
Fred M. Link	Chairman, National Site Selection Comm.	Dec86
Charles Lynk	Chairman, Paper of Year Comm.	Dec85
Roger Madden	Vice President	Dec87
Robert A. Mazzola	Chairman, Membership Committee	Dec87
George F. McClure	Chairman of Publications Comm. and Transactions Editor	Dec85
Samuel R. McConoughey	Immediate Past President	Dec86
Stuart Meyer	Senior Past President	Dec85
William Misskey	Vehicular Electronics Editor, Newletter	Dec87
Evan B. Richards	National Conference Coordinator	Dec87
Eric Schimmel	Chairman, Personal Radio Committee	Dec85

Sam McConoughey, President, Vehicular Technology Society, turned over the reins of the VTS to Robert E. Fenton (right), who moved from Vice President to President. Here, McConoughey receives a recognition certificate for his fine stewardship of the Society.

Robert E. Fenton, newly elected President of the Vehicular Technology Society, brings members up to date on affairs of the Society. Roger Madden was elected Vice President, and Evan Richards, National Conference Coordinator, was elected to the VTS Board. Samuel A. Leslie was re-elected Secretary, and Arthur Goldsmith was re-elected Treasurer.




May 21, 22 and 23, 1985
THE HILTON HARVEST HOUSE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John Murray Assoc.
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John H. Davis, Chair.

Communication
John H. Davis
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Transportation
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CONF. COORDINATOR
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AMERITECH Mobile Comm.
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SECRETARY
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Cross Information Co.
303-444-7799

ARRANGEMENTS
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Public Service Company of Co.
303-427-2411

SPOUSE PROGRAM
Dorcas Murray
303-447-0709

REGISTRATION
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303-377-2004

Hal Weeks
303-466-6649

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Herb Bass Assoc.
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Colo. Electro-Optics
303-494-3200

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Tri-State G & T
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Tri-State G & T
303-452-6111

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Fred Link, Consultant
Fred Stearns, Martin Marietta
H.E. (Bud) Taggart, Consultant
Bill Cheek, Sky Switch
Leonard Lewin, Univ. of Colo.
Dick Neal, Motorola
John Shafer, Nat. Parks Serv.

Chapter News

Gaspar Messina
Chapter News Editor

Meetings

New Jersey Coast (EMC/VT/AP)

Sixteen and Eight Channel Multiplexers for Cellular Systems
by Dr. A. Kent Johnson, AT&T Bell Laboratories, Whippany, New Jersey.
Held on March 19, 1985, with 20 attending including 4 guests.

"Land Mobile Radio From The 20's, Through the 80's"
by Mr. Stuart Meyer, E.F. Johnson Company, Arlington, Virginia.
Held on April 16, 1985, with 28 attending including 2 guests.

"FCC Authorization Testing Program"
by Mr. Art Wall, Office of Science and Technology, Federal Communication Commission, Columbia, Maryland.
Held on March 27, 1985, with 74 attending including 26, guests.

Open House "AT&T-Information Systems All-Weather Open Area Test Site"
by Mr. D. H. Heirman
Held March 28, 1985, with 46 attending including 16 guests.

Gaspar Messina
Editor and Chapter Activities Chairma
9800 Marquette Drive
Bethesda, Maryland 20817

Dr. T. Suzuki (left) of Nippon Telegraph & Telephone Public Corp., receives the Paper of the Year Award for a paper presented at the 1984 Vehicular Technology Conference in Pittsburgh, Pennsylvania. Dr. Suzuki's colleagues Masahiko Hirono, Toshio Miki and Kazuaki Murota presented a paper titled "Multilevel Decision Method for Band-Limited Digital FM with Limiter-Discriminator Detection." Presenting the award is Charles Lynk, Chairman of the Paper of the Year Award Committee of VTS.

Board of Directors Report

Samuel A. Leslie
VTS Secretary

MINUTES OF THE IEEE VTS BOARD OF DIRECTORS MEETING

The IEEE VTS Board of Directors met on May 20, 1985 at the Hilton Harvest House in Boulder, Colorado. The Board meeting was called to order at 2:00 PM.

ROLL CALL

The following were in attendance:

#Samuel R. McConoughey	President
#Robert E. Fenton	Vice-President
#Arthur Goldsmith	Treasurer
#Fred M. Link	National Site Selection
#Evan Richards	National Conf. Coord.
#Eric J. Schimmel	Personal Radio Chairman
#William Misskey	Veh. Electronics Editor
#Stuart Meyer	Junior Past President
#Samuel A. Leslie	Secretary
#Roger Madden	Senior Past President
#George McClure	Publications Chairman
#Chuck Lynk	Paper of Year Chairman
#Al Goldstein	Noble Award Chairman
John Murray	'85 Denver Conference Chairman
John Tary	'85 Denver Conference Finance
Jack Neubauer	Awards and Standards
Robert W. McKnight	VTS Publicity Chairman
Greg Austin	San Fransisco Chapter
Frank Lord	PACE Chairman

(# denotes elected Board member)

Thirteen of the nineteen present were elected Board members. A minimum of eight elected board members are necessary for voting on matters that come before the Board.

MINUTES OF LAST MEETING

George McClure moved, Bob Fenton seconded that the minutes of the last meeting be approved as presented. The motion carried with all in favor.

NOMINATION CHAIRMAN REPORT

Stu Meyer reported on the results of the recent combined election, with the following being elected:

Term Ending Dec. 86	Term Ending Dec. 87
A. Kent Johnson	Arthur Goldsmith
Samuel A. Leslie	Roger Madden
Fred Link	Robert Mazzola
Sam McConoughey	Evan B. Richards
Al Goldstein	William Misskey

In addition, he noted that the following elected members have terms expiring at the end of this year:

Term Ending Dec. 85
Robert E. Fenton
Charles Lynk
George F. McClure
Stuart Meyer
Eric J. Schimmel

Candidates are to be solicited for the Dec. 88 term, with an election to be held this Fall.

TREASURER'S REPORT

Art Goldsmith reported that the Society is in better shape finanically than originally projected, with a $17.7K surplus being achieved for 1984.

A preliminary budget has been submitted for 1986, with an income of $167.6K against expenses of $155.3K being projected.

The Treasurer again noted the importance of obtaining prior approval from the President for expenses which are expected to be reimbursed by the Society, and that properly executed receipts are to be submitted for such expenses.

Roger Madden moved, George McClure seconded that the Treasurer's report be accepted. The motion carried with a unanimous vote.

VICE PRESIDENT'S REPORT

Bob Fenton reported that a large majority of the Land Transportation Committee (LTC) of the IAS voted in favor of switching to our Society. Some 500 members in the LTC are involved. He reported that this matter is back on the agenda for the next TAB meeting.

Stu Meyer moved, George McClure seconded that the Society accept a memorandum of understanding to welcome the IAS Land Transportation Committee members into the land transportation section of VTS. The motion carried with a unanimous vote.

Also, an updated and edited Field of Interest for the Society was passed to the Constitution and ByLaws Committee Members for review.

CONFERENCE COORDINATOR REPORT

Evan reported that the Convergence '84 financial report is not available due to the printing bill not yet being finalized. However, per John Witoszynski, Conference Finance Chairman, the Society can expect a minimum of $40K return on an investment of $10K.

The 1985 Boulder Conference appears to be a success in spite of the United Airlines strike, with over 200 paid registrations being recorded the first day of the conference.

Evan noted a problem with the manufacturers symposia, with only one manufacturer signing up for the Boulder conference. Some of the Board members felt that the rate was too high for a half-hour exposure; others felt that solicitation of potential manufacturers was not done soon enough. Stu Meyer moved, Eric Schimmel seconded that the half-hour rate be changed from $750 to $250 (above any room charge rate that may be incurred for the symposia) for future conferences. The motion carried unanimous in favor.

The 1986 Conference in Dallas has selected a theme of "Technology on the Move", and is in the process of issuing a call for papers. The conference is to be held at the Anatole Hotel in the Dallas/Fort Worth area on May 20-22, 1986. The Chairman of the Dallas Conference is:

Al Markwardt
Northern Telecom
1201 E. Arapaho Road
Richardson, TX 75081
Bus: (214) 234-7197
Home: (214) 235-0996

Planning for the 1987 Tampa Conference is proceeding smoothly, with funding being done on a 50/50 basis with the IEEE/VTS Florida West Coast Section. The Chairman of the conference will be:

Alan Gondeck (813) 974-2581 ext 272
University of South Florida
Engineering Department, Eng 118
Tampa, FL 33620

George McClure is to be the Technical Papers Chairman, and Bob McKnight is to obtain a Transportation Committee Chairman for this conference.

Fred Link moved, Stu Meyer seconded that an initial advance of $1000 be made jointly with the Florida West Coast Section for the funding of the Tampa Conference, with an upper limit of $3000 being set. The motion carried with the vote unanimous in favor.

CONFERENCE SITE SELECTION

Fred Link submitted a letter from John E. Bauer (dated April 25, 1985) of the IEEE Philadelphia Section which indicated that they were willing to host the 1988 VTS Conference. After discussion, Fred Link moved, George McClure seconded that the Society accept the Philadelphia's invitation to host the 1988 VTS Conference. The motion carried with the vote unanimous in favor. This conference is tentatively scheduled for June 15-17, 1988, which immediately follows the ICC Conference scheduled for June 12-15.

A short discussion followed on potential locations for the 1989 and 1990 Conferences, with Orlando and a location in the Northwest being mentioned as two possibilites.

LAND MOBILE SHOWCASE

Eric Schimmel reported that the EIA/VTS Land Mobile Showcase is still on track for September 26-28 in the Washington, D.C. Convention Center. VTS is to host one of the seminars.

TRANSACTIONS REPORT

George McClure reported that Bill Lee has moved to the West Coast, and that he is arranging to obtain an assistant with close ties to Bell Labs to help him with the Transactions Communications Editor chores.

He reported that the page budget continues at 272 pages per year and that he expects to be within budget.

A special issue featuring the work of the ad-hoc committee on mobile propagation is planned for 1986, with Neal Shepherd as guest editor.

IEEE PRESS BOOK

Sam McConoughey reported that the royalties for the Land Mobile Communications Press Book has amounted to an income of $1500 for the Society and $1500 for the Authors, split three ways.

PUBLICITY

Bob McKnight reported that he had prepared six press releases for the Boulder Conference for distribution to over 150 publications in the radio, transportation, automotive and communications fields.

PACE REPORT

Frank Lord reported on PACE activities, and presented a list of the 1984 USAB Task Force and Committee Membership. He noted that any IEEE member can be a corresponding member (i.e., be on the mailing list to receive committee reports) of any of the committees.

NEWSLETTER ADVERTISING

Stu Meyer noted that there were no paid advertisters lined up for the Newsletter as of this date.

FELLOW AWARDS

The Board noted that the contact for Fellow Awards is AL Isberg. Fred Link also noted that the failure of any member who has been listed as a reference to return the evaluation sheet is sufficient to cause a nomination for Fellow grade to be rejected.

DAN NOBLE SCHOLARSHIP AWARD

Al Goldsmith reported that Steven G. Rothweiler has been selected for the 1985 Scholarship Award. Mr. Rothweiler attends Rutgers University, and has a 3.53 grade point average out of a possible 4.0.

Al also reported that last year's recipient has accepted a job rather than to continue with the Master's program, thus resulting in only half of the scholarship award being expended.

Al futher reported that there have been problems in getting checks mailed in time to the recipients of the scholarship awards, with the delays apparantly being in getting all the necessary approvals for the release of funds.

To resolve this matter, Roger Madden moved, Bob Fenton seconded that the Society president's letter to Dr. Engelson (dated April 17, 1985) recommending that "disbursement of funds be made by IEEE Headquarters solely upon the request of the Dan Noble Scholarship Committee Chairman with his statement that the recipient and the amount has the approval of the VTS Board of Directors" be approved as the Society's position. The motion carried with the vote unanimous in favor.

PAPER OF YEAR

Chuck Lynk reported that two papers from Japan have been selected, with one as the "paper of the year" and the other as the runner-up.

CHAPTER OF THE YEAR

Stu Meyer reported that the Chapter of the Year Award goes to the New Jersey Coast Chapter.

CERTIFICATES OF APPRECIATION

Stu Meyer stated that certificates of appreciation for Eddie Simon (1982 Conference Chairman), Vino Vinodrai (1983 Conference Chairman), Tom Selis (1984 Conference Chairman), Dave Talley (VTS Financial Advisor), and Dave Dobson (Standards and Liason) have been prepared. These certificates were presented to Vino and to Dave Talley, who were present at the conference.

IEEE FCC REPRESENTATION

Sam McConoughey indicated that Eric Schimmel has been appointed a member of the to attend the IEEE Communications and Information Policy Committee. Stu Meyer is also assigned to the committee to cover any technical issues that may come up. Eric noted that any board member that has an interest in this issue is welcome to attend.

STANDARDS COMMITTEE

Jack Neubauer noted that two IEEE measurement standards are five years in arrears (Spurious Emissions from Land Mobile Transmitters and FM Receiver Measurement Procedures), and that the Vehicular Ignition Measurement Procedure is also in arrears.

EXECUTIVE COMMITTEE ELECTION

Stu Meyer presented a slate for election of the Society President, Vice President, and Treasurer for the upcoming year. Nominees were Bob Fenton for President, Roger Madden for Vice President, and Art Goldsmith for Treasurer. A problem was noted with the Bylaws for the position of Treasurer, since the Bylaws state that a Board member cannot be elected to the same office for more than two consecutive terms. After discussion, the Board decided to not fill the treasurer position by election at this time, but to temporarily appoint Art Goldsmith to this position until the problem can be resolved.

There were no further nominations from the Board, and George McClure moved, Evan Richards seconded that the slate for nominations be closed. The motion carried, unanimous in favor.

Stu Meyer then moved, Evan Richards seconded that the slate as presented for the President and Vice President be accepted, and that the election for Treasurer be withheld until such time that the Society can investigate modifying the Bylaws. The motion carried with the vote unanimous in favor.

Bob Fenton then appointed Art Goldsmith to continue as Treasurer, and Sam Leslie to continue as Secretary. He also noted that all other appointments are to continue as before.

NEXT MEETING

The next Board meeting is tentatively scheduled to be held in conjunction with the EIA Land Mobile Showcase in September (26-28). A firm meeting date, time, and location will be mailed to the membership approximately six weeks before the show.

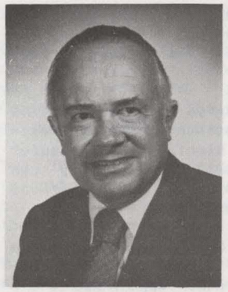
ADJOURNMENT

The meeting was adjourned at 6:00 PM.

Respectfully submitted,

Samuel A. Leslie
IEEE VTS Secretary

Steven Rothweiler (right) receives the Daniel Noble Fellowship Award from Alvin M. Goldstein, of the Noble Candidate Selection Committee. The award in honor of Dan Noble, research scientist and Motorola executive, provides funding for graduate work in electrical engineering. Steven Rothweiler, a graduate of Rutgers University, will use the funds to continue his work toward a Master's Degree in the EE field.



Professional Activities

Frank E. Lord
Professional Activities Editor

THE LEGISLATIVE FRONT

A great deal happens in legislatures that affects our profession and our career environment. Until recently we had little or no participation in these processes. However, with the advent of professional activities in the Institute and the establishment of the United States Activities Board (USAB) we have the authority and means to be involved.

In many matters we can be satisfied that USAB is doing for us all that needs to be done. On the other hand, in some legislative matters we as individuals can reinforce the actions of USAB through contacts with and letters to our individual representatives. USAB provides the means for individuals to keep informed on national legislative items through Legislative Reports and Legislative Alerts. The former reports on current legislative items that may affect us as a profession and can be useful in building up background knowledge and understanding. The Legislative Alerts are briefer, focus on one item and recommend action by the individual. You may get on the mailing list for these publications by writing to Heidi Fauth, IEEE USAB, 1111 19th St. N.W., Washington, DC, 20036 or call her at 202-785-0017.

There are two significant bills which may not be acted upon by the time you read this. One concerns immigration and the other pensions. Most members are familiar with the issues that affect us which are imbeded in these bills. By following these matters in the press or through the aforementioned USAB publications you can be prepared for communication with your representative at the appropriate time.

In April, the IEEE along with three other Scientific and Engineering Societies presented testimony before the House Subcommittee on Labor-Management Relations of the Committee on Education and Labor, one of many of the Congressional committees concerned with pension reform. I am encouraged by the fact that this testimony was a cooperative effort among four Societies. One can hope that such efforts can involve even more organizations in the future. I think this matter is important enough to most of us and our testimony significant enough that I am presenting here the entire STATEMENT SUPPORTING PENSION REFORM.

The IEEE, AIC, ASCE, and ASME commend the initiative of the Chairman in holding hearings on employee benefits and the need for a national retirement income policy. In order to address ourselves to these broad issues in a useful manner, our statement is limited to the issues of vesting, integration, portability, and defined contribution pension plans vs. defined benefit pension plans.

This statement represents the views of the memberships of IEEE, AIC, ASCE, and ASME who feel that existing pension laws are inequitable and unfair to engineers, scientists, and similar mobile individuals. The IEEE, which celebrated its centennial anniversary 1984, is the world's largest technical professional society, representing over 250,000 members. The AIC is a society of 5,000 professional chemists founded in 1923 which includes three members of the House of Representatives among its distinguished Fellows. ASCE is the oldest technical professional society in the United States, representing 100,000 members. ASME is a non-profit, educational, scientific, charitable society, founded over 100 years ago, whose membership of Mechanical Engineers and students exceeds 110,000. Our societies, who collectively represent almost a half million engineers and scientists, are an established and highly respected part of the nation's scientific and engineering infrastructure.

VESTING

The essence of our problem is embodied in the conflict between common vesting requirements and existing work patterns of our memberships, and other similarly mobile workers. The majority of our members are employees of corporations and are

participants in employer pension plans that utilize ten (10) year cliff vesting; however, the average time spent with a single employer is considerably less than ten (10) years. Mr. Chairman, we assure you that we are not "flightly people". It is simply a fact of modern life that technical professionals are frequently hired to solve specific technical problems; and, when those problems are solved, we move on. That is in the interest of the country, its productivity, its technological advancement, and its economic growth.

But, the price we pay for the fluid employment pattern in our profession is repeated pension forfeiture. Indeed, many of our members change employers again and again, forfeiting pension after pension, and thus find it difficult to become vested in an employer pension plan. This scenario is a fact for our memberships and unfortunately is even more of an acute problem for workers that are faced with greater mobility than engineering and scientific professionals -- e.g. women.

Therefore, Mr. Chairman, we recommend that ERISA vesting requirements be modified to require full vesting after an employee has completed one year of service, with credit being retroactive to the commencement of employment.

SOCIAL SECURITY INTEGRATION

The effects of integration of social security benefits with those provided by an employer-sponsored pension plan are confusing and difficult for most pension participants to understand. In many cases, an integrated plan may assure that lower paid workers receive little or nothing from their employer pension plan; however, this knowledge and understanding is generally discovered by the employee only when it is too late for remedial action.

It is our position that the integration of government and private plan benefits:

(1) invariably reduces the benefit provided by the private plan;

(2) effectively provides a disproportionate loss of private pension benefits to lower paid employees and a concomitant gain of private plan benefits to highly paid individuals; and,

(3) adds a substantial degree of complexity to pension plans, which mitigates against the clear understanding of plans by plan participants.

Therefore, we oppose integration of private and government benefits.

PORTABILITY OF VESTED PENSION BENEFITS

As mentioned in previous paragraphs, our members often forfeit pension benefits because of lack of vesting; however, on those rare occasions where they do become vested, an additional complication arises from the characteristic mobility. In the situation where an employee does manage to vest, the benefit is often exceedingly small unless the employment period is quite lengthy (e.g. 30 years). A mobile employee who may have been fortunate enough to vest in several pension plans during the course of a career finds that these vested benefits are individually worth very little, and are reposited with a multitude of different pension plans. Pension portability would allow these fortunate mobile employees to take their vested benefits with them as they move from employer to employer, thus giving them the benefit of one repository for these increments of vested benefits. This in turn would allow the mobile individual to accrue these vested retirement benefits in much the same manner as an employee who is not mobile and thus accrues vested benefits in only one employer's plan. This type of single repository would permit the employees to benefit from the larger accumulation of retirement monies and subsequent benefits of interest compounding over the span of a career. However, there may well be cases in which an employee may wish for the vested benefits to remain with the employer's pension plan, and this should be allowed.

Therefore, we support portability for all vested pension benefits, at the option of the employee.

DEFINED CONTRIBUTION PENSION PLANS

A basic objective of pension benefits is to provide an income sufficient to maintain a reasonable standard of living after an individual retires. Unfortunately, for mobile employees like engineers, this objective is often not met because of the basic nature of defined benefit pension plans. Under these plans, benefits are fixed when employees separate from their employers. The effects of inflation are to reduce the value of benefits over time. Under the system of Defined Contributions, however, portability and early vesting. In addition, an individual's benefit would not be frozen but would be commensurate with the plan investment return and would grow over the individual's career. Indeed, there are advantages to both the employee and the employer:

For the employer (simplicity):

* there is no need to designate a normal retirement age, and no actuarial computations are required for active employees, thereby resulting in a small expense saving;

* pension costs are always fully funded, and future costs do not need to be estimated; and,

* the plans are not subject to termination insurance, and there is no contingent liability if the plan should terminate.

For the employee (flexibility and possible portability):

* the participant can watch the account grow, and can, at any time, calculate its current value; additionally, unlike the defined benefit plan, the defined contribution plan does not have the risk of forfeiture;

* the participant can usually choose from a range of options on how to invest the account;

* the account fund continues to grow, even after the participant's employment terminates; and

* the entire account balance is available as a death benefit.

Therefore, we support legislation that would encourage new industries to offer defined contribution pension plans; in the case of existing defined benefit pension plans, we would encourage employers to start to make available defined contribution plans to new and existing employees without any loss of existing benefits deriving from defined benefit plans.

SUMMARY OF POSITIONS

Mr. Chairman, we recognize and commend actions taken in recent years by the Congress to assist individuals to save for their retirement. The expansion of IRA availability to all working individuals was a major step forward in encouraging people to provide for their own retirement through investment in these tax-deferred savings vehicles; however, we feel that there is much more that needs to be done to bring equity into the pension/retirement system. Thus, based upon the philosophies espoused in the foregoing pages, the IEEE, AIC, ASCE and ASME ask that the Subcommittee support legislation that would:

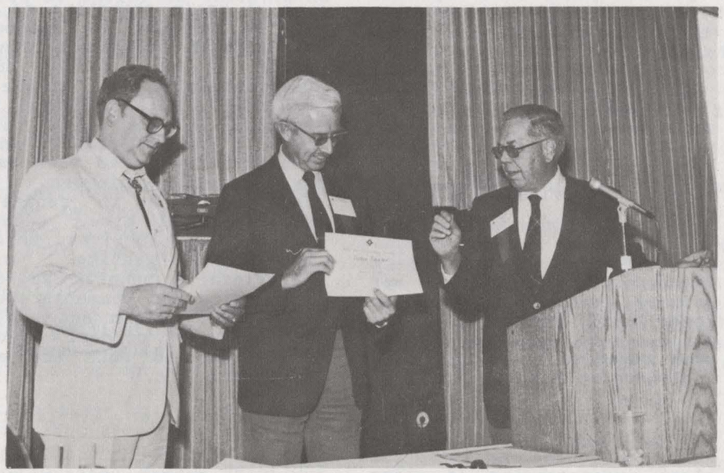
(1) Mandate full vesting after one year of employment, with credit being retroactive to the commencement of employment.

(2) Eliminate integration of social security with private pension benefits.

(3) Provide for portability of vested pension benefits, at the option of the employee; and,

(4) Encourage new employers to offer defined contribution plans, and encourage existing employers to offer new and existing employees the option of the defined contribution plan without any loss of existing benefits deriving from defined benefit plans.

Mr. Chairman, this concludes our testimony on behalf of the IEEE, AIC, ASCE, and ASME. We look forward to working with you, your colleagues and staff on these issues of concern to our memberships.



Receiving certificates of appreciation for their fine work in making the 1985 Vehicular Technology Conference such a success are Bill Whipkey (left), Chairman of the Arrangements Committee, and John Shafer, a Conference advisor. Presenting the awards is Sam McConoughey, immediate Past President (at the podium).

Transportation Systems

Bob McKnight
Transportation Systems Editor

VT 85 Conference was a success

The 1985 Vehicular Technology Conference can be characterized by these comments- good weather, scenic scenery, many excellent technical papers, wide ranging discussions, and a general atmosphere conducive to good technical conferences

Over 200 attended the May 21-23, meeting in Boulder, Colorado. Several features drew good sized crowds, especially the International Cellular Radio Panel on Wednesday afternoon where representatives of Canada, Federal Republic of Germany, Great Britain, Japan and the U.S. discussed systems and progress in their respective countries.

One of the highlights of the 3-day meeting was the Awards Luncheon on Wednesday at which time several members of VTS were honored for their exemplary service to the Society.

Highlight of the Wednesday evening banquet was the positive outlook for cellular radio world-wide forecast by John Davis, Director Cellular Telecommunications Laboratory of AT&T Bell Laboratories. Cellular radio is continuing its evolutionary path, gaining widespread acceptance in most every nation in the world. While mainly for voice transmission, the future bodes well for the additon of data and digital transmission as well.

Motorola' symposia held on two afternoons were well attended and generated considerable interest in cellular radio. Slide presentations augmented with demonstrations of equipment in operation provided attendees with full appreciation of the capability of cellular radio.

Additionally, following the banquet, Motorola presented a full color video tape describing the incredible amount of communications required and fully utilized at the 1984 Olympics in Los Angeles, California. The film gave many interesting details and descriptions of the great amount of planning and work that went on "behind the scenes" to make the Olympics run so soothly.

Hi-Tech eases transport transition

Transportation entities have relatively large capital investments in plant and equipment that often make it uneconomic to rapidly or dramatically change their methods of operations. However, the recent rapid advances in technology have enabled many transportation organizations to use modern scientific methods and equipment to bring them "up to speed" in the modern world.

How this is being done was described in five papers presented at the Vehicular Technology Conference held May 21-23 in Boulder, Colorado.

The Transportation Session lead off with a description of a Microprocessor Based Automated Voice Defect Detector System. The most widely used defect detector used by the railroads is the hotbox detector, which first made its appearance in 1956. Today over 3,000 such units are in service on U.S. and Canadian railroads.

Robert D. Douglas, president, Devtronics, Inc., manufacturer of the microprocessor based unit that gives a "voice" to the hotbox detector said a major advantage of this system is that the train crew can be alerted as soon as a train has passed the hotbox detector that an overheated journal has been found on the train. Thus the crew can take action to stop the train and examine the problem journal. The detector counts axles from the rear of the train and the voice message broadcast over the radio gives this information to the train crew. Also, they are told the side of the train on which the overheated journal is located.

While an earlier version of this talker used a voice recorder, the microprocessor provides a greater variety of information for transmission as well as greater flexibility to meet the various detector requirements.

Several railroads are now operating freight trains without cabooses- all crew members ride in the locomotives. Thus there is no one back at the rear of the train to observe any visual signal displayed at the detector location. So the "talking hotbox detector" is now a very useful tool for today's railroading.

Microprocessors provide a voice for the talking hotbox detector in which the defect can be relayed to the freight train crew via radio. Thus they can take action once the defect is found, reports Robert D. Douglas of Devtronics, Inc.

Automatic Vehicle Identification has many uses

A vehicle identification system which uses RF techniques in the near-microwave region has application to a variety of transportation modes, including bus, truck, and rail. The system, described by Daniel J. Reitz, Marketing Specialist, General Railway Signal Co., includes an active reader or reader device, a transmit/receive antenna and a series of uniquely encoded tags. An attractive feature of the tag is that it requires no direct power supply, as power is derived from the radiated RF energy of the reader. The system is being used in rail car, truck and automobile identification and bus vehicle location applications.

In one application, tractor-trailer trucks are being identified as they pass over weigh-in motion scales and tickets produced with the vehicles identity and weight. This system is being used to identify overweight trucks.

Automatic vehicle identification increases productivity and efficiency of transport operations, reports Daniel J. Reitz of General Railway Signal Co.

Melding the New with the Old in Transit

Bay Area Rapid Transit District in the San Francisco Bay area has now implemented a new radio system for fire protection and works it in with existing radio systems. This blending the new with the old is a constant situation on many rapid transit and railroad systems. They cannot economically remove a system completely and replace it.

"Improving Underground Radio Communications and Use of RF Simulcast Networks in Rapid Transit Operations," was the topic presented by Gregory E. Austin, Senior Communications Engineer for BART.

One of the new systems installed on BART provides simultaneous broadcast of emergency messages to all personnel regardless of whether they are on trains, in stations or along the right of way.

BART finds modern technology enables it to upgrade its radio systems to support more efficient rapid transit operations. Gregory E. Austin, senior communications engineer, BART, described these new systems.

Basic signal controls upgraded with hi-tech

The basic control for railway signaling is the track circuit. Originally powered by a battery feeding current into track rails and then through a relay, the application of microprocessors has brought this basic control unit into the 21st century.

"Evolution of Electronics in Railway Signaling from the Track Circuit Standpoint," was the subject of a paper presented by Robert T. Sewell, Director of Marketing, SAB Harmon Industries.

The evolutionary nature of the track circuit has been an advantage for the railroads in that the changes have enabled them to make progress without changing out enormous sections of controls at one time.

The microprocessor based track circuit controls used today eliminate the use of relays and the very vulnerable trackside pole line, susceptible to storm damage. The microprocessor based systems uses the rails for transmission of the controls.

Track circuits, the basic railway signal control function, are now making use of microprocessors, says Robert T. Sewell of SAB Harmon Industries, Inc.

Trains without cabooses; a hi-tech reality

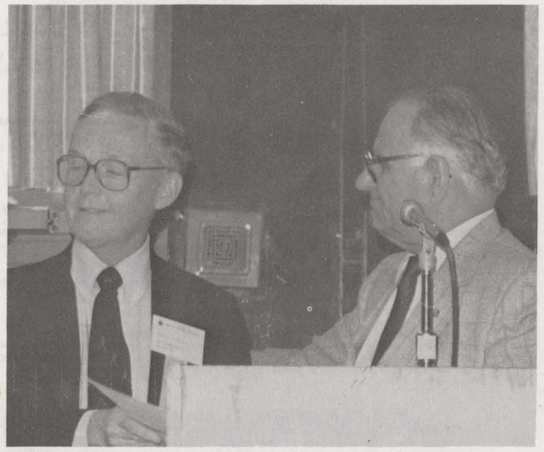
Railroads are now able to operate freight trains without cabooses, yet provide the engineer in the locomotive cab information about the air pressure at the rear of the train.

"End-of-train Monitor System for Caboose Elimination" was the title of the paper presented by Robert C. Kull, Manager Systems & Product Planning, Union Switch & Signal Division, American Standard, Inc.

Again, using a microprocessor coupled to an air brake gauge and a radio transmitter, the brake pipe pressure is mounted on the rear coupler of the last car of a freight train. Changes in brake pipe pressure are transmitted via UHF radio to the cab of the locomotive where the pressure in pounds per square inch is displayed for the engineer to see.

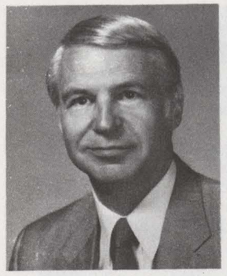
Now the crew rides in the locomotive and there is no need for the caboose at the rear of the train.

Freight trains can now operate without cabooses by using an end-to-train monitor system, reports Robert C. Kull of Union Switch & Signal.



Phil Porter (left) a member of the New Jersey Coast Chapter, accepts the Chapter of the Year award from Fred Link.

VTS President Robert Fenton discusses the new VTS chapter in Sweden with Sven-olof Ohrvik.



News From Washington

Eric Schimmel
Washington News Editor

NEW DOSE OF DOCKETS

Open wide and swallow the FCC's latest prescription to encourage new technology. But if it doesn't taste good, you can render a second opinion. In fact we are reprinting most of one of the new proposals in the hope that you will give the FCC your opinion either directly or via yours truly. I have recently been appointed to represent the VTS on the IEEE Committee on Communications and Information Policy. This policy body is expected to file formal comments in this proceeding (Docket 85-171) and I feel strongly that those comments should reflect VTS member opinion. I would, therefore, appreciate your feedback. Since this proceeding has a long fuze, with comments not due until December 16, it is an excellent opportunity to utilize the medium of our newsletter. The subject of the proceeding is a proposal to establish an "alternate type-acceptance" proceedure for equipment which utilizes new technologies.

Other recent rulemaking actions which may interest you include:

Docket 81-413, which authorizes limited use of spread spectrum modulation.

Dockets 85-172 and 173, which will explore additional land mobile sharing of UHF-TV channels.

Docket 85-129, which proposes to allow operation of a wide variety of low power communications devices between 1.6 and 10MHz.

Copies of these will have to be obtained from the FCC or its publications contractor.

Before the
Federal Communications Commission
Washington, D.C. 20554

FCC 85-288
35816

In the Matter of	)	
	)	
Technical Flexibility in the	)	GEN DOCKET NO. 85-171
Mobile Communications Services,	)	
Rules Parts 2, 22, 74, and 90.	)	

NOTICE OF INQUIRY AND PROPOSED RULE MAKING

Adopted: May 31, 1985 Released: June 11, 1985

By the Commission:

OVERVIEW OF PROPOSALS

11. The approach taken in this Notice is to define a new procedure to be called "Alternative Type Acceptance (ATA)" for land mobile transmitter authorization. ATA would be used for equipment which does not meet the conventional technical standards of existing mobile radio rules, such as Subpart I of Part 90. ATA consists of two basic steps. First, the manufacturer (or the distributor in the case of imported equipment) would perform specified tests to determine the interference potential of the equipment to conventional equipment. These tests would determine a power derating which would determine how much power had to be reduced compared to a conventional modulation type so that it did not cause more interference to co-channel and adjacent channel users. In the second step, the test data is sent to the Commission for review and possible replication. When the Commission is satisfied with the derating factors, it issues an ATA grant which includes the derating factors and the conditions of the test such as emission frequency relative to channel center frequency.

12. All Part 22 licensees (except in the Cellular Radio Telephone Service), those Part 90 licensees meeting the eligibility requirement discussed below in Paragraph 20 and all Part 74 licensees in the Remote Pickup Broadcast Service would have the option of using ATA equipment provided they use it with the emission spacing specified in the ATA grant and that they adjust the power of the transmitter(s) by applying the derating factor specified in the ATA grant. Since the ATA process determines the conditions under which the transmitters would not cause more interference than conventional equipment, the application of the derating factors should ensure that conventional users get no more interference than they would from conventional equipment.

13. The ATA application process would be generally similar to existing equipment authorization procedures. No public announcements of applications would be made until a grant is given. Thus, an applicant does not have to reveal the details of his technology to potential competitors at an early stage as he would have to do in a rulemaking process. The technical information, which is needed for the ATA application, is modeled on testing information which we have developed in the past for rulemakings dealing with new technology. We have generalized this experience in the proposed ATA rules.

ALTERNATIVE TYPE ACCEPTANCE TESTING

14. The specific ATA testing proposal determines the power derating needed for a new modulation by first measuring the new modulation signal level needed to cause interference to the signal using the standard modulation. That new modulation signal level is them compared to the level of an undesired standard modulation signal needed to cause interference. In the case of new modulations which are narrowband (i.e. more than one emission can occupy an standard channel) a group of transmitters using the new modulation are tested together as a unit using specified relative emission spacings. This is a worst case scenario with respect to a possible interference victim as it assumes all the new transmitters are on simultaneously at the closest possible distance to the victim.

15. The general testing setup to be used in ATA testing is shown in Figure A of the proposed of §2.1101 (see Appendix A). It involves three conventional systems (two transmitters and one receiver) as well as the new system, the equipment under test (EUT), which may be composed of more than one transmitter. (This discussion assumes that the equipment to be tested has a bandwidth less than a conventional channel width. The case in which the new equipment is wider is discussed in paragraph 18.) A switch in the setup selects one of two basic test conditions. We will discuss the first position initially. This position is used to determine the amount of co-channel conventional modulation which is needed to disrupt a communication path. The victim receiver is given a combination of two signals: a desired conventional signal which is attenuated to the level specified in the proposed rules and an undesired conventional signal which is attenuated by a variable attentuator. In the first part of the test, the variable attenuator is decreased until the victim receiver receives interference, which is defined as a 12 dB SINAD ratio. The undesired transmitter power that corresponds to this is noted as P_S.

16. In the next phase of the tests, the switch is moved to the second position to measure the interference potential of the EUT. Before the tests are started, the multiple transmitters are adjusted to different frequencies within the standard channel and to possibly different relative powers. The relative powers and frequencies are the choice of the manufacturer and are stated in his application for ATA. Analogous to the first part of the test, the variable attenuator is decreased until interference is observed. The interfering signal is actually composed of power from each of the transmitters within the EUT, so it is necessary to determine their individual powers, P_i, by now turning them on one at a time and measuring their power. Now the ratios P_i/P_S are the amount of decrease from the standard power from the standard modulation which are needed to ensure that the EUT causes no more interference than the standard modulation. These are a function of the frequency difference, f_i, of each transmitter with respect to the center of the channel. If a licensee with a current license which allows P_L watts of power on a channel with conventional technology were to switch to a new technology with several transmitters at frequencies, f_i, within his channel, he would not increase his interference to co-channel users if he adjusts the power on each f_i such that it is less than $P_L \times P_i/P_S$.

17. So far we have not discussed limits for emission outside of the conventional channel or inband emissions that may cause interference to adjacent channel users. Existing rules for the mobile radio services, such as §90.209 and §22.106, already cover out of channel emissions and a generalization of these standards is included in the proposed §2.1102(r). However, inband emissions near the channel edges may also affect adjacent channel interference. In order to address this problem, we propose two alternatives for the applicant. First, he can show compliance with existing in channel roll off standards for conventional transmitters. Alternatively, he could repeat the tests done previously but with the desired transmitter and victim receiver first tuned one channel above the original channel then tuned one channel below. In this option, the final P_i/P_S should be the lowest of the three frequencies for the victim and desired. This is a conservative measure in order to avoid interference to both co-channel and adjacent channel users.

18. A numerical example of using this procedure is given in Appendix B. This example assumes that the equipment proposed for ATA consists of 3 narrowband transmitters that would be spaced at 6 kHz intervals. Based on the ATA test results, a power derating for each of the transmitters is derived.

19. For wide band systems a similar approach is used. The major difference is that there is only one emission from the EUT, but that emission is wider than the bandwidth of the victim receiver. Therefore, the conventional equipment must be sequentially tested at each channel within the bandwidth of the EUT as well as at the channels adjacent to the wide band emission (if the EUT can not be shown to comply with the existing near channel edge roll-off standards). The most conservative power derating found on any channel would then become the overall derating.

20. In order for this type of tests to be reproducible, several technical parameters must be defined precisely. In doing this, we have tried to model our testing procedure after existing voluntary standards as much as possible. The specific sources of reference have been Electronic Industries Association RS-204-C (1/81) and ANSI C63.2-1982. The proposed rules, thus, give details in §2.1102(e) for input signals to all the transmitters, input signal levels, desired signal level to the receiver, receiver sensitivity, and receiver adjacent channel rejection.

21. While we have proposed specific test procedures and standards for this process, we recognize that none of these were originally developed for exactly the purpose for which we now propose to utilize them. Accordingly, we specifically invite comment on the suitability of these aspects of this proposal. Furthermore, if the comments indicate that significantly different standards or procedures would be preferable, we would expect to issue further proposals to ensure that the user public can comment fully on the standards prior to adoption. Obviously, these standards and procedures are critical to the success of this approach and they will receive our most careful consideration.

ELIGIBILITY

22. It is proposed that permission to use ATA equipment be given to all licensees in the Domestic Public Mobile Service (Part 22), except in the Domestic Public Cellular Radio Telecommunications Service, and to all Part 74 Broadcast Remote Pickup licensees. Private Land Mobile Radio Service Licensees (Part 90) may use ATA equipment if they are the exclusive licensee of a channel (only bands above 470 MHz have exlusive licensees) or if they have written consent of all co-channel licensees within a 75 mile radius. Nonexclusive licensees must notify the Commission of their intent to use ATA equipment and of the fact that they have the consent of all co-channel licensees. Whether ATA use will also require approval of frequency coordinating committees will be determined in FR Docket 83-737. Upon receiving this notification, the Commission will amend the license to specify that ATA equipment may be used. ATA users would receive the same protection that licensees with others emission modes receive. We recognize that several adjacent channels are needed for wideband systems and that in almost all cases multiple channel licensees have nonadjacent channels. Therefore, if we adopt the wideband aspects of the proposals, we will try to accommodate licensees trading channels among themselves, as they now can under §90.645(g).

NOTICE OF INQUIRY

23. We specifically seek comment on several aspects of the ATA test procedure and on the possible application of this approach to other radio services:

1. Characteristics of victim receiver
The victim receiver in the testing configuration should be typical of conventional receivers in the band in question. The sensitivity and bandpass of the receiver will have an impact on the results of tests. The proposed rules are based on the Electronic Industry Association's RS-204-A and require the receiver to have sensitivity and adjacent channel rejection within 3 dB of the standard. It this the appropriate standard? Should more receiver parameters be specified in order for the tests to be both representative and reproducible? If so, what standards are needed? Would a receiver whose intermediate frequency processing was implemented as a digital filter be a practical way of standardizing receiver performance for the purposes of this testing?

2. Standard Signal Levels
In the testing procedure, the standard transmitter is attenuated to 3 dB above the EIA recommended minimum sensitivity level for that band before its signal is mixed with the undesired signal. While it would be convenient to use only one attenuation for all tests, it may not be respresentative of all interference situations. How may desired standard signal levels should be tested? What should these levels be?

3. EUT Signal Power Measurement
We have not specifically proposed how to define the EUT power measured, P_i. While constant envelope technologies such as FM are well defined by average power, other technologies are better characterized in other ways such as with peak envelope power. We request comments on whether we should specify a power measurement approach, and if so, what approach should be used.

4. Definition of Interference
The proposed rules describe tests where power is adjusted until interference is noticed, as defined by a 12 dB SINAD measurement with a 1 kHz desired modulation signal. The SINAD measurement is a well recognized method of measuring FM receiver performance in general and we request comment on the adequacy of this approach. However, it may not be optimal for other technologies. Therefore, we request comment on the best approach for interference measurement. For example, a more complex objective measurement of performance such as "articulation index" 15/ or "speech communication index" 16/ could be used. Does the increased accuracy of these tests justify their complexity in this context?

5. Fading Simulation
All of the ATA tests specified above use steady signal strengths and laboratory test conditions. Actual mobile equipment use involves fading signal strengths. While it is well known that this type of desired/undesired interference testing is very difficult under field condition to do reproducibly, it is possible to simulate fading in the laboratory with appropriate equipment. How much of a difference in power level ratios, such as P_i/P_S, should be expected under fading conditions? Is it necessary to require fading simulation as part of the ATA testing procedures? If, so what combination of fading rates and depths should be tested?

6. Use of Wideband Emissions by Radio Common Carriers.
In order to assure high quality service in the Domestic Public Land Mobile Radio Service, we have not generally permitted interstitial channel use between existing channels as we have in the private land mobile services. New narrowband equipment, such as ACSB, may in some cases be able to provide a useful new service on interstitial channels without causing harmful interference to previous licensees. If we were to allow licensees to use wideband, multichannel emissions, they might do so in order to block new entrants on interstitial channels without providing more service themselves. We seek comment on how we can allow licensees the flexibility to use wideband emissions without encouraging anticompetitive conduct. Possible regulatory approaches could include a diligence requirement for implementing the wideband system and a minimum spectrum efficiency standard for wideband systems. Are such controls needed and, if so, what form should they take?

7. Use of ATA in the Private Land Mobile Services
In the Private Land Mobile Services, unlike Remote Pickup and Domestic Public Services, there are literally thousands of systems co-existing in an extremely limited amount of spectrum. In addition to being spaced relatively close together in relation to adjacent channel systems, in the vast majority of cases, private users share the frequency with numerous co-channel licensees in a given operating area. Even when all users operate with type-accepted equipment, interference problems arise because of the sheer volume of transmissions. Allowing licensees to use equipment which may not provide the same amount of interference protection could have severe impact on these services. On the other hand, it may be in crowded Private Land Mobile bands where added flexibility and spectrum efficient technologies are most needed. Therefore, we specifically request comments on whether the ATA procedures put forth here should be applied to Part 90 of the Commission's Rules.

8. Role of Coordinators in the Private Land Mobile Radio Services.
The role of coordinators in the private land mobile frequency selection process is currently under review in Docket No. 83-737. In order for coordinators to recommend the best possible frequency they must be fully apprised of the actual operating environment, including the technology used. We request comments on how the rules proposed herein would affect the frequency coordination process services and what steps, if any, need to be taken to ensure that coordinators are aware of entities using ATA equipment.

9. Less Complex Alternatives.
This proposal was drafted in order to minimize the a priori risk of interference to FM licensees. It does so by subjecting new types of equipment to a rigid testing program and limiting transmitter powers to very conservative values. We seek comment on whether less complex alternatives might be preferable.

Consider, for example, a type acceptance program that rated equipment as to peak output power, occupied bandwidth and frequency stability. Licensees might be authorized to utilize any combination of this type accepted equipment so long as the resulting system met the following conditions:

1. The stability of all transmitters was not less than that required of standard communications equipment.

2. No portion of any transmitter's occupied bandwidth could be outside the channel's authorized bandwidth.

3. The sum of the peak powers of all base station transmitters could not exceed the maximum currently permitted. The peak power of mobile transmitters must be reduced from that currently permitted by a factor equal to the ratio of non-standard to standard base station transmitters. 17/

Some systems authorized under this type of scheme might have the potential to create more interference than similarly powered standard communications systems. In other situations, non-standard systems could operate with substantially higher powers than authorized without causing any interference. Rather than providing absolute certainty that all systems would operate in harmony, this scheme would establish a framework within which affected parties could fine tune their systems' design to their mutual benefit. We seek comment on whether it, or some other similar approach, would provide a better balance between encouraging technical innovation and interference protection than the more complex procedure proposed above.

15/ See K. D. Kryter, "Methods for the Calculation and Use of the Articulation Index," J. Acoust. Soc. of Am. 34, 1689-1697 (1962) and K. D. Kryter, "Validation of the Articulation Index," J. Acoust. Soc. of Am. 34, 1698-1702 (1962).

16/ See K. D. Kryter and J. H. Ball, "A Meter for Measuring the Performance of Speech Communications Systems, "Report No. ESD-TDR-64-674, Electronic Systems Division, Air Force Systems Command (1964), AD 611 082.

APPENDIX A

PROPOSED CHANGES FOR FCC RULES AND REGULATIONS
PARTS 2, 22, 74, and 90

The authority citation for Part 2 continues to read: Sections 4(i), 4(j) and 303(r) of the Communications Act of 1934, as amended, 47 U.S.C. §§154(i), 154(j) and 303(r) and Section 553 of the Administrative Procedure Act, 5 U.S.C. 553.

1. New Section 2.1100 is added to read as follows:

2.1100 Alternative Type Acceptance (ATA) Grant

Alternative type acceptance (ATA) is intended as an expeditious alternative for manufacturers who wish to market new mobile radio technologies that do not comply with existing technical standards and channelization plans. Under this program licensees have an alternative option to use unconventional equipment with the understanding that they must adjust their transmitted power according to the manufacturer's instructions as indicated in the ATA grant in order to prevent interference to other licensees. While the alternative type acceptance procedures are more complicated for the manufacturer than regular type acceptance, under many circumstances they are simpler and faster than petitioning the Commission for a rule change - an option which remains open to the manufacturer.

2. New Section 2.1101 is added to read as follows:

2.1101 Applying for ATA Grant

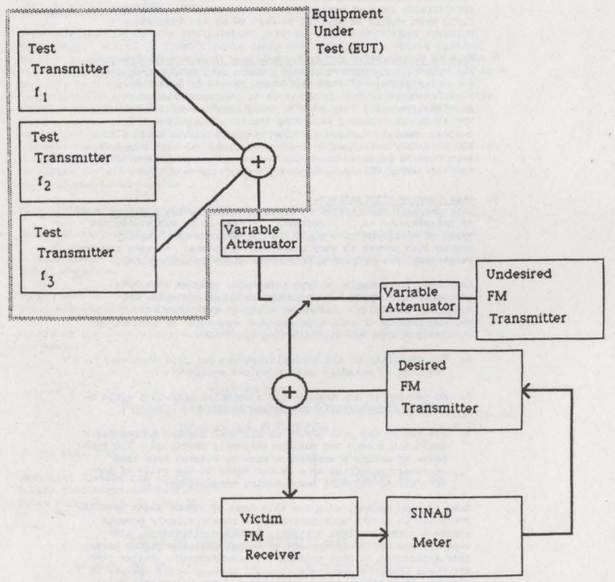
(a) The general provisions of this subpart, §§2.901, et seq. and of §2.983(a)-(g) shall apply to applications for and grants of alternative type acceptance.

(b) An applicant for an ATA grant must test the proposed equipment in the configuration shown in Figure A. The proposed equipment is shown as the equipment under test (EUT) and may consist of more than one transmitter for systems that are narrower in bandwidth than a conventional channel in the band involved. For the tests, the applicant proposes a relative power for each transmitter and a frequency offset from the channel center frequency f_1.

3. New Section 2.1102 is added to read as follows:

2.1102 Tests for ATA Grant

The applicant must perform the following tests:



§2.1101 Figure A. Test Setup

(a) With the standard desired transmitter, standard undesired transmitter, and victim receiver all tuned to the same channel, adjust the output level of the undesired transmitter until interference as defined in §2.1102(e) is noted at the victim receiver. The undesired received power is defined as P_s.

(b) With the EUT connected in place of the standard undesired transmitter and the transmitters within the EUT adjusted to their relative frequencies and powers, the EUT combined output signal level is adjusted to also cause interference at the victim receiver. This signal level is defined as the power contribution of each transmitter, P_i. The ratios P_i/P_s determine the power derating needed to limit co-channel interference. If the equipment can meet in-channel roll-off characteristics for the service in which it is intended to be used no additional tests are needed. However, if transmitter bandwidth standards for the proposed band and service can not be met the following test must be performed to show adjacent channel protection.

(c) Adjust the EUT first to the channel immediately above the channel of the other equipment and then to the channel immediately below it keeping the relative frequencies and powers of its internal equipment the same. At each channel perform the same tests as in §2.1102(a)-(b). For each transmitter i, pick as the power derating the lowest P_i/P_s of each of the three test conditions.

(d) For an EUT which is proposed to cover more than one conventional channel, the tests must be performed on all the conventional channels that the EUT proposes to cover as well as the adjacent channels if the EUT can not meet the near channel edge within channel roll-off for the service for which it is intended.

(e) For the above tests the following procedures shall be used:

(1) The desired transmitter shall be an FM transmitter whose deviation is normal for the frequency at which the test is performed. It shall be modulated with a 1 kHz sinusoid whose applitude is such that 60% of maximum deviation is obtained. The signal level from the transmitter shall be attenuated such that it is 6 dB stronger than the minimum sensitivity given in Section 7.3 of EIA-RS-204-C (1/82) for the receiver type being used.

(2) The victim receiver shall have an adjacent channel rejection within 6 dB and sensitivity within 3 dB of that given in EIA-RS-204-C (1/82) for the band being tested.

(3) The undesired standard transmitter shall be an FM transmitter with the normal deviation for the band being used. It shall be modulated with a 1.7 kHz sinusoid whose amplitude results in 60% of maximum deviation.

(4) Each EUT transmitter shall have as an input either a 1.7 kHz sinusoid or if it is not a voice radio, typical input signals. The input signal levels to the transmitters shall be typical of expected use.

(5) The definition of interference at the receiver for the purpose of this test shall be a SINAD ratio, defined in EIA-RS-204-C (1/82), of 12 dB.

(f) The EUT must be shown to meet the emission bandwidth limits for the band in which it is proposed to be used. For systems that produce a line spectrum for the test signals described in §2.985, those input signals shall be used. In other cases a typical input signal shall be used and compliance with the emission bandwidth limits shall be shown by measuring the power within a 100 kHz bandwidth and comparing it to the maximum 100 kHz bandwidth measurement on the inband signal. For frequencies below 1 GHz the quasi-peak detector described in ANSI C63.2 - 1980 shall be used. For frequencies above 1 GHz peak power shall be used with an instrument bandwidth appropriate to the existing service.

4. New Section 2.1103 is added to read as follows:

2.1103 Submission of ATA Grant Application

The applicant for ATA will submit with his application a description of the above test results, a table of derating factors for each transmitter in the EUT along with its frequency relative to the center frequency, and test results showing that the EUT as a whole complied with the out of emission bandwidth standards for the service for which it is intended.

5. New Section 2.1104 is added to read as follows:

2.1104 Transmitter Submission for ATA Grant

The Commission staff will review the application and may request the applicant to furnish a set of transmitters in order to reproduce the tests. If the application is acceptable to the Commission, an ATA grant which gives the power derating which must be used by a licensee in order to use the equipment will be issued.

The authority citation for Part 22 continues to read: Sections 4(i), 4(j) and 303(r) of the Communications Act of 1934, as amended, 47 U.S.C. §§154(i), 154(j) and 303(r) and Section 553 of the Administrative Procedure Act, 5 U.S.C. 553.

6. New Section 22.120(e) is added to read as follows:

22.120 Alternative Type Acceptance

* * * * *

(e) Alternative Type Acceptance. In addition to type accepted transmitters, licensees, except those the Cellular Radiotelephone Service, may use transmitters granted alternative type acceptance under §2.1100 et seq. provided that the transmitted power is decreased as provided in the alternative type acceptance grant.

The authority citation for Part 74 continues to read: Sections 4(i), 4(j) and 303(r) of the Communications Act of 1934, as amended, 47 U.S.C. §§154(i), 154(j) and 303(r) and Section 553 of the Administrative Procedure Act, 5 U.S.C. 553.

7. Section 74.451(a) is revised to read as follows:

74.451 Type Acceptance of Equipment

(a) Type Acceptance of Equipment. Applications for new remote pickup broadcast stations or systems or for changing transmitting equipment of an existing station will not be accepted unless the transmitters to be used have been type accepted by the FCC pursuant to the provisions of this subpart, or have been type accepted for licensing under Parts 21 or 90 of the FCC rules and do not exceed the output power limits specified in §74.461(b), or have been granted alternative type acceptance under §2.1100 et seq. and the output power does not exceed the limits in §74.461(b) decreased in accordance with the alternative type acceptance grant conditions.

* * * * *

The authority citation for Part 90 continues to read: Sections 4(i), 4(j) and 303(r) of the Communications Act of 1934, as amended, 47 U.S.C. §§154(i), 154(j) and 303(r) and Section 553 of the Administrative Procedure Act, 5 U.S.C. 553.

8. In Section 90.203, (a) is revised and a new (e) is added to read as follows:

90.203 Type Acceptance Required

(a) Type Acceptance Required. Except as specified in paragraphs (b) or (e) of this section, each transmitter utilized for operation under this part and each transmitter marketed as set forth in §2.803 (of Part 2) must be of a type which is included in the Commission's current Radio Equipment List as type accepted for use under this part; or, be of a type which has been type accepted by the Commission for use under this part in accordance with the procedures in paragraph (a)(2) of this section.

* * * * *

(e) Licensees may use transmitters granted alternative type accepted under §2.1100 et seq. provided that the transmitted power is decreased from the licensed power as provided in the alternative type acceptance grant and the following eligibility criteria are met

(1) Licensee is an exclusive licensee of the channel or
(2) Licensee furnishes the written consent of all co-channel licensees within a 75 mile radius and receives a license modification allowing use of alternative type acceptance equipment.

Appendix B

Numerical Example of Alternative Type Acceptance and Transmitter Derating

1. For this example, we assume that a licensee is presently authorized a 16K0F3E (formerly 16F3) FM transmission with 10 dBw mobile power and 20 dBw repeater power. The hypothetical proposed equipment for Alternative Type Acceptance (ATA) is a 6 kHz channel system. It is proposed to put one of the subchannels on the center of an existing 25 kHz channel and to center each of two others 6 kHz away from the center channel. The manufacturer proposes to attenuate the side channels 2dB relative to the center channel.

2. In the first ATA test, the desired FM signal level is set to -107 dBm. The undesired FM level is increased until a 12 dB SINAD is reached. This is found to be -100 dBm, which is P_s. The switch is moved for the EUT test and the attenuation is decreased until 12 dB SINAD is reached again. The following individual transmitter powers are then noted:

Frequency relative to channel center (f_i)	P_i	P_i/P_s
-6 kHz	-46 dBm	-6 dB
0 kHz	-44 dBm	-4 dB
+6 kHz	-46 dBm	-6 dB

The same test is repeated for the FM equipment adjusted to the lower adjacent channel and P_s is found to be -41 dBm. The switch is moved again and the following values are found for P_i.

Frequency relative to channel center (f_i)	P_i	P_i/P_s
-6 kHz	-46 dBm	-5 dB
0 kHz	-44 dBm	-3 dB
+6 kHz	-46 dBm	-5 dB

The largest values found for P_i/P_s were in the second test and this will be used for the derating in the ATA grant. Thus, the grant will have the following condition:

Frequency relative to channel center (f_i)	Derating from licensed power
-6 kHz	-6 dB
0 kHz	-4 dB
+6 kHz	-6 dB

For the hypothetical licensee described above, this leads to the following permitted powers:

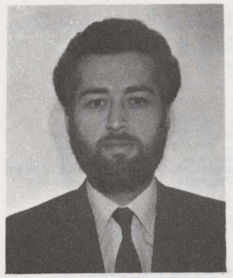
Frequency relative to channel center (f_i)	Repeater Power	Mobile Power
-6 kHz	14 dBW	4 dBW
0 kHz	16 dBW	6 dBW
+6 kHz	14 dBW	4 dBW

David Talley (left) receives recognition and appreciation certificate from Fred Link as an expression of appreciation for an excellent job of advising VTS on financial matters.

The 1983 Toronto VTS Conference Chairman C. Vinodrai (left) gets recognition and appreciation certificate from Fred Link.

Forecasting a bright future for cellular radio is Banquet Keynote Speaker John Davis, Director of the Cellular Telecommunications Laboratory of AT&T Bell Laboratories.

Communications



J. R. Cruz
Communications Editor

In this issue we are publishing another tutorial article in our continued series. This time the topic is mobile cellular systems. Its author, Dr. William Y.C. Lee, ITT Defense Communications Division, provides us with a birdseye view of the critical issues in cellular systems. We thank him for his contribution.

We continue soliciting articles on different topics of interest to our readership. In addition we will publish conference announcements, new product releases, book reviews and thesis abstracts.

Your correspondence with suggestions and comments about the format or content of our contribution is always welcome. Please address all correspondence to:

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ABSTRACTS

"A New Approach to Space Diversity Combining in Microwave Digital Radio," Y.S. Yeh and L.J. Greenstein, AT&T Technical Journal, Vol. 64, No. 4, April 1985.

In this paper we describe a new approach to dual-channel space diversity combining in microwave digital radio. This approach features (1) adaptive control of the relative amplitudes and phases of the two branch gains; and (2) a search strategy, based on noncoherent spectrum measurements at the combiner output, that simultaneously accounts for both dispersion and noise. Computer programs have been developed to simulate the search process and to analyze the resulting performance. Eight representative channel response pairs are postulated and performance results are presented for each. They show that the scheme provides a high degree of channel equalization over bandwidths up to at least 40 MHz, and that, in receivers not using adaptive equalizers, it offers major improvements in detection performance over selection diversity.

"A Simulation Study of Space Diversity and Adaptive Equalization in Microwave Digital Radio," L. J. Greenstein and Y.S. Yeh, AT&T Technical Journal, Vol. 64, No. 4, April 1985.

In this paper we analyze the performance of M-level quadrature amplitude modulation digital radio systems subjected to microwave multipath fading. We consider two kinds of adaptive receiver techniques, either singly or in combination: dual space diversity and adaptive equalization. The space diversity is assumed to be of either the selection type or the continuous-combining type, and the equalization is assumed to be ideal. We describe a specific form of combining which is optimal when no post-combiner equalization is used. A primary aim of the study is to quantify the performance of this combining approach and to compare it with alternate strategies. The study uses Monte Carlo simulations of the dual-channel fading response functions based on a recently published statistical model. For each response pair generated, a receiver detection measure is derived analytically in terms of the system parameters and receiver approach. Probability distributions of this measure, obtained by simulating several thousand response pairs, are then computed. They can be interpreted as displaying the link outage probability as a function of the number of modulation levels (M). We find that the appropriate combining scheme can serve in some cases to avoid the need for adaptive equalization. Also, where post-combiner equalization is used, the same scheme, while no longer optimal, can sharply reduce the dispersion seen by the equalizer input.

"Simple Simultaneous Carrier and Bit Synchronization System for Narrowband Data Transmission," J.P. McGeehan and A.J. Bateman, IEE Proceedings, Vol. 132, Pt. F, No. 2, April 1985.

The paper describes a simple technique for achieving bit synchronization wih transparent tone-in-band (TTIB) systems. The composite system operates such that carrier and bit synchronization with narrow-band data communications are attained simultaneously in fading and nonfading environments. Consequently, the technique has wide applications including line, satellite and mobile communications.

"Two Tracking Performance of a Narrowband Phase-Locked Loop in the Mobile Multipath Environment," J.P. McGeehan and J.P.H. Sladen, IEE Proceedings, Vol. 132, PT. F, No. 2, April 1985.

The paper describes the behaviour of narrowband phase-locked loops in the mobile multipath environment. It is shown that the loop will often track individual frequency components of the pilot's spectrum and that the loop can give rise to frequency-tracking errors of up to $\pm\ \omega_d$ rad/s in estimating the nominal frequency of the received pilot.

"Reduction of Threshold Noise in FM Receivers Operating in Quasisynchronous Field" M.O. Al-Nuaimi, IEE Proceedings, Vol. 132, Pt. F, No. 2, April 1985.

The threshold effect is a phenomenon experienced in the reception of frequency modulated (FM) signals. It is found to be particularly troublesome in FM quasisynchronous (QS) mobile radio schemes, in the parts of the coverage area where carrier cancellation occurs due to carrier components interaction. This results in sharp noise burst punctuating the receiver output and a consequent degradation in the speech quality. The paper describes a technique which was implemented as a receiver modification in the form of an add-on unit for the purpose of minimizing the threshold noise effects with satisfactory results. Measurements conducted on a commercial receiver incorporating this modification revealed that an improvement of 12 dB in the output S/N was achieved.

"Large Area Characterization of Urban UHF Multipath Propagation and its Relevance to the Performance Bounds of Mobile Radio Systems," A.S. Bajwa, and J.D. Parsons, IEE Proceedings, Vol. 132, Pt.F, No. 2, April 1985.

A large number of small-area statistical channel descriptors in the form of average-power/time-delay spread are meaningful parameters which adequately describe the dispersiveness of the channel, and the variability of these parameters over a large area has been used as part of a two-stage model for characterization of a UHF mobile radio channel. Surburban and urban areas exhibit quite different characteristics, reflecting the different nature of the environment. The variability of the statistical parameters is also a useful estimator of the performance bounds of radio systems. Using the measured data, together with relationships available in the literature for the performance of a given system in the presence of multipath, consideration is given to several systems, such as DPSK data, SSB with pilot, FM voice and a phase ranging automatic vehicle location system. It is concluded that system techniques such as diversity reception can often lead to useful improvements in performance.

"Linear Receivers for Correlatively Coded MSK," Peter Galko and Subbarayan Pasupathy, IEEE Trans. Comm., Vol. COM-33, No. 4, April 1985.

In this paper we show that many spectrally efficient modified MSK schemes, termed generalized MSK, although not representable as OQPKS, may nevertheless be (suboptimally) demodulated using an I-Q receiver with a proper choice of carrier-phase offset. Correlatively coded MSK schemes with I-Q receivers are studied, and it is concluded that duobinary MSK and $(1 + 2D + D^2)/4$ MSK represent good performance-bandwidth tradeoffs among first- and second-order correlative coding polynomial schemes. The optimal design of these receivers are considered subject to the constraint of a finite duration impulse response, especially for asymptotic cases of arbitrarily small and large SNR. Filter design based on a zero-intersymbol interference constraint for PAM-based approximations of the signals is also considered. The optimized linear I-Q receivers for $(1 + D)/2$ MSK and $(1 + D)^2/4$ MSK are presented. These receivers are only 0.28 and 1.24 dB poorer than the optimal (Viterbi) receivers at high SNR.

"When Not to Spread Spectrum- a Sequel," A.J. Viterbi, IEEE Communications Magazine, Vol. 23, No. 4, April 1985.

In the May 1979, Issue of Communications, under the title "Spread Spectrum - Myths and Realities," we pointed out some basic facts about spread spectrum techniques for a variety of communication system application system applications. To date, there have been no rebuttals; so, it would appear that the "realities" are well founded and the "myths" properly dispelled. Most of both were related to military communication.

Independently, however, there appears to have arisen a new and independent spread spectrum myth concerning small earth terminals for commercial satellite communication. Loosely stated, the claim is that spread spectrum techniques make smaller user terminals more efficient in two ways: frequency channel regulation is unnecessary, and interference, both terrestrial and that from nearby satellites, is mitigated.

1) By demonstrating that the space segment is so inefficiently used as to render the earth terminal savings, if any, inconsequential compared to the network cost increase through inefficient transponder utilization (unless there is such a glut of satellite capacity as to create artifically low space segment costs), and

2) By analyzing the effect of interference from adjacent satellites, showing that the degradation is greater for spread modulation than for unspread techniques.

In both cases we show that forward-error-correcting codes are valuable ingredients of the satellite communication system, and even more effective when spectrum is spread than when it is not.

"Double Symbol Error Rates for Differential Detection of Narrow-Band FM," Marvin K. Simon, IEEE Trans. Comm. Vol. COM-33, No. 5, May 1985.

This paper evaluates the double symbol error rate (average probability of two consecutive symbol errors) in differentially detected narrow-band FM. Numerical results are presented for the special case of MSK with a Gaussian IF receive filter. It is shown that, not unlike similar results previously obtained for the single error probability of such systems, large inaccuracies in predicted performance can occur when intersymbol interference is ignored.

"Error Performance Analysis for Narrow-Band Duobinary FM with Discriminator Detection," T.T. Tjhung, C.S. Ng, K.K. Yeo and P.H. Wittke, IEEE Trans. Comm., Vol. COM-33, No. 5, May 1985.

Of the more band-efficient constant envelope digital modulations, duobinary FM is attractive in terms of its potential error prformance, as indicated by the minimum distance of the signal structure. In this paper, the error performance of narrow-band duobinary FM, with discriminator detection in an additive Gaussian noise background is evaluated for a range of system bandwidths BT and frequency deviation ratios h. The effects of intersymbol interference, due to the restricted bandwidth, are taken into account in the analysis. In addition, at the narrower bandwidths, $0.5 \leq BT < 1.0$, the filtered background noise is correlated, and these effects are included. It is shown that with the usual duobinary detector, "clicks," which are a major contributor to errors in conventional digital FM, do not contribute significantly to errors for the low frequency deviation ratios which are commonly used. The error rate theory agrees well with results obtained experimentally.

The deviation ratios that give the best error performance for a given system bandwidth are presented. In a narrower bandwidth such as BT = 1/2, where duobinary FM is proposed, duobinary FM with a frequency deviation ratio of h = 0.7 performs better than binary FM.

"Performance of First-Order Digital Phase-Locked Loops in Mobile Radio Channels," S.M. Elnoubi and S.C. Gupta, IEEE Trans. Comm., vol. COM-33, No. 5, May 1985.

The performance of a first-order digital phase-locked loop (DPLL) using nonuniform sampling is studied in the mobile radio environments. The mobile radio channel is characterized by introducing fast Rayleigh fading and random phase variation to the signal envelope and phase, respectively.

The nonlinear stochastic difference equation describing the loop operation in fading environments is introduced. The joint probability density function (pdf) of the random variables of this equation is derived by transformation of random variables for fast Rayleigh fading channels. A closed-form expression for the transition probability of the Chapman-Kolmogorov (C-K) equation is obtained for phase step plus noise input and for frequency step plus noise input. The probability density function of the steady-state phase error is obtained by solving the C-K equation numerically.

"The Autocorrelation Function for Multi-h Coded Signals," T. Masent, IEEE Trans. Commun., Vol. COM-33, No. 5, May 1985.

The autocorrelation function of a binary multi-h coded signal is determined analytically. This is done by considering the probability density of the "phase change variable" and then deriving the characteristic function. From the autocorrelation, the power spectrum can be found by an analytical or numerical Fourier transformation. Two examples are given.

Al Markwardt, Chairman, 1986 Vehicular Technology Conference, invited all VTS'ers to come to Dallas, Texas in May of next year. The Big D will host the May 20-22, 1986 Conference.

FUNDAMENTALS OF MOBILE CELLULAR SYSTEMS

W.C.Y. LEE, FELLOW, IEEE,

ITT DEFENSE COMMUNICATIONS DIVISION

NUTLEY, NJ

I. INTRODUCTION

In our radio communication community, the major problem is the lack of available frequency resources. A conventional mobile system is usually designed by dividing a whole set of allocated frequency channels into several subsets and serving them in several geographical zones.

The communication coverage of each zone is normally planned as large as possible. If a call which initiates in a zone happens to be lost at its zone boundary, the user has to reinitiate the call again in a new zone. In this kind of system, the number of users is limited to the number of channels assigned to that zone. Also this system is not a desirable radio telephone system since there is no guarantee that every call can be a complete call.

It is always a great help to the FCC in allocating the frequency spectrum if a system needs less bandwidth and provides most usage of that band in service with consumer's satisfaction. One system which fits this requirement is the recently developed mobile cellular system. The cellular system embodies many different concepts which are described below.

II. REUSE OF FREQUENCY CHANNELS AND COCHANNEL INTERFERENCE CONSIDERATION

A particular frequency channel*, say F_1, used by one user in a geographical zone called a cell, say C_1, with a coverage radius R, will be used by another user in another cell with the same coverage raidus at a distance D away.

This frequency reuse concept is the core of the cellular mobile radio system. In this frequency reuse system, there is more than one user using the same frequency channel. Normally this would cause interference to occur. The interference due to the common use of the same channel is called cochannel interference.

Actually, cochannel interference is not a function of the transmitted power but a function of both the number of cochannel cells, N and a ratio of the radius R and the distance D, $a = D/R$. We may call the parameter a cochannel interference reduction factor.

For a 7-cell system, there are seven cochannel cells as shown in Figure 1. Among the seven cochannel cells, any one cell is interfered with by the other six cells. The signal-to-interference can be expressed as

$$\frac{S}{I} = \frac{R^{-\gamma}}{\sum_{i=1}^{6} D_i^{-\gamma}} \qquad (1)$$

where γ ($2 \leq \gamma \leq 5$) is a propagation factor dependent on the actual terrain environment. Assume that all D_i are the same for simplicity, then

$$\frac{S}{I} = \frac{R^{-\gamma}}{6 \cdot D^{-\gamma}} = \frac{a^{\gamma}}{6} \qquad (2)$$

Thus,

$$a^{\gamma} = 6 \cdot \frac{S}{I}$$

and

$$a = \left(6 \cdot \frac{S}{I}\right)^{1/\gamma} \qquad (3)$$

In Eq. (3) the value of S/I is based on the required system performance, and the specified value of γ based on the terrain environment. With given values of S/I and γ, the cochannel interference reduction factor a can be determined. In most cases we are specifying (S/I) to be 19 dB, and γ to be four, then

$$a \simeq 4.6 \qquad (4)$$

Based on $a = D/R$ the determination of D by choosing a radius R in Eq. (4) can be reached. Usually, we always like to achieve a larger value of a than that shown in Eq. (4). The larger the value of a, the less the cochannel interference. In a real environment, Eq. (1) is always true, but Eq. (2) is not. Since Eq. (4) is derived from Eq. (2), its value may not be large enough to maintain a signal-to-interference ratio of 19 dB.

---

* A frequency channel consists of a pair of two frequencies, one is from a low frequency band and the other is from a high frequency band and is used for a FDX System.

III. SEPARATION BETWEEN CELLS

Once the value of a is determined, the mobile cellular system is ready to be implemented in its service area. For a given value of radius R, a specified value of D is associated because of the value of a

$$D = a \cdot R \qquad (5)$$

For a startup system, the radius R of a cell can be very large, that means a large coverage for a light traffic density. The size of the cell is determined only by the required signal-to-noise ratio received at the cell boundary rather than the signal-to-interference ratio. Therefore, the size of the cell can be increased if the antenna height is increased, antenna gain is increased, and/or transmitted power is increased.

IV. HANDOFF MECHANISM

The handoff occurs each time the mobile unit enters in a different cell which associates with a different frequency. The handoff processing scheme is an important task for any successful system. How does one make any one of the necessary handoffs successful? How does one reduce all unnecessary handoffs in the system? Also there are circumstances when handoffs are necessary, but cannot be made. The first such circumstance is when the mobile unit is located at a signal strength hole within a cell but not at the boundary. Sometimes the mobile unit is at the cell boundary but the new cell which the mobile unit moves in may not have available frequency channels to be assigned. Under the first circumstance, the call has to be kept in the old frequency channel until the call drops due to the unacceptable signal level. Under the second circumstance, the call has to be dropped, or the new cell has to rearrange its frequency assignment based on the priority.

The system switching office usually controls the frequency assignment in each cell and can be smart enough to rearrange the channel assignment or split the cells when the second circumstance occurs. The cell splitting is described in the following section.

V. CELL SPLITTING

If the traffic density starts to build up, each set of frequency channels in each cell cannot provide enough mobile calls, then the original startup cell can be split into smaller cells. Usually after a first split the new radius is one-half of the original radius.

A new cell radius = 1/2 of the old cell radius (6)

Then based on Eq. (6), the following equation is true

A new cell size = 1/4 of the old cell size (7)

Let each new cell carry the same traffic load of the old cell

A new traffic load = 4x (the traffic load of the old cell) (8)

The transmitted power P_{t2} for a new cell due to its reduced size can be determined from the transmitted power P_{t1} of the old cell.

For a typical mobile radio environment

$$P_{t2} = \frac{P_{t1}}{16} \text{ (12 dB less than } P_{t1}) \qquad (9)$$

VI. NEAR-END AND FAR-END RATIO INTERFERENCE

In the mobile radio system, all the mobile units are in motion. Their relative positions change from time to time. There is no fixed frequency plan that can possibly be carried out to avoid mutual interference among themselves.

The situation, when a distance d_o between a calling mobile transmitter and a base-station receiver is much larger than the distance d_I between interfered mobile transmitter and the same base-station receiver with the interfered mobile transmitter close enough to override the desired base-station signal is shown in Figure 2. This interference based on the distance ratio can be expressed as

$$\frac{S}{I} = \left(\frac{d_o}{d_I}\right)^{-4} \qquad (10)$$

The ratio d_I/d_o is the near-end to far-end ratio. From Eq (10) the near-end to far-end ratio affects the signal-to-interference ratio according to the relative positions due to the motion of the mobile units.

If the calling mobile unit is 10 miles away from the base station receiver and the interfering mobile unit is 0.5 miles away from the base station receiver, then the signal-to-interference received at the base station receiver with $\gamma=4$ is

$$\frac{S}{I} = \left(\frac{d_o}{d_I}\right)^{-4} = (20)^{-4} \sim -52\text{dB} \qquad (11)$$

This kind of interference can be reduced only by the frequency separation with a specified filter characteristic.

VII. FREQUENCY MANAGEMENT

A frequency management plan is very crucial in a cellular system. As we have mentioned previously, the problems indicated in the frequency reuse, the handoff, the cell splitting, and the near-end to far-end ratio interference, depend upon a good frequency management plan. Here, we use an existing commercial frequency management chart to illustrate its advantages. The chart is shown in Figure 3. There are 7 cells, and 21 frequency channel sets which are provided for those seven. In each set, say 1A, the adjacent channel separation is 21B which is used to reduce the near-end to far-end ratio interference. The distance D for this system is 4.6R. For the sake of further reducing the cochannel interference, the insert in the center of the chart discloses a system using three 120° - directional antennas at each cell site in the system. The directivity is a mean to help reduce the cochannel interference.

VIII. SUMMARY AND CONCLUSION

The mobile cellular system is a high capability system. The idea of using the smallest frequency resource and providing the most telephone services has been described in this paper. The techniques include frequency reuse, handoff and cell splitting. The major problems which this system faces are cochannel interference and near-end to far-end interference. The reduction of transmitted power for small cells, the requirement of cochannel cell separation for cochannel interference reduction, and frequency channel separation for adjacent channel isolation are introduced. Finally, a typical frequency management chart is used to illustrate the implementation of a mobile cellular system.

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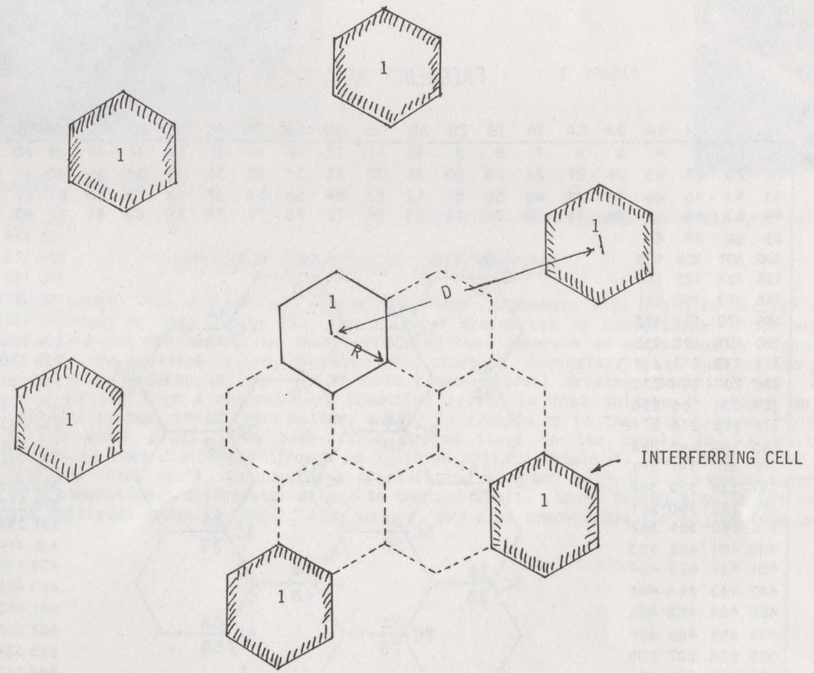
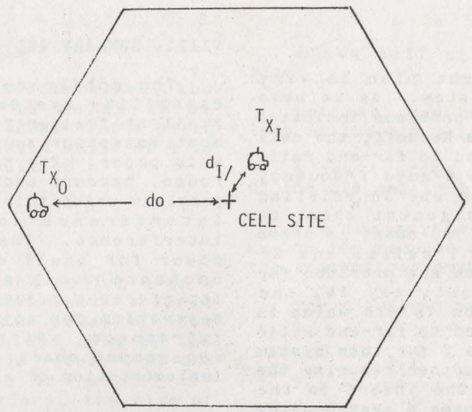


FIGURE 1 SIX INTERFERRING CELL OF CELL #1 IN A 7-CELL SYSTEM



d_o = 10 miles

d_I = 0.5 miles

T_{X_0} = the desired signal

T_{X_I} = the interferred signal

FIGURE 2 NEAR-END TO FAR-END RATIO INTERFERENCE

FIGURE 3 FREQUENCY MANAGEMENT CHART

1A	2A	3A	4A	5A	6A	7A	1B	2B	3B	4B	5B	6B	7B	1C	2C	3C	4C	5C	6C	7C
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42
43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63
64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84
85	86	87	88															103	104	105
106	107	108	109															124	125	126
127	128	129	130															145	146	147
148	149	150	151															166	167	168
169	170	171	172															187	199	190
190	191	192	193															208	209	210
211	212	213	214															229	230	231
232	233	234	235															230	251	252
253	254	255	256															271	272	273
274	275	276	277															292	293	294
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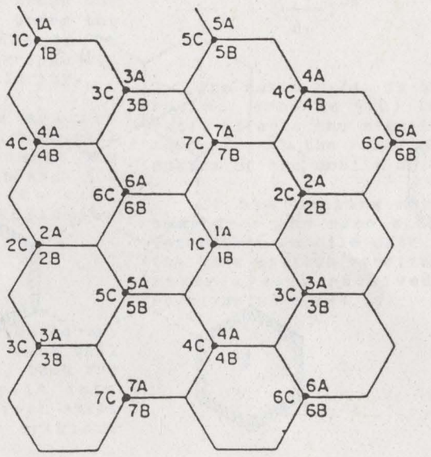
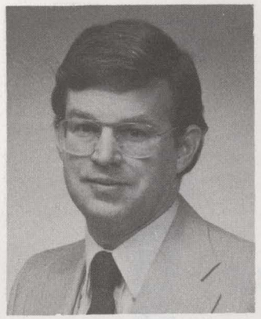
631	632	633	634	635	636	637	638	639	640	641	642	643	644	645	646	647	648	649	650	651
652	653	654	655	656	657	658	659	660	661	662	663	664	665	666						

16 CHANNELS/SET →

← 16 CHANNELS/SET





Automotive Electronics

Dateline: Detroit

Bill Fleming
Automotive Electronics Editor

SAAB EXPERIMENTAL VEHICLE ELECTRONIC VENTILATION

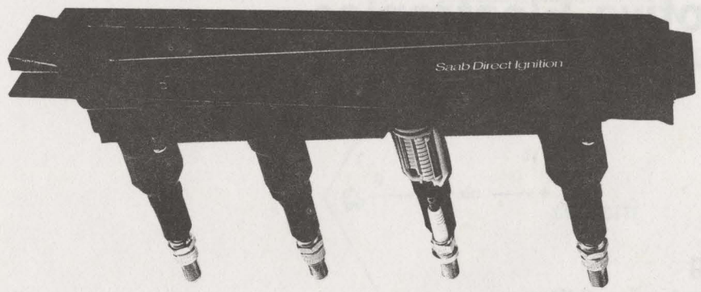
An experimental version of the Saab 900 Turbo was displayed at the Los Angeles Auto Expo on May 4, 1985 [1]. A distinctive feature of the experimental vehicle is an all-glass upper section, with the rear window and trunk lid being one unit. The removeable glass roof over the front seats incorporates 66 solar cells that power a fan in the ventilation air exhaust. Even with the car turned off, the fan runs if the solar cells "see" sunlight. Maximum fan capacity is 106 cfm -- which allows one interior air change per minute [1,2].

Experimental Saab Vehicle

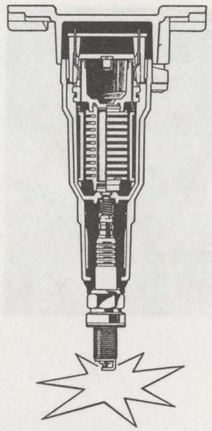
Solar cells continuously power electric ventilation.

SAAB-SCANIA COIL-PER-PLUG IGNITION SYSTEM

An innovative ignition system that combines all the high-voltage components into a single modular assembly has been developed in Sweden by Saab-Scania AB. The ignition system has no conventional distributor, and there are individual coils and condensors for each spark plug that generate an exceptionally high ignition voltage [4-6]. With this new ignition system, improved cold starting, insensitivity to fuel octane ratings, insensitivity to plug wear, and the ability to use cold plugs for all driving conditions were benefits gained. Saab's system differs from a conventional inductive system in that voltage is steped up in two stages. In a conventional system, the 12 volt battery supply is stepped up in the coil to some 25,000 volts and distributed to the spark plugs. The Saab-Scania method steps up the supply to 400 volts in a capacitor. That voltage is then discharged through an ignition coil to obtain 40,000 volts. A Hall-effect sensor is fitted near the crank shaft, to provide a spark-firing accuracy of $\pm$ 0.5 degrees, compared with the $\pm$ 3.0 degrees of a conventional distributor linked to the cam shaft. Spark timing signals are sent to a microprocessor, which initiates properly timed firing pulses, and also compensates for engine load and speed [4,6].



Saab Direct Ignition (SDI) four-plug ignition cartridge mounted in sealed metal casing.



Cross section of ignition cartridge leg, showing capacitor, ignition coil, and wide-gap spark plug.

ELECTRONICALLY CONTROLLED TRUCK RIGS

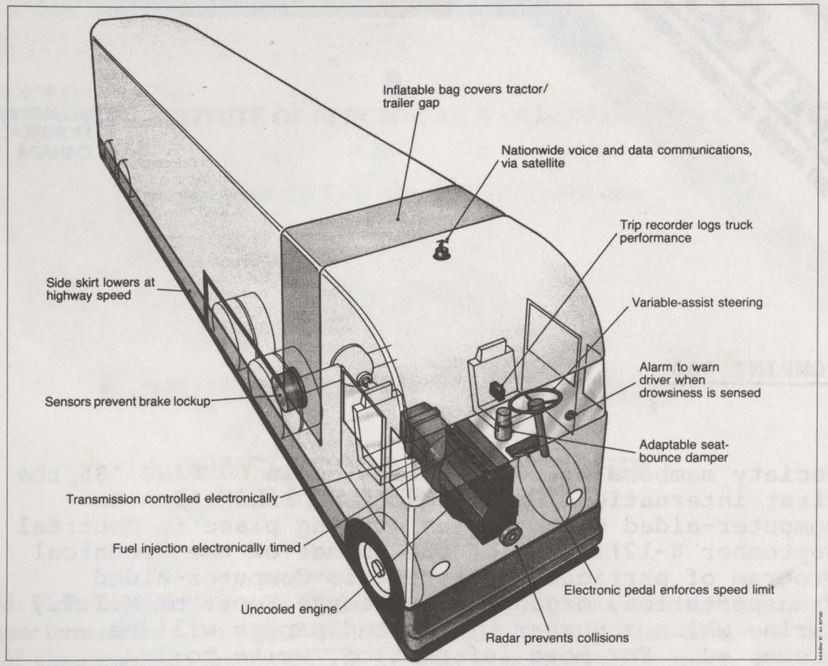
Truck makers are turning to electronic sensors, microprocessors and satellite communications to make the big rigs safer, more efficient, and easier to operate. Indeed, 21st-century truck drivers will function as supervisors who oversee a variety of computer based systems. The first step toward computerization of diesel engines has already been taken with the electronic truck engine control (ETEC) from TRW's Transportation Electronics Division in Farmington Hills, Michigan. ETEC was introduced in 1982 and is now used on about 9,000 trucks. One trucking company reports that ETEC improved fleet economy from 5.9 mpg to 7.1 mpg, saving over $1 million a year in fuel costs [3].

Following the introduction of electronic engine control, electronic control of transmission shifting should come next. These devices could radically simplify the drivers job. "We should not have people doing control systems work that a small, inexpensive computer can do more effectively," asserts Trevor O. Jones, Vice President and General Manager of TRW's Transportation Electronics Division. "I would like to see the driver not be an integral part of any control system other than the steering and to a limited extent, braking [3]."

A planned satellite communication service should begin in 1988, according to its developer, Mobile Satellite (King of Prussia, PA). Sensors on the truck (such as an electronic speedometer) will send the readings to an on-board microwave transmittor which can then relay the signals to a fleet terminal via satellite.

Such a hookup could also provide a continuous log of the trucks location to within 1/4 of a mile. What's more, a fleet manager could remotely control certain truck functions, such as the operation of the refrigeration unit when perishables are being shipped. The system could handle voice transmission as well, permiting truckers to talk to each other and to other companies from anywhere in the country. The celebrated CB radio, which can not reach past the horizion, may then become obsolete.

Human-factors problems would also be addressed such as driver fatigue. One example is the automatic adjustment of the springiness of the drivers seat which would be adjusted according to electronically sensed road conditions. On smooth highways the seat would be firm to minimize fatigue; on bumpy roads suspension would soften to absorb jolts. Another example is variable assist power steering. Drivers would get extra assistance at low speeds, when greater force is required to turn the wheels. Fuel would be conserved too, by shutting of the assist mechanism (servo motors, pneumatic or hydraulic pumps) at highway speeds [3].



Electronic innovations for improving safety, comfort, and efficiency of heavy-duty trucks.

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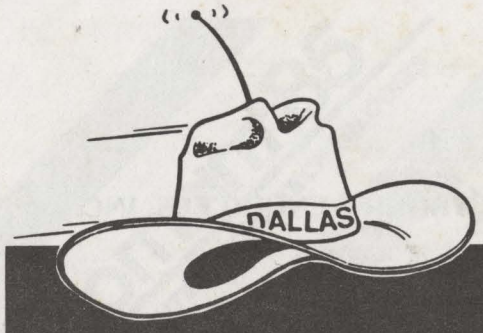

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Authors will be notified of acceptance by January 1, 1986. The complete text must be submitted by **March 1, 1986** and will be published in the 36th Vehicular Technology Conference Record, which will be available at the conference.