



IEEE

VEHICULAR TECHNOLOGY SOCIETY

NEWSLETTER

Vol. 37, No. 3, August 1990

ISSN 0161-7887

Editor: A. Kent Johnson

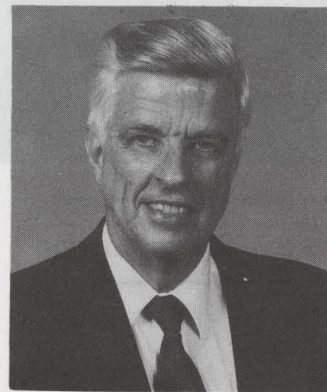


**People Mover
at Orlando
International
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Currently
Handling 16
Million
Passengers per
Year**



President's Message

George McClure
President
IEEE Vehicular Technology Society



Your Society is making great strides in keeping abreast of advancing mobile technology and its applications--whether to microcell mobile telephone, digital cellular, satellite-based tracking and communications systems, electric vehicles, mobile information systems, or transit control. The diversity of papers presented at our three conferences, VTC'90, NVIS, Joint Rail Conference, and at the workshop on vehicular electronics at CONVERGENCE, illustrates the point.

Renewed interest in standards is being shown, especially in applications such as data transfer for highway information, vehicle database systems, and interfaces and equipment for data transfers involved in control of rail cars. IEEE is anxious to support such standards activity, and VTS is a logical focal point for standards development in our areas of interest. Jesse Russell is chairman of our standards committee and will welcome any suggestions you may have for standards initiatives where VTS can serve its technical community.

Attention is turning once again toward electric vehicles. Utilities like the idea of their power plants being kept busy at night recharging batteries. Environmentalists like the resulting cleaner highways. The designer of the Gossamer Albatross, a human-powered flying machine that crossed the English Channel in 1979, has turned his energies toward efficient electric vehicles and the General Motors Impact is the result. Batteries with higher energy densities will greatly help acceptance of electric vehicles in the marketplace, but even with lead-acid batteries, a 120-mile cruising radius between charges is achievable when friction is minimized and low-loss control systems are used. With required replacements of present batteries, costs to own and operate an electric vehicle are 15 percent higher than for a comparable gasoline-powered car. Better battery technology is the key to market acceptance. Both the Electric Power Research Institute and the U.S. Department of Energy are testing a battery capable of 70 percent more full discharge cycles than the standard lead acid battery. This work bears watching.

With our very successful 1990 Fourtieth Annual Vehicular Technology Conference now history, we look forward to the vehicular electronics workshop, organized by Roger Madden, to be presented at CONVERGENCE '90 in Dearborn, Michigan, in October, and to 1991 when we will have the second VNIS conference, in Detroit, and our VTC'90 at the same location as the Joint Rail Conference, in St. Louis.

Our thanks to Frank Thatcher, our new chairman of the Papers Awards Committee, for putting us back on schedule in recognition of our fine authors: to Bill Lee for his planning of digital cellular conference panels and special Transactions issues, and to Transactions Editor Sang Rhee and his staff (J.R. Cruz, Communications; Giorgio Rizzoni, Vehicular Electronics; and Richard Uher, Transportation Systems) for their fine work in expanding our Transactions and shortening the time required for the review process. Special thanks to Kent Johnson, our Newsletter Editor, and to all his contributing editors, for the fine work they do in making our newsletter both newsworthy and readable.

Our Committee on 900 MHz Propagation will be active once again, now under the able leadership of Greg Stone.

We are continually seeking volunteers from among our members to aid in making our Society more effective in meeting the needs of its members. If you have suggestions or can offer assistance, please contact me.

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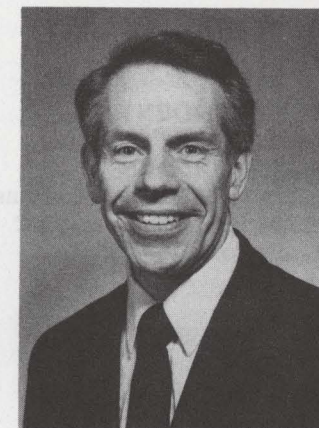
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Editor's Notes



A. Kent Johnson
Newsletter Editor

ELECTION RESULTS

We have held the presses on this issue of the newsletter in order to include results from the recently completed election for 5 members of the Board of Governors. I'll have to confess that some other factors influenced the lateness of this issue, but since we were late anyway we did hold for the election results. We extend our congratulations to the following who were recently elected to a term extending to the end of 1992:

- Linda Sue Boehmer -
- A. Kent Johnson -
- Samuel A. Leslie -
- Fred M. Link -
- Samuel R. McConoughey -

DAVID TALLEY PASSES AWAY

It is with regret that we announce the passing of our long time associate David Talley. Dave had recently been serving as Financial Advisor to the VTS Board of Governors. He passed away on Sunday, June 24, 1990.

IEEE Vehicular Technology Newsletter is published quarterly by the Vehicular Technology Society of The Institute of Electrical and Electronics Engineers, Inc. Headquarters: 345 East 47th Street, New York, NY 10017-2394. \$1.00 per member per year (included in Society fee) for 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. *Postmaster:* Send address changes to IEEE Vehicular Technology Newsletter, IEEE, 445 Hoes Lane, Piscataway, NJ 08854-4150.

Month of Issue	Final Copy to be Rec'd By VTS Editor	Target Mailing Date
November	9-14-90	10-12-90
February	12-28-90	1-31-91
May	3-10-91	4-14-91
August	6-7-90	7-12-90

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Vehicular Electronics (cont. from p. 14)

- R. Jurgen, "Mitsubishi Stops Show With Giant-Screen TV," *IEEE, The Institute*, p.6, March, 1990.
- "Technics Introduces 'Intelligent' Stereo," *Automotive Electronics Journal* p.27, February 12, 1990.
- C. Rowan and C. Altgelt, "The Reinvention of the Wheel: Progress in Car Radios and Their Future," presented at the SAE International Congress, Detroit, MI, Paper 900039, February 26, 1990.
- P. Frame and P. Alling, "Takata Planning Air Bag Blitz -- Joe Ziomek Leaves TRW For Takata's Ultra-Secret Skunkworks," *Automotive Electronics Journal*, page 1 and p.31, October 9, 1989.
- P. Frame, "Joe Blowin' In the Wind -- Joe Ziomek Leaves Takata For The Analytic Sciences Corporation," *Automotive Electronics Journal*, p.4, May 7, 1990.

OTHER EVENTS OF INTEREST

Event: Second Rutgers Workshop on Third Generation Wireless Information Networks
Date: October 18-19 1990
Location: Ramada Renaissance East Brunswick, New Jersey, USA
Contact: Sanjiv Nanda
 WIN Workshop
 Department of Electrical and Computer Engineering
 Box 909, Piscataway, NJ 08855-0909, USA
 Phone: (201) 932-5954
 Fax: (201) 932-3693

Professional Activities (cont. from p. 15)

I hope this discussion will make the reader more skeptical about dire predictions related to our numbers or ability to meet the needs of the nation and its people. Question the sources of data. Analyze situations in fundamental economic terms. When engineer shortages are mentioned, ask "at what salary level?" As always I welcome your comments.

Chapter News



Gaspar Messina
Chapter News Editor

Meetings

Philadelphia (Joint VTS/Land Transportation Division)

Subject: A New Conceptual Design For Bridge Pratt Terminal
By: Mr. P. Takis Salpeas
 SEPTA
 714 Market Street
 Philadelphia, PA 19107
Held: April 12, 1990
Attendance: 49 (36 guests)

Subject: 25 Hz For Electric Traction - A Special Case
By: Mr. Belknap Freeman
 119 Hickory Lane
 Bryn Mawr, Pennsylvania 19010
Held: May 10, 1990
Attendance: 40 (19 guests)

Philadelphia (Joint VTS/Land Transportation Division/EMC/IAS)

Subject Utility Corridor Design: Power Transportation Lines, Railroads and Pipelines
By: Mr. Marvin Frazier, Senior Scientist
 Basic Industry Research Laboratory,
 Northwestern University
 1801 Maple Avenue
 Evanston, Illinois 60201-3135
Held: June 14, 1990
Attendance: 31 (6 guests)

Washington, D.C. VTS/Land Transportation Committee

Subject: Benefits Of AC Drive
By: Mr. Karl Berger, Principal
 Lea & Elliott
 Washington, D.C.
Held: February 13, 1990
Attendance: 28 (14 guests)

Subject: The Georgetown Branch Study
By: Mr. Glenn S. Orlin, P.E., ACIP
 Montgomery County DOT
 Rockville, Maryland
Held: March 13, 1990
Attendance: 33 (11 guests)

Toronto Vehicular Technology Society

Subject: Impulse Noise in Land Mobile Communications
By: Mr. Gene Dempsey, Threshold Communications
 P.O. Box 188
 Brampton, Ontario L6V2L1
 Canada
Held: April 25, 1990
Attendance: 4

Gaspar Messina, Physicist/E.E.
 Editor and Chapter Activities Chairman
 9800 Marquette Drive
 Bethesda, Maryland 20817

CALL FOR PAPER

IEEE/ASME JOINT RAILROAD CONFERENCE
MAY 21-23, 1991
ST. LOUIS, MISSOURI

The Land Transportation Committee of the IEEE Vehicular Technology Society is seeking abstracts for technical papers to be considered for presentation and discussion at this conference.

Papers which review topics of current interest in the areas of system design, hardware development, and transportation technology advances with the aim to improve the operation of railroad and transit systems and increase their cost-effectiveness, are being sought. **Topics can include:**

- AC and DC propulsion systems
- Electromagnetic compatibility
- Automation and microcomputer control
- Signal and Communication Systems innovations
- Maintenance procedures, Monitoring and fault detection
- Safety and assurance programs
- High speed transportation systems
- Magnetic levitated systems
- People mover systems
- Transportation systems, the next generation
- Traction electrification system alternatives
- Energy efficient systems and energy conservation methods
- New transit system starts
- Computer modeling and simulation of transportation systems

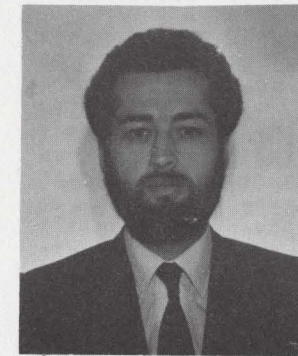
Authors are requested to submit five copies of the abstract for their proposed paper by September 30, 1990 to:

Robert B. Fisher
Meetings Chairman
Land Transportation Division, IEEE-VTS
Southeastern Pennsylvania Transportation Authority (SEPTA)
5800 Bustleton Avenue
Philadelphia, PA 19149

Selected papers are to be submitted on IEEE "Author's Kit" format by December 14, 1990.

For further information, call: **Robert Fisher (215) 580-4888**

Communications



J. R. Cruz
Communications Editor

ABSTRACTS

"Multiple-Symbol Differential Detection of MPSK," Dariush Divsalar, and Marvin K. Simon, IEEE Transactions on Communications, Vol. 38, No. 3, March 1990.

A differential detection technique for MPSK, which uses multiple-symbol observation interval, is presented and its performance analyzed and simulated. The technique makes use of maximum-likelihood sequence estimation of the transmitted phases rather than symbol-by-symbol detection as in conventional differential detection. As such the performance of this multiple-symbol detection scheme fills the gap between conventional (two-symbol observation) differentially coherent detection of MPSK and ideal coherent of MPSK with differential encoding. The amount

of improvement gained over conventional differential detection depends on the number of phases M and the number of additional symbol intervals added to the observation. What is particularly interesting is that substantial performance improvement can be obtained for only one or two additional symbol intervals of observation. The analysis and simulation results presented are for uncoded MPSK.

"Generalised ENCAP-4^N Digital Modulation Technique," A. Gusmao, and N. Esteves, IEE Proceedings, Vol. 137, Pt. I, No. 2, April 1990.

A class of encoding schemes for generating offset-QPSK-type signals is introduced. Each scheme supposes the specification of 4^N functions directly related to the eye-diagrams of the in-phase and quadrature signal components. The digital implementation of the encoding rules, by table look-up techniques, is straightforward, and leads to a flexible and cost-effective transmitter that allows high spectral efficiencies to be achieved without any selective linear filtering. The main features of the proposed modulation format are described, namely its connections with

well known modulation formats. It is shown that the new signal design method provides a unified representation of all OQPSK-type (MSK-type) signals recommended so far (IJF-OQPSK, TFM, GMSK, XPSK, 12PM3X, etc.), and allows the generation of a large variety of new signals. The conditions under which a linear filter and a nonlinear amplifier preserve the proposed format are discussed. It is also pointed out that, in most practical situations, the encoding rules can be modified so as to allow the transmission of a nonlinearly amplified signal of the proposed class, having a variable envelope.

PAPER OF THE YEAR

By Frank Thatcher

During the Orlando conference the Paper of the Year committee chaired by Frank Thatcher met to develop a more equitable and efficient method of selecting authors deserving an award. The plan which is now being implemented is designed to have a list of nominees ready for final consideration by the end of February of the following year. The selection will be approved by the end of March which will allow ample time for the preparation of certificates and checks to be presented at the next Awards Luncheon.

Awards announced during the 1990 conference were as follows:

PAPER OF THE YEAR (Two selected \$500 award for each)

Paper - "A Vector Space Solution To Incipient Sensor Failure Detection With Application To Automotive Environments"

Authors - P.S. Min PHD and W.B. Ribbens PHD

Paper - "Magnetostrictive Torque Sensor Performance, Nonlinear Analysis"

Author - W.J. Fleming PHD

BEST TRANSPORTATION PAPER (Two selected \$250 award for each)

Paper - "Field Test On A MAGLEV With Passive Guideway Linear Inductor Motor Transportation System"

Authors - T. Boldea PHD, A. Trica PHD, G. Papusoiu PHD and S.A. Nasar PHD

Paper - "Rail Transit Chopper Traction Interference Modeling Using The SPICE Circuit Simulation Package"

Authors - R.J. Hill PHD, S.L. Yu and N.J. Dunn

BEST COMMUNICATIONS PAPERS (Two selected \$250 award for each)

Paper - "On Optimum Combining At The Mobile"

Author - R.G. Vaughan PHD

Paper - "The Performance Of Trellis Coded Multilevel DBSK On A Fading Mobile Satellite Channel"

Authors - M.K. Simon PHD and D. Divsalar PHD

Transportation Systems



Bob McKnight
Transportation Systems
Editor

CALL FOR PAPERS FOR JOINT RAILROAD CONFERENCE IN 1991

A call for papers has been issued by the 1991 Joint Railroad Conference to be held May 21-23 in St. Louis, MO. Topics can include AC and DC propulsion systems, EMI compatibility, signal and communication systems innovations including microprocessor controls, various transportation systems including light rail, rail rapid transit, freight railroading, high-speed rail and others including people movers and magnetic levitation.

Authors are requested to send five copies of abstract by September 30, 1990 to Robert B. Fisher, PE, Meetings Chairman, LTD, IEEE-VTS, SEPTA, 5800 Bustleton Ave., Philadelphia, PA 19149. For further information call Bob Fisher at 215-580-4888.

JOINT RAILROAD CONFERENCE IN CHICAGO WAS A SUCCESS FOR ASME/IEEE

The 1990 ASME/IEEE Joint Railroad Conference held April 17-19 in Chicago had over 175 electrical and mechanical engineers in attendance. Four sessions included presentations of 23 papers, plus two luncheon speakers.

At the April 18 lunch, attendees were told of the success in welding rail commuter service (METRA- Metropolitan Rail), rapid transit (CTA- Chicago Transit Authority) and buses in the Chicago, Illinois metropolitan area covering five counties.

At the April 19 lunch, a Department of Energy consultant reported on a study made of feasibility of magnetic levitation systems done by the Argonne National Laboratory. Such mag-lev systems could operate up to 300 mph, on dedicated rights-of-way (proposed on the outside portions of existing Interstate Highways) and connecting airports of major cities. Costs were estimated at between \$10 and \$25 million per mile.

Newly elected officers of the Land Transportation Division of the Vehicular Technology Society, IEEE are: Chairman T. A. Kneschke of LTK Engineering Services, Vice Chairman J. U. Castellani of AEG Westinghouse, Secretary-Treasurer, Roger Avery of LS Transit Systems, Meetings Chairman R. B. Fishers of Southeastern Pennsylvania Transportation Authority, and Immediate Past Chairman Anthony Daniels of Morrison-Knudson Engineers. Linda Sue Boehmer of LSB Associates is running for the Board of Governors of VTS. Election results are not known at press time.

The 1991 IEEE/ASME Joint Railroad Conference will be held May 21-23 at the Sheraton-Westport Hotel in St. Louis, MO. This railroad meeting will be held in conjunction with the 41st Annual Conference of the IEEE Vehicular Technology Society, May 19-22, 1991.

This 1990 Chicago Joint Railroad Conference was sponsored by the Rail Transportation Division, American Society of Mechanical Engineers and the Land Transportation Division, Vehicular Technology Society of the Institute of Electrical & Electronics Engineers, and received cooperation from the American Society of Civil Engineers.

Abstracts of the papers presented at the April 1990 ASME/IEEE Joint Railroad Conference are presented herewith:

EFFECT OF MAINTENANCE PRACTICES UPON PERFORMANCE OF FREIGHT CAR RAILROAD TRUCKS, A PROGRESS REPORT

By V. Terry Hawthorne, Vice President Engineering, and R. D. Wronkiewicz, Senior Project Engineer, both of American Steel Foundries; and R. P. Sellberg, Director Engineering, Trailer Train Corp.

For many years the condemning limit for truck wear has been based upon shoe wear (with an indicator cast in the shoe) or "shoe rise". The values selected for the condemning limits were based upon geometrical considerations of the truck design and extensive road testing. The introduction of New and Untried Car Analytic Regime Simulation (NUCARS) now permits an analysis by specific car design with Association of American Railroads (AAR) Chapter XI promoting a basis for the expected performance of the vehicle.

A joint effort between American Steel Foundries and Trailer Train to quantify the effect of truck wear upon truck performance. Three measurable parameters were selected to evaluate the effect of wear upon the suspension system; warp stiffness, damping force, and spring force-displacement characteristics. There was a NUCARS analysis of the Trailer Train bi-level auto-rack car to determine the effect of wear upon the ride and hunting performance. This phase of the program established the feasibility of using shoe height as an indicator of the performance of the vehicle.

A REVIEW OF RAIL CORRUGATION PROCESSES UNDER DIFFERENT OPERATING MODES

By Donald R. Ahlbeck of Battelle Institute and Larry E. Daniels of Parsons, Brinckerhoff, Quade & Douglas.

An extensive literature review was conducted as part of a study of rail corrugations on the Baltimore, MD Metro track. Results of the review revealed basic differences in long wavelength (heavy haul railroad) and short wavelength (transit and higher speed passenger railroad) corrugations were established. The appreciation of these differences, along with analysis of the experimental data from both wayside and on-board transducers, allowed a focused theoretical analysis of the corrugation problem.

The overall corrugation problem is discussed, based on the results of the literature review. Some general conclusions and methods for controlling corrugations are presented.

SYSTEM CONSIDERATIONS FOR HEAVY HAUL DIESEL-ELECTRIC LOCOMOTIVES WITH THREE-PHASE TRACTION MOTORS

By R. W. Becker, AC Traction Systems Engineer, and J. S. Boggess, Project Engineer, both of Three Phase Traction Development, Electro-Motive Division, General Motors Corp.

Locomotive transmission systems incorporating three-phase traction motors and power inverters utilizing the latest power semiconductor devices are being considered for the next generation of heavy haul diesel-electric locomotive models. Technological developments in power semiconductors and in improved methods of cooling these devices are responsible for pursuing the application of three phase induction motors to traction drives. EMD and Siemens AG are currently active in jointly developing high tractive effort locomotive models with such drives.

A locomotive transmission study has been performed to determine the requirements and design of new three phase traction drive components for independent bogie control on a 6-axle freight locomotive. System considerations that affect locomotive high tractive effort capability and component ratings were investigated using computer models of the traction drive components. These include traction motor load sharing due to wheel-rail friction creep conditions, bogie weight shift, motor torque-speed characteristics and wheel diameter variations.

SOFTWARE DESIGN CRITERIA FOR THE SAFETY-CRITICAL PROTECTION OF AUTOMATED TRANSIT SYSTEMS

By Gary S. Krut of AEG Westinghouse Transportation Systems, Inc.

At AEG Westinghouse Transportation Systems microcomputers have been used in safety-critical applications since 1978. As the microcomputer replaced discrete logic in safety-critical applications, it became necessary to re-examine the methodologies used to analyze, design

and test such products. From these new methodologies, 15 software design rules have been established to assure the safety of our automatic transit systems.

AN AUTOMATIC SPEED ENFORCEMENT SYSTEM FOR HEAVY FREIGHT TRAINS

By Gerhard A. Thelen, Assistant Vice President Quality Control, and Y. H. Tse, Director Mechanical Engineering, both of Consolidated Rail Corp.

This paper describes an automatic speed enforcement (ASES) system developed specifically for use on heavy general merchandise, unit and intermodal trains. The automatic train control system was overlaid onto the existing continuous cab signal system on Amtrak's Northeast Corridor.

Earlier speed control systems pneumatically enforced locomotive air brake applications. With these speed control systems, 8 seconds after a downward change of the signal, the locomotive engineer was required to make a gradual air brake application up to full service to suppress penalty braking. Running releases from such service braking in certain types of terrain and train make-up can lead to severe in-train forces in freight trains.

With the new automatic system, a microprocessor is used to generate a speed profile corresponding to a specific change of cab signal. The system monitors train speed and, following a downward change of cab signal, requires that train speed be gradually reduced as the train moves farther into the block. The engineer can use a minimal air brake application, throttle reduction, dynamic braking, or a combination of the three to comply with the speed limit safely. A penalty brake application is imposed when the speed profile is violated.

HIGH SPEED RAIL TRANSPORTATION ON EXISTING INFRASTRUCTURE- THE SWEDISH APPROACH

By Per-Erik Olson of SwedeRail Consulting AB

The paper describes the background for the track/train dynamics research and development carried out in Sweden as a joint effort between the operating and the producing and constructing interests. The policy to utilize the infrastructure for both high-speed passenger and fast-freight is discussed, and the development and introduction of the X2 Fastrain passenger system is reviewed.

BENEFITS OF DRIVE ADVICE SYSTEM FOR LIGHT RAIL COMMUTER LINES

By Gordon W. English, Canadian Institute of Guided Ground Transport, Queen's University, and B. R. Benjamin and P. J. Pudney of the School of Mathematics and Computer Science, South Australian Institute of Technology.

The effectiveness of a microprocessor based coast advice system

for commuter train operations is evaluated via computer simulation. A software and hardware system developed by the South Australian Institute of Technology is tested on a 4-car Government of Ontario (GO) Transit train operating in normal service on the Lakeshore route near Toronto. Predicted fuel savings range from 10% to 20% depending on the locomotive used. There was good agreement between the simulation analysis and revenue service test results.

ANALYSIS OF RAILWAY VEHICLE SYSTEM DYNAMICS WITH THE MULTIBODY PROGRAM MEDYNA

By W. Kortum of DLR German Aerospace Research Establishment, Institute for Flight Systems Dynamics

The general purpose program MEDYNA is described with respect to its capabilities for analyzing the dynamics of railway systems. MEDYNA is an integrated approach, based on the method of multibody systems for simulating the dynamics of a large variety of mechanical systems.

The modeling capabilities, the computational methods and software aspects are addressed. Special emphasis is placed on MEDYNA's modeling assumptions for the wheel-rail contact mechanics and the railway operational modes such as critical speeds, dynamic curving and vehicle-guideway interaction. The use of MEDYNA for typical problems associated with the development of the ICE (high speed) train is demonstrated.

ALTERNATE FORMS OF MOTIVE POWER FOR SUBURBAN RAIL RAPID TRANSIT

By J. William Vigrass, Project Director, Hill International, Inc.

The purpose of this paper is to stimulate thought into consideration of unconventional modes of rail motive power.

The high capital cost of extending existing or new rail rapid transit lines into the more distant suburbs may have been a deterrent to implementation of some proposed extensions. Such high costs are caused, in part, by the use of third rail electrification with the perceived need for full grade separation. The longer the extension the less the traffic on its outer extremities is a general condition which works against extensions of full grade separated rail transit into the far suburbs.

Several forms of motive power are described that could offer much lower implementation costs for suburban rail rapid transit. The same concepts could apply to suburban electrified commuter railroads where electric operation is mandatory on critical center city terminal portions of a system. The proposed alternatives for heavy (i.e. high platform) rapid transit ought to have costs on the order of those usually associated with light rail transit, and yet would provide the spaciousness and comfort associated with suburban heavy

rail rapid transit.

The unconventional motive power units described herein are intended to allow extension of existing (or proposed) electric rail transit into distant suburbs using non-electrified railroad track that may be abandoned or used by an occasional freight train. Such existing rapid transit or commuter railroad lines are electrified because of underground operation in center cities. They generally have a roster of existing rolling stock that would have to be modified for use on non-electrified extensions and such modifications are described.

Precedent is cited in which transit trains have shared track with railroad freight trains.

METRO-NORTH/GE AC PROPULSION SYSTEM-RETROFIT PROGRAM

By T. M. McCarthy of Metro-North Commuter Railroad, and L. W. Ishler of GE Transportation Systems

Metro-North and GE are cooperating in a Demonstration Program for AC propulsion. Two DC powered 1100 Series Cars were retrofitted with the AC propulsion system. Extensive tests were conducted at GE on the propulsion system and now the cars are in revenue service at Metro-North. The demonstration test at Metro-North will continue throughout 1990.

In 1988, Metro-North and General Electric entered into an agreement under which GE would retrofit two of Metro-North's existing DCMU, 1100 series cars with variable voltage, variable frequency AC propulsion for revenue service testing purposes.

The braking system is a 26CMUE-80 electric pneumatic straight air pipe system supplied by New York Air Brake.

In order to accommodate the additions of dynamic as well as the possibility for regenerative braking, the brake system has been modified by the addition of an NYAB microprocessor controlled blending controller. This controller interfaces with the propulsion microprocessor and produces a blended brake rate equivalent to the air brake rate.

The driving reasoning for Metro-North's participation in this program is the opportunity to gain a great deal of experience with a number of technologies new to Metro-North which became available with the advent to railroads of microprocessor controllers and GTO (gate turnoff) inverters.

HOT-MIX ASPHALT RAILROAD TRACKBED SYSTEMS

By Jerry G. Rose and Yang Huang, both Professors of Civil Engineering, University of Kentucky

This paper describes and evaluates the use of hot mix asphalt (HMA) as a structural, confining and waterproofing layer for the rehabilitation and construction of railway trackbeds. Design procedures, typical installation practices, performance evaluations and economic considerations are discussed.

NEW HAVEN LINE CATENARY REPLACEMENT

By Michael W. Savchak, PE, Deputy Director Transportation Engineering, Metro-North Commuter Railroad.

Anyone who has observed the 1907 vintage catenary system while riding Metro-North Commuter Railroad's New Haven line must have been struck by the intricate tracery of the triangular overhead wires as they stretch out into the distance. It is especially dramatic to observe the wires at sunset from the rear of a speeding train, when one can watch the rhythmic rise and fall of the messenger silhouetted against a reddening sky. Unfortunately, aesthetics cannot overcome the effects of age, and the public's demand for efficient daily operation leaves little room for a system which requires an inordinate amount of daily maintenance and which is no longer reliable. The graceful old must be replaced with a more practical new.

The riding public is primarily concerned with items such as cleanliness of the equipment; whether the lights, heat or air conditioning work; and, most of all, whether the train arrives on time. As the power system is directly related to two of these concerns, Metro-North justly placed an emphasis on its modernization. Thus, in excess of \$277 million was set aside for the improvement to the railroad's power systems. This funding permitted the railroad to replace all of its obsolete rotary converter substations with 38 new solid state substations, replace approximately 200 miles of worn 70 lb. contact rail with new 150 lb. contact rail, provide remote control of all substations, and make other significant improvements. The replacement of the New Haven catenary system is the last major element of this program. This paper describes the engineering processes involved in the planning and design of this replacement project.

VALIDATION OF "SYSTEM 21" MONOBEAM TRANSIT WITH COMPUTER ANALYSIS AND LARGE MODELS

By L. K. Edwards, President, Futrex, Inc.; D. R. Ahlbeck, Manager, Dynamics Section, Battelle Memorial Institute; P. B. S. Lissman, Vice President, A.V. Dynamics; W. J. Mouton and R. O. Powell, both Professors at Tulane University.

Validation of four key features of the new SYSTEM 21 aerial rapid transit system are discussed:

- * Assessment of tension tie between car and beam.
- * Dynamic analysis of cars/trains traveling along the guideway at speeds up to 100 mph.
- * Analysis of guideway beam strength and rigidity.
- * Quarter-scale models to validate

outrigger kinematics and modular makeup of the guideway and station.

There are strong indications of suitability for operation at inter-city speeds as well. Most of this was done under a Department of Energy grant to

FUTREX in 1989, addressing issues identified by the National Bureau of Standards.

HOT BEARING DETECTION WITH THE "SMART BOLT"

By Ronald R. Newman, Director Applied Technology and Robert C. Leedham, Manager Instrumentation and Electronics, both of Burlington Northern Railroad; John Tabacchi, Project Manager, and David Purta, Scientist, both of Carnegie Mellon Research Institute; George C. Maderer, Development Manager and Richard Galli, Marketing Manager, Segment Development, both of General Railway Signal Co.

Current U.S. freight railway technology provides for automatic monitoring of defective, hot journal bearings through the use of intermittent wayside infrared detection devices. Standard practice is to place such wayside equipment at intervals of 15 miles or more along the right-of-way on certain lines. It has been proven that state-of-the-art roller bearings can fail in very short distances at moderate to high speeds, having passed a wayside detector at acceptable temperature only to encounter excessive temperature and catastrophic failure prior to reaching the next detector.

Advances in communication electronics and battery technologies as well as innovative packaging ideas have lead Carnegie Mellon Research Institute (CMRI) to the development of a thermal sensor-bolt which provides for "real time" continuous monitoring of bearing temperatures. The thermal sensor replaces a standard bearing end cap bolt at each end of an axle. The thermal sensor and transmitter contained in the body of the bolt, when activated, transmit a distress signal directly to the engineer in the locomotive. The system consists of a battery as a power source, a thermo-mechanical sensor and actuator, a transmitter and a receiver.

CMRI under the sponsorship of Burlington Northern Railroad and General Railway Signal has carried out an extensive joint development program, testing the system and various components in the laboratory, in a railroad yard and at AAR's Pueblo Test Center. Additional tests in railroad service will continue at Burlington Northern as the Smart Bolt production models are manufactured by GRS.

ELECTRIC TRACTION- A SPECIFIC CASE

By Belknap Freeman, Consulting Engineer

With standard off-the-shelf equipment there have been several conversion projects in the United States to convert electrified railroads from either 25 Hz or direct current electric traction configurations to 60 Hz arrangements directly connected to the 60 Hz transmission lines of utilities. With a recognized need to either rehabilitate and/or replace the largest system in the U.S. (New York to Washington Corridor), one is faced with

technical, operational, economic and political issues. This paper highlights some of the major issues bear on a contemporary question of 25 Hz at 12 Kv vs 60 Hz at 25 Kv. It is an interesting question when one recognizes in the Northeast Corridor there are considerations not applicable to the conversion projects previously carried out.

LOW-COST TRANSPONDER SYSTEM FOR DATA TRANSMISSION TO TRAINS IN REMOTE AREAS

By R. John Hill, School of Electrical Engineering, University of Bath; Jerry W. Palmer and Robert E. Barnard, both of GEC-Alsthom-GS Ltd.

Intermittent transmission of geographical location information or command data to moving trains may be achieved by track-mounted transponders. A need for inexpensive, passive transponders that require no electronics in the track equipment exists in remote areas. This paper reports a study of an inexpensive metal-plate transponder system where information is encoded in the plate pattern as laid between the running rails. The design problems are to devise reliable plate detector hardware and to select suitable decoding algorithms, to achieve protection against erroneous bit detection and incomplete reading of the message bits.

EFFECT OF COUPLER LOADING ON COUPLER KNUCKLE PIN STRESS

By Aaron B. Tanzer, Research Engineer, Metallurgy, and Swamidass K. Punwani, Manager Mechanical Engineering, both with the Chicago Technical Center, Association of American Railroads

In an effort to determine the cause of knuckle pin failure, standard AAR Type E couplers were statically loaded to determine if coupler knuckle pins would also load and, if so, what factors would contribute to the stress. From the tests it was determined that the factors which lower knuckle pin stress include (in order of influence) replacing the coupler body, tightening tolerances between knuckle and body at the rear pulling lug, using straight-hole design instead of hollowed-out knuckles, and replacement of worn knuckles with new knuckles. Use of a reduced diameter pin can result in vastly diminished pin stresses, but this may be of limited practicality as it allows the knuckle to open too far during uncoupling operations, locking it open.

STRESSES DUE TO NONAXISYMMETRIC TEMPERATURE DISTRIBUTIONS IN RAILWAY WHEELS

By G. F. Carpenter, M. W. Joerms, B. R. Rajkumar and D. H. Stone, all of Research & Test Department, Association of American Railroads

One factor contributing to the failure of wheels is the tensile residual stresses in the rim which result from plastic flow during severe brake heating. During previous tests at the AAR Chicago Technical Center and Transportation Test Center,

non-axisymmetric temperature distributions of wheel rims were observed with infrared thermography equipment during severe braking tests. The cause of such heating is not known. The present study was conducted to analytically determine the elastic stress distribution in such wheels. Two thermal load cases were modeled: one in which there was uniform rim surface temperature of 600 deg. F and a second which the surface temperature of a 90 deg. section was elevated by 200 deg F to 800 deg. F.

The results showed that the 200 deg F temperature differential increased the maximum radial plate stress by about 25% and increased the maximum rim hoop stress by about 20%. The residual stresses resulting from subsequent cooling were not determined; an elasto-plastic analysis would be required to determine this.

TIMKEN COMPANY AND BURLINGTON NORTHERN LOW-RESISTANCE HDL SEAL RESEARCH

By Donald R. Newman, Director Applied Technology, and Michael E. Smith, Manager Technology Analysis, both of Burlington Northern Railroad; and Samuel R. Williams, Senior Railroad Application Specialist, The Timken Co.

In a joint development program (1986-1990), The Timken Company and Burlington Northern Railroad have designed and tested a new low-resistance high-performance bearing seal. From extensive laboratory qualification testing conducted at Timken Research, Burlington Northern Research & Development and full-scale rolling resistance tests at the AAR Transportation Test Center in Pueblo, CO, and up to 200,000 miles of revenue service verification testing, the HDL seal has demonstrated superior performance and significant opportunities for savings in fuel. A base case railroad economic analysis indicates a strong return on investment for new HDL seal equipped bearings.

INTRODUCTION OF STATIC FREQUENCY CONVERTERS ON SEPTA'S 25 Hz COMMUTER RAIL SYSTEM

By Robert B. Fisher of Southeastern Pennsylvania Transportation Authority

The Southeastern Pennsylvania Transportation Authority provides commuter rail service to the suburban regions of Philadelphia utilizing two rail networks, the former Reading and the former Pennsylvania. The two networks were connected together in 1984 with a 4-track commuter tunnel in center city Philadelphia. Although both sides of the system are electrified at 11 Kv, 25 Hz, they are electrically separated with phase breaks. All of the electric traction power for the Pennsylvania side of the system is supplied from Amtrak's electrification network, and the electric power on the Reading side is supplied from a converter station at Wayne Junction. SEPTA is now in the process of replacing the 1928-vintage rotary converters at Wayne Junction with

static frequency converters. The first 15-MVA Static Frequency Converter was commissioned in 1985 and two more units are being installed and are scheduled to be in service in 1990.

This paper examines the development of this project, including the rationale for maintaining a 25-Hz traction power system. However, the specific emphasis is on the power factor control and harmonic distortion on the utility's 60-Hz system. The negotiations with the utility to connect the first static frequency converter to the existing relatively weak 13.2 Kv service, and to provide a 230-Kv service for the addition of two more static frequency converters are also discussed.

PARALLEL COMPUTER SIMULATION OF AUTOTRANSFORMER-FED AC TRACTION NETWORKS

By R. John Hill and Ibrahim H. Cevit, both of School of Electrical Engineering, University of Bath

Simulation of electrical conditions in power lines and rails in an on-line mode in AC and DC electrified railways is necessary for effective engineering design. This paper describes the use of a parallel computer to simulate voltages along an autotransformer-fed AC railway. The algorithm, based on the solution of algebraic equations for a single train, produces a faster-than-real-time continuous display of the catenary and rail voltages, with a historical record of train voltage as the train moves along the section. The simulation implemented enables parametric analyses to be made to optimize the power feeding, and shows that operation with constant current, rather than constant power, leads to better regulation of catenary voltage.

COMPUTER-AIDED MAINTENANCE AND RENEWAL OF TRACK

By Coenraad Esveld, Consulting Engineer, The Netherlands

Every year large amounts of money are spent on track maintenance and renewal. Cost reduction and better control of maintenance processes therefore remain actual issues. The paper describes an approach to analyze the deterioration of track components and suggests methods for helping the engineer decide when maintenance is necessary and when is the best time for renewal.

VEHICLE REACTIONS vs TRACK GEOMETRY

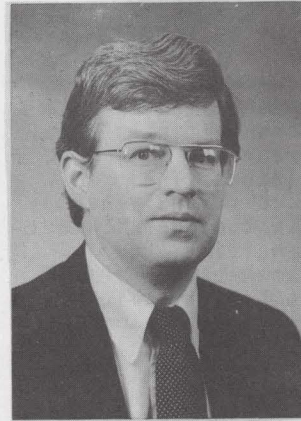
By Coenraad Esveld, Consulting Engineer, The Netherlands

There are several ways of looking at track quality. It is common practice for permanent way engineers to consider the track geometry components cant, level, alignment and gauge for track quality assessment. These data are normally provided by track recording cars. With the use of tamping machines the components cant, level and alignment can be corrected or improved in a certain waveband.

On the other hand vehicle reactions are the real decisive factors for an objective assessment of track quality. In this respect one should think of Y and Q forces for safety and track stability criteria and stresses in the track construction, as well as accelerations for passenger comfort and freight damage prevention.

For those interested, these papers are published in a Proceedings of the 1990 ASME/IEEE Joint Railroad Conference. For information about price and how to obtain, contact IEEE, Service Center, 445 Hoes Lane, Piscataway, NJ 08855-1331 or telephone (201) 981-1393.

Vehicular Electronics



Bill Fleming
Vehicular Electronics Editor

Letters, I Get Letters -- Ten years ago, I wrote an article titled, "Electronic Countermeasure Warfare on the Highway" [1]. In that article I described sale of microwave transmitters used to jam police radar and/or to fool police radar.

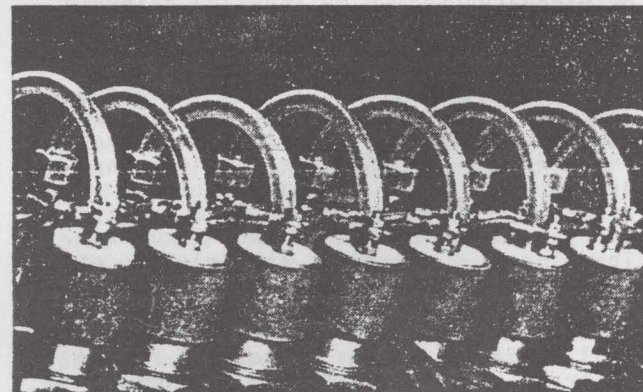
Soon after this, I received a letter from Jared Smith, P.E., who asked that I publish a retraction of the "irresponsible" article because it suggested that 10-GHz transmitters might be used to foil police radar. The implication was that I avored use of a Federal-approved 10-GHz frequency band for the purpose of countering the effectiveness of police radar.

Now, ten years later, in the February 1990 Newsletter, I wrote an article about "Radar Detector Wars" [2]. In this article, I described how Canadian police are using 10-GHz local-oscillator leakage radiation to locate and then confiscate illegal detectors. And I dared to suggest that citizens might be using detectors primarily to avoid police detection of their speeding vehicles.

Once again, soon after this, I got a letter. This one was from Janice Lee, President of RADAR (Radio Association Defending Airwave Rights, Inc., Tipp City, Ohio). She sent me four brochures that recounted the inaccuracies of, and evil uses (entrapment), by police using traffic radar. She then offered me a membership in her organization for a \$20.00 initiation fee.

In her letter, Janice said that I did a grave disservice to you readers by neglecting to separate news from opinion when writing about radar detector wars. Now in Janice's letter, the implication is that I oppose use of Federal-approved frequencies for the purpose of countering the effectiveness of police radar.

Well, you know what I think. I think its time that Ms. Lee was introduced to Mr. Smith. They can heatedly discuss their divergent opinions, and possibly their vested interests, on traffic radar. But I think I'll stay on middle ground, somewhere between their opposite-polarity viewpoints.



EIGHT WATER-COOLED HELENOID SOLENOIDS, ONE FOR EACH VALVE, ON A 4-CYLINDER ENGINE [4]

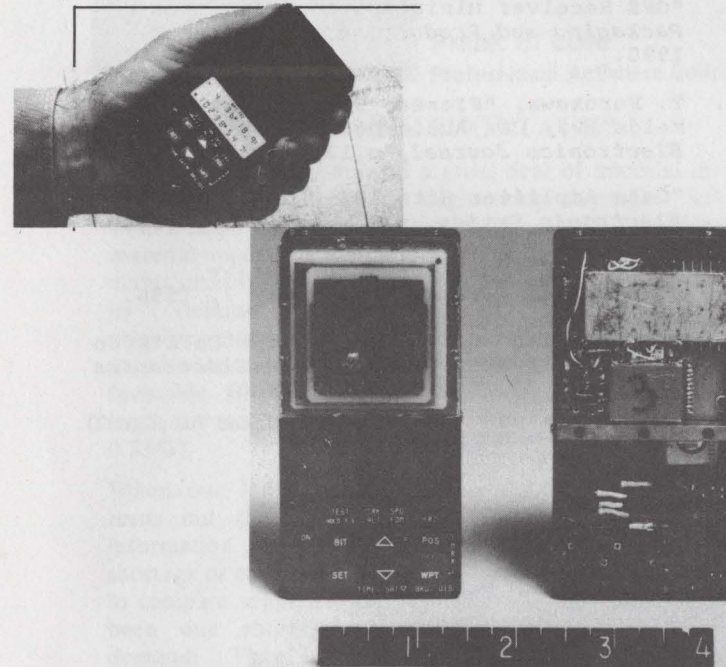
Camshafts May Sink In the Sunset -- By the year 2000, camshafts may no longer be necessary due to electronically controlled engine-valve systems [3]. At least that's what Siemens Automotive is projecting. Siemens predicts that engine idle will be reduced to 200 rpm, and reducing starter-motor torque requirements by two-thirds. This will be made possible by the increased availability of higher-energy, lower-cost magnet materials.

Yes these predictions are great, but real problems occur at high engine speed. For example, Lucas reported in 1979 that a four-cylinder engine with 8 electric actuators, one for each intake valve and one for each exhaust valve, required 400-watts of electrical power to operate at high engine speeds of 6500 rpm [4]. Water cooling was required to maintain actuator temperature. Lucas used Helenoid solenoids -- so possibly the use of the Siemens high-energy magnets will alleviate this problem.

Interestingly, TRW had a similar project to develop electronically controlled engine valves which was done back in 1986 at our skunkworks development lab in Belleville, MI. Like Siemens, TRW also planned to capitalize on availability of high-energy magnets.

In the end, TRW ran into the same problems as were reported by Lucas --namely, the high-power requirements of high-speed engine operation were hard to satisfy. And, more significantly, trying to control the dynamic motion of just one engine valve at high speed turned out to be a considerable challenge, regardless of power consumption.

Advanced Navigation -- Rockwell International has produced a hand-held, 100-cm³, 8-oz GPS (Global Positioning System) receiver [5]. The receiver automatically acquires satellite signals, solves navigation equations, and shows results on a LCD display. It includes a gallium arsenide MMIC (Monolithic Millimeter Wave Integrated Circuit) and a planar dual-patch antenna.

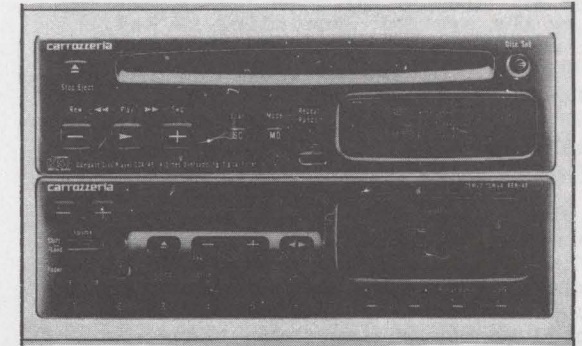


MINIATURIZED, HAND-HELD, GPS NAVIGATION RECEIVER MADE BY ROCKWELL [5]

There are many agricultural, truck, and off-highway applications for GPS navigation. Many of these were investigated at the TRW skunkworks lab some 4-to-6 years ago. As a matter of fact, TRW Space Park at one time was a leading contender for the government contract, that Rockwell eventually got, to build the hand-held GPS receiver.

Pioneer-Trimble go Rockwell one better and they combine the GPS with the vehicle audio system [6]. They call this a "satellite cruising system," (sort of a catchy name, don't you think) and it will be priced at \$2,229.00. Digital-map CD-ROMs, available in four disks, will cost about \$55 per disk. The GPS receiver will enable a driver to precisely locate and track the position of his or her car on a map shown on a 4-inch LCD display. By the way, the "satellite cruising system" also receives color television broadcast channels when the car is parked. Initial production of the system is limited to the Japanese home market.

Collision Avoidance Technology -- Varian Associates has announced the development of a

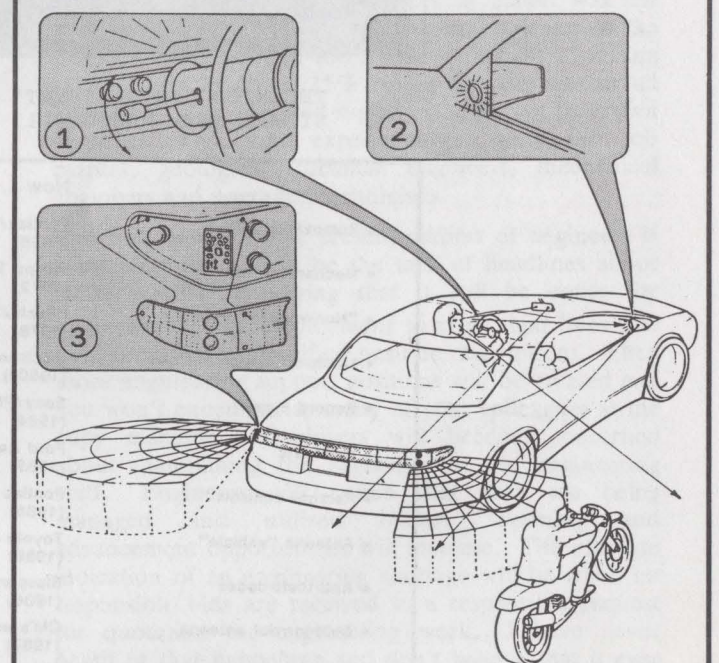


PIONEER-TRIMBLE "SATELLITE CRUISING SYSTEM" INCLUDES GPS NAVIGATION [6]

new HEMT (High-Electron Mobility Transistor) monolithic distributed amplifier made of a layer of indium gallium arsenide atop an indium phosphide substrate [7,8]. The amplifier delivers at least 5 dB of gain over a 5-GHz to 100-GHz bandwidth. Varian believes that the amplifier will be an important component in future automotive collision avoidance systems.

On the other hand, Auto-Sense has developed Sideminder, a much simpler collision avoidance system [9]. Three-to-six beams of pulsed infrared light are projected in fan-like patterns. Reflections of the IR light off obstacles in vehicle blind spots are detected by photodetector cells mounted in the vehicle rearview mirrors or in the taillights. Obstacles up to 7-feet away from the vehicle are

MINDING BLIND SPOTS



Source: Auto-Sense

AUTO-SENSE "SIDEMINDER" INFRARED BLIND-SPOT OBSTACLE DETECTION SYSTEM [9]

detected by the system According to Ref. [9], systems may be installed in 1995 Chrysler and Ford luxury vehicles at a cost of \$50.00 to \$80.00.

Intelligent Stereo -- Technics, a division of Panasonic, has introduced a logic car stereo [10,11]. The radio stores broadcast frequencies and play format styles of 4500 AM and 4900 FM stations located in 5100 U.S. cities. You pick the play style you want to listen to -- rock, jazz, all-talk, classical, etc. -- and the radio automatically finds stations in the selected genre, wherever you travel in the USA.

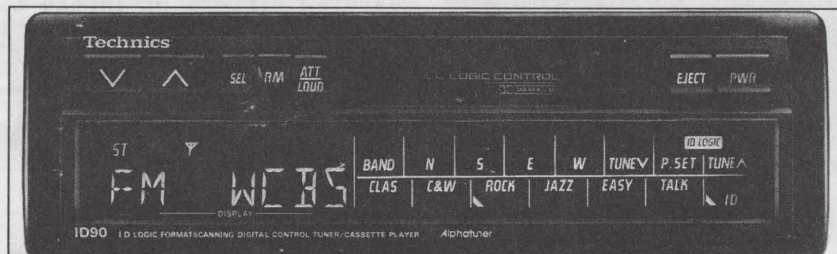
Reinventing the Wheel -- Rowan and Altgelt at Ford Motor Company have written almost as many SAE papers on car radio history as I have on magnetostrictive torque sensors. In their latest paper [12], they include an interesting chart that I thought many of the VTS readers might enjoy seeing. They conclude that in the case of car radio development, reinvention of old ideas appears to be the norm.

Tribute -- A former TRW fellow worker, Joe Ziomek, is on a "fast track," and has advanced through three jobs now in less than a year. Press reports have followed on the heels of each of Joe's job changes [13,14]. Should we be watching for another, imminent, press report? Only kidding. Good luck Joe.

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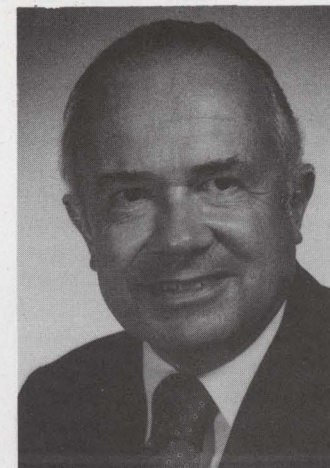


TECHNICS "INTELLIGENT" PROGRAM-STYLE-SELECTIVE SIGNAL SEEK RADIO [11]

	Now and then
• Removable units	Pontiac/Oldsmobile (1958)	First "car radios" (1920s)
• Mechanical memory	Philips Turnolock (1972)	Ford Adjust-O-Matic (1942)
• "Non-volatile" memory	Hitechi/Sanyo (1978)	Admiral Touch-O-Matic (1937)
• Multiple-function buttons	Electronic tuners (1980s)	Ford "5 x 10" (1972)
• Record player	Sony/Pioneer [CD] (1984)	Chrysler [16 2/3 rpm] (1956)
• Headsets	Ford Aerostar (1985)	Daimler (1923)
• Remote controls	Pontiac (1986)	First car radios (1920s)
• Antenna "vehicle"	Toyota (1986)	Bosch (1930)
• Anti-theft codes	Blaupunkt (1986)	Radio on/off key (1920s)
• Built-in roof antenna	GM's annular slot (1987)	"Chicken wire" (1920s)
• Multiple antenna	Clarion's diversity (1987)	Philco's selector key (1937)
• Noise cancelling	Adaptive Controls (1988)	Motorola's "Eliminode" (1935)

REINVENTION OF THE WHEEL IN CAR RADIOS [12]

Professional Activities



Frank E. Lord
Professional Activities Editor

ENGINEERING SHORTAGE?

You have probably noticed a great deal of material in the press lately about an engineering shortage. So what's new? What is somewhat different is that this material appears at the same time that there are articles about massive layoffs throughout industry, particularly in defense related industry. Engineering unemployment is at 2% and climbing while the general nationwide unemployment rate is at the relatively favorable 5.4% lever (the transition unemployment level for engineers at times of full employment is 0.35%).

When one looks into these items in more detail, it turns out that none of the writers have enough information to determine if there is or will be a shortage or surplus of engineers. To do that one needs to compare supply and demand figures. There has not been one shortage story that seriously examines demand. That is not surprising, for to forecast accurately significantly far into the future is not possible. If it were, why do we have a rash of forecast articles at the beginning of each year? What these recent engineering related articles do is examine current and projected supply figures, compare them with something, and try to draw conclusions. This year's shortage articles compare present and projected figures with those of the last decade and seeing them to be smaller, conclude that there will be an engineering shortage. In times past when present figures were larger than past, they were compared with Japanese numbers and the conclusion made that we had to catch up. It was not mentioned that Japanese engineers are utilized differently in their work environments than are ours. Prior to the severe Japanese competition, our engineer numbers were compared with those of the Soviet Union and we were told that if we did not produce more engineers, we would lose the cold war. It was not mentioned how much cruder Soviet technology was because of the flaws in their system of government and management.

Another thing that a reader will notice is that the supply numbers used in various articles look familiar. That is because they come from only one or two sources. The sources are not necessarily accurate or

authoritative, but when the numbers are repeated enough by organizations that are generally thought to be responsible, the public starts to believe them. Even Spectrum fell into this trap by producing a short article which appears on page 23 of the January 1990 issue and is titled "Demand to exceed supply for engineers." The supply numbers in this case were questionable and taken from a National Science Foundation (NSF) report. There was no consideration of demand in the NSF report. So the end result was that a respected publication misinterpreted a questionable report of a respected organization and gave credibility to a misleading notion. This occurred in spite of an IEEE USA position paper, *Interpretation of Engineering Supply and Demand Surveys*, which suggests extreme care in interpreting this type of material.

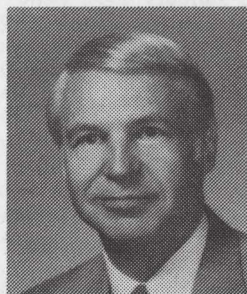
One of the safest wagers in the world would be to bet that in any year for which an engineering shortage is projected there will not be one. The historical precedent goes back to World War II, at least. This would be expected in most occupations in any free economy because, at least in theory, there is no such thing as a shortage in such an economy. Supply and demand come into equilibrium at some price. If the price (pay for the employee) is attractive, the supply increases. In the United States the supply of engineers is quite elastic because there are so many sources of them which include new engineering graduated, converts from mathematics and science, upgraded technicians, immigrant engineers, and people with engineering training and experience working in presently more attractive occupations. These short term sources would prevent the creation of any hardships in enterprises needing engineers until the college entrants, recognizing an attractive situation, could respond causing a rise in undergraduate enrollments and an eventual longer term adjustment.

A recent example of such forces in action was the avoidance of a shortage of petroleum engineers in the early eighties, through the simple expedient of raising salary levels to about 15% above the average for all engineers. The attracted supply came in part from civil engineers who were experiencing a very soft job market, geologists, chemical engineers, mechanical engineers and upgraded technicians.

The first sign that the present surplus of engineers is being assimilated, will be the lack of headlines about more layoffs. Following that it will be easier for engineers seeking employment to cross rigid lines that exist around over specified position descriptions. Then more engineering support positions will be created and you won't encounter as many of your colleagues at the copy machine. Employers will become concerned about maintaining the capability of the engineering staff. Engineers will notice that they are being managed and utilized better. Training and advancement opportunities will increase. The ultimate indication of an engineering shortage will be when no responsible bids are received to a responsible request for quotation for engineering work. I have never heard of that happening and don't believe that it ever will.

(Continued on page 2)

News From Washington



Eric Schimmel
Washington News Editor

MICROCELL-NANOCELLS-PICOCELLS ?

The FCC has recently begun what may prove to be the most significant telecommunication proceeding of the decade, if not the century. The text of the Notice of Inquiry in Docket 90-314 is reproduced in part or full (editors discretion) below and invites your comments by October 1. Whether your interest is in CT-2, DECT, PCN, PCS, Cordless Telephones, Wireless, PBX's and LANS, or any other micro or nanocell concept, this inquiry is your opportunity to speak up. We don't have sufficient spectrum for all of these proposals, so we must all help the FCC make the right selective decisions in this far reaching rule making proceeding.

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of Amendment of the Commission's Rules to Establish New Personal Communications Services: GEN Docket No. 90-314.

NOTICE OF INQUIRY

Adopted: June 14, 1990
Released: June 28, 1990
By the Commission:

1. By this action, the Commission commences a broad inquiry into the development and implementation of new personal communications services (PCSs), such as advanced cordless telephones and portable radio systems for personal use. The Commission seeks information that will assist it in developing regulatory policies concerning the possible implementation of such services. Specifically, the Commission is requesting information to determine which new PCSs are needed, where in the spectrum those services should be provided if at all, how much spectrum should be allocated to them, whether and how the services should be regulated, and what technical standards should be adopted. This Notice of Inquiry also discusses, by way of example, two petitions for rule making, from Cellular 21, Inc. (Cellular 21) and PCN America, Inc. (PCN America), that propose establishment of particular types of PCSs.

Background

2. PCSs encompass a broad range of radio communications services that free individuals from the constraints of the wireline public switched telephone network and enable them to communicate when they are away from their home or office telephone. Basic forms of PCSs include the current cordless telephone, which enable individuals to receive communications almost anywhere in or immediately adjacent to their home or office, and paging services, which notify individuals that someone is attempting to communicate with them. Car telephones represent a more advanced form of PCSs. Car telephone service has been in operation for over twenty years, but was available only to a limited number of users until the middle 1980's when cellular radio service began to be offered in most of the major cities in the United States. Since then, this form of PCS has experienced a very rapid growth. This growth is expected to continue into the 1990's with the continued increased use of hand-held portable telephones, as opposed to car installed telephones. Portable telephones enable individuals to call or be called at any time they are within a cellular system.

3. As the public has become more aware of PCSs and their benefits, demand has begun to appear for even more advanced forms of PCSs. The PCSs being developed today have significant improvements over those that are currently available, including cellular service. The most significant feature of the next generation of these services appears to be a movement towards person-to-person, instead of station-to-station, communications. Existing PCSs require the user to have a different telephone instrument depending upon whether the user is at home, in the office, or in the car. In addition, each of these devices requires its own telephone number. Advancements in PCSs technology have made light-weight, portable telephones more feasible; thus, future PCSs are expected to permit individuals to use the same device in several different environments, including in the home, in the office, perhaps in conjunction with a wireless PBX, or for mobile public telephone service. Thus, it may soon be possible to reach individuals at any time in any place using a single telephone number. Moreover, future systems can be expected to have greater capacity, thus reducing the likelihood of a call being blocked.

Finally, unlike most current PCSs communications, the digitization of future communications can be expected to make them more difficult to intercept and, therefore, more private.

4. Global interest in new PCSs has been developing rapidly over the last few years. This interest has arisen, in part, from some countries' desire to provide competition with existing cellular service, and to provide their citizens with new and better services. The United Kingdom has been especially active in the area of PCSs. It has allocated spectrum for an advanced digital cordless telephone technology, referred to as CT-2. CT-2 can be used in the home, at the office, or as a pay telephone at public access locations. Other European countries are also considering the implementation of an advanced cordless telephone using the developing digital European cordless telephone (DECT) technology.

5. The Europeans have also expressed substantial interest in personal communications networks (PCNs). While no precise definition of PCNs exists, in general, the current prevailing view is that PCNs will be cordless radiotelephone networks based on digital and microcell technologies. PCNs will be self-contained, but will have the capability of accessing the public switched telephone network (PSTN). Even though it has not yet identified a specific band for PCN, the United Kingdom already has licensed three PCN service providers, who are required to commence operations by the end of 1992. Also, the European Telecommunication Standards Institute (ETSI) is actively pursuing the establishment of a pan-European standard for digital mobile communications by 1992. Further, it is anticipated that the 1992 World Administrative Radio Conference (1992 WARC) will consider allocating spectrum in the 1700 MHz to 2300 MHz band for PCNs in Region 1 and possibly will address a similar allocation for other Regions as well. The 1992 WARC may even consider providing a worldwide allocation for PCSs in this portion of the spectrum.

6. Canada and Japan have also demonstrated considerable interest in advanced PCSs. The Canadian Department of Communications recently issued a gazette entitled, "Provision for Field Trials of Public Cordless Telephone Service in Canada and Public Consultation for Policy Direction," in an effort to begin development and implementation of PCSs in Canada. The gazette concerns the establishment of advanced cordless telephone communications, similar to CT-2 in the United Kingdom. The Japanese are active in developing personal communications systems and equipment for the next generation of microcell telecommunications. For instance, they are developing equipment that will provide increased system capacity and mobile controlled hand-off for multi-carrier TDMA systems.

7. The apparent market demand for PCSs, the new technological developments, and the growing world interest in these services has also stimulated interest in new PCSs in the United States. Several entrepreneurs have approached the Commission in recent months seeking authorizations and rule changes related to development of domestic PCSs. In particular, the Commission has received several requests for

experimental authorizations to develop equipment and to conduct market studies to assist in the implementation of CT-2 and PCN-type services. In addition, the Commission has received two petitions for rule making from Cellular 21 and PCN America, a subsidiary of Millicom, Inc., requesting that the Commission commence rule making proceedings to allocate spectrum for PCSs. We discuss the two petitions below as examples of possible PCSs. Parties responding to this inquiry, however, are strongly encouraged to address any other potential PCSs as well as those proposed by Cellular 21 and PCN America. Further, commenters should not limit themselves to any particular personal communications service or technology; rather, comparative consideration of all types of services is requested.

8. **Cellular 21 Petition.** Cellular 21 requests that the Commission allocate the 940-941 MHz band for second generation cordless telephone, CT-2, including telepoint-type services. Cellular 21 contends that CT-2 has technical advantages over today's services, such as the first generation cordless telephones. Cellular 21 states that these "older-style" cordless telephones are subject to both eavesdropping and interference. It proposes that the Commission channelize the band into nine 100 kHz channels with a 50 kHz guardband at each end and limit both the base stations and mobile stations (handset) to 10 milliwatts of power. Furthermore, it proposes that the Commission adopt the CAI signaling protocol that the United Kingdom has adopted for its CT-2 operations. Cellular 21 also requests that as CT-2 use increases, the 941-944 MHz band be made available for CT-2 operations and the current users of these bands be relocated to other bands.

9. **PCN America Petition.** PCN America requests that the Commission allocate the 1700-2300 MHz band for PCNs. Under PCN America's proposal, PCNs would be digital cordless telephone radio networks with extensive service areas built on microcell technology. These networks would use inexpensive pocket-sized terminals, intelligent networks, smart cards, and advanced signaling protocols like the SS-7 protocol and would be essentially self-contained, although some interconnection to the PSTN would be built into the network. They would provide integrated services including voice, data, and image delivery. Further, PCN America argues that PCNs can provide these services in a way that makes efficient use of the radio spectrum. In particular, PCN America proposes that PCNs use spread spectrum techniques to allow the sharing of the spectrum with the existing users.

10. Parties responding to this petition express varying views regarding precisely what a PCN would be, who should be the licensee(s), and what technical standards, if any, including protocol standards, should be established. Several parties, such as NYNEX Mobile Communications Company, claim that the perceived PCSs benefits are already being provided by cellular carriers or will be provided by them in the near future by the next generation of cellular equipment. These commenters argue, for example, that the flexibility provided by the Commission in GEN Docket No. 87-390 allows cellular radio to implement PCN-type services.

DISCUSSION

11. **Purpose of the Inquiry.** We believe that personal communications services will offer significant improvements in communications capabilities for individuals and that it is important to begin planning for the introduction of new services. As noted above, the personal communications requirements in the United States are rapidly changing as our society becomes more mobile and the demand for instantaneous communications grows. We are beginning to see interest, in particular on the behalf of consumers, in a number of new services and technologies, such as: wireless PBXs; smaller, lighter, portable cellular phones; portable fax machines; multi-channel cordless telephones; and services focusing on the ability to contact an individual instead of a particular station. Current cordless telephones, radio paging, and cellular radio may not be capable of meeting the demands for these new types of services beyond the next 5 to 10 years. Current cordless telephones operate on only a few channels, which are congested, and limited in use to the immediate vicinity of their base unit, and are not secure. Radio paging services are only one-way and generally require that the user establish connection by means of another communication link in order to hold a conversation. While cellular radio may be able to offer advanced PCSs, especially after the implementation of digital technology, it is unclear whether this service will satisfy all of the developing consumer demands for PCSs. Moreover, the cost of such services on cellular facilities may be beyond the reach of the average person and restrict its use primarily to businesses, as appears to be the case with the current cellular service.

12. In addition to the apparent domestic consumer interest in PCSs, other considerations may warrant our implementing these services. Internationally, the world appears to be moving towards establishing PCSs operations in the 1700 MHz to 2300 MHz band. In order that U.S. PCSs may be technically consistent with worldwide PCSs, the public interest may best be served if the Commission allocates spectrum for PCSs in or near this portion of the spectrum. Domestically, such an allocation would also enable the United States possibly to establish a nearly wireless telephone network that could provide emergency communications needs when disasters, such as earthquakes or tornados, render the PSTN temporarily inoperable. Furthermore, the establishment of one or more of these services may be warranted as a way of introducing additional competition to the current mobile radio services. We seek comment on these issues below.

13. **Need for an allocation.** In light of the foregoing, we request comment on the need for one or more allocations for PCSs. We seek commenters' assessments of the projected demand for various PCS-type services, including but not limited to CT-2 and PCN, and the amount of spectrum required to meet any identified demand. In addition, we seek information addressing the extent to which current services might not be able to meet the demands for new types of mobile services. We also request information on the specific frequency bands in which

PCSs would need to operate and whether these services can share with existing users or will require an exclusive allocation.

14. Besides the extent to which new PCSs can meet perceived public needs, other factors, such as spectrum efficiency and the time frames for service implementation, are important. For instance, if both CT-2 and PCN can address a particular public need that other current PCSs are unlikely to address but PCN cannot be implemented within a reasonable time, we may wish to consider the possibility of allocating spectrum for both CT-2 and PCN. Therefore, we request comment on how soon PCN-type services can be implemented and whether CT-2 type services might possibly be structured so that they can easily develop into PCN services as technology becomes available and economically feasible. Furthermore, commenters should address whether such considerations as the need for a worldwide PCSs allocation, a radio system that can provide emergency services, or additional competition in the PCSs market would be in the public interest and, thus, would support an allocation of spectrum for either of these two types of services or any other service.

Spectrum Allocation Issues

15. **Spectrum allocation options for CT-2.** With respect to the possibility of allocating spectrum in the 800/900 MHz bands for CT-2, one alternative is to focus on virgin spectrum in order that CT-2 may be implemented quickly. In this regard, we note that there are only three unused bands in the 800/900 MHz bands; i.e. 901-902 MHz, 930-931 MHz, and 940-941 MHz. One option would be to allocate these three bands for CT-2-type operations. However, we are concerned that technical problems could prohibit the development of CT-2 equipment that could operate over all three bands. We seek comment regarding whether CT-2 equipment, and in particular the equipment being developed for the British system, can be used on three, non-contiguous megahertz of spectrum. We also solicit comments as to any other spectrum options that may serve the requirements of CT-2 and what the impact of those options would be on any existing services. In particular, commenters should address the possibility of using any other bands of spectrum below 3 GHz.

16. **Spectrum allocation options for PCN-Type Services.** In its petition, PCN America states that an allocation in the 1700-2300 MHz range will adequately support a system based on microcell technology. PCN America claims microcell technology is necessary to maximize frequency reuse and thereby create an enormous capacity for PCN systems. It argues that frequencies below this range propagate too far and, therefore, are not appropriate with microcell technology, and frequencies above this range are unsuitable due to their very limited propagation characteristics. Further, PCN America notes that this band is being considered for PCN operations in other parts of the world and that an international allocation will be considered for Region 1 at the 1992 WARC.

17. PCN America observes that domestically this frequency range is divided into five bands. Two bands

are allocated for Government use, 1710-1850 MHz and 2200-2290 MHz, and three for non-Government use, 1850-1990 MHz, which is allocated for private operational-fixed microwave use, 1990-2110 MHz, which is allocated for auxiliary broadcast and cable television use, and 2110-2200 MHz, which is allocated for public fixed microwave use. It requests that the Commission consider the possibility of sharing one of these bands, in particular the 1850-1990 MHz band, using spread spectrum technology for PCN-type operations. It states that this band holds the most promise for sharing because the other non-Government bands have higher current usage or are used for video transmissions, which cannot share with spread spectrum systems. PCN America does not ask that the two Government bands be considered because the extent of their current usage cannot be determined.

18. Several commenters generally support providing an allocation for PCN-type operations. However, the existing users of the 1850-1990 MHz band are opposed to PCN America's proposal to provide for PCNs in the 1850-1990 MHz band. These users include utilities, public safety entities, and petroleum and natural gas companies. They argue that a reallocation of frequencies in this band would displace a large number of existing users, disrupt their operations to the detriment of the public, and require them to purchase new equipment. They also contend that PCN America's proposal to share this spectrum with PCNs using spread spectrum technology is speculative and premature.

19. We request information on the technical feasibility of operating PCN-type services in the 1850-1990 MHz band on a shared basis as proposed by PCN America and the effects such operation would have on existing and future microwave operations in the 1850-1990 MHz bands. We also invite comments on the availability and appropriateness of considering the other bands in the 1700-3000 MHz range of the spectrum for PCN. We anticipate that the experiment we recently authorized PCN America to perform in Orlando, Florida and Houston, Texas, will provide a substantial amount of information on these subjects. In the meantime, we request information on the following questions:

1. How much spectrum would be required for PCN-type operations if they overlay existing services?
2. How many PCN licensees would this spectrum support?
3. What would be the impact on the existing allocated services?
 - a. How many, if any, existing systems would have to be reaccommodated into other bands?
 - b. Who should pay the cost of any reaccommodation?
 - c. Would it be desirable to restrict future fixed systems in the 1850-1990 MHz band in major metropolitan areas in order to protect PCN systems?

20. In addition to the possibility of overlaying PCN on existing services using spread spectrum techniques, there are other accommodations that should be considered, including the possibility of an exclusive allocation. At best, mobile communications are only feasible on frequencies below 3000 MHz with current technology. However, no large blocks of unallocated spectrum remain available in that range. Therefore, an exclusive allocation of PCN would require the reallocation of spectrum currently allocated for a particular use and the relocation of any licensees using the spectrum. The spectrum allocated for fixed microwave operations appears to present the most feasible source of spectrum for new PCSs. Fixed microwave facilities can operate in higher frequency bands, although shorter path lengths due to higher attenuation may impose greater economic burdens and possibly reduce the quality of the transmission. Further, as the band 1700-2300 MHz contains the largest blocks of contiguous fixed microwave spectrum and appears to be a spectrally efficient place to locate a mobile service based on microcell technology, it would be a prime candidate for PCN operations. Additionally, an allocation in this band would be consistent with international trends.

21. Accordingly, we seek comment on the feasibility of relocating the microwave licensees in the bands 1850-1990 MHz, 1990-2110 MHz, and 2110-2200 MHz. As public safety entities, broadcasters, common carriers, utilities, and other important entities are using these bands at present, we recognize that a reaccommodation of the microwave licensees in these bands could require a considerable amount of time and would likely preclude the implementation of PCN in certain areas for several years. In order to assess the feasibility of reaccommodating licensees in these bands and to consider a possible time frame for that process, we request comment on several issues. Initially, we seek specific comment on the extent of current usage in each of these bands, where in the spectrum these licensees might be reaccommodated, and whether other transmission media, such as fiber optics or satellite facilities, present a viable alternative for some of these licensees' needs. In particular, commenters should address the availability and feasibility of using the microwave bands above 3000 MHz for microwave service users currently operating in the 1700-2300 MHz band and whether any other bands can be made available for these licensees. Further, we seek comment on the amount of embedded equipment these licensees have, the average life span of that equipment, and the plans of these licensees to implement in the future new or advanced technologies that may require the installation of new equipment. Finally, we ask commenters to address the minimum time period necessary to effectuate a reaccommodation.

22. As an alternative to clearing a band of existing occupants and reallocating it exclusively to PCN, one or more bands could be reallocated to PCN use on a primary basis with a secondary allocation for fixed service and a co-primary, grandfather provision for the existing fixed operations in the band. Fixed use of the band could be allowed to expand under the secondary

provision in areas where they do not conflict with PCN use. PCN licensees would then have the option of designing their systems around the grandfathered fixed stations or negotiating other arrangements, which could include the modification or relocation of specific fixed operations to free additional spectrum for PCN use where and when it is required. Such a system could avoid the administrative cost and delay that a forced clearing of the band would entail, as well as provide licensees with more flexibility to achieve the most efficient levels of fixed and PCN services. Since the cost of any reaccommodations would be borne by the same party who reaps the benefits, namely the PCN licensee, only those changes would occur that produce a net benefit. It could be argued, however, that such an approach would create high transactions costs due to the negotiation process. Comments are requested on the advantages and disadvantages of this method of accommodating PCNs.

Regulatory Issues

23. Regulatory structure for CT-2-Type Services. As the home and office operations of CT-2 services are essentially the same as conventional cordless telephone operations, there appears to be little need for anything more than technical regulation of the equipment. However, we are interested in the commenters' views on the need to license the mobile units and any base units used only in the home or office. While mobile units that are used in conjunction with public access service could be licensed under a blanket licensing arrangement, this licensing structure would not be available to users who install CT-2 equipment only in their home or office. While Section 301 of the Communications Act (Act) requires all radio transmitting devices to be licensed, we have not required licenses for currently authorized cordless telephones in the past because they are Part 15 devices. As such, the current cordless telephones operate on a secondary, or non-interference, basis to all other authorized services. If we were to adopt a discrete allocation for this service, licensing of the personal base and mobile units would appear to be required under the Act. This would be a substantial administrative burden on the agency. One option would be to ask Congress to modify Section 307 (e)(1) of the Act to exclude such facilities, as it did for the citizens band radio service and the radio control service. Comment is requested on this issue.

24. With respect to any CT-2 public access service, several regulatory and licensing issues arise. To the extent that CT-2 equipment can be used at public access locations, we need to determine how these base stations should be licensed, how many public access providers there should be, and how the CT-2 markets should be defined. While the United Kingdom has only four nationwide service providers for its telepoint service, nothing precludes us from authorizing any other number of providers or even permitting anyone who wishes to provide public access to do so, so long as the requisite technical standards are met. We request comment on how many public access providers we should authorize, whether there should be any preferences or restrictions regarding eligibility, and what methods and criteria we could use to select who

will provide public access service. Additionally, commenters are requested to address what requirements, if any, should be imposed on the CT-2 licensees and whether they should be regulated as common or private carriers. We further seek comment on both the need and our authority to conclude that state and local regulation of any common carrier activities would be preempted. Interested parties are also requested to address the extent to which public access providers should be required to file tariffs. We further request discussion and information addressing the size of the market that would be most appropriate for licensing service providers, e.g., nationwide, regional or local.

25. PCN regulatory structure. With regard to licensing of PCN systems, we also solicit comments on the best way to license the mobile units (hand sets). We request comment on whether mobile units should be authorized under a blanket licensing approach or whether licensing of mobile units should be required at all. We also request discussion regarding the method for licensing base stations. The number of base stations that will be needed for a PCN system will likely be large. Therefore, we request comment on whether we should require a license for each base station. We are also concerned about the feasibility of finding sites for all of the base stations and whether this consideration may be a reason to limit the number of licensees.

26. We ask that interested parties address how many service providers there should be in each market and, as with CT-2, how the PCN market should be defined. In particular, we seek the commenters' views regarding whether PCN licenses be issued based on local areas, regional areas, or a nationwide market.

27. Furthermore, commenters are invited to address whether there is a need for any restrictions on eligibility for a PCN license in a particular market. To the extent that PCN and future generations of cellular licenses should not be permitted to apply for a PCN license in any market where they are licensed to provide cellular service. Such a policy would appear to promote competition in the personal communications market and thus serve the public interest. On the other hand, it could be argued that local exchange carriers, many of which also provide cellular service, should not be barred from applying for PCN licenses in their service area. For example, we recognize that an argument can be made that, to the extent that PCN systems will provide telecommunications systems that complement the current landline system, the local exchange carriers should be able to participate in PCN service in order that they may continue to provide by radio those services that they have historically provided by wire. Finally, interested parties are invited to comment on whether particular PCN licenses should be set aside for certain groups of service providers. For instance, in cellular, only the wireline carriers were permitted to apply for the Block B licenses.

28. As with the public access services of CT-2, we envision that PCN-type services could operate on a common carrier or private carrier basis or both. As there will likely be multiple service providers, possibly

both private carrier and common carrier in nature, and as this service may be competitive with other existing mobile services, we would likely consider any common carrier PCN service providers to be non-dominant and subject to streamlined regulation. We request comment on these preliminary views. Further, we seek comment on both the need and our authority to conclude that state and local regulation of any common carrier activities would be preempted.

Technical Standards Issues

29. Technical Standards for CT-2-type Equipment. As discussed above, Cellular 21 and several parties request that the Commission adopt technical rules for CT-2 that are compatible with the equipment being used in the United Kingdom, particularly the CAI protocol standard. They assert that this would allow for the expeditious implementation of this service in the United States because it would take advantage of developmental work done in the United Kingdom. However, other commenters respond that this technology might not be the best for providing PCSs both in term of technology and spectrum efficiency. Therefore, we are soliciting comments on the following technical issues relating to CT-2-type operations:

1. What type of emission and spectrum access mode, e.g., TDMA, Frequency Division Multiple Access (FDMA), or CDMA, would be the most efficient and responsive to the needs of CT-2?
2. What channeling plan and technical standards would best provide for CT-2 services?
3. Should existing protocol standards (e.g., CAI) or a new standard be adopted or would it be desirable not to adopt any standards?
4. Are the units' operations likely to exceed the Commission's guidelines for environmental effects as set forth in Part 1, Subpart I or the rules?

30. Technical Standards for PCN-type Equipment. We also believe that it would be in the public interest to begin developing a public record with regard to what, if any, technical standards to establish for PCNs. Therefore, we are soliciting comments on the following technical issues:

1. What transmission standards, including channeling plan, power limits, and types of emission should be adopted?
2. Should protocol standards that allow for interface between one system and another be adopted and, if so, what should they be?

3. Is there a need to establish a numbering plan for telephone numbers and who should develop and implement this plan?
4. Are base station operations likely to exceed the Commission's guidelines for environmental effects as set forth in Part 1, Subpart I of the rules?

Commenters may raise any other technical issues that they consider appropriate.

31. Any commenter proposing a service other than CT-2 or PCN should address these issues to the extent they are applicable to the PCSs that the commenter is proposing. Again, comparison of the benefits and disadvantages of different types of PCSs is strongly encouraged.

PROCEDURAL MATTERS

32. Pursuant to applicable procedures set forth in Sections 1.415 and 1.419 of the Commission's Rules, 47 CFR section 1.415 and 1.419, interested parties may file comments on or before October 1, 1990 and reply comments on or before November 30, 1990. All relevant and timely comments will be considered by the Commission before taking further action in this proceeding. To file formally in this proceeding, participants must file an original and four copies of all comments, reply comments, and supporting comments. If participants want each Commissioner to receive a personal copy of their comments, an original and nine copies must be filed. Comments and reply comments should be sent to Office of the Secretary, Federal Communications Commission, Washington, D.C. 20554. Comments and reply comments will be available for public inspection during regular business hours in the Dockets Reference Room (Room 239) of the Federal Communications Commission, 1919 M Street N.W., Washington, D.C. 20554.

33. For further information concerning this Notice of Inquiry contact Mr. Fred Thomas (202) 653-8112, Office of Engineering and Technology, Federal Communications Commission, Washington, D.C. 20554.

FEDERAL COMMUNICATIONS COMMISSION

Donna R. Searcy
Secretary

Board of Directors Report

James M. Sears

VTS Secretary

IEEE VTS BOARD OF GOVERNORS MEETING MINUTES

The IEEE VTS Board of Governors met on May 6, 1990 at the Sheraton Plaza in the Florida Mall, Orlando, Florida. The meeting was called to order at 1:10 PM.

ROLL CALL

The following were in attendance:

	Joseph Castellani	Land Trans V. Chmn
	Don Cottrell	VTC'92 Denver Chmn
#	J. R. Cruz	Asoc Newsltr Edt.
#	Robert Fenton	Sr Past President
	Robert French	Nav/Info Sys Chmn
	David Goodman	Education Com Chmn
#	Kent Johnson	VTS Newsltr Editor
#	Sam Leslie	Treasurer
#	Fred Link	VTS Site Selection
	Sang Rhee	VTS Transaction Ed
	Ted Rappaport	Guest - VA Tech
	Giorgio Rizzoni	Assoc Newsltr Edt
#	Roger Madden	Vice President
#	George McClure	President
#	Sam McConoughey	Avant-garde & Public Relations
#	Stuart Meyer	Nominations, Standards, Awards
	Jim Sears	Secretary
	Eric Schimmel	CCIP Activities
	Frank Thatcher	Paper of Year Chmn
#	Ray Trott	Membership Chmn
	Jay Underdown	VTC '91 Conf Chmn.

Ten elected board members were present at this meeting. A quorum was thus present.

The President added several items to the agenda and the order was rearranged to facilitate some members with early flights. Sam McConoughey moved the revised agenda be adopted. It was seconded by Roger Madden and approved.

Minutes of the 2/10/89 previous meeting were approved with the following corrections. Kent Johnson, Sam McConoughey, and Dick Jaeger attended the meeting but their names were inadvertently left off the roll call.

The Board, at the previous meeting, unanimously expressed its sympathy to Kent Johnson on the loss of his wife. Under Old Business, correct the spelling of Anita Longley. Under New Business, Item 5, please add The Jack Neubauer Systems Paper Award. Fred Link moved the approval of the minutes as corrected. Bob Fenton seconded and approval was unanimous.

The Board unanimously expressed its sympathy to Sam Leslie due to the death of his wife. This motion was presented by Sam McConoughey and seconded by Fred Link.

TREASURER'S REPORT

Sam Leslie presented the treasurer's report.

Stuart Meyer moved and Roger Madden seconded its adoption. Approval was unanimous. In brief, Sam reported a strong financial position through the end of February, 1990. Over \$2,000 in interest income was received during the month of February from the Society's reserves excluding the fellowship funds. Total income for the society year-to-date as of February 28, 1990, was \$72,300. Expenses were \$11,000.

The second \$3750 installment of the 1989-90 Noble Fellowship award was issued February 27th to Mr. Stephen P. Emeott.

PRESIDENTS REPORT

The President's report is included with the minutes. Highlights mentioned at the meeting included comments on the dramatic USA growth of the cellular mobile telephone service which is expected to reach 25 million subscribers by 1995. In comparison, there are 130 million regular telephone access lines installed in the USA as reported in Wall Street Week telecast.

Interest in Vehicle Navigation and Information Systems (VNIS) is increasing. The VNIS '89 conference records were a sellout. As a result, the conference committee has ordered 400 additional copies to sell.

The President noted that with increased interest in cellular activities, consideration should be given to publishing a magazine dedicated to cellular. Also, the broadened areas of interest within VTC may justify a name change in the future for the society.

Gaspar Messina, chapter chairman, was requested by the President to update the society speakers list. He noted that air fares for speakers will be paid by the Society. The Chapter using the speaker is responsible for local expenses.

PUBLICATIONS

Bill Lee, Publications Committee Chairman, submitted a written report regarding committee activities. Two special issues, in the planning stage, are Highway Electronics slated for February 1991 publication and Digital Cellular planned for November 1990 release.

Transactions Editor, Sang Rhee reported that papers being submitted are very high quality. Two special issues are planned this year. He noted that paper guidelines are needed for special issues. The backlog of paper review has been depleted as a result of lots of work.

Sam McConoughey made a motion expressing appreciation for the efforts of the Transactions staff to get back on schedule and clear the backlog. Seconded by Roger Madden and unanimously approved.

J. R. Cruz, Associate Transactions Editor, reported that 29 papers had already been reviewed this year. A total of 66 papers were reviewed in 1989. In addition, a 35 paper backlog from 1988 required review. All but 5 are now complete.

Sang Rhee moved that papers for special issues be processed in the same manner as other papers with the addition of guest editors being used as reviewers. J. R.

Cruz seconded and the motion carried. Sang offered to contact the Transportations Editor regarding plans for the fall special issue of Transactions. He stated that his goal is to have one special issue per year in the future.

There was some question regarding how the money approved at the February Board meeting should be allocated for secretarial assistance to the Editors. Up to \$10,000 was provided for Communications secretarial services and up to \$5,000 each for the other publication editors. The University of Oklahoma is matching with equal funds the secretarial support for the Communications magazine.

Kent Johnson, Newsletter Editor, reported plans to upgrade the quality of the Newsletter print and paper. Better uniformity of print is also desired. He requested a 10% budget increase to cover the improvements. Cost of the last issue was approximately \$2400. Roger Madden moved that the Newsletter Editor be authorized to spend up to \$2000 per year additional to cover added expenses. Ray Trott seconded and the motion was unanimously approved.

The President recognized Ted Rappaport, assistant professor at Virginia Tech. Ted and Justin Chuang have volunteered, as members of both VTS and COMSOC (IEEE Communications Society) to provide a means of exchanging information and dialogue about future conferences, hot topics, and general trends of interest for the mutual benefit of members in both societies. He also gave a brief report of recent events in the Communications Society. Ted concluded by proposing the establishment of a liaison committee between COMSOC and VTS. Sam McConoughey voiced favor for such a committee and suggested cooperation with COMSOC to set up technical sessions at future conferences to cover VTS. President McClure noted that TAB does not approve joint publication issues between societies due to excessive mailing of larger volumes. The President appointed Sang Rhee as VTS interface person with Ted regarding publications. Another person will be named by the President to cover conferences.

CONFERENCES AND MEETINGS

Evan Richards was unable to attend the meeting. However, an update of previously listed conferences follows.

VTC'89 San Francisco

Frank Thatcher, conference chairman, reported that total revenues for the conference were \$111,308 with a surplus after expenses of \$25,414. Audit of the conference finances is in process. Fred Link moved that the VTC'89 conference be accepted. Motion was seconded by Kent Johnson and approved.

40th VTC Orlando, FL, May 6-9, 1990

George McClure, conference chairman, reported on the conference. A total of 318 persons advance registered for the conference. The 775-page conference record contained 131 papers to be given in 30 sessions. One thousand conference records were

ordered. The four supporting firms were Ericsson, AT&T, Astronet, and Decibel Products.

41st VTC'91 St. Louis, May 19-22, 1991, Sheraton Westport

Jay Underdown, conference chairman, reported that call for papers had been mailed to USA members. He had encountered difficulty in the mailing process for international mail. Those problems are now resolved. Jay offered to assist other conference leaders that may encounter similar mailing problems.

The ASME/IEEE joint conference will overlap the VTC'91 conference on Tuesday through Thursday at the same hotel. They do not plan a joint conference record. Jay suggested that, for future conferences in this situation, both conference chairmen get together early for planning. The Board suggested that conference chairmen should not encourage session sponsorship by manufacturers at technical conferences.

42nd VTC'92 Denver, May 11-13, 1992

Don Cottrell, conference chairman, reported that the downtown Hyatt Regency, with 540 rooms, had been selected for the conference site. John Tary is Finance chairman.

43rd VTC, 1993

Fred Link reported that Meadowland, New Jersey has been selected for this conference instead of an offshore site. Sam McConoughey moved that the North Jersey Coast section and the New York Section present a proposal for the conference. Stu Meyer seconded and motion carried.

44th VTC, 1994

The Stockholm VTS chapter has submitted a proposal to host the VTC '94 in Stockholm. Henry Scheffe, chapter chairman, made the proposal. He also pointed out that both the Swedish Telecom Radio and Ericsson Radio Systems had declared their support of the conference. Dave Goodman supported the idea of an offshore conference in 1994. There was some discussion regarding how to handle travel expenses to offshore conferences for the Directors. The President expressed the alternative to keep annual conferences in the USA and, in addition, hold regional offshore conferences.

After considerable discussion Dave Goodman moved that the Stockholm VTS Chapter proposal to hold VTC '94 be accepted as a 1 year trial for an offshore major conference. Roger Madden seconded and the motion was unanimously approved.

Convergence '90, Hyatt Regency, Dearborn, October 14-17

Bob Fenton, IEEE liaison to Convergence, reported that plans are in excellent condition. Sessions are complete and staffed with chairmen. Of special interest to VTS are two sessions on Intelligent Vehicle Highway Systems which were proposed by IEEE/VTS. Plans for President Bush's visit are proceeding smoothly. Bob has reserved one table at the banquet for 10 people at a cost of \$900.

Convergence '92, October 17-22, 1992 (VTS sponsored)

The conference is scheduled at the same location as the 1990 conference with Robert Mazzola serving as Conference Planner. No additional report given.

VNIS 1991 Conference, October 20-23, Dearborn

Bob French reported that Mark Krage, Southeast Michigan chapter, held the first organization meeting April 17th. Bill Spreitzer is General Chairman and Dan Frank the Treasurer. Roger Madden moved that \$3000 seed money be provided for VNIS '91. Stu Meyer seconded and motion was unanimously approved.

VNIS 1992

Bob French reported that the Stockholm chapter will be unable to sponsor VNIS '92 due to previous commitments to sponsor VTC a European co-sponsor. Bob is also following up with Dr. Vits in Brussels for his suggestions.

VNIS 1993

Planning is in process to secure a Canadian meeting site.

Bob distributed copies of issue #1 newsletter The Intelligent Highway. Bob French and Chris Quere are co-editors. There is an opportunity for VTS to initiate a magazine on Intelligent Vehicle Highway Systems (IVHS). This needs further discussion.

Joint RR/IEEE Conference, 1989

Joe Castellani, Vice Chairman Land Transportation division reported that a check had been forwarded to IEEE via Sam Leslie for \$4,868.15 as VTC's portion of the conference income.

Joint RR/ASME Conference, Chicago, April 17-20, 1990

No report was given.

Joint RR/IEEE Conference, St. Louis, May, 1991

An organizational meeting is planned in late September. Robert Love is ASME contact working in coordination with Jay Underdown. Joe Castellani moved that \$2000 seed money be provided for the conference. Motion was seconded by Bob Fenton and carried. Joe was instructed to initiate a letter to the treasurer requesting the seed money.

RR/ASME Conferences, 1992

For 1992 the conferences will not be held jointly. Instead, the RR conference will be held late September in St. Louis and the ASME conference will be in Atlanta. This is an ASME lead year.

Joint RR/IEEE Conference, 1993

Pittsburg has been selected as the conference site by ASME.

It was pointed out that the IEEE standard for AC motors needs updating. Also VTS membership brochure should be updated to include Land Transportation information. Ray Trott was asked by the President to investigate.

COMMITTEE REPORTS**Membership**

Ray Trott reported that half-page adds for the 1990-91 Potentials magazine had been ordered. The membership brochure has been updated and was available at the Orlando conference.

Publicity

No report was available for the meeting. A chairman is needed for this committee.

CCIP Representative

Eric Schimmel, CCIP representative, pointed out that he is not vice president of CCIP activities as reported in the previous minutes. Also the draft digital/analog radio standard just issued does not include cellular. Dr. Bob Powers, Chairman of the CCIP activities committee, mailed in a statement on H.R. 2965 Emerging Telecommunications Technologies Act of 1989.

His statement is attached to the minutes.

Transportation Electronics Fellowship

Bob Fenton reported that four candidates were evaluated for the Fellowship. All were considered of such a high quality that any one would have been an excellent recipient. Mr. Karl Schten who is currently studying for an MSEE at Purdue University was selected as the recipient. Fred Link moved that one candidate be funded at \$7500. This was seconded by J. R. Cruz and approved.

Dan Noble Fellowship

Tony van den Heuvel, Dan Noble Fellowship committee chairman reported by letter that Ms. April Maitre has been selected for the 1990 Dan Noble Fellowship award. She is a graduate of Drexel University with a Bachelor's degree in Electrical and Computer Engineering. She has been accepted for enrollment into Carnegie Mellon University to pursue a graduate degree.

Education Activities

David Goodman gave a brief update on his committee activities. No action was required. The Third Generation Wireless Information Networks Workshop is scheduled for October 18-19, 1990 at the Ramada Renaissance in East Brunswick, NJ.

Propagation Committee

Dr. Gregory Stone has been contacted about chairing the Propagation Committee, and has agreed to do so, if approved by the Board. Ray Trott moved that the nomination be accepted. Kent Johnson seconded and unanimously approved.

Nominations Committee

Stu Meyer, Nominations Chairman, reported that the list of 1989 nominees and 1990 incumbents has been prepared. He is still accepting nominations for other candidates.

NEW BUSINESS

1. Neubauer Award - Panasonic has proposed sponsorship of the Jack Neubauer award for the

best systems paper, a \$500 award plus plaque or certificate, awarded for the best Transactions paper embodying communications systems engineering. Panasonic has proposed a \$5000 contribution to the IEEE Foundation for the purpose of funding this award. This is subject to approval by IEEE headquarters.

2. Roger Madden moved that Tony Eastham be approved as a delegate for the South American Speakers Delegation. This was seconded by Stu Meyer and approved.
3. Section Congress, Toronto, Oct 5 to 7 - TAB has voted to support each Society to the extent of \$1000 to aid in sending chapter delegates to the Congress and RAB is covering cost of all meals and meeting arrangements. This leaves a cost of \$350 for hotel and ground transportation plus air fare to and from Toronto for each delegate.

Roger Madden moved that the motion in previous minutes be modified to allow one officer from each chapter to attend. Kent Johnson seconded and amendment was approved. The original motion would allow only chapter chairmen to qualify for \$400 from VTS to supplement trip expenses.

4. Vehicular Technology Magazine - The President appointed Giorgio Rizzoni to explore budgets etc. of the Communications Society regarding cost and procedures to initiate a new magazine. The magazine could be a replacement for the Newsletter. Kent Johnson was request to assist in the planning review.
5. Associate Membership - Ray Trott was appointed to pursue at the upcoming NABER meeting promotion of Associate memberships to VTS.

6. Press Conference Attendance - Sam McConoughey moved that Press reporters be allowed to attend conferences at the expense of VTS. Ray Trott seconded and motion was approved. The Conference Committee will be reimbursed by VTS for Press attendance cost. The VTS President should be notified in advance of Conference regarding expected cost.

7. Post Conference Sale of Records - Roger Madden moved that the Society pay for over run of Conference Records and pay shipping to future conferences for possible sale with a ceiling set of 50% more than recommended by the Conference. Motion was seconded by Ray Trott and unanimously approved.

NEXT MEETING

The next board meeting is scheduled Wednesday, October 17th, from 9AM - 5PM at the Hyatt Regency Hotel in Dearborn, Michigan. The meeting is being held in conjunction with the Convergence '90 conference scheduled Monday thru Wednesday at the same location.

ADJOURNMENT

The meeting was adjourned at 5 PM.

Respectfully submitted,
Jim Sears, Secretary

1991 IEEE/ASME
JOINT RAILROAD CONFERENCE

CALL FOR PAPERS

Deadline: Submittal of Abstract
Deadline: Final Manuscript

September 30, 1990
December 15, 1990

The Land Transportation Committee of the IEEE Vehicular Technology Society is seeking abstracts for technical papers to be considered for presentation and discussion at the:

IEEE/ASME
Joint Railroad Conference
St. Louis, MO.
May 21-23, 1991

Authors are requested to submit five copies of the abstract for their proposed paper by September 30, 1990 to:

Robert B. Fisher, P.E.
Meetings Chairman
Land Transportation Division, IEEE-VTS
Southeastern Pennsylvania Transportation
Authority (SEPTA)
5800 Bustleton Avenue
Philadelphia, PA 19149

Papers which review topics of current interest in the areas of system design, hardware development, and transportation technology advances with the aim to improve the operation of railroad and transit systems and increase their cost-effectiveness, are being sought.

Selected papers are to be submitted on IEEE "Author's Kit" format by December 14, 1990

For further information call:

Robert B. Fisher (215) 580-4888

Topics can include:

- AC and DC propulsion systems
- Electromagnetic compatibility
- Automation and microcomputer control
- Signal and Communication Systems innovations
- Maintenance procedures
- Monitoring and fault detection
- Safety and assurance programs
- High speed transportation systems
- Magnetic levitated systems
- People mover systems
- Transportation systems, the next generation
- Traction electrification system alternatives
- Energy efficient systems and energy conservation methods
- New transit system starts
- Computer modeling and simulation of transportation systems

I am interested in preparing a technical paper for the 1991 IEEE/ASME JOINT RAILROAD CONFERENCE in St. Louis, Missouri.

Please send me an author's kit.

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