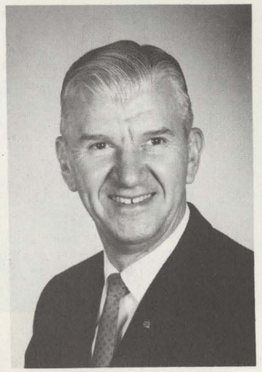
IEEE

# NEWSLETTER

VEHICULAR TECHNOLOGY GROUP

JANUARY 1975

# 25TH ANNUAL CONVENTION TORONTO ... JANUARY 21, 22



NICHOLAS ALIMPICH

# MESSAGE FROM THE PRESIDENT

At this writing, 1974 is drawing to a close and it seems appropriate at this time to reflect upon the past year while thinking ahead to 1975. In spite of our economic and other problems nationally, which in some way have affected everyone of us, VTG has made significant progress towards the goals set earlier in the year. Thanks to the perserverance of your Adcom and continuing support from the membership, we expect 1975 to be even better. Here are some of the accomplishments for 1974:

1) We sponsored a session at the ICC in St. Paul.

2) We sponsored the Automotive Electronic Committee at the SAE held in Detroit in February and again at Convergence 1974 in October in Troy, Michigan. The latter meeting drew over 600 attendees.

3) We sponsored the Mobile - Microwave Symposium in Boulder last September.

4) We established a full nominations committee who, under Bob Bloor, generated 16 candidates for ADCOM office. Five were elected, three are new to ADCOM.

5) We established an educational committee headed up by Arnie Brenner. This committee will generate a scholorship fund under the banner of VTG.

6) We reorganized our editorial staff for more efficiency and better timing for our transactions and newsletter. You are already seeing the results of the newsletter editor, Olin Giles, and Carl Brooks has assured me that the transactions will be on schedule as of the November issue.

7) Our membership continues to hold its own in the face of the economic recession.

8) The ADCOM meetings are well attended but could stand some improvement.

9) The President or Vice President are attending all of the Technical Activities Board meetings to establish a better rapport with headquarters and assure that our autonomy is not in jeopardy.

The above respresents many hours of work for your ADCOM and committee members. For 1975 even more work is on the horizon:

1) We must make an early decision regarding VTG involvement with Transportation Systems. A decision to take on this important area will require a highly motivated and dedicated transportation committee.

2) We must clearly identify the needs of you, the members. If you are asked to participate in a membership survey, please cooperate by answering all the questions promptly.

3) We must provide local chapters and regional conferences in the interest of better communications and better dissemination of information.

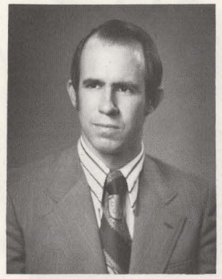
4) We must be unequivical in our support of various committees. If we expect to share in the proceeds of money-making conferences, we must participate in the conferences.

5) We must find ways to shorten the intervals of review for both Transactions and Conference records in the interest of shortening publication schedules. And, of course, all of the above must be done along with the normal amount of regular business.

On behalf of your Administrative and Committee members, I hope this report finds you in good health, and I sincerely hope that 1975 has the best in store for you.



# EDITOR'S NOTES



This is the last issue of the IEEE/VTG newsletter before the 25th annual convention in Toronto. I trust that it reaches you before the January 22 convention date. IEEE Headquarters assured me that they would pull all the stops to see that this happens. Now I would like to call your attention to several highlights in this issue.

First, you will find a complete listing of the technical program at the convention, including abstracts of all the papers. A tour of the Metropolitan Toronto Police communication system is programmed and is an entree you won't want to miss. George King has written an informative background article on this sophisticated communication system that you communication types will find interesting.

Secondly, on the automotive side of the house, Bill Flemming, Automotive Electronics Editor, has an excellent bylined story on the recently completed CONVERGENCE '74 automotive electronics conference. The event was highly successful and is certainly a solid indicator that the future of electronics is bright in Detroit.

Another item that I want to call to your attention is the story on IEEE Standards. The Standards Committee needs your feedback and help in directing their future efforts. What do you need in the way of IEEE standards? Neal Shepherd would like to hear from you. We will try to print several letters representative of the divergent viewpoints on this subject in a future issue of the newsletter.

And, of course, I cannot close without thanking everyone who contributed to this issue.

Happy New Year!!

OLIN GILES

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VTG NEWSLETTER DEADLINES

| Month of Issue | Final Copy To Be Rec'd. By Editor* | Target Mailing Date |
|---|---|---|
| April | 3-3-75 | 3-28-75 |
| July | 6-2-75 | 6-27-75 |
| October | 9-1-75 | 9-26-75 |
| January | 12-1-75 | 12-31-75 |

*Inputs for newsletter staff editors should be received 1-2 weeks before these dates.

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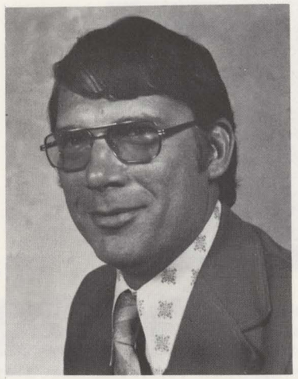
# CHAPTER NEWS

BY: JOHN DETTRA



M E E T I N G S

COLUMBUS — "Transportation Research Center of Ohio"
by James H. Leckrone on September 11, 1974, 17 attending.

"Utilization of Two-Way Radio for City of Columbus"
by Robert Geer on October 9, 1974, 17 attending.

"What's Going on at FCC?"
by Paul Krumm on November 13, 1974, 9 attending.

DALLAS — "A Mobile Radio Communication System for the North Central Texas Council of Government"
by William B. Carr on November 14, 1974.

WASHINGTON — "Increased Use of the Radio Spectrum Through Offset Channel Operation"
by Donald Walker on October 11, 1974, 27 attending.

* * * * * * * *

N E W  C H A P T E R  C H A I R M E N

CHICAGO — William V. Tranavitch, Jr.

SE MICHIGAN — Kenneth A. Niemi

* * * * * * * *

C H A P T E R  O F  T H E  Y E A R

SE MICHIGAN — The Southeastern Michigan Chapter has again earned the Chapter of the Year Award. Some members of the Chapter have organized technical symposiums, sessions, written chapters for technical books, as well as holding regular meetings. CONGRATULATIONS!

COLUMBUS - FLORIDA, WEST COAST - ORLANDO
Honorable mentions to these three chapters for a very active year.



# THE WASHINGTON SCENE

BY ERIC SCHIMMEL

FCC BECOMES AESTHETE

Webster defines Aesthete as one having sensitivity to the beautiful. It's true that the FCC has some nice heads on their premises, but that's not what this article is about.

By the time this article is in print, the Federal Communications Commission is expected to have issued an extensive rule-making in the area of environmental quality. Contingent upon final clearance by the General Accounting Office, the new regulations will become effective January 1, 1975.

What in the world, you may ask, does FCC have to do with controlling the environment? Well it began in August 1972, when the Commission issued proposed rules in docket 19555 for implementation of the National Environmental Policy Act of 1969 (NEPA). The thrust of that proposal was to give the Federal Government control over the placement and erection of antenna towers and structures. It is unlikely that the Commission would have voluntarily ventured into this arena, but since it had the muscle to control radio installations via its licensing authority, it has become a pawn of the Environmental Protection Agency. Unlike most EPA actions which focus on the toxicity of our water and atmosphere, this proceeding is almost exclusively devoted to the aesthetic considerations of antenna structures.

As a result of comments filed by interested parties in 1972, the original proposal has been refined in several aspects. The main points to which the FCC has acceded are: "(1) that the Commission should make a greater effort to identify those of its actions which are 'major' within the meaning of NEPA, and should require the submission of environmental data only for such actions; and (2) that the Commission should assume responsibility for conclusions regarding the environmental effect of its actions and not ask the applicant to do so."

The classes of facilities which the rulemaking defines as "major," and which may be of interest to VTG types, are:

A. Private and common carrier microwave relay antenna towers or supporting structures exceeding 100 feet in height, excluding pole mounted microwave antennas. (This category does not include the mounting of a microwave antenna on an existing tower or building.)

B. Other antenna towers or supporting structures including pole mounted microwave antennas, which exceed 300 feet in height and are not located in areas devoted to heavy industry or to agriculture. (This category does not include the mounting of small antennas on an existing tower or building.)

C. Communications facilities to be located in the following areas: (1) Facilities which are to be located in an officially designated wilderness area or in an area whose designation as a wilderness area is pending consideration:
(2) Facilities which are to be located in an officially designated wildlife preserve or in an area whose designation as a wildlife preserve is pending consideration;
(3) Facilities which will affect districts, sites, buildings, structures or objects, significant in American history, architecture, archeology or culture, which are listed in the National Register of Historic Places or are eligible for listing;
(4) Facilities to be located in areas which are recognized either nationally or locally for their special scenic or recreational value.

While acknowledging that communications is a "clean industry" and that the primary concern of the agency is with the visual appearance of communications facilities, the Commission included a footnote which requires licensees and applicants also to observe electromagnetic radiation exposure standards when evaluating the environmental effects of those facilities.

Procedurally, a form will become available for filing information on proposed "major" facilities. This information should provide a descriptive narrative of the area surrounding the proposed construction, from an environmental impact point of view, including considerations given to the selection of the site and a discussion of any unavoidable adverse effects. The pertinent Commission staff will then use this information to evaluate whether a formal environmental impact statement should be prepared and notice published in the Federal Register. In instances calling for formal publication, interested parties may file comments within 45 days and reply comments within an additional 21 days. It has been estimated that these administrative procedures could cause normal processing times to be extended by 4 months or more.

A tempering factor lies in the Commission's treatment of earlier comments which urged that Federal regulations should be applicable only in the absence of local zoning ordinances. In its report and order, the FCC states that it does not intend to pre-empt state or local land use policies. As a practical matter, we see this to mean that documented approval of the proposed facility from an environmental standpoint, by a local jurisdiction, will go a long way toward receiving token Federal concurrence.

At this writing, it seems likely that some petitions to change or delay the implementation of this proceeding will be filed once the official Report and Order is released. Whether the January 1 date will stand, will depend on the Commission's disposition of those petitions. Watch your trade press for the latest development.

AN OPPORTUNITY?

Someone is going to sell millions of specialized VHF receivers in the next few years. That's what was projected at a recent meeting which we attended at the U.S. Department of Commerce, called to brief telephone common carriers and representatives of industry on the National Oceanic and Atmospheric Administration's (NOAA) plans for a national weather warning system. Officials of the National Weather Service and the Department of Commerce's Bureau of Domestic Commerce described a proposed network of 400 transmitters and indicated that a White House announcement could be expected before the end of 1974.

The concept is not really new, and builds on an existing network of 77 transmitters, located primarily in major cities and coastal areas. The present expansion schedule calls for 269 transmitters to be operational within 18 months. The thrust of the program is to provide comprehensive weather reporting 24 hours a day to essentially the entire nation. A key feature of the system is the ability to trigger receivers with a tone code and generate a siren sound to alert the occupants on the premises to listen for an emergency message. Such alerts will usually pertain to imminent environmental hazards such as floods, crop damaging frosts, heavy ice or snow conditions, and any of a variety of severe storms.

In both normal operation and during emergency alerting, emphasis will be on specific local needs, e.g., agricultural areas will stress information of importance to farmers, and stations near waterways will include marine reports. Regional reports on road conditions will also be included for the benefit of travelers. Normal transmissions will have a duration of 4 to 6 minutes and are revised every 2 to 3 hours, or as frequently as changing conditions require.

It was stressed that the NOAA system is not intended to compete with commercial broadcast services or with telephone dial-up weather reports. The broadcast media is encouraged to use the NOAA reports for retransmission in their programing. With regard to telephone weather reports, it was noted that a survey in one city showed that calling increased after the introduction of the NOAA system.

Future refinements of the system would include the introduction of additional frequencies to provide greater geographical saturation with a minimum of interference caused by overlapping signals. The present operating frequencies are 162.55 MHz and 162.40 MHz. It is also expected that arrangements will be made with the nation's common carriers to operate and maintain the physical transmitter facilities.

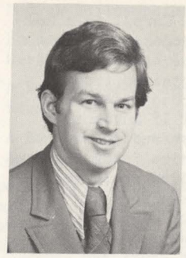
The success of the program, of course, lies in the willingness of the public to purchase receivers. At least one supplier offers a unit, complete with temperature and humidity gauge, for $29.50. A portable model is expected to become available in the $25 price range in the near future. These units are claimed to have communications quality sensitivity (0.5 UV) and high(80 db) interference rejection. It is estimated that there is a mass market of over 100 million units. When you consider that many persons will want a unit in their cars and boats, in addition to their homes, the number may indeed be conservative. This is not to mention the probability that most commercial, industrial and public facilities will be equipped to receive alerts. Perhaps you or your company may wish to go after a piece of the action. If so, you may obtain additional information from Mr. Harold Scott, Chief, Public Weather Information, 301-427-7858, or Mr. Tom Corless, Director of Telecommunications, Bureau of Domestic Commerce, 202-967-4821. If not, we hope that you will have found this information of some personal value.



# AUTOMOTIVE ELECTRONICS

## DATELINE: DETROIT

## BY BILL FLEMING



CONVERGENCE '74

Major news out of Detroit concerns proceedings at Convergence '74, the first International Colloquium on Automotive Electronic Technology. Participation in the conference was far greater than anticipated- at the final day's session more than 700 people were in attendance. Convergence '74 was held in Troy, Michigan and was jointly sponsored by SAE, IEEE, and our S.E. Michigan Chapter of VTG. Plans are already made for the next meeting, Convergence '76.

Twenty-five prominent executives from both the electronics and automotive industries participated in the two and one-half day conference. Published articles on the conference proceedings can be found in the following places:

1. "The Future for Automotive Electronics," *Automotive Engineering*, November 1974; Cover Feature and Text on pp. 29-39.
2. "Convergence '74: Auto Electronics Update," *Ward's Auto World*, November 1974; Cover Feature and Text on pp. 34-36.
3. "Project Omega--GM in New Microprocessor Effort," *Electronics News*, November 4, 1974; Cover Feature, continued on p. 7.

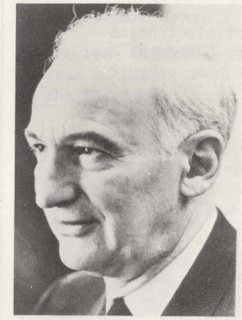
Detailed information can be obtained by ordering a copy of the Convergence '74 Proceedings ($20.00/copy, Society of Automotive Engineers, Inc., 18121 E. Eight Mile Road, East Detroit, Michigan 48021).

Our S.E. Michigan Chapter of VTG had a membership table at Convergence '74; the table was manned by Ken Niemi, Charlie Boyd, and myself. There was considerable interest in the automotive electronics activity of VTG. I estimated that approximately twenty conference attendees explicitly stated their intention of either joining IEEE or renewing expired membership in IEEE because of automotive electronics activities in VTG.

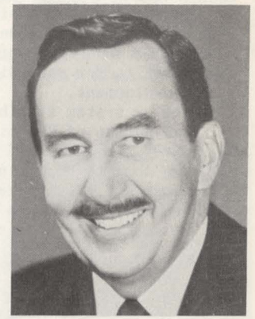
Trevor Jones of General Motors was the prime mover who made Convengence '74 a success. He arranged to have GM's newly elected president, Elliot Estes, give the keynote address, and to have Simon Ramo of TRW, and C. Lester Hogan of Fairchild give separate dinner presentations.

I thought it would be of interest to quote some comments made by speakers at Convergence '74 which I found noteworthy. They were as follows:

- Simon Ramo, Chairman of the Executive Committee of TRW, urged automotive and electronics industries to share both in the development and in the production of future automotive electronic products. He warned that "if the automotive industry does not work in a cooperative spirit with the electronics industry, the heralded marriage of the two technologies will suffer and the offspring of this marriage will be growth stunted." Ramo believed the wedding of electronics with the automobile is coming due to a great coincidence of timing. "Electronics technology has now advanced to a point where, fortunately, it can fulfill the stringent performance requirements suddenly thrust on the automobile."



Dr. SIMON RAMO



ELLIOTT M. ESTES

- Elliot Estes, President of General Motors, said that it is urgent today for electronics engineers and automotive engineers to get together. As one example, he mentioned how mathematical models of engine operation were derived by automotive engineers to permit proper design of engine control systems by electronics engineers. Estes went on to predict that an automotive powerplant, equipped with a central microcomputer, is a possibility by the early 1980's. Advanced concept vehicles, designated as the Omega series of vehicles, "will have a microcomputer which will control all aspects of engine operation including air-fuel mixture, ignition timing, and emissions control subsystems."

- Robert Noyce, President of Intel Corp., told how the rapid development of microprocessors has made the following statement true. "To a first approximation, if data can be obtained from sensors, computed results will come essentially free." He also pointed out that if automotive industries had made the same cost and speed improvements in cars as electronics industries made in microprocessors, a Cadillac would today only cost $1 and would reach a speed of six million mph. In rebuttal, Trevor Jones of General Motors said that maybe what Noyce was really pointing out was that ten years ago electronics were way overpriced, whereas cars were underpriced. Noyce, in turn, begged off by saying that he never meant to infer that either the electronics industries or the automotive industries have ever made unreasonably high profits.

- One speaker, who best go un-named, lauded the reliability of electronic products on vehicles by citing the record of the seat belt interlock circuit. He proudly proclaimed only 14 failures in 229,000 units for a 99.995% reliability rate. It was pointed out that he did not mention that there were only 14 "reported" failures, whereas the actual number of failures may never be known.

- Bernard Marren, President of American Microsystems, gave a list of advice for minimizing risk in joint development programs between electronics and automotive companies. His list included the following advice for automotive companies:

  1. Don't expect the electronics company to define a systems approach.
  2. Don't withhold desired performance specifications, and don't be afraid to expose advance products plans.
  3. Don't prejudge economics of electronics.
  4. Don't push state-of-the-art. Process development is far more difficult than circuit development.
  5. Allow system flexibility; e.g., take advantage of ROM circuits.
  6. Seek the advice of electronics companies and be open to exploring potential features.
  7. Work out a comprehensive contract in preference to a purchase order, and maintain continued close contact.

  Marren concluded that "just as MOS/LSI technology in America helped us to regain the computer/calculator market, it can be used by the automotive industry to show world leadership in automobile performance."

- Trevor Jones of General Motors first reviewed the spectacular advances in electronics technology. He then pointed out that the 13 electronic subsystems now onboard production vehicles have a total count of approximately 2500 electronic components. "If an LSI circuit could be made to accommodate all 2500 components, its total cost would only be about $2.50." Jones then gave a list of 60 additional electronics systems which are candidates for tomorrow's automobile. Explaining why these systems are not now available, he said an evaluation revealed a breakdown into the following major problem areas:

| Major Barrier | Number of Systems Barrier Applied to (out of 60) |
|---|---|
| High Cost | 56 |
| Technology Limited | 25 |
| Sensor Limited | 35 |
| Actuator Limited | 25 |
| Display Limited | 23 |

- Hermann Eisele, Director, Fuel Injection Division, Robert Bosch GmbH, reviewed the advantage of electronic fuel injection. He claimed that, although fuel injection is more expensive than the carburetor, its use is justified by:

  1. Better control of engine warm-up for cold start driveability.
  2. More precise air-fuel mixture control which permits leaner calibration of engines.
  3. More consistent operation, which allows engine tuning closer to emissions limits.
  4. Inherent adaptability to electronic engine controls.

  Eisele used as an example, the closed-loop control of engine of air-fuel ratio. An electrochemical oxygen sensor is placed in the exhaust pipe and provides the feedback signal which consists of a step-function-like transition in voltage at the stoichiometric air-fuel ratio. He described methods of biasing the time-averaged control point to either slightly rich or slightly lean air-fuel ratios (±0.3 ratios from stoichiometry). Eisele believes that a slightly rich calibration will permit the use of a reducing catalyst for nitric oxide abatement. An oxidizing catalyst with air injection is also needed to control hydrocarbons and carbon monoxide. Eisele concluded that "this concept appears especially attractive to heavy cars with higher displacement engines."

- Jerome Rivard, Director of Engineering at Bendix Corp., proudly announced that Bendix will manufacture an electronic fuel system for an American automobile this year. *Ward's Auto World* (November 1974, p. 34) reports that Cadillac will offer the Bendix system as an option around mid-December of this year. The system utilizes the speed/density method for determining mass air flow entering the engine. It includes five sensors:

  1. Throttle position sensor.
  2. Distributor shaft speed sensor.
  3. Intake manifold water temperature sensor.
  4. Intake manifold air temperature sensor.
  5. Manifold absolute pressure sensor, remotely located in electronic controller unit.

  Rivard predicted first production systems to have less than 1.5% failures to start with. To obtain better reliability, the electronic controller unit was located inside the passenger compartment, under the dash. Flexible calibration of systems was designed in by the use of programmable laser trimming of thick-film resistor networks. Rivard stated that analog circuitry was chosen over digital circuitry on the basis of design and calibration flexibility not obtainable from digital circuits. He predicted that once federal emissions legislation stabilizes, possibly by 1978, MOS and ROM large-scale integrated digital circuitry will be used, whereupon extra control functions will be added at essentially no extra cost. Rivard forecast that with time, as Bendix works on their experience curve, the cost of electronic fuel injection will eventually become less than the cost of carburetors.

- Takio Kitano, Executive Vice President of Nippondenso Co., described some experiences which he called the "contradiction in the application of electronics." He said that an electronic skid control system included a buzzer and/or lamp to warn the driver of wheel lock-up. They found that drivers of this car rapidly learned from this warning signal how to achieve excellent control of skid without further need for the electronic control system. A similar learning experience was had by drivers who used vehicles equipped with mile-per-gallon meters. He said one might conclude that these systems are only useful for driving school. While discussing the trade-offs in automotive electronics between ruggedness and precision, Kitano made the following memorable quote, "Automotive electronic elements have to be as strong as weeds on a roadside, meaning that currently available electronics, which are like a greenhouse plant or a well protected daughter, will never stand up to the cruel treatment of automotive use."

In summary, there was a prevailing technical theme, re-emphasized by many of the speakers at Convergence '74. Time and again, they said things like, "What turns a microprocessor on is data, but the data wouldn't come until cost/effective transducers are available." Besides transducers, speakers pointed out that automotive electronic systems require a depth of quantitative measurement which mechanical systems never before have needed. Donn Williams, President of Rockwell International, put it this way: "A rubbing together of electronics and mechanical disciplines will create the sparks of creativity necessary to make automotive electronics most fruitful."

## AUTOMOTIVE ELECTRONICS: SPECIAL EVENT

Special sessions on automotive electronics will be included in the upcoming Society of Automotive Engineers Conference to be held in Detroit, Michigan, February 26-28, 1975. More than 20 papers will be given during five sessions organized on this subject. These sessions will follow up the sessions already held at this year's SAE Conference and are of generally more advanced content.

A selection of topics to be discussed include the following:

- Electronic Equipment Earning its Place on European Vehicles
- Electronic Equipment Useage on Japanese Vehicles
- Electronic Display Systems in the Automobile
- Drive Circuits for Electronic Displays
- Adaptive Control of Automotive Engine Functions
- Closed-Loop Control of Air-Fuel Ratio Using a Carbureted Engine
- Engine Control by On-Board Computer
- Design Philosophies for Use of On-Board Computer
- Fundamentals of Automotive Electrical Power Distribution and Information Transfer
- A Subnanosecond Sensor for Pre-Collision Sensing and Braking Applications
- A Random Noise Radar Sensor for Automotive Applications

Speakers will come from USA, Japan, Germany, and England. Additional program information may be obtained from SAE, Inc., 18121 E. Eight Mile Road, East Detroit, Michigan 48021; telephone (313) 733-0700.

●●●

## VTG MEMBERS ELECTED NEW FELLOWS IN THE RADIO CLUB OF AMERICA

The Radio Club of America recently announced that a total of twenty-one new Fellows have been elected. Of these new Fellows, several are IEEE/VTG members. They are:

- Sam Lane
- Dearl Morrison
- Jack Neubauer
- Al Reiner

The photo shown was taken at the 65th Banquet, November 15, 1974. The Radio Club of America elevates a small number of its roughly 600 active members to the status of Fellow each year.

The current president of the Radio Club of America is Fred M. Link. Fred is also a newly elected member of the VTG ADCOM.

From L to R: Ashton; Covey; Tyne; Rypinski; Larsen; Busignies; Rose; Reiner; Pfeifer; Neubauer; Dannals; Jones; McLeod. (Lane; Higginbotham; Grimm; absent from photo)

# ADCOM HIGHLIGHTS

## BY: TOM McKEE

October Meeting

The October VTG Adcom meeting was held on 10/31 at the Somerset Inn in Troy, Michigan.

The following persons were in attendance:

| | |
|---|---|
| Nick Alimpich | Bob Fenton |
| Bob Bloor | Olin Giles |
| Arnold Brenner | Dave Howarth |
| Carl Brooks | Andy Missenda |
| John Dettra | Jack Newbauer |
| Bill Elder | Ted Schaller |
| Dick Emberson | |

The following elected Adcom members were unable to attend the meeting:

| | |
|---|---|
| John Cassidy | Dick Moore |
| Marty Cooper | Stu Meyer |
| Jack Germain | Jack Renner |
| Sam Lane | Neal Shepherd |
| Roger Madden | |

* * *

The Treasurer reported that VTG's financial picture continues bright. Reserves are expected to increase slightly during the year to about $20K. Such reserves allow VTG to do more for its members. Co-sponsorship, with SAE, of events in the automotive electronics field are an example currently under discussion.

* * *

John Dettra, the Chapter Activities Chairman, reported that VTG currently has 23 authorized chapters, and that he has received meeting reports from 10 of them during the past year. These 10 chapters have held 46 regular meetings having a total attendance of 1438. Six of the 10 reporting chapters meet solely as VTG chapters, while the others meet jointly with other groups.

* * *

The Membership Committee Chairman, Andy Missenda, reported a current membership of 2291. VTG membership booths have been manned at the latest APCO Convention and at the Convergence - 74, Automotive Electronics Colloquium.

Likely prospects for VTG membership will soon be sent a copy of the VTG Transactions and membership advertising.

* * *

Bob Bloor reported that the 1974 Nominating Committee has completed its work, and has submitted a list of 16 Adcom candidates to the membership. Ballots will be counted soon after the November 15 voting deadline. The five nominees receiving the most votes will be elected to the Adcom for a 3 year term.

* * *

With the Toronto Conference almost upon us, the Adcom looked beyond 1975, to future national conferences. The Washington D.C. Chapter is targeting on late March for the '76 conference and this time period was proposed as a suitable time for the '77 and later conferences also.

* * *

In the Automotive Electronics world, Ted Schaller was happy to report that Convergence - 74 was a great success. He suggested that VTG sponsor the next "Convergence".

In February 1975, VTG will again co-sponsor five automotive electronics sessions at the SAE International Conference. Nineteen interesting papers will be presented. A new automotive electronics book will result from these papers. Overall, Ted reported that VTG and the SAE were cooperating very well in the automotive electronics field.

* * *

There was considerable discussion on VTG's and IEEE's roll in the vehicular communications standards area. EIA (Electronics Industries Assn.) and I.E.C. (International Electrotechnical Commission) are very active in this area, and there are questions concerning the amount of use IEEE standards receive vs EIA or I.E.C. Several methods were suggested for determining the relative usefullness of IEEE vehicular communications related standards.

* * *

In the publications area, Carl Brooks reported that the Transactions are being pulled back on schedule, with the November issue being scheduled for late November. Several special issues of the Transactions are being worked on.

Publicity for the Automotive Electronics book was discussed. Ted Schaller indicated that the Southeastern Michigan Chapter would be offering the book for sale at its local chapter meetings.



Printing of 500 extra copies of the November Newsletter, to be used in recruiting new members, was decided upon. These will be available at the Toronto Conference.

* * *

There was a lengthy discussion of the work of the Awards Committee. Jack Neubauer indicated that he needs advocates to do the spade work necessary to submit worthy VTG members for consideration as Fellows. Jack also indicated that while the Adcom has been submitting a list of candidates for VTG Honorary Members, this can also be done by petition. The signatures of 50 VTG members, as well as the technical background and IEEE/VTG service record of the candidate are essential. This award is usually bestowed only on those with long years or IEEE/VTG service.

* * *

VTG's future roll in the IEEE Oceanographic Coordinating Committee got a thorough airing as a result of a letter from the OCC chairman requesting that VTG either increase its involvement in the work of the OCC or withdraw from the Committee. VTG's past involvement with the OCC has been mainly financial via support given several years ago when the OCC was just getting established. OCC's development has not included as much of common interest with VTG as had originally been expected. Several Adcom members questioned our continued involvement with OCC, and a motion was made to withdraw from OCC unless a way can be found for VTG to become more active in OCC programs. Resolution of this question will be via mail ballot of the Adcom members.

* * *

Ways of increasing VTG's involvement in the transportation systems area were discussed. While, thru Bob Fenton's efforts, the Group has been able to attract good transportation-oriented papers for the Transactions, we have been far less successful in attracting members interested in the field. It was felt that there is interest in the field within IEEE, but that those interested were scattered throughout the groups and societies. Bob Fenton agreed to write a 2 or 3 page report documenting the discussion and his feelings. The report will contain recommendations which can be acted upon at the January Adcom meeting.

# BOOK REVIEWS

## BY: CARROLL LINDHOLM

WELCOME

I want to welcome readers to the book review column. Since this column appears quarterly, there is opportunity to review only a few books per year. This matches nicely the relatively few books which appear within our confined area of specialty, as well as my rather limited time and tired eyes.

Also deferring to the small number of reviews, I will not spend my time panning a book. If I believe a book is poor, it will not be noticed here. Many books have promising titles and fail to deliver. Because of my personal prejudices, I will concentrate on books which I believe have something to offer the practicing design or systems engineer, rather than the theoretician. I personally enjoy well done theoretical works, but unless they touch reality somewhere, I won't mention them in this column.

Book Reviewed: Approximation Methods for Electronic Filter Design

Author: Richard W. Daniels, Bell Telephone Labs

Publisher: McGraw-Hill, $19.50

The selected book carries the subtitle "with applications to Passive, Active and Digital Networks." The book begins with a brief introduction to filters and filter jargon. Then we are introduced to the modern "classical" filter: Butterworth, Tschebyecheff, inverse Tschebyecheff and Elliptic, separate chapters being devoted to each. Mathematically and computationally, these (and much of filter theory) are a mess. The author carefully focuses attention on ways to handle the messiness and displays a variety of actual computer programs (admitting that actual filters are designed by computer calculations). Some might complain about the obscure computer language used (TELCOMP), but enough of the rules appear in an appendix that there seems to be no difficulty converting to a more familiar form such as BASIC or FORTRAN. TELCOMP is nearly identical to its father, JOSS, should the latter be familiar.

Frequency transformations and their applications are treated next, leading naturally, if not too smoothly, to the heart of synthesis procedures: choosing parameters to meet specifications and iterating these to secure "optimal" filters of one sort or another. Delay synthesis is treated as well as time-domain synthesis. Then, passive and active realizations are formed to wrap it all up. Digital filters are given a (too brief) treatment (apparently for completeness).

Though containing many problems at the end of each chapter, this book is not so valuable as a textbook as it is as a reference work for the practicing engineer. The problems are supplementary and of the "show that" variety rather than exercises to review the material.

Coupled with a good "op-amp" book such as "Operational Amplifiers-Design and Applications" by the Burr-Brown Boys, actual filters of substantial complexity can be designed and built. I recommend the book.

# IEEE STANDARDS

## BY: JACK NEUBAUER, NEAL SHEPHERD

The VTG Standards Committe has sponsored two Vehicular Performance Test Procedures. The first, Standard #263, was published in November 1965, and covered Methods of Measurement of Radio Noise Generated by Motor Vehicles and Affecting Mobile Communications Receivers in the Frequency Range 25 to 1000 MHz. The second, Standard #184, was published in April 1969, and covered Methods of Measurement of the Performance of Frequency Modulated Mobile Communications Receivers. A third standard has been prepared and is scheduled for release early in 1975. It covers Methods of Measurement of Spurious Emissions from Land Mobile Communications Transmitters.

The Committee wishes to continue to encourage the development of new standards which will provide the vehicular communications design engineer with practical means of determining if equipment developed by them, satisfies industry, government or FCC performance requirements. We are desirous of having the benefit of your experience in the application of the IEEE or any other standard, i.e., EIA, CCIR, or IEC. Keep in mind that there are two basic types of standards. One, of which EIA is an example, establishes minimum acceptable performance limits, with an appropriate method of measurement. This type of standard is all inclusive of electrical, electronic and environmental characteristics. The other, of which IEEE/VTG is an example, establishes a uniform method of test and measurement, which covers a complete scope of performance characteristics, particularly those which contribute to overall systems application. The characteristics are measured in terms or quantities which allow the design engineer to incorporate the equipment into an operational environment and predict the end-to-end performance.

The specific of objectives of EIA will be outlined. EIA publishes a combination of both measurement and minimum performance standards. The minimum performance standards are generally not up to the State-of-Art. They are written to comply with the FCC Rules or a level of performance for most equipment, where FCC Rules do not apply. The following standards are available from EIA Headquarters, 2001 Eye Street, N.W., Washington, D.C. 20006.

LAND MOBILE COMMUNICATION, FM OR PM TRANSMITTERS 25 to 470 MHz (RS-152-B, $4.30)

This Standard details definitions and methods of measurement of the characteristics of FM or PM Land Mobile Transmitters in fixed or vehicular installations. It is intended to promote compatibility of these transmitters with the systems in which they will operate.

MINIMUM STANDARDS FOR LAND MOBILE COMMUNICATION FM OR PM RECEIVERS (RS-204-A, $5.25)

This Standard covers standard test conditions and minimum performance standards for land mobile FM or PM receivers in the frequency range 25-470 MHz in the electrical performance and environmental area.

CONTINUOUS TONE-CONTROLLED SQUELCH SYSTEM (CTCSS) (RS-220, $3.50)

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 thirty-three different audio tones which can be used for designing a communication system in which the receiver squelch will only open when the transmitter is modulated by one of the low frequency audio tones. The system is designed for operation in the 25-470 MHz ranges and in either the Narrow or Wide Band deviation mode.

MINIMUM STANDARDS FOR LAND MOBILE COMMUNICATION SYSTEMS USING FM OR PM IN THE 25-470 MHz FREQUENCY (RS-237, $4.10)

This Standard details overall minimum performance requirements for land mobile communications systems such as (1) a radio transmitter including an associated transmission line and an antenna, and (2) a radio receiver with an associated transmission line and antenna. Definitions of pertinent system parameters are given and methods of measurement under controlled test conditions are included to determine whether minimum standards are met.

MINIMUM STANDARDS FOR PORTABLE/PERSONAL LAND-MOBILE COMMUNICATIONS FM OR PM EQUIPMENT 25-470 MHz (RS-316, $4.40)

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 protable power source and antenna.

MINIMUM STANDARDS FOR LAND MOBILE COMMUNICATION ANTENNA PART I - BASE OR FIXED STATION ANTENNAS (RS-329, $3.00)

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.

MINIMUM STANDARDS FOR LAND MOBILE COMMUNICATION ANTENNAS PART II - VEHICULAR ANTENNAS (RS-329-1, $2.20)

This Standard supplements RS-329 by covering vehicular antennas in the 132-1000 MHz frequency range.

LAND MOBILE SELECTIVE SIGNALING STANDARD (RS-374, $4.30)

This Standard presents the definitions, minimum performance standards and methods of test common to all selective signaling systems.

MINIMUM STANDARDS FOR TEST CONDITIONS COMMON TO FM OR PM LAND MOBILE COMMUNICATIONS FOR EQUIPMENT 25-470 MHz (RS-388, $2.70)

This Standard details common test conditions under which performance parameters of Frequency Modulated or Phase Modulated Land-Mobile communication transmitters, receivers, control and selective signalling units, power supplies, station combinations, personal, portable, or other assemblies of equipment, including complete operating packages, shall be measured.

The International Electrotechnical Commission (IEC) is preparing recommended methods of measurement for equipment and systems used in the mobile services. The publication plan includes 7 parts which will be covered in a future issue.



In turn, we in the VTG standards committees wish to complement these objectives, in a meaningful way, without conflicting redundancy. We also need to recognize how you, the design, systems or applications engineer, can best apply the procedures thus defined. We believe the VTG type of standard can become a basic criteria of all test and evaluation programs.

Should you have any helpful comments or suggestions, please address them to the chairman of the VTG Standards Committee:

Mr. Neal Shepherd
General Electric Company
Mountain View Road
Lynchburg, Virginia 24502

# NEW ADCOM MEMBERS

The returns from the VTG ADCOM election have been counted and the following members have been elected for a three year term beginning January 1, 1975:

Carl N. Brooks
Sam Lane
Fred M. Link
S.R. McConoughey
Thomas A. McKee

Congratulations to them on their election to the ADCOM.

The present ADCOM members and their respective terms are outlined below:

Term Ending 12/31/74

A. Brenner
Motorola, Inc.
Chicago, Illinois

J. Cassidy
General Motors
Warren, Michigan

S. Meyer
RCA
Washington, D.C.

J. Neubauer
Urban Sciences, Inc.
Philadelphia, Pennsylvania

N. Shepherd
General Electric Company
Lynchburg, Virginia

Term Ending 12/31/75

N. Alimpich
Michigan Bell Telephone Company
Detroit, Michigan

M. Cooper
Motorola, Inc.
Chicago, Illinois

R. Madden
Federal Communications Commission
Chicago, Illinois

R. Moore
City of San Jose, California
San Jose, California

J. Renner
Advance Technology Systems
Washington, D.C.

Term Ending 12/31/77

Carl N. Brooks
Motorola, Inc.
Schaumburg, Illinois

Sam Lane
County of Los Angeles
Los Angeles, California

Fred M. Link
Private Consultant
Pittstown, New Jersey

S. R. McConoughey
Federal Communications Commission
Washington, D.C.

Thomas A. McKee
General Electric Company
Lynchburg, Virginia

# AWARDS

## BY: JACK NEUBAUER

The VTG Awards Committee is in need of your help in identifying eligible candidates for nomination as recipients of the many Institute Field and Group/Society Awards as well as those qualified for the rank of Fellow of the Institute. Our VTG By-Laws also provide for the election of Honorary Members in the Group, in recognition of significant technical contributions and the performance of outstanding service to the profession and to the VTG. Other Awards include the Prize Awards made to contributors of outstanding papers.

A brief description of the various awards follows to assist you in identifying qualified nominees.

PRIZE PAPERS

WRG Baker -

This award is made to the author or authors of the best paper printed in the TRANSACTIONS and JOURNALS of the IEEE Groups and Societies or PROCEEDINGS of the IEEE during the period July 1-June 30. The recipient need not be a member of the IEEE.

Browder J. Thompson -

This award is made annually to the author, or joint authors, under thirty years of age at date of submission of original manuscript, for outstanding paper published in any of the IEEE publications. All papers by qualified authors published during the period July 1-June 30 are eligible for consideration for the award. The recipient need not be a member of the IEEE.

Alfred Noble Intersociety Award -

The award is given for a technical paper of exceptional merit accepted for publication in any of the technical publications of the four Founder Societies (AIME, ASCE, ASME and IEEE), and the Western Society of Engineers, provided the author has not passed his 31st birthday at the time the paper is submitted in its final form. The author must be a member of the IEEE. Papers published during the calendar year are eligible. (Papers by joint authors are not acceptable.)

GROUP/SOCIETY

Honorary Member -

This award is made to VTG members in recognition of outstanding service to the profession and VTG and for their significant technical contributions to the vehicular technology field.

Outstanding Service -

This award is annually made to members of the VTG who have made a notable contribution to the work of the Administrative Committee.

FIELD AWARDS

See the IEEE Field Awards table on the following page.

FELLOW GRADE

The grade of Fellow is one of unusual professional distinction and shall be conferred only by invitation of the Board of Directors upon a person of outstanding and extraordinary qualifications and experience in the fields of electrical engineering, electronics, radio, allied branches of engineering or the related arts and sciences, who has made important individual contributions to one or more of these fields. The candidate shall meet the requirements for Senior Member as stated in the Bylaws and shall have been a member in any grade for a period of seven years or more preceding the year of nomination, except that the seven-year provision in any individual case may be waived for cause by the Board of Directors.

Senior Member is the highest professional grade for which application may be made and shall require experience or attainment reflecting professional maturity. For admission or transfer to the grade of Senior Member, a candidate shall be an engineer, scientist, educator, technical executive or originator in the fields of electrical or electronics engineering and science, radio, allied branches of engineering or related sciences and arts.

He shall have been in the active practice of his profession for at least ten years and shall have attained distinction as measured by performance over a period of at least five of these years, such performance including one or more of the following:

- Publication of important original engineering or scientific papers, books or inventions, or
- Technical direction with evidence of accomplishment of important scientific or engineering work, or
- Creative contributions to the welfare of the scientific or engineering profession, or
- Establishment or furtherance of important scientific or engineering courses in a "school of recognized standing", or
- Contributions equivalent to those of above in such areas as technical editing, patent prosecution or patent law, provided these contributions serve to advance progress substantially in the fields of electrical engineering, electronics, radio, allied branches of engineering or the related arts and sciences.

* * * * *

We believe many of our members are qualified to receive at least one of these awards. It is up to you, our membership, to identify them. Will you help us? Address your recommendations to:

J. R. Neubauer
Awards Committee Chairman
Urban Sciences, Inc.
5434 King Avenue
Pennsauken, N. J. 08108



IEEE FIELD AWARDS*

| NAME OF AWARD | DISTINCTIVE FEATURES | PRESENTATION |
|---|---|---|
| Harry Diamond Memorial Award | Outstanding technical contributions in the field of government service in any country, as evidenced by publication in professional society journals. | One annually. Certificate and $1000. Date established: 1949 |
| William M. Habirshaw Award | Outstanding contribution in the field of transmission and distribution of electric power, to an individual or group. | One annually. Bronze Medal, Certificate and $1000. Sponsored by Phelps Dodge Foundation. Date established: 1958 |
| IEEE Award in International Communication in honor of Hernand and Sosthenes Behn | Outstanding contribution in the field of international communication, to an individual or group. | One annually. Plaque, Certificate and $1000. Sponsored by International Telephone and Telegraph Corporation. Date established: 1966 |
| Mervin J. Kelly Award | Outstanding contribution in the field of telecommunication to an individual or group. | One annually. Bronze Medal, Certificate and $1000. Sponsored by Bell Telephone Labs. Date established: 1959 |
| Morris E. Leeds Award | Outstanding contribution in the field of electrical measurement, to an individual or group. Special consideration given to value of contribution made before candidate reached 36th birthday. | One annually. Illuminated Certificate and $1000. Sponsored by Leeds & Northrup Foundation. Date established: 1958 |
| Morris N. Liebmann Memorial Award | Important contribution to emerging technologies recognized during preceding three calendar years. | One annually. Certificate and $1000. Date established: 1919 |
| Frederik Phillips Award | Outstanding accomplishments in the management of research and development resulting in effective innovation in the electrical and electronics industry, to an individual or group. | One annually. Gold Medal, Certificate and $1000. Sponsored by N.V. Phillips' Gloeilampenfabrieken. Date established: 1971 |
| David Sarnoff Award | Outstanding contribution in the field of electronics, to an individual or group. | One annually. Gold Medal, Certificate and $1000. Sponsored by RCA Corporation. Date established: 1959 |
| Vladimir K. Zworykin Prize Award | Outstanding technical contribution in the field of electronic television. | One annually until 25 awards have been made. Certificate and $1000. Date established: 1952 |

*To be awarded at an IEEE meeting of wide scope and interest upon the recommendation of the Awards Board. Nominations are due at IEEE Headquarters not later than April 1.

# THE 25TH ANNUAL VTG CONFERENCE

# TORONTO

There will be lots to do and see during your attendance at the Twenty-fifth Annual Vehicular Technology Group Conference. Our theme, "The Future in Vehicular Communications", is a fitting one for the SILVER ANNIVERSARY of this event.

Toronto is fast becoming famous throughout North America as the big city with the friendly touch - where you can do everything from skate outdoors at the City Hall to rub shoulders with the crowds on Yonge Street until the wee hours of the morning. You can see everything from an ancient castle, Casa Loma, to our new fascinating Science Center. And no one should miss taking a look at the CN Tower, the world's tallest, presently under construction - actually it is hard to miss, as you can see it standing out against the skyline long before you reach Toronto.

As you can see from the following program, the technical sessions will be interesting and informative, particularly the panel session, which will be difficult to stop once it gets rolling. I can also promise you that our two luncheon guest speakers will present new and challenging ideas.

SO COME TO TORONTO ********

MEET OLD FRIENDS ********

MAKE NEW ONES ********

Our Committee joins me in extending you all a very warm welcome.

Neil J. MacKinnon,
Chairman, Conference Committee

TOUR OF MTP COMMUNICATION SYSTEM

On Tuesday evening, January 21, a tour of the new Metropolitan Toronto Police Department communications system is planned. This promises to be one of the conference highlights. To stimulate your interest, a brief description of the MTP communications system follows.

* * * * * * *

The Metropolitan Toronto Police Department has what is believed to be the most advanced police communications system in the world. It is a computer-aided dispatch system that links over 700 police vehicles with a communications center by means of a 12 channel duplex radio network with 12 dispatchers and six base station locations and capable of handling both digital message traffic and voice communications. The system is expandable to 2000 units and 15 dispatcher positions. Base station capacity can also be increased. The area covered is Metropolitan Toronto which is 240 square miles with a population of 2.2 million people.

The original concept was initiated by George H. Long, of MTP. However, the system evolved to its present configuration by extensive consultation with the consultants and the supplier.

Some of the prime functional features are:

- Automatic routing of message traffic
- Automatic frequency assignment
- Push-button initiated generation of messages
- Error rejection
- Versatile dispatcher display system

Voice communications is by standard 16F3 FM modulation. Digital communications is by dedicated use of the same RF channels using bi-phase modulation at a data rate of 2400 bits/second where each message consists of 32 bits repeated 16 times.

Interconnection between the control center and the base stations is by telephone lines. The data rate over the telephone lines is 300 bits/second.

The system specification error rate for data at 12 dB SINAD is 1 in 3 million. To date, no wrong digital messages have ever been received.

The logic unit in each mobile has its own address which is sent automatically at the beginning of each transmission. In addition to responding to a discrete address, each unit can respond to group addresses. Other logic functions are the transmission and reception of standard messages.

Additional logic functions are built in to provide great system flexibility. For example, it is possible on a selective basis to erase or maintain messages stored in the unit's memory.

Each dispatcher can control up to 136 mobile units. Operational support is handled by computers; queueing, priority, assignments status, information storage and retrieval, base stations used and frequencies used are automatic, with all pertinent information displayed on video screens. Exept for priority calls, the dispatcher can "accept" a call on a first-in-line basis by pushing a single button.

A supervisory console has complete over-riding control. For example, the supervisor can take over the operation of any console and distribute individual vehicles or groups of vehicles to any dispatch position.

The system has enough capacity to serve Metropolitan Toronto for the next 10 years.



MTP COMMUNICATION SYSTEM CENTRAL CONTROL...WHERE IT ALL HAPPENS...

SESSION I

ANTENNAS, PROPAGATION AND
SPECTRUM MANAGEMENT

Chairman: A. J. Swain
Andrew Antenna Co., Ltd.
Whitby, Ontario, Canada

Mobile Antenna Gain at 900 MHz

Allen L. Davidson
Motorola, Inc.
Schaumburg, Illinois

Abstract ----
A program has been initiated to investigate the effect of the urban multipath environment on mobile antenna at 900 MHz. The program involves the construction of several mobile antennas, careful measurement of these antennas on an antenna range to determine their characteristics in a controlled environment, then measurement of their characteristics in the multipath environment of cities. Measured results are compared to computed results to permit generalized conclusions to be reached. This paper presents the results of the first phase of the program, measurements made in the controlled pattern range environment.

* *

A Double Phase Sweeping System for Diversity Reception In Mobile Radio: A.M. and F.M. Analysis

A. J. Rogers, Central Electricity Generating Board, Leatherhead, Surrey, England.

Abstract ----
Fading due to multipath propagation is a serious problem in mobile radio communications. Consideration is given to the theory of an effective means for combining the signals from a twin antenna space diversity arrangement using phase sweeping in opposite directions for the two antennae. An analysis is presented for various modulation methods. A mathematical model has been constructed and this is used to obtain results for phase swept A.M. and F.M. receivers, using practically realizable characteristics.
The resulting system should be compatible with existing receivers.
Some experimental results using a commercial V.H.F./A.M. receiver are included.

* *

## Statistical Analysis of Communications Range and Reliability in the Presence of Interference

Leon Jasinski
Motorola, Inc.
Fort Lauderdale, Florida

Abstract----
This paper presents a statistical method to calculate reduction of communication range and degradation of reliability caused by interference in land mobile communications systems. This method can be used for cases in which a desired signal is transmitted by a base station (or mobile unit) and received by a mobile unit (or base station) and is interferred with by a signal transmitted either by a fixed station or a mobile unit. The spatial probability distribution of mobile units is considered. The method is applicable to any frequency band for which path loss statistics are known. An example of this method is presented which calculates reduction in communication range, area and degradation of communication reliability for different values of splatter protection and distributions of mobile units.

* *

## Measures of Spectral Efficiency in Land Mobile Radio

Dale N. Hatfield
Office of Telecommunications Policy
Executive Office of the President
Washington, D.C.

Abstract----
Measures of spectral efficiency are very important to the resolution of contemporary issues in land mobile radio (LMR), because they ($_a$) allow the comparison of existing and proposed systems in terms of their spectral efficiency; (b) permit estimates to be made of the ultimate capacity of various system types at different levels of development; and (c) are useful in setting minimum standards for spectral efficiency. The purpose of this paper is to review the advantages, disadvantages, and limitations of various measures of spectral efficiency that have been proposed.

* *

## Spectrum Management

R. R. Hoodspith
Department of Communications
Ottawa, Ontario, Canada

* *

SESSION II
-- PANEL DISCUSSION --
"THE FUTURE IN VEHICULAR COMMUNICATIONS"

Moderator: D.M. Hinton, Bell Canada, Belleville, Ontario.
Panelists: R. Eldridge, British Columbia Telephone Co., Vancouver, British Columbia.
G.C. Brooks, Director, Telecommunication Engineering Service, Department of Communications, Ottawa, Ontario.
C.R. Rypinski, President, Rydax, Inc., San Rafael, California.
---- fourth member to be named ----

Is There A Bee in Your Bonnet?????

The aim of this session is maximum involvement from the floor. The members of the panel, drawn from the FCC, DOC, suppliers, and users, are there to trigger discussion, not to preach.

The theme is "The Future in ....", but no one should feel constrained by the title. If you have something to say which is of interest or of concern to VTG members, feel free to ask questions, answer questions, make statements, or comment on those of other conferees.

SESSION III
MOBILE RADIO SYSTEM ENGINEERING

Chairman: W.R. Young
Bell Telephone Labs
Holmdel, New Jersey

## Design Considerations for Data Devices in the Mobile Environment

Robert Beckman
Motorola
Schaumburg, Illinois

Abstract ----
In recent years the rapid growth of municipal and state public safety data bases has given rise to the need for computer access from the vehicle. Mobile alphanumeric terminals, which consist of a keyboard, display, and/or printer are presently being considered and used by police departments throughout the United States. The purpose of this paper is to call attention to the environmental, human engineering, and safety problems peculiar to such computer access devices when exposed to land mobile operation.

* *

## New York City Police Department Command and Control System

H. Bloomberg
New York City Police Department
New York, N.Y.

Abstract ----
The design of a command and control system for radio dispatching with built in flexibility, so that add-ons, and deletions in channel capabity are easily made, was the prime consideration.
The command and control system interfaces with the 'sprint' computer and the common carrier telephone system, so that remote locations can be on line with radio control.
To ensure operation under all conditions, the system operates on a system of dispatcher and supervisor priorities. The system can generate: tone keying, d.c. keying, and frequency shift coded keying to control the base stations in a prescribed mode of operation.
To facilitate add-ons, deletions, and changes in channel capacity, all control consoles are terminated in a common matrix, where solid state matrix control, crosspoint, and input/output modules process and control the dispatching.

* *



## AVM - Optimized for Multi-User Economics

George W. Gruver
Information Identification, Inc.
Fort Worth, Texas

Al Eschner
Hoffman Electronics Corporation
El Monte, California

Abstract ----
The different operational methodologies and economic constraints of a variety of potential users of automatic vehicle monitoring (AVM) are discussed. An RF proximity signpost AVM system which has been designed and tested to meet multiple-user requirements is described.
Unique features of this system include (1) variable location accuracy to meet different user's requirements, (2) different reporting modes for different users, (3) use of existing mobile radios, (4) no user or city size growth restrictions and (5) low cost.

* *

## Systems Considerations in the Expansion of a Low Capacity Tone Paging System Through Time Sharing With High Capacity Signaling

David F. Willard
Ronald E. Sharp
Motorola, Inc.
Fort Lauderdale, Florida

Abstract----
Many existing two-tone (possibly 3 tone "bellboy") paging systems in our metropolitan areas have reached system capacity. By allocating a small percentage of air time for a higher signalling rate and larger code capacity pager, channel capacity can be increased several times. The low capacity pagers can then be phased out slowly, allowing graceful systems growth. The resultant false alarm rates caused by this channel sharing of several signalling types is discussed along with the sequential and simulcast transmission effects. The sequential 5-tone system and several generalized digital techniques are considered in this evaluation.

* *

## Design for System Reliability in Personal Radio Signalling

George P. Schleicher
Illinois Bell Telephone Company
Chicago, Illinois

Abstract--
Innovative techniques and attention to frequently ignored factors have been combined in a new personal radio signaling system. Accessed by means of 'touch-tone' (R) service, customer dialing errors are effectively controlled through the use of self-checking numbers, eliminating a common cause of missed or false signals. A multiplicity of radio transmitters are arranged to provide adequate building penetration for the entire service area. Simultaneous transmitter operation and low speed digital receivers work together to make use of multi-path radio propagation. Combining all of the above design features has resulted in a service that is significantly more reliable than that which is provided by systems of earlier design.

SESSION IV

VEHICULAR ELECTRONICS AND EQUIPMENT DESIGN

Chairman: G.H. King
Canadian General Electric Co.
Toronto, Ontario, Canada

## An Ultrashort Pulse Radar System for Pre-Collision Vehicular Sensors

Louis L. Nagy
Electronics Department
General Motors Research Laboratories
Warren, Michigan

John A.M. Lyon
Electrical and Computer Engineering Department
University of Michigan
Ann Arbor, Michigan

Abstract----
An ultrashort pulse radar system was designed, developed and fabricated for an automotive hazard evaluation program. Tests verified that this unique system, which had a pulse duration of approximately one nanosecond, did meet its design goals. Reflectively characteristics of several road surfaces and RF scattering cross sections of selected highway objects were measured. Experiments verified the capability of the system to identify one object from another, even for a multiple object environment. An analytical model was developed that describes the fresnel region scattering characteristics of simple objects.

* *

## A Comparison of Two Efficient Digital Modulation Systems

R. E. DeBuda
Communications Systems and Services Department
Canadian General Electric Company
Toronto, Canada

Abstract----
The 4-phase PSK and the fast FSK are two different digital modulation systems; both perform well when it is required to conserve power as well as bandwidth. This report discusses some of the subtle differences between their signal structures, their spectral occupancy, and between the circuitry which "self-synchronizes", i.e. regenerates carrier phase and clock references at their receivers.

* *

## Selectivity Measurements in the Production and Maintenance of Mobile Communications Receivers

J. Everett McTaggart
The Singer Company
Los Angeles, California

Abstract----
Selectivity specifications, measurement techniques and test equipment for evaluating selectivity in mobile communications receivers are discussed. The trend to greater government regulation of receiver performance, the anticipated growth of the mobile radio market, and the pressures to increase the cost-efficiency of technical personnel will combine to intensify the need for new techniques and equipment capable of more rapid comprehensive evaluation of communication equipment performance. The advent of programmable test equipment and the rapid advancement in microcomputer technology will introduce a new level of sophistication to mobile radio manufacturing test and maintenance procedures.

* *

## Thick Film/Flip Chips - A Systems Approach

Randolph C. Early,
Mobile Radio Products Department
General Electric Company
Lynchburg, Virginia

Abstract----
This paper deals with the thick-film hybrid integrated circuit process currently being used to realize complex circuit functions in hybrid form. The thick-film technology, active device attachment, and packaging all play important roles in the overall systems approach. A description of the various processes will be presented, starting with the ceramic substrate and ending with the completed package. Extensive use is made of computer controlled laser trimming for both static trimming of resistors and functional trimming of modules after assembly. When properly used, the laser is a powerful tool. Active devices are attached using a solder reflow technique. The techniques employed result in thick-film hybrid integrated circuits that are economical, reliable, high in yield, and offer considerable flexibility to the hybrid manufacturer.

# CONFERENCES

1974 VEHICULAR TECHNOLOGY GROUP CONFERENCE

Toronto, Ontario, Canada
January 21-22, 1975

Come see the latest and the best in the field of spectrum management, propagation, system design, and automotive electronics.

Sponsor: IEEE G-VT

* *

THE IEEE INTERNATIONAL SOLID-STATE CIRCUITS CONFERENCE

Philadelphia, Pennsylvania
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The theme of the conference is safety, security, and protection of person and property of the private citizen. Topics of the coverage: EDP security, police systems, automatic vehicle monitoring, contraband detection, alarm systems, personnel identification, security equipment standards, and progress reports of current research and development work.

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29TH ANNUAL FREQUENCY CONTROL SYMPOSIUM

Atlantic City, New Jersey
May 28-30, 1975

Topics: Fundamental Properties of Natural and Synthetic quartz, Theory and Design of Piezo electric Resonators, Resonator Processing Techniques, Filters Quartz Crystal Oscillators and Frequency Control Circuitry, Atomic and Molecular Frequency Standards, Laser Frequency Standards, Frequency and Time Coordination and Distribution, Radio and Systems Applications of Frequency Control Devices, Specifications and Measurements.

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INTERNATIONAL CONFERENCE ON COMMUNICATIONS (ICC'75)

San Francisco, California
June 16-19, 1975
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# INTERMOD... WHERE?

## BY: A.K. "KENNY" GUTHRIE

We gave you a review of the how and why of intermodulation interference in the August issue. In the November issue, we went into spurious outputs and spurious responses, and put in a plug for the pocket electronic calculator people. We showed how a calculator can be used to predict what may happen, and to explain what has already come to pass. In this article, we continue along the calculation kick, but revert to intermod. This time, we take the emphasis off "what?" and put it upon "where?" Here are some practical shortcuts which will allow you to predict where the IM products may fall. They will also help you understand the mechanism behind the products which suddenly appear, disturbing the tranquility of all concerned. Pinpointing the mechanism is a necessary prelude to working out a solution.

The highest level products which fall into the same band as the off-channel signals (and therefore create the most misery) are listed in Figure 1. There are, of course, higher-order products and products which derive from more than three signals. One of them will rise up to bite you, sooner or later. We figure that the ones listed are enough for one sitting. If you can manipulate them, you won't have much trouble with the others.

Intermodulation frequency calculations can go both directions. You may go forward, working from a known concentration of signals, predicting the IM products. You may go backward, starting with a known product and backing in to the mechanism and the unknown contributors. Either way, you can speed matters up by constructing a "Table of Frequency Differences." It is easier to manipulate the intervals (or differences) than to manipulate the frequencies. You'll appreciate this observation more after seeing the commonality between many mechanisms after they are expressed in terms of the frequency differences. See Figure 2.

One must be systematic in playing this game. I assign letters to the frequencies in descending order of frequency. A is the highest frequency, B is the next highest, etc. We follow this convention for the rest of this article (and it can make a difference as we get a little deeper).

In the vertical column A, we show the difference between Frequency A and each other frequency, lower than A, which is under investigation. Under the vertical column B, you'll find the difference between Frequency B and each frequency lower than B. So it goes, for as many frequencies are of concern.

To use the output from the Frequency Difference Table, we must rework the mechanisms shown in Figure 1 in terms of the differences.

The two-signal products are "duck soup." The 3rd-order and 5th-order products from A and B become:

(3rd) A + (A-B), and B - (A-B)

(5th) A + 2(A-B), and B - 2(A-B)

Although it shows in the formulae, it's worth repeating in English. The products from two signals always appear above the higher and below the lower--never in-between.

If your calculator has a memory feature, you are in luck. Put the difference, A-B into memory, and you can really sail through the two-signal products. There is a step-by-step procedure in Figure 3.

We show a total of three frequencies in the table of Figure 2. In Figure 3, we worked out the two-signal products from only one of the pairings, Frequency A and Frequency B. To complete the task, you must redo the calculations in Figure 3, using the pairings A and C, and also B and C. When N is the number of frequencies, you are done with the job when you have figured N(N-1)/2 pairings and have four product frequencies for each pairing.

Going to the 3-signal 3rd-order products (shown as (E)-(G) of Figure 1), we can restate them, also, in terms of frequency differences. For the group A,B,C, these are:

A $\pm$ (B-C) and C $\pm$ (A-B)

It happens that A - (B-C) and C + (A-B) work out to be the same frequency. We can ignore one step. The 3-signal, 3rd-order products are then:

A + (B-C) and C $\pm$ (A-B)

The benefit in using frequency differences may not be apparent now, but it soon will be. We can expand the procedure shown in Figure 3. It will flow past the two-signal products and display the three-signal products also.

At this point, we refer you to Figure 4. We restate the listing of products and expand it to include all of the two-signal pairings from three signals. Each listing is converted into a statement which involves a frequency difference. Each of

the differences, A-B, A-C and B-C, shows up many times.

Figure 5 reduces the entire computation for three signals to a "program" for your pocket calculator, and demonstrates the merit of the memory feature. We've shown a sample computation, using frequencies from Figure 2. If you want to expand the program to more than three frequencies, you need only do more of the same. Be my guest!

This article pretty well handles the forward look in intermodulation frequency calculations--it deals with prediction. In a subsequent article, we'll show how to go directly from a frequency difference table to discovery of the mechanism which produces a known IM product.

THE MOST TROUBLESOME IM PRODUCTS

| | | |
|---|---|---|
| 2-SIGNAL, 3rd-ORDER PRODUCTS, in the form: | 2A - B | (A) |
| | 2B - A | (B) |
| 2-SIGNAL, 5th-ORDER PRODUCTS, in the form: | 3A - 2B | (C) |
| | 3B - 2A | (D) |
| 3-SIGNAL, 3rd-ORDER PRODUCTS, in the form: | A + B - C | (E) |
| | B + C - A | (F) |
| | C + A - B | (G) |
| 3-SIGNAL, 5th-ORDER PRODUCTS, in the form: | A + 2B - 2C | (H) |
| | A + 2C - 2B | (I) |
| | B + 2A - 2C | (J) |
| | B + 2C - 2A | (K) |
| | C + 2A - 2B | (L) |
| | C + 2B - 2A | (M) |

Figure 1

A FREQUENCY DIFFERENCE TABLE

| | A<br>152.45 | B<br>152.33 | C<br>152.27 | D |
|---|---|---|---|---|
| A<br>152.45 | X | | | |
| B<br>152.33 | A-B<br>.12 | X | | |
| C<br>152.27 | A-C<br>.18 | B-C<br>.06 | X | |
| D | A-D | B-D | C-D | X |

Note; Freq A > Freq B > Freq C.....

Figure 2



CALCULATING 3rd- AND 5th-ORDER 2-SIGNAL PRODUCTS

| | | Example from Figure 2 |
|---|---|---|
| 1. | PUT THE DIFFERENCE (A-B) INTO MEMORY | .12 |
| 2. | ENTER FREQUENCY A (THE HIGHER FREQ) | 152.45 |
| 3. | ADD (A-B) FROM MEMORY AND READ THE UPPER 3rd-ORDER PRODUCT | 152.57 |
| 4. | ADD (A-B) AGAIN FROM MEMORY AND READ THE UPPER 5th-ORDER PRODUCT | 152.69 |
| 5. | ENTER FREQUENCY B (THE LOWER FREQ) | 152.33 |
| 6. | SUBTRACT (A-B) FROM MEMORY AND READ THE LOWER 3rd-ORDER PRODUCT | 152.21 |
| 7. | SUBTRACT (A-B) FROM MEMORY AGAIN AND READ THE LOWER 5th-ORDER PRODUCT | 152.09 |

Figure 3

THE MOST TROUBLESOME IM PRODUCTS

(in terms of frequency difference)

2-SIGNAL PRODUCTS

| Third Order | Fifth Order |
|---|---|
| 2A - B = A + (A-B) | 3A - 2B = A + 2(A-B) |
| 2B - A = B - (A-B) | 3B - 2A = B - 2(A-B) |
| 2A - C = A + (A-C) | 3A - 2C = A + 2(A-C) |
| 2C - A = C - (A-C) | 3C - 2A = C - 2(A-C) |
| 2B - C = B + (B-C) | 3B - 2C = B + 2(B-C) |
| 2C - B = C - (B-C) | 3C - 2B = C - 2(B-C) |

3-SIGNAL PRODUCTS

| | |
|---|---|
| A + B - C = A + (B-C) | A + 2B - 2C = A + 2(B-C) |
| | A + 2C - 2B = A - 2(B-C) |
| | B + 2A - 2C = B + 2(A-C) |
| | B + 2C - 2A = B - 2(A-C) |
| A + C - B = C + (A-B) | C + 2A - 2B = C + 2(A-B) |
| B + C - A = C - (A-B) | C + 2B - 2A = C - 2(A-B) |

Figure 4

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POCKET CALCULATOR "PROGRAM" FOR IM PRODUCT FREQUENCIES

3-SIGNALS

Enter A-B (.12) Into Memory

| | | | |
|---|---|---|---|
| A (152.45) | + | (A-B) = 2A-B | (152.57) |
| | + | (A-B) = 3A-2B | (152.69) |
| B (152.33) | − | (A-B) = 2B-A | (152.21) |
| | − | (A-B) = 3B-2A | (152.09) |
| C (152.27) | + | (A-B) = A+C-B | (152.39) |
| | + | (A-B) = C+2A-2B | (152.51) |
| C (152.27) | − | (A-B) = C+B-A | (152.15) |
| | − | (A-B) = C+2B-2A | (152.03) |

Enter A-C (.18) Into Memory

| | | | |
|---|---|---|---|
| A (152.45) | + | (A-C) = 2A-C | (152.63) |
| | + | (A-C) = 3A-2C | (152.81) |
| C (152.27) | − | (A-C) = 2C-A | (152.09) |
| | − | (A-C) = 3C-2A | (151.91) |
| B (152.33) | − | (A-C) = B+C-A* | |
| | − | (A-C) = B+2C-2A | (151.97) |
| B (152.33) | + | (A-C) = B+A-C | (152.51) |
| | + | (A-C) = B+2A-2C | (152.69) |

Enter B-C (.06) Into Memory

| | | | |
|---|---|---|---|
| B (152.33) | + | (B-C) = 2B-C | (152.39) |
| | + | (B-C) = 3B-2C | (152.45) |
| C (152.27) | − | (B-C) = 2C-B | (152.21) |
| | − | (B-C) = 3C-2B | (152.15) |
| A (152.45) | + | (B-C) = A+B-C* | |
| | + | (B-C) = A+2B-2C | (152.51) |
| A (152.45) | − | (B-C) = A+C-B* | |
| | − | (B-C) = A+2C-2B | (152.33) |

* DUPLICATION OF PREVIOUS CALCULATION

FIGURE 5