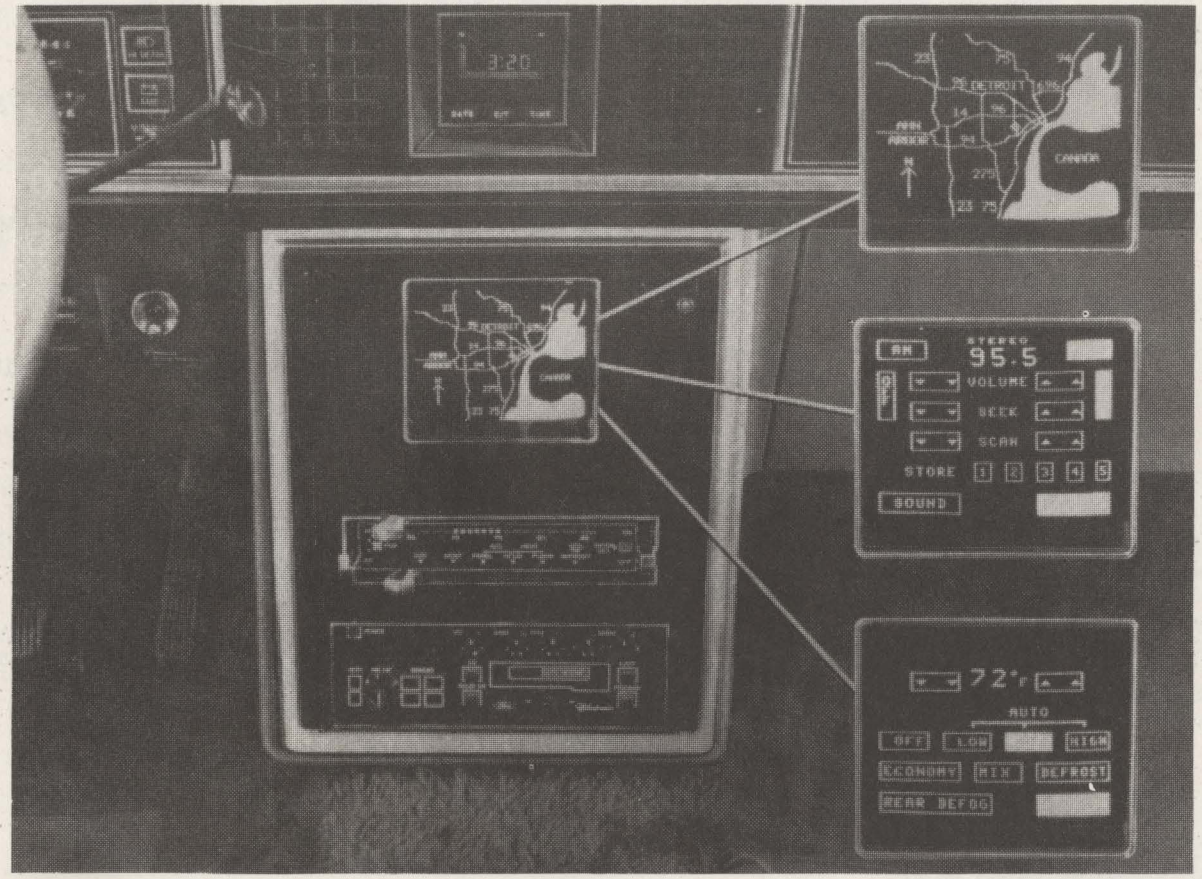
IEEE

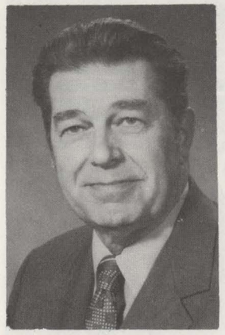
VEHICULAR TECHNOLOGY SOCIETY NEWSLETTER

Vol. 29, No. 4, November 1982 (ISSN 0161-7887) Editor: A. Kent Johnson



Ford Multifunction Information Center

See Automotive Electronics on page 16



President's Message

Stuart F. Meyer
President
IEEE Vehicular Technology Society

IEEE - VTS President's Message

As this issue reaches you, I will have just about completed my two years as president of the Vehicular Technology Society. I have enjoyed this assignment and look forward to a continuing role in VTS as I assume the traditional duties of the Immediate Past President.

As you know, we have been behind in our election of members to the board, however this upcoming election will put us back on schedule. Because of this, the present board at its recent meeting during Convergence 82 in Detroit, voted ot hold the next election of officers at the 1983 Annual Conference in Toronto.

Convergence 82 was another excellent activity which I thoroughly enjoyed attending. Holding a board meeting in conjunction with this event gave us an excellent opportunity to meet with the VTS members who are automotive electronic and ground transportation oriented. Elsewhere in this newsletter you will read about the "Avante Garde" awards which were made in these disciplines at the luncheon.

In this issue of the newsletter you will find additional information on our 1983 Annual Conference and I look forward to meeting many of you at this great event next spring. Vino and his committee have been hard at work and I am impressed with their enthusiasm and gung ho spirit. Toronto in 1983 is sure to be another winner.

We are always looking for suggestions from the members of VTS relating to all aspects of our activities. Please do not hesitate to drop me a line (or write to one of the related committee members) so that we can give your ideas and suggestions consideration at the executive committee and board meetings.

Oh behalf of the officers, directors and committee chairman of the Vehicular Technology Society, I express our warmest and most sincere wishes for a happy and healthy holiday season.

Stuart Meyer
President, IEEE - VTS

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Month of Issue	Final Copy To be Rec'd By IEEE Editor*	Target Mailing Date
February	12-14-82	1-18-82
May	3-09-83	4-13-83
August	6-09-83	7-13-83
November	9-15-83	10-20-83

*Inputs for newsletter staff editors should be received by newsletter editor at least one week before these dates.

Editor's Notes

A. Kent Johnson
Newsletter Editor

You will note that in this issue of the newsletter we have repeated the call for papers for the 1983 VTS Conference in Toronto. Though the original deadline has come and gone the Toronto committee is anxious to have a few more papers and so have extended the deadline. We encourage you to contact them immediately if you are interested in presenting a paper in Toronto.

PRESS RELEASE

IEEE Vehicular Technology Society
Announces Committee to
Develop Propagation Models for
800 - 900 MHz Land Mobile Radio

The Board of Directors of Vehicular Technology Society of the Institute of Electrical and Electronic Engineers, Inc. at its October 6, 1982 meeting in Dearborn, MI. approved the formation of an Ad Hoc Committee to develop radio propagation model(s) for land mobile radio services operating in the 806 - 947 MHz radio spectrum. Propagation models(s) are expected to provide the U.S. Industry and Governments with statistical methods of predicting reliable service areas and co-channel interference.

The society asks that experts in radio propagation who are interested in participating in the Ad Hoc Committee contact

Continued on page 22.

IEEE Vehicular Technology Society Newsletter is published by the Vehicular Technology Society of the Institute of Electrical and Electronics Engineers, Inc. Headquarters: 345 East 47th Street, New York, NY 10017. Sent automatically and without additional cost to each member of the Vehicular Technology Society. Printed in U.S.A. Second-class postage paid at New York, NY and at additional mailing offices.

Board of Directors Report

Samuel A. Leslie

VTS Secretary

The IEEE VTS Board of Directors met on October 6, 1982 at the Hyatt Regency in Dearborn. The meeting was held on the last day of the Convergence '82 Conference.

The Board meeting was called to order at 9:00 AM.

ROLL CALL

The following were in attendance:

*Stuart Meyer	President
*Robert Fenton	Treasurer
*James J. Mikulski	Awards Committee
*Alvin Goldstein	National Conference Coordinator
*Fred Link	Chairman, National Site Selection Committee
*Samuel R. McConoughey	Vice President
Jack Neubauer	Chairman, Awards & Standards Committees
*Kent Johnson	Newsletter Editor
*Samuel A. Leslie	Secretary
Vino Vinodrai	'83 Conference Chairman
*Robert A. Mazzola	Membership Committee Chairman

(* denotes elected Board member)

Nine of the eleven present were elected Board members. Thus, a quorum was present for voting on matters before the Board.

MINUTES OF LAST MEETING

Bob Fenton moved, Fred Link seconded that the minutes of the May 26 meeting be approved as published.

COMMITTEE REPORTS

Financial Report:

Stu Meyer stated that a surplus of $2150 was available from the March 81 Washington Conference, and that an estimated surplus of $2000 would be available as a result of the May 82 Conference in San Diego. Two action items were identified; Meyer is to write Art Goldsmith requesting that he close out the books on the '81 conference and Eddie Simon is to get the San Diego Finance Chairman to close out the '82 conference books.

Bob Fenton reported that the financial outlook for VTS was bleak for next year. A small loss of from $2000 to $4000 was expected this year, and from $4000 to $10,000 was projected for next year.

Much discussion followed, with several methods being explored to reduce the anticipated deficit. Among several other items, it was pointed out that a considerable budget expense has been the providing of travel expense funds to those members who did not have travel funds available from other sources.

Fenton then moved, Mikulski seconded, that the Society President limit the amount of discretionary funds for travel expenses until such time that the Society's finances are on more sound footing, and to limit such expenditures to only air fare via the cheapest available route for those Board members whose presence is required at the meeting and who do not have funds available from other sources.

Meyer stated that he would write the VTS members currently on the Speaker of the Year list to advise them of the Society's current budget problems, to request that they obtain travel funds from other sources whenever possible, and to obtain prior approval from the Society President for any additional funds before accepting a speaking engagement.

Awards Committee Report:

Jack Neubauer reported that IEEE limits the amount of funds that a Society can expend on awards to 3 percent of the Society's annual budget. Next year's budget for awards was targeted at $5000; the 3% figure will limit the value for awards to $3000. Fenton was then instructed by Meyer to readjust next years budget to reflect the new upper limit of $3000.

A motion was then made by Sam McConoughey that the Awards Committee be redirected to eliminate the concept of cash awards beginning in 1983, with the exception of the papers of the year award program. Further, the amount of cash awards for papers during a fiscal year is not to exceed $1000. Also, the awards committee is to proceed with the awards pyramid concept, with a one-time budget not to exceed $1500 for the start up of such an award program. Jim Mikulski seconded this motion, and approval was unanimous by the Board.

Several action items were then identified, as follows:

The awards committee is to meet before year end to finalize the new pyramid awards program for approval by the Board at the next Board meeting (at the Toronto Conference). The meeting is to include a representative from IEEE headquarters knowledgeable in awards program matters. Also, Neubauer is to send a handwritten draft of the proposed awards program to Meyer, who will then have it typed and mailed to the Board members for review before the Toronto meeting. The target date for the awards committee meeting is during the second week in December.

Following a suggestion from Fred Link, the awards committee is to also explore the possibility of the Radio Club of America sponsoring a portion of the VTS awards program.

Kent Johnson is to publicize the awards nomination form in each issue of the Newsletter.

Newbauer is to investigate the use of the standard IEEE medallion in leu of the special VTS medallion previously proposed, and Mikulski is to explore methods of providing VTS-specific insignia as a part of the medallion. The medallion as previously proposed would have had to be significantly changed since it had an appearance similar to the IEEE medallion, and therefore would have violated the Institute's trademark rules. Furthermore, the Board felt that the $2500 expense required to strike a mold for a new medal could not be afforded at this time.

Dan Noble Award:

Al Goldstein recommended that the Dan Noble award committee deliver the $5000 scholarship in two increments, with the first being upon the recipient's registration for the fall semester of his Master's program, and the second upon successful completion of that semester.

Al Goldstein also provided a motion that the scholarship program be limited to qualified Universities located in IEEE regions I through VII, and that the recipients of the award be limited to U.S. or Canadian nationals or those individuals intending to become U.S. or Canadian nationals. The motion was seconded by Bob Fenton, and approval was unanimous.

Kent Johnson is to publicize the availability of the Noble Scholarship in the Newsletter.

Publications Committee Report:

McClure reported via telephone prior to the Board meeting that progress is being made on the publication of VTS's Land Mobile Communication Engineering book, and that IEEE headquarters has agreed to rectify the mistakes made in the publication of the cumulative index. He further reported that he has not been successful in appointing associate transactions editors for the automotive electronics and transportation systems positions. The automotive electronics position remains vacant while Bob Fenton continues in an acting capacity as the transportation systems editor.

OLD BUSINESS

Several items of an old business nature were covered at the meeting, as follows:

Status of Board Election for the 1983-1985 Term:

Madden also reported via telephone prior to the Board meeting on his progress with the slate of candidates for the next term. He has sent out forms for biographies to eight potential candidates, and asked for Board guidance on two additional candidates. His goal is to have ten candidates, from which the VTS membership is to select five to serve on the Board for a three year term. The candidates have been tentatively identified (as of the newsletter deadline date) as:

Vincent Esposito	George F. McClure
Robert E. Fenton	Stuart F. Meyer
Leo A. Himmel, Sr.	James J. Mikulski
Robert Kirk	William B. Morton
Charles Lynk	Carlos Roberts

Madden's current schedule is to mail the completed biographies from the candidates to IEEE headquarters the third week in October. He reported that results from the election should be known six to eight weeks after he mails in the information.

1983 Toronto Conference Committee Report:

Vino Vinodrai reported that 40 papers have been received and 10 booths have been booked to date. Their targets are to have 70 papers from which to make their selections and to have 20 booths signed up for exhibitor displays. The conference will be held at the Prince Hotel in Toronto May 25-27, 1983.

1984 Pittsburgh Conference Report:

The date for this conference has been tentatively selected, and is May 20-23, 1984. No hotel has been selected yet; problems regarding the organization of the conference committee have been reported. Meyer reported that this problem is being attacked.

Discussions regarding a previous motion made by the Board last year to change the format for commercial exhibits from the formal exhibit activity to a sustaining member format. Commercial exhibits would still be allowable, but the exhibitors would be responsible for setting up their exhibits, perhaps in a suite rented from the hotel. Goldstein is to meet with Tom Selis, the 1984 Conference Chairman, to explore the feasibility of eliminating the exhibit area and allowing the manufactures to exhibit via suites and to advertise in the Conference Program.

VTS Support of Washington Miniconference:

Meyer is to explore the feasibility of supporting next year's Land Mobile Expo East (the successor to the miniconference) with a technical session.

1985 Conference Location Status:

Fred Link reported that the candidate cities for the 1985 conference currently are: Denver, Houston, Dallas, Atlanta, D.C., Chicago, and the New York area. Meyer assigned Goldstein the task of determining the feasibility of Dallas or Chicago as a potential site, while Fred Link is to continue exploring the possibility of holding the conference in either the New York area or Denver.

NEW BUSINESS

The Board covered the following new business items at this meeting:

800 MHz Propagation Model:

Sam McConoughey presented a memorandum to the Board containing a resolution that an Ad Hoc Committee be formed to provide industry and the U.S. Government an industry-accepted model for predicting reliable service areas and minimum separations required for frequency reuse. McConoughey moved, Fenton seconded that the resolution be accepted, with the provision that no financial commitments be made at this time for travel assistance to attend such meetings. The motion carried with the Board being unanimous in favor.

Election of VTS Officers for 1983:

Jim Mikulski moved, Kent Johnson seconded that the election of officers be delayed until the first Board meeting of next year. The motion carried with the Board being unanimous in favor. The current slate of officers will continue in their present positions until the election.

Next Board Meeting:

The next Board meeting will be held Tuesday afternoon before the start of the Toronto conference (May 24, 1983).

Adjournment

The meeting was adjourned at 4:00 PM.

Respectfully submitted,

Samuel A. Leslie

Samuel A. Leslie
VTS Secretary

Society Officers and Board of Directors

SOCIETY OFFICERS

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BOARD OF DIRECTORS

NAME	RESPONSIBILITY	TERM
Robert E. Fenton	Treasurer	Jan80-Dec82
Arthur Goldsmith		Jan82-Dec84
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 Meetings Committee	Jan82-Dec83
Charles Lynk	Chairman, Paper of Year Comm.	Jan80-Dec82
Roger Madden	Junior Past President	Jan82-Dec84
George F. McClure	Chairman of Publications Comm. and Transactions Editor	Jan80-Dec82
Samuel R. McConoughey	Chairman, Chapter Activities	Jan82-Dec83
Stuart Meyer	President	Jan80-Dec82
James J. Mikulski	VTS Rep. IEEE Comm. on Social Implications of Technology	Jan80-Dec82
George J. Mitchell		Jan82-Dec84
Ronald G. Rule	Education Committee	Jan82-Dec84
Robert A. Mazzola	Chairman, Membership Committee	Jan82-Dec84

Chapter News

Gaspar Messina
Chapter News Editor

Meetings

Chicago

"Future Ground Transportation Systems"
by Dr. Robert Fenton, Ohio State University; Treasurer, VTS; VTS Speaker's Bureau
Held on September 20, 1982 with 12 attending, including 1 guest.

Commentary

As the new VTS Editor and Chapter Activities Chairman, I hope the 1982-1983 VTS calender year will see a flurry of Meeting Reports and Election Results sent into the Chapter Activities Chairman.

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

1982 IEEE Vehicular Technology Society

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WASHINGTON, D.C.	Dan Davies Motorola, Inc. 4710 Auth Place Suitland, MD 20746 (301) 849-3950

VTS Avant Garde Awards as of October, 1982

Nick Alimpich — 9/80
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Lee M. Augustus — 9/80
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A. B. Buchanan — 9/81
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R. L. Casselberry — 9/80
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Oak Park, Illinois 60302

C. Lester Hogan — 10/82

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33rd Vehicular Technology Conference

An Invitation to Authors

THE PRINCE HOTEL, TORONTO, CANADA
25-27 MAY 1983

Our 1983 **THEME** is:
"CREATIVE RESOURCES MANAGEMENT
new directions in Vehicular Technology"

AUTHORS are invited to submit 500 word abstracts immediately to:

Norman Haslett
Manager, Telecom & Electronics
Metro Toronto Police
2050 Jane Street
Weston, Ontario M9N 2V3
Canada Tel: (416) 967-2411

Since our emphasis in 1983 is on "....new directions...." papers that explain the new technologies and their applications will be especially welcome.

MOBILE COMMUNICATIONS... including trunked and cellular systems; single sideband; mobile satellite; packet radio; spread spectrum; spectrum management

AUTOMOTIVE ELECTRONICS... engine and vehicle control systems; collision avoidance and safety systems; new directions in instrumentation; electromagnetic compatibility

TRANSPORTATION... downtown people movers; automatic vehicle monitoring; automated vehicles; computer aided dispatch; rapid transit control technology; economics of transportation

HIGHWAY ELECTRONICS... traffic monitoring and control; automated highways; traffic surveillance systems; driver information systems

IEEE VEHICULAR TECHNOLOGY SOCIETY

Professionally Obsolete?

Profession - an occupation requiring extensive and continuing education in a branch of science.

Obsolete - Out-of-date, no longer useful, discarded.

If you are a professional in the electrical engineering, electronics, computer engineering, computer science and the allied branches of engineering and related arts and sciences -- you must be concerned about obsolescence.

Our profession is one of the most rapidly changing imaginable. If you have been out of school five years and studied nothing since -- you already are approaching obsolescence, ten years and you are totally obsolete.

How can you stay in touch with the rapid changes in technology? Join the Institute of Electrical and Electronics Engineers, Inc. (IEEE) and the Group(s) or Societ(ies) related to your specific interests, at a cost less than your daily newspaper.

Applications

1. Applications for admission to the IEEE or for transfer to a higher grade shall be made on a form provided by IEEE and shall embody a record of the general technical education of the applicant and his/her technical career. The applicant shall provide the names of references as specified below. References for admission or transfer to Member or Senior Member grade shall be requested to fill out a prescribed confidential form commenting on the qualifications of the applicant.

2. Applicants for membership shall furnish names of references as follows:
   For Member - One IEEE member holding Fellow, Senior Member or Member grade for an applicant who automatically meets the educational requirements for Member grade as specified below.
   - Three Fellows, Senior Members or Members for any applicant who does not automatically meet the educational requirements specified below, and whose application for membership must be considered by the Admission and Advancement Committee.
   For Associate - One IEEE member in any of the following grades: Member, Senior Member, Fellow, Honorary.
   For Student - The Counselor at the applicant's institution, if such Counselor exists; otherwise, a member of the faculty of the applicant's institution, who must be an IEEE member.

Should an applicant for admission or transfer certify that he/she is not personally known to the above specified number of IEEE members who are sufficiently familiar with the applicant's experience to justify him/her in using their names as references, the Admission and Advancement Committee may, in its discretion accept other references who are familiar with the applicant's professional work, preferably engineers or scientists of standing.

Qualifications

Membership qualifications pertain to designated fields of interest to IEEE, including electrical engineering, electronics, computer engineering and computer sciences, and the allied branches of engineering and related arts and sciences.

Member grade is a professional grade limited to those who have demonstrated professional competence in IEEE designated fields. For admission or transfer to the grade of Member, a candidate shall be either:

(a) An individual engaged in IEEE designated fields (1) who shall have graduated from a course of study of at least four academic years duration, in those fields, in a "school of recognized standing" or its equivalent, or (2) who shall have had at least three years of experience, in a position normally requiring the qualifications listed under (1), which may be accepted in lieu of the educational requirements at the discretion of the Admission and Advancement Committee.
(b) A teacher of a subject in an IEEE designated field who shall have graduated from a course of study of at least four academic years duration, or its equivalent, in those fields, in a "school of recognized standing," or who has had at least three years of professional teaching experience and shall have participated in planning and conducting courses.
(c) A person regularly employed in IEEE designated fields for at least six years who, by experience, has demonstrated competence in work of a professional character.
(d) An executive who, for at least six years, has had under his/her direction important technical, engineering or research work in IEEE designated fields.

Associate: For admission or transfer to the Associate grade, an applicant must have graduated from a course of study of at least two academic years duration or its equivalent in IEEE designated fields in a "school of recognized standing" or the applicant must satisfy the IEEE that he/she is interested in and capable of rendering service to IEEE designated fields and that his/her admission to this grade will contribute to the welfare of the IEEE.

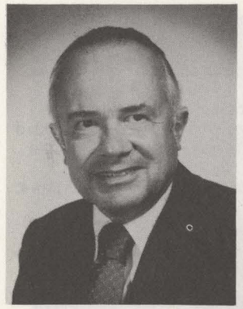
Student:

(a) A Student member must carry at least 50 percent of a normal full-time academic program as a registered undergraduate or graduate student in a regular course of study in IEEE designated fields.
(b) Student members, upon graduation with at least a bachelor's degree or its equivalent from a "school of recognized standing," shall be transferred to Member grade.
(c) Student members other than those qualifying under subparagraph (b), upon graduation with at least a two-year degree, shall be transferred to Associate grade.

Note: The above has been extracted from the IEEE Bylaws.

So join now, receive "Spectrum" the readable monthly magazine covering all IEEE fields. Join the Vehicular Technology Society (VT-06) as well and stay up-to-date in Land Mobile, Land Transportation, and Automotive Electronics and receive the Newsletter and the VTS Transactions.

For a membership application, write: IEEE Service Center, Membership Development, 445 Hoes Lane, Piscataway, NJ 08854 or call (201) 981-0060.



Professional Activities

Frank E. Lord
Professional Activities Editor

In my last column I commented on the eleven goals of the United States Activites Board (USAB) for this year. Readers could observe from these goals that the activities of USAB are many and varied. This view is reinforced when we note that there are more than 250 USAB leaders and task force members working on the many matters of concern to our profession.

In addition to these, we have close to 300 active PACE (Professional Activities Committees for Engineers) members working within the entities of the geographic and technical structure of the Institute. This might be a good time to mention that many PACEs have several members in addition to the Chairman.

In VTS, at the moment, I am a one-man committee and would be more than pleased to hear from members who would like to work in this area.

To provide some further insight into the kinds of matters that USAB is involved with I am reproducing below the report of the July 14 and 15 USAB meeting as written by staffer Bob Walleigh, who indicates that the following actions were taken:

- Approved, for submission to the IEEE Executive Committee and the Board of Directors, a proposed 1983 budget for USAB.
- Selected recipients for USAB Awards and Recognition. (Executive Session)
- Selected by ballot vote, the 1982 USAB Nominations and Appointments Committee. (Executive Session)
- Approved a motion that USAB collect information from a representative sample of United States members through an opinion survey, or in connection with a salary survey, or through some other means, on the attitude of IEEE members toward establishing a Political Action Committee. This action is being submitted for approval to the IEEE Executive Committee and Board of Directors pursuant to the action proposed by USAB at its May 20 meeting which recommended to the Board of Directors that they seek such information through a vote of members of Regions 1 through 6.

  In connection with the foregoing motion, a related motion was passed to encourage the IEEE Board of Directors to clearly set out what process it will use to come to a conclusion on whether to establish a Political Action Committee for IEEE.
- Approved a position paper of Freedom of Technology Transfer to be submitted to the IEEE Executive Committee with a recommendation that it be adopted as an IEEE Position Paper.
- Approved a position statement on Engineering Manpower in the United States as a USAB Position Paper.
- Referred to the USAB Technology Activities Council for review, approval and resubmission to USAB, a proposed Charter for the Technology Policy Committee.
- Discussed AAES - IEEE Board of Directors - USAB interrelationships, problems and suggestions for making AAES more effective. Requested USAB Ad Hoc Review Committee of AAES to report recommendations to USAB at the November meeting.
- Continued a discussion, begun at the meeting in May, concerning a USAB Communications and Publications Plan.
- Discussed and suggested revisions to a draft USAB Position Paper on Technology Transfer in the United States and agreed to consider adoption at the next USAB meeting.
- Discussed a problem posed by the Pittsburgh Section of the impact on our members of the lack of funds at present in the Export Import Bank (Ex Im) on sales of U.S. technology to other countries, and referred this matter to USAB OpCom for further action.
- Discussed two projects being sponsored by the Japanese through MITI to develop advanced computers and gave consideration to a question as to whether IEEE should encourage the U.S. Government to support a parallel development in this country to one of the developments, a super computer geared to the 1990's. The matter will be referred to an appropriate task force for further consideration.
- Received a report on actions to resolve the differences between the IEEE and the AAES proposed Codes of Ethics.
- Received a report on alien engineer and manpower issues.
- Received a report on progress to develop a Charter for the Committee and the Environment.

- Received reports from the Vice President, Professsional Activities, the USAB Council Chairmen, the PACE Chairman, the USAB Controller, the USAB Staff Director, and the USAB/EAB Liaison.

- Noted that a question has been raised and is being considered as to whether the Technology Transfer Committee should continue as a Ad Hoc Committee, or be made permanent.

The report above barely touches on the activities of over thirty task forces that work on matters ranging from U.S. Technological Policy to Service Contracts and from Surveys to Congressional Fellows. From time to time we may focus upon important developments emerging from some of these task forces.

Daniel E. Noble Fellowship Available

A Graduate Fellowship in Electrical Engineering, carrying a stipend of $5,000, has been established as a memorial to Daniel E. Noble, in recognition of his valuable contributions to the development of two-way vehicular communications and solid state technology. The stipend is provided annually by income from an endowment fund, established jointly by the IEEE Vehicular Technology Society and Motorola Inc. Dr. Dan Noble, and executive of Motorola from 1940, was former Vice Chairman and Director Emeritus of Motorola, Inc., and was Motorola's Science Advisory Board Chairman at the time of his death. He was Director of the Institute of Radio Engineers from 1957 to 1962, and Director of the Institute of Electrical and Electronics Engineers during 1963 and 1964.

The fellowships are for one year of full-time graduate studies in Electrical Engineering or Physical Science at an engineering school of recognized standing, located in the United States and Canada. Recipients of this award are selected by a committee on the basis of the candidate's potential to contribute to the profession of Electrical Engineering, specifically in the following areas.

The Vehicular Technology Society embraces the interests of three major fields of engineering science, research and development. The society's primary goal is to promote mutual interaction among engineers working in mobile radio communications, automotive elctronics and ground transportation.

Radio communications includes the use of mobile radio on land, sea and in the air. The design, manufacture and application of two-way and one-way radio communications equipment, includes the recognition of the natural and engineering sciences which effect electromagnetic propagation and the systems planning necessary to accomplish effective radio communication.

Automotive electronics is a rapidly expanding technology which applies the design and development of electrical and electronic devices to the increasing need of safety and convenience features in automotive vehicles. The applicable technologies include such pervasive examples as on-board microprocessors for fuel and performance management as well as collision avoidance systems and dynamic braking systems.

Ground transportation systems recognize the requirement, in today's mobile society, for sophisticated means of better management and operation of public transportation systems. The technologies utilized include specialized design and development of communications and automotive electronics that provide traffic aid and control systems, automated vehicle location and monitoring systems and automated transport systems.

To be eligible, the student must have received a Bachelor's Degree from an Engineering University or College of recognized standing. Preference will be given to applicants about to begin their first year of graduate studies.

Recipients of this Fellowship may not hold or receive other Fellowships for the same academic year. The Fellowship may be supplemented with grants to cover tuition, fees and other expenses, and assistantships, which are directly related to the graduate studies. Thus, recipients must pursue full-time graduate studies in Electrical Engineering or Physical Sciences, and evidence of satisfactory academic performance is required.

For further information please contact:

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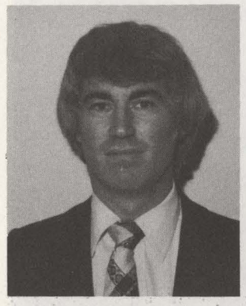


Communications

Tom Rubinstein
Communications Editor

RADIOWAVE PROPAGATION BIBLIOGRAPHY

We recently expanded the bibliography published in last February's Newsletter. Thanks to Granam Jones of Motorola in Dallas for a source of several additional entries. Anybody who wants a copy of the updated bibliograpny is asked to send me an 8 3/4" x 11 1/2" (222mm x 292mm) self-addressed, stamped envelope with sufficient U.S. postage for tnree ounces. Tnis comes to 54¢ domestic or $2.40 overseas airmail.

FIELD SURVEY METHODS

INTRODUCTION

Most of us nave done RF propagation field surveys at one time or another. Field surveys are useful as a tool in system design, as a tool in troublesnooting, and for verifying old or postulating new propagation calculation algoritnms. Several field survey methods nave been proposed and/or utilized in the field. These include tne following general types:

I. Limiter meter reading

II. Limiter reading on strip cnart recorder

III. Attenuator plus limiter meter

IV. Automated techniques

Each of tnese nas its advantages and drawbacks; nowever, tne following concerns are common to all measurement techniques:

a. Calibration can change with temperature. This possibility should be considered in selecting a test receiver.

b. Calibration can change with input voltage. If tnis property is observed, it can be corrected by connecting a well regulated DC-DC converter between the vehicle power source and the receiver.

c. Communications receivers are not designed to be used as signal strengtn measurement instruments. Therefore, tneir limiters may nave very narrow dynamic range. Tnis makes measurement difficult. We have observed tnat lower cost communications receivers seem to nave limiters with wider dynamic range than the "high end" radios. Another approach is to use a receiver designed for use in antenna pattern measurements. These receivers generally nave an analog output proportional to signal strengtn and have a wide dynamic range.

I. LIMITER METER READING METHOD

Tnis is the simplest of all methods of field surveying. It merely involves connecting a meter to measure tne receiver's limiter voltage. See figure 1. Since limiter voltage is directly proportional to tne input signal level, it is indicative of tne signal level. A calibration chart relating tne input signal level to its corresponding limiter reading can be readily prepared.

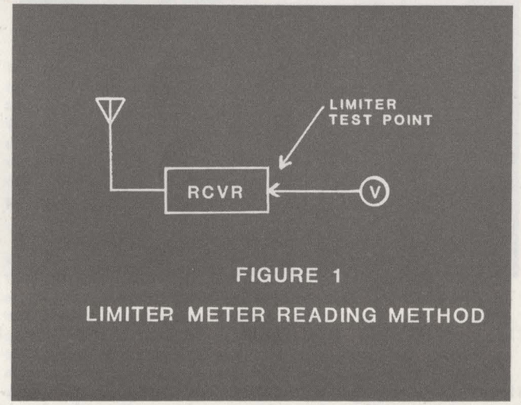


FIGURE 1
LIMITER METER READING METHOD

Potential problem areas include the following:

As this is a manual system, a route and checkpoints must be initially laid-out and numbered. Data sheets must be made for manually recording and reducing data. A moderate amount of effort is required for reducing data. The limiter meter reading method also requires the operator to "eyeball average" tne meter reading before recording tnem. Thus, it is only applicable wnere gross indications of signal strength are acceptable. For example, it would be acceptable in situations where the measurements are being used as a troublesnooting tool.

II. LIMITER READING ON STRIP CHART RECORDER

This method is very similar to the limiter meter reading method. The only difference is the use of a strip chart recorder to make a permanent record of the reading. It has most of the limitations and applications as the limiter meter reading method. The significant differences are summarized below:

a. A permanent record is kept, permitting the user to evaluate the statistics of the signals much more accurately. Data reduction is, however, extremely tedious because the strip chart readings are output in volts (rather than dBm), thus requiring frequent interpolation with the calibration data.

b. Because of this ability to determine signal strength information with greater accuracy, this method may be utilized in almost any application, except for those requiring dynamic range beyond that available with the receiver in use.

c. Checkpoint numbers may be recorded on the strip chart, making it, in effect, the "raw data sheet".

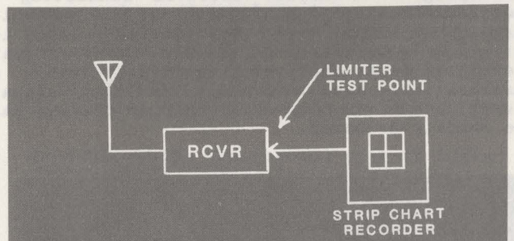


FIGURE 2

LIMITER READING
ON STRIP CHART RECORDER

III. EXTENDING THE DYNAMIC RANGE OF METHODS I AND II

Since many communications receivers have limiters which saturate after only a few decibels of dynamic range, a method of extending the dynamic range is essential for using those receivers in signal strength measurement programs. Fortunately, such a method is very straightforward.

It is only necessary to place a step attenuator between the antenna and the receiver antenna input. See figure 3. In the case of a strip chart recording, the attenuator can be adjusted to keep the reading "on scale" and the inserted attenuation can be manually written on the strip chart recording along with the check point number. This facilitates later data reduction.

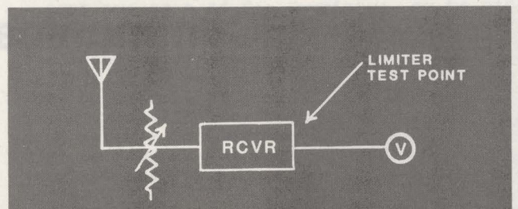


FIGURE 3

EXTENDED DYNAMIC RANGE

In the case of meter reading, two options are possible. The user can use the attenuator only when the receiver limiter is in saturation. In this case, he records the following data for each check point:

Check point number
Meter reading
Attenuator reading

Data reduction is accomplisned by determining the signal strength reaching the receiver by referring to the calibration data, then adjusting this value by the amount of attenuation inserted.

An alternate approach is to select a low signal value as a precalibrated reference, then adjust the attenuator to bring the meter reading to the precaliorated value. This approach simplifies both data recording and data reduction.

IV. AUTOMATED TECHNIQUES

Automating signal strength measurements can overcome several disadvantages of manual signal strength measurements, including the following:

- Inaccuracy due to "eyeball averaging"
- Tedium and labor cost of data reduction

In addition, automation features can be added to provide the following additional benefits:

- Reading can be taken at specific intervals
- Data reduction can be done as part of the program
- Data is output in a form suitable for further processing
- If location information is initially incorporated, all the information is available to directly draw a coverage map. In addition, checkpoint numbers need not be entered.

A typical automated test setup is shown in figure 4. The boxes in dotted lines are not essential to operation, but add capability to the system. Reference 1 is an excellent discussion of one such automated system.

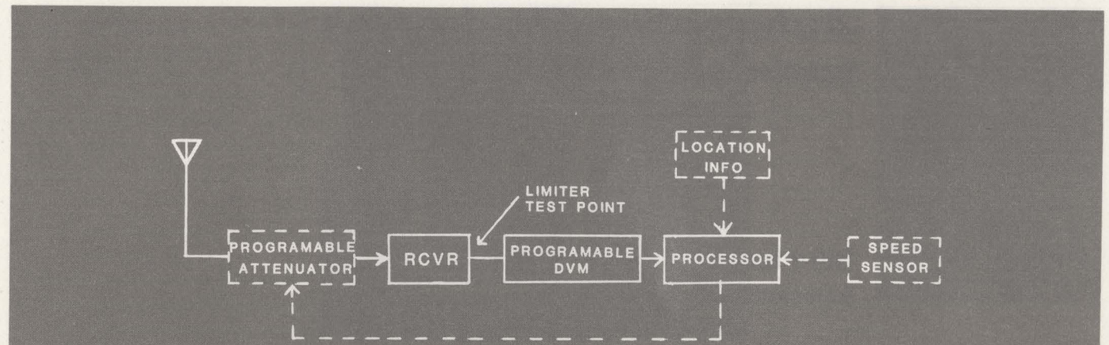


FIGURE 4

AUTOMATED TEST SETUP

CONCLUSION

The foregoing was not intended to be a comprehensive list of propagation measurement methods, but rather a comparison of the major features of the more popular methods. Other methods may come to mind and are no less valid than those listed. It is our hope that this article has provided "food for thought" for engineers considering signal strength measurement schemes.

1. O'Kelly, P.D., I.S. Scales, and J.K. Sin, "Low Cost Processor - Controlled RF Field Strength Measurement System for 850 MHz Coverage Evaluation", 32nd IEEE Vehicular Technology Conference Record: pp. 111-115, 1982.

Book Review

George F. McClure

POWER SOURCES 8: Research and Development in Non-mechanical Electrical Power Sources, edited by J. Thompson; London: Academic Press, 1981. 630 pages, $128.00.

A record of the proceedings of the twelfth International Power Sources Symposium, held at Brighton, England, in September 1980, POWER SOURCES 8 contains each of the forty papers presented at the symposium followed by an edited record of the ensuing discussion. A short summary of a two-hour informal discussion on the commercial future of lithium batteries, is also presented, concluding that there is an application in the consumer market for small solid-cathode lithium batteries, but that the future for the larger liquid cathode lithium batteries was far less certain, except to meet special requirements.

Papers presented in the book cover a wide variety of topics, from the chemistry and processes used for batteries to specific applications. Among the latter are a thermoelectric heater for low-temperature operation of military vehicles and an aluminum-air-powered generator for field use, mechanically rechargeable with an output of 40 watts per cell.

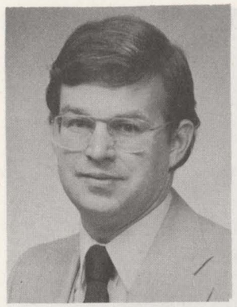
Of interest in vehicular applications are nickel-zinc batteries for electric hybrid vehicles, a nickel oxide-iron traction battery, thermal management of a nickel-zinc battery for electric vehicle propulsion, and a sealed rechargeable metal-oxygen traction battery. Solutions to shelf-life problems with silver oxide-zinc primary cells for electronic applications are presented, promising lifetimes to five years.

Thermal batteries, reserve-type molten salt electrolyte primnary cells operating at a working temperature between 400°C and 600°C, are reviewed in a paper comparing the performance of the older calcium or magnesium anodes with the newer lithium anodes. Widely used in missile systems, these batteries are inefficient but the lithium system is shown to have three times the operating life for the same battery volume as a calcium system in one application that was measured.

The symposium is held biannually and seven earlier proceedings volumes are also available in this series. The first two are titled BATTERIES and BATTERIES, 2 (1963 and 1964, respectively). POWER SOURCES 1966, published in 1967, was the first volume under the new name.

This book is recommended to those working in the development of batteries as well as for those concerned with understanding the advantages and limitations of various battery technologies for specific applications.

G. F. McClure



Automotive Electronics

Dateline: Detroit

Bill Fleming
Automotive Electronics Editor

FORD ELECTRONIC ENGINE CONTROL, EEC-IV

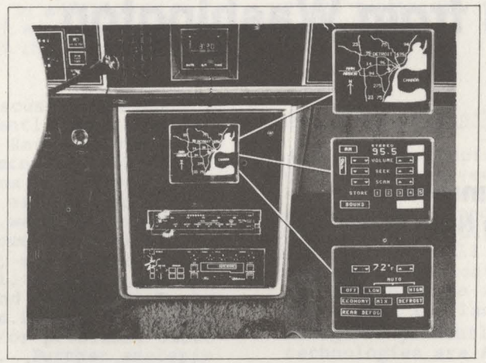
Jerry Rivard, Chief Engineer for the Electrical and Electronics Division, announced the EEC-IV, a "fourth generation" electronic engine control (Ref. 1). Mr. Rivard said that EEC-IV, is "the world's most advanced electronic engine-control system", and it will be used on 1.6-liter electronic fuel injection engines for the 1983 Ford Escort and EXP and Mercury Lynx and LN7.

In the above photo, the size of the company's original Electronic Engine control (EEC-1), right, is compared to that of the new fourth-generation EEC-IV. While EEC-1 used seven custom large-scale integrated circuits for limited control of engine functions, EEC-IV achieves greatly expanded control with only two devices -- a custom high-performance microprocessor and a large-capacity memory -- each on a chip less than a quarter-inch square.

FORD INFORMATION CENTER

Other electronic products now in development at Ford include a multifunction cathode-ray-tube information center being readied for late in the decade (Ref. 2). Three of the functions Ford is exploring on a 5-inch CRT are illustrated here. One is a satellite navigation system that pinpoints a car's location on a map display, shown above and in the inset at the upper right. Other insets show a radio-control panel (center) and an automatic temperature-control panel. Touching the appropriate area in each display will either change the display, call up additional information, or even affect the vehicle's functions.

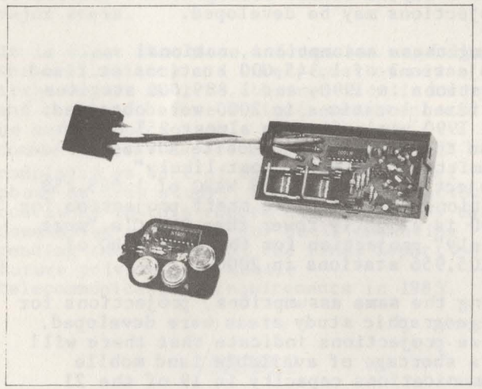
An experimental car with a 7-inch whip antenna has received latitude and long itude signals from an orbiting transit satellite. The car's position is then updated between the 90-minute satellite passes using its odometer and a magnetic flux gate that senses the earth's magnetic field.



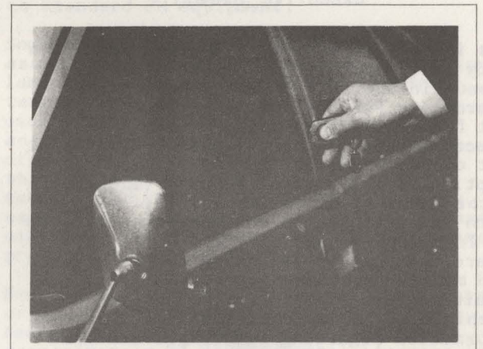
RENAULT INFRA-RED DOOR LOCKING SYSTEM

A remote infra-red control for central door locking systems has been developed in France by Neiman (Ref. 3). It has been adopted by Renault as OE for its R20 and R30 cars, with other models to follow. The miniature transmitter is housed in a matchbox-size keyring, and is aimed through the car window at the receiver detector integrated in the dashboard. Squeezing the sender case triggers the electro-magnetic locking circuit in either the on or off mode. Operating range is 2 meters.

Aside from eliminating the hazard of frozen locks in winter, the high-security system provides over 59,000 possible coded combinations, far more than any key variations. Coding programs for individual lock installations are issued by the manufacturer in a regular numerical sequence for production cars to minimize the risk of duplication. Recognition of a signal by the receiver alternately actuates two output relays operating the locking and unlocking mechanisms in the doors, trunk lid, and gas filler cap. A red LED on the transmitter indicates battery status, and the normal car key can still be used in case of any failure.



System Detector (above) Is Fitted to Dashboard And Infra-Red Transmitter (below) is Hand Held



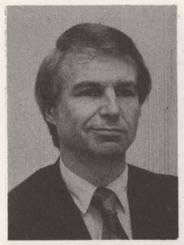
Hand Held Infra-Red Transmitter Triggers Central Locking System Detector Through Car Window

REFERENCES

1. A. Fleming, "Ford Shows Cars That Talk -- And Hear," Automotive News, June 7, 1982, pp 3 and 62.

2. A. Rosenblatt, "There's a CRT in Ford's Cockpit," Electronics, June 2, 1982, p. 54.

3. D. Scott, "Remote Control Increases Door Lock Security," Automotive Engineering, September 1982, p. 78.



News from Washington

Eric Schimmel
Washington News Editor

Land Mobile Spectrum Analysis

Reproduced below are excerpts from a new interim report prepared by the FCC's Private Radio Bureau planning staff. It is entitled "Future Private Land Mobile Telecommunications Requirements" and is intended to reflect the preliminary projections generated by the Comments received earlier this year in the Notice of Inquiry which carried the same title (Docket 82-10). In addition to the summaries, we have also included the section dealing with new technologies. Copies of the entire report are available from the FCC or the Downtown Copy Center, 1114 21st St., NW, Washington, DC 20037.

EXECUTIVE SUMMARY

This interim report is the second part of a study initiated by the Private Radio Bureau, in the fall of 1981, to provide information for developing a strategy to meet future private land mobile telecommunications requirements. The first part of the study culminated in the adoption of a Notice of Inquiry (Inquiry) by the Commission, on January 13, 1982, which was designed to solicit comments from the land mobile community and other interested parties regarding future private land mobile telecommunications requirements. This report was prepared as a vehicle to consolidate the available information regarding future private land mobile telecommunications requirements, as well as information regarding possible alternative means for meeting the future requirements which are identified. It is expected that the land mobile community and other interested parties will review this report, and participate in a cooperative effort to expand upon and refine the information contained herein, in order to prepare a final report on future private land mobile telecommunications requirements.

Chapter 1 serves as an introduction to the study, and outlines its purposes and objectives, as well as the approach taken by the staff. Chapter 2 reviews prior demand projections for the private land mobile services, growth factors which have and will affect the demand for land mobile communications, and trends which are likely to affect the future demand for land mobile communications. Chapter 3 presents a set of preliminary demand projections which were developed by the staff, as well as projections submitted as comments to the Inquiry. Projections are included, nationally, for the Public Safety Radio Services as a group, and for all other Private Land Mobile Radio Services. Projections are also provided for 21 geographic areas for all Private Land Mobile Radio Services combined. These projections are predicted on the assumption that there will be no changes in technology, and no changes in the types of communications carried out on private land mobile radio systems. These assumptions will be relaxed in the final report for this study, and a revised set of projections may be developed.

Using these assumptions, national projections of 1,345,000 stations at fixed locations in 1990, and 1,889,000 stations at fixed locations in 2000 were obtained. The 1990 projection is almost 25% higher than the Private Land Mobile Advisory Committee's (PLMAC) "most likely" projection for the 1979 WARC of 1,085,258 stations in 1990. The staff projection for 2000 is slightly lower than PLMAC's "most likely" projection for the 1979 WARC of 2,105,956 stations in 2000.

Using the same assumptions, projections for 21 geographic study areas were developed. These projections indicate that there will be a shortage of available land mobile communications capacity in 19 of the 21 study areas by 1990. A substantial gap between required land mobile communications capacity and available land mobile communications capacity is projected for the Los Angeles/San Diego and New York areas by 1990. A smaller but significant gap is projected for the Chicago, Baltimore/Washington and Philadelphia areas by 1990. By 2000, all 21 study areas are projected to require more land mobile communications capacity than will be available. The projected shortage of communications capacity is most severe in the Los Angeles/San Diego, New York and Chicago urban areas. For example, Chicago, which has the smallest requirement of the three areas, will need more than 77 MHz of additional spectrum by 1990, an increase of approximately 170% over its current level

of available spectrum. In addition, significant shortages of at least 40-50 MHz are projected for all of the 21 study areas by 2000.

Chapter 4 contains a discussion of the amount of spectrum currently available in the Private Land Mobile Radio Services, as well as a number of alternative sources of additional communications capacity such as: additional sharing of spectrum with other radio services as well as within land mobile; additional allocations exclusively for private land mobile; and technological advances such as digital, trunking, narrow band, spread spectrum and cellular. Each of these alternatives is identified, along with its attributes and/or problems, based on a preliminary review. Further analysis will await a final set of demand projections, plus additional information from the land mobile industry regarding the cost, timing and feasibility of a number of emerging technologies such as cellular, narrowband, spread spectrum, digital and trunking.

Given the time required to implement new technologies, it is reasonable to assume that new technology will not be able to absorb a significant portion of any shortage of communications capacity by 1990. Also, given the pending requests for spectrum from the 900 MHz land mobile reserve, it is possible that land mobile will obtain little more than 6 MHz of the remaining 41 MHz of reserve, hardly enough to satisfy the projected demand in the major areas.

It is clear that more information regarding the availability and likely cost of new technologies must be obtained from industry and analyzed before a final assessment can be made about possible shortages of communications capacity. This task will be completed as part of the third and final phase of this study. However, information contained in this report can be used by the Commission as a tool for decision-making pending the release of the final report on future private land mobile telecommunications requirements in 1983.

CHAPTER 3

Summary

To summarize, by 1990, assuming current technologies and types of communications, it is projected that there would be a substantial gap between required communications capacity and available communications capacity in the Los Angeles/San Diego area and the New York area. It appears that a problem would also exist for the Chicago, Baltimore/Washington and Philadelphia areas, but of a smaller magnitude. However, by 2000, and using the same set of assumptions, all 21 study areas are projected to exceed their communications capacity. The projected range of shortages is from approximately 800 two-way communication links in New Orleans to a sizeable 5500 communication links in the New York and Los Angeles/San Diego areas.

CHAPTER 4

New Technologies/Systems

All previous topics have dealt with releasing reserved spectrum, interservice sharing and identifying potential sources of additional spectrum for land mobile use with current equipment and technologies. This section will identify new technologies and new communications systems which have the potential to increase the efficiency of and demand for land mobile communications. Among the presently considered new technologies are Amplitude Compandored Single Side Band (ACSB), a narrow band approach, and digital modulation techniques. Among the new systems techniques are the use of trunking and cellular communications.

Single sideband techniques, to reduce the transmitted bandwidth, were developed prior to World War II. However, incorporation of compandors, devices which reduce the dynamic range of a signal, and the use of frequency control, are new to land mobile. The possible use of ACSB has been the subject of much comment from various parties. Supporters of ACSB claim that the system (with a 5 kHz bandwidth) can be interleaved within the presently allocated 15 and 25 kHz land mobile channels. The detractors claim that ACSB is not suited to land mobile operations and is not superior to standard FM equipment.

Some of the technical constraints associated with ACSB use above 450 MHz in a land mobile environment are the system temperature/stability of crystals oscillators between the base and mobile units, and the ability of the tracking circuitry to compensate for the doppler shift of a moving vehicle. However, technology has overcom previous problems associated with the use of single sideband equipment and the assumption is that these problems will also be resolved.

Because of the lack of any field test data or experience involving this new technology, the Commission has granted approximately 20 developmental licenses for various ACSB systems. It is hoped that this approach will provide sufficient information to compare the ACSB system performance with that of FM, in an actual land mobile environment. Further, any potential interference between ACSB and FM systems could be determined, so that the current debate regarding how many ACSB channels can be assigned between the current channels can be resolved.

Assuming that all of these problems have been resolved, how can the land mobile community (and the Commission) take advantage of single sideband technology. As noted previously, the critical short fall of spectrum is projected to occur in the major urban environments. If no more new spectrum is made available to land

mobile, the only option remaining is reuse of presently occupied spectrum. ACSB could provide additional new channels in the 50 MHz, 150 MHz and the 450-512 MHz bands presently occupied by land mobile. Depending upon the results of current field tests, the advantages of using ACSB will be the number of new channels which can be placed between the current assignments.

Since equipment techniques are separate from system use techniques, ACSB could be combined with trunking methodology. This approach could provide the additional benefit of expanding the spectrally efficient trunking methodology into previously filled bands, with the possibility of accommodating many more potential users.

The basic concept of trunking in communcations is to provide a number of unreserved channels over which multiple messages can be sent simultaneously from a central control point through a transmitter (repeater). The unreserved channels are called "trunks". The advantage of trunking channels is that more messages can be accommodated (via a centrally controlled switch) on a group of channels, than can be accommodated on same number of conventional (reserved) channels which are not being used at all times. For example, if ACSB and trunking were expanded into the 150 MHz band, one possible benefit would be to allow the Taxicab Radio Service to make increased use of its assignments at 152.435 MHz and 152.450 MHz. Using both ACSB and trunking, additional channels may be allocated between these two assignments which could accommodate many additional mobiles. Another large fleet user, the Police Radio Service, may be able to achieve similar benefits in large urban areas.

Cellular communications systems are another possible source of additional communications capacity for the Private Land Mobile Radio Services. The essential elements of the spectrum efficient cellular concept are frequency reuse and cell splitting to provide for increasing numbers of mobile units, while using a limited amount of spectrum. Low power transmitters are used, which allows for a significant amount of frequency reuse within a geographic area, thus limiting the total amount of spectrum required to operate a cellular system. Cellular has been considered by some of those who submitted comments in PR Docket 82-10 to be a panacea for current and projected land mobile communications congestion problems. While it is clear that the addition of cellular systems will add significantly to the available stock of land mobile communications capacity, it is by no means clear to what extent the service to be provided on cellular systems will serve as a substitute for current and potential uses in the Private Land Mobile Radio Services. Specific comments which address this issue would be particularly helpful.

Cellular could also be combined with ACSB, thus reaping the advantages of both of these spectrum saving techniques, and significantly increasing the quantity of communications capacity. However, there is a disadvantage to cellular system at present: the current cost of equipment. Also, while cell splitting is the most spectrum efficient way to increase the capacity of a cellular system, the cost of modifying the existing fixed cellular equipment may be very high. These increased costs will have to be weighed against the opportunity cost of allocating additional spectrum for cellular systems.

Another method for providing more communications capacity is to use a spread spectrum (wide band) modulation scheme. The mere mention of spread spectrum modulation immediately institutes a debate among communication engineers as to the efficient use of the spectrum in a multi-user environment. The debate is also likely to continue into the future since new technological advances often result in changes that make systems, often thought to be wasteful, much more attractive in terms of spectrum conservation. Spread spectrum communications is an example of one such area that has been and will most likely be affected by technological changes. Recent advances in surface acoustic wave (SAW) and charge coupled devices (CCD) have simplified spread spectrum systems and made them much more attractive for use in land mobile radio services.

There are various methods for generating spread spectrum signals including direct sequence, frequency hopping, time hopping and chirp systems. The basic direct sequence frequency system operates from a 3 kHz voice signal which is digitized into a binary stream, and put through a pseudo-random noise generator (PRN). The resultant wave form is then multiplied by a carrier frequency in a balanced modulator which produces a wideband, bi-phase, phase-shift-keyed (PSK) waveform. At the receiver, the reverse process is used to produce a 3 kHz voice signal.

The spread spectrum systems could be used throughout the commercial (VHF/UHF) broadcast television bands. The advantage of using TV bands is the large amount of continuous spectrum. A spread spectrum system should have a large transmitted spectrum, that is, an operating bandwidth greater than 6 MHz, in order to take advantage of the out-of-band rejection capabilities of commercial TV receivers. Increasing the RF (transmitted signal) bandwidth in effect reduces the overall level of spectral power density in a band and thus, in general, reduces the potential to cause unacceptable interference to any users of conventional land mobile and TV systems already operating in that band.

The principal feature of a spread spectrum system is that more users could be accommodated because each user would have a discrete access code which would be used when either receiving or transmitting from a mobile unit. The use of a large number of frequencies is a form of frequency diversity that significantly reduces the

degradation due to fading in a moving vehicle. A potential user of a spread spectrum system can access the system at any time without waiting for a free channel. Since all users occupy the same band, all associated hardware is identical except for a filter in each user's set with a unique access code. Priority messages (e.g., public safety vehicles) can be accommodated in the same system, even in an overloaded condition, by either increasing the transmitted output power level, on an emergency basis, or by increasing the time-bandwidth product of the access code. These systems, because of the modulation techniques, do provide a high degree of message security.

However, there are also some disadvantages to using spread spectrum systems, both from a technical and a regulatory standpoint. The technical disadvantages include cost, because dynamic (RF) output power control is required in order to prevent mobiles near the base station from overpowering more distant mobiles, and the fact that fully coherent detection is not possible in a fast fading environment. The spread spectrum approach may not be particularly attractive for large cellular systems because of cost. Very little actual field experience exists regarding potential interference between spread spectrum users and other radio services.

From a regulatory perspective, it is almost impossible for the Field Operations Bureau (FOB) to monitor a spread spectrum (or any digitized) system for message content without first having access to the code of the licensee. Therefore, potential violators of Commission Rules and Regulations and licensees creating interference are, for the most part, undetectible.

Spread spectrum (digital wide band) systems' future appeal appears to be in paging, with its ability to provide status reporting from a data base to the mobile units for public safety, load management in the utility services, and automatic vehicle monitoring.

The future for digital systems looks the brightest in 5 to 10 years using various portions of the UHF land mobile/television (470-806 MHz) bands and the 900 MHz reserve band for dispatch services. The potential to create inteference both to other land mobile equipment and commercial UHF-TV receivers must be thoroughly investigated.

The Policy Development Division, in its report on digital technology, extensively discussed the various advantages and disadvantages and the potential future of digital technology. Some of the general conclusions given in that report were:

o The transformation from analog to digital will result from: the rapid development of personal computers and large digital integrated communication networks; the need to use the spectrum efficiently in order to accommodate more users; and the desire for enhanced flexibility of operation that can be provided by digital technology.

o There will be modest growth in land mobile digital voice systems in the near-term as the importance of secure communications continues to grow.

o Two-way data and status reporting systems can substitute for voice systems in some types of operations.

o Digital paging can provide improvements in spectrum efficiency and receiver-operating convenience, but at higher cost in the near-term.

o Digital (alphanumeric readout) pagers may substitute for voice pagers, but this probably will not occur to a great extent in the private services.

o Non-voice communications will increase in all private services at a modest rate during the next five years.

o Advanced systems (packet radio, spread spectrum, integrated radio systems) can facilitate development of digital communications and can offer enhanced flexibility for the system designer and user.

The major disadvantage to the increased use of digital technology at present is the increased cost over analog (FM) systems. The Commission may want to address a number of related issues including, but not restricted to, permissible communications, service distinctions, regulatory structure, and technical standards.

An example of increased efficiency using computer aided digital dispatch techniques is the taxicab radio service in Canada. A private company, Canadian Systems Group (CSG), is providing a computer aided dispatch service that has three times the channel capacity and 6 times the dispatch rate over conventional voice (FM) land mobile systems. If the system were to cover a large urban market, such as Los Angeles, the computer aided digital system could be used with a trunking or quasi-cellular technique as noted previously.

Another possible systems approach combining all or some of the above technologies may be the use of land mobile satellites. They could be used for wide area coverage in lightly populated areas, or geographic areas that have highly irregular terrain features that make standard land mobile communication systems expensive to install and maintain. Specific details of how this type of system could benefit land mobile and advantages of using satellite communications over conventional systems must await a report being prepared by NASA. Also, spectrum requirements, including frequency, bandwidth and effective radiated power (ERP) must be determined.

In summary, while there are a number of possible sources of additional communications capacity, in theory, many of the possibilities discussed above could have major practical problems. Some of these problems are: (1) it may not be economically feasible for land mobile equipment manufacturers to produce equipment which operates either in a very limited band (e.g., 220-222.5 MHz) or in only a few geographic areas; (2) new technologies which significantly increase the effective communications capacity of land mobile spectrum are unlikely to be implemented fast enough to prevent the shortages projected in the major cities by 1990; and (3) new technologies which may enable the use of spectrum above 1 GHz are unlikely to be available at a competitive price in time to help solve the projected shortages in the major cities by 1990.

CHAPTER 5

Summary

The analysis of historical data, prior demand projections, growth factors, and trends in the Private Land Mobile Radio Services clearly indicate that the Private Land Mobile Radio Services will continue to grow and expand through the end of this century. Preliminary projections made by the staff and by several parties that commented in this proceeding indicate that availability of adequate communications capacity will continue to be a problem in the major urban areas. Not surprisingly, the top three areas now in terms of spectrum congestion, New York, Chicago, and Los Angeles, are projected to be the top three areas in 1990 and 2000 in terms of spectrum requirements, although the ranking of the three areas changes. Los Angeles, with a requirement in 2000 of 276.6 MHz, moves to number one, followed by New York and Chicago, with requirements of 276.3 MHz and 157.6 MHz in 2000, respectively. The projections also indicate that especially fast-growing areas such as Dallas and Houston will encounter more severe communications crowding problems in 1990 and 2000 than they faced in 1980. In fact, 19 of the 21 study areas are projected to have spectrum shortages by 1990, and all 21 areas are projected to have shortages by 2000.

The projections in this report are preliminary, and may be revised after an assessment of the impact of new technologies such as narrow band, trunking, cellular, digital, and spread spectrum, on both the amount of spectrum required to accomplish a give quantity of land mobile communications, and the quantity of communications which is likely to result from the increased communications capabilities of these and other new technologies. Quantifying the changes likely to result from new technology will be a very difficult undertaking. A concerted cooperative effort by the staff and the land mobile equipment manufacturers will be required to successfully complete this task.

The preliminary discussion of spectrum supply was developed to provide a common base of information for additional research and analysis. Current spectrum allocations for the Private Land Mobile Radio Services have been identified, by frequency band and by service. Possible additional souces of communications capacity have also been identified, including a variety of new technologies and a number of possible sharing arrangements. These sources have been included in the discussion, even if they are not expected to provide significant spectrum relief before 1990, in order to generate further dialogue. It is expected that through the combined and cooperative efforts of all current and future users of land mobile communications, a set of feasible and workable alternatives can be generated for increasing the quantity of land mobile communications capacity in the major urban areas through the end of the century. The urgency of this task is clearly dependent on the magnitude of the demand projections which will be developed in the next phase of this study, and when it is projected that various geographic areas will suffer from serious shortages of land mobile communications capacity. Although there is still a great deal of work to do to develop to develop final demand projections, it seems highly unlikely that the projections will change the initial indication of this interim report that significant problems of under-capacity will have to be faced and resolved in the Los Angeles/San Diego, New York, Chicago, Baltimore/Washington and Philadelphia areas by 1990.

Continued from page 3

Mr. Stuart Meyer, IEEE-VTS President c/o E. F. Johnson Co., 1601 N. Kent Street, Arlington, Virginia 22209 (tel. no. 713-525-6286) giving their name, address, organization and telephone number.

An organizational meeting is planned on January 26, 1983 in Washington, D.C. at time and place to be announced.

The Society's objectives call for a draft report to be completed within 12 months and final report no more 12 months later. No more than 6 - 8 meetings are believed necessary.

The Board, in taking this action, noted the growth of conventional, trunked, cellular and paging land mobile in the 806 - 947 MHz portion of the spectrum. It unanimously concurred in the need for an Industry accepted propagation model(s) for predicting reliable service areas and co-channel interference.

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