Gate to New Concepts in Vehicular Technology

May 1-3, 1989

Sir Francis Drake Hotel
San Francisco, California
President’s Message

George McClure
President
IEEE Vehicular Technology Society

Your Society is working to serve you and the rest of its members, through publications and conferences, by addressing emerging areas of interest, by increasing awareness of our areas of technology among student members, and by building bridges to strengthen relationships with our chapters.

As you will see from the minutes of our latest board meeting, in this issue, initiatives in all these areas are being pursued.

1. Our new publications officers are projecting close to 600 pages in the Transactions for 1990, following a special issue on Vehicular Electronics later this year.

2. Growth in our annual conference is seen by comparing recent conference records with those of ten years ago. The number of pages has more than doubled. This year’s conference in San Francisco will have authors from 17 countries presenting papers.

3. Following publication of its report in the February 1988 issue of the Transactions, the Ad hoc Committee on Propagation was elevated to full committee status in VTS. We are currently seeking a chairman for this committee to replace the late Neal Shepherd.

4. Dr. Bob French chairs our new Navigation & Information Systems Committee, recognizing the strong interest in this emerging area. In addition, the vehicle navigation & information system (VINS) Conference, to be held in Toronto in September, is now a biannual meeting under VTS joint sponsorship. Growing interest makes this an annual event in the near future.

5. The Joint Railroad Conference, with participation by our Land Transportation Division, will be co-located with our annual V1 conference for the first time in 1991, in St. Louis. This will increase the synergism between the two events, enabling participants to attend both conferences.

6. We plan to continue the recent upsurge in student membership in VT by further advertising in the student magazine, IEEE Potentials, during the upcoming school year.

7. Support for chapter activities is a concern, for Vehicular Technology as well as for other IEEE societies. We want to strengthen our ties to our chapters. Reports from chapters are sketchy, with some chapters not being heard from at all. Our annual competition for best chapter includes only a small percentage of chapters in the running, because most do not send us copies of their L3I meeting reports. We have sent letters to all chapters to be sure we have current chapter officer information. Feedback from chapters is welcomed; tell us what you are doing and how we can help you.

This issue of the Newsletter is being published earlier than usual to get timely conference information in your hands. Look it over and plan to attend. See you in San Francisco!

George F. McClure

Editor’s Notes

A. Kent Johnson
IEEE Vehicular Technology Society Newsletter Editor

Arthur Goldsmith Elected IEEE Director, Division VI

At the recent Board of Governors meeting (see minutes published elsewhere), Arthur Goldsmith resigned his position as treasurer of the Society due to his election as IEEE Director, Division VI. We are pleased to congratulate Art on his election, but will miss him very much as Society Treasurer. He has been an excellent treasurer and it has been a pleasure working with him. As noted in the minutes, Samuel Leslie will take over as treasurer after many faithful years as Society Secretary. He in turn will be replaced by James Sears. We look forward to working with these men in their new positions.

VTS Conference in San Francisco May 1-3

This edition of the newsletter features the upcoming Annual VTS Conference to be held at the Sir Francis Drake Hotel in San Francisco from May 1-3, 1989. Elsewhere in the newsletter you will find the complete advanced program of the conference and as you will see, the committee has arranged for an outstanding technical program. It is once again clear that there is great interest in cellular technology and land mobile systems from the number of papers being presented in those areas. It should be an exciting conference and we hope you will be able to make it to San Francisco.
Board of Directors Report

The Board was honored by the attendance of Ralph Wyndom, the IEEE Division III Director. Ralph discussed some of the procedures for nominations for higher IEEE offices, and asked the board for inputs on how the administrative processes with Headquarters can be improved. Several members of the board noted that response time for many time-critical forms was too slow. Getting calls for papers not in timely manner was mentioned as an example, where delay of 2 to 3 months after submission has been noted.

SPECIAL NOMINATIONS COMMITTEE REPORT

Art Goldsmith resigned his position as treasurer of the Society, effective December 31, 1988. This was due to his election as Division VI director, and the IEEE bylaws do not allow an IEEE Director to hold an executive position on a Society’s board.

Stu Meyer then moved, Bob Fenton seconded that the Board accept Art’s resignation with regret, and that Art’s services to the Board over the past five years be expressed in appreciation.

Stu Meyer then moved, Kent Johnson seconded that the secretary, Sam Leslie, be nominated by acclamation as treasurer of the Society. The vote was unanimous in favor.

Stu Meyer next moved, Fred Link seconded that Stu be appointed as secretary of the Society. The vote was unanimous in favor.

Other appointments are made as follows:

- Ray Trout: Membership Chairman
- Art Goldsmith: Constitution & Bylaws Chairman
- Public Relations: & Anita Gerke
- Sam McConnahay: Engineer
- Bob Fenton: Membership Chairman
- Stu Meyer: Membership Chairman

TREASURER’S REPORT

Art Goldsmith provided a summary of the Society’s financials for 1988. Art noted that the Society continues with its excellent financial position, even though the financial results for 1988 reflect a deficit. This is strictly due to the bookkeeping procedures used by HQ, that the EEOC transferred to the Convergence Fellowship fund was entered as an expense. The net worth on a per-member basis for the VTS Society is close to $85, which compares favorably with a $95 average for all of the IEEE Societies.

Dave Talley provided his financial advisor’s report, and he indicated that he was in close agreement with the results that were discussed. Dave also noted that the board would consider additional means for putting the remainder of the Society’s reserves to the best use for the membership.

After board discussion, Art Goldsmith moved, Stu Meyer seconded that the president appoint an ad hoc committee to look at the use of the Society’s reserves for additional scholarships, awards and other uses. The proposal was accepted, Bob Marzouk, Lee Hinnell and Roger Maddox to this committee.

Sam McConnahay moved, Ray Trout seconded that the board accept the past treasurer’s report. The vote was unanimous in favor.

PUBLICATIONS

Bill Lee reported on the goals for his committee for this year and next. In particular, efforts are to be placed on special issues of the transactions. Upcoming special issues which are under consideration are:

- Vehicular Electronics (November #8)
- Digital Cellular (June 98 — Early 99)
- Non-Communications (1990)

The committee estimated that the Transactions budget for 1990 is near the 600 page mark, which is more than double that allocated for 1989. Sam McConnahay moved, Stu Meyer seconded that the budget be increased from 592 pages to 600 pages. The vote was unanimous in favor.

Sing Rhee reported that the reduction of the backorders of renewed papers is getting back on schedule.

Society Officers and Directors Report

GEORGE F. McCCLURE, PRESIDENT
MARIA MARITTA, SECRETARY
P.O. Box 5237, MP522
OAKLAND, CA 94652
(415) 357-3872

PRESIDENT: ROGER MADDOX
VICE PRESIDENT: GEORGE F. MCCCLURE
SECRETARY: MARIA MARITTA
TREASURER: SAMUEL L. LESLIE

IEEE Vehicular Technology Society Newsletter
May 1989

All IEEE papers presented at the 1988 ASME/IEEE Joint Vehicular Technology Conference were evaluated by a panel of reviewers. Prizes are awarded at the IEEE luncheon each year to the previous year’s winners. The following awards presented by Linda Sue Boehmer Wednesday April 26:

1st Prize - $150.00
R. T. Hill, Jr. & Yo. Electronics
Interference Calculations in Third-Rail Rapid Transit railways

2nd Prize - $100.00
D. Becher, C. Radl & P. A. St mouth Dynamic Solution of a Diesel-Electric Locomotive Propulsion System

3rd Prize - $50.00
G. English, C. Schier The Technical and Economic Issues of AC Tractive in N.A. Freight Locomotives

STUDENT PAPER AWARD
Linda Sue Boehmer
IEEE Vehicular Technology Society Newsletter
May 1989

IEEE DIVISION III DIRECTOR’S REPORT

The board was honored by the attendance of Ralph Wyndom, the IEEE Division III Director. Ralph discussed some of the procedures for nominations for higher IEEE offices, and asked the board for inputs on how the administrative processes with Headquarters can be improved. Several members of the board noted that response time for many time-critical forms was too slow. Getting calls for papers not in timely manner was mentioned as an example, where delay of 2 to 3 months after submission has been noted.

SPECIAL NOMINATIONS COMMITTEE REPORT

Art Goldsmith resigned his position as treasurer of the Society, effective December 31, 1988. This was due to his election as Division VI director, and the IEEE bylaws do not allow an IEEE Director to hold an executive position on a Society’s board.

Stu Meyer then moved, Bob Fenton seconded that the Board accept Art’s resignation with regret, and that Art’s services to the Board over the past five years be expressed in appreciation.

Stu Meyer then moved, Kent Johnson seconded that the secretary, Sam Leslie, be nominated by acclamation as treasurer of the Society. The vote was unanimous in favor.

Stu Meyer next moved, Fred Link seconded that Stu be appointed as secretary of the Society. The vote was unanimous in favor.

Other appointments are made as follows:

Ray Trout: Membership Chairman
Art Goldsmith: Constitution & Bylaws Chairman
Public Relations: & Anita Gerke
Sam McConnahay: Engineer
Bob Fenton: Membership Chairman
Stu Meyer: Membership Chairman

TREASURER’S REPORT

Art Goldsmith provided a summary of the Society’s financials for 1988. Art noted that the Society continues with its excellent financial position, even though the financial results for 1988 reflect a deficit. This is strictly due to the bookkeeping procedures used by HQ, that the EEOC transferred to the Convergence Fellowship fund was entered as an expense. The net worth on a per-member basis for the VTS Society is close to $85, which compares favorably with a $95 average for all of the IEEE Societies.

Dave Talley provided his financial advisor’s report, and he indicated that he was in close agreement with the results that were discussed. Dave also noted that the board would consider additional means for putting the remainder of the Society’s reserves to the best use for the membership.

After board discussion, Art Goldsmith moved, Stu Meyer seconded that the president appoint an ad hoc committee to look at the use of the Society’s reserves for additional scholarships, awards and other uses. The proposal was accepted, Bob Marzouk, Lee Hinnell and Roger Maddox to this committee.

Sam McConnahay moved, Ray Trout seconded that the board accept the past treasurer’s report. The vote was unanimous in favor.

PUBLICATIONS

Bill Lee reported on the goals for his committee for this year and next. In particular, efforts are to be placed on special issues of the transactions. Upcoming special issues which are under consideration are:

- Vehicular Electronics (November #8)
- Digital Cellular (June 98 — Early 99)
- Non-Communications (1990)

The committee estimated that the Transactions budget for 1990 is near the 600 page mark, which is more than double that allocated for 1989. Sam McConnahay moved, Stu Meyer seconded that the budget be increased from 592 pages to 600 pages. The vote was unanimous in favor.

Sing Rhee reported that the reduction of the backorders of renewed papers is getting back on schedule.

Kent Johnson reported that he was moving the deadline up for the next issue of the newsletter to March 1 in order to get information to the membership in time for the San Francisco VTC.

CONFERENCES AND MEETINGS

1989 VNS Conference, September 12 – 14, 1989, Toronto

Eric Evans reported that the VNS conference has been the successful conference of the year. One of the reasons was the strong session that was held on the VTS conference committee.

Eric Evans reported the successful conference of the year. One of the reasons was the strong session that was held on the VTS conference committee.

Eric Evans reported that, through a misunderstanding, the remainder of the money originally approved by the board has not been spent in the budget. This was rectified by having the Society President send the IEEE HQ authorization to disburse the remaining of $10500 used money to the San Francisco Conference.

The board noted that the next meeting will be held on the Saturday before the conference at the Franciscan Drake Hotel (2:30 PM). After discussion on what to hold the board dinner, Sam McConnahay moved, Eric Evans seconded that the board dinner be held on Wednesday evening following the conference in order to allow the conference attendees and their spouses to attend. The motion passed with 14 in favor, 1 against.
IEEE Vehicular Technology Society Newsletter

6th VTC Orlando Conference, May 6-9, 1980

George McClure reported on the status for 1980 VTC, to be held at the Holiday Inn Concourse Plaza in Orlando. A call for papers has been prepared, and will be distributed at the San Francisco conference.

Evan Richards moved, Ray Trubelst moved that up to $5000 seed money be approved as fee for the Orlando committee. The vote was unanimous. The chairmen is to write a letter to the treasurer to document the Orlando committee’s request for the seed money.

5th VTC St. Louis, May 20–22, 1981: Sturgeon-Westport

Evan Richards reports that the St. Louis committee has prepared a preliminary budget, and that they have selected a theme. Also, Jim Hess has been named as the publications chairman for this conference. Evan also noted that this conference is to be sponsored jointly by the IEEE St. Louis section and VTS on a 50/50 basis.

4th VTC Dinner Conference (1982)

There has been no activity in regard to this conference since the last board meeting.

1981 VTC Conference

Fred List reported that he has had little luck in finding a location in the Florida area for the 1983 VTC, but that he and Ray Trubelst will give it another try. He mentioned the possibility of holding this conference in Canada, possibly Montreal, if the Boston area did not pan out. Furthermore, the possibility of holding the 1991 VTC conference jointly with the 1993 VHS conference was discussed.

Bob Foston also reported that the board had been interested in holding a VTC in Europe. After discussion, the board decided to bid on an overseas conference to consider.

Conference ‘81

Bob Mazzella reported that the official paid attendance for this conference was 1359, and that over 3000 in total had attended. This was the highest attendance ever with the return of surplus funds to the IEEE Southeastern Michigan Section and the Society anticipated at being around the IBK in 1980 mark. Also, it was noted that international participation was up greatly over past conferences, being around the 30% mark.

Dates have been set for the upcoming VTS Conferences, as follows:

- October 13–17, 1980
- October 17–22, 1992

1988 VTS/IEEE Conference Workshop

Roger Medlock reported that there were 63 registered attendees at this workshop, and that it was financially successful. He reported that a misunderstanding by the hotel resulted in the workshop report being given away to the Congress attendees rather than to the paid registrants of the workshop. After discussion, Roger is to follow through on the most reasonable method in getting additional copies of the workshop report to the paid registrants.

Evan Richards reported that Roger got a copy of the workshop report to George Biersted, associate transactions editor, vehicular electronics, as quickly as possible.

Also, Roger is to explore the possibility of holding the workshop annually, and to report to the board at the next meeting.

Scandinavian Distilled Smoke Tour

Bob Foston reported that this has become a dead issue, that the original tour was canceled due to insufficient interest.
IEEE/ASME JOINT RAILROAD CONFERENCE
April 26 & 27, 1989
Hershey Hotel
Philadelphia, PA

SESSION 1: ELECTRIFICATION AND MOTIVE POWER

US Railway Freight Electrification, Does It Have a Future? (Presentation Only)
E. T. Harley, C.T.K. Engineering Services, Philadelphia, PA

AC Drive Technology for Locomotives
R. Wagner, Siemens AG, Erlangen, W. Germany

AC Three-Phase Power Transmission System for Amtrak's New F69 PH-AC Locomotives
J.W. Fischer, Siemens AG, Erlangen, W. Germany

Development of a Dual Mode Locomotive
C.M. Smith, Louis T. Klauder & Assoc, Philadelphia, PA
D.E. Comer, Metro North Commuter Railroad, New York, NY

Traction Power Supply at German Federal Railway's 400Kv/Hz Systems
W. Harprecht, German Federal Railway, Frankfurt, W. Germany
R. Siefert, German Federal Railway, Munich, W. Germany
F. Klebing, Siemens AG, Erlangen, W. Germany

SESSION 2: SYSTEM DESIGN

Safety and Productivity Improvement of Railroad Operations by Advanced Train Control Systems
R.D. Burns, Rockwell International Corp., Cedar Rapids, IA
R.B. Turner, ACEX Technologies, Inc., Los Angeles, CA

Development and Validation of General Purpose Railroad Vehicle Dynamics Simulation (NURCS)
F.B. Blader, Transangle, Concord, MA
J.A. Elko & N.G. Wilson, Transportation Test Center, Pueblo, CO
P.E. Klauser, AAR, Chicago, IL

Applications and Economic Justification of On Board Locomotive Computers
D.M. Fishman, AITECH Systems Ltd., Herzliya, B, Israel

A PC Based Voice Data Entry System (Presentation Only)
M. Saeger, Trailer Train Co., Chicago, IL

Use of On-Frequency-Radio (OFR™) Repeater and Distributions Copun System to Solve Railroad Mobile Coverage Problems
Y.S. Kuaminsa, KAVAL Electronics, Inc., Don Mills, Ontario

SESSION 3: TRACK AND TRUCK CONSIDERATIONS

Railway Track Admittance, Earth-Leakage and Track Circuit Analysis
R.J. Hill & D.C. Carpenter, University of Bath, School of Electrical Engineering, Bath, England

Three Piece Truck Cross Bracing: How It Works and What It Does
R.E. Smith, UTDC, Kingston, Ontario, Canada
R.J. Anderson, Queens University, Kingston, Ontario, Canada

RailTel System - Extending the Life of Bolted Rail
D. Archambauve, Fatigue Technology, Inc., Seattle, WA

Theoretical and Experimental Determination of Heat Flow into a Wheel Due to Bearing Overheating

The Effect of Magnetic Saturation, Hysteresis and Eddy Currents on Rail Truck Impedance
D.C. Carpenter, R.J. Hill, University of Bath, School of Electrical Engineering, Bath, England

SESSION 4: MAINTENANCE AND OPERATIONS

CP Rail Freight Truck Component Refurbishing Facility
W.W. Petersen & S. Bilgin, CP Rail, Montreal, Quebec, Canada

Transportation Technology Advances with Work Order Management Systems
Benaron, Automated Monitoring and Control International, Omaha, NE

Implementation of Freight Car Planned Maintenance of CP Rail
J. Runnecolls & J.C. Maimon, CP Rail, Montreal, Quebec, Canada

SCAN: A Decision Support System for Railroad Scheduling
D. Jowodick, P.T. Harker, University of Pennsylvania, Phila, PA

FIELD TRIP 3:00 - 5:30 pm TUESDAY
Tour of Amtrak's Northeast Corridor Control Center

RECEPTION AND LUNCHEON SPONSORED BY IEEE WEDNESDAY Speaker: James A. Early, Assistant Chief Engineer - Communication, Signal, and Electric Transmission - Amtrak

CONFERENCE RECEPTION AND DINNER
WEDNESDAY EVENING Speaker: Louis J. Gambaccini, General Manager, Southeastern Pennsylvania Transportation Authority

RECEPTION AND LUNCHEON SPONSORED BY ASME THURSDAY Speaker: Dr. John M. Samuels, Assistant Vice President, Industrial Engineering, Conrail

Chapter News

Gaspard Messina
Chapter News Editor

Meetings

Philadelphia (Joint VTS/Land Transportation Division)
Subject: Vital Microprocessors For Rail Road Signaling
By: Mr. James P. Miccolis
Conrail, Room 1203
15N, 32nd Street
Philadelphia, Pennsylvania 19100
 Held: February 16, 1989
Attendance: 57 (32 guests)

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

Transportation Systems

Bob McKnight
Transportation Systems Editor

Satellites, Data Links, and Computers
Give Real-Time Control to Vehicles

Optimum efficient management of land vehicles is a reality through the use of computers, high-speed data links, radio transceivers and satellites operating in geostationary orbits above the earth. Now it is possible to pinpoint locations of trains, trucks, emergency vehicles such as fire trucks, ambulances and police cars, and even off-highway vehicles.

IEEE Vehicular Technology Society Newsletter

Two such vehicle management and location systems have been developed by Railstar Control Technology, Inc. One developed for the railroad industry is known as a Train Management System while the other called Scantrak is for vehicle monitoring and control.

Both systems are essentially the same in that they contain a user unit which may include a data entry unit, the vehicle radio transmitter, the geostationary satellite that relays the signals from the vehicle radio to the ground station, and the computer complex that receives and processes the signals and then stores and transmits data about the vehicle to the user. At Railstar Control a computer complex that develops a myriad of reports, charts, graphs, trends and statistical and operating data for the vehicle owner or transportation carrier. Such computer generated reports and data are transmitted over commercial communications carriers or other communications channels as the transportation company and Railstar may decide.

Real-time Control Capability

A major factor in the success of these systems is the automatic transmission of data to the vehicle on a periodic basis, once every minute or every hour and as often as transportation company desires. Thus real-time control is possible. In addition to vehicle identity and other information such as "health" of the vehicle (locomotive fuel capacity, etc.), and commodity status such as temperature or liquid or pressure of a gas, the periodic transmission from the vehicle provides a computer with the necessary facts to monitor the movement and operation of trains.

At present, location is provided by a combination of transmission to the satellite and local computer data along with vehicle identity. When more geostationary satellites are available, location can be obtained by the triangulation method using two or more satellites.

One satellite is now in geostationary orbit over the earth, the GTE Spacenet III, Seastar 801 and the GTE 6-4 Star III/Geostar 802, which was orbited late last year. Transmission to the satellites is at 1.5 GHz. The satellites have repeaters with full internal digital processing. They convert the received signals from the satellites and retransmit them to Railstar Control receiving equipment. All retransmitted messages are received from the satellites through large, specially designed antennas and high sensitivity radio receivers tuned to the downlink signals. The signals are demodulated and processed in the multi-stage and redundant computer complex at Railstar Central. The spread spectrum encoding is stripped away, the address of the sender is identified and the message is converted to usable information. Railstar Central integrates all received information and complete management data base and forward data as required through any selected commercial link to the transportation company's control and management centers.

Many Opportunities for Better Rail Control for Railroads, the system concept is...
centered on sensing, by automatic means, a myriad of contributing factors such as train location, locomotive health, etc., and transmitting them to the central data base in real time. Accumulation of extensive information across the entire spectrum of operation will allow a high level of pre-programmed decision making to optimize ongoing operation on a continuous basis.

Once accumulated, the same data, reprocessed can also provide automatic daily or extended period performance reporting and such supplements as locomotive availability, failure analysis, recommended maintenance cycles, etc.

For transportation departments, the system will display position and other data to provide the dispatcher with timely and accurate information on the whereabouts of all trains. With this information at his fingertips, the dispatcher can plan and provide for better train meeting arrangements and maximize working time for each train as well as for maintenance personnel involved.

For mechanical departments of railroad, the system will provide monitoring of locomotive performance in dynamic state-when towing tonnage trains, does the engine fuel efficiently functions the system can provide include:

- Determine specific performance of trailing units while moving in consist.
- Provide advance information on specific causes of lack of performance under dynamic conditions.
- Determine amount of additional power required.
- Devise shutdown sequences in order to prevent damage to the unit while running and to minimize repair time.
- Provide a data base for maintenance planning purposes.

Locomotive automatic reporting could include the following:
- *Alarms*—over threshold, trend analysis.
- *Tachometers*—over speed.
- *Diage data*—mileage, hours, amp-hours.
- *Detail on demand*—event reconstruction.
- *Parameters*—unit identification, isolation, tone and reverser position, speed, ammeter (loadline), brake pipe pressure, brake cylinder pressure, engine pressure, ground relay, wheel slip and dynamic brake performance.

For engineering, there are advantages of this satellite-communications system. Non-shunting vehicles, such as maintenance of way work equipment, rail detector cars, track inspection cars, etc., or high-rail vehicles, could be fitted with a Railstar transceiver to send data on identity, location, etc. Such units could be fitted into the operational plan of the railroad along with the train movement data base to improve the efficiency and safety of the operation of this type of equipment. Also, the operators of such vehicles could instantly transmit notice of unusual conditions noted along the right of way. Such advisories could be entered directly into the control system so that requirements for precaution would immediately be directed to the dispatcher. It is to be noted that a data entry unit can be used with the vehicle transceiver for inputting local information for transmission via satellite to Railstar Central and ultimately to the railroad's control center.

The train management system is being tested by Guilford Transportation Industries (Boson & Maine, Delaware & Hudson and Maine Central Railroads) and by Amtrak. Amtrak has equipped a locomotive and is considering equipping cafe cars. Using cafe cars as an onboard terminal, a conductor would input data via a keyboard or encoded tickets taken from passengers to provide immediate information as to proper passenger loading. Often passengers will overbook on Amtrak trains and not show at the boarding station. Hence on reserved trains it is not uncommon for the ticket agent to have information that all trains is "sold out" between two stations only to have vacant seats on the train between these points because there is at present no fast enough means for the conductor to be informed of the agents or reservation system know what seats are actually filled on the train.

Vehicle monitoring—A trucker's delight

Scantrel, the satellite tracking and communications system can do for trucks or motor vehicles what the Train Management System does for railroad. As with the other, each vehicles would be equipped with a Railstar transceiver and a data entry unit for entering specific detailed data about the vehicle and its load.

Several management control opportunities exist:
- Monitor any vehicle nationwide from a management control center in real time.
- Detect and advise if a vehicle is not moving in accordance with schedule or is "out of service".
- Report virtually any vehicle or commodity health parameter providing recognition of incipient problems.
- Report automatically when predetermined loading parameter thresholds are transgressed on any vehicle.
- Provide savings and other benefits from failure avoidance.
- Continuous record of vehicle movement and commodity physical parameters.
- Develop performance histories by commodity, carrier and shipper.
- Provide data for development of more effective need-based maintenance programs.
- Provide data for development of more effective shipping criteria.
- Detect unauthorized or accidental unloading in addition to recording of loading/unloading authorization.
- Such information gathering, recording and dissemination would be most useful in cases of emergencies involving hazardous material transportation.

It is understood that several federal government agencies are interested and have conducted tests using the scantrel system for tracking special shipments.

Future—two-way transmission via satellite

With an operational satellite in orbit, it is recognized that a valuable addition to the present system is two-way two-letter transmission between vehicles and ground station control centers.

This is being done with several interested parties including governmental agencies that have the need to keep track of special shipments.
Professional Activities

Frank E. Lord
Professional Activities Editor

RECENT HAPPENINGS

1989 IEEE U.S. Technology Policy Conference--This year's conference which was held on February 21 in Washington D.C. was titled "Policy Imperatives for Commercialization of U.S. Technology." It was based on the widely held view that during the last half of this century both the Federal government and the private sector have supported a wide range of R&D programs, but the commercialization of the U.S. technology base has often been an overseas success of foreign-based manufacturers. The United States is facing enormous impediments that limit its ability to commercialize its technology competitively in the global marketplace. The Conference explored specific policies needed to turn U.S. R&D into new commercial products that are attractive in world markets. The conference consisted of four panels that each addressed a major imperative.

On "Imperatives for Engineering Education" the panel recommended a streamlining education-related policies that might contribute to solving the U.S. lag in the technological marketplace. It reviewed the full U.S. educational spectrum, examined what we should adopt from other country's experiences, and discussed how to provide career paths for the U.S. engineer that are commercially viable yet professionally rewarding in dynamic, competitive technological areas.

The panel on "Imperatives for Technological Innovation" took the position that the commercialization of U.S. technology is desirable from national and nationalistic points of view and that one way to make technological innovation commercially available is through consortia. The panel then presented examples of consortiums, including how one is organized, how existing ones are being worked, the pros and cons as based on experience, and what is needed to make them successful.

A panel on "Imperatives for International Competitiveness" explored the link between a U.S. economic growth rate and a corresponding slide in performance by U.S. companies in international competition. It then focused on the national effort required for more effective use of existing and emerging technology as an essential element to achieve a competitive turnaround.

May 1989

Communications

J. R. Cruz
Communications Editor

ABSTRACT


Short distance, low antenna height signal attenuation measurements are presented for use in the design of future microcellular radio networks. Measurements presented are based on the propagation along busy city streets in a direction radial to a fixed antenna site.

Antenna heights between 5 m and 20 m were chosen for the fixed site, while 1.5 m was chosen for the mobile vehicle. The signal strength was then measured out to a distance of 1 km in a line of sight path from the fixed site at both 870.15 MHz and 1.8 GHz.

Current cellular systems designs are often based on the work of Okumura [1] or Hata [2] who have not considered propagation from low antenna heights (less than 30 m) or over the short distance (less than a kilometer) expected in microcells. The measurements show that extrapolation of the Hata [2] and Okumura [1] formula into the low antenna height, short distance area is not valid and can lead to inaccuracies.

The results show that at short distances from the antenna the signal attenuation along a line is very much less than that predicted by extrapolating the results of Hata [2] and Okumura [1]. In addition, the measurements also suggest that the signal drop off increases as the distance between the fixed and mobile site is also increased.

IEEE Vehicular Technology Society Newsletter


A new discrete-time method is proposed for estimating the impulse response of a frequency selective digital modulated communication channel. The received signal is first demodulated and sampled and then the fourth-order cumulante of the resulting discrete response is estimated. The method estimates the channel impulse response from the complex cepstrum of the aforementioned fourth-order cumulante (i.e., tri- correlation function of the input). The asymptotic information about the channel and its activities, or to offer your efforts to the subcommittees, contact the IEEE-USA Office in Washington, D.C.

May 1989

Health Care--IEEE-USA's Health Care Engineering Policy Committee is looking for IEEE members who are interested in serving on one of the newly established subcommittees. Beginning in 1989, the Committee is establishing groups to consider the impact of regulation on device development; the role of biomedical engineering research; and the role of biomedical engineers in health care delivery. The Committee has established 10 years ago, "to bring IEEE's interests and capabilities health care-related technologies to bear on national health care policy issues." Interested information about the Committee and its activities, or to offer your efforts to the subcommittees, contact the IEEE-USA Office in Washington, D.C.


There has recently been much deliberation regarding whether indoor wireless communications systems should operate in the 900 MHz band or the 1.7 GHz band. However, there are no propagation results available in the literature which clearly indicate the performance in either band. Preliminary indoor measurements were taken in two bands. This paper presents the results of temporally and spatially distributed wideband impulse response measurements on fixed indoor radio channels in these bands. Impulse response parameters, as well as envelope fading and frequency correlation statistics are presented and compared for the two bands, and for different buildings. Results from the temporal experiments show that for a specific location in either of the two buildings, the dynamics of indoor channels are slightly less random at 910 MHz than at 1.7 GHz. It is believed, with due regard for the quasi-static nature of indoor shadowing, that this is due mainly to greater channel diversity and poorer performance on a given transmit/receive link in the 900 MHz band.

The spatially distributed measurements show that the structure of the impulse response does not vary significantly for channels in the two buildings. In one building, rms delay spreads were slightly greater in the 1.7 GHz band for over 90 percent of transmit/receive link configurations. In the other building, rms delay spreads were marginally greater in the 900 MHz band with a 95% confidence. We also found that the standard deviation of rms delay spreads for different link configurations was greater for both frequency bands in the 900 MHz band. The rms delay spread for the standard deviation was greater for the 1.7 GHz band results. These differences in rms delay spread standard deviations are considered to be important when evaluating the impulse response in different buildings and for different frequencies of operation.


It has been proposed in current literature that future urban mobile radio systems be configured with small cells...
having low-powered base stations with street-light-level at-
tennas. This configuration contrasts with conventional designs for urban mobile systems in which one centrally located, high-

power base station with an elevated antenna is employed to serve a large coverage area. The results of measurements made to determine propagation characteristics on urban mobile radio-
d channels with the mobile receiver taking advantage of sight-

line between the base and mobile units are reported in this paper. Cumulative distribution functions for envelope fading, as well as delay spread and fractional delay statistics are presented. In addition, comparisons are made to similar statistics com-
piled for conventional radio systems. It is concluded that there are no previously published papers regarding these characteristics on microcellular-type channels.

Results show that the fading propagation conditions would be significantly less severe if small-celled systems were imple-
mented. Root mean square delay spreads averaged by considering all multipath signal components with powers greater than 25 dB below the peak were reduced by a factor of approximately four in comparison to those typical in conven-
tional systems. In addition, microcellular-type channels have Ricean, rather than Rayleigh, envelope fading characteristics, and correspondingly different frequency correlation statistics. It is shown by means of Ricean channels throughout the paper and is primarily Rayleigh, although Ricean and log-normal distribu-
tions fit some of the data. Shadowing effects of common factory equipment likely to obstruct indoor radio paths are also given here.


There has been recent interest in characterizing UHF prop-
agation characteristics in microcellular-type channels, however, have not been discussed previously in the literature. This paper details the results of narrow-band propagation meas-
urings at five frequencies. The results show a significant amount of path loss is dependent upon local surroundings and is log-normally distributed, weighted fading is Ricean, and small-scale fading is Rayleigh. Medium-sized UHF channels are primarily Rayleigh, although log-normal and Rice distributions fit some of the data. Shadowing effects of common factory equipment likely to obstruct indoor radio paths are also given here.


We describe and analyze a flexible, robust, multichannel TDMA radio communications system that is ideally suited for portable microphone applications. The microphone is a low-cost, low-power, low-energy consuming microphone that is omnidirectional and is capable of detecting both voice and music. The system is designed to be implemented using a small building with a central architecture that allows for the easy extension of the system. In addition, a cellular architecture can be used to extend the capacity.

The TDMA protocol allows the users the flexibility of choosing their own desired rates of data communications.

Moreover, the capability of using different levels of coding gives the users the option of selecting their own error performance. Thus, a simple single stage of coding may be chosen for voice and another for data. We show that a two-stage coding to permit reliable data communications by overcoming both multipath fading and interference. The ability to combat interference is one of the key features of this system that is not present in many other systems.

"User Access in Portable Radio Systems in a Co-

A computer simulation study of user access in a universal digital portable communications (UPDC) system is described. An access algorithm consists of relative power channel-assignment followed by data-error detection is evaluated and compared to an optimal reference in a co-channel interference environment. For typical propagation conditions and radio configu-
rations, it was found that an access algorithm based on the ranking of system channels by relative power provides a viable means of channel selection for the portable radio. It was found that for lower signal power levels, the gain in diversity quality in a co-channel interference environment, approaching the optimum with respect to a 99 percent statistical reliability criterion.


Teletraffic performance of highway microcellular mobile radio systems has an overlaid macrocell that spans about 10 times the area. A large number of small microcells, com-
pounded of concatenated segments of the highway where each seg-
ment is a microcell, typically, 1000-2000 m long, is the most-cost-effective mobile call-off load-effort-past elevations. A narrow-band time division multiple access arrangement supporting 16 chan-
nels per carrier and one carrier per base station is employed. The microcell has a virtual carrier frequency bank and power control algorithm for radio channel utilization.


We extended to the case of minimum shift keying (MSK) modulation the differentially coherent receiver of Goldstein et al. that stabilizes the phase (PSK) modulation. A new differentially coherent detector for MSK is thereby derived. The receiver is based on the phase of a matched filter and an equalizer to suppress inherent intermodulation interfer-
ence. We show that performance can be improved when the delay between a matched filter and an equalizer is increased from one to M bit time intervals. This decreases the effect of noise correlation and, consequently, decreases the bit error rate while keeping the order to keep the differential detector simple, M should be odd.

The bit error probability of the proposed receiver is calcu-
ed for a 1-1 coherent channel and is found to be very close to that of an independent channel. The bit error probability of the delay M, is obtained with M = 3. For the same probability of error the required Eb/N0 in the present case is just 1.15 dB less than that of an independent channel. The proposed rece-
iver performs better than conventional differentially receivers.

"Soft Decision Decoding of Block Codes Using Re-

The corded error rate (FER) performance of nonco-
here and soft decision decoding methods is evaluated. The first large second algorithm is investigated in a Rayleigh fading channel. The received signal envelope is sampled and used as channel estimates. The second algorithm is divided and the lower bounds of the BER are derived assuming independent Rayleigh envelope samples in a received block. When the Golay (23, 12) code is used, the bit error rate decoding of hard deci-

Theoretical analysis was supported by laboratory experiments.

"Channel Modeling and Adaptive Equalization of In-

This paper analyzes the benefits of using a decision feed-
back equalization technique in the indoor radio environment and ex-
amines the results of performance predictions for different chan-
nel models. It is found that a QPSK/JDL modem with second-order decision feedback equalization reduces the error rate to an order of magnitude higher than a QPSK modem without equal-
ization. A given set of measured profiles of the channel impulse response is used to design second-order and higher order equalizers. The continuous channel model is represented by the delay power spectrum and the discrete channel model by the en-
velope delay profile. The performance varies with the delay time distribution, the sensitivity of the performance to the shape of the delay power spectrum, the shape of the envelope delay power spec-
trum, and the arrival rate of the paths is analyzed.


The German Telecommunications Administration (CEPT) have recently defined the standard for the Pan-European land mobile system. It is based on digital voice and mo-

This makes the receiver robust both to fast Doppler shifts and to multipath. Simulation results are presented which show the performance in different multipath environments, with echo delay in excess of 20 μs an speed up to 250 km/h. These results are obtained using the propagation channel models defined by CEPT experts on the basis of field tests. The adaptive receiver is being implemented as a test bed.


A new type of carrier recovery circuit suitable for coherent detection in digital land mobile radio transmission is studied experimentally. This paper proposes a dual-mode carrier recovery (DCR) circuit which adaptively selects one of two phase locked-loop operation modes: the conventional mode, or the adaptive carrier-tracking (ACT) mode. The ACT mode digitally controls the reference phase, and enables instantaneous phase tracking in burst signal operation and/or in a fast fading environment. The DCR coherent demodulator performance is similar to that of conventional detection in the low CNR region, and to that of differential detection in the high CNR region where the ACT mode is selected.


This paper is concerned with the performance analysis of a fast frequency hopping spread spectrum multiple-access (FFH–SSMA) system with binary frequency shift keying (BFSK) modulation, where the data traffic modulation, operating in a combined environment of Rayleigh selective fading, other users interference, and additive white Gaussian noise (AWGN). Improvement of system performance (PSK) is studied in terms of bit error rate (BER). Expressions of the BER are evaluated when a maximum likelihood decision criterion is used to show the advantages of the use of frequency hopping in selective Rayleigh fading channels. Results obtained in this study show the equivalence between frequency hopping and direct sequence (DS) communications. The rate of improvement, in terms of incoherent error probability (IEP), is compared to that of the synchronous direct sequence (DS–CPSK) and is shown to be very significant, for instance, when E/G is not significantly different. For instance, when the diversity order is equal to 4, the IEP is approximately 10^-4 for both systems.


We characterize multiple-access interference for cellular mobile networks, in which users are assumed to be Poison– distributed in the plane and employ frequency–hopped spread–spectrum signaling with a transmitter–oriented assignment of frequency– hopping patterns. Exact expressions for the bit error probability and packet error probability are derived for coherent and noncoherent systems and various approximations are applied when forward error–control coding is employed. In all cases, the effects of varying interference power are accurately taken into account according to the value of the equivalent interference power density.

Numerical results are given in terms of bit error probability for the exact case and throughput for the approximate analysis. These results are compared to the conventional case.


A continuous–time Markov chain model for an asynchronous communication spread spectrum code division multiple access (CDMA) packet radio network is developed. The network is composed of N users, the receiver–based code is considered; a terminal with a packet to send looks up the destination's code and transmits on that code. Each user senses the channel load, and the channel load vector will exceed the channel threshold. The model allows us to study the threshold effect of channel load on the performance of the CDMA packet radio network. Improvements in performance of spread spectrum packet radio networks due to channel load sensing are shown. Steady–state results for throughput versus offered traffic and the delay versus throughput are obtained.


A computer simulation is described for studying the interference effects of building reflections on the system performance of local access radio (LAR). The simulation is based upon geometric optics. Coverage probability, defined as the fraction of subscriber locations that can be served by radio within a given range, is calculated. It is shown that only half of the potential building–induced reflections can be served by the node site. Of those, a majority are not limited by self–interference caused by reflections. Most of the strong interference time from structures near the subscriber. Increasing the node mast height has little effect on the coverage. Changing node antenna from three 120° sectors to 6 sectors each covering 60° does not effect the coverage probability. Coverage can be increased by increasing the subscriber mast height. Up to half of the system users can be served by an 180° optimally placed node site using different channel frequencies.


This correspondence discusses the symbol error probability of maximum–selection diversity radio reception over Rayleigh fading channel. The symbol error probability of a hop–by–hop linearly weighted and spread–spectrum signaling with a transmitter–oriented assignment of frequency–hopping patterns. Exact expressions for the bit error probability and packet error probability are derived for coherent and noncoherent systems and various approximations are applied when forward error–control coding is employed. In all cases, the effects of varying interference power are accurately taken into account according to the value of the equivalent interference power density.

Numerical results are given in terms of bit error probability for the exact case and throughput for the approximate analysis. These results are compared to the conventional case.


This paper is concerned with the performance of binary frequency shift keying (FSK) communications over frequency selective wide–sense–stationary uncorrelated–scattering Rayleigh fading channels. Numerical results of FSK communications over frequency–selective channels have considered the average probability of error for specific models for the fading channel and typically assume that the two FSK signals are orthogonal. This paper describes a technique for obtaining bounds on the average error probability for FSK in terms of one or two parameters obtainable from multipath spread or frequency correlation function channel measurements.


This paper describes an architecture and implementation design which support an interface to the X.400 mail environment using the full Open Systems communications protocols for a portable computer. The implementation is designed to be used over a cellular radio telephone network to provide mobility. The use of the message store, the User Agent interface of the CCITT X.413 (1988) Message Store. A full set of security facilities, designed for use with Inter–Personal Messaging (IPM), are included in the architecture. The facilities are existing and proposed International Standards as far as possible.

A number of important issues are discussed regarding the placement and management of keys for the IPM security, as well as authentication between the user and the portable computer and between the User Agent and the Message Store. To support the use of the CCITT X.413 Message Store model, it was necessary to implement a full protocol stack for Open Systems Interconnection (OSI) on the portable computer; our design and experiences are described.


This paper presents an open–loop technique for estimating and removing the effects of Doppler shift–keyed (MDPSK) receiver. The novelty of the scheme is based upon the observation that the phase of the complex (phase) signal contains the symbol interval contains only the Doppler–induced phase shift, thus, by proper processing, the latter can be estimated and removed from the former.

Analytical and simulation results are given for the variance of the above estimator and the error probability performance of the MDPSK receiver is evaluated in the presence of the Doppler correction. Next, the practical considerations associated with the application of this technique on bandlimited Nyquist channel, are discussed and incorporated into the final design. In particular, the effects of a modified multiple sample per symbol detection algorithm, is shown that the receiver can, in the absence of timing error, be designed to single–handedly Doppler correction and data detection with no penalty due to intersymbol interference (ISI). Finally, the effects of ISI due to timing jitter are assessed by computer simulation.


A time diversity automatic repeat–request (ARQ) scheme with the finite number of transmissions in investigated for a digital FM mobile radio with frequency demodulation (FD). It processes all the retransmissions of a single block using postdetection diversity combining. The analysis of the signal energy per bit required for a given bit error rate (BER) and the spectral efficiency in a cellular mobile radio system are presented, and the results presented here show that this ARQ scheme offers a performance superior to both the basic ARQ scheme and the time diversity scheme.


To meet increasing demand for mobile communications with a fixed spectrum and at reasonable cost, directional antennae have been used in cellular mobile radio systems. This paper reviews recent achievements so far, and then describes how to achieve high capacity systems by taking a new approach to the design of cellular patterns. Some novel methods of obtaining high capacity cellular patterns are described. Performances are assessed in terms of the first decile carrier–to–cochannel interference (C/I) and traffic density for given blocking probability. Cell efficiency is also considered.


The paper presents a differential detection scheme for noncoherent detection of digital FM signals received over bandwidth–limited channels. The new differential detection scheme observes the phase of the FM signal at centres of signalling intervals and removes the phase encoding of transmitted data is required for preventing error propagation. Numerical results show that the new differential detection yields a significant improvement over two–channel schemes where conventional differential detection becomes unusable. Error probabilities and optimum ST values are presented assuming that bandlimiting is caused solely by IF filtering.
Vehicular Electronics

**POWER VALET "JUICE SWITCH" FOR ZR-1 CORVETTE**

The long-awaited ZR-1 Corvette is now available with its up to 400 hp. four-cam, 32-valve, V-8 engine. The multivalve high-performance engine was jointly developed by Chevrolet and Group Lotus, Inc. To prevent reckless use by other drivers, such as parking valets, the car is equipped with a second keylock switch that switches between reduced and full power outputs. In the reduced power position, half of the 16 fuel injection valves are closed and one of the two cam lobes is disabled. The power valet feature is also known as the "juice switch," because available engine power more than doubles when the "juice key" unlocks and makes available full power operation [1].

---

**STEALTH FAIRING**

Innovations Research, in Denver, CO, now sells what it calls the Cabrella Stealth Fairing. The fairing consists of a car bra that incorporates microwave absorbing material to make vehicles fitted with it less susceptible to detection by police radar 4.

"Hey, what about night driving? Wouldn't headlight reflectors contribute such large cross-sectional radar return so as to minimize effectiveness of the fairing?" And what about safety hazards associated with narrow-minded stealth-equipped drivers speeding across the countryside? Why in hell are things like this allowed to be sold? Only in America, land of the free, free to endanger fellow man. ... I could go on, but you get my point.

---

**REFERENCES**


CALL FOR PAPERS*

You are invited to submit a paper for presentation at the 1990 VT Conference. Topics include, but are not limited to the following:

1) Research and Development 2) System Design 3) Hardware/Software Design
4) Engineering Test Results 5) Applications Engineering

for

TRANSPORTATION SYSTEMS
Control systems
Traffic monitoring
Vehicle location
Maglev
Electromagnetic compatibility
Robotics applications
Headway management

MOBILE COMMUNICATIONS
Signaling
Spectrum efficiency
Propagation
Portable communication
System control
Regulatory issues
Digital cellular
Simulation and test
Modular techniques
Dispatch systems
Emergency communications
Two-way radio
Rural radio service
Satellite technology
Voice synthesis/recognition
Channel coding
Voice code
Antenna systems
Public safety
Data transmission
RFI reduction
Components
Computer-aided design

VEHICLE ELECTRONICS
Information display
Vehicle control
Collision avoidance
Land navigation
Map generation
Multiplexed signaling
Pollution sensing and control
Microprocessor applications
Robotics
Signal Processing
Propulsion
Guidance

* Authors of accepted papers agree to present their papers at the 1990 conference.

Send your summary to IEEE VTC '90, Papers Committee, P.O. Box 1317, Winter Park, Florida, 32790, USA

AUTHOR'S SCHEDULE:
* Submit four copies of typed summary of Paper (250 words maximum) and a résumé by
  August 1, 1989
* Authors notified of acceptance of Papers
  November 30, 1989
* Send final manuscripts to VT Conference Record by
  January 3, 1990

(407) 629-5712  (407) 629-5712