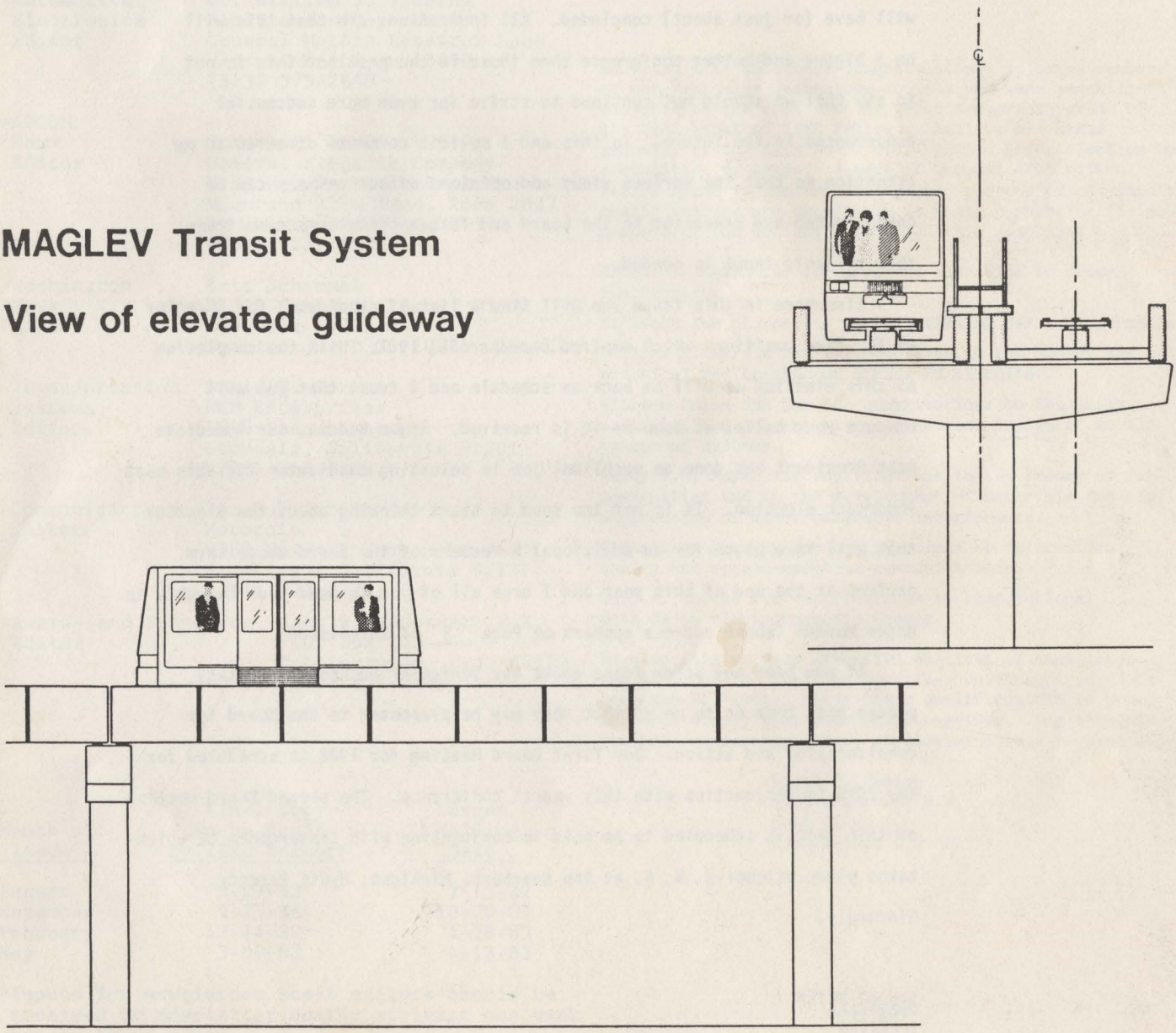
IEEE
VEHICULAR TECHNOLOGY SOCIETY
NEWSLETTER

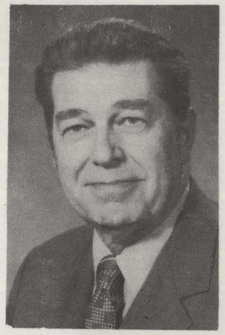
Editor: A. Kent Johnson Vol. 29, No. 2, May 1982 (ISSN 0161-7887)

MAGLEV Transit System

View of elevated guideway



President's Message



Stuart F. Meyer
President
IEEE Vehicular Technology Society

PRESIDENT'S MESSAGE

As this issue of the Vehicular Technology Society newsletter crosses your desk, the 1982 Thirty-second Annual Vehicular Technology Conference will have (or just about) concluded. All indications are that this will be a bigger and better conference than those in the past but this is not to say that we should not continue to strive for even more successful conferences in the future. To this end I solicit comments directed to my attention so that the various views and opinions of our members can be consolidated and presented to the board and future conference committees. YOUR valuable input is needed.

Elsewhere in this issue you will find a list of candidates for Director of the five positions which expired December 31, 1981. With the completion of this election we will be back on schedule and I trust that you will execute your ballot as soon as it is received. Roger Madden, our immediate past President has done an excellent job in selecting candidates for this most important election. It is not too soon to start thinking about the election that will take place for an additional 5 Members of the Board whose term expires at the end of this year and I urge all of you to send your thoughts to Roger Madden (whose address appears on Page 3 of this issue).

If you have any other ideas about our Vehicular Technology Society, please pass them on to me so that they may be presented to the Board for consideration and action. Our first Board Meeting for 1982 is scheduled for May 26th in conjunction with this years' conference. The second Board meeting of this year is scheduled to be held in conjunction with Convergence 82 which takes place October 4, 5, 6, at the Dearborn, Michigan, Hyatt Regency.

Sincerely,

STUART MEYER
President
IEEE-VTS

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

*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

We would like to extend congratulations to seven members of the Vehicular Technology Society who were recently elevated to the most distinguished membership grade of the IEEE--that of IEEE Fellows. Fellows are named annually by the IEEE Board of Directors after election by a committee of peers. A mark of unusual distinction, Fellow grade is conferred only upon persons of outstanding qualifications and experience in their particular fields. Members of our society so honored this year are:

Shashi B. Dewan for research and education in power electronics.

Al Gross for pioneering work in VHF and UHF mobile radios.

William J. Kerwin for contributions to the theory and practical realization of active RC circuits.

William Chien-Yeh Lee for contributions to the analysis, modeling, and conceptual and practical design of mobile telephone systems.

Ferdy P.M. Mayer for contributions to the theory of ferromagnetics and to the development of materials for the suppression of electromagnetic interference.

Michael B. Pursley for contributions to information theory and spread-spectrum communications.

Gary A. Thiele for contributions to computational methods in electromagnetic theory.

We also call to your attention the list of candidates for Director for the five positions which expired December 31, 1981. Study their qualifications so you can vote wisely when your ballot arrives. Any thoughts you have concerning future candidates should be sent to:

Roger D. Madden
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BOARD OF DIRECTORS

NAME	RESPONSIBILITY	TERM
William H. Chriss	Past Treasurer	Jan79-Dec81
Robert E. Fenton	Treasurer	Jan80-Dec82
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	Jan79-Dec81
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	Vice President	Jan79-Dec81
Ronald G. Rule	Education Committee	Jan79-Dec81
Robert A. Mazzola	Chairman, Membership Committee	Jan79-Dec81

Board of Directors Report

Samuel A. Leslie
VTS Secretary

IEEE VTS EXECUTIVE COMMITTEE MEETING
Washington, D.C.
February 25, 1982

The following Board Members were in attendance at the Executive Committee meeting:

Stuart Meyer	- President
Roger Madden	- Past President and Nominations Chairman
Bob Fenton	- Treasurer
Kent Johnson	- Newsletter Editor
Sam McConoughey	- Chapter Chairman
Sam Leslie	- Secretary

The Executive Committee met to accomplish the following:

1. Generate a slate of candidates for the 1982-1985 term.

2. Explore solutions to a potential future income problem with the treasurer.

3. Propose a slate of officers to be elected by the Board for the 1982 calender year.

4. Generate an agenda for the upcoming VTS Board meeting at the San Diego Conference on May 23-26.

SLATE OF CANDIDATES:

The tentative list of candidates for election to the VTS Board (as of the newsletter publication date, and subject to Board approval), is as follows:

Transportation Systems:

John H. Auer, Jr., General Railway Signal. Mr. Auer is a new candidate for the Board.

Art Goldsmith, U. S. Department of Transportation, retired. Mr. Goldsmith is also a new candidate for the Board.

Ronald G. Rule, Boeing Aerospace Co. Dr. Rule is currently serving as chairman of the education committee, and is standing for re-election to the Board.

Automotive Electronics:

Robert A. Mazzola, TRW Automotive Worldwide. Mr. Mazzola is currently serving as chairman of the membership committee, and is standing for re-election to the Board.

Communications:

V. Edgerton, ITR, Inc. Edgerton has served the Board previously as PAC chairman, and is a new candidate for the Board.

W. C. Y. Lee, ITT Defense Communications. Mr. Lee is currently appointed by the Board as the Associate Transactions Editor, Communications, and is a new candidate for the Board.

Roger Madden, Federal Communications Commission. Mr. Madden is the past president of VTS, and is currently serving the Board as the nominations chairman and as chairman of the constitution and bylaws committee. He is standing for re-election to the Board.

George Mitchell, Motorola. Mr. Mitchell is currently serving as the vice president of the Board, and is standing for re-election.

Carlos Roberts, Director of Land Mobile Development of MA/COM (Microwave Associates). Formerly Chief of the Private Radio Bureau at the FCC, Mr. Roberts is a new candidate for election to the Board.

Of these candidates, five will be elected for the 1982-1985 term. The attendance record for the above candidates who have been serving in previous VTS Board assignments is included with this report for your reference.

VTS DUES INCREASE:

The VTS Treasurer, Bob Fenton, reported on an anticipated loss of approximately $7000 in cash position for the Society in 1982. The ensuing discussion indicated that most of the other IEEE Societies currently have higher rates, and that VTS has not had a dues increase in four years. Furthermore, a review of the financial data from the IEEE Headquarters indicate that the cost for printing and mailing the VTS Transactions and the VTS Newsletter is in the $25 to $30 range for each member. Providing inflation and increased operating expenses as a reason, Madden then moved, Fenton seconded, that the yearly VTS dues be increased to ten dollars. This motion is subject to mail ballot approval by the elected board members.

EXECUTIVE COMMITTEE ELECTION:

The nominations chairman, Roger Madden, proposed that the present executive committee continue for the 1982 year:

President - Stuart Meyer
Vice President - George Mitchell
Treasurer - Bob Fenton

This slate is subject to confirmation by the elected members of the Board, which is to be accomplished via mail ballot.

RESULTS OF LAST MAIL BALLOT:

Since a quorum of elected Board members was not present at the last Board of Director's meeting, a mail ballot was held on those motions which were made at the meeting and which required approval by a majority of the Board. The results are as follows:

1. 13 in favor, one not responding, to approve the minutes of the June meeting as published.

2. 12 in favor, one against, one not responding, to approve the purchase of transcribing equipment, amount not to exceed $200.

3. 13 in favor, one not responding, to approve the placement of VTS funds not needed for general operation of the Society into IEEE's Option 2 money market fund.

4. 12 in favor, one against, one not responding to approve an additional $1500 seed money for the San Diego Conference.

5. 13 in favor, one not responding, to approve $1000 seed money for the 1983 Toronto VTS Conference.

6. 13 in favor, one not responding, to approve Washington as the site of the 1984 Conference, and to consider a joint APCO/VTS Conference in 1985.

MISCELLANEOUS:

Meyer reported that the Pittsburgh VTS Chapter has asked to sponsor a VTS conference. The possibility of holding the 1984 conference in Pittsburgh instead of Washington was discussed, with the Washington conference possibly being moved to 1986. This matter will be explored further at the next Board of Director's meeting in San Diego.

McClure reported via phone the upcoming IEEE VTS book titled "Mobile Communications Engineering" should be ready for ordering by the end of May. Order blanks for this book will be prepared for distribution at the San Diego Conference.

The first Board of Director's meeting of the year will be held on Wednesday, May 26, at the San Diego Conference. The Executive Committee has tentatively recommended that the second board meeting be held at Convergence '82, which is scheduled for October 4 through 6 in Dearborn.

Respectfully Submitted,

Samuel A. Leslie

Samuel A. Leslie
IEEE VTS Secretary

Chapter News

Sam McConoughey
Chapter News Editor

CHAPTER NEWS

MEETINGS

Cleveland

"Marine and Rescue Communications"
by Lt. Fred Adams, USCG 9th District
Held on November 17, 1981 with 20 attending, including 12 guests.

"Technology Briefing Session and Tour, NASA-Lewis Research Center"
by Richard Athay
Held on December 9, 1981 with 25 attending, including 18 guests.

"Electronic Compatibility"
by John Cunningham, (Chairman A-B), Senior Technical Director, Cleveland Institute of Electronics.
Held jointly with Audio-Broadcasting on March 9, 1982 with 19 attending, including 6 guests.

Washington, D.C.

"Living with Lightning"
by Mr. A. K. Guthrie, General Electric Co.
Held on October 23, 1981 with 26 attending, including 6 guests.

"Current Status of International Mobile Radio Services"
by Mr. Wendell R. Harris, Federal Communications Commission
Held on December 11, 1981 with 22 attending, including 5 guests.

"Single Sideband for Land Mobile, Today, Tomorrow, the Future"
by Mr. Niles L. Barlow, President
Sideband Technology, Inc. Rochester, N.Y.
Held on March 12, 1982 with 41 attending, including 10 guests.

By Samuel R. McConoughey, Editor & Shiela Parker
c/o F.C.C., 1919 M Street, N.W., Room A-309
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1982 IEEE Vehicular Technology Society

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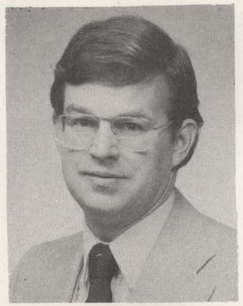
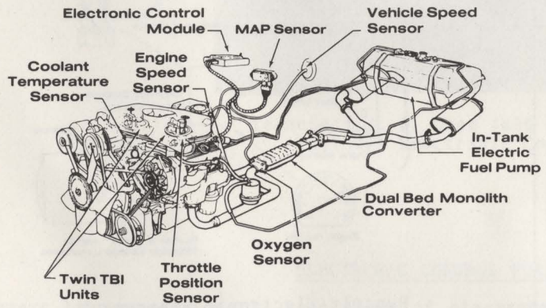


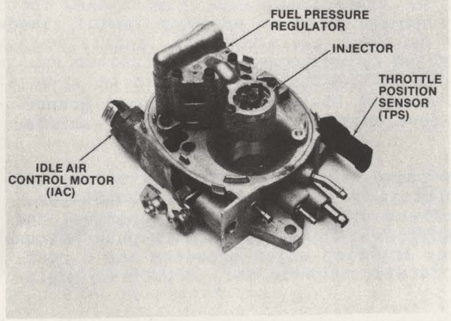
Automotive Electronics

Dateline: Detroit

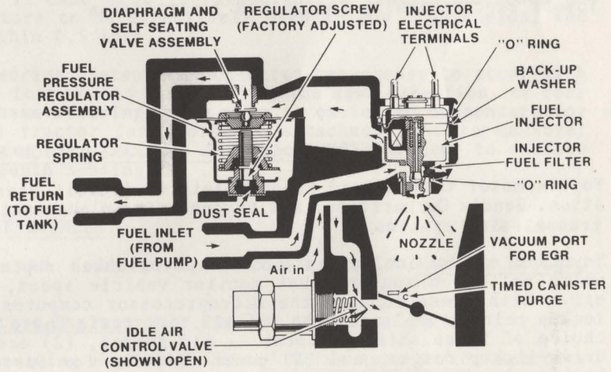
Bill Fleming
Automotive Electronics Editor



Chevrolet "Cross-Fire"
EFI V-8 Engine and Controls



Photograph of Throttle Body Fuel Injector Assembly



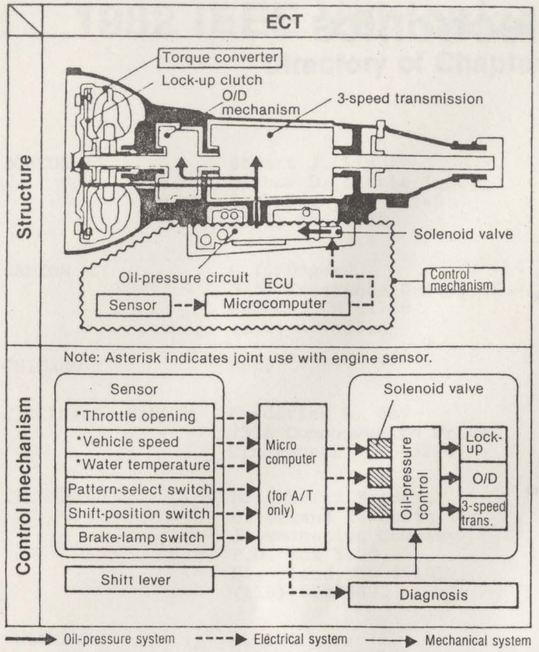
Schematic Diagram of Throttle Body Fuel Injector Assembly

GENERAL MOTORS "CROSS-FIRE" ELECTRONIC FUEL INJECTION

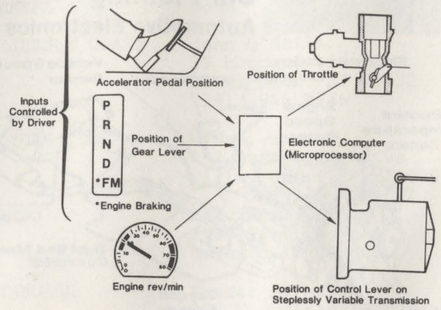
For 1982, General Motors has introduced "cross-fire" electronic fuel injection on 5-liter V-8 engines available in newly designed Camaro Z28 models. Two throttle-body fuel injectors are mounted on a "cross-fire" intake manifold which has runners tuned to feed fuel to the cylinder banks farthest from the injectors. The engine produces 165 hp, 25 hp more than the carbureted versionof the same engine.[1]

The throttle body injector assemblies contain electronic fuel injectors, individual fuel pressure regulators, a throttle position sensor, and an idle air control motor. Fuel injectors open and close in response to signals from an electronic control module. The amount of fuel delivered depends on the length of time the injector is open. Pulse duration ranges from about one to six milliseconds, depending on engine operating needs.[2]

The EFI system on the "cross-fire" engine is considered to be an especially sophisticated version of black box electronic controls. Consequently, GM's Delco Electronics repair manuals for this version of Computer Command Control devote 70 pages to diagnosis-and-repair trouble trees to assure quality service for this high-tech car.[3]



Toyota Electronically Controlled Transmission



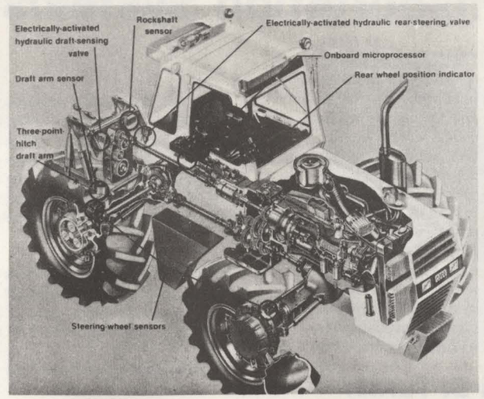
Renault Electronic Management of Engine and Transmission

ELECTRONIC CONTROL OF TRANSMISSION SHIFTING GAINS INTEREST

Toyota Motor Company and Renault join GM Detroit Diesel Allison Division, Borg-Warner Corporation, Bendix Corporation, and Laycock-GKN in announcing developments in electronically shifted transmission systems.[4-7]

Toyota's system includes a microcomputer which replaces normal hydraulic-pressure values and which relies on sensors that monitor vehicle speed, throttle position, coolant temperature, etc. With these inputs, the microprocessor computes optimum shift points, gear changes, and lockup points; while sending signals to actuate these functions. Toyota provides a push-button choice of three shift patterns -- (1) normal, (2) economy shifting which broadens the direct-drive lockup ranges, and (3) power shifting for faster acceleration or more effective engine braking.[4]

In Renault's system, the transmission and engine speeds are controlled by a microcomputer that matches the gear ratio to throttle opening to maximize fuel efficiency for any power demand. Instead of the usual mechanical linkage to the throttle, the throttle is positioned by a servo actuator controlled by signals from the microcomputer. The vehicle includes a steplessly-variable ratio van Doorne transmission to permit a greatly expanded range of gear ratio selection. In this system, the driver sets the accelerator pedal position which determines only the commanded rate of acceleration or desired road speed, but does not directly control the throttle position.[5]



Tenneco's J. I. Case 4690 Farm Tractor Includes Electronic Controls

ELECTRONIC CONTROL FOR FARM TRACTORS

Farmers have traditionally been leery of electronic controls for their equipment, but strong gains in reliability and pressing needs for higher productivity are increasing acceptance of such devices. For example, Tenneco's J. I. Case 4690 four-wheel-drive tractor includes an electronic steering system. For farm tractors to be effectively used in row crop fields, the rear wheels must track the front wheels within 0.5 inch.

With electronic conrol of the hydraulic steering system, the operator can choose to steer with front wheels only, rear wheels only, or all four wheels "crabbed" in the same direction, or rear wheels turned opposite to front wheels. These steering modes make it easier to compensate for ground slopes, to accurately position the tractor for implement attachment, or to maneuver around obstacles in tight spaces. The tractor also includes microelectronic systems to enhance three-point hitch draft control, and plow depth sensing.[8,9]

REFERENCES

1. "GM Unveils New Front-Drive A-Cars and Redesigned Camaro/Firebird," Machine Design, December 10, 1981, pp. 23-26.

2. "GM's 2.5-liter L-4 Gets EFI," Automotive Engineering, October 1981, pp. 40-43.

3. Mike Scanlon, "The Painful Art of Servicing High-Tech Cars," Wards Auto World, February 1982, pp. 51-54.

4. "Transmissions By Electronics Reach Market," Ward's Engine Update, October 1, 1981, p. 7.

5. "Engine/Transmission Management Cuts Renault Consumption," Automotive Engineering, January 1982, pp. 45-47.

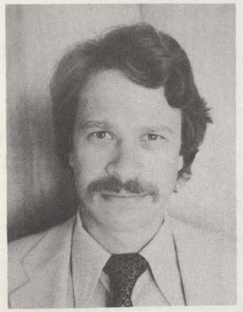
6. A. L. Miller, "Microcomputer Controlled Automatic Transmission," SAE Paper 820394, presented at the SAE International Congress, Detroit, Michigan, February 22, 1982.

7. B. M. Forster, "A Microprocessor Controlled Overdrive for Optimization of Fuel Consumption," SAE Paper 820391, presented at the SAE International Congress, Detroit, Michigan, February 22, 1982.

8. R. T. Dann, "Agricultural Equipment: The Race for Innovation," Machine Design, September 10, 1981; pp. 82-90.

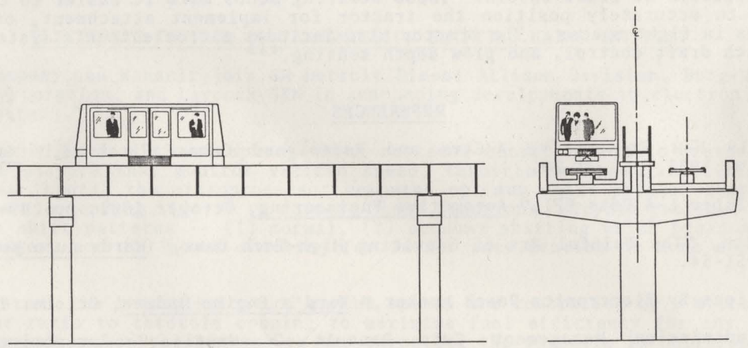
9. "Microelectronic Controls," Automotive Engineering, February 1982, p. 134.

Transportation Systems



David B. Turner

The following news from England on a commercial MAGLEV project under construction shows that the driving force behind transportation system development is still strong. The upcoming Vehicular Technology Conference (May 23 - 26) in San Diego will showcase other work in progress in transit technology. See you there!



MAGLEV Transit System

View of elevated guideway

The Henderson Busby Partnership
Consulting Engineers and Economists

Cusick House, Church Street,
Ware, Herts, SG12 9EF.

THE BIRMINGHAM MAGLEV TRANSIT LINK

GENERAL

The construction has recently started on the magnetic levitation (MAGLEV) transit link at Birmingham Airport, England. When the transit link is handed over to passenger service in June 1984, it will be the first revenue-earning MAGLEV system in the world. This follows more than seven years of research and development effort.

The project is a joint venture of the People Mover Group (PMG), West Midlands County Council (WMCC), British Rail (BR) and the British Government's Departments of Trade and Industry.

The PMG consists of the following companies:

- Balfour Beatty Power Construction
- Brush Electrical Machines
- Metro-Cammell
- GEC Rectifiers
- GEC Witton Kramer
- GEC General Signal
- GEC Transportation Projects

The overall project management and system eingineering is by GEC Transportation Projects, with WMCC as the system operators.

The MAGLEV link connects the new airport terminal building with BR station and the National Exhibition Centre by means of two independent tracks mounted on an elevated guideway 630 metres long.

Each track can accommodate a single, or a train of two, 6-metre-long vehicles. With a journey time of 90 seconds and a dwell time of 40 seconds, track capacity is 1100 passengers/direction/hour when a single vehicle is in operation. The second track and vehicle provide increased flexibility and availability.

TECHNICAL

The power supply is 600V DC from two trackside conductor rails rated 500A. An emergency consumption of 0.165kWh/passenger-km results in a very economical system. The operation is fully automatic, computer-controlled and monitored from a remote control centre.

Propulsion is by means of a linear induction motor with 4kN thrust supplied by an on-board variable voltage and frequency transistor inverter. This provides smooth traction and braking forces without mechanical contact with the track. The reaction rail consists of a steel beam with an extruded aluminum cover plate.

Suspension and guidance are by means of dc-controlled electro-magnets mounted in pairs under each vehicle corner. The magnets are fed by transistor chopper amplifiers so that an attractive force can be produced to lift the vehicle and keep it nominally 15mm from the two laminated steel suspension rails. Because the magnets uniformly distribute the load, in contranst to wheeled vehicle, the track design is relatively economical.

The vehicle chassis employs light-weight welded aluminum construction, supporting a moulded GRP body shell.

OPERATION

Since the system employs very few moving parts, the maintenance requirements are small, while a high reliability is assured.

Self-checking and diagnostic features are included in the design to facilitate trouble-shooting and repair. In case of power supply failure or major equipment malfunction, the vehicle comes into contact with two rails and gradually slows by means of gravity brake pads. Acceleration and deceleration are limited to ensure a high level of passenger comfort.

SAFETY

Fail-safe automatic train operation and protection are based on proven conventional railway engineering standards using the latest technology. Fire risk is minimised due to absence friction, moving parts, rubber tyres, lubricants, oil and fuel. Fire-retardent materials are employed throughout. For passenger security, facilities for TV surveillance and two-way speech communication with the vehicles are provided.

FUTURE

The Birmingham MAGLEV Transit Link will demonstrate the advantages of this advanced system over conventional people-movers, and allow other airports, seaports, and public facilities to confidently apply the MAGLEV solution to their traffic problems. The worldwide demand for efficient and environmentally acceptable transportation systems will increased in response to public concern for energy shortage and pollution control.

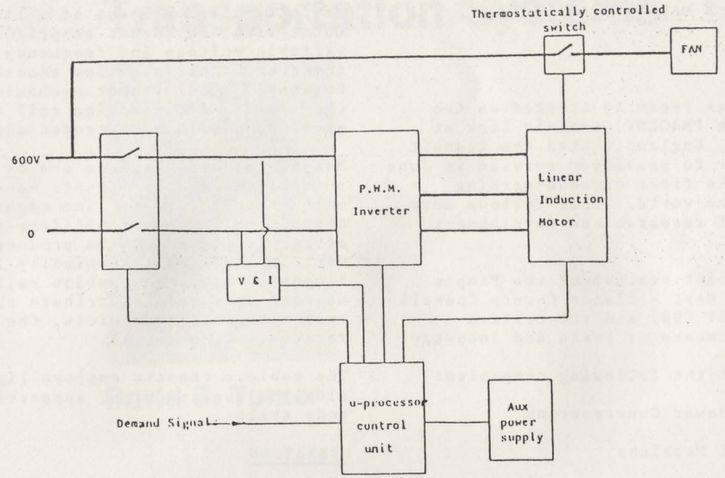


Figure 1 - Linear Motor Propulsion System

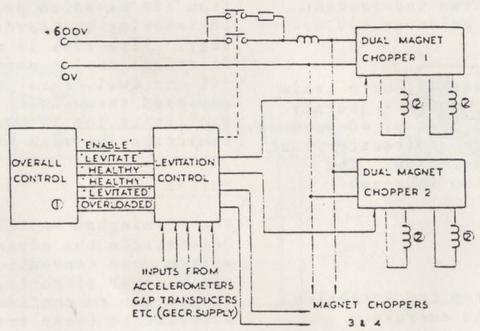


Figure 2 : Block Diagram of Suspension System

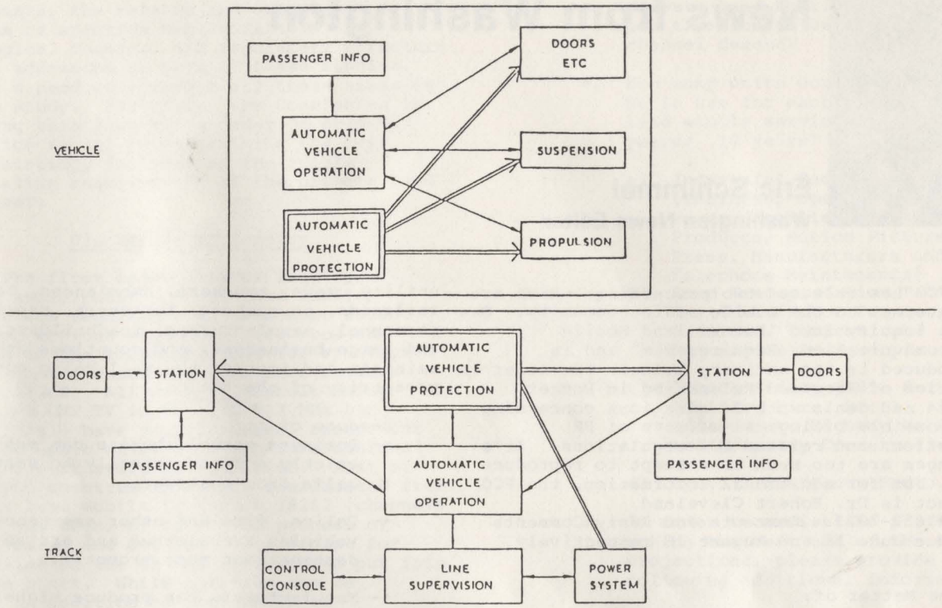


Figure 3 : Control System

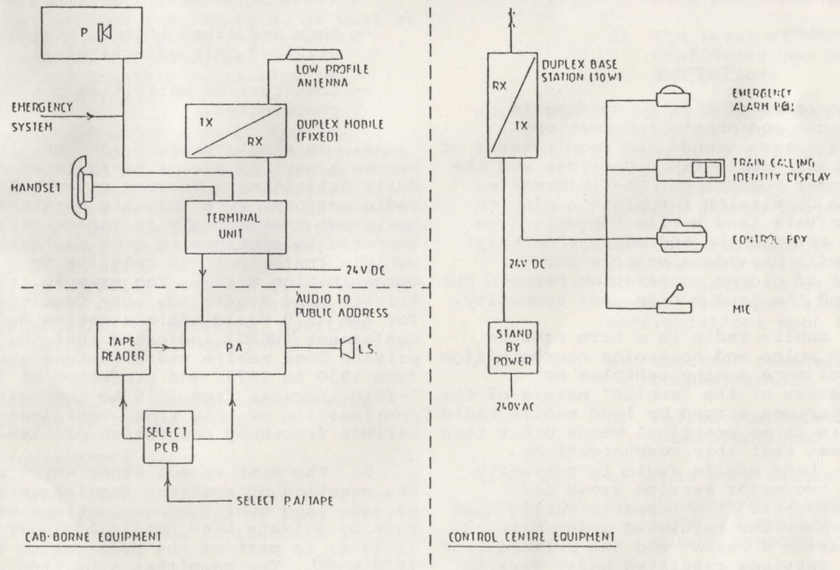
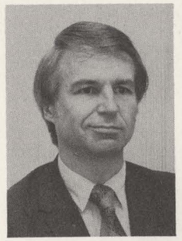


Figure 4 : Schematic Communications System



News from Washington

Eric Schimmel
Washington News Editor

The FCC has released two proceedings which are of interest to the mobile radio community. One is an inquiry into "Future land Mobile Telecommunications Requirements" and is reproduced in its entirety below. The other is a Notice of Proposed Rulemaking in Docket 79-144 and deals with 24 questions concerning the possible biological effects of RF radiation, and related FCC regulations. It's 43 pages are too much to attempt to reproduce here, but for additional information, the FCC contact is Dr. Robert Cleveland (202) 632-7073. Comments and Reply Comments are due June 18 and August 18 respectively.

In the Matter of:

Future Private Land Mobile Telecommunications Requirements) PR DOCKET NO. 82-10

NOTICE OF INQUIRY

Adopted: Jan. 13, 1982 Released: Jan. 26,1982

By the Commission:

Purpose

1. The purpose of this proceeding is to solicit comments and obtain information regarding the future trends amd requirements of the Private Land Mobile Radio Services and the land mobile user community. The information will help the Commission formulate a plan to accomodate private land mobile communication requirements through the end of this century. Further, it will provide a vehicle for establishment of closer cooperation between the Commission and the land mobile user community.

2. Land mobile radio is a term used to describe both voice and non-voice communication between two or more moving vehicles or persons. Because of the "mobile" nature of the vehicles or persons served by land mobile radio systems, there is no practical means other than radio which can meet this communications requirement. Land mobile radio is currently divided into two major service areas for regulatory purposes: The Domestic Public Land Mobile Radio Services regulated under Part 22 of the Commission's rules; and the Private Land Mobile Radio Services regulated under Part 90 of the Commission's rules. Although there is some overlap between these two service areas, this proceeding is concerned primarily with the Private Land Mobile Radio Services.

3. Private land mobile radio is used extensively by doctors, police, firefighters, utility crews, truckers, ambulances, taxis, railroads, newspapers, foresters, repair personnel, manufacturers, roadbuilders, small and large businesses, and countless others to maintain and improve the well being and prosperity of the nation.

Because of it:

-- Business establishments can respond more quickly and economically to service calls from customers.

-- Police, fire and other emergency vehicles are alerted and arrive at their destinations more promptly.

-- Manufacturers can produce higher quality products at lower cost.

-- Public utilities can respond more quickly to trouble calls.

-- Forest crews can put out forest fires with less personal danger and reduced loss of valuable timber.

-- Snow and other highway equipment can be utilized more effectively.

-- Construction activities can be better coordinated.

4. In short, private land mobile radio has become a part of almost every facet of our daily activities. Because private land mobile radio performs such valuable services, its use has grown tremendously in recent years, and is expected to continue to grow as fuel, labor and vehicle costs increase relative to communication costs. For example, the 1976 Private Land Mobile Advisory Committee report for the 1979 World Administrative Radio Conference (WARC) indicated that the number of private land mobile radio systems grew 43-fold from 1950 to 1975, and projected at least a 7-fold increase from 1975 to the year 2000. A continuation of this trend could result in a serious frequency congestion problem.

5. The most recent study which addressed the question of spectrum requirements for private land mobile communications was the one made by Private Land Mobile Advisory Committee, in 1976, as part of the preparation for the 1979 WARC. The committee submitted a report which contained information regarding projected spectrum requirements for private land mobile communications. It has now been almost six years since that report was submitted. There is clearly a need to review and update the projections developed for the WARC. In addition, while previous studies have

concentrated on the question of spectrum requirements, the related and critical questions of spectrum availability, Technological changes, and regulatory structure were not addressed as part of these studies. There is a need to consider all these areas in a single study. Therefore, the Commission is initiating this Inquiry in order to obtain information to aid in determining the best overall strategy for meeting the future communication requirements of the private land mobile user.

Discussion of Inquiry

6. The first major area of inquiry concerns anticipated private land mobile communication requirements. The most recent Commission actions which resulted from an awareness of the increased need for spectrum for land mobile communications were Dockets 1821 and 18262. All of the channels being shared with UHF TV in the 470-512 MHz band (Docket 18261) have been assigned, except for those geographic areas in which international agreements must still be completed. Most of the 800 MHz spectrum which was reallocated from UHF TV to land mobile in Docket 18262 (channels 70 - 83) has been, or is in the process of being released and put into use, except for what remains of the 45 MHz of spectrum put into a reserve block. While spectrum may be required in addition to that which is eventually made available to land mobile from the 45 MHz reserve, a reasonably accurate estimate of how much spectrum will be needed is not available. One objective of this Inquiry is to solicit comments from the private land mobile user community on anticipated spectrum requirements through the end of this century. Projections should allow for expansion of current communication requirements, as well as any additional communication requirements resulting from new technologies, new applications and possible relaxation of restrictive standards.

7. The second major area of inquiry concerns possible sources of spectrum to meet future private land mobile communication requirements. Increased communications requirements can be met in a number of ways: Additional spectrum; narrower channels; sharing with other services; and technological innovations which allow increased communications capacity within a given amount of spectrum. The Commission is seeking comments on a number of potential spectrum sources, in terms of their desirability and/or feasibility.

8. Therefore, the Commission requests comments in the following areas:

Spectrum Requirements

1. What factors are likely to affect the rate of growth of land mobile communications in the next 10-20 years?

2. What new land mobile communication applications do you anticipate over the next 10-20 yrs.? What will be the impact on spectrum requirements?

3. What is the most appropriate unit for measuring spectrum use in the private land mobile services? How can these units be translated into channel demand?

4. How many units would you project to be in use for each of the following land mobile service categories in 5 years? 10 years? 20 years?

   a) Industrial Radio Services (Business, Special Industrial, Power, Petroleum, Forest Products, Motion Picture, Relay Press, Manufacturers and Telephone Maintenance)
   b) Land Transportation Radio Services (Motor Carrier, Railroad, Taxicab, and Automobile Emergency)
   c) Public Safety Radio Services (Police, Fire, Local Government, Highway Maintenance and Forestry Conservation)
   d) Special Emergency Radio Services

5. In order to assist the staff in making the best use of the above projections, please provide the following additional information:

   a) Major assumptions upon which each projection is based;
   b) Sources of data used for each projection;
   c) The methodology used to develop each projection;
   d) The level of statistical confidence you have in each projection;

6. What would you suggest as reasonable channel loading levels for each of the above land mobile service categories in order to translate usuage projections into channel demand projection?

7. Do you forsee specific system requirements within the next 10 - 20 years which would necessitate special spectrum configurations such as:

   a) Unpaired channels for 1-way communication?
   b) Paired channels for 2-way communications?
   c) Data only channels?
   d) Contiguous channels for wideband systems, including spread spectrum?
   e) Other (please specify)?

8. Do you see a need to make special allocations to accommodate any of the above system types? If so, how large would you suggest these allocations be?

Spectrum Availability/Suitability

1. How would you rank the following approaches to providing additional spectrum for private land mobile? Why?

   a) Possible new exclusive or shared allocations.

   b) Increased sharing between land mobile and other services (e.g., UHF-TV Broadcastind, review of present TV assignment standards).

   c) Use of new, more efficient narrowband or wideband technologies and systems such as trunking, cellular, digital, ACSB, and spread spectrum.

2. How much additional communication service might be accommodated under each approach in various geographic areas?

3. What problems are associated with each approach (e.g., interference, competing spectrum demands)?

4. Are there other approaches that should be considered? What are their advantages or disadvantages?

5. How might the various approaches interact with each other (e.g., using new technology and releasing reserve spectrum)?

6. Should the current private land mobile service categories be regrouped, redefined or ranked? If so, how?

7. To what extent can technical improvements be expected to substitute for additional spectrum requirement; in the various services? When do you expect these technical improvements to be available?

8. To what extent can new common carrier services (e.g., cellular substitute for additional private land mobile spectrum?

9. How is current spectrum availability/suitability affected by existing technical standards? Can these standards be modified to increase availability/suitability? If so, how?

10 What approaches to establishing technical standards will provide maximum spectrum availability/suitability for new applications and new technologies? What approaches would provide maximum benefits from utilization of new technologies?

9. The Commission recognizes the broad scope of this Inquiry and the inherent difficulty in projecting private land mobile communication requirements for the future. However, the information obtained in this Inquiry will be useful only to the extent that it is specific and comprehensive. Commenters are encouraged to provide detailed information about the future requirements for private land mobile communications and the availability of suitable radio spectrum so that the Commission staff can evaluate all possible regulatory alternatives.

Administrative

10. Accordingly, the Commission adopts this Notice of Inquiry, under the authority contained in Sections 4(i) and 303(r) of the Communications Act of 1934, as amended, 47 U.S.C. 154(i) and 303(r). Pursuant to the procedures set out in Section 1.415 of the Commission's Rules, 47 CFR 1.415, interested persons may file comments on or before June 9, 1982 and reply comments on or before July 7, 1982. All relevant and timely comments will be considered by the Commission before final action is taken in this proceeding. In reaching its decision, the Commission may take into consideration information and ideas not contained in the comments, provided that such information or a writing indicating the nature and source of such information is placed in the public file and the fact of the Commission's reliance on such information is noted in the Report and Order.

11. In accordance with the provisions of Section 1.419 of the Commission's Rules, 47 CFR 1.419, formal participants shall file an original and five copies of their comments and other materials. Participants wishing each Commissioner to have a personal copy of their comments should file an original and 11 copies. Members of the general public who wish to express their interest by participating informally may do so by submitting one copy. All comments are given the same consideration, regardless of the number of copies submitted. All documents will be available for public inspection during regular business hours in the Commission's Public Reference Room at its headquarters in Washington, D. C.

12. Points of contact on this matter are Joseph A. Levin and Arthur J. Radice (202) 254-3301.

More on Spread Spectrum

A number of readers of our November issue, in which we reprinted FCC Docket 81-413 (Notice of Inquiry into Spread Spectrum and other wideband emissions), have requested additional references on that subject. In response, we are reproducing below, those which appeared in various footnotes.

Footnotes From FCC Spread Spectrum Docket #81-413

1/ Although there is no universally accepted measure of spectrum efficiency, it can be defined in general terms as the ratio of communications accomplished to spectrum used. These terms as the ratio of communications accomplished to spectrum used. These terms are usually difficult to quantify, but they may involve parameters such as: information delivered, users satisfied, radio frequency

bandwidth occupied, geographical area covered and the time the spectrum is denied to other users. For a detailed discussion of metrics in this area see D. Hatfield, "Measures of Spectral Efficiency in Land Mobile Radio", IEEE Transactions on Electromagnetic Compatibility, Vol. EMC-19, No.3, Aug. 1977, p. 266 and D. R. Ewing and L. A. Berry, "Metrics for Spectrum-Space Usage", Office of Telecommunications, OT Report 73-24, 1973.

2/ J. P. Costas, "Poisson, Shannon, and the Radio Amateur", Proc. IRE, Vol 47, pp. 2058-2068, December 1959.

4/ On March 6, 1981 the Private Radio Bureau issued a Special Temporary Authorization (STA) to the Amateur Radio Research and Development Corporation (AMRAD) for the purpose of conducting experiments on spread spectrum modulation. In order to permit spread spectrum, the STA waived two sections of the Commission's Rules. Thus, even the Amateur Radio Service, which is dedicated "to the advancement of the radio art", implicitly forbids spread spectrum modulation.

5/ International Telecommunication Union, International Radio Consultative Committee, Recommendations and Reports of the CCIR, 1978, XIVth Plenary Asembly, Kyoto, 1978, "Spread Spectrum Modulation Techniques", Report 651, Volume 1, pp. 4-14.

6/ R. C. Dixon, Spread Spectrum Systems, New York, Wiley-Interscience, 1976, p. 3.

7/ Spread Spectrum Techniques, ed. Robert C. Dixon, New York, IEEE Press, 1976. Walter C. Scales, "Potential Use of Spread Spectrum Techniques in Non-Government Applications", The MITRE Corporation, PB 81-165284, December 1980.

8/ George R. Cooper, Ray W. Nettleton, and David P. Grybos, "Celluar Land Mobile Radio: Why Spread Spectrum?", IEEE Communications Magazine, Vol. 17, No. 2, pp. 17-24, March 1979; Robert P. Eckert and Peter M. Kelly, "Implementing Spread Spectrum Technology in the Land Mobile Radio Services", IEEE Transactions on Communications, Vol. COM-22, pp. 867-869, August 1977.

9/ L. A. Berry and E. J. Haakinson, "Spectrum Efficiency for Multiple Independent Spread-Spectrum Land Mobile Radio Systems", U.S. Department of Commerce, National Telecommunications and Information Administration, Report 78-11, PB-291539, November 1978.

10/ Report and Order, PR Docket 80-9, adopted January 8, 1981, FCC 81-1, For information concerning the ability of spread spectrum systems to share spectrum with conventional systems, see the following submissions:
Comments of Delnorte Technology, Inc. dated 3/31/80.
Reply Comments of Hewlett-Packard Company dated 5/15/80.
Reply Comments of American Telephone and Telegraph Company dated 5/16/80.

11/ International Telecommunication Union, International Radio Consultative Committee, Recommendations and Reports to the CCIR, 1978, XIVth Plenary Assembly, Kyoto, 1978, "Considerations of Interference from Spread-Spectrum Systems to Conventional Voice Communications Systems", Report 652, Volume 1, pp. 14-22.

12/Leonard Farber and J. Cormack, "Performance of Voice Communications Systems in the Presence of Spread Spectrum Interference", IIT Research Institute, Report No. ESD-TR-77-005, AD A050844, December 1977.

13/ J. R. Juroshek, "A Preliminary Estimate of the Effects of Spread-Spectrum Interference on TV", U.S. Department of Commerce, National Telecommunications and Information Administration, Report 78-6, PB-286623, June 1978.

14/ J. R. Juroshek, "A Compatability Analysis of Spread-Spectrum and FM Land Mobile Radio Systems", U.S. Department of Commerce, National Telecommunications and Information Administration, Report 79-23, PB-300651, August 1979.

15/ Paul New House, "Procedures for Analyzing Interference Caused by Spread-Spectrum Signals", IIT Research Institute, Report No. ESD-TR-77-003, AD A056911, February 1978.

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