IEEE

VEHICULAR TECHNOLOGY SOCIETY NEWSLETTER

Vol.32, No.2, May 1985 (ISSN 0161-7887) Editor: A. Kent Johnson

35th Annual VTS Conference
Boulder, Colorado
May 21 - 23, 1985

President's Message

Sam McConoughey
President
IEEE Vehicular Technology Society

Thanks for the memories.." are the words to Bob Hope's sign-off theme song. Those words express my sentiments at this time.

At the 35th annual Vehicular Technology Conference, to be held in Boulder, CO on May 21-23, I will have served my limit of two years as President of your Society.

To you, the Membership; the Board of Directors; the Committees; IEEE Headquarters staff; Conference committees; wives, & families; employers and others; all of whom have contributed to the support of the objectives of the IEEE and this Society..... I express my sincerest thank you.

"When it's spring-time in the Rockies..." is another song that comes to mind...because that's when and where our 35th Annual Vehicular Technology Conference will be held. I hope you've made plans to attend. A study of the Advance Program should convince you (and your boss) that participation is an investment in the future.

Your Board of Directors will meet during the conference. Those recently elected will be installed. One of their many duties will be the election of a new slate of officers to serve for the upcoming year. The results will be announced and introductions made during the conference. It is an excellent opportunity to meet and exchange views with your elected representatives...please do so.

Your Society is only what you, the Membership, make of it. We are continually in search of persons who will volunteer for a task. WE NEED YOU! Why not do one or more of the following:

* Get a colleague to join IEEE/VTS.
* Attend Section/Chapter meetings.
* Author & publish or present a paper.
* Volunteer to serve on committees.
* Run for election to the Board of VTS.
* Attend our annual conferences.

Why should I, you say? Well, here are a few reasons I think you should.

Engineering is a profession. Those who hold themselves out to be Engineers must make every effort to stay current with the rapidly advancing technology. The only way to do this is to continue to STUDY. The excellent publications and conferences of the IEEE and its Societies are an excellent way to do this. To be a professional, you must behave like one.

The expected growth in this Society's field of interest is expected to be explosive..... for example. Land mobile radio sales are predicted to triple (in constant dollars) by 1987, from those of 1982, to $4 Billions! And cellular mobile telephone sales alone, are predicted to reach $10.6 Billions by 1993. Jerry Rivard, Chief Engineer of Ford's Electrical & Electronic Engineering Division predicts that the dollar content of the electronics in the average U.S. vehicle will more than double in the next decade. Transit systems operate electronically, and trains are replaceing the "little red caboose" with electronics. Vehicular Technology is on the MOVE...are you?

Personal satisfaction, is not the least of the benefits of IEEE & VTS participation. As I look back over my career it is difficult to tell you the many wonderful people I've had the opportunity to meet and to work with. Some are the giants of our industry, others are of lesser stature, but neverthless have also made contributions to the advancement of mankind. It gives me great satisfaction to run over our membership list, recognizing the names of those I've come to know, world-wide, as a result of belonging to IEEE-VTS. Do you have that satisfaction?

The good LORD willing, and the creek bed dry, I hope to visit with many of you at the Boulder Conference. But if I don't get a chance to tell you face-to-face, let me say again, thanks for giving me the privelege of being your President these past two years, and...."Thanks for the memories..."

Best Regards,
S. R. McConoughey
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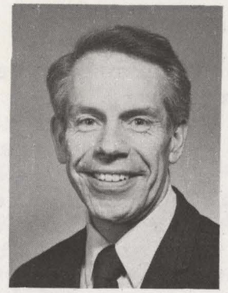
Month of Issue	Final Copy to be Rec'd By VTS Editor	Target Mailing Date
August	6-09-85	7-13-85
November	9-13-85	10-15-85
February	12-30-85	01-27-86
May	3-10-86	04-14-86

Editor's Notes



A. Kent Johnson
Newsletter Editor

We are pleased to feature the upcoming 35th Vehicular Technology Conference in this issue of the newsletter. The conference will by held May 21-23 at the Hilton Harvest House Hotel located in Boulder, Colorado. We are reproducing much of the advanced program in this copy of the newsletter. John Murray and his staff have worked long and hard to prepare what looks to be an excellent conference and knowing the kind of work they do from past associations with them, I am sure it will be an excellent conference. The Rockies are beautiful in the springtime and the conference should be a great experience. We look forward to seeing you all there.

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VTC 85 — Boulder in May

The 1985 Vehicular Technology Conference will be held in Boulder, Colorado on May 21-23. Make your plans and reservations as soon as possible for the high-technology forum for mobile communications and vehicular and transportation electronics. Twelve sessions will be held covering the following topics:

- Cellular Systems Engineering I & II
- Antennas, Propagation, and Measurements
- Guided Communications
- Communications Systems Design and Techniques I & II
- Vehicular Communications Equipment, Theory, Design and Applications
- Modulation and Coding Techniques
- Satellite Communications
- Automotive Electronics
- Off-Highway Electronics - An Emerging Technology
- Transportation

John Murray
Chairman, VTC 85

Spectacular scenery in the Colorado High Country, the mile-high climate and atmosphere of a University and research community, and springtime in the Rockies will complement the technical program to make this one of the most productive professional investments you can make.

See you in Boulder!

John Murray
Chairman, VTC 85

Technical Program

COMMUNICATIONS SESSIONS

Cellular Systems Engineering - I
Session Chairman: K.E. Alterman

* "Frequency Planning of Cellular Radio By The Use of A Topographical Data Base", R. W.-Lorenz, Deutschen Bundespost Research Institute, Federal Republic of Germany.
* "Relationships For Three Dimensional Modeling Co-channel Re-use", P. T. Porter, Bell Communications Research, Inc.
* "Power Control Methods in Cellular Systems" A.N. Rosenberg, AT&T Bell Laboratories.
* "Cellular Spectrum Efficiency", J. F. Whitehead, AT&T Bell Labs.

Cellular Systems Engineering - II
Session Chairman: Roger Pachuta

* "An Integrated Approach To Cellular Radio Network Planning", R. Beck, et al. Phillips TEKADE, Federal Republic of Germany.
* "Techniques For Increasing Frequency Spectrum Utilization In Mobile Radio Communication System", H. Sekiguchi, et al, Musashino Electrical Communications Lab, NTT, Japan.
* "Interference Control in Cellular Radio Systems", T. Brenig, General Electric.
* "The Role of Field Strength Measurements In Engineering Cellular Systems", G. L.-Schrenk, Comp.Comm., Inc.
* "A Study of the Effects of Propagation and Antenna Variations on Handoff Errors in Cellular Systems", V. Graziano, Motorola, Inc.

Antennas, Propagation, and Measurements
Session Chairman: Leonard Lewin

* "Vertical Pattern of Mobile Antenna at UHF Frequencies", K. Nishkawa and Y. Asano, Toyota Central Research and Development, Japan.
* "Cross-Polarization Coupling Measured For 800 MHz Transmission In and Around Houses and Large Buildings", D. C. Cox et al, Bell Communications Research, Inc.
* "Advantages of Point to Area Cellular Propagation Models", P. L. Rice, Philip Rice Associates.
* "Cochannel Interference Measurement in Mobile Radio Systems", S. Kozono and M. Sakamoto, NTT, Japan.
* "Co-Channel Interference Reduction By Using a Notch in Tilted Antenna Pattern", W. C. Y. Lee, ITT.
* "Air-to-Ground Propagation", Joseph Child, Consultant.

Guided Communications
Session Chairman: S. Rhee

* "Quadrupole Loop Self Inductance Formula", M. Mills, Federal Highway Administration.
* "A Guided Radio System Using CATV Amplifiers and Pressure Taps to Feed Distributed Antennas", R. A. Isberg, Communications Engineering.
* "Reradiation Systems For Cellular Radio", F. J. Schaefer, AT&T Bell Laboratories.
* "Roadside Radio System for Broadcasting on Expressways By 24 Seperate MediumWave Radio Stations of Traffic Information Automatically Edited", K. Muraoka et al, Omron Tateisi Electronics, and K. Takigawa, et al., Hanshin Expressway Public Corp., Japan.

Communications Systems Design and Techniques - I
Session Chairman - D. D. Crombie

* "Determining the Updating Interval of a Round Robin Sequence for Token Passing Mobile Networks", P. Mookerjee and Y. I. Gold, Univ. of Connecticut.
* "Applications of Personal Computer Techniques in Cellular Telecommunications", A. Barshefsky, AT&T Bell Laboratories.
* "Using Microcomputers For Engineering Cellular Systems", L. K. Sakayama, AT&T Bell Laboratories.
* "The Application of CCIR Radiopaging Code No. 1", P.J. Mabey et al, Phillips Research and C. Desmarchelier, King's College, U.K.
* "A Case Study of an Operational High Technology Vehicular Positioning System", H. M. Gates and M. T. Perkins, BDM Corp.

Communications Systems Design and Techniques - II
Session Chairman: Jim Mikulski

* "System Integration of Land, Maritime, Aeronautical Mobile Telephone Services", T. Suzuki, et al, NTT, Japan.
* "Simulation in a Distributed Mobile Switching Center Environment", M. Burke and K. Felix, Motorola, Inc.
* "An Evaluation of the Tone Calibrated Technique for Data Transmission Over Land Mobile Radio Channel", S. H. Goode, Motorola, Inc.
* "Progress in the 800 MHz Land Mobile Telephone System in Japan", K. Tsujimura et al, NTT, Japan.
* "Introduction of Cellular Radio in the United Kingdom", D. Barnes, Telecom Securicor Cellular Radio, Lt., U.K.
* "Band III - A New Mobile Radio Service For the United Kingdom", J. Durkin and R. M. Skiffins, Dept. of Trades and Industry, U.K.

Vehicular Communications Equipment, Theory, Design and Applications
Session Chairman: David Lowry

* "A New Adaptive Digital Echo Canceller as Hand's Free Phone For Cellular Mobile Radio Telephone Equipment", K. Hosoda and A. Fukasawa, OKI Electric, Japan.
* "Data and Voice Privacy Methods for the AUTOPLEX Cellular Systems", J. Peggeler, et al, AT&T Bell Laboratories.
* "Quality Aspects of Installation of Vehicular Cellular Terminal Equipment", N. Erlich, AT&T Bell Laboratories and W. Serber, General Motors.
* "Custom IC Design For Cellular Terminals", M. El Banna, et al, Novatel Comm. Ltd.
* "A Novel Realization of Signal Dividers for Mobile Radio Receiver Distribution Systems", H. R. Mgombelo, University of Dar es Salaam, Tanzania and J. G. Gardiner, University of Bradford, U.K.
* "Design of Antenna Masts", L. Gach, AT&T Bell Laboratories.

Modulation and Coding Techniques
Session Chairman: J. R. Cruz

* "Experiments on Real-Zero-SSB Transceiver Demodulation of SSB Signal Without Envelope", K. Daikoku and H. Ohdate, NTT, Japan.
* "Speech Transmission Using DPCM Coding, Partial Response Continuous Phase Modulation and Diversity", S. C. Gupta and V. Varma, Southern Methodist University.

* "Mobile Digital Transmission With Soft Decision Decoding", P. J. Mabey, Phillips Research Labs, U.K.
* "The Feasibility of the Nyquist Baseband Filtered 4-Level FM For Digital Mobile Communications", K. Kage, et al, NEC Corp., Japan.
* "Digitized Speech Transmission Through VHF FM Repeaters", P. M. Petrovic, Elektronska Industrija, Yugoslavia.
* "Review of Protection Measurements and Spectrum Efficiencies on ACSB and FM Mobile Radio Systems", D. D. Crombie, U. S. Department of Commerce, NTIA.

Satellite Communications
Session Chairman: Craig Farrill

* "Theory and Measurements of Propagation for Satellite to Land Mobile Communication at UHF and L-Band", W. J. Vogel, University of Texas and E. K. Smith, Jet Propulsion Lab.
* "The Skylink Mobile Satellite System", R. Chandler, Skylink Corp.
* "Omninet's STARSAT- An Advanced Mobile Satellite Communications System Design", A. Salmasi, Omninet Corporation.
* "Hardware Simulator Assists Mobile Satellite Experiment", F. Davarian, Jet Propulsion Lab.

AUTOMOTIVE ELECTRONICS
Session Chairman: David Howarth

* "Integrated Vehicle Electronics", David C. Wight and Kenneth R. Baker, Buick-Oldsmobile-Cadillac Group, General Motors Corp.
* "From Crystal Sets to Microprocessors: Brief History of Early Car Radios", Carlos Altgelt and Clem W. Rowan, Ford Motor Co.
* "Hi-Fi in GM Automobiles: Today and Tomorrow", John Auzins, Delco Electronics Division, General Motors Corporation.

OFF-HIGHWAY ELECTRONICS - An Emerging Technology
Session Chairman: David Howarth

* "Radar Ground Speed Sensors" William J. Fleming, Advance Technology Center, and Arun K. Hundiwal, Transportation Electronics Division, TRW.
* "Diesel Engine Control: Past, Present, and Future" Mark J. Gutwald, Transportation Electronics Div., TRW.
* "Integrated Electronic Tractor Controls" Barry D. Batchellor and Robert G. Eggs, Steiger Tractor, Inc.

TRANSPORTATION SESSION
Session Chairman: Robert McKnight

* "Microprocessor Based Talking Unit which provides a voice message via radio to train crews informing them that a detector has found a defect in their trains.", R. D. Douglas, Devtronics, Inc.
* "Improved underground radio communications and the use of simulcast to improve rapid transit operations", G. E. Austin, Bay Area Rapid Transit.
* "Electronic based automatic vehicle identification system can improve rail, bus, transit, and trucking operations", F. W. Smallenburg, General Railway Signal Co.
* "Improved safety of operations on railroads can be achieved with electronic track circuits", R. T. Sewell, SAB Harmon Industries.
* "End-of-train detector sends air brake pipe pressure from the rear of the last car to the locomotive engineer using UHF Radio. Thus, the trains can operate without cabooses.",- R. C. Kull, Union Switch and Signal, Div. American Standard.

Society Officers and Board of Directors

SOCIETY OFFICERS

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BOARD OF DIRECTORS

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Al Goldstein	Conference Coordinator	Jan82-Dec83
A. Kent Johnson	Newsletter Editor	Jan82-Dec83
Samuel A. Leslie	Society Secretary	Jan82-Dec83
Fred M. Link	Chairman, National Site Selection Comm.	Jan82-Dec83
Charles Lynk	Chairman, Paper of Year Comm.	Jan83-Dec85
Roger Madden	Senior Past President	Jan82-Dec84
Robert A. Mazzola	Chairman, Membership Committee	Jan82-Dec84
George F. McClure	Chairman of Publications Comm. and Transactions Editor	Jan83-Dec85
Samuel R. McConoughey	President	Jan82-Dec83
Stuart Meyer	Immediate Past President	Jan83-Dec85
James J. Mikulski	Awards Committee	Jan82-Dec84
Ronald G. Rule	Education Committee	Jan82-Dec84
Eric Schimmel	Chairman, Personal Radio Committee	Jan83-Dec85

Gaspar Messina
Chapter News Editor

Chapter News

Meeting

New Jersey Coast EMC/VT/AP

Extrapolation of Point Rain-Rate Distributions
by Dr. Ta-Shing Chu, AT&T Bell Laboratories,
Holmdel, N. J.
Held on February 19, 1985, with 12 attending.

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

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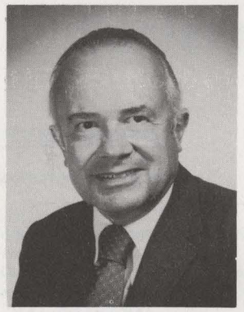


Professional Activities

Frank E. Lord
Professional Activities Editor

Who is an Engineer?

In the Institute there are over thirty Societies dedicated to subspecialties of Electrical and Electronics engineering. We also know there are at least a score of major engineering professional organizations devoted to disciplines other than ours. Thus, the variety of activity that is encompassed by "engineering" is such as to cause one to wonder about its definition and how to define those who practice it.

In French, the word "ingénieur" has an obvious relationship to the word meaning ingenious. In English, "engineer" relates to "engine" in most peoples' minds. Rather than being thought of as professionals who exert ingenuity, many imagine that we drive trains or do something akin to that. Many of us would be satisfied with the definition of an ingenious person who uses knowledge to create systems and/or products that improve the quality of life for mankind. But how do you measure ingenuity and knowledge and determine who is employing them effectively and who is not?

There are many definable ways of becoming classed as an engineer. One is to graduate from a college with a degree of BSXE. In this case, the college says you are an engineer. Or are they just saying that you are a Bachelor or Science? There is also the question of accreditation, i.e., did some other recognized authority say that the college's course of instruction was of adequate quality to produce people worthy of BSXE.

Another way of becoming an engineer is to have an employer label you as one. There are many such engineers having no other credentials. When such a person is no longer with the company, as they say, is he still an engineer? The employers who create engineers include industry, government and the military. An employer can also choose to withhold the title and call engineers something else, such as Member of the Technical Staff, thus lumping them with chemists, metallurgists and statisticians.

Some people become engineers by making a career change from a related field, such as mathematics, physics or chemistry. This is done to cope with the realities of the employment market and, of course, requires that an employer be willing.

One can also become an engineer by meeting state-administered requirements, which include test and experience criteria. Those who successfully meet these requirements are licensed by the state as engineers and can exercise responsibility for the public safety that non-licensed engineers cannot. This route to becoming an engineer has the advantage of being uniform for all practitioners within a state and the license is clearly recognized. The license is not required for most engineering work, however, because of broad exemptions that the states grant.

Membership in a professional society such as ours might be a way of becoming an engineer and there are many who think that this is sufficient. However, is does not take a great deal of observation to note that we have among our membership those whose ability to perform creative engineering work is doubtful. Some of these are even in positions of leadership in the national structure of the Institute.

You could be declared an engineer by your colleagues or peers. This happens informally in the workplace. Some engineers are recognized and admired by their peers for their engineering expertise and most everyone at that workplace is aware of it. This can be one of the most personally satisfying ways of realizing the engineer status. Of course, such engineers have usually already met the definition by one of the other methods. In the Institute we do something similar, but in a more formal manner with our grade structure and awards program. There usually also are a few non-functional engineers whose reputations are widespread. The knowledge of who's who among engineers at the workplace, as seen by engineers, is not necessarily the same as that which is visualized by management.

Finally, you could simply declare yourself to be an engineer. This has been done by many with flimsy credentials, who subsequently managed to convince an employer to grant the title. No matter how qualified you are, however, it is illegal to give yourself a title which is controlled by law in your state. Thus, we IEEE members who think of ourselves as Electrical Engineers cannot call ourselves such in most states unless registered in that discipline.

We all know of engineers who have left the profession, so one might examines the data on engineering graduates for the last forty or fifty years and applies mortality factors, it turns out that there are fewer people in that pool than there are people presently employed as engineers. This applies for electrical engineers, as well as all engineers as a group. The difference must be attributable to those who enter the employed-engineer class through one of the aforementioned paths that does not include graduating from an engineering curriculum.

It must be further recognized that there are engineers who practice engineering, those who manage engineering and those who teach engineering. Some do more than one of these competently. It can only be concluded that it is virtually impossible to characterize the present mix of engineers in a few sentences.

Does it really matter who is an engineer or not? There are several reasons to believe that it does. First, there is the matter of pride among those who are, in fact, engineers, and who are offended by the non-engineers who carry the "engineer" label. Also, consider that the Institute exists, in part, to serve the needs of engineers for technical information exchange and career development. How can that be done without characterizing the functioning engineers? Also, the present lack of definition may be at the heart of the controversy over whether or not there is ever a shortage of engineers. If it is not known who the engineers are, how can they be counted and a shortage or surplus determined?

It might not be so difficult to count the ingénieurs and then it might be discovered that that is where any shortage occurs. In other words, the problem would turn out to be one of quality, not quantity.

As always, I would welcome members' thoughts on this topic.

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 February 19, 1985 at the Embassy Suites Hotel in Washington, D.C. The Board meeting was called to order at 9:37 AM.

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
#A. Kent Johnson	Newsletter Editor
#Samuel A. Leslie	Secretary
#Roger Madden	Senior Past President
John Murray	'85 Denver Conference Chairman
Richard A. Uher	IAS Liaison
Gregory G. Gagarin	IAS Liaison
Robert W. McKnight	VTS Publicity Chairman

(# denotes elected Board member)

Nine of the fifteen 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

Art Goldsmith submitted the following correction to the minutes of the last meeting:

> The Treasurer noted that his report (copy appended) which is in agreement with the IEEE Headquarters Report, shows that the Net Worth of the VTS is $57.7K less than that shown on the corrected report of the VTS Board's Financial Advisor. There is an error of $32.7K in the latter's figures as the Outstanding Loans and the VTS Investments are already included in the Current Operating Net Worth. The remaining difference is due to the way in which the value of the VTS share of the Dan Noble Scholarship Fund is handled. In the official VTS records it is not treated as a current asset. Arthur Goldsmith is to resolve these differences with the Society's Financial Advisor, Dave Talley.

Fred Link moved, Art Goldsmith seconded that the minutes of the last meeting be approved as amended. The motion carried with all in favor.

VICE PRESIDENT'S REPORT

The updating of the VTS Charter to clarify the three main areas of interest (Vehicular Communications, Transportation, and Electronics) was discussed, with potential overlap issues with the IAS organization being discussed. Dick Uher felt that these issues would be resolved within the transportation portion of IAS by the March time frame, thus allowing VTS to proceed with the updating of the charter.

Art Goldsmith moved, Evan Richards seconded a motion to remove the charter question from the TAB agenda for now, and to tentatively resubmit it to TAB for consideration at the upcoming May meeting. The vote was unanimous in favor.

CONFERENCE COORDINATOR REPORT

Evan reported that the Convergence '84 preliminary results indicate that this conference will be the most successful ever. Attendance was over 2200.

The planning for the 35th Annual VTS Conference in Boulder is proceeding on a tight schedule. John Murray suggested that future conference chairmen should form and start their committees at least a year and a half rather than just a year before the actual conference date to allow adequate time for the committee members to achieve their goals.

The advance program for the Boulder Conference was reviewed, and minor changes were suggested. The board also suggested that the registration fee for non-IEEE members be set at $125. John Murray will incorporate the changes, and will start mailing the advance program mid-March.

John Murray also provided a revised (updated) budget for the Boulder Conference. Break-even is planned for 275 attendees. To assist with anticipated conference expenses, Art Goldsmith moved, Evan Richards seconded a motion to raise the seed money limit for the Boulder Conference from $3000 to a $5000 limit. The vote was unanimous in favor.

The 1986 Dallas Conference is in the formulative stages of getting a committee together. A conference chairman has not as of this date been selected. To cover any unanticipated expenses in the setting up of this conference, Evan Richards moved, Fred Link seconded that VTS make available up to $3000 seed money for this conference. The vote was unanimous in favor.

The 1987 Tampa VTS Conference will be chaired by Professor Alan Gondeck from the University of South Florida.

Fred Link reported that he is considering an area in the northeast for the 1988 VTS Conference, possibly Philadelphia. Fred Link moved, Bob Fenton seconded that the Board should consider Philadelphia or some other area in the northeast for the 1988 Conference. The vote was unanimous in favor.

PUBLICITY CHAIRMAN

Sam McConoughey appointed Bob McKnight as chairman of the Publicity Committee.

COMPINT '85

Bob Fenton reported that there were no new inputs other than that publicity for this conference were reported in the last newsletter.

EIA LAND MOBILE SHOWCASE

Eric Schimmel reported that the second EIA LAND MOBILE SHOWCASE will be held September 26 through 28 at the Convention Center in Washington D.C. This show is anticipated to be the Fall show for the land mobile industry. Eric reported that they are planning seminars for this conference, based on the positive response for the seminars held at the first Showcase Conference.

VTS AD HOC PROPAGATION COMMITTEE

Sam McConoughey reported that the IEEE Press Book operation considers the results of the Ad Hoc Propagation committee to be too limited for general publication. The committee is now considering a special VTS Transactions issue for the publication of the committee's work.

The propagation committee has a current schedule of late 1985 to finish up the work. This will result in a 1986 publication date in the Transactions, which will increase the publication costs for that year.

Sam McConoughey assigned the Advance Planning Committee Chairman (Bob Fenton) and Art Goldsmith the task of starting work on the 1986 VTS budget.

NEWSLETTER EDITOR REPORT

Kent Johnson reported that he is currently budgeting for 24 to 32 pages per issue.

Sam McConoughey noted that the Board should consider getting a quote from an outside printing shop for the publication of the VTS Newsletter, primarily to reduce the amount of time to get the Newsletter to the membership.

Stu Meyer, chairman of the advertising committee, submitted a report on advertising rates for the VTS Newsletter.

Bob Fenton moved, Evan Richards seconded that the following rate structure for ads be adopted and listed in the Newsletter:

Full Page	$300.00 per issue
Half Page	210.00 per issue
Quarter Page	120.00 per issue
Eighth Page	80.00 per issue

Discounts of 5, 10 or 15 percent are to be allowed for ads that are listed for 4, 8, or 12 consecutive issues, respectively.

Also, the following rate structure for institutional listings (approximately 1.0 x 3.25 inches in size) for the Newsletter are to be adopted:

4 Consecutive Listings:	$300.00
8 Consecutive Listings:	$500.00
12 Consecutive Listings:	$720.00

No discounts are to be provided for institutional listings. All ads and institutional listings must be in camera-ready form, and checks must be made to IEEE VTS.

The Board vote was unanimous in favor.

CHAPTER CHAIRMAN REPORT

Gaspar Messina reported that he has updated the list of the Chapter Chairmen, and that the list in the latest VTS Newsletter should be up to date. He reports that the most active chapters at this point in time are the New Jersey Coast, Cleveland, Denver, and Washington D.C. Chapters.

FELLOW GRADE NOMINATIONS

Sam McConoughey noted that VTS members should forward names of potential Fellow Grade candidates to Al Isberg.

MEMBERSHIP COMMITTEE REPORT

Sam McConoughey also noted that Carl Stevenson has sent a mailing to promote membership in the Society.

ELECTION OF BOARD MEMBERS

Stu Meyer reported that the ballot for both the 1986 and 1987 terms should be in member's hands by mid-March. Sam McConoughey assigned Stu the task of having a list of candidates for the 1988 term in time for discussion at the next board meeting in May.

NEXT MEETING

The next Board meeting will be held at the Boulder Conference. The Board meeting will begin at 2:00 PM May 20 (Monday). Also, a reception and dinner for the Boulder Conference Committee members and their spouses, and the VTS board members and spouses will be held Monday night. The reception is to start at 6:00 PM, and the dinner is to start at 7:00 PM. Any Board business that remains will be finished following the dinner meeting.

ADJOURNMENT

Bob Fenton moved, Fred Link seconded that the meeting be adjourned at 4:00 PM. Vote was unanimous in favor.

Respectfully submitted,

Samuel A. Leslie

Samuel A. Leslie

VTS Member Anna Hauksdottir Honored by IEEE

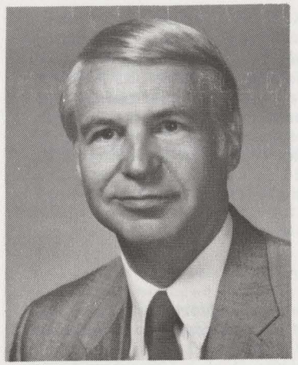
Anna Soffia Hauksdottir, an Ohio electrical engineer with the Department of Electrical Engineering at Ohio State University in Columbus, was honored recently as a Centennial Young Engineer by The Institute of Electrical and Electronics Engineers, Inc. (IEEE). Ms. Hauksdottir was recognized at a special banquet concluding IEEE's Centennial Year, attended by some 700 engineers and scientists as well as leaders from government, industry and academe. The Institute is the world's largest technical professional organization with more than 250,000 members in over 120 countries.

Cited by the IEEE Vehicular Technology Society, Hauksdottir received a "Centennial Key to the Future" from IEEE President Richard J. Gowen. The "Keys to the Future" were presented to 34 individuals representing the Instituts's 33 technical societies. Each recipient was identified as an individual in the early stages of his/her career "who best demonstrates sound understanding of the evolving technologies" in the individual's chosen field and whose "progress shows the greatest promise for applying these technologies toward the development of new industrial products and systems for the improvement of society."

The keys were laser cut from a three-inch disc of 256K metal oxide semiconductor (MOS) material. The Vehicular Technology Society is part of IEEE Division III encompassing communications technology.

Left to right: Dr. Richard J. Gowen, 1984 IEEE President; Anna Soffia Hauksdottir, IEEE; and Dr. Robert Fenton 1984 Vice President, Vehicular Technology Society.

Hauksdottir received her BSEE degree from the University of Iceland in 1981 and th MSEE degree from Ohio State in 1983. She is currently a Graduate Teaching Associate in the Department of Electrical Engineering at Ohio State where she is working on her Ph.D. She is the author of a paper on digital control of vehicles.



News From Washington

Eric Schimmel
Washington News Editor

TECHNICAL STANDARDS

One of the stabilizing factors for our industry is the ongoing development and subsequent acceptance of minimum performance standards for our products. While application of these standards is voluntary, they frequently form the basis of technical standards such as the FCC's Rules and Regulations. A major source of these standards is the Electronic Industries Association. To give credibility to its standards, the association's engineering department has a policy of inviting participation by all qualified parties, regardless of whether or not they are members in the association. A broad consensus of the participants must be achieved before a standard is proposed for adoption.

Reproduced below is a list of EIA standards currently in publication. A review of these standards is currently underway to determine if updating and revision is indicated. Anyone wishing to participate in standards development is encouraged to contact Hal Berge at EIA, 202/457-8737.

A catalog of all EIA standards as well as specific standards are available from EIA Standards Sales, 202/457-4966, 2001 Eye Street, NW, Washington, DC 20006.

IS-3-B	Cellular Systems Mobile Station - Land Station Compatiblity Specification @ $20.00 (July, 1984)
REC-141	VHF RECEIVING ANTENNA PERFORMANCE, PRESENTATION AND MEASUREMENT @ $5.00 This Standard contains standards and directivity, relative gain, and VSWR with measurements procedure. (Mar., 1954)
RS-152-B	MINIMUM STANDARDS FOR LAND MOBILE COMMUNICATION, FM or PM TRANSMITTERS, 25-470 MHz @ $11.00 This Standard details definitions and methods of measurement of the characteristics of FM or PM Land Mobile Transmitters in fixed or vehicular installation. It is intended to promote compatibility of these transmitters with the systems in which they will operate. (Feb., 1970).
RS-204-C	MINIMUM STANDARD FOR LAND-MOBILE COMMUNICATION FM or PM RECEIVERS 25-947 MHz @ $14.00 This Standard details definitions and methods of measurements of the characteristics of FM or PM land-mobile receivers in fixed or vehicular installations. The Standard is intended to promote compatibility of these receivers with the systems in which they will operate. The document was revised to incorporate the technical content of IEC Recommendation 489-3 "Method of Measurement for Radio Equipment Used in Mobile Services" (1979), into the familiar format of RS-204-C. (Jan., 1982).
RS-225	RIGID COAXIAL TRANSMISSION LINES, 50 Ohms @ $5.00 This Standard pertains exclusively to gas-filled rigid coaxial transmission lines and their connectors containing electrically transparent supporting structures. It is the intent of this standard to provide complete mechanical interchangeability for all lines and connectors. (Aug., 1959; Reaffirmed March, 1969; Aug., 1975).
RS-210	TERMINATING AND SIGNALING EQUIPMENT FOR MICROWAVE COMMUNICATION SYSTEMS, Part 1: Telephone Equipment @ $8.00 The Standards included herein are for terminating and signaling equipment to be used in telephone service. Because there are so many accepted practices in the telephone industry, each devised to meet pertinent requirements in specific situations, it is difficult to reduce these practices to a single standard. Where it appears impractical to establish a numerical value for a standard, examples of current practices, or informative notes on relative importance are given. A list of applicable terms, their sponsors and references are included. (Aug., 1958).
RS-220-A	MINIMUM STANDARDS FOR LAND MOBILE COMMUNICATION CONTINUOUS TONE-CONTROLLED SQUELCH SYSTEMS (CTCSS) @ $13.00 This Standard describes a Continuous Tone Control System along with performance standards and environmental tests for operation of both the transmitter and receiver. The Standard provides for a choice of any one of 33 different audio tones which can be used for designing a communication system in which the receiver squelch will only open when the trnamitter is modulated by one of the low frequency audio tones. The system is designed for operation in the 25-470 Mz ranges and in either Narrow or Wide Band deviation mode. (March, 1979).
RS-222-C	STRUCTURAL STANDARDS FOR STEEL ANTENNA TOWERS AND ANTENNA SUPPORTING STRUCTURES @ $14.00 The objective of this Standard is to provide minimum criteria for specifying and designing Steel Antenna Towers and Antenna Supporting Structures. The standard is not intended to replace or supersede any applicable codes. (March, 1976).
RS-252-A	STANDARD MICROWAVE TRANSMISSION SYSTEMS @ $14.00 The purpose of this Standard is to make it possible to describe the baseband characteristics of the radio and multiplex equipment to allow evaluation of their compatibility. This standard applies to the characteristics of the transmission path between the multiplex baseband send terminals and multiplex receiver terminals in both directions of transmission. (Sept., 1972). This is a COMPANION document to RS-250-B.

RS-258 SEMI-FLEXIBLE AIR DIELECTRIC COAXIAL CABLES AND CONNECTORS, 50 Ohms @ $5.00
This Standard pertains to air dielectric semi-flexible cables with their connectors. Typical cables included in this standard are those having a helical or tubular dielectric supporting the inner conductor and sheathed with ductile or semi-flexible outer conductor, those having the inner conductor supported with frequently spaced beads such that forming the line will also form the inner conductor, and those having a foamed dielectric between inner and outer conductor. (March, 1962).

RS-259 RIGID COAXIAL TRANSMISSION LINES AND CONNECTORS, 75 Ohms @ $5.00
This Standard pertains exclusively to gas-filled rigid coaxial transmission lines and their connectors containing electrically transparent supporting structures. It is the intent of this standard to provide complete interchangeability for all lines and connectors. (March, 1962).

RS-261-B RECTANGULAR WAVEGUIDES (WR3 TO WR2300) @ $5.00
This Standard contains 34 EIA designations for rigid rectangular waveguides, along with standard dimensions and frequency ranges. (May, 1979).

RS-271-A WAVEGUIDE FLANGES - PRESSURIZABLE CONTACT TYPES FOR WAVEGUIDE SIZES WR90 TO WR2300 @ $13.00
Section I of this Standard pertains to pressurizable contact flanges for use with rectangular waveguides as specified in the latest issue of RS-261; Section II pertains to contact flanges for sizes WR770 through WR2300. The Standard contains a list of pertinent drawings of waveguide flange assemblies utilizing two types of pressurizing gaskets. By specifying assembly dimensions in lieu of detail part drawings, it provides for interchangeability and permits manufacturing flexibility with regard to the method of joining the flange to the waveguide. (Nov., 1963).

RS-285 WAVEGUIDE FLANGES - DUAL CONTACT PRESSURIZABLE AND MINIATURE TYPE FOR WAVEGUIDE SIZES WR90 to WR975 @ $8.00
This Standard pertains to waveguide flanges where two waveguides are in close proximity such as short slot hybrid, dual TR tubes, etc., and provides a dual contact pressurizable flange for use with two rectangular waveguides per EIA RS-261. It also provides for a miniature version for the waveguide sizes from WR90 to WR284. Drawings and tables showing the actual dimensions are given. (Nov., 1963).

RS-304 RIDGE WAVEGUIDES @ $5.00
This Standard pertains to both single ridge and double ridge waveguides, having bandwidth ratios of 2.4 to 1 and 3.6 to 1. (Feb., 1965).

RS-306 MEASUREMENT OF SMALL SIGNAL HF, VHF, AND UHF POWER GAIN OF TRANSISTORS @ $5.00
This Standard provides a method of measurement for small-signal HF, VHF and UHF power gain of low power transistors (May, 1965; Reaffirmed April, 1981).

RS-311-A MEASUREMENT OF TRANSISTOR NOISE FIGURE AT MF, HF, AND VHF @ $11.00
This Standard describes a test method for measurement of transistor noise figure and effective input noise temperature at MF, HF, and VHF. This Standard also adds the necessary information to make "effective input noise temperature measurements." This method is a revision of RS-311 and incorporates material previously found in RS-283. (Nov., 1981).

RS-316-B MINIMUM STANDARDS FOR PORTABLE/PERSONAL RADIO TRANSMITTERS, RECEIVERS AND TRANSMITTER/RECEIVER COMBINATION LAND MOBILE COMMUNICATIONS FM OR PM EQUIPMENT 25 - 1000 MHz @ $14.00
This Standard details the minimum performance requirements for radio transmitters, receivers or combinations of both which can be hand-carried or worn on the person, and which are operated from their own portable power source and antenna. (May, 1979).

RS-329-A MINIMUM STANDARDS FOR LAND-MOBILE COMMUNICATION ANTENNAS PART 1 BASE OR FIXED STATION ANTENNAS (ANSI/EIA RS-329-A-78) @ $8.00
This Standard details the minimum performance requirements for base or fixed station antennas. Test conditions and methods for measuring the characteristics of these antennas are given for establishing conformance to these requirements. (Dec., 1975).

RS-329-1 MINMUM STANDARDS FOR LAND-MOBILE COMMUNICATION ANTENNAS PART II VEHICULAR ANTENNAS @ $5.00
This Standard supplements RS-329-A by covering vehicular antennas in the 132-1000 MHz frequency range. (Aug., 1972).

RS-368 FREQUENCY DIVISION MULTIPLEX EQUIPMENT STANDARD FOR NOMINAL 4 kHz CHANNEL BANDWIDTHS (NON-COMPANDORED) AND WIDEBAND CHANNELS (GREATER THAN 4 kHz) @ $11.00
These Standards are intended to be used as multiplex equipment performance criteria. As such, these Standards may find a typical application in layout of a communication system incorporating other types of equipment (such as microwave or cable equipment). An added purpose, however, is to furnish a basis for the user to evaluate and specify multiplex equipment on a terminal or a back-to-back basis. (Sept., 1969).

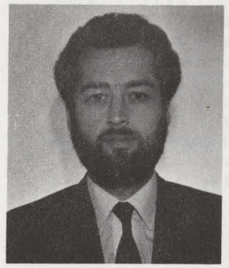
RS-374-A LAND MOBILE SIGNALLING STANDARD @ $15.00
This Standard has focus on key areas of signaling sensitivity, falsing, and potentially degrading interference modes. Many signalling parameters require no testing, but are merely descriptive in nature. Nevertheless, these parameters should be specified in order to allow intelligent comparison of systems. A generalized signaling system is shown and defined to clarify terminology. Some of the descriptive parameters are also listed in this Standard and briefly defined. (March, 1981).

RS-384 TIME DIVISION MULTIPLEX EQUIPMENT FOR NOMINAL 4 kHz CHANNEL BANDWIDTHS @ $13.00
This Standard considers two types of multiplex equipments. Class I multiplex is intended primarily for use in multiple link (built-up) circuits and/or long-haul circuits. Class II multiplex is intended for use in those applications which do not justify Class I equipment. (Dec., 1970).

RS-409 MINIMUM STANDARDS FOR AMATEUR RADIO ANTENNA PART I - BASE OR FIXED STATION ANTENNA @ $5.00
It is the purpose of this Standard to establish a reference antenna to which all antenna gain and/or directivity specifications can be related and to define parameters of measurement and establish standard methods of measurement of such antennas. This standard will assist both the manufacturer and the user in specifying antenna performance. (Dec., 1973).

RS-424 MINIMUM STANDARDS - CITIZENS RADIO SERVICE - SSB TRANSCEIVERS OPERATING IN THE 27 MHz BAND @ $5.00
This Standard details definitions and methods of measurement of characteristics of SSB transmitters and receivers or SSB/AM transmitters and receivers, operating in the SSB mode, intended for operation in the class "D" Citizen Radio Service as defined in Part 95 of the FCC Rules and Regulations. (Feb., 1975; Reaffirmed March, 1981).

RS-450 STANDARD FORM FOR REPORTING MEASUREMENTS OF LAND MOBILE, BASE STATION AND PORTABLE/PERSONAL RADIO RECEIVERS IN COMPLIANCE WITH FCC PART 15 RULES @ $13.00
This Standard reporting form has been developed at the suggestion of the FCC. Its purpose is to provide a uniform method of making and reporting the summary of measurements outlined in the above title of the standard. This form is not complete in itself. It supplements the Part 15 Rules and must be used in conjuction with them. (Sept., 1978).



Communications

J. R. Cruz
Communications Editor

We continue publishing our series of articles on different topics of interest to our readership. In this issue we are including an article that addresses the autonomy of portable radios from a user's standpoint. Its author, William E. Thomson is with Tecnotronic Ltda. Our editorial goal is to strike a balance between technical oriented tutorials and more practical articles. The present contribution falls in the latter category. We hope to meet the expectations of a large sector of our membership and encourage the submission of manuscripts by the widest possible spectrum of readers. Original work, tutorials and survey papers are welcome.

Papers should be clearly written in English, and are typically from seven to eleven double-spaced typed pages in length. Copies of manuscripts and illustrations should be submitted to the Communications Editor, Dr. J.R. Cruz, School of Electrical Engineering and Computer Science, The University of Oklahoma, Norman, OK 73019.

ABSTRACTS

"Land-Mobile Satellite Start-Up Systems", W.A. Sandrin, COMSAT Technical Review, vol. 141, no. 1, Spring 1984.

In view of the increasing interest in initiating a Land-Mobile Satellite System (LMSS) to complement cellular terrestrial-mobile communications systems, the relationships between space segment mass, mobile terminal charactersitics, and system capacity are presented for a "start-up" (or experimental) contiguous United States (CONUS) coverage LMSS. Multipath fading, mobile terminal antennas and voice modulation alternatives have been studied. Models for multipath fading vs. mobile terminal antenna gain, for mobile terminal costs vs. mobile terminal antenna gain, and for space payload mass are developed for LMSS's operating in the bands near 800 and 1,600 MHz. LMSS configurations are given for three specific examples, which correspond to the payload mass equivalent of an INTELSAT V maritime communications subsystem (MCS) package, an SBS spacecraft, and an INTELSAT V spacecraft. For each of these cases, system alternatives are given that illustrate tradeoffs among mobile terminal cost (and antenna gain), modulation type and system capacity. One such example is a 10-channel, 800-MHz-band system using adaptive delta modulation and mobile terminals with 5-dBi antenna gains, and requiring a space payload mass of 67 kg.

"Carrier Synchronizer For Overlapped Raised Cosine Pulse Amplitude Modulation," W.C. Hagman, COMSAT Technical Review, vol. 14, no. 1, Spring 1984.

It is well known that high bandwidth efficiency can be achieved by the use of a signaling scheme with overlapping signal pulses. Such schemes can result in appreciable intersymbol interference (ISE), which deteriorates the detection and synchronizer performance. This paper describes the ISI effects on an 8-phase PSK carrier synchronizer and illustrates the necessary analysis procedure for thisspecial case. The computations are based on a raised cosine pulse shape with 50-percent overlap to each side. The demonstrated methods are equally applicable to any other pulse shape.

The effects of ISI on carrier synchronization can easily be reduced by a simple transverse equalizer in conjunction with the synchronizer. Equations are derived for the tracking variance resulting from both additive white Gaussian noise (AWGN) and the self-noise associated with ISI. Computer simulation results for carrier synchronizer performance, with and without ISI equalization, are in close agreement with theoretical predictions from derived equations.

"A New Description of Trellis Codes," R. Calderbank and J.E. Mazo, IEEE Trans. Inform. Theory, vol IT-30, no. 6, November 1984.

A trellis code is a "sliding window" method of encoding a binary data stream as

a sequence of real or complex numbers that are input to a noisy transmission channel. Ungerboeck has constructed simple trellis codes that provide the same noise immunity as is given by increasing the power of uncoded tranmission by factors ranging from two to four. His method is to specify an underlying convolutional code and a rule (mapping by set partitioning) that maps the output of this code onto a fixed signal constellation. A new description of a trellis code is given that combines these two steps into one. The new description is analytic rather than graphical. Many practical codes can be described very simply, and strict bounds on performance can be obtained. A method for differential encoding trellis codes is presented that was suggested by the authors' representation.

"An Improved Algorithm for Evaluating Trellis Phase Codes," M.G. Mulligan and S.G. Wilson, IEEE Trans. Inform. Theory, vol. IT-30, no. 6, November 1984.

A method is described for evaluating the minimum distance parameters of trellis-phase codes, including continuous phase frequency shift keying (CPFSK), partial-response FM, and, more importantly, coded continuous-phase modulation (CPM) schemes. The algorithm provides drramatically faster execution times and smaller memory requirements than previous algorithms. Results of sample calculations and timing comparisons are included.

"Rate 3/4 Convolutional Coding of 16-PSK: Code Design and Performance Study", S.G. Wilson, H.A. Sleeper, II, P.J. Schottler, and M.T. Lyons, IEEE Trans. Comm., vol. COM-32, no.12, December 1984.

Convolutional coding coupled with 16-PSK modulation is investigated for bandwidth efficient transmission. Rate 3/4, small memory codes are found which are optimized in the free-distance sense on the Gaussian channel. These codes provide up to 4.8 dB of coding gain with 32 states over uncoded a 8-PSK, a scheme having the same spectral efficiency as the codes described. The performance is compared with earlier findings of Ungerboeck and some recent results on R=2/3 coded 8-PSK. In addition, we present results of a channel transmission study to asses the performance of the four-state code on the band-limited nonlinear channel, and find that performance of the coded scheme degrades comparably with uncoded 8-PSK, i.e., coding gain is roughly preserved.

"A Three-Node Packet Radio Network," M. Sidi and A Segall, IEEE Trans. Comm., vol.COM-32, no. 12, December 1984.

A two-hop packet radio network consisting of three nodes is considered. The three nodes have infinite buffers and share a common radio channel for transmitting their packets. Two of the nodes forward their packets to a third node that acts as a source of data as well as a relay that forwards all the packets entering the network to a main station. We assume that two of the nodes are granted full rights in accessing the channel while the third node uses a random access scheme. For this network we derive the condition for steady state and the generating function of the joint queue length distribution at the nodes in steady state. We also give several numerical examples and compare the performance of the network with and without a relay node.

"Convolutional Coding Combined with Continuous Phase Modulation," S.V. Pizzi and S.G. Wilson, IEEE Trans. Comm. Vol. COM-33, No. 1, January 1985.

Background theory and specific coding designs for combined coding/modulation schemes utilizing convolutional codes and continuous-phase modulation (CPM) are presented. In this paper the case of r=1/2 coding onto a 4-ary CPM is emphasized, with short-constraint length codes presented for continuous-phase FSK, double-raised-cosine, and triple-raised-cosine modulation. Coding buys several decibles of coding gain over the Gaussian channel, with an attendant increase of bandwidth. Performance comparisons in the power-bandwidth tradeoff with other approaches are made.

"Serial MSK-Type Detection of Partial Response Continuous Phase Modulation," A. Svensson and C.E. Sundberg, IEEE Trans. Comm., Vol COM-33, no. 1, January 1985.

Partial response continuous phase modulation (CPM) schemes have a high spectrum utilization and also a high immunity to nonlinear distortion, since they have a constant envelope. Schemes with high power efficiency can also be designed when they are coherently detected with a Viterbi detector. These schemes are sometimes complex, however. In this paper two minimum-shift-keyed (MSK) type receivers are studied. The MSK-type receiver can be implemented as a serial receiver and as a parallel receiver. Both receivers are useful for binary modulation schemes with modulation index h=1/2. Only

coherent detection of signals transmitted over an additive white Gaussian noise channel is considered.

The serial receiver can be implemented with only two filters and simple decision logic. The decisions are made serially in one decision eye pattern. Two types of receiver filters are considered. Error probability results are presented for the receiver, both with and without phase and timing error present in the receiver. It is shown that, assuming perfect phase and time synchronization, the serial and parallel receivers have equal performances. The advantages of the serial receiver over the parallel receiver are the same for partial response continuous phase modulation as for classical MSK; i.e., both in implementation aspects and in the reduced sensitivity to phase errors.

"Bandwidth Efficient Quadrature Overlapped Squared Raised-Cosine Modulation," I. Sasase, R. Nagayama, and S. Mori, IEEE Trans. Comm., vol COM-33, no. 1, January 1985.

This correspondence describes staggered quadrature overlapped squared raised-cosine (QOSRC) modulation. The power spectrum of QOSRC attains good spectral characteristics over a bandpass hard-limited channel compared to quadrature overlapped raised-cosine (QORC) modulation because of less fluctuation of the signal envelope. It is found that QOSRC has better bit error probability performance than QORC.

"Measured Frequency Diversity Improvement for Digital Radio," P.L. Dirner and S.H.Lin, IEEE Trans. Comm., vol COM-33, no. 1, January 1985.

This paper presents the measured frequency diversity improvement factor for 6 GHz 16-QAM 90 Mbit/s digital radio on the 26.4 mi Atlanta-Palmetto path in Georgia. Two channels with a center frequency separation of 59.3 MHz were used in a one-by-one frequency diversity experiment. The 1980 data and the 1982 data indicate a frequency diversity improvement factor of 100 and 45, respectively, at the outage threshold of 10^{-3} BER. This is in contrast to the improvement factor of 9 predicted for analog FM radio at the same fade margin. The measured one-by-one frequency diversity improvement factor is comparable to the measured space diversity improvement factor with 30 ft antenna spacing on the same path. We conclude that 1) frequency diversity can provide a large improvement factor for digital radio, 2) as an alternative to space diversity, frequency diversity can provide substantial cost savings for digital radio routes, and 3) the frequency diversity calculation based on analog FM radio experience is too conservative (i.e., pessimistic) for digital radio application. These experimental findings are in agreement with recent advances in digital radio diversity modeling.

Digital radio performance depends heavily on the multipath disperison in the channel. The measured data indicate that the power fade depths in the two channels are highly correlated, whereas the multipath dispersion in the two channels is decorrelated. This correlation difference provides insight into the measured large frequency diversity improvement factor for digital radio.

"Nonparametric Receiver for FH-MFSK Mobile Radio," R. Viswanathan and S.C. Gupta, IEEE Trans Comm., vol COM-33, no. 2, February 1985.

Various parametric receivers such as the maximum likelihood and the hard-limiter have been analyzed for their performance in decoding the frequency hopped multilevel FSK (FH-MFSK) messages in mobile environment. Here, some nonparametric receivers such as the maximum rank sum receiver (MRSR) and the reduced rank sum receiver (RRR) are considered. RRR and MRSR are nearly identical in performance but the former is much simpler to implement. The results indicate that RRR is a competing alternative to the parametric receivers.

"The Effect of Channel Coding on the Efficieny of Cellular Mobile Radio Systems," D.J. Goodman and C.E. Sundberg,IEEE Trans. Comm, vol. COM-33, 0.3, March 1985.

Error correcting codes have two opposite effects on the efficiency of cellular mobile-radio systems. Although they increase the bandwidth per channel, the codes also make signals more robust and thereby reduce the required distance between users of the same frequency band. This paper reports a mathematical study of the interactions of these two effects in determining the efficiencies of a large number of source-code and channel-code combinations.

Within a statistical performance objective (baseband SNR>11dB for 90 percent of the users), the most efficient scheme in this study has an embedded differential pulse code modulation (DPCM) source code and a rate 1/2 channel code that protects 2 bits of each 4 bit DPCM code word.

Based on a conservative model of cellular transmission, we estimate that the bandwidth efficiency is 3 users/cell/MHz of system bandwidth. By

contrast, there are only 1.2 users/cell/MHz with uncoded transmission and 4.5 users/cell/MHz with a rather complicated variable-rate scheme.

We also observe that the embedded source code, originally devised for variable-rate operation, has a higher baseband SNR than conventional DPCM in certain fixed-rate environments.

"A Nonlinear Device to Suppress Strong Interfering Signals with Arbitrary Angle Modulation in Spread-Spectrum Receivers," P.W. Baier, and K.J. Friederichs, IEEE Trans. Comm., vol. COM-33, no. 3, March 1985.

A device which can be used to suppress strong constant-envelope interfering signals at the input of spread-spectrum receivers is described and analyzed. Unlike similar circuits known from literature, this device is not restricted to the suppression of narrow-band jamming signals; it can also cope with broad-band interfering signals bearing any kind of angle modulation. The theoretical results are confirmed by measurements.

"Mobile Packet Radio Networks; State-of-the Art," R. Singh, and S.C. Gupta, IEEE Comm. Magazine, vol. 23, no. 3, March 1985.

Much work has been done in the areas of packet switching, packet radio, and random communication channels. However, efforts combining these areas are not as plentiful. There are several reasons for this. One reason is, the packet communications area is relatively young. Much of the research into packet communications has been accomplished by computer scientists rather than communciations engineers, with a resulting emphasis on architecture, protocols, software, and so on. Even the development of packet radio has not fostered extensive examination of link effects on system performances. The UHF line-of-sight links and SHF satellite links have been assumed to be perfect with packet collisions as the dominant error source, which is a good assumption under normal circumstances. However, abnormal circumstances including ionospheric scintillations and multipath fading are another source of error on degraded packet radio links, which characterize Mobile Packet Radio Networks (MPRNET) and present their channel characteristics. The performance evaluation of some channel access protocols for a Mobile Packet Radio Network link, which is a typical example of a degraded packet radio channel, is described.

Radio Channel Traffic and Its Effect on Portable Radio Autonomy

William E. Thomson

Tecnotronic Ltda.
Santiago, Chile

Abstract

This paper relates the radio channel traffic, workshift duration and portable radio battery capacity to answer the basic question, will my portable radio be operative throughout the total workshift? The answer to this question is of particular importance in applications such as police foot-patrols, mining operations and all those others where the radio user does not have the possibility to recharge his radio's battery throughout his workshift. Hazardous situations to the radio user may result if the matters discussed in this article are not considered when designing two-way radio systems where portable radios will be used.

Many times we have heard users of portable radios complain that something seems to be wrong with the batteries of their portable radios since they wear out before the end of their workshift. A simplistic approach has almost always been to blame the battery itself or tell the users that maybe they didn't charge them completely before using them. But are these the actual reasons why this is happening? Is it not possible that the radio is being affected by an excess traffic in the radio channel during the duration of the workshift?

In the following paragraphs we will show some simple mathematical equations which will demonstrate that it is extremely important to analyze the radio channel traffic in applications involving portable radios.

Definition of Parameters to be Used

The mathematical expressions will use and relate the following parameters:

AH = Portable radio battery useful capacity expressed in milliampere-hours (maAH). The nominal value will be used, but we would like to point out to our readers that care should be taken about this value when the radio is to be operated in cold weather, since the actual available capacity will decrease.

WH = Work hours per shift. It is assumed that the radio should remain in operations throughout the shift.

T = Total accumulated transmission time available from the radio, in hours, under certain traffic conditions and for the duration of the workshift.

R = Total accumulated receiving time, in hours, resulting from traffic in the radio channel generated by co-users for the duration of the workshift.

S = Total accumulated time in stand-by condition resulting of a certain traffic value in the radio channel and for the duration of the workshift.

Traf = Ratio of total accumulated time that the radio channel is busy during the workshift to the workshift duration. Its value is equivalent to the average traffic in erlangs, measured for the total duration of the shift.

I_s = Current drain from the battery when the portable is in stand-by. Expressed in milliamperes.

I_r = Current drain from the battery when the portable is receiving a transmission and its audio output is set to its nominal specified value. Expressed in milliamperes.

I_t = Current drain from the battery when the portable is transmitting at its nominal RF output power. Expressed in milliamperes.

Demonstration of the Mathematical Expressions Relating the above Parameters

a) $R + T + S = WH$
b) $R + T = WH \times Traf$
c) $S = WH\ (1 - Traf)$

By replacing R in d) by its value in b) and also by replacing S in d) by its value in c), we end up with an expression as follows:

e)

$$(WH \times Traf - T) \times I_r + T \times I_t + WH\ (1 - Traf) \times I_s = AH$$

From e), we can obtain the following equation for T:

f)

$$T = \frac{AH - WH\ (I_s + Traf\ (I_r - I_s))}{I_t - I_r}$$

The above equation for T is very important since by analyzing its numerator, it can be seen that for a certain combination of the parameters, the result will be T = 0, which means that under those conditions the portable cannot transmit at all during the shift if its battery is to last for the shift's duration and if the portable transmits at any time, its battery will not last for the whole shift!

The combination of parameters for which T = 0 will define a maximum radio channel traffic, generated by other users of the same channel, which will totally discharge the portable's battery unless some special considerations are taken in the design of the radio system or in its operation that will make the portable under consideration not "feel" the total channel traffic, for instance by using selective calling or by use of coded squelch.

The expression for that maximum traffic can be obtained by making the numerator of f) equal to zero. The resulting equation is as follows:

g)

$$Traf_{max} = \frac{AH - WH \times I_s}{WH\ (I_r - I_s)}$$

Some obvious results can be deduced by analyzing the above expression and these are:

1) Total independence of $Traf_{max}$ from I_t means that the common consideration of giving some users a lower RF output radio, thinking it may help under this traffic condition, is totally false. This is obvious since the battery is being discharged by traffic in the channel generated by other users.

2) Longer workshifts result in a lower value for the maximum traffic for which T = 0. This is important if the operation of the portable often considers overtime beyond the shifts duration.

3) If portable radios are to be added to an existing system and the traffic expected in the channel exceeds the value obtained from g) above for the type of portable, special precautions have to be taken such as selective call, coded squelch, vehicular chargers or carrying fully charged spare batteries otherwise these additional portables will be practically useless if expected to last throughout the workshift.

From the same set of equations listed in a) through d) an equation for R can be obtained and it is the following:

h)

$$R = \frac{WH\ (I_s + Traf\ (I_t - I_s)) - AH}{I_t - I_r}$$

The importance of this equation is total accumulated time the portable can receive during the workshift and the traffic in the channel.

One way to use this equation h) is when the value of R, traffic in the channel generated by others, can be known or estimated then the value of Traf can be calculated and then this same value is used in evaluating T by use of f).

To give an example on the use of the formulas indicated in f), g) and h) we will use data corresponding to a portable made by a well known two-way radio manufacturer. Notice that in this particular case we ignore the RF output power of this portable.

This particular radio uses a 450 mAH Nicad battery and the values of the current drained from the battery are as follows:

I_s = 12 mA

I_r = 85 mA

I_t = 1000 mA

As it is the most common situation we assume that WH = 8 hours.

From g) we obtain:

$Traf_{max}(T=0) = 0.606$ Erlangs

This means that if the existing traffic in the radio channel is 0.606 Erlangs or that the channel is busy a total of 4.849 hours out of 8, adding this type of portables to this system is useless unless special features such as those mentioned before are considered for the portable, i.e., selective call, vehicular charger, carrying a spare battery or, if available, using a larger capacity battery.

Assuming that the other units in the system produce a channel occupancy of 1.5 hours during the shift, what is the time available for transmission, by this portable, during the shift, if its battery is to last throughout the 8 hours?

To answer this question we start from h) by making R = 1.5 hours.

$$1.5 = \frac{8(12 + Traf\ (1000 - 12)) - 450}{1000 - 85}$$

$Traf = 0.218$ Erlangs

Replacing this value of Traf = 0.218 in g), we obtain:

$$T = \frac{450 - 8(12 + 0.218\ (85 - 12)}{1.000 - 85}$$

$T = 0.248$ Hrs.

The value just calculated for T means that this type of portable in the assumed system would have a battery capacity left to be able to transmit a maximum of 0.148 hours during the total 8 hour shift. Is this enough for the system requirement? What would happen to a portable having a lower RF output power? (Assuming that there is no coverage problem).

Let us consider a portable with the same parameter values, except that I_t = 640 mA.

In this case, Traf would be equal to 0.236 Erlangs and T = 0.390 Hrs. Here we see that the value of T has increased 57.3% by an approximate reduction of RF power output of slightly over 3 dB. Is the value of T adequate now?

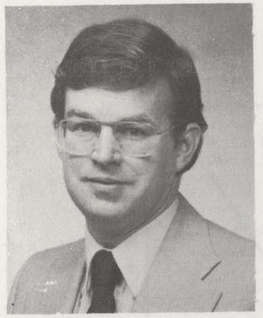
Notice that the value R generated by traffic from other users will probably be altered as a result of the transmissions of the portable being considered. This would tend to decrease the value of T really available from that calculated. Successive iterations would lead to a more accurate result if needed but as far as the system's design criteria the basic analysis above is adequate.

Another application of the above formulas is to simply calculate the values of T and R from the known equipment parameters and a reasonably accurate estimate of the radio channel traffic.

The analysis of the hours of operation available from a specific portable, within a radio system, made by using the above relations is extremely important to the systems engineers if they want to avoid embarrassment of portables not being operative the proper number of hours of the shift and very specially in those cases where the portable is important to the safety of its user.

As a final consideration, let us analyze the following: How useful is it to the user or the systems engineer the way the manufacturers indicate the autonomy of their portables? Is the specification that the battery will last 8 hours or more under a 5-5-90 duty cycle enough? We do not think so. This means that the portable's battery will last for 8 hours if the traffic in the channel is 0.10 Erlangs with 0.05 Erlangs generated, during the whole shift, by all the other users of the radio channel. This can be totally unrealistic depending on the type and number of users in the channel.

It is strongly recommended that manufacturers should list the battery capacity and the current drain under all three conditions (Transmit, receive, stand-by) since the usual sentence stating that the battery will last for 8 hours or more under a 5-5-90 duty cycle is almost useless.



Automotive Electronics

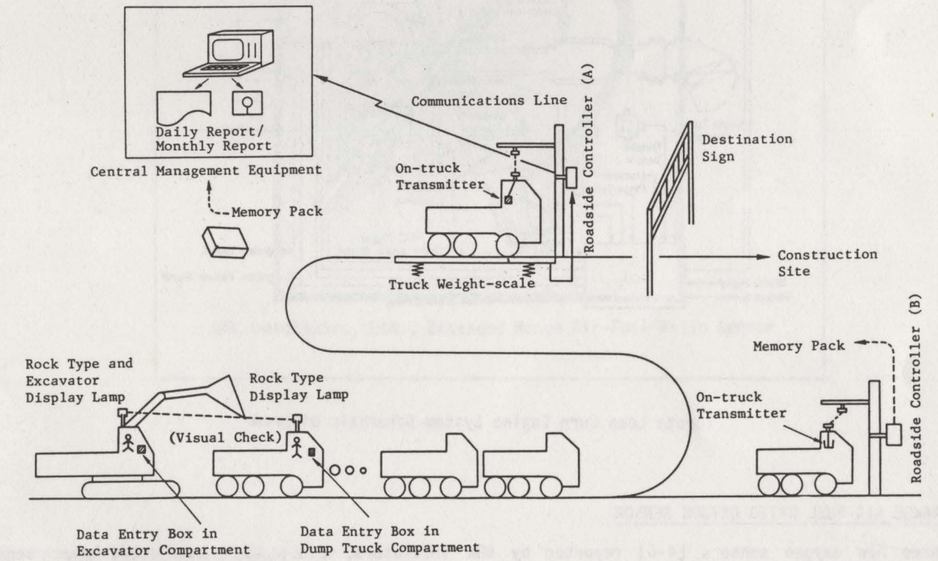
Dateline: Detroit

Bill Fleming
Automotive Electronics Editor

AUTOMATED HAULER TRUCK MANAGEMENT

Sumitomo Electric Industries, LTD., has developed an automated truck data collection and management system[1]. This system collects load data, controls truck destinations, and totals loads of individual trucks. Communications between the trucks and roadside controllers are done via electromagnetic inductive radio communications which do not require licensing and are able to operate under harsh environmental conditions. Hauler trucks pass under roadside controllers and transmit necessary information, such as dump truck identification number and load contents, to the controller. Information gathered by the roadside controller is sent to a central management station through a communications line.

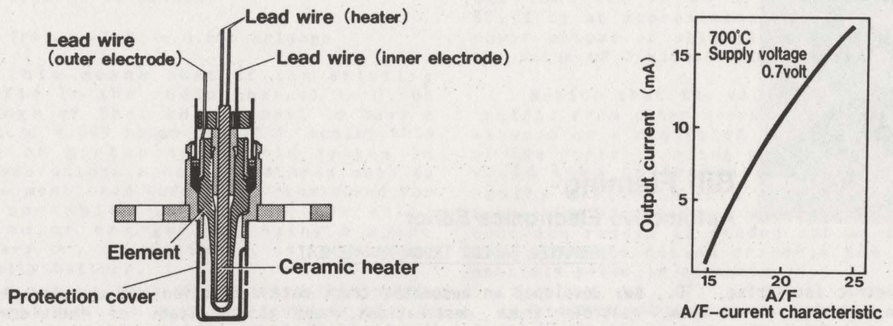
Data gathered in this manner can be totaled and classified by subcontractor, by hauler truck type, and by excavator type. Results are printed in daily or monthly reports. Destinations of each truck are made in accordance with the construction progress and are also designated using a destination sign. When a measurement command is received from the roadside controller, and when a measurement start signal and data on the number of axles on the hauler truck are received, the weigh-scale starts to weigh the vehicle as it passes over the scale. Total hauler truck weight is sent from the weigh scale back to the road side controller.



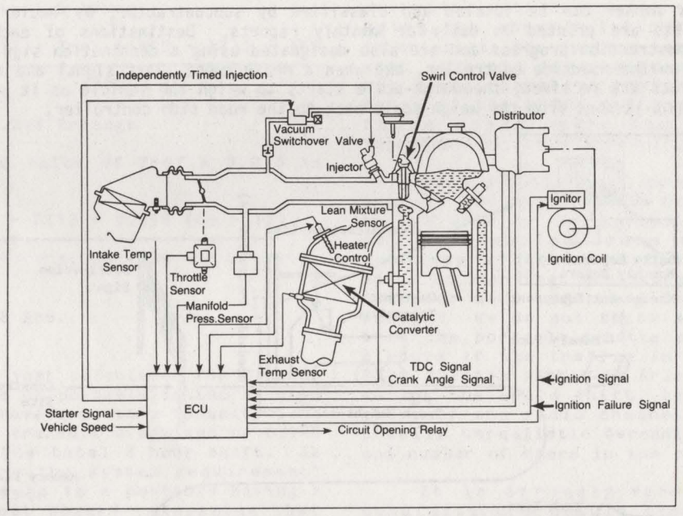
Automated Hauler Truck Data Collection and Management System

TOYOTA LEAN AIR-FUEL RATIO MIXTURE SENSOR

It is well known that operation of an engine at a sufficiently lean air-fuel ratio mixture, not only controls NOx emissions, but also improves fuel economy. Toyota has developed a Lean Combustion System through a combination of oxidation catalysts and feedback control of the air fuel ratio [Refs. 2,3]. The lean air-fuel sensor was developed in cooperation with Nippondenso Company, LTD. The sensor resembles a conventional zirconia oxygen sensor, but differs in the following ways. A cylindrical ceramic heater is employed to keep the sensing element temperature above 650 degrees centigrade. At this temperature the solid electrolyte has sufficient ionic conductivity to permit oxygen pumping. In addition, a diffusion layer is formed on the outer electrode of the sensor by plasma spray coating. Detailed experimental results given in Reference 3 show that the amount of current produced at a fixed applied voltage is an accurate measure of the oxygen concentration in the exhaust stream, and thereby gives an indication of lean air-fuel ratio.



Toyota-Nippondenso Lean Air-Fuel Ratio Sensor and Sensor Output Characteristic.

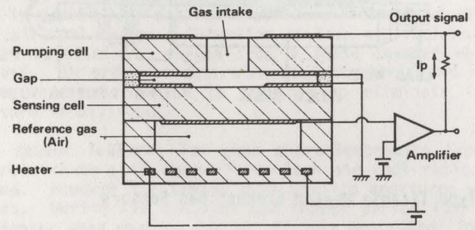


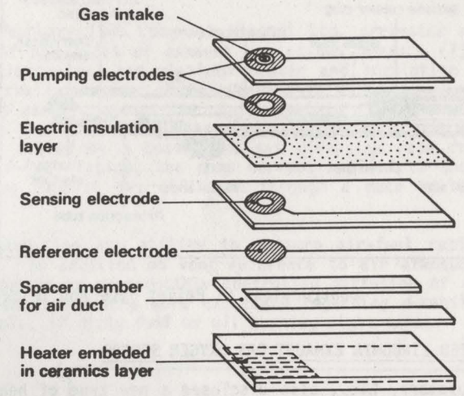
Toyota Lean Burn Engine System Schematic Diagram

NGK WIDE-RANGE AIR-FUEL RATIO OXYGEN SENSOR

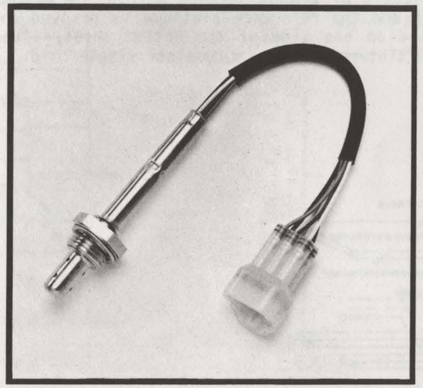
One of three new oxygen sensors [4-6] reported by NGK Insulators, Ltd., is a new multi-layer sensor for wide-range air-fuel ratio measurement. The sensor consists of two electro chemical cells -- a pumping cell and a sensing cell -- and a heater which has been developed. It utilizes laminating and co-firing technologies. The sensor dimensions are five millimeters wide and one and one half millimeters thick. Exhaust gas is detected as it diffuses through a 0.8 millimeter diameter hole and enters a cylindrical sensing gap. The sensor operates such that the gas mixture in the area of the gap internal to the sensor is maintained in an almost stoichiometric air-fuel ratio at all times. This is done via the pumping cell which either pumps oxygen into the gap or out of the gap depending on whether the air-fuel is rich or lean. The required pumping current and the sign change of the pumping current determines whether the air-fuel ratio is rich or lean and also determines the magnitude of the air-fuel ratio.

The authors of the Toyota/Nippondenso paper, Reference 3, concluded that the aperture-type sensor described in the NGK paper, Reference 4, was too temperature sensitive. For this reason the Toyota/Nippondenso authors use the diffusion-type sensor. On the other hand, the NGK sensor has the ability to measure air-fuel ratio over an extended range including both lean and rich values. This is something that the Toyota/Nippondenso sensor is unable to do.





Schematic Diagram And Exploded View Of Extended-Range Air-Fuel Ratio Sensor

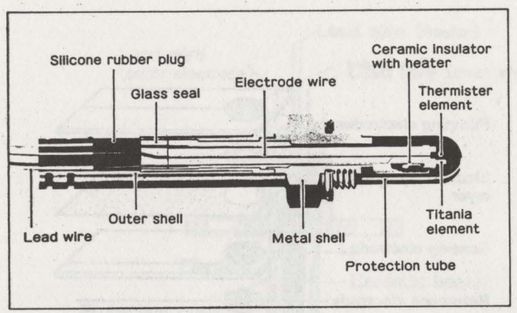


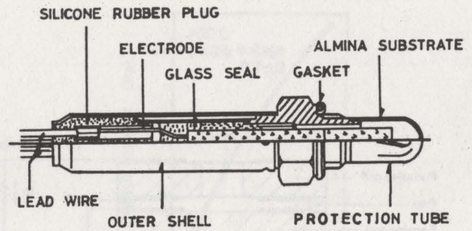
NGK Insulators, Ltd., Extended Range Air-Fuel Ratio Sensor

NGK LEAD TOLERANT EXHAUST GAS SENSOR

NGK Spark Plug Company, Ltd., working together with Nissan Motor Company have done further development on the titania exhaust gas sensor. Special emphasis has been placed on making the sensor tolerant to exposure to leaded fuels. Two types of sensors were described: first, a pellet type of heated sensor was shown, and second, a thick film type of heated sensor was shown [5]. It was shown that titania is mucn more tolerant to exposure to leaded fuel than is zirconia. In addition, because the titania sensor requires no air reference, it can survive submerging in water and splashing in water.

Heated operation of the sensor helps avoid deposits of lead compounds which can poison the sensor. On the other hand, excessively high temperatures cause rapid and undesireable chemical reactions between the sensor and the lead deposits. Therefore an appropriate design must make a compromise between the amount of electrical heating power and the quantity of catalyst needed to survive the effects of poisoning. Because of the potentially low cost due to the mass production methods of making the sensor and their superior tolerance to lead poisoning, it was concluded that titania sensors will find increased vehicular applications in the future.

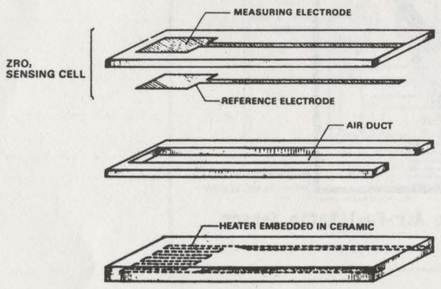


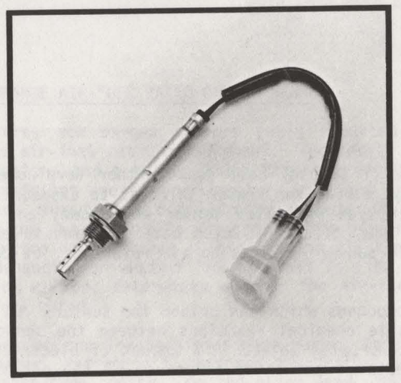


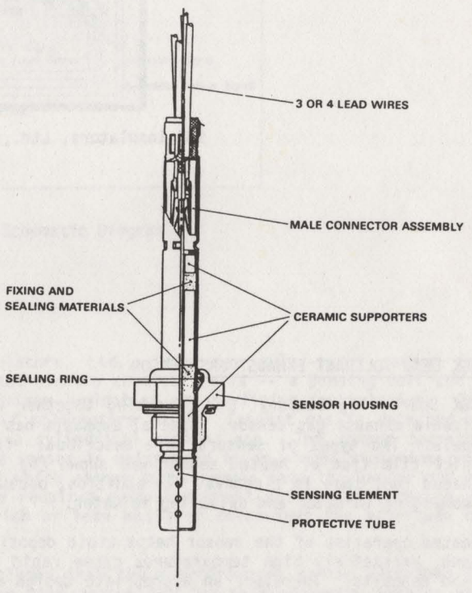
Contructions Of Pellet Type And Thick-Film Type Titania Heated Exahust Gas Sensors

NGK HEATED ZIRCONIA EXHAUST GAS OXYGEN SENSOR

NGK Insulators, Ltd., also disclosed a new type of heated zirconia exhaust gas oxygen sensor which serves as a low cost, nigh performance alternative to conventional sensors [6]. The sensing element and sensor have been miniaturized by use of monolithic construction together with thick film techniques. The sensing element consists of three zirconia green sheets fabricated by a tape forming method. A measuring platinum electrode is screen printed on one side of the top sheet and the reference platinum is printed on the other side. A resistor for heating the element is screen printed on one side of the bottom sheet. The three sheets are then laminated together by a hot press tecnnique and sintered to form a complete single chip.





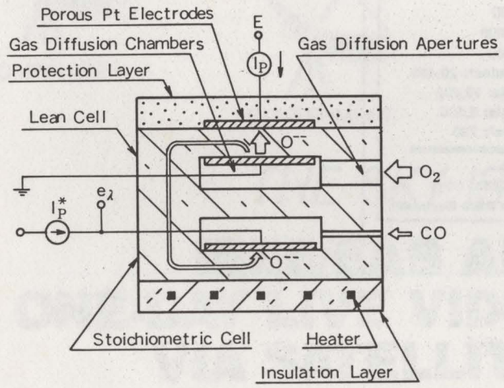


Schematic Exploded View And Structure Of NGK Thick Film Heated Exahust Gas Oxygen Sensor

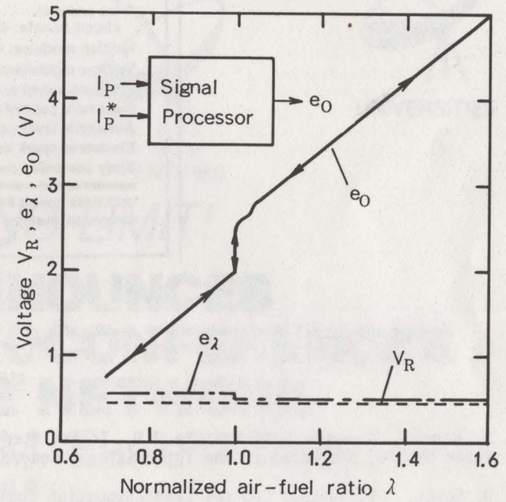
HITACHI THICK-FILM ZIRCONIA AIR-FUEL RATIO SENSOR

Not to be outdone in this remarkable session at the SAE February 1985 Congress Hiatchi Ltd. presented a fifth paper in a series of papers specifically on the subject of new types of exhaust gas oxygen sensors [7]. The sensor consists of two plate-type zirconia cells, three electrodes, and platinum heater and insulation layers which are laminated by thick-film processing. The sensor really consits of two sensors in one: one sensor is used to detect lean air fuel ratios, and the other sensor is used to detect the stoichiometric air-fuel ratio and rich air-fuel ratios. Detection of lean air-fuel ratios is accomplished by measuring the amount of pump current needed to eliminate oxygen from a sense chamber which is filled by a controlled gas diffusion rate from the exhaust. In order to determine stoichiometric and rich air-fuel ratios, the pump current applied to the other diffusion chamber which is required to eliminate inflowing exhaust gas diffusion through a much smaller gas aperture is utilized.

This sensor features low cost microelectronics type construction and ability to measure air-fuel ratio over entire rich-to-stoichiometric-to-lean air-fuel ratio range. In addition no vent reference to air atmosphere is needed. However the sensor does utilize apertures which depend on reproducibly controlled diffusion of exhaust gasses. During the question and answer period for this paper, concerns were expressed regarding durability of the sensor when engines are not cleanly operating; for example, if dirty fuel or oil burning might exist.



Schematic Diagram Showing Construction Of Hitachi Air Fuel Ratio Sensor



Characteristic Curve Of Hitachi Tri-State Air-Fuel Ratio Sensor.

AUTOMOTIVE ELECTRONICS -- FROM THEN TO NOW

Just as today the usage of car headphones is banned in some parts of the United States, early car radios were on occasions deemed to be safety hazzards as well. Not only were they considered fire hazzards on account of the numerous short circuits that were commonplace at the time, but regulations were proposed in 1920 to prohibit the playing of car radios while the vehicle was moving. The regulations stated that "Radios played in moving cars distract the driver and cause accidents, the act of tuning a radio takes the driver's attention away from the road, and radio music lulls drivers to sleep" [8]. The Ford Motor Company authors of Reference 8, go on relate the fascinating story on the origins and developments of the car radio which have been made possible by modern technology.

For example, consider the typical daily production output at Delco Electronics Division as shown in the below table [9]. To make this kind of production possible, Delco has established itself as a leader in such areas as surface mounting, hybrid circuit fabrication and assembly, bipolar linear integrated circuits, power devices and sensors. It is also a leader in the application of machine vision to production. More than 200 machine vision applications are already being employed in Delco's plants.

Daily production

Integrated circuits: 240,000
Plated through-hole circuit boards: 50,000
Print-and-etch circuit boards: 45,000
Ignition modules: 40,000
Voltage regulators: 36,000
Pressure sensors: 25,000
Electronic control modules[1]: 20,400
Automatic level controls: 10,400
Electronic spark controls: 6,500
Body computer controls[2]: 720

[1]optimizes fuel-air mixture
[2]integrated systems (Cadillacs only)

Source: Delco Electronics

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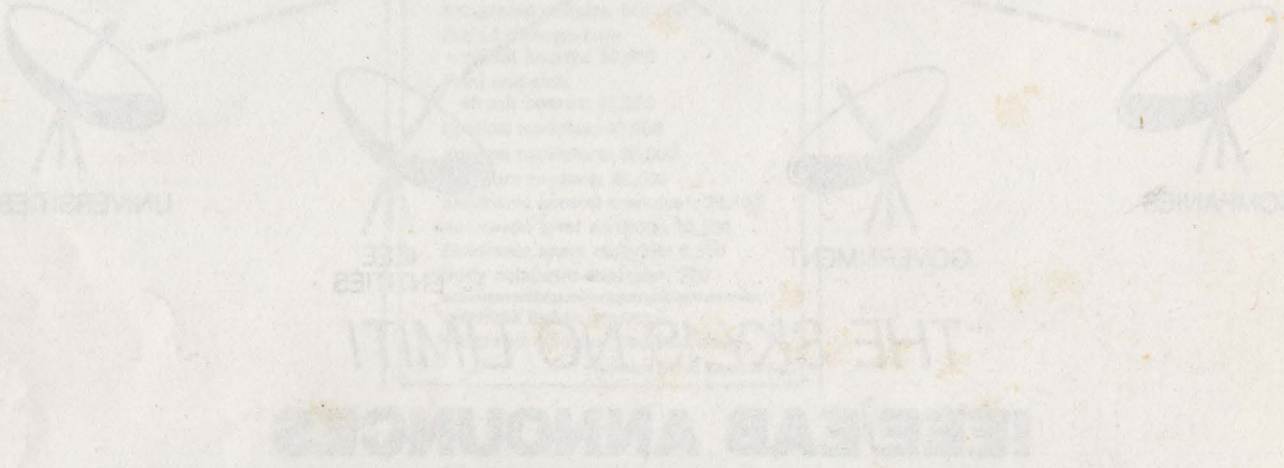

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